

# **K**

## **TWO-CYCLE ENGINES**

### **TWO CYLINDER SERVICE MANUAL**

**MODELS: K295-2, K295-2AX,  
K340-2, K340-2AX,  
SK340-2AS, K399-2,  
K399-2AX, K440-2,  
K440-2AS, K440-2AX,  
K618-2**

**REVISION NO. 11-73**

This is a complete revision.

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## SAFETY PRECAUTIONS

- Do not add fuel while engine is running. Stop engine and, if possible, allow cooling period to prevent spilled fuel from igniting on contact with hot engine parts.
- Make sure ignition switch is in "OFF" position and spark plug disconnected before working on engine.
- Make sure all safety guards on engine and driven equipment are in proper position and secure.
- Make sure hands, feet and clothing are at a safe distance from any movable parts prior to starting.
- Do not operate engine in closed building unless exhaust is piped safely outside.
- Fuel may escape from fuel tank vent when operating over rough terrain, on an incline, or from expansion, and ignite from hot engine or electrical spark. Stop engine and remove some fuel from tank!

# PRE-START INSTRUCTIONS

**COOLING:** Make sure baffles and cooling shrouds are in place and tight. Air intake openings must be kept clean and unrestricted at all times.

**RUN-IN (NEW ENGINE):** During the first hour, run for short periods of time at varying speeds up to 3/4 throttle. Avoid operation at low and continuous speeds as this causes buildup of heat especially during warm weather or heavy load conditions. After first hour, operate normally up to full throttle--no further "babying" of the engine is necessary.

**BATTERY:** If battery has been removed or disconnected for any reason, make sure that the negative (-) terminal is connected to ground when battery is reinstalled.

**FUEL MIXTURE:** Mix leaded Regular or Premium grade of gasoline (92 octane minimum) with SAE 30 or SAE 40 two-cycle, air-cooled type engine oil in a gasoline to oil ratio of 20 to 1 for the first fill on a new engine and thereafter at a 40 to 1 ratio. Low lead or non-leaded gasoline is not approved for two-cycle operation. The use of a Premium grade gasoline may be especially beneficial in warm weather operation to help prevent detonation or after-run condition. Pre-mix the fuel thoroughly in a separate container before filling fuel tank on the vehicle. Add about 1 gallon of gasoline to the mixing container first then add the oil and mix thoroughly before pouring in the remaining quantity of gasoline. The chart below lists the 40 to 1 ratio for some common size containers.

GASOLINE	1 Gallon	2 Gallons	3 Gallons	4 Gallons	5 Gallons	6 Gallons
OIL (U.S. STD. MEASURE)	3.25 Ounces	6.5 Ounces	9.5 Ounces	13 Ounces	16 Ounces	19 Ounces
OIL (IMPERIAL MEASURE)	4 Ounces	8 Ounces	12 Ounces	16 Ounces	20 Ounces	24 Ounces

## STARTING PROCEDURE

If engine has been out in snow, make sure air intake or baffle is cleared before attempting to start.

**CAUTION:** Throttle must move freely to prevent accidental sticking in running position during start-up. Check for freedom of movement.

1. **CHOKE:** Pull choke full on in cold weather. Little or no choking required with warm engine. After engine starts, open choke.
2. **PRIME:** If vehicle has primer button, press button several times before attempting to start (when cold). Choking not normally required with primer.
3. **THROTTLE:** Hold throttle slightly off idle while cranking engine.
4. **CRANK ENGINE:** (A) **RETRACTABLE START MODELS:** Turn ignition switch ON, pull starting rope in quick, steady motion. Do not allow handle to snap back.

(B) **ELECTRIC START MODELS:** Move switch to START position--release as soon as engine starts (switch will remain in "ON" position). Do not continue cranking if engine fails to start after 20 seconds. Allow starter to cool off before making another attempt. Use retractable starter if battery is low or dead.

## STOPPING PROCEDURE

1. **THROTTLE:** Release throttle and allow engine to idle for a few moments under no load.
2. **IGNITION SWITCH:** Move switch to OFF position.

**EMERGENCY STOPPING:** After operating under heavy load in warmer weather, engine may be hot enough to continue running after ignition is turned off. To stop the engine under this condition, pull full choke and open throttle to shut off air and stall engine.

## OPERATION

**WARM-UP:** Allow gradual warm-up by operating at moderate speed and load for the first few minutes after starting. **DO NOT** attempt to race or place engine under heavy load immediately--performance is best after engine is thoroughly warmed.

**IDLING:** Avoid idling or slow speed operation for prolonged periods as this can result in crankcase flooding, carbon accumulation in head, and spark plug fouling.

# TROUBLE SHOOTING

Always take a systematic approach to trouble shooting. First of all, determine what is actually causing the problem. Is it due to poor quality or insufficient fuel, or is it caused by a weak or improperly timed ignition spark or is it poor compression? If the complaint is poor performance, don't just assume that it is the engine without first checking out the vehicle drive--the drive belt could be loose or worn or the track could be binding. If these items check out OK, then go back to the engine. Do the easiest things first--make a visual check for loose connections, broken wires, etc. If you find that the problem is poor compression due to internal damage, don't just replace the damaged parts--look for and correct the causing factors which are usually fuel related.

Although parts may work loose, crack or break simply because they were not tightened properly in the first place, the rough terrain so common to vehicles powered by 2-cycle engines is very conducive to vibration and the resulting loosening of nuts, bolts, etc. Periodically check for and retighten engine mounts, air cooling shrouds, intake manifolds, starter mounts, etc. Other sources of damage from vibration are: unevenly worn drive belts, missing cleats, misaligned drive components, low or flat tire on ATV or sudden shocks and jarring from riding over railroad ties or along rough washboard roads and trails.

The following chart is presented as a guide to systematic trouble shooting. It lists some of the most common causes--for example, if the engine does not start, it may also be due to poor compression which you'll note is not checked; however, the factors which are checked are perhaps the most likely causes. Note too that the problems are grouped under fuel, ignition and compression with the more easily detected causes and easiest remedies listed first. Use this as a check list for faster, more accurate trouble shooting.

## TROUBLE SHOOTING GUIDE

ENGINE PROBLEM	POSSIBLE CAUSES (SEE DETAILS BELOW AND ON NEXT PAGE)					
	NO FUEL	INCORRECT FUEL	TOO MUCH FUEL	NO IGN. SPARK	POOR IGNITION	POOR COMPRESSION
WILL NOT START	X		X	X		
HARD STARTING		X	X		X	X
LACKS POWER		X	X		X	X
POOR ACCELERATION		X	X		X	X
PINGS UNDER LOAD		X			X	
BACKFIRES, RUNS UNEVENLY		X			X	
STOPS OR STALLS SUDDENLY	X			X		X

### FUEL RELATED CAUSES

#### NO FUEL

1. Tank empty
2. Fuel valve turned off
3. Tank vent closed or plugged
4. Line disconnected
5. Line kinked, plugged
6. Filter, screens blocked
7. Impulse tube off or plugged

#### INCORRECT FUEL

1. Stale fuel - won't vaporize
2. Air leaks - loose components
3. Improper fuel and/or mixture
4. Carburetor set wrong
5. Fuel lines restricted
6. Exhaust port blocked
7. Vapor lock

#### TOO MUCH FUEL

1. Overchoking, flooded
2. Restricted air intake
3. Carburetor set wrong
4. Carburetor malfunctioning
5. Wrong carburetor
6. Choke left on

## FUEL SYSTEM TESTS:

FUEL IN COMBUSTION CHAMBER: If engine won't start, remove spark plug, if electrodes are wet this probably indicates fuel is getting to engine. If dry, check out system from carburetor back to tank.

FUEL TO CARBURETOR: If fuel flows out of carburetor and from inlet line when disconnected from carburetor, this indicates fuel is getting this far.

## IGNITION RELATED CAUSES

### NO IGNITION SPARK

1. Switch turned off
2. Leads disconnected or broken
3. Bad plug
4. Ignition switch faulty
5. Breaker points oxidized
6. Breaker points stuck
7. Condenser faulty
8. Ignition coil faulty

### POOR IGNITION

1. Plug wet
2. Plug gap incorrect
3. Plug carbon fouled
4. Wrong plug
5. Breaker points dirty or bad
6. Point gap wrong
7. Timing wrong
8. Condenser weak

## IGNITION TESTS

SPARK PLUG: Remove plug, set gap at .020", place plug with side electrode against cylinder head then crank engine at speed sufficient to produce a good spark--if a sharp snappy spark is noted between the electrodes, this eliminates the ignition components as the fault--wrong timing could however be causing problems.

SWITCH: Unplug the switch (disconnect all terminals)--if the engine can be started with switch disconnected, check for wrong connections or if none are found replace the switch.

CONDENSER: Use commercial condenser tester per tester manufacturer's instructions--bad condenser will cause premature failure of points.

COIL: Check on coil tester--continuity must be indicated.

## COMPRESSION RELATED CAUSES

### POOR COMPRESSION

1. Spark plug loose
2. Head loose
3. Head gasket leaking
4. Piston rings sticking
5. Cylinder badly worn
6. Burned piston

### ABNORMAL COMPRESSION

1. Build up of carbon
2. Wrong head

COMPRESSION TEST: Most causes of poor compression are readily evident. If none of the easier tests reveal the cause, it will be necessary to disassemble heads and cylinders to find reason. Insufficient fuel is often the primary factor leading to damage to pistons and cylinders--check out this system too.

## PREVENTIVE SERVICE SCHEDULE

SERVICE AT INTERVALS INDICATED	EVERY 50 HOURS	100-150 HOURS	200-250 HOURS
SPARK PLUG: Check condition, reset gap	-----X		
SPARK PLUG: Replace with new plug	-----	-----X	
BREAKER POINTS: Check, regap, retime ignition	-----	-----X	
COMBUSTION CHAMBER: Remove carbon	-----	-----X	
EXHAUST PORT: Clean out deposits	-----	-----	-----X
PISTON RINGS: Clean carbon, free rings	-----	-----	-----X

# FUEL, FUEL SYSTEM

## FUEL REQUIREMENTS

Since most 2-cycle engines, including Kohler, receive lubrication only from the oil which must be mixed in with the gasoline, it is of utmost importance that the oil be of proper quality and thoroughly mixed plus mixed in the correct proportions. On Kohler Engines the correct ratio of gasoline to oil is 40 to 1. If there is proportionately too little oil, overheating, scuffing and scoring, and eventual seizure are certainties. Too much oil, on the other hand, causes incomplete combustion and rapid build up of carbon which badly fouls spark plugs and often becomes especially heavy on top of the piston.

**GASOLINE:** A good quality REGULAR grade gasoline with an octane rating of at least 92 is required. Premium grades may also be used. The use of Premium may, in fact, be beneficial especially in warmer weather in preventing detonation or after-run conditions. Heavier build-up in the combustion chamber may, however, be expected when using Premium because these fuels contain greater amounts of lead additives which leave deposits. The new non-leaded gasoline fuels have not yet been approved for 2-cycle operation. Promote using "name" brand gasolines purchased from popular service stations to avoid stale gasoline or leftover gasoline not adjusted to seasonal changes.

**OIL REQUIREMENTS:** Air-cooled operation encompasses more widely varying speeds and much higher combustion chamber temperatures than experienced with water-cooled engines. For this reason, out-board type motor oils are definitely not suitable for use in 2-cycle air-cooled engines. Automotive type multi-viscosity oils are also not suitable because they contain many additives not intended for 2-cycle type operation.

Always recommend using an SAE 40 weight, diluted, 2-cycle air-cooled type motor oil. A good quality SAE 30 weight 2-cycle air-cooled type oil may be used as a temporary substitute; however, a diluted oil does have some advantages. The diluent makes the oil pour more freely, even more important at low temperatures common to many 2-cycle applications. As oil gets colder, one of its ingredients takes on an interlocking crystalline form which bind together until finally the oil solidifies and becomes too thick to pour--a diluent blocks formation of these crystals.

A quart of oil should be mixed with 10 gallons of gasoline to attain the fuel to oil ratio of 40 to 1 for Kohler Engines. A dye is usually included to give the user visual proof that oil has in fact been mixed in with the gasoline. For correct mixing, always pour some of the gasoline into the container first then add the oil, agitate this partial mixture then add the rest of the gasoline. Many filling station operators will pour the oil into the can first. They think that pump pressure is adequate to mix the fuel and oil. This method does not mix properly. Don't do it this way! Agitate thoroughly after final amounts are in the can. Once mixed, the oil will remain in solution indefinitely. If, however, storing fuel for any length of time, add a gasoline stabilizer to prevent oxidation and the resulting formation of varnish and corrosive acids which will ruin an engine.

In addition to using a poor grade of gasoline and oil or improperly mixed fuel, there are numerous other conditions which result in operation with insufficient lubrication. The most prevalent cause is perhaps the incorrectly adjusted or malfunctioning carburetor. Other causes are partially blocked filters or screens, kinked or pinched fuel lines, wrong size fuel lines, plugged vent hole in gas cap and a cracked or loose impulse tube.

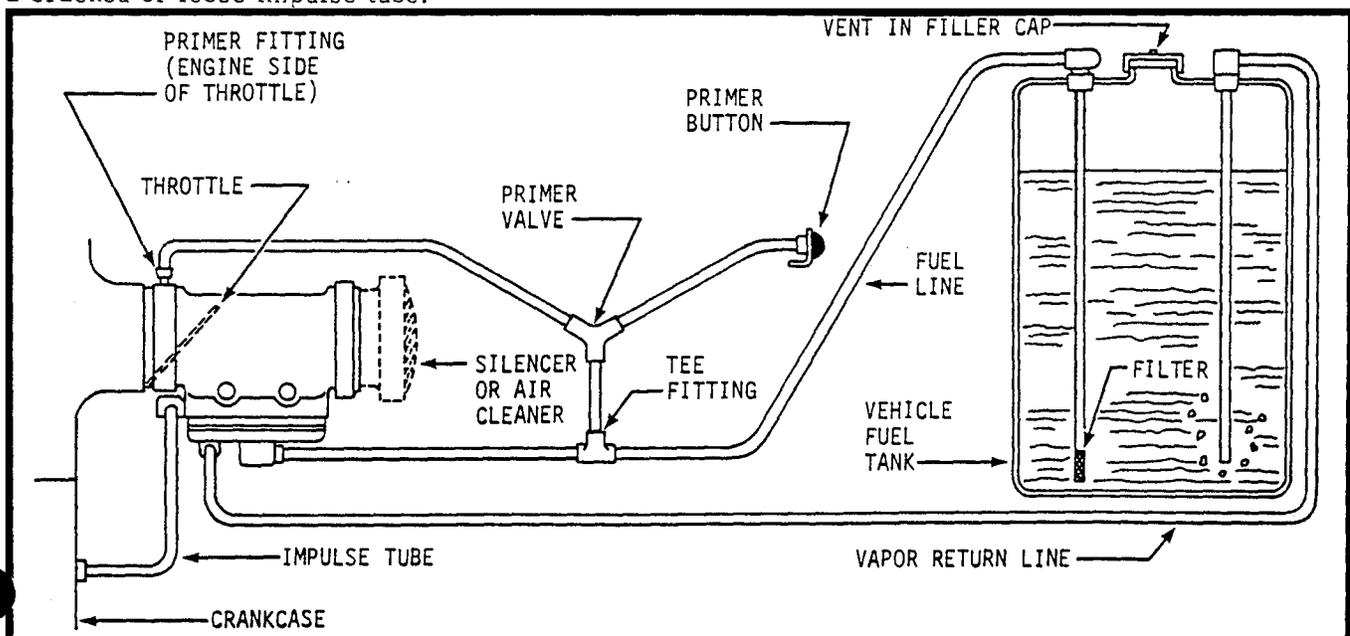


FIGURE 2-1 -- SCHEMATIC OF A TYPICAL 2-CYCLE ENGINE FUEL SYSTEM

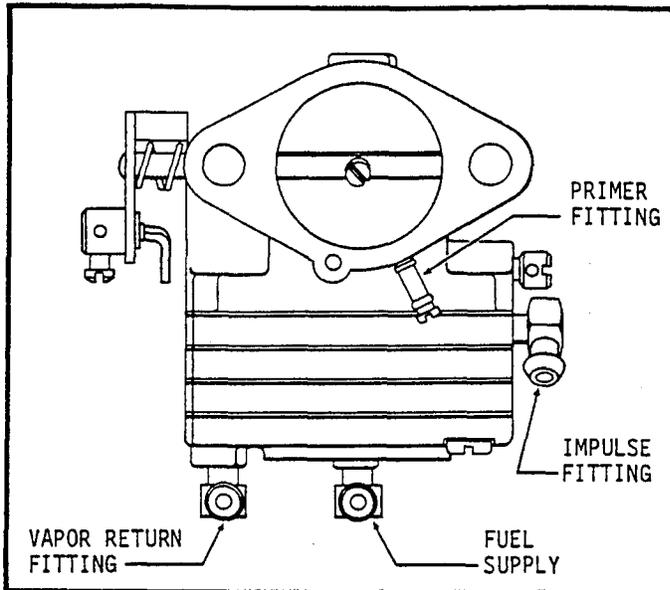


FIGURE 2-2 -- MODEL WR CARBURETOR

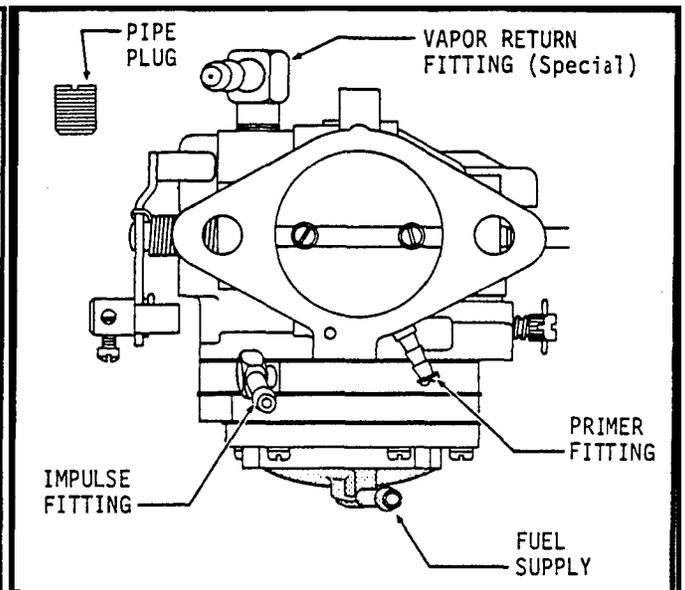


FIGURE 2-3 -- MODEL HR CARBURETOR

With the possible exception of the carburetor, fuel system components are usually furnished by the vehicle manufacturer but since these parts can seriously affect engine operation, some of the main points about each are brought out in the following.

Fuel tank filler caps must be vented. If a vent is not provided or if it becomes clogged, fuel starvation will result. Several different types of filler caps are in use. One type combines a fuel gauge with the cap--some of these have an open vent hole while others have a screw type valve which can be closed to prevent loss of fuel thru evaporation. Vent holes in caps are usually formed with baffled configuration to prevent entrance of foreign material.

In addition to the screen in the tank, there is a filter screen in the carburetor. Full flow filters, often of the see thru kind, are frequently inserted in the fuel line between the tank and carburetor. These cannot be overlooked as potential source of fuel starvation.

If replacing any fuel system components make sure they meet the vehicle manufacturer's specifications, for any part that restricts flow of fuel not only results in operation with insufficient gasoline, but more important, insufficient lubrication.

**IMPULSE TUBE:** This tube transmits pulsating crankcase pressures to the diaphragm of the carburetor for pumping fuel. If replacing an impulse tube, make sure the replacement is the same length. If the tube length is greater than 8", pumping action is lost. With WR and WD carburetors, the tube is connected to the #1 cylinder--with HR and HD carburetors, the tube is connected to #2. Change impulse location if changing from one type of carburetor to another.

**VAPOR RETURN LINES:** If the area around the carburetor or air into the carburetor becomes hot enough to vaporize gasoline inside the carburetor, the pockets of vapor so formed will stop all flow of fuel--whenever this occurs, the engine will remain vapor locked and will not run until the temperature drops low enough for the vapor to return to liquid state again. The best way to avoid vapor lock is to use a carburetor having vapor return--with this feature, any vapor forming is directed back thru a separate return line into the tank where the pressure can be relieved.

## CARBURETORS

Diaphragm type carburetors are used on some Kohler 2-Cycle Engines while float type carburetors are used on other models--the float type carburetors are furnished by the equipment manufacturer. The main job of any carburetor is to meter a correct amount of fuel for all load or speed conditions and in so doing, to change fuel from liquid to vapor and mix this with air in correct proportions to form the volatile gas needed for combustion. These diaphragm type carburetors provide an additional function of pumping fuel from the storage tank.

**CARBURETOR:** Don't change carburetor settings as this affects the amount of lubrication your engine receives. Since the optimum setting varies with each application due to differences in carburetors, mufflers, power requirements, etc., the settings are not published in this manual.

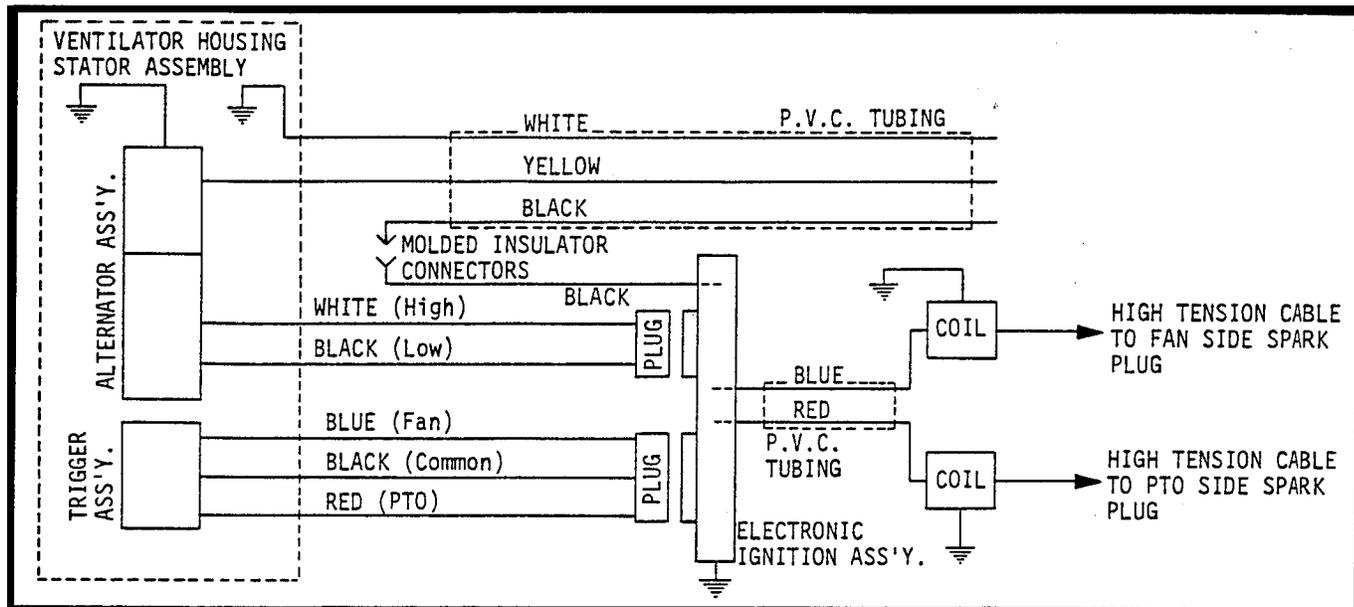


FIGURE 3-2 -- WIRING DIAGRAM: CAPACITOR DISCHARGE IGNITION SYSTEM

## SPARK PLUGS

**SPARK PLUG SELECTION:** Observe color of electrodes when removing plug as this often gives a good indication of operating conditions. Take the necessary corrective action if other than normal operation is indicated--the indicators are:

BLACK	TAN	WHITE
CARBON FOULING	NORMAL	OVERHEATING

Replace plug if carbon fouled or if porcelain is cracked. Do not sandblast, scrape or otherwise attempt to service a plug that is in poor condition--best results are obtained with a new plug. Use plugs selected from the accompanying chart only.

**SPARK GAP (ALL PLUGS).... .020"**  
**TIGHTENING TORQUE ... 18 FT. LBS.**

### SPARK PLUG RECOMMENDATIONS

Engine Model	Plug Size	Kohler Part Number		Bosch Number		Champion Number	
		Normal Duty	Normal Duty	Normal Duty	Heavy Duty*	Normal Duty	Heavy Duty*
K295-2T	14mm	38 132 03	W 260 T2	W 260 T2	W 280 T20S	N2	N57
K295-2AX	14mm	38 132 03	W 260 T2	W 260 T2	W 280 T20S	N2	N57
K340-2T	14mm	40 132 02	W 260 T1	W 260 T1	W 280 M1	L78	L77J
K340-2AX	14mm	38 132 03	W 260 T2	W 260 T2	W 280 T20S	N2	N57
SK340-2AS	14mm	—	—	—	—	N19V**	—
K399-2T	18mm	33 132 02	M 240 T1	M 240 T1	M 260 T1	K8	K7
K399-2AX	14mm	38 132 03	W 260 T2	W 260 T2	W 280 T20S	N2	N57
K440-2T	18mm	33 132 02	M 240 T1	M 240 T1	M 260 T1	K8	K7
K440-2AX	14mm	38 132 03	W 260 T2	W 260 T2	W 280 T20S	N2	N57
K440-2AS	14mm	—	—	—	—	N19V**	—
K618-2	18mm	—	M 240 T1	M 240 T1	M 260 T1	K8	K7

\*Heavy duty plugs for all terrain vehicles and summer use. \*\*Use surface gap spark plugs only.

# IGNITION SYSTEMS

## FLYWHEEL-MAGNETO IGNITION

Two types of flywheel-magneto ignition systems are used. One type has 2 primary (low tension) ignition coils on the stator while the other type uses a single primary ignition coil. Both systems have 2 external high tension coils--one for each spark plug. Without actually checking the stator to see if it has single or double primary coils, the only way to tell which system is used is by checking the color of the ignition leads off the primary coil or coils. If a solid blue lead and a blue-white are found, the system is the two primary coil type. The two ignition leads are color coded solid blue and blue-red on the single primary coil system.

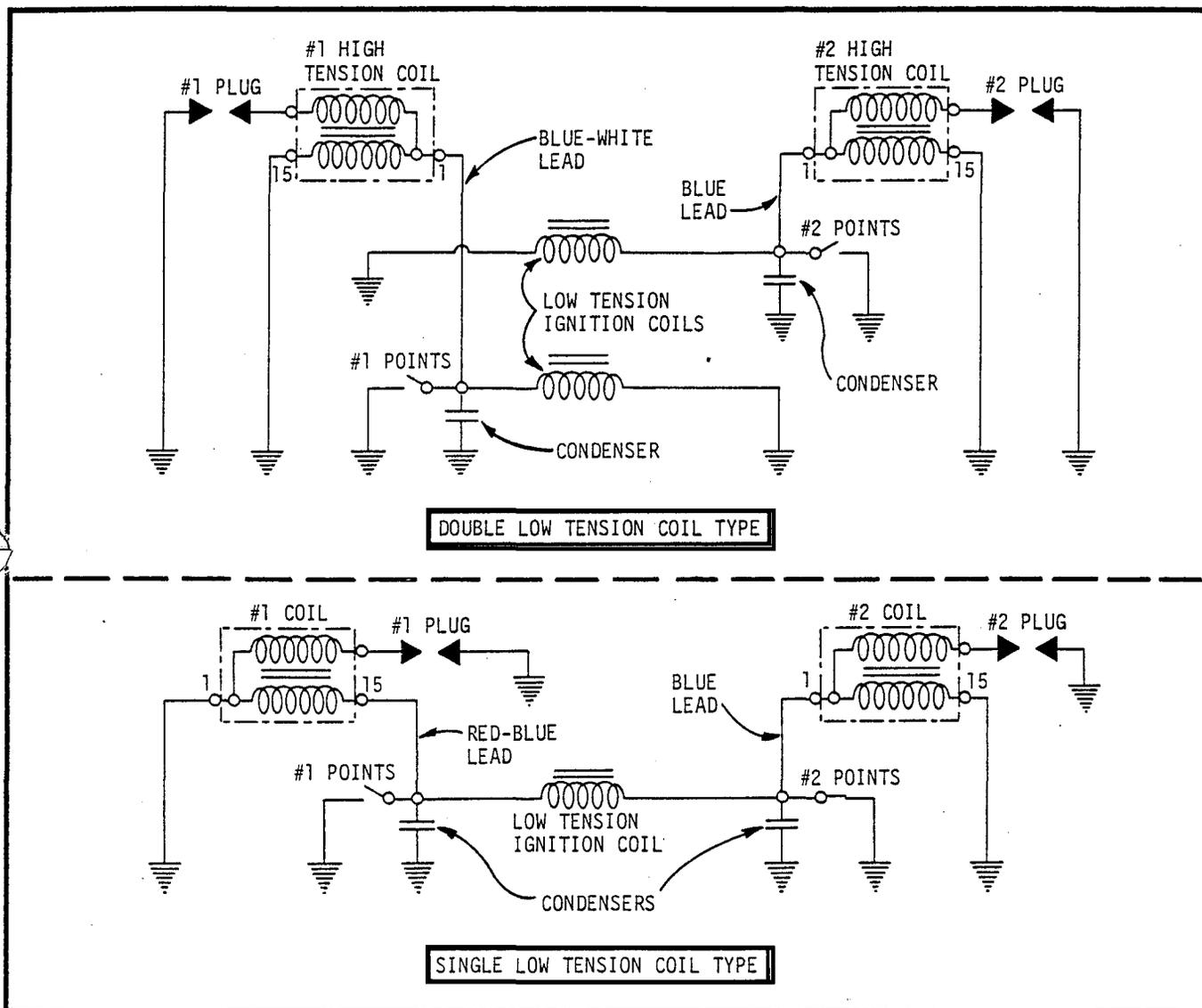


FIGURE 3-1 -- SINGLE AND DOUBLE PRIMARY COIL IGNITION CIRCUITS

The ignition leads are not connected the same on the two systems--after identifying which system is involved, connect the ignition leads to the numbered terminals of high tension coils as shown in the accompanying diagrams. Reversing the leads may result in damaged coils on the two primary coil system--on the single primary coil system, a weaker spark will be produced if improperly connected. This will usually be evident by immediate and repeated fouling of the spark plug electrodes.

## CAPACITOR DISCHARGE IGNITION

Engines with model suffix designation AS are equipped with Kohler-Tron solid state capacitor discharge ignition (CDI) system. Surface gap (Champion N19V or equivalent) spark plugs are used with this type ignition. This system, which is shown schematically in Figure 3-2, is described in detail starting on page 3.6.

## BREAKER POINTS

After about every 100 - 150 hours, remove the retractable starter, pulley drive cup and breaker cover to check condition of gap setting of the breaker points. You may have to rotate the crankshaft until the points become visible through the openings in the flywheel-magnet ring assembly. Turn crankshaft until points are wide open. If the points are dirty, clean them off with a small brush--if oily, dip the brush in gasoline first then blow out the gasoline with compressed air. If points are pitted or built-up, it is best to replace the set.

To replace points, remove blower housing first then flywheel to gain access to points. After this is done, remove terminal nut and disconnect lead running to the condenser, remove circlip and adjusting screw then lift point assembly off the retaining pin. Reverse procedure to install new set. Remember to adjust point gap and retune the ignition after installing new points.

To adjust point gap, turn the engine until the points are wide open--the rubbing block will then be at the highest point on the cam. Insert feeler gauge between points to measure gap--if correctly gapped, it will be .016" (.014 to .018"). If adjustment is needed, loosen adjusting screw, insert screwdriver blade in adjusting notches and move until gap is at .016. On 2 cylinder engines, repeat procedure for the second set of points. Retune engine with timing tool after adjusting, replacing or servicing points.

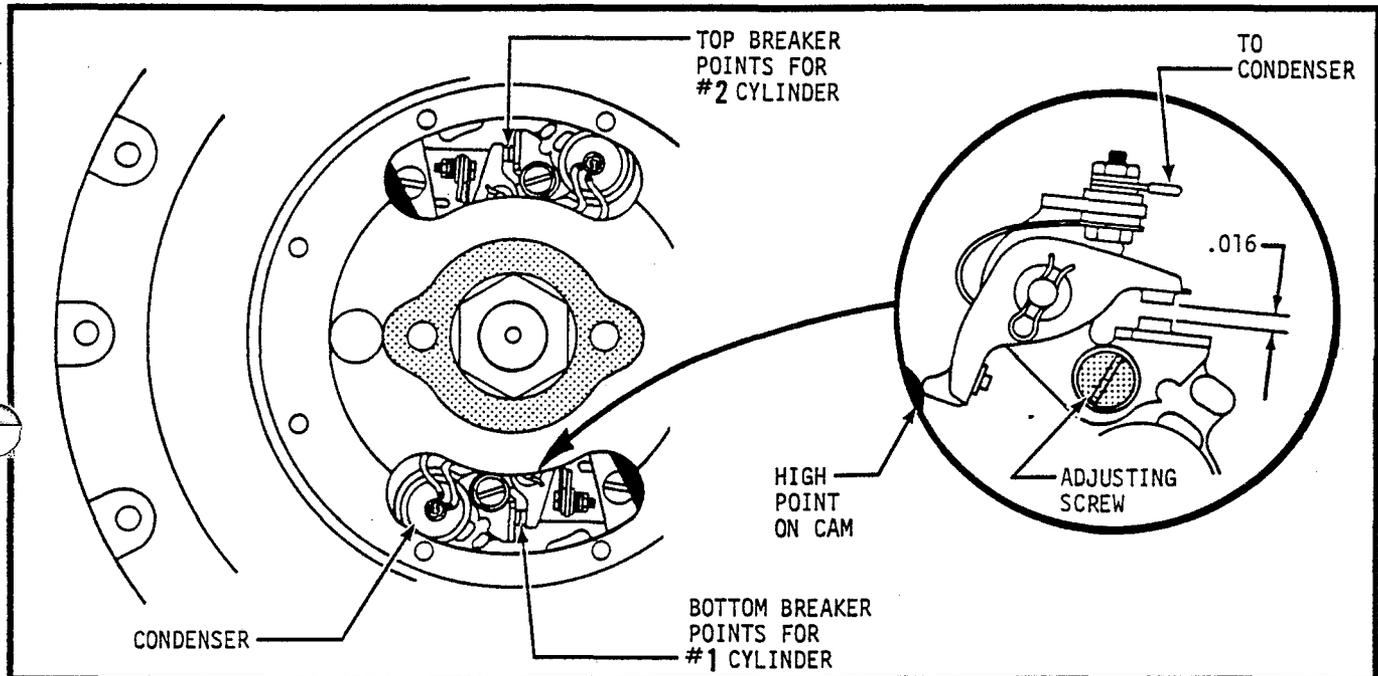


FIGURE 3-3 -- BREAKER POINTS, CONDENSER LOCATED UNDER FLYWHEEL OR HUB

## CONDENSER

If the condenser shorts out, the system will be unable to produce full output. If it decreases in capacitance, the output voltage will be greatly reduced and the ignition points will burn excessively. If badly burned breaker points occur too frequently, the condition of the condenser should be suspected. If condenser has too little capacitance, metal will transfer from the stationary contact to the movable contact. If capacitance is too high, metal will build up on the stationary contact.

The condenser may be tested with an ohmmeter or a commercial condenser tester. To check with the ohmmeter, remove the condenser then connect leads between the condenser lead and a good ground on the engine. At first, a low resistance should be indicated; however, this should very quickly rise to a high value. If low resistance is indicated continuously, the condenser is definitely faulty and must be replaced. When using a commercial condenser tester, follow instructions given by the tester manufacturer.

To replace condensers, it is necessary to remove the blower housing, flywheel, and detach the stator plate from the bearing plate. Use a Kohler condenser removal tool to avoid damaging stator--follow instructions included with the tool.

## IGNITION COILS

Ignition coils, internal or external, do not require regular service; however, keep them clean and check terminals frequently to see that connections are tight. Rubber nipples must be in good condition to prevent leakage across exposed surfaces.

## TIMING PROCEDURE (REFER TO PAGE 3.9 FOR TIMING ENGINES WITH CDI IGNITION)

The only accurate way to check timing is with a flashlight type continuity tester and dial indicator installed in place of the spark plug as shown in the accompanying illustration. With these tools it is possible to determine the exact location of the piston at the precise instant when ignition occurs. Timing specifications are given in inches of piston travel (before top dead center) with timing in the full advance position. Timing can be changed by resetting breaker point gap and also by shifting position of the stator plate. Since no two people set point gap exactly alike, range of .014-.018" is stated to account for this variation, however, keep the gap setting as close as possible to .016". When points are wide open and adjusted properly, only a slight drag should be felt on the .016" feeler gauge. Always recheck gap setting after tightening the adjusting screw as this sometimes alters the gap. Use the following procedure to check ignition timing:

1. Remove spark plugs and install timing tool in #1 cylinder first on twin cylinder models.
2. Connect timing light leads between black ignition lead (for #1 first) and good ground on engine--turn light on.
3. Adjust point gap as close as possible to .016"--do this to both sets of breaker points on twins. Recheck gap after retightening adjusting screw as this sometimes changes the gap.
4. Turn flywheel clockwise until piston is at TDC (dial will suddenly reverse direction) then set dial at zero at this point.
5. Move timing advance lever into full advance and hold this position while checking timing.
6. Turn flywheel counterclockwise until light change is noted--if this occurs when dial indicator is within range, repeat procedure on #2 cylinder. If light changes when indicator is outside the specified timing range, readjust timing per the following instructions.

**TIMING ADJUSTMENT:** First try to correct timing by making slight changes to point gap setting--if the timing light change occurred before the indicator reached the specified timing point, increase gap slightly. If it goes past the specified range, decrease the gap slightly. If timing cannot be brought within range by changing the point gap, it will be necessary to reset the gap at .016" then shift the stator until timing is within specifications. After timing is corrected for #1, check timing on #2 cylinder--don't readjust #2 by shifting the stator plate as this would throw timing off for #1--adjust #2 by changing point gap only.

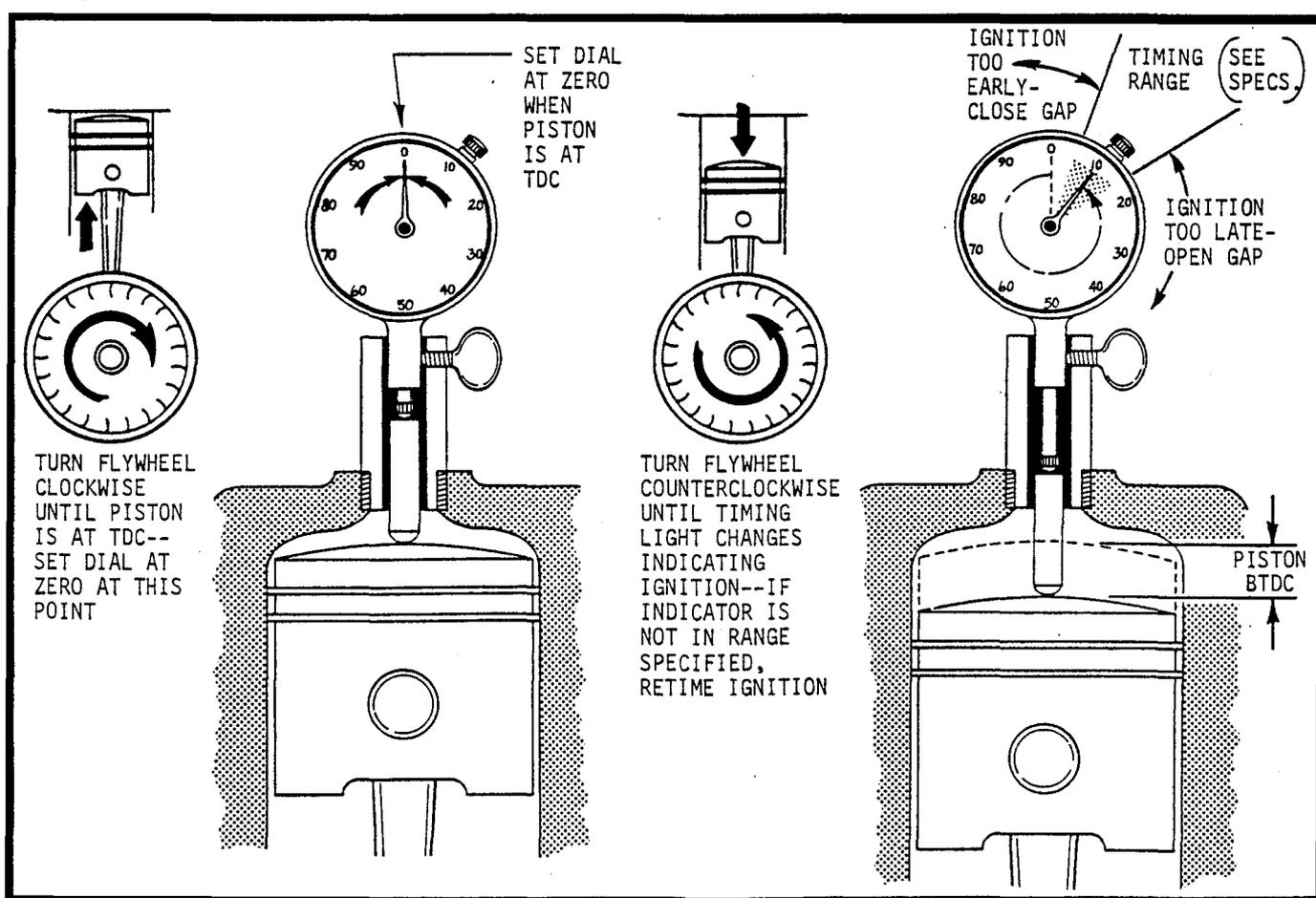


FIGURE 3-5 -- IGNITION TIMING PROCEDURE WITH TIMING GAUGE

# CAPACITOR DISCHARGE IGNITION

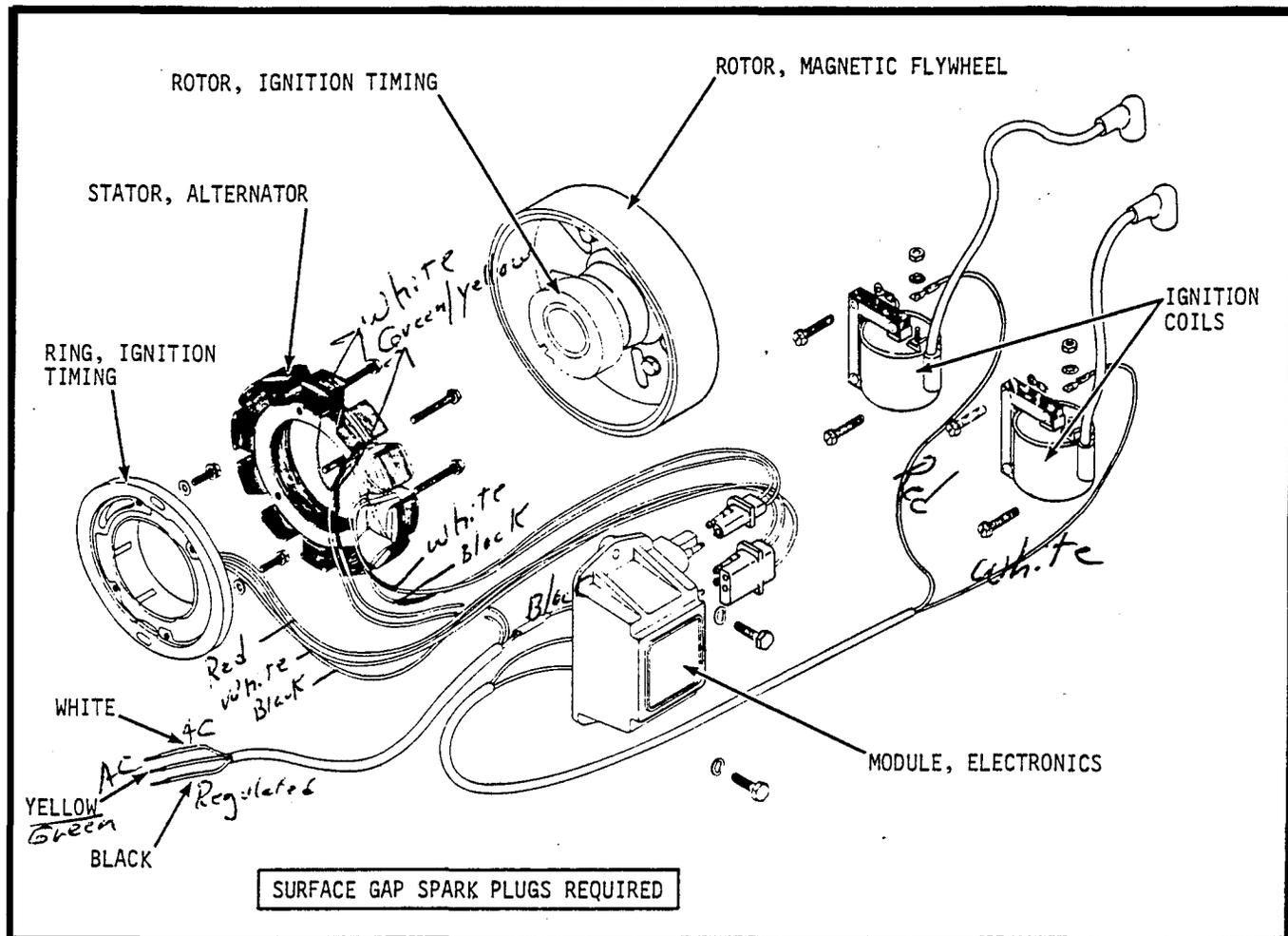


FIGURE 3-7 -- MAIN COMPONENTS OF KOHLER-TRON IGNITION SYSTEM

The KOHLER-TRON Ignition System is a combination permanent magnet flywheel alternator and solid state capacitor discharge ignition system. The magnet supplies the high voltage for ignition and generates the current required for battery charging and/or for lighting systems.

**OPERATION:** The flywheel rotor, which incorporates a special flexible magnet and is mounted on the engine crankshaft, revolves around the alternator stator which is fixed to the engine. Current is generated in the windings on the twelve poles of the stator plate, nine of which supply power for the vehicle's lights and/or for charging the battery, and three of which supply power for ignition.

The electronic module incorporates the ignition condensers and the necessary solid-state circuitry for charging and discharging them. The timing rotor, revolving within the timing ring, triggers the discharge of these condensers through the electronic box to the ignition transformers, which "step up" the voltage to a level necessary to insure successful firing of the surface gap spark plugs.

## TROUBLE SHOOTING THE IGNITION SYSTEM

**PRELIMINARY CHECKS:** Check all plugs in connections to make certain they are clean and tight. Check all leads to make certain one is not broken or has rubbed through the insulation and is grounding out. Since the ignition system and charging system operate independent of each other, the trouble shooting and service procedures are separated into their respective sections.

Disconnect a plug wire from one cylinder and connect it to a test plug (Wico #14281). Turn the switch to the on position, then pull the starter and check for a spark at the test plug. Test both cylinders in the same manner. If sparks are observed at the test plug, for both cylinders, the problem lies elsewhere in the engine (carburetion, timing, or mechanical failure).

1. If a spark discharge is observed at one cylinder but not the other, the problem lies in the coil or high tension lead; the timing ring, or the electronics module. The easiest method for locating

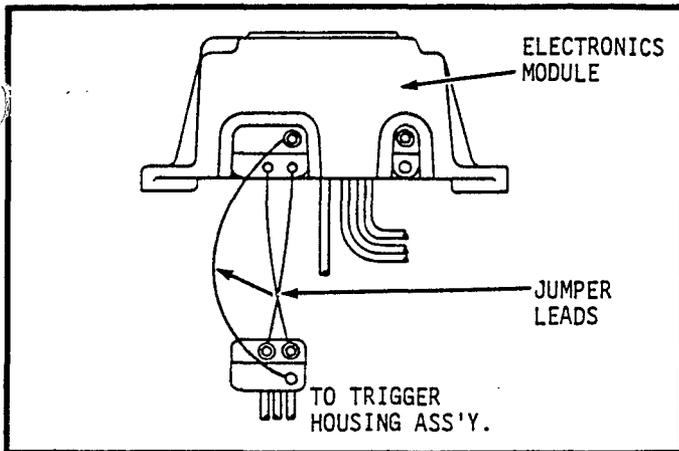


FIGURE 3-8 -- ELECTRONICS MODULE TEST

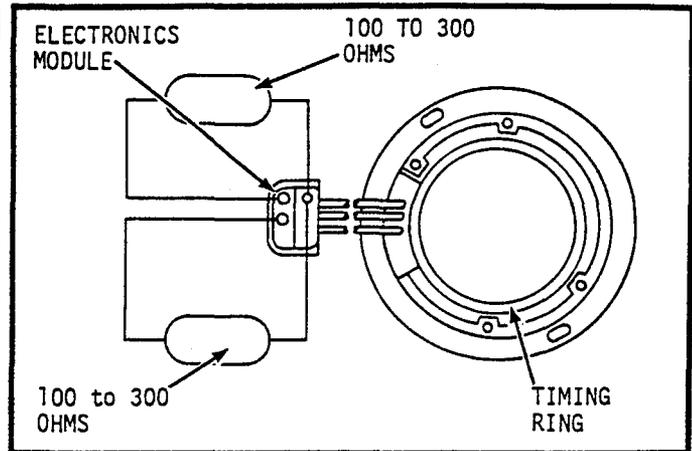


FIGURE 3-9 -- TIMING RING TEST

the faulty component is to use an ohmmeter and measure resistances. The ohmmeter test procedure for resistance values is stated later; however, if an ohmmeter is not available the following test procedure can be used.

- A. **Coil Test** - Disconnect the primary lead from the nonfiring coil. (red or white lead). Disconnect the primary lead from the firing coil and install it on the nonfiring coil. Do not hold the primary lead on the coil primary terminal as a severe electrical shock may result. Turn the ignition switch on and pull the starter. If the nonfiring coil now produces a spark, the coil is good. Reconnect the primary leads to the proper coils and proceed to timing ring test. If the nonfiring coil still does not produce a spark, the coil is defective and must be replaced. (Check high tension lead before replacing coil)
- B. **Timing Ring and Electronics Module Test** - Make three short jumper leads terminated with one male and one female bullet type connector to mate with the terminals in the three lead plug-in connector at the electronics module. (Could use jumper leads with small alligator clips.) Unplug the three lead plug-in terminal from the electronics module. Connect the three jumper leads as shown in Fig. 3-8. (Make sure of good electrical connections.) Turn the ignition switch on and pull starter. If the nonfiring coil now produces a spark, the problem lies in the timing ring and it must be replaced. If the nonfiring coil still does not produce a spark, the problem lies in the electronics module and it must be replaced.

**NOTE:** Do not operate the starter with the plug-in connectors completely disconnected from the electronics module. Internal damage can result to the electronics module.

2. If spark discharges are not observed at either cylinder, the system will have to be tested with an ohmmeter or checked by replacing components. However, before testing the system, make certain the on-off switch is not the problem. Disconnect the lead from the switch, position the lead so the terminal cannot contact ground, and again check for spark discharges at the test plug.

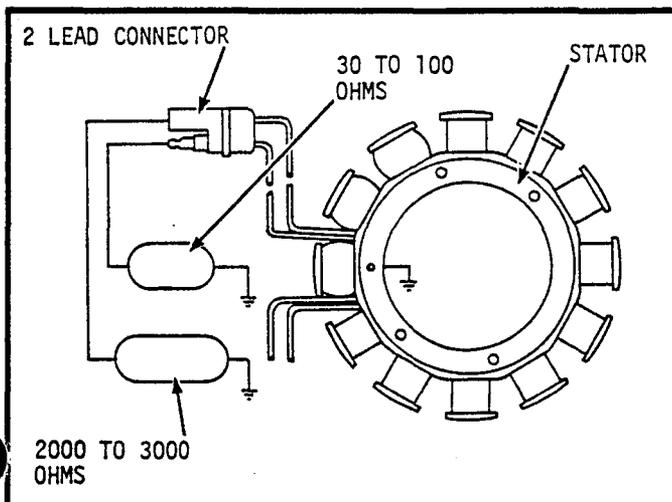


FIGURE 3-10 -- ALTERNATOR STATOR IGNITION TEST

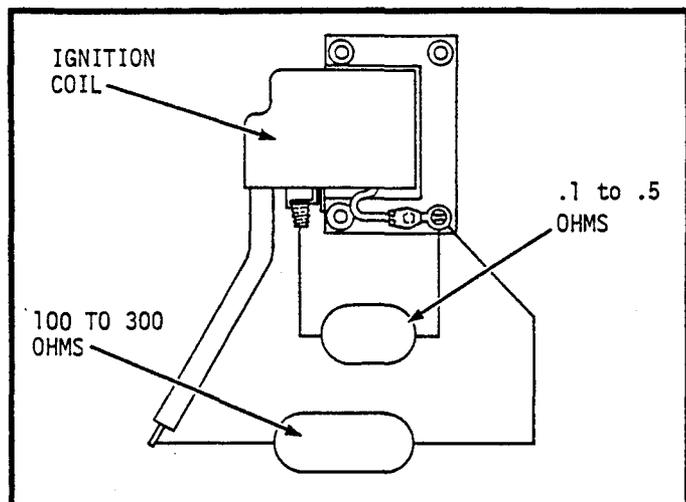


FIGURE 3-11 -- IGNITION COIL TEST

## COMPONENT REPLACEMENT METHOD

If component replacement is going to be used to locate the faulty component, the following sequence is recommended.

1. Ignition Coils
2. Electronics Module
3. Alternator Stator
4. Timing Ring
5. Flywheel

## OHMMETER TEST PROCEDURE

Make certain the ohmmeter being used is accurate and the batteries are fresh. Periodically zero the meter during the tests.

**STEP 1:** Unplug the three-lead connector from the electronics module and make the following checks at the connector on the wiring harness. Connect the ohmmeter leads between the red lead terminal and the white lead terminal. The ohmmeter should indicate between 100 and 300 ohms. Connect the ohmmeter leads between the white lead terminal and the black lead terminal. The ohmmeter should indicate between 100 and 300 ohms. Connect one ohmmeter lead to the engine block. Then check the three terminals with the other ohmmeter lead. The ohmmeter must indicate an open circuit (infinity) at all three terminals. (See Fig. 3-9) If these readings are not obtained, the timing ring assembly is defective and must be replaced.

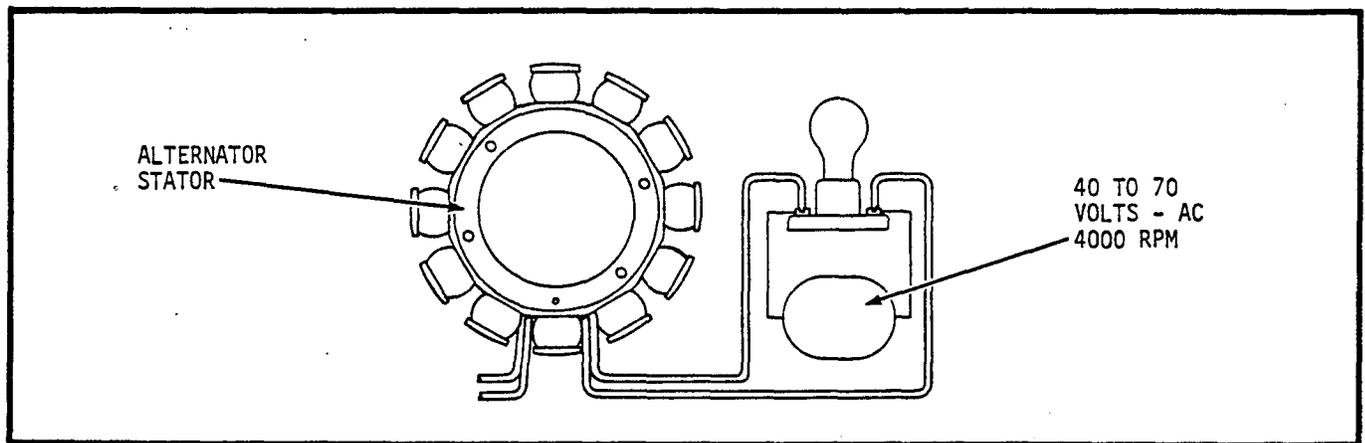


FIGURE 3-12 -- ALTERNATOR STATOR AC OUTPUT TEST

- STEP 2:** Unplug the two-lead connector from the electronics module and make the following checks at the connector on the wiring harness. (See Fig. 3-10) Connect one ohmmeter lead to a good ground connection on the engine block. Connect the other ohmmeter lead to the black lead terminal. The ohmmeter should indicate between 30 and 100 ohms. Remove the ohmmeter lead from the black lead terminal and connect it to the white lead terminal. The ohmmeter should indicate between 2000 and 3000 ohms. (Change scales and reset ohmmeter to zero if necessary.) If these readings are not obtained, the stator assembly is defective and must be replaced.
- STEP 3:** Remove the coil cover to expose the ignition coils. Check each coil separately. Remove the primary lead from the coil (red or white lead). Connect one ohmmeter lead to the primary terminal stud on the coil. Connect the other ohmmeter lead to the ground connection at the coil. (See Fig. 3-11) The ohmmeter should indicate .1 to .5 ohms. Because of the low primary resistance, make certain the ohmmeter has been set to zero. Remove the ohmmeter lead from the ground connection and connect it to the spark plug wire terminal. The ohmmeter should indicate 100 to 300 ohms. If the above readings are not obtained, the coil is defective and must be replaced. Use the same procedure to test the other coil. (Check high tension lead before replacing coil.)
- STEP 4:** If all tests to this point have been within the listed specifications, the trouble presumably lies in the electronic package. Because of the many variables involved when testing solid state componentry with an ohmmeter, we suggest checking the electronic package by replacement only.

## TROUBLE SHOOTING THE ALTERNATOR SECTION

The alternator can be tested for output using either an AC voltmeter or a 60 watt 125 volt light bulb with test leads. To test the alternator it will be necessary to disconnect the green/yellow lead and white lead from the system wiring. A preliminary check of the alternator can be made with an ohmmeter to determine if the leads or stator are open or grounded. The resistance of the stator assembly should be 0.2 to 0.6 ohm when checked between the green/yellow lead and white lead. The ohmmeter should read infinity when checking between either lead and the engine housing. No reading across the two leads would indicate an open circuit and a reading from either lead to ground would indicate a grounded circuit. If a problem is indicated, check the lead wires for worn or broken insulation or a broken lead.

**TESTING OUTPUT-AC VOLTMETER:** Connect the AC voltmeter to the green/yellow lead and white lead. (See Fig. 3-12) Start the engine and run the speed up to approximately 4000 RPM. The AC voltmeter should indicate 40 to 70 volts.

**TESTING OUTPUT-TEST BULB:** Connect the test bulb to the green/yellow lead and white lead. (See Fig. 3-12) Start the engine and hold the speed at approximately 2000 RPM. The test bulb should have a soft orange glow. The bulb should get brighter, as the engine speed is increased. At approximately 7000 RPM, the bulb should be about normal brightness.

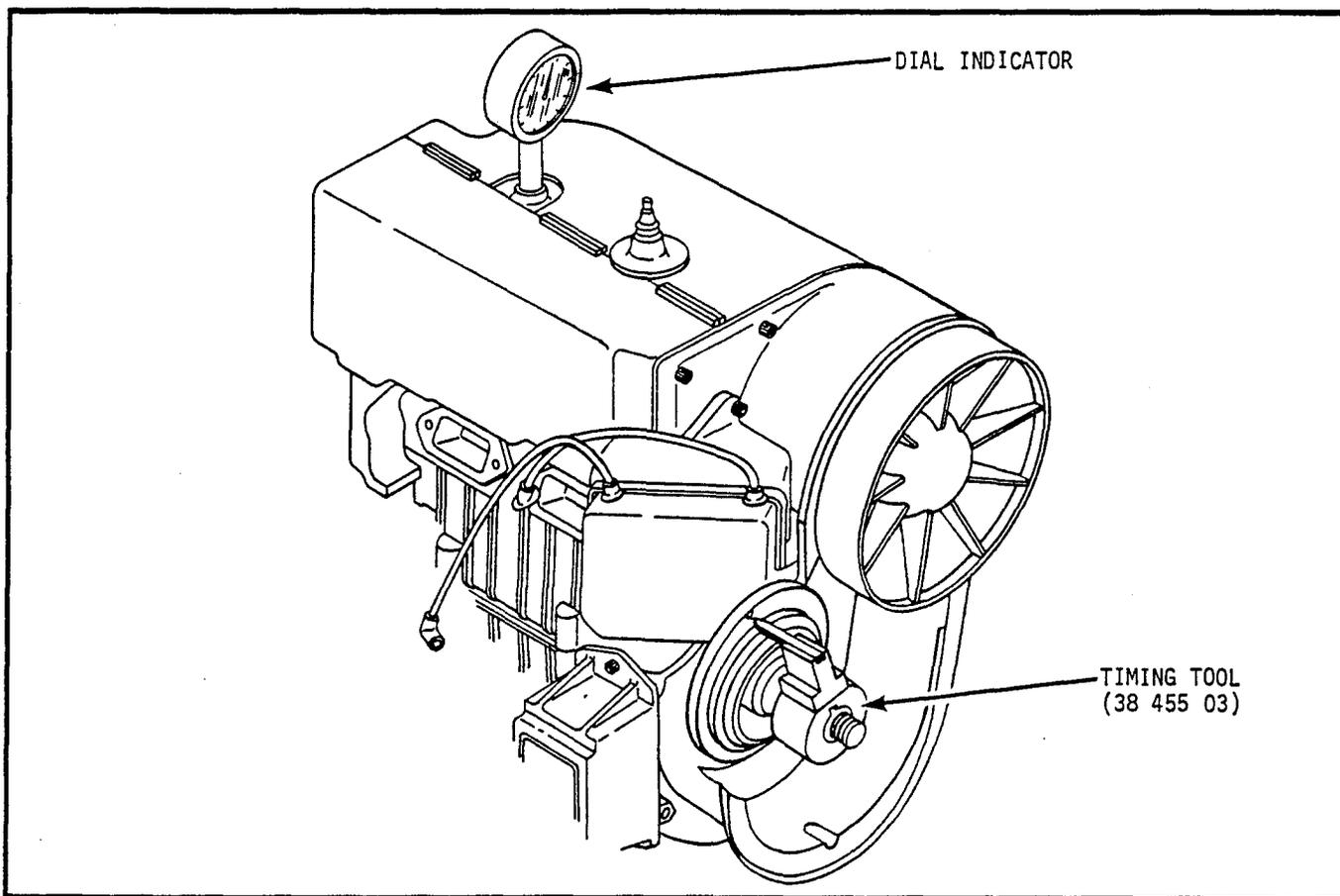


FIGURE 3-13 -- TIMING KOHLER-TRON SYSTEM WITH TIMING TOOL

## TIMING ENGINES WITH KOHLER-TRON IGNITION

**TIMING:** Use the following procedure to time the ignition on engines with the capacitor discharge system.

**STEP 1:** Remove recoil, starter cap, sheaves, flywheel assembly, stator assembly and spark plugs.

**STEP 2:** Install dial indicator in #1 cylinder spark plug hole, set dial at "0" with piston at TDC, install Kohler timing tool part #38 455 03 on crankshaft as illustrated making sure the tool is all the way on the crankshaft key and taper, loosen the two trigger ring screws.

**STEP 3:** Rotate crankshaft counter clockwise until 0.95-0.100 BTDC is indicated on the dial, rotate trigger ring until pointer on tool is matched with timing mark (timing mark is the long mark in the middle) on the trigger ring, tighten the two screws on trigger ring.

# ELECTRICAL SYSTEMS

There are several types of electrical charging systems in use on the two cylinder models. Electric start K618-2 engines use a belt driven motor-generator system while other electric start models, with the exception of the SK340-2AS and K440-2AS, use 40, 75, 100 or 123 watt flywheel-alternator systems. The SK340-2AS and K440-2AS use a 150 watt flywheel-alternator system which is combined with a capacitor discharge ignition circuit--this is described on pages 3.6-3.9. The other systems are described separately on the following pages.

The battery for electric start models must be of 12 volt size with an amp hour rating of at least 32. It should be securely strapped to the vehicle and have spill proof caps. The battery must be kept safely away from the fuel tank. The negative terminal must be grounded to the vehicle frame. If the engine is rubber mounted so that it is isolated electrically from the vehicle, a heavy gauge ground wire (#4 or 6) should be connected between the engine and the frame of the vehicle. Use #6 gauge wire for any connection that must carry heavy battery current.

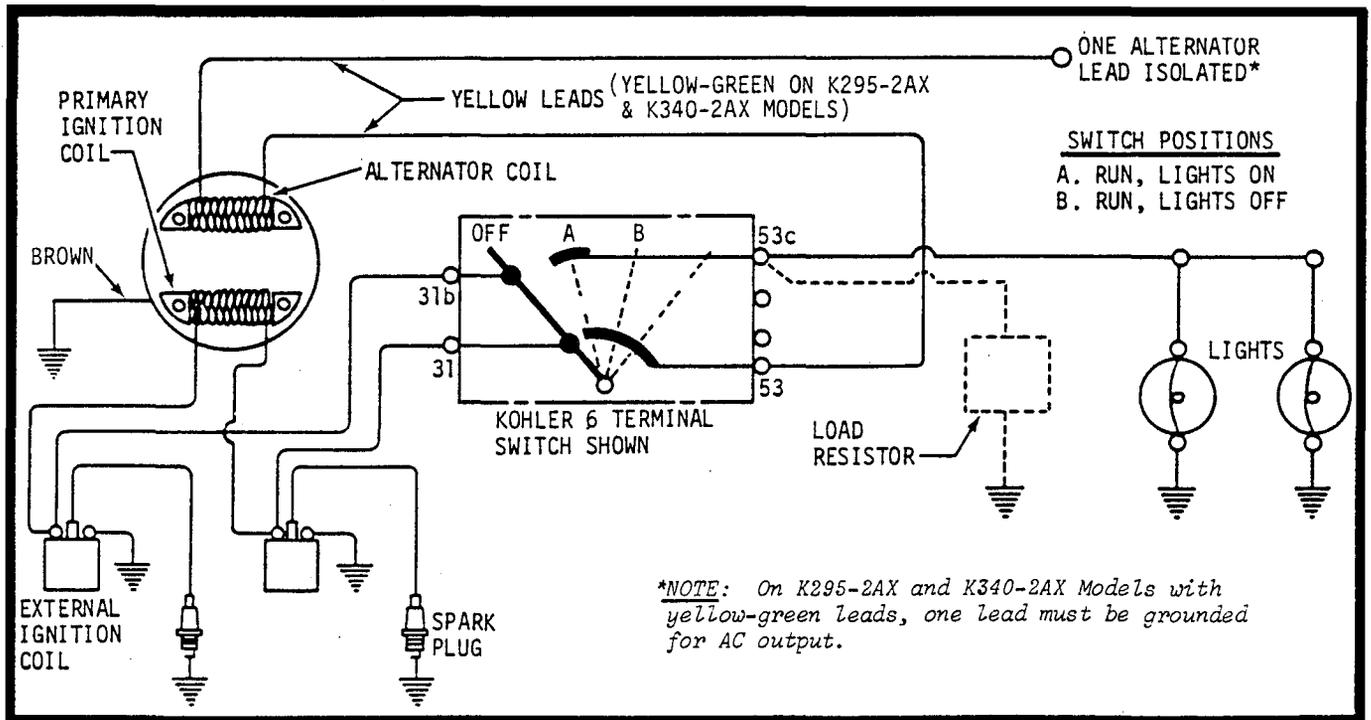


FIGURE 4-1 -- 75 WATT, MANUAL START SYSTEM WITH KOHLER SWITCH

## FLYWHEEL-ALTERNATOR SYSTEMS

The electrical system functions to provide energy for lighting and/or charging a 12 volt storage battery for electric starting. An alternator coil attached to the stator plate also uses the magnetic field of the permanent magnets on the flywheel. By alternate placement of North-South poles in relation to the coil, an alternating current is induced in the alternator coil windings. On battery equipped models, the leads from the alternator are brought out to a rectifier to convert the AC to DC which must be done for charging the battery. On manual start engines without battery, rectification is not required; therefore, one lead is isolated and the other is brought out to the light switch.

Some applications use separate voltage regulators which control voltage regardless of load--most, however, have unregulated systems which are controlled only by amount of load. To avoid an over-voltage condition on non-regulated systems and resulting rapid burn out of bulbs, always recommend using full output of the electrical systems. If the vehicle lights seem excessively bright, this usually indicates an overvoltage condition--on the other hand, dim lights could indicate that the load is too great. For example, if you have a manual start engine with a 40 watt system, use a 5 watt taillight and a 35 watt headlamp to total 40 watts. Get as close as possible to capacity but don't exceed it. On the 75 watt systems allow 15 watts to charge the battery on electric start models. On manual start models, use a resistor of appropriate value to make up for any load not used for lights.

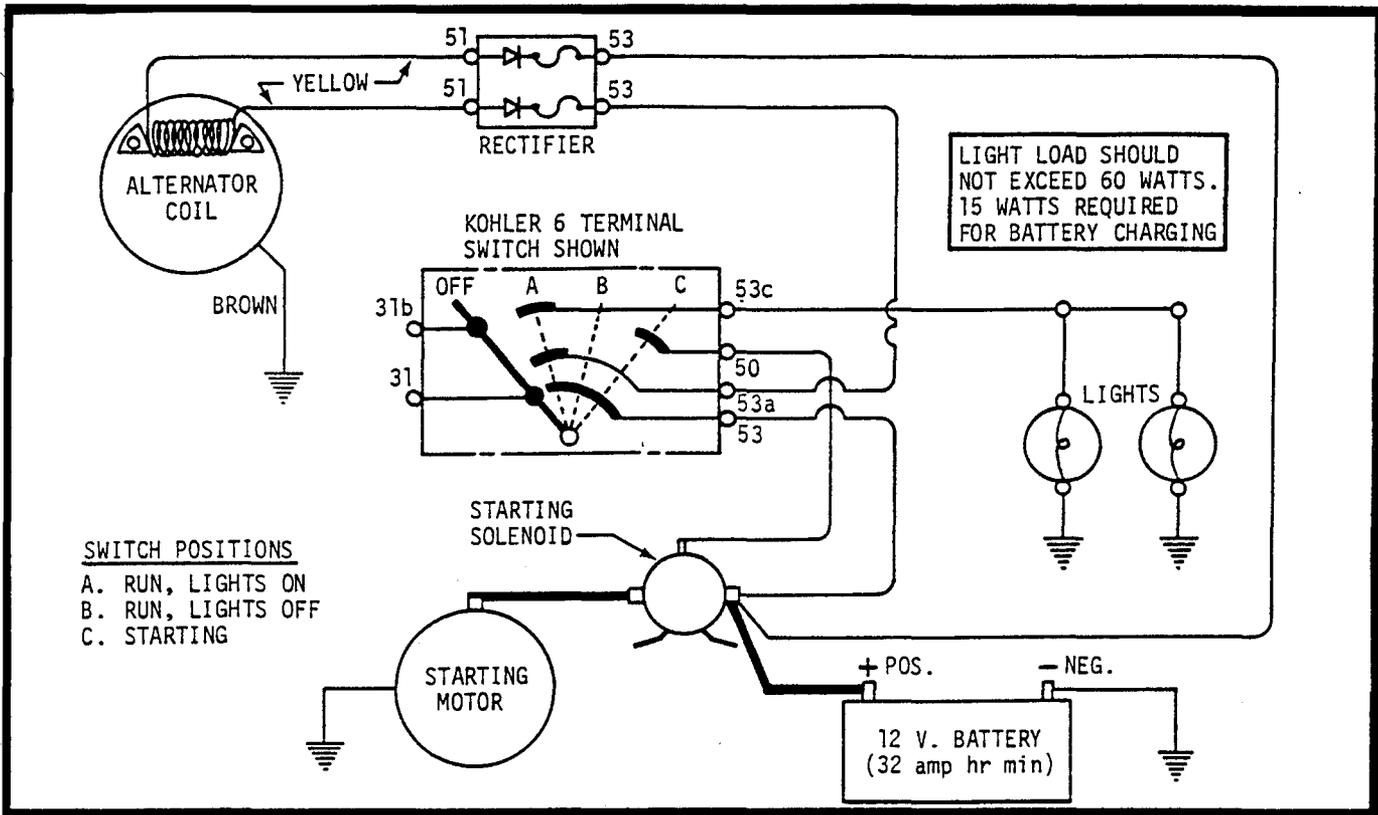


FIGURE 4-2 -- 75 WATT, ELECTRIC START SYSTEM WITH KOHLER SWITCH

The fuses inside the rectifiers do not protect the lights from burning out from overvoltage or other causes but rather protect the solid state electronic devices from damage in the event the battery is hooked up backwards. Battery must be negative ground. The lights will continue to operate with a blown fuse but the battery cannot be charged when this occurs. If lights will not turn on and the bulbs are OK, check the ignition switch first. If the switch is OK, the alternator may be at fault. On Kohler Engines an ignition centering tool must be used to establish proper air gap between the alternator coil and magnets.

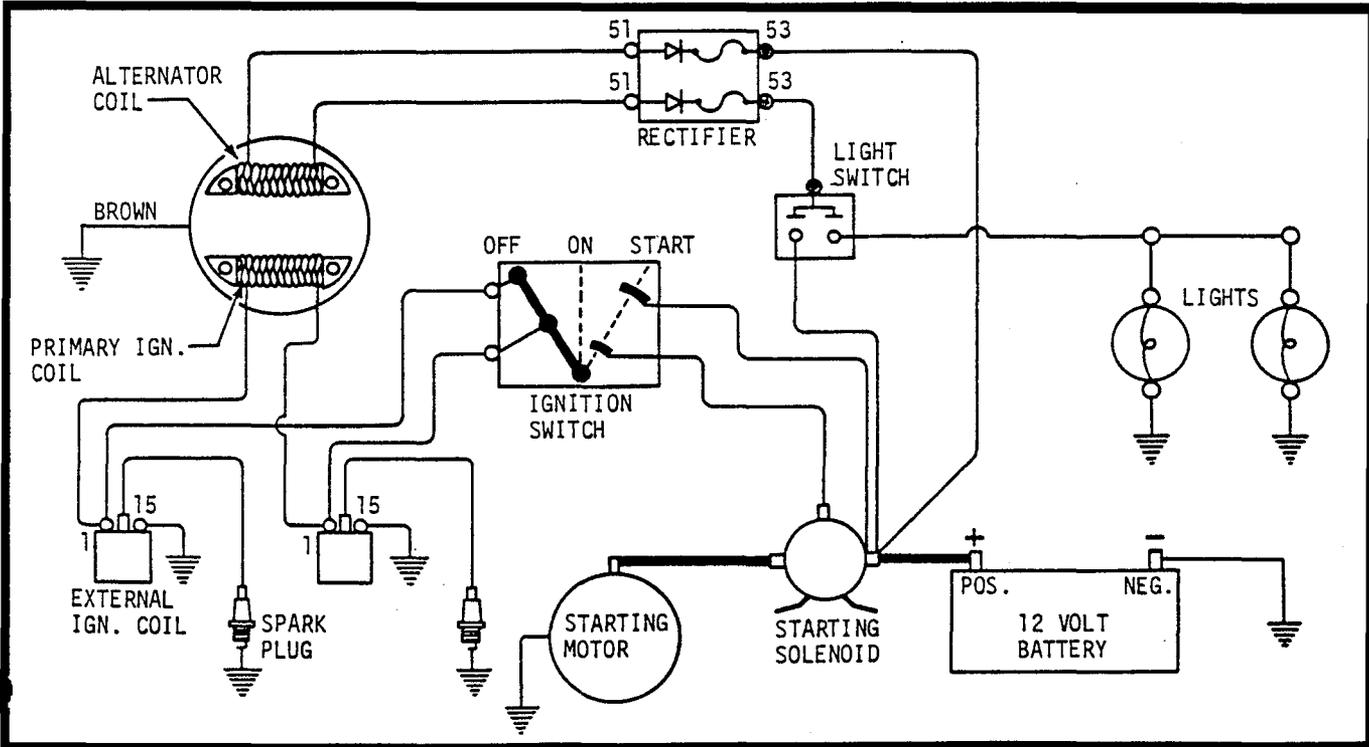
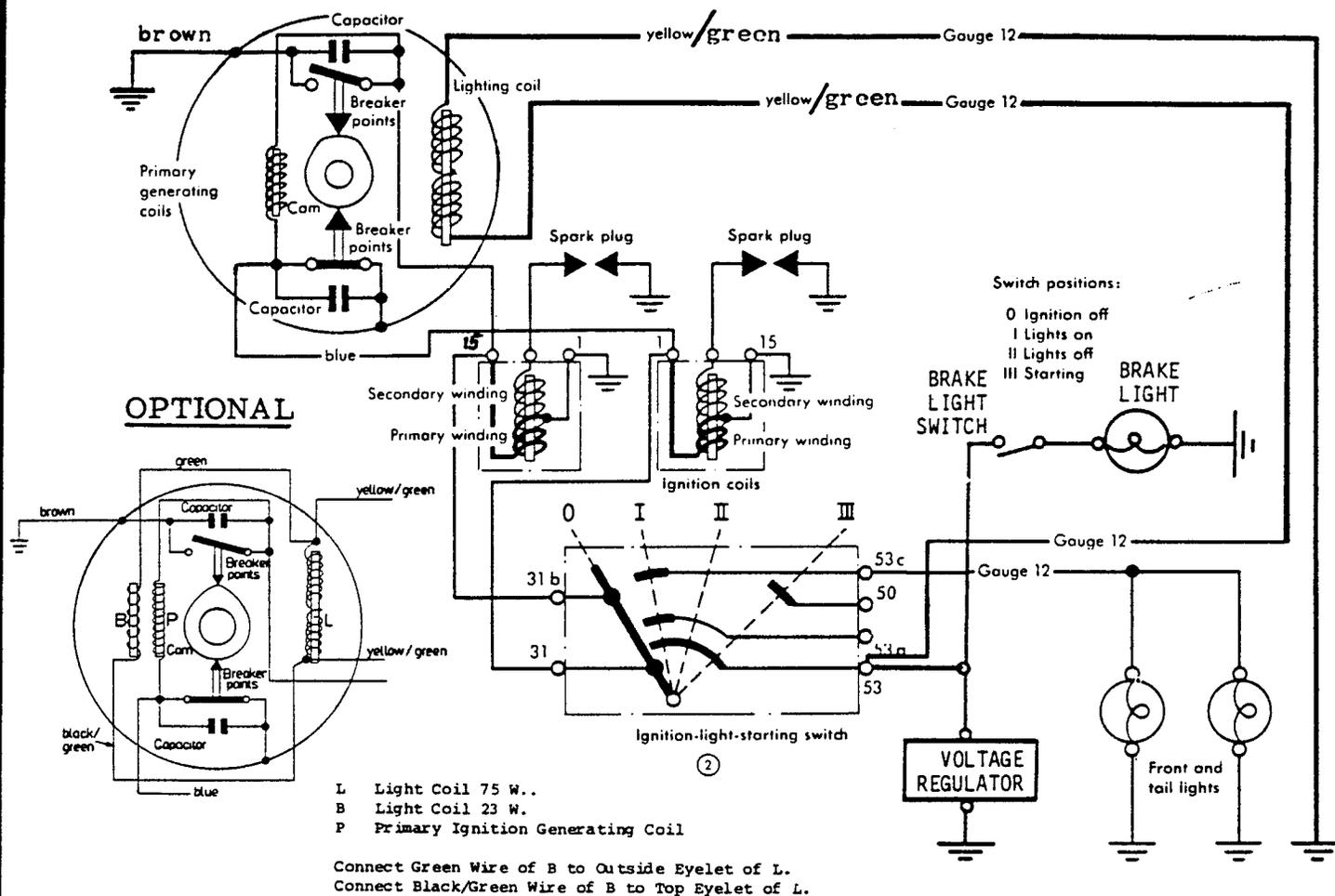


FIGURE 4-3 -- 75 WATT, ELECTRIC START SYSTEM WITH SEPARATE LIGHT SWITCH

Single Primary Ignition Coil  
Without Starting motor, battery  
With voltage regulator and brake light



**Circuitry for day and night operation**

Only one winding lead (yellow) is connected for this circuit, the second winding lead (yellow) will not be connected and is insulated.

Day driving: The connected winding lead is disconnected by the light switch ②.

Switch position II

Night driving:

Switch position I

FIGURE 4-4 -- RECOMMENDED WIRING: MANUAL START 75, 100, 123 WATT SYSTEM

# ELECTRIC STARTERS

Bendix drive type starting motors are used on all electric start models except the Model K618-2 electric start which uses a belt driven motor-generator unit. The two types are discussed separately on the following pages.

**BATTERY REQUIREMENTS:** Energy for cranking is provided by a 12 volt battery with a rating of at least 32 amp hr. In all cases, the negative terminal (-) is the ground--refer to the accompanying wiring diagrams. Spill-proof caps must be used because of the rough terrain and extreme angles so common to vehicles powered by 2-cycle engines.

With the exception of the motor-generator equipped model, energy for charging the battery is furnished by an alternator coil which is mounted on the stator plate under the flywheel. The alternating current produced in this coil is converted to Direct Current in a rectifier unit. Two 5 amp fuses are provided in the rectifier to protect the diodes against damage from overcurrent--this condition could occur, for example, if the battery is hooked up wrong.

## BENDIX TYPE STARTING MOTORS

These starters are self-lubricated and require, therefore, very little attention. The brushes and commutator should be inspected only when there are indications that these are getting worn or dirty. Some of the problems that are possible are listed below in the trouble shooting guide--if the corrective action stated fails to remedy a problem, the starter should be disassembled and serviced per the instructions on the following page. It is not necessary to realign the starter when it is reinstalled--perfect alignment is provided by the precision machined surface of the mounting pad and position of the mounting studs.

**TROUBLE ANALYSIS:** Although a problem may appear to be caused by a faulty starter, check other items first as inciated in the following chart.

SYMPTOM	PROBABLE CAUSE/SUGGESTED REMEDY
1. Starter does not turn or turns too slowly.	<p><u>1a:</u> Battery low or dead; recharge or replace as needed.</p> <p><u>1b:</u> Electrical connections poor or broken. Clean terminals, tighten connections.</p> <p><u>1c:</u> Faulty starter switch - replace.</p> <p><u>1d:</u> Brushes, commutator dirty or excessively worn. Clean or replace as needed.</p>
2. Starter stops when pinion engages.	<p><u>2a:</u> Battery charge low - recharge.</p> <p><u>2b:</u> Battery cables too long or connections causing excessive voltage drop.</p> <p><u>2c:</u> Starter solenoid defective - replace solenoid.</p> <p><u>2d:</u> Brush tension too low due to excessive wear or weak springs. Replace.</p> <p><u>2e:</u> Engine siezed or locked up.</p>
3. Starter spins, but will not engage.	<p><u>3a:</u> Pinion sticking in retracted position due to dirt or grease on splined shaft - clean.</p> <p><u>3b:</u> Chipped teeth on pinion and/or ring gear. Replace.</p> <p><u>3c:</u> Burrs forming on gear teeth to block engagement - file edges.</p>
4. Starter does not disengage properly after engine starts.	<p><u>4a:</u> Pinion dirty or return spring broken. Clean or replace as needed.</p> <p><u>4b:</u> Gear teeth dirty or damaged. File off burrs or replace.</p>

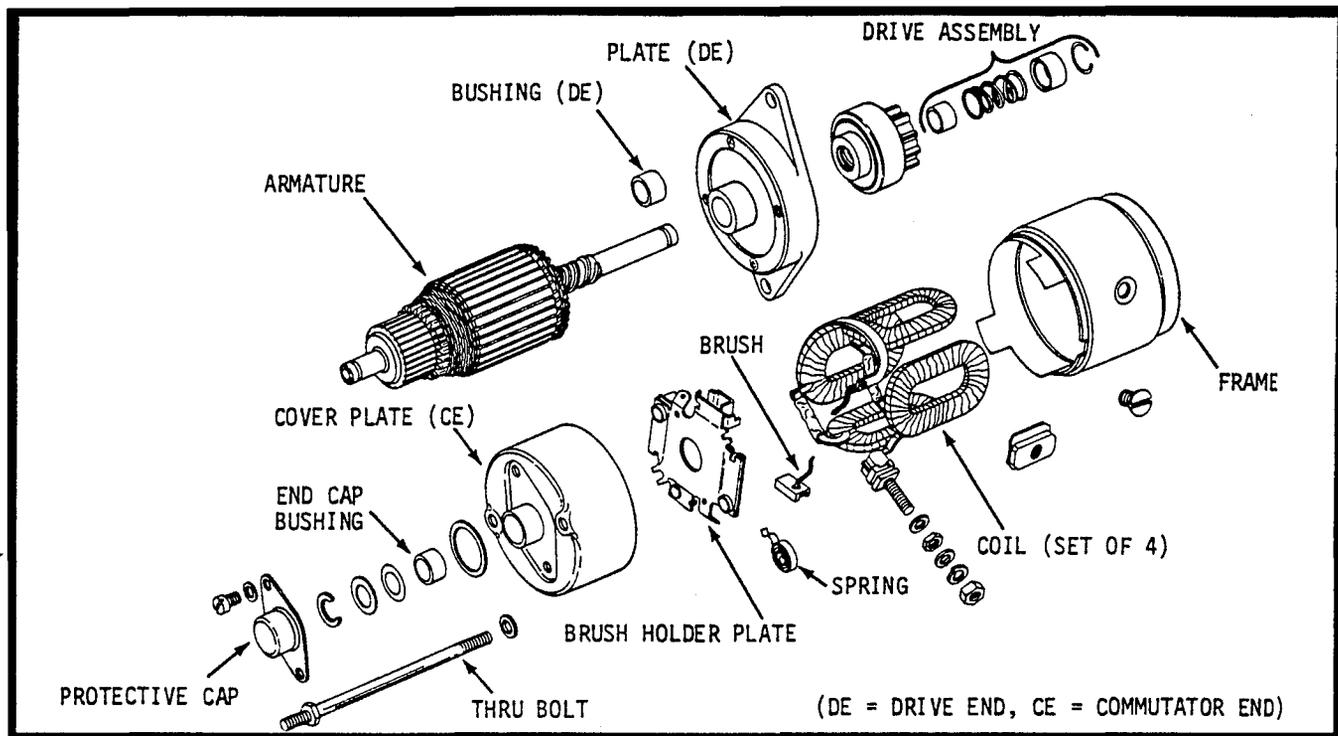


FIGURE 5-1 -- EXPLODED VIEW SHOWING TYPICAL STARTING MOTOR

**BRUSH SERVICE:** The starter does not have to be removed from engine to service brushes. To gain access to the brushes on these starters, remove the bushing protective cap, the clip washer at end of the armature, then the commutator end (C.E.) cap or plate. Note that it may be necessary to loosen the lower nut on the terminal post so that the plastic terminal insulator will not crimp and hold the end cap. Tap end cap lightly to free it from the starter frame, then slip it off over the end of the commutator and armature. Use a small hook to lift springs then remove each brush from its holder for inspection and cleaning. If brushes are worn unevenly or worn down to less than 5/16" (about half original length) unsolder leads and replace all 4 brushes.

Clean commutator with coarse, lint free cloth--do not use emery, or sand paper for this. If grooved, scored or extremely dirty, the commutator should be turned down on a lathe; however, this calls for removal of the armature.

When reinstalling, leave brushes out and springs off until after the brush ring is over the commutator. Insert brushes then hook springs and position on brushes--CAUTION: Brushes can be damaged if the springs are allowed to "snap" against the top of the brushes. Align thru bolts and pull the end cap down tight then install clip (after making sure end play washers are in place). Reinstall and secure the bushing cap to complete brush service.

**BENDIX DRIVE SERVICE:** The starter must be removed from the engine to inspect Bendix drive assembly. If the splined shaft or pinion are dirty, clean with solvent which does not leave a film--the drive works best with only small amount of lubricant--use dry spray type.

If damaged, replace the complete Bendix drive assembly. To remove, drive the ring stop back toward the pinion, then remove snap ring. Spring, bushing and pinion assembly can now be removed. Reverse this procedure to reinstall new Bendix.

## MOTOR-GENERATOR (K618-2)

If unit fails to crank properly, inspect entire cranking circuit for loose or badly corroded connections and damaged wiring. Check battery to determine condition. When battery is satisfactory and wiring and connections are in good condition, close starting switch. If unit fails to crank, wire around motor switch with a heavy jumper lead. If motor-generator operates, the switch is defective and should be replaced. If unit fails to operate, the trouble can be attributed to the engine or to the motor-generator. Excessive friction in the engine from tight bearings or pistons may be causing hard cranking. If unit fails to crank properly when engine is known to be in good operating condition and the rest of the cranking circuit is found to be satisfactory, the motor-generator should be removed for further checking.

# RETRACTABLE STARTERS

While retractable starters do not require regular service, they should be checked occasionally to make sure they are secure and that the rope is in good condition. If the rope is frayed, replace it immediately before it breaks--if it does break, the pulley is free to rewind violently which can result in a broken rewind spring or other internal damage. Complete disassembly of the starters is covered in Section eleven--the following deals with rope replacement and alignment of the retractable starters. Note that a different type of starter is used on the Axial Flow models--follow the appropriate instructions for the engine model and starter involved.

**ROPE REPLACEMENT - BLOWER MODELS:** It is not necessary to disassemble this type starter to replace a broken belt. This starter must be aligned when installed on the engine. To replace the rope, remove starter from the engine and proceed as follows:

**STEP 1:** Remove any pieces of the broken rope from the starter pulley and handle.

**STEP 2:** Fuse both ends of the new rope by burning with a match then install one end in the starter handle.

**STEP 3:** Pre-tension rewind spring by rotating pulley counterclockwise until it cannot rotate further (about 1/2 to 3/4 turns), then back off until notch in pulley lines up with rope guide in housing --hold pulley in this position then insert rope thru guide and notch--slip washer over the rope then tie permanent knot in rope.

**STEP 4:** Gradually release pulley allowing rope to rewind slowly--don't release all at once as this could damage starter internally. Use following instructions to align starter.

**STARTER ALIGNMENT - BLOWER TYPE:** Reinstall starter to blower housing but do not tighten mounting capscrews, pull handle out about 8" until dogs engage in drive cup then hold in this engaged position while tightening the mounting screws.

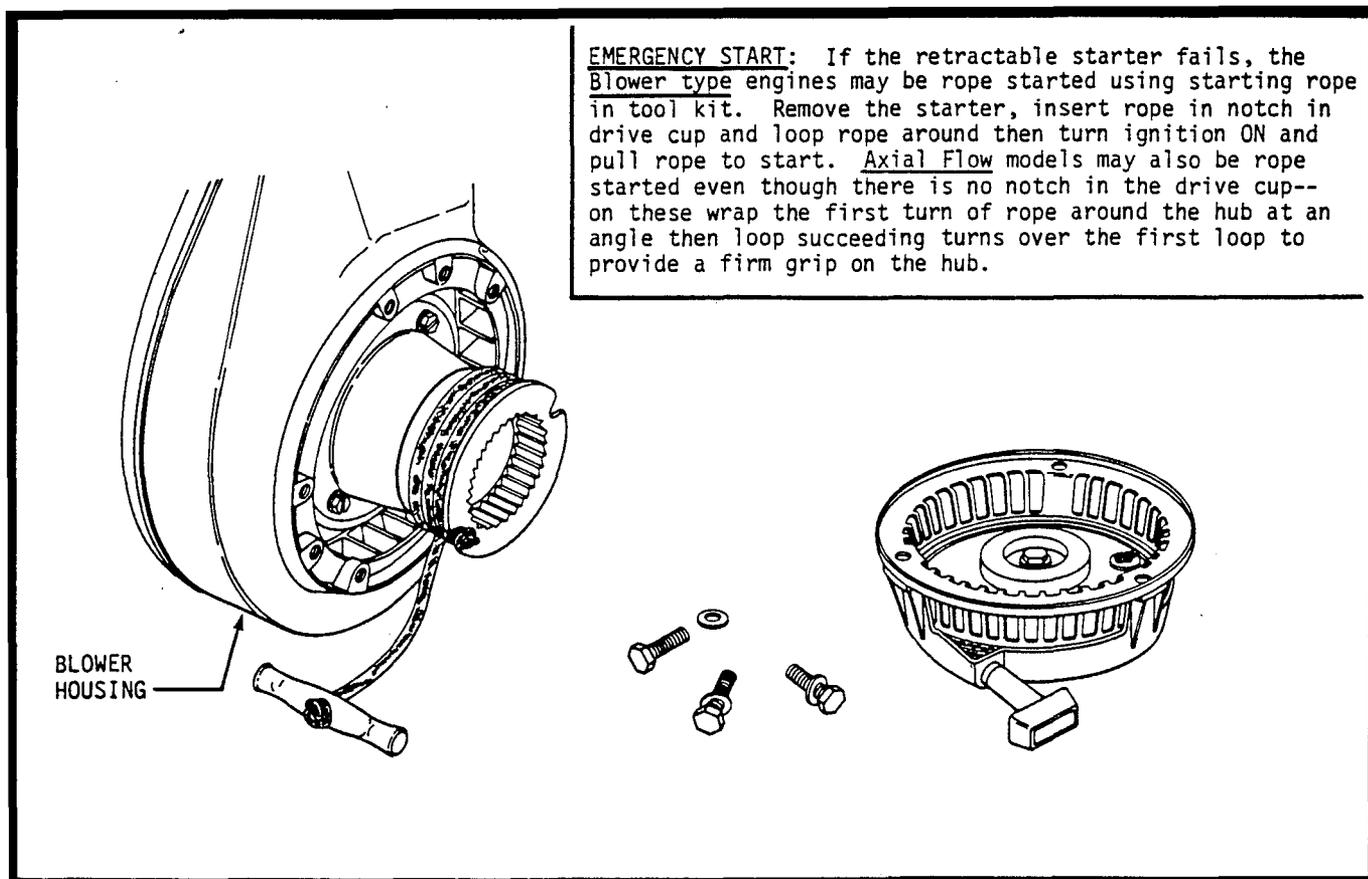


FIGURE 6-1 -- RETRACTABLE STARTER REMOVED - BLOWER TYPE ENGINE

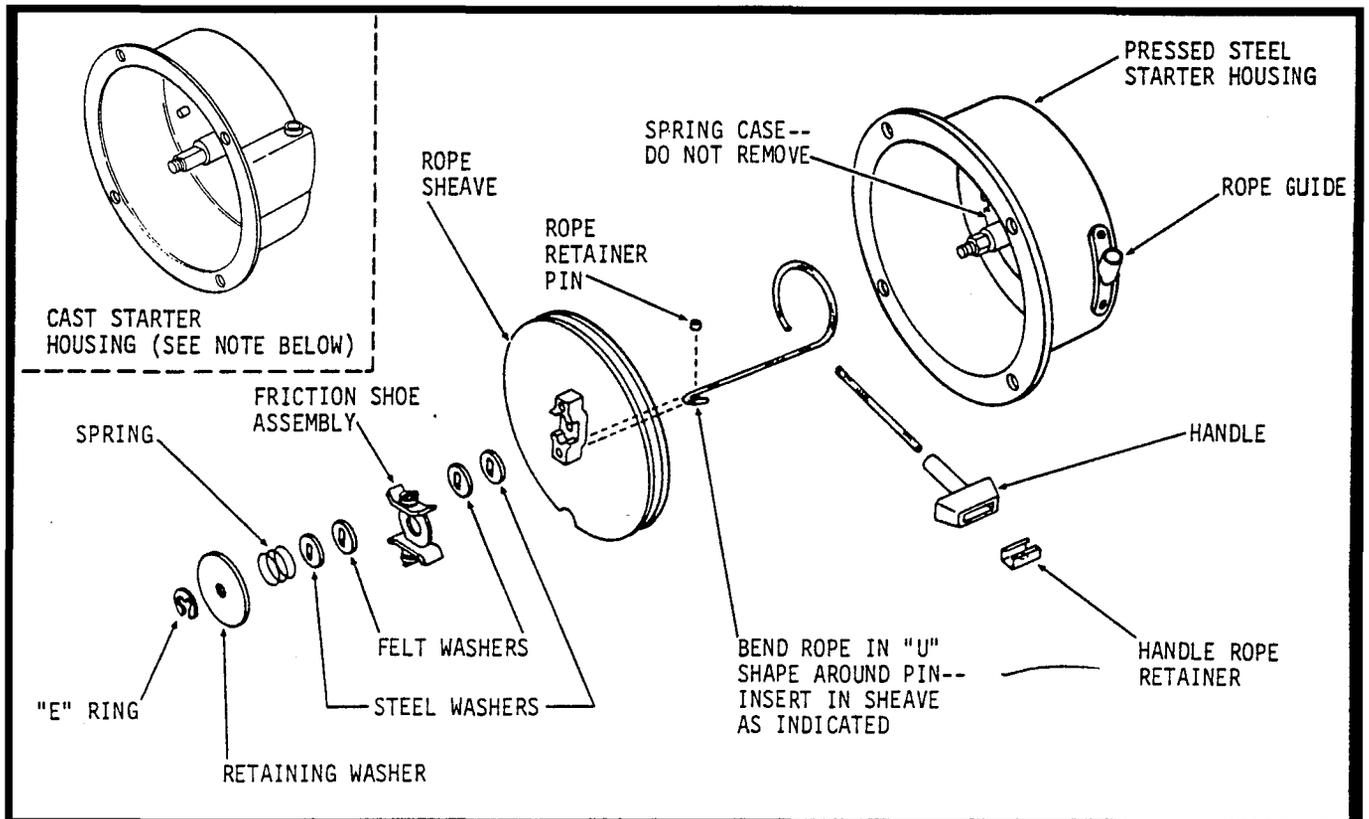


FIGURE 6-2 -- RETRACTABLE STARTER - AXIAL FLOW MODELS

**NOTE:** Recent axial flow models use a retractable starter which has a cast housing rather than the pressed or formed steel housing as shown above. When replacing the rope or aligning the starters with the cast housing, follow the procedure stated on page 6. 1--the cast housing type starters are similar to those used on the blower engines. For starters with the pressed steel housing, use the procedure below.

**ROPE REPLACEMENT - AXIAL FLOW MODELS:** This starter must be partially disassembled to replace the rope. Use the following procedure for rope replacement.

- STEP 1:** After removing starter from engine, remove the E ring, retaining washer, steel and felt washers and the friction shoe assembly--carefully note sequence of these parts when removing.
- STEP 2:** Carefully lift the sheave out of the housing. Remove any pieces of the old rope remaining in this sheave--save the pin that the sheave end of the rope is wrapped around.
- STEP 3:** Fuse both ends of the new rope with a match then bend one end into a "U" shape around the pin (see illustration) then insert this into hole in sheave hub. Run the rope in the groove on inside of pulley then wrap the rope around the sheave in counterclockwise direction (when facing outside face of sheave).
- STEP 4:** Pull the open end of the rope thru the notch in the sheave then reinstall sheave in the housing and reassemble washers, friction shoe assembly in the same position as removed.
- STEP 5:** Pre-tension sheave by rotating it counterclockwise 3-1/2 to 4 turns then hold in this position and thread the rope end thru the rope guide.
- STEP 6:** Pull the rope out about 1/2 foot, tie a slip knot in the rope to prevent it from retracting then insert the rope thru the handle and hole in the retainer. Tie a permanent knot in the end of the rope then install the retainer in the handle.
- STEP 7:** Release the slip knot and guide the rope slowly back into the retracted position then reinstall starter on the blower housing--this type starter does not have to be aligned.

# EXHAUST SYSTEMS

On 2-cycle engines, the exhaust system does more than just muffle the sound and direct the exhaust gases away from the vehicle. When properly designed, it helps scavenge or clean all exhaust gases from the combustion chamber plus helps get each new fuel charge in more rapidly for cleaner, more complete combustion. When built to specifications, it also momentarily holds the fuel charge in the cylinder during the time the exhaust port is opened. It thus helps prevent fuel from being drawn out of the cylinder along with the exhaust gases.

To understand how the exhaust system does all this, remember that sound waves are actually waves of air pressure and are a definite source of energy. If you have a wash tub full of water and toss a rock into the center you will note that the waves move outward in circular motion from the impact point, then when they reach the side, the waves bounce off the side or reflect back in toward the center. Likewise, sound waves move outward at a terrific rate of speed then reflect back toward the source which in this case is where the hot gases escape from the exhaust port. By careful calculation, the exhaust components are positioned at a specific distance or built so that the energy of the reflected waves reach the port at the precise moment to block off or hold most of the new charge of fuel to prevent it from being carried along with the gases.

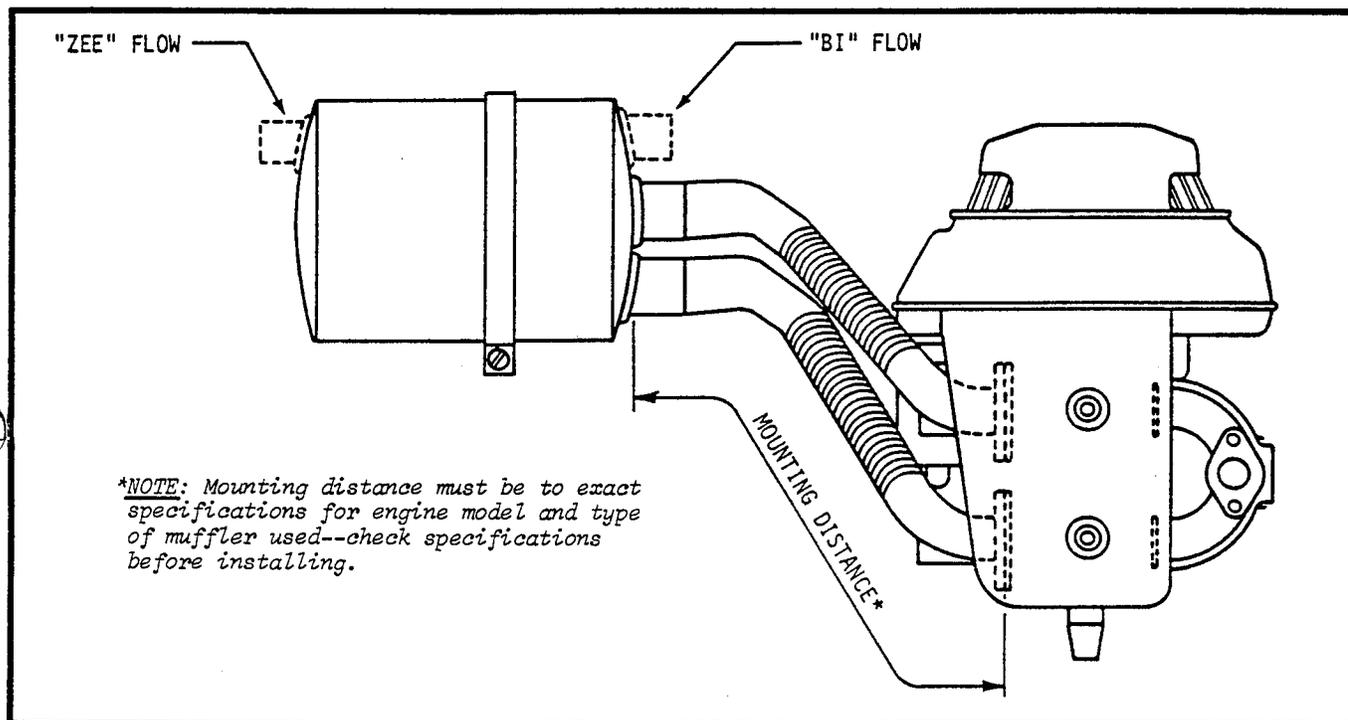


FIGURE 7-1 -- EXHAUST SYSTEM REQUIREMENTS--2-CYCLE OPERATION

Some mufflers are made with a megaphone-like device which first amplifies sound to speed up scavenging of the gases then silences the sound thru a series of baffles which must be designed to offer maximum silencing but minimum back pressure. If back pressure is too great, the intake of fuel thru the transfer port will be retarded plus the exhaust gases will not be completely expelled resulting in a dirty mixture during the next combustion or power portion of the cycle. Equipment for competitive events often includes expansion chambers for more rapid replacement of the fuel charge which in effect offers a super charging effect but, in this case, from the exhaust side rather than from the intake side. An expansion chamber is a popular method of increasing performance by amplifying sound waves for the purpose of speeding up exhaust and fuel transfer portion of 2-cycle operation.

## INSTALLATION

When installing a muffler, make sure it is the right kind and that the inlet to the muffler is at the specified distance from the exhaust outlet on the engine. Use flexible tubing or flexible ball joints, these absorb vibration to prevent cracking and breaking which can be a problem especially when traveling over rough terrain which is common to many 2-cycle engine applications.

# ENGINE - GENERAL SERVICES

## CARBON REMOVAL

If excessive carbon is noted on the spark plug, it is a good idea to check the condition of the combustion chamber and top of the piston as these, too, may be carbon fouled. Remove the cylinder heads and remove the carbon deposits with a wood or plastic scraper to avoid cutting or scratching the aluminum heads and pistons. If carbon build-up is heavy on top of the piston, the rings are often stuck or about ready to stick in the grooves. To clean the rings, remove the cylinder barrel, apply oil to the rings then work the rings back and forth until they slide free in the grooves. The oil usually dissolves the carbon--clean off the oil before reinstalling barrels. Apply lubrication to cylinder wall then use the Kohler ring compressor (for 2-cycle engines) and install the barrels over the piston. Tighten barrel nuts and cylinder heads to torque value specified. Always use a new cylinder head gasket if the particular model does use one--some models have precision machined surfaces and do not require gaskets between barrel and head.

## DRAINING CRANKCASE

Some models have drain plugs at low points on the crankcase. On these, remove the plugs occasionally to allow drainage of any fuel or oil that may have accumulated in the crankcase. Excessive amounts of fuel in the crankcase may upset the fuel-air ratio and cause erratic operation. Accumulation may be especially heavy after starting difficulties have been encountered.

## ENGINE MOUNTS

Check engine mounting at frequent intervals to make sure these are tight. This is especially important after running over rough terrain. If mounting bolts work loose, the resulting vibration may loosen and weaken other parts and cause serious damage. Check the vehicle drive too--vibration caused by loose pulleys, unevenly worn belts, etc., may be transmitted back to the engine.

## COOLING SYSTEM

Blower engines are cooled by a fan attached to the flywheel while the Axial Flow models are cooled by a belt driven blower. Never operate your engine with missing or loose air shroud covers or with broken fins on flywheel or blower fan. Keep air intake openings on vehicle and engine clean and unobstructed at all times to prevent overheating. Proper belt tension must be maintained on Axial Flow models for proper cooling. Don't operate Axial Flow engines with broken or badly frayed belts.

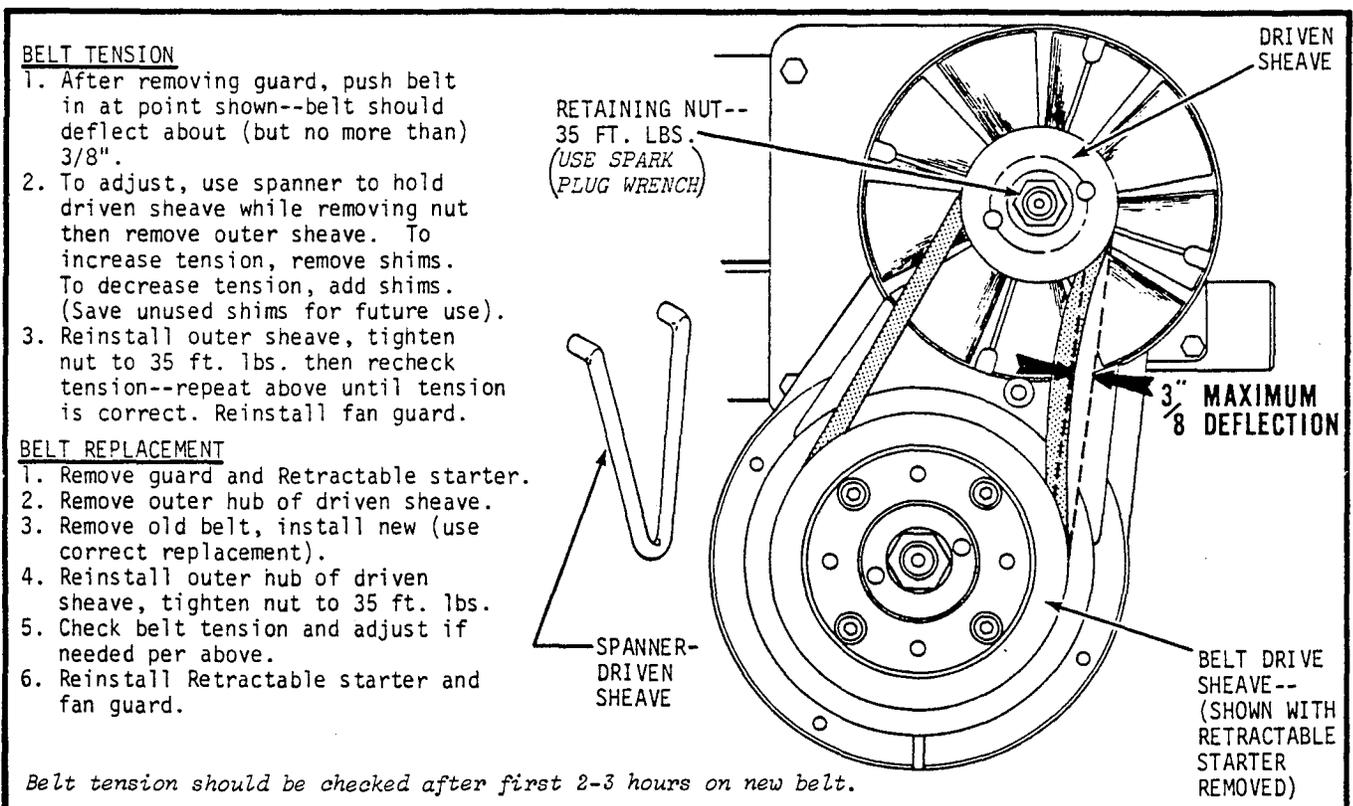


FIGURE 8-1 -- BELT TENSION, BELT REPLACEMENT - AXIAL FLOW MODELS

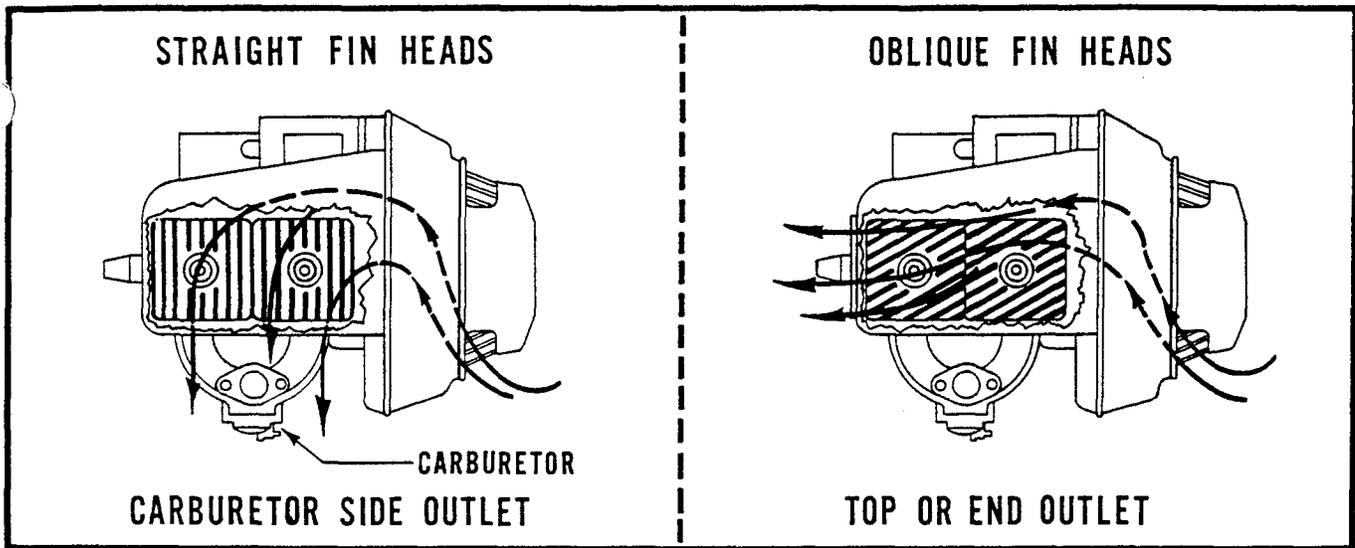


FIGURE 8-2 -- CYLINDER HEAD FIN DIRECTION DIFFERENCES

## REPLACEMENT PARTS

Always use the Genuine Kohler Service Parts for replacements. This insures a quality replacement and keeps clearances or tolerances within specifications. Substitute parts are often designed to fit several engine models with specific categories and may not, therefore, be perfectly suited for use on any one model in the range. Use the Kohler 2-Cycle Engine Parts Manual to obtain the correct part for the engine being repaired. Mention Engine SPECIFICATION, SERIAL and MODEL number when ordering parts.

## POWER TRANSMISSION

While the drive or power transmission units are mainly the responsibility of the vehicle manufacturers service organization, anyone repairing engines should know how to disconnect then reconnect the drive properly to retain the correct belt tension and alignment of drive components. The engine repair specialist should also know enough about the drive unit to know when the transmission, rather than the engine, is causing poor performance and lack of power.

Don't hammer on the crankshaft to "bump" the pulley loose--this may destroy side play of the connecting rods thus squeezing and ruining the needle bearings. Use a puller but be careful not to distort the pulleys. Pulleys must be maintained in perfect alignment to minimize belt drag and resulting wear. Always check the converter manufacturer's literature when doing any work that requires removal of the drive pulley. On Kohler Engines, drive pulleys are secured to a taper of the crankshaft with a capscrew.

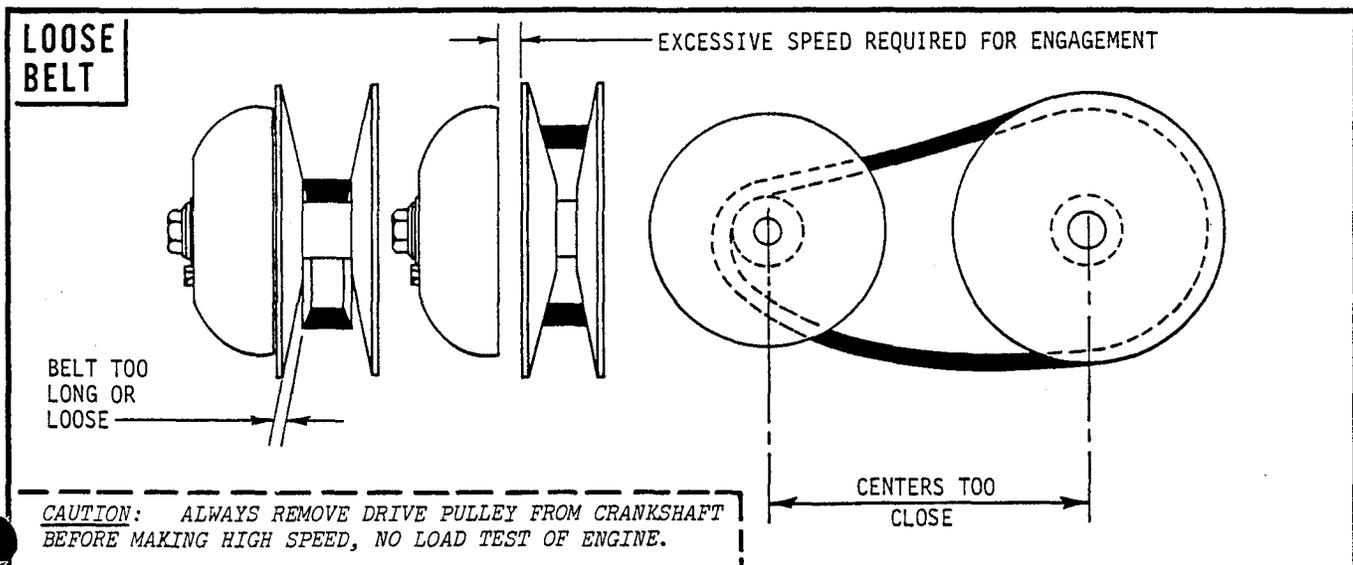


FIGURE 8-3 -- LOOSE DRIVE BELT MAY INDICATE POOR PERFORMANCE

# OVERHAUL AND REPAIR

Before starting to disassemble an engine, make sure that the work area is clean and well lighted. Observe all rules of safety when working on an engine--for instance, wear safety glasses and don't smoke or use an open flame around the cleaning solvents or other flammable materials found in many shops. The best defense against accidents in all situations is good common sense!

## TOOLS REQUIRED

Make sure that adequate tools are on hand to do the job. If you're in the business of repairing engines, the engine stand developed specifically for Kohler 2-Cycle Engines will be an invaluable tool. The Basic Tool Kit is a must for any overhaul job--the same applies to the Ignition Timing Tool and the Ignition Tool. Part numbers for these and other useful tools are listed at the back of this manual.

Some earlier 2-cycle models require metric size wrenches--refer to the Model Variation paragraph below to determine if the engine has Metric or U. S. Standard size threads.

## INSPECTION

Start looking for causes of engine problems before you remove it from the vehicle. If cracked or broken parts are evident, check for loose engine or torque converter mounts. Excessive vibration may also come from an unevenly worn drive belt, misaligned pulleys, missing cleats, flat tire on ATV, etc. Frequently, parts vibrate loose over rough terrain and are simply ignored and not retightened in time to prevent damage. Some other types of damage and probable causes follow.

PISTON BURN-THRU: If a hole is burned right thru the piston, look for an improperly adjusted carburetor or incorrect timing. If these items check out OK, you may want to question the owner about the use of wrong oil or improperly mixed fuel. The wrong type of spark plug for conditions involved may also be the cause of abnormally high combustion temperatures which cause burn-thru.

FOREIGN MATERIAL: Operating without an air intake silencer or not cleaning out around spark plug openings before removing plugs can lead to piston damage from foreign objects dropping into the engine--if the damage is on the piston crown, something probably fell into the opening when the plug was removed. Damage on the sides of piston may indicate that an object was drawn into the intake.

LOOSE NEEDLE, RETAINERS, PINS: Piston and cylinder damage caused by loose needle bearings, pin retainers or piston pins is usually quite easy to diagnose. A needle bearing is hard enough to cut right thru piston rings without leaving jagged edges--a loose retainer will not cut clean but will break the ring. If retainer falls out or is not installed in the first place, the pin may rub a regular groove in the cylinder wall. Often damage such as this goes by unnoticed until power becomes extremely poor due to lack of compression.

RING BREAKAGE: If a ring breaks, the engine may continue running; however, it will probably back-fire badly and it cannot be restarted after it is shut down. Ring breakage occurs from overheating due to lack of proper lubrication. A poor quality or wrong type of oil may have been used or the oil may have been poorly mixed or mixed in incorrect proportion with the gasoline. A ring that has been subjected to overheating often becomes soft and is easily bent.

RINGS STICKING: If there have been repeated complaints of spark plug fouling and dark exhaust smoke from the same engine, the rings might be stuck in the grooves due to carbon fouling. This usually occurs from an "overrich" fuel mixture. If the build-up is shellac rather than carbon, this probably indicates use of a poor quality oil.

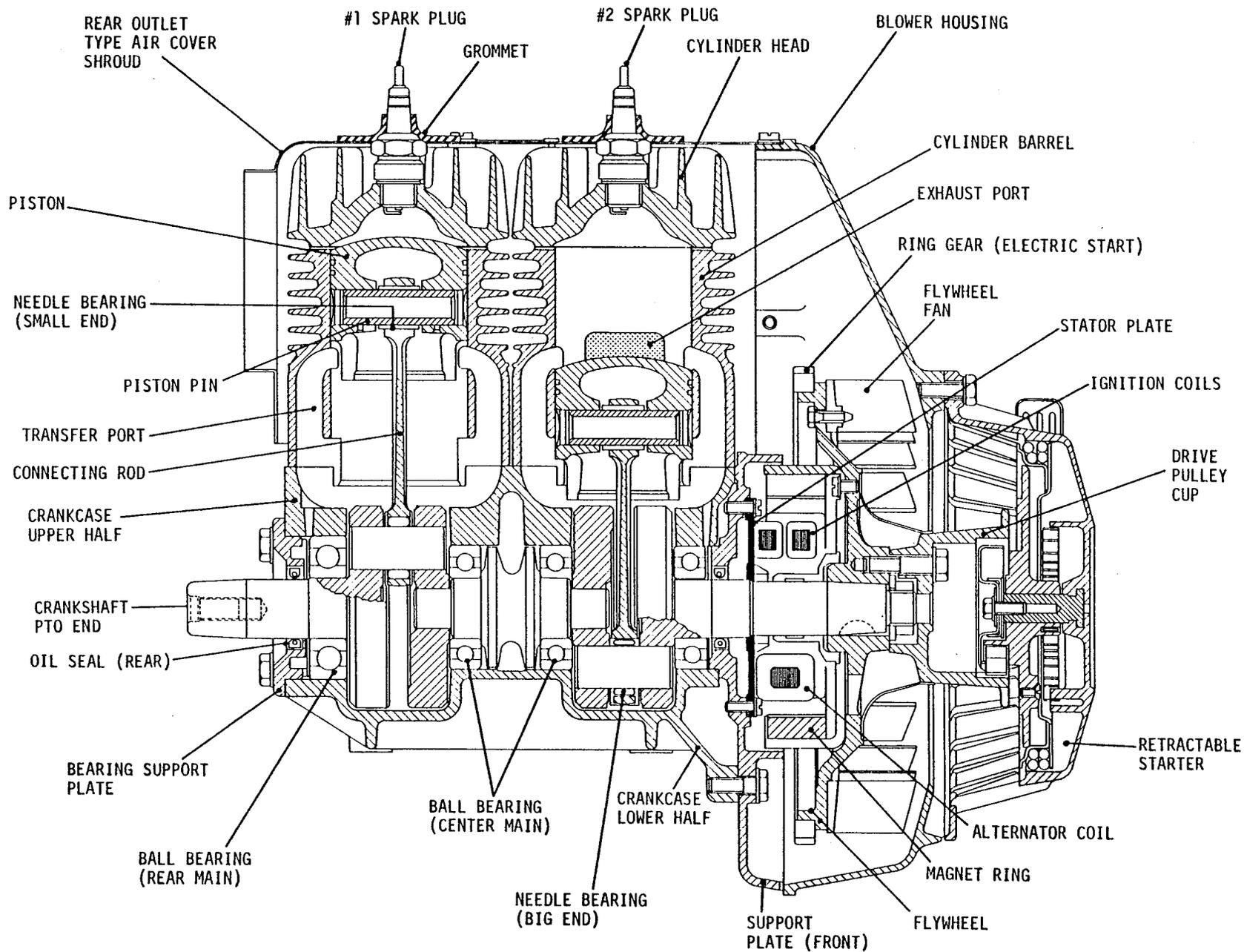
BROKEN, DAMAGED RODS: Pounding on the end of the crankshaft to remove the flywheel can play havoc with connecting rods and rod bearings. This practice can push the counterweights together squeezing the rod small end bearing, indicated by the metal lapped over edges. This, of course, freezes the needle bearing and snaps the connecting rod. Always use a puller to remove the flywheel and also to get the drive pulley off the taper of the crankshaft.

## MODEL VARIATION

If the engine you are working on has a seven digit ENGINE SPECIFICATION number and the suffix (last 2 digits) is 05 or lower, this indicates that the engine has metric size threads. If the suffix is 06 and higher or if a six digit engine specification number is found, the engine has U. S. Standard thread sizes. The model variation is described in further detail at front of each parts manual.

FIGURE 10-1 -- CROSS-SECTIONAL VIEW OF A TYPICAL 2 CYLINDER MODEL

10.1



# DISASSEMBLY

Before removing the engine from the vehicle, color code wiring leads and make note of hose connections, etc. This will prevent wrong connections and possible damage later when the reconditioned engine is reinstalled. Disconnect spark plugs first as a safety precaution--this eliminates chances of unintentional starting. Disconnect muffler or exhaust tubes, lines and drive pulley or whatever else is necessary to separate the engine from the vehicle. Remove drain plugs from crankcase (if provided) to allow fuel oil to drain out. Before moving engine to bench for disassembly, thoroughly clean all exterior surfaces. Items such as the engine stand, which are listed in the tool section, can be very helpful and time saving in repairing 2-cycle engines--some of the tools listed are absolutely essential. Metric wrenches are required for all model K618-2 and some K399-2 engines--if the suffix or last two digits of the K399-2 specification number is 05 or lower, it has the metric size. All other K399-2 models have U.S. Standard sizes. The following is offered as a suggested sequence of disassembly--it may have to be changed to accommodate special equipment and accessories.

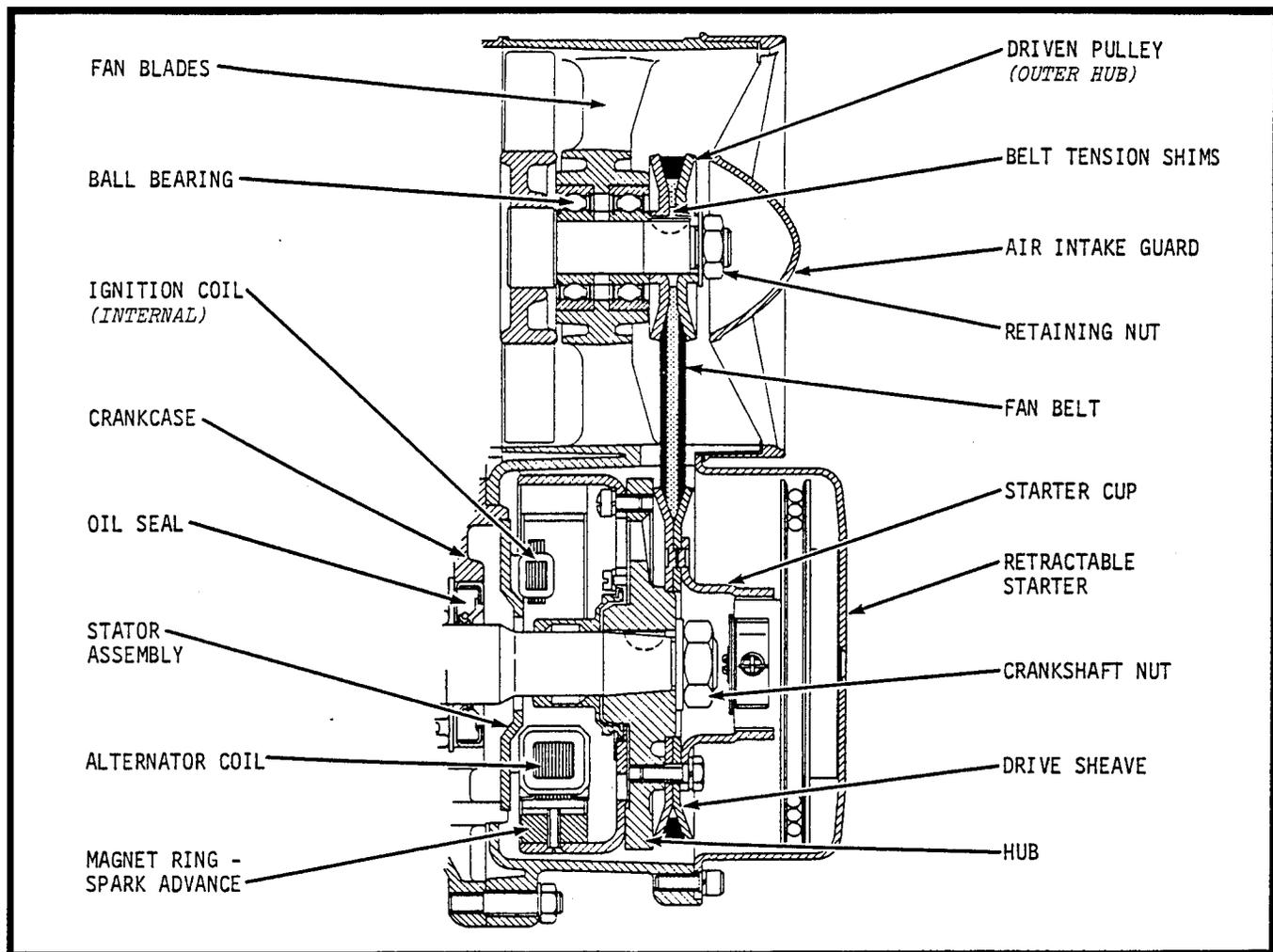


FIGURE 10-2 -- CROSS SECTIONAL VIEW OF A TYPICAL AXIAL FLOW MODEL

## 1. SPARK PLUGS

Remove spark plug boots then, as the first step, remove both spark plugs to prevent unintentional starting.

## 2. STARTER

The engine may have retractable starter, electric starting motor or both. With retractable starter, mark position of handle so that it will be installed in same position during reassembly then remove the starter. On blower type models, remove the electric starting motor or, if manual start, the starter pad cover.

### 3. FAN - AXIAL FLOW

After removing the air intake guard, use spanner wrench to hold fan sheave (upper) then remove sheave retaining nuts, outer sheave and belt tension shims (count shims and save). Remove belt from lower (drive) sheave.

### 4. HUB - AXIAL FLOW MODELS

On these models, the crankshaft nut, hub and magnet ring - spark advance assembly must be removed before the ventilator housing can be removed. To hold the crankshaft for removing the nut, wrap a chain wrench around the drive sheave then loosen the nut. Remove the sheave from the hub then use a puller for removing the magnet ring - spark advance assembly.

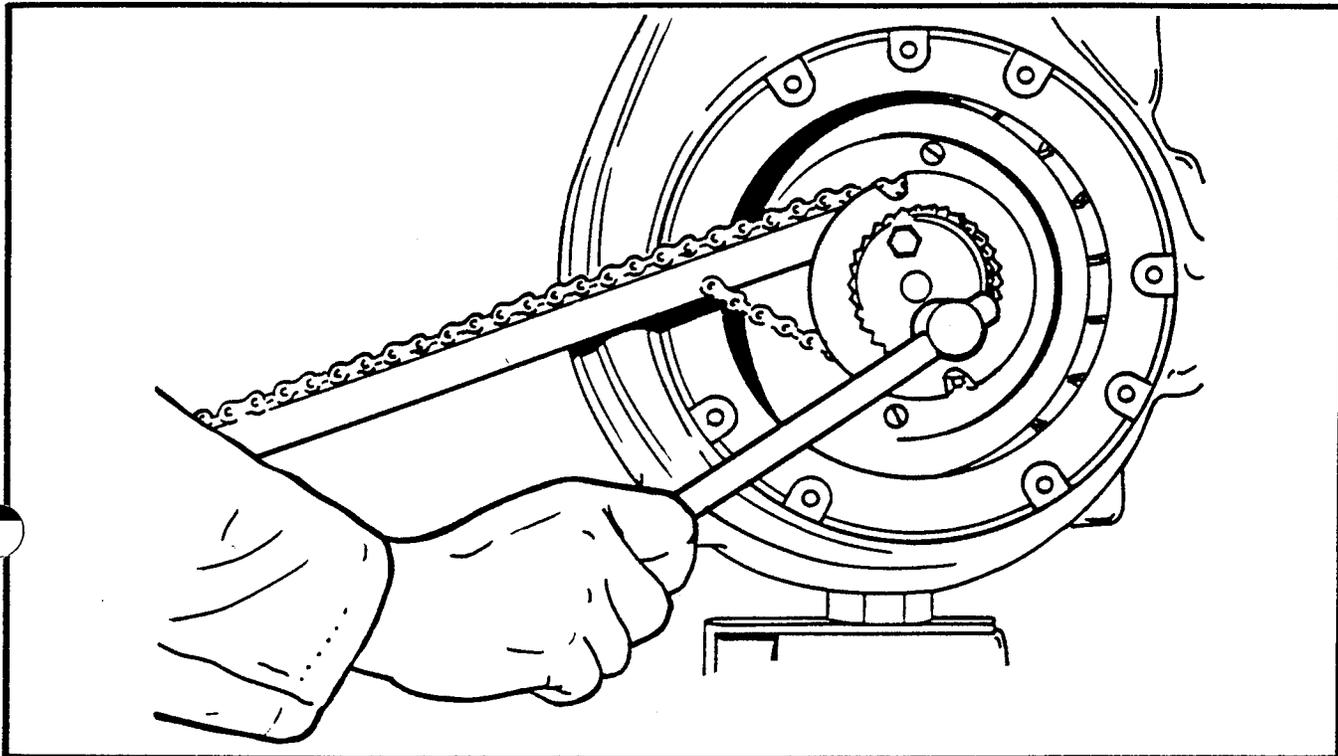


FIGURE 10-3 -- USE CHAIN CLAMP TOOL TO HOLD DRIVE CUP FOR REMOVAL - BLOWER ENGINES

### 5. BLOWER OR VENTILATOR HOUSING

The blower housing (or ventilator housing on Axial Flow models) is secured at five points on most models but at nine points on the K399-2AX and K440-2AX. Remove all retaining screws to remove the housing. On blower type engines, the starting motor or starter pad cover must also be removed before the blower housing can be detached.

### 6. FLYWHEEL - BLOWER TYPE ENGINES

Remove the rope start pulley first--use chain wrench to hold pulley while removing the two capscrews. The pulley is recessed to be a snug fit over the flywheel retaining nut--to free it, tap or work it from side to side until loose.

Remove dust cover then use an impact wrench to remove the flywheel retaining nut or hold flywheel with chain clamp wrench and remove the nut with a breaker bar. When using the chain clamp, make sure the chain links mesh with the ring gear teeth or if no ring gear, make sure chain is on flat surface of flywheel--keep chain away from fan blades.

The flywheel is mounted and keyed to a taper on the crankshaft. Use puller to remove--do not bump end of crankshaft to loosen.

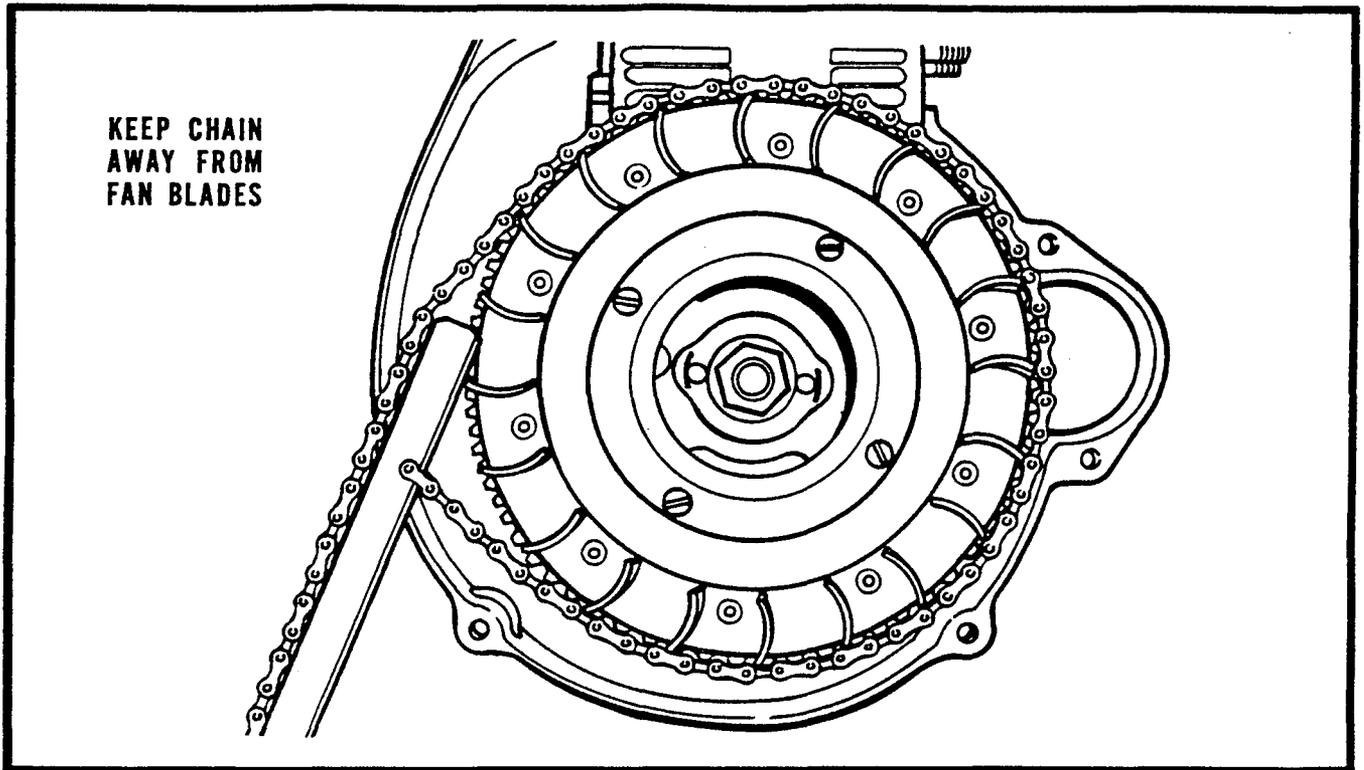


FIGURE 10-4 -- HOLD FLYWHEEL WITH CHAIN CLAMP WHILE REMOVING NUT - BLOWER ENGINES

## 7. STATOR ASSEMBLY

Scribe matching marks on stator and bearing plate or crankcase on Axial Flow models (no bearing plate) so that stator can be reinstalled in exactly the same position later. Disconnect necessary leads then remove stator mounting capscrews and detach stator.

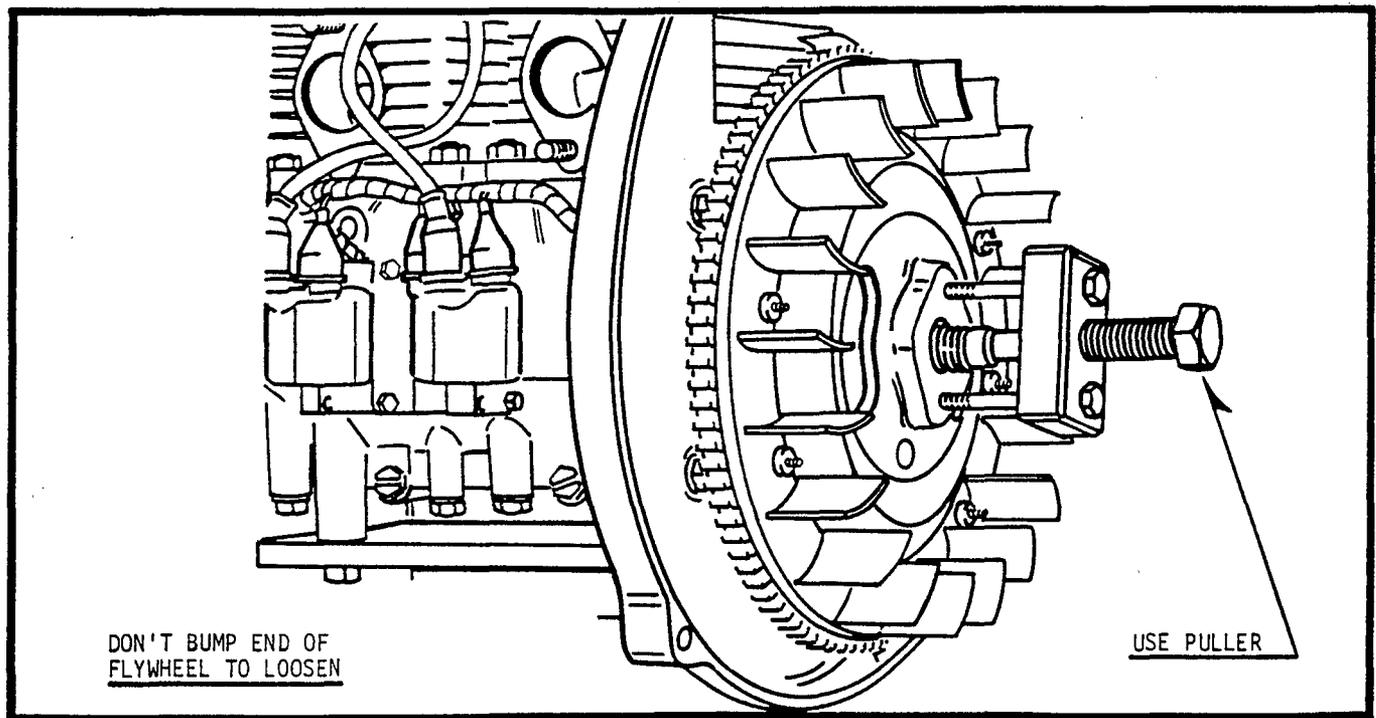


FIGURE 10-5 -- USE PULLER TO REMOVE FLYWHEEL-MAGNET RING ASSEMBLY - BLOWER ENGINES

## 8. CARBURETOR - INTAKE MANIFOLD

Disconnect impulse tube from fitting on crankcase, remove nuts securing intake manifold to crankcase then remove carburetor and intake manifold as a unit. Detach carburetor only if it is to be reconditioned. Note: Axial Flow models have a two piece intake manifold.

## 9. AIR SHROUDS

Remove all screws securing air shrouds. On blower type models lift air shroud cover over top of cylinder barrels then remove cylinder baffle. Axial Flow models have a two section air shroud which is split in center and is removed from the sides.

## 10. FRONT BEARING PLATE - BLOWER TYPE ENGINES

To remove the front bearing plate (not on Axial Flow models) remove capscrew then tap plate gently with soft head hammer. After plate is detached, remove old "O" ring and crankshaft end play adjusting shims--note number of shims and use same number here later during reassembly. Shims are also used at PTO end bearing plate which is removed later.

## 11. CYLINDER HEADS, CYLINDERS

Before disassembly, put matching marks on intake side cylinder heads, cylinder and crankcase. On engines with removable flange type exhaust tubes, remove the brass nuts and detach both tubes. On engines with threaded exhaust tubes, do not attempt to remove the tubes unless replacement is necessary--a special sealer compound is used during installation which hardens with use making removal difficult.

Remove cylinder head capscrews (note position of support spacers for air shrouds) then detach heads. Remove cylinder barrel nuts then remove barrels over top of pistons. Keep #1 and #2 cylinder parts separate. Discard head and base gaskets.

## 12. PISTONS

Remove circlips from ends of pin (pry out with pick-like instrument) then use a piston pin extractor tool to push pin out and separate pistons from rods.

## 13. CRANKCASE, CRANKSHAFT

On all models except K399-2AX and K440-2AX, remove PTO end bearing plate, "O" ring and shims (note number of shims). On all models, remove nuts and capscrews used to secure crankcase halves. A sealant is used between the halves--to break the seal, lift the top assembly and tap gently on the crankshaft with a soft head hammer until the halves separate. Lift the top half off over the studs. On K399-2AX and K440-2AX, remove the oil seals, snap ring and shims at both ends. Lift the crankshaft out of the bottom half--if it sticks, tap bottom half gently until shaft is free then remove.

# RECONDITIONING

## CRANKSHAFT - CONNECTING ROD

If a visual check fails to uncover any damage, install crankshaft-rod assembly in vise--use protective caps on jaws. Make the following tests to determine if the crankshaft-rod assembly can be reused. Do not attempt to disassemble crankshaft for reconditioning--special tools and equipment are required for this. If center main or rod bearings or crankshaft are damaged or worn beyond limits, replace assembly as a unit. Do not reinstall outer main bearings until after end play is established.

**ROD BEARING CHECK:** First check connecting rod small end bearing for evidence of binding or roughness. Turn rod back and forth as shown--if bearings are in good condition, rotation will be smooth. The small end bearing may be removed and replaced if necessary.

**MAIN BEARINGS:** The center main bearings cannot be removed--if these are damaged, replace crankshaft assembly. The outer main bearings can be removed and replaced. Use one of the special bearing removal tools (see tool listing at back of this manual). Place expansion ring within 1/2" of bearing for best results in removing bearing. Do not install new outer main bearings until after the crankshaft end play has been checked--use dummy bearings for this during reassembly of the engine. Before fitting new bearings, heat them in clean oil to about 100 - 150° F., then press them onto the crankshaft.

**ROD SIDE PLAY:** Mount dial indicator as shown in Figure 11-2 to check lateral movement of connecting rod. Move rod back and forth laterally--if movement stays within the .008 - .016" range, end play is within allowable limits.

**SHAFT ALIGNMENT:** Install crankshaft in the lathe centers and check concentricity with dial indicator riding on shaft as shown in Figure 11-3. If run-out exceeds .003" TIR, remove shaft and try to bring back into alignment by either pinching weights closer together in a vise or by spreading them further apart with a metal wedge. Repeat alignment check after repositioning weights. If this fails to bring shafts back into alignment, a new assembly must be used.

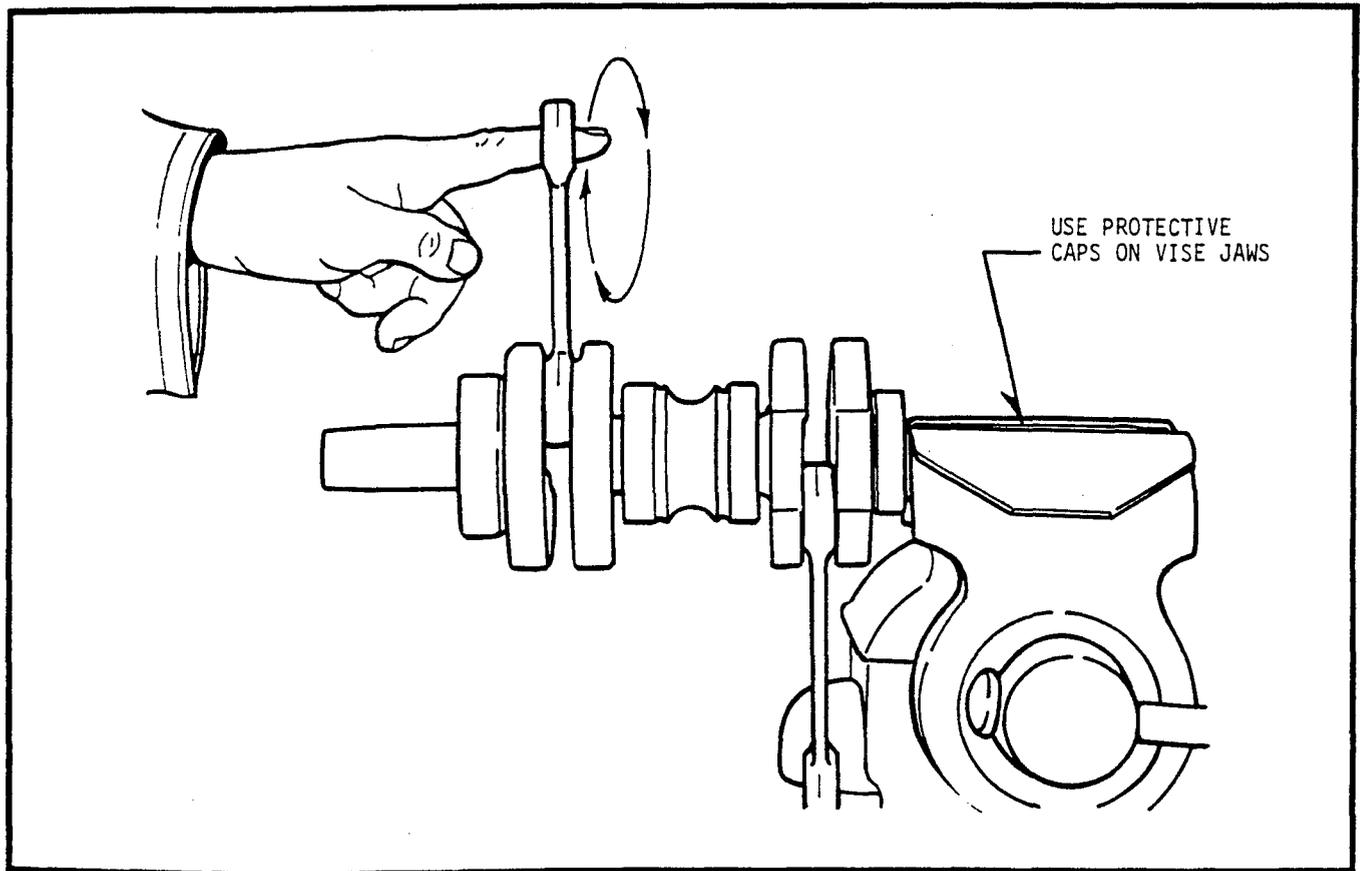


FIGURE 11-1 -- ROTATE CONNECTING ROD TO CHECK FOR ROUGHNESS OR BINDING OF NEEDLE BEARINGS

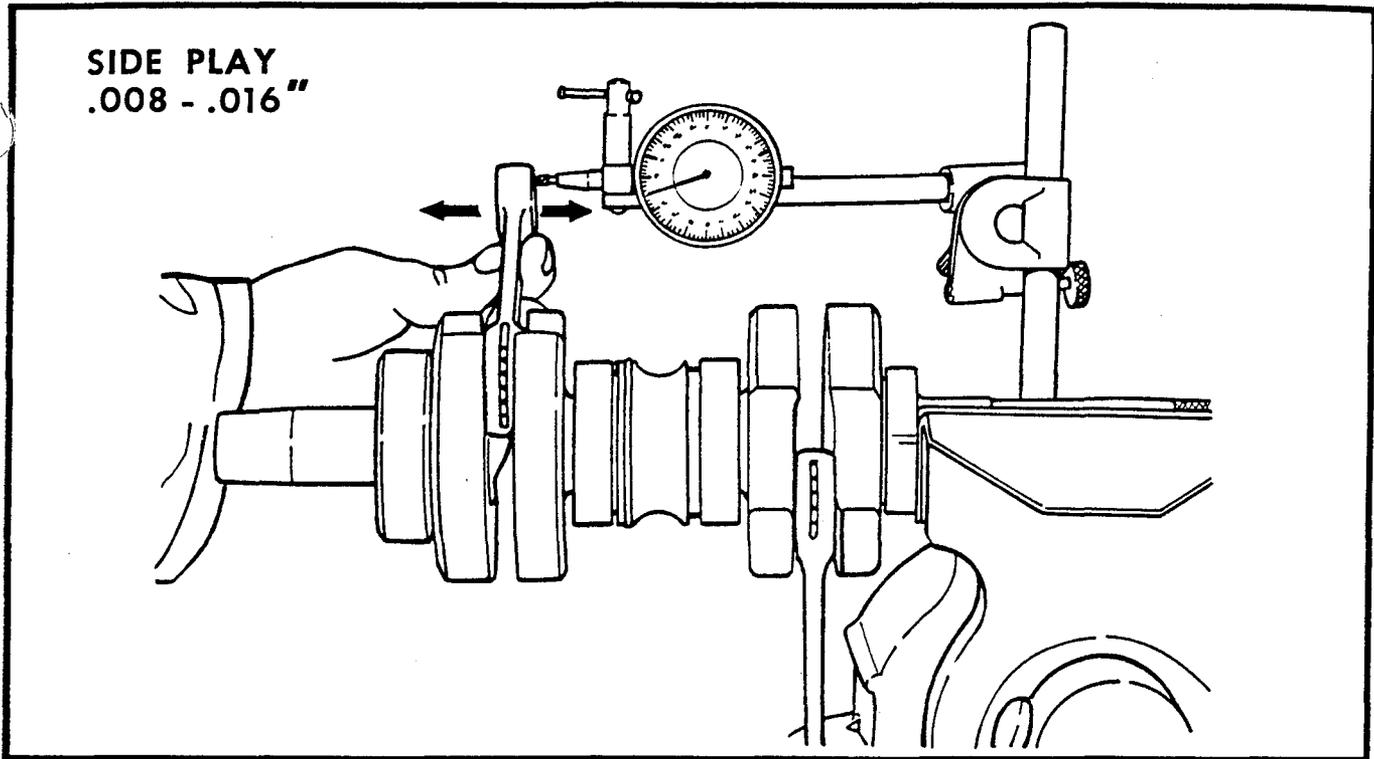


FIGURE 11-2 -- CHECK LATERAL MOVEMENT (SIDE PLAY) OF CONNECTING ROD

**CLEANING:** After checking shaft, thoroughly clean assembly in a type of cleaning solution which does not leave an oily film--use light naphtha or similar solution. Do not, for example, use kerosene as this leaves an oily film. Alcohol or lacquer thinner also must not be used as these, on the other hand, leave parts too dry and may cause seizure during initial start up after reconditioning.

## CRANKCASE

Carefully inspect upper and lower halves of crankcase assembly. Check mating surfaces--replacement of the crankcase assembly may be required if surfaces are badly nicked or grooved. Make sure that all screw threads, studs, etc., are clean and undamaged. Remove varnish, gum, etc., deposits from internal surfaces, also thoroughly clean external surfaces.

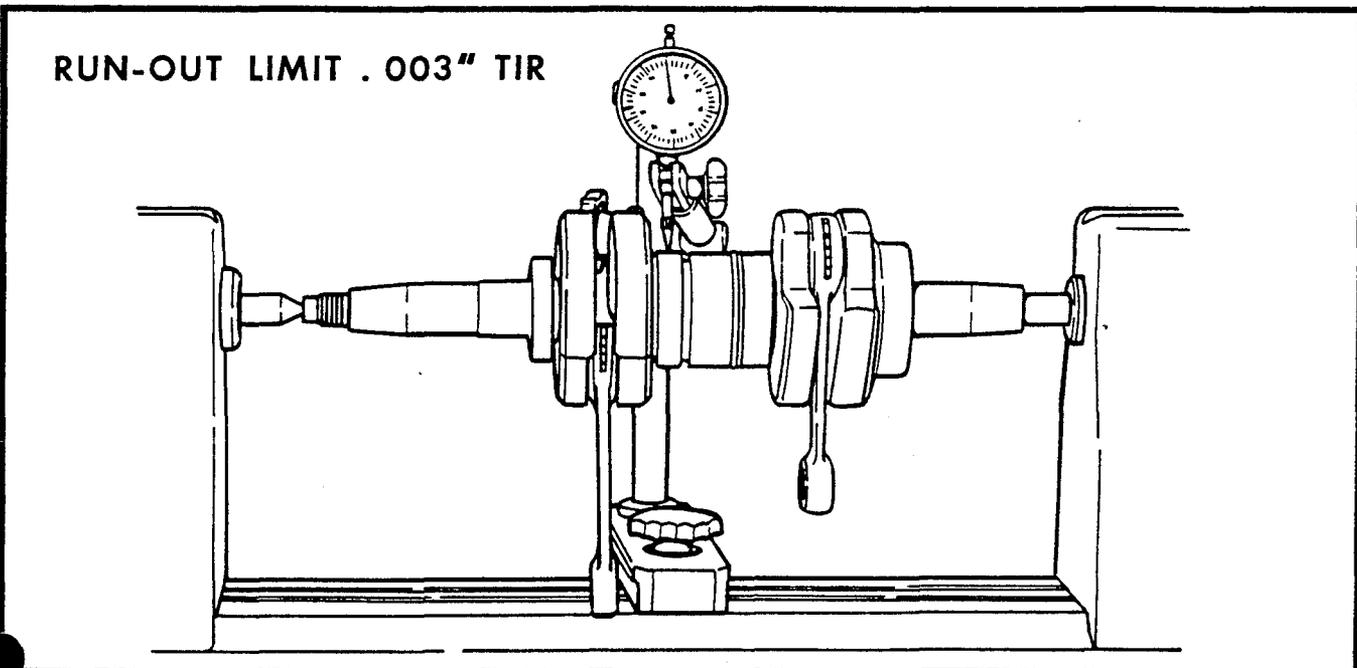


FIGURE 11-3 -- CHECK ALIGNMENT OF SHAFTS WITH DIAL INDICATOR

## BEARING PLATES - OIL SEALS

Check bearing recess for signs of wear--replace plates if recess is grooved or damaged. First check the depth to which the old oil seals are pressed then remove the seals and thoroughly clean the bearing plates. Remove all trace of gasket and sealer material. Lubricate new oil seals liberally then, using a driver of size which presses against most of the flat surface of the seal, press the new seal squarely into the plate to the same depth as the old seal. The spring side of the seal must be toward the inside or facing crankcase of the engine. Lubricate the seals again when the plates are slipped over the crankshaft during reassembly.

## CYLINDER HEAD

Make certain that cooling fins are unbroken and that threads for spark plug are clean and undamaged. Also check gasket surface of head. Replace head if internal surface is scratched, nicked or distorted.

Clean out any carbon deposits from inside the combustion dome--if badly varnished or if carbon deposits cannot be removed, use a new cylinder head.

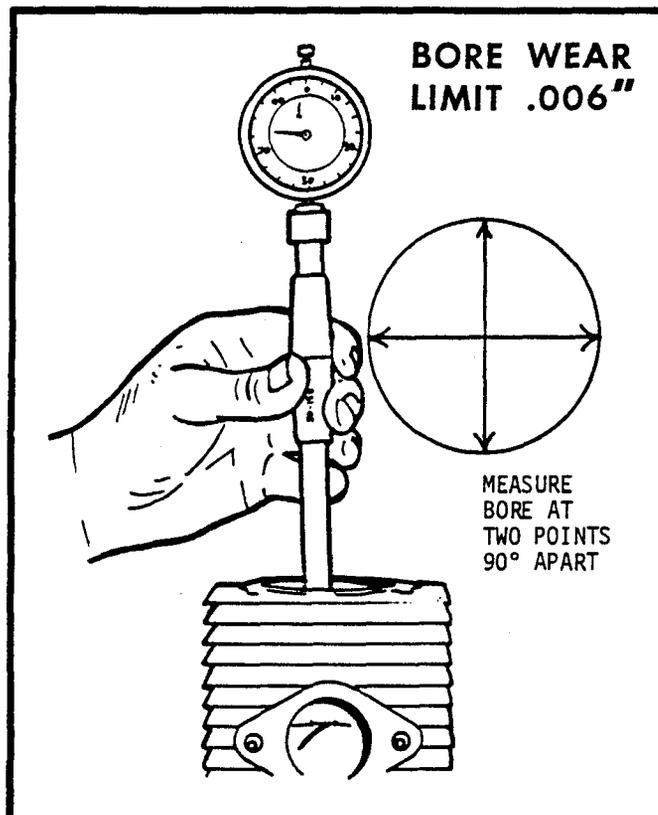


FIGURE 11-4 -- CHECK BORE FOR WEAR

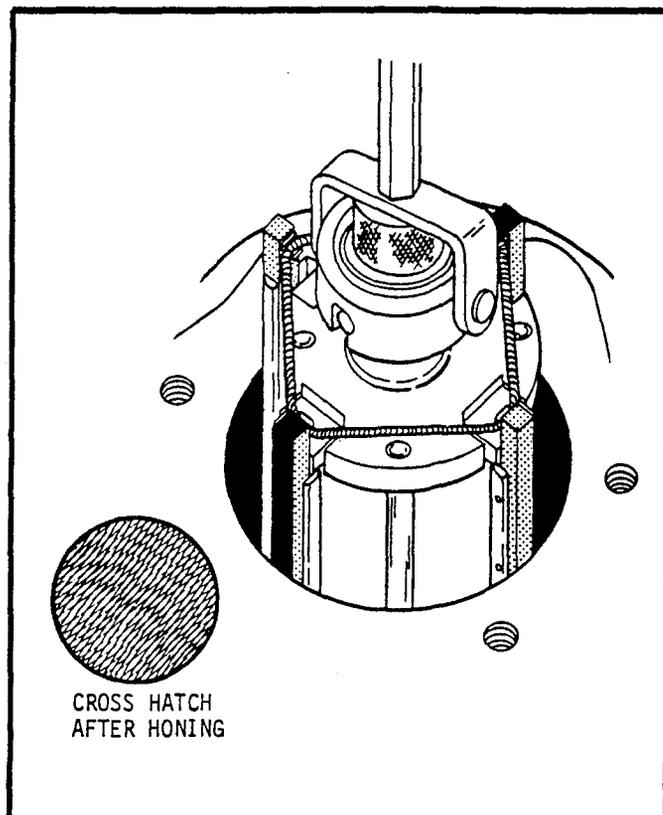


FIGURE 11-5 -- REBORING CYLINDER WITH HONE

## CYLINDERS

Carefully observe cylinder bore for signs of scuffing, check gasket surfaces for nicks or grooves which could prevent proper sealing, check for badly chipped or broken fins. Also make sure threads are not stripped. Use a new cylinder barrel if damage is noted. If none is evident, measure cylinder bore for wear--use inside micrometer or bore gauge and check area just below top of bore. Wear will be indicated by a "step" worn into the wall. Measure at right angles to the piston pin axis at the top where most wear occurs. If worn more than .006", the cylinder will have to be replaced or rebored providing oversize piston and rings are available. **NOTE:** On AS models, pistons and cylinders are color coded--make sure both have the same color coding when replacing. Oversize cylinders are not available for AS models. Chrome plate cylinders are used on the AS models.

If oversizes are available (check parts manual sections) rebore cylinder oversize and use corresponding oversize pistons and rings--.010", .020" and .040" oversizes are available for some models while only .020" and .040" are available for certain models. Check available oversizes before reboring. After reboring remove any burrs that may have formed at edges of ports. Thoroughly wash walls with kerosene and clean rags then, after cleaning, apply light coating of SAE 10 oil on walls to prevent formation of rust. Make sure all trace of gasket material is removed from surfaces.

MEASURE PISTON SKIRT (JUST BELOW BOTTOM RING) PERPENDICULAR TO PIN

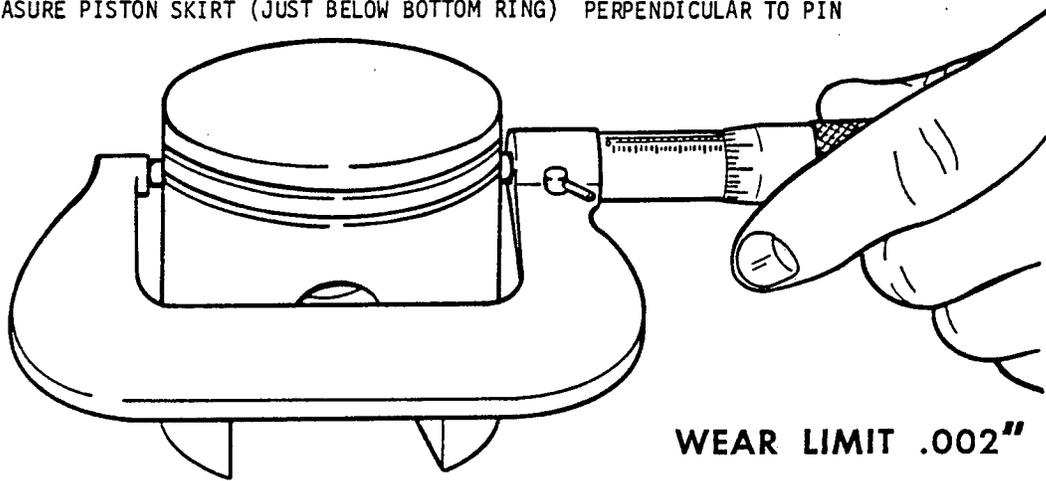


FIGURE 11-6 -- CHECK PISTON SKIRT FOR WEAR WITH MICROMETER

## PISTON - PISTON RINGS

To check wear, measure piston at the top level of the piston skirt (just below bottom ring) and at right angle to the piston pin--if wear exceeds  $.002''$ , the piston must be replaced. Also replace if there is any evidence of pitting on top of the piston. If cylinder has been rebored oversize, use appropriate oversize piston and rings. Check parts manual for available oversizes--oversizes are not available for certain models. **NOTE:** On AS models, pistons and cylinders are color coded--make sure the piston has the same color coding as the cylinder when replacing. Oversizes are not available for AS models.

If piston is undamaged and can be reused, remove used rings and fit new rings; never reuse rings. After removing old rings, break one of the old rings in half and use this to clean carbon deposits from the ring grooves--be careful not to scratch or enlarge grooves when doing this.

Before installing new rings, insert each ring into the bottom of the cylinder bore, square with piston then check ring end gap with feeler gauge.

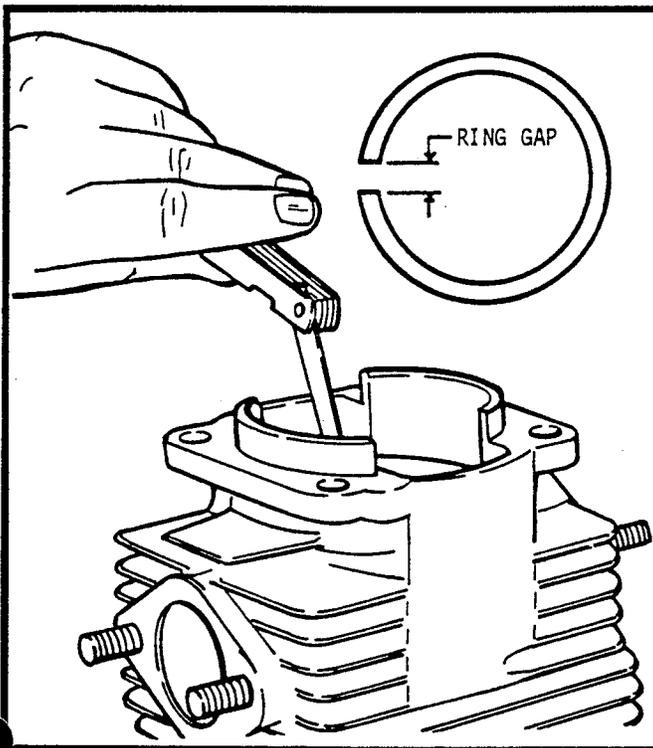


FIGURE 11-7 -- CHECK RING END GAP

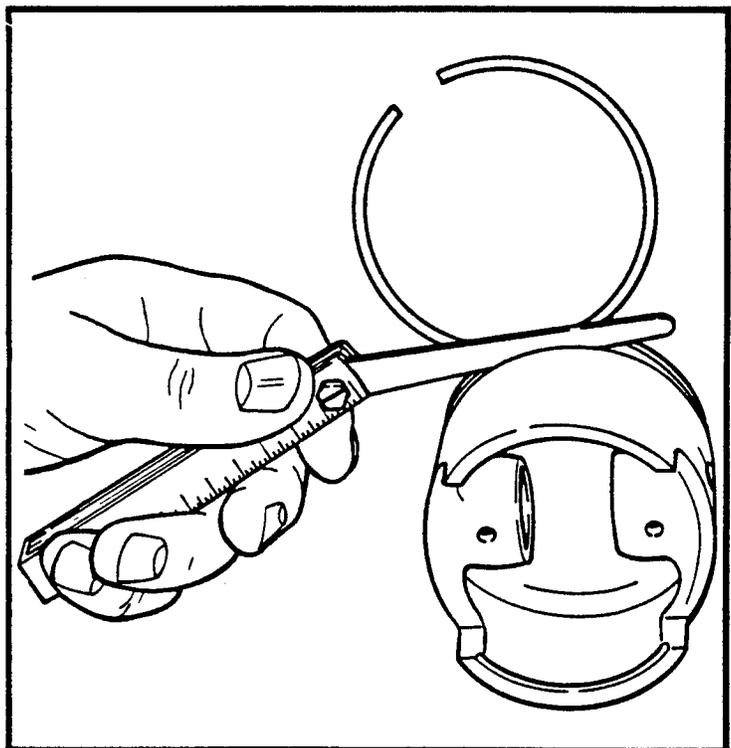


FIGURE 11-8 -- CHECK RING SIDE CLEARANCE

Ring side clearance must also be checked before installation. To do this, place ring in its proper groove and check side clearance with feeler gauge as shown in the accompanying illustration. Side clearance must not be more than that specified below. If more than this, groove is worn beyond limits and piston must be replaced.

PISTON RING DETAIL	ENGINE MODEL (CLEARANCE IN INCHES)							
	K295-2*	K340-2T	K340-2AX	K399-2T	K399-2AX**	K440-2T	K440-2AX***	K618-2
SIDE CLEARANCE - TOP RING	.0022 - .0037	.0028 - .004	.0022 - .0037	.0028 - .004	.0022 - .0037	.0028 - .004	.0022 - .0037	.0035 - .0048
SIDE CLEARANCE - BOTTOM RING	.0012 - .0024	.0024 - .0036	.0012 - .0024	.0024 - .0036	.0012 - .0024	.0024 - .0036	.0012 - .0024	.0028 - .004
END GAP - TOP & BOTTOM RING	.008 - .014	.010 - .016	.008 - .014	.010 - .016	.008 - .014	.010 - .016	.008 - .014	.012 - .018

\*K295-2T & 2AX \*\*SK340-2AS also \*\*\*K440-2AS also

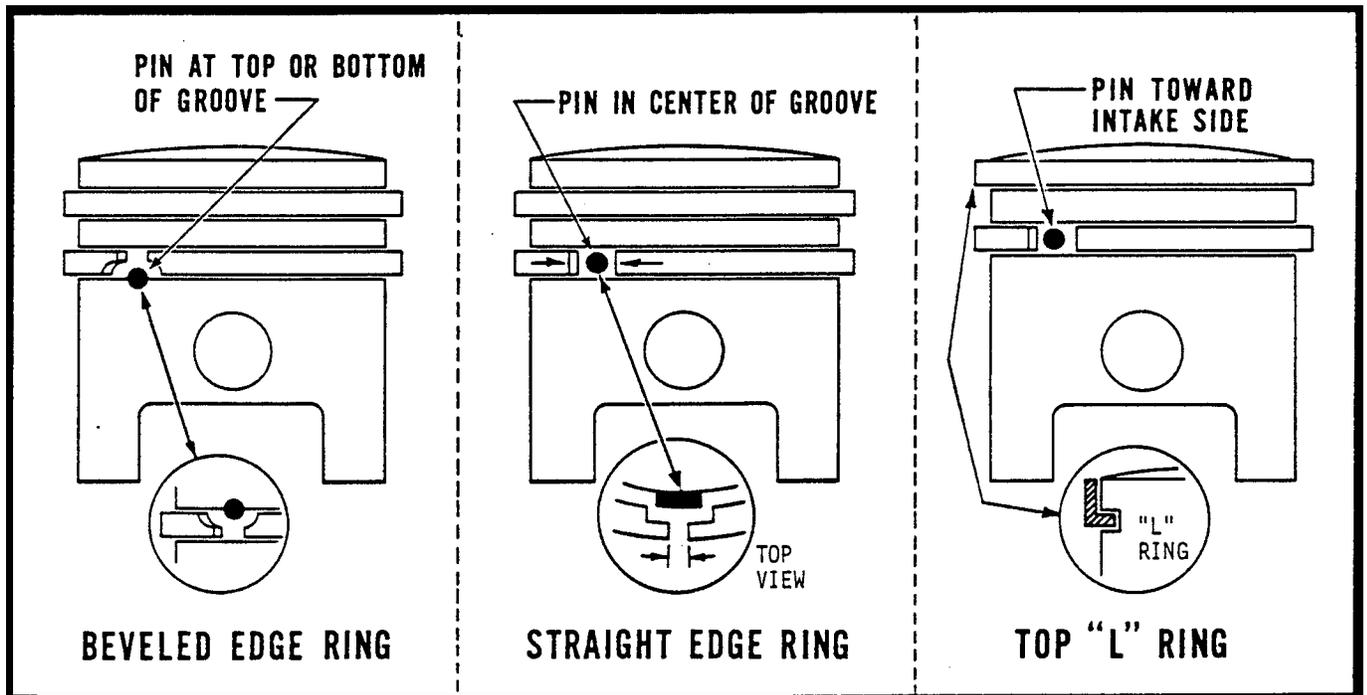


FIGURE 11-9 -- PISTON RING VARIATIONS AND INSTALLATION DETAILS

When installing rings for blower type engines (except K295-2T), install the lighter appearing ring in the bottom groove (nearest pin) first then install the top ring which is the duller or darker moly coated ring in the top groove. The Axial Flow and K295-2T engines use "L" shaped ring in the top groove. Use ring expander to install rings. On all models, turn rings so that the ring gap is over the small locating pins in the piston grooves.

## SPARK ADVANCE MECHANISM

Check surface of cam. Replace cam if worn or damaged in any way. To replace the cam, detach screws and cam retaining clip. When installing new cam, engage tongue on centrifugal flyweight lever in slot on cam. Check spring to make sure that it moves freely but without excessive play on the pivot pin. Use small amount of Kohler cam grease on wick (on breaker points) to insure adequate lubrication of cam and breaker point lifter--an amount about the size of a match head is usually adequate.

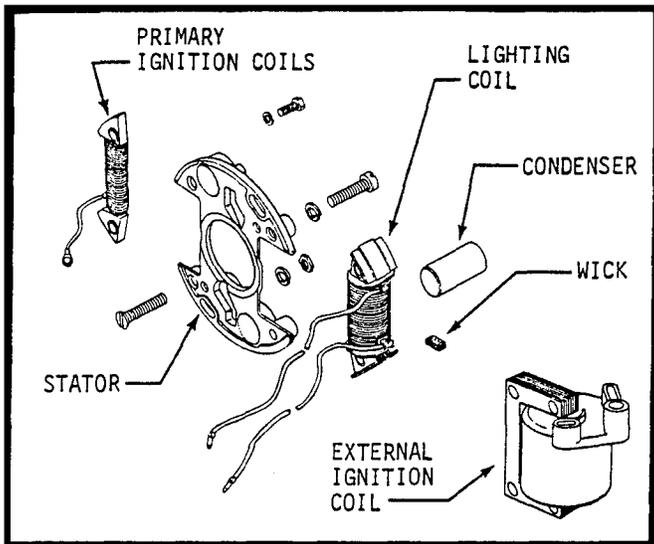


FIGURE 11-10 -- STATOR EXPLODED VIEW

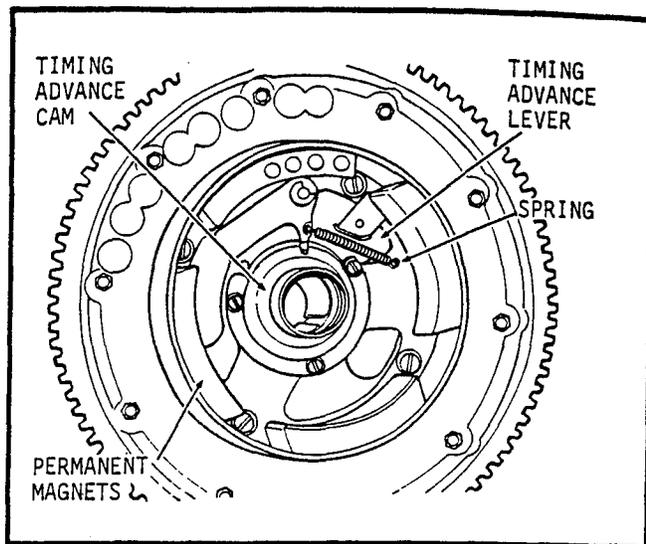


FIGURE 11-11 -- SPARK ADVANCE MECHANISM

## IGNITION-ELECTRICAL SYSTEM

The ignition service centering tool is required whenever the breaker points, ignition or alternator coils are replaced. Use of this tool establishes the proper air gap and also allows precision setting of the breaker point gap. Use the following procedure when servicing or replacing components.

**BREAKER POINTS:** If points are badly worn or pitted, they must be replaced. To remove, loosen nut and remove leads from ignition coil and condenser. Remove circlip and setscrew then lift point pivot arm off pin. Remove point gap setscrew then detach bracket portion of breaker point assembly. Reverse procedure to install new breaker points. Use of the cam sleeve allows precision adjustment of the breaker point gap. Set gap at .016". Apply a small amount of Kohler cam grease (about size of match head) to the wicks.

**CONDENSER:** To remove, unsolder two leads then break locking burrs (if present) before pressing or driving condenser out of stator plate. When reinstalling condenser, apply pressure slowly and gently to avoid damaging condenser. To prevent distortion or cracking of the stator plate, use the condenser replacement tool per instructions in the kit.

**IGNITION & LIGHTING COILS:** To replace ignition coil, unsolder wire running to condenser at the condenser, then remove the two screws which secure the coil to the stator. The lighting or alternator coil is removed in the same manner except that the leads do not have to be unsoldered.

After reinstalling coil, loosen capscrew slightly then slide coil outward until both ends of coil contact metal centering ring. Tighten screws while holding coil firmly against the ring. This correctly establishes air gap at .012".

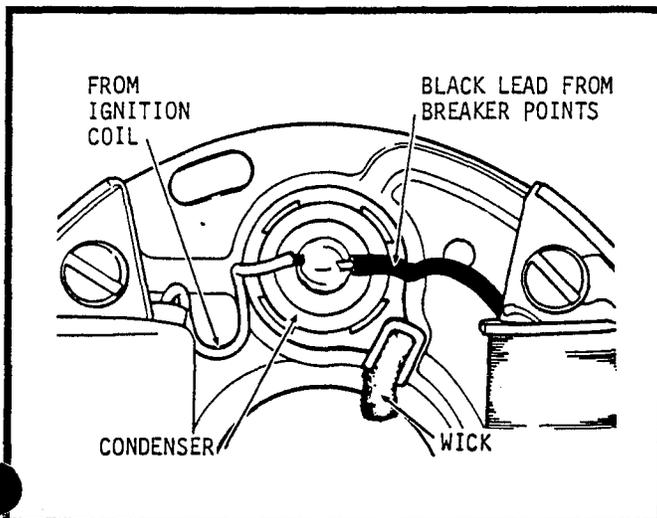


FIGURE 11-12 -- CONDENSER DETAILS

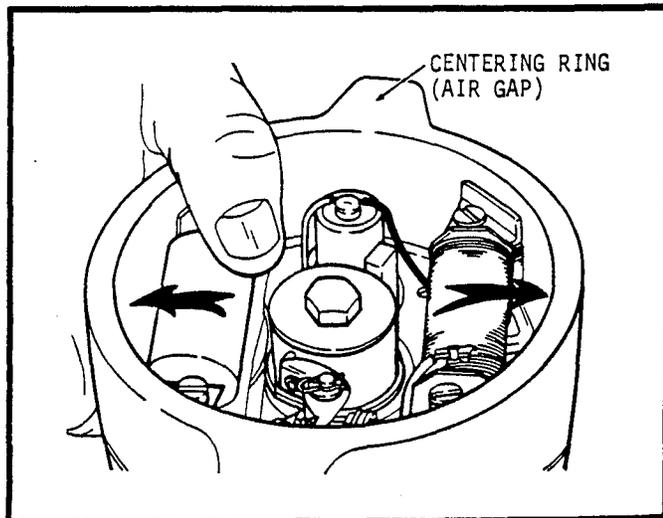


FIGURE 11-13 -- IGNITION SERVICE TOOL

# RETRACTABLE STARTERS

Retractable starters do not need regular service and should not require complete disassembly unless rope breaks or starter will not engage due to worn or broken parts. If starter works properly but rope looks frayed and about ready to break, replace rope. To do this pull handle all the way out, block and hold starter pulley in position, then untie or cut knotted end of rope and remove and discard old rope. Insert end of new rope in pulley hole, install washer then tie knot in rope. With nylon rope, the knot can be permanently fused by burning with a match--use proper precautions when doing this.

**DISASSEMBLY:** If starter must be disassembled, use the following procedure.

**STEP 1:** Remove capscrews and detach retractable starter from the engine.

**STEP 2:** If rope is not broken, pull handle out about 8" and tie temporary knot at this point. Pry rope retainer out of handle then untie knot and remove handle and retainer. Hold pulley, untie temporary knot then allow pulley to unwind slowly (brake with thumb on pulley surface) until all tension on spring is released.

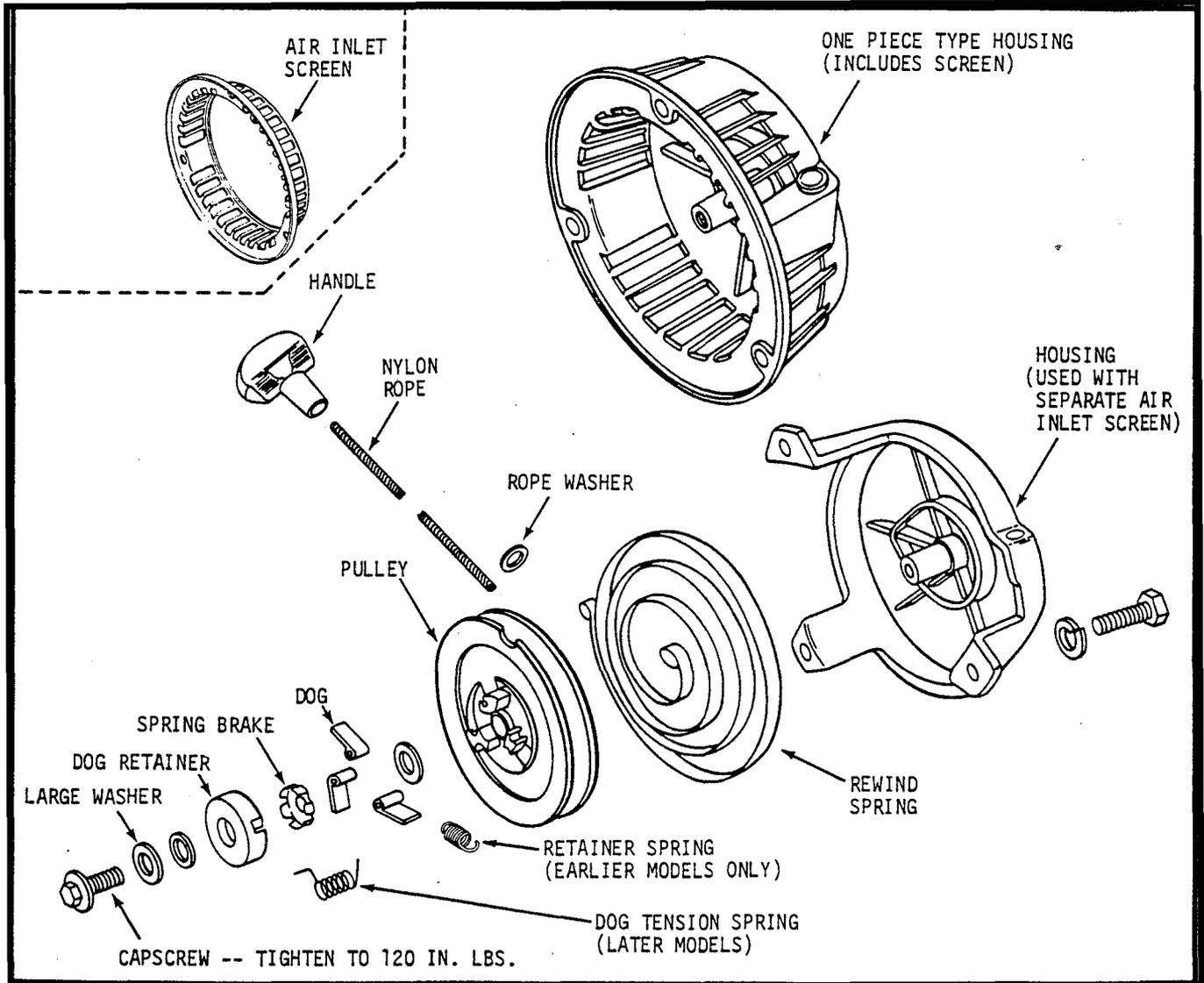


FIGURE 11-14-- EXPLODED VIEW: RETRACTABLE STARTERS

**STEP 3:** Remove capscrew on dog retainer then detach retainer and associated parts from pulley (Note sequence of removal).

**STEP 4:** Use extreme caution when removing pulley--the inside of the rewind spring fits into a slot in the hub of the pulley. The pulley must be carefully lifted out of housing to insure that the spring detaches from the hub.

**RECONDITIONING:** Use extreme caution (safety glasses, etc.) when removing, handling or installing rewind springs. Do not remove spring from recess in starter housing unless replacement is absolutely necessary.

1. **SPRING REPLACEMENT:** Carefully remove rewind spring--start on inside loop, pull one loop out at a time. Place new spring in housing, then after blocking spring to prevent lateral movement, carefully remove retaining clip and tape if used--tape must be cut and removed in segments --do not peel from spring.
2. **REPLACING BROKEN ROPE:** When the rope breaks, the pulley unwinds violently and may damage other parts. Carefully inspect dogs, dog retainers, etc., and replace if worn or damaged. Tie a knot at one end of the new rope, slide the washer over rope up next to the knot then guide other end through hole in pulley. Pull rope through until washer (and knot) are tight against the outside surface of pulley. Wind rope around groove.
3. Position pulley on top of spring in the housing--knotted end of rope facing up. Note hole in hub of pulley--insert piece of stiff wire or nail into this hole then turn pulley. The wire will guide the inside end of spring into the hub and allow the pulley to drop into position in the housing.

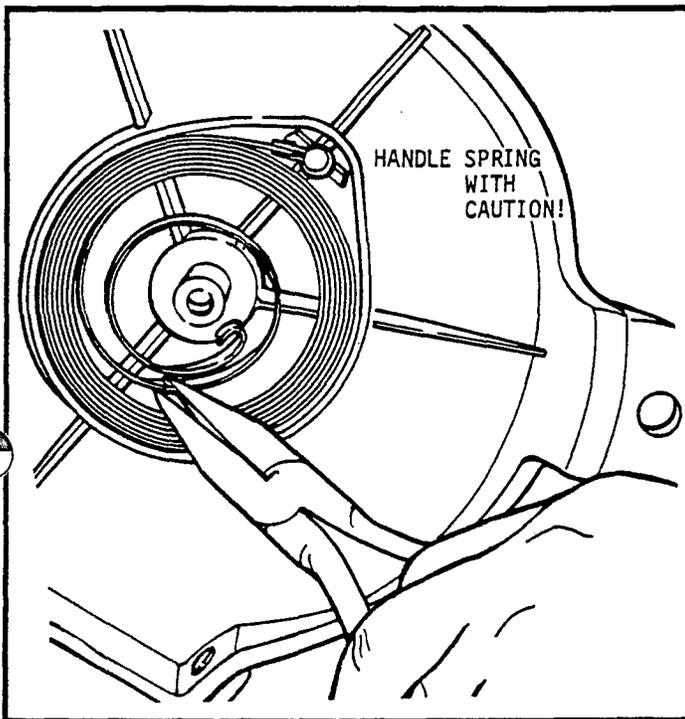


FIGURE 11-15 -- USE CAUTION WITH REWIND SPRINGS

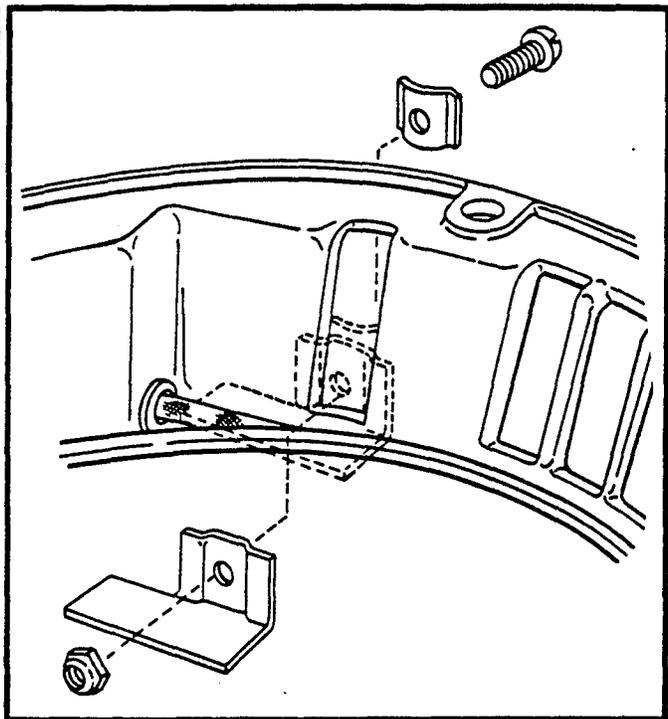


FIGURE 11-16 -- RETAINER KEEPS ROPE ON PULLEY

4. Reinstall dogs (pawls) in hub of pulley. Some starters use individual springs under each dog rather than the small spring which hooks over the post. Hook spring (when used), which is attached to the retainer, over post of hub then install washers, spacers and retainer. Note that the smaller washer is placed next to the retainer. Check sequence of washers and make sure holes are centered as the retainer is reassembled. Tighten dog retainer capscrew with torque wrench to 120 in. lbs. When this is done, a slight drag will be felt when retainer is turned by hand; however, when handle is pulled, dogs will readily move into engaged position. If loose, the dogs will not engage or will only partially engage and damage teeth in starting cup. Inspect and replace damaged drive cup.
  5. To pre-tension rewind spring, thread rope through bushing and pull all the way out to the fully extended position. Hold pulley in this position then slack off on rope (make loop about diameter of pulley) then work pulley around one full turn to increase tension. Pull rope out again and make temporary knot to hold while reinstalling handle and retainer. Release temporary knot and test--pull rope all the way out until the knot is even with bushing in housing, then work pulley with thumbs in counterclockwise direction about 1/4 turn more or to the point where it is next to the first post. If properly pretensioned, pulley cannot be turned further than this.
- Make sure starter is properly centered when reinstalled on engine. Reinstall starter loosely on engine then pull handle out about 8" until dogs are firmly engaged in starter cup--hold rope in this position while securing starter mounting capscrews.

RETRACTABLE STARTER - AXIAL FLOW ENGINES: Use the following procedure to recondition retractable starters used on Axial Flow engines.

### DISASSEMBLY

- STEP 1: Remove starter from ventilator housing on engine.
- STEP 2: Push "E" ring out with screwdriver blade then remove retaining washer, spring, steel and felt washers and the friction shoe assembly.
- STEP 3: Carefully lift sheave out of starter housing.
- STEP 4: If rewind spring is broken remove the spring case assembly as a unit--don't attempt to separate case covers.

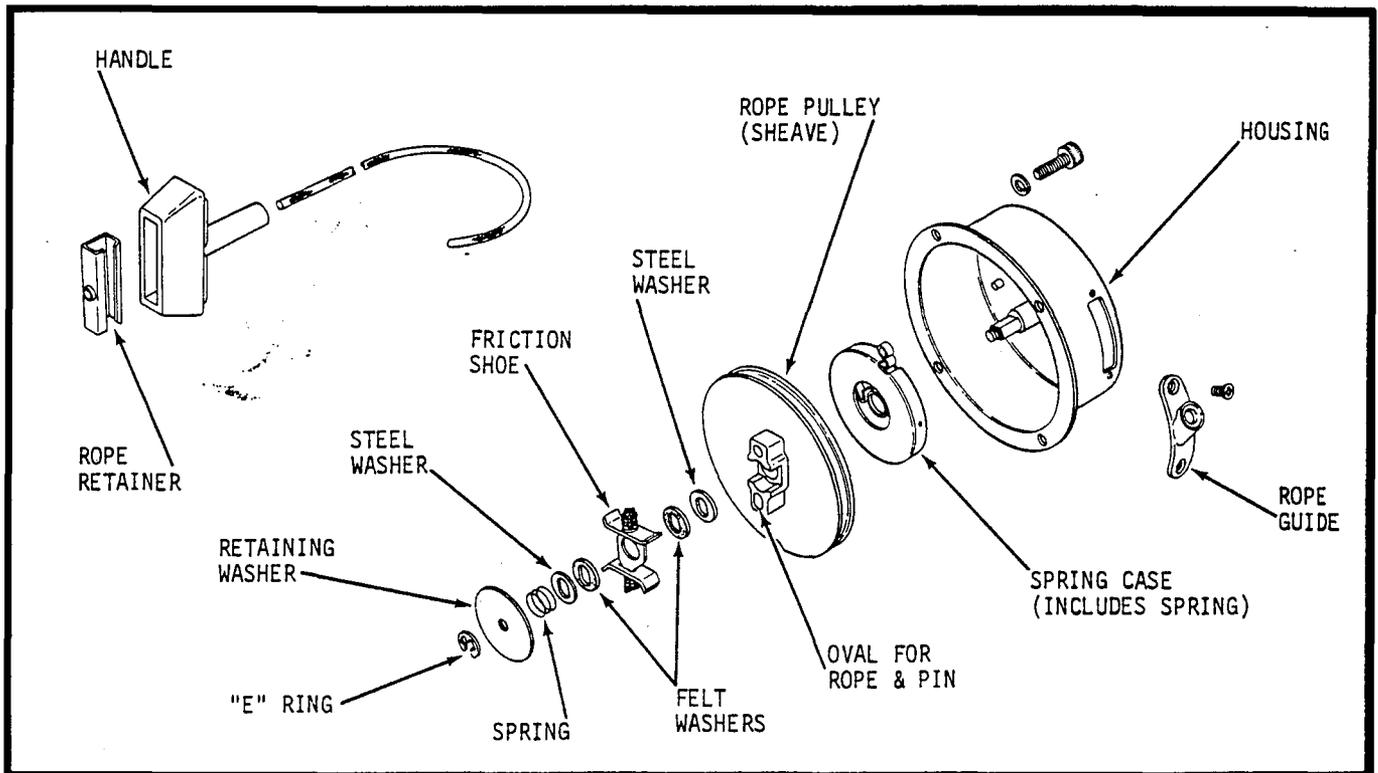


FIGURE 11-17 -- DISASSEMBLED VIEW - RETRACTABLE STARTER USED ON AXIAL FLOW MODELS

### REPAIR - REASSEMBLY

- STEP 1: Replace rewind spring and case assembly with a new unit.
- STEP 2: If rope is frayed replace as follows. Remove old rope from hole in hub and disconnect other end from handle. Fuse both ends of new rope with match, bend end of rope in "U" shape around retaining pin and insert this end in hole in sheave hub then wrap rope in counterclockwise direction around sheave.
- STEP 3: Insert free end of rope thru notch in outer face of sheave then install pulley in starter housing.
- STEP 4: Reinstall felt washers, steel washers, friction shoe assembly (if installed right side up, sharp edge of dogs will be toward outside) spring in sequence illustrated and lock in position with washer and "E" ring.
- STEP 5: Pre-tension rewind spring by rotating sheave in counterclockwise direction about 3-1/2 to 4 turns then hold in this position and thread rope end thru rope guide. Pull rope out from guide about 1/2 foot, tie slip knot in rope to prevent starter from rewinding, insert rope thru handle and hole in retainer, tie permanent knot in end and reassemble retainer in handle. Release the slip knot then reinstall starter on engine--no alignment procedure required on this type starter.

# CARBURETOR REPAIR

There are numerous versions of the HR series carburetors and Model WR carburetors being used on these twin cylinder engines. The main differences between models is usually found in calibration and/or location of throttle and choke lever assemblies. Because of these differences, several repair kits are needed--make sure the correct kit is used for the model being reconditioned. Complete disassembly of the carburetor is not usually necessary--check the contents of the repair kit first as this will usually determine the extent of disassembly.

## HR CARBURETORS

Select a clean work area because dirt and carelessness are the causes of most carburetor trouble. Proceed as follows to recondition the standard model HR carburetor. **CAUTION:** Some solvents and cleaners have a damaging effect on the synthetic rubber parts used in carburetors. It is best to use a petroleum product for cleaning. Do not use alcohol, acetone, lacquer thinner, benzol or any solvent with a blend of these ingredients unless the rubber parts and gaskets are removed. If in doubt about a solvent, test a used part in it and observe the reaction.

**DISASSEMBLY:** The entire carburetor should be cleaned by flushing with fuel and blown dry with compressed air before disassembly. The carburetor should be inspected for cracks in the casting, bent or broken shafts, loose levers or swivels and stripped threads.

1. Inspect the idle speed screw, washer and tension spring. Inspect the casting for thread damage. In the event the casting is stripped of threads, repair by drilling and tapping then insert an 8 - 32 Heli-coil 3/16" long.
2. The fuel inlet and filter cover are removed by removing the center screw. Remove the filter cover, the cover gasket and the filter screen. The filter screen should be cleaned by flushing with fuel or solvent and blowing with compressed air. It is advisable to replace the gasket whenever the filter screen is serviced. Flush all dirt from the plastic cover before assembly.
3. Remove the six body screws and the fuel pump cover casting. Remove the fuel pump diaphragm and gasket. Inspect pump diaphragm; it must be flat and free from holes. The gasket should be replaced if there are holes or creases on its sealing surface. Be certain to reassemble these parts in the correct order. The pump gasket should be assembled onto the diaphragm cover first, then the fuel pump diaphragm should be assembled next to the gasket and flap valve member next to the fuel pump diaphragm so that the flap valves will seat against the fuel pump cover.

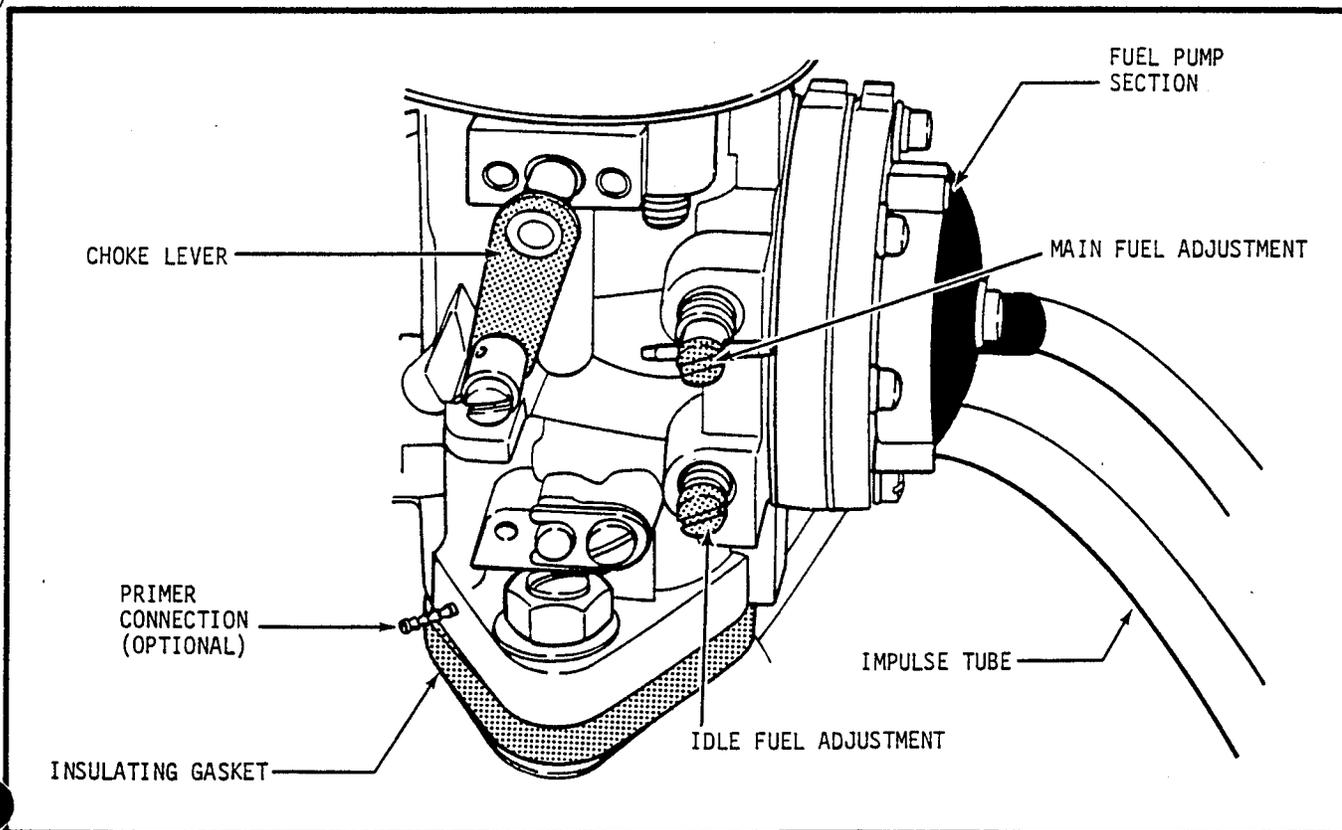


FIGURE 11-18 -- TYPICAL MODEL HR CARBURETOR

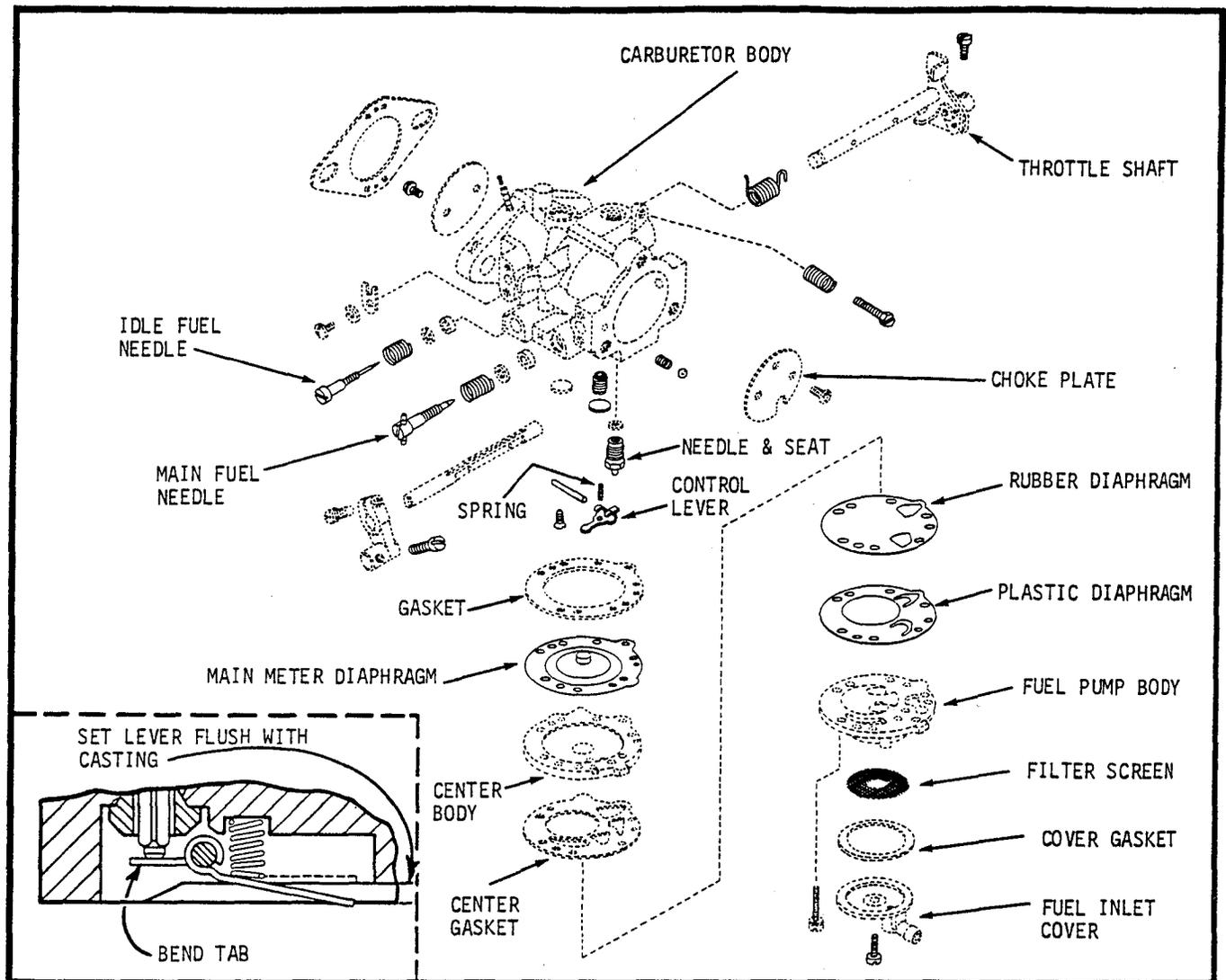


FIGURE 11-19 -- DISASSEMBLED VIEW - TYPICAL MODEL HR CARBURETOR

4. Remove the diaphragm cover casting, the metering diaphragm and diaphragm gasket. Inspect the diaphragm for holes, tears and imperfections. These parts must be reassembled in the correct order. The diaphragm gasket is assembled onto the body casting first and the metering diaphragm is assembled next to the gasket.
5. Remove the fulcrum pin retaining screw, the fulcrum pin, inlet control lever and the inlet tension spring. Use caution in removing these parts because the spring pressure may cause the inlet lever to fly out of the casting. Inspect the parts for wear or damage. The inlet control lever must rotate freely on the fulcrum pin.
6. Handle the inlet spring carefully. Do not stretch this spring or in any way change its compression characteristics. If in doubt about its condition, replace it.
7. Remove the inlet needle. Remove the inlet seat assembly using a 5/16 inch thin wall socket wrench. Remove the inlet seat gasket.

● The inlet seat assembly consists of a brass cage and a rubber insert for the inlet needle seat. The insert goes into the cage only one correct way. Looking at the insert, one side is flat and smooth; the other side has a ridge or rim molded around the outside edge. This ridge is to be assembled away from the inlet needle point.

● Some models of the HR carburetor are equipped with a rubber tipped needle, a brass inlet seat and a copper gasket. The installation instructions below are applicable to both types of inlet seats. The inlet needles and seats are matched and tested for leaks at the factory and the

parts should not be interchanged--they must be kept in matched sets. When installing the insert cage into the carburetor body, use a new gasket. Do not force the cage, as you may strip the threads or distort the insert. Use a torque wrench to apply 25 to 30 in. lbs. pressure. The needle and seat assembly must be clean to insure correct performance.

Remove and inspect the points of both the high speed and idle mixture screws. Notice the idle mixture screw point has the step design to minimize point and casting damage. Through misuse, either mixture screw point may be bent, extruded from being forced into the casting seat or possibly broken off in the casting. If either mixture screw is damaged, be sure to inspect the condition of the casting. If the adjustment seats are damaged, a new body casting is required.

9. The idle bypass ports and main nozzle ball check valve are sealed from the metering chamber by welch plugs. It is seldom necessary to remove either of these plugs because there is no wear in either section, and any dirt that may accumulate can usually be blown out with compressed air through the mixture screw holes. If the carburetor is unusually dirty and the welch plugs must be removed, it will require careful work. Drill through the welch plug, using a 1/8 inch drill. Allow the drill to just break through the welch plug. If the drill travels too deep into the cavity, the casting may be ruined. Pry the welch plug out of its seat, using a small punch.

Inspect the idle bypass holes to insure they are not plugged. Do not push drills or wires into the metering holes. This may alter carburetor performance. Blow plugged holes clean with compressed air. Remove the main nozzle ball check assembly with a screwdriver of correct blade width. If this ball check is defective, the engine will not idle unless the high speed mixture screw is shut off or there will be poor high speed performance with the high speed mixture screw adjusted at 1-1/4 turns open. Replace the defective part.

10. The choke and throttle shafts may be removed if there is evidence of wear on these parts. The shafts do not have to be removed before cleaning the body casting if the parts are not worn.

Mark the throttle and choke shutters before removing them so that they can be reassembled correctly. The edges are tapered for exact fit into the carburetor bores. Remove two screws and pull the shaft out of the casting. Examine the shaft and the body bearings for wear. If the shaft shows excessive wear, replace it. If the body bearing areas are worn, replace the body casting. Remove the choke shaft from the body carefully so that the friction ball and spring will not fly out of the casting. Inspect the shaft and bushings.

11. Clean all parts before reassembling the carburetor. The metal parts can be cleaned in a good grade of commercial carburetor solvent. If the carburetor is not very dirty, it can be cleaned by blowing the parts with compressed air and carefully blowing out each channel and orifice in the castings.

**REASSEMBLY:** Make certain that all parts are kept clean before they are assembled to the body casting. Few measurements are required to complete the assembly of this simple unit:

1. Tighten the inlet seat to 25-30 in. lbs. of torque.
2. Adjust the inlet control lever so that the center of the lever that contacts the metering diaphragm is flush to the metering chamber wall as shown in the drawings.
3. Install new welch plugs at the nozzle well and bypass chamber if the original parts were damaged or removed. Place the new welch plug into the casting counter bore convex side up and flatten it to a tight fit, using a 5/16" flat end punch. If the installed welch plug is concave, it may be loose and cause uncontrolled fuel leak. The correctly installed welch plug is flat.
4. Assemble the gaskets, diaphragms and castings in the correct order.
5. Assemble the throttle shaft into the carburetor body and attach the throttle shaft clip before assembling the throttle shutter. With the shaft secured in place, assemble the shutter into the shaft. Make certain that the shutter fits accurately into the throttle bore in the closed position.
6. Assemble the spring and ball into the choke shaft hole and assemble the shaft into position. Assemble the shutter into the choke shaft. Make certain that the choke shutter fits lightly to the carburetor bore in the closed position.

A carefully rebuilt HR model carburetor should perform well. The two most likely causes of carburetor failure are dirt and a careless repair job. A clean, carefully assembled unit should be as good as new.

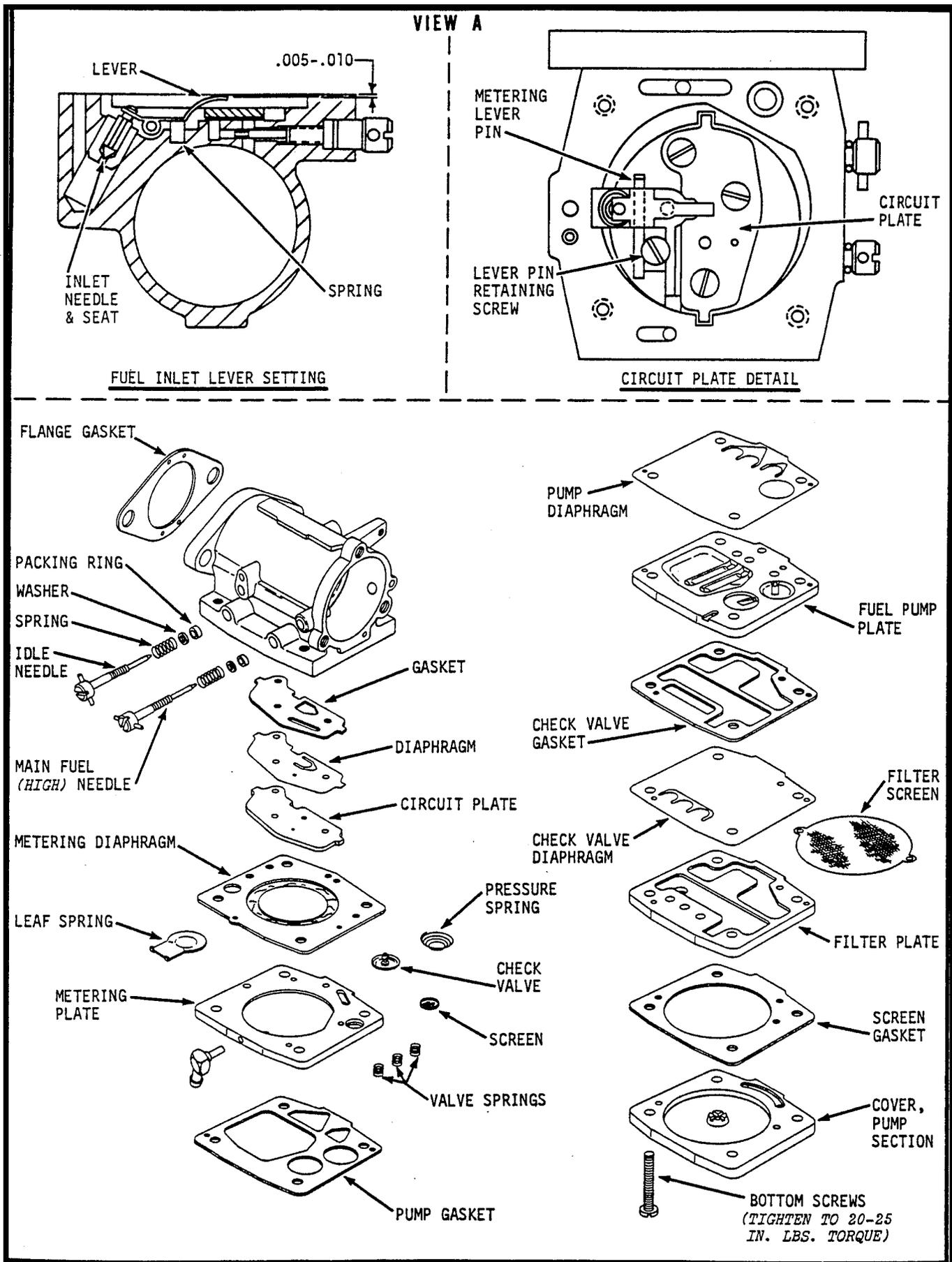


FIGURE 11-20 -- DISASSEMBLED VIEW - TYPICAL MODEL WR CARBURETOR

## WRI CARBURETORS

Before deciding to recondition a carburetor, make sure that the problem is not caused by some other item in the fuel system. If, for example, the problem cannot be corrected by readjustment, check the impulse line and the complete fuel system--if these are loose, restricted, or kinked, the carburetor cannot deliver sufficient fuel even when it is in excellent condition. After removing the carburetor, clean the external surfaces using a petroleum base type solution. Always use the carburetor repair kit for reconditioning. Recondition the WRI carburetor as follows:

**DISASSEMBLY:** Refer to the exploded view for parts identification and disassemble the carburetor in the following sequence:

1. Pump section cover (4 screws)
2. Filter screen and gasket
3. Filter plate
4. Check valve diaphragm and gasket
5. Fuel pump plate
6. Pump diaphragm and gasket
7. Metering plate and diaphragm
8. Inlet needle and seat (from carburetor body)
9. Circuit plate, diaphragm and gaskets (from body)
10. Remove idle and main fuel needles and packing, etc.

**RECONDITIONING PROCEDURE:** Wash all metal parts such as the carburetor body, cover and plates in the carburetor cleaning solution. Blow out passages with compressed air. Discard all parts which can be replaced by items from the repair kit. Carefully inspect the carburetor body particularly in the area around the throttle and choke shafts--if the bearing area of the shafts are worn enough to admit air, replace the shafts or carburetor if the body is worn.

**REASSEMBLY:** After all trace of cleaning solution is removed, reassemble and adjust carburetor as follows:

1. Place new packing rings in the carburetor body then install washers, springs, and the idle and main fuel needles--turn the needles all the way in until they bottom lightly, then back out 1-1/4 turns on both--for preliminary adjustment--reset the needles as specified for the particular engine model involved in the Fuel System Section of this manual before placing the engine in operation.
2. Position the two circuit plate gaskets, diaphragm and circuit plate on the body and secure with the 3 screws.
3. Install inlet needle and seat, spring, lever and pin then lock pin in place with the screw as shown--set the lever .005-.010" from the surface as shown in detail A.
4. Position a new metering diaphragm then install the metering plate--make sure springs, leaf spring pressure spring and check valves are installed and in good shape.
5. Install pump gasket, diaphragm and fuel pump plate.
6. Position check valve gasket, diaphragm and filter plate.
7. Install filter screen, screen gasket then install and secure the pump section cover with the 4 bottom screws--tighten these screws to 20-25 inch lbs. to complete reassembly of the carburetor.

# REASSEMBLY

The following is the suggested sequence for reassembly of a typical two cylinder engine--some of the procedure may have to be altered to account for special equipment or accessories. The procedure does not, in most cases, cover reassembly of the various sub-assemblies. This has been covered in the Reconditioning Section. Make sure work area and all parts are kept clean during final assembly of the engine.

## 1. END PLAY DETERMINATION

Install thru bolts in bottom half of crankcase before attaching to engine stand. After mounting the bottom crankcase on the stand, the first step is to establish proper end play of the crankshaft--use the following procedure.

**END-PLAY ADJUSTMENT:** Carefully lower crankshaft into position in the bottom crankcase then on engines using front and rear bearing plates, install these plates on the bottom half of the crankcase. On K399-2AX and K440-2AX models, which do not have end plates, install the snap rings in grooves at both ends of the bottom crankcase.

To check end play, push on the PTO end of the crankshaft until the front ball bearing touches the crankcase. With a feeler gauge, measure clearance between the rear bearing and the PTO end bearing plate or snap ring on engines so equipped.

The correct clearance is attained by installing .006" shims between the bearings and bearing plate or snap ring. If, for example, a clearance of .033" is measured, subtract .009" (nominal end play - .006-.012) from .033" to determine the uncorrected end play which in this case is .024" (.033-.009 = .024"). Next divide .006 (thickness of shims) into .024 to determine number of shims required--in this case 4 shims are required (.024 ÷ .006 = 4). As final proof, subtract the total thickness of the 4 shims (.024") from the actual measurement (.033") to arrive at the adjusted end play which is .009" (.033 - .024 = .009")--this is within acceptable end play limits of .006" to .012". When installing, put an equal number of shims at each end of the shaft whenever possible.

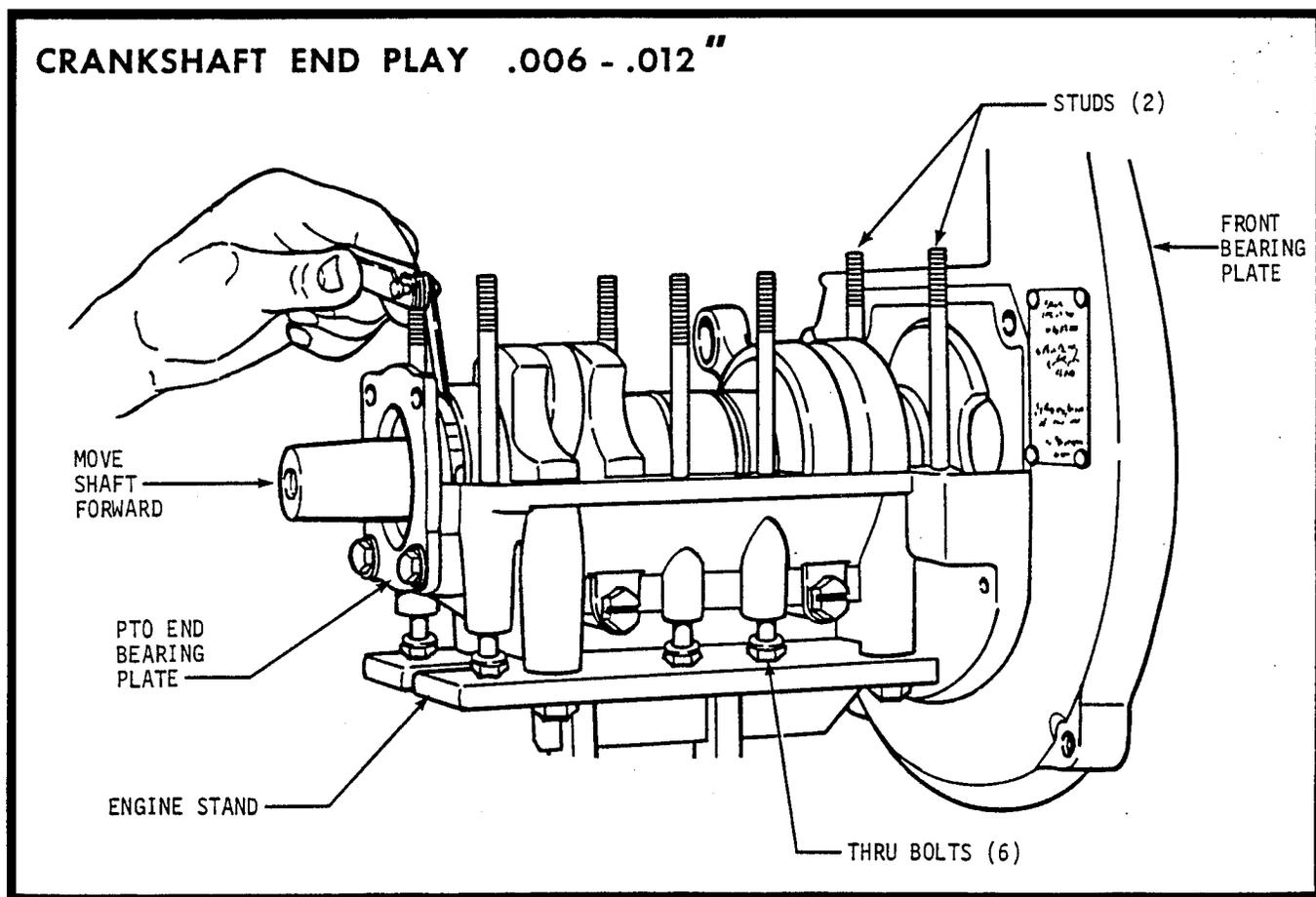


FIGURE 12-1 -- ESTABLISH CRANKSHAFT END PLAY BEFORE FINAL ASSEMBLY

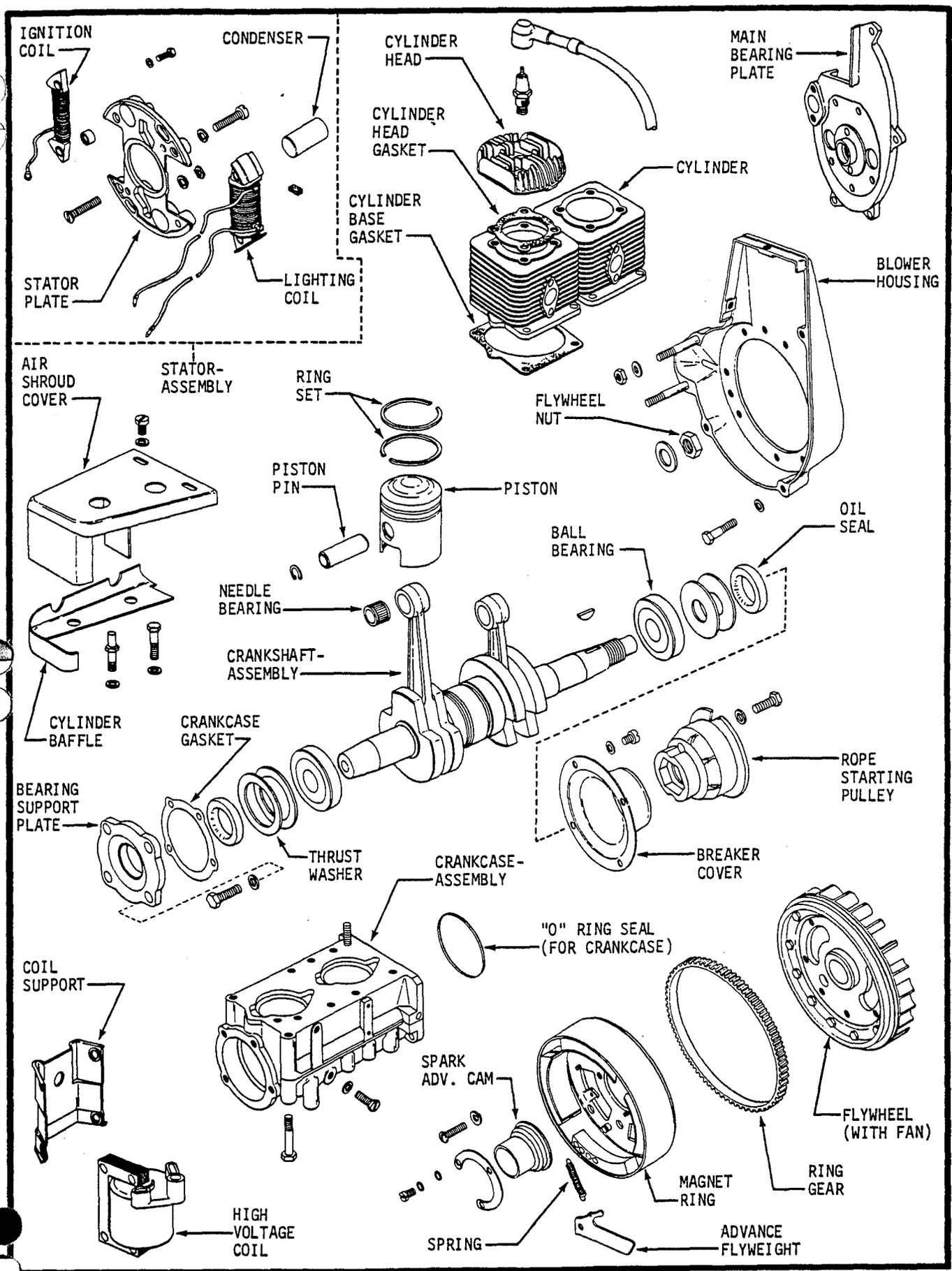
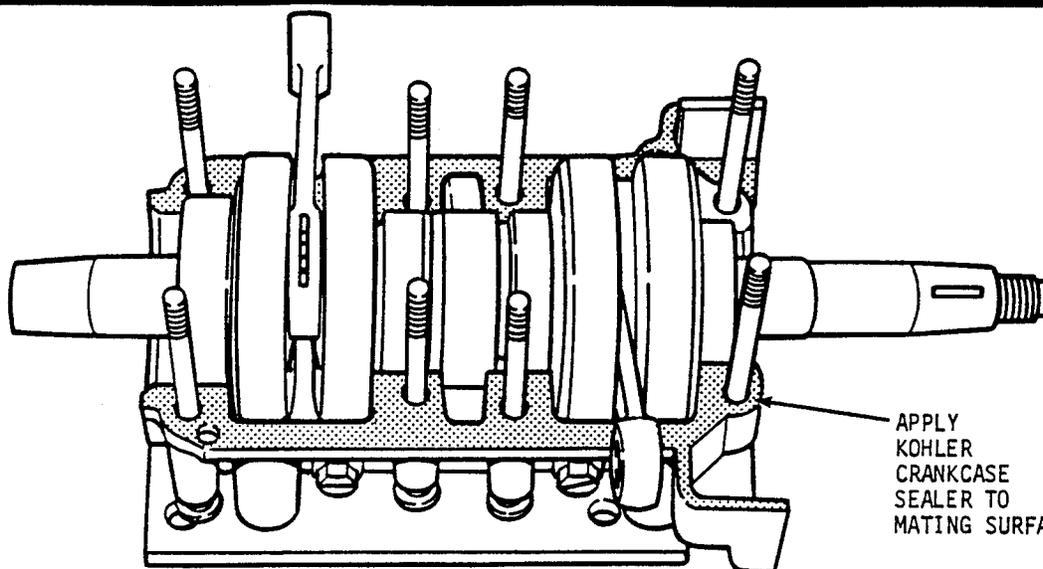


FIGURE 12-2 -- DISASSEMBLED VIEW - TYPICAL BLOWER TYPE ENGINE

LUBRICATE  
BEARINGS  
BEFORE  
INSTALLING  
TOP HALF OF  
CRANKCASE



APPLY  
KOHLER  
CRANKCASE  
SEALER TO  
MATING SURFACES

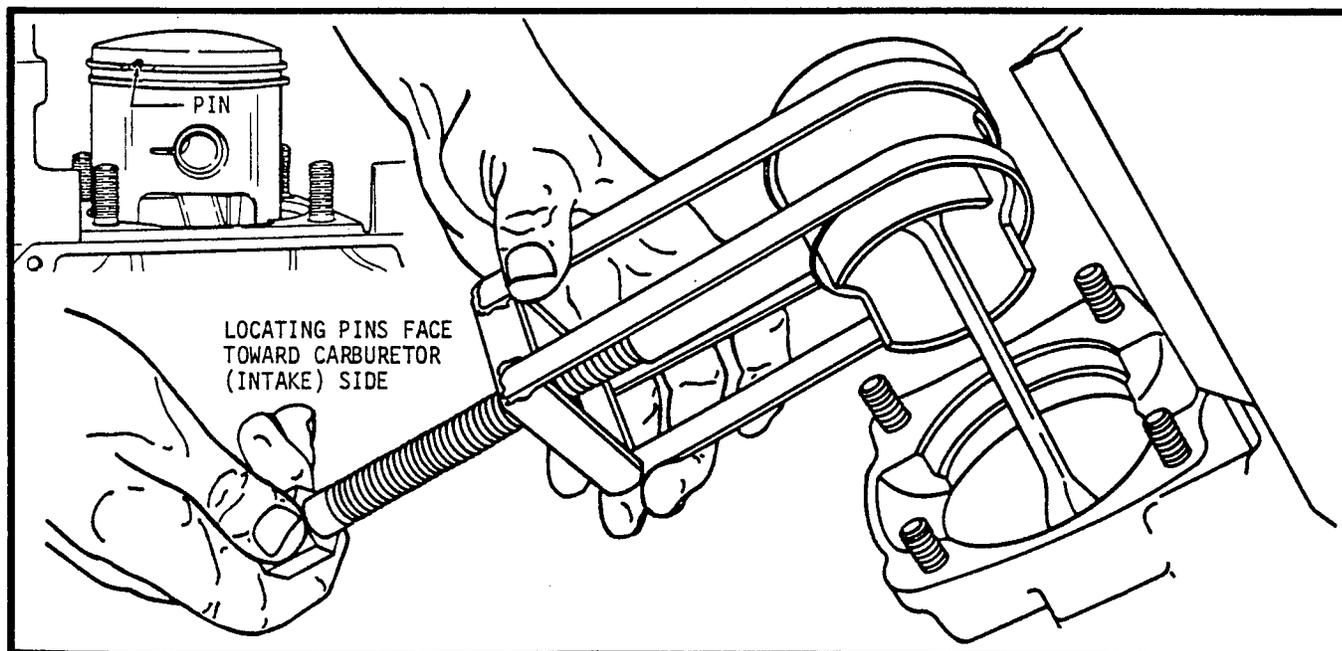
FIGURE 12-3 -- APPLY SEALER TO MATING SURFACES OF CRANKCASE HALVES

## 2. CRANKCASE, CRANKSHAFT

Remove bearing plates or snap rings and crankshaft from bottom half of crankcase after end play adjustment is determined then apply Kohler crankcase sealer (or similar sealant) to mating surfaces of crankcase sections. Next, lubricate all bearings with SAE 10 weight oil, install shims (number determined in Step 1) at both ends of shaft then install crankshaft in bottom half of crankcase. On models using snap rings, install rings in groove at both ends of crankcase. Carefully lower the top half of the crankcase into position on the lower half. On models with studs in center, tighten nuts just enough to hold the halves together--the thru bolts and end studs cannot be tightened until cylinder barrels are installed

## 3. BEARING PLATES, OIL SEALS

On engines with bearing plates, new oil seals should have been installed in the plates during reconditioning--don't reuse old seals. On these models, carefully guide bearing plates over ends of crankshaft and into position on crankcase then secure with capscrews. On K399-2AX and K440-2AX models, press new seals in with seal driver of appropriate size. Make sure seals are installed the right way with lip toward inside.



LOCATING PINS FACE  
TOWARD CARBURETOR  
(INTAKE) SIDE

FIGURE 12-4 -- USE PIN EXTRACTOR TOOL TO INSTALL PISTON PIN

## 4. PISTON - RING ASSEMBLY

Pistons (new rings installed during reconditioning) must be installed so that locating pins will be toward carburetor side of engine. Insert circlip in groove at one end of piston, heat piston to about 100° F. then position piston over connecting rod, carefully insert piston pin thru needle bearing in connecting rod and piston then lock by installing circlip at open end. Use the piston pin tool when installing pin.

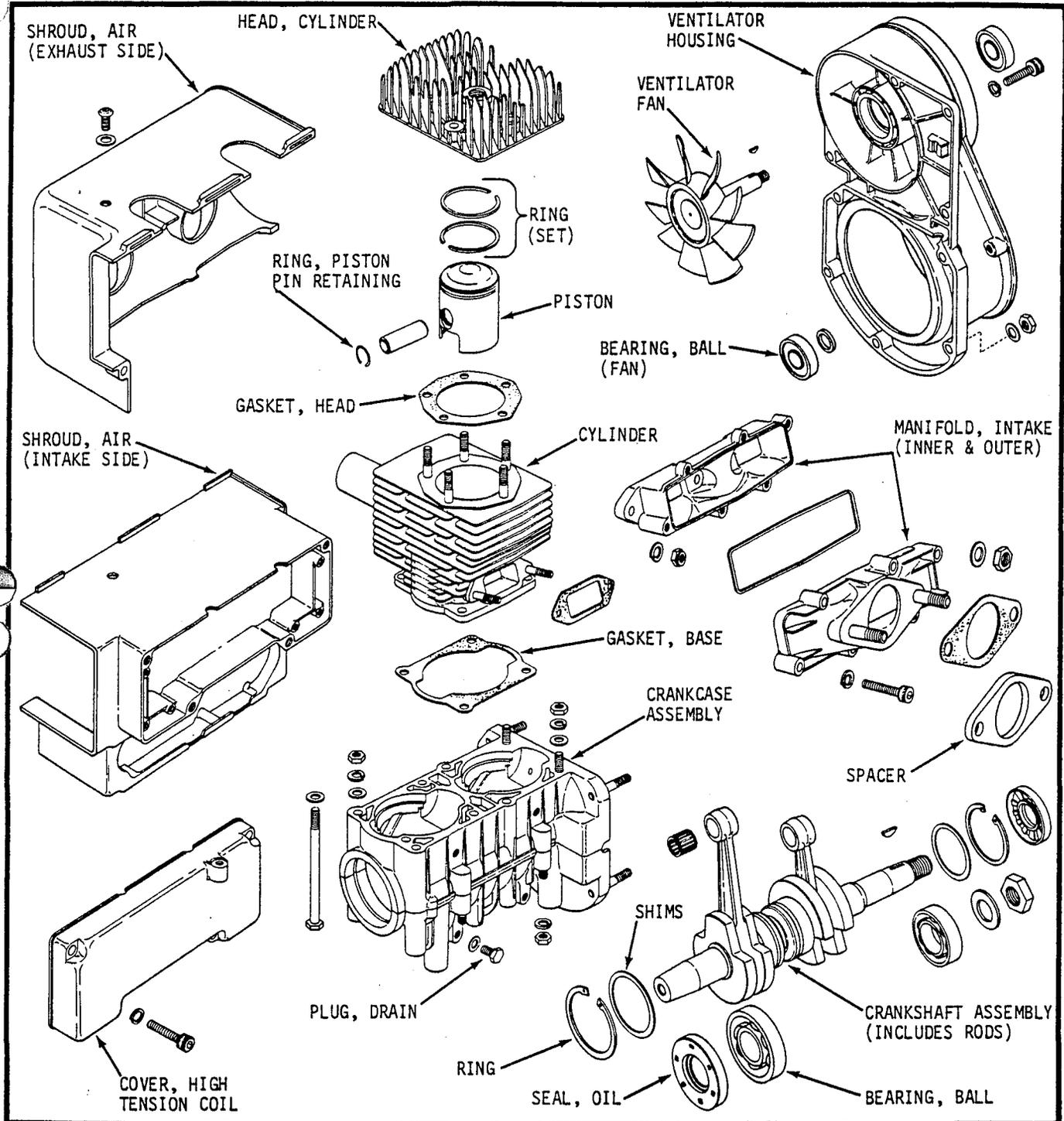


FIGURE 12-5 -- DISASSEMBLED VIEW - TYPICAL AXIAL FLOW MODEL

## 5. CYLINDERS

Install new base gaskets on crankcase, lubricate piston and rings then using ring compressor tool from tool kit, carefully guide cylinders over pistons and into position on crankcase. Reinstall washers and nuts but do not tighten completely at this time. Install intake manifold to cylinders for alignment purposes then tighten all retaining nuts to 180-190 in. lbs. or about 16 ft. lbs.

## 6. CYLINDER HEADS

Position new head gaskets on cylinders then install cylinder heads. On models with side outlet cooling, heads are installed with fins at right angles or perpendicular to the crankshaft. Heads with fins running at an oblique angle are installed as illustrated on page 8.2. Make sure the special air shroud support nuts are installed in correct position. Tighten head nuts in criss-cross pattern to torque value called for in the Specifications section.

## 7. AIR SHROUDS, BAFFLES

On Axial Flow models remove the intake manifold (installed in Step 5 for cylinder alignment) then install air shroud sections. On blower type engines, the intake manifold does not have to be removed to install baffles and air shrouds.

## 8. VENTILATOR HOUSING (AXIAL FLOW MODELS)

On Axial Flow models, assemble ventilator housing to crankcase and to air shrouds.

## 9. STATOR ASSEMBLY

Align matching marks on stator to mark on bearing plate or crankcase on Axial Flow models, then secure stator assembly. Thread ignition and alternator leads thru grommet on bearing plate or ventilator housing then connect ignition leads to ignition coils--refer to accompanying diagram for connections.

## 10. MAGNET RING, FLYWHEEL

Check the magnets to make sure they are clean and free of metallic particles. On blower models, reinstall flywheel with magnet ring and fan attached on the crankshaft and tighten retaining nut to specified torque value. On Axial Flow models, install magnet ring to the hub then install this assembly on the crankshaft--tighten nut to torque value specified. Time engine per instructions found in Section 3.

## 11. BLOWER HOUSING (BLOWER MODELS)

Reinstall blower housing on engine and secure with capscrews. Reinstall starting motor or starter pad cover on manual start models.

## 12. FAN BELT (AXIAL FLOW MODELS)

Install belt on drive sheave first then place shims (5 or 6 usually needed) on the fan shaft next to the inner sheave section, place belt on sheave then assemble outer sheave assembly--use spanner wrench to hold sheave while tightening the retaining nut. Check belt tension--remove or add shims as necessary to obtain 3/8" deflection--refer to Section 8 for adjustment procedure.

## 13. RETRACTABLE STARTERS

The retractable starter used on blower type engines must be realigned when installed--the type used on the Axial Flow models does not. Refer to Section 6 for alignment instructions on blower type engines.

## 14. ENGINE SYSTEMS, ACCESSORIES

Reinstall carburetor, air cleaners, exhaust tubes or mufflers, etc., to complete reassembly of engine. Use new gasket or parts whenever applicable. Tighten screws and nuts to torque value as specified.

## RUN - IN PROCEDURE

After engine has been completely reassembled, bench test engine if facilities are available and make necessary adjustments. If engine cannot be bench tested, reinstall engine in vehicle and make final adjustments under actual load conditions. Run-in recommendations for a reconditioned engine are the same as for a new engine--refer to Section 1 for run-in instructions.

# RING GEAR INSTALLATION (AXIAL FLOW ENGINES)

Two types of ring gears are used on the electric start axial flow engines. One type includes a ring gear which is secured to a locking flange with four socket head capscrews. The other type is flangeless in that it is a one piece ring gear assembly. Different procedures are involved in removing and reinstalling the two types of ring gears--follow the procedure which applies to the engine involved.

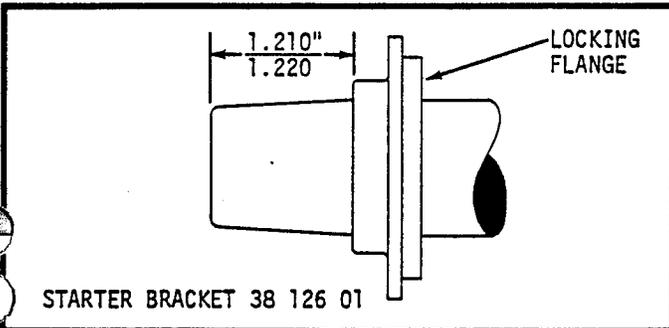
## DISASSEMBLY

On flange type, remove the four capscrews securing the ring gear hub to the flange then separate the hub from the flange. Use standard flywheel puller to remove locking flange or ring gear assembly on flangeless type from the crankshaft.

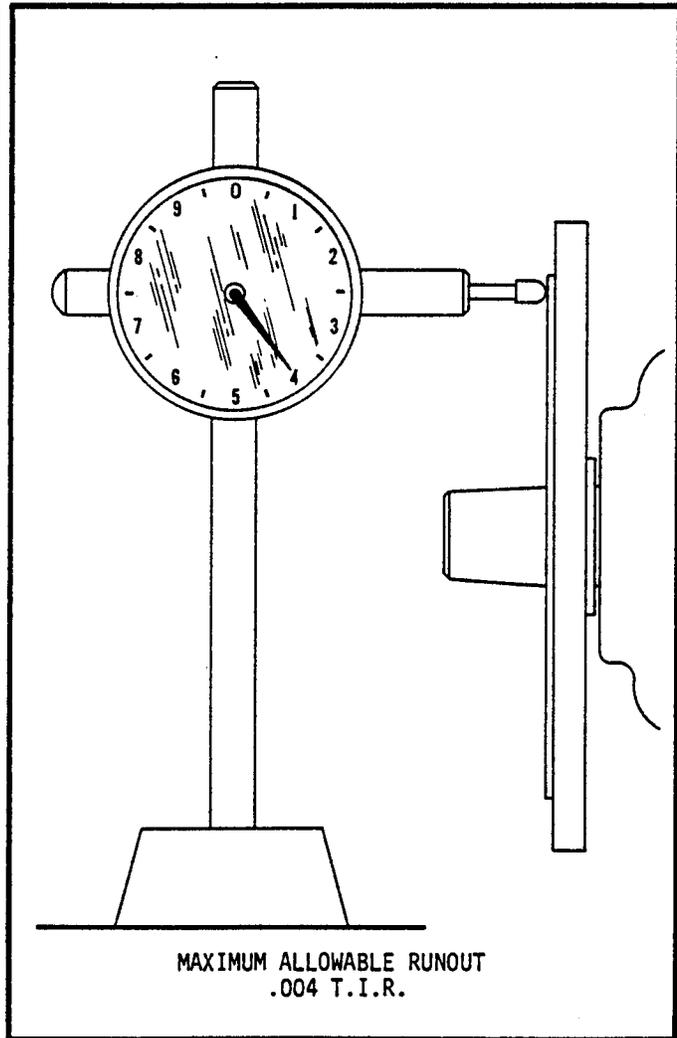
## REASSEMBLY

**FLANGE TYPE:** Heat locking flange in oven or hot oil to about 500° to 550° F. When thoroughly heated, flange will fit easily on PTO end of crankshaft. Make sure heated flange does not touch the oil seal--make sure flange is 1.210" to 1.220" from end of shaft as shown below. Allow flange to cool to room temperature, position ring gear hub on the flange then secure with the four socket head capscrews and washers--apply general purpose Loktite to screws before installing. Tighten capscrews to 55-65 in. lbs. torque. Use dial indicator to check ring gear hub alignment as shown below--run out must be within .004" T.I.R. to avoid vibration.

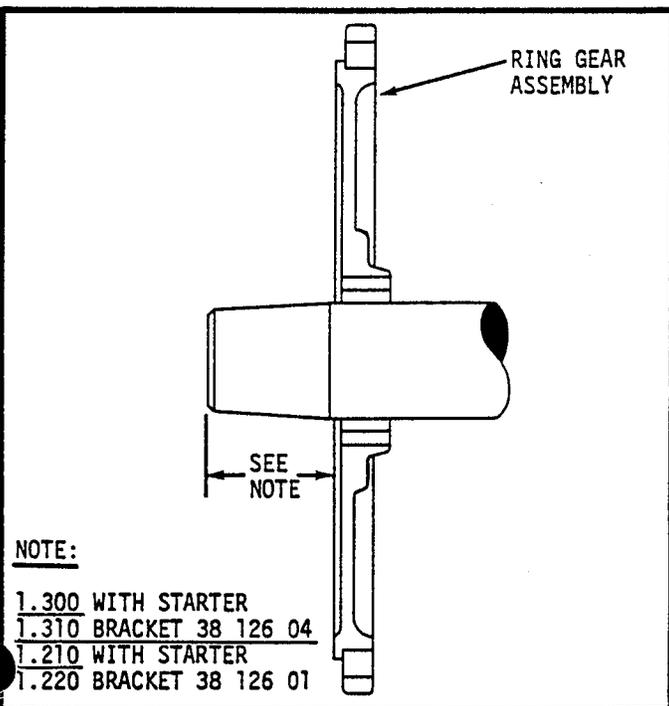
**FLANGELESS:** Position ring gear assembly with boss facing crankcase, then using a pipe of appropriate length and diameter and a long 1/2" NF stud, press the ring gear on the crankshaft until it is at the dimension shown below--note that this varies according to type of starter bracket used. Use dial indicator to check ring gear alignment as shown below--run out must be within .004" T.I.R. to avoid vibration.



FLANGE TYPE



CHECKING RING GEAR RUNOUT



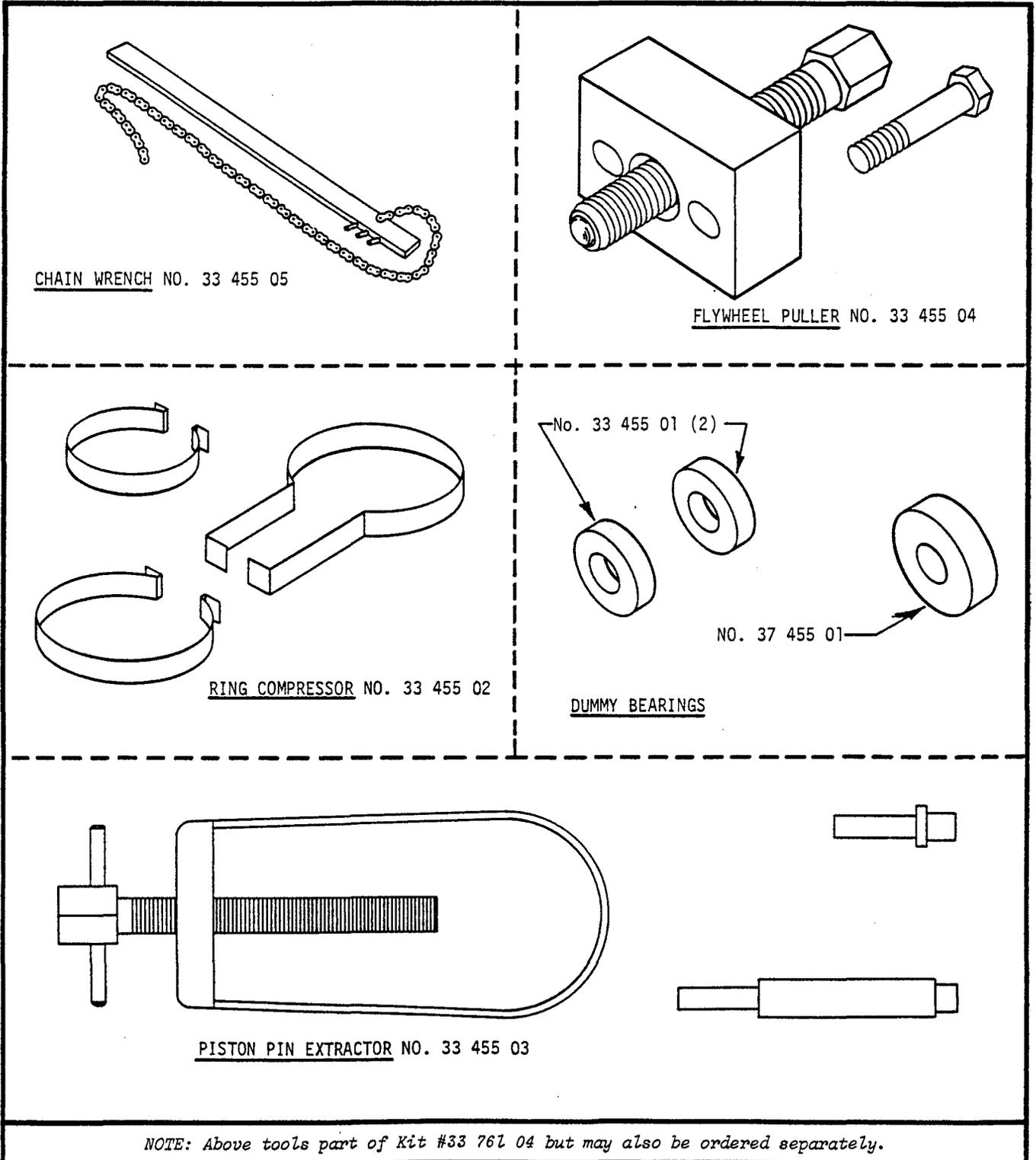
### NOTE:

- 1.300 WITH STARTER
- 1.310 BRACKET 38 126 04
- 1.210 WITH STARTER
- 1.220 BRACKET 38 126 01

FLANGELESS

# SPECIAL TOOLS

Completely equipped shops will have most, if not all, of the tools shown below and on the next page. All are designed specifically for repair of Kohler 2-Cycle Engines and accessories. Some of the tools, such as the ignition timing gauge kit are absolutely essential even if only tune-up work is being performed. The basic tool kit listed below is recommended for any shop engaged in the repair of Kohler 2-Cycle Engines. These special tools will not only save time but will insure accurate replacement without damage when properly used. Refer to the Kohler Tool Catalog for an up-to-date listing of available 2-cycle engine tools.



CHAIN WRENCH NO. 33 455 05

FLYWHEEL PULLER NO. 33 455 04

RING COMPRESSOR NO. 33 455 02

DUMMY BEARINGS

PISTON PIN EXTRACTOR NO. 33 455 03

*NOTE: Above tools part of Kit #33 761 04 but may also be ordered separately.*

FIGURE 13-1 -- Contents of Basic Tool Kit No. 33 761 04

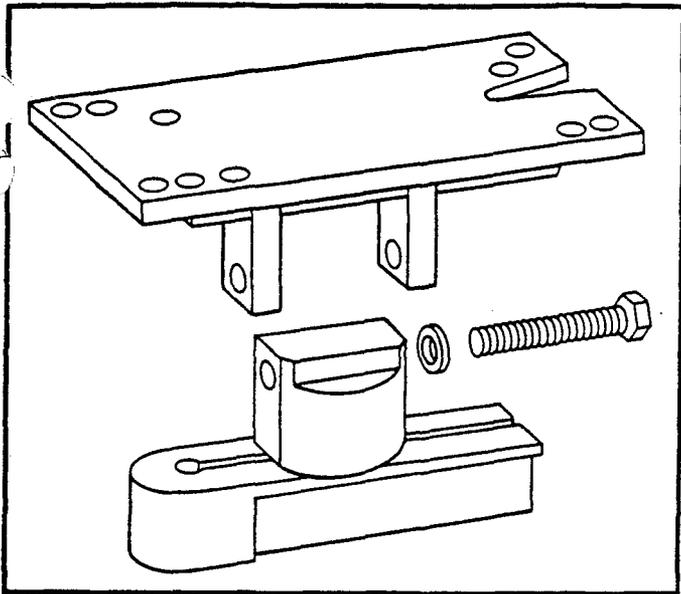


FIGURE 13-2 -- ENGINE STAND 33 761 05

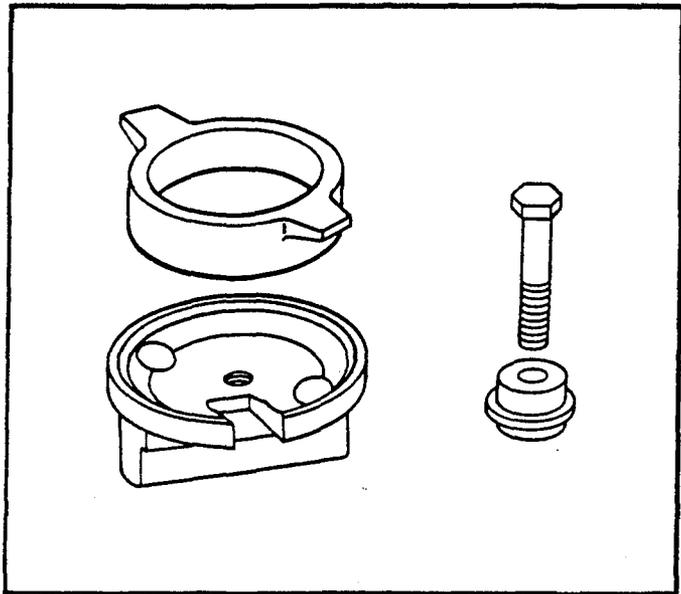


FIGURE 13-3 -- IGNITION TOOL 33 455 08

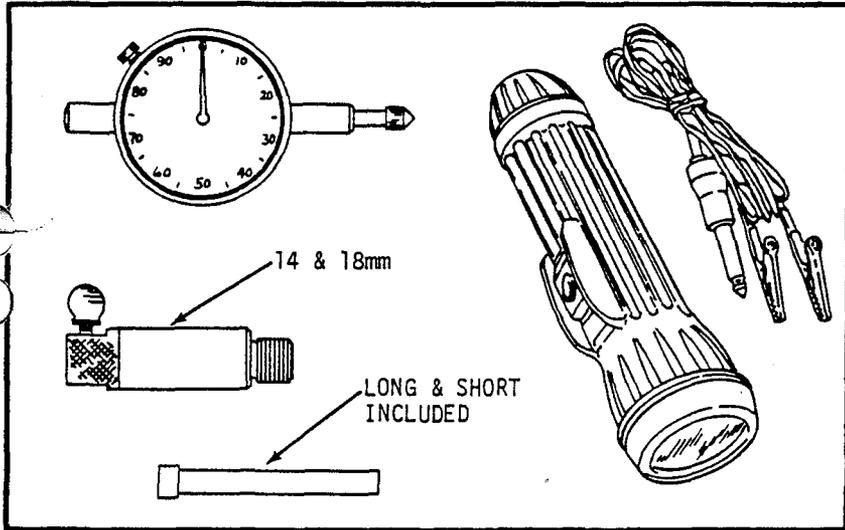


FIGURE 13-4 -- IGNITION TIMING GAUGE KIT 33 755 03  
(LIGHT 33 455 10)

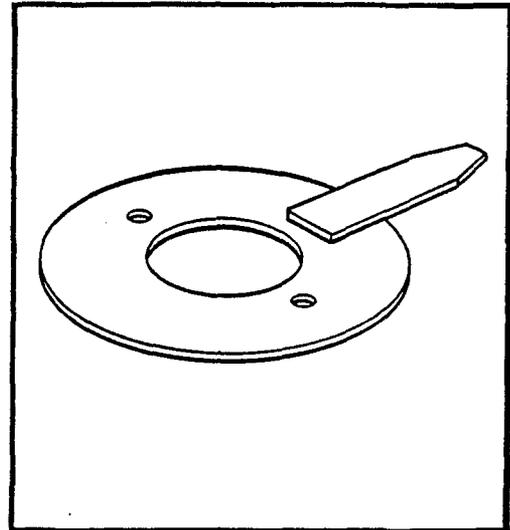


FIGURE 13-5 -- FLYWHEEL HOLDER  
(38 455 02)

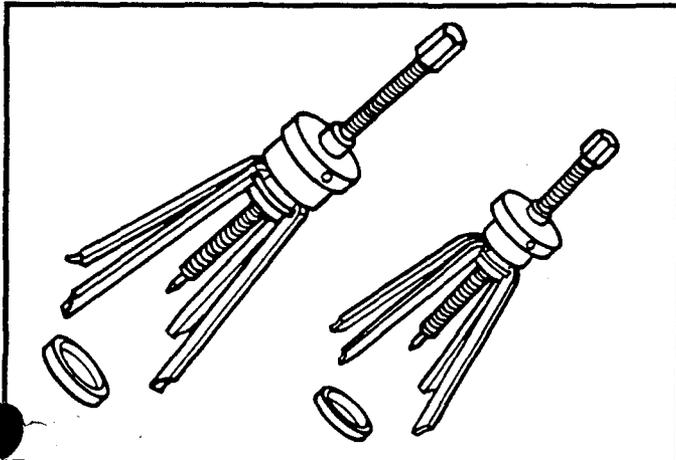


FIGURE 13-6 -- BEARING PULLER SET 33 761 06

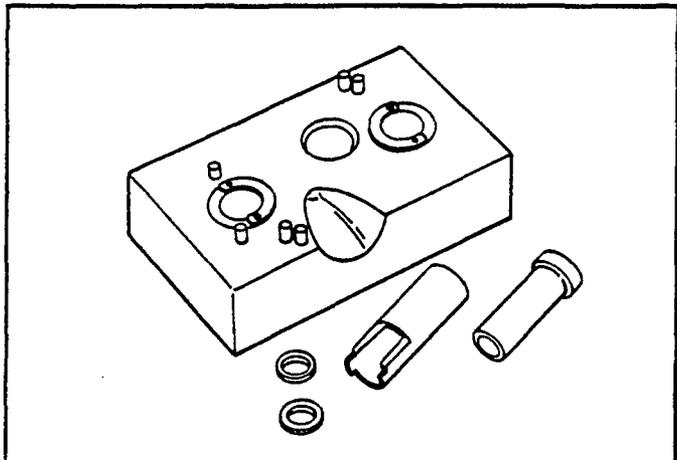


FIGURE 13-7 -- CONDENSER REPLACEMENT KIT 33 455 09

# SPECIFICATIONS - BLOWER MODELS

SPECIFICATION	K295-2	K340-2	K399-2	K440-2	K618-2
<b><u>CYLINDER BORE</u></b>					
New Standard	2.2641	2.4412	2.5612	2.6775	2.9531
1st O.S. (.010")	--	2.4511	2.5711	2.6873	2.9629
2nd O.S. (.020")	2.2838	2.4609	2.5809	2.6972	2.9727
3rd O.S. (.040")	--	2.4806	2.6006	2.7168	2.9923
Wear Limit	.006	.006	.006	.006	.006
<b><u>PISTON SIZE</u></b>					
New Standard	2.2604	2.4368	2.5549	2.6730	2.9469
1st O.S. (.010")	--	2.4467	2.5648	2.6829	2.9567
2nd O.S. (.020")	2.2801	2.4565	2.5746	2.6927	2.9665
3rd O.S. (.040")	--	2.4762	2.5943	2.7124	2.9862
<b><u>STROKE</u></b>					
	2.205	2.205	2.362	2.362	2.756
<b><u>PISTON RING</u></b>					
Ring Gap	*.008-.014	.010-.016	.010-.016	.010-.016	.012-.018
Side Clearance (Top)	*.0022-.0037	.0028-.0040	.0028-.0040	.0028-.0040	.0035-.0048
Side Clearance (Bottom)	.0012-.0024	.0024-.0036	.0024-.0036	.0024-.0036	.0028-.0040
<b><u>CONNECTING ROD</u></b>					
Lateral Play	.008-.016	.008-.016	.008-.016	.008-.016	.008-.016
<b><u>CRANKSHAFT</u></b>					
End Play	.006-.012	.006-.012	.006-.012	.006-.012	.006-.012
Shaft Alignment	.003	.003	.003	.003	.003
<b><u>IGNITION</u></b>					
Spark Gap	.018-.022	.018-.022	.018-.022	.018-.022	.018-.022
Breaker Point Gap	.014-.018	.014-.018	.014-.018	.014-.018	.014-.018
Timing**	.090 ±.005	.090 ±.005	.090 ±.005	.090 ±.005	.090 ±.005
<b><u>TORQUE SPEC.</u></b>					
Crankcase Halves	215-225 in. lbs.	215-225 in. lbs.	215-225 in. lbs.	215-225 in. lbs.	4 x 17 ft. lbs. 8 x 32 ft. lbs.
Bearing Plates	150-160 in. lbs.	150-160 in. lbs.	150-160 in. lbs.	150-160 in. lbs.	190-200 in. lbs.
Cylinder Head	200-220 in. lbs.	240-260 in. lbs.	240-260 in. lbs.	240-260 in. lbs.	32 ft. lbs.
Flywheel Nut	90-100 ft. lbs.				
Blower Housing	150-160 in. lbs.	150-160 in. lbs.	150-160 in. lbs.	150-160 in. lbs.	190-200 in. lbs.
Pulley (Rope Start)	170-180 in. lbs.				
Retractable Starter	150-160 in. lbs.				
Exhaust Tubes	---	130-150 in. lbs.	130-150 in. lbs.	130-150 in. lbs.	130-150 in. lbs.
Intake Manifold	145-155 in. lbs.				
Carburetor	110-130 in. lbs.				
Spark Plug	18 ft. lbs.				

**NOTE:** All dimensions are in inches.

\*Engine K295-2 is equipped with a "L-ring" on the top.

\*\*Piston inches BTDC - advance.

# SPECIFICATIONS - AXIAL FLOW MODELS

SPECIFICATION	K295-2AX	K340-2AX	SK340-2AS	K399-2AX	K440-2AX	K440-2AS
<b><u>CYLINDER BORE</u></b>						
New Standard	2.2641	2.4412	2.362	2.5599	2.6775	2.677
Wear Limit	.006	.006	--	.006	.006	--
<b><u>PISTON SIZE</u></b>						
New Standard	2.2604	2.4376	2.358	2.5564	2.6740	2.673
<b><u>STROKE</u></b>						
	2.205	2.205	2.362	2.362	2.362	2.362
<b><u>PISTON RING</u></b>						
Ring Gap	.008-.014	.008-.014	.010-.016	.008-.014	.008-.014	.010-.016
Side Clearance (Top)	.0022-.0037	.0022-.0037	.0022-.0037	.0022-.0037	.0022-.0037	.0022-.0037
Side Clearance (Bottom)	.0012-.0024	.0012-.0024	.0012-.0024	.0012-.0024	.0012-.0024	.0012-.0024
<b><u>CONNECTING ROD</u></b>						
Lateral Play	.008-.016	.008-.016	.008-.016	.008-.016	.008-.016	.008-.016
<b><u>CRANKSHAFT</u></b>						
End Play	.006-.012	.006-.012	.006-.012	.006-.012	.006-.012	.006-.012
Shaft Alignment	.003	.003	.003	.003	.003	.003
<b><u>IGNITION</u></b>						
Spark Gap	.018-.022	.018-.022		.018-.022	.018-.022	
Breaker Point Gap	.014-.018	.014-.018		.014-.018	.014-.018	
Timing (Advance-Piston BTDC)	.090+ .005	.090+ .005	.090+ .005	.090+ .005	.090+ .005	.090+ .005

## TORQUE SPECS.

	K295-2AX/K340-2AX	K399-2AX/K440-2AX	SK340-2AS/K440-2AS
Crankcase halves - cylinder block ....	180-190 in. lbs.	180-190 in. lbs.	180-190 in. lbs.
Crankcase halves (only) .....	90-100 in. lbs.	150-160 in. lbs.	150-160 in. lbs.
Ventilator housing .....	150-160 in. lbs.	150-160 in. lbs.	150-160 in. lbs.
Cylinder head .....	220-240 in. lbs.	220-240 in. lbs.	220-240 in. lbs.
Flywheel nut .....	90-95 ft. lbs.	90-95 ft. lbs.	90-95 ft. lbs.
Nut to fan .....	30-35 ft. lbs.	30-35 ft. lbs.	30-35 ft. lbs.
Screws to air shroud and coil cover ..	90-100 in. lbs.	90-100 in. lbs.	90-100 in. lbs.
Retractable starter .....	80-90 in. lbs.	80-90 in. lbs.	80-90 in. lbs.
Drain plug .....	90-100 in. lbs.	90-100 in. lbs.	90-100 in. lbs.
Manifold halves .....	150-160 in. lbs.	90-100 in. lbs.	90-100 in. lbs.
Carburetor 5/16 nut .....	110-130 in. lbs.	110-130 in. lbs.	110-130 in. lbs.
Carburetor 3/8 nut .....	160-170 in. lbs.	160-170 in. lbs.	160-170 in. lbs.
Spark plug .....	18 ft. lbs.	18 ft. lbs.	18 ft. lbs.

**KOHLER CO. of KOHLER, WIS. 53044**