

KOHLER
ENGINES
SERVICE MANUAL

TWO-CYCLE
SINGLE
CYLINDER

KOHLER OF CANADA LTD.

FOREWORD

Kohler Two-Cycle Engines are manufactured under the close supervision of skilled technicians. The engines are carefully machined and assembled to deliver many hours of reliable service.

It is imperative that a planned maintenance program, as outlined in this manual, be followed. Read each section carefully. It will help to insure trouble-free operation and long engine life.

Owners and operators are cautioned against the use of any parts other than genuine Kohler service parts. These parts have been designed and tested to give maximum performance on Kohler Engines. Use of other than genuine Kohler service parts may result in excessive wear, premature failure, and will void the engine warranty.

In communications concerning your engine, please refer to the nameplate for the model, serial and specification number. This information will aid in making fast, effective service possible. Contact your local dealer for genuine Kohler service parts.

KOHLER OF CANADA LTD.

KOHLER

TWO-CYCLE

ENGINES

SINGLE CYLINDER

SERVICE MANUAL

MODELS:

K295-1

K309-1

K335-1

REVISION NO. 9-69

This is a complete revision.

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MODEL VARIATION

Some of the earlier model K309-1 engines have metric threads while later models have U.S. Standard thread sizes. All K295-1 and K335-1 engines have the U.S. Standard sizes. Before doing any work on a K309-1, determine what thread size is involved so that the correct wrenches will be used. Thread size can be determined by the suffix (last two digits) of the engine specification number--if the suffix is 05 or lower, the engine has metric threads while 06 and above indicates U.S. Standard. Make sure that the thread type has been correctly established before ordering replacement parts for K309-1 models. Refer to first page of parts manual for complete explanation.

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 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!

OPERATING INSTRUCTIONS

PRE-START INSTRUCTIONS

FUEL MIXTURE: Mix REGULAR grade gasoline (92 octane minimum) with Kohler SAE 40 diluted two-cycle oil. In emergency use SAE 30 two-cycle (air-cooled) engine oil. Gasoline to oil mixture 20 to 1. Pre-mix fuel thoroughly in separate container before filling fuel tanks on vehicle. Add about 1 gallon of fuel first then add oil and mix thoroughly before pouring in the rest of the gasoline. The ratio chart below is for mixing with some common size containers.

FUEL RATIO CHART

20 to 1 Ratio	GASOLINE CONTAINER CAPACITY					
(GAS to OIL)	1 GALLON	2 GALLONS	3 GALLONS	4 GALLONS	5 GALLONS	6 GALLONS
OIL AMOUNT	8 ounces	16 ounces	24 ounces	32 ounces	40 ounces	48 ounces

EQUIVALENT VALUES (APPROX.)

OUNCES	4	5	6	7	8	9	10	11	12	13	14	15	20 OUNCES
PINT %	1/5	1/4	3/10	7/20	2/5	9/20	1/2	11/20	3/5	13/20	7/10	3/4	1 PINT

2 pints = 1 quart 1 quart = 40 ounces (IMPERIAL MEASUREMENTS)

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: On new vehicle or after battery has been removed for servicing, make sure battery negative (-) terminal is grounded.

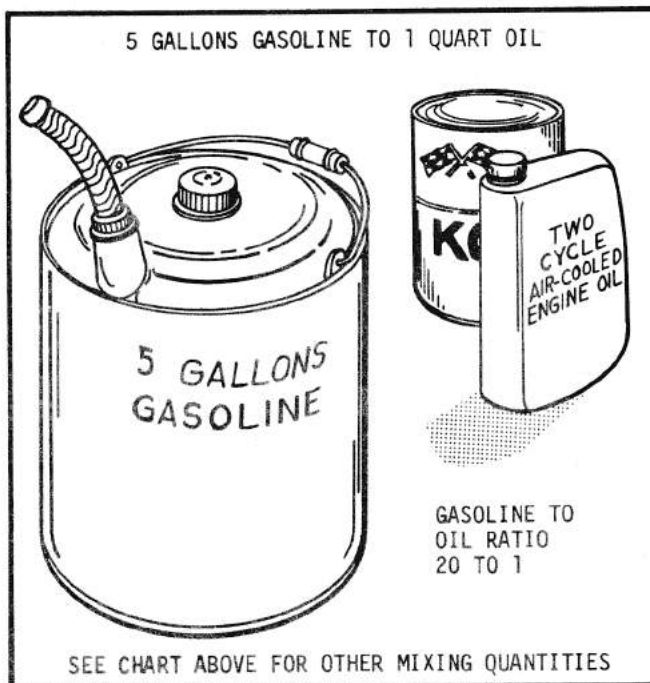


FIGURE 1-1 -- FUEL MIXTURE

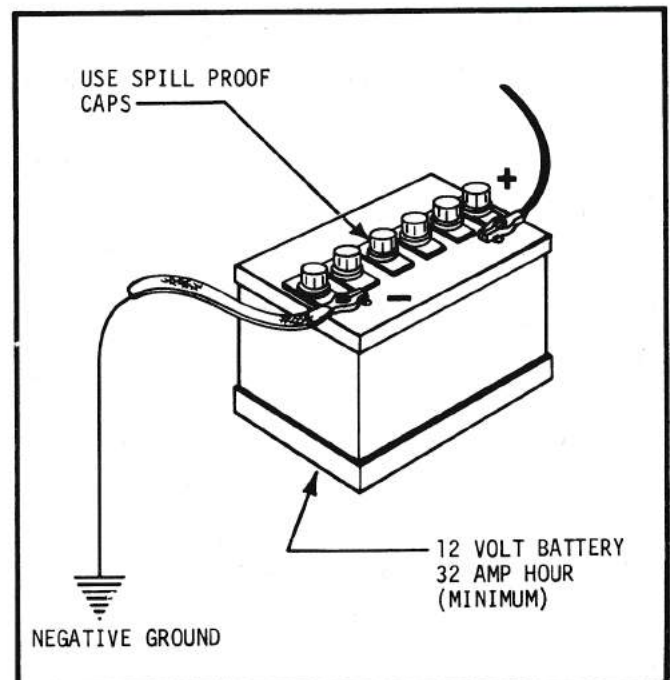


FIGURE 1-2 -- BATTERY POLARITY (ELECTRIC START)

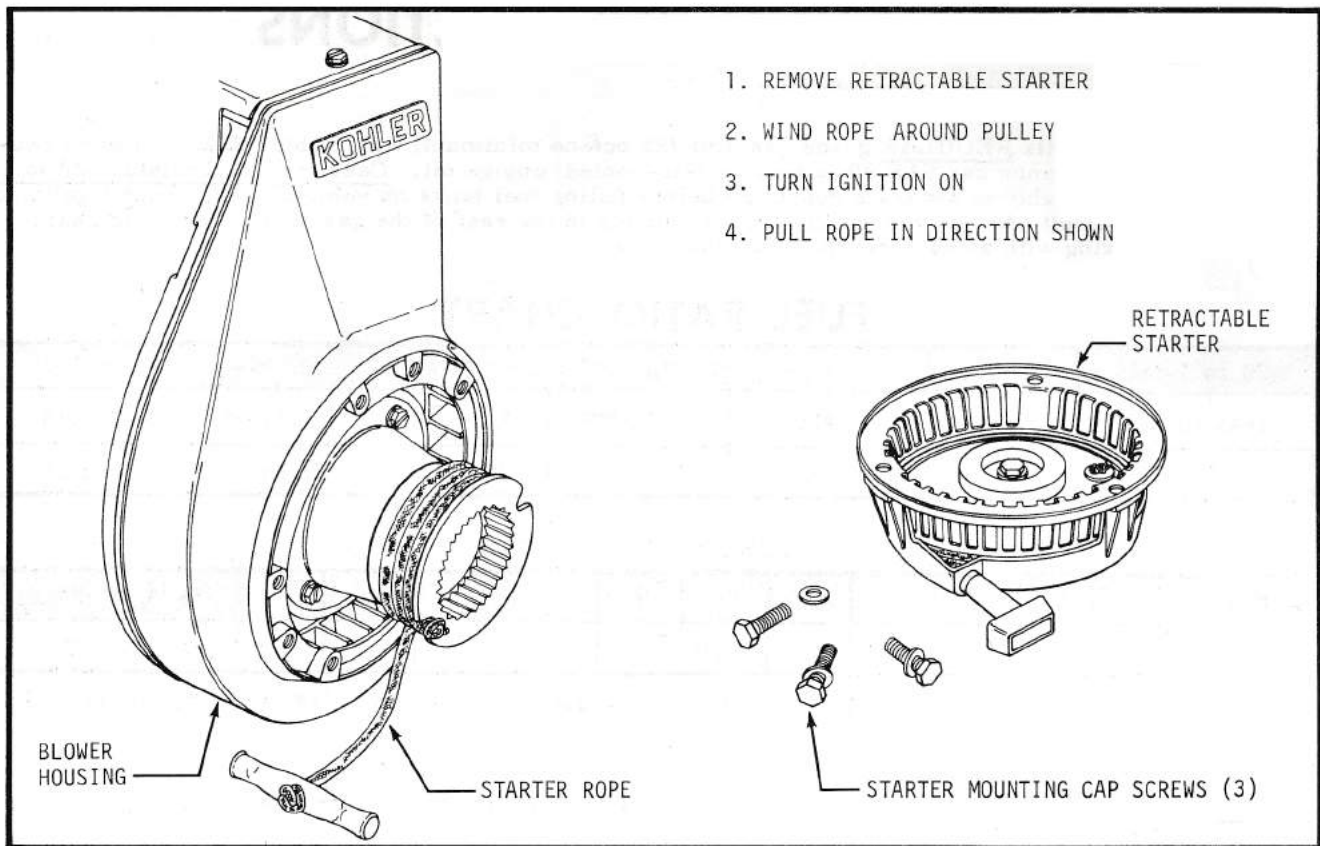


FIGURE 1-3 -- EMERGENCY ROPE START PROCEDURE

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. **COMPRESSION RELEASE (K335-1 ONLY):** Pull compression release knob out and after engine starts push knob in. Caution: Do not leave knob in out position--use only when starting!
4. **THROTTLE:** Hold throttle slightly off idle while cranking engine.
5. **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.

(C) **EMERGENCY START:** If battery won't start engine or retractable starter fails, the engine can still be started with rope. Remove retractable starter then wind rope clockwise around pulley - drive cup (see illustration). Turn ignition switch ON and pull rope to start. Refer to installation instructions on page 1.4 when reinstalling recoil starter.

(D) **STARTING AIDS:** If aid such as ether is sprayed into intake for starting in extreme cold, do this only once as ether provides no lubrication.

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.

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 Dieselize and continue running after ignition is turned off. To stop the engine under these conditions, pull full choke and open throttle to shut off air and stall engine.

TROUBLE ANALYSIS

The pre-requisites for easy starting and top performance are: proper fuel, good ignition and good compression. Problems which may occur during normal usage are listed below along with probable causes. The remedy is, in most cases, obvious. If the problem is major or if it persists after simple corrective steps are taken, return engine to the nearest Kohler service center for repair.

HARD STARTING OR WONT START

LACK OF FUEL

1. Tank empty.
2. Line pinched or disconnected.
3. Plugged vent hole in filler cap.
4. Fuel filter plugged.
5. Impulse tube loose or pinched.

POOR OR NO IGNITION SPARK

1. Ignition not turned on.
2. Spark plug wet or carbon fouled.
3. Spark electrodes broken or improperly gapped.
4. High tension lead loose or broken.
5. Breaker points damp, pitted or improperly gapped.
6. Ignition switch faulty.
7. Ignition coil faulty.
8. Condenser faulty.

INCORRECT FUEL - AIR MIXTURE

1. Engine flooded, overchoking.
2. Fuel stale, doesn't vaporize properly.
3. Water in fuel.
4. Dirt or gum forming to restrict fuel supply.
5. Carburetor loose -- too much air.

POOR COMPRESSION

1. Spark plug loose.
2. Cylinder head loose.
3. Cylinder head gasket "blown".
4. Piston rings broken.
5. Piston and cylinder badly worn.

CRANKS TOO SLOW (ELECTRIC START)

1. Loose or corroded battery connections.
2. Weak battery.
3. Starting solenoid faulty.
4. Moisture in starter.

RUNNING TROUBLES

LACKS POWER

1. Poor quality or improperly mixed fuel.
2. Water in fuel.
3. Air inlet restricted.
4. Exhaust port and/or muffler plugged.
5. Loose or improperly adjusted carburetor.

6. Ignition timing wrong.
7. Poor compression.

RUNS UNEVENLY

1. Spark plug in poor condition.
2. Wrong spark plug.
3. High tension lead loose.
4. Breaker points pitted.
5. Fuel bubbles in carburetor from overheating.

POOR ACCELERATION (ENGINE "FOURSTROKES")

1. Choke closed.
2. Carburetor improperly adjusted or malfunctioning.
3. Dirt on carburetor inlet needle.
4. Exhaust port heavily coated with carbon.

WILL NOT ACCELERATE

1. Carburetor idle mixture too lean.
2. Carburetor diaphragm coverplate loose.
3. Carburetor diaphragm gasket leaking.
4. Carburetor and/or manifold loose and leaking.
5. Carburetor malfunctioning.

BACK FIRES THRU CARBURETOR

1. Insufficient fuel.
2. Spark plug "too hot".
3. Water in carburetor.
4. Air leakage from faulty gaskets or oil seals.

PINGS UNDER HEAVY LOAD, FULL THROTTLE

1. Ignition timing too early.
2. Spark plug wrong heat range.
3. Carburetor main fuel set too lean.
4. Combustion chamber coated with carbon.

ENGINE STOPS

1. Fuel tank empty.
2. Vapor locks.
3. Ignition inadvertently turned off.
4. Exhaust pipe plugged.
5. Stalls from overload.
6. Clogged, restricted cooling system.
7. Cooling shrouds not in place or fan damaged.
8. Insufficient oil content in fuel.
9. Fuel line between tank and pump plugged or leaking.
10. Impulse tube plugged, kinked or loose.
11. Carburetor inlet screen or passages clogged.

FIGURE 1-4 -- TROUBLE SHOOTING CHART

CARBURETOR

Changing carburetor settings on two-cycle engines alters the amount of lubrication the engine receives. If adjustment is necessary, stop engine then turn IDLE FUEL and MAIN FUEL adjustments all the way in until they bottom lightly (do not force closed). Set IDLE FUEL adjustment at 3/4 turn open on Tillotson carburetor and 5/8 turn open on Kohler carburetor. For initial MAIN FUEL adjustment, set Tillotson at 1-1/4 turns open and Kohler at 3/4 turn open. Final adjustment is made with engine running at normal operating temperatures. MAIN FUEL adjustment may be "leaned" slightly for better performance; however, this setting must never be less than 1 turn open on Tillotson or 5/8 turn open on the Kohler carburetor.

ADJUSTMENT	TILLOTSON	KOHLER
IDLE FUEL	1 3/4 Turn Open	5/8 Turn Open
MAIN FUEL	1 ^{3/8} / ₈ 1-1/4 Turns Open	3/4 Turn Open

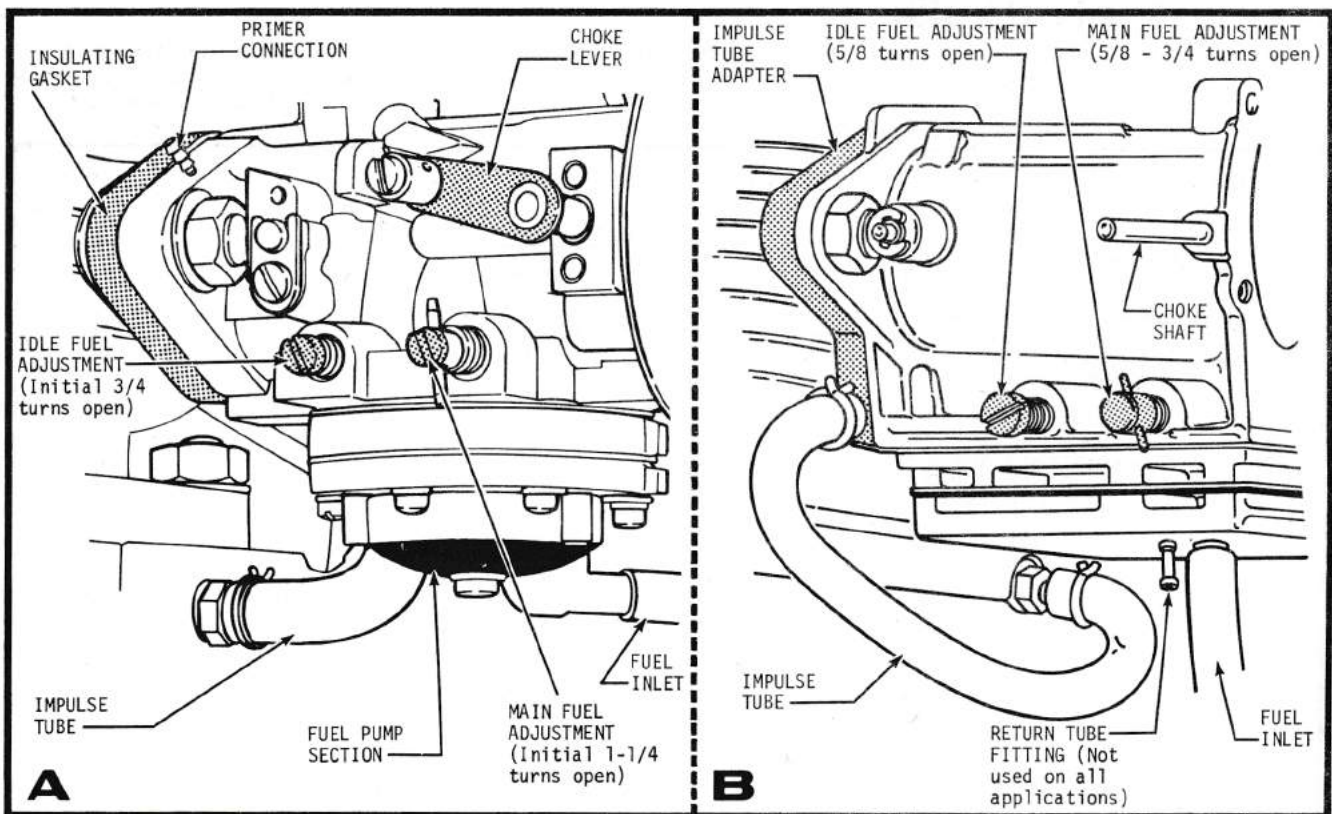


FIGURE 1-5 -- CARBURETOR ADJUSTMENTS (A) TILLOTSON (B) KOHLER CARBURETOR

RETRACTABLE STARTER

The retractable starter does not require service; however, if it is removed or works loose on engine, it must be realigned. If this is not done, teeth in pulley - drive cup will be damaged. Use the following procedure to align starter.

1. Install starter on engine but do not tighten capscrews.
2. Pull starter handle out about 8" so that starter centers as dogs engage in pulley - drive cup.
3. Hold rope in this position while tightening starter mounting capscrews to complete installation.

CAUTION: Do not attempt to disassemble starter as rewind spring can unwind violently if improperly handled and cause injury or damage.

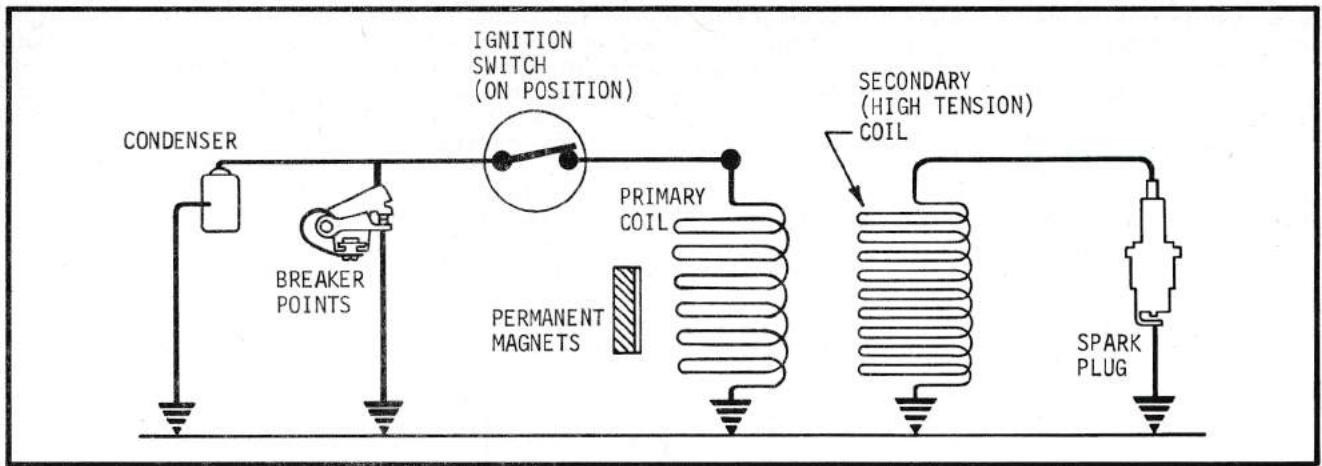


FIGURE 1-6 -- SCHEMATIC DIAGRAM OF IGNITION SYSTEM USING INTERNAL COIL (40 WATT METRIC)

IGNITION SYSTEMS

There are two different types of flywheel magneto ignition systems. The type in use on the metric model K309-1 has the high tension ignition coil mounted internally under the flywheel. All other models, including U.S. Standard (Spec. Suffix .06 and above) model K309-1 engines, use a system with a low tension or primary coil mounted under the flywheel and a high tension coil which is mounted externally on the crankcase.

With the exception of the externally mounted high tension coil, spark plug and wires, all other ignition components are located on the stator plate which is secured to the front half of the crankcase assembly. The retractable starter or intake screen, rope start pulley and breaker cover must be removed to service the breaker points. The flywheel must also be pulled whenever replacement of the condenser, breaker points, ignition or lighting coil becomes necessary. The ignition centering - adjusting tool must be used to establish proper air gap (.012"). The stator plate must be removed from the crankcase and mounted in this tool when parts are renewed. With the tool, the breaker point gap can be precision adjusted to .016" (.014-.018" range). Ignition must be retimed after stator plate and flywheel have been reinstalled--timing instructions are stated following the ignition service details. Refer to Reconditioning Section for details on parts replacement and use of ignition tool.

OPERATION: Energy for ignition is induced in the ignition windings on stator by permanent magnets in the magnet ring mounted on the flywheel. The magnet ring also includes the automatic spark advance mechanism. As engine speed increases, centrifugal force moves the timing advance lever outward and shifts the ignition cam thereby causing the breaker points to open earlier. Rotation of the permanent magnets causes current to flow in the primary winding. When ignition is required, the breaker points are opened by the action of the breaker rod. This causes a halt in current flow in the primary winding

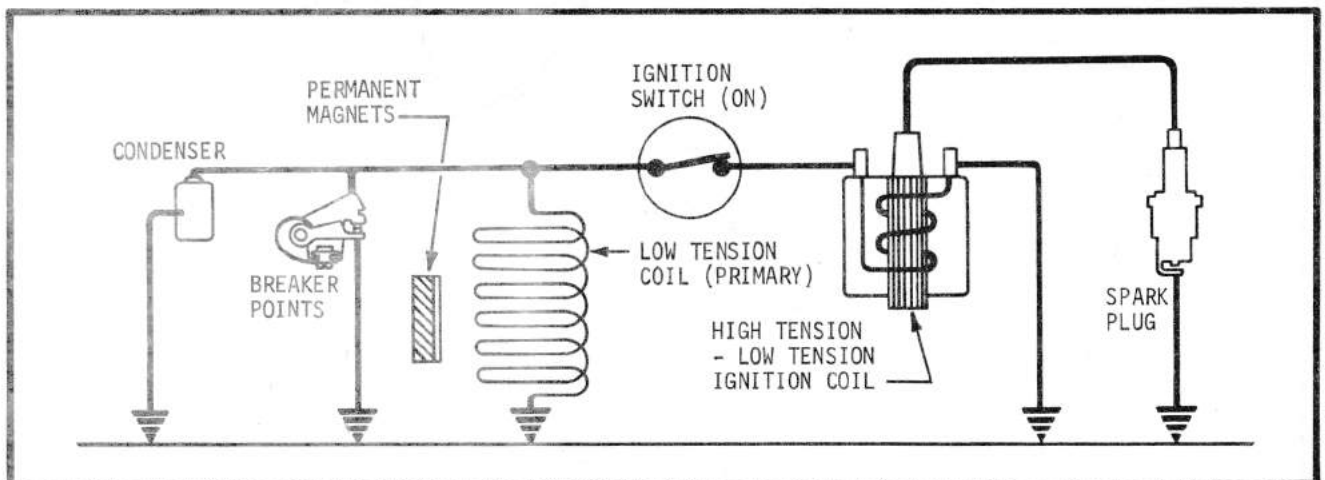


FIGURE 1-7 -- SCHEMATIC DIAGRAM OF IGNITION SYSTEM WITH INTERNAL AND EXTERNAL COILS

and results in a sudden collapse of the magnetic field surrounding the coil windings. At this instant, the rapid change in the concentration of magnetism causes a voltage to be induced in every turn of both the primary and secondary windings. In the primary winding the energy, which may be as high as 250 volts, is quickly absorbed by the condenser. The condenser thus acts as a reservoir for the surge of energy in the primary coil winding. If this energy had nowhere to go, it would arc across the points and cause a complete breakdown of the entire function. The condenser holds this energy only for an instant after which time it is released back into the primary. The voltage built up in the secondary, which has up to 100 times as many turns as the primary, could go as high as 25,000 volts. Normally, however, voltage does not increase to this value. It increases only to the amount sufficient to bridge the spark gap. This is usually between 6,000 and 20,000 volts. The actual value depends upon such variables as compression, speed, shape and condition of electrodes, width of spark gap, etc.

SPARK PLUG SERVICE: Remove spark plug and check condition--replace if carbon fouled or if porcelain is cracked. The color of the spark plug is a good indicator of operating condition. Take corrective action if other than normal operation is indicated. Refer to accompanying spark condition chart.

BLACK	TAN	WHITE
CARBON FOULING	NORMAL	OVERHEATING

Do not sandblast, scrape or otherwise attempt to service plug that is in poor condition--best results are obtained with a new plug. Spark plugs should be selected according to the type of operating conditions. Select plug from accompanying plug chart. Standard plugs are suitable for average operating conditions including occasional runs at full throttle, heavy load. Heavy duty plugs are for pulling thru heavy, wet snow and/or warm weather. Use plugs from chart only--do not use booster gap types. Set plug gap at .020" and make sure plug is tightened to 25 foot lbs. --a loose plug is a definite and often overlooked cause of overheating.

PLUG TYPE	STANDARD	COLD
KOHLER/BOSCH	33 132 02 (M 240 T1)	33 132 05 (M 280 T1)
CHAMPION	K9 or K7	K7

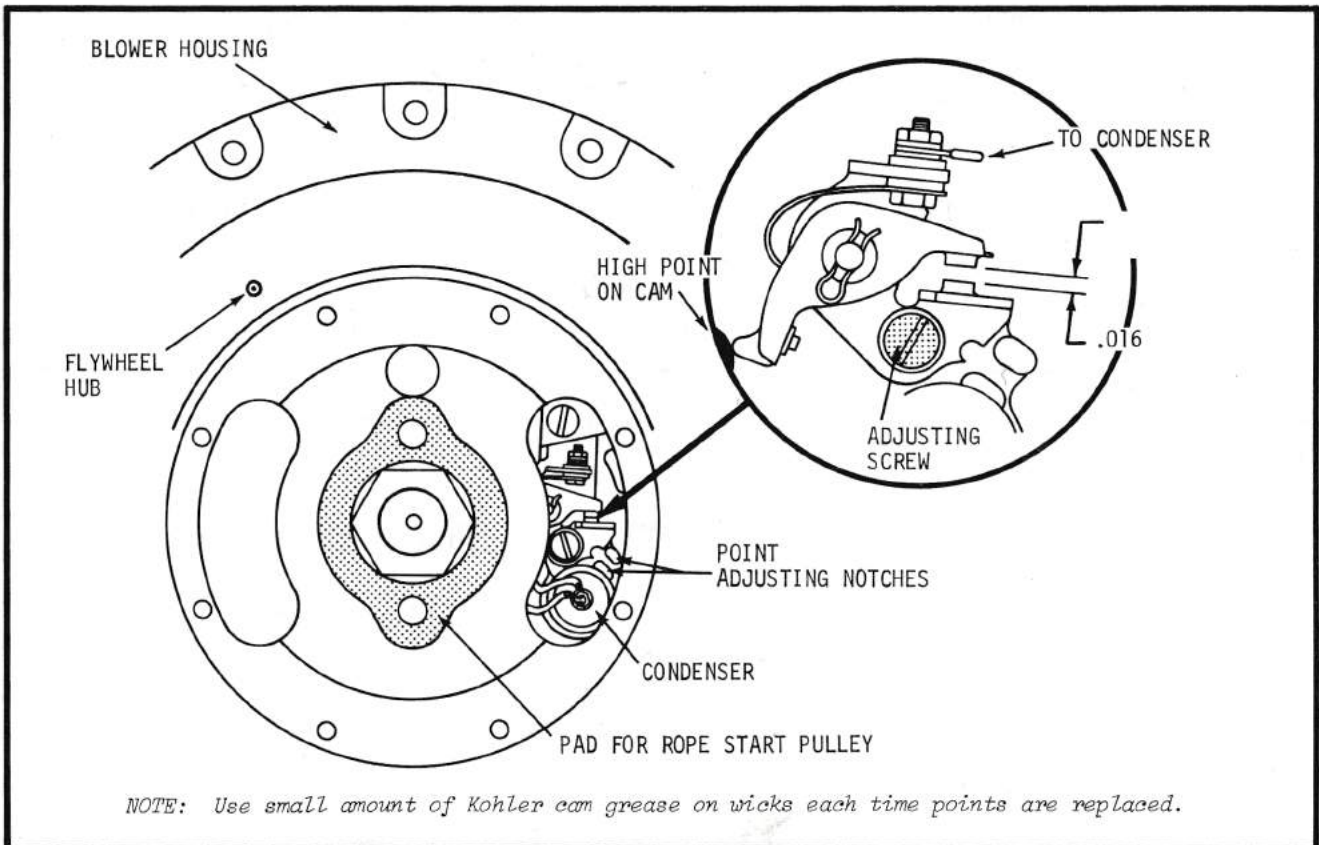


FIGURE 1-8 -- BREAKER POINT LOCATION AND ADJUSTMENT DETAILS

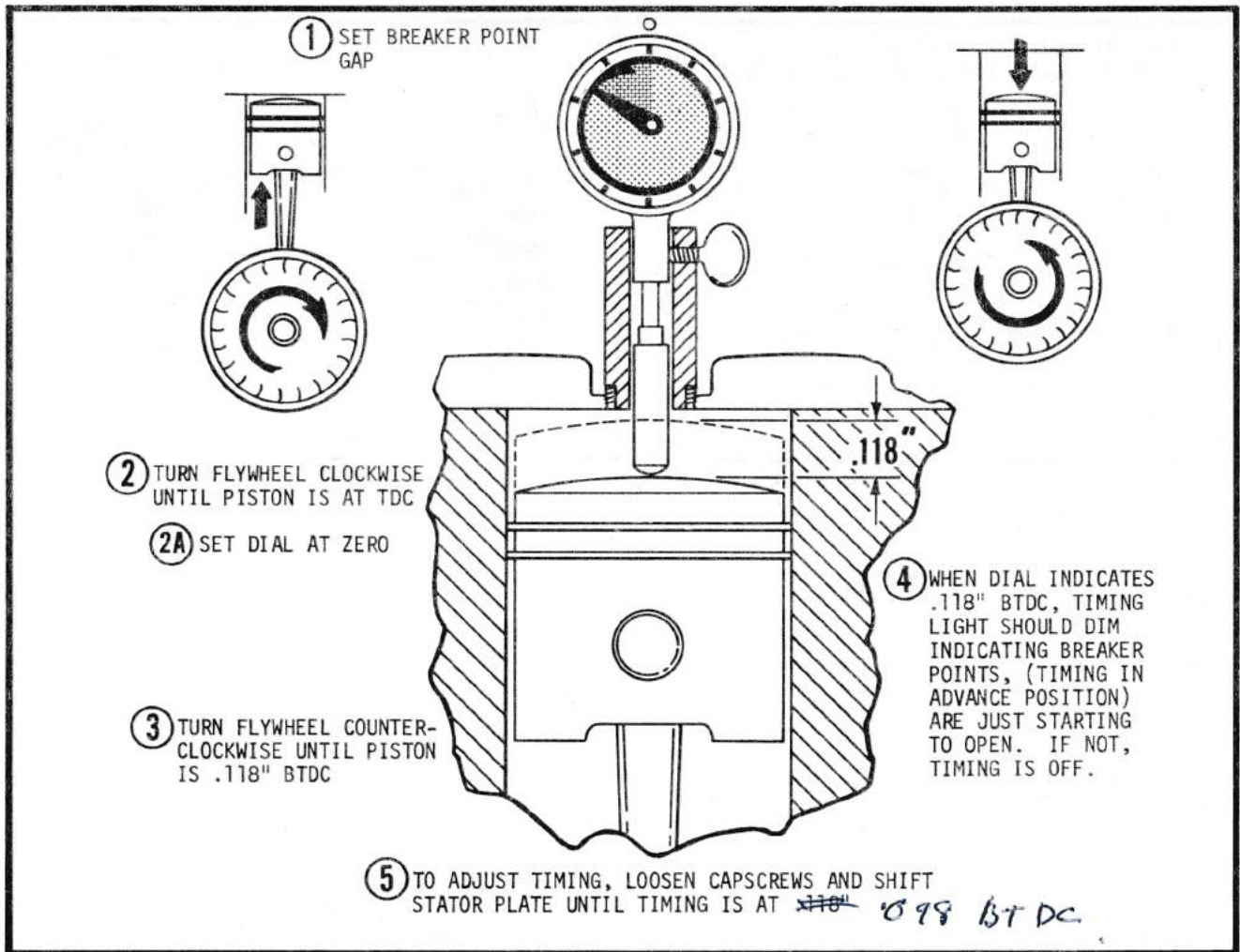


FIGURE 1-9 -- TIMING PROCEDURE WITH IGNITION TIMING TOOL

IGNITION TIMING PROCEDURE: Hard starting and loss of power are most often caused by incorrect timing. Before the ignition timing can be checked, it is necessary to remove retractable starter or intake screen, rope start pulley and breaker cover. A timing kit is also required for the following procedure.

- STEP 1:** Check breaker point gap first. Turn flywheel in clockwise direction until points are wide open then measure gap with feeler gauge. Maximum gap should be .016". If adjustment is required, loosen adjustment screw, shift plate until gap is at .016".
- STEP 2:** Remove spark plug and install timing tool body (18mm) in its place. Install rod and dial indicator--lock indicator with thumb screw.
- STEP 3:** Disconnect black wire which runs from switch to breaker points--disconnect at switch. Clip black tester lead to this wire then touch and hold tester body to engine--light should turn on and stay on if good contact is made.
- STEP 4:** First turn flywheel clockwise (viewed from flywheel end) until indicator shows that piston is at Top Dead Center (TDC). Set dial at zero to mark this point, then turn flywheel counter-clockwise until dial travels (counter-clockwise) all the way past zero to the 90 mark then lift timing advance lever and hold in the advance position, then continue backing off until the dial reads 82--this actually indicates that the piston is .118" BTDC. When this point is reached, tester should dim slightly to indicate that points are just starting to open. If it dims earlier or later, timing is off--if so, adjust per instructions in Step 5.
- STEP 5:** Loosen stator plate screws and shift plate into the position where tester light dims when the piston is .118" BTDC with timing lever in full advance position.

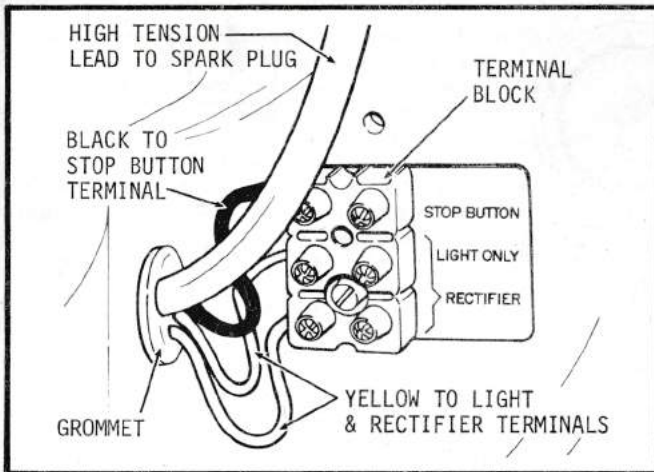


FIGURE 1-10 -- TERMINAL BLOCK ON METRIC K309-1 ENGINES

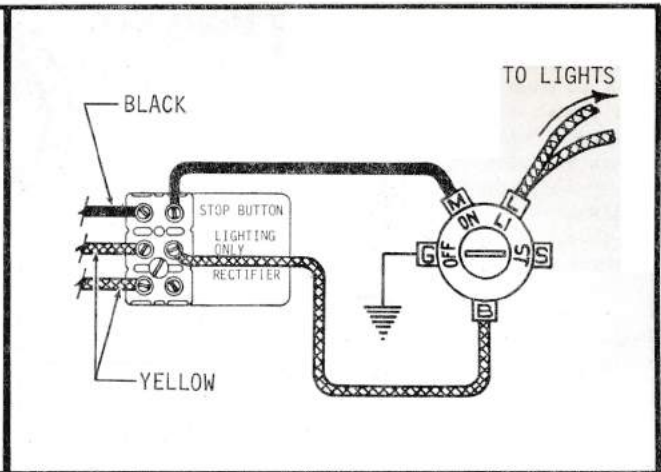


FIGURE 1-11 -- WIRING HOOK-UP OF MANUAL START METRIC K309-1

ELECTRICAL SYSTEMS

The electrical system provides energy for lighting and/or charging a storage battery. A 12 volt, 32 amp hour (minimum) battery is required for the electric start models. On the manual start models, the full output of the system must be used--for example, on a 40 watt system, use a 30 watt lamp on the front light and a 10 watt for the taillight to total 40 watts. If the total output is not used, bulbs will burn out almost immediately. On 75 watt systems used on manual start models, a load resistor may have to be added to the system to make up for any unused load. On electric start models, any energy left over after lights can be used to charge the battery. A 40 watt system with a 40 watt lamp load will not provide any charging unless run with the lights off. The higher capacity 75 watt systems provide charging even with a full light load which is normal on these vehicles.

The 40 watt systems are used on Metric model K309-1 engines (spec. suffix 05 or lower) while the 75 watt systems are used on all the other single cylinder models. The 75 watt system is easily identified by the ignition coil which is externally mounted on the crankcase just below the carburetor. On 40 watt systems, the coils cannot be seen as they are located internally under the flywheel.

An alternator or lighting coil located on the stator plate produces alternating current (AC) when the permanent magnets are rotated around the stator. On manual start 75 watt systems, one end of the coil is isolated internally so that only about 1/2 the energy is available for the lights. On 75 watt electric start, both coil leads (yellow from alternator) are brought out and connected to a rectifier where it is converted to Direct Current for lights and for charging the battery. The rectifier contains two fuses which prevent damage due to reversed polarity of battery--make sure that the negative terminal of the battery is used as ground.

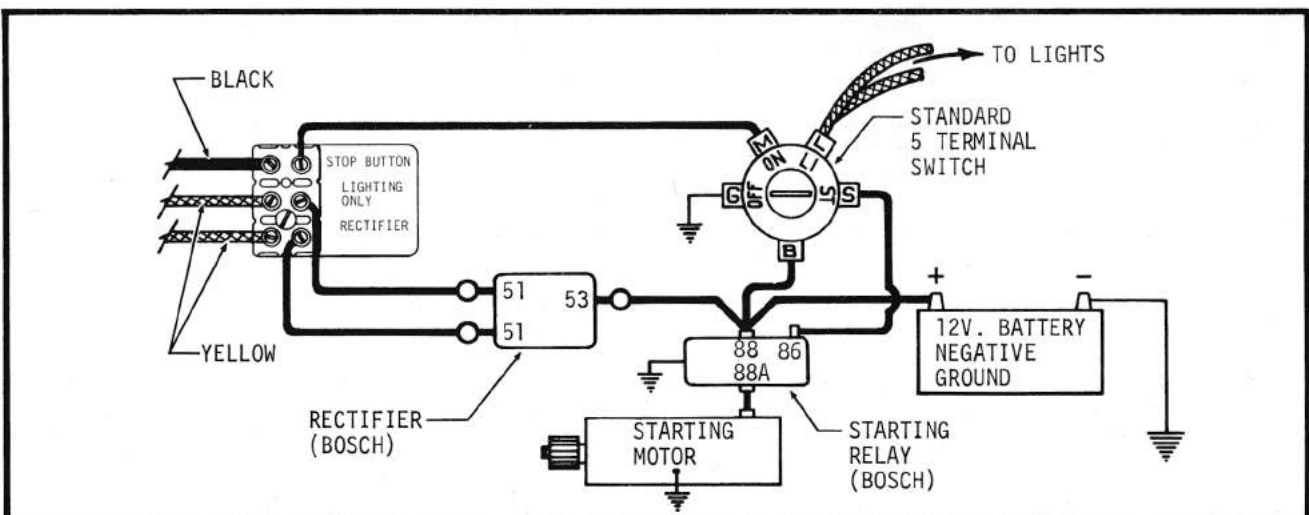


FIGURE 1-12 -- WIRING OF ELECTRIC START SYSTEM - 40 WATT SYSTEM ON METRIC K309-1

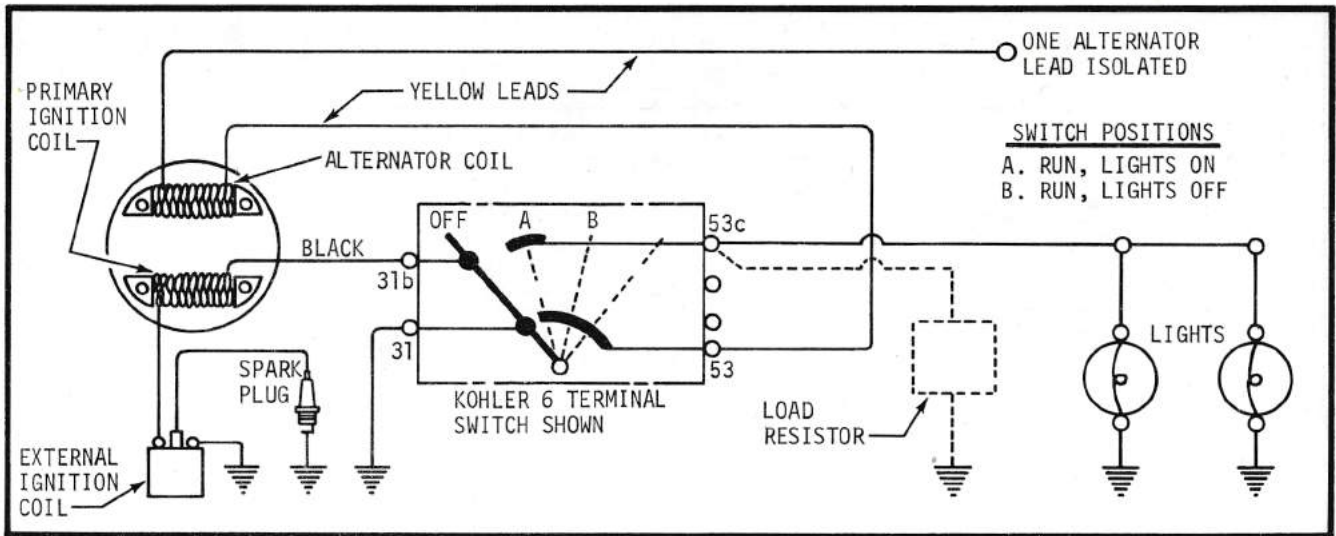


FIGURE 1-13 -- WIRING OF MANUAL START - 75 WATT SYSTEM

If lights will not come on, check ignition switch. If switch is OK, alternator coil may be at fault. To gain access to the alternator coil for replacement, the retractable starter or grass screen, rope drive pulley breaker cover and flywheel must first be removed. The ignition centering tool should also be used to make sure that the proper air gap is established between the new alternator coil and the permanent magnets--this cannot be done after the flywheel is reinstalled. Refer to the Reconditioning Section for instructions on use of the ignition tool.

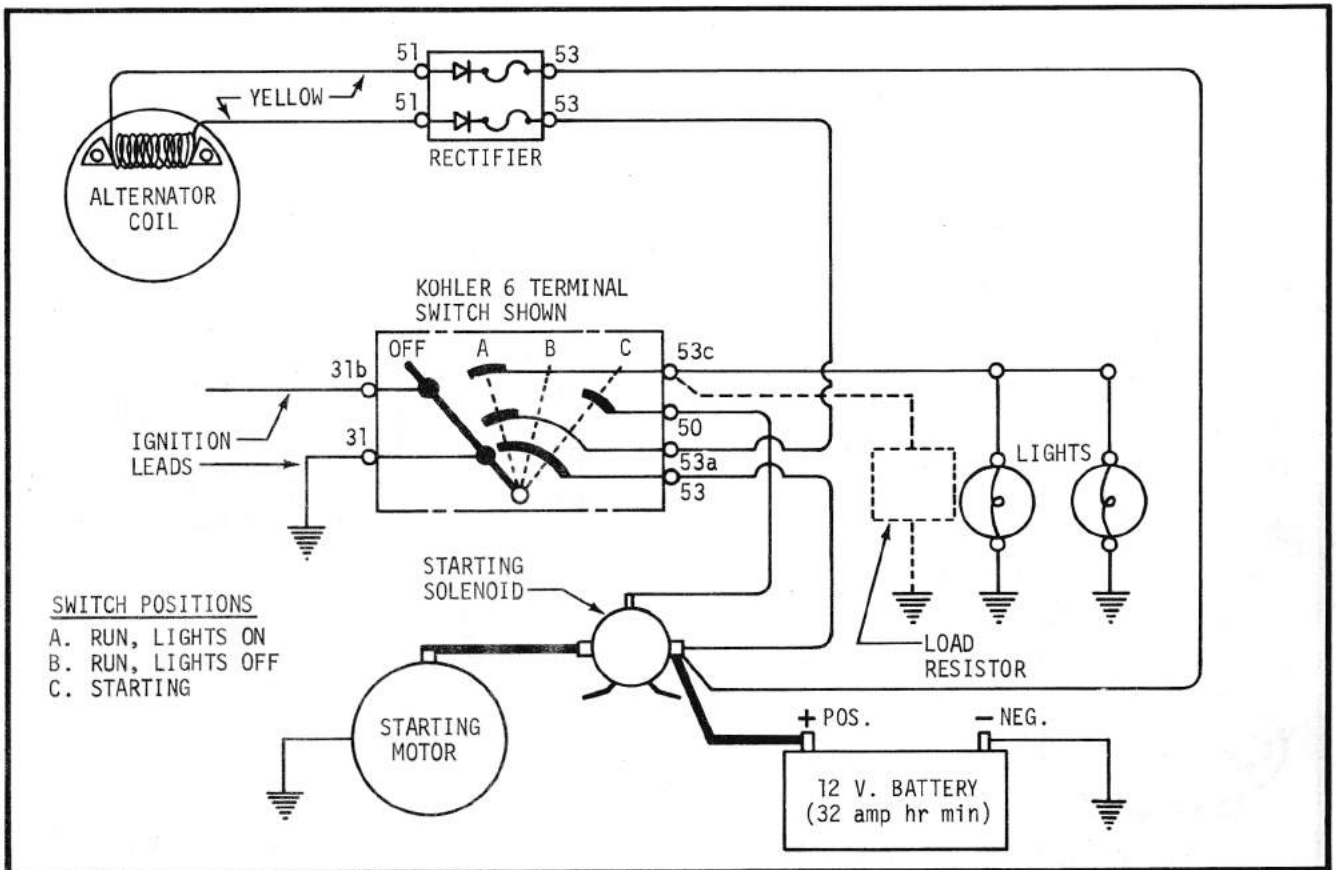


FIGURE 1-14 -- WIRING OF ELECTRIC START - 75 WATT SYSTEM

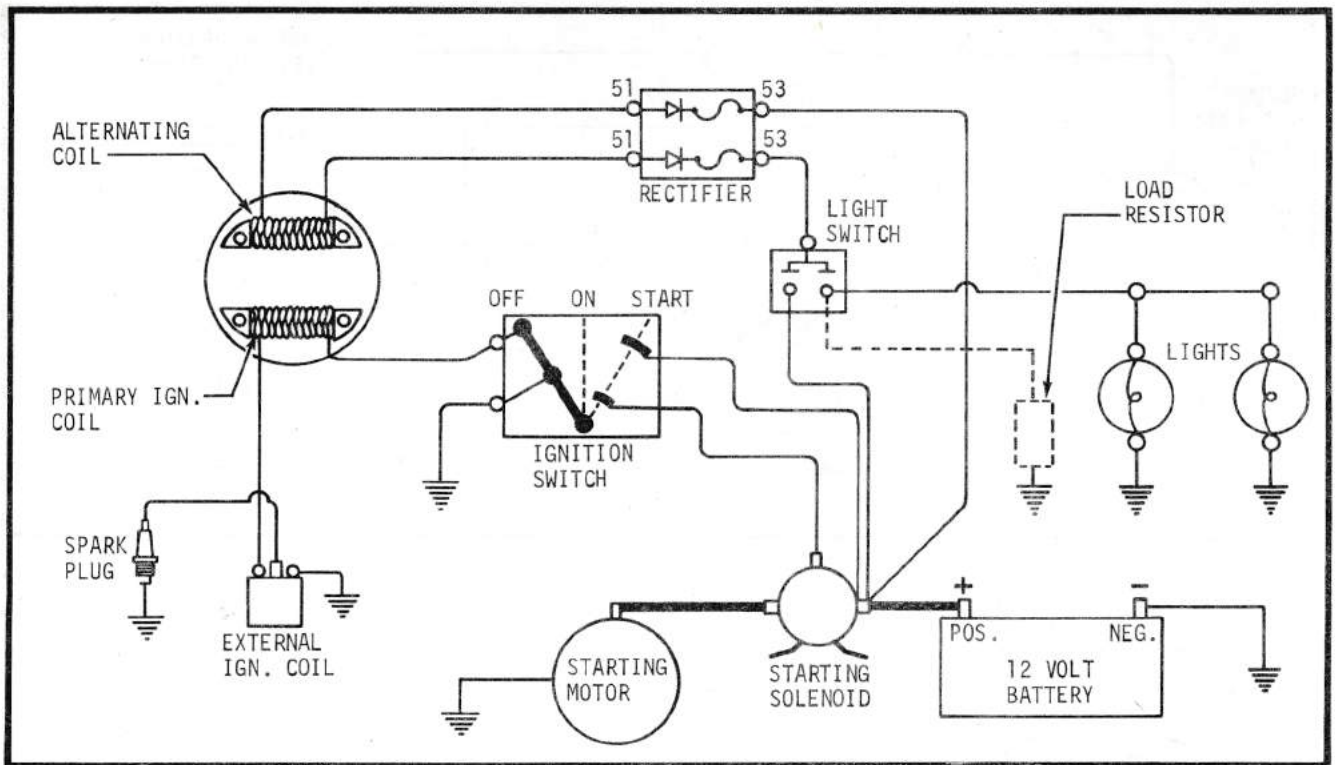


FIGURE 1-14 -- ELECTRIC START WITH SEPARATE LIGHT SWITCH - 75 WATT SYSTEM

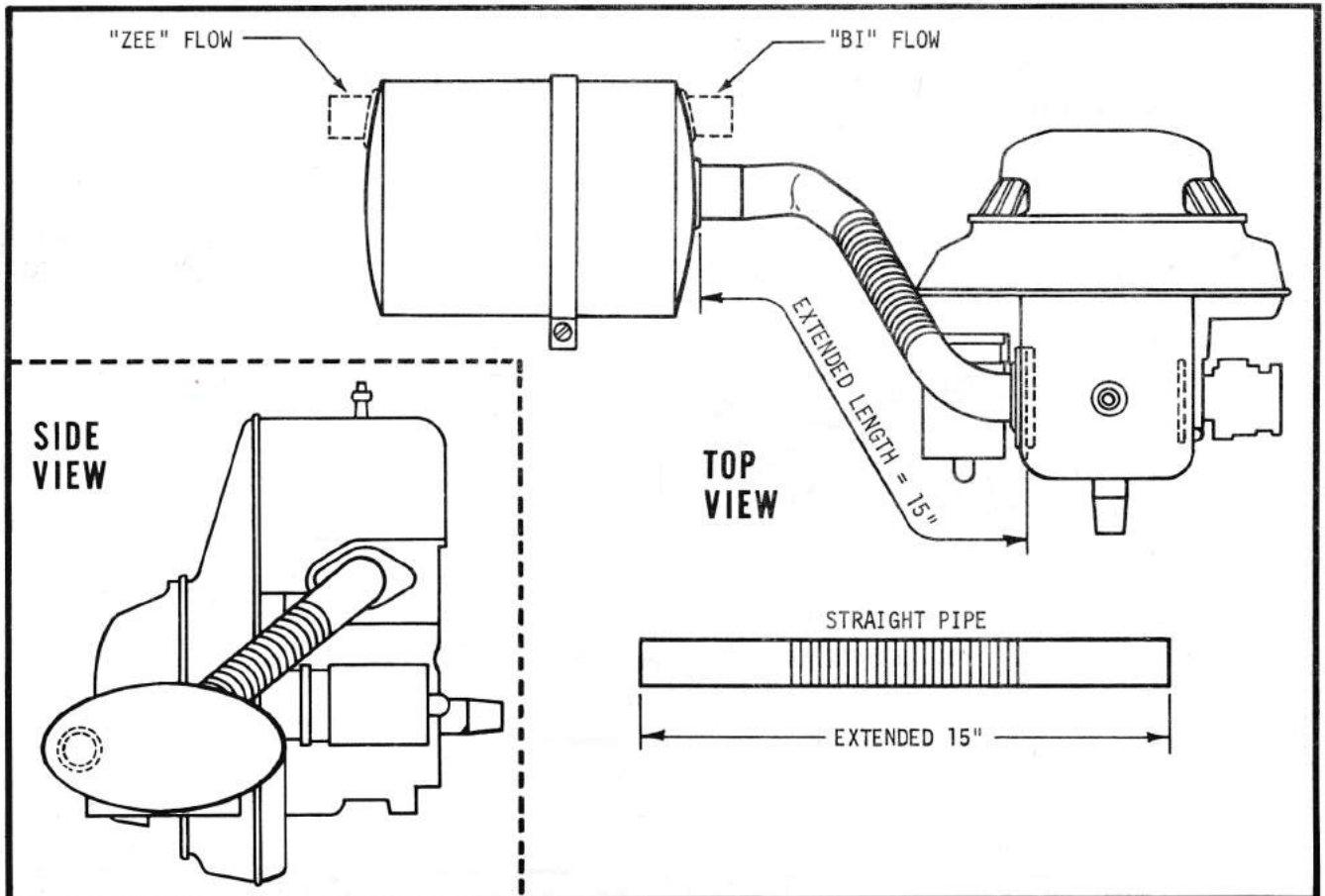


FIGURE 1-15 -- EXHAUST SYSTEM

EXHAUST SYSTEM

On two-cycle engines, the exhaust must be "tuned". This is done by extending the exhaust piping exactly 15" from engine outlet to the end of the pipe or inlet side of the muffler. This is illustrated in Figure 1-15. When pipe length is correct, the sound waves emanating from the exhaust momentarily hold the fuel charge in the combustion chamber. If an incorrect length is used, the fuel charge may go straight through the chamber and into the exhaust before ignition occurs. When replacing exhaust components, use only replacements designed specifically for your engine--substitutes may cause restriction and upset the normal flow.

Best performance is attained with a "Power Tuned" muffler. The megaphone feature of these mufflers allows the exhaust gases to be efficiently scavenged plus it quickly draws the new fuel charge into the chamber thus promoting cleaner, more complete combustion. The muffler also provides just enough back pressure to prevent overscavenging. A straight pipe offers no such advantages. Use only genuine Kohler replacements parts.

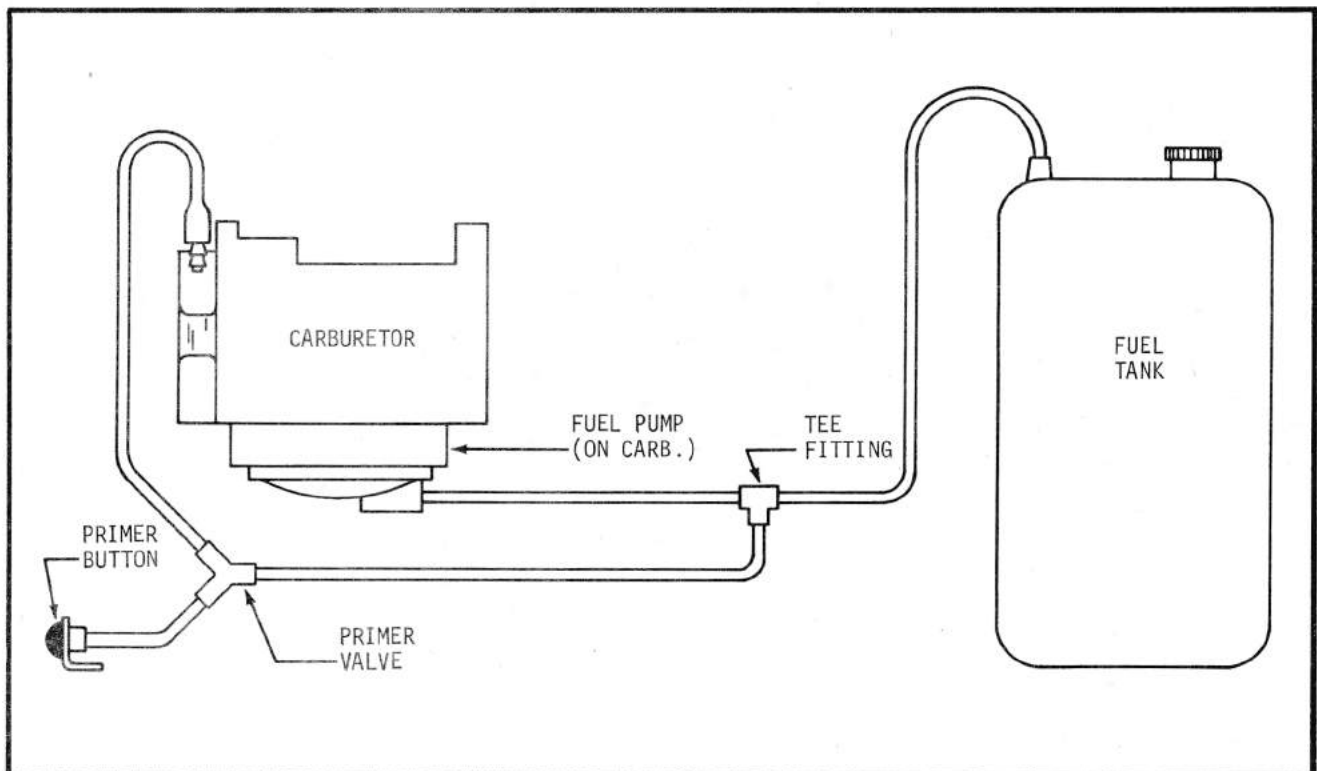


FIGURE 1-16 -- PRIMER BUTTON (OPTIONAL) CONNECTION DIAGRAM

ENGINE - GENERAL SERVICES

COOLING SYSTEM: On single cylinder models, cooling air is drawn into the blower housing by fan in flywheel, circulated past cooling fins on the block and cylinder head and is then ejected toward the clutch or power take-off end of engine. **DO NOT** operate engine with missing or loose air shroud cover or broken fins on flywheel. Keep cooling fins, air intake screens and compartment cooling inlets clean and unobstructed at all times. Fins on cylinder head must be parallel to crankshaft on single cylinder models.

CYLINDER HEAD: Poor performance may be caused by carbon buildup inside cylinder head. If spark plug is badly fouled, have head removed and cleaned at the first opportunity. This service should be performed only at an authorized service center for serious damage can result if done improperly.

DRAIN CRANKCASE: Crankcase should be drained occasionally since accumulation of fuel and oil in crankcase may throw the fuel-air ratio off and cause erratic operation. Remove hex.-head screw driver slot screw at low point on crankcase just below the carburetor. After draining fuel, reinstall and tighten screw.

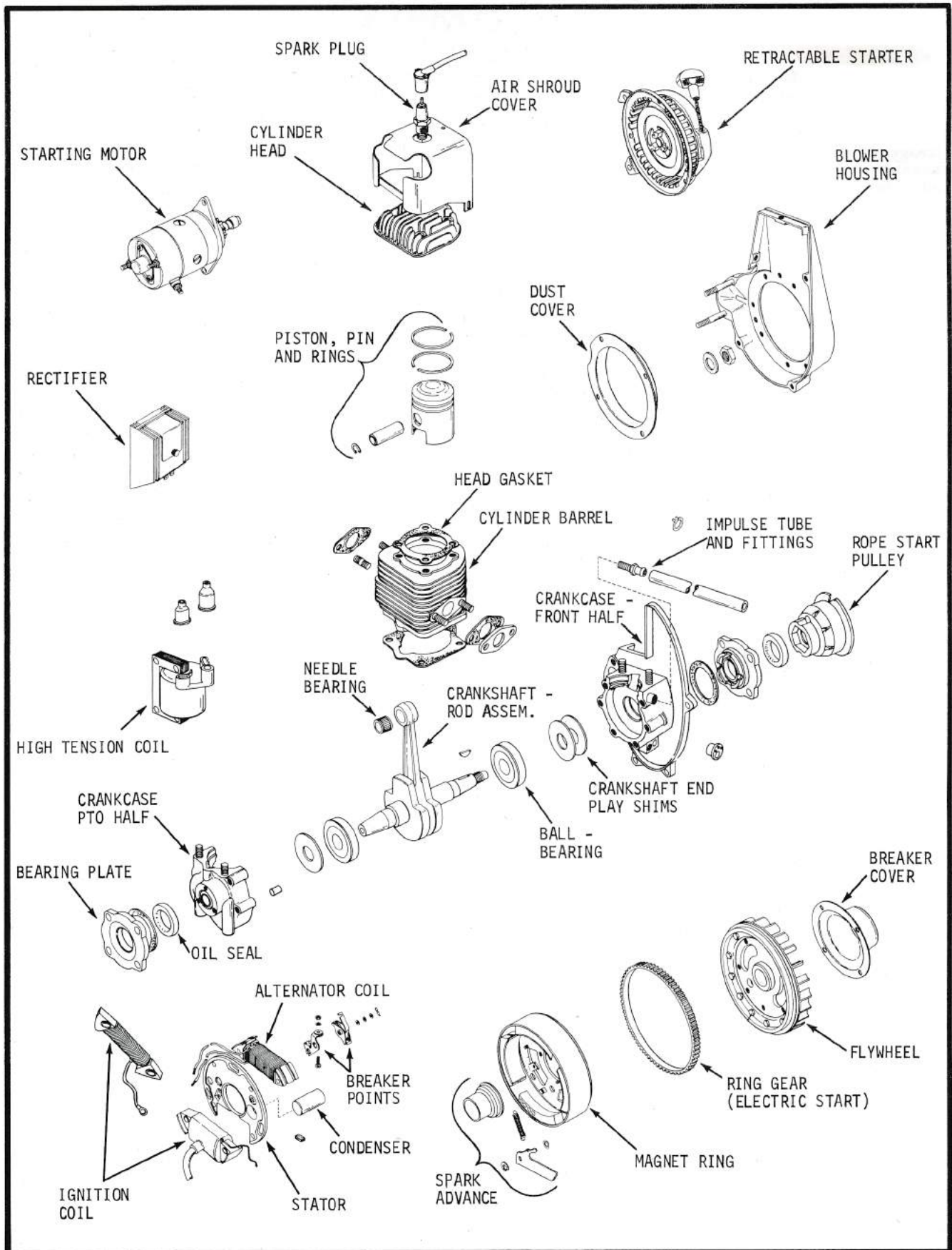


FIGURE 2-1 -- EXPLODED VIEW OF SINGLE CYLINDER TWO CYCLE ENGINE

DISASSEMBLY

GENERAL

Before removing engine from the vehicle, put matching numbers on or color code any wires which will have to be disconnected. This prevents damage from wrong connections and also will speed up reconnection during reassembly. Disconnect and remove spark plug first. Detach exhaust pipe muffler or whatever is necessary to remove engine from the vehicle. Thoroughly clean exterior surfaces of engine before bench disassembly. Tools, such as the engine stand, can be very helpful and time saving when repairing two cycle engines--refer to tool listing at the end of this manual. Some models will require metric wrenches while others use U.S. standard size tools--the last two digits or the suffix of the engine specification number indicates the actual size. If the suffix number is 05 or under, the engine has metric threads while anything over this has U.S. standard. Make sure the proper size tools and replacement parts are used to avoid damage. The following procedure is the suggested sequence of disassembly--it may have to be altered in some parts to accommodate special equipment and accessories. Always make sure spark plug is removed to prevent unintentional starting.

1. SPARK PLUG

Detach lead and remove.

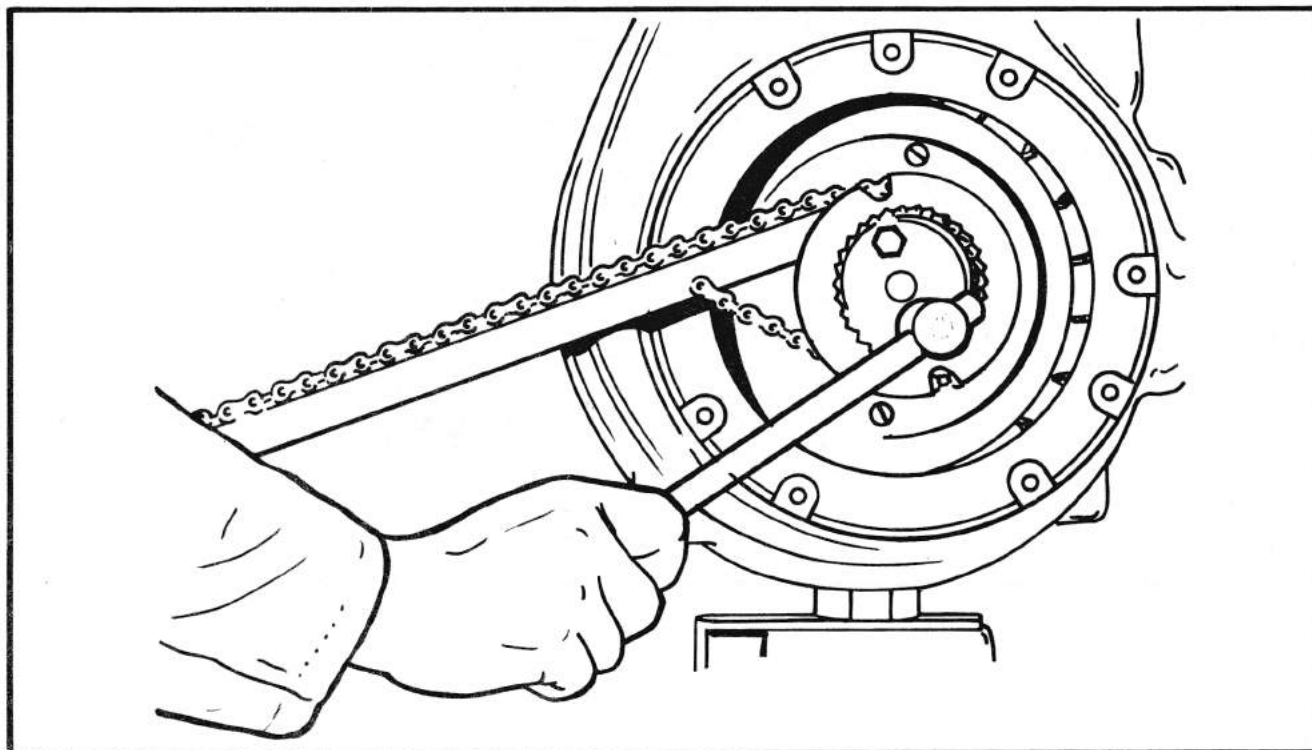


FIGURE 2-2 -- REMOVING ROPE START PULLEY USING CHAIN CLAMP TOOLS

2. STARTER

The engine may have retractable starter, electric starter or both. With retractable starter, note or mark position of starter handle before detaching starter--there are nine possible positions. Remove three capscrews and remove retractable starter and air inlet screen from blower housing. On some retractable starters, the screen is part of starter housing.

3. CARBURETOR

Disconnect impulse tube from fitting on crankcase, remove the two nuts securing carburetor to the crankcase then slip carburetor off studs and remove gaskets and insulator blocks.

4. AIR SHROUD COVER

Remove three capscrews (one on top--other two on sides), then lift air shroud cover off over top of the cylinder barrel.

5. ROPE START PULLEY

Remove air intake screen or retractable starter from blower housing first. Use chain clamp wrench from tool kit to hold pulley while removing two capscrews inside pulley. 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.

6. BLOWER HOUSING

The blower housing is secured to the crankcase at five points. If engine does not have starting motor, remove starter mounting cover plate nuts. On other models, detaching the starter eliminates these two connecting points. On all models remove three remaining capscrews, then remove blower housing.

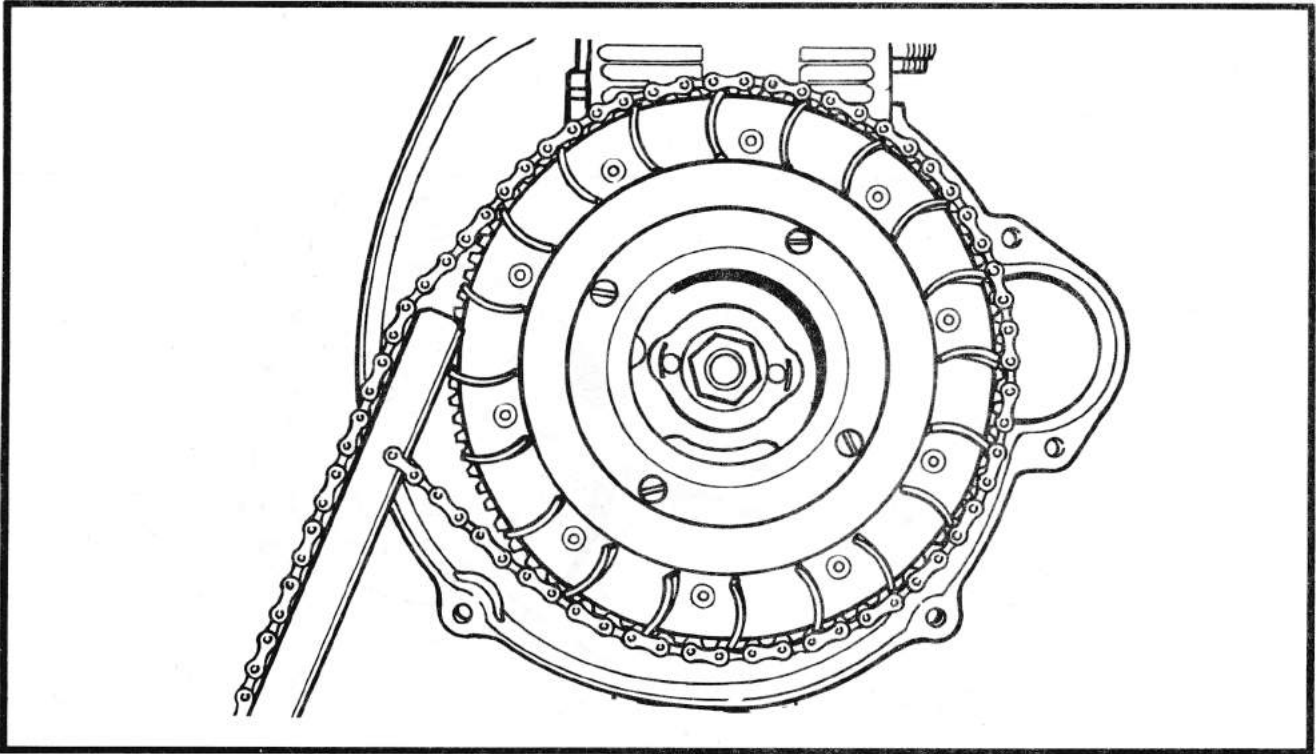


FIGURE 2-3 -- HOLD FLYWHEEL WITH CHAIN CLAMP WHILE REMOVING FLYWHEEL NUT

7. FLYWHEEL NUT

Remove dust cover. Use an impact wrench to remove flywheel retaining nut or hold flywheel with chain clamp tool and remove nut with breaker bar and 1-1/16" socket. When using chain wrench, make sure chain links are meshed with the ring gear or chain is on the flat surface of flywheel--keep chain away from the fan.

8. FLYWHEEL

The flywheel is mounted and keyed to a taper on the crankshaft. Use puller (as shown) to remove. Do not "bump" end of crankshaft to loosen as this may weaken crankshaft. It will not be necessary to remove fan from flywheel unless fan replacement is needed. If so, note that one fin may be specifically marked (edge filed off at steep angle) for ignition timing purposes. This is not done on all engines but if found on engine, scribe mark on flywheel adjacent to fin and re-mark new fan at the same spot.

9. STATOR ASSEMBLY

Remove 4 dust guard capscrews and dust guard. Disconnect wiring and pull thru grommet. Scribe matching marks on stator and on crankcase assembly (for reassembly) then remove stator mounting capscrews and detach stator assembly.

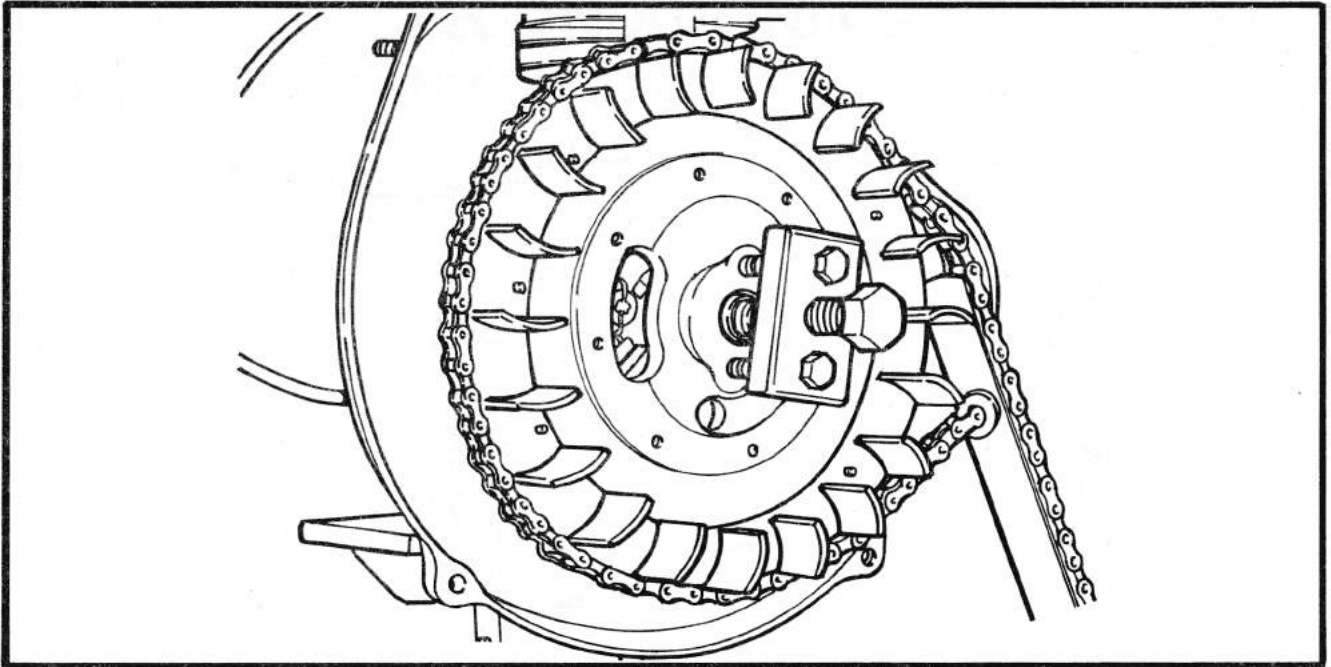


FIGURE 2-4 -- USE PULLER TO REMOVE FLYWHEEL

10. CYLINDER HEAD, BARREL & PISTON

File matchmarks on intake side of head, cylinder barrel and crankcase to insure proper reassembly of these parts. Remove 4 capscrews then remove cylinder head and head gasket. Remove 4 nuts from crankcase assembly studs then carefully lift cylinder barrel off over top of piston. Also remove barrel to crankcase gasket. Heat piston lightly, remove circlips at both ends of piston pin then push pin out (pin extractor tool) to disconnect piston from the connecting rod.

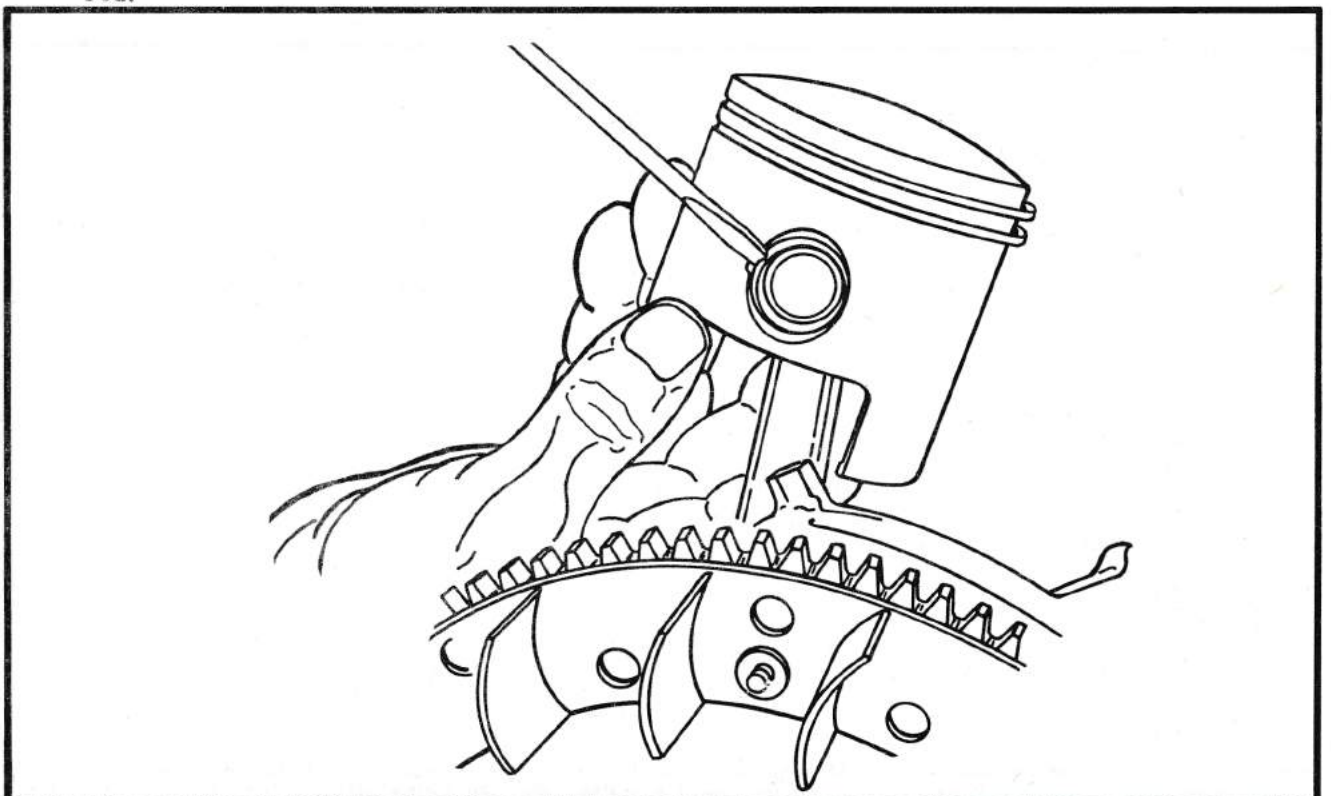


FIGURE 2-5 -- REMOVE CIRCLIPS FROM BOTH ENDS OF PISTON, PUSH PIN OUT WITH EXTRACTOR TOOL

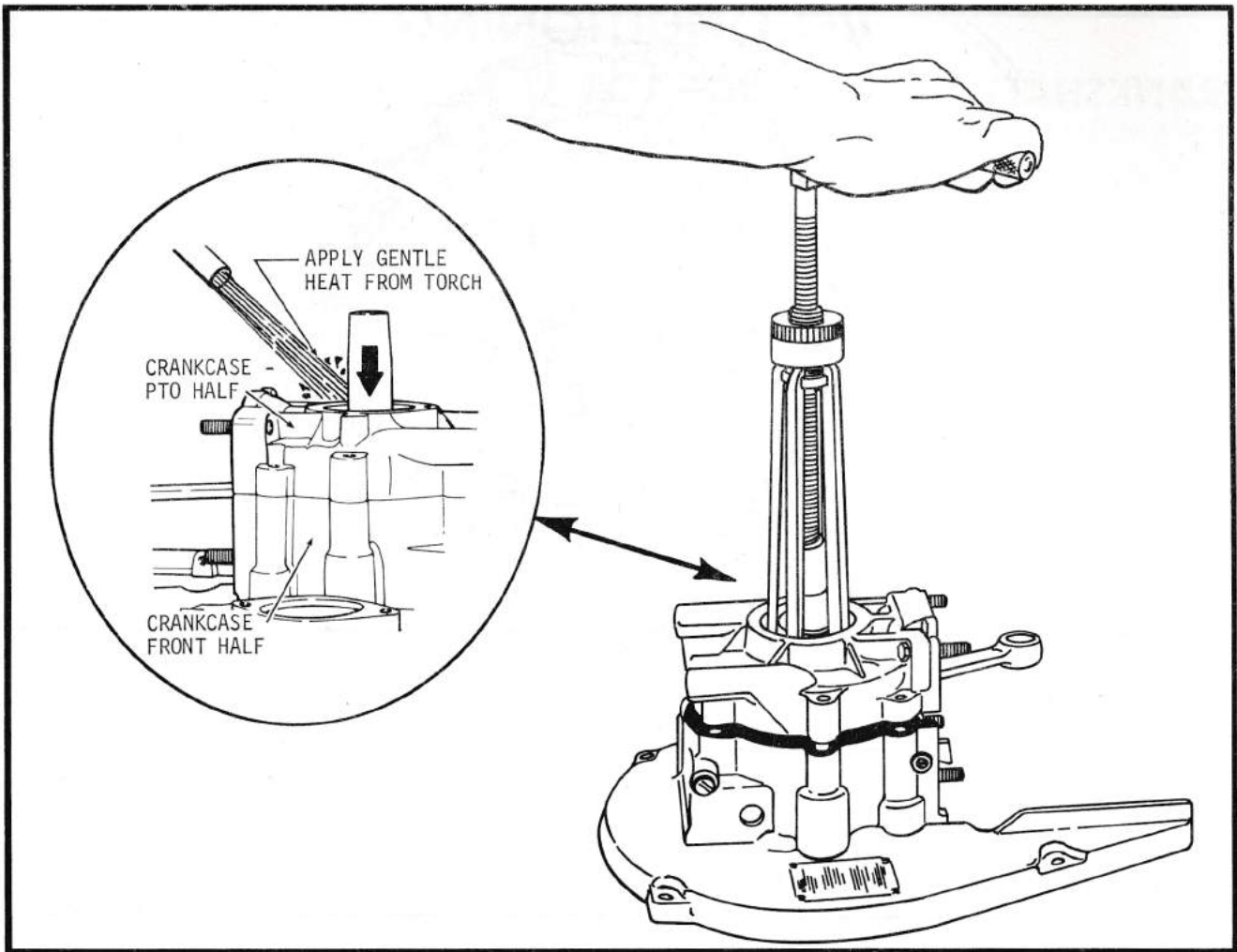


FIGURE 2-6 -- USE BEARING PULLER TOOL AND HEAT TO SEPARATE CRANKCASE HALVES.

11. BEARING PLATES

Bearing plates are removed only when seals must be replaced or if further disassembly is necessary. There are two bearing support plates--one at the front or flywheel end of engine and the other at the Power Take Off end (PTO). Remove 3 capscrews from each then detach both bearing plates, pry loose with screwdriver.

12. CRANKCASE HALVES, CRANKSHAFT

Further disassembly is required only if crankcase is damaged or if crankshaft or bearing replacement is called for. The bearing puller tool should be used to separate the crankcase halves. Apply gentle heat from a torch to the PTO half of crankcase while turning the bearing puller jack screw. As pressure and heat are applied, the bearing should work free of the tight fit in the crankcase PTO half. Repeat heat-pressure procedure to separate remaining half of crankcase from the crankshaft.

13. BEARING REMOVAL

Before removing bearings from crankcase, check condition by spinning (by hand--do not spin with air hose)--if they turn easily and noiselessly and there is no evidence of scoring or grooving on the races, they can be cleaned and reused. Clean bearings in a solution such as naphtha which does not leave film, then after cleaning reoil to prevent formation of rust.

Use the bearing puller tool to remove both bearings when this is needed. Place the expansion ring within 1/2" of the bearing for best results. Do not reinstall bearings on crankshaft at this time.

RECONDITIONING

CRANKSHAFT-CONNECTING ROD

If visual check fails to uncover damage, install crankshaft-rod assembly in vise--use protective caps on jaws. Make the following tests to determine if the crankshaft-rod assembly is suitable for reuse. Do not attempt to separate crankshaft halves for reconditioning--special tools and equipment are required for this. If small end rod bearing or crankshaft are damaged or worn beyond limits, replace crankshaft-rod as a unit. Do not reinstall anti-friction 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 bearing is in good condition, rotation will be smooth. The small end bearing should be removed and replaced as necessary.

ROD SIDE PLAY: Mount dial indicator as shown in Figure 3-2 to check lateral movement of connecting rod. Move rod back and forth laterally--if movement is in the .035 - .059 range, end play is within allowable limits.

CLEANING: After checking shaft, thoroughly clean assembly in a 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, nor alcohol or lacquer thinner as these, on the other hand, leave parts too dry and may cause seizure during initial start up after reconditioning.

CYLINDER BARREL

Carefully observe cylinder bore for signs of scuffing then check gasket surfaces for nicks or grooves which could prevent proper sealing. Check for badly chipped or broken fins. Make sure threads are not stripped. Use a new barrel if any damage is noted--if not, check cylinder bore to see if reboring is needed.

To check wear, use inside micrometer and check just below the top of the cylinder--wear will be indicated by a "step" worn into the wall in this area. 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 rebored. If wear is less than .006 and the bore is not damaged, only a light deglazing (with fine emery cloth) may be needed.

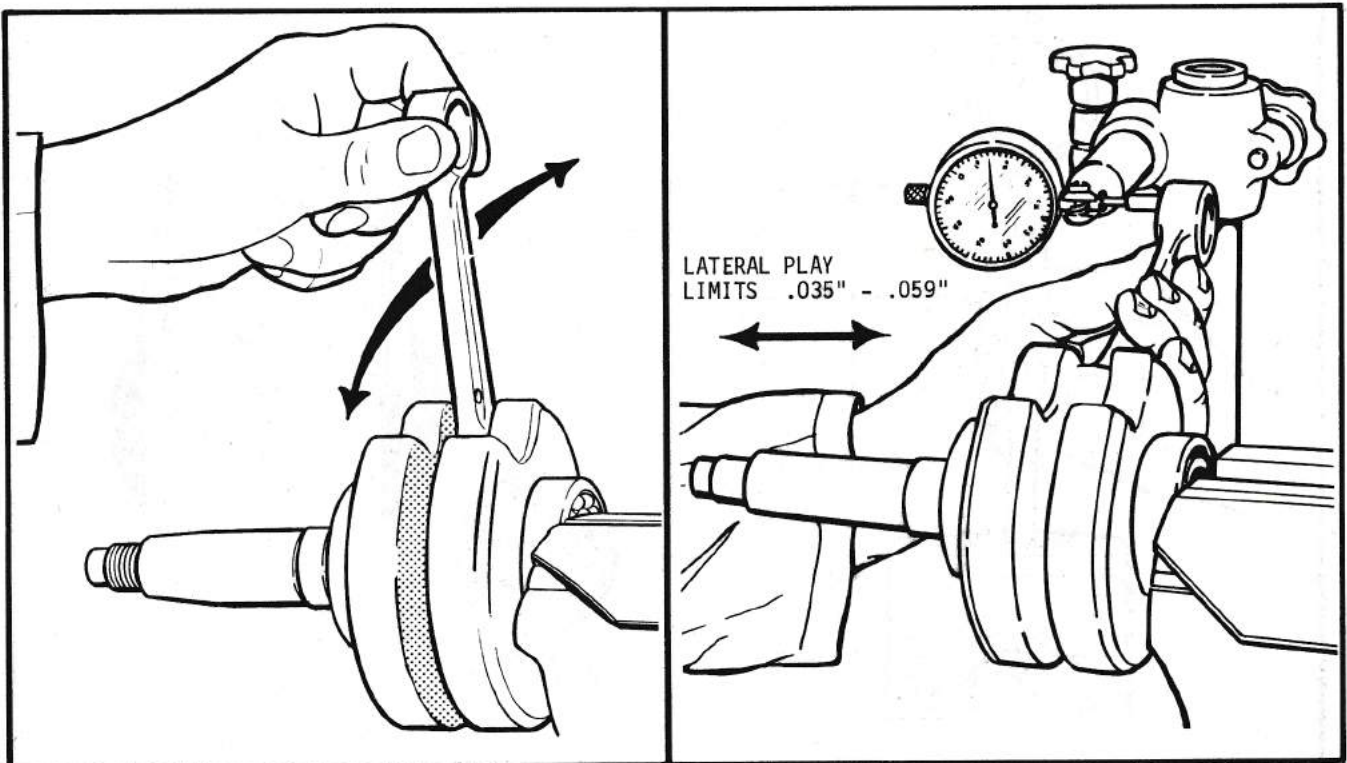


FIGURE 3-1 -- CHECKING CONNECTING ROD BEARINGS

FIGURE 3-2 -- CHECKING ROD SIDE (LATERAL) PLAY

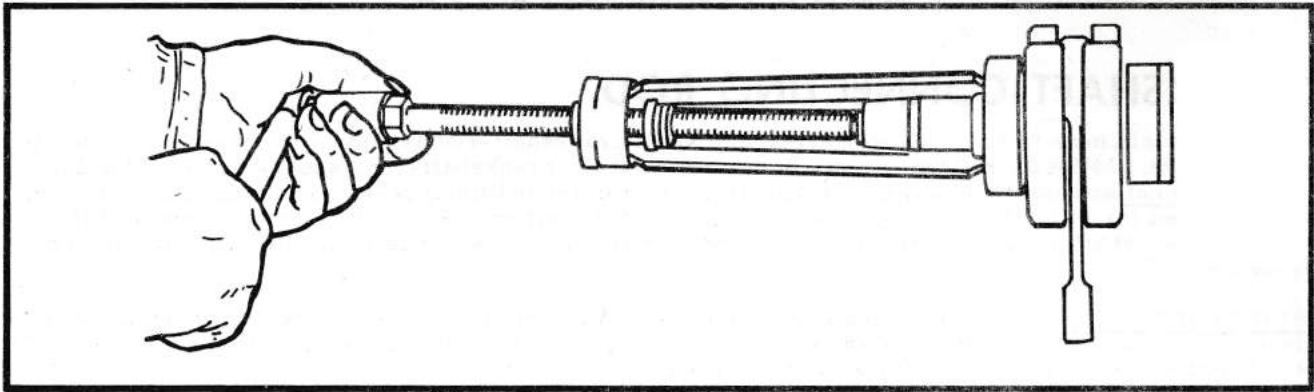


FIGURE 3-3 -- USING BEARING PULLER TOOL

Rebore cylinder oversize to use standard oversize pistons. Cylinder bore finish dimensions are: Standard Diameter, First Oversize (.010), Second Oversize (.020), Third Oversize (.040). Refer to Clearance Section in the back of this manual for actual bore sizes for your particular engine model. After reboring, remove any burrs that may have formed around ports. Thoroughly clean cylinder walls with kerosene and clean rags. After cleaning, apply light coat of SAE 10 to prevent formation of rust.

Make sure ports are clean and that all gasket material is removed from surfaces.

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 cannot be removed use a new cylinder head.

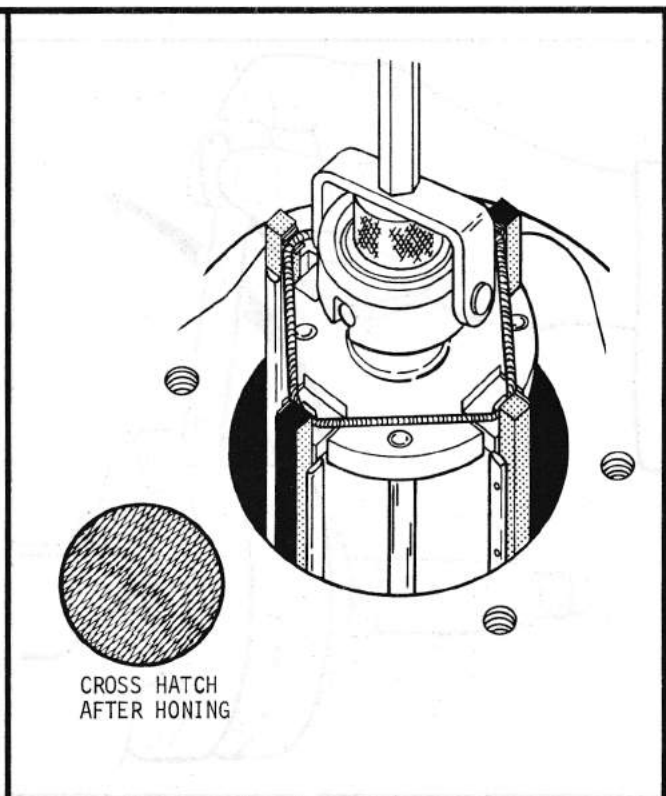
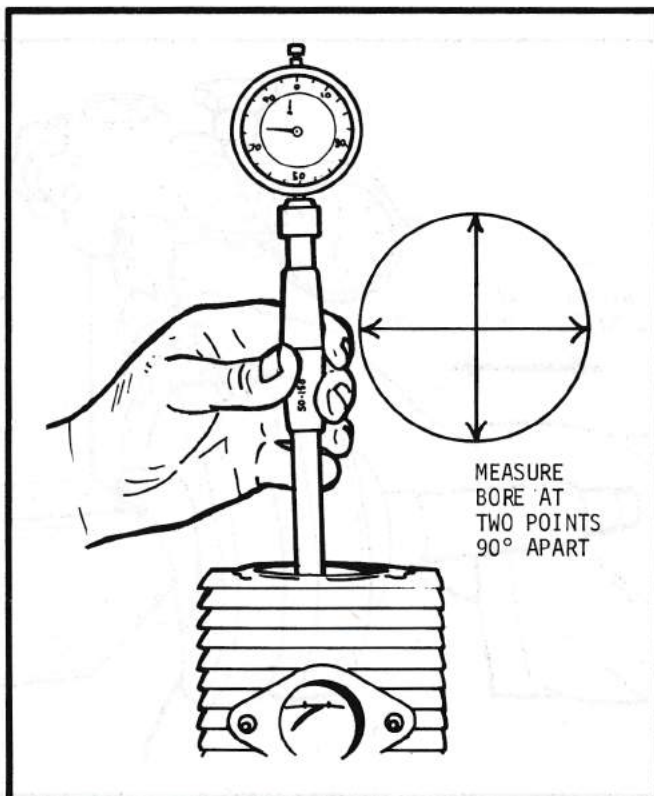


FIGURE 3-4 -- CHECKING CYLINDER BORE FOR WEAR

FIGURE 3-5 --REBORING CYLINDER WITH HONE

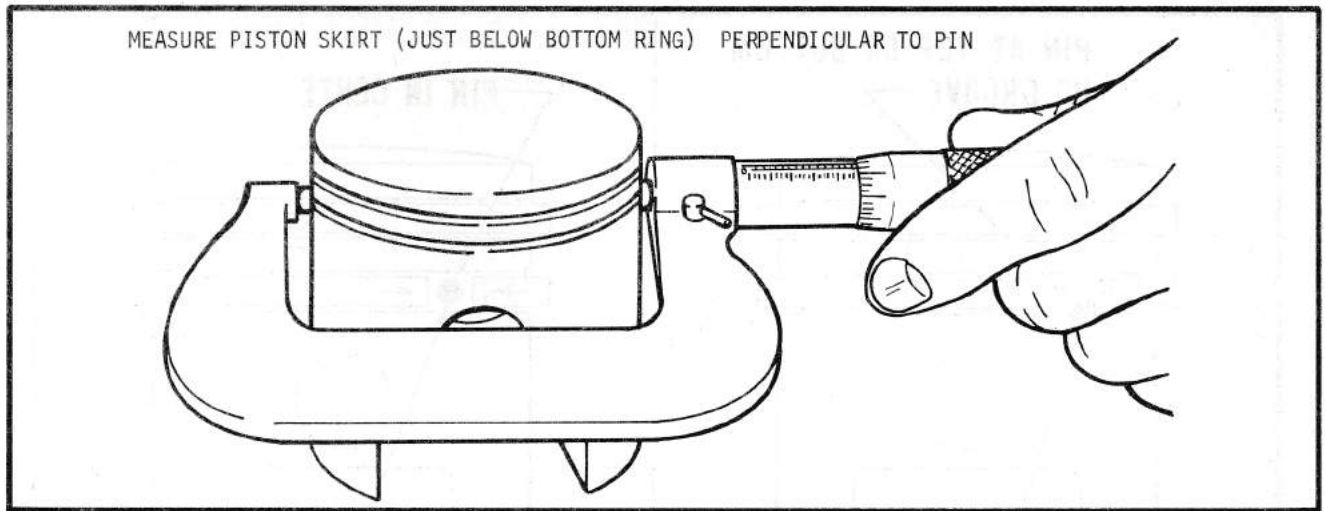


FIGURE 3-6 -- MEASURE PISTON WEAR WITH MICROMETER

PISTON-PISTON RINGS

To check wear, measure piston at the top level of the piston skirt and at right angles to the piston pin axis. If wear exceeds .002", the piston must be replaced. Also replace if there is any evidence of pitting on the top of the piston. If cylinder has been rebored oversize, the appropriate oversize piston must also be used. Replacement pistons are furnished with rings and piston pins. Pistons are available in standard size and .010", .020" and .040" oversizes. Refer to Clearance Section for dimensions.

If piston is undamaged and can be reused, remove used rings and fit new rings; never reuse rings. Make sure rings with beveled edges are used on piston with pins at top or bottom of groove--see illustration. 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.

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 exceed .008". If more than this, groove is worn beyond limits and piston must be replaced.

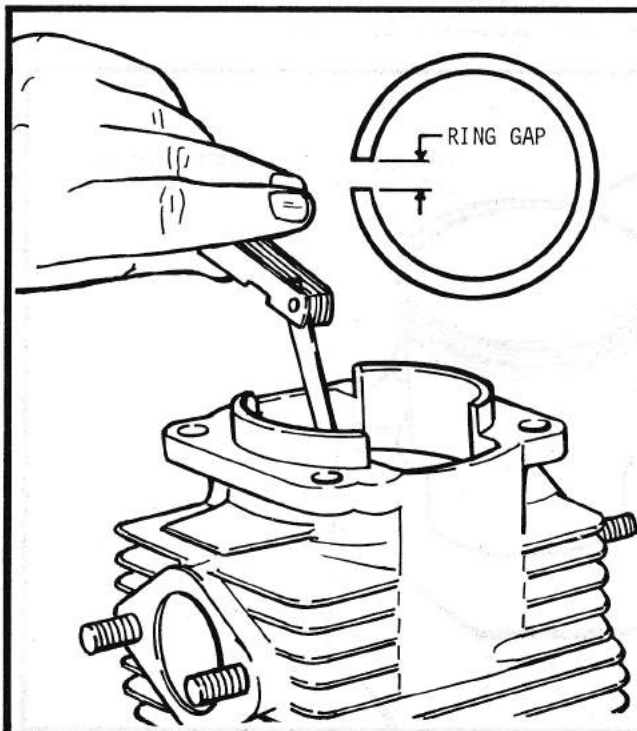


FIGURE 3-7 -- MEASURING RING END GAP

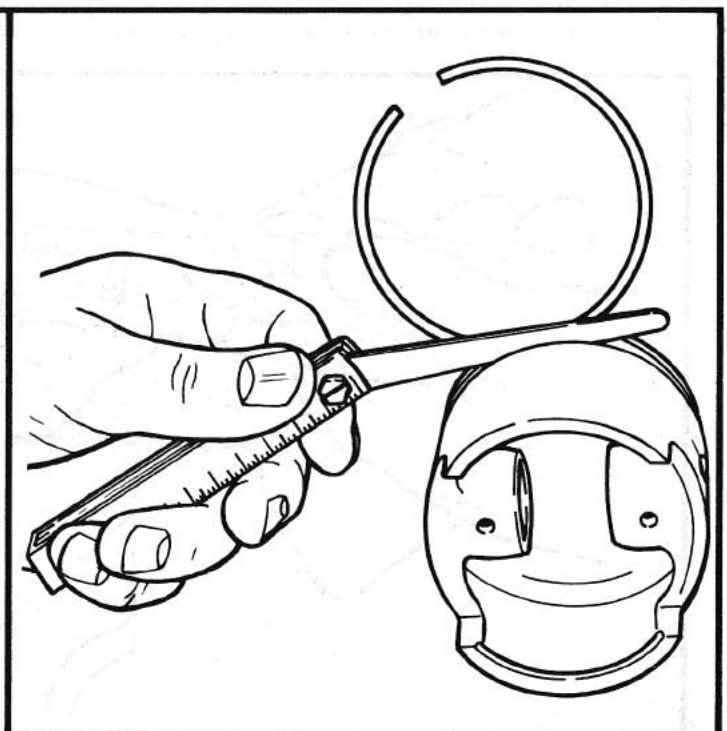


FIGURE 3-8 -- MEASURING RING SIDE CLEARANCE

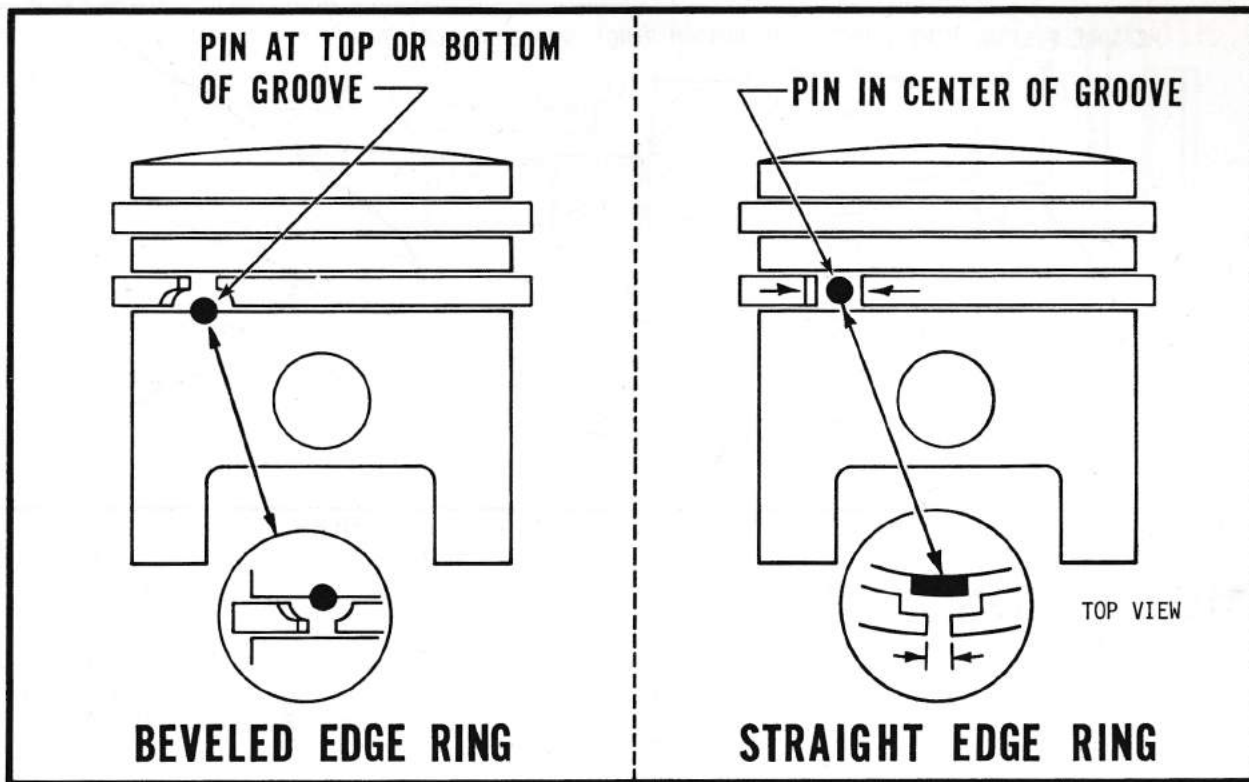


FIGURE 3-9 -- PISTON PIN LOCATION AND RING DIFFERENCE

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. Ring gap must be .012 to .018".

When installing rings, make sure that the lighter appearing ring is installed in the bottom (nearest pin) groove. Use ring expander and install bottom ring first. Top ring or duller appearing, dark colored ring (moly coated) must be installed in the top groove. Align rings with beveled ends so that gap is positioned over the small locating pins in the piston grooves--see illustration.

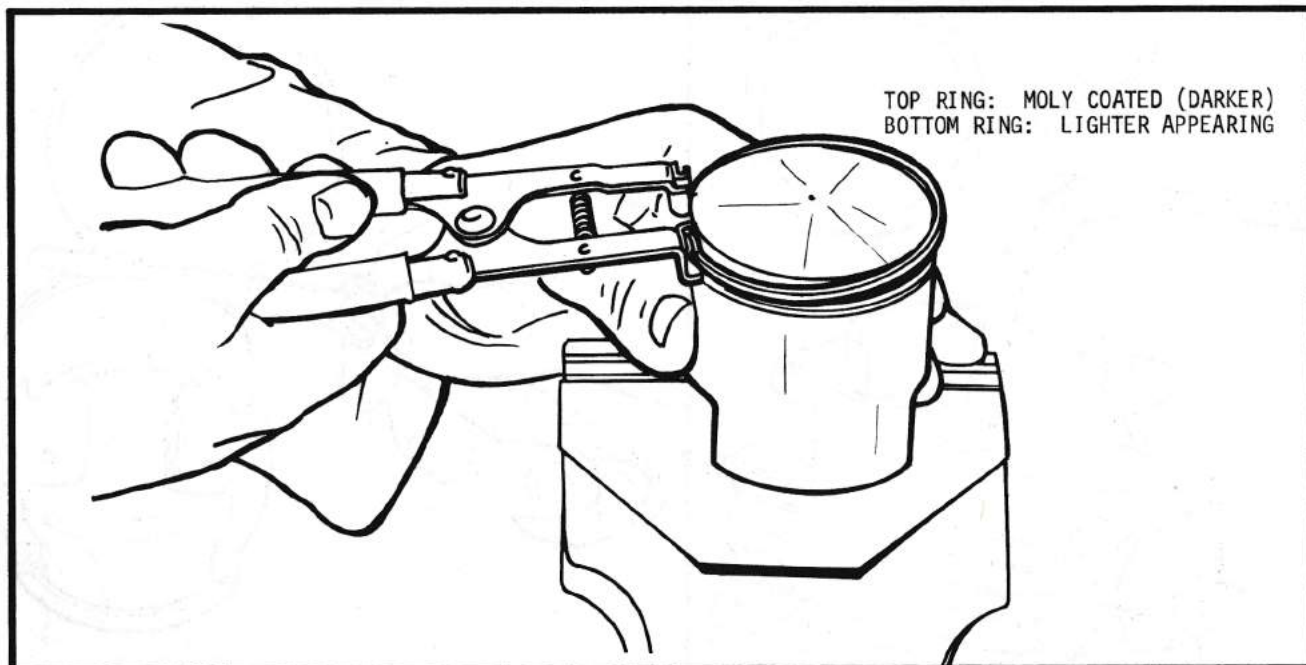


FIGURE 3-10 -- USE RING EXPANDER WHEN INSTALLING NEW RINGS

IGNITION-ELECTRICAL SYSTEMS

The centering tool is required whenever the breaker points, ignition or alternator coil are replaced. Use of the centering tool establishes the proper air gap and also allows 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 off pin. Remove point gap setscrew then detach bracket portion of breaker point assembly. Reverse this foregoing procedure to install new breaker points. Use the center sleeve for precision adjustment of breaker point gap--set gap (maximum) at .016".

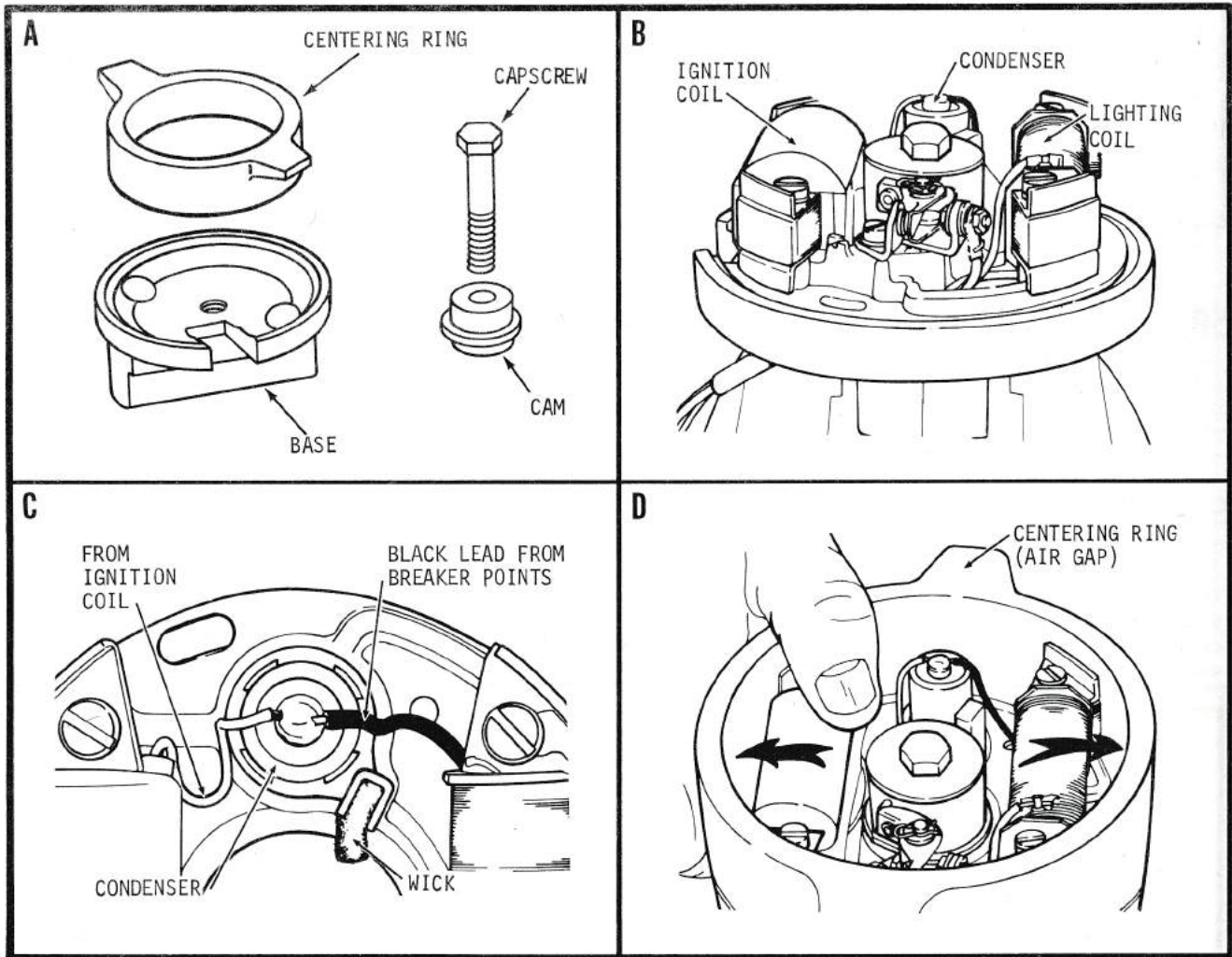


FIGURE 3-11 -- (A) IGNITION TOOL COMPONENTS (B) STATOR MOUNTED IN BASE
(C) CONDENSER, CAM WICK DETAILS (D) USE CENTERING RING TO SET AIR GAP

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 plate or condenser. If available, use Kohler condenser replacement tool.

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 properly establishes air gap at .012".

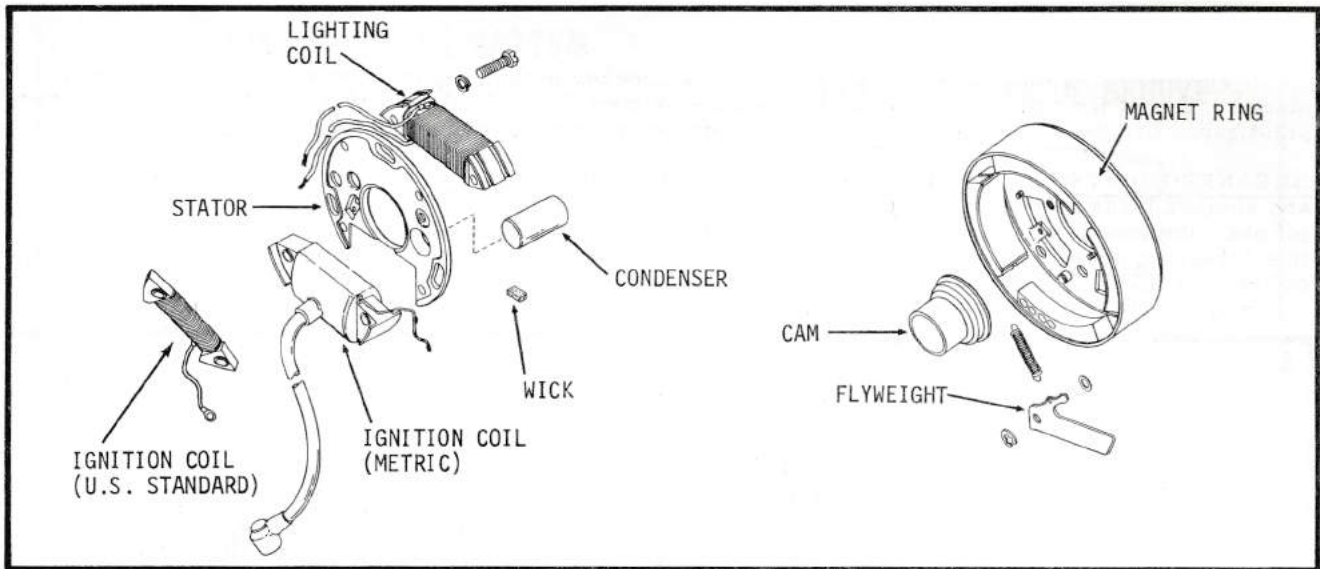


FIGURE 3-12 -- EXPLODED VIEW: IGNITION STATOR, SPARK ADVANCE MECHANISM COMPONENTS

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.

STARTING MOTOR

Bendix drive type starters do not require servicing at regular intervals. Bushings are made of special self-lubricating material and should not, therefore, require attention. Brushes and commutator should be inspected only when performance indicates that they may be dirty or worn. Some problems that can possibly occur are listed in the accompanying trouble analyses chart. If the corrective actions stated fail to remedy the problem, the starter must be serviced or reconditioned. Service, replacement and overhaul instructions follow the trouble analysis chart.

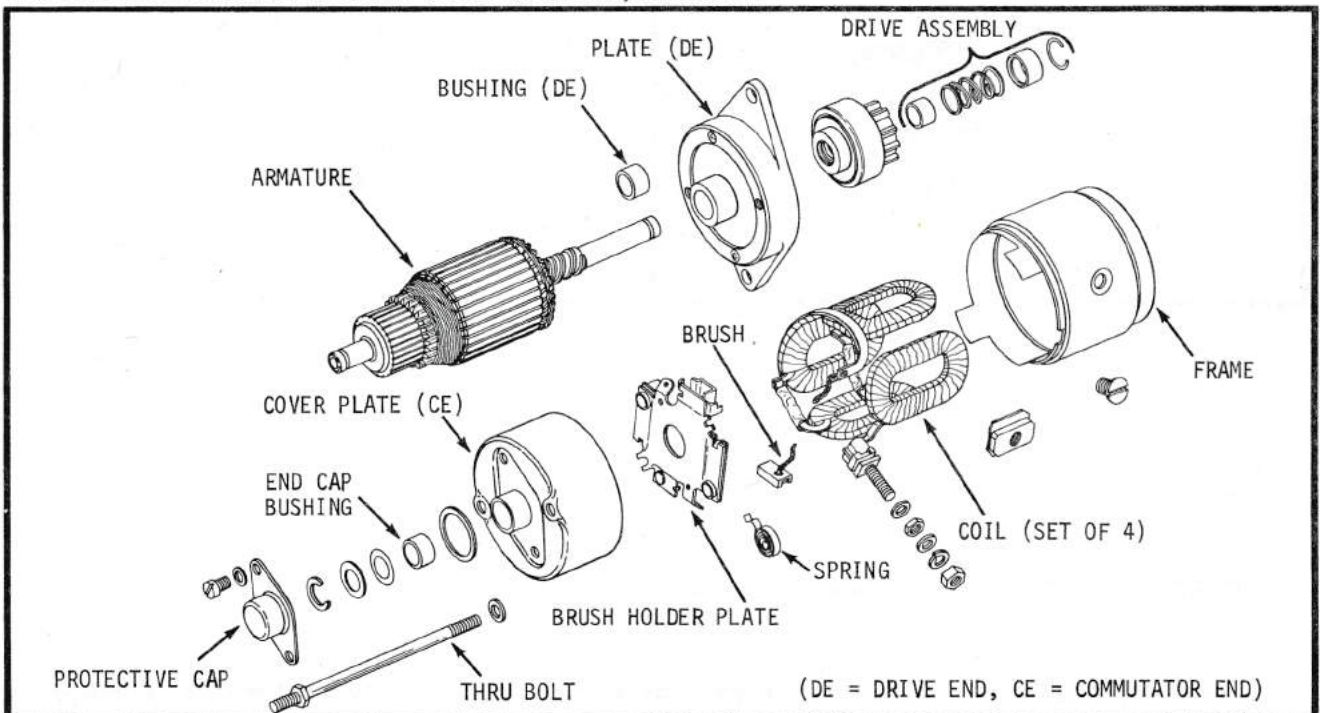


FIGURE 3-13 -- EXPLODED VIEW: ELECTRIC STARTING MOTOR

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>

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.

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.

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.

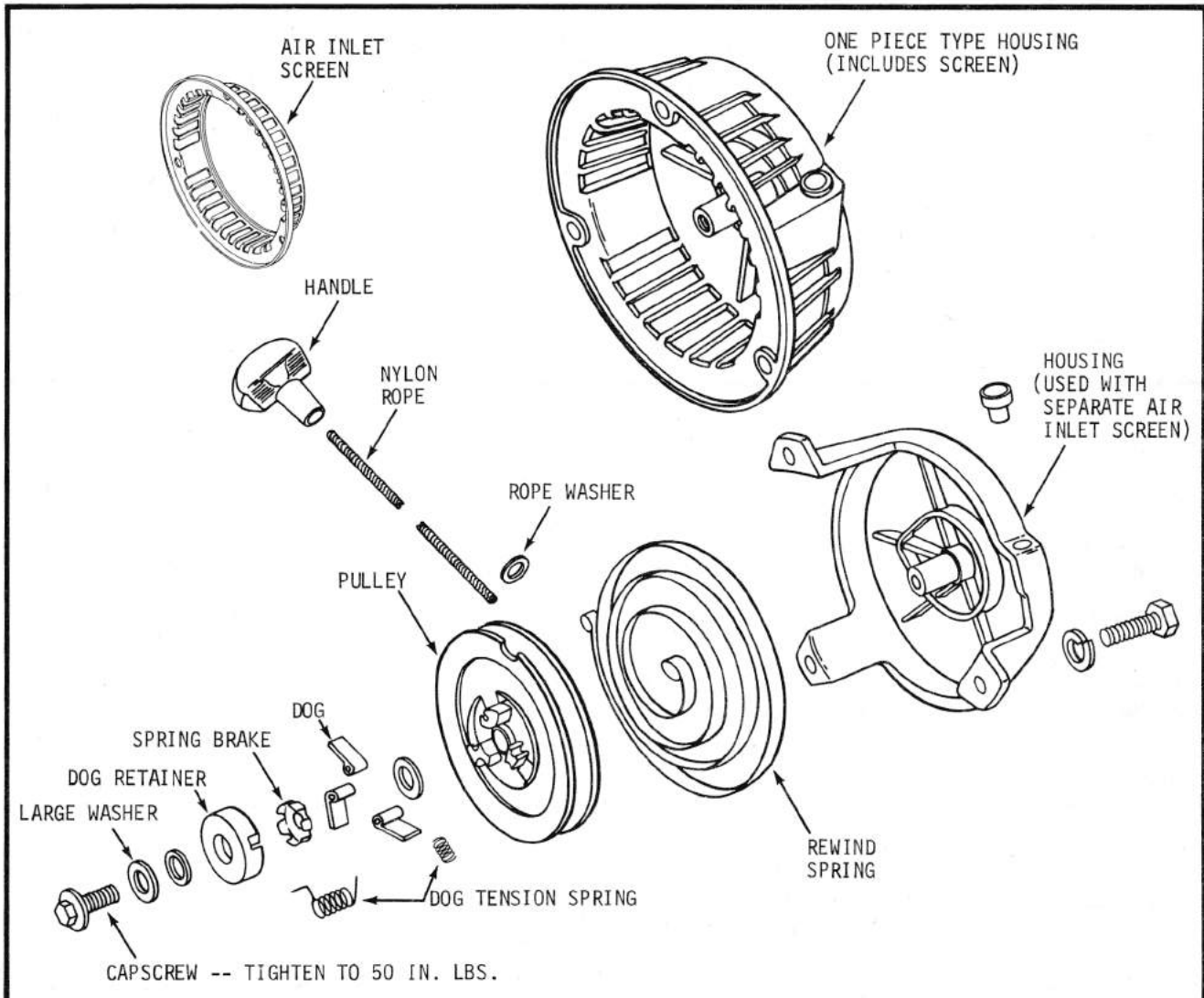


FIGURE 3-14 -- EXPLODED VIEW: RETRACTABLE STARTERS

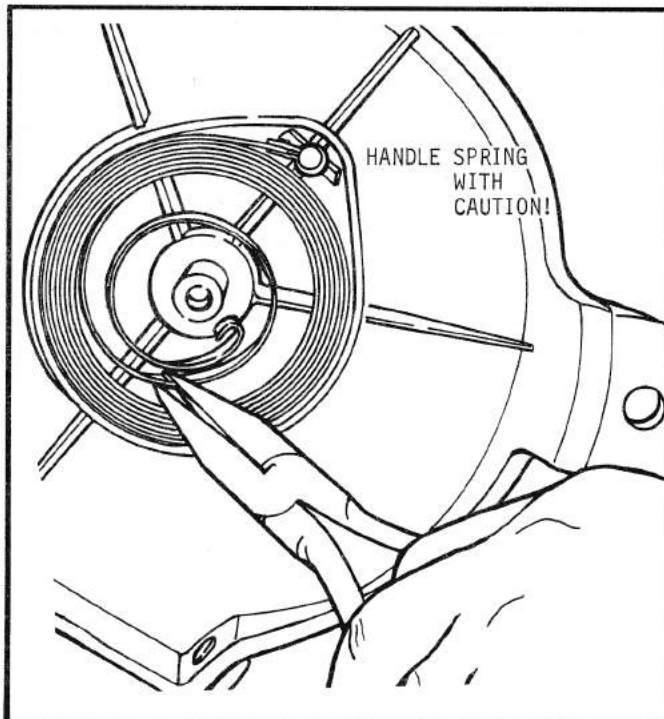


FIGURE 3-15 -- USE EXTREME CAUTION WITH REWIND SPRING

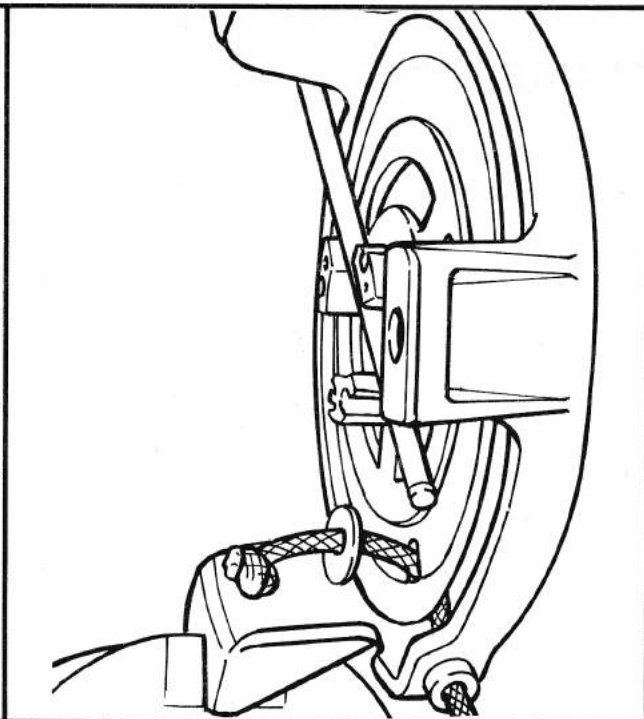


FIGURE 3-16 -- METHOD OF HOLDING PULLEY

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.
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 50 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.
6. 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.

CARBURETORS

There are several different carburetor models in general use on the single cylinder engines. A Kohler Carburetor is standard on the K335-1 but may be found as optional equipment on other single cylinder models. Make sure that the correct repair kit is used for the particular model being reconditioned. In the HR series, the difference involves the choke and throttle levers--the model variation is as follows:

33 053 02 (HR 22A) -- Standard K295-1, K309-1: Throttle and choke shaft levers on right-hand side of carburetor when viewed from air intake side of carburetor. Both levers have swivel wire clamp. Choke lever is adjustable.

33 053 03 (HR 23A) -- K295-1, K309-1: Same as 33 053 02 but includes throttle wire clamp (part number 33 174 01). This carburetor is not available from Kohler Co. For field replacement, order carburetor 33 053 02 and clamp (part number 33 174 01).

33 053 04 (HR 31A) -- K295-1, K309-1: Throttle and choke shaft levers on right-hand side of carburetor when viewed from air intake side of carburetor. Choke lever only has swivel wire clamp.

33 053 05 (HR 41A): This is the basic or "universal" model with double ended shafts so that levers can be installed on either side. Use this model to replace above HR models.

37 053 01 Kohler - Standard K335-1: Throttle and choke levers on either side. Identification may be made by Kohler tag or if this is not on, by insulator gasket which includes fitting for impulse tube.

Complete disassembly of a carburetor is not always necessary--check contents of repair kit as this may indicate that it should be only partially disassembled. Use repair kit 33 106 02 for HR series carburetors. Use HR 41A (#33 053 05) to replace model HR 22A, HR 23A or HR 31A carburetors. Carburetor kit 37 757 01 is for the Kohler Carburetor. Transfer levers, etc., when replacing complete carburetor.

MODEL 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.

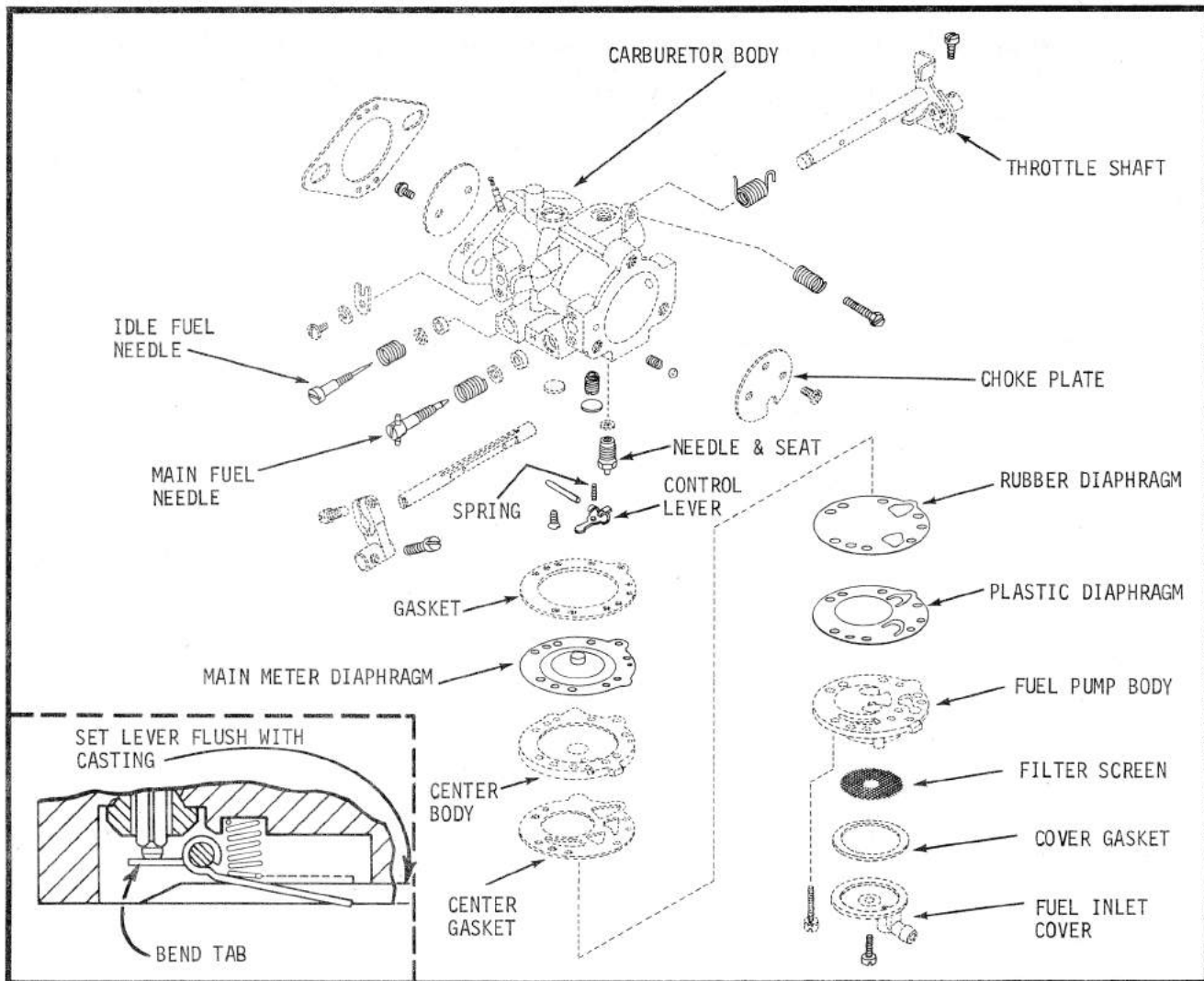


FIGURE 3-17 -- EXPLODED VIEW: TYPICAL HR TYPE CARBURETOR

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.

8. 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 nearly as good as new.

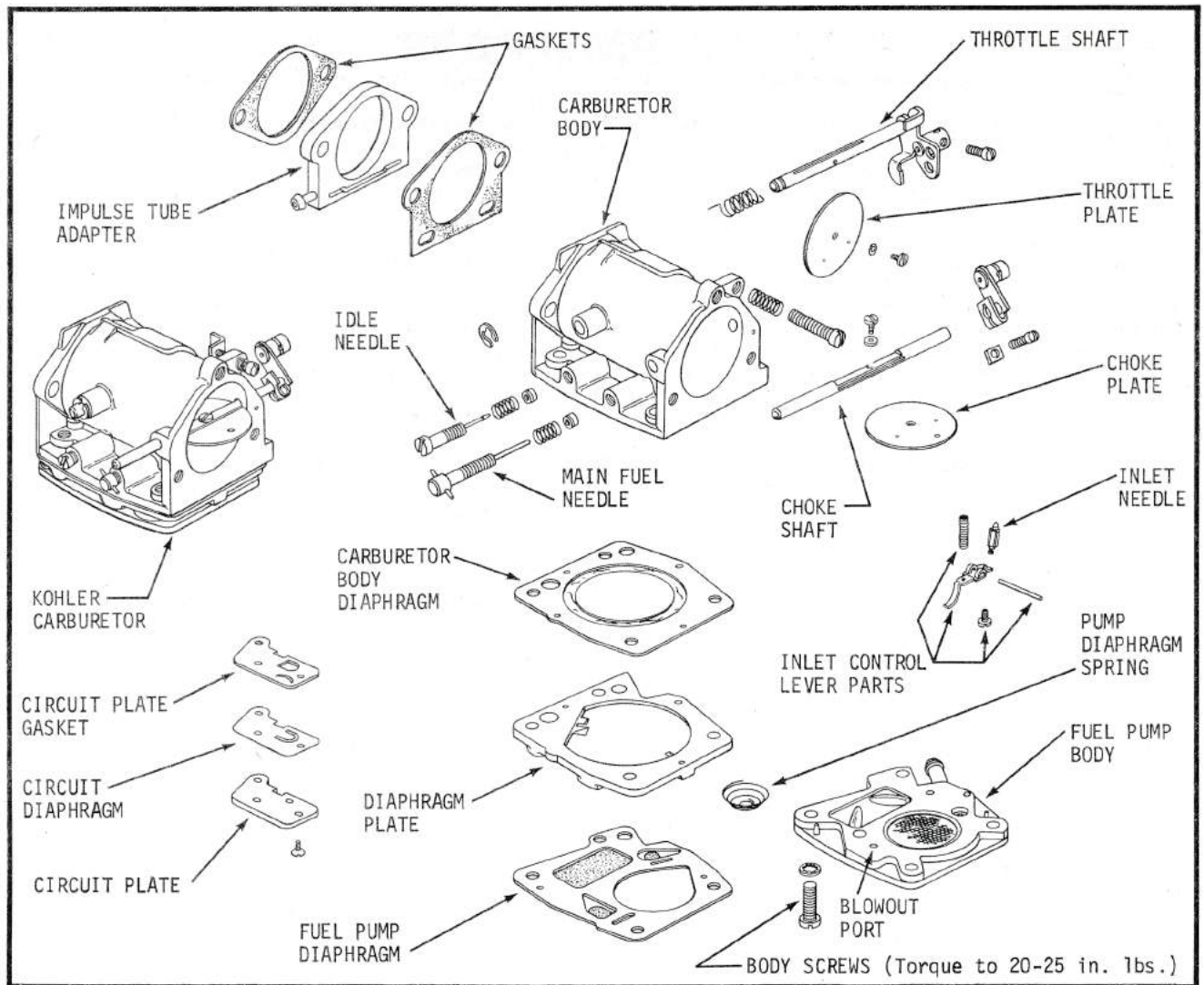


FIGURE 3-18 -- EXPLODED VIEW: KOHLER CARBURETOR

KOHLER CARBURETOR

After removing carburetor and impulse tube adapter from engine, carefully inspect these parts for signs of damage which could make them unsuitable for reuse. Replace adapter if cracked. Look for signs of wear around throttle and choke shafts--replace carburetor and/or shafts if worn to the point where air could enter around shafts and upset the fuel-air ratio. Use carburetor repair kit to insure satisfactory performance. Recondition Kohler carburetor as follows:

DISASSEMBLY: The carburetor does not always have to be torn down completely--for example, do not remove throttle and/or choke plates and shafts unless parts must be replaced. If the screen in the fuel pump body is dirty, connect air hose to the blowout port (see figure above)--this could be the cause of carburetor problems.

STEP 1: Remove four capscrews and remove fuel pump body.

STEP 2: Remove fuel pump gasket and spring.

STEP 3: Remove diaphragm plate from carburetor body.

STEP 4: Separate carburetor diaphragm from carburetor body.

STEP 5: Remove screw then detach fuel inlet control lever, pin, spring and inlet needle valve from body.

STEP 6: Remove circuit plate and separate gasket from plate and/or body.

STEP 7: Remove idle and main fuel needle valves. Carburetor is now ready for cleaning.

CLEANING PROCEDURE: Remove all gasket or diaphragm material from metal parts then soak parts in a good carburetor cleaning solution. After soaking, blow out all passages with compressed air then air dry their parts and keep them clean until reassembly. Make sure that old gaskets and diaphragms are not inadvertently used during reassembly.

REASSEMBLY: Because of the design configurations, it is impossible to install gaskets or diaphragms wrong on this carburetor. To reassemble carburetor reverse the disassembly procedure. There are, however, certain details that need attention--when replacing fuel inlet control lever assembly, make sure spring is properly installed. One end of the spring should be in the hole in the body casting and the other end must be over the centering protrusion on the lever. Check this after tightening the retaining screw--the spring can be off center and still give the impression that it is functioning properly. Also check that the pressure spring is correctly positioned between the diaphragm plate and fuel pump diaphragm.

Tighten fuel pump body screws to 20-25 in. lbs. torque. Turn idle and main fuel needles all the way in until they bottom gently (do not force closed) then turn both out 5/8 turn for initial adjustment--slight readjustment may be needed after reassembly to engine.

REASSEMBLY

The following is the suggested sequence for reassembly of a typical single 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. CRANKSHAFT END PLAY

Before final assembly of the crankshaft and crankcase halves, crankshaft end play must be correctly established. The dummy ball bearings facilitate temporary assembly of the crankshaft-crankcase for the end play check. Slip the 2 dummy bearings onto the crankshaft then install crankshaft in crankcase. Secure crankcase half with 2 capscrews placed thru the 2 hollow locating dowels. Secure the capscrews and tighten to 16 ft. lbs. Install gaskets then bearing plates (without oil seals) and secure with 3 capscrews in each.

Measure crankshaft end play with dial indicator. End play must be in the .006 - .012 range. End play is controlled by adding .006 shims between the ball bearings and bearing plates. If, for example, .0275" is shown on dial, addition of 3 shims ($.006 \times 3 = .018$ ") would bring the end play down to .0095 which is within the acceptable range. Disassemble unit then remove dummy bearings. Shims are not added until the actual final assembly.

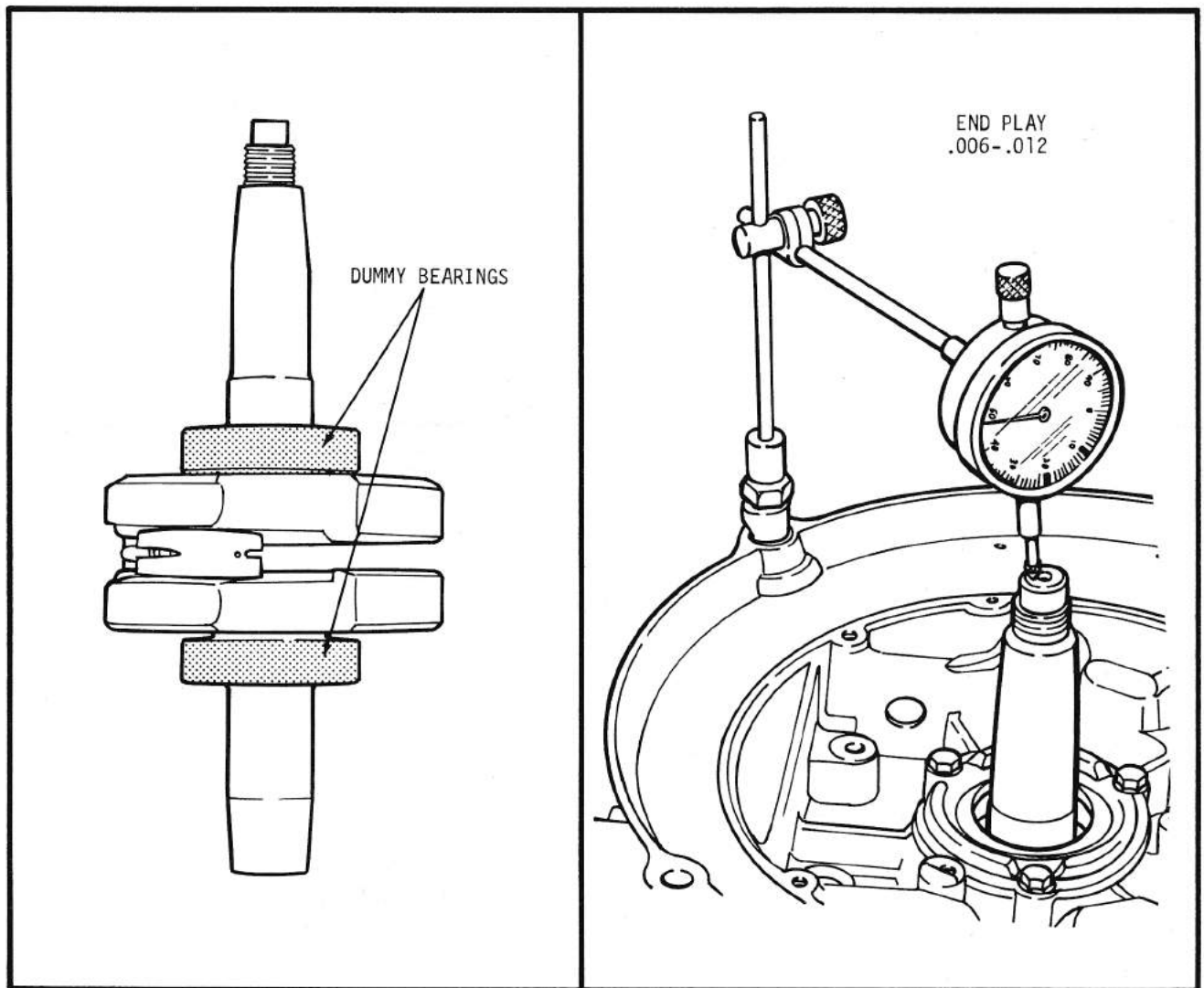


FIGURE 4-1 -- USE DUMMY BEARINGS TO ADJUST END PLAY

FIGURE 4-2 -- CHECKING CRANKSHAFT END PLAY

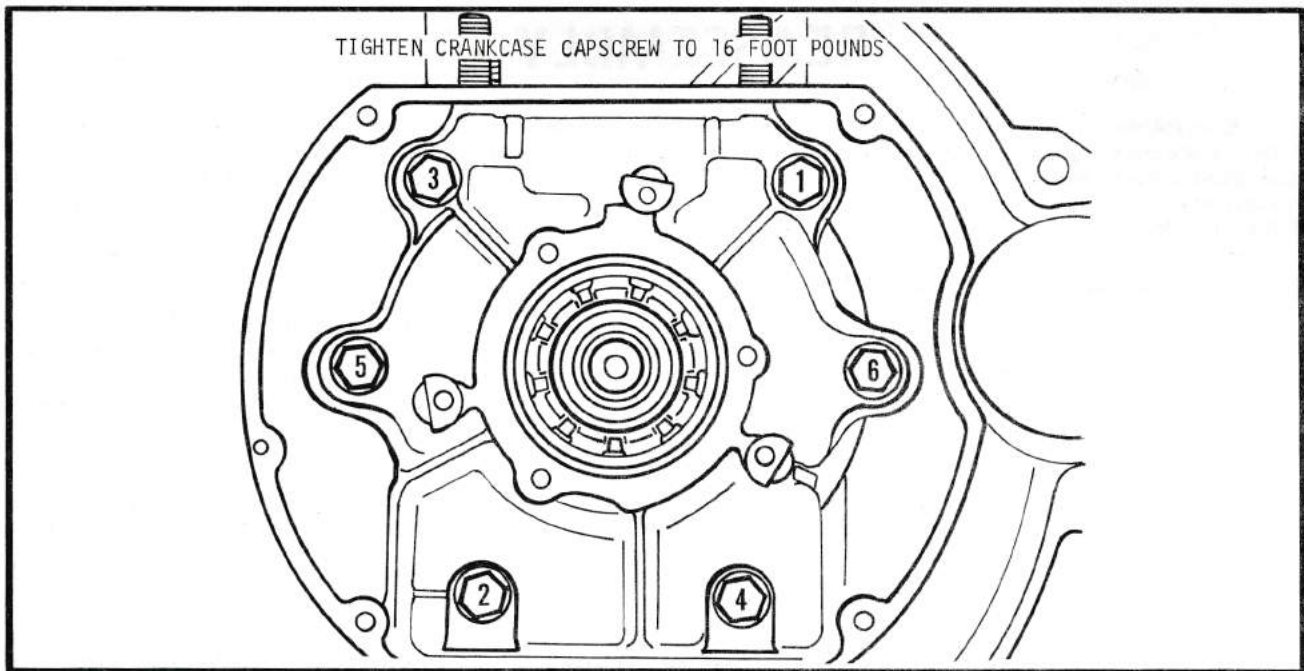


FIGURE 4-3 -- CRANKCASE CAPSCREW TIGHTENING SEQUENCE AND TORQUE SPECIFICATIONS

2. CRANKCASE-CRANKSHAFT ASSEMBLY

Heat ball bearings (hot oil or in oven) to about 100-150° F. then carefully guide them into position on the crankshaft. After fitting, oil bearings (also connecting rod big end bearing) with SAE 10 oil.

Hold crankshaft in vise (with protective caps) in vertical position with threaded end up. Heat flywheel half of crankcase to about 100-150° F. then install this half on crankshaft. Case will fit tightly around bearing outer race as it cools. Reverse shaft in vise, apply small amount of Kohler Crankcase Sealer to crankcase mating surfaces then repeat heating-installation procedure with PTO half of case.

After placing unit in engine stand, reinstall crankcase cap screws (6) and tighten in criss-cross pattern with torque wrench to 16 ft. lbs.

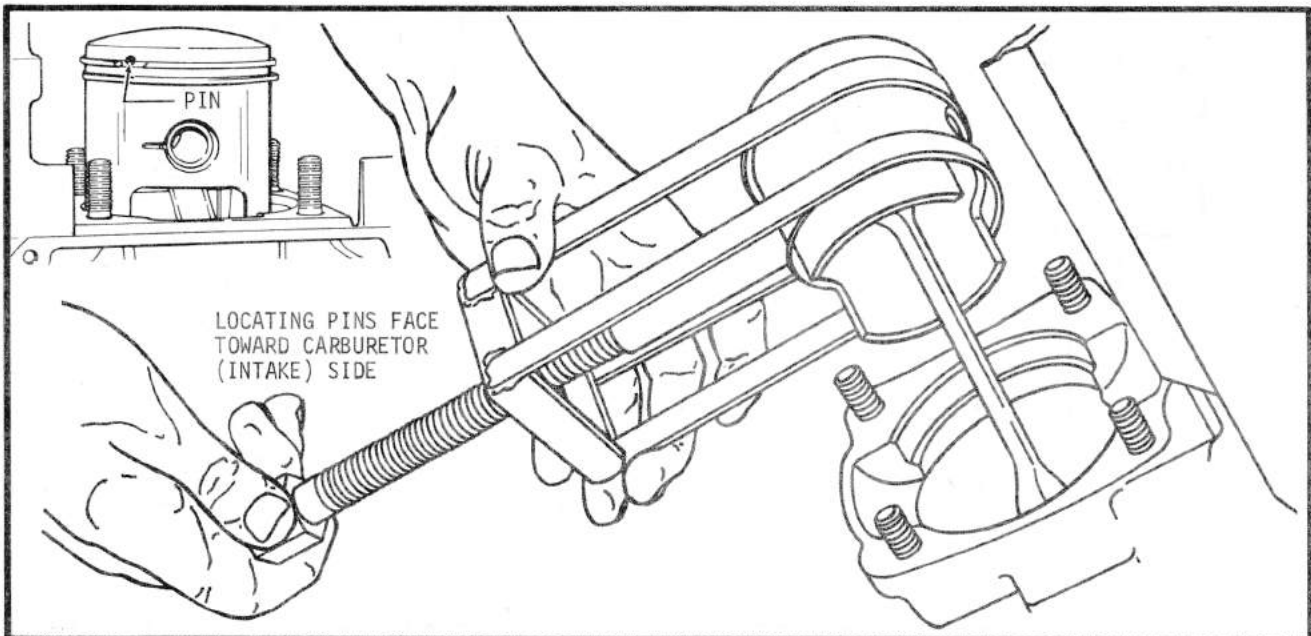


FIGURE 4-4 -- USING EXTRACTOR TOOL TO INSTALL PISTON PIN

Place end play adjusting shims (split number evenly if possible) over each end of the crankshaft. Fit new oil seals in bearing plates, if this has not been done previously, (with seal lip facing inside toward bearing), lubricate lip lightly with petroleum jelly then position new gaskets, install and secure bearing plates.

3. PISTON-ROD ASSEMBLY

Lubricate needle bearing and insert bearing in connecting rod small end. Install circlip in groove at one end of piston then position piston so that pins (in ring grooves) face direction shown. The pin can be cooled or the piston heated slightly to facilitate easier installation of the pin in the piston. After installing pin, make sure circlip (retaining ring) is installed in the remaining groove at the other end of the pin. Check to make sure circlips are properly installed at both ends of pin.

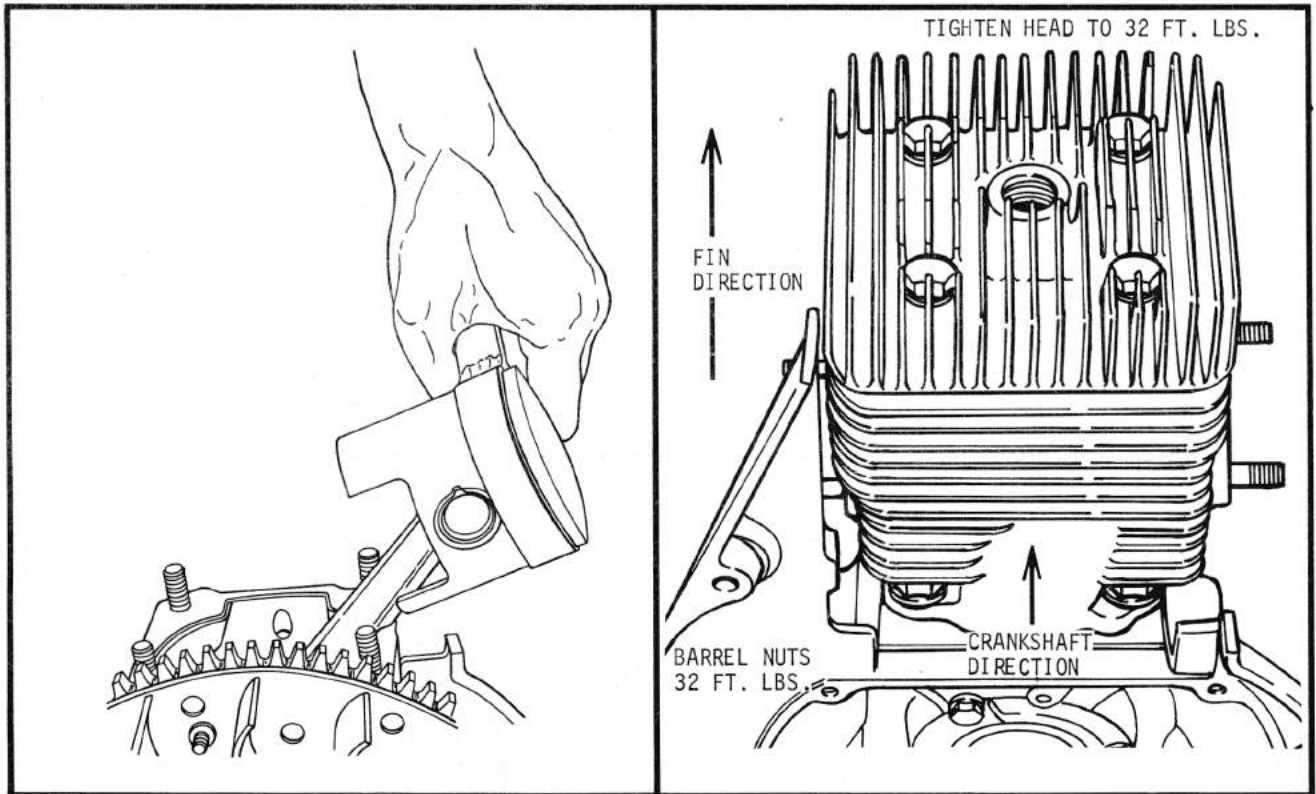


FIGURE 4-5 -- INSTALL BARREL OVER PISTON
USING SPECIAL RING COMPRESSOR

FIGURE 4-6 -- FINS ON HEAD

4. CYLINDER BARREL & HEAD

Thoroughly lubricate piston and cylinder walls with SAE 10 oil. Place new base gasket on crankcase. Use special ring tool (with split compressor ring) to compress rings then carefully guide cylinder barrel down over piston. Release and remove compressor after both rings are started into the bore. Make sure intake and exhaust ports are facing the right way then secure barrel to crankcase with 4 nuts. Tighten nuts in crisscross pattern to 32 ft. lbs. torque value.

Place new head gasket on cylinder barrel then position head with matchmarks aligned and with fins running parallel to the crankshaft. Secure head with 4 capscrews--tighten these in crisscross pattern to torque value of 32 ft. lbs.

5. STATOR PLATE

Lubricate grommet with silicon spray then thread ignition and lighting wires from stator through wire passage in crankcase then thru grommet. Secure stator plate to crankcase with matchmarks aligned. Secure plate (if marks are present and aligned) then reinstall dust cover. Ignition timing must be checked after engine is further reassembled.

6. FLYWHEEL

Clean and degrease tapered portion of crankshaft before reinstalling flywheel. Also check magnet ring--remove any metallic particles found on the magnets. Position woodruff key then install flywheel on shaft. Hold flywheel with chain clamp wrench and place washer then tighten flywheel retaining nut to 90 ft. lbs. torque value. Check flywheel for freedom of movement--if flywheel rubs against dust guard, remove flywheel and re-center guard. After replacing flywheel, make sure nut is retightened to the proper torque. Check to make sure starting pulley can be installed over flywheel nut. If necessary, reposition nut by tightening slightly then reinstall pulley to test--remove pulley after testing--this will be installed later.

7. IGNITION TIMING

At this point in reassembly the ignition timing must be checked. Use the ignition timing procedure stated in Section 1 of this manual.

8. BLOWER HOUSING

Position blower housing on crankcase and secure with 3 capscrews--tighten capscrews to 16 ft. lbs. torque value. Also place electric starter or if starter not used, starter cover then tighten nuts to 16 ft. lbs. torque value.

9. PULLEY, ROPE

Carefully position pulley over flywheel retaining nut then tap into position with soft head hammer. When pulley seats against flywheel, secure pulley with 2 capscrews--tighten these to 16 ft. lbs. torque.

If engine does not have retractable starter, position air intake screen and secure to blower housing with 3 capscrews.

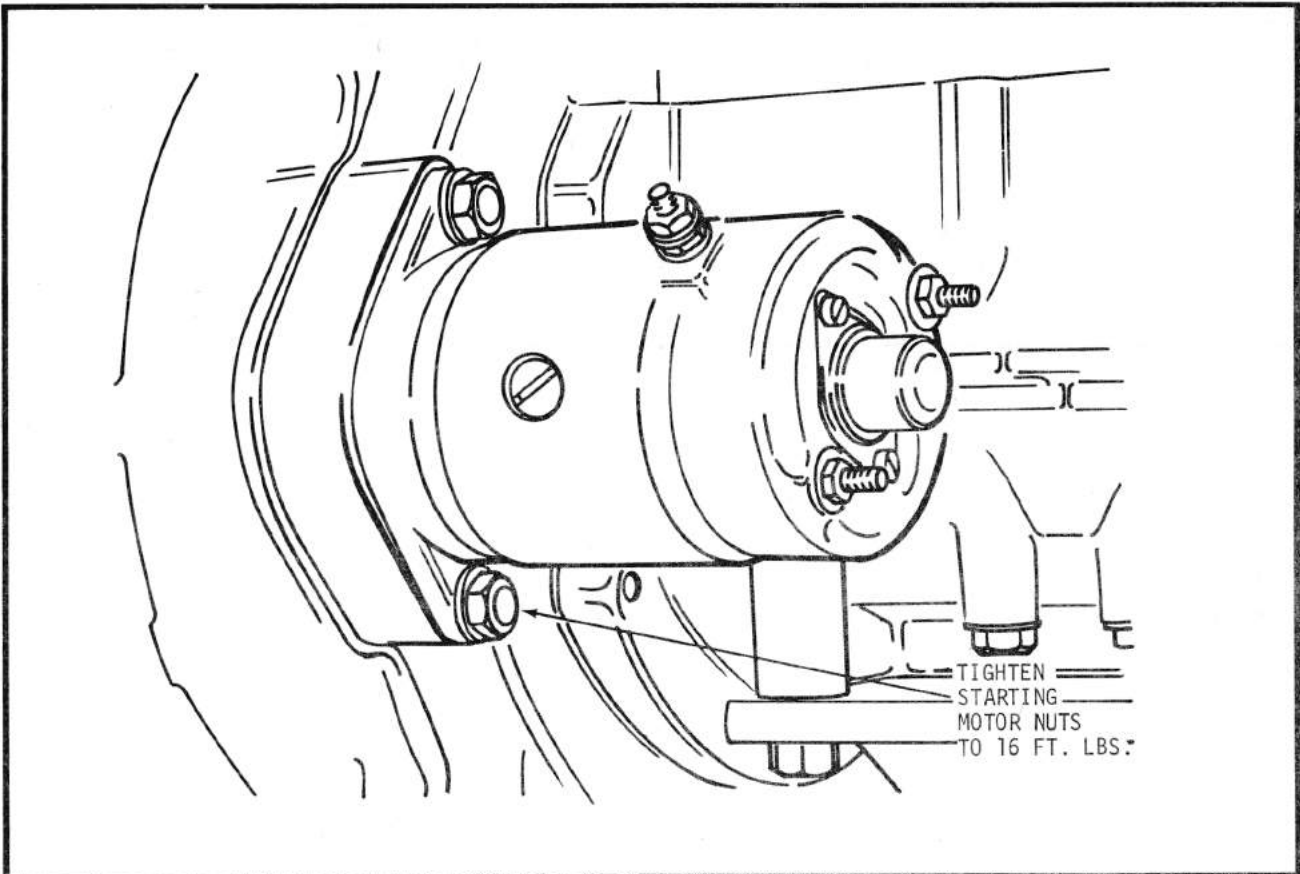


FIGURE 4-7 -- ELECTRIC STARTING MOTOR INSTALLED

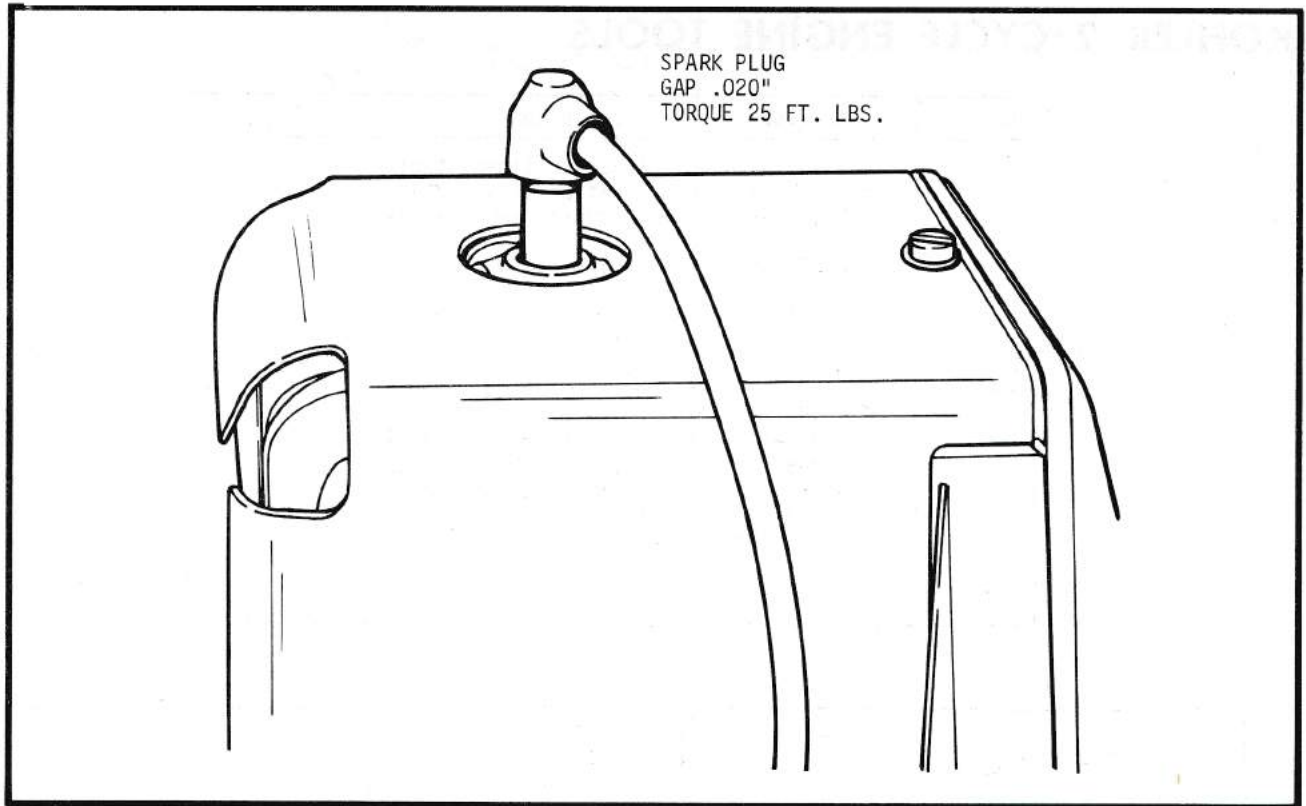


FIGURE 4-8 -- AIR SHROUD COVER, SPARK PLUG DETAIL

10. AIR SHROUD COVER--SPARK PLUG

Install shroud over cylinder barrel and secure with 3 screws. Install new spark plug (gap set at .020") and tighten to 25 ft. lbs. torque. Attach boot and high tension lead to spark plug. Reconnect leads to proper terminals. Refer to wiring diagrams in Section 3.

11. CARBURETOR

Position one carburetor gasket next to cylinder, then the insulator block and the other gasket. Install carburetor and secure with 2 nuts and washers. Push one end impulse tube over fitting on crankcase and attach other end to carburetor. Use clips as needed.

12. RETRACTABLE STARTER

Machined mounting surfaces and studs provide proper alignment of starter pinion to ring gear on engine. The retractable starter can also be installed at this time--tighten the 3 mounting capscrews to 16 ft. lbs. torque. Make sure handle of retractable starter is in the same position as removed.

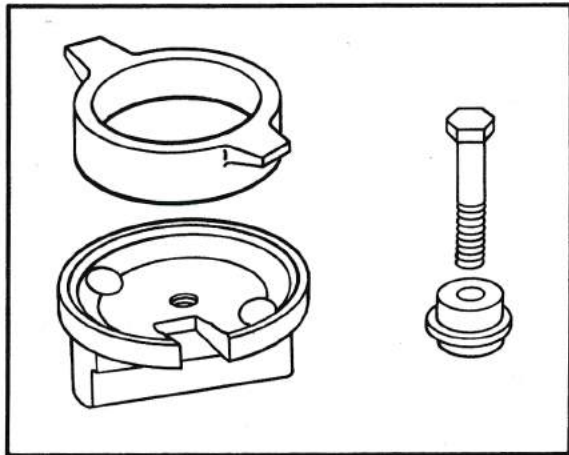
RUN-IN PROCEDURE

After the engine is completely reassembled and all necessary adjustments have been made, bench test engine if facilities are available. If not, install engine in vehicle then check it out--make final adjustments under actual load conditions. Run-in recommendations for a rebuilt engine are the same as for a new engine--refer to page 3 for these instructions.

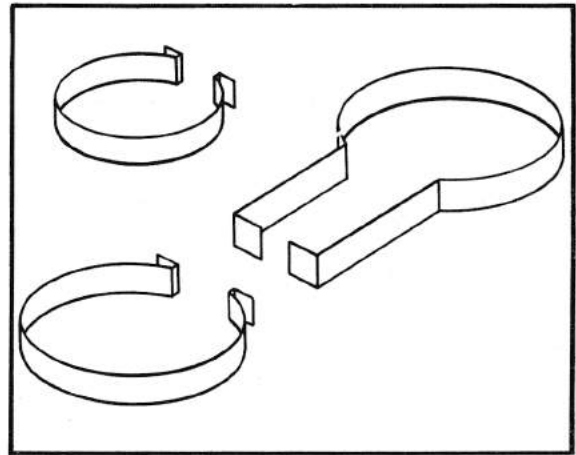
KOHLER 2-CYCLE ENGINE TOOLS

Qty.	Part No.	Description
1	33 755 01	Ignition timing tool
1	33 455 08	Ignition service tool
1	33 455 09	Condenser replacement tool
1	33 760 05	Engine stand
1	33 761 06	Bearing puller set
1	33 761 04	Basic tool kit
2	33 455 01*	Dummy bearings (K295-1 & K309-1)
1	33 455 01*	Dummy bearings (K335-1)
1	33 455 02*	Piston ring compressor
1	33 455 03*	Piston pin extractor
1	33 455 04*	Flywheel puller
1	33 455 05*	Chain wrench

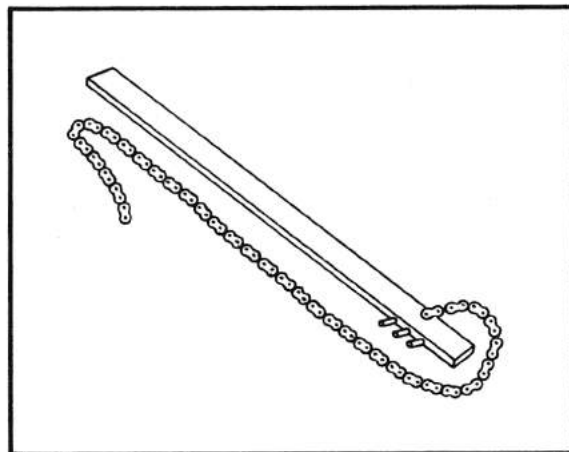
**Part of Basic Tool Kit 33 761 04 -- also available individually.*



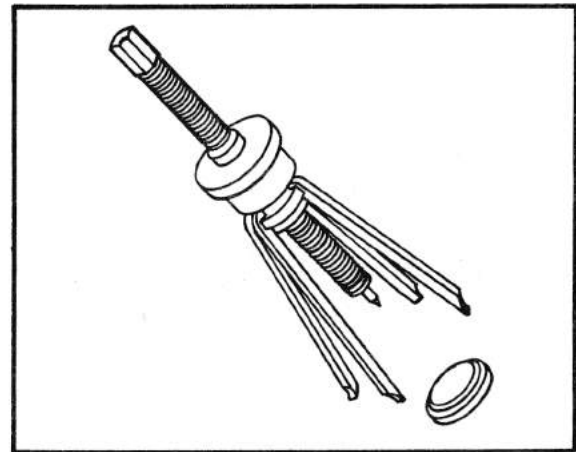
IGNITION TOOLS



RING COMPRESSOR



CHAIN WRENCH



BEARING PULLER

SPECIFICATIONS

SPECIFICATION	K295-1	K309-1	K335-1
<u>IGNITION</u>			
Spark Gap	.020	.020	.020
Point Gap	.014-.018	.014-.018	.014-.018
Time. on Piston*	.110 " BTDC	.110 " BTDC	.110 " BTDC
(*ADVANCE POSITION)	-0.98	0.98	0.98
<u>TORQUE SPEC.</u>			
Crankcase Halves	16 ft. lbs.	16 ft. lbs.	16 ft. lbs.
Bearing Plate	16 ft. lbs.	16 ft. lbs.	16 ft. lbs.
Cylinder Head	32 ft. lbs.	32 ft. lbs.	32 ft. lbs.
Flywheel Nut	90 ft. lbs.	90 ft. lbs.	90 ft. lbs.
Blower Housing	16 ft. lbs.	16 ft. lbs.	16 ft. lbs.
Starter Nuts	16 ft. lbs.	16 ft. lbs.	16 ft. lbs.
Pulley, Rope St.	16 ft. lbs.	16 ft. lbs.	16 ft. lbs.
Retr. Starter	16 ft. lbs.	16 ft. lbs.	16 ft. lbs.
Exhaust Tube	16 ft. lbs.	16 ft. lbs.	16 ft. lbs.
Carburetor	18 ft. lbs.	18 ft. lbs.	18 ft. lbs.
Spark Plug	25 ft. lbs.	25 ft. lbs.	25 ft. lbs.
Cylinder Barrel Nuts	32 ft. lbs.	32 ft. lbs.	32 ft. lbs.

BRITISH AIRWAYS

WARRANTY

We warrant each new engine sold by us to be free from manufacturing defects in normal service for a period of one (1) year commencing with delivery to the original user.

OUR OBLIGATION UNDER THIS WARRANTY IS EXPRESSLY LIMITED TO THE REPLACEMENT OR REPAIR AT KOHLER OF CANADA LTD., OR AT A POINT DESIGNATED BY US, OF SUCH PART OR PARTS AS SHALL APPEAR TO US TO HAVE BEEN DEFECTIVE.

WE SHALL NOT BE LIABLE FOR CONSEQUENTIAL LABOR COSTS OR TRANSPORTATION CHARGES IN CONNECTION WITH THE REPLACEMENT OR REPAIR OF DEFECTIVE PARTS.

WARRANTY IS VOIDED BY UNAUTHORIZED REPAIRS OR MODIFICATIONS OR USE OF ENGINES IN ANY FORM OF COMPETITION.

WE MAKE NO WARRANTY WITH RESPECT TO TRADE ACCESSORIES. THEY ARE SUBJECT TO THE WARRANTIES OF THEIR MANUFACTURERS.

WE SHALL NOT BE LIABLE FOR CONSEQUENTIAL DAMAGES OR CONTINGENT LIABILITIES NOR FOR THE FITNESS OF ANY ENGINE FOR ANY PARTICULAR PURPOSE.

WE MAKE NO OTHER EXPRESS, IMPLIED OR STATUTORY WARRANTY, NOR IS ANYONE AUTHORIZED TO MAKE ANY IN OUR BEHALF.

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Malton, Ontario
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