KOHLER

Model K341L

Engine Service Manual

contents

TP-1152

KOHLER CO. KOHLER, WISCONSIN 53044

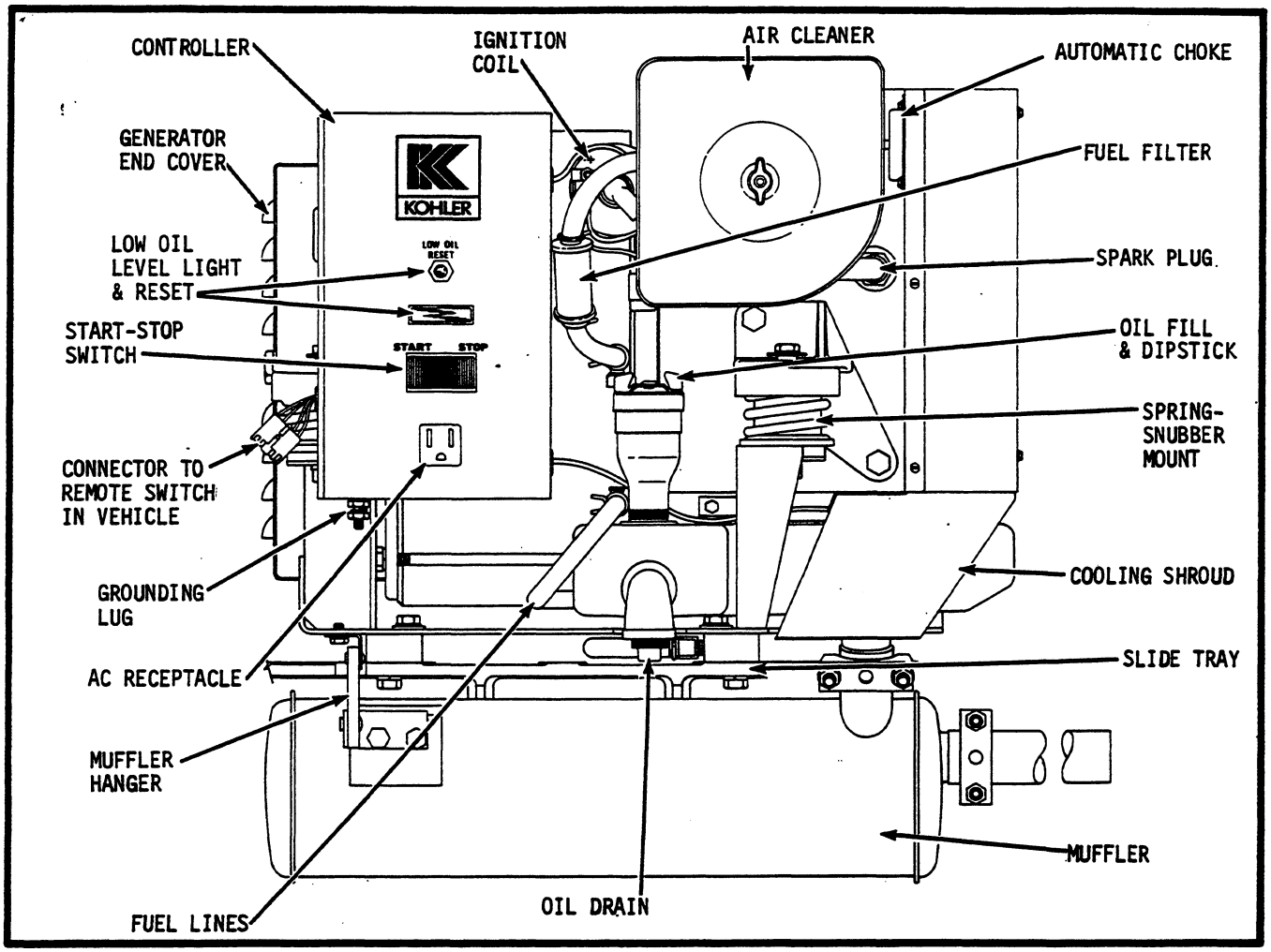


FIGURE 1 -- 4000 WATT MOTOR HOME GENERATOR SET WITH K341L ENGINE

OPERATING INSTRUCTIONS

PRE-START CHECKLIST

To insure continued satisfactory operation, the following items should be checked before each start-up:

- OIL LEVEL: Should be at or near Full mark.
- AIR INLETS: Must be clear and unobstructed.
- COMPARTMENT: Interior must be clean.
- AIR CLEANER: Must be properly installed.
- AIR SHROUDING: Must be tight and in proper position.
- EXHAUST: Tail pipe must be clear, muffler and piping tight and in good condition.

STARTING - STOPPING

The engine is cranked for starting by the generator which functions as a starting motor as long as the start-stop switch is held in the START position. The engine can be started and stopped by either the switch on controller or the switch inside the vehicle. The switch must be held in the STOP position until the engine is completely stopped. Whenever possible, the generator set should be run at low or no load for a few moments prior to shut-down to allow a brief cooling period.

GENERAL

GENERAL SPECIFICATIONS

This manual covers the Kohler Model K341L Engine which powers the Model 4GM21 generator set. The K341L is a four stroke-cycle, single cylinder, air-cooled engine. Other general information on this engine is listed below--refer to the appropriate service section for specific details.

BORE X STROKE	3-3/4 x 3-1/4
DISPLACEMENT (CUBIC INCHES)	35.89
OIL CAPACITY	3 Quarts
SPARK PLUG SIZE (XH10 OR EQUIVALENT)	14mm
SPARK PLUG GAP	.025"
BREAKER POINT GAP	.020"
IGNITION SPARK RUN (PISTON DEGREES BTDC)	20°
IGNITION TYPE	Battery
VALVE COLD CLEARANCE - INTAKE	.008 - .010"
VALVE COLD CLEARANCE - EXHAUST	.017 - .020"
BATTERY (NEGATIVE GROUND)	12 Volt
FUEL (REGULAR GRADE GASOLINE)	90 Octane (min.)
STARTING	Electric-Exciter Crank

FUEL SPECIFICATIONS

A good quality regular grade of gasoline with an octane rating no lower than 90 should be used. Make sure the fuel is fresh to avoid gum deposits in carburetor. The low lead or non-leaded gasoline fuels are recommended as this keeps combustion chamber deposits to a minimum. The approximate fuel consumption of the K341L engine in the 4GM21 generator set is stated at various load levels in the following chart.

APPROXIMATE FUEL CONSUMPTION

GALLONS * PER HOUR

No load	1/4 load	1/2 load	3/4 load	Full load
.295	.413	.455	.536	.661

*U.S. STANDARD MEASUREMENT

FUEL FILTER: In addition to a serviceable fuel filter located inside the fuel pump, some generator sets also have a see-thru filter as shown in Figure 1. Replace the see-thru filter when excessive amounts of impurities are noted--service the fuel pump filter per instructions on page 9.

SERVICE SCHEDULE

DAILY (OR BEFORE EACH START UP)	EVERY 100 HOURS (OR 12 MONTHS -- WHICHEVER OCCURS FIRST)
● Check oil level. ● Check to make sure cooling air intake openings are clear. ● Remove loose dirt from compartment.	● Service spark plug. ● Check breaker points. ● Check generator brushes. ● Retighten electrical connections. ● Check mounting bolts and vibro mounts. ● Replace air cleaner element.
EVERY 50 HOURS (OR 6 MONTHS -- WHICHEVER OCCURS FIRST)	**EVERY 200 HOURS OR EVERY YEAR**
● Change lube oil. ● Service air cleaner. ● Service fuel filter. ● Check battery.	● "Tune up" at authorized service center.

SERVICE

LUBRICATING OIL

The lube oil capacity of the K341L in the 4GM21 generator set is 3 quarts--this set has a low oil level warning light plus switch which will shut down the set when the oil level drops about 1 full quart (2 quarts remain in oil pan). In the event of shut-down on low oil, the indicator light will stay on until the level is brought up to the full mark and the reset button on the shut-down switch is pressed.

OIL CHANGE: New engines include special run-in oil which should be drained after the first 5 hours of operation. Thereafter, the oil should be changed at 50-hour intervals or every 6 months, whichever occurs first. Drain oil more frequently when operating under extremely dusty or dirty conditions. Drain oil while hot--the oil will flow faster and carry away more contamination when this is done.

OIL LEVEL CHECK: To avoid the inconvenience of having the engine shut down on low oil level, remove the dipstick and check the level before each start-up. Accurate measurement is not possible when the vehicle is parked on an incline. Do not attempt to check the level unless the engine is stopped--oil will spray out of the oil fill tube if the dipstick is removed while the engine is operating. Do not overfill--the Full mark on dipstick must not be exceeded.

OIL TYPE: The lubricating oil used in this engine must meet the requirements of the American Petroleum Institutes (API) Service Classification SC. NOTE: If the vehicle engine calls for an API Class SE oil, this same oil type can be used in the K341L if this is more convenient for the owner. Oil weight (SAE viscosity) should be selected according to anticipated ambient temperature--use SAE 30 weight oil when temperature is above 32° F, SAE 10W-30 for 0° to 32° F, or SAE 5W-30 when temperature falls below 0° F.

OIL TYPE	VISCOSITY (WEIGHT)			REFILL CAPACITY	SHUT-DOWN LEVEL
	Above 32°F	32° - 0°F	Below 0°F		
API SC*	SAE 30*	SAE 10W-30*	SAE 5W-20*	3 Quarts	1 Quart Low

** Or use same type and weight as vehicle engine - see above.*

AIR CLEANER

This engine is equipped with dry element air cleaner. Under normal operating conditions, the element should be removed for cleaning every 50 hours or every 6 months, whichever occurs first. To clean, tap the element lightly against a flat surface--this will dislodge loose dirt from the element surface. Do not clean element in any liquid or clean with compressed air as this will ruin the filter material. Replace the element after 100 to 200 hours depending on operating conditions.

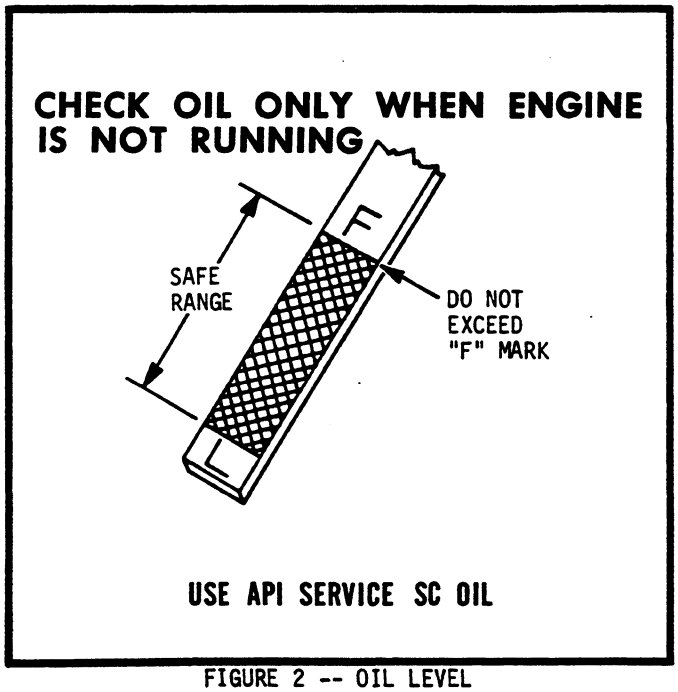


FIGURE 2 -- OIL LEVEL

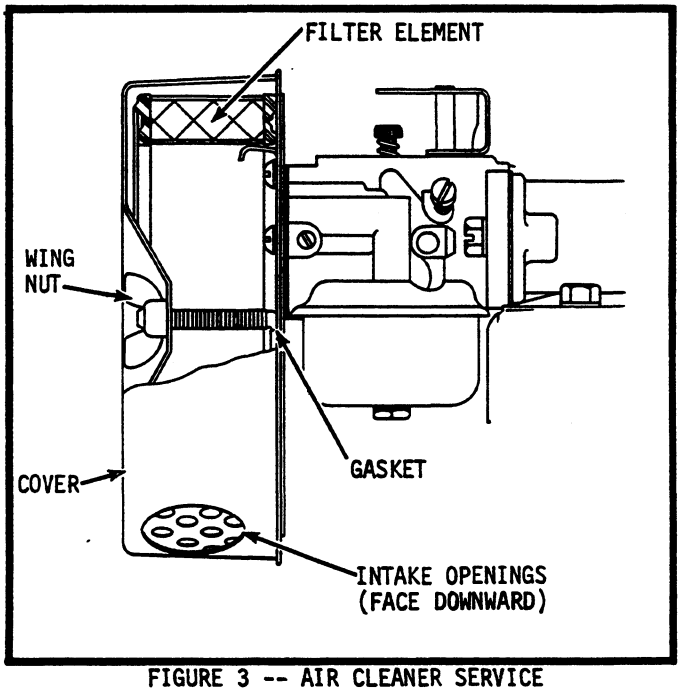


FIGURE 3 -- AIR CLEANER SERVICE

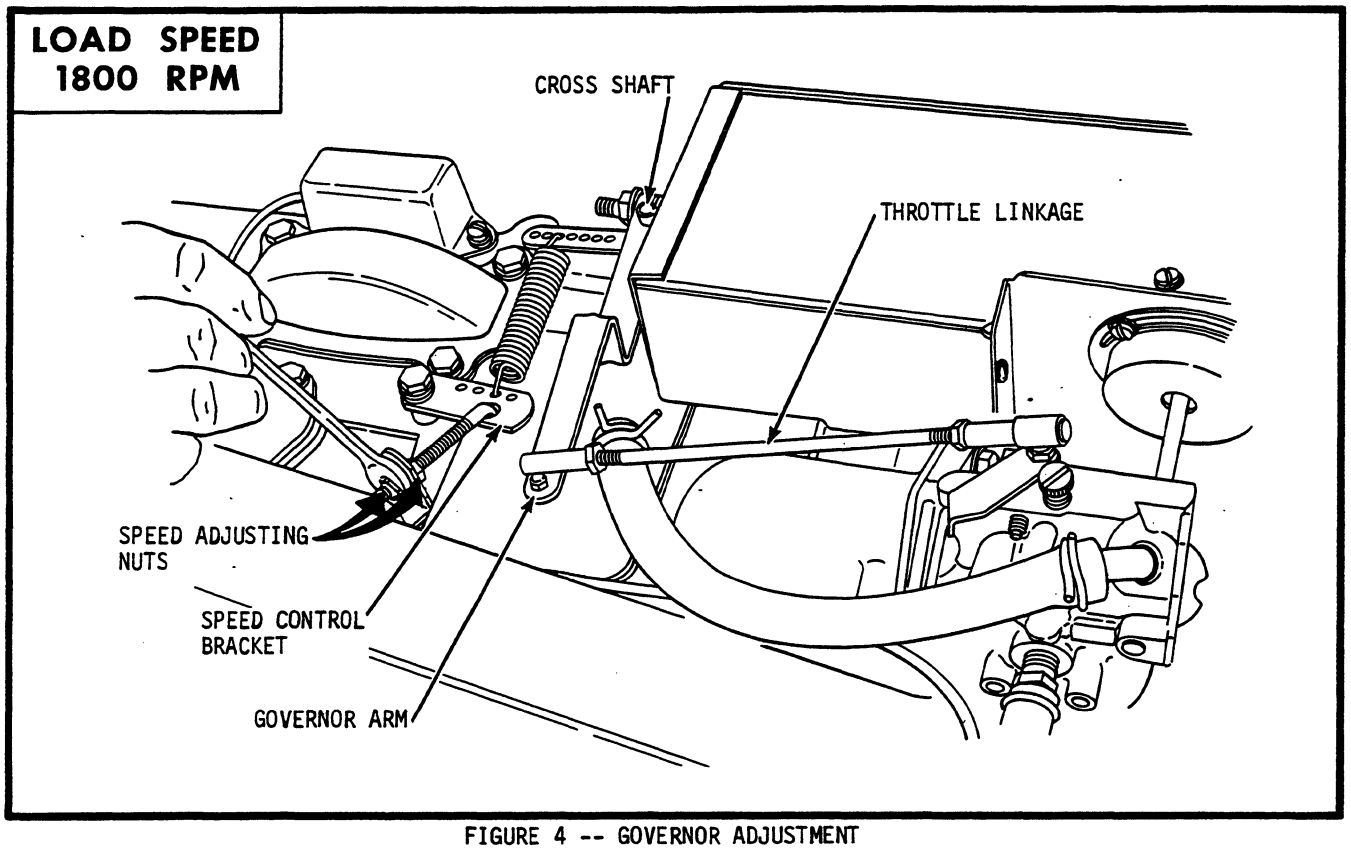


FIGURE 4 -- GOVERNOR ADJUSTMENT

COOLING SYSTEM

Cooling air is drawn into the fan housing by fan blades on the rotor which is attached to the armature of the generator. The air is then forced past the cooling fins on the cylinder block and head and into ductwork where it is expelled as heated air outside the vehicle. The rotor also draws cooling air in thru the louvers in the generator end bracket cover and circulates this air thru the generator internally. The exhaust outlet elbow and tube are located inside the ductwork to help keep the compartment cool. Keep all air inlet and outlets into the compartment and on the generator set clean and clear of obstruction at all times to prevent overheating. Optimum operating temperatures can be maintained with a properly serviced system even at ambient temperatures up to 110° F.

GOVERNOR ADJUSTMENT

The governor functions to maintain engine speed under changing load conditions and also acts as a speed limiting device. Governor is set in the factory and further adjustment should not be required unless linkage works loose or becomes disconnected. Readjustment should be made if engine surges with changing load or if speed drops considerably when a normal load is applied.

INITIAL ADJUSTMENT: With engine stopped, loosen (do not remove) hex nut securing governor arm to governor cross shaft. Grasp end of cross shaft with pliers and turn shaft as far as possible in counterclockwise direction--tab on shaft will stop internally against governor gear mechanism. Hold shaft in this position, pull governor arm all the way away from carburetor then retighten governor arm nut to complete initial adjustment.

SPEED ADJUSTMENT: This engine must be operated at 1890 RPM no load or 1800 RPM at full load. If frequency or overspeed condition is suspected, check RPM with hand tachometer or frequency meter and readjust; loosen speed adjusting nut to decrease, or tighten to increase speed.

SENSITIVITY ADJUSTMENT: If speed drops considerably when a normal load is applied, governor should be set for greater sensitivity. If set too sensitive, speed surging will occur with changing load. Governor sensitivity is adjusted by repositioning governor spring in holes provided on arm and speed control brackets. Increase tension on spring (and sensitivity) by moving spring hooks into holes spaced further apart--conversely, decrease sensitivity by reducing tension on spring.

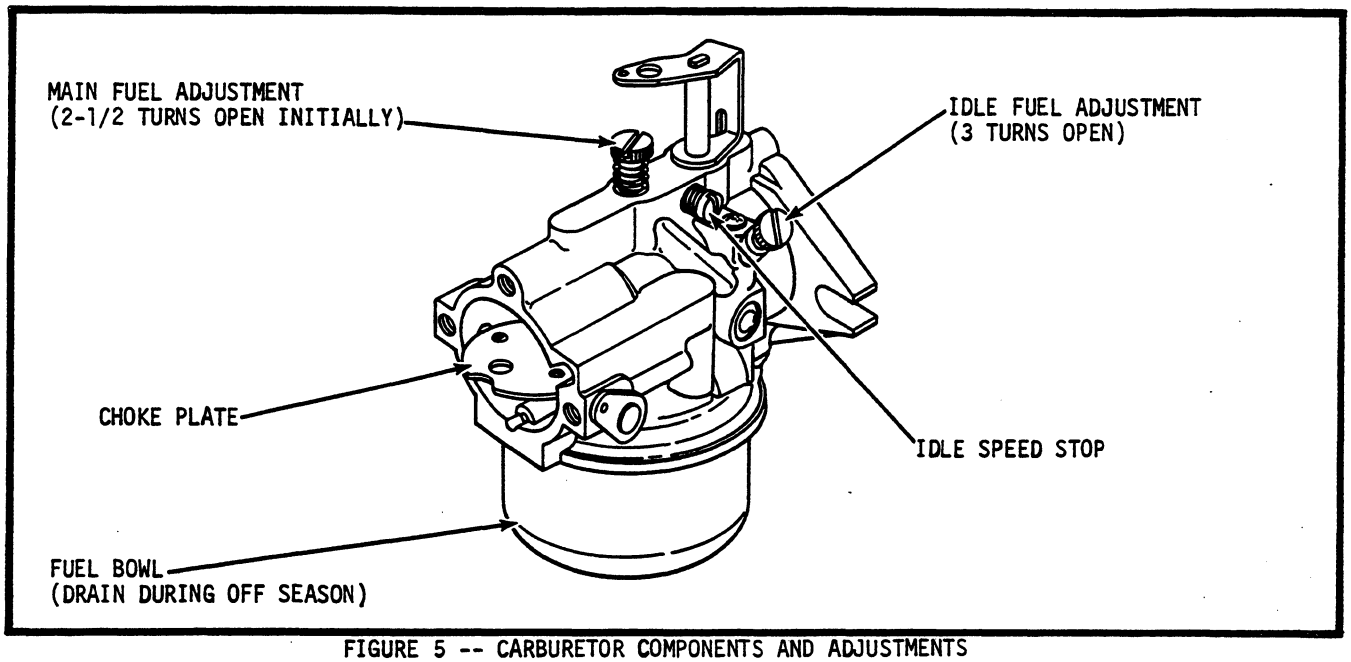


FIGURE 5 -- CARBURETOR COMPONENTS AND ADJUSTMENTS

CARBURETOR ADJUSTMENT

Lack of power and black sooty exhaust smoke usually indicates that fuel mixture is too rich. An "overrich" mixture may also be caused by a clogged air cleaner--check this before readjusting carburetor. Fuel mixture may be too lean if engine "skips" or backfires.

MAIN FUEL ADJUSTMENT: For preliminary setting, turn MAIN FUEL screw in clockwise direction until it bottoms lightly (do not force) then back out 2-1/2 turns. With engine thoroughly warmed up and running at 1800 RPM and full load, turn MAIN FUEL screw in until engine slows down (lean setting) then turn screw out until engine regains speed and then starts to slow down (overrich setting). Turn screw back in until it is positioned halfway between lean and overrich settings--when properly adjusted, engine will operate with steady governor action.

IDLE ADJUSTMENT: On this generator set, the idle system functions only as the engine comes up thru idle range to 1800 RPM. For this reason, idle system has only a momentary effect. To adjust, stop engine then turn IDLE FUEL screw all the way in (clockwise) until it bottoms lightly (do not force screw), then back out 3 turns--no further adjustment is needed.

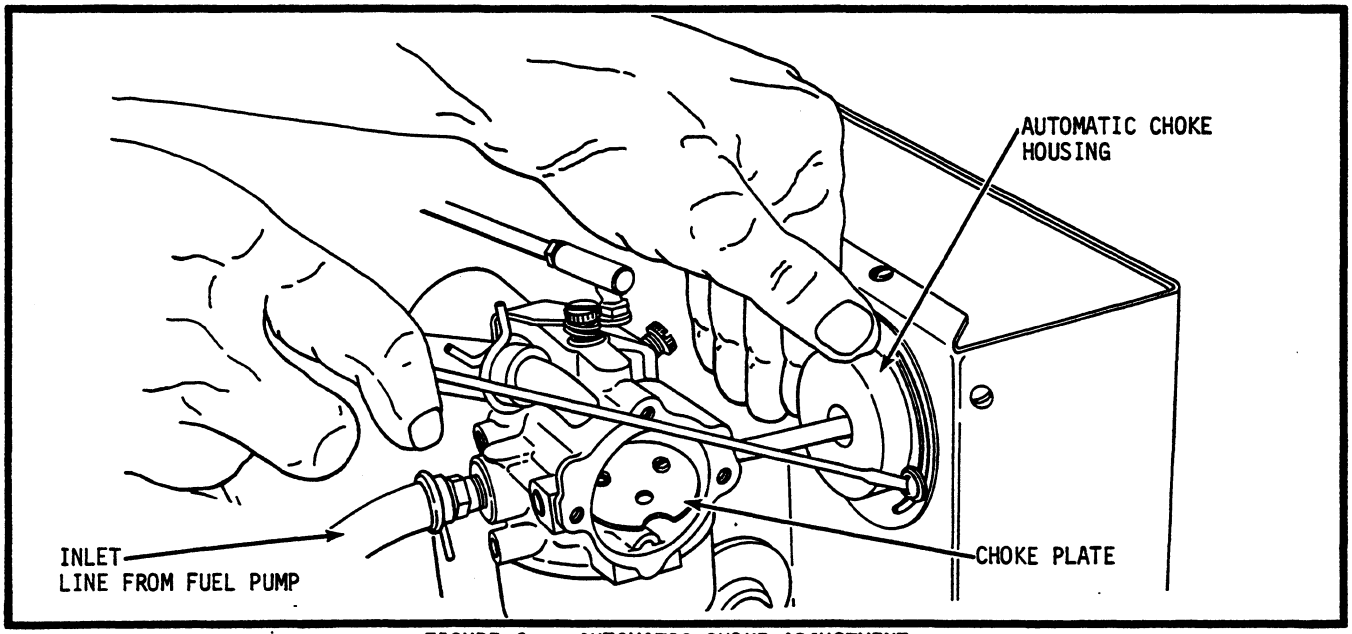


FIGURE 6 -- AUTOMATIC CHOKE ADJUSTMENT

AUTOMATIC CHOKE

Chokes are set at the factory but may have to be readjusted to suit local conditions. Remove air cleaner from carburetor to observe position of choke plate. Choke adjustment must be made on cold engine. If starting in extreme cold, choke should be 35° from full open position before engine is started. A lesser degree of choking may be needed in milder temperatures. If adjustment is required, loosen screws which secure the choke housing to the ductwork and shift the housing until the choke plate is 35° from full open position (with ambient 75° temperature).

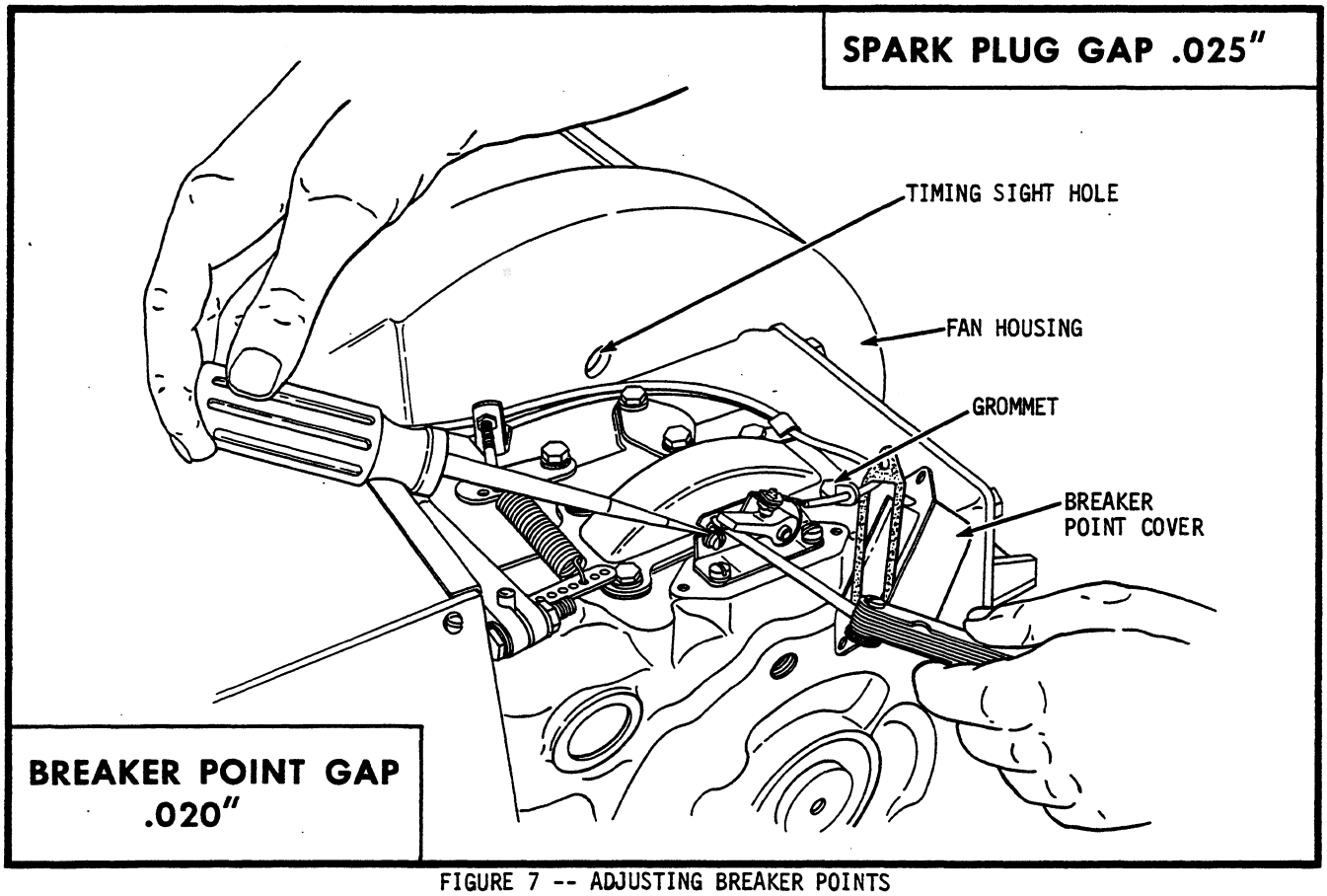


FIGURE 7 -- ADJUSTING BREAKER POINTS

IGNITION SYSTEM

Hard starting, roughness, low power and erratic operation are often attributed to faulty ignition. All ignition components must be in top condition and the ignition spark must be properly timed to maintain good performance.

Spark Plug: Every 100 hours remove plug and check condition. Good operating conditions are indicated if plug has light coating of gray or tan deposit. A dead white, blistered coating could indicate overheating. A black (carbon) coating may indicate an "overrich" fuel mixture caused by clogged air cleaner or improper carburetor adjustment. Do not sandblast, wire brush, scrape or otherwise service plug in poor condition--best results are obtained with new plug. Set standard type spark plug gap at .025". Tighten plug to 22 ft. lbs. (264 in. lbs.) torque when installing. Use 14 mm standard H-10 (or equivalent) plug.

Breaker Points: Every 100 hours breaker points should be inspected and serviced as needed. If oxidized, dirty or oily, clean with coarse cloth--do not use emery cloth or sandpaper. Slightly pitted points can be dressed with point file--replace badly pitted or burned points. The gap must be adjusted after points are serviced or replaced since this setting establishes ignition timing. To adjust, crank engine until points are at maximum opening--check with feeler gauge. If gap is not .020", loosen adjusting screw then shift movable plate until .020" gap is obtained. After retightening screw, recheck to make sure gap is still properly set, then replace cover.

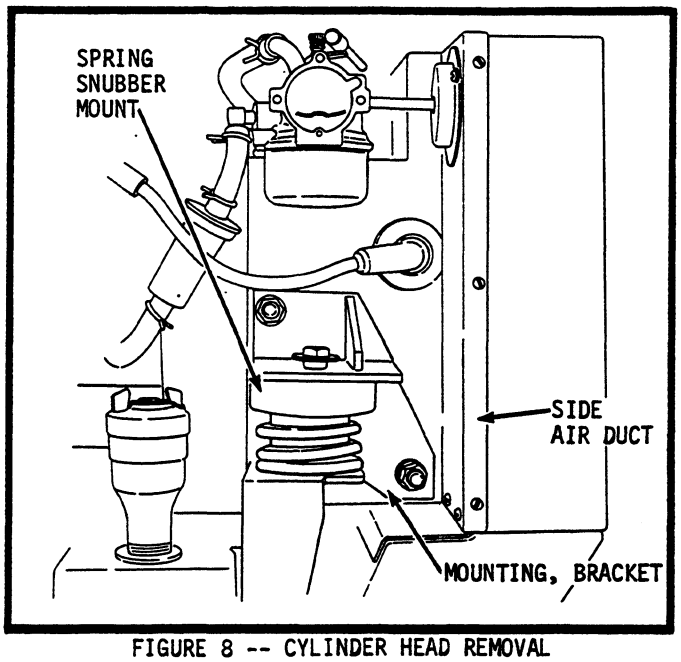


FIGURE 8 -- CYLINDER HEAD REMOVAL

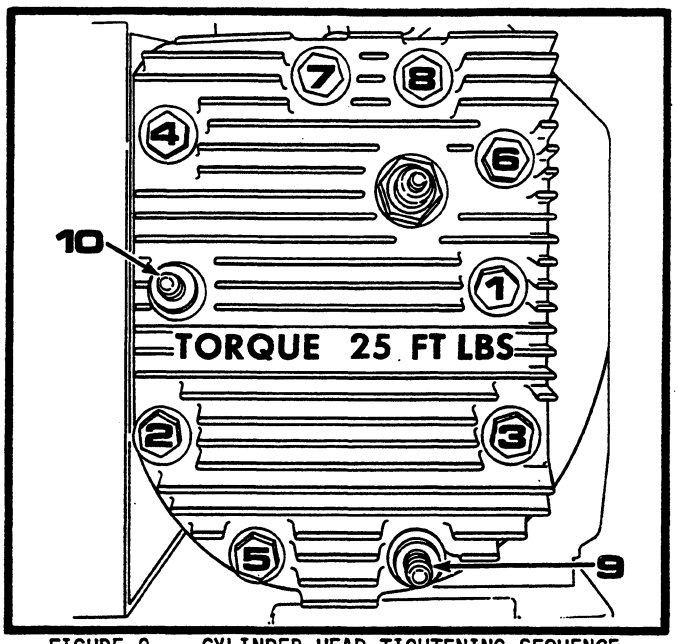


FIGURE 9 -- CYLINDER HEAD TIGHTENING SEQUENCE

CYLINDER HEAD SERVICE

To retain top operating efficiency and performance, the cylinder head should be removed for carbon cleaning after every 200 operating hours. To service the head, pull the generator set out of the compartment, lift the engine end of the unit then disconnect the spring snubber mount from the mounting bracket attached to the cylinder head. Remove the mounting bracket, side air duct and the cylinder head

To remove the carbon, use a piece of wood or plastic material to avoid scratching the aluminum head. After cleaning, install a new cylinder head gasket and reinstall the cylinder head--tighten head bolts in sequence shown and to the torque specified in the above illustration.

TROUBLE SHOOTING - ENGINE

When troubles occur, don't overlook simple causes which might seem too obvious to be considered. A starting problem could, for example, be attributed simply to an empty fuel tank. The chart below lists some common causes of engine troubles--use this as a guide to locate causing factors.

PROBLEM	FUEL RELATED CAUSES			IGNITION CAUSES		OTHER CAUSES						
	NO FUEL	IMPROPER FUEL	FUEL MIX. WRONG	NO SPARK	POOR IGNITION	IMPROPER COOLING	IMPROPER LUBRICATION	POOR COMPRESSION	VALVE PROBLEMS	CARBON BUILD-UP	GOVERNOR FAULTY	ENGINE OVERLOADED
WILL NOT START	X			X				X	X			
HARD STARTING		X	X		X	X		X	X			
STOPS SUDDENLY	X			X			X		X			
LACKS POWER		X	X		X	X		X	X	X		X
OPERATES ERRATICALLY		X	X		X						X	
KNOCKS OR PINGS		X	X			X				X		X
"SKIPS" OR MISFIRES			X		X							
BACKFIRES			X		X				X			
OVERHEATS			X		X	X			X			X

FUEL PUMP

In addition to the see-thru fuel filter furnished on some generator sets, a serviceable fuel filter element is located inside the electric fuel pump as shown below. Remove the cover of the fuel pump and service this element at the end of each operating season or more frequently if an unusual amount of impurities are noted in the see-thru filter. To clean the element, swish in cleaning solvent or in fresh, clean gasoline. Make sure that the cover is securely tightened after reinstalling the serviced filter element.

This fuel pump includes a check valve which prevents drain back of the fuel when the set stops. If the pump malfunctions, replace the complete unit.

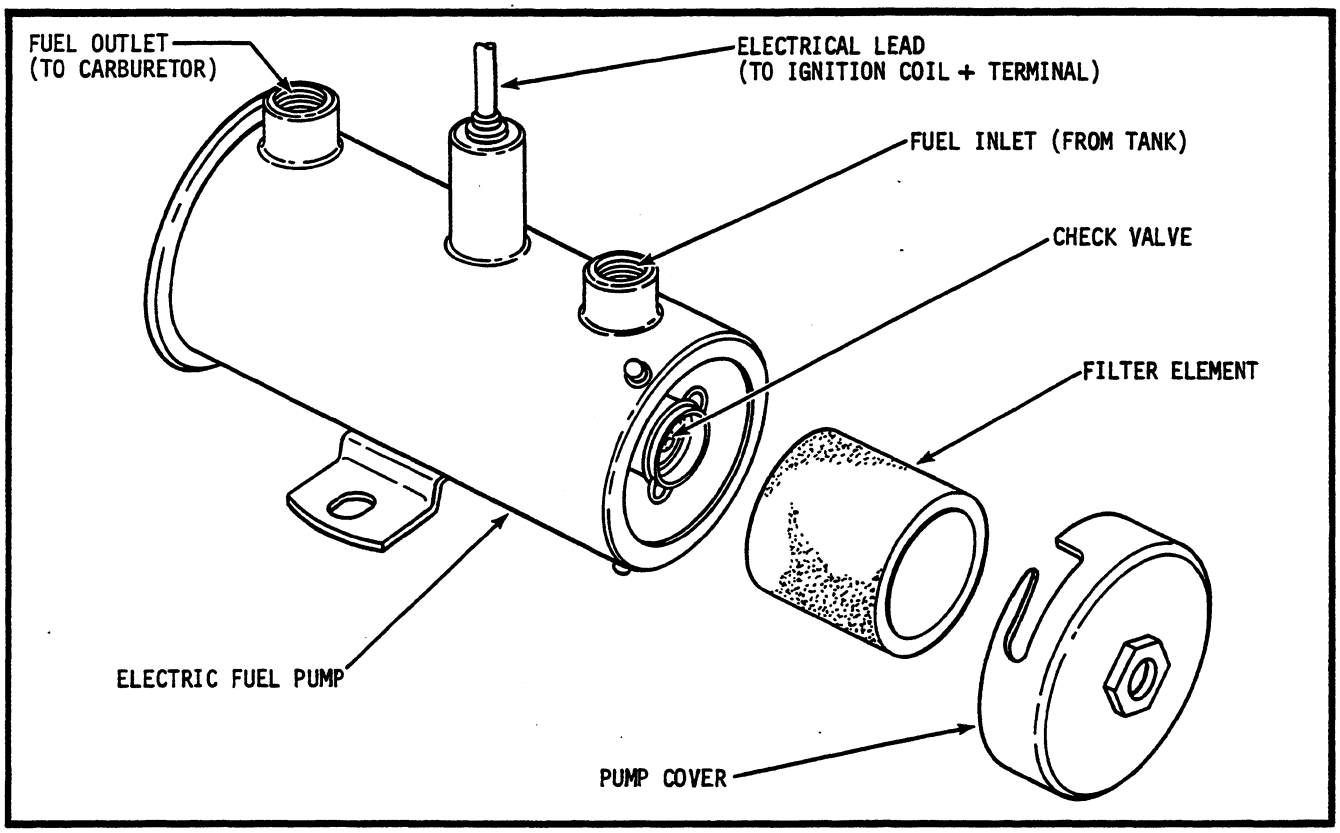


FIGURE 10 -- FILTER IN ELECTRIC FUEL PUMP

VALVE CLEARANCE ADJUSTMENT

After each 500 hours of operation, remove the valve cover and check the clearance between the end of the valve stems and the tappets. Clearance is checked when both valves are closed at which point the cam will have no effect on the tappets. Check clearance with cold engine. Cold clearance should be set at .008 - .010" on the intake valve and .017 - .020" on the exhaust valve. To adjust, turn adjusting screw on tappet in or out until proper clearance is obtained. Adjusting screw is self-locking. Reinstall crankcase breather components in proper sequence after adjusting valve clearances.

STORAGE PROCEDURE

Use the following procedure to preserve the generator set before placing the recreational vehicle in storage during the off season. Operate the set to bring it up to normal temperatures then stop the set and drain the oil from the crankcase while it is still hot. Flush with clean, lightweight oil then drain this oil and refill crankcase with fresh oil of weight and grade specified on page 4. Drain fuel from system--disconnect and empty fuel bowl on carburetor, disconnect fuel pump cover to allow drainage here and disconnect any fuel lines in which fuel could be trapped. Reconnect all items after draining. Clean compartment and exterior surfaces of the generator set. Spread a light film of oil over any exposed surfaces subject to corrosion. Remove the spark plug and pour about one tablespoon of oil into the spark plug hole then crank engine several times before replacing the spark plug. Block any openings in compartment to prevent entrance of moisture, dust, rodents, etc., during storage but make sure these are opened before placing the unit in operation at the start of the next season. Store unit in clean, dry area whenever possible.

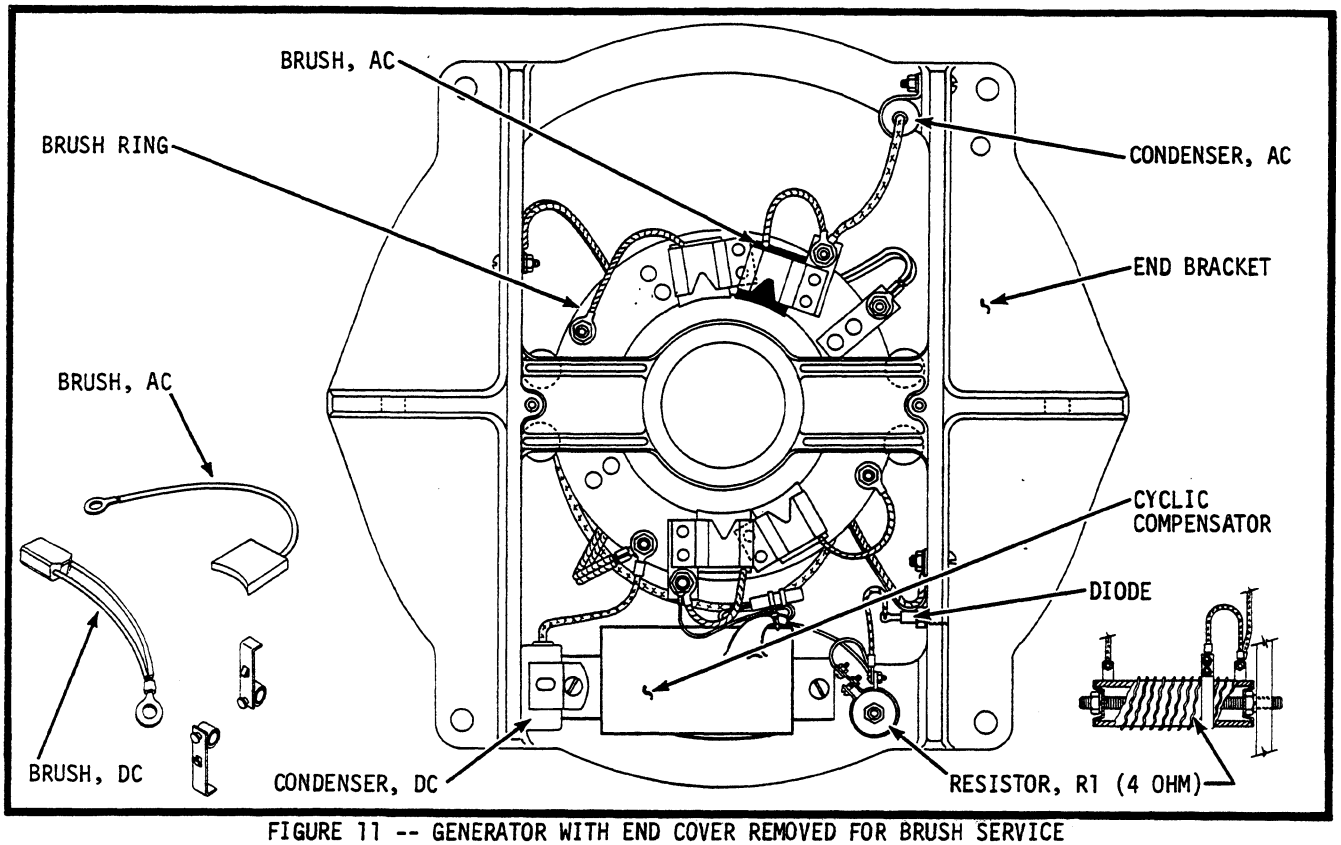


FIGURE 11 -- GENERATOR WITH END COVER REMOVED FOR BRUSH SERVICE

GENERATOR SERVICE

Generators do not normally require service on a regular basis; however, it is a good idea to remove the end cover and check the commutator and brushes at least every six months (or every 50 hours) or more often under dusty, dirty conditions. Make a visual check of the commutator first--if a thin skinlike film of uniform thickness is evident on the surface, this usually indicates normal operation--this film acts as a lubricant and promotes longer brush life. If the surface is streaked or has ridges of dirt, clean it with a coarse cloth or, if this doesn't work, use fine sandpaper or a commutator stone--do not use emery cloth. Lift brushes and check surface--replace brush if unevenly worn or when worn down to about 5/16" or 1/2 original length. Use genuine Kohler replacement brushes only--substitutes may not be of correct material and will wear out rapidly or cause commutator damage. Other common causes for rapid brush wear are wrong brush tension, rough commutator surface, high mica on commutator and brush chatter. Blow dust out with dry compressed air after servicing.*

GENERATOR TROUBLE SHOOTING

SYMPTOM	POSSIBLE CAUSE
NO OUTPUT	● LOOSE TERMINAL CONNECTIONS: Check for loose or bad connections. ● BRUSHES NOT SEATED: Check for loose springs or brushes sticking in holder. ● DIRTY COMMUTATOR: Poor contact caused by build up of dirt or oily film on commutator. ● SHORT IN AC CIRCUIT: If engine labors while running, check for short circuit in AC line. If a short develops in the AC armature, the armature will get very hot. ● BATTERY CONNECTIONS REVERSED (MUST BE NEGATIVE GROUND)
LOW OUTPUT OR EXCESSIVE DROP IN VOLTAGE	● ENGINE SPEED TOO LOW: Check with tachometer. Readjust governor speed. ● OVERLOAD: Make sure plant capacity is not being exceeded. ● ENGINE IN POOR CONDITION: Poor compression, excessive carbon, faulty ignition, wrong polarity or any other condition causing poor performance may show up in reduced output. ● CYCLIC COMPENSATOR DEFECTIVE ● BRUSHES WORN EXCESSIVELY
EXCESSIVE ARCING	● BRUSHES STICKING: If brushes are wrong size, they may stick in holder and chatter. ● BRUSH TENSION WRONG: If spring tension is wrong, brushes may chatter. ● WRONG BRUSHES: Brush grade and material must be correct--use only specified brushes.
ABNORMAL VOLTAGE	● CYCLIC COMPENSATOR FAULTY: Replace unit

CYCLIC COMPENSATOR

At the relatively low speed of 1800 RPM, the speed of a single cylinder engine decreases slightly as the piston approaches the ignition point on the compression stroke and increases on the following power stroke. Although the speed change is hardly perceptible, the associated change in voltage is noticed as an annoying flicker of the lights. The Cyclic Compensator momentarily functions as a voltage regulator to keep the voltage within specific limits where the variation will not cause flicker. It does this through an electronic circuit which is triggered by the engine ignition breaker points. The Cyclic Compensator shorts out the field resistor to increase field current during the "slow" or compression portion of the cycle which, in turn, restores the voltage to acceptable levels. The resistor is kept in the circuit while the piston is on the remaining strokes. The field resistor is adjusted during run-in tests at the factory for the best compensation--the minimum resistance setting is 3.0 ohms while the maximum is 3.8 with an average of about 3.5 ohms. If the resistance value is lowered, voltage will increase; however, this also reduces the anti-flicker effect. Increasing the resistance reduces voltage but increases the anti-flicker effect. Because of this effect on voltage, the resistor should not be readjusted out of these limits. CAUTION: DO NOT adjust the resistor when set is running--compensator may fail as a result if this is done.

TROUBLE SHOOTING: Some problems that could be attributed to defects in the Cyclic Compensator circuit are described in the following.

1. No AC output. If the battery is hooked up wrong, no output can be obtained because the diode acts to block the shunt field circuit. The battery must be negative ground. Failure of the diode in the open mode could also be the cause of no output.

2. Abnormal AC output voltage. Variations in voltage could be caused by loose connections in the circuit--if this condition is found, the Cyclic Compensator could be damaged as a result. Higher than normal voltage may be an indication that the compensator is continuously shorting out the field resistor. Lower than normal voltage may indicate that the compensator is not triggering.

3. Test to establish cause. Since the symptoms described in foregoing may be due to causes other than a faulty Cyclic Compensator, make the following test to determine if the compensator is actually at fault. Replace compensator unit if faulty.

   STEP A: Operate the generator set and record the output voltages.

   STEP B: Stop the set then disconnect the red lead at the field resistor. CAUTION: Severe arcing will occur if the set is running when this lead is disconnected.

   STEP C: Restart the set and compare output voltage to that obtained in Step A. If voltage was high and decreases with red lead disconnected, the Cyclic Compensator has failed "shorted". If voltage was low and disconnecting the red lead has no effect, the compensator has failed "open" or the connections to it are not proper. Shorting the resistor should cause the voltage to go higher than normal.

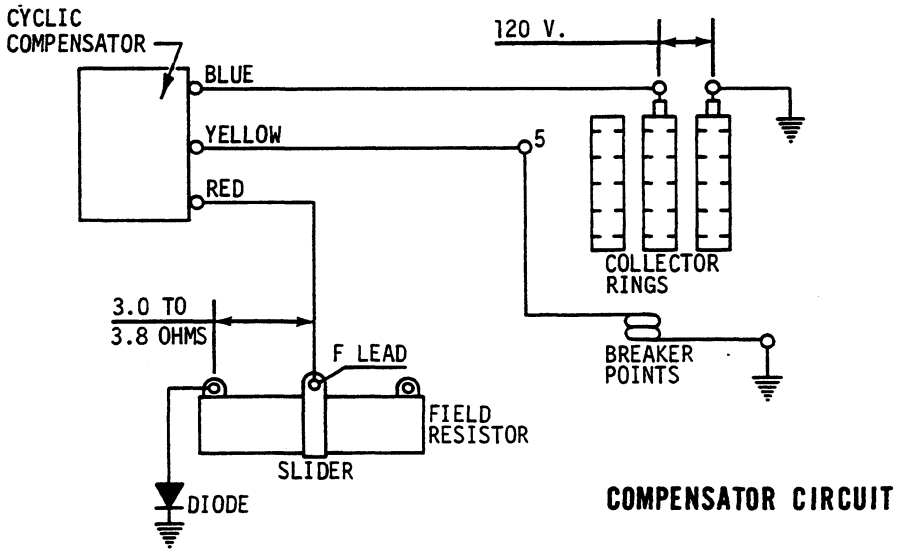


FIGURE 12 -- CYCLIC COMPENSATOR CIRCUIT SCHEMATIC

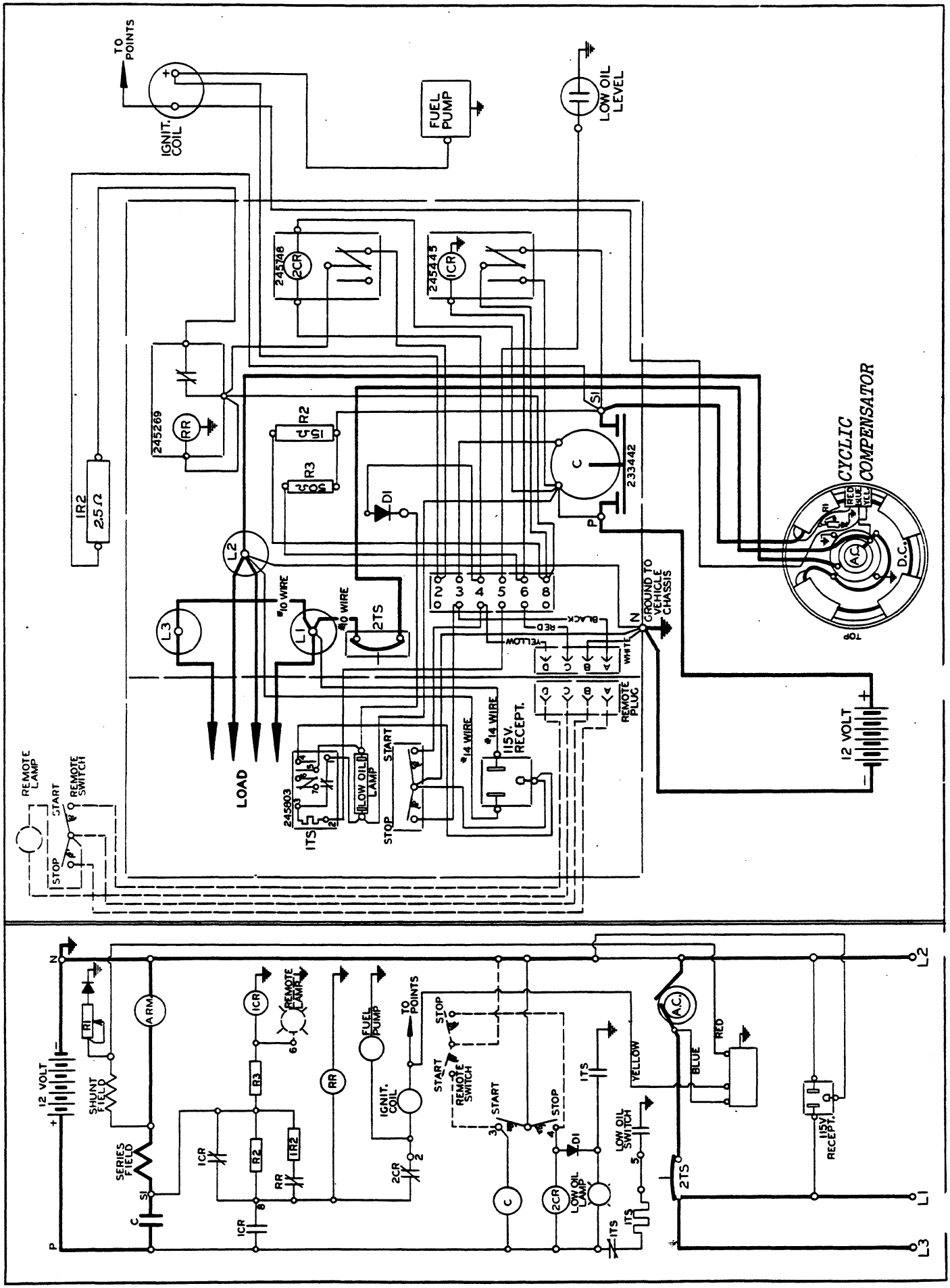


FIGURE 13 -- GENERATOR SET WIRING DIAGRAM

CONTROLLER OPERATION

The controller includes a push button for starting and stopping the generator set. The switch must be held in the START position until the engine starts running and held in the STOP position until the engine comes to a complete halt. It also provides regulated battery charging for maintaining charge in the generator set battery. The engine is cranked by the exciter by means of a 12 volt - negative ground storage battery. The controller has a safety shut-down circuit which functions when a low oil level condition occurs. The sequence of operation is briefly outlined as follows:

1. Press and hold Start button until set starts.
2. Cranking contactor C energizes.
3. Engine cranks and runs.
4. Relay 1CR energizes.
5. Power supplied to load.
6. Press and hold stop switch until set stops.

BATTERY CHARGING: Charging is provided from the exciter thru the contact of relay 1CR and parallel resistors R2 and 1R2. Regulator relay RR senses battery voltage and automatically varies the charge rate from 6 to .3 amps.

LOW OIL SHUT-DOWN: This circuit includes a float switch mounted in the oil pan, a time delay thermal switch and a low oil level indicator lamp. The lamp lights and the thermal switch trips when the set shuts down on low oil level. To restart, the oil must be added to proper level and the oil reset button (on cover) pressed.

CIRCUIT BREAKER: The circuit breaker (2TS) protects the main AC circuit against overload.

OPERATIONAL SEQUENCE: Paths of current in the various steps of operation may be traced as follows:

1. Press Start button to connect battery negative to solenoid coil C. Battery current flows to terminal P, coil of cranking contactor C, terminal 3, start switch to ground and back to the battery.

2. Cranking contactor C energizes allowing heavy current from battery to flow to terminal P, contacts of C, terminal S1, cranking series field of generator, exciter armature to ground and back to the battery. Current also flows thru the normally closed contacts of 1CR to terminal 8, thru normally closed contacts of 2CR to terminal 2, to the ignition coil and electric fuel pump and back to ground.

3. Engine cranks and runs: After engine starts and runs, release start switch.

4. Relay 1CR energizes: As exciter voltage builds, relay 1CR energizes. Due to a higher voltage potential of the exciter, current will flow from the exciter thru the series field to S1, thru resistor R2 and 1R2, thru normally closed contacts of relay RR to terminal 8, thru now closed contacts of relay 1CR to the battery. Regulator relay RR energizes only when battery voltage reaches approximately 14.2 volts. This will break the current path thru resistor 1R2. The R2 resistor (greater resistance) will allow a smaller amount of current to flow to the battery.

5. Power is supplied to load - Power is furnished to the load from collector rings through the 2TS and terminals L1, L2 and L3.

6. Press stop switch to stop engine - To stop the generator set, press and hold the stop switch which energizes the 2CR relay causing 2CR contact to open. When 2CR contact opens, current to the fuel pump and to the ignition coil is disrupted, causing the engine to stop. This controller is designed so that a remote start-stop switch may be used by connecting to terminals A, B, C and D.

NOTE: If optional 12 volt DC hour meter is required, connect it across terminal 2 and ground.

REPAIR GUIDE: K341L ENGINE

COMPONENT TO BE REPAIRED OR REPLACED	GENERATOR REMOVAL		ENGINE ASSEMBLY		
	NOT REQUIRED	REQUIRED	NOT REQUIRED	PARTIAL	COMPLETE
Adapter, carburetor	X		X		
Adapter, rotor		X	X		
Bearing, ball		X		X	
Bearing, governor needle	X			X	
Camshaft		X		X	
Carburetor	X		X		X
Crankcase		X			X
Crankshaft		X		X	
Duct, chute air	X		X		
Duct, cover air	X		X		
Duct, side air	X			X	
Duct, top air	X			X	
Elbow, exhaust	X			X	
Gasket, cylinder head	X			X	
Gasket, oil pan	X		X		
Gear, gov. - assembly	X			X	
Guide, valve	X			X	
Head, cylinder	X			X	
Housing, fan		X	X		
Indicator, oil level	X		X		
Insert, valve seat		X			X
Keeper, valve	X			X	
Mounts, support	X		X		
Pan, oil	X		X		
Pin, camshaft	X			X	
Piston	X			X	
Plate, closure	X		X		
Retainer, valve spring	X			X	
Rings, piston	X			X	
Rod, connecting	X			X	
Rotator, valve	X			X	
Rotor, fan		X	X		
Seal, oir (Gen. Side)		X		X	
Seal, oil (Outer)	X		X		
Shaft, governor cross	X			X	
Spring, actuating (ACR)	X			X	
Spring, valve	X			X	
Switch, oil level ind.	X		X		
Tappet	X			X	
Tube, exhaust	X			X	
Valves	X			X	

ENGINE OVERHAUL AND REPAIR

The generator set must be completely removed from the vehicle to make the repairs described in this section. The engine-generator must also be separated from the mounting skid--the threaded hole at the top of the generator frame is for a lifting eye. CAUTION: The generator set weighs approximately 300 pounds--make sure the hoist or lift used is adequate for this weight. The following procedure is suggested for the preliminary steps.

REMOVAL - GENERATOR SET FROM VEHICLE

1. Shut off fuel to the set then disconnect the fuel inlet line at the fitting on the bottom of the mounting skid.
2. Disconnect battery leads from solenoid inside the controller then unplug the switch leads from the connector at the side of the controller box. If the set is grounded to the vehicle frame, disconnect this lead from the connector on the upper corner of the generator frame. Disconnect load leads from terminals L1, L2 and L3 inside controller.
3. Remove the muffler from the bottom of the mounting skid.
4. Remove the four capscrews which secure the mounting skid to the support rails then slide the set out of vehicle.
5. Disconnect the fuel line running from the skid to the fuel pump at the fitting on the pump, remove the mounting screw from each of the four rubber mounts then lift the engine-generator off the mounting skid.

The generator does not have to be separated from the engine to perform certain repairs--for example, the connecting rod, piston, cylinder head, valves, oil pan, etc., can be reached without complete disassembly of the engine. However, if this is needed, separate the generator from the engine as follows.

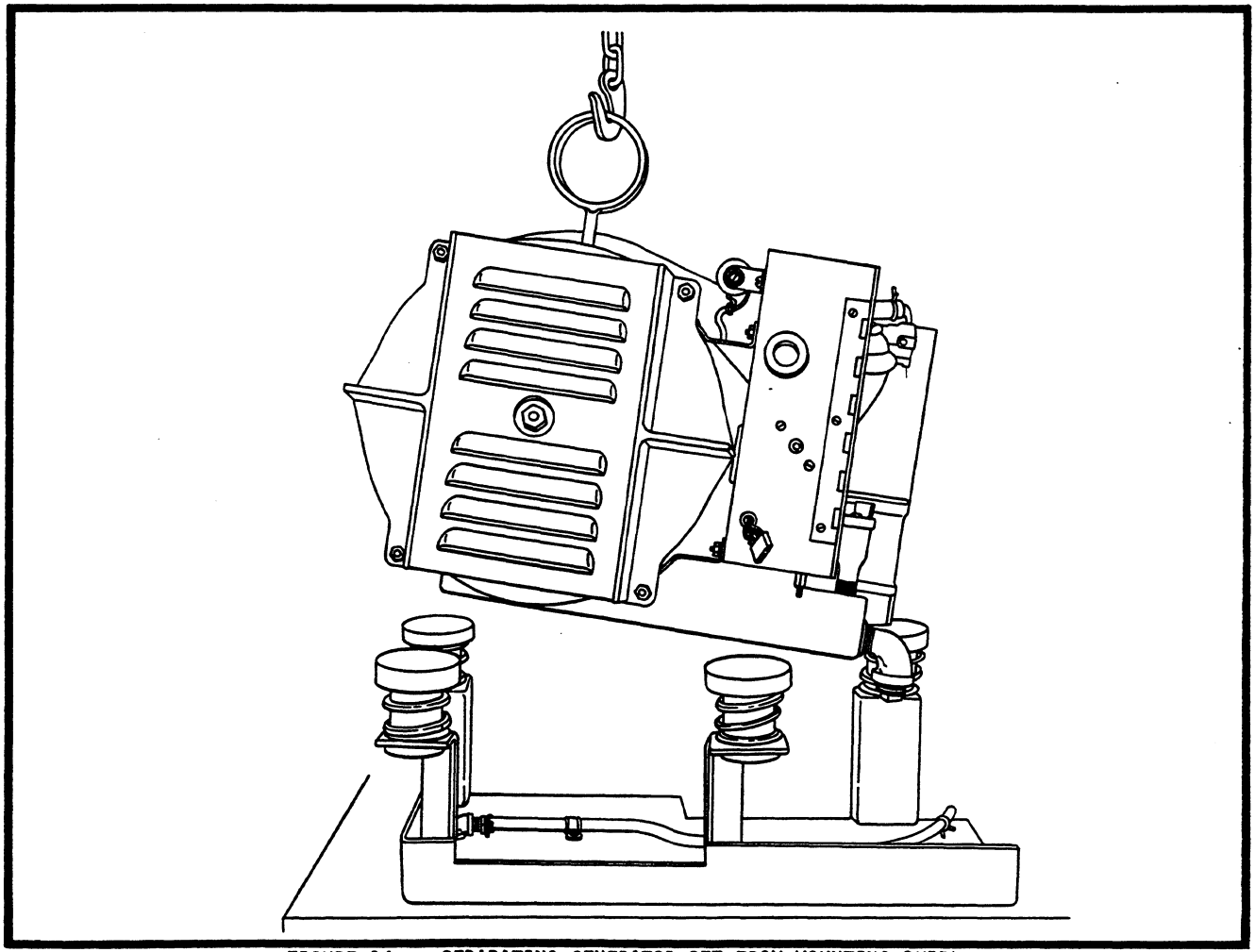


FIGURE 14 -- SEPARATING GENERATOR SET FROM MOUNTING SKID

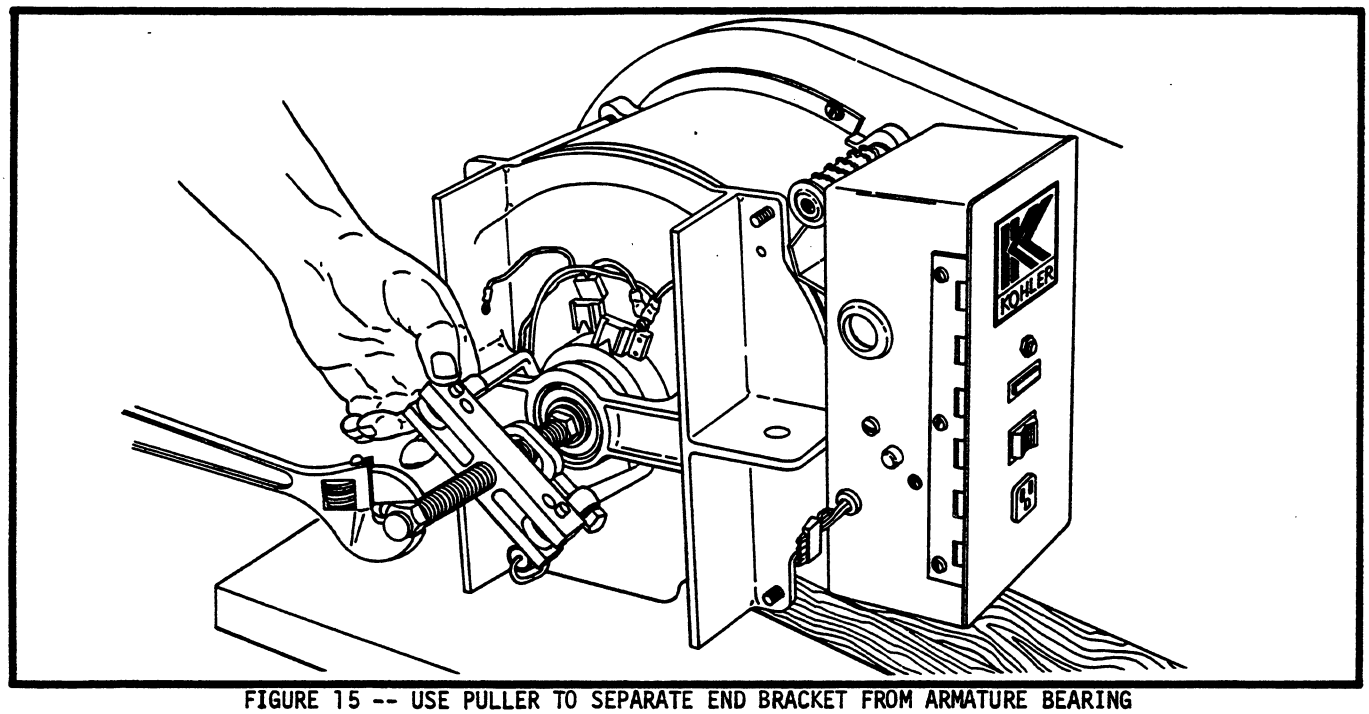


FIGURE 15 -- USE PULLER TO SEPARATE END BRACKET FROM ARMATURE BEARING

SEPARATING GENERATOR FROM ENGINE

After removing the mounting skid, place blocks under the engine-generator so that the weight of the unit rests on the oil pan of the engine then remove the generator using the following procedure.

1. Disconnect leads at terminal 5 in the controller--these go to ignition coil and electric fuel pump.

2. Remove generator end cover, lift AC and DC brushes then remove the four nuts which secure the end bracket assembly to the frame of the generator. Use puller to separate the end bracket from the ball bearing.

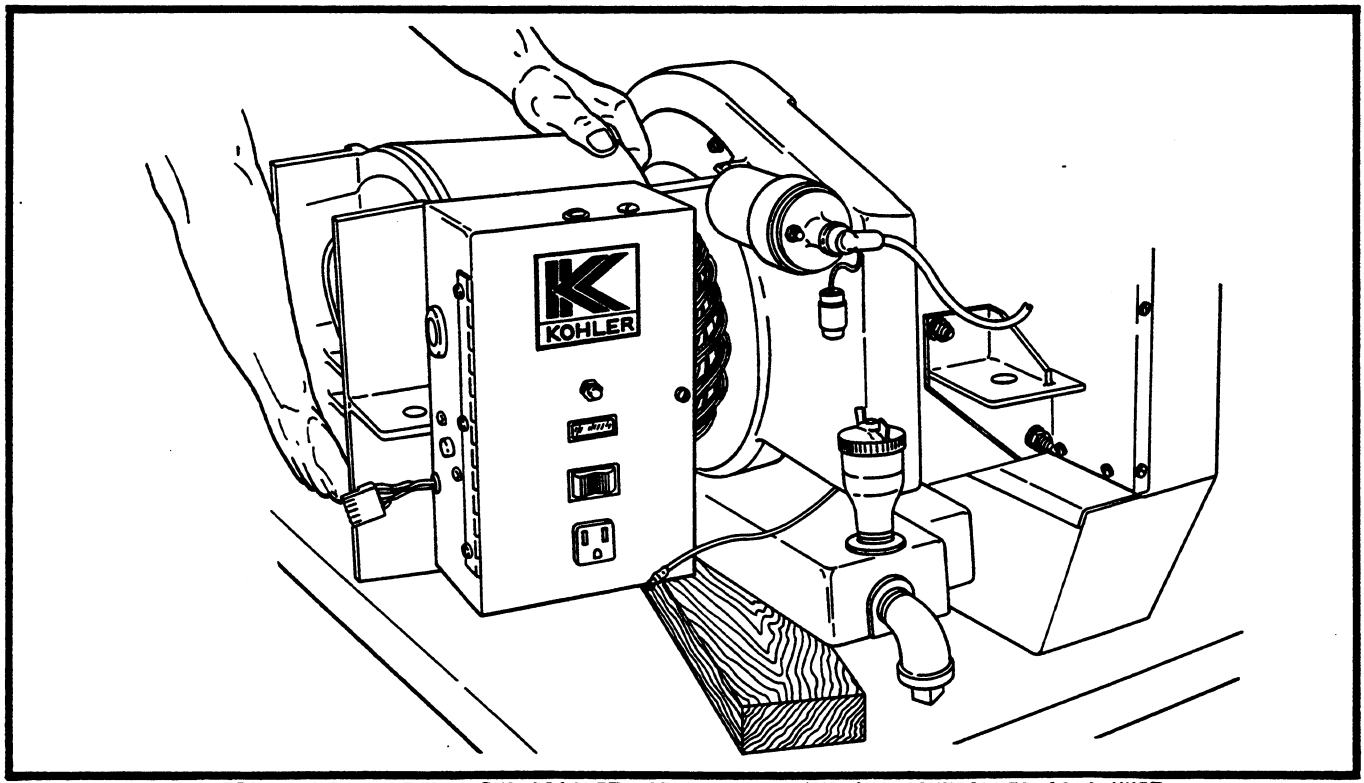


FIGURE 16 -- REMOVE END BRACKET, GENERATOR FRAME AND CONTROLLER AS A UNIT

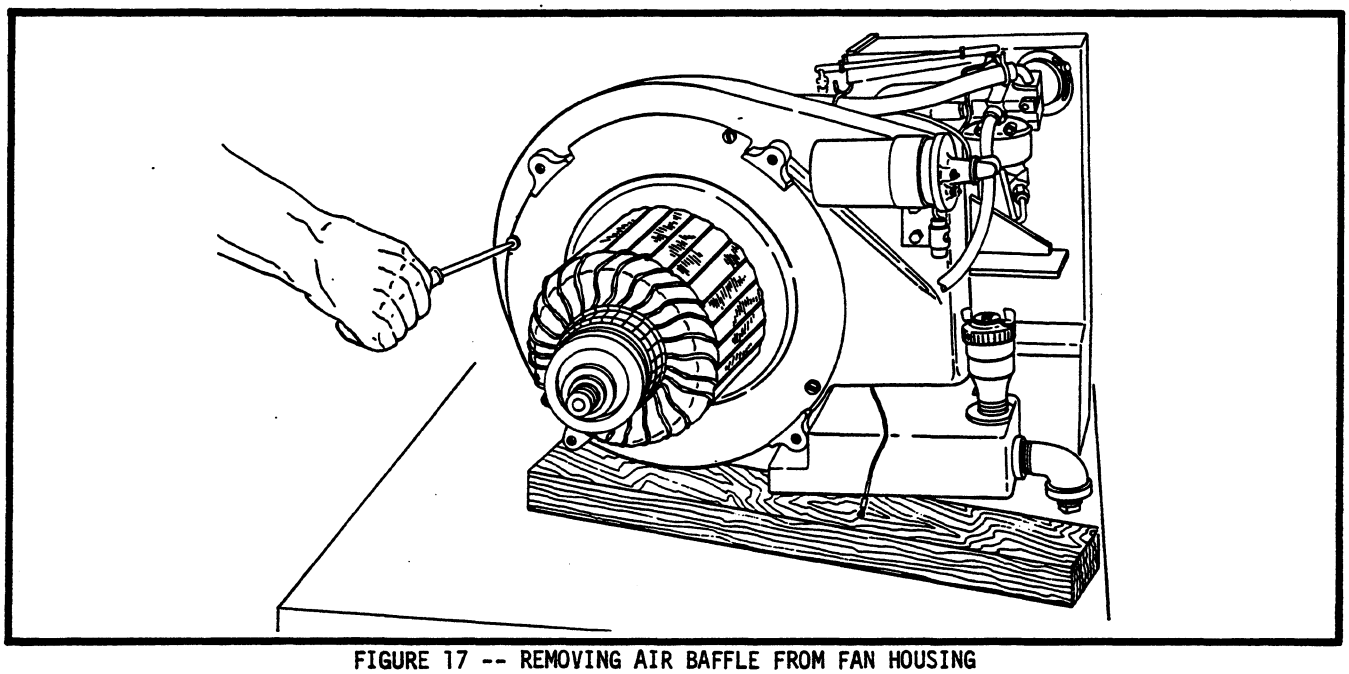


FIGURE 17 -- REMOVING AIR BAFFLE FROM FAN HOUSING

3. The end bracket and generator frame (with controller attached) can now be slipped over the end of the armature and removed.

4. Remove the air baffle from the fan housing, turn the thru bolt out about 2-3 turns then bump the end of the thru bolt (with soft head hammer) until the armature separates from the taper on the engine crankshaft. Do not separate the rotor and adapter from the armature unless it is necessary to replace either of these items.

5. To avoid bending the studs or resulting breakage of the fan housing at the stud bosses, remove the 4 long studs from the housing--this completes the procedure for removing the generator from the engine.

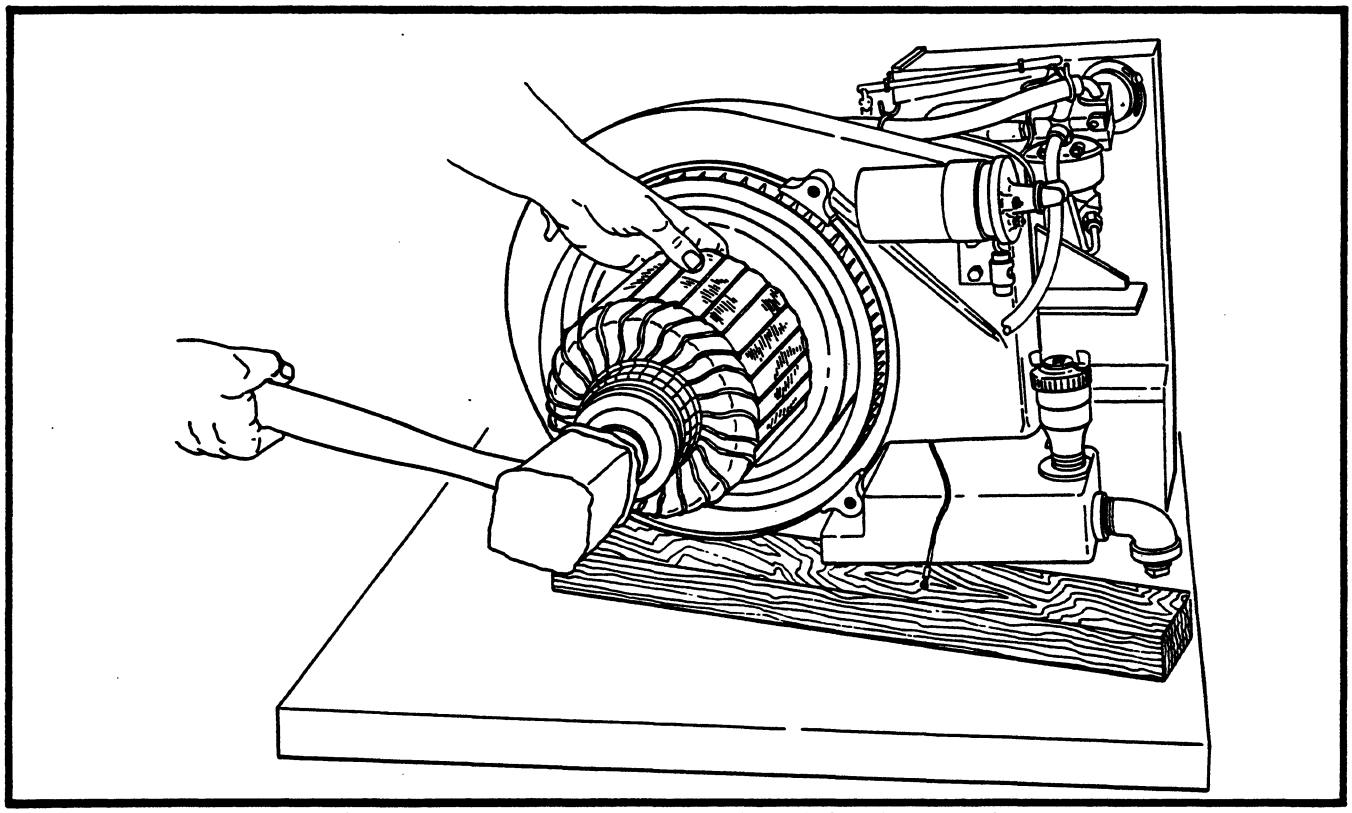


FIGURE 18 -- LOOSEN THRU BOLT THEN BUMP END TO SEPARATE ARMATURE FROM CRANKSHAFT

ENGINE DISASSEMBLY - COMPLETE

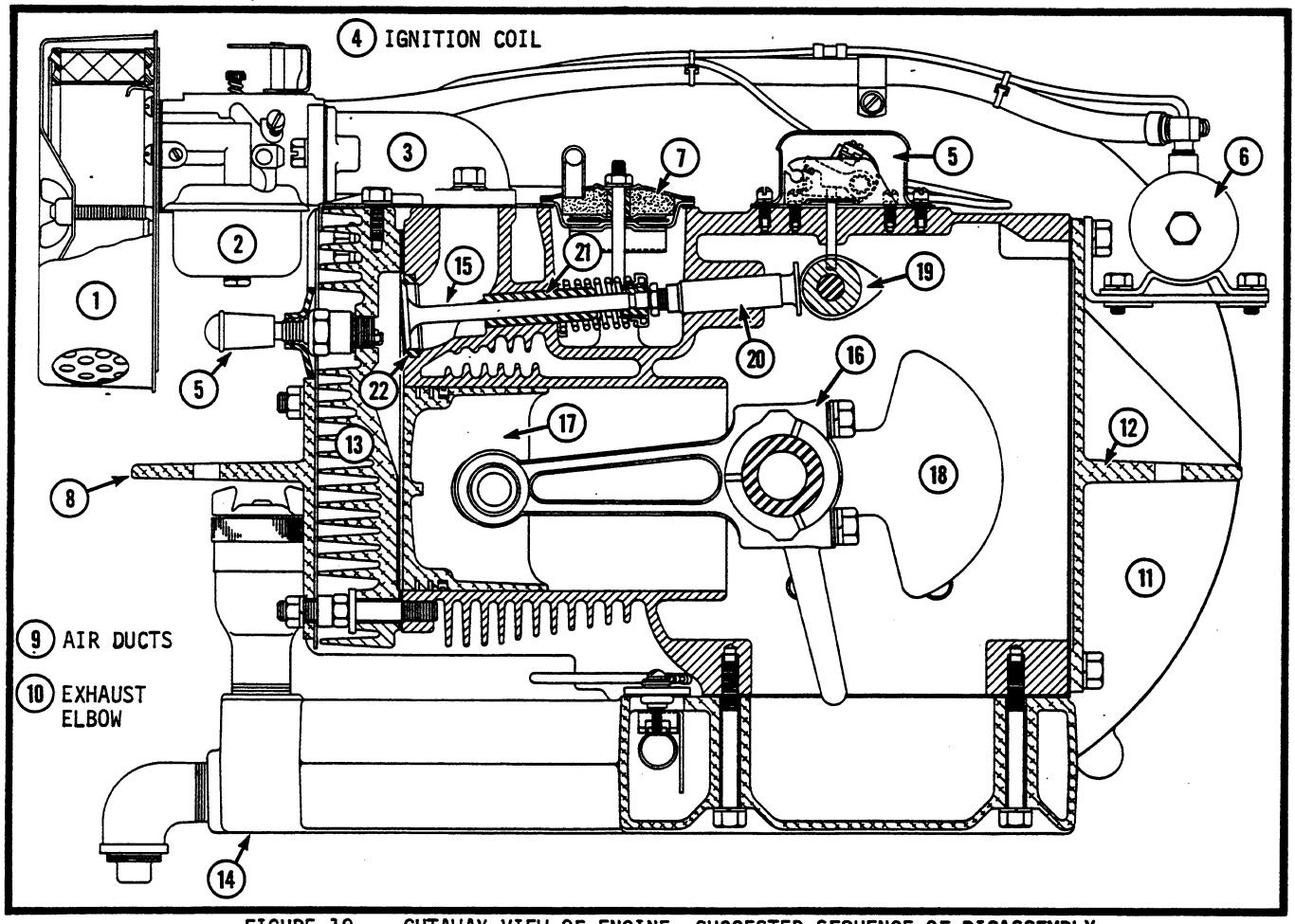


FIGURE 19 -- CUTAWAY VIEW OF ENGINE--SUGGESTED SEQUENCE OF DISASSEMBLY

SEQUENCE OF DISASSEMBLY

The following is the suggested sequence of disassembly to be used in the event the engine must be completely disassembled. Refer to the following pages for the reconditioning procedure for individual items or also for repairs requiring only partial disassembly. Reassembly is essentially the reverse of the sequence listed below.

1. Air cleaner
2. Carburetor
3. Carburetor adapter
4. Ignition coil, condenser
5. Spark plug, breaker points
6. Fuel pump and lines
7. Breather - valve cover
8. Mounting bracket (cyl. head)
9. Air ducts, chute
10. Exhaust elbow, tubes
11. Fan housing
12. Closure plate
13. Cylinder head
14. Oil pan
15. Valve mechanism
16. Connecting rod cap
17. Piston - ring - assembly
18. Crankshaft
19. Camshaft
20. Tappets
21. Valve guides
22. Seat inserts

RECONDITIONING

The following describes, in alphabetical sequence, the required procedure for replacing or reconditioning the main internal components of the K341L engine. Whenever complete disassembly of the engine or generator is called for to accomplish the particular repair involved, refer to the instructions on page 16 for generator disassembly or to page 18 for complete disassembly of engine.

ADAPTER, ROTOR

The generator must be disassembled to replace the rotor adapter or rotor. The adapter and rotor are secured as a unit to the generator armature. If rotor replacement is needed, it is not necessary to separate the adapter from the armature. If replacing the adapter, make sure the roll pin is used to locate the replacement adapter--this is for balancing the rotor adapter.

BEARING, BALL

The generator must be separated from the engine and the crankshaft removed from the engine to replace either of the ball bearings. After removing the fan housing and closure plate, disconnect the connecting rod then press the crankshaft out of the crankcase. The ball bearings are press fitted on the crankshaft--use an arbor press to remove the faulty bearing and also to press the replacement bearing on the shaft. Crankshaft end play must be checked after reinstallation (refer to crankshaft procedure) and new oil seals should also be installed.

CAMSHAFT

To repair or replace the ACR actuating spring on the cam gear, remove the gear cover at top of engine and turn the crankshaft until the ACR mechanism appears. To replace the camshaft, removal of the generator, fan housing, closure plate and crankshaft is required. The camshaft is hollow and rides on a pin pressed into both sides of the crankcase. Press the pin out thru the fan housing side of the crankcase then remove the camshaft. When installing replacement camshaft, use .005 and .010" spacers as required to establish .005-.010" end play--refer to Figure 21 for end play details. The pin must be pressed in from the fan housing side of the crankcase due to tapered bore on the opposite end of the crankcase.

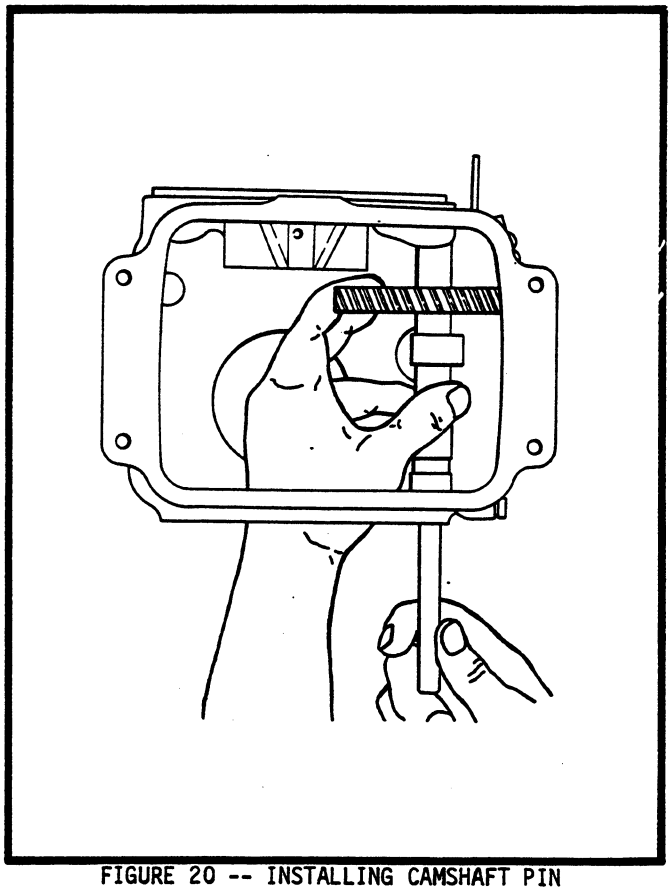


FIGURE 20 -- INSTALLING CAMSHAFT PIN

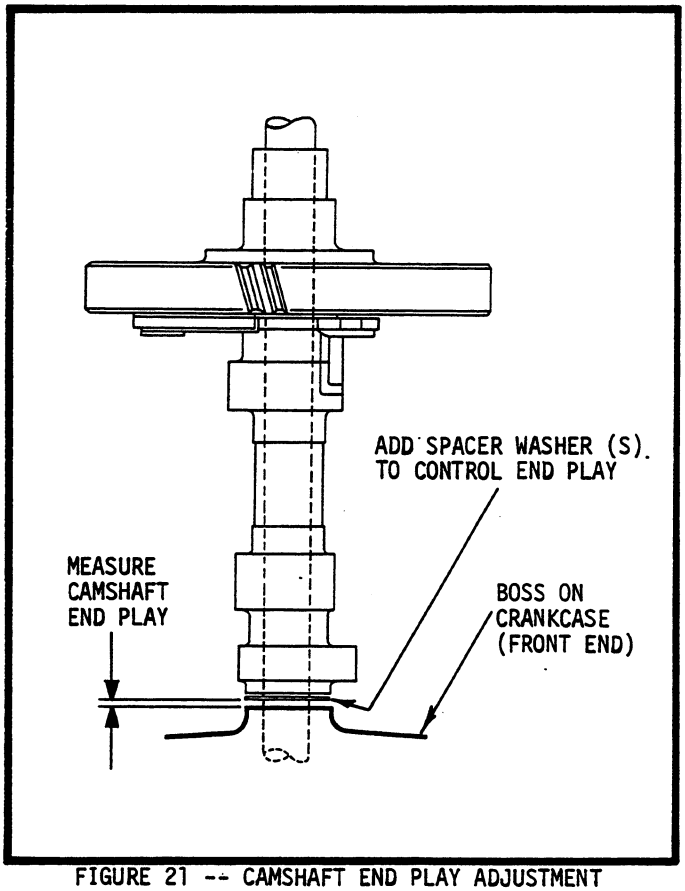


FIGURE 21 -- CAMSHAFT END PLAY ADJUSTMENT

CRANKCASE

The generator must be removed and the engine completely disassembled to facilitate replacement or reboring of the crankcase. If the engine is damaged extensively, a new short block assembly should be used. The short block includes crankcase with all internal parts such as crankcase, camshaft, piston-rod, valves plus fan housing installed. All other items are either transferred from the failed engine or taken from stock to build the short block up to a complete engine. If reboring is needed, rebore cylinder .010, .020 or .030" oversize and use the corresponding oversize piston-ring assembly. New diameter of the cylinder is 3.750"--rebore to the nearest oversize when cylinder bore is worn to 3.753" or taper exceeds .0015" or the bore is out of round more than .005". These measurements are shown in Figure 22.

CYLINDER REBORING PROCEDURE: While most commercially available cylinder bores can be used with either portable drills or drill presses, the use of a low speed drill press is preferred as it facilitates more accurate alignment of the bore in relation to the crankshaft crossbore. Reboring is best accomplished at drill speed of about 600 RPM. After installing coarse stones in hone, proceed as follows.

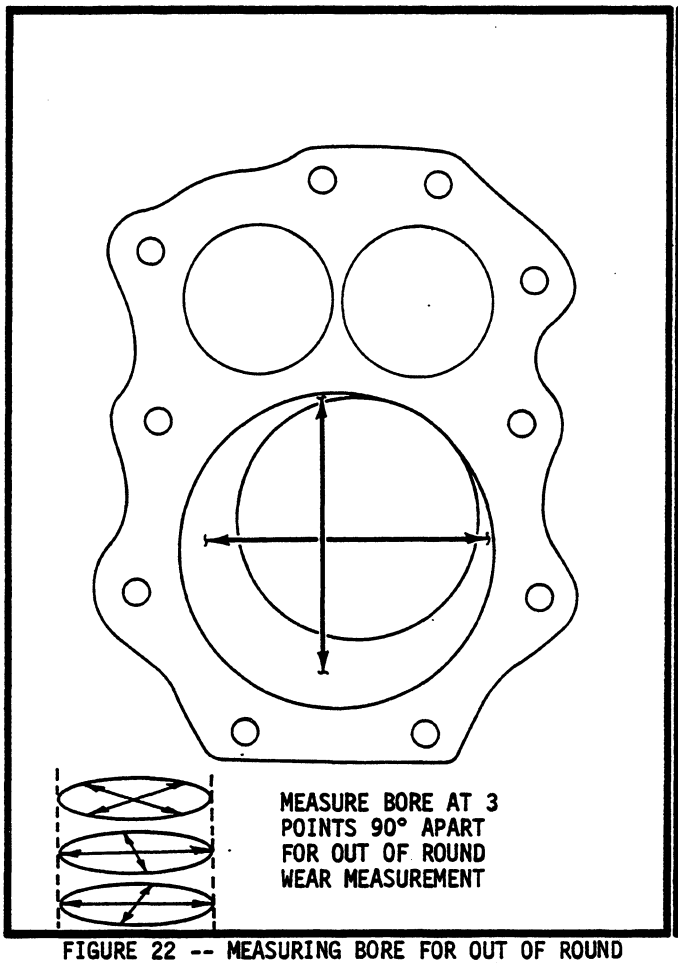


FIGURE 22 -- MEASURING BORE FOR OUT OF ROUND

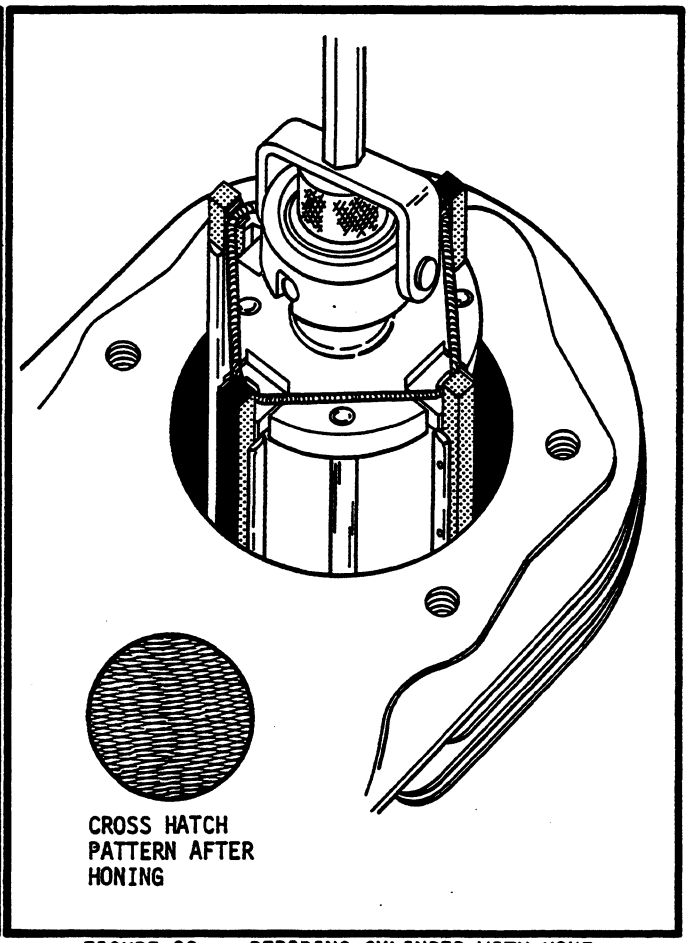


FIGURE 23 -- REBORING CYLINDER WITH HONE

1. Lower hone into bore and after centering, adjust so that stones are in contact with walls. Diesel fuel oil or kerosene can be applied to the stones as a cutting-cooling agent.

2. With the lower edge of each stone positioned even with the lowest edge of the bore, start drill and honing process. Move hone up and down while reboring to prevent formation of cutting ridges. Check size frequently.

3. When bore is within .0025 of desired size, remove coarse stones and replace with burnishing stones. Continue with burnishing stones until within .0005 of desired size then use finish stones and polish to final size.

4. After reboring, carefully clean cylinder wall with soap and water, then after drying thoroughly, apply light coat of SAE 10 oil to prevent rust.

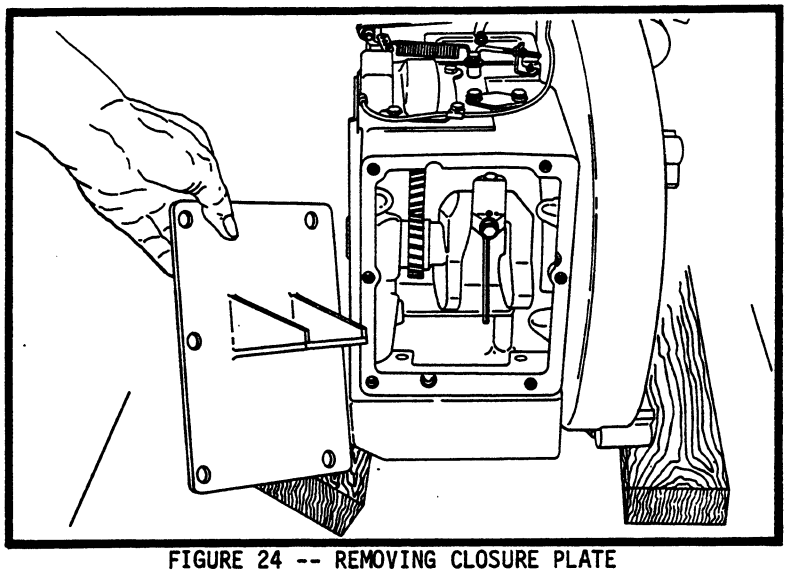


FIGURE 24 -- REMOVING CLOSURE PLATE

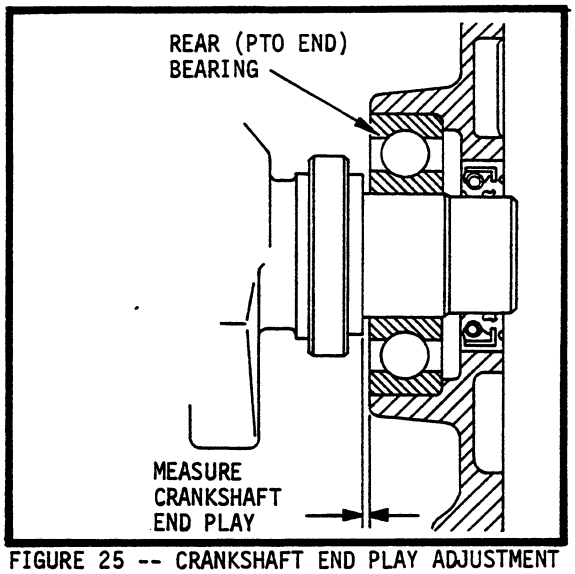


FIGURE 25 -- CRANKSHAFT END PLAY ADJUSTMENT

CRANKSHAFT

The generator, closure plate and fan housing must be removed before the crankshaft can be removed. New diameter of the crankpin is 1.500--regrind crankpin or replace crankshaft if the crankpin out of round exceeds .0005 or if the taper exceeds .001". If keyway or gear teeth are worn or chipped, replace the crankshaft. Slight scoring of the crankpin can be cleaned with crocus cloth soaked in oil. If crankpin limits stated above are exceeded, replace crankshaft or regrind crankpin to use the .010" undersize connecting rod. Crankshaft end play is established by installation of .010 and .020" fan housing gaskets as required to obtain correct end play of .003-.020"--refer to Figure 25 for details. Install thick gasket next to crankcase. When installing crankshaft, the timing marks on crankshaft and camshaft must be aligned as shown in Figure 26.

GEAR, GOVERNOR

The generator, fan housing, crankshaft and camshaft must be removed before the governor gear assembly can be replaced. Individual components of this assembly are non-serviceable--the assembly must be completely replaced if faulty. To replace, remove the welch plug, cross shaft bushing (see Figure 27) then pull the governor cross shaft out of the bushing so that it can be moved out of the way of the gear assembly. Press the gear assembly out of the crankcase, install new spacer washer, then replacement gear assembly. Reinstall cross shaft, welch plug, etc. The spacer washer eliminates the necessity for end play adjustment.

GUIDE,VALVE

To replace the valve guides, remove the valve cover, crankcase breather parts, cylinder head and valves then press guides into the valve chamber and carefully break protruding end until guide is completely removed. The guides should be replaced when the guide to valve stem clearance exceeds .0045". Press replacement guides to depth shown in Figure 36 then ream guide to .312-.313" I. D. with suitable valve guide reamer.

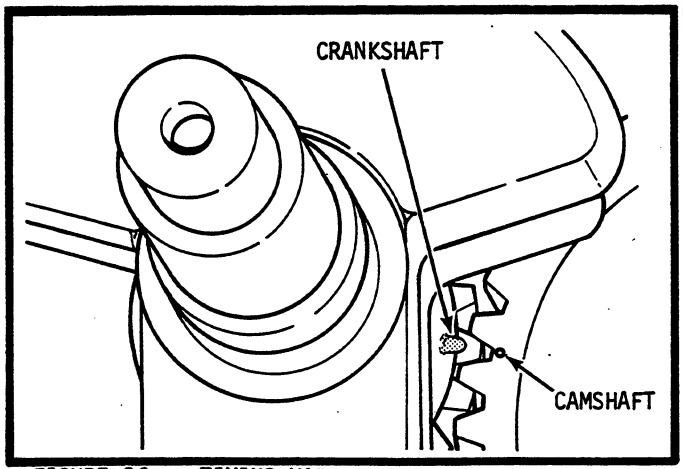


FIGURE 26 -- TIMING MARKS ON CRANKSHAFT-CAMSHAFT

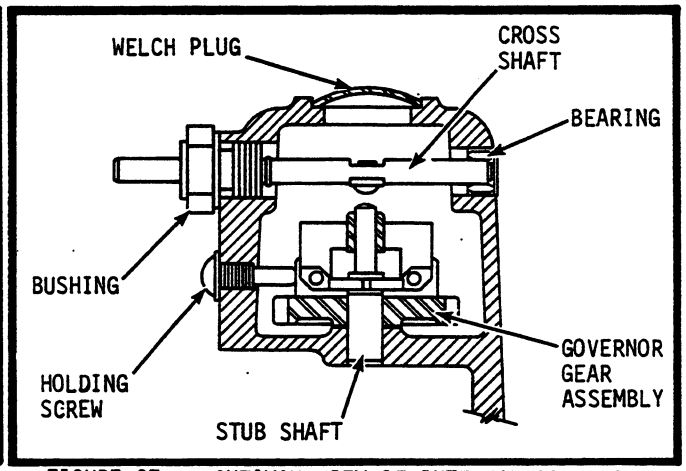


FIGURE 27 -- CUTAWAY VIEW OF INTERNAL GOVERNOR

HOUSING, FAN

Generator must be removed to replace the fan housing. The housing is secured to the engine crankcase with four countersunk screws. Detach the ignition coil, condenser and electric fuel pump from housing being replaced and install these on replacement housing after it is in position.
NOTE: Use same number of gaskets between housing and crankcase as this controls crankshaft end play.

INSERT, VALVE SEAT

Cylinder head and valves must be removed to inspect or recondition the valve seat inserts. Seating surfaces can usually be reconditioned--seating angle is 89° and width should be as close to 1/32" as possible. If width exceeds 1/16", recondition with 45° and 15° cutters. After recutting, valves must be lapped in to provide proper seat. Make sure valve clearance is readjusted after reconditioning the seat inserts.

PAN, OIL

To replace the oil pan or gasket, drain oil from pan, disconnect the engine and generator mounts, lift the engine-generator off the mounting skid then remove the four capscrews securing the pan to the crankcase then remove the oil pan. If the pan is to be replaced, remove the oil level indicator mechanism and transfer to the replacement pan.

HEAD, CYLINDER

To remove the cylinder head, disconnect the engine and generator mounts, then lift the engine-generator off the mounting frame. After this is done, remove the front mount support, spark plug, carburetor (detach at adapter), side air duct then the cylinder head and gasket. Blocked cooling fins often cause localized "hot spots" which can result in "blown" cylinder head gaskets. If gasket fails in area surrounding one of the retaining capscrews, high temperature combustion bases can burn away portions of aluminum alloy head. If no evidence of this is found, head should be checked for flatness. A slightly warped head can be resurfaced by simply rubbing it on a piece of sandpaper positioned on a flat surface. Carefully clean carbon deposits from cylinder head if it is to be reused--use putty knife of similar blade to scrape deposits. Be careful not to nick or scratch aluminum, especially in gasket seat area. Always use new cylinder head gasket and tighten cylinder head capscrews in the sequence and to the torque value specified (refer to Figure 9).

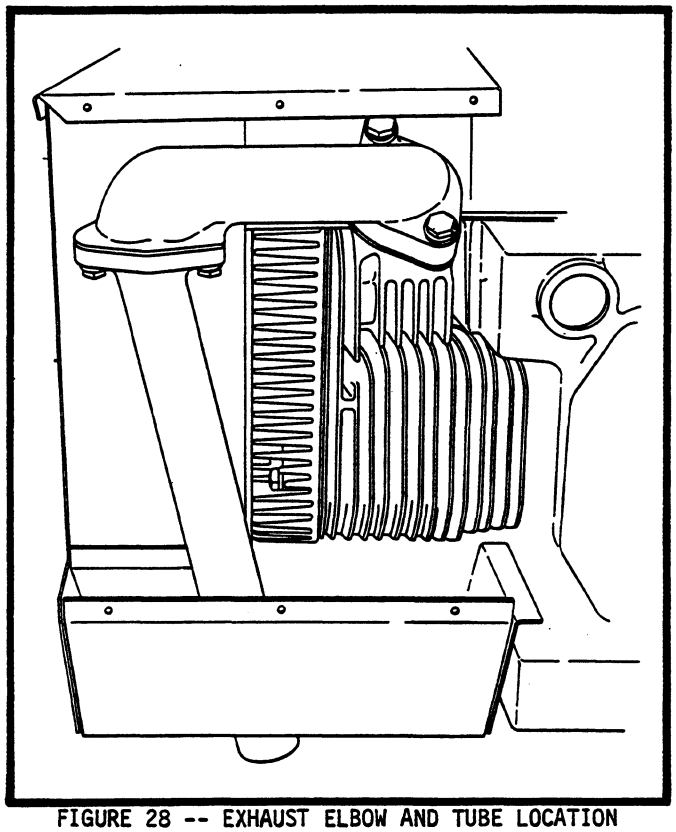


FIGURE 28 -- EXHAUST ELBOW AND TUBE LOCATION

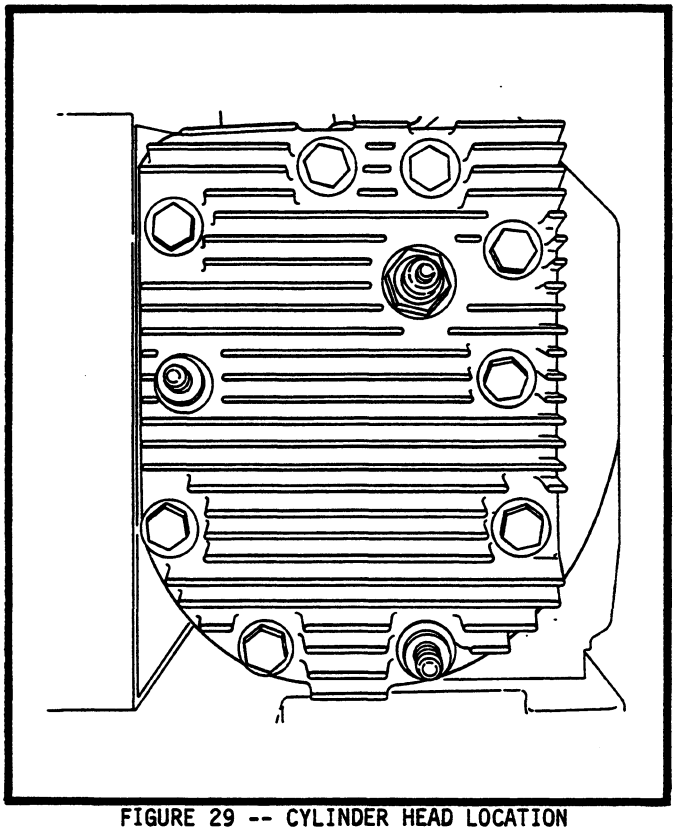


FIGURE 29 -- CYLINDER HEAD LOCATION

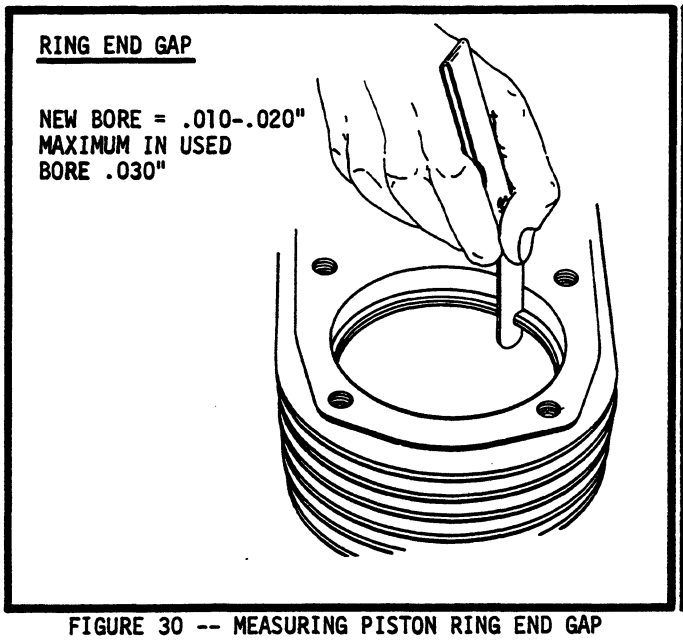


FIGURE 30 -- MEASURING PISTON RING END GAP

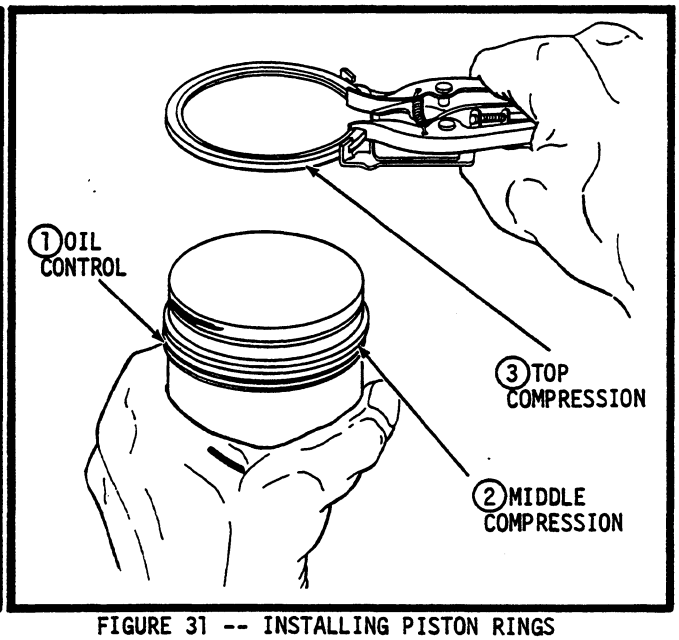


FIGURE 31 -- INSTALLING PISTON RINGS

PISTON - PISTON RINGS

The piston-rod assembly can be removed without complete disassembly of the engine. To remove, disconnect engine and generator from the skid, lift the engine-generator off the skid then remove closure plate and cylinder head. Detach connecting rod from crankshaft then push piston-rod out thru head side of the cylinder. If a ridge has formed on outer edge of the cylinder, this will have to be removed with reamer before piston can be pushed out. Always install new piston rings--service rings are available in a standard set for use with original bore size and in .010", .020" and .030" oversize sets for rebored cylinders. Piston assemblies, including rings, pin and retaining rings, are also available in standard size and .010", .020" and .030" oversizes.

DAMAGE ANALYSIS: Scuffing and scoring of pistons and cylinder walls occurs when internal temperatures approach the melting point of the piston. Temperatures high enough to do this are created either by friction, which is usually attributed to improper lubrication, and/or overheating of the engine itself due to improper cooling. Ring failure is usually indicated by excessive oil consumption and blue exhaust smoke. When rings fail, oil is allowed to enter the combustion chamber where it is burned along with the fuel. High oil consumption can also occur when ring gap is incorrect--rings cannot properly conform to the cylinder walls under this condition. Oil control is also lost when ring gaps are not staggered during installation. When cylinder temperatures get too high, lacquer and varnish collect on pistons causing rings to stick which results in rapid wear of rings. A worn ring takes on a shiny or bright appearance. Scratches on rings and pistons are caused by abrasive material such as carbon or pieces of hard metal. Detonation damage occurs when a portion of the fuel charge ignites spontaneously from heat and pressure shortly after ignition. This creates two flame fronts which meet and explode to create extreme hammering pressures on a specific area of the piston. Detonation generally occurs from using fuels with too low octane rating. Pre-ignition or ignition of fuel charge before the timed spark can cause damage similar to detonation. Pre-ignition damage is often more severe than detonation damage--often, a hole is quickly burned right thru the piston dome by pre-ignition. Pre-ignition is caused by a hot spot in the combustion chamber such as glowing carbon deposits, blocked fins, improperly seated valves or wrong spark plug.

INSTALLATION: Before installing rings on piston, insert rings in cylinder bore to check for proper end gap. If cylinder bore is original size, ring end gap will be .010-.020"--if the bore is worn but within tolerances, end gap up to .030" is acceptable. Replace piston if thrust face diameter is worn beyond 3.7425--measure this just below the oil control ring groove and at right angles to the piston pin. Cylinder bore must be deglazed before using service ring sets.

RINGS-PISTON (Refer to Piston-Piston Rings)

ROD, CONNECTING

Inspection of the connecting rod can be accomplished after lifting the engine-generator off the mounting skid and removing the closure plate.

DAMAGE ANALYSIS: Whenever a rod failure is encountered, look for telltale signs of heat discoloration in the big end area. Note that tin-plated connecting rods do not become black from overheating as do rods that are not plated--tin-plated rods will, however, discolor sufficiently to recognize overheat-

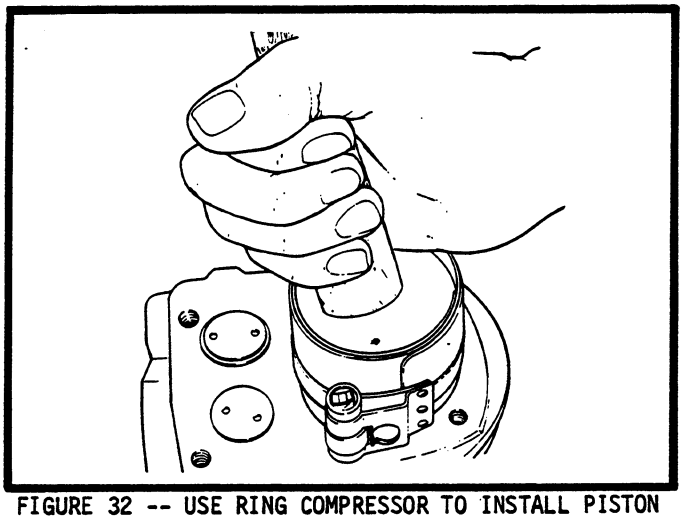


FIGURE 32 -- USE RING COMPRESSOR TO INSTALL PISTON

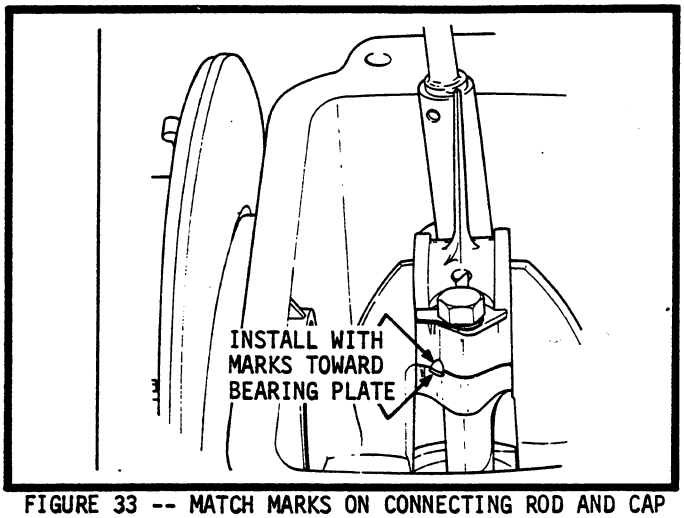


FIGURE 33 -- MATCH MARKS ON CONNECTING ROD AND CAP

ing. Discoloration indicates overheating due to lack of proper lubrication. Improper lubrication results from using the wrong type of oil, operating with contaminated oil or oil that has broken down from extensive use. Running completely out of oil or operation with oil level below or above the safe range also contributes to rod failures. When such indicators are noted, stress the importance of using the right oil, keeping the level in the safe range, and changing oil at the specified intervals. Rod failures also occur from carelessness during installation. Apply liberal amounts of oil on crankpin, rod cap and capscrews and tighten rods to the torque values specified. When a rod literally pounds to pieces, the rod capscrews were probably undertightened.

ROD REPLACEMENT: The cylinder head and piston-rod assembly must be removed to replace the rod. Check big end (or crankpin end) for score marks, excessive running and/or side clearance. Replace rod if big end diameter exceeds 1.5025 or if rod to crankpin clearance exceeds .0035". Side clearance should be 1.180". Rods are available in .010" undersize for use with reground crankshaft.

SEAL, OIL

The seal on the outside of the crankcase can be replaced without any disassembly. The generator must be removed to gain access to the inner oil seal which is pressed into the fan housing.

INSTALLATION: Care must be used during installation to prevent the lip of the seal from rolling and creasing. Apply a liberal amount of light grease such as Lubriplate on the seal lip area. Use seal driver and seal sleeve of appropriate size. Press only against outer edge of seal when installing. Press squarely into position to the depth specified in Figure 34.

SWITCH, OIL LEVEL INDICATOR

The switch can be replaced or readjusted without any disassembly of engine or generator. Refer to Figure 35 for correct adjustment of float level. To replace or readjust the indicator switch, simply remove the cover on the outside edge of the oil pan. Make sure lead is connected to the correct post.

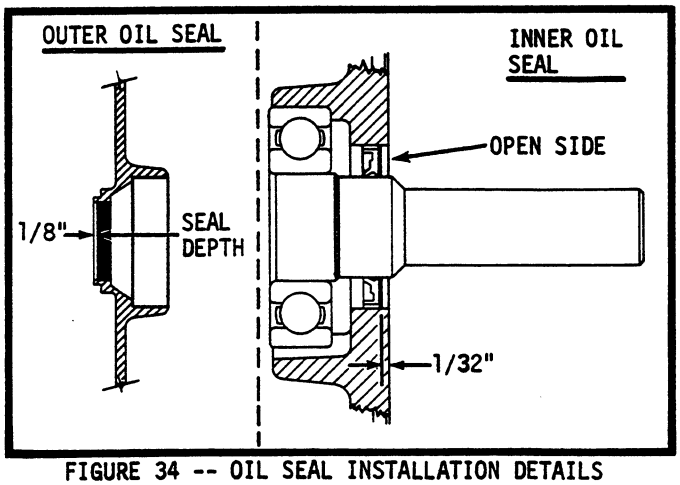


FIGURE 34 -- OIL SEAL INSTALLATION DETAILS

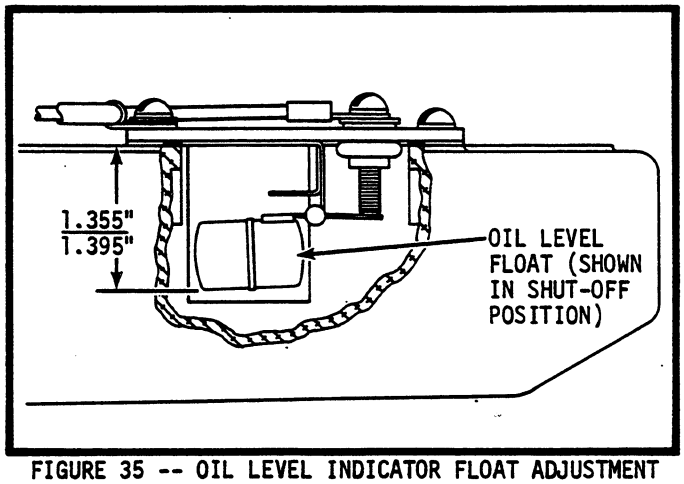


FIGURE 35 -- OIL LEVEL INDICATOR FLOAT ADJUSTMENT

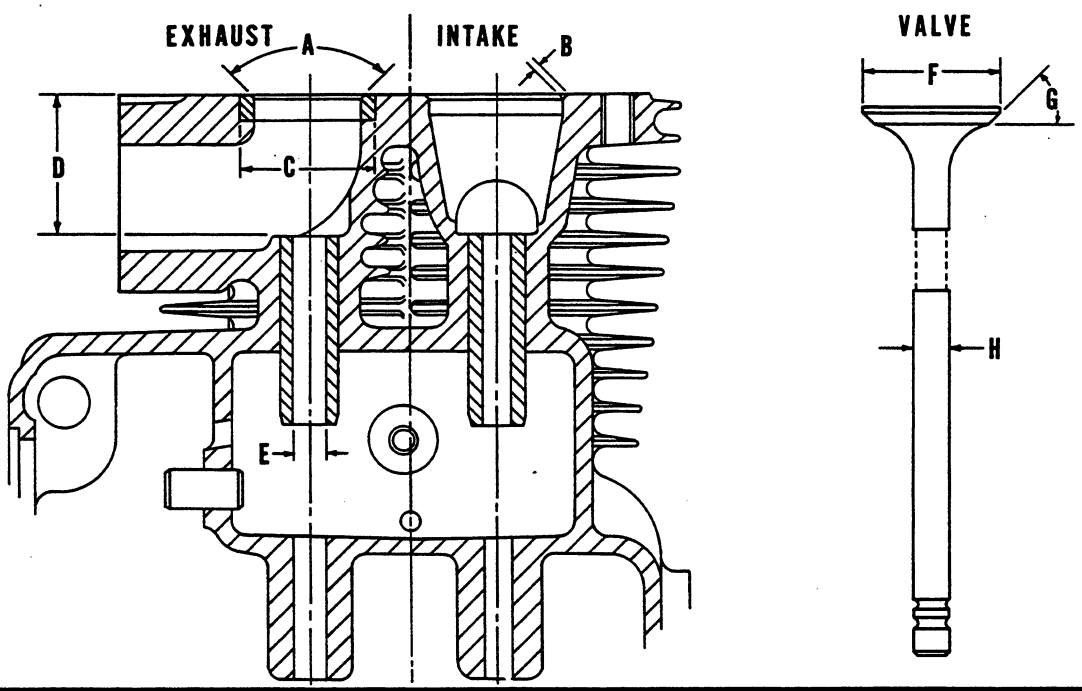
VALVE MECHANISM

Valve clearance can be checked without disassembly of generator or engine. To check or replace valves, valve springs, etc., the engine-generator must be lifted off the mounting skid and the cylinder head must be removed. Hard starting, loss of power accompanied by high fuel consumption could be symptoms of faulty valves although these symptoms could also be attributed to faulty rings--check the valves first.

VALVE ANALYSIS: After removal, clean valve head, face and stem with power wire brush then carefully inspect for defects such as warped head, excessive corrosion, worn stem end. If face and margin are in good shape and the margin is not less than 1/32", the valve could be reconditioned and reused. Corrosion on stem occurs from condensation due to improper preservation during storage or when engine is repeatedly stopped before it has a chance to reach normal operating temperatures. Replace corroded valves. An exhaust valve subject to overheating will have dark discoloration in area above valve guide--worn guides or faulty valve springs could cause this--also check for clogged air intake, blocked cooling fins, or too lean fuel mixture setting when this condition is found. Lead build-up on the inside of the intake valve head indicates the valve is leaking, allowing exhaust gases to enter the intake port. Gum deposits result from using stale fuel--fuel must be drained during the off season to prevent this condition.

REPLACEMENT: After removing the cylinder head and breather components, compress the valve spring with valve compressor, remove keepers, rotator, spring and retainer then release the compressor and remove the valve. If seating surface is in good condition (refer to Insert-Valve Seat), insert replacement valve then lap in to provide proper seat. Use a valve grinder with suction cup and coat valve face with a "fine" grade of grinding compound. Continue rotating valve on seat until a smooth surface is obtained on seat and valve. Remove all traces of grinding compound before reassembly of valve components. Readjust valve clearance before reinstalling breather parts and cylinder head.

VALVE ADJUSTMENT: Turn crankshaft until both valves are closed. In this position, the cam has no effect on the tappets. Correct valve stem to tappet clearance (engine cold) is .008-.010" for the intake and .017-.020" for the exhaust valve. To adjust, turn the self-locking setscrew on tappet in or out until clearance is correct.



VALVE	A SEAT ANGLE	B SEAT WIDTH	C INSERT O.D.	D GUIDE DEPTH	E GUIDE I.D.	F VALVE HEAD DIA.	G VALVE FACE ANGLE	H VALVE STEM DIA.
INTAKE	89°	.037" / .045"	---	1.586"	.312" / .313"	1.380" / 1.370"	45°	.3110" / .3103"
EXHAUST	89°	.037" / .045"	1.5045" / 1.5035"	1.497"	.312" / .313"	1.380" / 1.370"	45°	.3091" / .3085"

FIGURE 36 -- VALVE PORT SPECIFICATIONS

RUNNING CLEARANCES - WEAR TOLERANCES

CYLINDER BORE	
New Diameter	3.750"
Wear Diameter - Maximum	3.753"
Taper - Maximum	.0015"
Out of Round - Maximum	.005"
CRANKSHAFT	
End Play (Free)	.003-.020"
Crankpin - New Diameter	1.500"
Crankpin - Max. Out of Round	.0005"
Crankpin - Max. Taper	.001"
CAMSHAFT	
Running Clearance on Pin	.001-.0035"
End Play	.005-.010"
CONNECTING ROD	
Big End - Max. Diameter	1.5025"
Rod To Crankpin - Max. Clearance	.0035"
Small End - New Diameter	.87585"
Rod To Pin Clearance	.0003-.0008"
PISTON - PISTON RINGS	
Thrust Face* - Max. Wear Diameter	3.7425"
Thrust Face to Bore Clearance	.007-.010"
Ring - Max. Side Clearance	.006"
Ring End Gap - New Bore	.010-.020"
Ring End Gap - Max. In Worn Bore	.030"
VALVE - INTAKE	
Cold Clearance - Valve to Tappet	.008-.010"
Valve Lift - Zero Lash	.324"
Stem to Guide - Max. Clearance	.0045"
Tappet Clearance in Block	.0008-.0023"
VALVE - EXHAUST	
Cold Clearance - Valve to Tappet	.017-.020"
Valve Lift - Zero Lash	.324"
Stem to Guide - Max. Clearance	.0065"
Tappet Clearance in Block	.0008-.0023"
IGNITION	
Spark Plug Gap	.025"
Breaker Point Gap	.020"
Spark Run °BTDC	20°
TORQUE SPECIFICATIONS	
Spark Plug	18-22 ft. lbs.
Cylinder Head	25 ft. lbs. **
Connecting Rod	300 in. lbs.

* Measure just below oil control ring at right angles to piston pin.

**See Page 8 for tightening sequence

TORQUE (CONTINUED)

STANDARD BOLTS, SCREWS AND NUTS

Size	Tightening Torque		
	Grade 2	Grade 5	Grade 8
1/4-20	70 in. lb.	115 in. lb.	165 in. lb.
1/4-28	85 in. lb.	140 in. lb.	200 in. lb.
5/16-18	150 in. lb.	250 in. lb.	350 in. lb.
5/16-24	165 in. lb.	270 in. lb.	30 ft. lb.
3/8-16	260 in. lb.	35 ft. lb.	50 ft. lb.
3/8-24	300 in. lb.	40 ft. lb.	60 ft. lb.
7/16-14	35 ft. lb.	55 ft. lb.	80 ft. lb.
7/16-20	45 ft. lb.	75 ft. lb.	105 ft. lb.
1/2-13	50 ft. lb.	80 ft. lb.	115 ft. lb.
1/2-20	70 ft. lb.	105 ft. lb.	165 ft. lb.
9/16-12	75 ft. lb.	125 ft. lb.	175 ft. lb.
9/16-18	100 ft. lb.	165 ft. lb.	230 ft. lb.
5/8-11	110 ft. lb.	180 ft. lb.	260 ft. lb.
5/8-18	140 ft. lb.	230 ft. lb.	330 ft. lb.
3/4-10	150 ft. lb.	245 ft. lb.	350 ft. lb.
3/4-16	200 ft. lb.	325 ft. lb.	470 ft. lb.

CONVERSION TABLE (INCH LBS. TO FOOT LBS.)										
FOOT LBS.	5	10	15	20	25	30	35	40	45	50
INCH LBS.	60	120	180	240	300	360	420	480	540	600

Divide inch lbs. by 12 for foot pound values.
Multiply foot lbs. by 12 for inch pound values.

GENERATOR SPECIFICATIONS

Output - watts 4000

Output - voltage (regulation ± 5%) 120

Cyclic Compensator Setting ..... 3.5 ohms

Exciter Voltage ..... 36 - 40

Battery charge rate-high ..... 6 amps

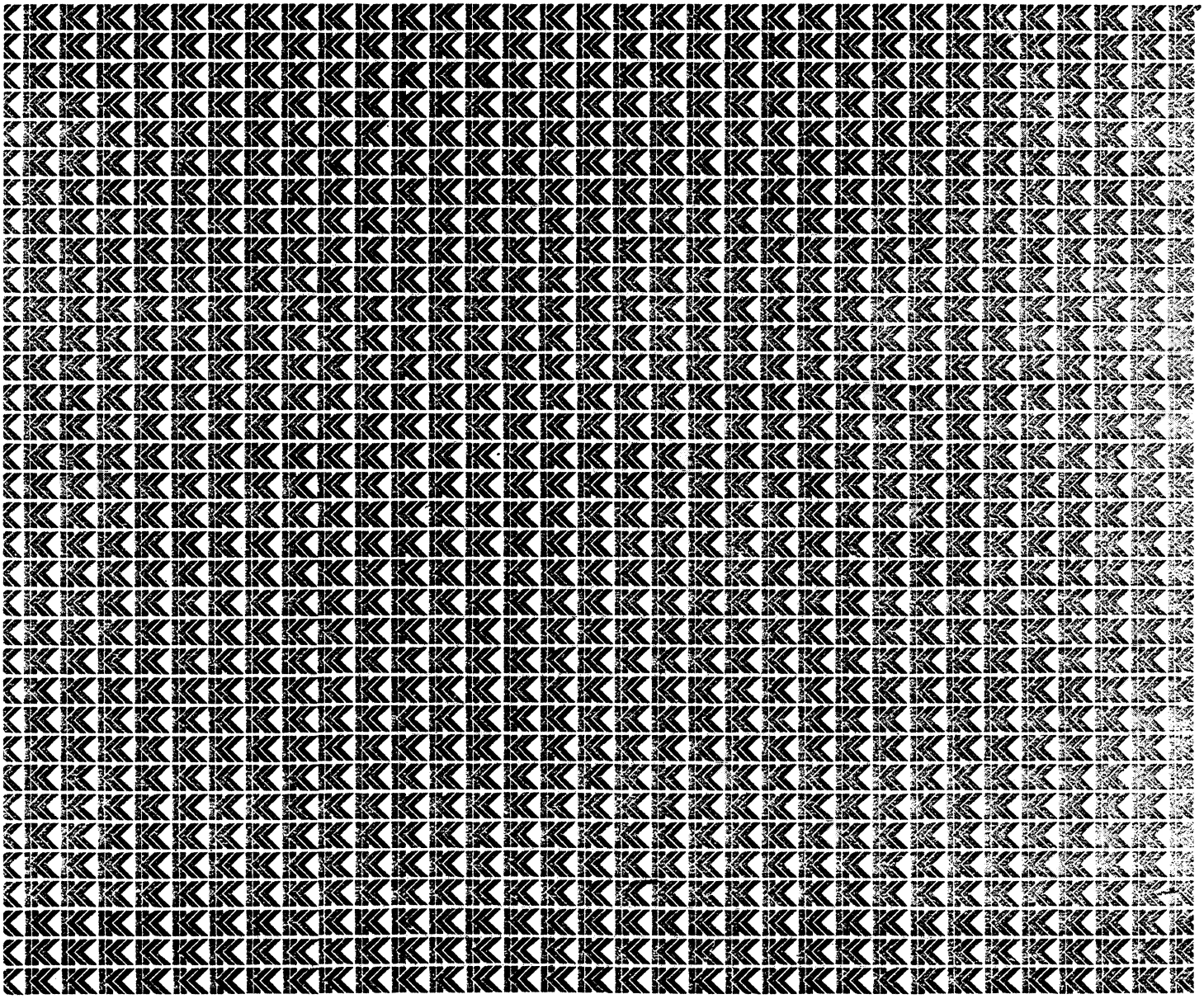
Battery charge rate-low ..... .3 amps

Shunt Field Resistance - Cold ..... 3 ohms

Shunt Field Resistance - Hot ..... 3.7 ohms

KOHLER

K341L ENGINE SERVICE MANUAL



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