

# Service Manual

## RV Generator Sets



### Models:

3.5CM21  
3.5CM61  
3.5CFM21  
3.5CFM61  
4.5CM21  
4.5CM61  
4.5CFM21  
4.5CFM61  
5.5CM21  
5.5CM61  
5.5CFM21  
5.5CFM61  
7CM21  
7CM61

**KOHLER**<sup>®</sup>  
POWER SYSTEMS

# TABLE OF CONTENTS

	Page		Page
Safety Precautions .....			
<b>SECTION 1. INTRODUCTION AND SPECIFICATIONS</b>		<b>SECTION 5. DECISION MAKER CONTROLLER</b>	
1-1. Introduction .....	1-1	5-1. Description .....	5-1
1-2. Model 3.5CM21-RV .....	1-1	5-2. Sequence of Operation .....	5-1
1-3. Model 4.5CM21-RV .....	1-1	5-3. Fuses .....	5-3
1-4. Model 5.5CM21-RV .....	1-1	5-4. Circuit Boards .....	5-3
1-5. Model 7CM21-RV .....	1-1	5-5. Circuit Board Foil Repair .....	5-3
1-6. Oil Specifications .....	1-4		
1-7. Fuel Specifications .....	1-4		
<b>SECTION 2. OPERATION</b>		<b>SECTION 6. GENERATOR</b>	
2-1. General .....	2-1	6-1. General .....	6-1
2-2. Prestart Checklist .....	2-1	6-2. Troubleshooting .....	6-1
2-3. Operation .....	2-1	6-3. Generator Disassembly .....	6-2
		6-4. Build-Up Circuit .....	6-5
<b>SECTION 3. SCHEDULED MAINTENANCE</b>		6-5. Brushes .....	6-5
3-1. General .....	3-1	6-6. Collector Rings .....	6-5
3-2. Scheduled Maintenance .....	3-1	6-7. Exciter Voltage Regulator .....	6-6
		6-8. Stator .....	6-8
<b>SECTION 4. TROUBLESHOOTING</b>		6-9. Rotor .....	6-8
4-1. General .....	4-1	6-10. Interlock Circuit Board .....	6-9
4-2. RV Systems Check .....	4-1	6-11. Generator Reassembly .....	6-10
4-3. Troubleshooting .....	4-3		
		<b>SECTION 7. CHOKE, SHUTDOWN CONTROL, AND GOVERNOR</b>	
		7-1. Choke Testing and Adjustments (3.5kW, 4.5kW) .....	7-1
		7.2 Choke Testing and Adjustments (5.5kW, 7kW) .....	7-3
		7.3 Positive Shutdown Control .....	7-3
		7.4 Governor (3.5kW, 4.5kW) .....	7-4
		7.5 Governor Hunting Checks (4.5kW Only) .....	7-5
		7.6 Governor (5.5kW, 7kW) .....	7-5
		<b>SECTION 8. WIRING DIAGRAMS</b>	

# Safety Precautions

A Generator Set, like any other electro-mechanical device can pose potential dangers to life and limb if improperly maintained or imprudently operated. The best safeguards against accident are to be ever mindful of the potential dangers and to always use good common sense. In the interest of safety, some general precautions relating to operating of a Generator Set are presented below. Keep these in mind.

## WARNING

**LETHAL EXHAUST GAS!** An engine discharges deadly carbon monoxide as part of the exhaust when operating. Carbon monoxide is particularly dangerous in that it is an odorless, tasteless, and nonirritating gas, but be ever mindful that it can cause death if inhaled for even a short period of time. Have only qualified specialists install and replace exhaust system components and have the system inspected frequently. Be careful when parking your coach to avoid obstructing the exhaust outlet. The exhaust gasses must discharge freely, otherwise carbon monoxide may deflect under and into the vehicle or enter through open doors, windows, or vents. Also make sure that your exhaust cannot be discharged toward neighboring RV's, campers, or any occupied building. Be especially watchful for exhaust accumulation under calm, windless conditions.

## WARNING

**ELECTRICAL SHOCK!** Battery can cause electrical burns and shocks. Exercise reasonable care when working near the battery to avoid electrical connections through tools. Remove wristwatch, rings, and any other jewelry.

## WARNING

**HIGH VOLTAGE!** Remember that the function of a generator set is to produce electricity and that wherever electricity is present, there is the potential danger of electrocution. Take the same precautions with electrical appliances in your coach that you would observe in your home. Keep away from electrical circuits and wiring while the set is running and have electrical service performed only by qualified electricians. Make sure unqualified persons, especially children, cannot gain access to your set — keep the compartment door locked or securely latched at all times. Be sure that generator is properly grounded. Never touch electrical leads or appliances with wet hands, when standing in water, or on wet ground as the chance of electrocution is especially prevalent under such conditions.

## WARNING

**UNIT STARTS WITHOUT NOTICE!** To prevent accidental starting on units with a remote start/stop switch, always disconnect battery (remove negative lead first and reconnect it last) to disable generator set before working on any equipment connected to generator.

## WARNING

**DANGEROUS ACID!** Avoid contact with battery electrolyte. It contains acid which can eat holes in clothing, burn skin, and cause permanent damage to eyes. Always wear splash-proof safety goggles when working around the battery. If battery electrolyte is splashed in the eyes or on skin, immediately flush the affected area for 15 minutes with large quantities of clean water. In the case of eye contact, seek immediate medical aid. Never add acid to a battery once the battery has been placed in service. Doing so may result in dangerous spattering of electrolyte.

## WARNING

**EXPLOSIVE BATTERY GASES!** The gases generated by a battery being charged are highly explosive. Do not smoke or permit flame or spark to occur near a battery at any time, particularly when it is being charged. Avoid contacting terminals with tools, etc., to prevent burns and to prevent sparks that could cause an explosion. Remove wristwatch, rings, and any other jewelry before handling battery. Any compartment containing batteries should be well ventilated to prevent accumulation of explosive gases. To avoid sparks, do not disturb battery charger connections while battery is being charged and always turn charger off before disconnecting battery connections. Turn automotive test equipment off when connecting or removing battery clips. When removing or reconnecting battery cables, make sure ignition switch and all accessories are turned off.

## WARNING

**EXCESSIVE NOISE!** Never operate without adequate muffler or with faulty exhaust system — exposure to excessive noise is not only tiring but can lead to impairment of hearing.

## WARNING

**HOT PIPING!** An engine gets hot while running and exhaust system components get extremely hot. Do not work on generator set until unit is allowed to cool.

## WARNING

**DANGEROUS FUELS!** Use extreme caution when handling, storing, and using fuels — all fuels are highly explosive in a vapor state. Store fuel in a well-ventilated area away from spark producing equipment and out of the reach of children. Never add fuel to the tank while the engine is running to prevent spilled fuel from igniting on contact with hot parts or from ignition spark. Keep fuel lines and connections tight and in good condition — don't replace flexible fuel lines with rigid lines. Flexible sections are used to avoid breakage due to vibration. Should any fuel leakage, fuel accumulation, or electrical sparks be noted, **DO NOT OPERATE GENERATOR SET.** Have sys-

tems repaired by qualified specialists before resuming generator operation. Additional precautions should be taken when using the following fuels:

**Gasoline**—Store gasoline only in approved red containers clearly marked **GASOLINE**. Don't store gasoline in any occupied building.

**Propane (LP)**—Adequate ventilation is mandatory. Propane is heavier than air; install gas detectors low in room. Inspect detectors often.

 **WARNING**

**UNINTENTIONAL STARTING!** To prevent accidental starting when checking choke operation, remove spark plug lead(s) at spark plug(s).

 **WARNING**

**FLASH FIRE!** A sudden flash fire can cause serious burns. To avoid the possibility of a flash fire, do not smoke or permit flame or spark to occur near carburetor, fuel line, fuel filter, fuel pump, or other potential sources of spilled fuel or fuel vapors.

 **WARNING**

**ELECTROCUTION!** Your RV generator set must not be used to “backfeed” by connecting it to building/camp-ground electrical circuits. Doing so can cause serious injury or death to utility personnel working on utility transmission lines and may also seriously injure persons in your household. Unauthorized connection may be unlawful in some states and/or localities. A transfer switch must be installed in the RV to prevent interconnection of generator and outside source of power.

 **WARNING**

**BACKFIRE!** A sudden backfire can cause serious burns. Keep hands and face away from the carburetor when the air cleaner is removed.

 **WARNING**

**FIRE HAZARD!** Keep the compartment and generator set clean and free of debris to minimize chances of fire. Also remember that hot exhaust gases and exhaust system parts could start grass fires. Keep away from hot engine and generator parts to avoid burning yourself.

 **WARNING**

**MOVING PARTS!** Do not open generator set compartment door when unit is running, except for servicing by qualified specialists. Replace guards, covers, and screens (if used) before operating generator set.

 **WARNING**

**HIGH VOLTAGE!** When the power cord is plugged in during voltage regulator test, the AC pins become “hot” and there is danger of electrocution.

 **WARNING**

**EXPLOSION!** Use generator sets specified for RV use in RV installations only.

## SECTION 1

### INTRODUCTION AND SPECIFICATIONS

#### 1-1. INTRODUCTION

This manual covers operation, scheduled maintenance troubleshooting and corrective maintenance for Kohler generator sets designed and built for recreational vehicles. The four standard models are the 3.5CM21-RV, 4.5CM21-RV, 5.5CM21-RV and 7CM21-RV. These models are referred to by their kilowatt output, 3.5KW, 4.5KW, 5.5KW and 7KW. Differences between models are noted throughout the manual. All models feature Kohler designed and built 4-cycle air-cooled gasoline engines, rotating field generators and Decision Maker Controllers. See Table 1-1 for specifications and model variations, Table 1-2 for dimensions and weight, and Table 1-3 for engine specifications. Refer to the wiring diagrams in the back of the manual.

#### 1-2. MODEL 3.5CM21-RV

This 3500 watt generator set is powered by a single cylinder model K181QS engine. The set produces 120 volt, 29 amp alternating current. It has a rotor with two magnetic poles and operates at 3600 R.P.M., producing 60 hertz or 3000 R.P.M., producing 50 hertz, 13 amp current. A 30 amp circuit breaker protects the set from overload damage. Due to its compact size and lightweight, it is installed in RV's with limited suspension support and compartment space. See Figure 1-1 for major components.

#### 1-3. MODEL 4.5CM21-RV

This 4500 watt generator set is powered by a single cylinder Kohler Model K341QS engine. The set produces 120 volt, 37.7 amp alternating current. It has a rotor with four magnetic poles and operates at 1800 R.P.M., producing 60 hertz. A 40 amp line circuit breaker protects generator against damage due to overload. See Figure 1-2 for major components.

#### 1-4. MODEL 5.5CM21-RV

The 5500 watt generator set is powered by a two cylinder Kohler Model K582QS engine. The set produces 120 volt, 46 amp alternating current. It has a rotor with four magnetic poles and operates at 1800 R.P.M., producing 60 hertz. A 50 amp circuit breaker (on most models) protects against damage due to overload. See Figure 1-3 for major components.

#### 1-5. MODEL 7CM21-RV

The 7000 watt generator set is powered by a two cylinder Kohler Model K582QS engine. The set produces 120 volt, 58 amp alternating current. It has a rotor with four magnetic poles and operates at 1800 R.P.M., producing 60 hertz. A 60 amp circuit breaker (on most models) protects against damage due to overload. See Figure 1-3 for major components.

Model	Volts	Amps Per Terminal	Watts	Freq. (HZ)	RPM	Wires	Phase
3.5CM21-RV	120	29	3500	60	3600	2	1
3.5CM61-RV	120/240	14.5	3500	60	3600	3	1
3.5CFM21-RV	120	26.6	3200	50	3000	2	1
3.5CFM61-RV	120/240	13.3	3200	50	3000	3	1
4.5CM21-RV	120	37.5	4500	60	1800	2	1
4.5CM61-RV	120/240	18.8	4500	60	1800	3	1
4.5CFM21-RV	120	30	3600	50	1500	2	1
4.5CFM61-RV	120/240	15	3600	50	1500	3	1
5.5CM21	120	46	5500	60	1800	2	1
5.5CM61	120/240	23	5500	60	1800	3	1
5.5CFM21	120	37.5	4500	50	1500	2	1
5.5CFM61	120/240	18.8	4500	50	1500	3	1
7CM21	120	58	7000	60	1800	2	1
7CM61	120/240	26	7000	60	1800	3	1

Table 1-1. Generator Specifications

Specification	3.5 Model	4.5 Model	5.5 Model	7.0 Model
Weight (approximate)	146 lb.	237 lb.*	315 lb.	350 lb.
Length — Overall	22"	23-13/16"	26"	27-1/2"
Width — Overall	13-3/4"	18-3/16"	21-1/2"	21-1/2"
Height — Overall	15-3/4"	19-1/16"	20-3/8"	20-3/8"

Table 1-2. Dimensions and Weight

\*Earlier Models 250 lb.

Specifications	3.5 Model	4.5 Model	5.5 Model	7.0 Model
Fuel Inlet Connection Size	1/4" I.D.	1/4" I.D.	1/4" I.D.	1/4" I.D.
Battery Voltage	12V	12V	12V	12V
Battery Amp Hr.	32 to 45	32 to 45	32 to 45	32 to 45
Battery Ground	Negative	Negative	Negative	Negative
Battery Cranking Current	40 amps	76 amps	98 amps	98 amps
Battery Charging Current	15 amps	7 amps	7 amps	7 amps
Engine Model	K181QS	K341QS	K582QS	K582QS
Breaker Point Gap	0.020"	0.016" to 0.020"	0.020"	0.020"
Number of Cylinders	1	1	2	2
Cylinder Block	Cast Iron	Cast Iron	Cast Iron	Cast Iron
Rated Horsepower	8	9.2	13.8	13.8
RPM	3600	1800	1800	1800
Bore	2.94"	3.50"	3.50"	3.50"
Stroke	2.75"	3.25"	3"	3"
Valve Material				
Intake	Forged Steel	Forged Steel	Forged Steel	Forged Steel
Exhaust	Stellite	Stellite	Stellite	Stellite
Valve Rotators	Exhaust Valves	Exhaust Valves	Exhaust Valves	Exhaust Valves
Cylinder Head	Aluminum Alloy	Aluminum Alloy	Aluminum Alloy	Alluminum Alloy
Piston Rings	2 Compression 1 Oil	2 Compression 1 Oil	2 Compression 1 Oil	2 Compression 1 Oil
Crankshaft	Ductile Iron	Ductile Iron	Ductile Iron	Ductile Iron
Bearings	Anti-Friction Ball Bearing	Anti-Friction Ball Bearing	Steel Backed Sleeve Type	Steel Backed Sleeve Type
Connecting Rod	Tin Plated Aluminum Alloy	Tin Plated Aluminum Alloy	Tin Plated Aluminum Alloy	Tin Plated Aluminum Alloy
Governor	Oil Bathed, Flyweight	Oil Bathed, Flyweight	Oil Bathed, External Flyweight	Oil Bathed External Flyweight
Lubrication System	Splash	Splash	Pressure	Pressure
Fuel System Choke	Automatic Thermal/Electric	Automatic Thermal/Electric	Automatic Thermal/Electric	Automatic Thermal/Electric
Fuel Pump	Anti-Vapor Lock-Electric 12V	Anti-Vapor Lock-Mechanical	Anti-Vapor Lock-Electric 12V	Anti-Vapor Lock-Electric 12V
Fuel Pump Outlet Pressure	2.75 to 3.50 psi	0.29 to 0.65 psi	2.75 to 3.50 psi	2.75 to 3.50 psi
Ignition Type	Battery	Battery	Battery	Battery
Spark Plug Type	Resistor	Resistor	Resistor	Resistor
Spark Plug Size	3/8" Reach (14mm)	3/8" Reach (14mm)	7/16" Reach (14mm)	7/16" Reach (14mm)
Spark Plug Gap	0.035"	0.035"	0.035"	0.035"
Starter Motor	Bendix Auto- motive Type	Bendix Auto- motive Type	Bendix Auto- motive Type	Bendix Auto- motive Type
Air System				
Combustion	16 cfm	16 cfm	25 cfm	25 cfm
Cooling	360cfm	380cfm	650cfm	650cfm
Total Air Requirements	376cfm	396cfm	675cfm	675cfm
Frequency Regulation	5%	5%	5%	5%
Fuel Consumption				
25% Load	0.35 gal/hr	0.52 gal/hr	0.55 gal/hr	0.56 gal/hr
50% Load	0.46 gal/hr	0.60 gal/hr	0.61 gal/hr	0.66 gal/hr
75% Load	0.57 gal/hr	0.73gal/hr	0.73 gal/hr	0.84 gal/hr
100% Load	0.75 gal/hr	0.92 gal/hr	0.88 gal/hr	1.08 gal/hr

Table 1-3. Engine Specifications

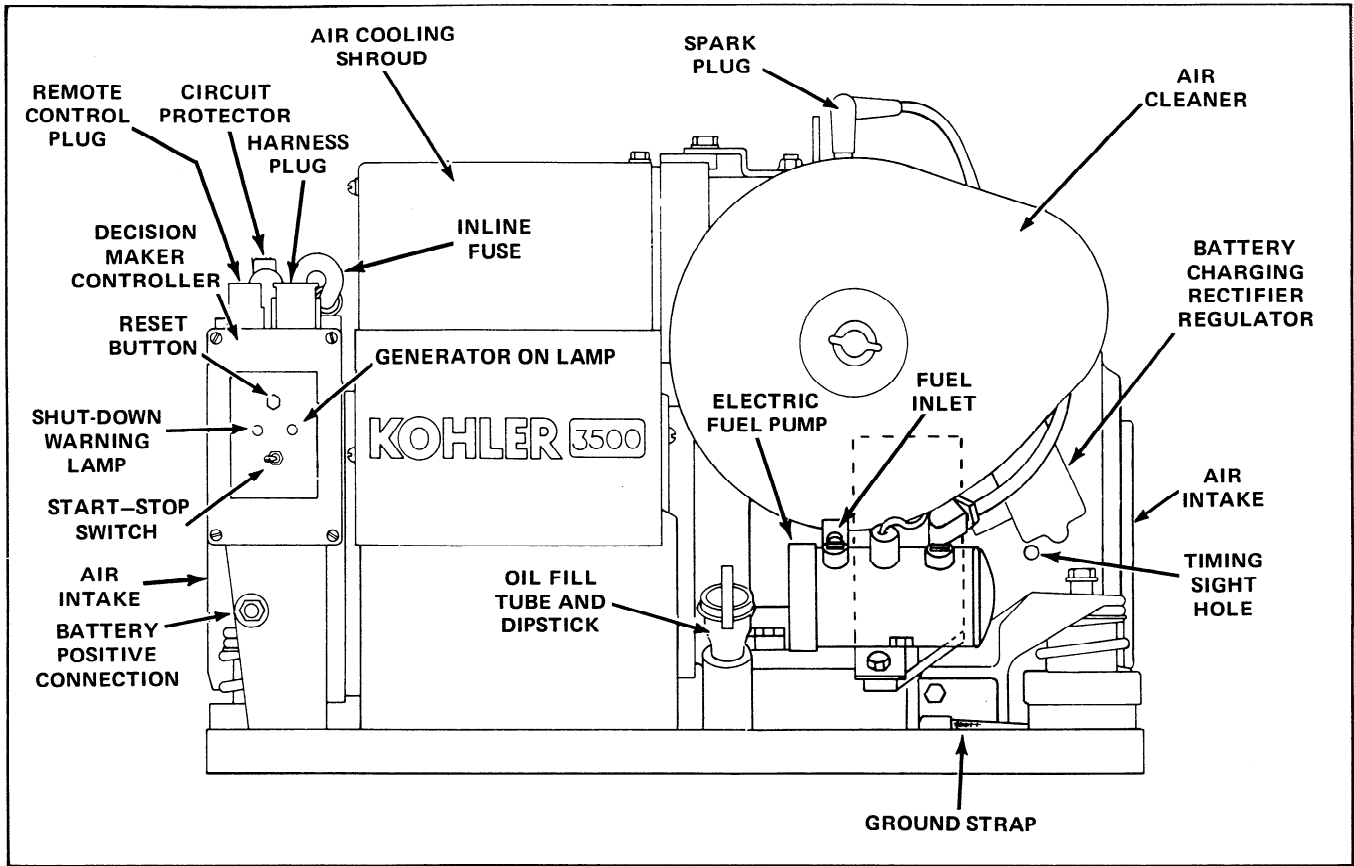


Figure 1-1. Service Side View of a Kohler 3.5CM21-RV Generator Set

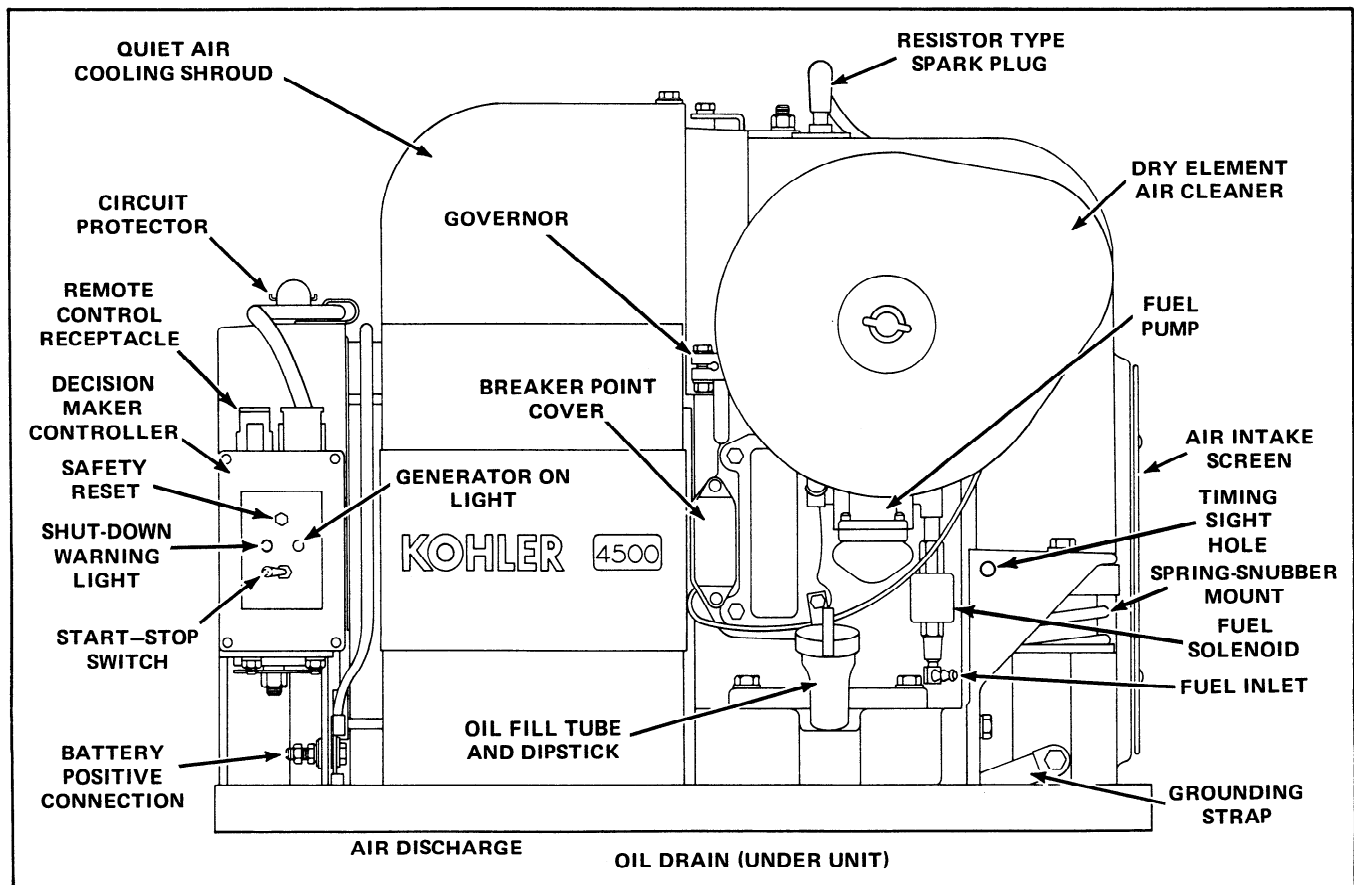


Figure 1-2. Service Side View of a Kohler 4.5CM21-RV Generator Set

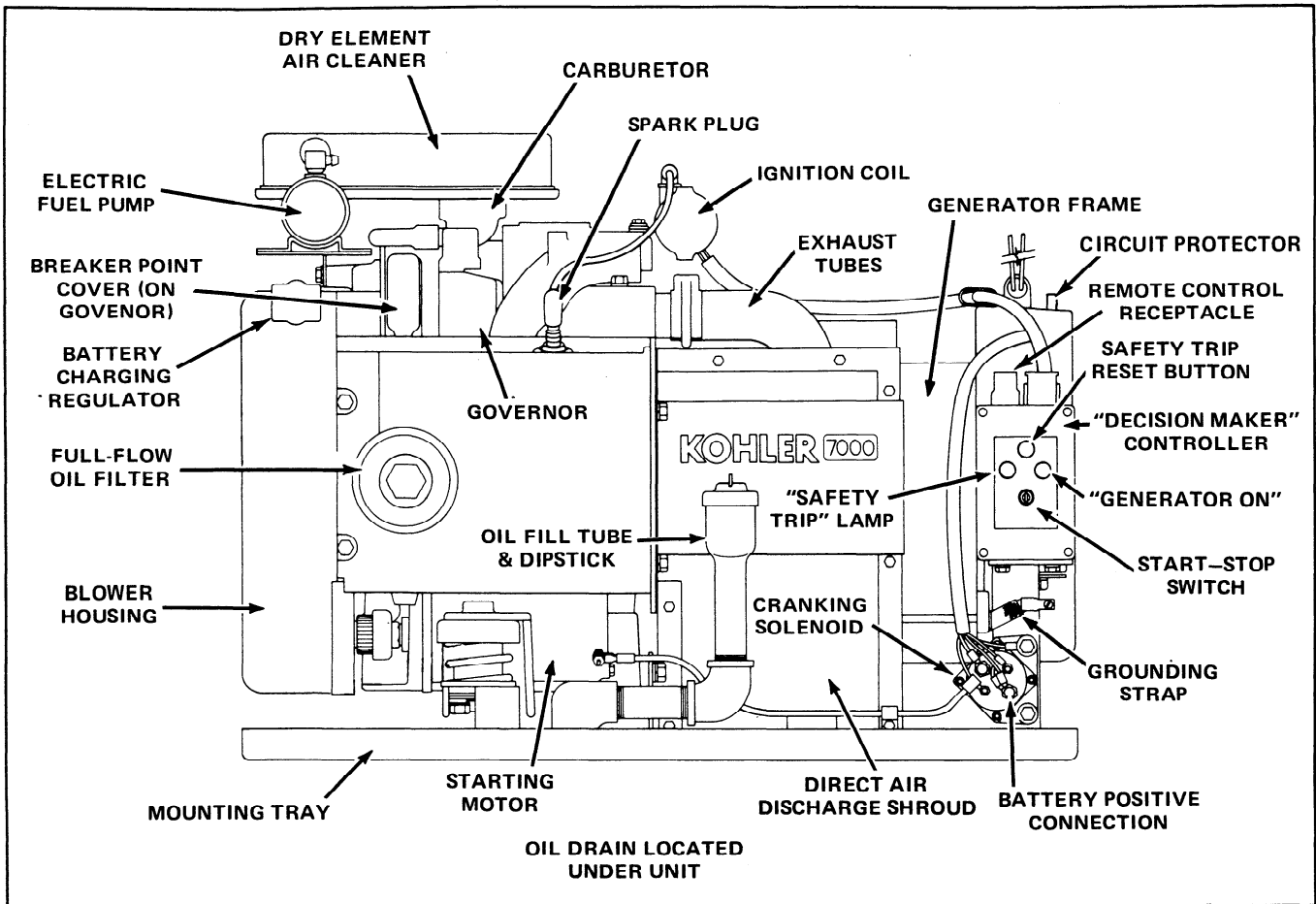
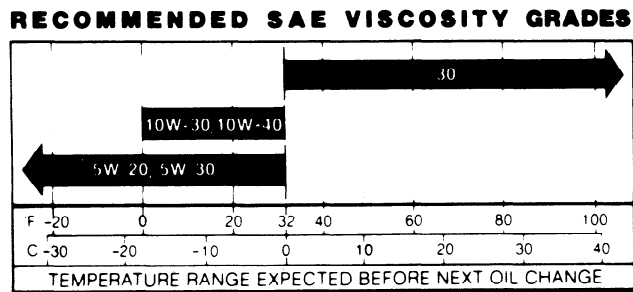


Figure 1-3. Service Side View of a Kohler 5500 or 7000 Watt RV Generator Set

### 1-6. OIL SPECIFICATIONS

Use high quality detergent oil of API (American Petroleum Institute) service class SF. Select viscosity based on the air temperature at the time of operation as shown below:



Straight 30 weight oil is preferred. If multi-viscosity is used, be aware of the resulting increase in oil consumption and combustion deposits when used in temperatures above 32° F (0° C).

Using other than service class SF oil, or extending oil change intervals longer than recommended could cause engine damage which is not covered by the engine warranty.

**For Overhauled Engines Or Those Rebuilt With A New Short Block or Miniblock**—Use straight SAE 30, SF-quality oil for the first 5 hours of operation. Change the oil after this initial run-in period. Refill with SF-quality oil as specified.

MODEL	CAPACITY
3.5CM	1 Quart
4.5CM	2 Quarts
5.5CM	4 Quarts (Additional 1/2 quart when filter is replaced)
7CM	4 Quarts (Additional 1/2 quart when filter is replaced)

Table 1-5. Oil Capacity

### 1-7. FUEL SPECIFICATIONS

For best results, use only clean, fresh, regular grade unleaded gasoline with a pump sticker octane rating of 87 or higher in the U.S.A. In countries using the Research rating method, it should be 90 octane minimum.

Unleaded is recommended since it leaves less combustion chamber deposits. Regular grade leaded gasoline may also be used; however, be aware that the combustion chamber and cylinder head will require more frequent service.

Use fresh gasoline to ensure it is blended for the season, and to reduce the possibility of gum deposits forming which could clog the fuel system. Do not use gasoline left over from the previous season.

Do not add oil to the gasoline.



## SECTION 2 OPERATION

### 2-1. GENERAL

Operation of the generator set is controlled by a single switch on the Kohler Decision Maker Controller (Figure 2-1). This switch is a momentary contact, three-position, start—run—stop switch. The controller has two indicating lamps and a safety reset button. The GENERATOR ON lamp lights up (green) when AC output is available. The SAFETY TRIP lamp lights up (red) when the generator set automatically stops due to the engine overheating. On the 5.5KW and 7KW, low oil pressure will cause red light. If this happens, the cause of overheating or low oil pressure must be eliminated and the SAFETY RESET button pressed before the set can be restarted. The controller includes a keyed connector for installing a remote switch. Operating procedure is the same for the Decision Maker Controller and the optional remote switch.

### 2-2. PRESTART CHECKLIST

Refer to Table 2-1 for all prestart checks.

CHECK	REQUIREMENT
Oil Level	Near Full (Not Over)
Air Inlets	Unobstructed
Compartment	Clean
Air Cleaner	Clean, Properly Installed
Air Shrouding	Tight, Proper Position
Exhaust System	Unobstructed, Properly Installed
Electrical Connections	Clean and Tight

**Table 2-1. Prestart Checklist**

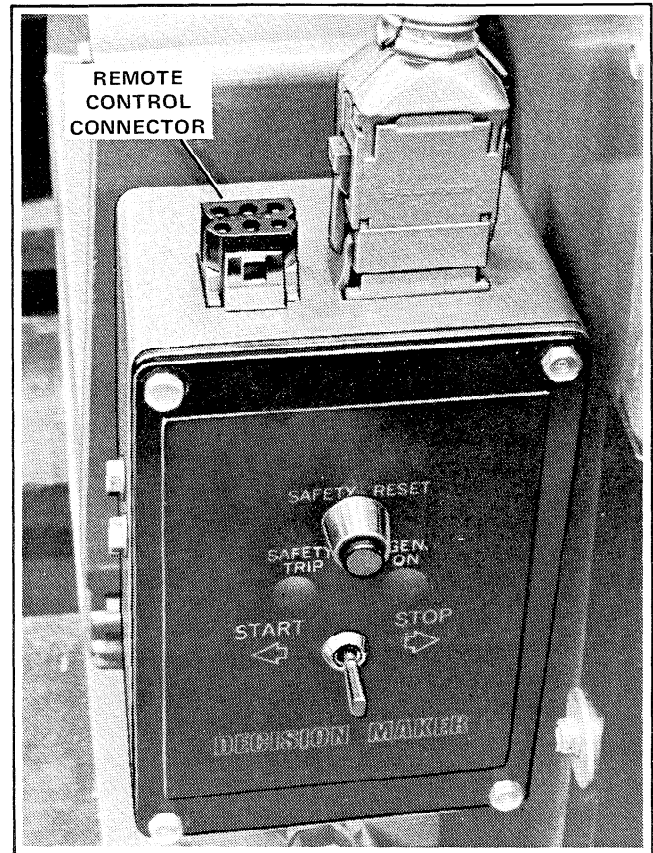
### 2-3. OPERATION

#### NOTE

If the engine shuts itself down due to high engine temperature, overload or other reasons, press the reset switch on the Decision Maker Controller before attempting restart. Also, make sure the circuit protector is in the "on" position so generator output is transferred to the load.

#### CAUTION

In the event of a "false start", that is, the engine gets up sufficient speed to disengage the starter but fails to continue running, allow the engine to come to a complete halt before making a restart attempt. If the flywheel is still rotating when the starter is engaged, the starter pinion and ring gear will clash which may damage the ring gear teeth.



**Figure 2-1. Decision Maker Controller**

1. Move the START-STOP button on the Controller to START position and hold until the engine is running but not more than 10 seconds. Normally the engine will start within five seconds. If the engine does not start in 10 seconds, release the switch and wait a few seconds before moving back to START position. This allows the choke to reset in the full choke position.

2. Whenever possible allow a brief cooling period by running the set at low or no load for a few minutes just prior to shutdown. To stop, move the switch to STOP position and hold until the set comes to a complete halt.

## SECTION 3

### SCHEDULED MAINTENANCE

#### 3-1. GENERAL

Scheduled maintenance is "preventive" maintenance. Major repair can be avoided by correcting problems when they are small. When performing maintenance, always look for signs of potential trouble, such as loose connections or dirty components. When running the set, listen for any unusual noises.

#### 3-2. SCHEDULED MAINTENANCE

Refer to Table 3-1 for scheduled maintenance requirements. Perform each function at the indicated time interval. For each function, refer to the applicable paragraph for instructions.

#### IMPORTANT

For maintenance work on engine components, refer to the Kohler engine service manual which covers the engine model.

Function	Before Each Startup	Every 25 Hours	Every 50 Hours	Every 100 Hours	Every 500 Hours
Compartment – Remove dirt. Blow dry compressed air through cooling inlets (set running).	X				
Air Inlet and Outlet – Clean.	X				
Oil Level – Check.	X				
Check Exhaust Pipe.	X				
Oil – Change.		X			
Oil Filter – Change.				X	
Air Cleaner Element – Clean (change every 200 hrs.).			X		
Fuel Sediment Bowl or Filter (if equipped) – Remove and clean.			X		
Clean Electric Fuel Pump Filter – See owner's manual.			X		
Spark Plug – Clean and regap.				X	
Point Contacts – Service or replace.				X	
Brushes and Collector Rings – Check and service.				X	
Ignition Timing – Check and correct.					X
Rectifier – Regulator – Check condition and battery charging.					X
Alternator Stator – Check leads and connections.					X
Starting Motor – Check brushes & commutator.					X
Engine External Surface – Clean screen, cooling fins, block, oil fill area.					X
Valve Clearance – Check and adjust valve stems and tappets.					X
Crankcase Breather – Check valve and gaskets, clean filter, check hoses.					X
Cylinder Head – Remove, clean and inspect.					X
Electric Fuel Pump – Service filter.			X		

**Table 3-1. Scheduled Maintenance**

## SECTION 4

### TROUBLESHOOTING

#### 4-1. GENERAL

When troubleshooting a generator set, always consider the simplest causes first. Narrow the problem down to a functional system, such as fuel or ignition. To operate efficiently, an engine must have sufficient fuel, a good ignition spark and good compression. All adjustments must be correct. For a generator to produce the required electricity, all parts must be clean, all connections tight, and all components in working order. See Table 4-1 for Engine Troubleshooting and Table 4-2 for Generator Troubleshooting.

#### 4-2. RV SYSTEMS CHECK

The "RV Systems Check" is designed to check the electrical status of an RV generator set prior to connecting and testing with the controller. If the generator does not check out in each step, correct the malfunction before proceeding to the next step.

#### CAUTION

Do not push the CRANK button after the engine is running. Starter damage will result.

#### CAUTION

Do not push the V.B.U. button after the "GEN ON" lamp is on. Voltage regulator damage may result.

#### CAUTION

Do not use the RV Systems Check as a replacement for a Decision Maker. The hi-temp and low oil pressure switches will not shut the machine down in the event of a malfunction. Generator damage will result.

1. Make sure the battery is properly connected and oil is at proper level.

2. Check the three fuses in RV Systems Check tester (Figure 4-1). Replace any blown fuses.

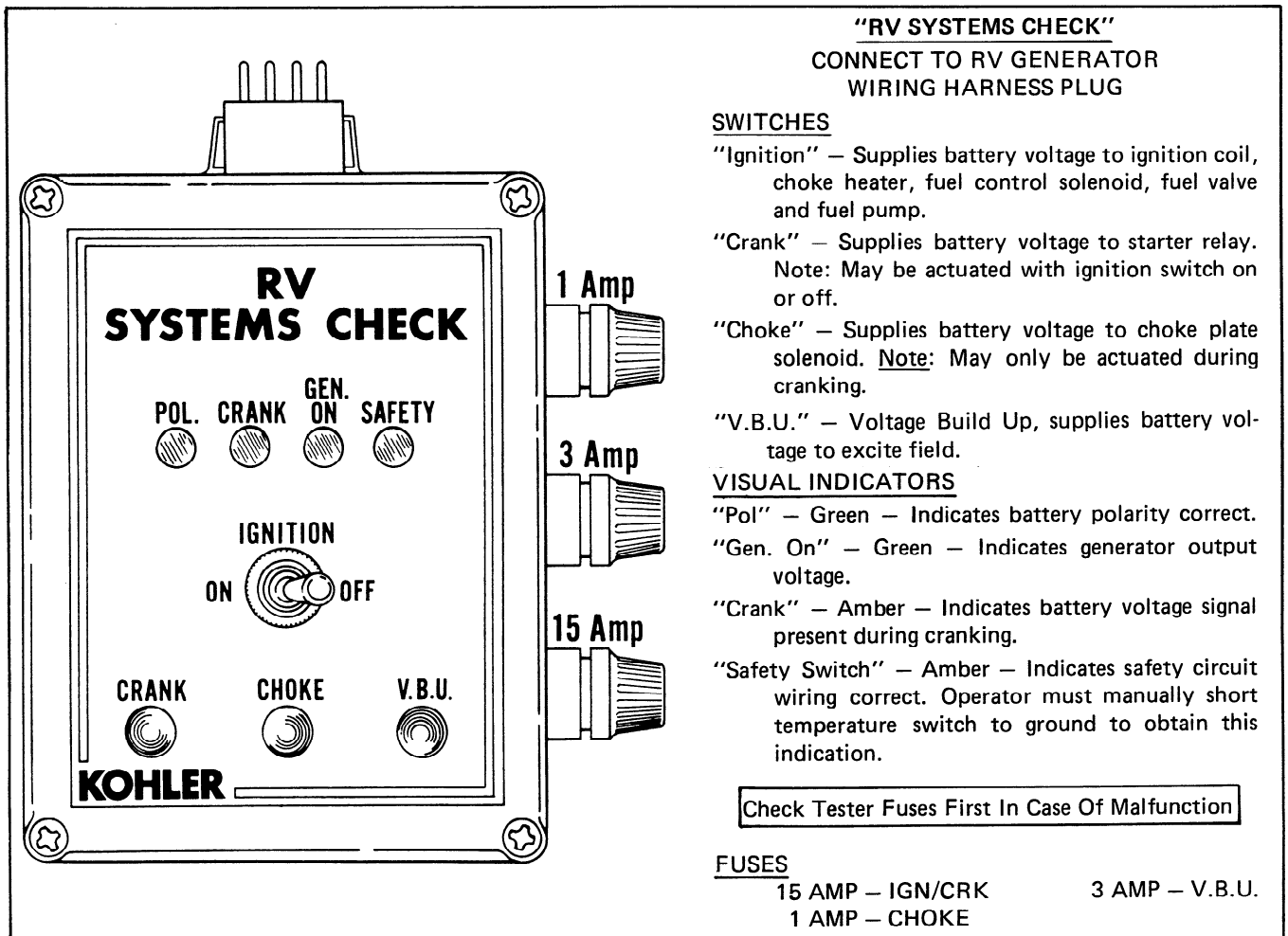


Figure 4-1. RV Systems Check

3. Remove the 12 pin connector from the Decision Maker controller and plug it to the tester.
4. Observe the POL (polarity) lamp. Green light indicates battery polarity is correct. If lamp does not light, check for correct battery connection to the generator set.

#### NOTE

On 5.5KW and 7KW sets the SAFETY lamp will also be on. This indicates the low oil pressure switch is functioning properly.

5. With the IGNITION switch in OFF position, press the CRANK button. The CRANK lamp should light and the engine should crank. If the lamp does not light, no voltage from the battery is present.
6. Remove the air cleaner cover to observe the choke plate during the next step.
7. Again, with the IGNITION switch in OFF position press the crank button. While the engine is cranking, press the CHOKE button to supply battery voltage to the choke plate solenoid. Make sure the choke plate is functioning properly. If not, see Section 7. Release the CRANK and CHOKE buttons.
8. With the IGNITION switch ON, start the engine, using CRANK and CHOKE buttons as needed. If engine does not start, see Troubleshooting, Table 4-1. With engine at opera-

ting speed, press V.B.U. (voltage build-up) button momentarily. Observe GEN ON lamp. Green light indicates generator output voltage is available. If no output voltage is available see Generator Troubleshooting, Table 4-2.

9. Turn the IGNITION switch to OFF position to stop the engine.

#### NOTE

On 5.5KW and 7KW sets, the SAFETY lamp will go off after the engine has begun operating and oil pressure rises above 15 psi.

10. To check the high temperature cutout and/or the low oil pressure cutout. For proper operation start the generator set and connect a jumper wire from the cutout device to ground. The amber "safety" lamp should light, indicating the protective circuit is functioning properly.

11. If all checks are OK, connect the 12 pin connector to the generator set controller.

If the 15 amp fuse blows check for defective cranking solenoid, fuel pump or fuel solenoid, ignition coil, choke heater, fuel shutdown control or shorted wiring.

If the 1 amp fuse blows check for defective choke solenoid or wiring.

If the 3 amp fuse blows check for shorted or grounded generator rotor or defective voltage regulator.

4-3. TROUBLESHOOTING

Refer to Table 4-1 for engine troubleshooting. To make engine repairs, refer to the Kohler engine service manual which covers the engine model. A troubleshooting chart

cannot cover every possible cause of malfunction. Always consider every possible cause of malfunction. Knowledge of four cycle engines and battery ignition systems can be applied. Refer to Table 4-2 to troubleshoot the generator. The table refers to applicable paragraphs in the manual.

CONDITION	POSSIBLE CAUSE
A. Hard Starting or Loss of Power	<ol style="list-style-type: none"> <li>1. Faulty Ignition.                             <ol style="list-style-type: none"> <li>a. Loose or grounded high tension or breaker point leads.</li> <li>b. Improper breaker point gap and timing.</li> <li>c. Defective breaker points.</li> <li>d. Faulty spark plug or improper gap.</li> <li>e. Faulty condenser or coil.</li> </ol> </li> <li>2. Faulty Fuel System.                             <ol style="list-style-type: none"> <li>a. Gasoline not getting to carburetor.                                     <ol style="list-style-type: none"> <li>1. Dirt or gum in fuel line.</li> <li>2. Fuel pump faulty.</li> </ol> </li> <li>b. Dirt in carburetor.</li> <li>c. Carburetor improperly adjusted.</li> <li>d. Choke faulty or improperly adjusted.</li> </ol> </li> </ol>
B. Overheating	<ol style="list-style-type: none"> <li>1. Insufficient available cool air.</li> <li>2. Dirty air intake screen, shroud or cooling fins.</li> <li>3. Improper fuel.</li> <li>4. Fuel mixture too lean.</li> <li>5. Improper ignition timing.</li> <li>6. Engine overloaded.</li> <li>7. Tight tappet clearance.</li> <li>8. Insufficient hot-air discharge opening.</li> </ol>
C. Backfiring	<ol style="list-style-type: none"> <li>1. Fuel mixture too lean.</li> <li>2. Improper timing.</li> <li>3. Valve "Sticking".</li> </ol>
D. Occasional "Skip" at High Speed	<ol style="list-style-type: none"> <li>1. Spark plug gap too wide.</li> <li>2. Improper carburetor setting or lack of fuel.</li> <li>3. Wrong type spark plug. Use resistor type plug.</li> <li>4. Improper timing.</li> </ol>
E. Operating Erratically	<ol style="list-style-type: none"> <li>1. Clogged fuel line.</li> <li>2. Water in fuel.</li> <li>3. Faulty choke control.</li> <li>4. Improper fuel mixture.</li> <li>5. Loose ignition connections.</li> <li>6. Air leaks in manifold or carburetor connections.</li> <li>7. Vent in gas cap plugged.</li> <li>8. Fuel pump faulty.</li> </ol>

Table 4-1. Engine Troubleshooting

Refer to Kohler Service Manual for Repair.  
 Refer to Generator Owner's Manual for Adjustments.

CONDITION	POSSIBLE CAUSE/CORRECTION
No AC output, green lamp off.	Fuse in controller blown (5-3).
Engine starts, then stops when start switch is released.	10 amp fuse blown (5-3). If blows after replacement check for defective wiring, generator and generator voltage regulator.
Engine runs, AC voltage is present but green lamp does not come on.	1 amp fuse blown (5-3).
Engine will not crank.	1. Defective switch circuit board (5-4). 2. Loose pin in electrical connector. 3. Open in foil pattern of Main Circuit Board.
Engine cranks but will not start.	1. Defective main circuit board (5-4). 2. Foil burnt (5-5). 3. Defective choke. 4. In line fuse to ignition coil blown.
Engine shuts down.	1. 10 amp in-line fuse blown (5-3). 2. Radiated electrical noise from ignition circuit affecting logic circuitry in the controller.
No AC output, green lamp "on".	1. Circuit protector left in OFF position. Reset to ON position. If the breaker trips after starting, reduce the load on the generator set. 2. Short circuit. Check all wiring and voltage regulator.
Low output or excessive drop in voltage, green lamp "ON".	1. Set overloaded. Reduce the load. 2. Defective voltage regulator. Replace.
Engine will not crank properly.	Check for loose wiring connections.
Low AC voltage. (Below 110V)	1. Worn brushes (6-5). 2. Defective voltage regulator (6-7); replace. NOTE: Before installing use thermal compound (#287945) and apply thin coat on base of regulator. 3. Low engine speed.
High AC voltage.	1. Defective voltage regulator (6-7); replace. NOTE: Before installing, use thermal compound (#287945) and apply thin coat on base of regulator). 2. High engine speed.
Engine starts, then stops when start switch is released (no red or green light).	Check the 110 Volt AC output at available outlet while the start button is being held on. If AC output is present, replace AC interlock board (6-10). If no 110 Volt AC output is present – a. Check for open or short circuit. b. Check brushes (6-5) for cracks or broken leads and make sure they are making proper contact on the slip rings. c. Check rotor (6-9) and stator (6-8) resistance. d. Check voltage regulator (6-7). If defective, replace voltage regulator. NOTE: Before installing apply thermal compound (thin coat) on base of regulator. e. Check stator (6-8) for grounded, open or shorted windings.
Engine runs, AC voltage is present, engine stops running after a short time.	Faulty exciter voltage regulator (6-7).

Table 4-2. Troubleshooting Generator

## SECTION 5

### DECISION MAKER CONTROLLER

#### 5-1. DESCRIPTION

All generator set functions are dependent upon the Decision Maker Controller. See Figure 5-1 for parts identification. For operation instructions, refer to Section 2. The controller includes a keyed connector for installing a remote switch and hour meter panel. This optional remote switch allows the operator to start and stop the generator set from another location in the vehicle. The hour meter records the hours of generator set operation. The controller can be removed by removing the two snap connectors and two cap screws underneath the controller. This section covers troubleshooting, fuse replacement, inspection of the circuit boards and controller foil repair.

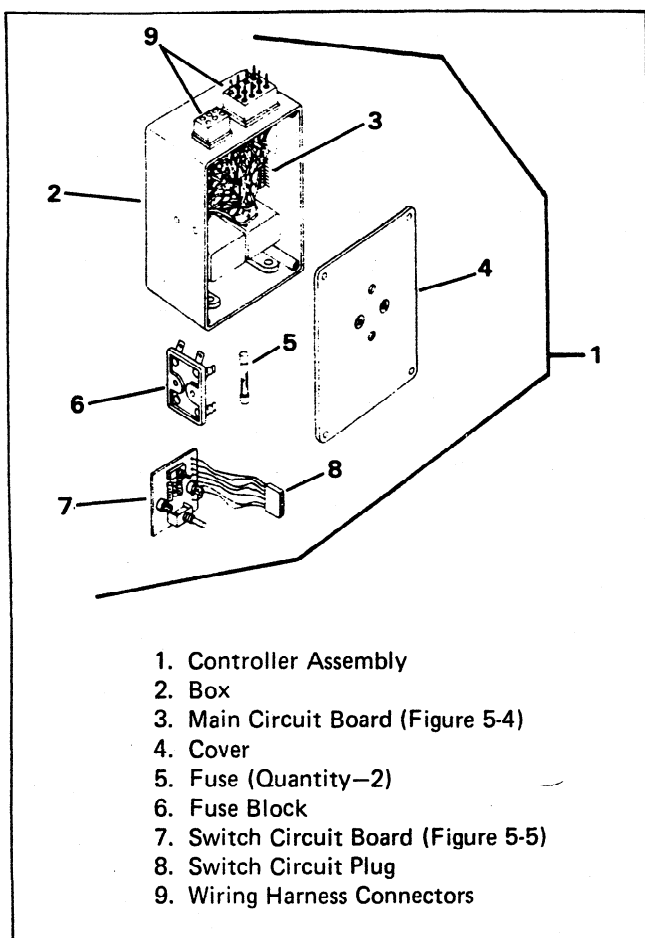


Figure 5-1. Decision Maker Controller

#### 5-2. SEQUENCE OF OPERATION

The Decision Maker is the controlling point for generator set operation. The following is the sequence of operations controlled by the Decision Maker. Refer to Figure 5-2.

1. Pressing the start/stop switch to the start position allows battery current to flow through a set of normally closed 1CR contacts (main circuit board) to the coil of the crank-

ing solenoid "C" through the switch and return to ground. This energizes the cranking solenoid "C".

2. When these "C" contacts are closed, battery current of approximately 90 amperes can flow to the engine cranking (starter) motor. Current can now also flow to the choke solenoid through transistor Q6 (main circuit board) to ground. After approximately 5 seconds Q6 turns off, de-energizing the choke.

3. With the "C" contacts still closed, current can also flow through normally closed contacts 1CR and the 10 amp fuse to terminal "B" of the voltage regulator. This supplies field flashing to the generator via the brushes and rotor collector rings. This is called the build-up circuit.

4. Transistor Q1 also receives a forward bias when the "C" contacts close and allows current to flow through the coil of the 2CR relay. Energizing of the 2CR relay provides a path of current which flows to the ignition coil, engine, choke, fuel solenoid, etc.

5. With battery current being supplied to the ignition and fuel circuit the engine should run, driving the generator. This completes the cranking and ignition portion of the Decision Maker's function.

6. With the engine driving the generator at the specified speed, AC voltage from the stator terminals 33 and 44 is furnished to the AC terminals input of the voltage regulator. The regulator rectifies this AC to DC and furnishes the rotating field with a regulated current supply from the + and - terminals of the regulator via the brushes and collector rings.

7. When the engine is operating at its rated speed, it is important that the starter motor is not again energized. If this should occur the teeth on the starter or ring gear would be damaged or the starter motor itself could be ruined.

8. To prevent this from happening a cranking interlock is provided. This consists of a circuit which provides a forward bias to transistor Q10 allowing the 1CR relay to be energized as long as AC is available from generator stator terminals 33 and 44. When the 1CR relay is energized, the normally open 1CR contacts close to provide a holding supply to B+ for the 1CR relay after the "C" contacts open.

9. Normally closed 1CR contacts in series with the "C" solenoid will open when AC is present preventing the "C" coil from being energized. This prevents the possibility of cranking when the engine is running.

10. The 1CR contacts supplying initial field flashing current to the "B" terminal of the regulator also open when AC is present (engine running). Note that the Q10 transistor also provides the ground path for the green "gen. on" LED.

11. If no signal to the bias circuit of the Q10 transistor is received from the interlock circuit, the engine will remain running only as long as the start switch is held in the start position.

12. If a reverse bias is furnished to the Q1 transistor, it will cease to conduct and allow the 2CR relay to become de-energized, removing battery supply to the ignition coil, fuel pump, etc.; therefore, shutting down the engine.

13. Reverse biasing of the Q1 occurs when:

1. The start/stop switch is moved to the stop position.

2. The engine safety cutouts are activated.

3. Forward bias is removed by opening of both the "C" and 1CR contacts disconnecting battery and source from the bias circuit.

14. The red "safety trip" LED will light if the circuit was shut down by a reverse bias signal to the Q1 transistor other than from the stop switch. This signal could be caused by the hi-temp. or low oil pressure switch. An SCR in this circuit maintains this bias.

15. Pressing the reset button opens the circuit of the SCR which allows the system to reset.

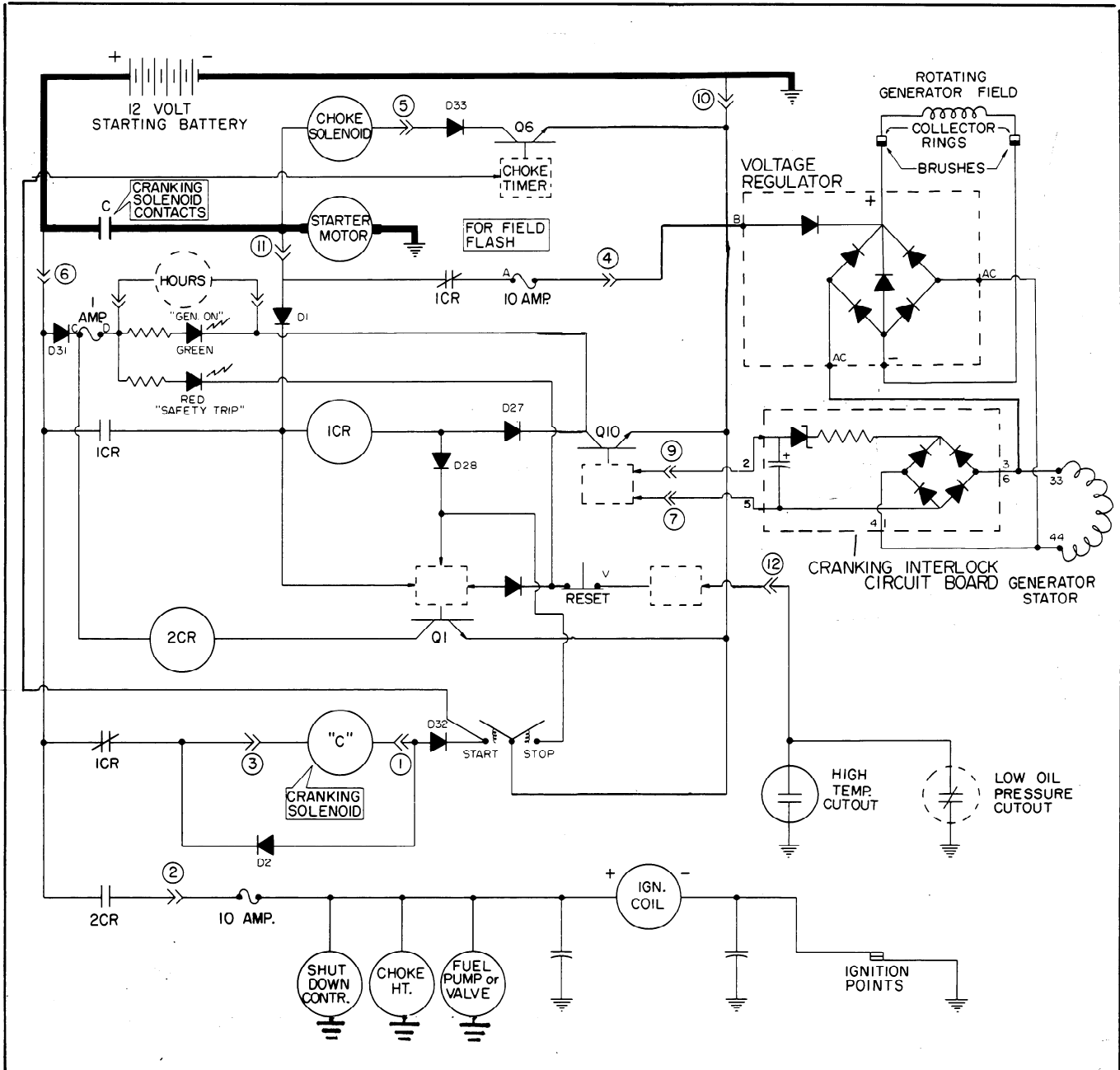


Figure 5-2. Sequence of Operation Schematic



### 5-3. FUSES



### WARNING

**UNIT STARTS WITHOUT NOTICE!** To prevent accidental starting on units with a remote start/stop switch, always disconnect battery (remove negative lead first and reconnect it last) to disable generator set before working on any equipment connected to generator.

5-3.1. Two fuses are located inside the controller (Figure

5-3). The pink leads are connected to a 10 Amp fuse. The gray leads are connected to a 1 Amp fuse (See Generator Wiring Diagram). Fuse identification is labeled on the inside of the controller. The 1 Amp fuse protects the controller from damage if a short develops in the wiring harness to the remote control (option). The 10 Amp fuse protects the Decision Maker in case a short circuit or malfunction occurs within the generator buildup circuitry.

5-3.2 A 10 Amp in-line fuse (later models only) is mounted in the lead from pin number 2 in harness plug to ignition coil positive terminal. It protects the controller in the event of a shorted or faulty ignition coil, choke-heater, fuel pump, shut-down control, or engine wiring.

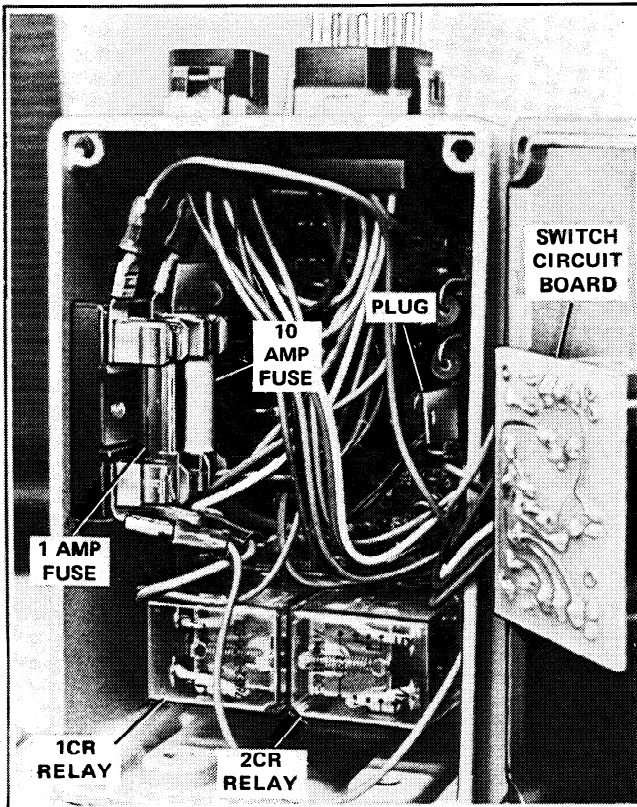


Figure 5-3. Decision Maker Controller, Cover Removed

### 5-4. CIRCUIT BOARDS

Figures 5-4 and 5-5 show the circuit board components and

wiring. Replace a circuit board if any parts are burned or damaged. The foil can be repaired by soldering. Refer to Paragraph 5-5.

### 5-5. CIRCUIT BOARD FOIL REPAIR

5-5.1 General. On later models sets, the controller is protected by a 10 Amp in-line fuse. However, the foil could be burnt as a result of a pinched wire or short in the controller.

5-5.2. Foil Repair. 1. For field repair of the board, the following equipment is required.

- a. Tinned copper wire (#16 – #20).
- b. Solder (60/40 composition – resin core).
- c. Soldering iron (24 to 40 watt rating).
- d. Wire cutters.
- e. Pocket knife.

2. Use the following procedure to repair the foil.

- a. Disconnect the wiring harness from the connectors on top of the Decision Maker Controller. Remove the cover of the Decision Maker control box and disconnect the cover circuit plug.
- b. Remove the two screws holding the fuse block to the side of the control box. Also remove the four corner hold down screws on the main circuit board (circuit board in back of box).
- c. Remove both wiring harness connectors by pressing on expander clips and pushing them into the box.
- d. Visually inspect all foil runs on the solder side of the circuit board for burnt foil.
- e. To remove burnt foil, cut around the burn with a pocket knife 1/8" into the undamaged foil and lift off the board.
- f. Cut a piece of tinned copper wire 1/8" longer than the section just removed from the circuit board.
- g. Solder the piece of wire across gap into the foil run. *DO NOT* allow solder to flow into adjoining foil runs.
- h. Reattach the circuit board to the control box with the hold down screws. Reinsert both connectors. (Make sure they are locked in place.) Refasten the fuse block to the control box with the two screws.
- i. Replace the control box cover and the four corner screws. Reconnect the wiring harness to the top of the Decision Maker Controller.

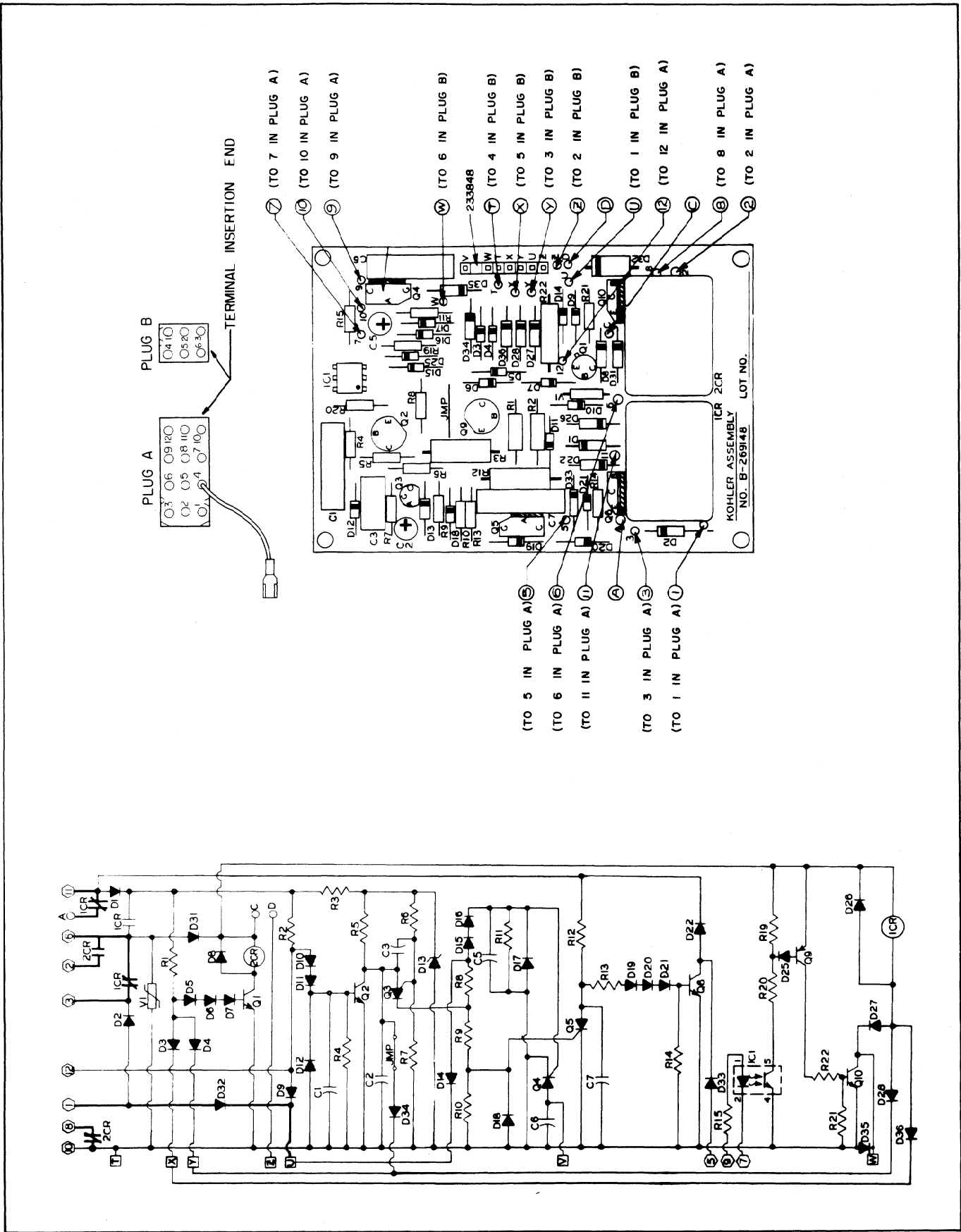
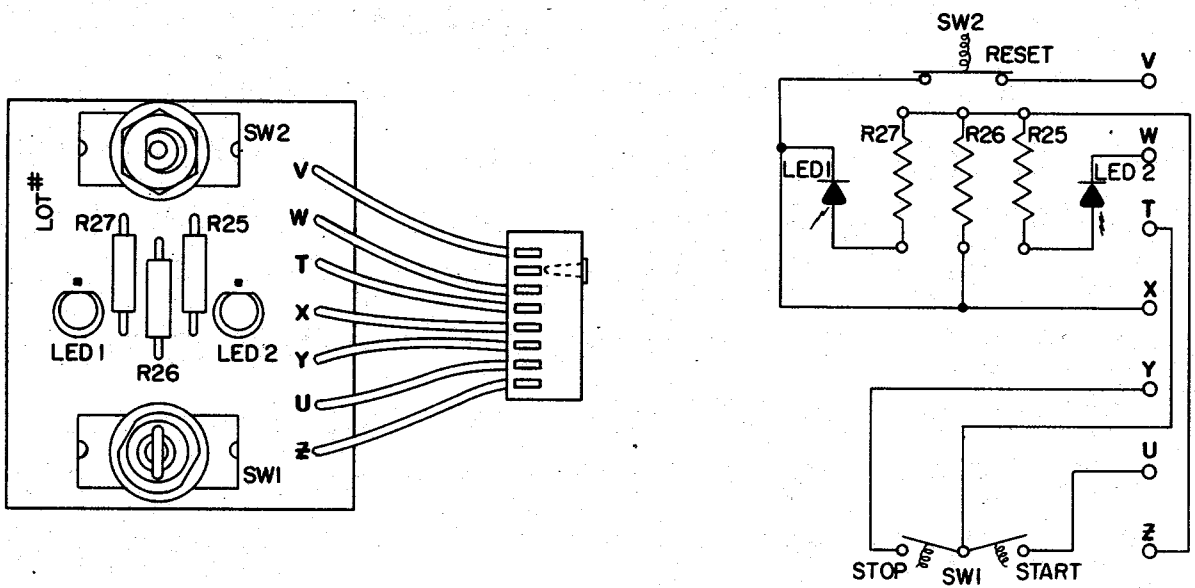


Figure 5-4. Main Circuit Board, Controller



I.D.	DESCRIPTION
R25	560 $\Omega$ - 1/2 W. $\pm 10\%$ CARBON FILM
R26	390 $\Omega$ - 1/2 W. $\pm 10\%$ CARBON FILM
R27	560 $\Omega$ - 1/2 W. $\pm 10\%$ CARBON FILM
LED 1	RED LED
LED 2	GREEN LED
SW 1	C & K #7105-P3-D-V30-Q-E
SW 2	C & K #8121-C-V3 W/8004 BUSHING

Figure 5-5. Switch Circuit Board

## SECTION 6

### GENERATOR



**HIGH VOLTAGE!** Remember that the function of a generator set is to produce electricity and that wherever electricity is present, there is the potential danger of electrocution. Take the same precautions with electrical appliances in your coach that you would observe in your home. Keep away from electrical circuits and wiring while the set is running and have electrical service performed only by qualified electricians. Make sure unqualified persons, especially children, cannot gain access to your set — keep the compartment door locked or securely latched at all times. Be sure that generator is properly grounded. Never touch electrical leads or appliances with wet hands, when standing in water, or on wet ground as the chance of electrocution is especially prevalent under such conditions.

#### 6-1. GENERAL

This chapter covers disassembly, inspection, and testing of the generator components. See Figures 6-1 and 6-2 for parts identification.

#### 6-2. TROUBLESHOOTING

Refer to Table 4-2 to troubleshoot the generator. Follow the disassembly procedure in Paragraph 6-3 as far as necessary to inspect a component, then start reassembly procedure in Paragraph 6-10 at the point the component is replaced. When a fuse must be replaced, always inspect the related components and wiring to locate the cause. Refer to the wiring diagrams in the back of the manual.

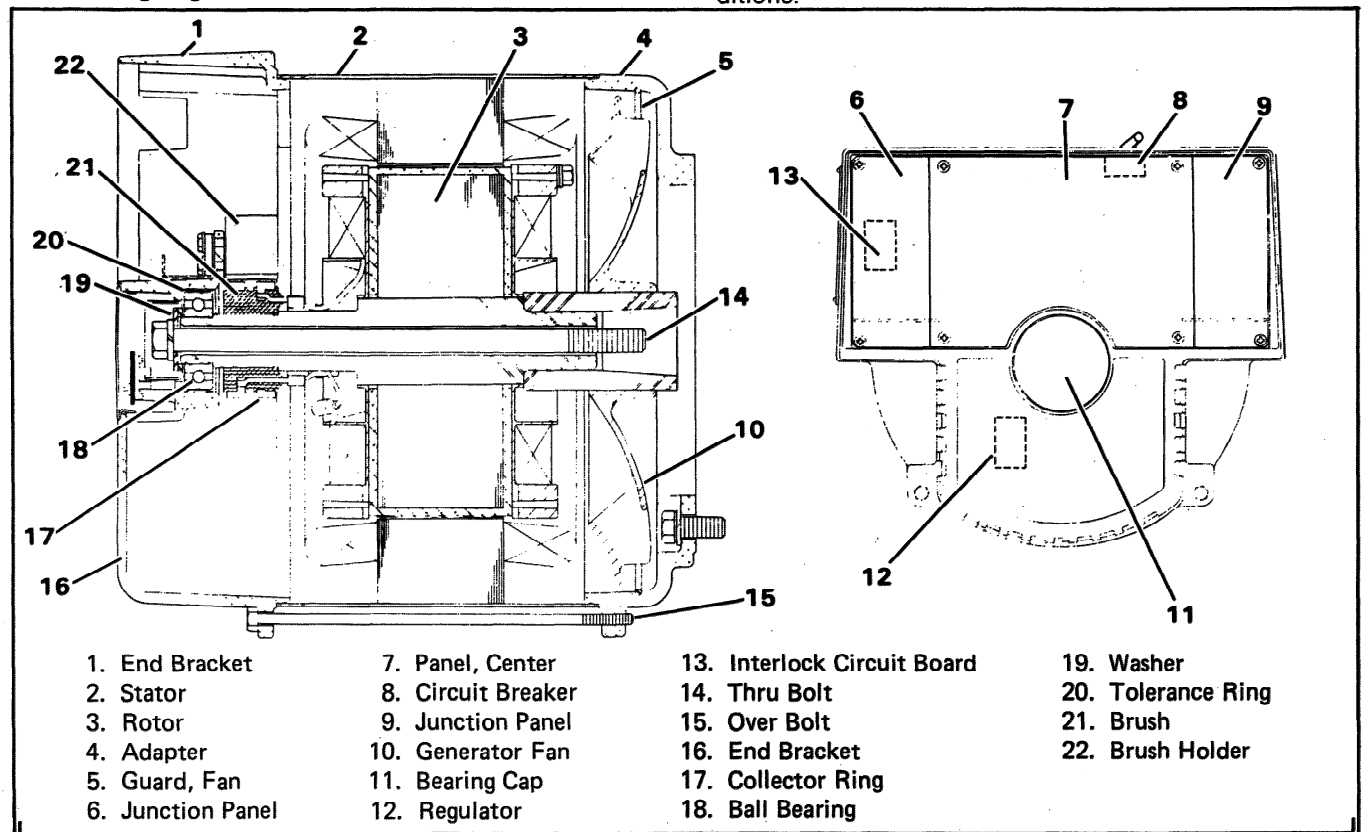


Figure 6-1. Generator, Cross Sectional View

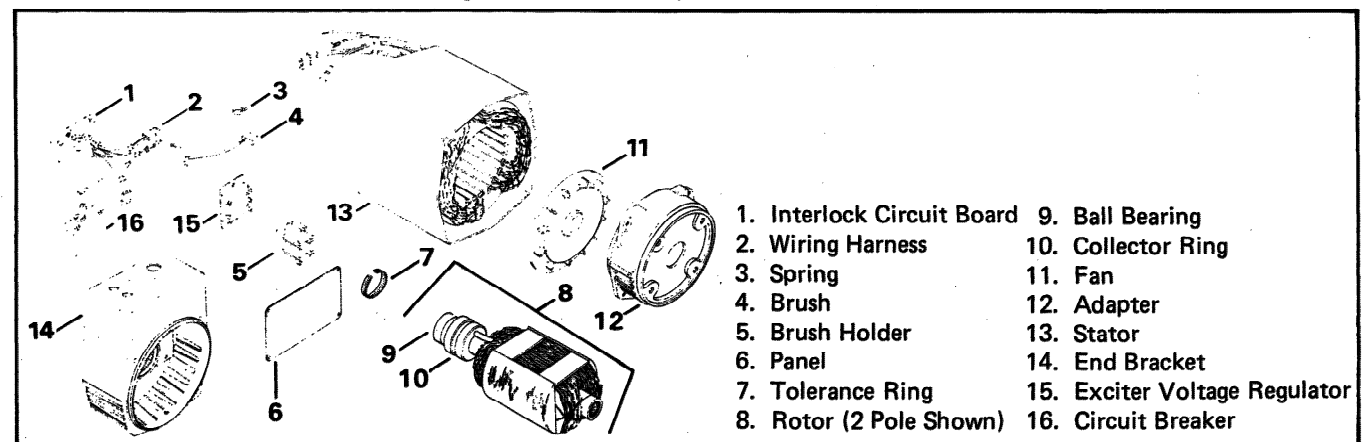


Figure 6-2. Generator Parts Identification

### 6-3. GENERATOR DISASSEMBLY

#### NOTE

Tag leads to ease re-installation. Scratch aligning marks on parts before removing to aid reassembly.

1. Disconnect the battery positive lead from the generator positive (+) stud (Figure 1-1, 1-2 or 1-3). Remove the stud from the generator mounting.
2. Disconnect the generator ground strap at the tray (Figure 6-3 or 6-4).

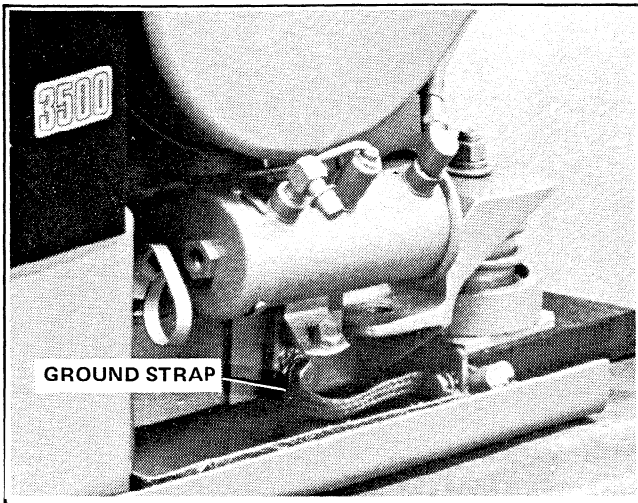


Figure 6-3. Generator Ground Strap (3.5KW Shown)

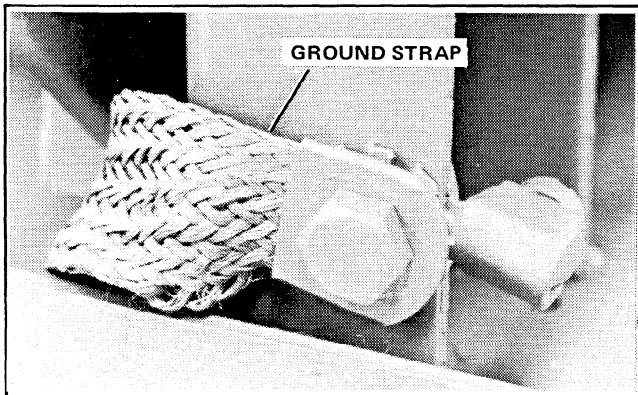


Figure 6-4. Generator Ground Strap (5.5KW, 7KW)

3. Remove the center panel (Figure 6-5 or 6-6). The safeguard breaker can be removed.
4. Remove the side panels (Figure 6-5) (4.5, 5.5 7KW).
5. Remove the plug from the interlock circuit board (Figure 6-7). The circuit board can now be removed.
6. Remove the top housing (Figure 6-8).

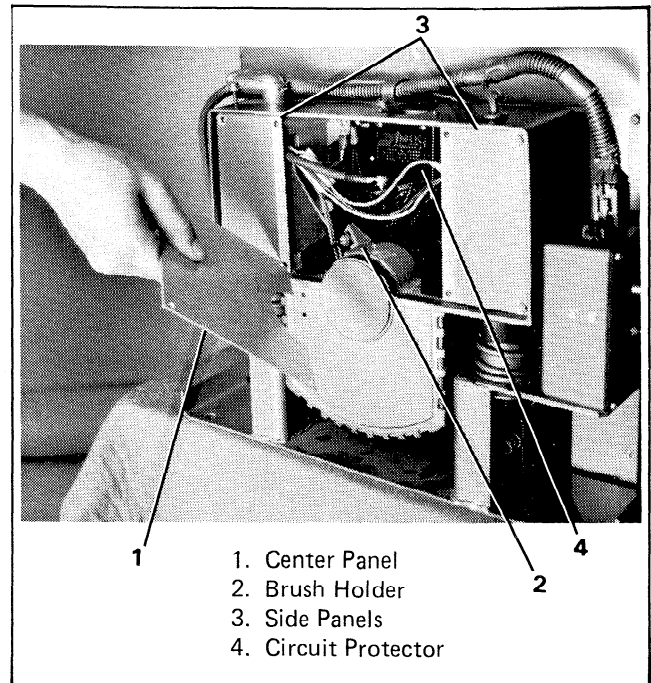


Figure 6-5. Center Panel Removal (4.5, 5.5, 7KW)

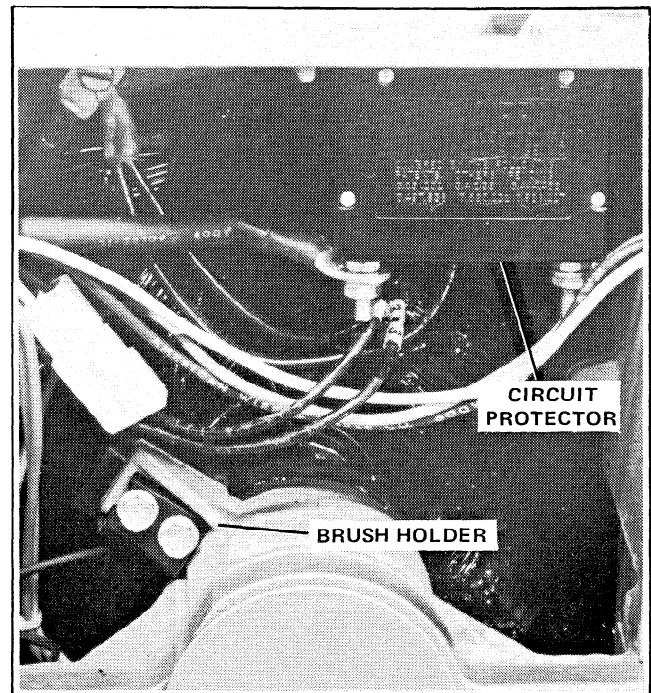


Figure 6-6. End Panel Removed (3.5KW)

7. Remove the exhaust tube (Figure 6-9).
8. Remove the side housings.
9. Remove the inside housings (Figure 6-10).
10. Loosen the vibro-mounts (Figure 6-11) and lift the generator from the base.

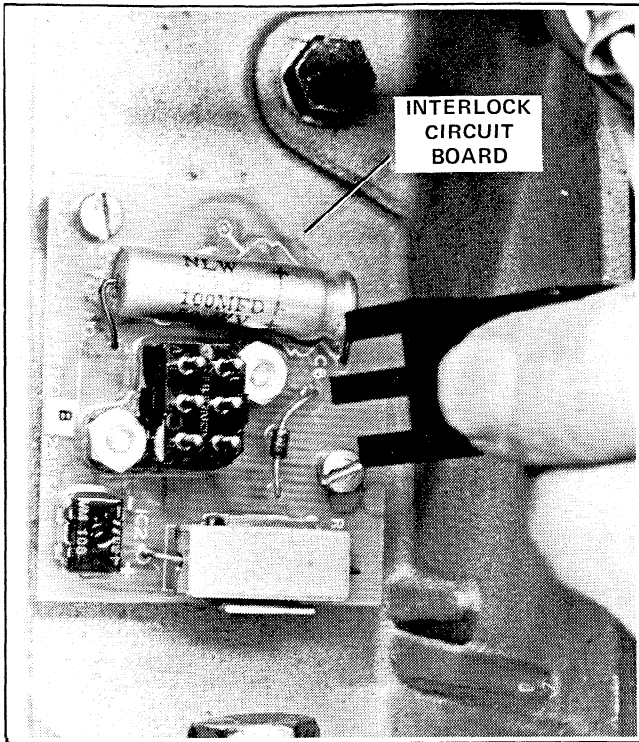


Figure 6-7. Removing Plug From Interlock Circuit Board

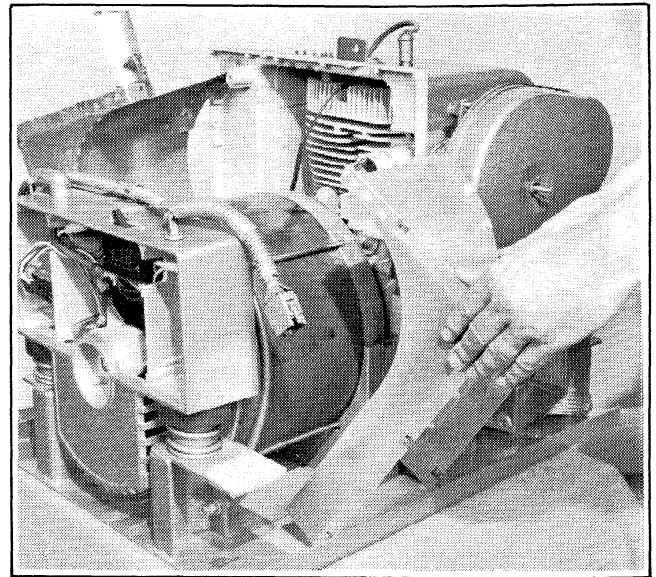


Figure 6-10. Inside Housing Removal

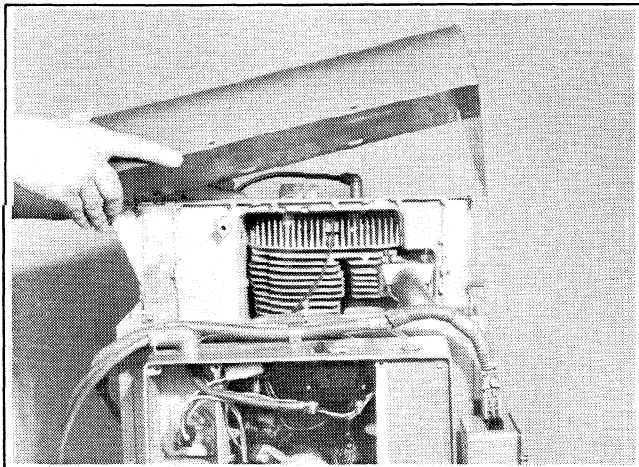


Figure 6-8. Top Housing Removal

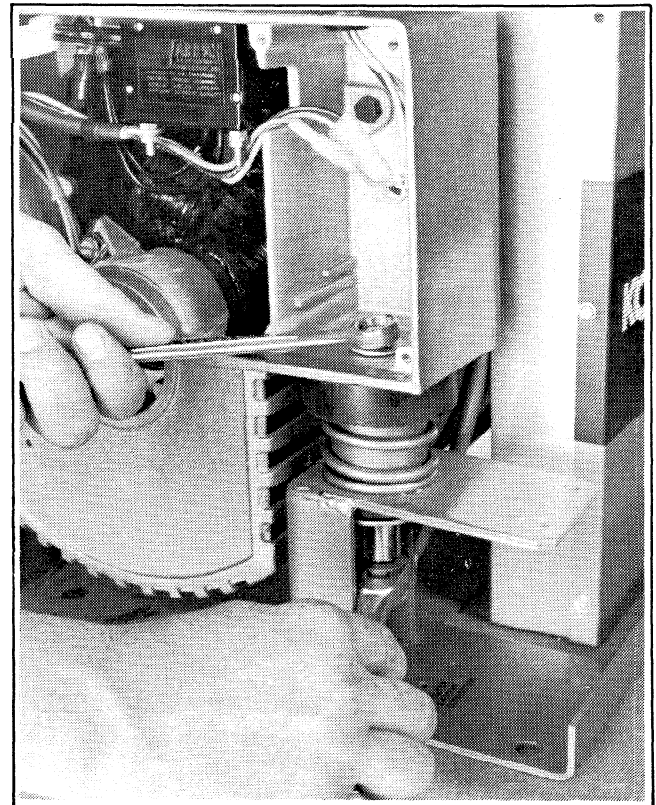


Figure 6-11. Vibro-Mounts

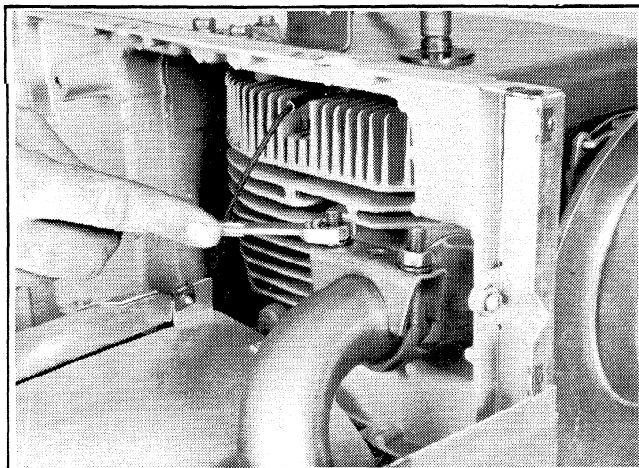


Figure 6-9. Exhaust Tube

11. Tilt the generator end up and place blocks under the generator adapter.

12. Lift the brushes by the leads and lock in this position by inserting a retainer wire as shown in Figure 6-12.

13. Remove the four long over bolts (Figure 6-13 and 6-14) and remove the end bracket to reveal the exciter voltage regulator (Figure 6-14). Disconnect the stator leads from the regulator.

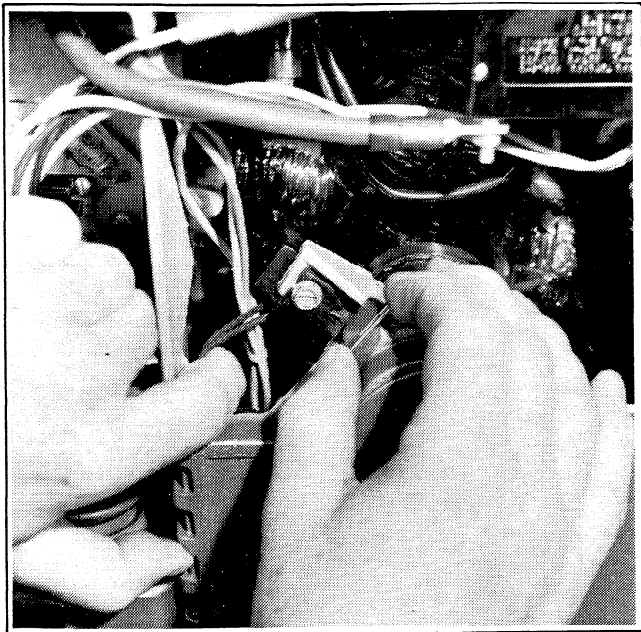


Figure 6-12. Locking Brushes

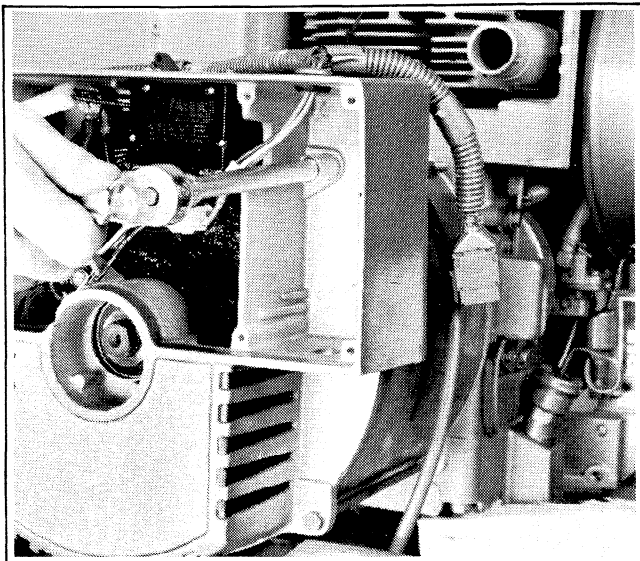


Figure 6-13. Over Bolt Removal (Two Shown)

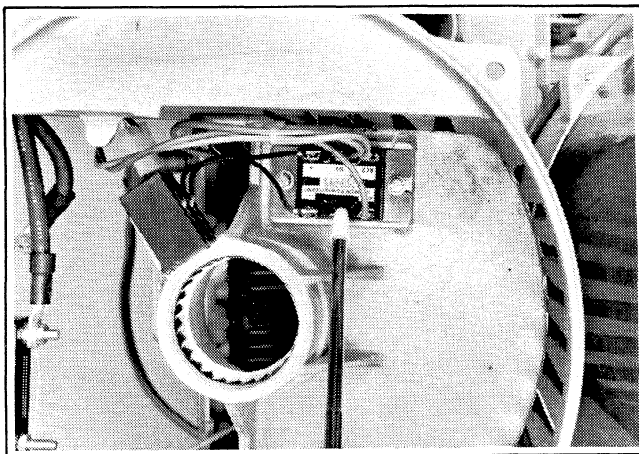


Figure 6-14. Exciter Voltage Regulator

#### NOTE

Voltage regulators will appear as shown in Figure 6-14 or 6-15. Terminal connections and testing will be the same for both.

14. The stator (Figure 6-16) can be tested at this time (Paragraph 6-7). Remove the stator by guiding it to the rear.

#### NOTE

The rotor is threaded on the crankshaft (right hand threads) on the 3.5KW only. Remove with a strap wrench.

15. Loosen thru bolt one or two turns and bump the thru bolt with a lead mallet to break the rotor loose (4.5KW, 5.5KW, 7KW only) to remove the rotor (Figure 6-17). If the bearing (Figure 6-18) turns freely and has no sign of damage do not remove. The fan will be removed with the rotor (Figure 6-19).

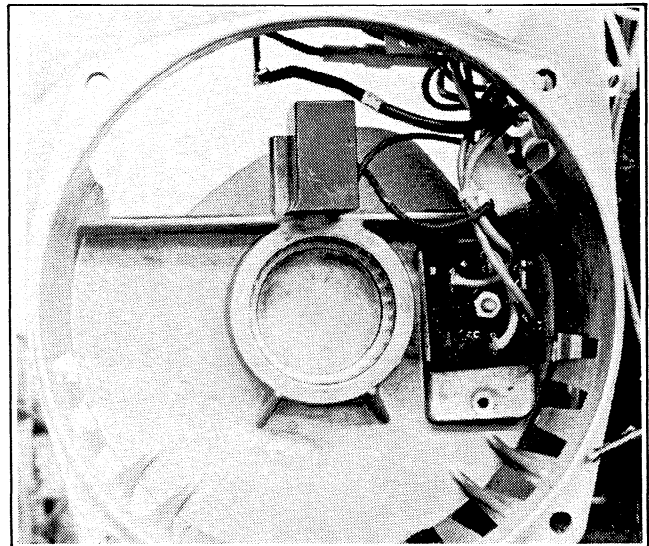


Figure 6-15. Exciter Voltage Regulator (3.5KW Shown)

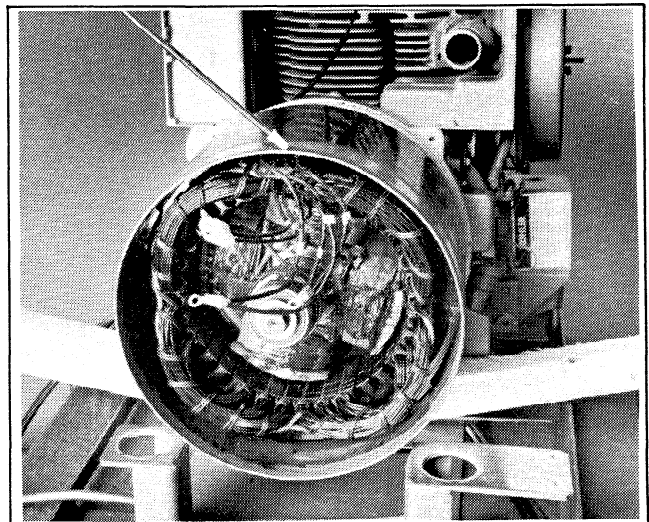


Figure 6-16. Stator

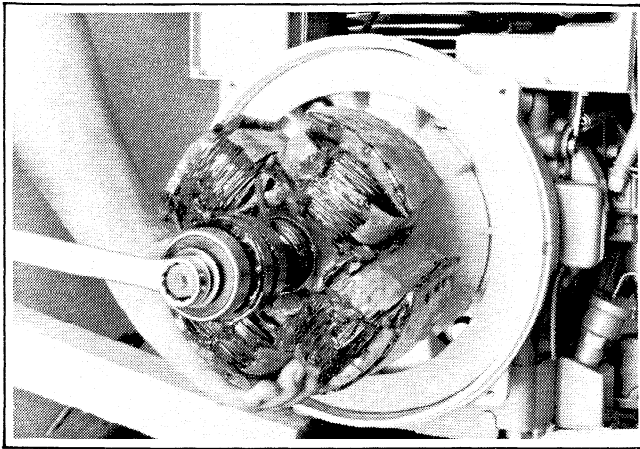


Figure 6-17. Rotor Thru Bolt

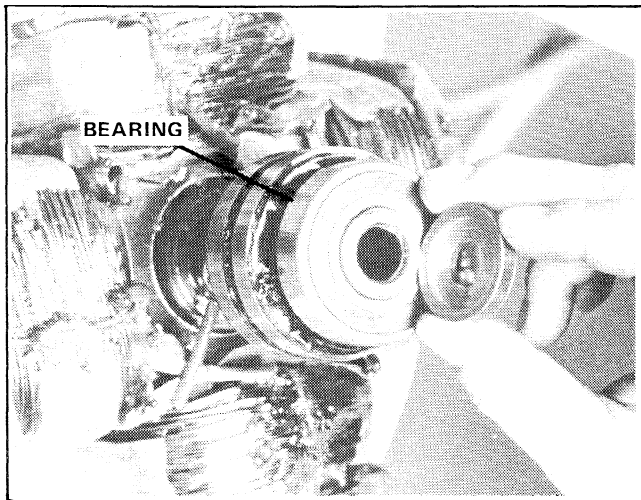


Figure 6-18. Rotor Bearing

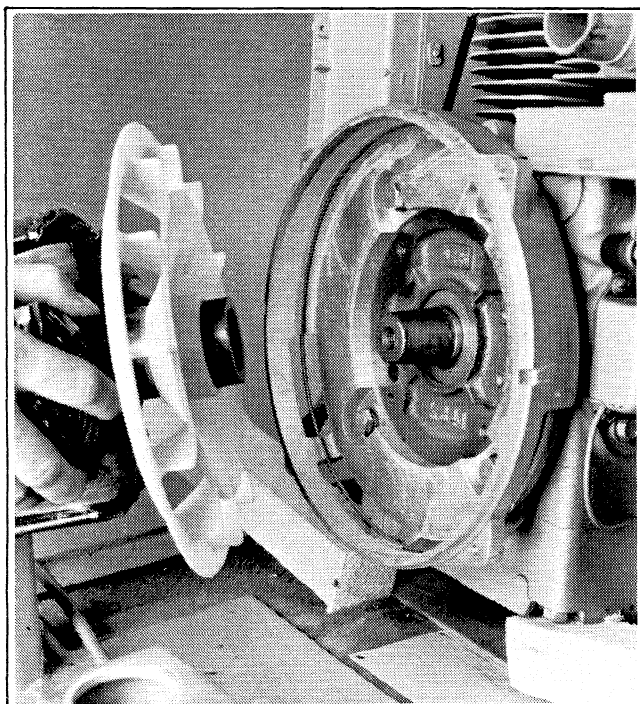


Figure 6-19. Removing Rotor

#### 6-4. BUILT-UP CIRCUIT

This circuit magnetizes the rotor during cranking. When the switch on the Decision Maker Controller is moved to the start position, DC current flows from the battery to brushes and collector rings on the rotor. See Figure 6-20.

#### 6-5. BRUSHES

6-5.1. General. The brushes transfer current from the voltage regulator to collector rings. The brushes carry a very low current (approximately 2 amps) and should last the life of the generator set. Abrasive dust on the collector rings could, however, shorten the life of the brushes. Excessive arcing at the brushes could damage the voltage regulator. Arcing could be caused by weak springs, damaged collector rings, sticking brushes, loose holder, or poor brush contact.

#### 6-5.2. Maintenance.

1. Remove the end bracket panel to gain access to the brushes.
2. The brushes must be free to move within the holder and held in proper contact by the springs. When properly positioned, spring pressure on the brush surface will cause the brush to wear evenly. Figure 6-21 shows normal brush wear.
3. Replace the brushes if worn excessively or unevenly.
4. Replace the springs if damaged or discolored.
5. Be sure to use original or identical screws (1/2 inch) when reinstalling the brush holder. Longer screws will break the holder when tightened.
6. To install the brushes and holder insert a wire as shown in Figure 6-22, to hold the brushes in. Position the brushes on the collector rings and install the two screws. Remove the wire.

#### CAUTION

If the retainer wire is not removed, the voltage regulator will be damaged when the generator is started.

#### 6-6. COLLECTOR RINGS

Collector rings acquire a glossy brown finish in normal operation. Do not attempt to maintain a bright, newly-machined appearance. Ordinary cleaning with a dry, lint free cloth is usually sufficient. Very fine sandpaper (#00) may be used to remove roughness. Use light pressure on the sandpaper. Do not use emery or carborundum paper or cloth. Clean out all carbon dust from the generator. If the rings are black or pitted, remove the rotor and remove some of the surface material by using a lathe.



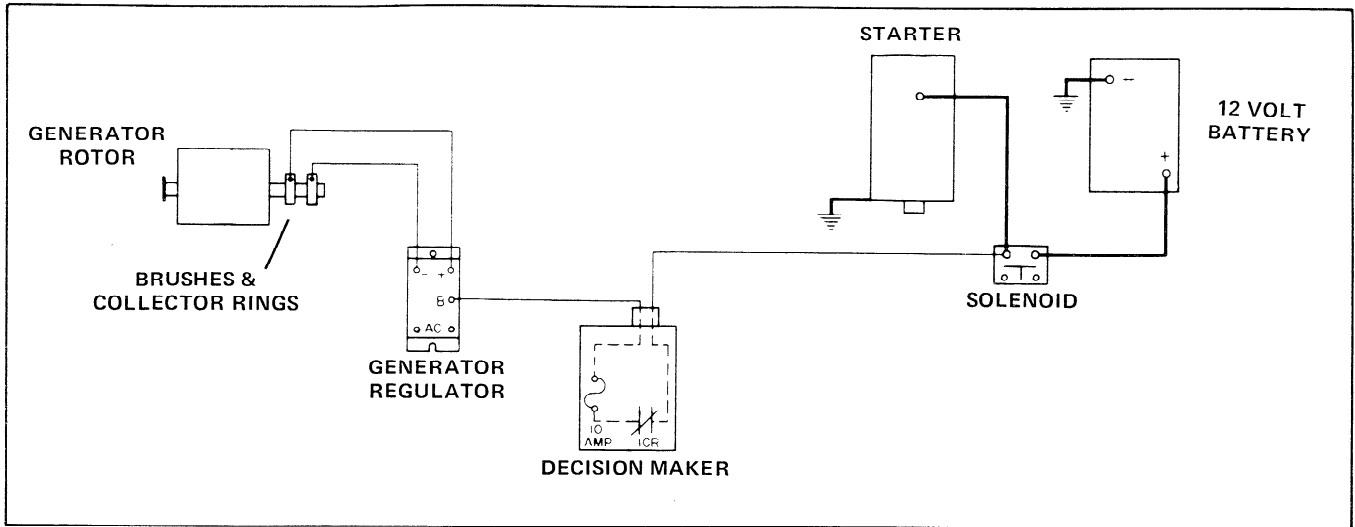


Figure 6-20. Buildup Circuit

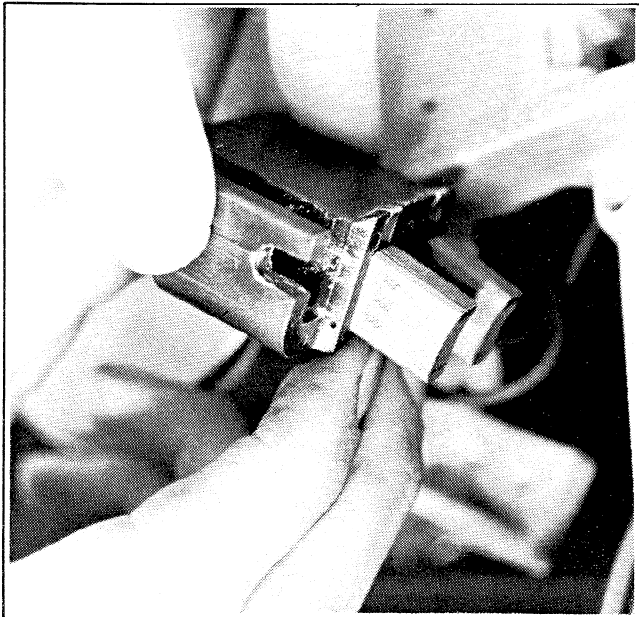


Figure 6-21. Brushes

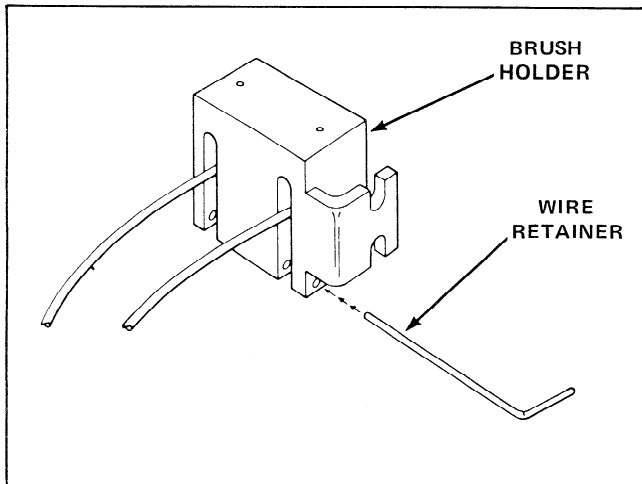


Figure 6-22. Brush Holder

## 6-7. EXCITER VOLTAGE REGULATOR

6-7.1. General. The voltage regulator assembly (Figure 6-23) includes a bridge rectifier and a voltage regulating circuit. AC from the stator is received at the "AC" terminals on the regulator. This current is rectified to DC by the bridge rectifier and supplied to the rotor from terminals (+) and (-) through the brushes and collector rings. This AC is constantly monitored by the regulator to maintain  $\pm 2\%$  variation of the stator output.

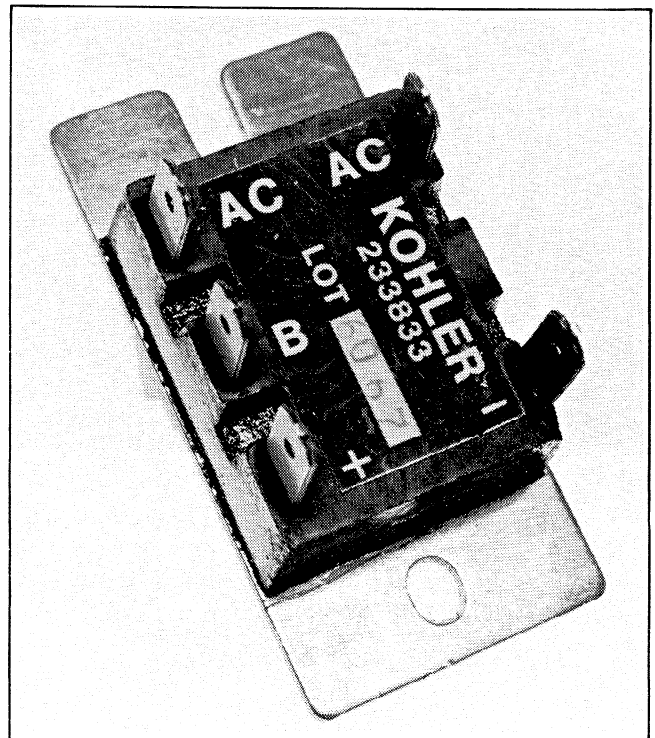


Figure 6-23. Exciter Voltage Regulator

**⚠ WARNING**

**HIGH VOLTAGE!** Remember that the function of a generator set is to produce electricity and that wherever electricity is present, there is the potential danger of electrocution. Take the same precautions with electrical appliances in your coach that you would observe in your home. Keep away from electrical circuits and wiring while the set is running and have electrical service performed only by qualified electricians. Make sure unqualified persons, especially children, cannot gain access to your set — keep the compartment door locked or securely latched at all times. Be sure that generator is properly grounded. Never touch electrical leads or appliances with wet hands, when standing in water, or on wet ground as the chance of electrocution is especially prevalent under such conditions.

Since this test is designed for use in the field, it only checks regulator output when “cold” and does not check voltage build-up.

To complete the test you'll need the following equipment:

- Two 120V/100 watt bulbs and sockets.
- 110/120V AC power source or variable transformer.
- Switch, SPST, 120V, 2 amp. minimum
- Fuse, 2A (in holder)
- Jumpers
- Multimeter

Figure 6-24 shows the typical voltage regulator terminal identifications:

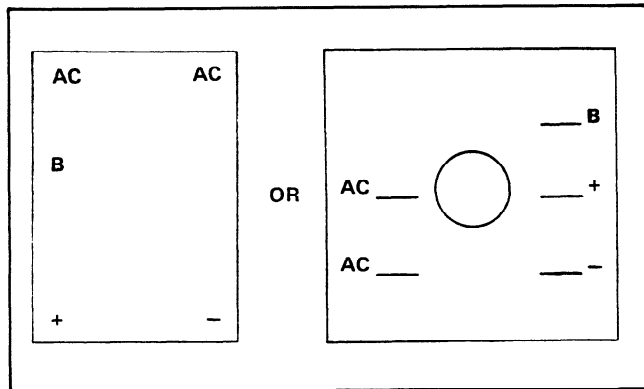


Figure 6-24. Terminal Identification

1. Connect two 100 watt light bulbs across “+” and “-” terminals of regulator. See Figure 6-25.
2. Set multimeter range to 100 volts DC. Connect meter across light bulbs. Check for correct polarity (refer to Figure).

**CAUTION**

Do not touch electrical equipment when standing in water or when your hands are wet.

3. Completely disconnect 120V AC source from primary power source before connecting across regulator.

**CAUTION**

When AC pins become “hot” there is danger of electrocution.

4. Connect one pole of (on-off) switch and the fuse to one of the “AC” terminals on the regulator. Connect other pole of switch to the 110/120 AC source (Figure 6-25). Connect other “AC” terminal to 110/120V AC source.
5. Turn on 110/120V AC source.
6. With multimeter connected across light bulbs, turn on switch. Bulbs should light immediately, DC voltmeter should register 10 to 50V DC.

**NOTE**

If bulbs flash momentarily and extinguish, flicker dimly or glow steadily the regulator is functioning properly. These conditions are caused by the amplitude of the “AC” supply voltage used. A momentary flash results when supply voltage is above the regulating voltage or regulator under test. Flickering results when supply voltage and regulating voltage are within a few volts. If a variable transformer is available, it should be used to adjust the AC supply until the bulbs glow steadily. The variable transformer will adjust the voltage to coincide with the approximate regulating voltage of the regulator.

7. Test field build-up circuit by connecting one end of jumper to either “AC” terminal. Touch the other end of jumper, to “B” terminal. Bulbs should glow brighter. Voltmeter should indicate 50-75 volts DC.

**⚠ WARNING**

**HIGH VOLTAGE!** When the power cord is plugged in during voltage regulator test, the AC pins become “hot” and there is danger of electrocution.

**NOTE**

If voltage readings coincide with above recommended test results, regulator may be used in generator set.

**CAUTION**

Completely disconnect 120V AC source from primary power source before disconnecting from regulator.

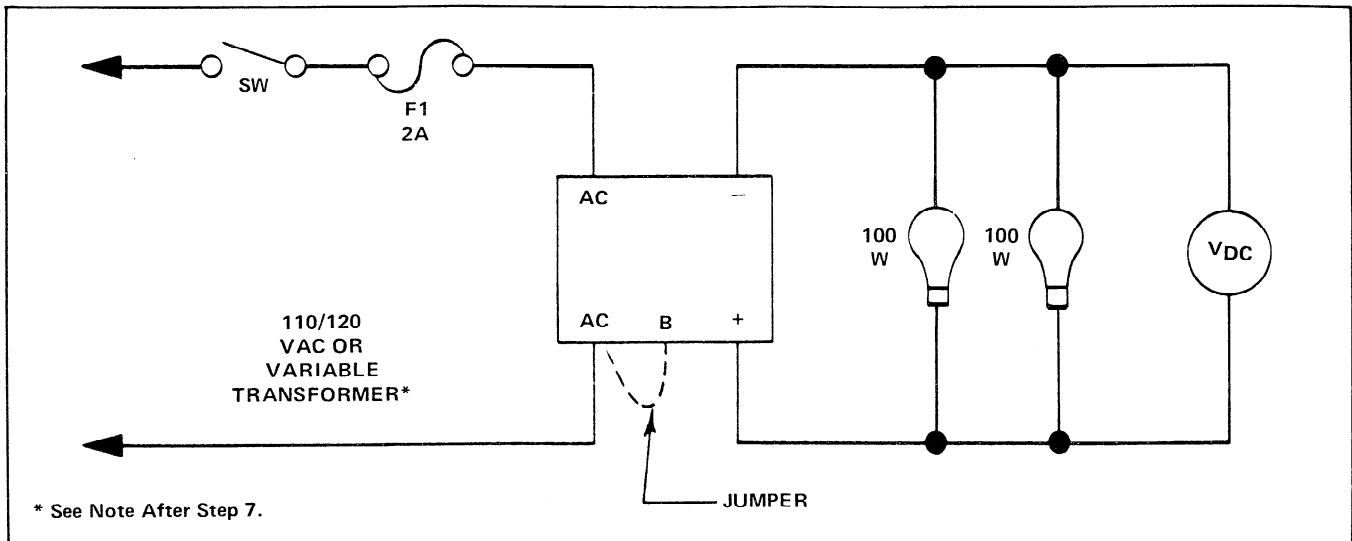


Figure 6-25. Wiring Diagram – Voltage Regulator Field Test

### 6-8. STATOR

6-8.1. General. The stator (Figure 6-26) consists of a series coils of wire laid in a laminated steel frame. The stator leads (see generator wiring diagram) supply voltage to the AC load and exciter regulator.

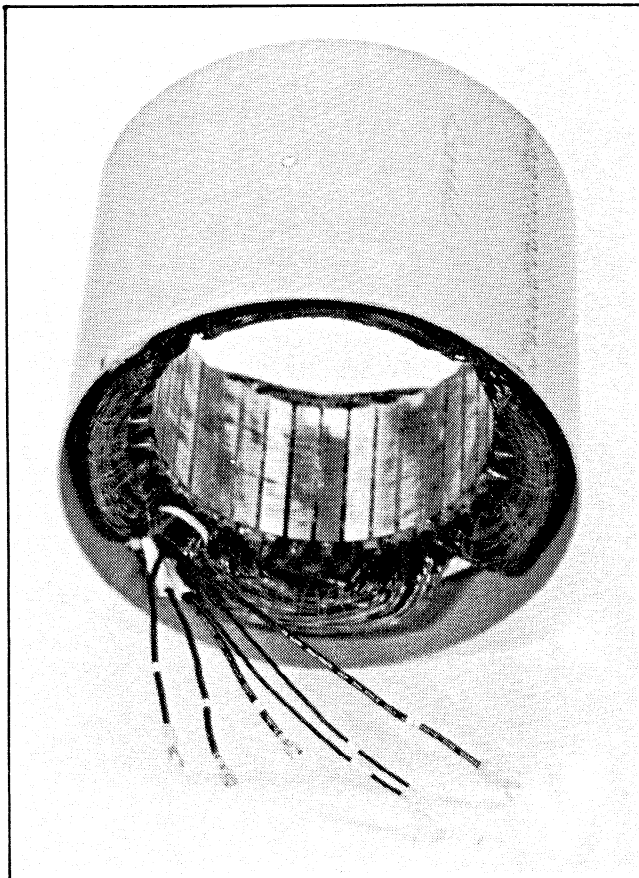


Figure 6-26. Stator

6-8.2. Inspection. The stator should have 0.25 ohms resistance across each winding. To test, connect an ohmmeter between leads 1 and 2, 3 and 4, and then 33 and 44. The leads are tagged with the lead number.

### 6-9. ROTOR

The function of the rotor is to create a magnetic field. The 3.5KW has a rotor with two electromagnetic field poles (Figure 6-27). The 4.5KW, 5.5KW and 7KW each have a rotor with four electromagnetic field poles (Figure 6-28). Rotor resistance readings are given in Table 6-1. Measure resistance (ohms) between the two collector rings.

MODEL	RESISTANCE
3.5KW	9 to 11 ohms
4.5KW	8 to 10 ohms
5.5KW	8 to 10 ohms
7KW	8 to 10 ohms

Table 6-1. Rotor Resistance

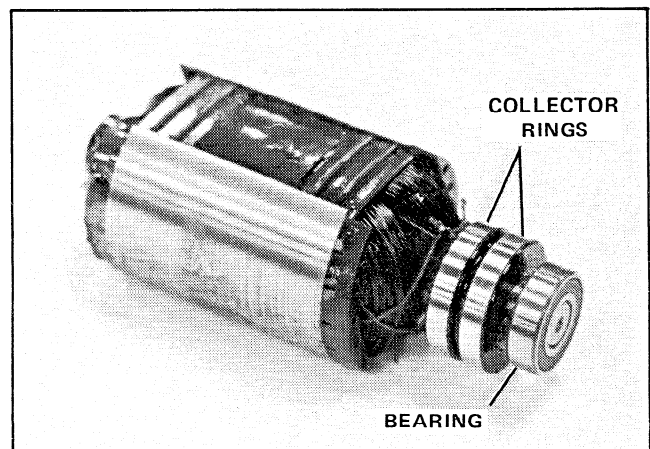


Figure 6-27. Two Pole Rotor

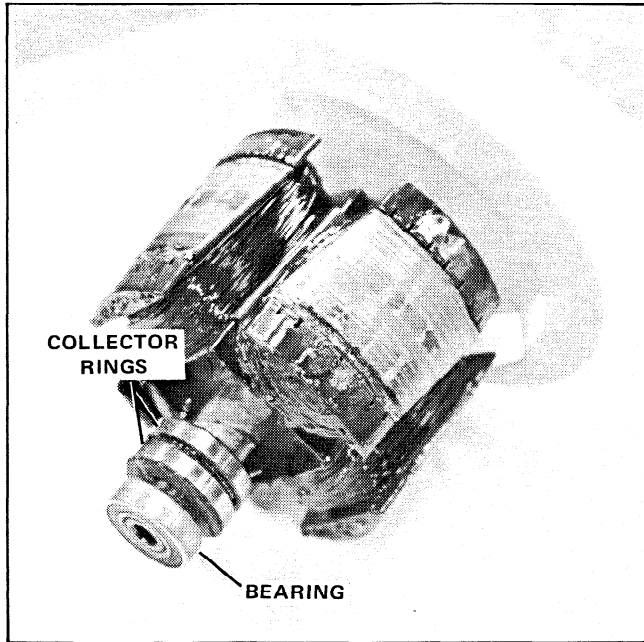


Figure 6-28. Four Pole Rotor

## 6-10. INTERLOCK CIRCUIT BOARD

6-10.1. General. The interlock circuit board (Figure 6-29) is located in the end bracket assembly. Its function is to prevent the starter motor from reengaging the ring gear if the start switch is activated while the engine is running. It performs this function by sensing generator output voltage and sending a signal to the Decision Maker Controller whenever this voltage is present. If no voltage is present the Decision Maker will shut the engine down.

### 6-10.2. Removal and Inspection.

1. Remove generator end panels.
2. Disconnect plug and remove mounting screws holding circuit boards to the end bracket.
3. Examine front and back of circuit board for burnt components or damaged foil.

### 6-10.3. Testing.

1. Connecting an ohmmeter across the interlock board pins and rectifier terminals, perform the following resistance tests with the meter set on R x 1000 ohm scale.

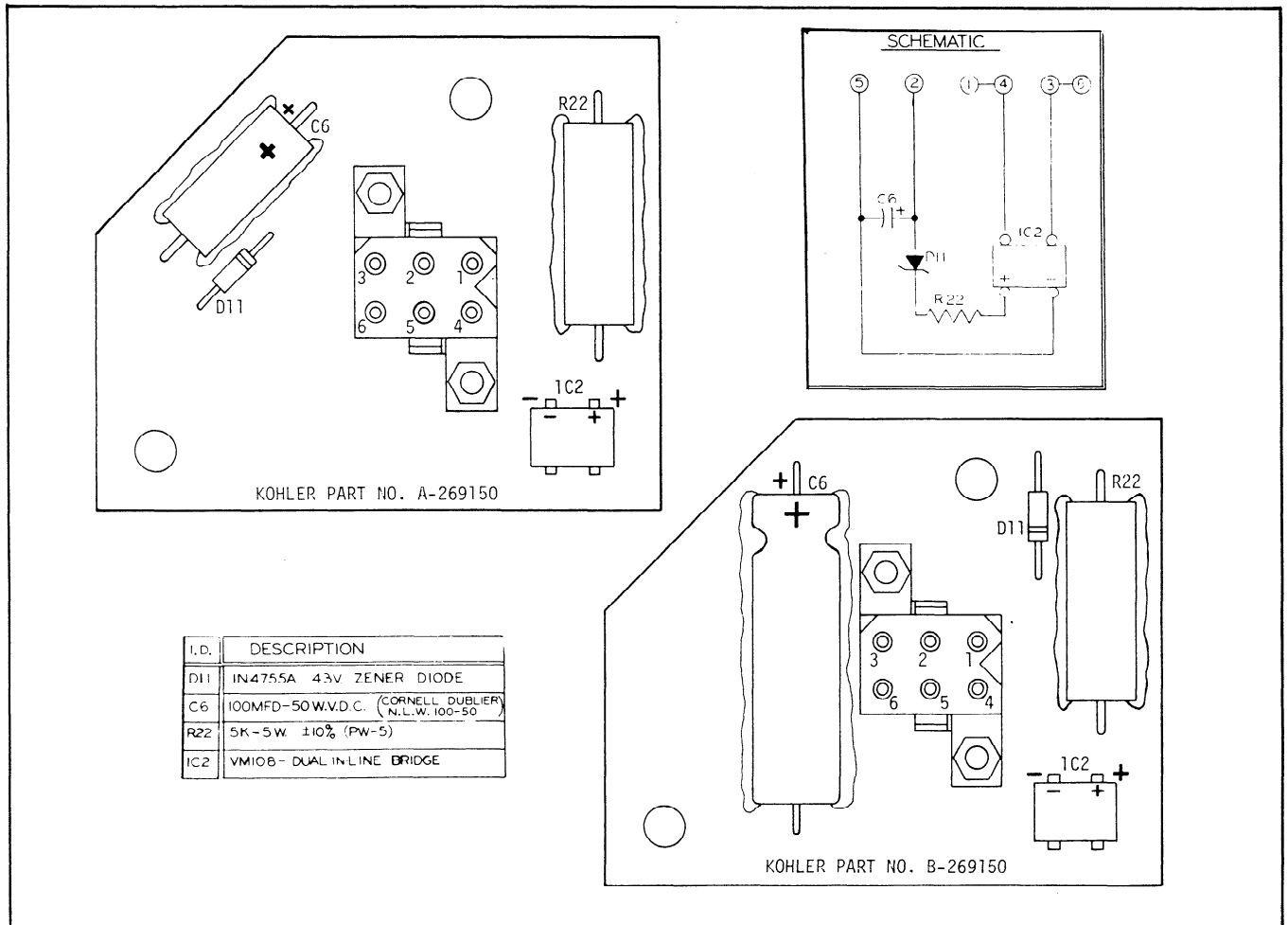


Figure 6-29. Generator Interlock Circuit Board

PIN	TO	PIN (METER COMMON LEAD)	READING SHOULD BE:
5		3	1,800 – 2,200 ohms
5		1	1,800 – 2,200 ohms
3		“+” Terminal on Rectifier (1C2)	1,800 – 2,200 ohms
1		“+” Terminal on Rectifier (1C2)	1,800 – 2,200 ohms
2		“+” Terminal on Rectifier (1C2)	9,500 – 12,500 ohms

2. Connect a 100 or 1000 ohm resistor across pins 2 and 5 with jumpers.

3. Set a multimeter at 60 volt DC range. Connect the meter across the resistor.

4. Apply 110-120 volt AC source between pins 3 and 4. Using a 100 ohm resistor, voltage drop reading should be 1.15 to 1.55 volts, DC. With a 1000 ohm resistor the reading should be 11.5 to 12.5 volts DC. If these voltages are present, interlock board B-269150 is functioning correctly.

#### 6-11. GENERATOR REASSEMBLY

1. On the 3.5KW, apply antiseize compound to the rotor threads (Figure 6-30). Thread the rotor onto the drive shaft and tighten with a strap wrench.

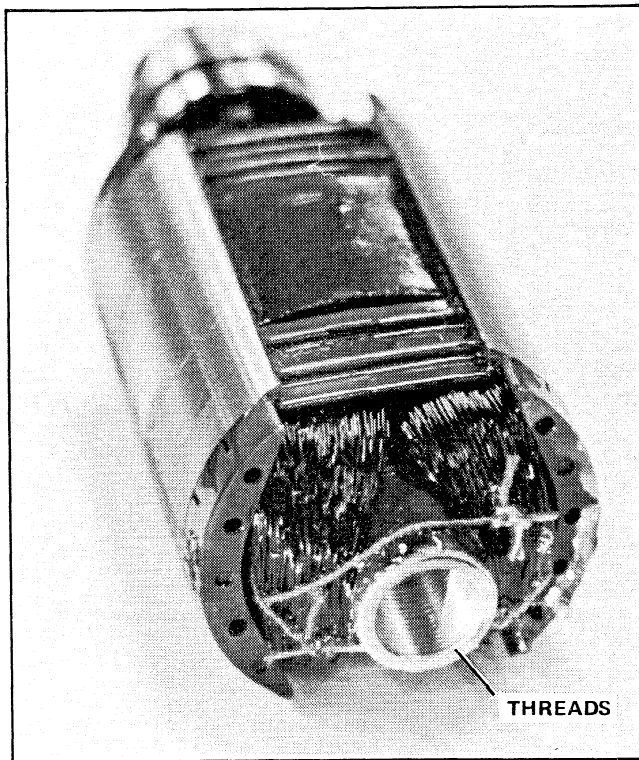


Figure 6-30. Rotor (3.5KW)

2. On the 4.5KW, 5.5KW or 7KW, apply antiseize to the crankshaft stub (Figure 6-31). Install the rotor onto the crankshaft with the thru bolt. See Table 6-2 for torque value.

SIZE	TORQUE
5/16	100 to 125 in. lbs.
3/8	175 to 200 in. lbs.
1/2	40 to 55 ft. lbs.

Table 6-2. Generator Thru Bolt Torque

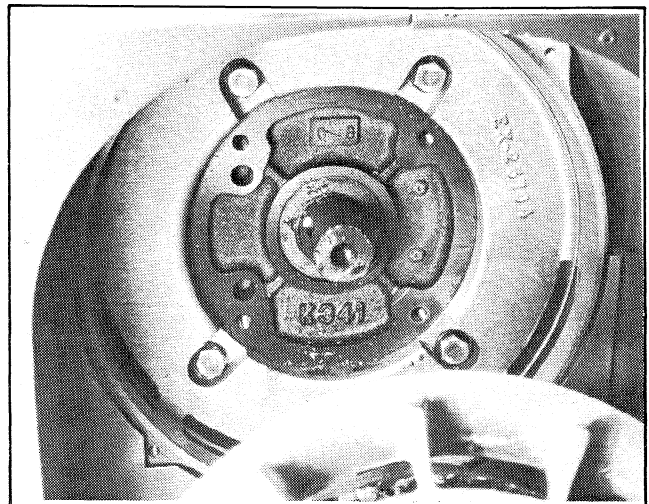


Figure 6-31. Driveshaft (4.5KW Shown)

3. Slide the stator into position making sure the leads are at 12 o'clock position (Figure 6-32).

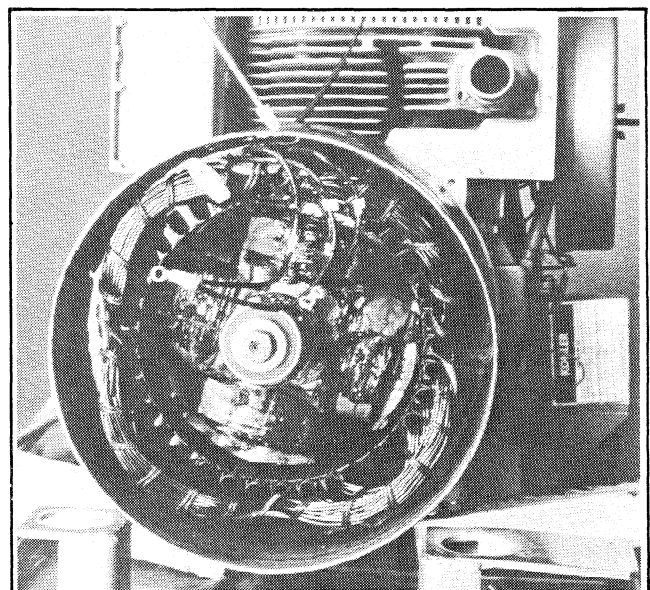


Figure 6-32. Stator and Rotor

4. Install the exciter voltage regulator onto the end bracket. Refer to Generator Wiring Diagram to connect leads.

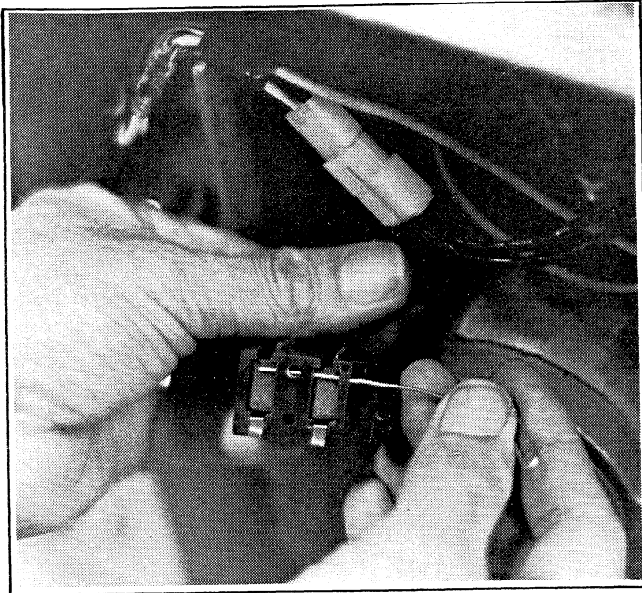


Figure 6-33. Brush Retaining Wire

5. Install the end bracket with the four long over bolts.

6. Position the brush holder on the collector rings and install the two brush holder screws. To install the brush holder, it will be necessary to retain the brushes with a wire (Figure 6-33). Remove the wire when the brushes are installed.

7. Install the generator to the base.

8. Install the inside housings.

9. Install the exhaust tube. Install the side housings and top housing.

10. Install the interlock circuit board and plug. See Generator Wiring Diagram for connections.

11. Install the safeguard breaker and end panels (Figure 6-34).

12. Connect the generator ground strap to the base.

13. Connect the battery positive lead to the generator positive stud.

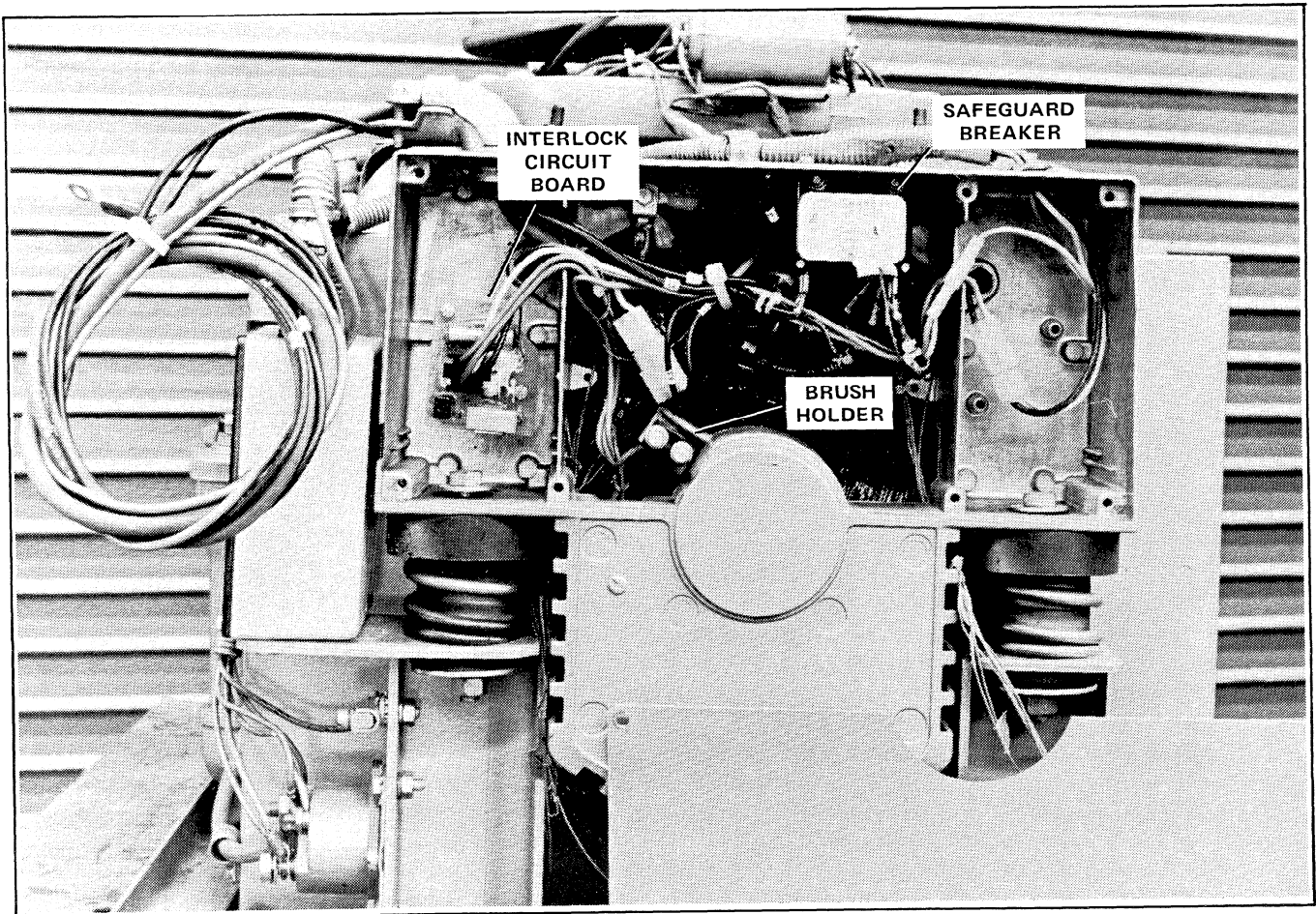


Figure 6-34. End Panels Removed (4.5KW Shown)

## SECTION 7

### CHOKE, SHUTDOWN CONTROL AND GOVERNOR

#### 7-1. CHOKE TESTING AND ADJUSTMENTS (3.5kW, 4.5kW)

7-1.1 General. When the engine start switch is activated, battery current activates the rotary solenoid in the electric choke unit (Figure 7-1). The choke lever pushes the choke plate into full choke position. A timer inside the Decision Maker controller de-energizes the solenoid after five seconds. When the solenoid de-energizes, the choke plate opens to a position determined by a thermostatic spring and the ambient temperature. As the engine warms and less choking is needed, the thermostatic spring allows the choke plate to gradually move to full open position.

#### **WARNING**

**BACKFIRE!** A sudden backfire can cause serious burns. Keep hands and face away from the carburetor when the air cleaner is removed.

#### **WARNING**

**UNINTENTIONAL STARTING!** To prevent accidental starting when checking choke operation, remove spark plug lead(s) at spark plug(s).

#### **NOTE**

Defective choke may cause failure of the Decision Maker Controller.

#### 7-1.2. Inspection.

1. Disconnect the high tension lead from the spark plug so the engine will not start.
2. Remove the air cleaner cover, element and base plate.

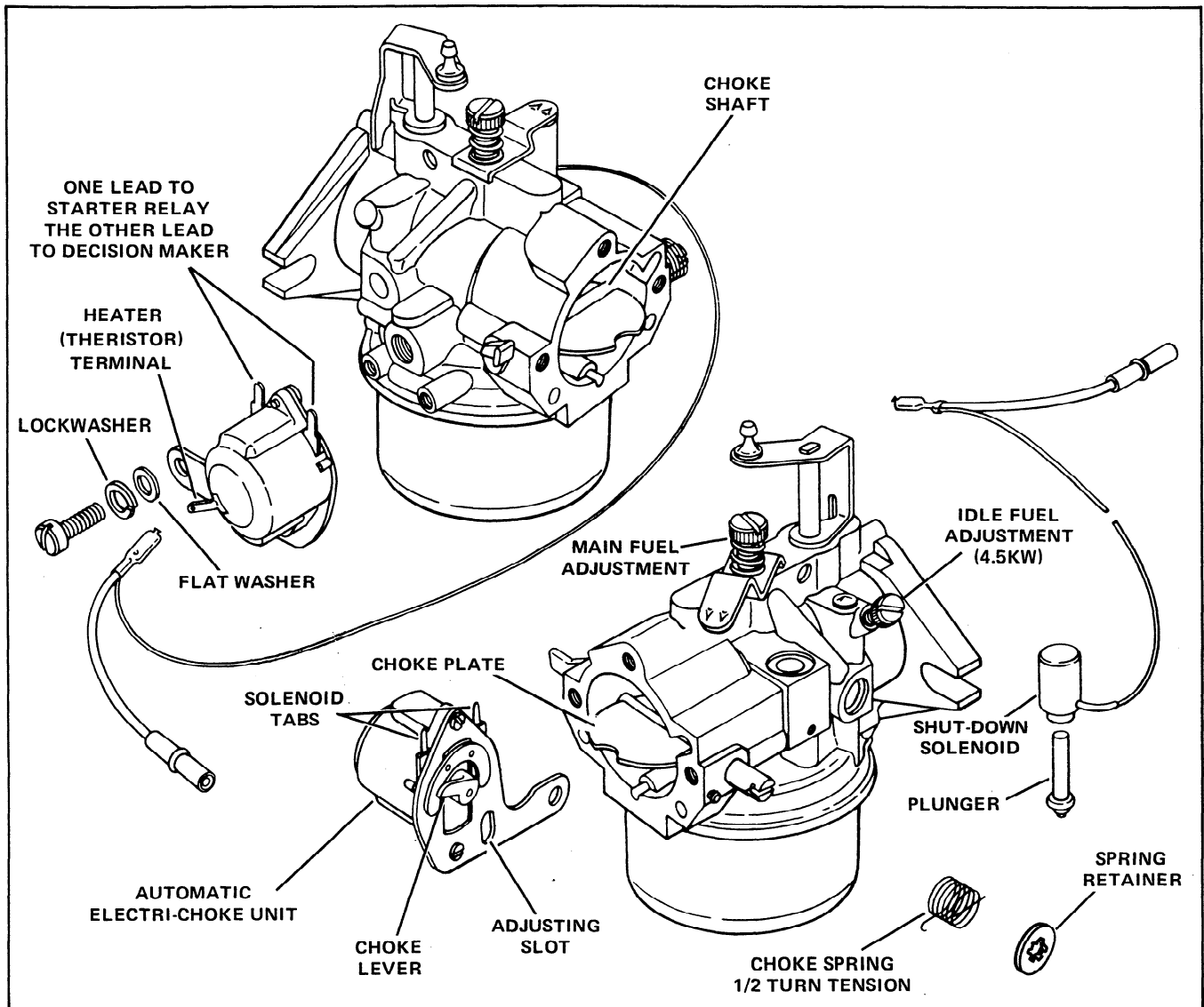


Figure 7-1. Choke and Carburetor (3.5KW, 4.5KW)

3. Push the start switch on the Decision Maker Controller to the start position and hold for five seconds. The choke plate should close a minimum of 45° at an ambient temperature of about 75°F. The plate will close more at lower temperatures. The choke plate should open when the switch is released.

4. During cranking the choke will remain closed only five to ten seconds, as closing time is controlled by the Decision Maker Controller.

5. If the choke does not function properly, refer to Choke Troubleshooting, Table 7-1.

7-1.3. Testing – Choke Solenoid (3.5, 4.5KW).

1. Disconnect leads from the solenoid tabs (Figure 7-1).
2. Check the resistance of the solenoid by connecting an ohmmeter or multimeter across the solenoid tabs. Solenoid resistance should be approximately 23 ohms or higher.

7-1.4. Testing – Choke Heater (3.5, 4.5KW).

1. Remove the lead from the heater terminal.
2. Check heater resistance. Connect one lead of an ohmmeter or multimeter to the heater terminal. Connect the other lead to the carburetor body (ground).
3. The resistance should read at least three ohms. If not, replace the choke.

7-1.5. Replacement and Adjustment.

**NOTE**

When installing the choke, make sure the choke plate arm goes under the choke lever.

1. Position the choke with the two mounting screws slightly loose.

2. Push the choke unit all the way down, then, keeping slight pressure on it, move the chokeplate (in carburetor) into the full open position allowing the choke unit to rise.

3. Rotate the choke unit clockwise (viewed from choke side) with a slight pressure. Continue to rotate the choke until it can no longer be rotated without closing the choke plate. (An internal spring will be wound up in the last 5 to 15 degrees of rotation before internal stop is reached).

4. When the choke plate is full open tighten the bracket screws and install the three leads.

5. Check choke function by removing the spark plug lead and cranking the engine. The choke plate should close a minimum of 45° at a temperature of about 75°F. The plate will close more at lower temperatures. The choke will remain closed only 5 to 10 seconds as determined by controller.

PROBLEM	CAUSES	SOLUTIONS
Choke won't close when cranking.	<ol style="list-style-type: none"> <li>1. Faulty lead wires or terminals.</li> <li>2. Air cleaner gasket interference with choke shaft lever. (4.5KW only.)</li> <li>3. Faulty solenoid.</li> <li>4. Faulty Decision Maker or ground in Decision Maker.</li> <li>5. Choke lever lacks sufficient travel or smooth movement.</li> </ol>	<ol style="list-style-type: none"> <li>1. Change lead wires or replace choke.</li> <li>2. Reposition flat of gasket to provide clearance for choke shaft lever.</li> <li>3. Test solenoid.</li> <li>4. Replace lead to Decision Maker with a jumper wire to ground. If choke functions properly check Decision Maker.</li> <li>5. Manually move the choke lever until the choke plate is fully closed. Replace the choke unit if it does not move freely.</li> </ol>
Choke will not fully open.	<ol style="list-style-type: none"> <li>1. Choke spring not properly adjusted.</li> <li>2. Choke shaft fails to move freely.</li> <li>3. Faulty choke adjustment.</li> <li>4. Faulty heater.</li> </ol>	<ol style="list-style-type: none"> <li>1. Remove spring retainer and with choke wide open wind up spring 1/2 turn, replace spring retainer.</li> <li>2. Replace choke shaft.</li> <li>3. Adjust choke.</li> <li>4. Test heater resistance.</li> </ol>

Table 7-1. Troubleshooting Choke (3.5KW, 4.5KW)



## 7-2. CHOKE TESTING AND ADJUSTMENTS (5.5KW, 7KW)

7-2.1. General. The choke on the 5.5KW and 7KW models is an integral part of the carburetor. The electrical lead to the choke is connected so that current flows to the thermostatic element only when the ignition is turned on. Tension of the thermostatic spring is set to allow full choke at starting. Current through a heating element furnishes heat which releases the spring tension and allows the choke plate to return to the open position.

### 7-2.2. Inspection.

1. Disconnect the high tension leads from both spark plugs so the engine will not start.
2. Remove the air cleaner cover, element and base plate.
3. Push the start switch on the Decision Maker Controller to the start position and hold for five seconds. The choke should fully close and release when the start switch is released.
4. If the choke does not function properly (Step 3) see troubleshooting, Table 7-2.

7-2.3. Adjustment. The choke unit (Figure 7-2) is set at the factory for average conditions. To readjust for local conditions, loosen the cover retaining screws and shift the cover in clockwise direction for richer setting or counter-clockwise direction for leaner setting. Tighten the cover retainer screws.

### 7-3. POSITIVE SHUTDOWN CONTROL

7-3.1. General. If an engine has been working under load, it tends to continue running or "diesel" after the switch is moved to the stop position. This is prevented on these generator sets by a solenoid and plunger which positively stops all flow of fuel when the switch is moved to the stop position. See Figure 7-1 or Figure 7-3. The solenoid is mounted on the carburetor. When the switch is in the

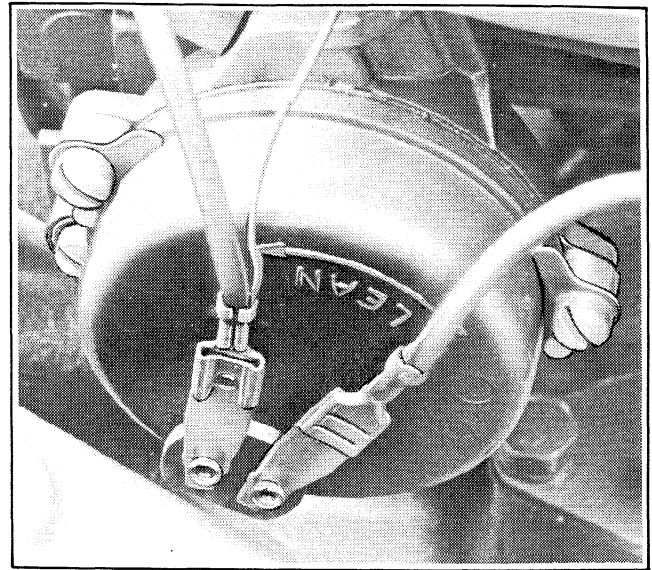


Figure 7-2. Choke (5.5KW, 7KW)

start position, battery current thru the solenoid holds the plunger and continues to hold it while the engine is running. When the switch is moved to the stop position the solenoid de-energizes and drops the plunger into porting in the carburetor to stop all flow of fuel.

### 7-3.2. Inspection and Repair.

1. Make sure the solenoid has a secure electrical connection and good contact with the hold down bracket (ground).
2. Check for stuck plunger. Replace if damaged.
3. Check for defective solenoid with an ohmmeter or multimeter. Solenoid resistance is approximately 20 ohms.

### 7-3.3. Temporary Field Fix.

1. Turn the main fuel adjusting needle out then shift the solenoid retaining bracket.

PROBLEMS	CAUSES	SOLUTIONS
Choke won't close during cranking.	Faulty lead to choke.	<ol style="list-style-type: none"> <li>1. Check for secure lead connections</li> <li>2. Make continuity check on lead. Replace if no continuity.</li> </ol>
	Faulty lead to ground.	<ol style="list-style-type: none"> <li>1. Check for secure lead connections.</li> <li>2. Make continuity check on lead. Replace if no continuity.</li> </ol>
	Poor adjustment.	<ol style="list-style-type: none"> <li>1. Adjust choke.</li> <li>2. Repair with kit or replace choke.</li> </ol>
Choke will not fully open.	<ol style="list-style-type: none"> <li>1. Poor adjustment.</li> <li>2. Faulty choke.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust choke.</li> <li>2. Repair with kit or replace choke.</li> </ol>

Table 7-2. Troubleshooting Choke (5.5KW, 7KW)

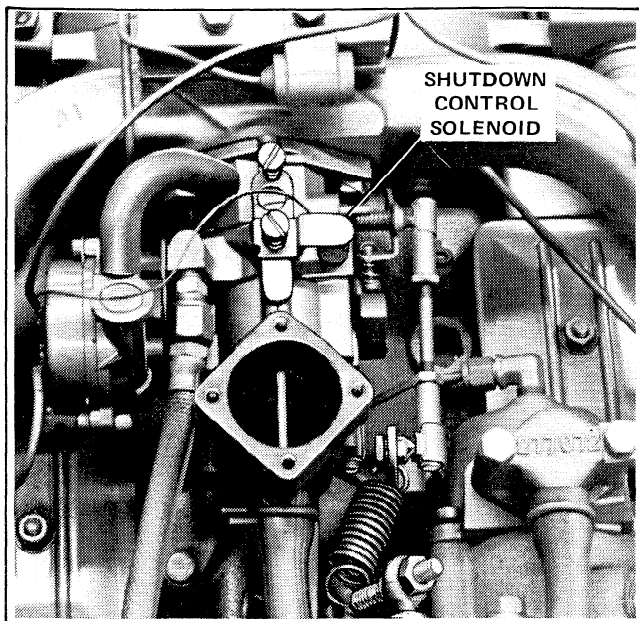


Figure 7-3. Shutdown Control Solenoid

2. Lift the solenoid and remove the plunger.
3. Replace the solenoid and retaining bracket and readjust the main fuel needle. (See Carburetor Adjustment).

#### 7-4. GOVERNOR (3.5KW, 4.5KW)

7-4.1. General. All Kohler Single Cylinder Engines are equipped with centrifugal flyweight mechanical type governors. The governor gear flyweight mechanism is mounted within the crankcase and driven off gear on the camshaft. In operation, centrifugal force causes the flyweights to move outward with increase in speed and inward with decreasing speed. As the flyweights move outward, they force the rod portion of the assembly to push outward. Tension of the governor spring pulls the flyweights back inward with decrease in engine speed. The rod, in turn, contacts a tab on the governor cross shaft causing it to rotate with changing speed. One end of the cross shaft protrudes thru the side of the crankcase. Thru external linkage, the action of the cross shaft is transmitted to the throttle (or butterfly) valve in the carburetor. When the engine is at rest, the tension of the governor spring should hold the throttle valve in open position.

7-4.2. Adjustments. The governor maintains engine speed when changing loads and limits the engine speed. Initial adjustment is made at the factory and should not be required in the field unless the linkage works loose or becomes disconnected. Speed adjustment should be made if the engine surges when changing loads or if speed drops considerably when a normal load is applied.

##### A. Initial Governor Adjustment (Figure 7-4 or 7-5).

1. With engine stopped, loosen (do not remove) the arm retaining nut which secures the governor arm to the cross shaft.

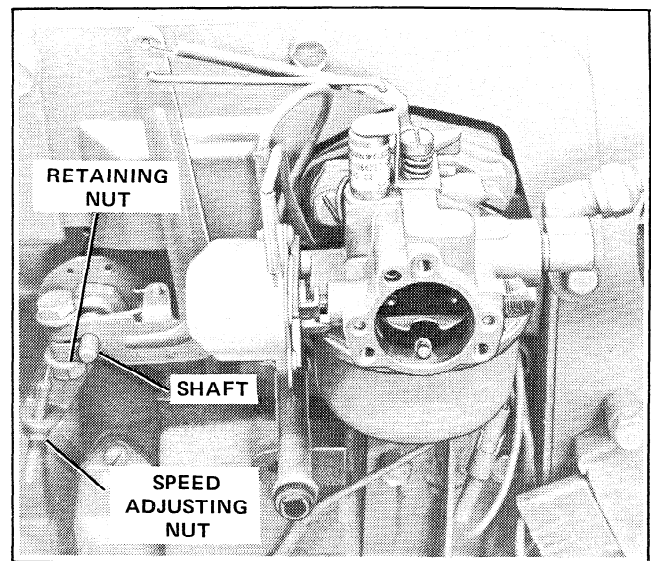


Figure 7-4.

#### Governor Components and Adjustment Points (3.5KW)

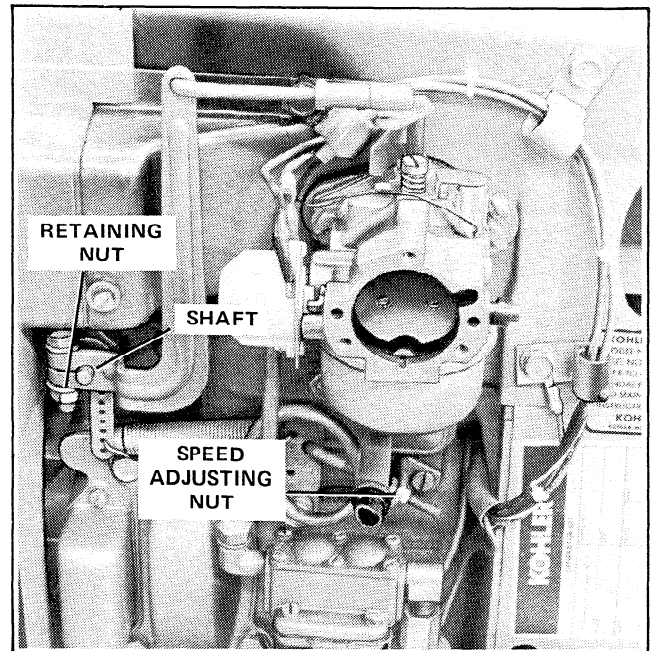


Figure 7-5.

#### Governor Components and Adjustment Points (4.5KW)

2. Grasp the end of the shaft with pliers and turn the shaft as far as possible in counterclockwise direction until the internal tab on the shaft stops against the governor gear mechanism. Hold shaft in this position, pull governor arm all the way from the carburetor then retighten the arm retaining nut.

##### B. Governor Speed Adjustment.

1. If overspeed or underspeed condition is suspected, check speed with a tachometer or frequency meter at rated load.
2. Loosen speed adjusting nuts to decrease speed and tighten speed adjusting nuts to increase speed.

C. Sensitivity Adjustment. If the speed drops considerably when a normal load is applied, the governor may not be sensitive enough. If speed surging occurs with changing load, the governor may be too sensitive.

1. To make the governor MORE sensitive, increase the spring tension by moving the spring hooks into holes spaced further apart.

2. To make the governor LESS sensitive, decrease the spring tension by moving the spring hooks into holes spaced closer together.

#### 7-5. GOVERNOR HUNTING CHECKS (4.5KW ONLY).

Governor hunting is a periodic frequency variation. If the variation (hunting) is audible to the unaided ear, it is not acceptable. Use the checklist below to help maintain proper governor operation. The items in this list may be used singly or in combination to achieve smoothest possible operation.

1. Set the point gap to 0.020 with a feeler gauge and adjust the carburetor for peak performance.

2. With the engine not running check for free governor linkage movement from idle to full throttle. (Note: Remove excess paint from governor spring and damper and make sure choke wires do not interfere.)

3. With the engine shut down the throttle will be in wide open position. Adjust the governor linkage so that approximately 1/32" space exists between the throttle lever and carburetor body. (Note: This can be done by sight, no fine measurement is necessary.)

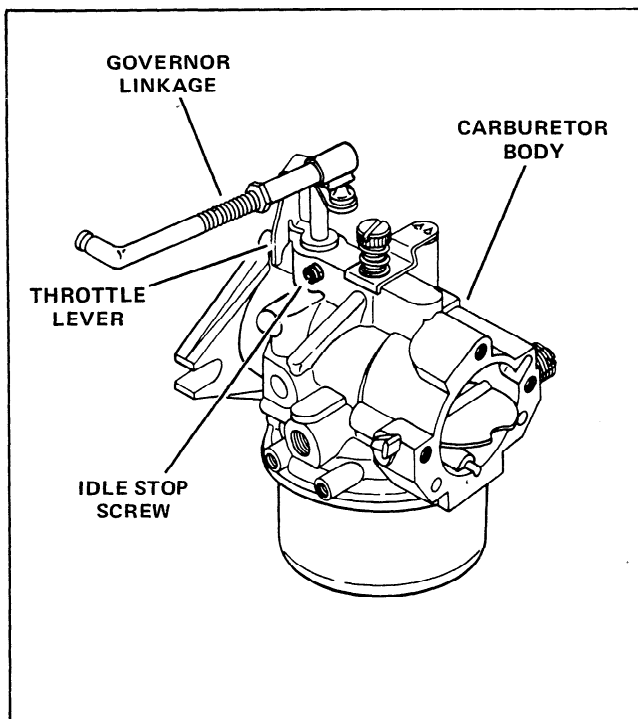


Figure 7-6. Carburetor (4.5KW)

4. Check idle speed, at no load, with the throttle lever against the idle speed screw and set speed to approximately 1680 RPM (56 CPS).

5. Reposition the governor spring in the governor lever. On most units the 2nd hole from the bottom provides the best operation. Whenever the governor spring is moved in the governor lever the governor speed control must be adjusted, at no load, to approximately 1890 RPM (63 CPS).

6. If poor governing remains, the spring may be moved to the bottom hole. If the governing is good but the speed drop from no load to full load is too great (over 90 PRM (3 CPS)) the governor spring can be moved up one hole in the governor lever.

#### 7-6. GOVERNOR (5.5KW, 7KW).

7-6.1. General. These models are equipped with centrifugal flyweight type mechanical governors which are externally mounted. See Figure 1-3 for location. The governor drive gear is driven by the camshaft gear. Lubrication is provided through an external oil line which connects to the engine lubrication system.

7-6.2. Speed Adjustment. The throttle shaft is fixed at a definite length to establish a load speed of 1800 RPM. Any variation in speed frequency changes the output of the generator. For this reason only slight readjustment of speed is possible. Proceed as follows:

1. To increase speed, loosen the inside speed adjusting nut (Figure 7-7) and tighten the outside nut to draw the eyebolt closer to the bracket which is mounted on the governor. This will pull the throttle open.

2. To decrease speed, loosen the outside nut and tighten the inside nut to force the eyebolt away from the bracket.

3. When speed is correct, tighten the nut that was loosened to lock the eyebolt at the new setting.

7-6.3. Sensitivity Adjustment. If the governor is too sensitive, speed surging will occur with change in load. If the governor is not sensitive enough, a big drop in speed will occur when normal load is applied.

1. To make the governor more sensitive, loosen the upper nut and tighten and lower nut to force the eyebolt downward.

2. To make the governor less sensitive, loosen the lower nut and tighten the upper nut to draw the eyebolt upward.

3. Retighten the nut that was loosened to lock the eyebolt at the new setting.

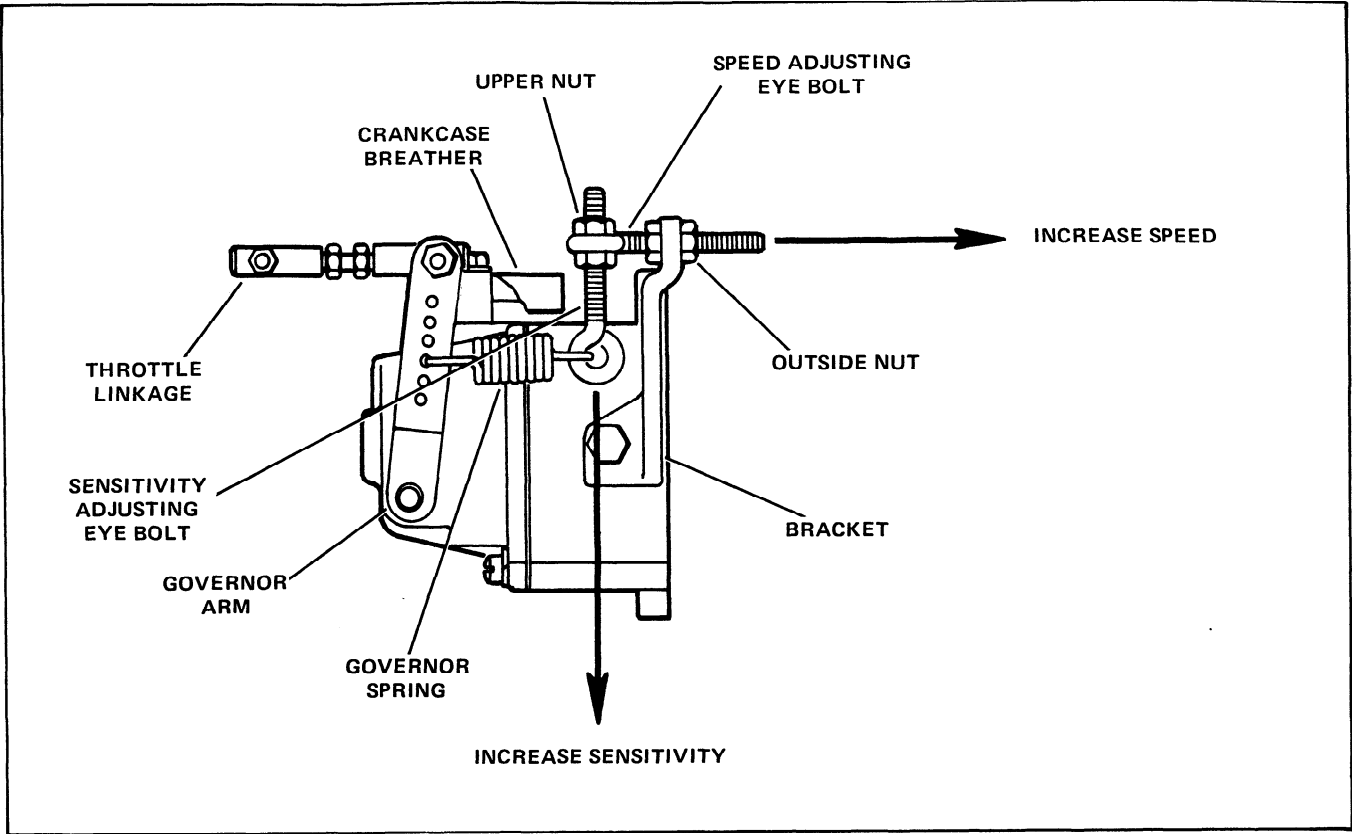
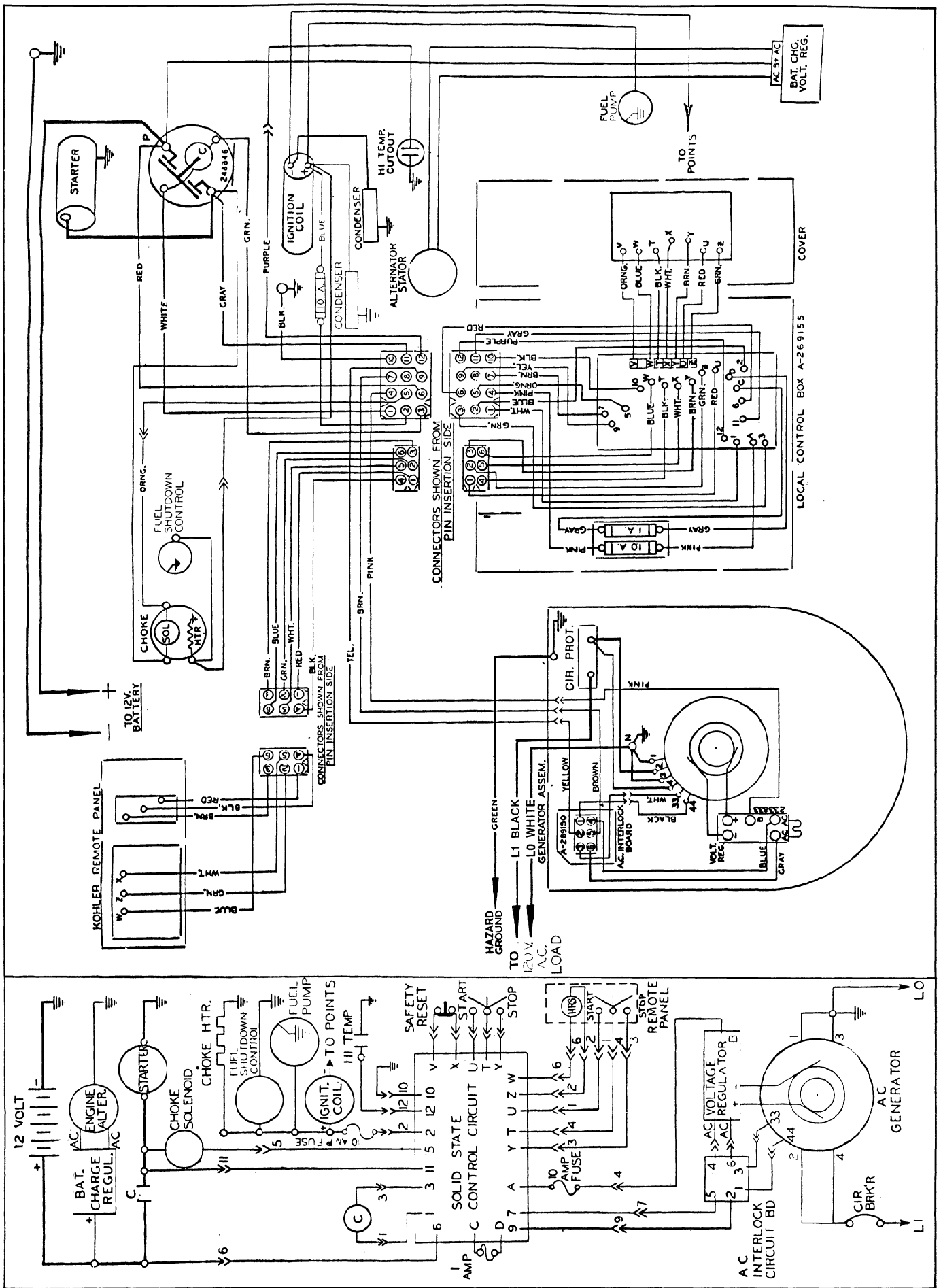
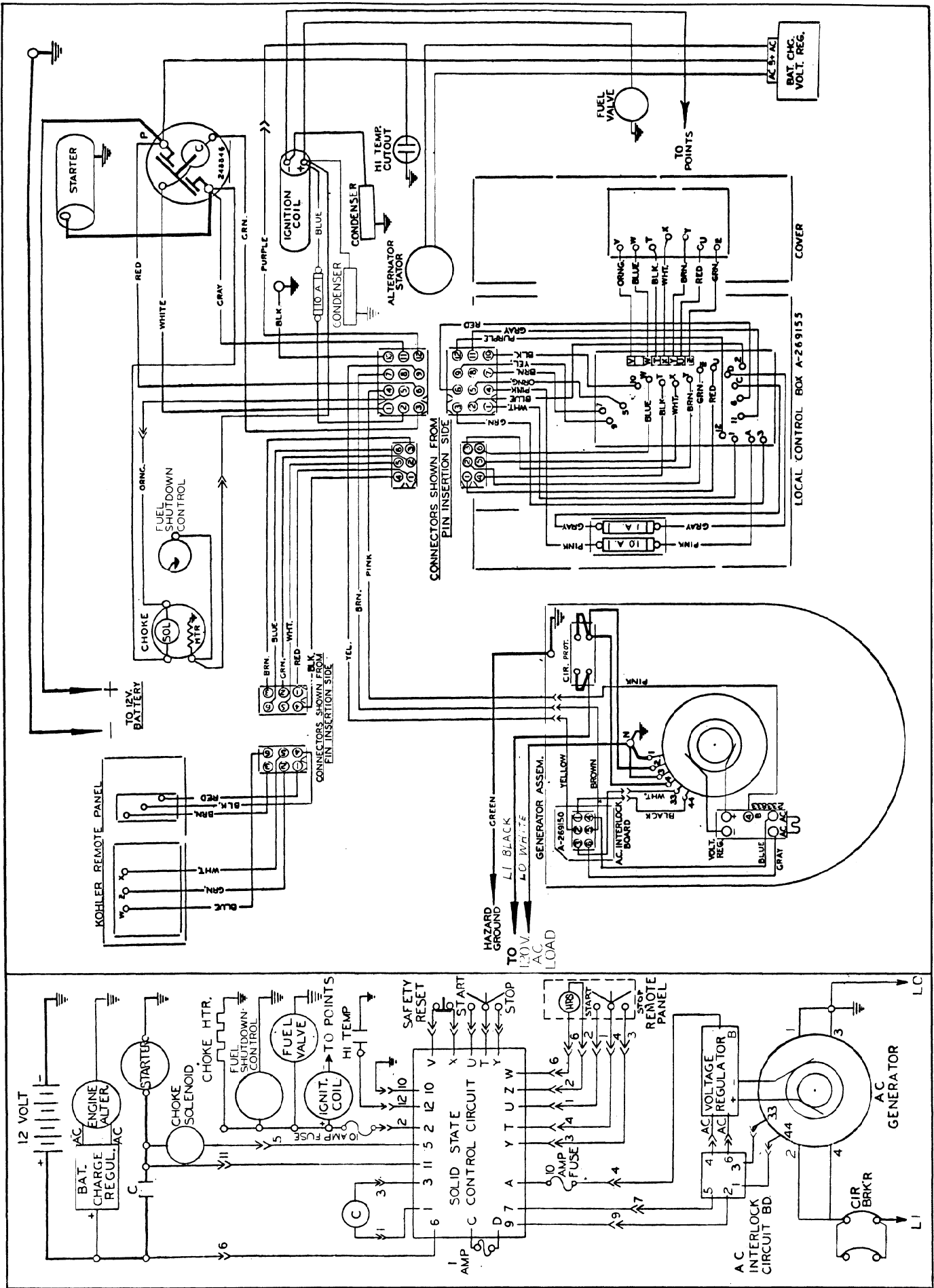


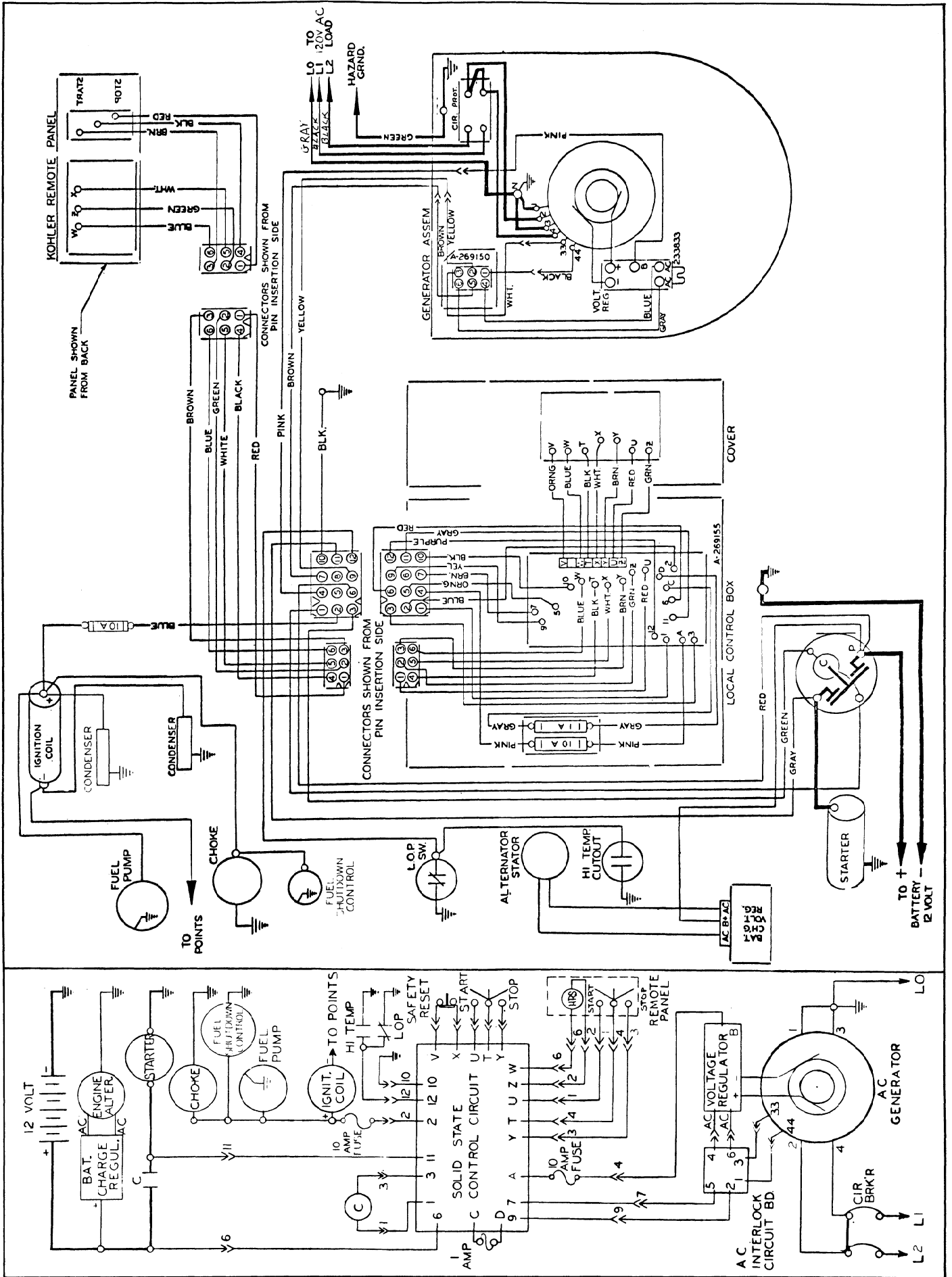
Figure 7-7. Governor Components and Adjustments (5.5KW, 7KW)



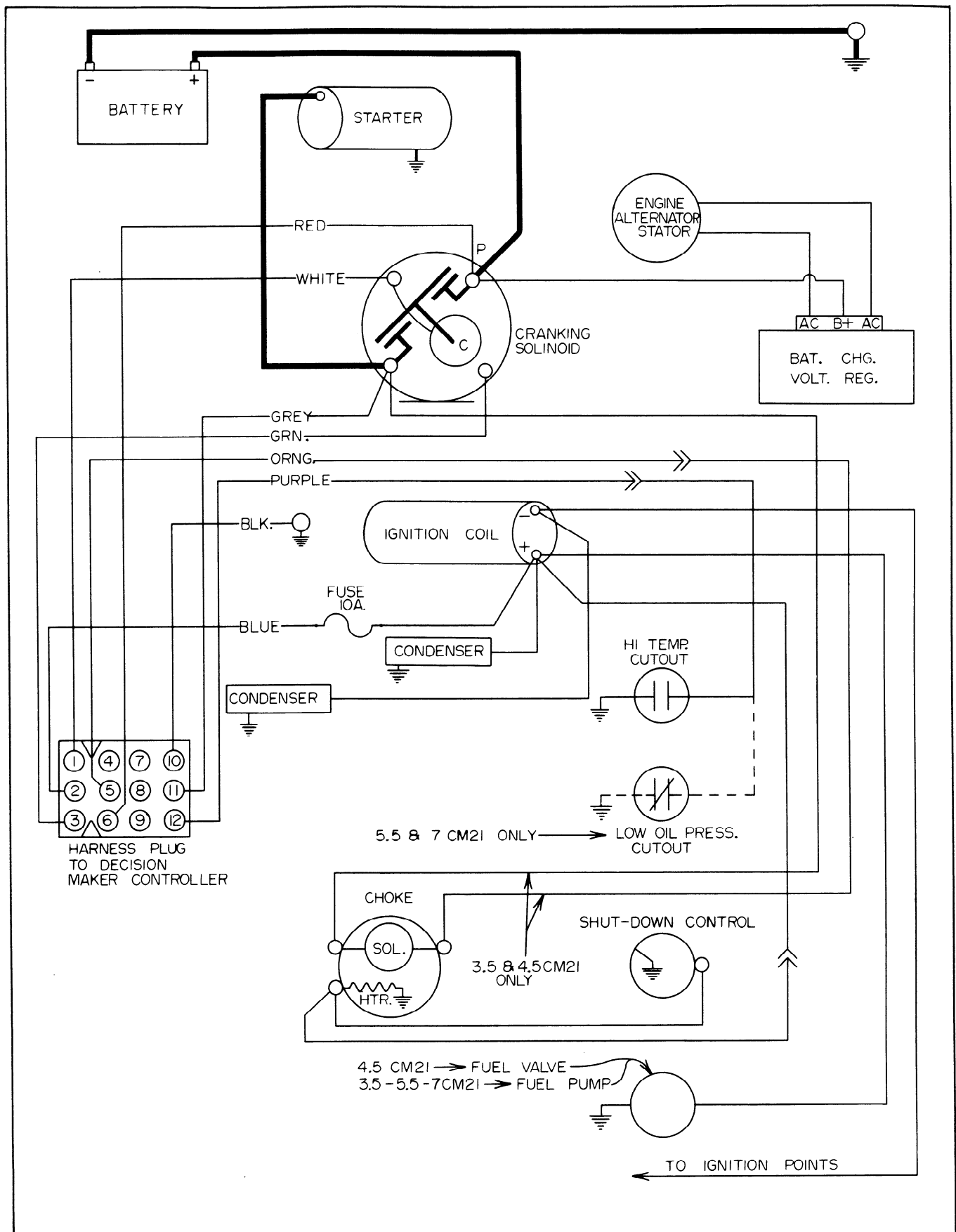
Wiring Diagram 3.5CM21 Generator Set (RV)



Wiring Diagram 4.5CM21 Generator Set (RV)



Wiring Diagram 5.5CM21 and 7CM21 Generator Sets (RV)



Engine Electrical Wiring Diagram



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