Service Manual

Mobile Generator Sets

Models:

10CC
12CC
10CZ
12CZ
10CFC
12CFC
10CFZ
12CFZ

KOHLER®
POWER SYSTEMS

TP-5422 9/90

Table of Contents

Introduction

This manual covers the general operation, maintenance, troubleshooting and repair of Kohler 10CC, 10CZ, 12CC, and 12CZ mobile generator sets. Prior to operating the generator, READ THIS MANUAL. Carefully follow the operating procedures and observe all safety precautions to ensure proper generator operation and to avoid serious bodily injury. Additional information on servicing and troubleshooting the generator engine is available separately.

Service Assistance

See the Yellow Pages of your Telephone Directory under Generator – Electric for your closest Kohler Generator dealer or distributor.

Provide MODEL, SPECIFICATION, SERIAL, and ENGINE numbers from the generator nameplate to receive current parts and information for your generator set.

KOHLER CO., Kohler, Wisconsin 53044
Phone 414–565–3381, Telex 26888,
Fax 414–565–3648
For Sales & Service in U.S.A. & Canada
Phone 1–800–544–2444

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 way to prevent accidents is to be aware 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 follow. Keep these precautions in mind. This manual contains several types of safety precautions which are explained below.

⚠ DANGER

Danger is used to indicate the presence of a hazard which *will* cause *severe* personal injury, death, or substantial property damage if the warning is ignored.

⚠ WARNING

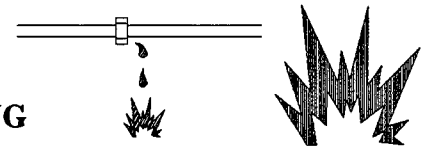
Warning is used to indicate the presence of a hazard which *can* cause *severe* personal injury, death, or substantial property damage if the warning is ignored.

⚠ CAUTION

Caution is used to indicate the presence of a hazard which *will* or *can* cause *minor* personal injury or property damage if the warning is ignored.

NOTE

Note is used to notify people of installation, operation, or maintenance information which is important but not hazard-related.



⚠ WARNING

All fuels are highly explosive in a vapor state. Use extreme care when handling, storing, and using fuels

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 since spilled fuel may ignite on contact with hot parts or from ignition spark. Do not smoke or permit flame or spark to occur near potential sources of spilled fuel or fuel vapors. 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. Additional precautions must be taken when using the following fuels:

Gasoline – Store gasoline only in approved red containers clearly marked GASOLINE. Do not 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.

Natural Gas – Adequate ventilation is mandatory. Natural gas rises; install gas detectors high in room. Inspect detectors often.

⚠ CAUTION

Short circuits can cause bodily injury and/or equipment damage. Do not contact electrical connections with tools or jewelry while adjustments are made. Remove wristwatch, rings, and jewelry that can cause short circuits.

⚠ CAUTION

Fuel leakage can cause an explosion. Check LP gas fuel system for leakage using a soap–water solution with fuel system test pressurized to 6–8 ounces (10–14 inches water column). Do not use test solutions that contain ammonia or chlorine, since the soap will not bubble for an accurate leakage test.

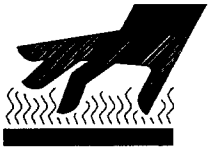
⚠ WARNING

A flash fire can cause serious burns. 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. When removing fuel line or carburetor, use a proper container to catch all fuel.

Spilled fuel can ignite on contact with hot engine parts. Use a container to catch fuel when draining fuel system. Wipe up all spilled fuel after draining system.

NOTE

Fuel leakage could cause an explosion. After all LP–Gas connections have been completed, the entire system must be test pressurized to 6–8 ounces (10–14 inches water column).



⚠ CAUTION

Hot parts can cause personal injury. Do not touch hot engine parts. An engine gets hot while running and exhaust system components get extremely hot.

⚠ CAUTION

Hot parts can cause personal injury. Avoid touching generator field or exciter armature. Generator field and exciter armature will get hot if shorted.

⚠ CAUTION

Hazardous noise can cause loss of hearing. Never operate generator without adequate hearing protection or muffler. Never operate generator with faulty exhaust system.

⚠ WARNING

Hazardous voltage can cause death or severe injury.

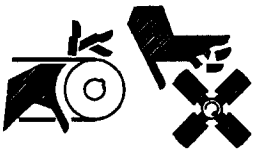
Perform electrical service only as prescribed in equipment manual. Be sure that generator is properly grounded. Never touch electrical leads or appliances with wet hands, when standing in water, or on wet ground as the chance of electrocution is especially prevalent under such conditions. Wiring should be inspected at the interval recommended in the service schedule — replace leads that are frayed or in poor condition. The function of a generator set is to produce electricity and wherever electricity is present, there is the hazard of electrocution.

⚠ WARNING

Hazardous "backfeed" voltage can cause death or severe injury.
The generator must not be used to "backfeed" by connecting it to building electrical circuits. Install a transfer switch in standby/mobile generator installations to prevent connection of generator and other sources of power. Electrical backfeed into a utility electrical system can cause serious injury or death to utility personnel working on transmission lines.
Hazardous voltage can cause death or severe injury. Follow instructions of test equipment manufacturer when performing high voltage test. Improper test procedure can damage equipment or lead to future generator failures.

Hazardous voltage can cause death or severe injury. When testing voltage regulator, always unplug power cord from AC power source before connecting or disconnecting wires to prevent danger of electrocution. When the power cord is plugged in during voltage regulator test, the AC pins become "hot" and there is danger of electrocution.

⚠ WARNING



Exposed moving parts can cause severe injury.
Keep hands, feet, hair, and clothing away from belts and pulleys when unit is running. Replace guards, covers, and screens before operating generator set. Do not open generator compartment door when unit is running.

⚠ WARNING

Accidental starting can cause death or serious personal injury. Turn Generator Master Switch to OFF position, disconnect power to battery charger, and remove battery cables (remove negative lead first and reconnect it last) to disable generator set before working on any equipment connected to generator. The generator set can be started by automatic transfer switch or remote start/stop switch unless these precautions are followed.

⚠ WARNING

Hot coolant can cause severe burns.
Allow engine to cool and release pressure from cooling system before opening pressure cap. To release pressure, cover the pressure cap with a thick cloth then turn it slowly counterclockwise to the first stop. After pressure has been completely released and the engine has cooled, remove cap. If generator set is equipped with a coolant recovery tank, check coolant level at tank.

⚠ WARNING

A sudden backfire can cause serious burns.
Do not operate with air cleaner removed.

⚠ WARNING

Battery gases can cause an explosion.
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. Never connect negative (–) battery cable to positive (+) connection terminal of starter solenoid. Do not test battery condition by shorting terminals together or sparks could ignite battery gases or fuel vapors. Any compartment containing batteries must be well ventilated to prevent accumulation of explosive gases. Do not mount battery in generator compartment. To avoid sparks, do not disturb battery charger connections while battery is being charged and always turn charger off before disconnecting battery connections. When disconnecting battery, remove negative lead first and reconnect it last.

⚠ WARNING

Hazardous voltage can cause death or serious injury. The heat sink of the voltage regulator contains high voltage. Do not touch voltage regulator heat sink when testing or electrical shock will occur.

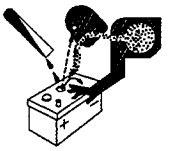
⚠ WARNING

Hazardous voltage can cause death or severe injury. Do not contact electrical connections with adjustment tool while the generator is running. Remove wristwatch, rings, and jewelry that can cause short circuits. Do not touch electrical equipment when standing in water, on wet ground, or when your hands are wet.

Hazardous voltage can cause severe personal injury.
When testing or servicing generator set and there is the presence of hazardous voltage, carefully follow instructions in the equipment manual.

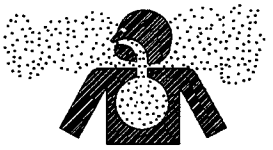
⚠ CAUTION

Short circuits can cause bodily injury and/or equipment damage. Do not contact electrical connections with tools or jewelry while adjustments are made. Remove wristwatch, rings, and jewelry that can cause short circuits.



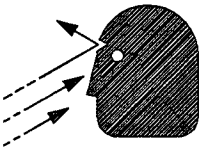
⚠ WARNING

Sulfuric acid in batteries can cause permanent damage to eyes, burn skin, and eat holes in clothing. 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 hazardous spattering of electrolyte.



⚠ WARNING

Carbon monoxide can cause death, severe nausea or fainting. Never operate the generator set inside a building unless the exhaust gas is piped safely outside. Never operate in any area where exhaust gas could accumulate and seep back inside an occupied building or vehicle. Be careful when parking your coach to avoid obstructing the exhaust outlet. The exhaust gases must discharge freely, otherwise carbon monoxide may deflect into the vehicle. Avoid breathing exhaust fumes when working on or near the generator set. Carbon monoxide is particularly dangerous because it is an odorless, colorless, tasteless, nonirritating gas which can cause death if inhaled for even a short period of time. The exhaust system must be leakproof and routinely inspected.



⚠ CAUTION

Flying projectiles can cause injury. When making adjustments or servicing generator set, do not loosen crankshaft hardware or rotor thru–bolt. If rotating crankshaft manually, direction should be clockwise only. Turning crankshaft or rotor thru–bolt counterclockwise can loosen hardware and result in serious personal injury from hardware or pulley flying off engine while unit is running. Retorque all crankshaft and rotor hardware after servicing.

NOTE

RV/mobile generator sets do not comply with United States Coast Guard (U.S.C.G.) requirements and must not be used for marine applications. Use only generator sets specified for marine use in marine installations. U.S.C.G. Regulation 33CFR183 requires a generator set to be "ignition protected" when used in a gasoline–fueled environment.

⚠ CAUTION

Engine block heater can cause electrical shock. Remove engine block heater plug from electrical outlet before working on block heater electrical connections.

NOTE

Block heater will fail if not immersed in water. Always unplug block heater(s) before draining coolant and fill engine block with coolant prior to plugging in block heater(s). Block heater element MUST be immersed in engine coolant before being energized.

Warning Decals

Warning decals are affixed to the generator set in prominent places to advise the operator or service technician of potentially hazardous situations. These decals are reproduced here to improve operator recognition and thereby increase decal effectiveness. For a further explanation of decal warnings, reference preceding safety precautions. Before operating or servicing the generator set, be sure you understand the message of these decals. Replace decals if missing or damaged

⚠ WARNING

Hazardous voltage. Backfeed to utility system can cause electrocution or property damage.

When generator is used for standby power, use of automatic transfer switch is recommended to prevent inadvertent interconnection of standby and normal sources of supply.

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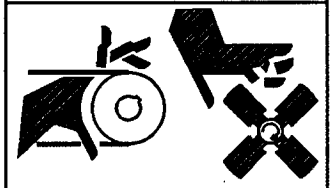
⚠ WARNING



Rotating parts. Can cause severe injury.

Do not operate generator set without all guards, screens or covers in place.

249808

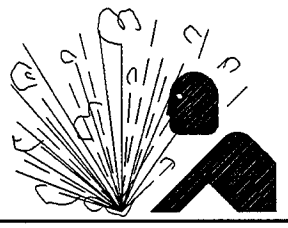
⚠ CAUTION

Hot engine and exhaust system. Can cause severe burns.

Do not work on generator set until unit is allowed to cool.

249809

⚠ WARNING

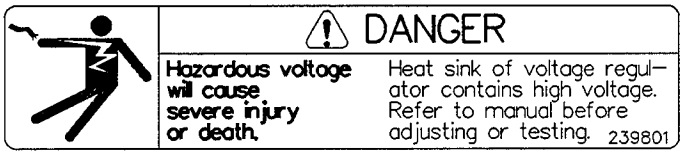


Hot coolant and steam. Can cause severe burns and personal injury.

Before removing cap stop generator, allow to cool and loosen cap to relieve pressure. Fill system before starting unit.

249810


DANGER
Hazardous voltage.
Will cause severe
injury or death.
Moving rotor.
Will cause severe
injury.
Do not operate generator set without all
guards and electrical enclosures in place.
Operate and service by trained personnel only.
Refer to manual prior to installation,
operation or service.
Manuals available from Kohler Co.
Kohler, Wisconsin 53044
257438


DANGER
Hazardous voltage
will cause
severe injury
or death.
Heat sink of voltage regulator contains high voltage.
Refer to manual before
adjusting or testing.
239801

SECTION 1. SPECIFICATIONS

General Specifications

	10CC & 10CFC	12CC & 12CFC	10CZ & 10CFZ	12CZ & 12CFZ
Dimensions - L x W x H —in. (mm)	42.9 x 22 x 26.6 (1089 x 558 x 676)	45 x 22 x 26.6 (1143 x 558 x 676)	51 x 22 x 26.6 (1295 x 558 x 676)	51 x 22 x 26 (1295 x 558 x 676)
Weight - lbs. (kg)	532(241)	590(268)	572(259)	640(290)
Air Requirements - 60 Hz				
Combustion - cfm (cm)	30(0.85)	35(1.0)	30(0.85)	35(1.0)
Cooling - cfm (cm)	2400(68)	2400(68)	2400(68)	2400(68)
Fuel Consumption		**Gasoline - gph (Lph)**		
Load	25%	50%	75%	100%
10CC/CZ				
60 Hz	0.75(2.8)	1.0(3.8)	1.2(4.5)	1.5(5.6)
50 Hz	0.62(2.3)	0.83(3.1)	1.0(3.8)	1.3(4.9)
12CC/CZ				
60 Hz	1.0(3.8)	1.3(4.9)	1.5(5.7)	1.8(6.8)
50 Hz	0.8(3.1)	1.1(4.1)	1.3(4.9)	1.5(5.7)
Fuel Consumption		**LP Gas - cfh(m^3/hr.)**		
Load	25%	50%	75%	100%
10CC/CZ				
60 Hz	44(1.3)	53(1.5)	60(1.7)	68(1.9)
50 Hz	37(1.0)	44(1.2)	50(1.4)	56(1.6)
12CC/CZ				
60 Hz	36(1)	48(1.4)	60(1.7)	75(2.1)
50 Hz	30(0.8)	40(1.1)	50(1.4)	63(1.8)
Fuel Consumption		**Natural Gas - cfh(m^3/hr.)**		
Load	25%	50%	75%	100%
10RY	64(1.8)	81(2.3)	96(2.7)	122(3.5)
10RFY	53(1.5)	67(1.9)	80(2.3)	101(2.9)
12RY	82(2.3)	107(3.0)	127(3.6)	166(4.7)
12RFY	68(1.9)	89(2.5)	105(3)	138(3.9)

Engine

Some general engine specifications are listed below. Refer to the appropriate service section and the engine service manual for specific service details.

	10CC/CZ	12CC/CZ
Manufacturer	Ford	
Model	VSG-411	VSG-413

Engine – cont'd.

	10CC/CZ		12CC/CZ
Cycle		4	
Number Cylinders		4	
Compression Ratio	9.5:1		9.5:1
Displacement – cu.in. (cc)	67(1100)		79(1300)
Rated Horsepower	17		23
RPM		1800 (60 Hz)	
Bore – in. (mm)	2.7(68.68)		2.91(73.96)
Stroke – in. (mm) 3.126 (79.4)	2.97(75.48)		2.97(75.48)
Valve Material		Forged Steel	
Valve Clearance – in. (mm)			
Intake	0.009(0.22)		0.009(0.22)
Exhaust	0.013(0.32)		0.013(0.32)
Cylinder Block Material		Cast Iron	
Cylinder Head Tightening Torque – ft. lbs (Nm)		Step 1: 22(30) Step 2: Turn 90° More Step 3: Turn 90° More	
Cylinder Head Material		Cast Iron	
Piston Rings		2 Compression/ 1 Oil	
Crankshaft Material		Nodular Cast Iron	
Bearings, Number & Type	3, Replaceable Insert		5, Replaceable Insert
Governor		Electronic	
Lubrication System		Full Pressure	
Oil Capacity (with filter) – qts. (L)		3.5 (3.3)	
Oil Type (API)		SG	
Oil Pressure – psi (kPa)		21.7 (150)	
Fuel Type		Gas/Gasoline*	
Battery Voltage		12	
Battery Ground		Negative	
Battery Recommendation		400 Cold Cranking Amps. Min.	
Battery Charging		Belt-Driven Alternator	
Spark Plug Type		Motorcraft AGSF 22C	
Spark Plug Gap – in. (mm)		0.039 (1)	
Spark Plug Tightening Torque – ft. lbs (Nm)		11–15 (15–20)	
Ignition System		Distributorless	
Coil Type		High Output DIS Coil	
Coil Output		37 KV Minimum	
Primary Resistance at Coil Tower (ohms)		0.5 – 1.0	
Starter Motor		Positive Engagement	
Cooling System		Water-Cooled	
Cooling System Capacity – qts. (L)		12.4 (11.8)	
Engine Firing Order		1–2–4–3	
Timing		Fixed	
Intake Manifold Bolt Torque – ft. lbs. (Nm)		12–15 (16–20)	
Alternator Belt Tension – lbs. (kg)		New: 79–101 (36–46) Used: 56–75 (25–34) **	

* Depends on Fuel System Option Installed on Generator Set (Gasoline, LP Vapor or LP Liquid Withdrawal)

** A belt in operation longer than 10 minutes is considered used.

Generator (10 kW Models)

	10CC	10CFC	10CZ	10CFZ
Rated kW	10	10	10	10
Frequency – Hz	60	50	60	50
RPM	1800	1500	1800	1500
Rated Voltage	120/240	120/240 115/230 110/220	Broadrange	110/220 110/190 220/380 240/416 120/208
Rated Amps.	42	*	*	*
Excitation Method	Static Excited	Static Excited	Brushless Exciter	Brushless Exciter
Coupling Type	Flexible Disc			
Overbolt Torque – in. lbs. (Nm)	70(7.9)			
Rotor Resistance (ohms)**	3–5	3–5	2.5–4.5 (Main Field) 0.71 (Exciter Arm.)	2.5–4.5 (Main Field) 0.71 (Exciter Arm.)
Stator Resistance (ohms)**				
Leads:				
1–2, 3–4	0.09	0.09		
33–44	0.09	0.09		
55–33	1.3	1.3		
B1–B2	0.07	0.07		
1–4, 2–5, 3–6 etc.			0.19	0.19
55–66			1.4	1.4
B1–B2			0.05	0.05
Exciter Field			5	5
Voltage Regulator Type	PowerBoost III or IIIE	PowerBoost III or IIIE	PowerBoost V	PowerBoost V
Number of Output Leads	4	4	12	12
Insulation (Rotor and Stator)	Class F, Epoxy Varnish, Vacuum Impregnated			
Fungus Resistance	Meets Mil–E–04970A Standard			
Winding Material	Copper			
Bearing, Quantity and Type	1, Replaceable Ball			
Circuit Protection				
Controller	Replaceable 10 Amp. Fuse			
Generator	Optional Line Circuit Breaker (Size Dependent on Voltage)			
Voltage Regulator	Replaceable 10 Amp. Fuse (CC/4–Lead Models Only)			

* Amperage will vary with voltage selected.

1–Phase Amps. = 1–Phase watts ÷ Volts

3–Phase Amps. = (3–Phase watts ÷ 0.8) ÷ 1.73) ÷ Volts

** Most ohmmeters will not give accurate readings when measuring less than 1 ohm. The rotor/stator can be considered good if a low resistance reading (continuity) is obtained and there is no evidence of shorted windings (discoloration). Do not confuse a low resistance reading with a reading indicating a shorted winding.

DERATION: The kilowatts of the generator set will decrease 4% for each 1000 feet (305 meters) above sea level and 1% for each 10°F (5.5°C) increase in ambient temperature above 85°F (29°C). Ambient temperature is measured at air cleaner inlet.

Generator (12 kW Models)

	12CC	12CFC	12CZ	12CFZ
Rated kW	12	12	12	12
Frequency – Hz	60	50	60	50
RPM	1800	1500	1800	1500
Rated Voltage	120/240	120/240 115/230 110/220	Broadrange Reconnectible	110/220 110/190 220/380 240/416 120/208
Rated Amps.	50	*	*	*
Excitation Method	Static Excited	Static Excited	Brushless Exciter	Brushless Exciter
Coupling Type		Flexible Disc		
Overbolt Torque – in. lbs. (Nm)		70(7.9)		
Rotor Resistance (ohms)**	2.5–4.5	2.5–4.5	2.5–4.5 (Main Field) 0.71 (Exciter Arm.)	2.5–4.5 (Main Field) 0.71 (Exciter Arm.)
Stator Resistance (ohms)**				
Leads:				
1–2, 3–4	0.06	0.06		
33–44	0.06	0.06		
55–33	1.1	1.1		
B1–B2	0.05	0.05	0.05	0.05
1–4, 2–5, 3–6 etc.			0.17	0.17
55–66			1.3	1.3
Exciter Field			5	5
Voltage Regulator Type	PowerBoost III or IIIE	PowerBoost III or IIIE	PowerBoost V	PowerBoost V
Number of Output Leads	4	4	12	12
Insulation (Rotor and Stator)	Class F, Epoxy Varnish, Vacuum Impregnated			
Fungus Resistance	Meets Mil–E–04970A Standard			
Winding Material	Copper			
Bearing, Quantity and Type	1, Replaceable Ball			
Circuit Protection				
Controller	Replaceable 10 Amp. Fuse			
Generator	Optional Line Circuit Breaker (Size Dependent on Voltage)			
Voltage Regulator	Replaceable 10 Amp. Fuse (CC/4–Lead Models only)			

* Amperage will vary with voltage selected.
1–Phase Amps. = 1–Phase watts ÷ Volts
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DERATION: The kilowatts of the generator set will decrease 4% for each 1000 feet (305 meters) above sea level and 1% for each 10°F (5.5°C) increase in ambient temperature above 85°F (29°C). Ambient temperature is measured at air cleaner inlet.

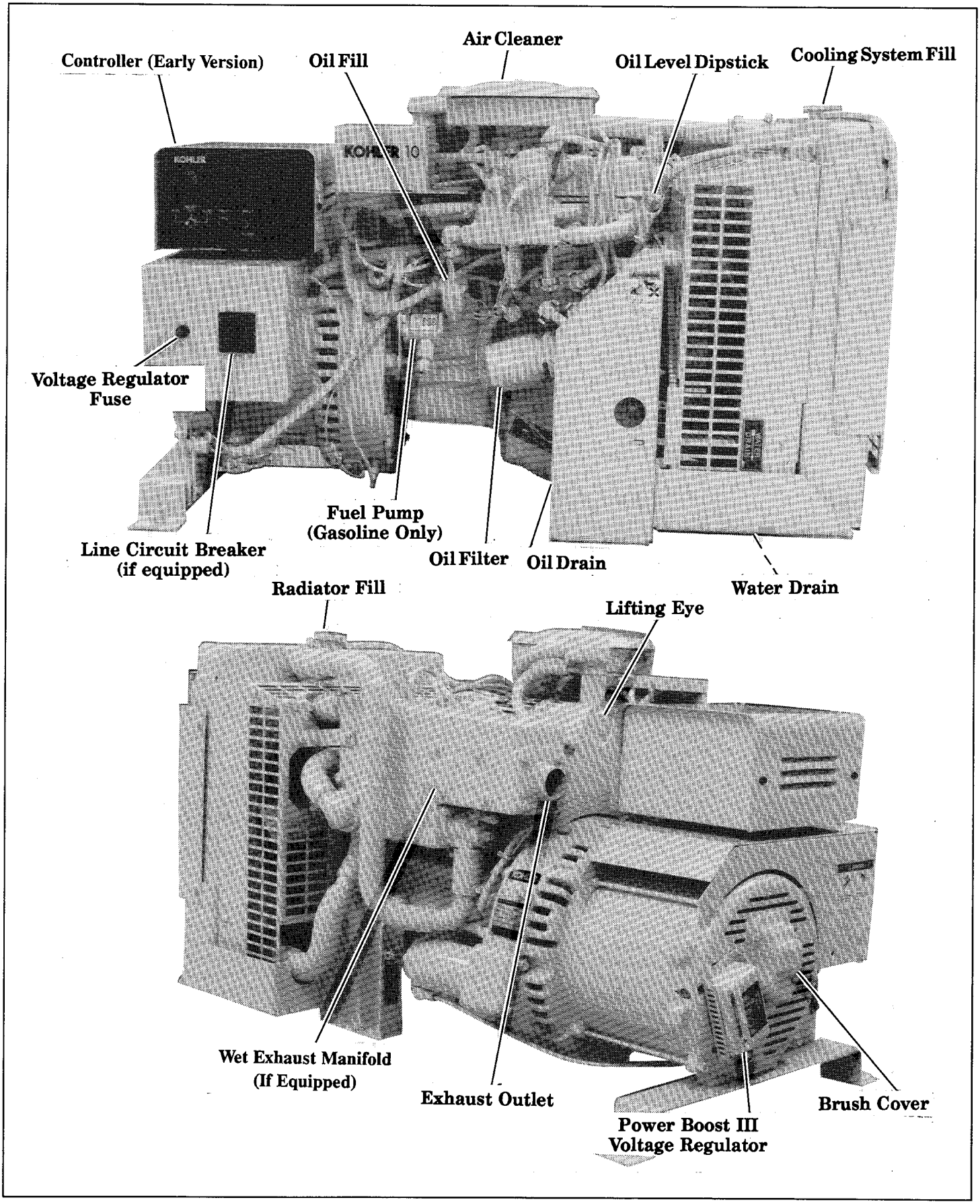


Figure 1–1. Service Views – 10CC & 12 CC (4–Lead) Generator Sets

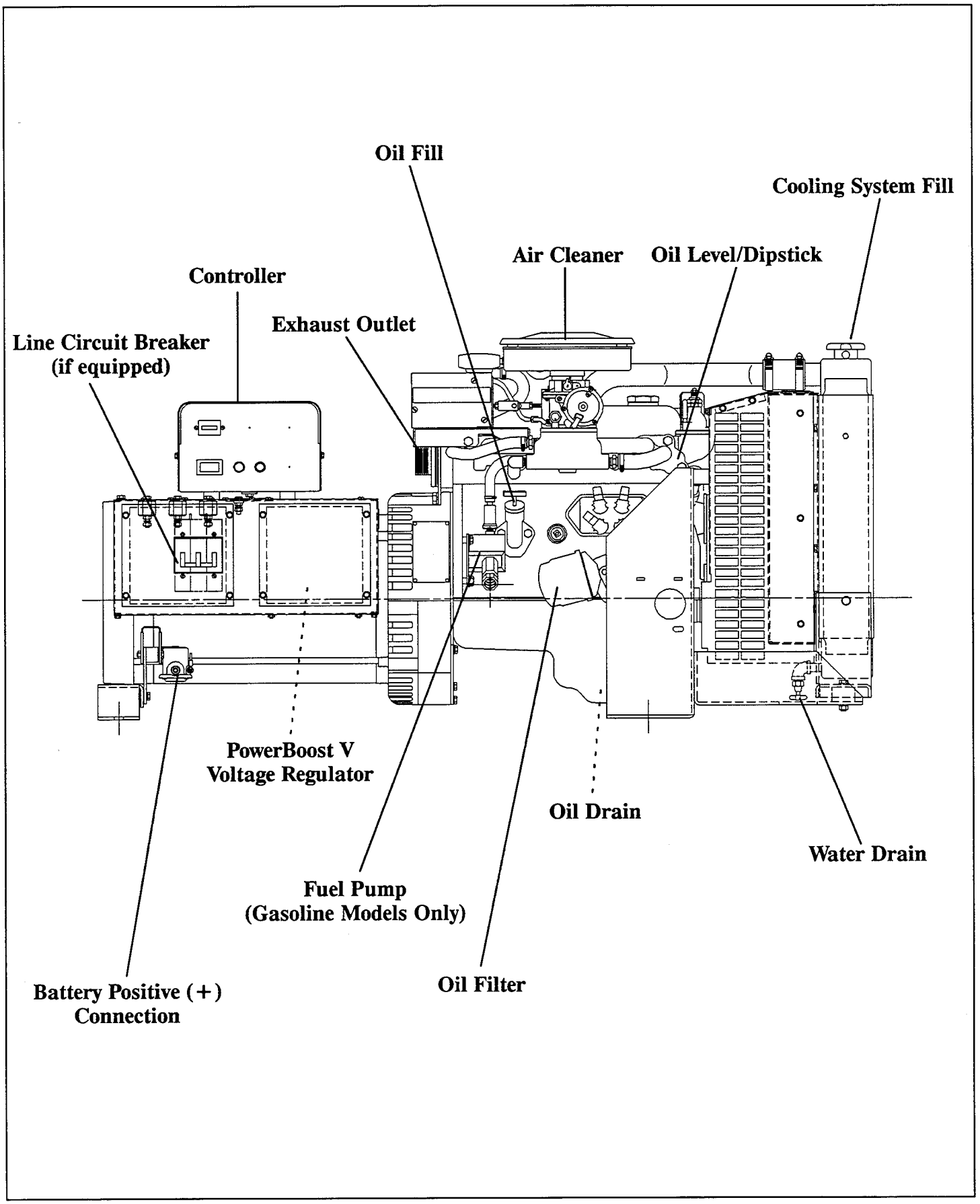


Figure 1–2. Service View – 10CZ & 12CZ (12–Lead) Generator Sets

SECTION 2. OPERATION

Prestart Checklist

The following items should be checked before each start–up of manually controlled generator sets and at regular intervals on sets equipped with automatic transfer switches. See your engine operation/maintenance manual for specific service procedures.

OIL LEVEL: Should be at or near FULL mark on dipstick –– not over.

FUEL LEVEL: Make sure there is adequate supply; keep tanks full to allow operation for extended periods.

BATTERY: Check connections and level of battery electrolyte.

COOLANT LEVEL: Maintain coolant level at approximately 3/4 to 1–1/2 in. (19 – 38 mm) below the radiator filler neck seat when the engine is cold. If the unit is equipped with a coolant recovery tank, level in tank should be between 1/3 full (cold) and 2/3 full (hot). See "Safety Precautions" before filling radiator. A coolant solution of 50% ethylene glycol and 50% clean, softened water is recommended to inhibit corrosion and prevent freezing to –34°F (–37°C). Do not use alcohol or methanol antifreeze or mix them with the specified coolant. Do not add coolant to an engine that has overheated until engine has cooled. Adding coolant to an extremely hot engine can cause a cracked block or cylinder head.

NOTE

Do not turn on block heater (if equipped) before filling cooling system. Run engine until warm and refill radiator to purge air from the system. Block heater may be damaged if not immersed in water.

AIR CLEANER: Must be clean and properly installed to prevent unfiltered air from entering the engine.

DRIVE BELTS: Make a visual check of radiator fan, water pump and battery charging belts to make sure they are properly tensioned and in good condition.

OPERATING AREA: Make sure there are no obstructions that could block the flow of cooling air. Make sure the area is clean. Rags, tools, or debris must not be left on or near the generator set.

EXHAUST SYSTEM: Exhaust outlet must be clear; silencer and piping must be tight and in good condition. Exhaust gas must be vented safely outside. See "Safety Precautions" Section.

Controller Features

To identify components of the relay controller, refer to Figure 2–1 and the following descriptions.

Fault Lamp – lights to indicate a fault condition. Generator will shut down on Overspeed, High Engine Temperature, and Low Oil Pressure faults. See "Fault Shutdowns" section following.

Hourmeter – records total generator set operating hours for reference in maintenance scheduling.

Generator Stop/Start Switch – used to start and stop generator set. Refer to Start/Stop procedure following.

Controller Fuse – 10 Amp. fuse protects controller circuitry.

Remote Switch Connection – connect remote start/stop switch (includes 15 ft. harness) to operate the generator at a location remote from the set. Request Remote Start Panel PA–254999.

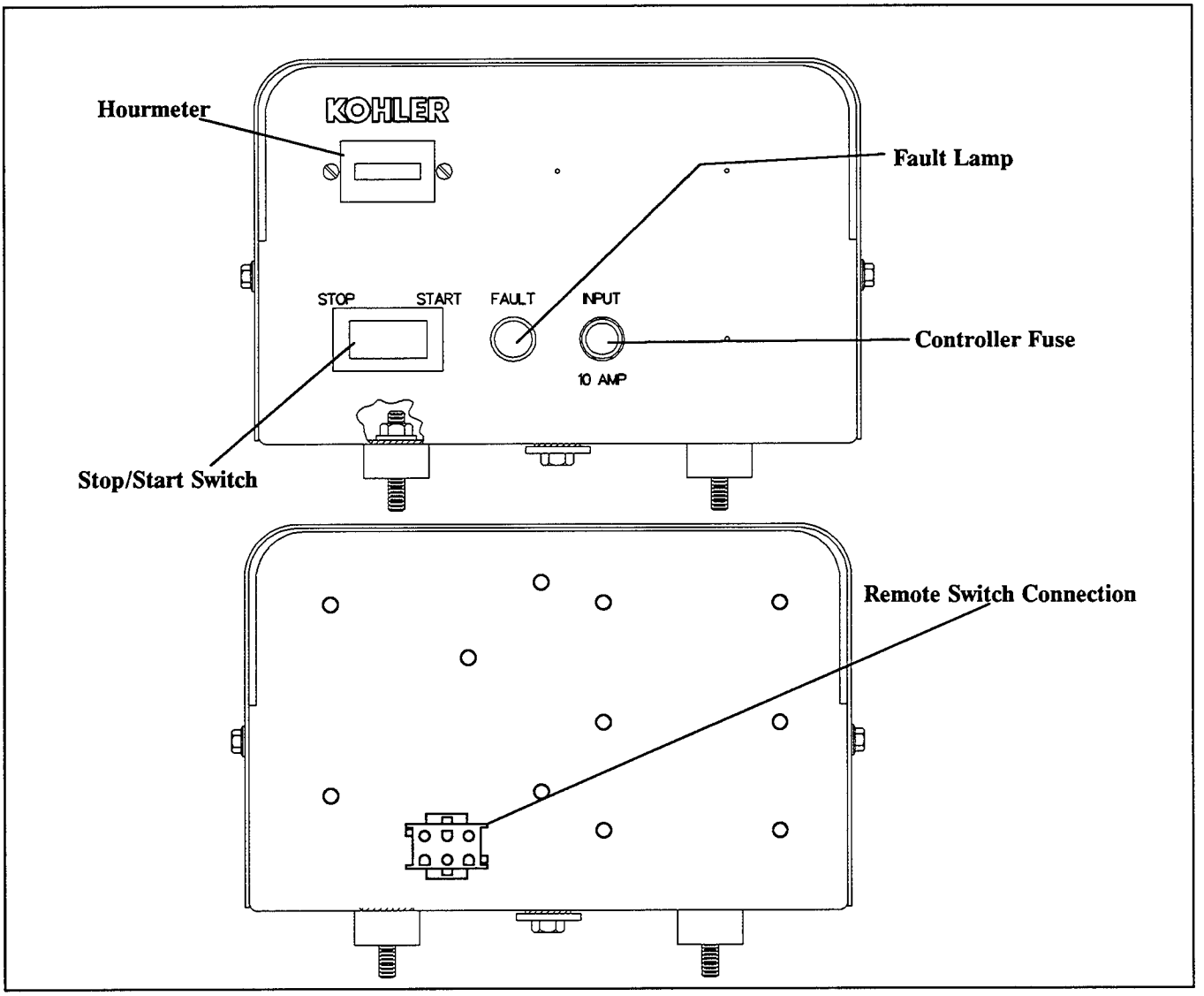


Figure 2–1. Controller Features

Start/Stop Procedure

Starting

Hold controller or remote Start/Stop switch in "Start" position until the engine starts. Normally the engine will start within 2 seconds. However, if the engine fails to start after cranking for 5 seconds, release the switch. Wait for the engine to come to a complete stop before attempting restart.

NOTE

Do not crank engine continuously for more than 10 seconds at a time. A 60 second cool-down period must be allowed between cranking attempts if the engine does not start. If the unit does not start after three attempts, contact an Authorized Service Dealer for repair.

Stopping

1. Run generator set at no load for 5 minutes to allow engine cool-down.
2. Hold controller or remote Start/Stop switch in "Stop" position until generator completely stops.

Fault Shutdowns

The generator will shut down automatically under the following fault conditions. The generator cannot be restarted until the fault condition has been corrected. The shutdown switches will automatically reset when the problem is corrected or the generator set cools (if overheating was the problem).

OVERSPEED - Generator will shut down immediately if governed frequency exceeds 70 Hz (2100 rpm) on 50 and 60 hz models.

HIGH ENGINE TEMPERATURE - Shutdown occurs 10–20 seconds after fault. Fault occurs when engine coolant temperature reaches 218°F (103°C).

LOW OIL PRESSURE - Shutdown occurs 10–20 seconds after fault. Fault occurs when engine oil pressure drops below 15 psi (103 kPa).

Circuit Protection

Controller Fuse

The controller circuitry is protected by a replaceable 10 Amp. fuse. If the generator will not crank and the battery and/or connections appear okay, the controller fuse may be "blown". If the controller fuse "blows" repeatedly, refer to Section 8, "Component Testing" to determine the source of the trouble.

Voltage Regulator Fuse

A replaceable 10 Amp. fuse protects the voltage regulator circuitry **on 4-lead (CC) generator sets**. See Figure 2-2. If this fuse is "blown", the generator set will shut down. The set will not start until the voltage regulator fuse is replaced. If the regulator fuse "blows" repeatedly, refer to Section 7, "Generator Troubleshooting" and Section 8, "Component Testing" to determine the source of the trouble.

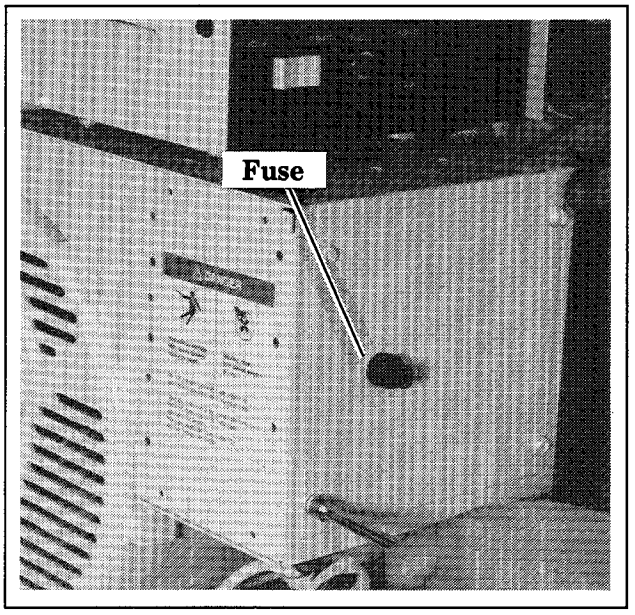


Figure 2-2. Voltage Regulator Fuse (CC/4-Lead Generators Only)

Line Circuit Breaker

An optional line circuit breaker (sized for generator output) is available to protect the generator from damage due to overload or short circuits. If the circuit breaker trips, reduce the load and switch the breakers back to the "ON" position. With the breaker in the "OFF" position, the generator will run but there will be no output voltage. The average wattage requirements of electrical motors are listed in the following chart. Use these figures to calculate the total load on your set and avoid the inconvenience of having the circuit breaker trip due to overload.

NOTE

If the generator circuit breaker trips repeatedly at reduced load, refer to Section 7, "Generator Troubleshooting and Section 8, "Component Testing" to determine the cause of the overload.

Motor Requirements		
Size	Starting (In-Rush) Watts	Running Watts
1/4 HP	750	350
1/3 HP	1000	400
1/2 HP	1500	600
3/4 HP	2000	750
1 HP	3300	1100
2 HP	4000	2000
3 HP	5000	3000

Exercising the Generator

If the generator set is not equipped with an automatic transfer switch, or the transfer switch does not have the automatic exercise option, run the generator set once a week for one hour (under load). The operator should be in attendance during this period. Be sure to make all "Prestart Checks" before starting the exercise procedure. To start the generator set, follow the starting procedure outlined earlier in this section.

SECTION 3. SCHEDULED MAINTENANCE

General

Schedule routine maintenance using the "Maintenance Schedule" following and the hourmeter located on the generator controller. If the generator will be subject to extreme operating conditions, service the unit more frequently. Instructions to perform most of the scheduled services are provided in the following pages. Refer to the engine service manual for engine maintenance procedures not provided in this manual. Items in the maintenance schedule marked with an asterisk (*) should be performed more often if the generator set is operated in dirty, dusty conditions. Items identified with asterisks (**) should only be performed by an Authorized Kohler Service Dealer.

NOTE

The items listed in the service schedule must be performed at the designated intervals for the life of the generator. For example, an item to be serviced "Every 100 Hours or 3 Months" must also be serviced after 200 hours or 6 months, 300 hours or 9 months, etc. The generator will eventually accumulate enough hours to warrant a complete overhaul. The exact time at which extensive service will be necessary cannot be predicted. However, rough operation, lack of power, and excessive oil use indicate serious generator problems. As part of a preventative maintenance program, service the engine (clean cylinder head, inspect valves, check compression, etc.,) and generator (replace bearing, inspect wiring, remove debris, etc.) at the earliest indication that a serious problem exists.

Maintenance Schedule

Perform Service at Intervals Indicated (X)	Before Each Start–up	Every 100 Hours or 3 Months	Every 400 Hours or 6 Months	Every 800 Hours or Yearly
Check engine oil level	X			
Check coolant level	X			
Check fuel supply	X			
Verify proper operation of gauges (if equipped)	X			
Clean air intake screen (if equipped)	X			
Check electrolyte level in battery	X			
Change engine oil and filter *		X		
Inspect air cleaner element		X		
Clean crankcase vent system breather cap		X		
Inspect/adjust engine belts		X		
Lubricate throttle, governor, and choke linkage		X		
Change air cleaner element *			X	
Inspect cooling system (inspect hoses, clean exterior of radiator)			X	
Inspect/replace spark plugs *			X	
Retighten electrical connections			X	
Clean slip rings and inspect brushes (CC/4–lead generators only) **			X	
Blow dust out of generator			X	
Check and adjust valve clearance **			X	
Replace crankcase vent system breather cap **			X	
Torque intake manifold bolts **				X
Check throttle and governor operation and adjust as necessary **				X
Check nuts and bolts for tightness				X

* Service more frequently if operated in dusty areas.

** Should be performed by Authorized Kohler Service Dealer.

Lubrication System

Oil Check

Check the oil level in the crankcase daily or before each start–up to insure that the level is in the safe range on the dipstick. See Figure 3–1. Allow several minutes for engine oil to drain after shut–down to ensure an accurate oil reading. Add oil as needed to maintain oil in the safe range. Do not operate the set if the oil level is below the "SAFE" range on dipstick.

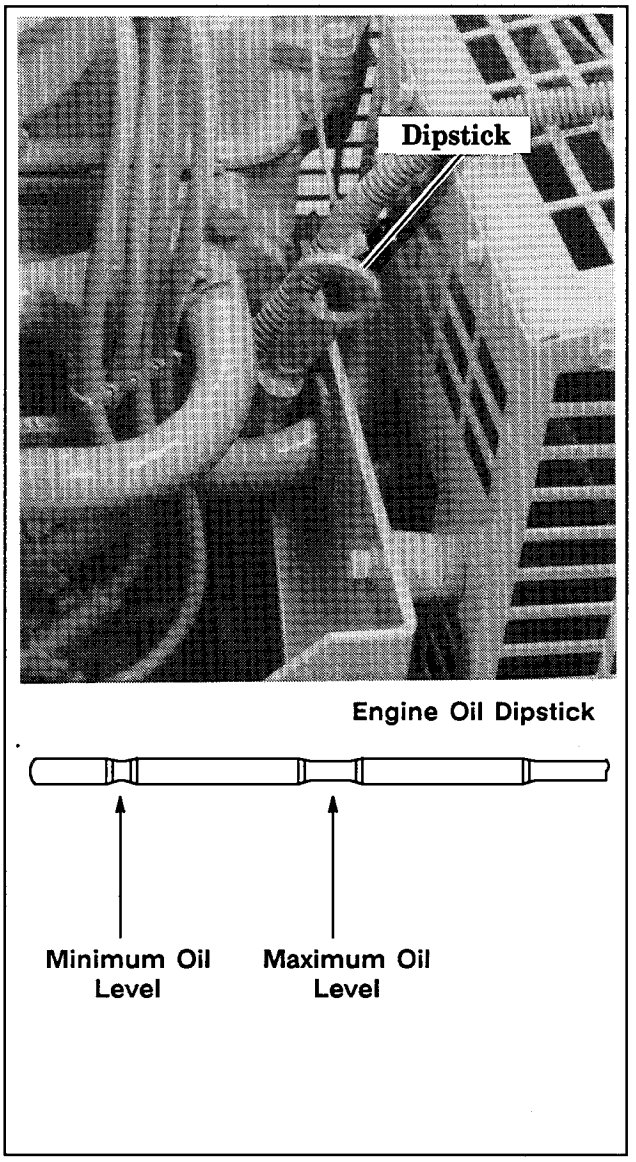


Figure 3–1. Engine Oil Dipstick/Safe Range

Oil Type

Oils labeled API SG or in combination with other classifications (SG/CC, SG/CD) are preferred as they offer improved wear protection. Avoid mixing different brands of oils and lubricants; oils of different manufacturers may be incompatible and deteriorate when mixed. Base oil weight selection on temperature at time of start–up. Consult the chart in Figure 3–2 to select proper weight oil.

SINGLE VISCOSITY OILS	
When Outside Temperature is Consistently	**Use SAE Viscosity Number**
– 10°F to +60°F (–23°C to 16°C)	* 10W
+10°F to +90°F (–12°C to 32°C)	20W–20
Above +32°F (0°C)	30
Above +50°F (10°C)	40
MULTI VISCOSITY OILS	
When Outside Temperature is Consistently	**Use SAE Viscosity Number**
Below +10°F (–12°C)	*5W–20
Below +60°F (–16°C)	5W–30
10°F to 90°F (–23°C to 32°C)	10W–30
Above –10°F (–23°C)	10W–40 or 10W–50
Above +20°F (–7°C)	20W–40 or 20W–50

* Not recommended for severe service

Figure 3–2. Oil Selection Guide

Oil Change

Change the engine lube oil and filter every 100 hours or 3 months of operation. Change oil more frequently if the set is operated under continued light load or in dirty, dusty conditions. Drain engine oil while engine is warm to ensure good drainage. Drain engine lube oil, according to the following procedure.

1. Place a suitable container beneath engine oil drain plug. See Figure 3–3.

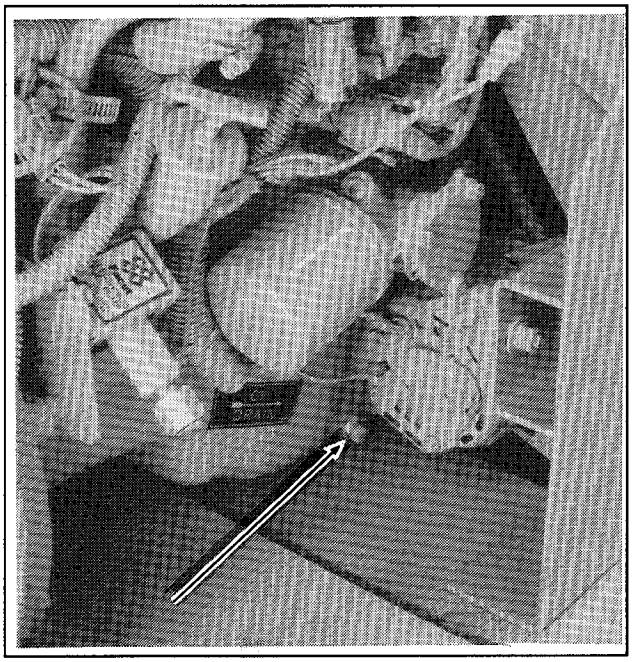


Figure 3–3. Engine Oil Drain

2. Loosen drain plug. Allow adequate time for oil to drain completely. Remove engine oil filter. See "Oil Filter" following. **Dispose of used engine oil in an environmentally safe manner. Take used oil to a suitable collection facility in your area. DO NOT POUR USED OIL ON THE GROUND, DOWN SEWERS, OR INTO STREAMS OR OTHER BODIES OF WATER.**
3. Replace drain plug and tighten securely. Install new oil filter. See "oil Filter" following. Add proper weight/type oil to crankcase until oil reads in "safe" range on dipstick (Figure 3–4).

Crankcase Capacity – 2.9 qts. (2.8 L)
with Filter – 3.5 qts. (3.3 L)

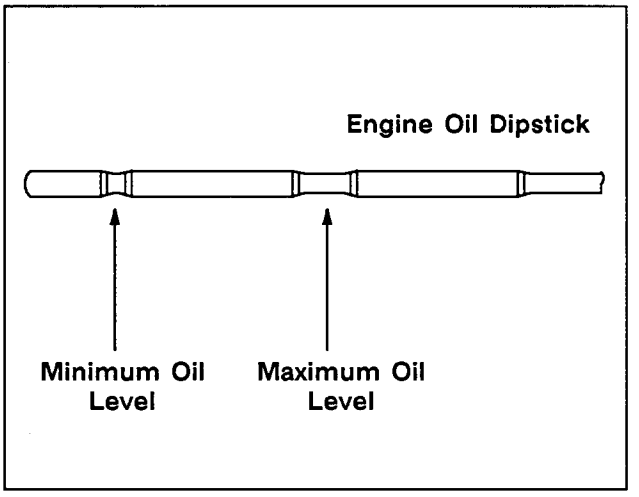


Figure 3–4. Lube Oil Safe Range

Oil Filter

Change the oil filter every 100 hours of operation at time of oil change. See Figure 3–5 and refer to the following procedure.

1. Remove old filter from engine adapter by rotating filter counterclockwise.
2. Apply a thin coat of engine oil to rubber gasket on new oil filter. Hand–tighten filter clockwise onto adapter until the filter gasket contacts adapter face; then rotate filter an additional one–half turn.
3. Refill engine crankcase with oil as specified in "Oil Change" section preceding.

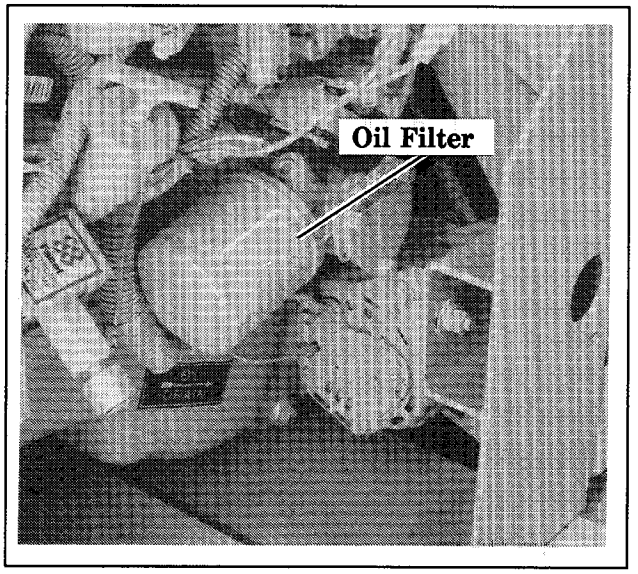


Figure 3–5. Engine Oil Filter

4. Start generator set and check for leaks at oil filter and drain plug. Tighten filter and/or drain plug if leaks occur.

Low Oil Pressure (LOP) Shutdown

The low oil pressure (LOP) shutdown feature protects the engine against internal damage if the oil pressure drops below 15 psi (103 kPa) due to oil pump fault or other engine malfunction. The LOP shutdown does not protect the set from damage due to operating with the oil level below the safe range -- IT IS NOT A LOW OIL LEVEL SHUTDOWN. The only protection against running out of oil is to check the oil level regularly and add oil as needed. Location of the LOP shutdown switch is shown in Figure 3–6.

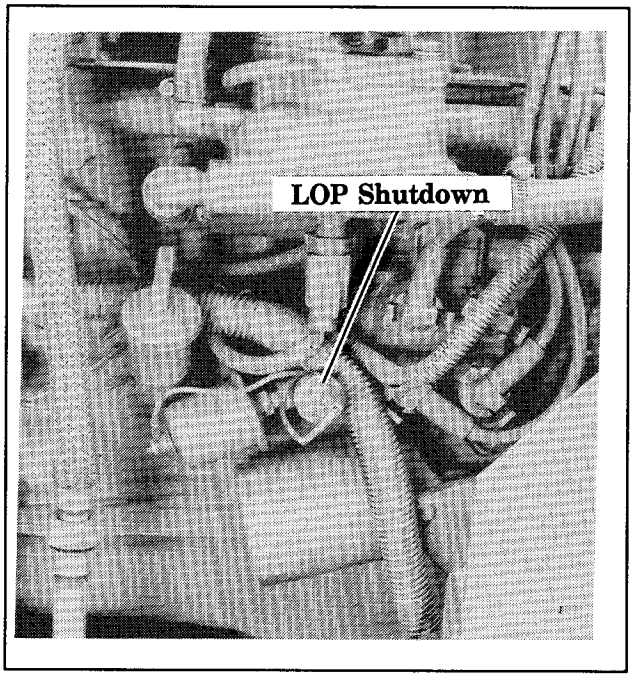
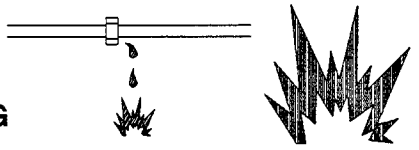


Figure 3–6. Low Oil Pressure Shutdown

Fuel System

The generator set can be equipped with four different fuel systems: gasoline, straight gas (LP/natural gas), gas/gasoline, and LP liquid withdrawal. Each of these systems is discussed in the following paragraphs. Observe the following safety precautions when operating the generator set.



⚠ WARNING

All fuels are highly explosive in a vapor state. Use extreme care when handling, storing, and using fuels

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 since spilled fuel may ignite on contact with hot parts or from ignition spark. Do not smoke or permit flame or spark to occur near potential sources of spilled fuel or fuel vapors. 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. Additional precautions must be taken when using the following fuels:

Gasoline – Store gasoline only in approved red containers clearly marked GASOLINE. Do not 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.

Natural Gas – Adequate ventilation is mandatory. Natural gas rises; install gas detectors high in room. Inspect detectors often.

Gasoline Fuel System

Fuel Specifications

Use only clean, fresh, regular grade unleaded gasoline with a pump sticker octane rating of 87 or higher in the U.S.A. Ford engines should operate satisfactorily on gasohol blends containing no more than 10% ethanol by volume and having an antiknock index of 87 or higher. (Gasohol, a mixture of gasoline and ethanol (grain alcohol), is available in some areas.) Use fresh gasoline to ensure it is blended for the season and to reduce the formation of gum deposits which could clog the fuel system. If the generator set is to be stored longer than two months, refer to Section 11. Storage Procedure.

NOTE

In some cases, methanol (wood alcohol) or other alcohols may be added to gasoline. Ford engines should operate satisfactorily on blends containing up to 5% methanol by volume when cosolvents and other necessary additives are used. If not properly formulated with appropriate cosolvents and corrosion inhibitors, such blends may cause engine performance problems or damage fuel system materials. Insufficient data is available to insure the suitability of all methanol/gasoline blends at this time. To avoid jeopardizing your engine warranty or incurring unnecessary repair costs, DO NOT USE blends than contain more than 5% methanol by volume, or blends that do not contain cosolvents and corrosion inhibitors.

If you are uncertain as to the presence of alcohols in the gasoline you are purchasing, check the label on the pump or ask the fuel station attendant.

NOTE

Discontinue use of any gasohol or alcohol/gasoline blend if fuel system problems occur. Do not use such fuels unless they are unleaded.

Fuel Filter Service

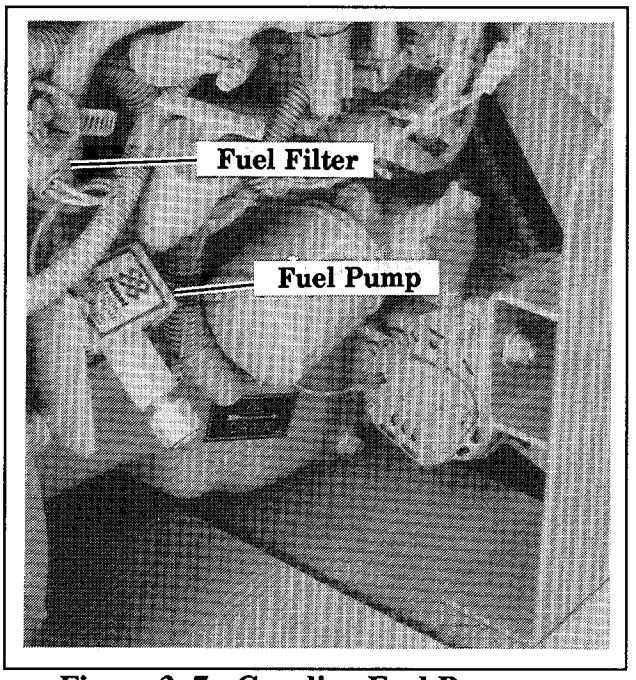


Figure 3–7. Gasoline Fuel Pump and Filter

⚠ WARNING

A flash fire can cause serious burns. 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. When removing fuel line or carburetor, use a proper container to catch all fuel.

The generator set utilizes an in–line fuel filter connected to the outlet side of the electric fuel pump. Replace the filter every 6 months/400 hours of operation or when rough operation indicates an engine tune–up may be necessary. Location of the gasoline fuel filter is shown in Figure 3–7.

Gasoline Carburetor Adjustments

Correct carburetor adjustment cannot be obtained unless engine compression and ignition meet specifications. Do not adjust the carburetor to compensate for other engine disorders.

Always check the condition of the air cleaner before adjusting the carburetor. A dirty air cleaner will adversely affect engine performance and carburetor adjustment

Do not adjust carburetor to increase/decrease engine speed (Hz). Change engine speed through electronic governor adjustment. See Section 8, "Electronic Governor."

The engine uses a fixed–jet Nikki carburetor with an electric choke and anti–dieseling solenoid. The only adjustment necessary is the idle speed mixture. The idle system functions only as the engine comes up through idle range to governed speed. For this reason, idle system has only a momentary effect. Under normal circumstances, carburetor adjustment will not be necessary. However, if the carburetor is removed or tampered with, carburetor adjustment may be required to obtain optimum engine performance. Minor carburetor adjustment may also be necessary to compensate for differences in altitude, fuel, and temperature.

1. With ENGINE STOPPED, turn idle speed mixture screw in (clockwise) until it seats lightly. DO NOT FORCE! Turn idle speed mixture screw out 1–3/4 turns. See Figure 3–8.

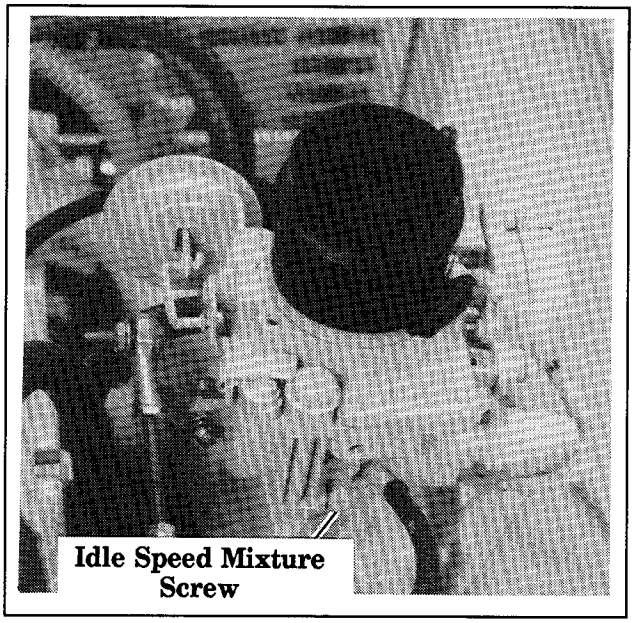
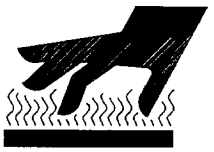


Figure 3–8. Idle Speed Mixture Adjustment

NOTE

Throttle stop adjustment screw should be turned out to prevent interference with governor/carburetor throttle rod. The throttle rod must be allowed to travel through full range of motion to avoid interfering with governor action. The throttle stop screw should have no effect on engine speed during adjustments and operation.

2. Start engine and let it run at no load for about 5 minutes. Before making adjustments, engine should be thoroughly warmed up.



⚠ CAUTION

Hot parts can cause personal injury. Do not touch hot engine parts. An engine gets hot while running and exhaust system components get extremely hot.

3. Adjust carburetor idle speed mixture screw +/– 3/8 turn to achieve best stability results at no load.

4. STOP generator set.

5. If engine governed speed is incorrect, refer to Section 8, "Electronic Governor" to make adjustments.

Gasoline Choke Adjustment

The automatic choke on the gasoline carburetor enriches the fuel mixture to improve starting at cooler temperatures. As the ambient air or engine temperature decreases, the choke automatically closes. As the engine or ambient air temperature increases, the choke plate automatically opens. If readjustment is needed, loosen the screws securing the choke bracket and shift the position of the choke assembly. See Figure 3–9. When properly set, the choke plate should be within 10 degrees of full open at an ambient temperature of approximately 70°F (21°C).

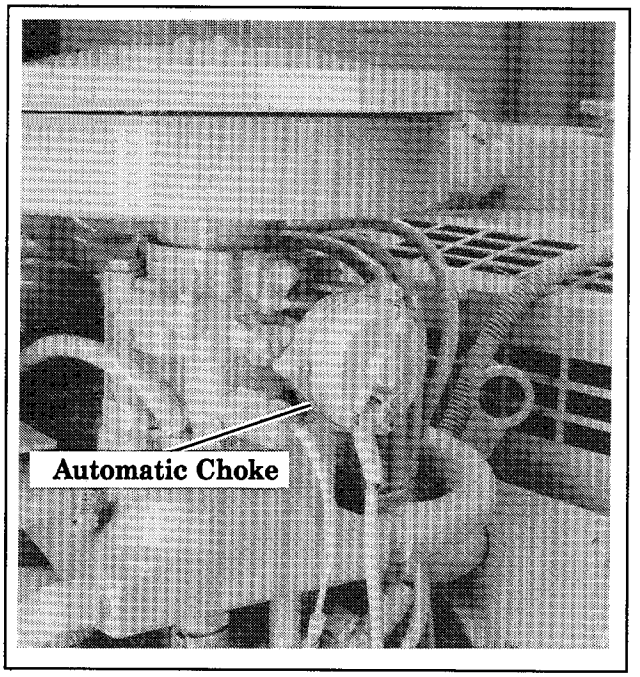


Figure 3–9. Choke Adjustment

Straight Gas Fuel System

The straight gas fuel system utilizes a fuel valve (with solenoid) to control fuel flow to the fuel regulator. The generator–mounted regulator reduces fuel pressure as fuel passes to the carburetor. See Figure 3–10. The carburetor controls the ratio of fuel to air under varying load and speed conditions. Since the carburetor receives fuel in a gaseous state, it does not have to provide vaporization of the fuel. When switching from natural gas to LP gas and vise–versa, verify that engine speed meets specifications. The electronic governor should compensate for different types of fuel and maintain rated engine speed (1800 or 1500 rpm). If engine speed is incorrect, refer to Section 8, "Electronic Governor" to make adjustments.

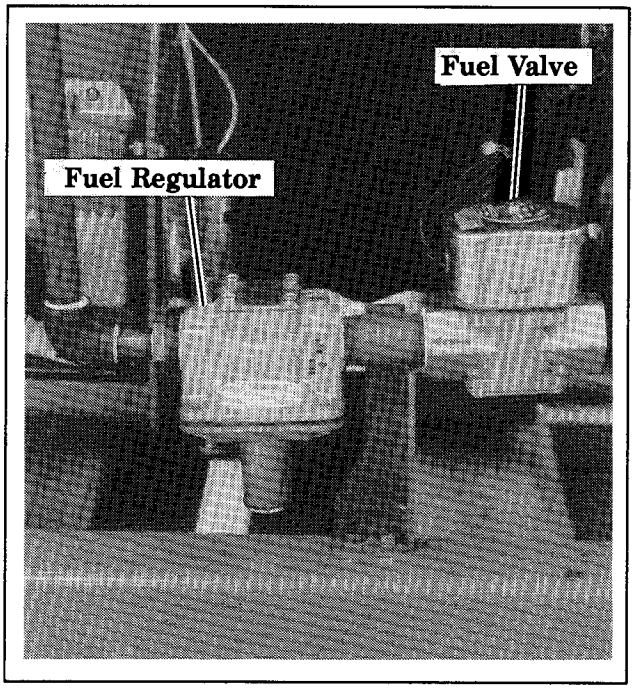


Figure 3–10. Fuel Regulator and Valve

LP Gas/Natural Gas Conversion (Straight Gas Fuel System)

The generator set can be operated on LP gas or natural gas fuel. If the set is to be operated on LP gas, remove the internal spring from the gas regulator. The spring must be in place if the generator is to be operated on natural gas.

To remove the internal spring from the gas regulator, remove the retaining screw from the underside of the regulator. See Figure 3–11. Remove retainer and spring then reinstall retaining screw. The regulator spring and retainer should be saved for conversion back to natural gas (if necessary). If the generator is converted back to natural gas (by replacing spring and retainer), a manometer check must be made on the carburetor side of the regulator. Rotate spring retainer on regulator to obtain a 7–11 in. water column measurement on manometer.

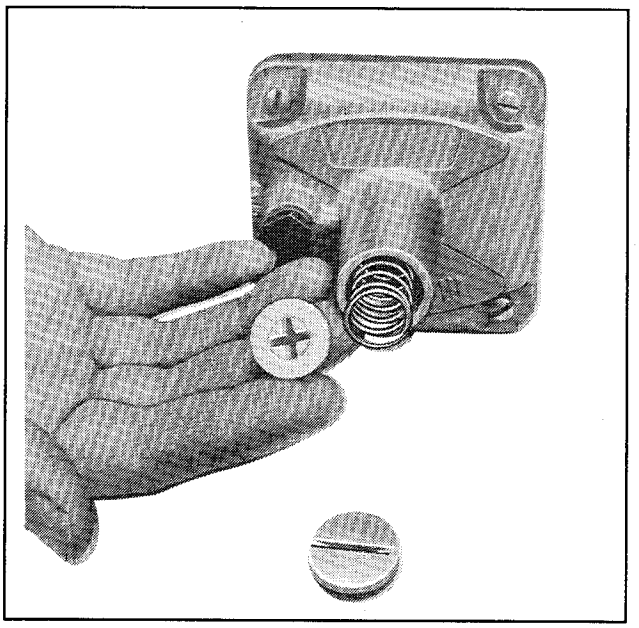


Figure 3–11. Regulator Spring and Retainer

Carburetor Adjustments (LP/Natural Gas)

Correct carburetor adjustment cannot be obtained unless engine compression and ignition meet specifications. Do not adjust the carburetor in an attempt to compensate for other engine disorders. If engine speed is incorrect, adjust electronic governor to obtain 1800 rpm (60 Hz) or 1500 rpm (50 Hz). If desired engine speed cannot be obtained through governor adjustment, carburetor adjustment may be necessary.

The only carburetor adjustment necessary or possible is the engine fuel mixture. Under normal circumstances, carburetor adjustment will not be necessary. However, if the carburetor is removed or tampered with, carburetor adjustment may be required to obtain optimum engine performance

To adjust the carburetor, the generator should be running at half-load. Rotate engine fuel mixture screw (figure 3-12) clockwise or counterclockwise until the engine runs smoothly. Apply varying loads and adjust carburetor again (if necessary) to achieve smooth engine performance at all loads.

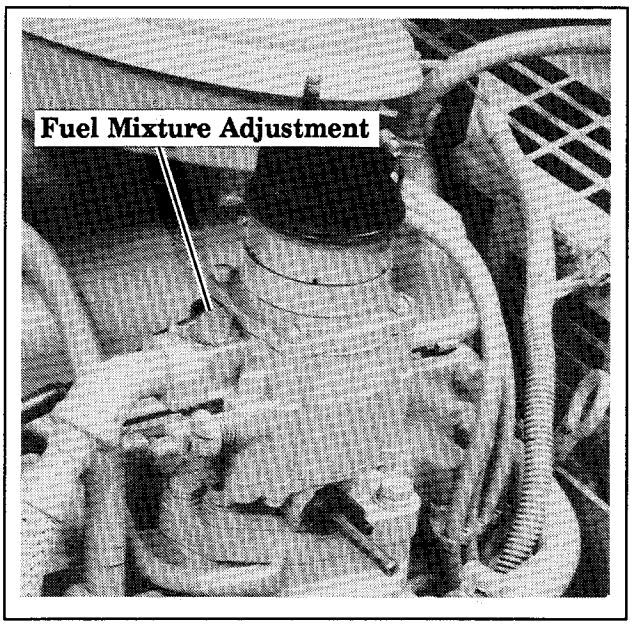


Figure 3-12. Fuel Mixture Adjustment

LP Liquid Withdrawal Fuel System

With the LP liquid withdrawal fuel system, LP fuel in liquid form is directed under pressure from the tank to a vaporizer. The vaporizer converts the fuel from a liquid to gaseous state. After vaporization, the LP fuel is drawn off to the carburetor. The system also includes a fuel valve which shuts off the fuel flow when the engine is stopped. The LP liquid withdrawal fuel system is available as an accessory from your dealer or distributor.

Combination Gas/Gasoline Fuel System

The gas/gasoline fuel system will operate on gas (LP, natural gas) or gasoline without modification or extensive mechanical changeover. The combination system utilizes gas as the primary fuel and gasoline in emergency situations. This allows continued generator operation when a gas fuel supply is unavailable. The combination gas/gasoline fuel system is available as an accessory from your dealer or distributor.

Ignition System

Theory of Operation

The engine ignition system ignites the engine fuel/air mixture at the correct time for maximum power and efficiency. The distributorless ignition system used is comprised of four components: the electronic spark control module, the ignition coil, the engine crank position sensor and the spark plugs. The electronic spark control module computes spark advance based on engine crankshaft position, crankshaft speed, engine temperature, and engine vacuum (load). Crankshaft position and speed is relayed to the module by the crank position sensor mounted adjacent to the flywheel. As the engine speed increases, the sensor output signal to the module increases in frequency and amplitude. Engine temperature information is sent to the spark control module by a temperature sensor located in the intake manifold water jacket. Engine load (vacuum) is monitored by a pressure transducer located within the spark control module.

Based upon these signals, the spark control module interrupts the primary voltage to the ignition coil to release the ignition spark at the

optimum moment. Ignition timing is adjusted constantly by the spark control module based upon sensor input. The ignition coil, when energized by the spark module, supplies voltage to the spark plugs for ignition of the fuel/air mixture. The four spark plugs are paired so that one plug fires during the compression stroke and its companion plug fires during the exhaust stroke. The next time that coil is fired, the plug that was on exhaust will be on compression and the plug that was on compression will be on exhaust. The spark in the exhaust cylinder is wasted but little of the coil energy is lost. The ignition system is essentially maintenance-free, with only the spark plugs requiring inspection and replacement at the specified intervals. Refer to the engine service manual for information on servicing the spark control module, ignition coil, and related components.

Distributorless Ignition Timing

With the distributorless ignition system, the electronic control module monitors the engine load, speed and operating temperature and determines what degree of spark advance is correct for all operating conditions. Because the engine timing is fixed and there are no moving parts in this system, no maintenance is required except for periodic spark plug checks. However, if the spark plugs or leads are removed for servicing, be sure the spark plug lead from each cylinder is inserted in the correct location on the ignition coil. See Figure 3–13.

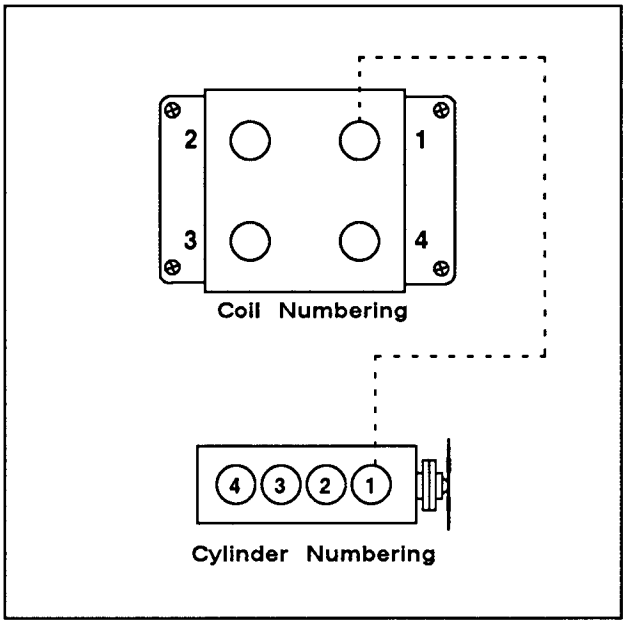
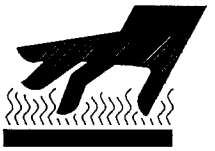


Figure 3–13. Ignition Coil Terminal Identification

Spark Plugs



⚠ CAUTION

Hot parts can cause personal injury.
Do not touch hot engine parts. An engine gets hot while running and exhaust system components get extremely hot.

Recommended Spark Plug: **Motorcraft AGSF-22C**

Every 400 hours of operation remove the spark plugs and check their condition. Proper generator operation is indicated by a light deposit of gray or tan material on plug electrodes. A dead-white, blistered coating could indicate overheating. A black (carbon) coating may indicate an overrich fuel mixture caused by clogged air cleaner or improperly adjusted carburetor. Do not sandblast, wire brush, or use similar methods to service a plug in poor condition. Best results are obtained with a new plug. Service spark plugs as described in the following steps.

1. Clean the area around the spark plug with compressed air. Remove spark plug cap(s) and use a wrench to remove spark plugs.

2. Visually inspect the spark plugs. Replace plug(s) if the insulation is cracked or damaged.

3. Measure the plug gap with a feeler gauge. See Figure 3–14. Adjust plug gap to 0.039 in. (1.0 mm) as shown in Figure 3–15.

4. To prevent cross-threading, thread spark plug(s) into engine by hand until snug.

5. Use a plug wrench to final tighten spark plug(s) to 11–15 ft. lbs. (15–20 Nm). Replace spark plug cap(s).

NOTE

Do not overtighten spark plugs. Overtightening may distort spark plug outer shell and change spark plug gap.

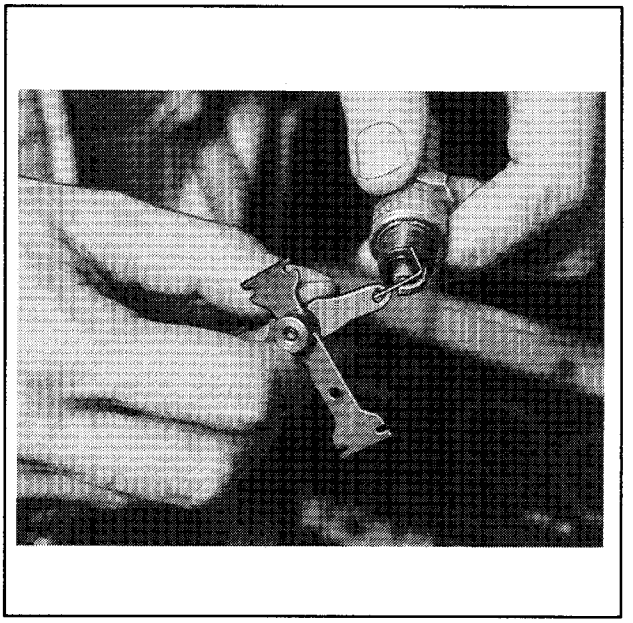


Figure 3–14. Measuring Plug Gap

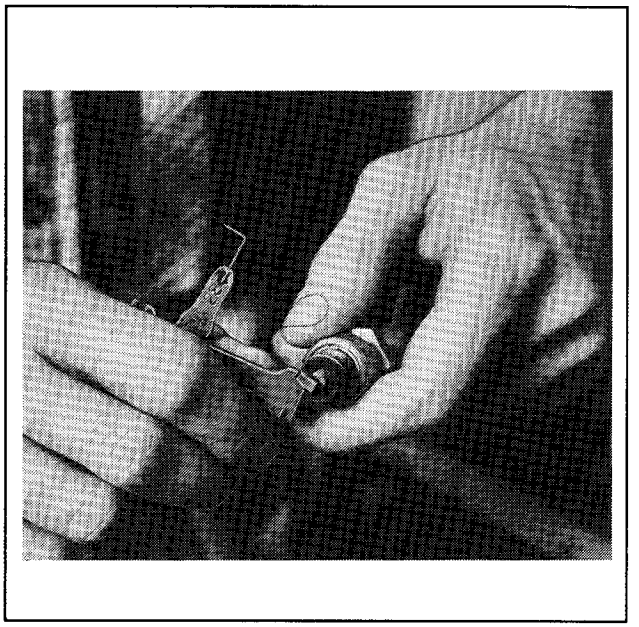


Figure 3–15. Spark Plug Gap Adjustment

Air Cleaner Service

The engine is equipped with a dry type air cleaner. Every 400 hours or 6 months of operation, replace the air cleaner element. Replace the element more frequently if the generator is operated under dirty, dusty conditions. Operating the set with a dirty air cleaner element may cause engine damage and also increase fuel consumption. At time of service, remove all dust and foreign matter from the air cleaner housing. See Figure 3–16.

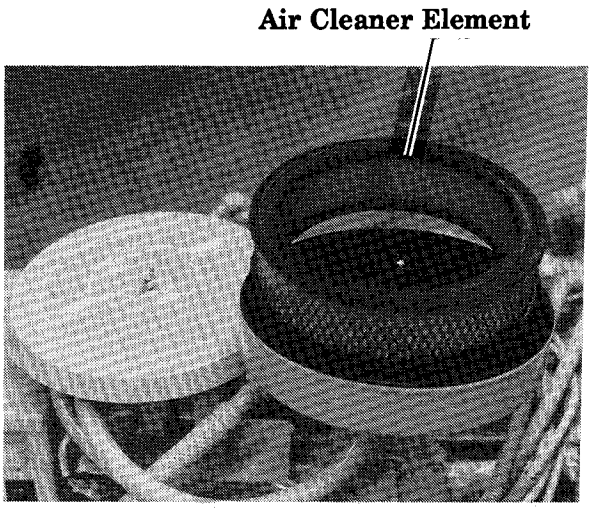


Figure 3–16. Air Cleaner Assembly

Crankcase Ventilation System

The generator engine is equipped with a positive crankcase ventilation system. Clean air is supplied to the breather cap on the engine rocker cover by a tube from the air cleaner. A calibrated port in the cap regulates the flow of fumes into the intake manifold for combustion. See Figure 3–17. The breather cap should be cleaned in a petroleum solvent every three months or 100 hours of operation and replaced yearly or every 800 hours of operation.

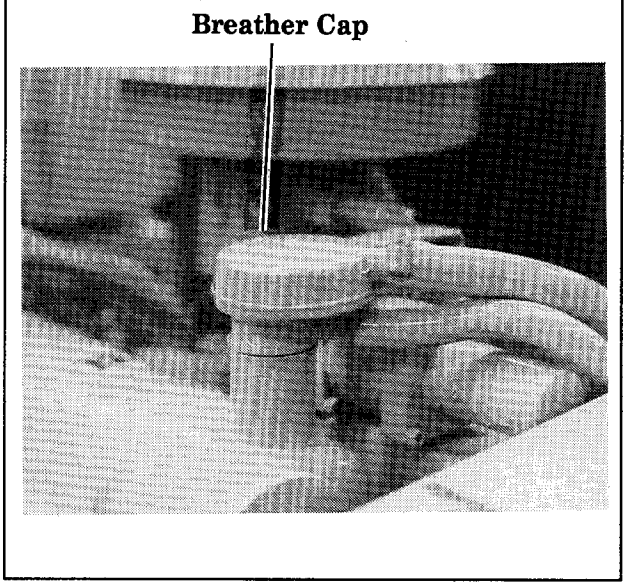


Figure 3–17. Crankcase Vent System Breather Cap

Cooling System

General

The engine is cooled by circulation of a coolant solution through passages in the engine. When the engine is started, coolant in the engine block and head absorbs heat diffused by the engine during combustion. When the coolant temperature reaches approximately 195°F (90°C), the cooling system thermostat opens and allows heated coolant to flow through the radiator. A fan on the water pump blows air past the radiator to lower the temperature of the coolant. The coolant is then recirculated (by the water pump) through the engine to cool the engine. The cooling system is equipped with an air bleed feature to automatically draw off accumulated air from the cooling system. Do not remove the air bleed orifice from the system or engine overcooling will result.

Some generators may be equipped with a wet manifold in which the coolant solution is circulated through the manifold to lower the exhaust temperature. The direction of coolant flow on a unit equipped with a wet manifold is illustrated in Figure 3–18. (Coolant flow in an engine with a dry exhaust is based upon the same principal; however, coolant flows only through engine and then back to radiator.) The customer may install a heat recovery option to provide a heat source for an external application. A heat exchanger option is also available to further lower the exhaust temperature and provide a heat source for an external application.

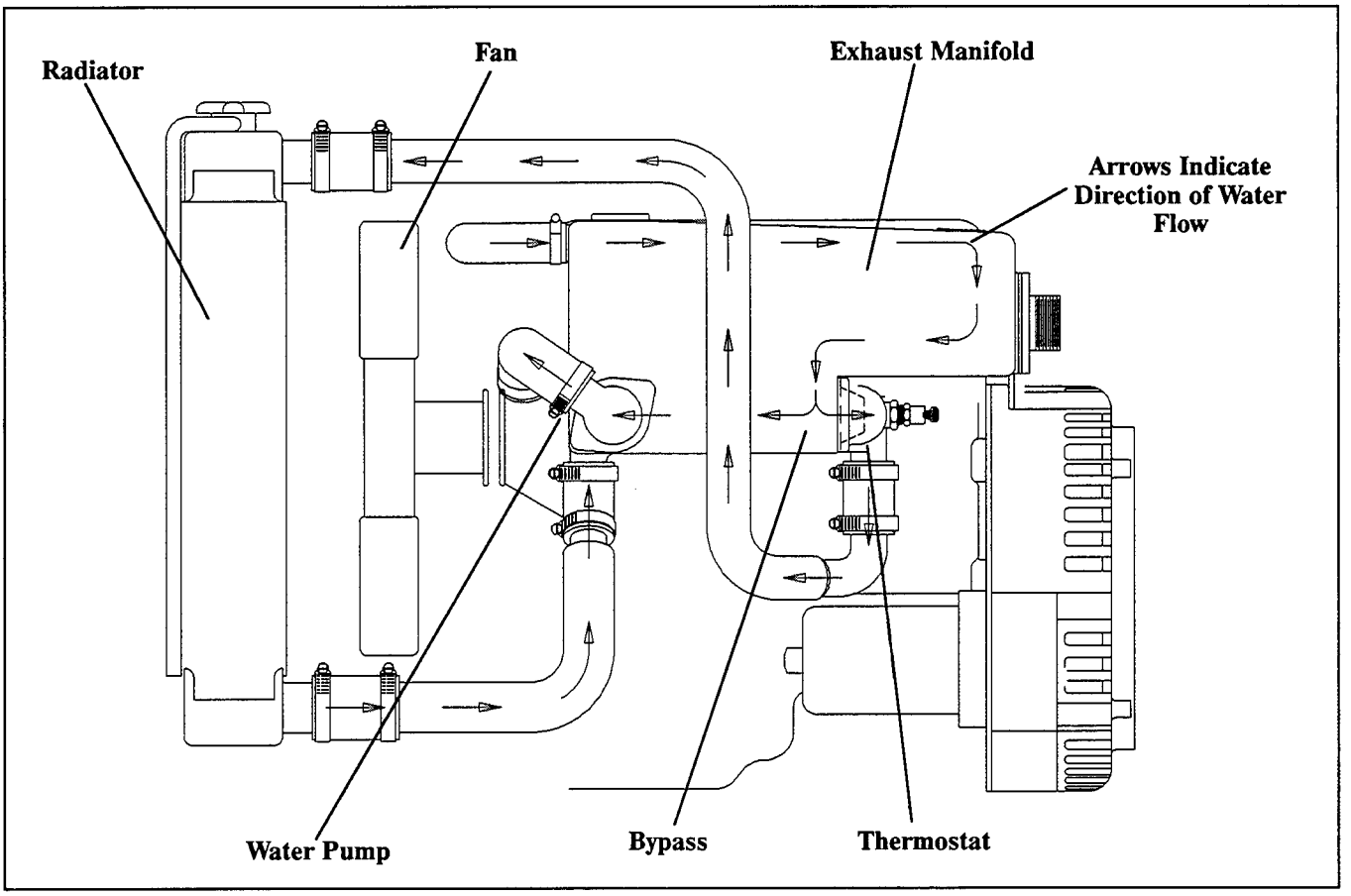


Figure 3–18. Cooling Water Circulation (Wet Manifold)

The cooling system may be drained by opening the petcock on the bottom of the radiator and the drain plug on the engine block. To refill the cooling system, close drain plug and petcock and fill radiator to the proper level with the recommended coolant mixture. Operate the engine until the thermostat opens and the radiator upper hose becomes hot. Stop the engine and add coolant to the radiator to 3/4 to 1-1/2 in. (19–38 mm) below radiator filler neck. See figure 3–19. The cooling system is equipped with an air bleed feature to automatically draw off accumulated air from the cooling system. Do not remove the air bleed orifice from the system or engine overcooling will result.

⚠ WARNING

Hot coolant can cause severe burns.
Allow engine to cool and release pressure from cooling system before opening pressure cap. To release pressure, cover the pressure cap with a thick cloth then turn it slowly counterclockwise to the first stop. After pressure has been completely released and the engine has cooled, remove cap. If generator set is equipped with a coolant recovery tank, check coolant level at tank.

NOTE

Block heater will fail if not immersed in water. Always unplug block heater(s) before draining coolant and fill engine block with coolant prior to plugging in block heater(s). Block heater element MUST be immersed in engine coolant before being energized.

To prevent generator shutdown and/or damage due to overheating, service the cooling system every 400 hours (or 6 months) of generator operation. Inspect the exterior of the radiator for obstructions; remove all dirt and foreign material with a soft brush or cloth (to avoid damaging radiator fins). If available, clean radiator with compressed air or a stream of water in direction opposite normal air flow. Check all hoses and connections for leaks and replace any hoses that are cracked, frayed, or feel spongy. When coolant level checks are made, check condition of radiator cap rubber seal; replace if cracked or deteriorating. Remove dirt and other debris from radiator cap and filler neck.

Maintain coolant level at 3/4 to 1-1/2 in. (19–38 mm) below the radiator filler neck when the engine is cold. If the unit is equipped with a coolant recovery tank, the level in the tank should be between 1/3 full (cold) and 2/3 full (hot). Cooling system capacity is 12.4 qts. (11.8 L). Use only a permanent-type coolant that meets specifications. A coolant solution of 50% etheylene glycol and 50% clean, softened water is recommended to inhibit corrosion and prevent freezing to -34°F (-37°C). Do not use alcohol or methanol antifreeze or mix them with the coolant.

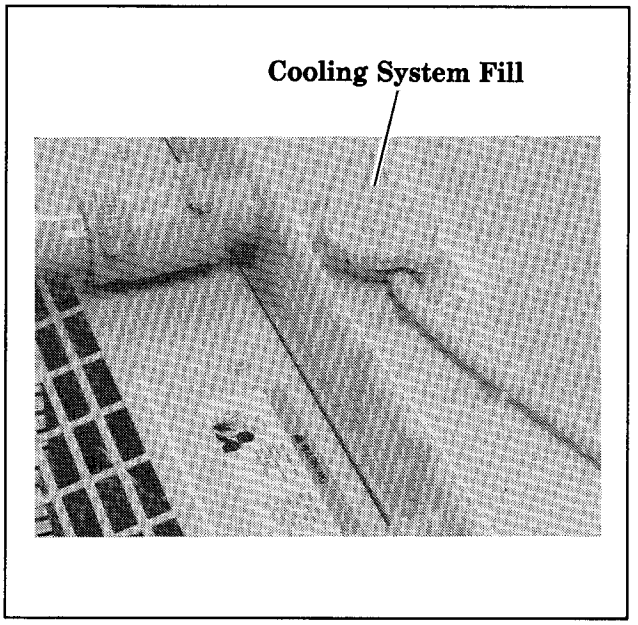


Figure 3–19. Cooling System Fill

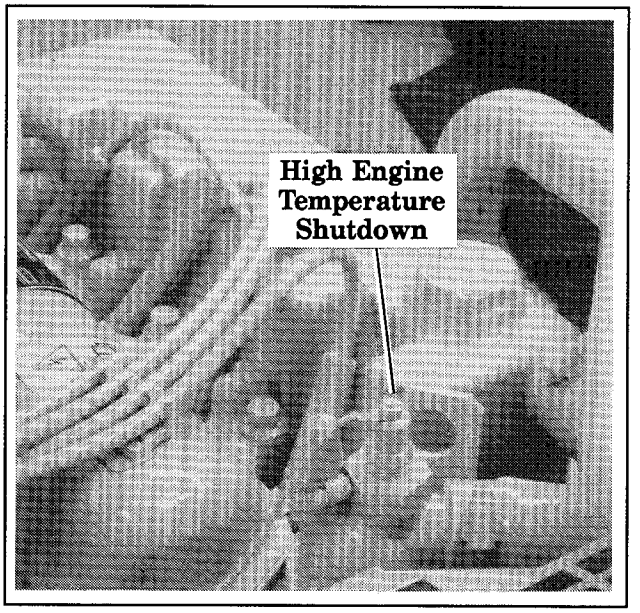


Figure 3–20. High Engine Temperature Shutdown

High Engine Temperature (HET) Shutdown

The engine will automatically shut down 10–20 seconds after the engine temperature reaches 218°F (103°C). The engine cannot be restarted until the cause of the shutdown has been corrected or the engine has cooled. Location of the shutdown switch is shown in Figure 3–20.

NOTE

The High Engine Temperature (HET) shutdown is not a low coolant level switch. Engine coolant level must be maintained for the HET shutdown switch to function.

Drive Belts

The alternator, fan, and water pump are belt driven. The drive belts must be properly adjusted at all times since a loose drive belt causes the belt to overheat and also results in improper operation of belt–driven components. Overtightening the belt may cause excessive wear on the alternator and water pump bearings, as well as premature belt wear. It is recommended that a belt tension gauge be used to check and adjust the belt tension. See "Belt Tension" following. Any belt that has operated for a minimum of 10 minutes is considered a used belt.. Adjust belt to the tension shown in the specifications.

Belt Tension

Position the belt tension tool on the drive belt and check the tension according to the instructions of the tool manufacturer. See Figure 3–21. If the tension is not set to specifications, loosen the alternator and/or governor mounting and adjusting bolts. Move the component away from the engine until the correct tension is obtained. The belt tension should be 79–101 lbs. (36–46 kg) on a new belt and 56–75 lbs. (25–34 kg) on a used belt. (A belt in operation longer than 10 minutes is considered a used belt.) Retighten component mounting bolts.

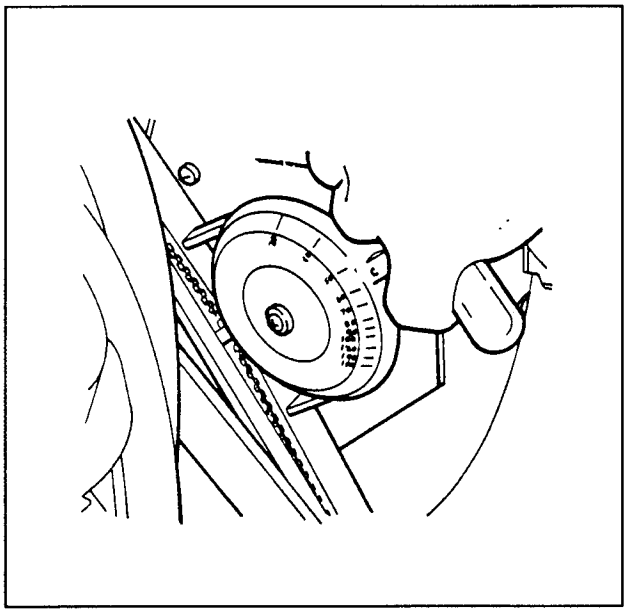


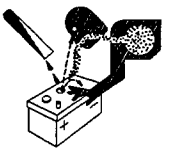
Figure 3–21. Adjusting Belt Tension

Battery

Use a 12 Volt battery with a rating of at least 400 Cold Cranking Amps (CCA). When using a "maintenance free" battery, it is not necessary to check the specific gravity or electrolyte level. Otherwise, these procedures should be done at the intervals specified in the service schedule. Battery connections are shown on the wiring diagram. Note that a negative (–) ground system is used. Make sure battery is properly connected and terminals are tight.

NOTE

The generator set will not start if the battery connections are made in reverse.



⚠ WARNING

Sulfuric acid in batteries can cause permanent damage to eyes, burn skin, and eat holes in clothing.

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 hazardous spattering of electrolyte.

⚠ WARNING

Battery gases can cause an explosion. 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. Never connect negative (–) battery cable to positive (+) connection terminal of starter solenoid. Do not test battery condition by shorting terminals together or sparks could ignite battery gases or fuel vapors. Any compartment containing batteries must 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. When disconnecting battery, remove negative lead first and reconnect it last.

Cleaning

Keep the battery clean by wiping it with a clean, damp cloth. Keep all electrical connections dry and tight. If corrosion is present, disconnect cables from the battery and remove corrosion with a wire brush. Clean the battery and cables with a solution of baking soda and water. Be careful that cleaning solution does not enter battery cells. When cleaning is complete, flush battery and cables with clean water and wipe with a dry cloth. After the battery cables are reconnected, coat terminals with petroleum jelly or other nonconductive grease.

Checking Electrolyte Level

Check the level of electrolyte before each start–up. Remove filler caps and check that electrolyte level is up to bottoms of filler holes. See Figure 3–22. Refill as necessary with distilled water or clean tap water. DO NOT add fresh electrolyte. Be sure filler caps are tight.

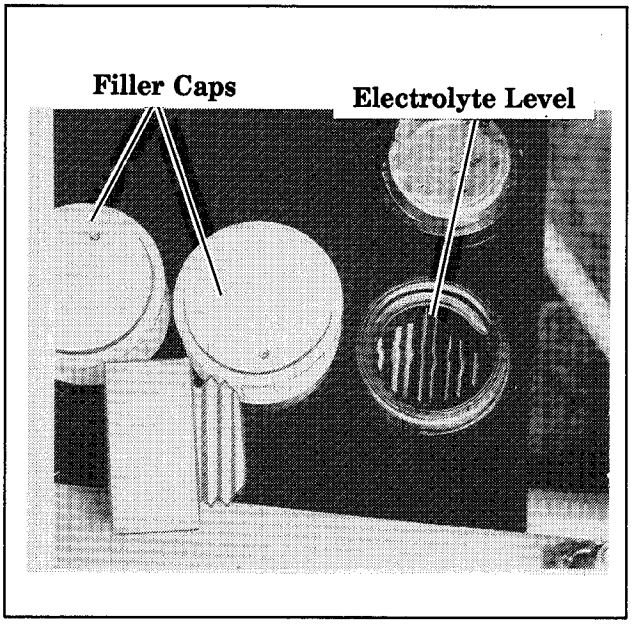
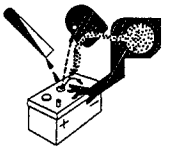


Figure 3–22. Battery Electrolyte Level



⚠ WARNING

Sulfuric acid in batteries can cause permanent damage to eyes, burn skin, and eat holes in clothing. 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 hazardous spattering of electrolyte.

Checking Specific Gravity

Use a battery hydrometer to check the specific gravity of the electrolyte in each battery cell. While holding the hydrometer vertically, read the number on the glass bulb at the top of the electrolyte level. The battery is fully charged if the specific gravity is 1.260 at an electrolyte temperature of 80°F (26.7°C). The difference between specific gravities of each cell should not exceed 0.01. The battery should be charged if the specific gravity is below 1.215 at an electrolyte temperature of 80°F (26.7°C). **The temperature of the battery electrolyte will affect the specific gravity reading and must be taken into consideration when checking battery specific gravity. If the hydrometer used does not have a temperature correction table, use the one shown in Figure 3–23.**

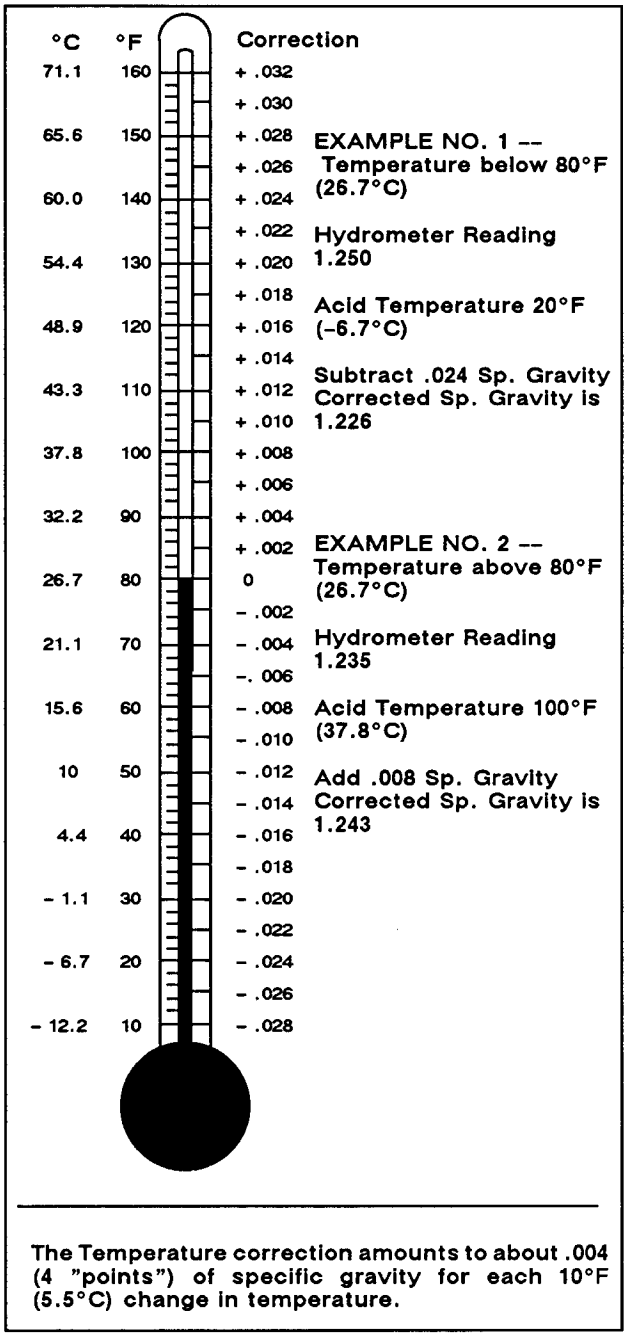


Figure 3–23. Specific Gravity Temperature Correction

Battery Charging

The generator is equipped with a belt–driven battery charging alternator to keep the starting battery fully charged. See Figure 3–24. The alternator requires no maintenance other than maintaining belt tension. To adjust alternator belt tension, see "Drive Belts" earlier in this section. Be sure to observe battery polarity when connecting battery to the generator set.

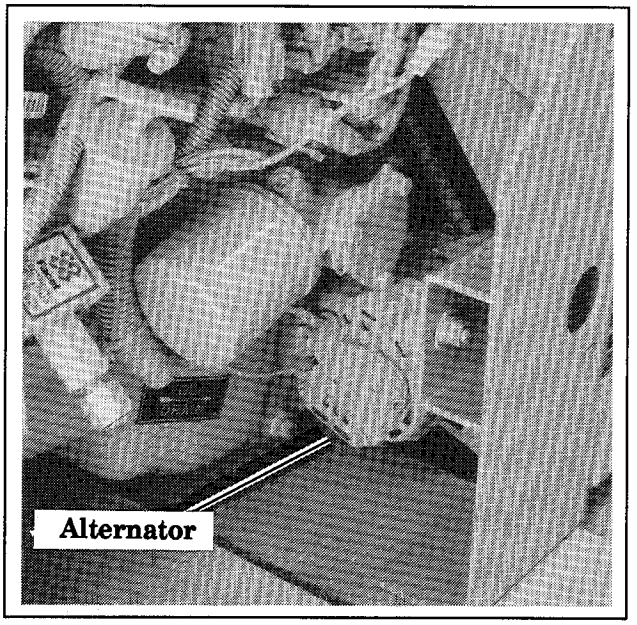


Figure 3–24. Battery Charging Alternator

Intake Manifold Bolt Torque

The intake manifold bolts should be torqued to specifications every 800 hours of operation or yearly. Use a torque wrench to tighten the intake manifold bolts to 12–15 ft. lbs. (16–20 Nm). Location of the intake manifold bolts is shown in Figure 3–25.

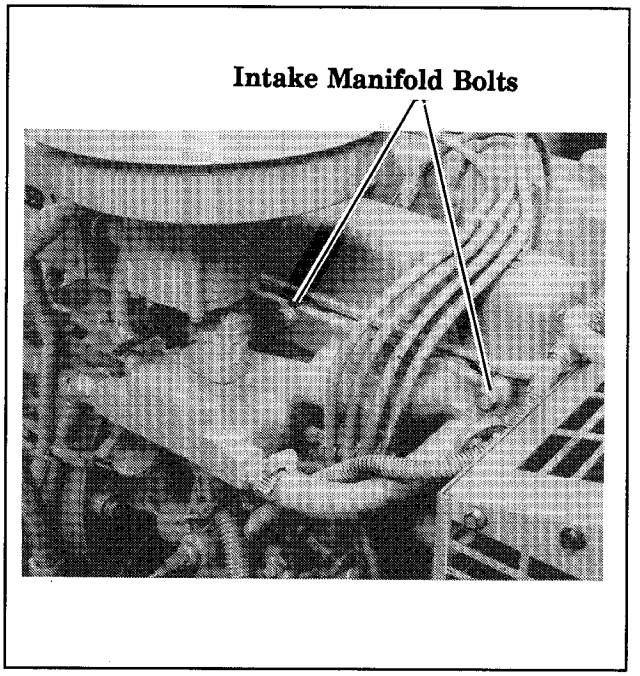
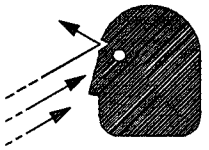


Figure 3–25. Intake Manifold Bolts

Valve Adjustment

Every 400 hours or six months of operation the engine valve clearance may require adjustment. With poppet–type valve mechanisms, each valve is spring–held in the closed position until forced open by the action of the rocker arm. The rocker arm is in contact with the push rod which is moved by the tappet. The tappet rides on a lobe of the camshaft. Rocker arms have self–locking adjusting screws for adjusting valve stem–to–rocker arm clearance. Check clearance with the engine cold. See "Specifications – Engine" for intake and exhaust valve clearances. Use the following procedure and see Figure 3–26.

⚠ CAUTION



Flying projectiles can cause injury.
When making adjustments or servicing generator set, do not loosen crankshaft hardware. If rotating crankshaft manually, direction should be clockwise only. Turning crankshaft counterclockwise can loosen hardware and result in serious personal injury from hardware or pulley flying off engine while unit is running. Retorque all crankshaft and rotor hardware after servicing.

1. Remove rocker arm cover screws using 10 mm socket wrench. Remove oil breather cap. Carefully pry rocker arm cover from cylinder head. Wipe excess oil from components using a clean rag.

2. Rotate the crankshaft clockwise (as viewed from engine end) using ratchet wrench on crankshaft pulley bolt until No. 1 cylinder is at top of compression stroke. At this point the timing marks should read TDC. This is the period between the closing of the intake valve and the opening of the exhaust valve. At this point the No. 1 piston is at TDC (top dead center), and both intake and exhaust valves will be closed.

   NOTE

   To reduce force needed to rotate crankshaft, remove spark plugs to eliminate compression stroke.

3. Insert feeler gauge between rocker arm and exhaust valve. If necessary, adjust screw so that very slight drag is felt on the feeler gauge as it is withdrawn. Repeat step for intake valve.

4. Rotate crankshaft 180 degrees clockwise and set valve clearance on No. 2 cylinder.

5. Rotate crankshaft 180 degrees clockwise and set valve clearance on No. 4 cylinder.

   NOTE

   Sequence of adjustment is based on engine firing order of 1–2–4–3.

6. Rotate crankshaft 180 degrees clockwise and set valve clearance on No. 3 cylinder.

7. With mating surfaces clean and gasket properly aligned, install rocker arm cover and torque screws to 3–4 ft. lbs. (4–5 Nm). Replace oil breather cap. Remove ratchet wrench from crankshaft pulley.

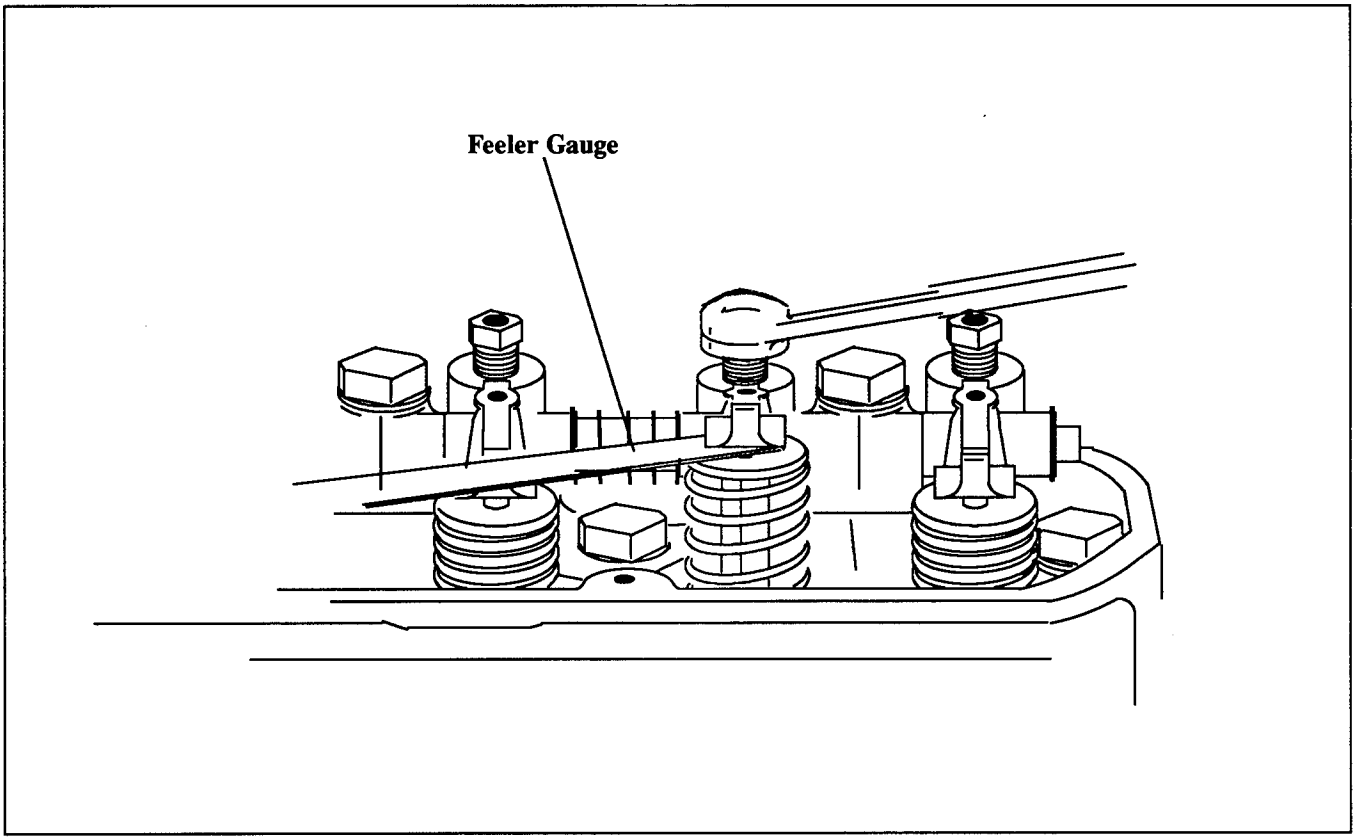


Figure 3–26. Valve Adjustment

SECTION 4. GENERATOR SERVICE

Under normal conditions, generator service will not be required on a regular basis. If operating under extremely dusty and dirty conditions, use DRY compressed air to blow dust out of the generator. Do this with the generator running and direct the stream of air through openings in the generator end bracket. This service is generally required every 400 hours or six months of operation. The generator brushes (on CC/4–lead models) operate at a very low amperage and should last indefinitely. However, abrasive dust on the slip rings could shorten the life of the brushes. Every 400 hours or six months of operation have the brushes and slip rings inspected for damage or wear.

The end bracket bearing should be replaced every 10,000 hours of operation in standby and prime power applications. Service more frequently if bearing inspection indicates excessive rotor end play or bearing damage from corrosion or heat build–up. The end bracket bearing is sealed and requires no additional lubrication. All generator service must be performed by an authorized service dealer.

Generator engine service should be performed at the intervals specified by the engine manufacturer in the engine service literature. Contact your Kohler Generator Dealer or Distributor to obtain service literature for specific models.

SECTION 5. TROUBLESHOOTING

Use the following table as a quick reference in troubleshooting individual problems. Generator faults are listed by specific groups and correlated with possible causes and suggested remedies. The source of more detailed information is indicated. Sources of additional information include various sections of this manual and the engine service manual. Testing and corrective action often requires knowledge of electrical and electronic circuits. For this reason, it is recommended that repairs only be done by Authorized Service Dealers. Improper repair by unauthorized personnel can lead to additional failures.

Engine

Problem	Possible Cause	Corrective Action/Reference
Unit will not crank	Weak or dead battery	Recharge or replace battery.
	Reversed or poor battery connections	Check connections.
	Defective starter solenoid	Check continuity of circuit. See Section 8 and Section 12.
	Defective starter	Rebuild or replace. See Engine Service Manual,"Starting System."
	Defective start/stop switch (controller or remote)	Test function of switch. See Section 8 and Section 12.
	Fuse blown in controller	Replace fuse; if fuse blows again, check circuit and components. See Section 8.
	Open in wiring , terminal pin, foil etc. (P1/P2/P3 connector)	Check continuity. See Section 9 and Section 12.
	Oil viscosity too heavy	Use proper viscosity oil. See Section 3, "Oil Type."
	Defective controller circuit board	Check circuit board operation. See Section 8.

** Gasoline-Fueled Sets Only

Engine – cont'd.

Problem	Possible Cause	Corrective Action/Reference
Cranks but will not start	Out of fuel	Replenish fuel supply.
	Air cleaner clogged	Clean or replace. See Section 3.
	Defective fuel solenoid **	Test and/or replace solenoid See Section 8.
	Defective ignition system (spark control or ignition coil)	Test and/or replace components. See engine service manual, "Ignition System–Distributorless"
	Faulty spark plugs or loose connections	Replace (and regap) spark plugs See Section 3, "Spark Plugs."
	Defective/misadjusted choke **	Replace/readjust choke See Section 3. "Choke Adjustment" and Section 8.
	Defective fuel pump **	Verify operation with 12 Volts DC applied. Check fuel pressure of 2–3.5 psi (14–24 kPa). See Section 8 for additional info.
	Clogged fuel filter **	Replace fuel filter. See Section 3. "Fuel Filter Service."
	Defective fuel regulator/valve (on LP/natural gas systems)	Check regulator/valve operation. See Section 3, "Straight Gas Fuel System" and Section 8.
	Faulty ground (–) connection	Clean and retighten
	Weak or dead battery	Recharge or replace. See Section 3, "Battery."
	Low oil pressure (LOP) shutdown	Correct cause of shutdown. See Section 2, "Fault Shutdowns", Section 8 and engine service manual.
	High engine temperature (HET) shutdown	Check engine coolant level, belt tension, HET switch. See Section 2, "Fault Shutdowns", Section 8, and engine service manual.
	Overspeed shutdown	Check electronic governor and voltage regulator. See Section 8.
	Bad fuel mixture	Replace fuel; clean carburetor.
	Blown voltage regulator fuse (CC/4–lead models only)	Replace fuse. If fuse blows again check generator components as described in Section 8.

** Gasoline–Fueled Sets Only

Engine – cont'd.

Problem	Possible Cause	Corrective Action/Reference
Engine starts but stops after start switch is released	Defective controller main circuit board	Test circuit board operation as described in Section 8.
	Engine defective (stuck valves poor compression)	Repair engine. See engine service manual.
	No generator output	Separately excite generator. Check AC voltage and stator continuity. See Section 7 and Section 8.
	Open wiring (P1/P2/P3)	Check continuity of plug and wiring. See Section 12.
	Low oil pressure (LOP) shutdown	Check engine oil level, oil pressure and oil pump. Operating oil pressure is approximately 21.7 psi (150 kPa). LOP switch contacts close at oil pressure below 15 psi (103 kPa). See Section 3 (for location), Section 8, and engine service manual.
	Defective low oil pressure (LOP) shutdown switch	Attempt start–up. If unit shuts down, remove lead from LOP switch. A successful restart attempt indicates a faulty LOP shutdown switch. LOP contacts close at approximately 15 psi (103 kPa). See Section 3 (for LOP location). **NOTE:** Verify proper engine oil pressure before performing test and/or replacing LOP shutdown switch.
	High engine temperature (HET) shutdown	Check cooling system (coolant level, belt tension, HET switch, etc.). See Section 2, "Fault Shutdowns."

** Gasoline–Fueled Sets Only

Engine – cont'd.

Problem	Possible Cause	Corrective Action/Reference
Engine starts but stops after start switch is released – cont'd.	Defective high engine temperature (HET) shutdown switch	Attempt start–up. If unit shuts down, remove lead from HET switch. A successful restart attempt indicates a faulty HET shutdown switch. HET contacts close at engine temperature of approximately 218°F (103°C). See Section 3 (for HET location), and Section 8. **NOTE:** Verify proper engine coolant level, belt tension, and operating temp. of 175–195°F (77–91°C) before performing test and/or replacing HET shutdown switch.
	Defective controller circuit board	Test circuit board operation as described in Section 8.
Hard starting	Stale or bad fuel	Replace fuel
	Air cleaner clogged	Replace element. See Section 3.
	Carburetor adjustment incorrect	Readjust carburetor. See Section 3
	Faulty spark plug(s)	Replace (and regap) plug(s). See Section 3.
	Defective ignition components (spark control or ignition module)	Test/replace ignition components. See engine service manual.
	Improper cooling	Inspect cooling system (low coolant level, loose belt, radiator obstructions, etc.). See Section 3.
	Choke misadjusted **	Readjust choke. See Section 3.
	Defective choke **	Test and/or replace. See Section 8.
	Worn piston ring, valves	Check compression. See engine service manual.
	Fuel vapor lock	Check fuel line routing.

** Gasoline–Fueled Sets Only

Engine - cont'd.

Problem	Possible Cause	Corrective Action/Reference
Stops suddenly	Out of fuel	Replenish
	Air cleaner clogged	Replace element. See Section 3.
	Fuse blown in controller	Replace fuse. See Section 2.
	Faulty spark plug(s)	Replace (and regap) plug(s). See Section 3.
	High engine temperature (HET) shutdown	Inspect cooling system (low coolant level, loose belt, radiator obstructions, etc.). See Section 3.
	Low oil pressure (LOP) shutdown	Check engine oil level, oil pressure and oil pump. Operating oil pressure is approximately 21.7 psi (150 kPa). LOP switch contacts close at oil pressure below 15 psi (103 kPa). See Section 3 (for location), Section 8, and engine service manual.
	Overspeed shutdown	Check electronic governor and voltage regulator. See Section 8.
	Defective fuel valve/fuel regulator (on LP/natural gas systems only)	Check regulator/valve operation. See Section 3 and Section 8.
	Defective fuel pump **	Check fuel pump operation. See Verify operation with 12 Volts DC applied. Check fuel pressure of 2–3.5 psi (14–24 kPa). See Section 3 and Section 8 for additional information.
	Vapor lock **	Check fuel line routing
	Clogged fuel filter **	Replace filter. See Section 3.
	Defective fuel solenoid **	Test and/or replace solenoid. See Section 8.
	Defective ignition system (spark control or ignition coil)	Test and/or replace components. See engine service manual, "Ignition System–Distributorless"

** Gasoline–Fueled Sets Only

Engine – cont'd.

Problem	Possible Cause	Corrective Action/Reference
Stops suddenly – cont'd.	Blown voltage regulator fuse (CC/4–lead models only)	Replace fuse. If fuse blows again, test generator components as described in Section 8.
	Engine overloaded	Reduce electrical load. See Section 2, "Line Circuit Breakers".
	Loss of output voltage to K1 relay	Check AC at rectifier (BR1). Check continuity of stator B1/B2 leads. See Section 8.
Operates erratically	Air cleaner clogged	Replace element. See Section 3.
	Dirty fuel filter	Replace filter. See Section 3.
	Stale or bad fuel	Replace fuel
	Faulty spark plugs	Replace (and regap) plugs. See Section 3.
	Carburetor adjustment incorrect	Readjust carburetor. See Section 3.
	Carburetor choke improperly adjusted	Readjust choke. See Section 3.
	Governor adjustment incorrect	Adjust electronic governor. See Section 8.
	Defective fuel pump **	Verify operation with 12 Volts DC applied. Check fuel pressure of 2–3.5 psi (14–24 kPa). See Section 8 for additional information.
	Carbon build–up in engine	Clean cylinder head. See engine service manual.
	Engine valves not seating properly	Inspect valves and valve seats. See engine service manual.

** Gasoline–Fueled Sets Only

Engine – cont'd.

Problem	Possible Cause	Corrective Action/Reference
Lacks power	Air cleaner clogged	Replace element. See Section 3.
	Generator overloaded	Reduce load. See Section 2, "Line Circuit Breaker."
	Bad or stale fuel	Replace fuel
	Faulty spark plug(s)	Replace (and regap) plug(s). See Section 3.
	Carburetor adjustment incorrect	Readjust carburetor as described in Section 3.
	Engine not running at rated rpm	Adjust governor. See Section 8.
	Governor defective or misadjusted	Test/readjust governor. See Section 8.
	Improper cooling	Inspect cooling system (low coolant level, loose belt, radiator obstructions, etc.). See Section 3.
	Choke misadjusted **	Readjust choke. See Section 3.
	Fuel line restriction	Inspect fuel lines
	Dirty fuel filter **	Replace fuel filter. See Section 3.
	Defective ignition system (spark control or ignition module)	Test and/or replace. See engine service manual.
	Carbon build-up in engine	Clean cylinder head. See engine service manual.
Overheats	Improper cooling	Inspect cooling system (low coolant level, loose belt, radiator obstructions, etc.). See Section 3.
	Air cleaner clogged	Replace element. See Section 3.
	Carburetor adjustment incorrect	Readjust carburetor. See Section 3.

** Gasoline–Fueled Sets Only

Generator

Problem	Possible Cause	Corrective Action/Reference
No AC output	Circuit breaker open or defective (if equipped)	Reset breaker to ON position. Check AC voltage on generator side of circuit breaker. See Section 1, "Service Views" (for location) and Section 12.
	Circuit breaker tripping due to overload on generator set	Reduce load. See Section 2, "Line Circuit Breakers."
	No battery voltage to voltage regulator during cranking: "+" and "–" terminals on PB III; Terminals "10" and "12" on PB V	Check for DC voltage at voltage regulator terminals listed. See Section 8 and Section 12..
	Blown fuse in regulator circuit (CC/4–lead models only)	Replace fuse; if fuse blows again, check voltage regulator and/or stator auxiliary windings. See Section 8 and Section 12.
	Open wiring, terminal, or pin in build–up circuit (Stator B1/B2 to BR1)	Check continuity. See Section 8. and Section 12.
	Open D5 or D8 diode	Check for open or shorted diode. (A good diode has high resistance one way and low resistance the other way when measured with an ohmmeter. See Section 8 and Section 12.
	K1 relay normally–closed contacts open	Check circuit board operation. See Section 8.
	Brushes sticking in brush holder or broken brush spring (CC/4–lead models only)	Check brush position and condition. See Section 8.
	Rotor slip rings dirty or corroded (CC/4–lead models only)	Check slip ring condition. See Section 8.
	Defective rotor/exciter armature (open, shorted, grounded windings)	Check voltage and continuity. See Section 8.

Generator – cont'd.

Problem	Possible Cause	Corrective Action/Reference
No AC output cont'd.	Defective stator (open, grounded or shorted windings)	Check voltage and continuity. See Section 8.
	Defective or misadjusted voltage regulator (PBIII and PB V)	Excite rotor separately and check for AC output. See Section 7.
		Readjust voltage regulator. See Section 8.
	Defective rectifier module (CZ/12–lead models only)	Check rectifier module. See Section 8.
Low output or excessive drop in voltage	Engine speed too low	Check engine speed using tachometer or frequency meter. Adjust governor as necessary. See Section 8.
	Generator overloaded	Reduce load.
	Defective voltage regulator	Test/readjust voltage regulator. See Section 7 and Section 8..
	Voltage regulator improperly adjusted	Test/readjust voltage regulator. See Section 8.
	Defective rotor/exciter armature	Test and/or replace. See Section 8.
	Defective stator	Test and/or replace. See Section 8.
No battery charging output	Defective battery charging alternator	Test/replace alternator. See engine service manual
	Alternator belt loose	Retighten belt.
	Loose or corroded battery connections	Clean and tighten battery connections.
	Defective battery	Check battery electrolyte level and specific gravity (batteries with filler caps only). See Section 3.

Generator – cont'd.

Problem	Possible Cause	Corrective Action/Reference
High generator Output voltage	Engine speed too high	Check engine speed using tachometer or frequency meter. Adjust governor as necessary. See Section 8.
	Defective voltage regulator or loose regulator connections	Test/readjust voltage regulator. See Section 8.
	Voltage regulator improperly adjusted	Readjust voltage regulator. See Section 8.
	Loose voltage regulator connections (including stator sensing leads).	Check voltage regulator connections. See Section 12.

SECTION 6. CONTROLLER TROUBLESHOOTING

This section covers the controller sequence of operation during generator start, run, stop and fault shutdown modes. Use this section as a starting point for controller fault identification. Refer to the appropriate schematic (Figure 6–1 or 6–2) for the generator set. The LED's on the controller circuit board are intended to assist you in the troubleshooting process. An illuminated LED indicates the respective relay is receiving power; the LED does not indicate whether that relay is energized. (Additional relay test procedures are included in Section 8.)

Sequence of Operation – All Generators

Starting

- Close the start/stop switch between N and 47 (local or remote).
- K2 relay is energized (LED 2 lights). Normally–open K2 contacts close to energize K3 relay (LED 3 lights), engine components (fuel pump/valve, choke, ignition, etc.) and field–flashing (rotor/exciter) circuit.
- Normally–open K3 contacts close to energize K5 relay. K5 relay normally–open contacts close to energize starter.

Running

- When proper output is obtained from generator B1/B2 winding, K1 relay is energized (LED 1 lights). **NOTE:** voltage to the K1 relay is regulated at 12 Volts DC by the VR1.
- Normally–open K1 contacts close to maintain voltage to K2 relay, energize generator "on" lamp and to provide circuit for fault shutdowns. Normally–open K2 contacts remain closed to maintain voltage to engine components. Normally–closed K1 contacts open to disconnect field flashing circuit.
- When the unit is running, start switch contacts N and 47 are opened by releasing Start/Stop switch.
- Normally–closed K1 contacts (in series with K3 relay) open to deenergize K3 relay (LED 3 goes out). K3 contacts open to deenergize K5 relay (starter solenoid) and prevent accidental reenergizing of starter motor. (K5 relay contacts open to deenergize starter motor.) TDR relay energizes after 5 seconds of running time and normally–open TDR contacts close to provide fault shutdown circuit.

Stopping

- Close stop switch between N and 43 (local or remote). K4 relay is energized (LED 4 lights) and normally–closed K4 contacts open to deenergize engine components. Unit stops.

Low Oil Pressure (LOP) Shutdown

- When engine lube oil pressure falls below a safe level, LOP switch closes and K4 relay is energized (LED 4 lights). Normally–closed K4 contacts open to deenergize engine components. Unit shuts down. **NOTE:** TDR relay prevents LOP shutdown during first 5 seconds after start–up.

High Engine Temperature (HET) Shutdown

- Ten to twenty seconds after the engine operating temperature reaches 218°F (103°C), HET normally–open contacts close. K4 relay is energized (LED 4 lights). Normally–closed K4 contacts open to deenergize engine components . Unit shuts down. **NOTE:** TDR relay prevents HET shutdown during first 5 seconds after start–up.

Overspeed Shutdown

When engine speed exceeds 70 Hz (2100 rpm) on 50/60 Hz sets, SDR relay normally–open contacts close to energize K4 relay (LED 4 lights). K4 normally–closed contacts open to deenergize engine components. Unit shuts down.

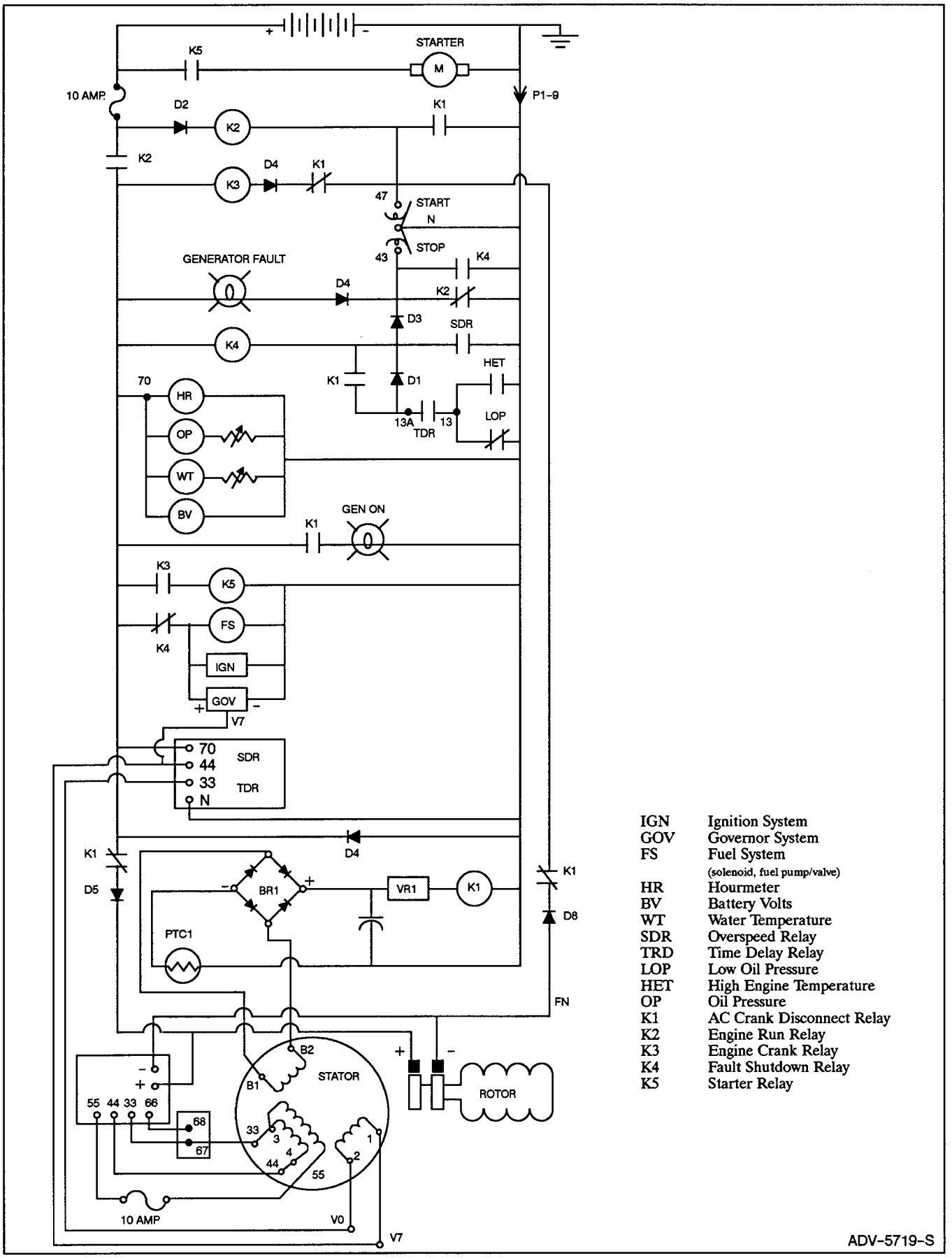
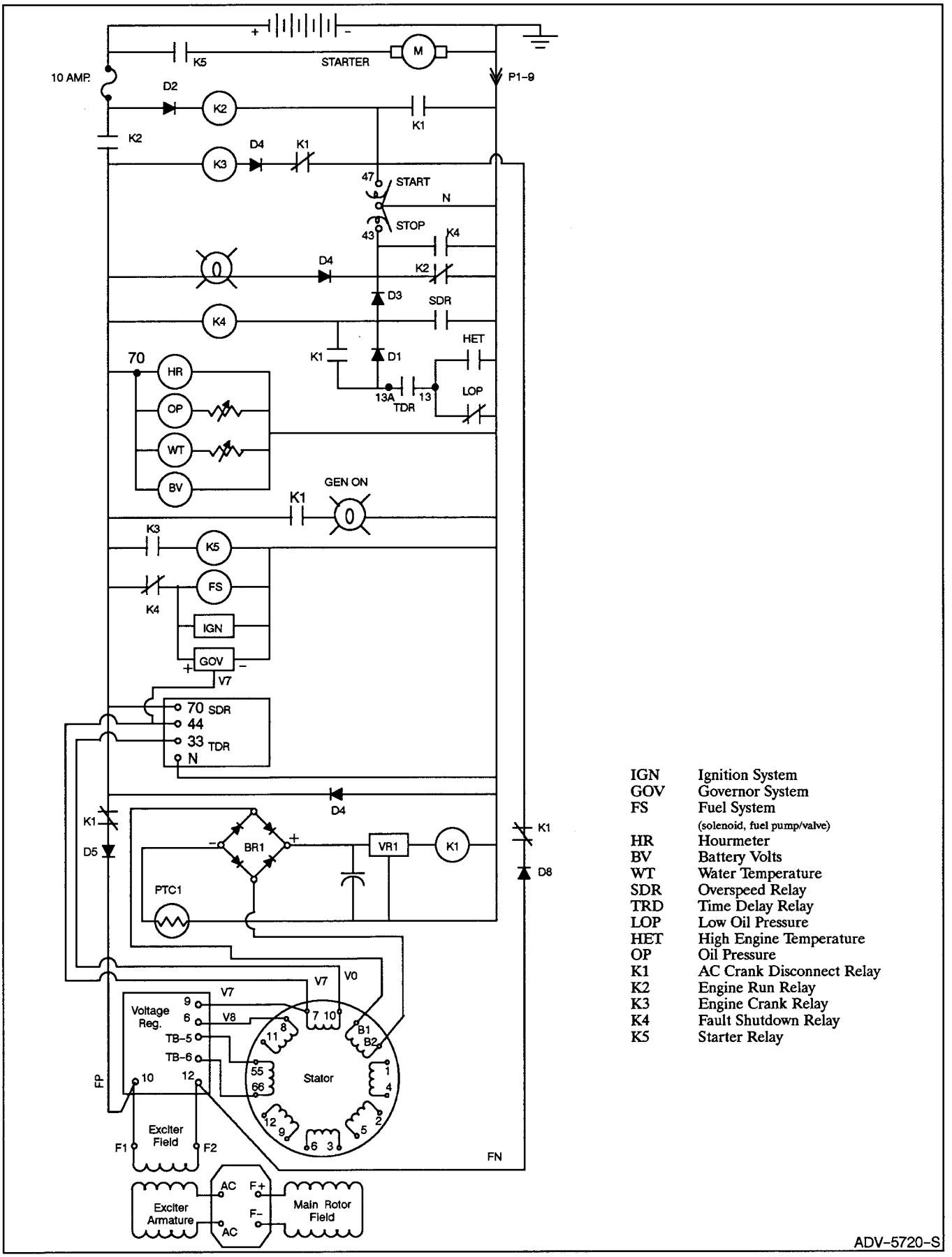


Figure 6–1. 10CC & 12CC Mobile Generator Schematic (Single–Phase, 4–Lead Generator)



IGN	Ignition System
GOV	Governor System
FS	Fuel System (solenoid, fuel pump/valve)
HR	Hourmeter
BV	Battery Volts
WT	Water Temperature
SDR	Overspeed Relay
TRD	Time Delay Relay
LOP	Low Oil Pressure
HET	High Engine Temperature
OP	Oil Pressure
K1	AC Crank Disconnect Relay
K2	Engine Run Relay
K3	Engine Crank Relay
K4	Fault Shutdown Relay
K5	Starter Relay

Figure 6–2. 10CZ & 12CZ Mobile Generator Schematic (Three–Phase, 12–Lead Generator)

SECTION 7. GENERATOR TROUBLESHOOTING

Theory of Operation CC/4-Lead Generators

The CC/4–lead models utilize a rotating field generator to produce AC current. When the start switch is activated, the rotor (field) is magnetized by DC current from the battery. When the magnetized rotor is rotated within the stator windings, an electrical current develops within the stator. As engine speed and generator output increase, stator output current (rectified by the voltage regulator) is fed to the rotor through the brushes/slip rings to increase the strength of the rotor field. As the rotor field increases in strength, generator output also increases. The voltage regulator monitors the generator output current through leads 33 and 44 and allows the correct amount of DC current to flow to the rotor to meet load requirements.

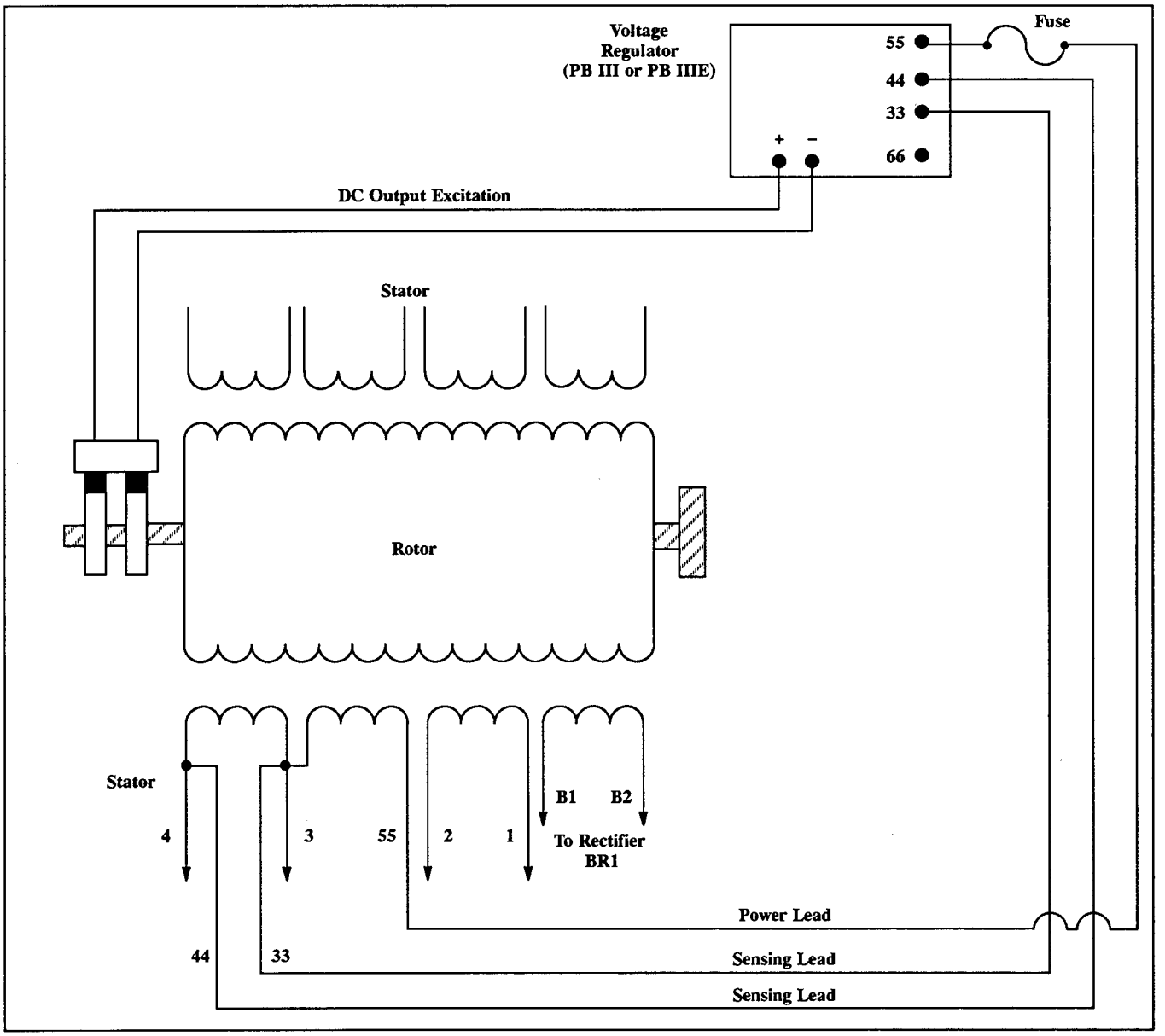


Figure 7–1. CC/4–Lead Generator Schematic

Troubleshooting - CC/4-Lead Generators Only

To determine the cause of no or low AC output on CC/4–lead generators, refer to the troubleshooting flow chart (Figure 7–1) and the separate excitation procedure following. Before beginning the troubleshooting procedures, read all safety precautions at the beginning of this manual. Additional safety precautions are included with the tests; OBSERVE THESE PRECAUTIONS!

Begin the troubleshooting procedure by checking the condition of the voltage regulator 10 Amp. fuse. See Section 2 (for fuse location) and Section 8, "Component Testing." If the fuse is okay, separately excite the generator. The generator field (rotor) may be excited (magnetized) using an outside power source (12 Volt automotive battery). In the separate excitation test, you will be duplicating the role of the voltage regulator in providing excitation current to the rotor. By separately exciting the generator to determine the presence of a faulty voltage regulator, it is possible to determine if a running fault exists in the rotor and/or stator. A generator component that appears good while static (stationary) may exhibit a running open or short while dynamic (moving). This fault can be caused by centrifugal forces acting on the windings during rotation or insulation breakdown as temperatures increase. The flow chart in Table 7–2 summarizes the troubleshooting procedure.

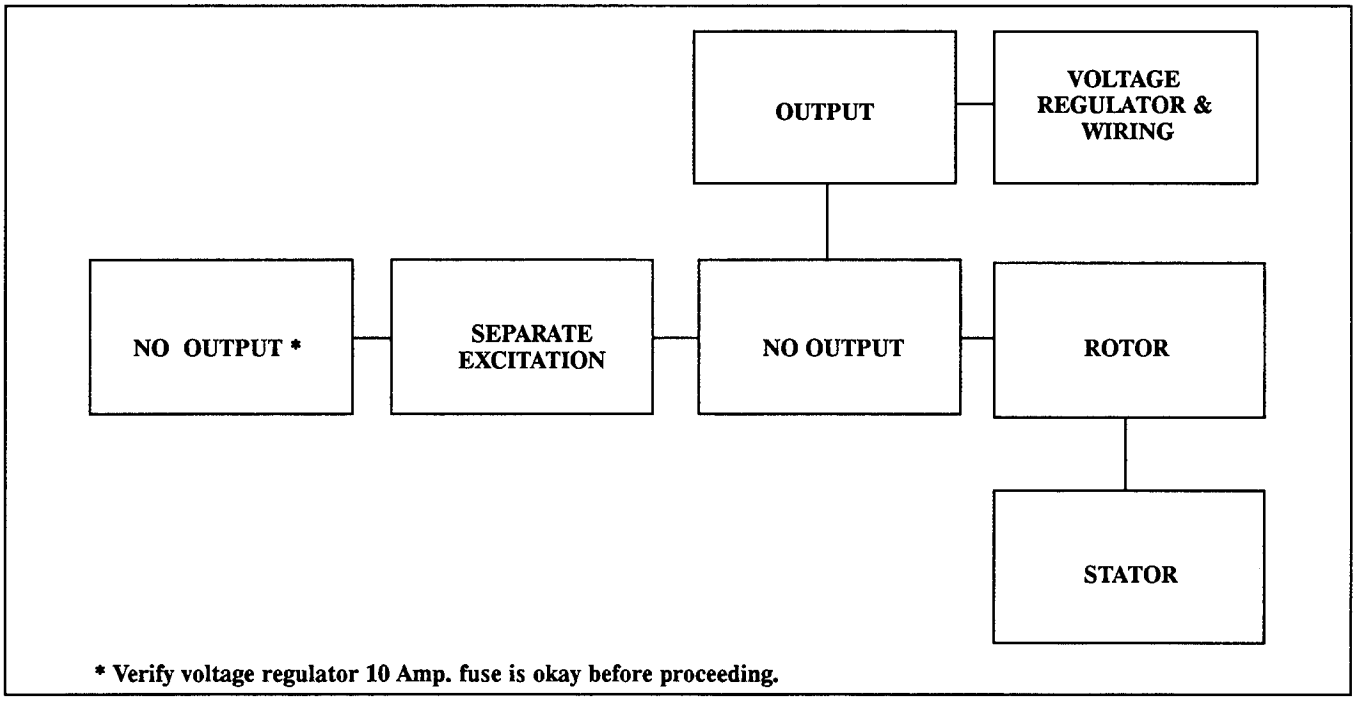


Figure 7–2. Generator Troubleshooting – CC/4–Lead Generators

⚠ WARNING

Hazardous voltage can cause death or severe injury.

Perform electrical service only as prescribed in equipment manual. 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. Wiring should be inspected at the interval recommended in the service schedule -- replace leads that are frayed or in poor condition. The function of a generator set is to produce electricity and wherever electricity is present, there is the hazard of electrocution.

⚠ CAUTION

Short circuits can cause bodily injury and/or equipment damage. Do not contact electrical connections with tools or jewelry while adjustments are made. Remove wristwatch, rings, and jewelry that can cause short circuits.

Separate Excitation - CC/4-Lead Generators Only

1. Disconnect all leads from voltage regulator. See Figure 7–3.
2. Connect an ammeter and a 12–Volt automotive battery to the positive (+) and negative (–) brush leads. Refer to Figure 7–4. Note and record the ammeter reading.
3. The approximate ammeter reading should be battery voltage divided by specified rotor resistance. Specified rotor resistance for the 10CC generator set is approximately 4 ohms. Specified rotor resistance for the 12CC generator set is approximately 3.5 ohms.

Example: 10CC Generator

$$\frac{\text{12 Volts (Battery Voltage)}}{\text{4 Ohms (Rotor Resistance)}} = \text{3 Amps. Rotor Current}$$

4. Start engine and check that ammeter remains stable. An increasing meter reading indicates a shorted rotor. A decreasing meter reading to zero or an unstable reading suggests a running open. Refer to Section 8, "Component Testing." If ammeter is stable proceed to Step 5.
5. Check for AC output across stator leads (See Section 8. "Stator") and compare to readings in Table 7–1. If readings vary considerably from those in Table 7–1, a faulty stator is likely. Refer to Section 8. "Stator" for further information.
6. If rotor and stator test good in prior steps, the voltage regulator is probably defective.

Leads	10CC	12CC
1–2, 3–4, 33–44	100 Volts	90 Volts
33–55	150 Volts	140 Volts
B1–B2	8 Volts	8 Volts

Table 7–1. Stator Output Voltages with Separately Excited Rotor (12–volt Battery)

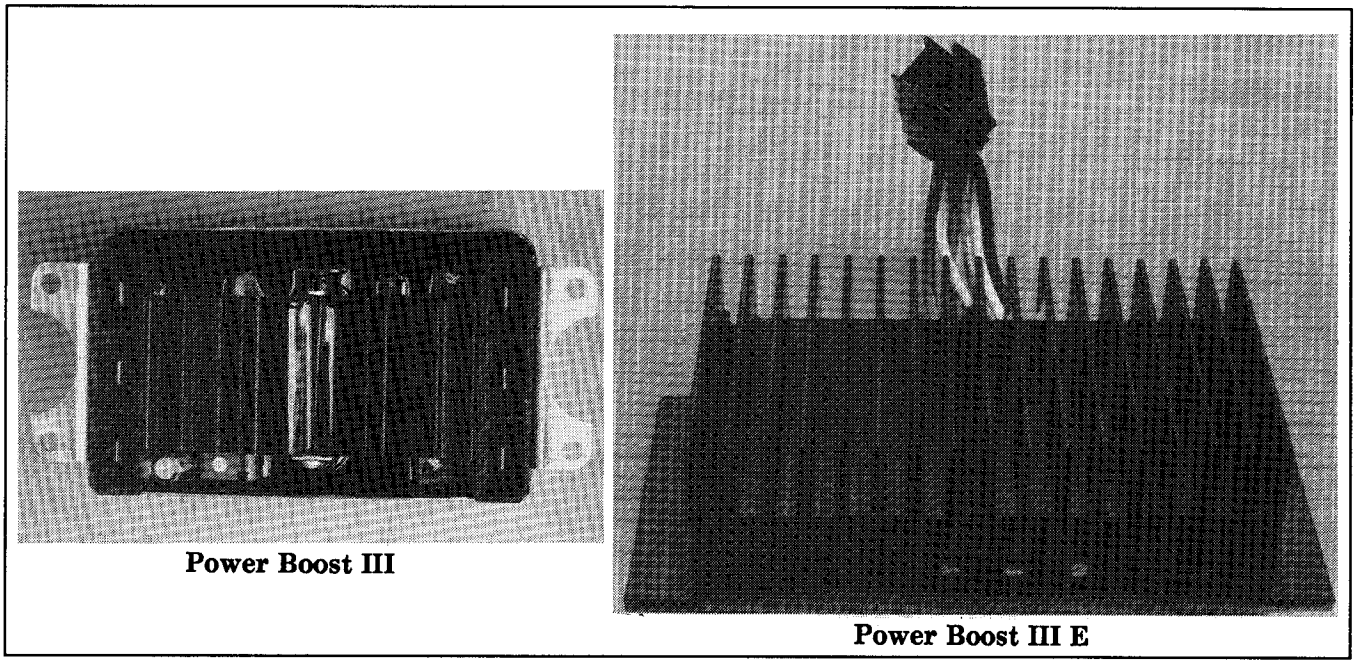


Figure 7–3. PowerBoost III and IIIE Voltage Regulators

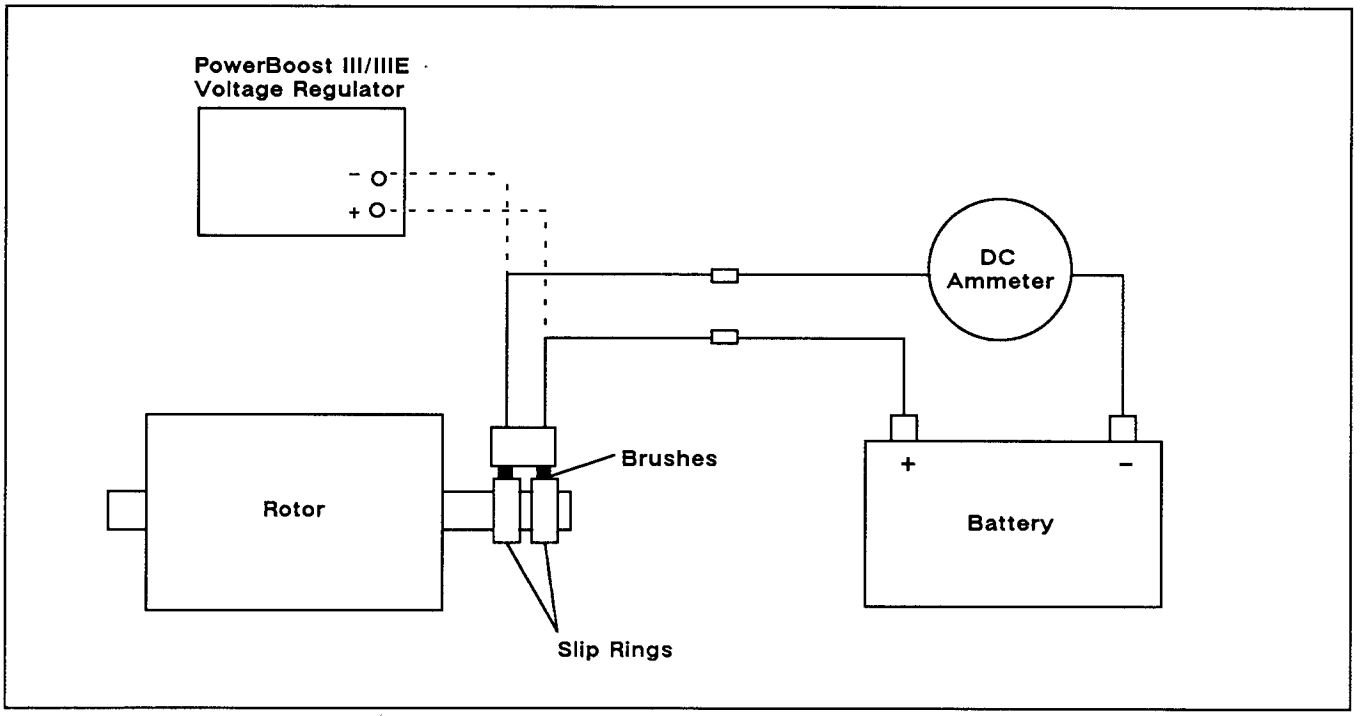


Figure 7–4. Separate Excitation Connections

Theory of Operation
CZ/12-Lead Generators

The CZ/12–lead models utilize a wound field brushless excited generator to produce AC current. When the start switch is activated, the exciter field is magnetized by DC current from the battery. When the exciter armature is rotated within the magnetized exciter field windings, an electrical current develops within the exciter armature. As the engine speeds up, exciter armature output increases. Exciter armature current (converted to DC by the rectifier module) magnetizes the generator main field. The main field rotating within the stator windings imparts AC current in the stator windings. As the main field increases in strength (as supplied by exciter armature), generator output also increases. The voltage regulator monitors output voltage through stator leads 7 and 10 to supply the correct amount of DC current (rectified by the voltage regulator) to the exciter field to meet the generator load requirements. Exciter field current (other than start–up) is supplied by stator windings 55 and 66 through the voltage regulator.

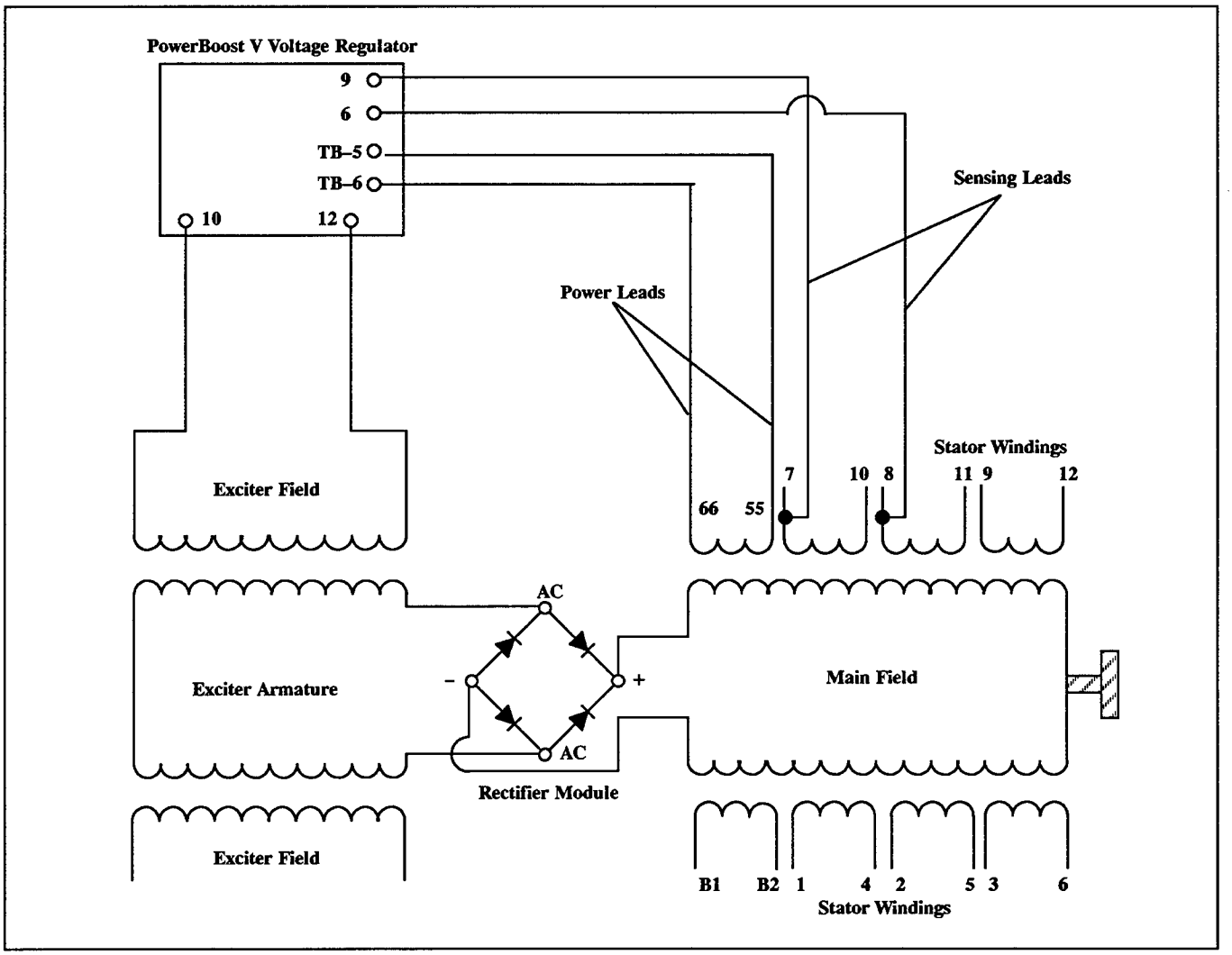


Figure 7–5. CZ/12–Lead Generator Schematic

Troubleshooting - CZ/12-Lead Models Only

To determine the cause of no or low AC output on CZ/12–lead generators, refer to the troubleshooting flow chart (Figure 7–6) and the separate excitation procedure following. Before beginning the troubleshooting procedures, read all safety precautions at the beginning of this manual. Additional safety precautions are included with the tests; OBSERVE THESE PRECAUTIONS!

Begin the troubleshooting procedure by separately exciting the generator. The generator field (rotor) may be excited (magnetized) using an outside power source (12 Volt automotive battery). In the separate excitation test, you will be duplicating the role of the voltage regulator in providing excitation current to the exciter field. By separately exciting the generator to determine the presence of a faulty voltage regulator, it is possible to determine if a running fault exists in the rotor and/or stator. A generator component that appears good while static (stationary) may exhibit a running open or short while dynamic (moving). This fault can be caused by centrifugal forces acting on the windings while rotating or insulation breakdown as temperatures increase. The flow chart in Figure 7–6 summarizes the troubleshooting procedure.

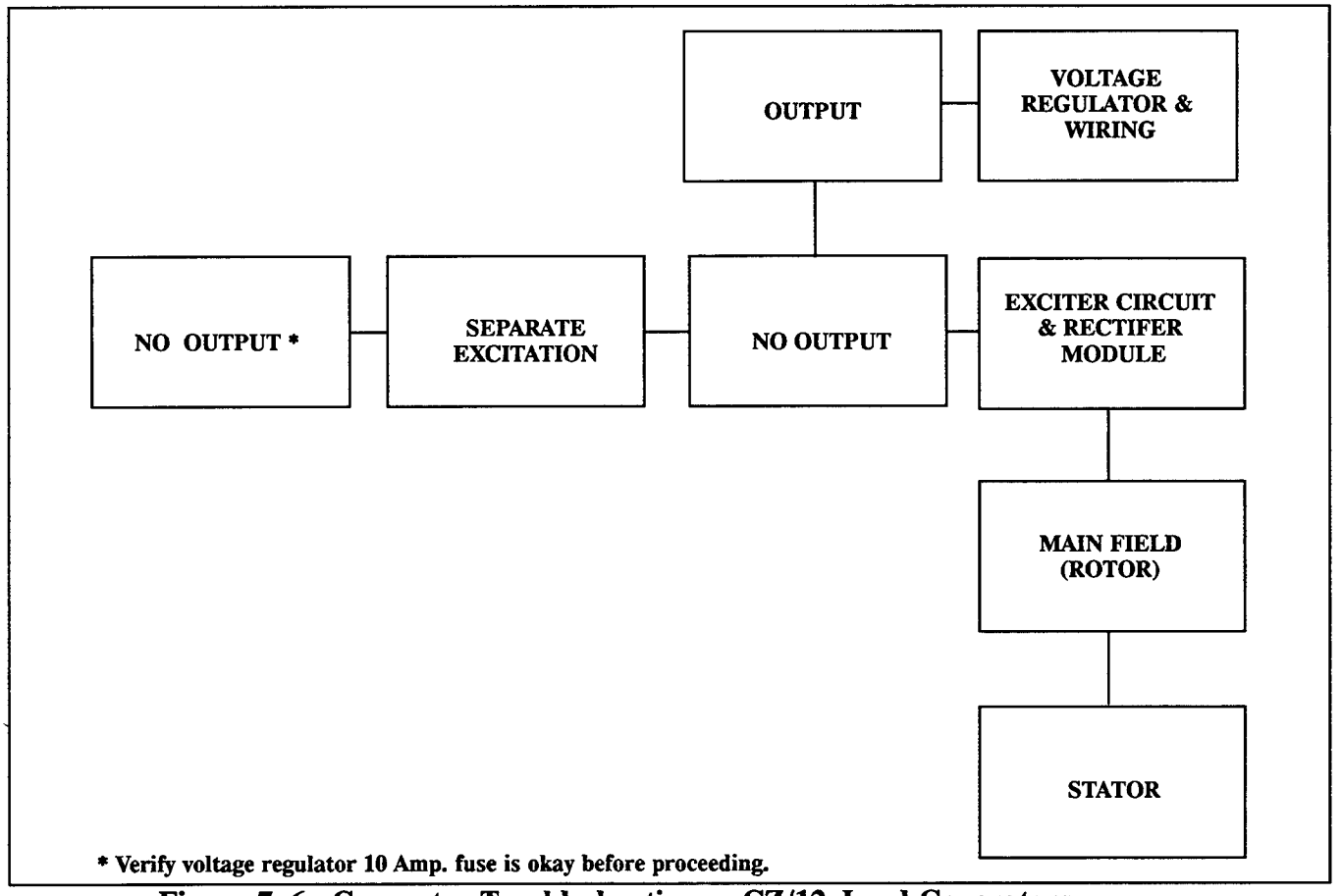


Figure 7–6. Generator Troubleshooting – CZ/12–Lead Generators

⚠ WARNING

Hazardous voltage can cause death or severe injury. Perform electrical service only as prescribed in equipment manual. 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. Wiring should be inspected at the interval recommended in the service schedule -- replace leads that are frayed or in poor condition. The function of a generator set is to produce electricity and wherever electricity is present, there is the hazard of electrocution.

⚠ CAUTION

Short circuits can cause bodily injury and/or equipment damage. Do not contact electrical connections with tools or jewelry while adjustments are made. Remove wristwatch, rings, and jewelry that can cause short circuits.

Separate Excitation - CZ/12-Lead Generators Only

1. Disconnect all leads from voltage regulator. See Figure 7–7.
2. Remove exciter field F1 and F2 leads from TB2 terminal strip.
3. Connect separate excitation circuit as shown in Figure 7–8. (Connect an ammeter in series with F1.) Note and record the ammeter reading.
3. The approximate ammeter reading should be battery voltage divided by specified rotor resistance. Specified rotor resistance for the 10/12CZ generator set is approximately 3.5 ohms.

Example: 10CC Generator

$$\frac{\text{12 Volts (Battery Voltage)}}{\text{3.5 Ohms (Rotor Resistance)}} = \text{3.4 Amps. Rotor Current}$$

4. Start engine and check that ammeter remains stable. An increasing meter reading indicates a shorted rotor. A decreasing meter reading to zero or unstable reading suggests a running open. Refer to Section 8, "Component Testing." If ammeter is stable proceed to Step 5.
5. Check for AC output across stator leads (See Section 8. "Stator") and compare to readings in Table 7–2. If readings vary considerably from those in Table 7–2, a faulty stator is likely. (Refer to Section 8. "Stator" for further information.)
6. If rotor and stator test good in prior steps, the voltage regulator is probably defective. If there is no generator output during normal operation but output is available when the set is separately excited, the voltage regulator is probably defective.

Leads	10CZ & 12CZ
1–4, 2–5, 3–6, etc.	175 Volts
55–66,	190 Volts
B1–B2	25 Volts

Table 7–2. Stator Output Voltages with Separately Excited Rotor (12–volt Battery)

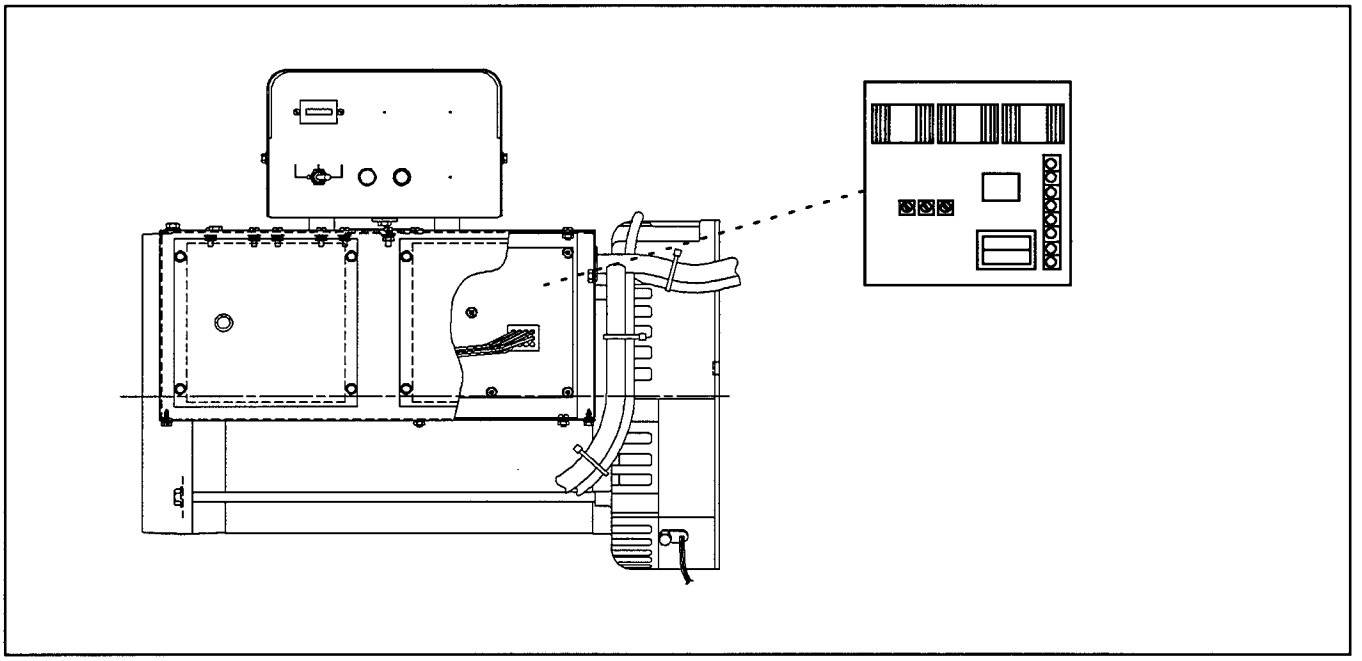


Figure 7–7. PowerBoost V Voltage Regulator

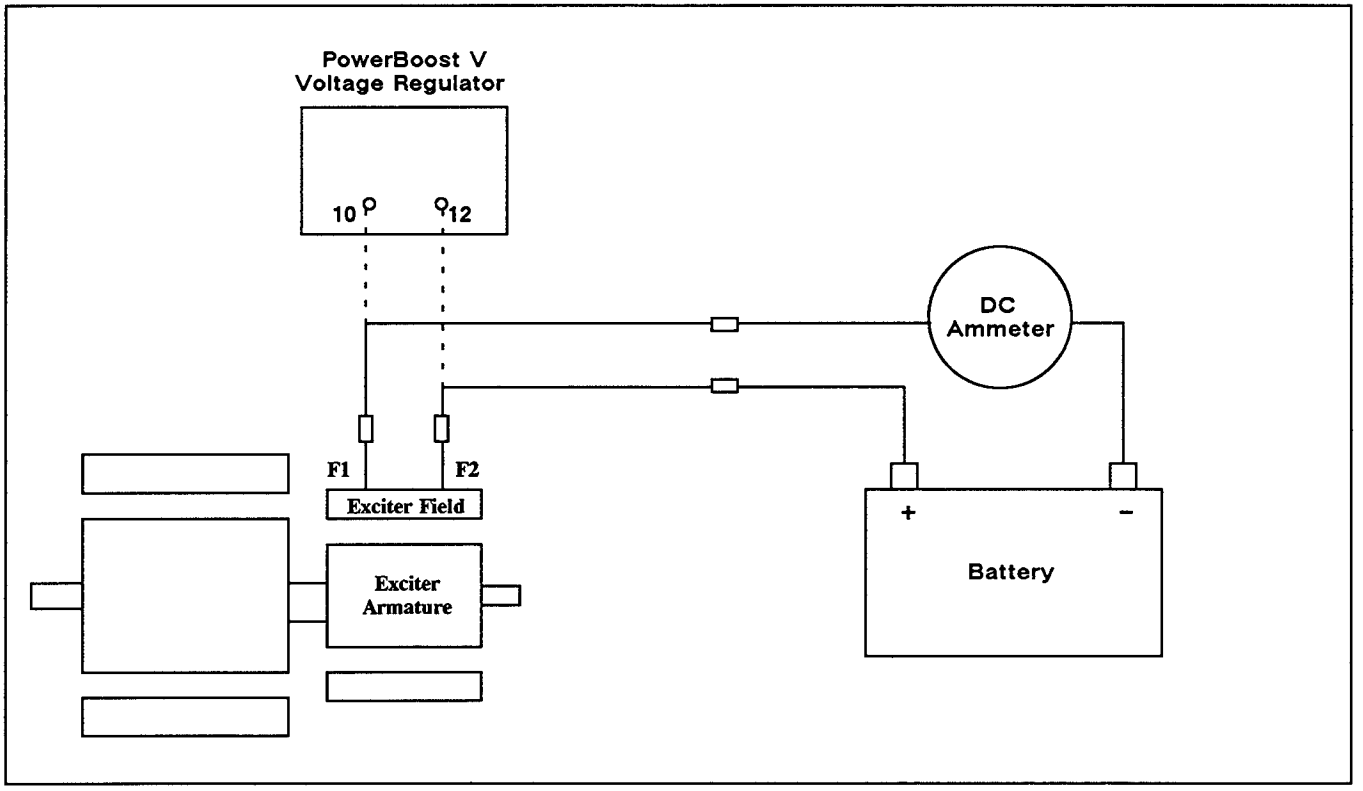


Figure 7–8. Separate Excitation Connections

SECTION 8. COMPONENT TESTING & ADJUSTMENT

This section is a guide for checking generator components for improper operation and performing component adjustment. To avoid confusion, the testing/adjustment procedures have been divided by generator type: CC/4–lead or CZ/12–lead generators. Be sure to follow the correct test procedures for the generator set being serviced. Follow the safety precautions at the beginning of this manual during all test procedures. Additional safety precautions are included with the tests; OBSERVE THESE PRECAUTIONS!

CC/4-Lead Generators

Voltage Regulator Test – PowerBoost III & PowerBoost IIIE

Early model generators were equipped with PowerBoost III voltage regulators; later models are equipped with PowerBoost IIIE regulators. Refer to Figure 8–1a or 81b to identify the voltage regulator used in the set being serviced. Differences in test/adjustment procedures are noted in the text.

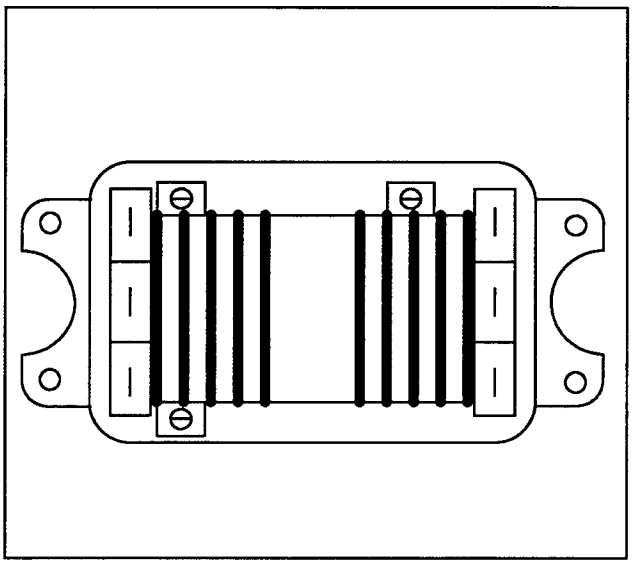


Figure 8–1a. PowerBoost III Voltage Regulator

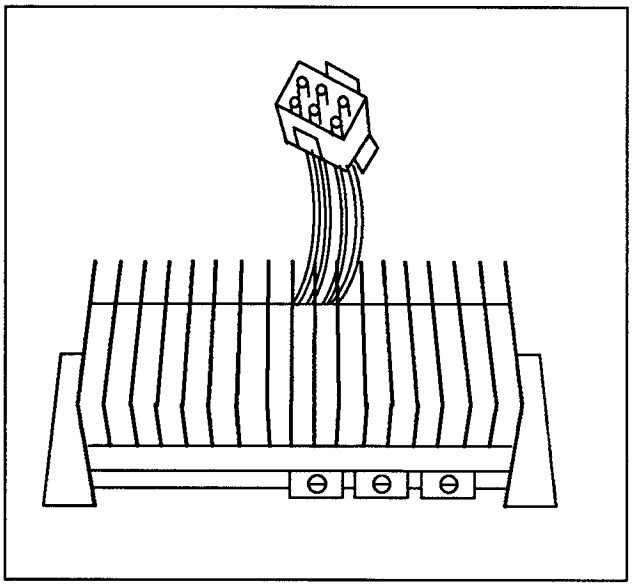


Figure 8–1b. PowerBoost IIIE Voltage Regulator

The voltage regulator monitors output voltage magnitude and frequency to supply current to the generator exciter field. If the regulator 10 Amp. fuse is blown, the generator will shut down; Verify regulator fuse is good before proceeding with test. To determine if the voltage regulator is functioning properly, reduce engine speed (Hz) and watch for a corresponding drop in AC voltage. AC voltage should remain constant until engine speed drops below 57.5 Hz (on 60 Hz models) or 47.5 Hz (on 50 Hz models). When frequency drops below 57.5/47.5 Hz, AC voltage should decline. If this test proves inconclusive, perform the following test to check regulator output. To test the voltage regulator the following components will be needed:

- Variable Transformer, 0–140 Volts (0.5 Amp. Minimum)
- 120 Volt AC Plug
- 120 Volt, 100 watt Lamp
- AC Voltmeter
- #14 AWG Copper Wire (minimum)

⚠ WARNING

Hazardous voltage can cause death or severe injury. Perform electrical service only as prescribed in equipment manual. 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. Wiring should be inspected at the interval recommended in the service schedule -- replace leads that are frayed or in poor condition. The function of a generator set is to produce electricity and wherever electricity is present, there is the hazard of electrocution.

⚠ WARNING

Hazardous voltage can cause severe personal injury. When testing or servicing generator set and there is the presence of hazardous voltage, be alert and use care to prevent electrical shock.

⚠ CAUTION

Short circuits can cause bodily injury and/or equipment damage. Do not contact electrical connections with tools or jewelry while adjustments are made. Remove wristwatch, rings, and jewelry that can cause short circuits.

1. Connect components as shown in Figure 8–2a or 8–2b.

2. Turn variable transformer setting to zero. Plug in variable transformer.

3. Turn variable transformer on. Slowly increase variable transformer voltage to 100 Volts. The lamp should go on. If the lamp does not light, turn the voltage adjustment pot. clockwise. If the light still does not go on, the voltage regulator is defective and should be replaced. A voltage regulator testing bad as described would cause a generator no/low output condition.

4. Slowly increase voltage to 120 Volts. The lamp should go out and stay out as voltage is further increased. If the lamp does not go out, turn the voltage adjustment pot. counterclockwise. If the light still does not go out, replace the voltage regulator. A voltage regulator testing bad as described would cause a generator high voltage output condition.

5. Turn variable transformer to zero and unplug AC cord.

NOTE

Terminal 66 on voltage regulator (PowerBoost III and PowerBoost IIIE) is intended for connection of a remote rheostat in applications where fine voltage adjustment is required.

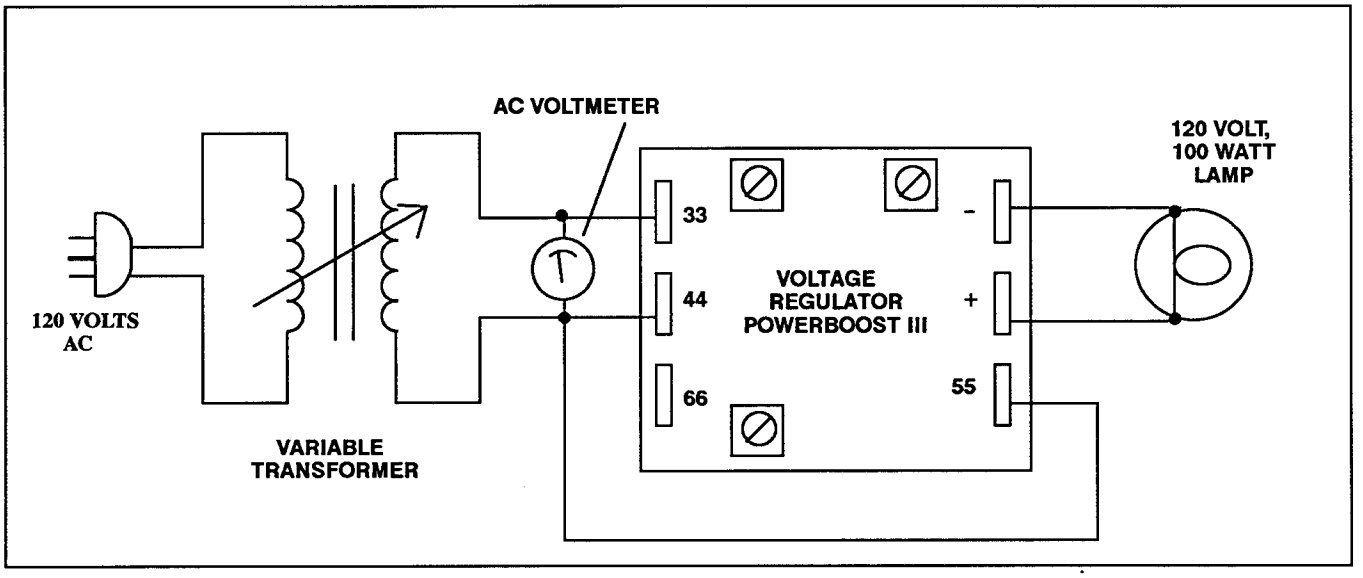


Figure 8–2a. PowerBoost III Voltage Regulator Test

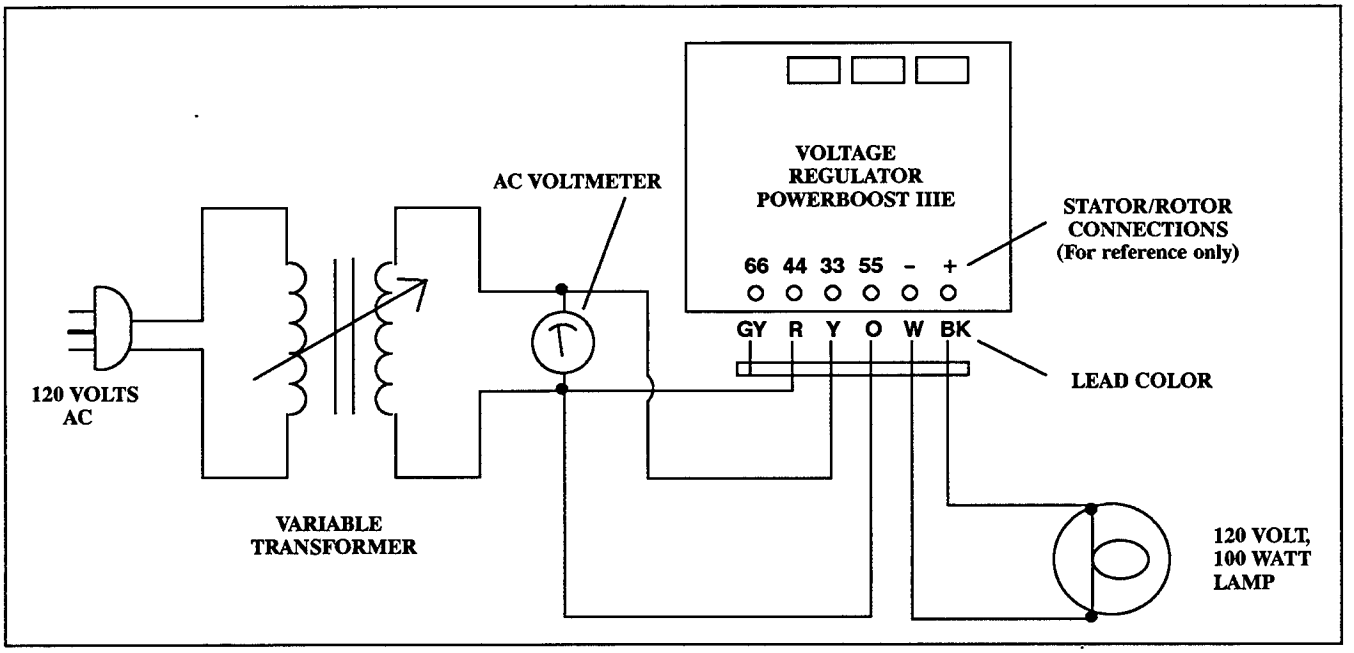


Figure 8–2b. PowerBoost IIIE Voltage Regulator Test

Voltage Regulator Adjustment

The PowerBoost IIIE and PowerBoost III voltage regulator monitors generator output to control current flow to the generator field. However, unlike earlier PowerBoost regulators, PowerBoost IIIE maintains generator output at specified voltage under load until the generator engine speed drops to a pre-set level (factory setting 57.5 Hz on 60 Hz models and 47.5 hz on 50 Hz models). At this point the regulator allows generator voltage and current to drop. This drop will allow the engine to pick up the load. When the generator speed returns to normal (60 Hz or 50 Hz) as load is accepted, generator output also returns to normal. The voltage regulator is factory set for proper generator operation under a variety of load conditions. Under normal circumstances, no further adjustment is necessary. However, if the regulator is replaced or has been tampered with, readjust according to the following procedure. Voltage regulator components are identified in Figure 8–3a and 8–3b and described in the following paragraphs.

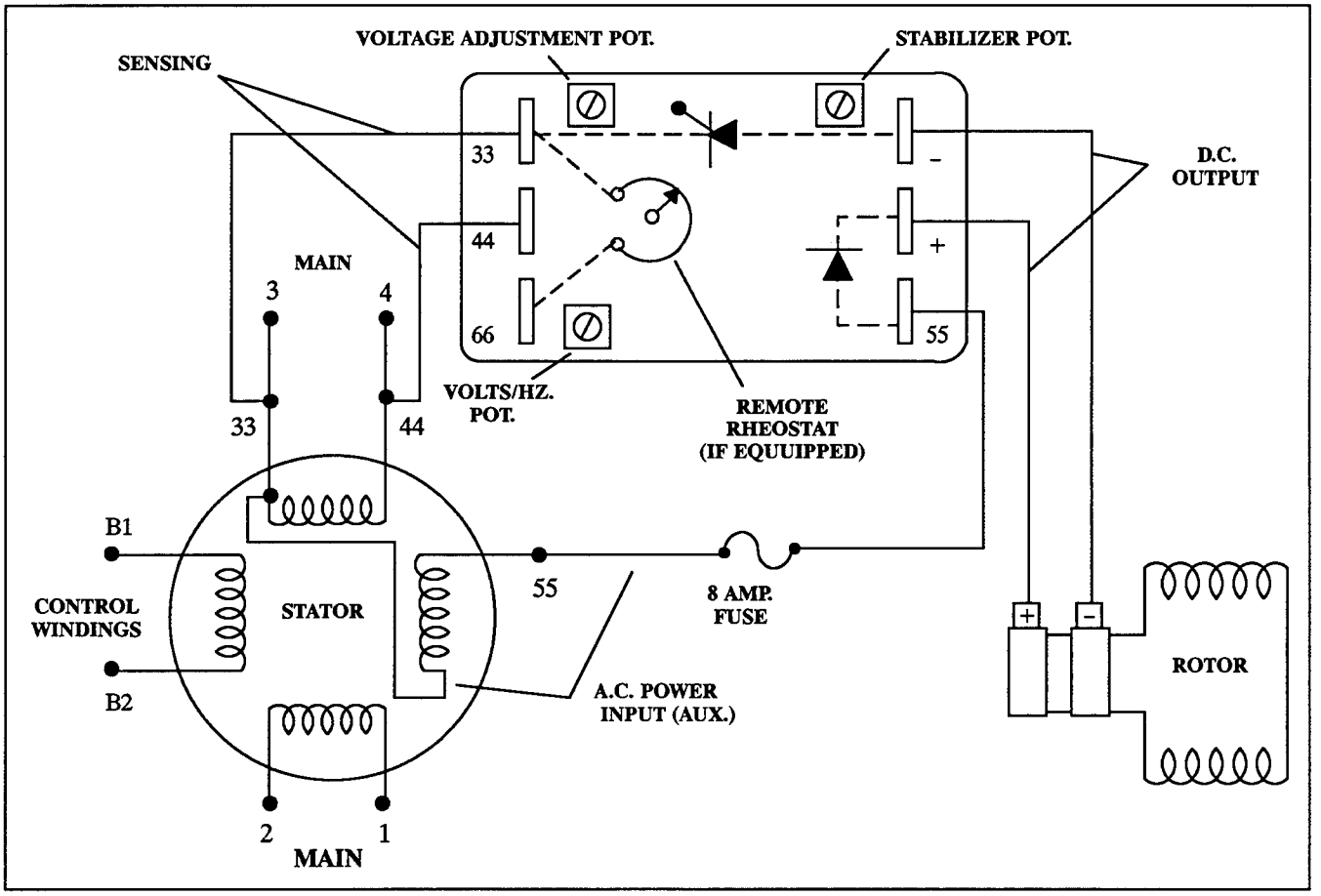


Figure 8–3a. PowerBoost III Voltage Regulator

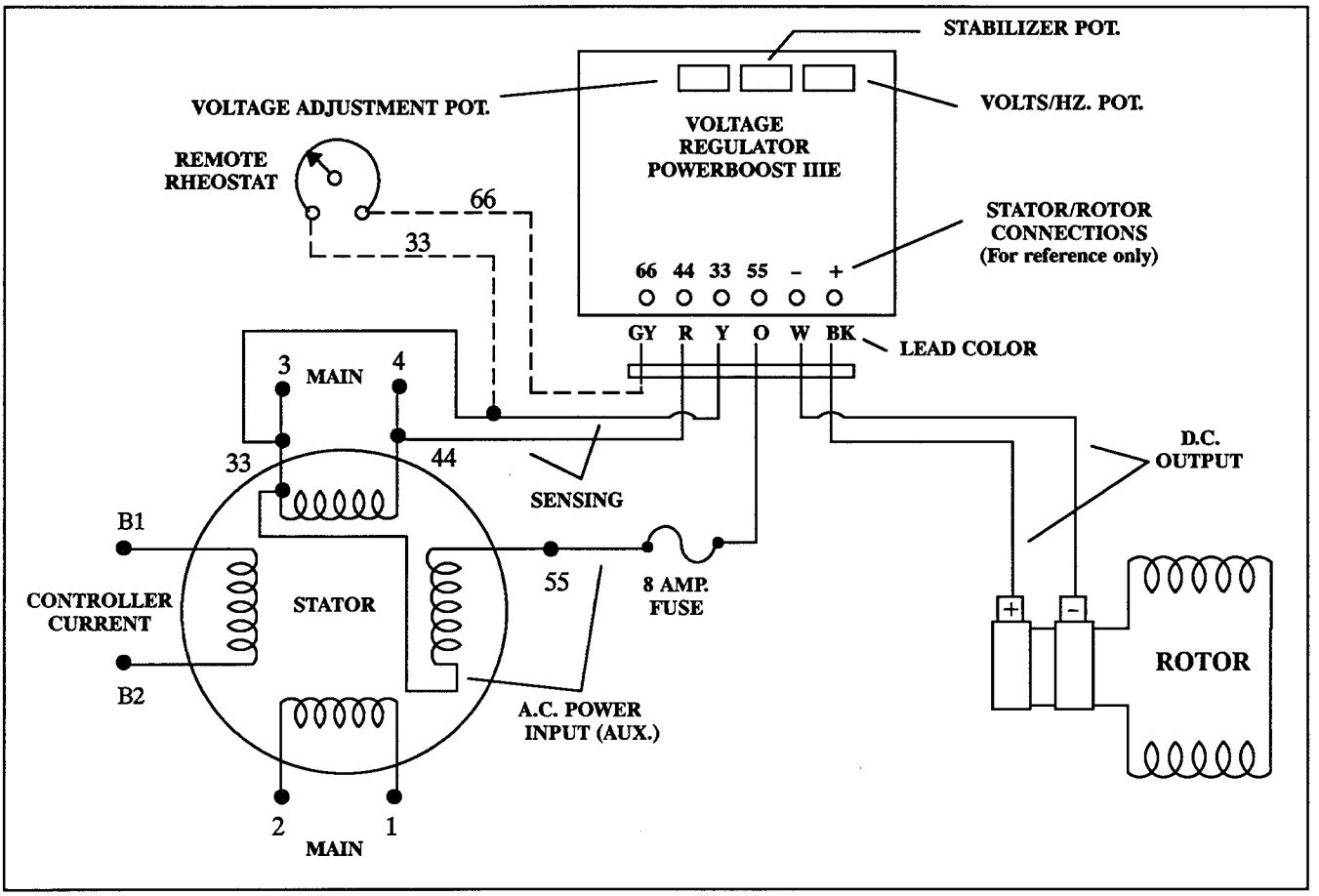


Figure 8–3b. PowerBoost IIIE Voltage Regulator

NOTE

The voltage regulator is located on the generator end bracket and is serviceable by removing four screws.

Voltage Adjustment Pot. – Adjusts generator output within range of 100–130 Volts.

NOTE

A customer–provided rheostat may be connected across regulator leads/terminals 33 and 66 to adjust generator output voltage from a location remote from the set. The rheostat (10k ohms, 1/2 watt minimum) will provide a 5 Volt adjustment range.

Stabilizer Pot. – "Fine–tunes" regulator circuitry to reduce light flicker.

Volts/Hz Pot. – Adjustment determines engine speed (Hz) at which generator output voltage will begin to drop.

⚠ WARNING

Hazardous voltage can cause death or serious injury. The heat sink of the voltage regulator contains high voltage. Do not touch voltage regulator heat sink when testing or electrical shock will occur.

⚠ CAUTION

Short circuits can cause bodily injury and/or equipment damage. Do not contact electrical connections with tools or jewelry while adjustments are made. Remove wristwatch, rings, and jewelry that can cause short circuits.

Adjustment Procedure

1. With generator set off, turn remote rheostat (if equipped) to mid-point. Turn voltage, Volts/Hz, and stability pots. fully counterclockwise. Connect voltmeter to AC circuit or an electrical outlet.

2. Start generator set. Rotate voltage adjustment pot clockwise (increase voltage) or counterclockwise (decrease voltage) until desired output voltage is achieved.

3. Rotate stability pot. clockwise until minimum light flicker is obtained.

4. Readjust voltage adjustment pot. (if necessary).

5. Adjust engine speed to desired cut-in frequency by installing a jumper on the electronic governor circuit board "-2.5Hz/ Freq" terminals. See "Electronic Governor" later in this section. When a jumper is placed across these terminals, generator frequency will drop by 2.5 Hz. The recommended cut-in frequency is 57.5 Hz for 60 Hz operation and 47.5 Hz for 50 Hz operation (as measured on frequency meter).

6. Rotate **Volts/Hz adjustment pot.** clockwise until voltage level begins to drop (as measured on voltmeter). When set to these specifications, the generator will attempt to maintain normal output until engine speed drops below the frequency set in step 5 (as load is applied).

7. Remove jumper from governor circuit board "-2.5/Freq." terminals.

8. Readjust **voltage adjustment pot.** (if necessary).

9. Readjust **stability pot.** (if necessary).

10. Use remote rheostat (if equipped) to make final voltage adjustments. STOP GENERATOR SET.

Rotor (Main Field)

The four–pole rotor creates the magnetic field needed to raise alternating current in the stator windings. Prior to testing, inspect the rotor for visible damage to pole shoes, insulation, exposed coil windings, and slip ring surfaces. Check bearing for noise when rotated, wear, or heat discoloration.

Slip 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 using a lathe.

⚠ WARNING

Hazardous voltage can cause severe personal injury. When testing or servicing generator set and there is the presence of hazardous voltage, be alert and use care to prevent electrical shock.

1. Disconnect generator starting battery (negative lead first) and power to battery charger (if equipped).
2. Check the rotor for continuity and resistance. Measure the rotor resistance (ohms) between the two slip rings (Figure 8–4). Raise the brushes from the slip rings while performing ohmmeter tests. See Table 8–1 for typical readings. If the resistance test proves inconclusive, perform megohmmeter test on rotor as described in next step.

NOTE

Since ohmmeters do vary in their accuracy, use Table 8–1 as a reference for approximate readings. Readings must be at room temperature.

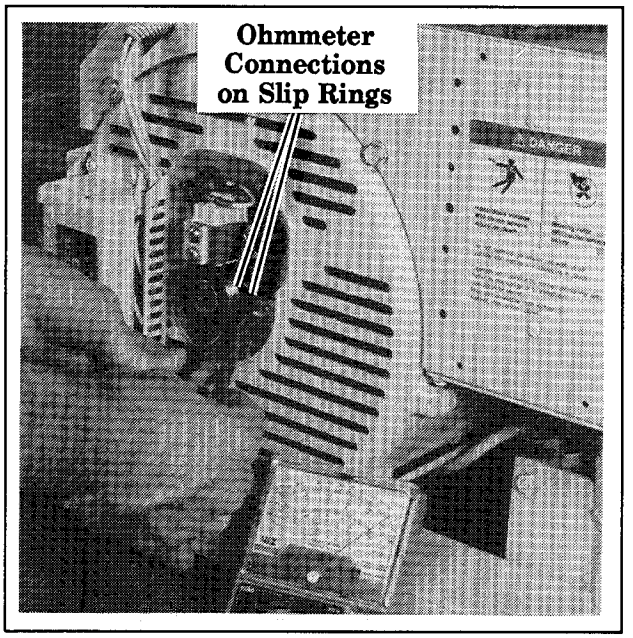


Figure 8–4. Rotor Resistance Check

MODEL	RESISTANCE +/– 10%
10CC	3–5 Ohms
12CC	2.5 – 4.5 Ohms

Table 8–1. Rotor Resistance

⚠ WARNING

Hazardous voltage can cause death or severe injury. Follow instructions of test equipment manufacturer when performing high voltage test. Improper test procedure can damage equipment or lead to future generator failures.

3. Determine whether the rotor is shorted to ground by performing a megohmmeter test. Raise brushes away from slip rings and secure in this position by inserting a retaining wire in the brush holder hole. Using a megohmmeter, apply 500 Volts DC to either rotor slip ring and rotor poles or shaft. See Figure 8–5. (Follow the instructions of the megohmmeter manufacturer when performing this test.) A reading of approximately 500K ohms (1/2 megohm) and higher indicates the rotor is good. A reading of less than 500K ohms (approximately) indicates deterioration of winding insulation and possible current flow to ground. Repair or replacement of the rotor is necessary. Following test, remove retainer wire from brush holder and verify that brushes are properly positioned on slip rings.

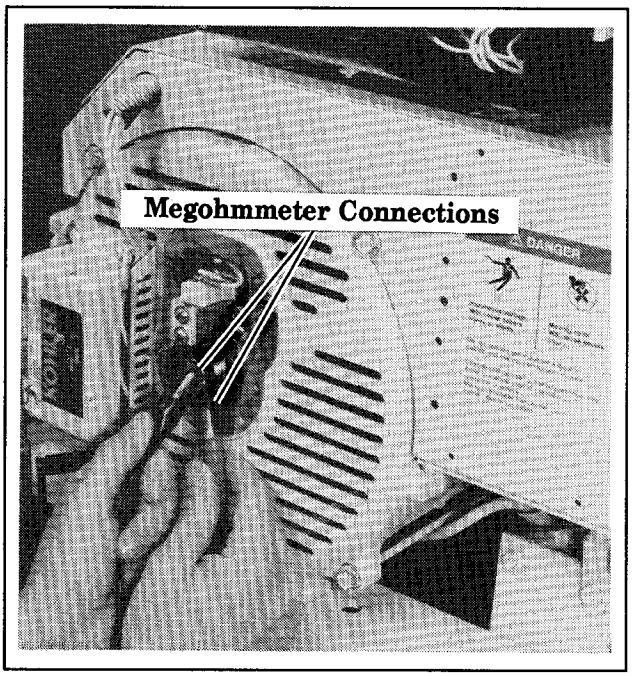


Figure 8–5. Performing Megohmmeter Test on Rotor

Stator

The stator consists of a series of coils of wire laid in a laminated steel frame. The stator leads supply voltage to the AC load and exciter regulator. Prior to testing, inspect the stator for heat discoloration and visible damage to housing lead wires, exposed coil windings, and exposed and varnished areas of frame laminations. Be sure the stator is securely riveted in the stator housing.

NOTE

Disconnect all stator leads prior to performing all stator tests.

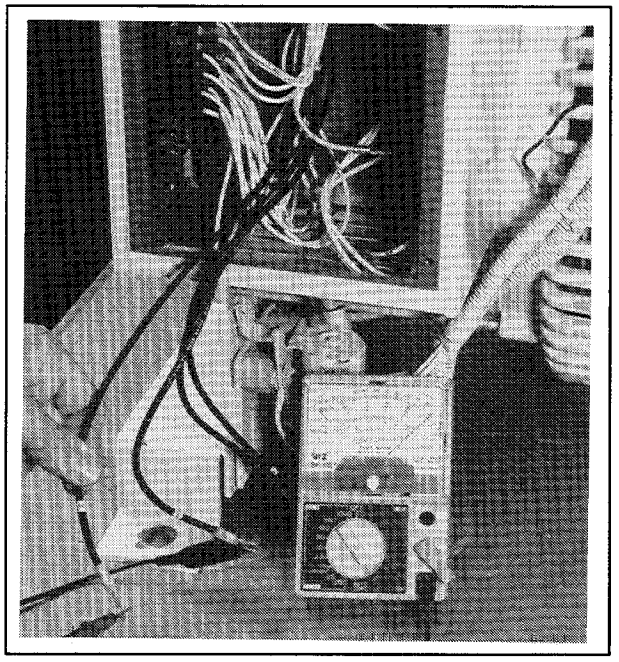


Figure 8–6. Testing Stator Windings

⚠ WARNING

Hazardous voltage can cause severe personal injury. When testing or servicing generator set and there is the presence of hazardous voltage, be alert and use care to prevent electrical shock.

1. Disconnect generator starting battery (negative lead first) and power to battery charger (if equipped).

2. To check stator continuity, set ohmmeter on R x 1 scale. Contact the red and black meter leads; adjust ohmmeter to zero ohms. Check stator continuity by connecting meter leads to stator leads as shown in Figure 8–6.

   Leads 1, 2, 3, and 4 are the generator output leads. Leads 33, 44, and 55 are the voltage regulator sensing and supply leads. The output of leads B1 and B2 is rectified (BR1) to supply control voltage. Refer to the schematic in Figure 8–7 when performing the following tests.

   - There must be continuity between leads 1 and 2.
   - There must be continuity between leads 3 and 4.
   - There must be continuity between leads 33 and 44.
   - There must be continuity between leads 3 and 44.
   - There must be continuity between leads 55 and 3.
   - There must be continuity between leads 55 and 33
   - There must be continuity between leads B1 and B2.
   - There must be NO continuity between lead 1 and leads 3, 4, 33, and 44.
   - There must be NO continuity between lead 1 and leads 55, B1, and B2.
   - There must be NO continuity between lead 4 and leads B1, and B2.
   - There must be NO continuity between lead 55 and leads B1 and B2.
   - There must be NO continuity between any stator lead and ground on stator housing or frame laminations.

3. Contact ohmmeter leads and readjust ohmmeter to zero ohms. Check cold resistance of stator windings by connecting meter leads to stator leads 1 and 2, 3 and 4, 33 and 44, 55 and 33, and B1 and B2. Typical stator winding resistance readings are listed in Table 8–2. If the resistance test proves inconclusive, perform a megohmmeter test on stator as described in next step.

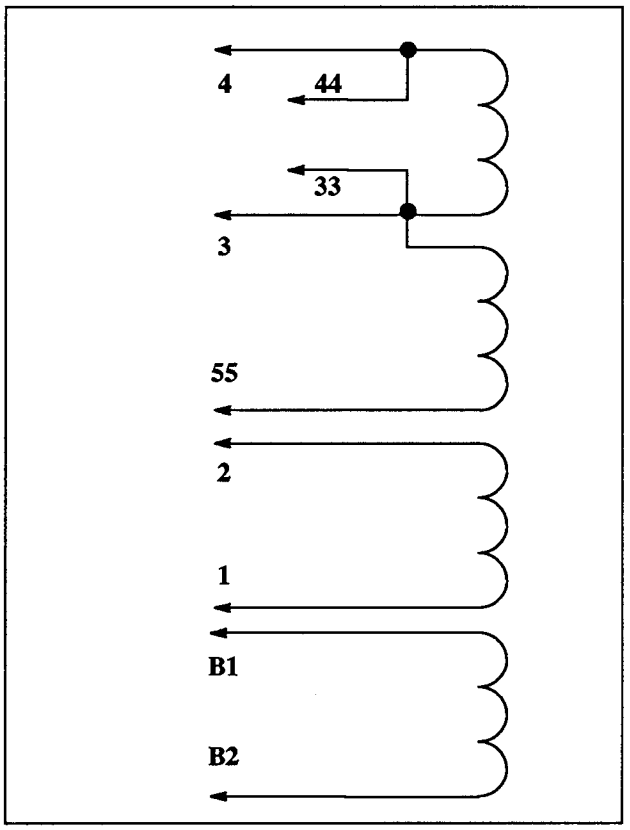


Figure 8–7. Generator Stator Leads

NOTE

Since ohmmeters do vary in their accuracy, use Table 8–2 as a reference for approximate readings. Ohmmeter readings must be taken at room temperature.

NOTE

Most ohmmeters will not provide accurate readings when measuring less than 1 ohm. The stator can be considered good if a low resistance reading (continuity) is obtained and there is no evidence of shorted windings (heat discoloration).

STATOR LEADS	RESISTANCE (OHMS) +/- 10%
1–2, 3–4	0.06
33–44	0.06
55–33	1.26
B1–B2	0.05

Table 8–2. Stator Winding Resistance

⚠ WARNING

Hazardous voltage can cause death or severe injury. Follow instructions of test equipment manufacturer when performing high voltage test. Improper test procedure can damage equipment or lead to future generator failures.

4. Determine whether the stator is shorted to ground by performing a megohmmeter test. Using a megohmmeter, apply 500 Volts DC to any stator lead and stator frame. (Follow the instructions of the megohmmeter manufacturer when performing this test.) Repeat test on other stator leads until each coil is tested. See Figure 8–8. A reading of approximately 500K ohms (1/2 megohm) and higher indicates the stator is good. A reading of less than 500K ohms (approximately) indicates deterioration of winding insulation and possible current flow to ground. Repair or replacement of the stator is necessary.

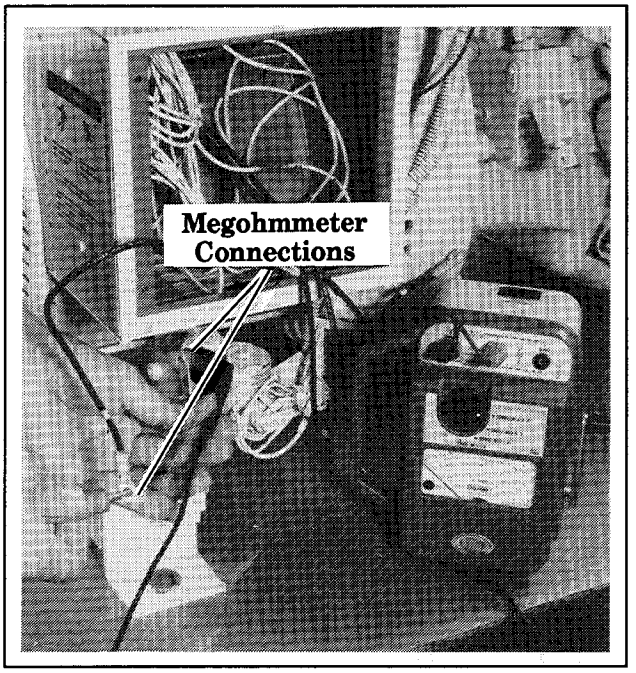


Figure 8–8. Perfoming Megohmmeter Test on Stator

Brushes

The brushes transfer current from the voltage regulator to the slip rings. Since the brushes carry a very low current (approximately 2 Amps.), they should last the life of the generator. Abrasive dust on the slip 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 slip rings, sticking brushes, loose holder, or poor brush contact.

The brushes must be free to move within the holder and be held in proper contact by the springs. When properly positioned, spring pressure on the brush surface will cause the brush to wear evenly. Brushes must ride 100% on the rings or arcing will occur and cause burned rings or failure of the voltage regulator. Figure 8–9 shows the correct positioning of the brushes. Add or remove shims as necessary to center brushes on slip rings.

Replace brushes if they show excessive or uneven wear.

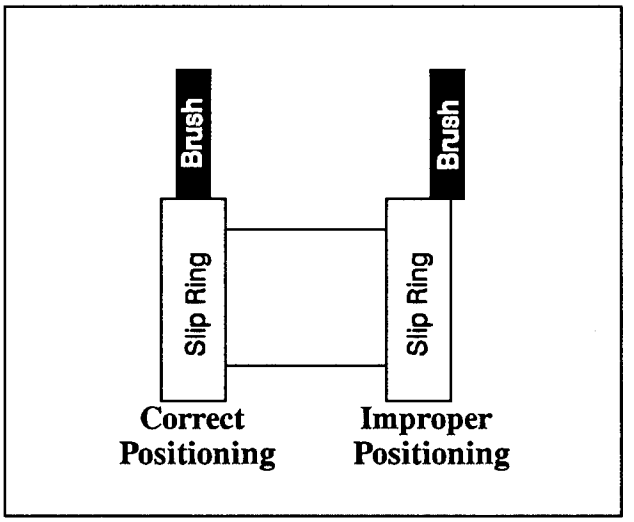


Figure 8–9. Brush Positioning

Notes

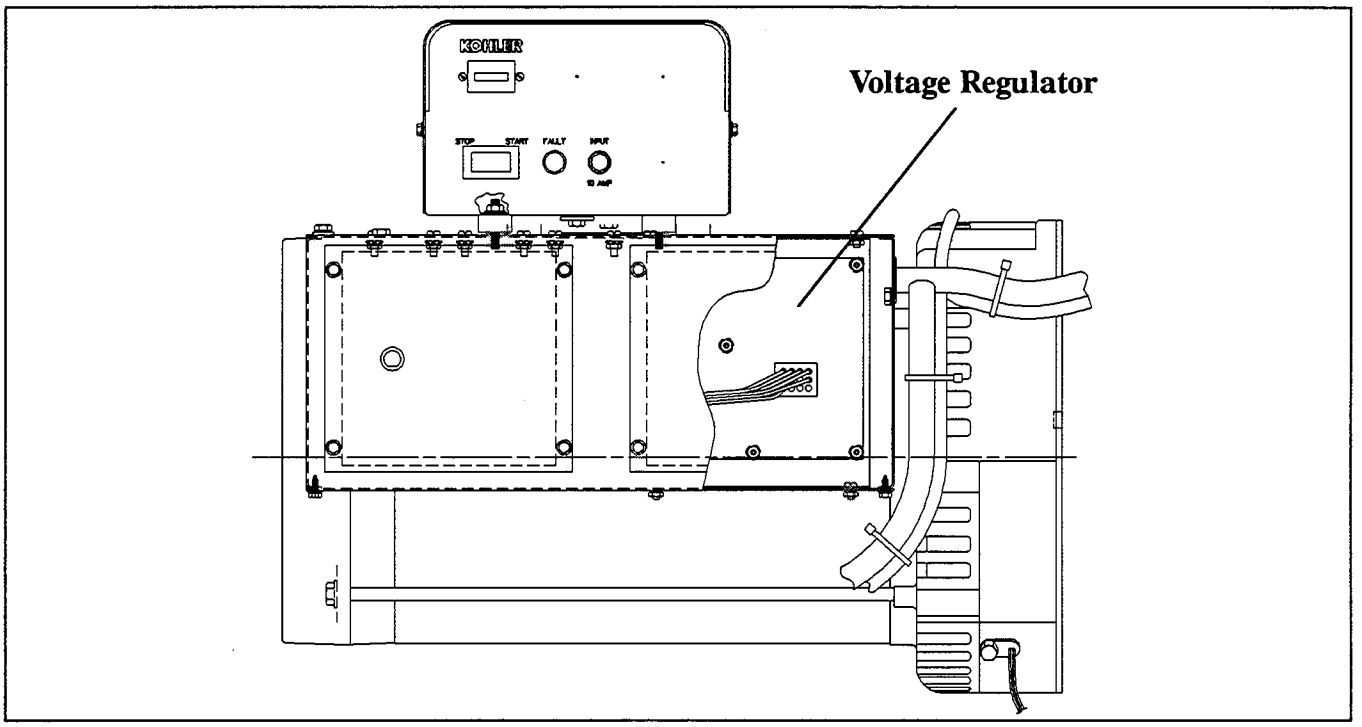


Figure 8–10. PowerBoost V Voltage Regulator

CZ/12-Lead Generators

Voltage Regulator Test - PowerBoost V

The PowerBoost V voltage regulator monitors output voltage magnitude and frequency to supply current to the generator exciter field. See Figure 8–10. To determine if the voltage regulator is functioning properly, reduce engine speed (Hz) and watch for a corresponding drop in AC voltage. AC voltage should remain constant until engine speed drops below 57.5 Hz (on 60 Hz models) or 47.5 Hz (on 50 Hz models). When frequency drops below 57.5/47.5 Hz, AC voltage should decline. If this test proves inconclusive, perform the following test to check regulator output. To test the voltage regulator the following components will be needed:

- Variable Transformer, 0–140 Volts (0.5 Amp. Minimum)
- 120 Volt AC Plug
- 120 Volt, 100 watt Lamp
- AC Voltmeter
- #14 AWG Copper Wire (minimum)

⚠ WARNING

Hazardous voltage can cause death or severe injury. Perform electrical service only as prescribed in equipment manual. 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. Wiring should be inspected at the interval recommended in the service schedule -- replace leads that are frayed or in poor condition. The function of a generator set is to produce electricity and wherever electricity is present, there is the hazard of electrocution.

⚠ WARNING

Hazardous voltage can cause severe personal injury. When testing or servicing generator set and there is the presence of hazardous voltage, be alert and use care to prevent electrical shock.

⚠ CAUTION

Short circuits can cause bodily injury and/or equipment damage. Do not contact electrical connections with tools or jewelry while adjustments are made. Remove wristwatch, rings, and jewelry that can cause short circuits.

1. Connect components as shown in Figure 8–11.
2. Turn variable transformer setting to zero. Plug in variable transformer.
3. Turn variable transformer on. Slowly increase variable transformer voltage to 100 Volts. The lamp should go on. If the lamp does not light, turn the voltage adjustment pot. clockwise. If the light still does not go on, the voltage regulator is defective and should be replaced. A voltage regulator testing bad as described would cause a generator no/low output condition.
4. Slowly increase voltage to 120 Volts. The lamp should go out and stay out as voltage is further increased. If the lamp does not go out, turn the voltage adjustment pot. counterclockwise. If the light still does not go out, replace the voltage regulator. A voltage regulator testing bad as described would cause a generator high voltage output condition.
5. Turn variable transformer to zero and unplug AC cord.

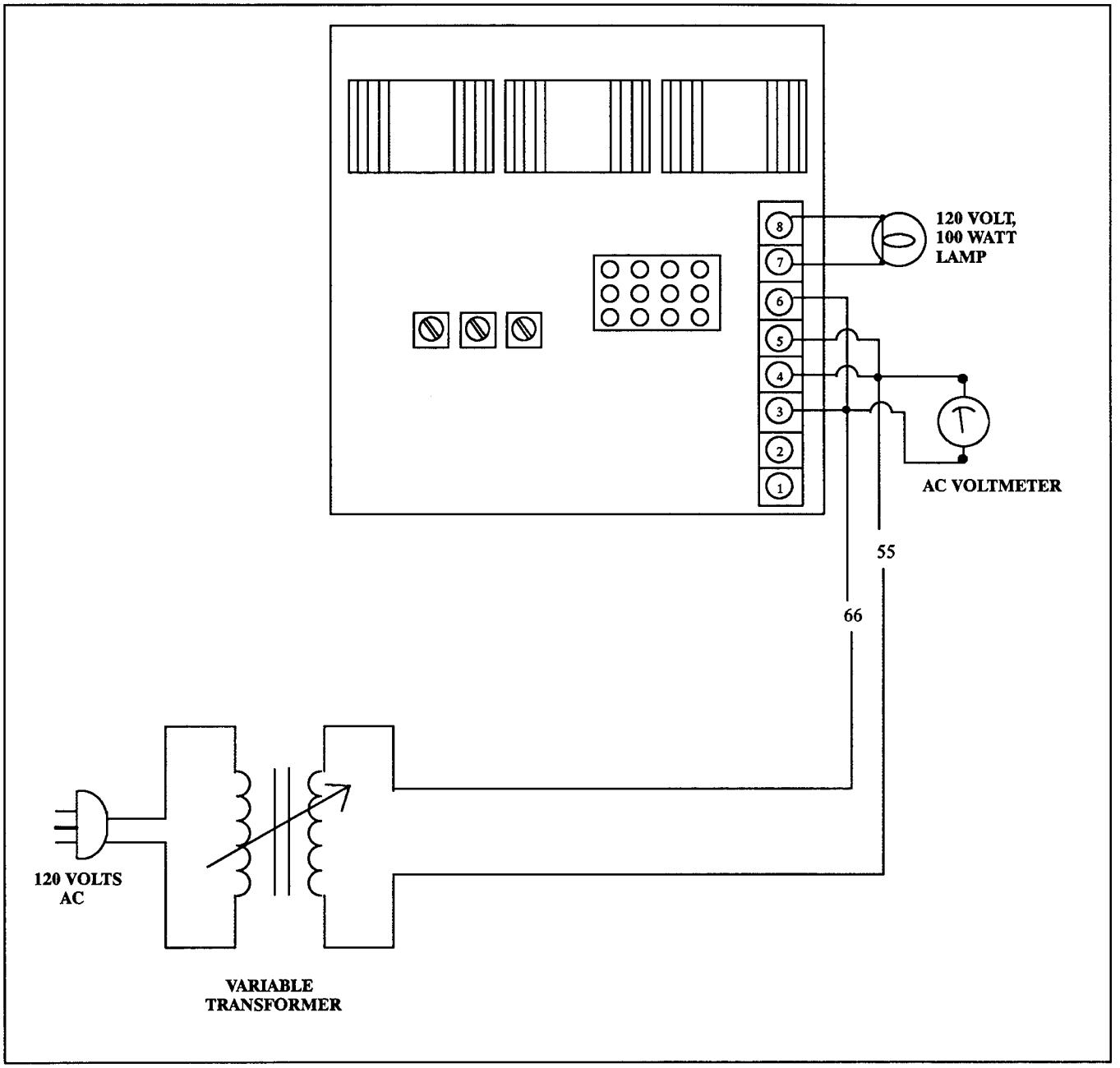


Figure 8–11. PowerBoost V Voltage Regulator Test

Voltage Regulator Adjustment

The PowerBoost V voltage regulator monitors generator output to control current flow to the generator field. However, unlike early PowerBoost regulators, PowerBoost V maintains generator output under load until the generator engine speed drops to a pre-set level (factory setting 57.5 Hz on 60 Hz models and 47.5 hz on 50 Hz models). At this point (under factory settings) the regulator allows generator voltage and current to drop to a level sufficient to handle load. When the generator speed returns to normal (60 Hz or 50 Hz) as load is accepted, generator output also returns to normal. The voltage regulator is factory set for proper generator operation under a variety of load conditions. Under normal circumstances, no further adjustment is necessary. However, if the regulator is replaced or has been tampered with, readjust according to the following procedure. Voltage regulator components are identified in Figures 8–12 and 8–13 and described in the following paragraphs.

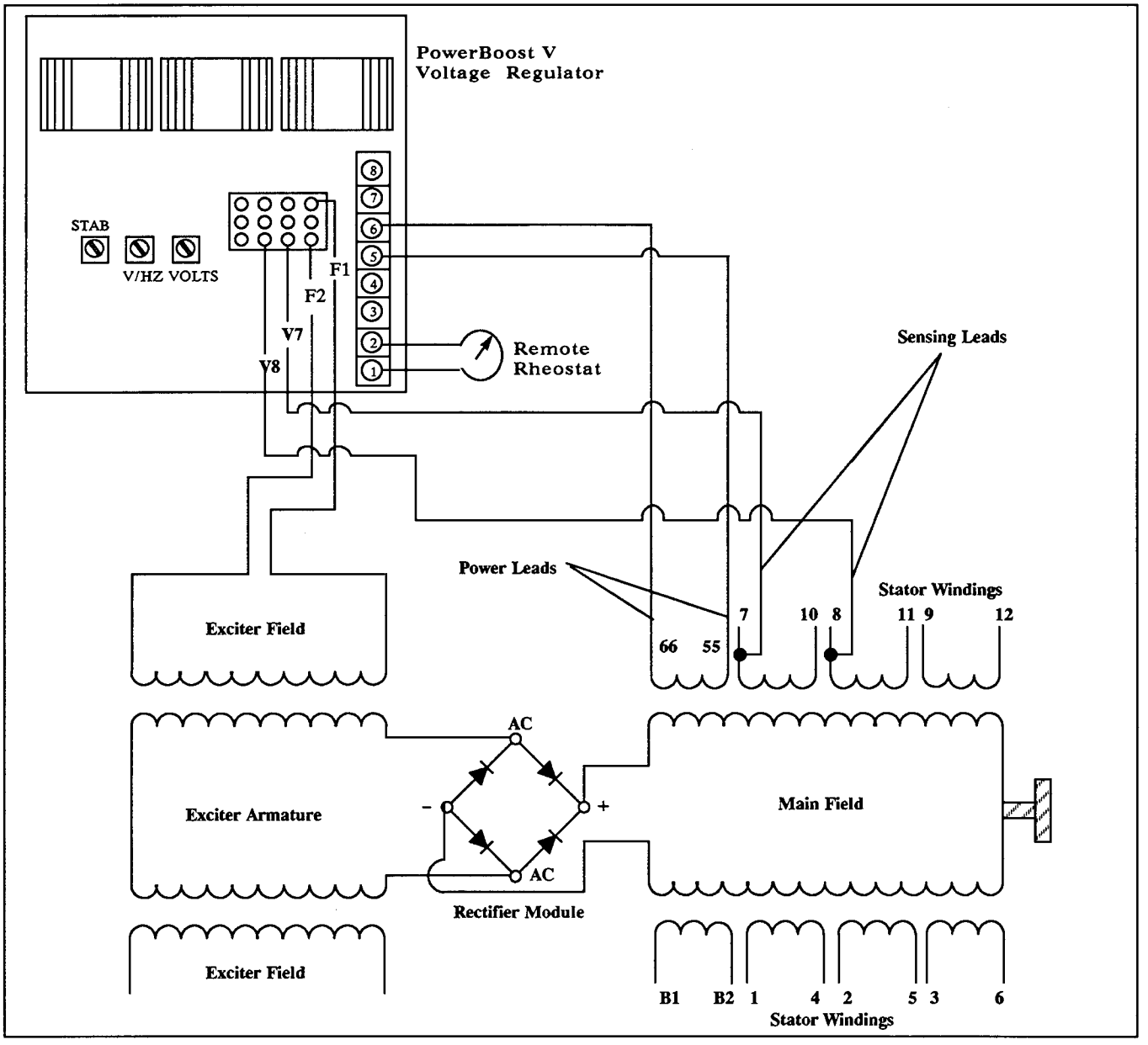


Figure 8–12. PowerBoost V Voltage Regulator

Voltage Adjustment Pot. – Adjusts generator output within range of 190–270 Volts (line–to–line).

NOTE

A customer–provided rheostat may be connected across regulator terminals 1 and 2 to adjust generator output voltage from a location remote from the set. The rheostat (10k ohms, 1/2 watt minimum) will provide a 5 Volt adjustment range.

Stabilizer Pot. – "Fine–tunes" regulator circuitry to reduce light flicker.

Volts/Hz Pot. – Adjustment determines engine speed (Hz) at which generator output voltage will begin to drop.

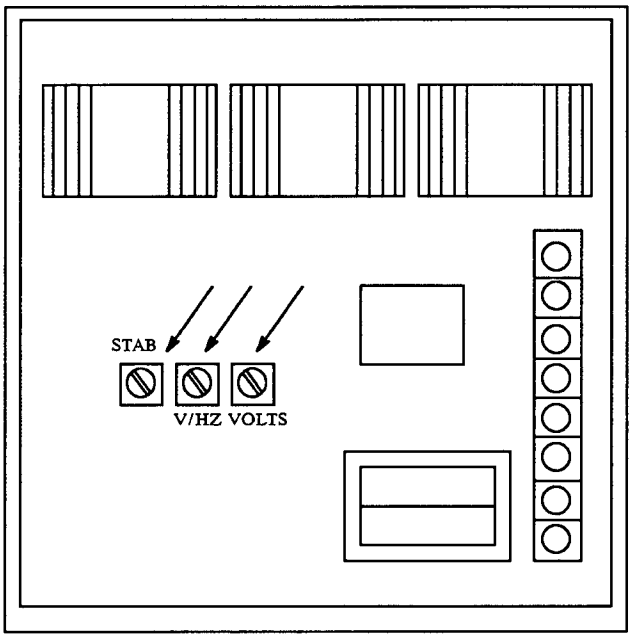


Figure 8–13. PowerBoost V Adjustments

⚠ WARNING

Hazardous voltage can cause death or serious injury. The heat sink of the voltage regulator contains high voltage. Do not touch voltage regulator heat sink when testing or electrical shock will occur.

⚠ CAUTION

Short circuits can cause bodily injury and/or equipment damage. Do not contact electrical connections with tools or jewelry while adjustments are made. Remove wristwatch, rings, and jewelry that can cause short circuits.

PB V Voltage Regulator Adjustment Procedure

1. With generator set off, turn remote rheostat (if equipped) and stability pots.to mid–point. Turn voltage and Volts/Hz pots. fully counterclockwise. Connect voltmeter to AC circuit or an electrical outlet.
2. Start generator set. Rotate voltage adjustment pot clockwise (increase voltage) or counterclockwise (decrease voltage) until desired output voltage is achieved.
3. Rotate stability pot. clockwise until minimum light flicker is obtained.
4. Readjust voltage adjustment pot. (if necessary).

5. Adjust engine speed to desired cut–in frequency by installing a jumper on the electronic governor circuit board "–2.5Hz/ Freq" terminals. See "Electronic Governor" later in this section. When a jumper is placed across these terminals, generator frequency will drop by 2.5 Hz. The recommended cut–in frequency is 57.5 Hz for 60 Hz operation and 47.5 Hz for 50 Hz operation (as measured on frequency meter).
6. Rotate **Volts/Hz adjustment pot.** clockwise until voltage level begins to drop (as measured on voltmeter). When set to these specifications, the generator will attempt to maintain normal output until engine speed drops below the frequency set in step 5 (as load is applied).
7. Remove jumper from governor circuit board "–2.5/Freq." terminals.
8. Readjust **stability pot.** (if necessary).
9. Readjust **voltage adjustment pot.** (if necessary).
10. Use remote rheostat (if equipped) to make final voltage adjustments. STOP GENERATOR SET.

Exciter Field

The exciter field is magnetized by DC from the battery. When the exciter armature is rotated within the magnetized exciter field windings, an electrical current develops within the exciter armature. Test the exciter field according to the following procedure.

1. Disconnect generator starting battery (negative lead first) and power to battery charger (if equipped). Disconnect exciter leads F1 and F2 at TB2 terminal strip.
2. Check exciter field resistance by connecting an ohmmeter across exciter field F1 and F2. See Figure 8–14. The resistance reading for a cold exciter field should be approximately 5 ohms. A low reading indicates an internal short and a high reading indicates an open winding. Repair or replace exciter field if ohmmeter readings indicate exciter field is defective. If resistance test proves inconclusive, perform a megohmmeter test on exciter field as described in the next step.

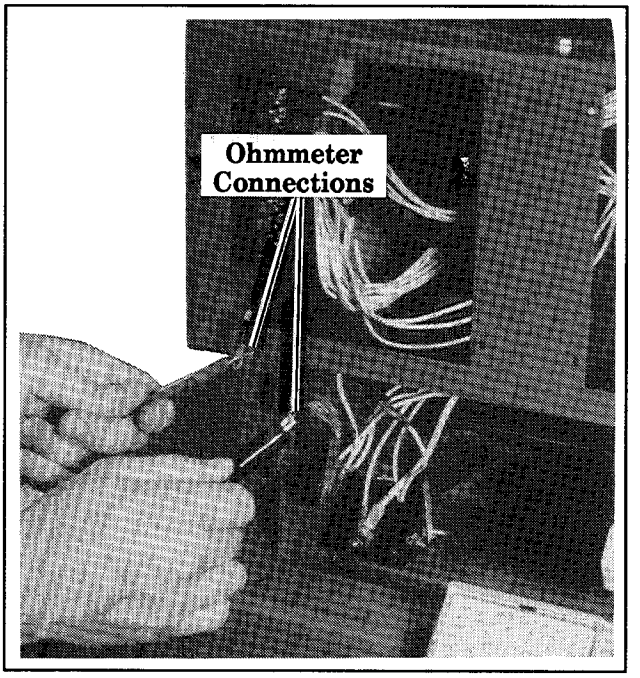


Figure 8–14. Checking Exciter Field Resistance

⚠ WARNING

Hazardous voltage can cause death or severe injury. Follow instructions of test equipment manufacturer when performing high voltage test. Improper test procedure can damage equipment or lead to future generator failures.

⚠ WARNING

Hazardous voltage can cause severe personal injury. When testing or servicing generator set and there is the presence of hazardous voltage, be alert and use care to prevent electrical shock.

3. Check exciter field for a grounded condition. Using a megohmmeter, apply 500 Volts DC to F1 or F2 lead and exciter field frame. See Figure 8–15. (Follow the instructions of the megohmmeter manufacturer when performing this test.) A reading of approximately 500K ohms (1/2 megohm) and higher indicates the field winding is good. A reading of less than 500K ohms (approximately) indicates deterioration of winding insulation and possible current flow to ground. Repair or replacement of the exciter field is necessary.

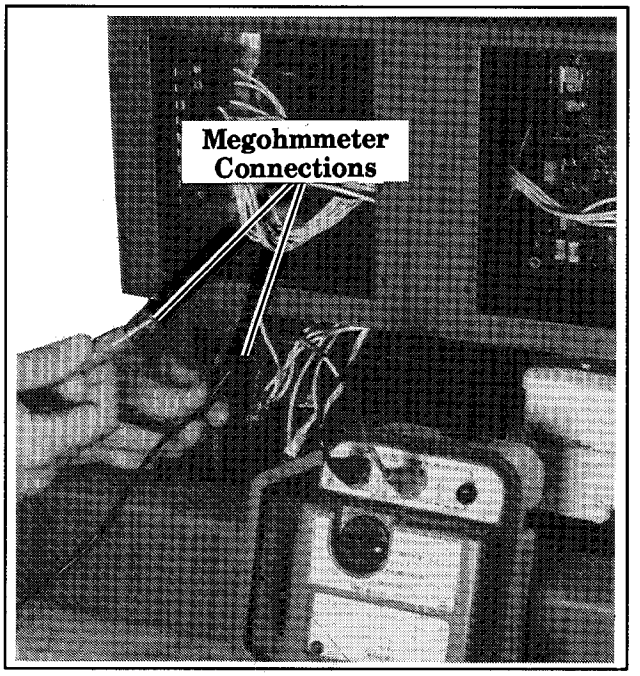


Figure 8–15. Megohmmeter Connections on Exciter Field

Exciter Armature

The exciter armature supplies excitation current to the generator main field (through the rectifier module). Test the exciter armature as described in the following steps. (The generator must be disassembled prior to performing this test.)

1. With generator disassembled, disconnect armature leads from rectifier module AC terminals.

2. With an ohmmeter on the R x 1000 scale, check resistance across exciter armature leads. See Figure 8–16. The armature resistance should be approximately 0.71 ohms (continu-

ity). No continuity indicates an open armature winding. If the resistance test proves inconclusive, perform a megohmmeter test on the exciter armature as described in the next step.

NOTE

Most ohmmeters will not provide accurate readings when measuring less than one ohm. The exciter armature can be considered good if a low resistance reading is obtained (continuity) and there is no evidence of shorted windings (heat discoloration).

Figure 8–16. Exciter Armature Ohmmeter Test

⚠ WARNING

Hazardous voltage can cause death or severe injury. Follow instructions of test equipment manufacturer when performing high voltage test. Improper test procedure can damage equipment or lead to future generator failures.

⚠ WARNING

Hazardous voltage can cause severe personal injury. When testing or servicing generator set and there is the presence of hazardous voltage, be alert and use care to prevent electrical shock.

3. Check exciter armature for a grounded condition. Using a megohmmeter, apply 500 Volts DC to either armature lead and armature frame. (Follow the instructions of the megohmmeter manufacturer when performing this test.) See Figure 8–17. A reading of approximately 500K ohms (1/2 megohm) and higher indicates the exciter armature is good. A reading of less than 500K ohms (approximately) indicates deterioration of winding insulation and possible current flow to ground. Repair or replacement of the exciter armature is necessary.

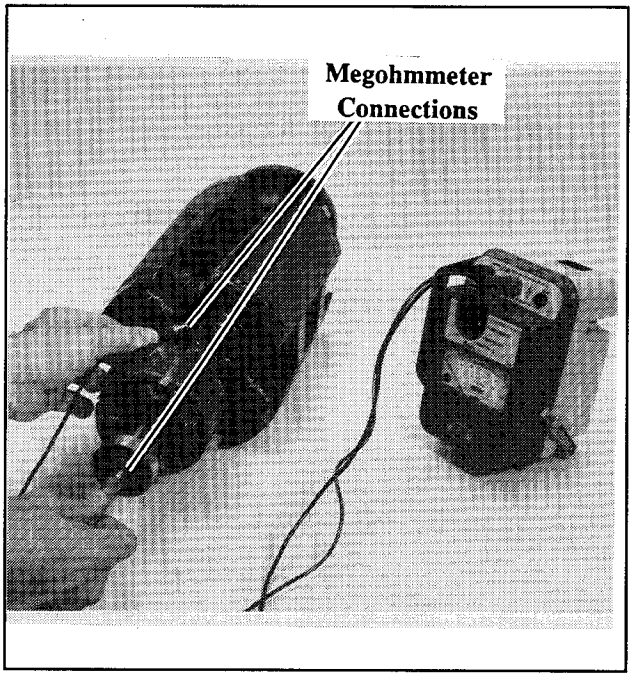


Figure 8–17. Megohmmeter Connections on Exciter Armature

Rectifier Module

The rectifier module (located between exciter armature and main field) converts the AC from the exciter armature to DC which magnetizes the generator main field. Test the rectifier module as described in the following steps.

1. Disconnect exciter armature and main field leads from rectifier module.

2. Using an ohmmeter on the R x 100 scale, check resistance between rectifier diodes (as shown in Figure 8–18. To test CR3, for example, place ohmmeter leads on rectifier terminals B3 and B4. The ohmmeter should show a low resistance in one direction and, upon reversing ohmmeter leads, a high resistance in the other direction. Replace the rectifier module if any of the diodes tests different than described.

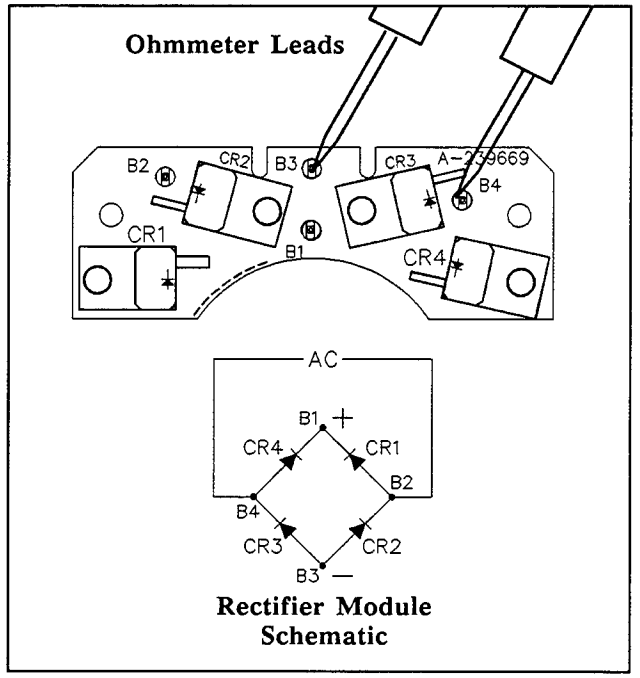


Figure 8–18. Testing Rectifier Module

Generator Main Field

The generator main field (magnetized by DC from the rectifier module) rotating within the stator windings induces AC in the stator windings. Test generator main field as described in the following steps. (The generator must be disassembled prior to performing this test.).

1. With the generator disassembled, disconnect generator main field windings from rectifier module B2 and B4 terminals (F+ and F–).

2. Check main field resistance by connecting an ohmmeter across main field F+ and F– leads. See Figure 8–19. The resistance reading for a cold main field should be 2.5–4.5 ohms (approximately). A low reading indicates an internal short and a high reading indicates an open winding. Repair or replace main field if ohmmeter readings indicate main field is defective. If the resistance test proves inconclusive, perform a megohmmeter test on the main field as described in the next step.

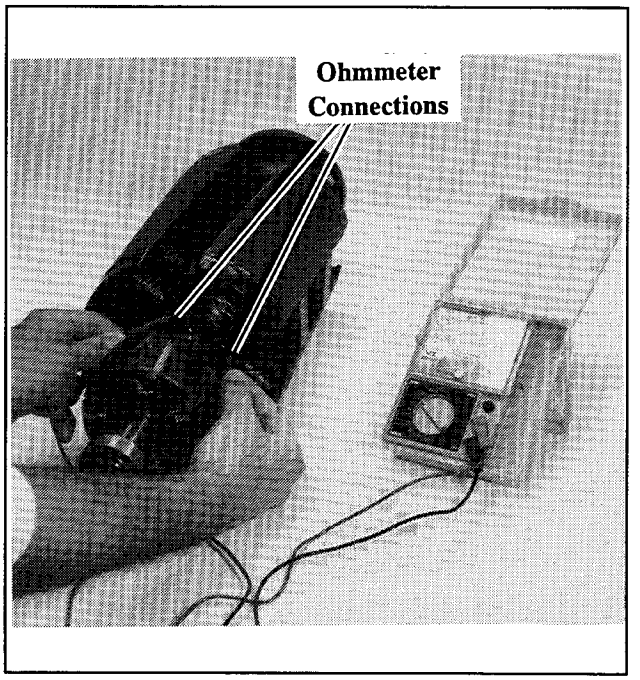


Figure 8–19. Ohmmeter Connections on Main Field

⚠ WARNING

Hazardous voltage can cause death or severe injury. Follow instructions of test equipment manufacturer when performing high voltage test. Improper test procedure can damage equipment or lead to future generator failures.

⚠ WARNING

Hazardous voltage can cause severe personal injury. When testing or servicing generator set and there is the presence of hazardous voltage, be alert and use care to prevent electrical shock.

3. Check main field for a grounded condition. Using a megohmmeter, apply 500 Volts DC to either field lead and main field frame. (Follow the instructions of the megohmmeter manufacturer when performing this test.) See Figure 8–20. A reading of approximately 500K ohms (1/2 megohm) and higher indicates the main field is good. A reading of less than 500K ohms (approximately) indicates deterioration of winding insulation and possible current flow to ground. Repair or replacement of the main field is necessary.

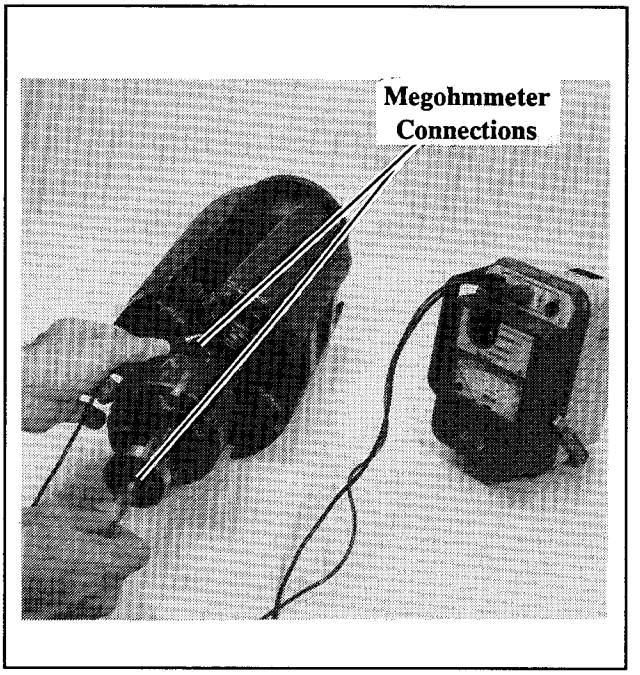


Figure 8–20. Megohmmeter Connections on Main Field

Stator

The stator produces electrical output (AC) as the magnetized main field rotates within the stator windings. Test the condition of the stator according to the following procedure.

1. Disconnect generator starting battery (negative lead first) and power to battery charger (if equipped).
2. Check the generator output leads for proper connections (see wiring diagrams in Section 12).
3. Check condition of V0, V7, V8, and V9 at stator, TB2 terminal strip, and at voltage regulator.
4. Use an ohmmeter to check continuity of V7, V8, and V9 leads between stator and voltage regulator. No continuity (low resistance) indicates an open lead. Repair any open leads.
5. Inspect stator for evidence of shorted windings (heat discoloration). If the stator shows signs of heat discoloration, test stator windings as described in the following steps before replacing stator.
6. Disconnect all stator windings to isolate windings. Using an ohmmeter, check resistance of each pair of leads. High resistance across "A" or low resistance (continuity) across "B" or "C" indicates a faulty stator. Repair or replacement of the stator is necessary. See Figures 8–21 and 8–22. If the resistance test proves inconclusive, perform a megohmmeter test on stator as described in the next step.

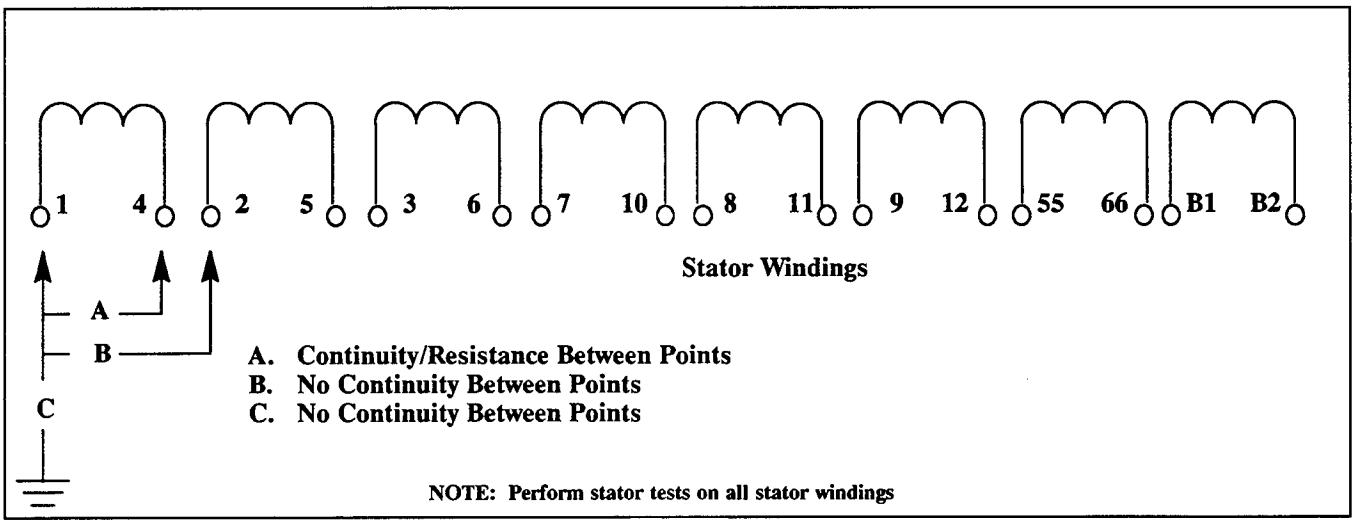


Figure 8–21. Stator Winding Test

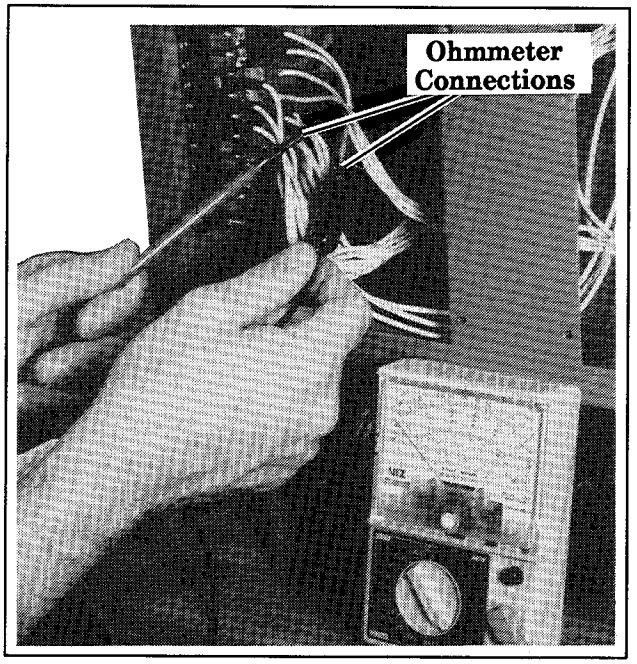


Figure 8–22. Stator Ohmmeter Connections

⚠ WARNING

Hazardous voltage can cause death or severe injury. Follow instructions of test equipment manufacturer when performing high voltage test. Improper test procedure can damage equipment or lead to future generator failures.

⚠ WARNING

Hazardous voltage can cause severe personal injury. When testing or servicing generator set and there is the presence of hazardous voltage, be alert and use care to prevent electrical shock.

7. Check stator for a grounded condition. Using a megohmmeter, apply 500 Volts DC to any stator lead from each winding and stator frame. See Figure 8–23. (Follow the instructions of the megohmmeter manufacturer when performing this test.) Repeat test on other leads until all stator windings have been tested. A reading of approximately 500K ohms (1/2 megohm) and higher indicates the stator is good. A reading of less than 500K ohms (approximately) indicates deterioration of winding insulation and possible current flow to ground. Repair or replacement of the stator is necessary.

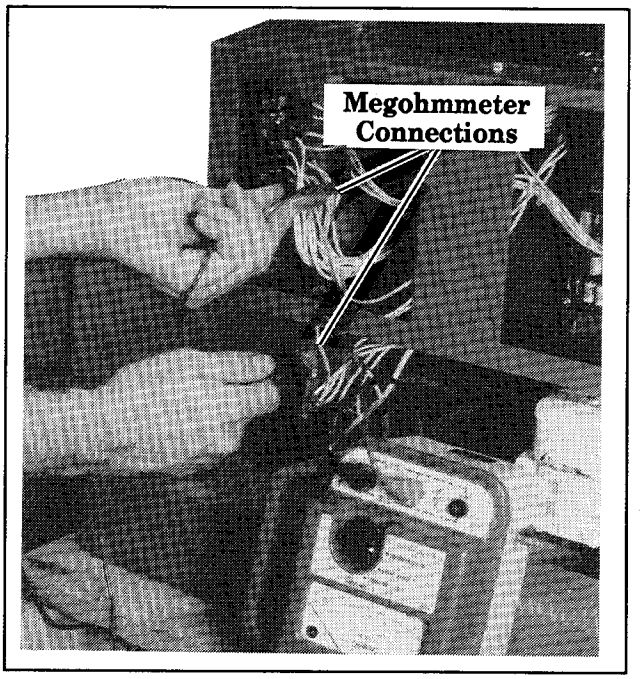


Figure 8–23. Megohmmeter Connections on Stator

Notes

All Generators

Controller Circuit Board

Use this section as a starting point for controller fault identification. Refer to the appropriate schematic (Figure 8–24 or 8–25) for the generator set. The LED's on the controller circuit board are intended to assist you in the troubleshooting process. An illuminated LED indicates the respective relay is receiving power; the LED does not indicate whether that relay is energized.

Sequence of Operation – All Generators

Starting

- Close the start/stop switch between N and 47 (local or remote).
- K2 relay is energized (LED 2 lights). Normally–open K2 contacts close to energize K3 relay (LED 3 lights), engine components (fuel pump/valve, choke, ignition, etc.) and field–flashing (rotor/exciter) circuit.
- Normally–open K3 contacts close to energize K5 relay. K5 relay normally–open contacts close to energize starter.

Running

- When proper output is obtained from generator B1/B2 winding, K1 relay is energized (LED 1 lights). **NOTE:** voltage to the K1 relay is regulated at 12 Volts DC by the VR1.
- Normally–open K1 contacts close to maintain voltage to K2 relay, energize generator "on" lamp and to provide circuit for fault shutdowns. Normally–open K2 contacts remain closed to maintain voltage to engine components. Normally–closed K1 contacts open to disconnect field flashing circuit.
- When the unit is running, start switch contacts N and 47 are opened by releasing Start/Stop switch.
- Normally–closed K1 contacts (in series with K3 relay) open to deenergize K3 relay (LED 3 goes out). K3 contacts open to deenergize K5 relay (starter solenoid) and prevent accidental reenergizing of starter motor. (K5 relay contacts open to deenergize starter motor.) TDR relay energizes after 5 seconds of running time and normally–open TDR contacts close to provide fault shutdown circuit.

Stopping

- Close stop switch between N and 43 (local or remote). K4 relay is energized (LED 4 lights) and normally–closed K4 contacts open to deenergize engine components. Unit stops..

Low Oil Pressure (LOP) Shutdown

- When engine lube oil pressure falls below a safe level, LOP switch closes and K4 relay is energized (LED 4 lights). Normally–closed K4 contacts open to deenergize engine components. Unit shuts down. **NOTE:** TDR relay prevents LOP shutdown during first 5 seconds after start–up.

High Engine Temperature (HET) Shutdown

- Ten to twenty seconds after the engine operating temperature reaches 218°F (103°C), HET normally–open contacts close. K4 relay is energized (LED 4 lights). Normally–closed K4 contacts open to deenergize engine components . Unit shuts down. **NOTE:** TDR relay prevents HET shutdown during first 5 seconds after start–up.

Overspeed Shutdown

When engine speed exceeds 70 Hz (2100 rpm) on 50/60 Hz sets, SDR relay normally–open contacts close to energize K4 relay (LED 4 lights). K4 normally–closed contacts open to deenergize engine components. Unit shuts down.

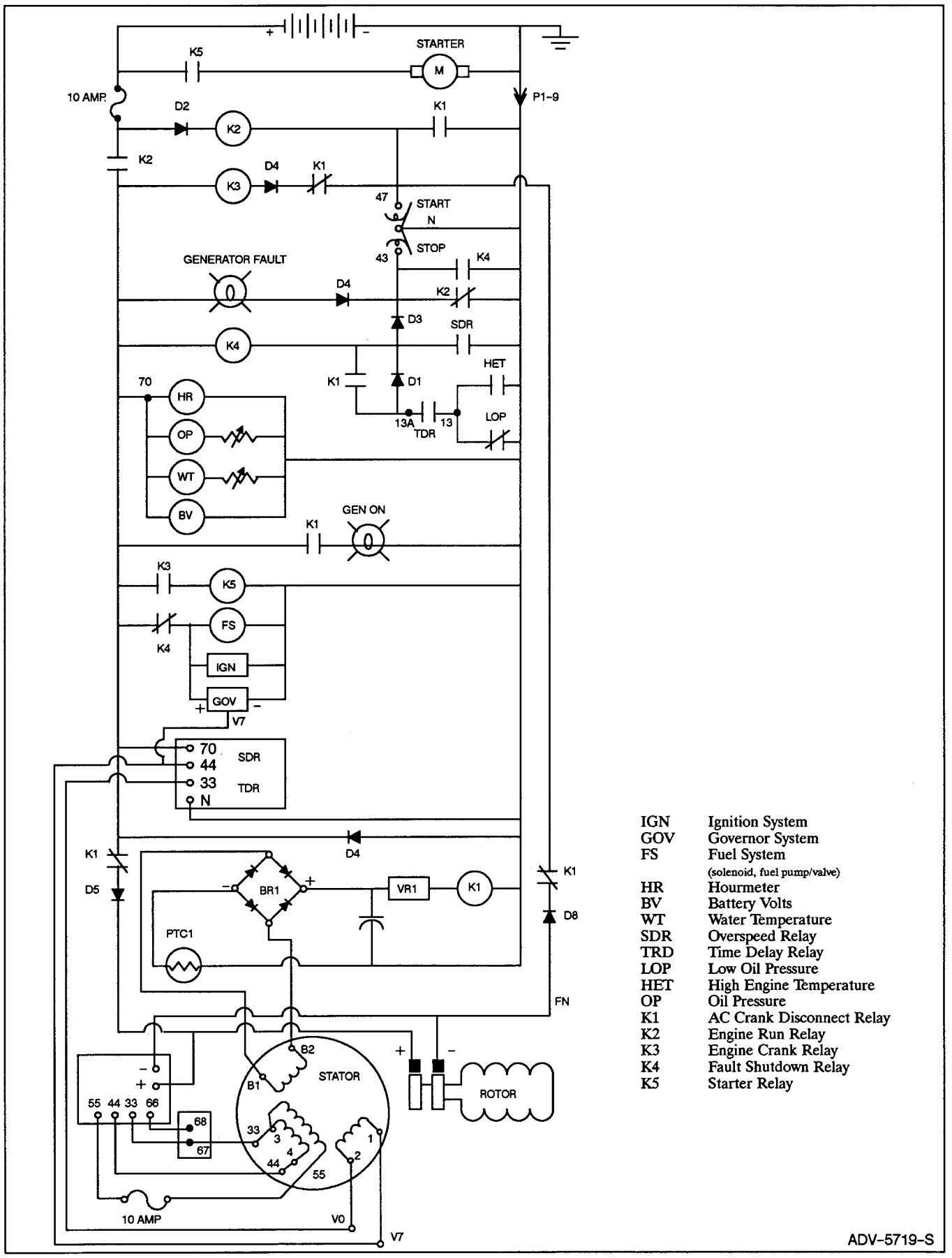
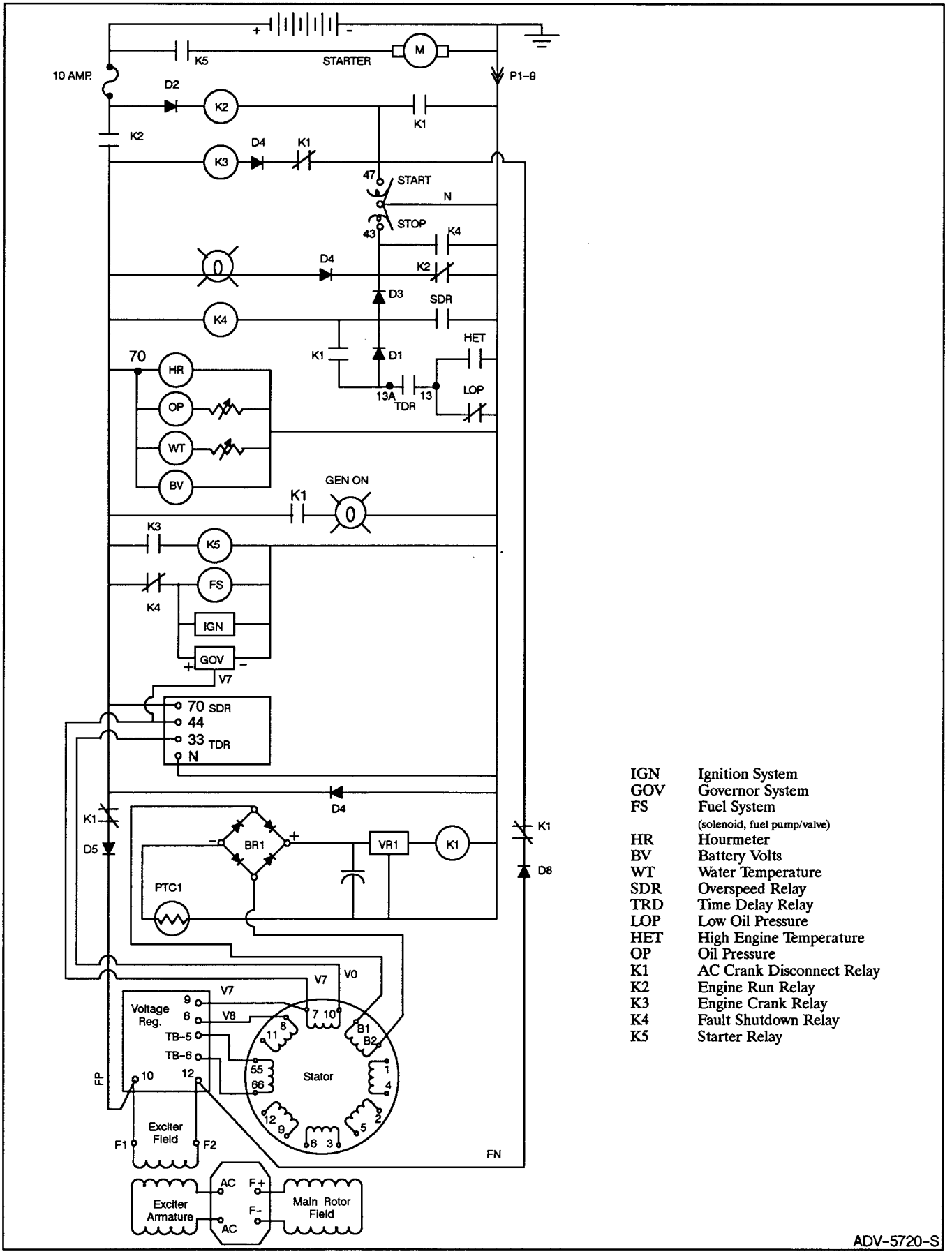


Figure 8–24. 10CC & 12CC Mobile Generator Schematic (Single–Phase, 4–Lead Generator)

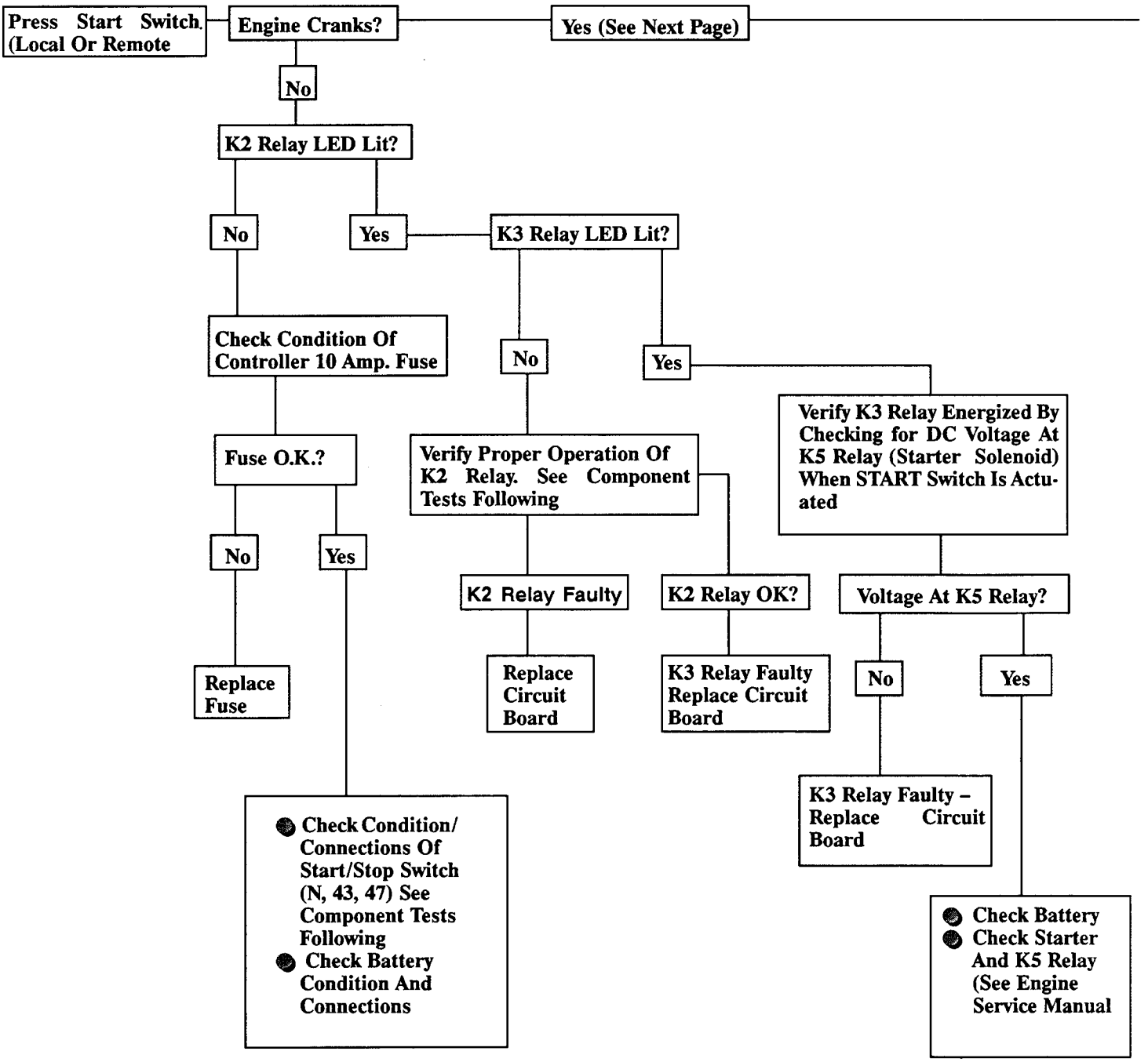


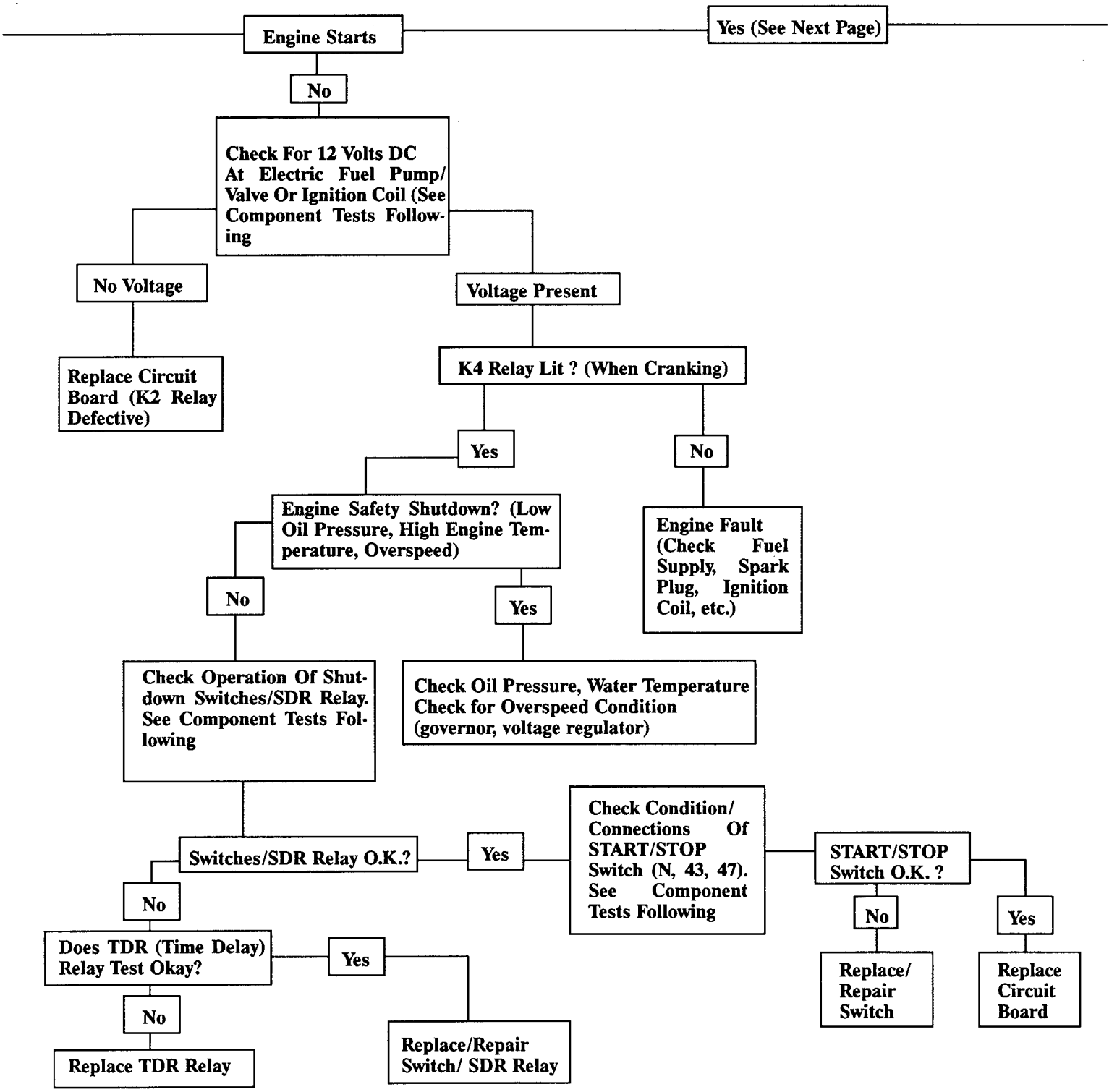
IGN	Ignition System
GOV	Governor System
FS	Fuel System (solenoid, fuel pump/valve)
HR	Hourmeter
BV	Battery Volts
WT	Water Temperature
SDR	Overspeed Relay
TRD	Time Delay Relay
LOP	Low Oil Pressure
HET	High Engine Temperature
OP	Oil Pressure
K1	AC Crank Disconnect Relay
K2	Engine Run Relay
K3	Engine Crank Relay
K4	Fault Shutdown Relay
K5	Starter Relay

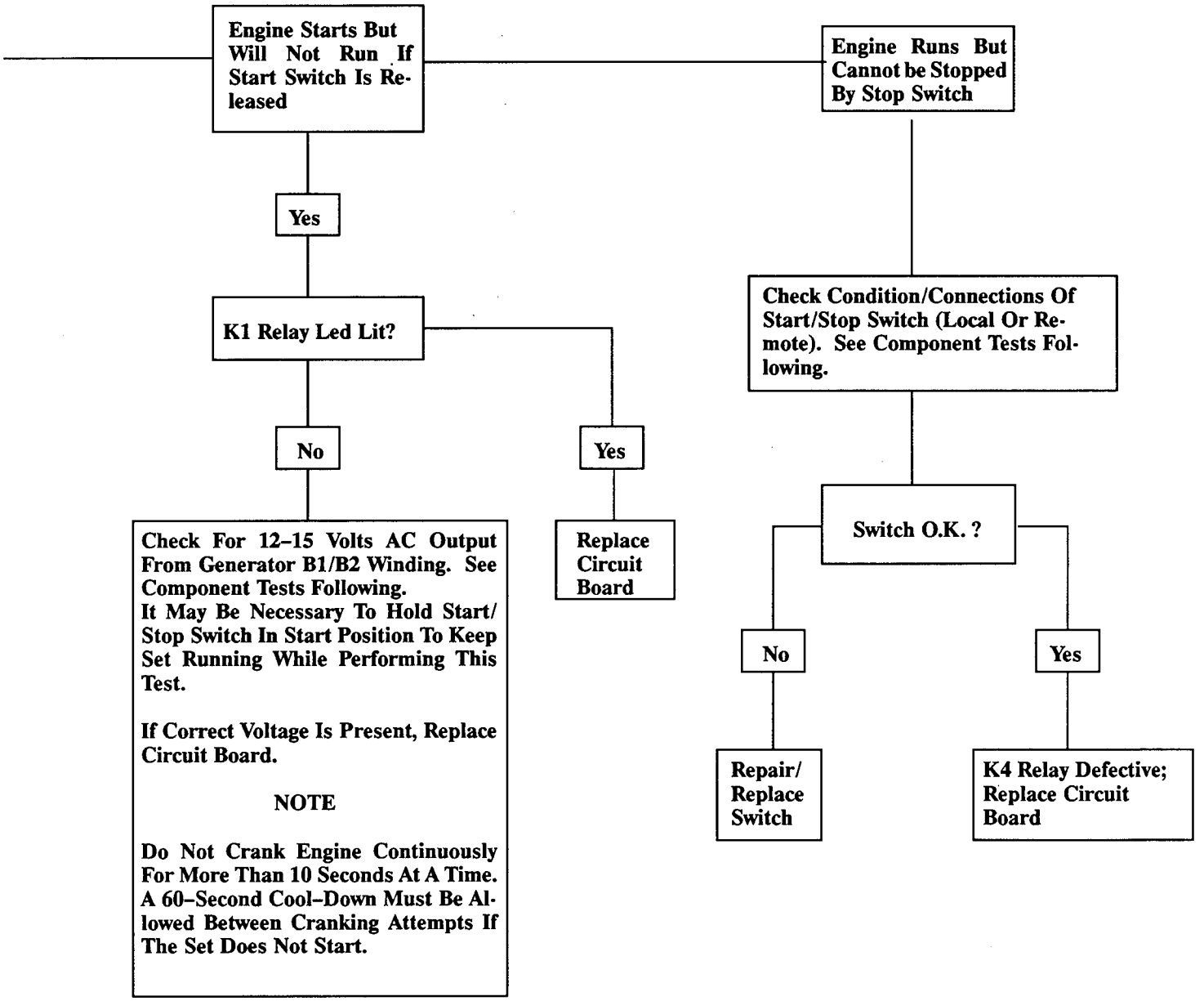
Figure 8–25. 10CZ & 12CZ Mobile Generator Schematic (Three–Phase, 12–Lead Generator)

Controller Circuit Board – cont'd.

Use the following flow chart as an aid in troubleshooting the circuit board and generator set. If the prescribed remedy does not correct the problem, the circuit board may have to be replaced. The controller circuit board is equipped with LED's (light emitting diodes) to indicate relay coil power and aid in circuit board and generator fault detection. When the K1, K2, K3 , or K4 relays are receiving power, the corresponding LED will light. The LED does not indicate whether the relay coil is energized. This conclusion can only be reached through analysis of generator faults and by performing a continuity test on the relay coil (covered later in this section).




Engine Starts
Yes (See Next Page)
No
Check For 12 Volts DC At Electric Fuel Pump/ Valve Or Ignition Coil (See Component Tests Following
No Voltage
Voltage Present
Replace Circuit Board (K2 Relay Defective)
K4 Relay Lit ? (When Cranking)
Yes
No
Engine Safety Shutdown? (Low Oil Pressure, High Engine Temperature, Overspeed)
Engine Fault (Check Fuel Supply, Spark Plug, Ignition Coil, etc.)
No
Yes
Check Operation Of Shutdown Switches/SDR Relay. See Component Tests Following
Check Oil Pressure, Water Temperature Check for Overspeed Condition (governor, voltage regulator)
Switches/SDR Relay O.K.?
Yes
Check Condition/ Connections Of START/STOP Switch (N, 43, 47). See Component Tests Following
START/STOP Switch O.K. ?
No
Yes
Does TDR (Time Delay) Relay Test Okay?
Yes
No
No
Replace/ Repair Switch
Replace Circuit Board
Replace TDR Relay
Replace/Repair Switch/ SDR Relay


Engine Starts But Will Not Run If Start Switch Is Released
Yes
K1 Relay Led Lit?
No
Yes
Check For 12–15 Volts AC Output From Generator B1/B2 Winding. See Component Tests Following.
It May Be Necessary To Hold Start/ Stop Switch In Start Position To Keep Set Running While Performing This Test.
If Correct Voltage Is Present, Replace Circuit Board.
NOTE
Do Not Crank Engine Continuously For More Than 10 Seconds At A Time. A 60–Second Cool–Down Must Be Allowed Between Cranking Attempts If The Set Does Not Start.
Replace Circuit Board
Engine Runs But Cannot be Stopped By Stop Switch
Check Condition/Connections Of Start/Stop Switch (Local Or Remote). See Component Tests Following.
Switch O.K. ?
No
Yes
Repair/ Replace Switch
K4 Relay Defective; Replace Circuit Board

Controller Circuit Board – cont'd.

It is possible to check some controller circuit board components without removing the component from the board. These checks should be made prior to installing a new board and attempting start–up. Most of the tests are referenced in Section 5, General Troubleshooting.

Use a high quality multimeter and follow the manufacturer's instructions. To obtain accurate readings when testing, remove all circuit board connectors and conformal coating (transparent insulation) from component leads. Use the following chart and see the controller circuit board schematic (Figure 8–26).

Component	Ohmmeter Connection	Remarks	Results
K1 Relay Coil	K1 Coil Terminals (See relay schematic)	Ohmmeter on R x 10 scale	If good, approx. 200 ohms. Low resistance (continuity) – shorted coil. High resistance – open coil
K2 Relay Coil	K2 coil contacts (See relay schematic)	Ohmmeter on R x 10 scale	If good, approx. 160 ohms. Low resistance (continuity) – shorted coil. High resistance – open coil
K3 Relay Coil	K3 coil contacts (See relay schematic)	Ohmmeter on R x 10 scale	If good, approx. 400 ohms. Low resistance (continuity) – shorted coil. High resistance – open coil
K4 Relay Coil	K4 coil contacts (See relay schematic)	Ohmmeter on R x 10 scale	If good, approx. 160 ohms. Low resistance (continuity) – shorted coil. High resistance – open coil

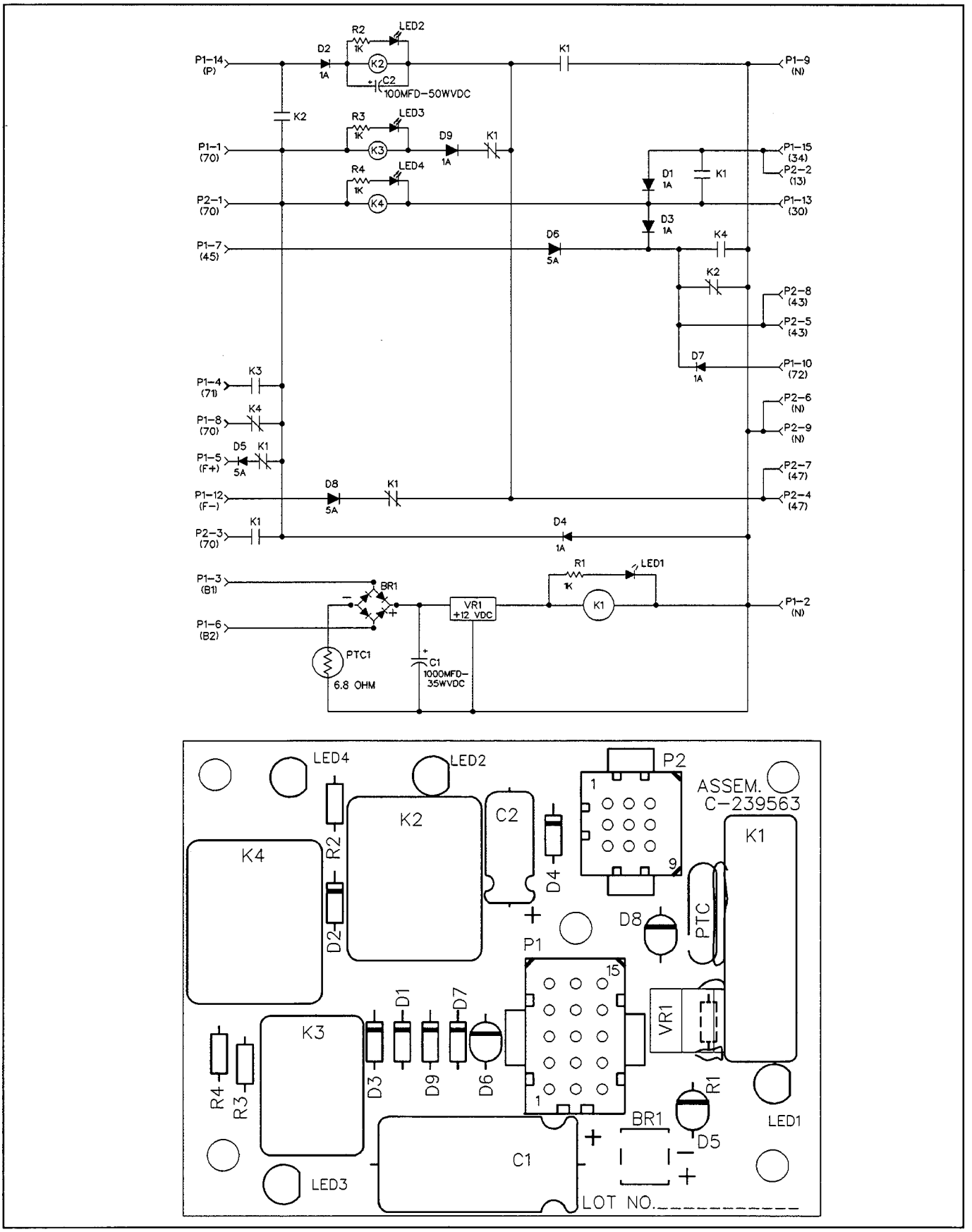


Figure 8–26. Controller Circuit Board Testing

Engine/Generator Components

With the generator set battery connected, the wiring harness and some engine/generator components can be checked. Place the controller or remote start/stop switch in the prescribed position and check for 12 Volts DC at each component using a DC voltmeter. This will verify that the switches function and 12 Volts DC is present at each component.

Component	Voltmeter Connections	Procedure
Hourmeter and wiring	Red test clip to (+) terminal. Black test clip to (–) terminal.	Start generator set. Voltmeter setting 12 Volts DC or greater. 12 Volt DC reading indicates wiring harness is okay. Hourmeter will function if good.
Generator "ON" lamp	Red test clip to (+) terminal. Black test clip to (–) terminal.	Start generator set. Voltmeter setting 12 Volts DC or greater. 12 Volt DC reading indicates wiring harness is okay. Lamp will function if good.
B1 and B2 stator aux. winding	B1 and B2 leads in controller	Add fully–insulated push–on terminals to B1/B2 leads in controller.Voltmeter setting 20 Volts AC or greater. Start generator set and allow to reach rated speed. Reading of 12–16 Volts AC indicates B1/B2 winding is good.
Choke heater, carburetor solenoid (gasoline), fuel pump, fuel valve (LP).	Red test clip to each component positive (+) terminal. Black test clip to engine block (ground).	Place controller or remote switch to START position. Voltmeter setting 12 Volts DC or greater. 12 Volt DC reading indicates wiring harness is okay.To determine if fuel pump, fuel valve (LP), or vaporizer solenoid (LP) is good, proceed to next step. Also see engine component ohmmeter checks following.
Fuel Pump (gasoline only)	None	Disconnect fuel pump battery positive (+) lead and apply 12 Volts DC. **WARNING**: See Safety Precautions before proceeding. If good – fuel pump will operate.

All Generators

Component	Voltmeter Connections	Procedure
Fuel Valve (LP gas only)	None	Disconnect fuel valve battery positive (+) lead and apply 12 Volts DC. **WARNING:** See Safety Precautions before proceeding. If good – fuel valve will actuate; fuel valve will make audible "click" sound.
Governor Actuator	None	Disconnect actuator harness and apply 12 Volts DC to actuator. If good, actuator will thrust. Actuator should return to relaxed position when DC is removed.
Water Temperature Gauge (if equipped)	Red test lead to positive side (wire 70) of gauge. Black test lead to generator ground connection.	Start generator set to test voltage. Battery voltage (approx. 12 Volts DC) should be read. If no voltage, check controller circuit board and wiring. If voltage is present at gauge, stop set and check continuity of wiring between gauge and ground. (Resistance of sender will be read during continuity check. See " Water Temp. Sender" later in this section) If wiring tests okay, replace gauge.
Oil Pressure Gauge (if equipped)	Red test lead to positive side (wire 70) of gauge. Black test lead to generator ground connection.	Start generator set to test voltage. Battery voltage (approx. 12 Volts DC) should be read. If no voltage, check controller circuit board and wiring. If voltage is present at gauge, stop set and check continuity of wiring between gauge and ground. (Resistance of sender will be read during continuity check. See "Oil Pressure Sender" later in this section.) If wiring tests okay, replace gauge.
Voltmeter (if equipped)	Red test lead to positive side (wire 70) of gauge. Black test lead to generator ground connection.	Start generator set. Battery voltage (approx. 12 Volts DC) should be read. If no voltage, check controller circuit board and wiring. If voltage is present, stop set and check continuity of wiring between meter and ground. If wiring tests okay, replace meter.

To further check generator set components, disconnect the battery and remove wiring harness plugs from the controller circuit board. Use an ohmmeter to check continuity and to isolate defective components. Use the following chart and Figure 8–27 or 8–28.

NOTE

Before performing ohmmeter checks, disconnect generator set battery to prevent damage to the ohmmeter.

⚠ CAUTION

Short circuits can cause bodily injury and/or equipment damage. Do not contact electrical connections with tools or jewelry while adjustments are made. Remove wristwatch, rings, and jewelry that can cause short circuits.

Component	Ohmmeter Connections	Procedure	Results
Controller Switch	P2–4 (47) and P2–6 (N)	Ohmmeter on R x 1000 scale. Place start switch in START position	If good – zero ohms. Any resistance other than zero – replace switch.
	P2–5 (42) and P2–6 (N)	Ohmmeter on R x 1000 scale. Place start switch in STOP position	If good – zero ohms. Any resistance other than zero – replace switch.
Remote Switch	P2–7 (47) and P2–9 (N)	Ohmmeter on R x 1000 scale. Place start switch in START position	If good – zero ohms. Any resistance other than zero – replace switch.
	P2–8 (43) and P2–9 (N)	Ohmmeter on R x 1000 scale. Place start switch in STOP position	If good – zero ohms. Any resistance other than zero – replace switch.
Remote Switch Light (if equipped)	(+) and (–) terminals	Ohmmeter on R x 1 scale	If good – continuity No continuity – replace light.
Hourmeter	(+) and (–) terminals	Ohmmeter on R x 1 scale	If good – continuity No continuity – replace hourmeter.
P3 wiring harness to remote switch	P3–1 and P3–5	Ohmmeter on R x 1000 scale. Place rocker switch in START position	If good – zero ohms. Any other reading indicates P3 wiring or switch is defective. To check remote switch, disconnect leads and test separately.
	P3–1 and P3–6	Ohmmeter on R x 1000 scale. Place rocker switch in STOP position	

All Generators

Component	Ohmmeter Connections	Procedure	Results
Carburetor Shutdown solenoid (gasoline–fueled sets only)	(+) and (–) leads	Ohmmeter on R x 1 scale.	If good, 4–5 ohms. Disconnect solenoid leads when testing.
Choke heater	Choke terminals	Ohmmeter on R x 1000 scale.	If good – continuity.
P1 wiring harness	P1–9 and ground	Ohmmeter on R x 1 scale	If good – zero ohms. Any other reading indicates a poor ground connection.
	P1–3 and P1–6 (B1 and B2 stator leads)	Ohmmeter on R x 1 scale	If good – continuity (zero ohms).
Controller 10 Amp. fuse and wiring	P1–14 and battery positive (+) cable	Ohmmeter on R x 100 scale	If good – zero ohms. No continuity – open circuit and/or blown fuse.
Voltage regulator circuit 10 Amp. fuse (CC/4–lead models only)	P4–5 and stator lead 55 at fuse holder	Ohmmeter on R x 100 scale	If good, zero ohms. No continuity – blown fuse or open wiring.
K5 relay coil (starter solenoid and wiring)	P1–4 and P1–9 (ground)	Ohmmeter on R x 1 scale.	If good – 5–7 ohms. Low resistance – shorted K5 relay coil and/or wiring. High resistance – open K5 relay coil and/or wiring.

All Generators

Component	Ohmmeter Connections	Procedure	Results
Low Oil Pressure (LOP) and High Engine Temperature (HET) shutdown switch	Overspeed circuit board terminal 13 and engine block (ground)	Ohmmeter on R x 1000 scale.	With all switches connected, zero ohms (continuity). Disconnect LOP switch (normally–closed) and isolate LOP terminal. Meter should show high resistance (open circuit). (HET switch is normally open.)

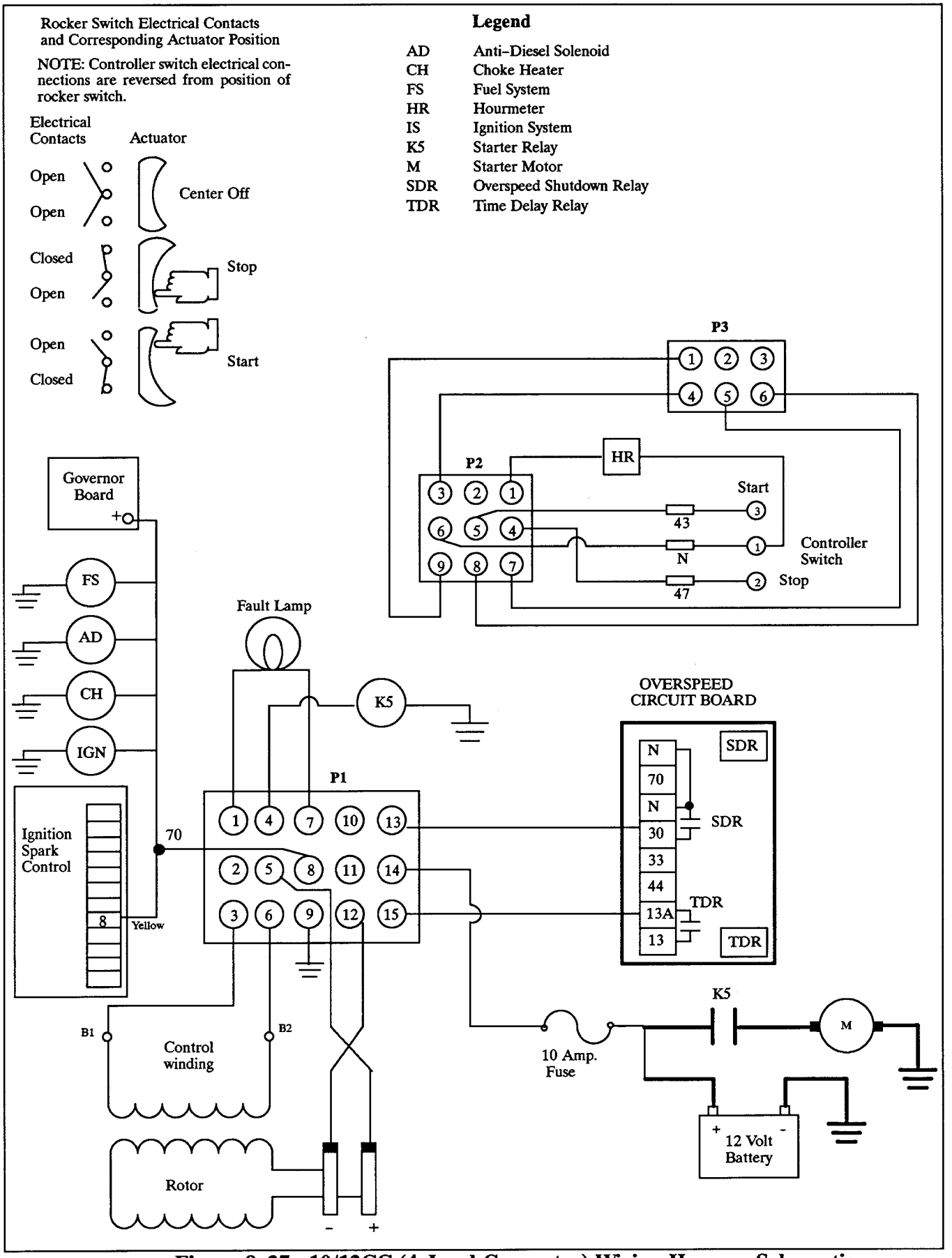


Figure 8–27. 10/12CC (4–Lead Generator) Wiring Harness Schematic

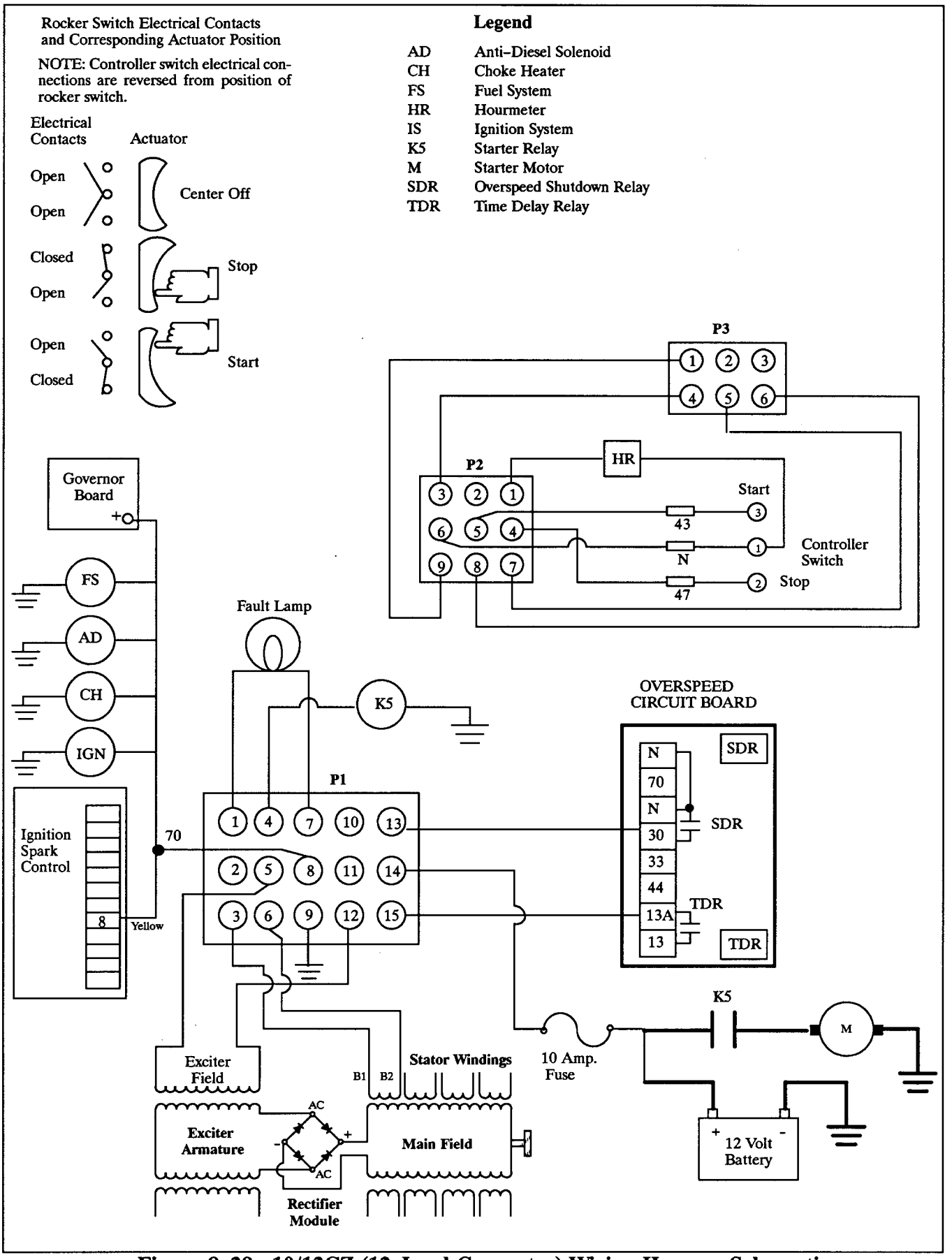


Figure 8–28. 10/12CZ (12–Lead Generator) Wiring Harness Schematic

Overspeed/Time Delay Circuit Board

The overspeed circuitry protects the generator set and equipment connected to it from over–frequency. Over–frequency could occur if the electronic governor was misadjusted or defective. Shutdown will occur immediately should frequency reach 68–70 Hz. or greater.

The time delay circuitry provides approx. 5 second delay before generator set is subject to fault shutdown from low oil pressure (LOP), or high engine temperature (HET).

NOTE

Overspeed is not subject to the five second shutdown delay.

This approx. five second delay is necessary during starting to allow engine to build–up oil pressure. This time delay is present at cranking only. Once the generator set comes up to proper AC voltage, the time delay circuitry times out. After approx. 5 seconds, engine fault shutdowns are operative.

Both relays and circuit board can be tested for proper function. See Figure 8–29 and use the following procedure. Tests are made with circuit board in place and connected to generator set. Generator should be running with no load connected.

Overspeed Circuitry and Relay

1. 12 Volts DC should be present across terminals 70 (positive DC) and N (negative DC). This is the supply voltage.
2. 120 Volts AC (60 Hz.) should be present across terminals 33 and 44. These are the sensing leads for frequency. Connect frequency meter to these terminals.
3. There should be no continuity between terminals 30 and N when frequency is at the normal 60–63 Hz.
4. Momentarily increase frequency by moving governor–to–carburetor linkage.
5. When frequency reaches 70 Hz. or greater terminals 30 and N should be a closed circuit.
6. If the above checks are okay, the overspeed circuitry and relay are functioning properly.

Time Delay Circuitry and Relay

1. 120 Volts AC should be present across terminals 33 and 44 after generator set comes up to speed.
2. Initially contacts 13 and 13A should be open.
3. After approx. 5 seconds, contacts 13 and 13A will close.
4. If the above checks are okay, the time delay circuitry and relay are functioning properly.

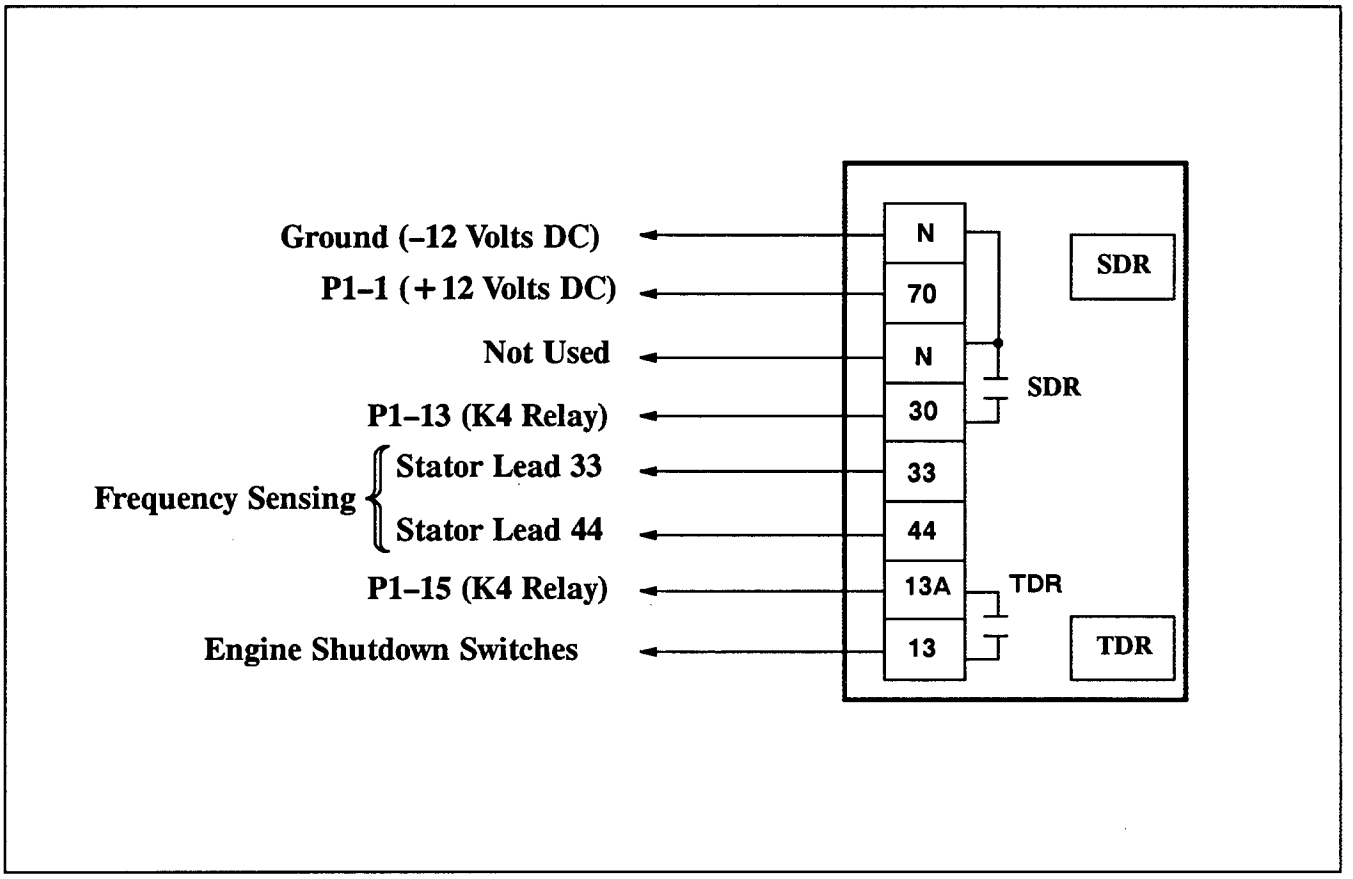


Figure 8–29. Overspeed/Time Delay Circuit Board

Water Temperature and Oil Pressure Senders (if Equipped)

Some generators may be equipped with water temperature and oil pressure senders to activate remote-mounted meters. To test the water temperature sender, connect one ohmmeter lead to the sender terminal and the other ohmmeter lead to ground. See Figure 8–30 for sender location and the chart below for sender resistance at different water temperatures. Start the generator set and check the sender resistance. As water temperature increases, a corresponding change in sender resistance should occur. Replace the sender if resistance readings vary greatly from those shown. Generally, a sender can be presumed good if the sender resistance value changes with temperature. A defective sender will either test open (no reading) or shorted (continuity).

Temperature	Resistance +/–10%
100°F (38°C)	450 ohms
160°F (71°C)	130 ohms
220°F (104°C)	47 ohms

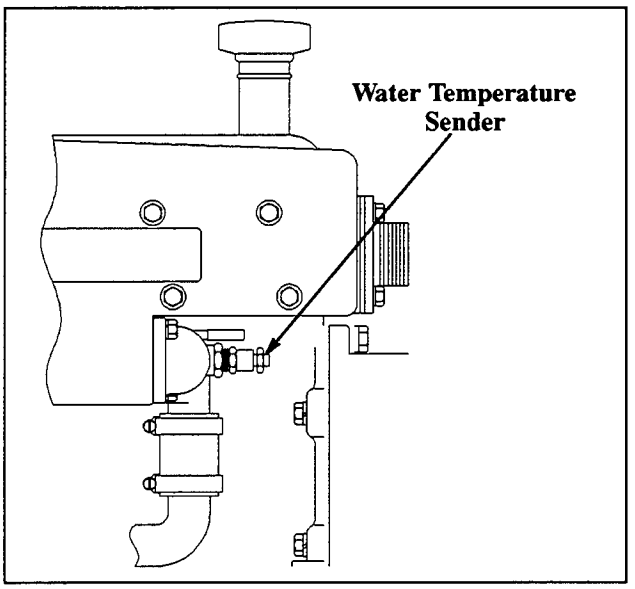


Figure 8–30. Water Temperature Sender

To test the oil pressure sender, connect one ohmmeter lead to the sender terminal and the other ohmmeter lead to ground. See Figure 8–31 for sender location and the chart below for resistance of the oil pressure sender at different pressure levels. Start the generator set and check the sender resistance. As oil pressure increases, a corresponding change in sender resistance should occur. Replace the sender if resistance readings vary greatly from those shown. Generally, a sender can be presumed good if the sender resistance value changes with pressure. A defective sender will either test open (no ohmmeter reading) or shorted (continuity).

Oil Pressure	Resistance
0 psi/kPa	227–257 ohms
25 psi (172 kPa)	138–162 ohms
50 psi (345 kPa)	92–114 ohms
75 psi (517 kPa)	50–80 ohms
100 psi (690 kPa)	21–50 ohms

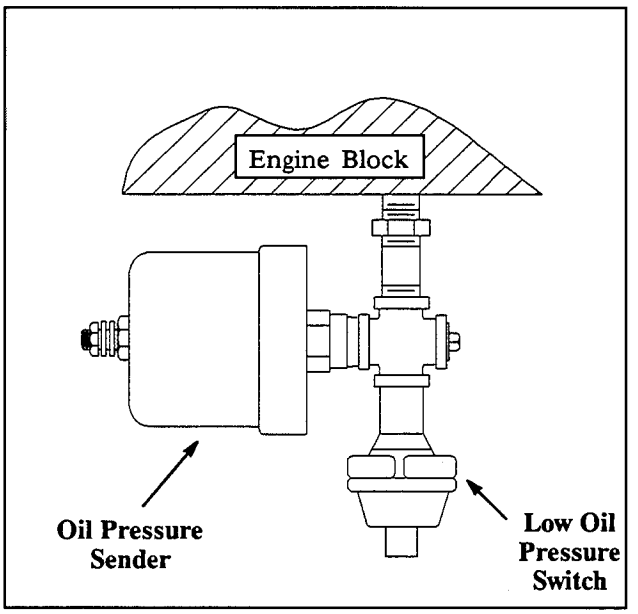


Figure 8–31. Oil Pressure Sender

Electronic Governor

The isochronous electronic governor monitors generator output to maintain engine speed at 1500 rpm (50 Hz) or 1800 rpm (60 hz). When generator output frequency increases or decreases, a sensor on the stator winding sends a signal to the governor control circuit board. The circuit board interprets the signal from the sensor to control current input to the throttle actuator. The throttle actuator adjusts the engine throttle position to maintain engine speed. Under normal circumstances, the governor will not require maintenance or adjustment. However, if any component of the governor is removed or tampered with, readjust the governor according to the following procedure.

NOTE

The "–2.5 Hz/Freq." terminals on the governor circuit board are used to change engine speed during voltage regulator adjustment. Do not tamper with these terminals during governor adjustment.

1. Verify that swivel on actuator arm is fully–threaded on actuator shaft and secured with lock nut. Adjust throttle rod assembly as shown in Figure 8–32. When properly adjusted, the throttle rod assembly should measure approximately 3–7/8 in. (98 mm) between centers of ball joints. See Figure 8–33. When throttle rod is set to proper length, tighten ball joint lock nuts to maintain rod length. When properly adjusted, the throttle linkage operates smoothly with no binding. The carburetor throttle should be fully–closed with the actuator in the relaxed position (power off).

⚠ WARNING

Hazardous voltage can cause death or severe injury. Do not contact electrical connections with adjustment tool while the generator is running. Remove wristwatch, rings, and jewelry that can cause short circuits. Do not touch electrical equipment when standing in water, on wet ground, or when your hands are wet.

⚠ WARNING

Hazardous voltage can cause death or severe injury.

Perform electrical service only as prescribed in equipment manual. 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. Wiring should be inspected at the interval recommended in the service schedule –– replace leads that are frayed or in poor condition. The function of a generator set is to produce electricity and wherever electricity is present, there is the hazard of electrocution.

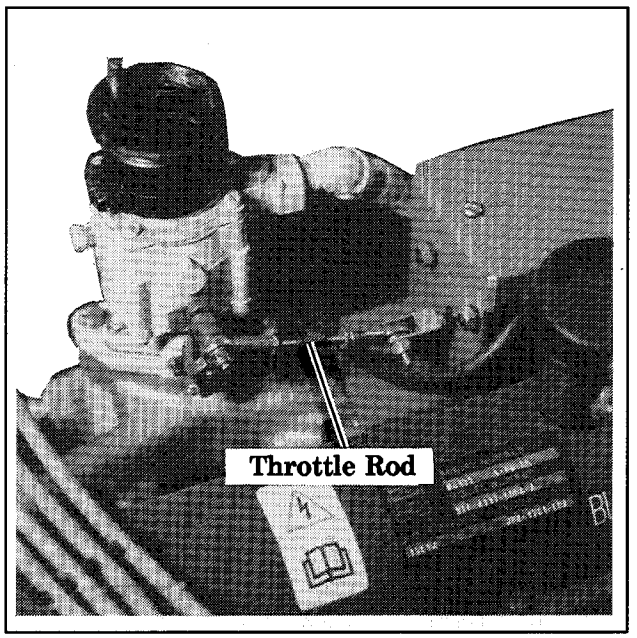


Figure 8–32. Governor Actuator/Throttle Rod

2. Select governor speed (50 Hz/1500 rpm or 60 hz/1800 rpm). Install a jumper across "50 Hz/60 Hz" terminals on governor circuit board for 50 Hz operation. For 60 Hz operation, **NO** jumper should connect the "50 Hz/60 Hz" terminals. See figure 8–34. If generator speed (frequency) is changed, the voltage regulator will also require adjustment. See voltage regulator adjustment information earlier in this section.

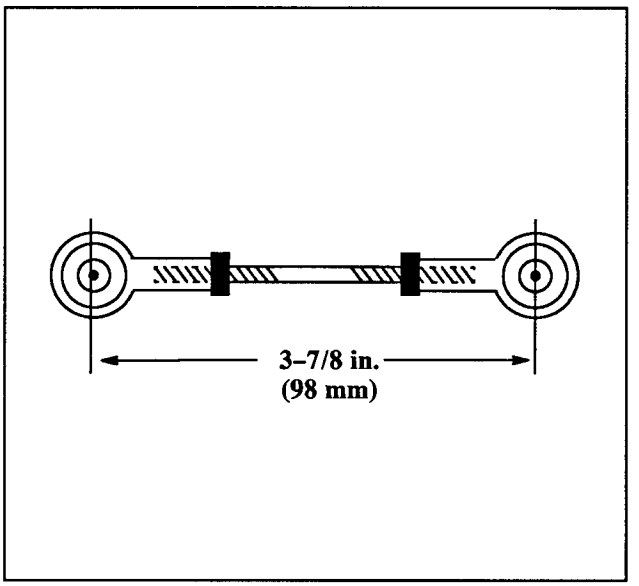


Figure 8–33. Throttle Rod Length (Side View)

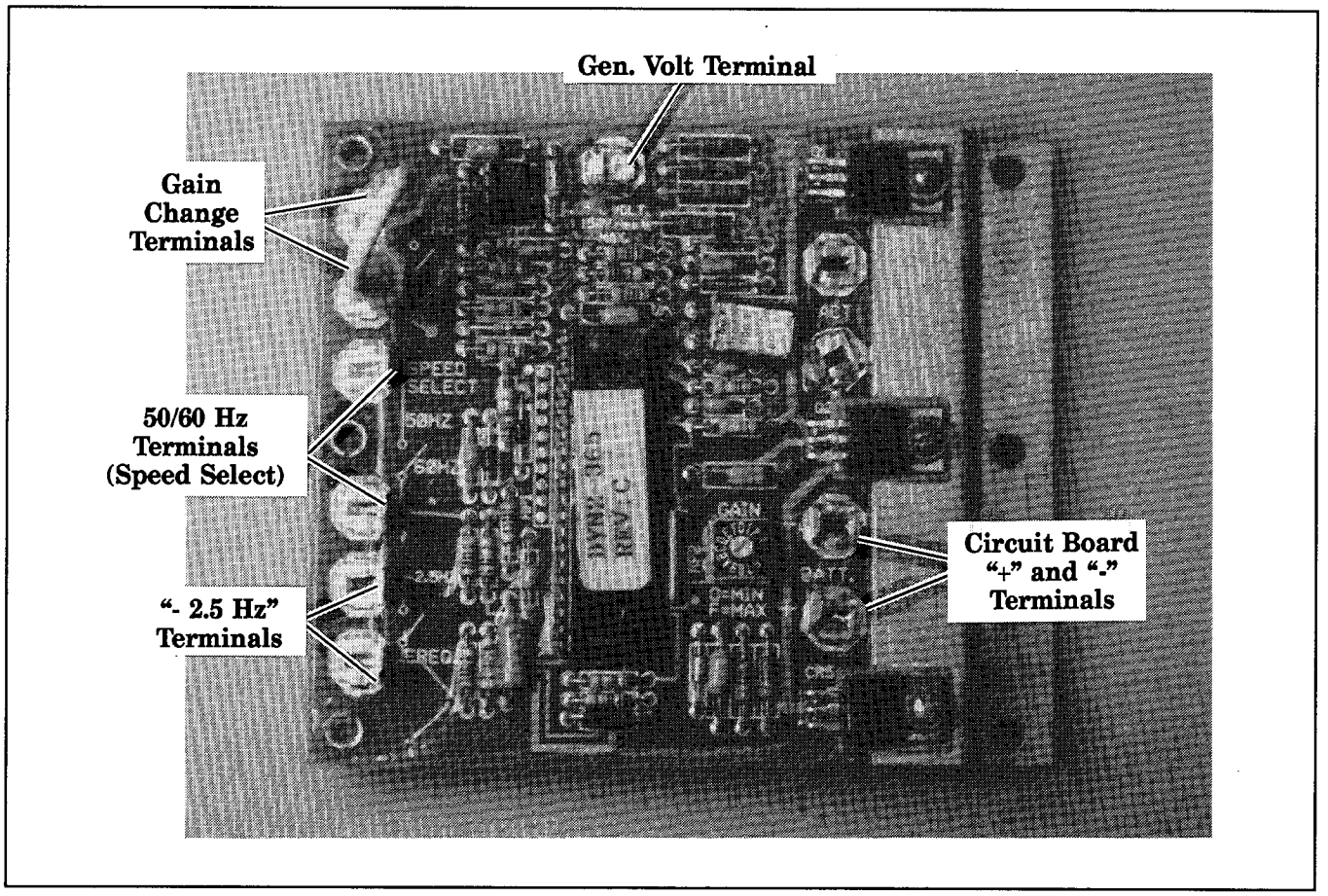


Figure 8–34. Governor Circuit Board

3. Install a jumper across "Gain Change" terminals on governor circuit board. (Installing a jumper on the gain terminals creates a narrower band of adjustment and allows the gain to be "fine–tuned.") Turn gain pot. to setting "3" (0 = minimum and F = maximum gain). Start generator set and apply full load. Rotate gain pot clockwise until actuator lever starts to oscillate then rotate gain pot. counterclockwise until actuator lever is stable. Perform same adjustment at different loads (3/4, 1/2, 1/4, no–load).

4. If the generator will not pick up or maintain rated load, check the following items:

a. Battery voltage to the governor circuit board "+" and "–" terminals should be at least 11 Volts DC. If governor board DC voltage is low or absent, check related wiring and connections and controller main circuit board operation. See "Controller Circuit Board" earlier in this section.

b. AC voltage at governor board "Gen Volt." terminal should be at least 90 Volts AC. If AC voltage is low or absent, check related wiring and connections between AC terminal block and governor circuit board. If wiring/connections appear okay, check generator output as described in Section 7. "Generator Troubleshooting."

c. Fuel pressure on natural gas–fueled units should be at least 5 in. water column. Fuel pressure must be maintained at 5 in. water column at carburetor side of regulator. Readjust pressure regulator, if necessary, to obtain specified fuel pressure.

d. On gasoline–fueled generators, be sure that carburetor choke is set properly. See Section 3, "Gasoline Choke Adjustment."

5. If the items listed in step 4 appear okay but the set still will not pick up or maintain load, lengthen actuator rod linkage. With generator stopped, manually hold throttle open. Loosen lock nuts securing rod ball joints. Turn actuator shaft one full turn so the linkage is lengthened. Retighten lock nuts and verify linkage moves freely and does not bind. Start the unit and check generator response to load. If the generator fails to pick up or maintain load, repeat this step until unit picks up load. **Do not lengthen rod to the extent that unit goes into overspeed condition or stays above 60 Hz (or 50 Hz, if applicable) when load is removed.**

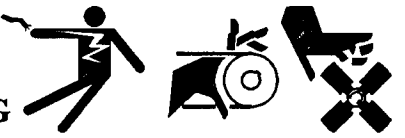
SECTION 9. GENERATOR RECONNECTION

The generator may be reconnected to supply a different output voltage (or phase on 12–lead generators) than listed on the generator nameplate. Refer to the reconnection procedure that applies to your generator set. (Refer to ADV–5720 in Section 12 for connection diagram for 600 Volt generator sets.) Observe the following safety precautions during the reconnection procedure.

⚠ WARNING

Hazardous voltage can cause death or severe injury.

Perform electrical service only as prescribed in equipment manual. 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. Wiring should be inspected at the interval recommended in the service schedule –– replace leads that are frayed or in poor condition. The function of a generator set is to produce electricity and that wherever electricity is present, there is the hazard of electrocution.



⚠ WARNING

Accidental starting can cause death or serious personal injury. Turn Generator Master Switch to OFF position, disconnect power to battery charger, and remove battery cables (remove negative lead first and reconnect it last) to disable generator set before working on any equipment connected to generator. The generator set can be started by automatic transfer switch or remote start/stop switch unless these precautions are followed.

Four-Lead Reconnectible (CC) Generators

10/12CC (60Hz) generators with four–lead stators can be reconnected to 120–Volt or 120/240–Volt systems. 10/12CFC (50Hz) generators can be reconnected to 120/240, 115/230 or 110/220–Volt systems. Contact the factory before attempting to convert the set from 60 to 50 Hz voltages and vise–versa. (Not all 4–lead alternators can be reconnected to 50/60 Hz voltages.)

NOTE

Voltage regulator adjustment may be required to achieve the 50 Hz voltages listed. See Section 8, "Voltage Regulator."

NOTE

If generator is reconnected to a voltage different than nameplate rating, new voltage should be recorded on generator. Voltage change decals for this purpose are available from Kohler Service Parts.

120–Volt (60 Hz) or 110–Volt (50 Hz) Voltage Connection

The jumper lead should be placed on the line side of the circuit breaker. See Figure 9–1. Leads L1 and L2 can either be left as separate leads or can be connected depending upon application (Figure 9–2). Regardless of the number of output leads used in the application, both circuit breakers must have leads attached to the load side. It is recommended that the jumper lead be used for all straight 120–Volt systems to help balance the generator set load.

Leads	60Hz	50 Hz
L0–L1	120–Volt	110–Volt
L0–L2	120–Volt	110–Volt

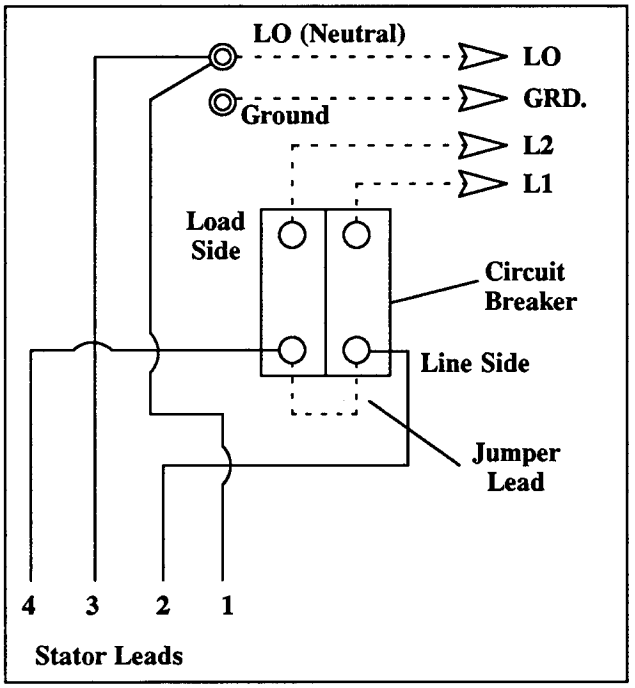


Figure 9–1. 4–Lead, 120–Volt (60 Hz) or 110–Volt (50 Hz) Connection

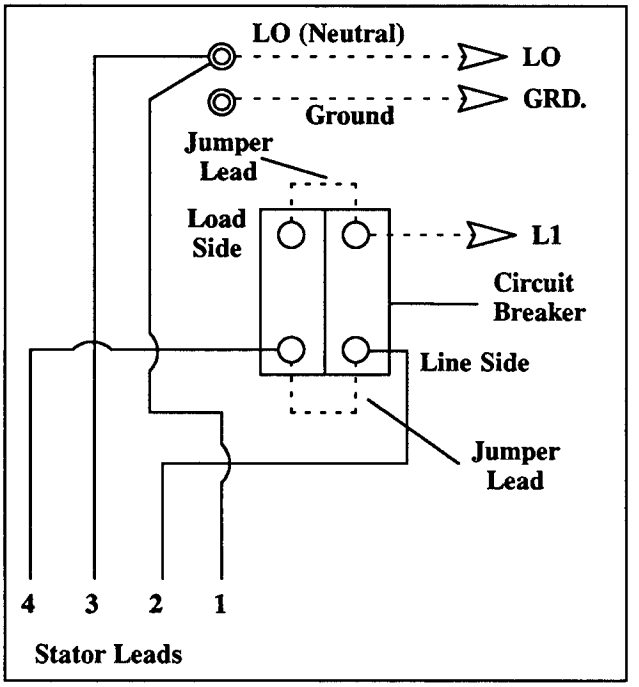


Figure 9–2. 3–Lead, 120–Volt (60 Hz) or 110–Volt (50 Hz) Connection

Dual Voltage Connections 120/240–Volt (60 Hz) 110/220, 120/240, 115/230–Volt (50 Hz)

In these systems, the jumper lead is not used. If the unit was originally wired for straight 120–Volt (60 Hz) or 110–Volt (50 Hz), be sure jumper lead is removed from circuit breaker line side. Leads L1 and L2 are different phases and must never be connected together. See Figure 9–3 for dual voltage connection.

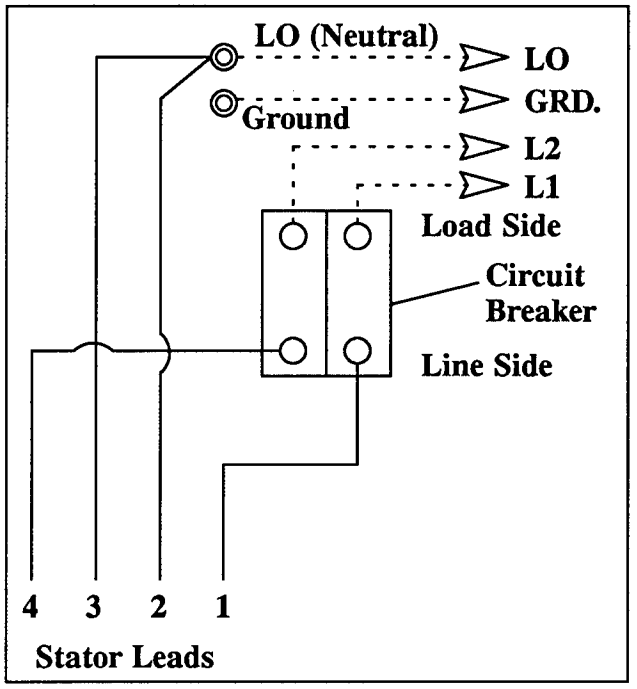


Figure 9–3. Dual Voltage Connection

Leads	Voltage at 60 Hz
L0–L1	120–Volt
L0–L2	120–Volt
L1–L2	240–Volt

Leads	Voltage at 50 Hz *
L0–L1	110, 115, or 120–Volt
L0–L2	110, 115, 120–Volt
L1–L2	220, 230, 240–Volt

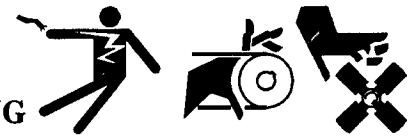
* Voltage regulator adjustment may be required to achieve 50 Hz voltages listed. See Section 8, "Voltage Regulator."

12-Lead Reconnectible (CZ) Generator Sets

Three–phase generators can be reconnected to the voltages and phases shown in Figure 9–3. Observe the following safety precautions when performing this procedure.

NOTE

If generator is reconnected to a voltage different than nameplate rating, new voltage should be recorded on generator. Voltage change decals for this purpose are available from Kohler Service Parts.



⚠ WARNING

Accidental starting can cause death or serious personal injury. Turn Generator Master Switch to OFF position, disconnect power to battery charger, and remove battery cables (remove negative lead first and reconnect it last) to disable generator set before working on any equipment connected to generator. The generator set can be started by automatic transfer switch or remote start/stop switch unless these precautions are followed.

⚠ WARNING

Hazardous voltage can cause death or severe injury.

Perform electrical service only as prescribed in equipment manual. 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. Wiring should be inspected at the interval recommended in the service schedule -- replace leads that are frayed or in poor condition. The function of a generator set is to produce electricity and that wherever electricity is present, there is the hazard of electrocution.

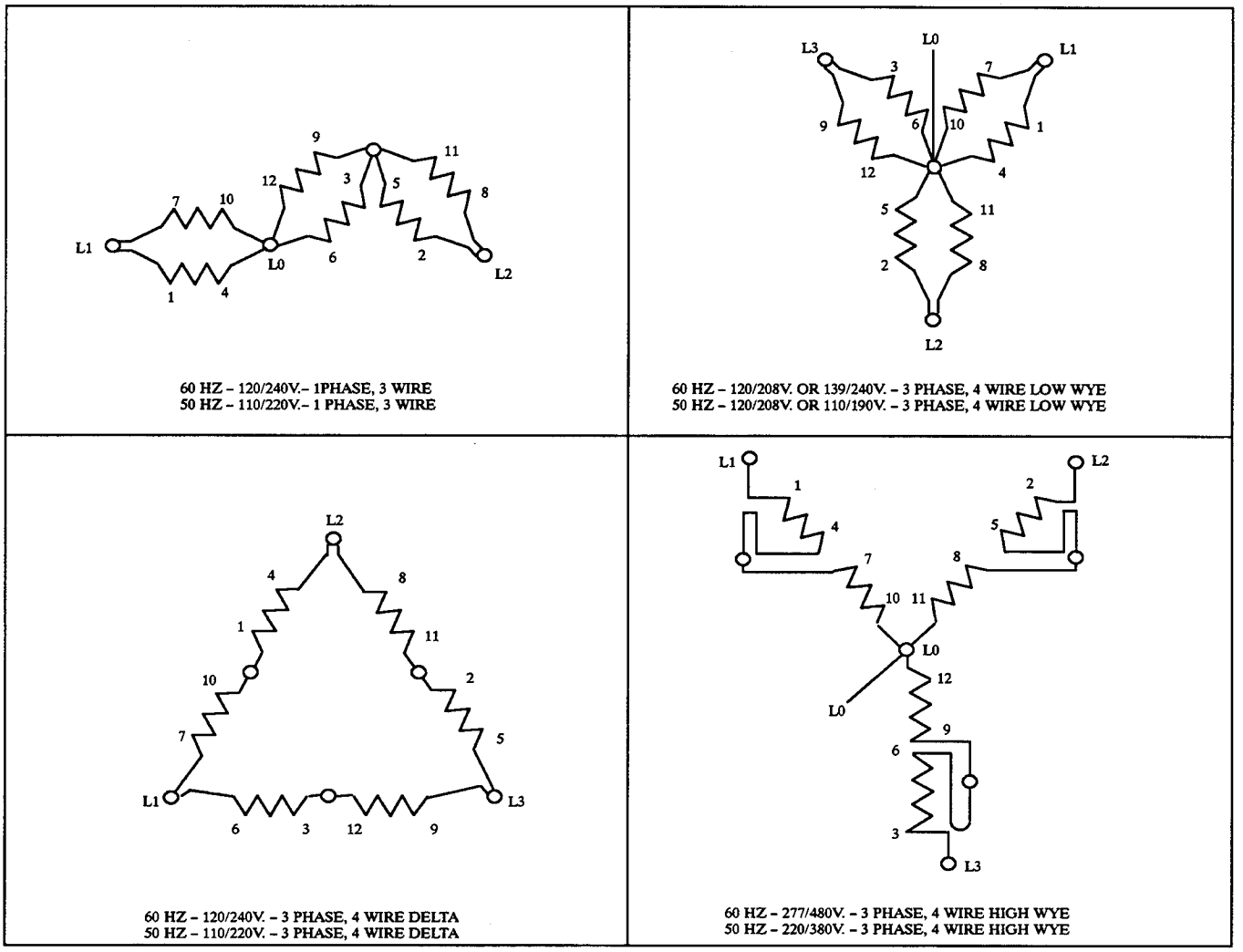


Figure 9–4. 12–Lead (CZ) Generator Reconnection

12–Lead Reconnection Procedure

NOTE

All three–phase generator sets will derate substantially if reconnected for single–phase voltages. Contact the factory for specific derate information.

1. Stop generator set by depressing "Stop" switch on controller/remote Start/Stop switch.
2. Disconnect engine starting battery, negative (–) lead first. Disconnect power to battery charger (if equipped).
3. Select desired voltage connection from Figure 9–4. Connect output leads according to the diagram for desired phase and voltage.

NOTE

Line circuit breakers, transfer switch, and all other accessories must be properly sized for the voltage selected.

4. Reconnect starting battery, negative lead last. Move controller master switch to the RUN position to start the generator set. Check voltmeter (customer supplied) for proper voltage. Adjust voltage, if necessary, with the voltage adjustment on the voltage regulator. Change frequency (Hz), if necessary, by adjusting electronic governor. **See Section 8 for governor and voltage regulator adjustment procedures.**

SECTION 10. DISASSEMBLY/REASSEMBLY

Prior to disassembly, the generator set must be removed from the enclosure. Disconnect battery (negative lead first), fuel line, exhaust system, remote switch, and load leads. In addition to the precautions included in the text, observe all safety precautions listed at the beginning of this manual during the disassembly/reassembly procedure.

Disassembly

Accidental starting can cause death or serious personal injury. Turn Generator Master Switch to OFF position, disconnect power to battery charger, and remove battery cables (remove negative lead first and reconnect it last) to disable generator set before working on any equipment connected to generator. The generator set can be started by automatic transfer switch or remote start/stop switch unless these precautions are followed.

1. Disconnect battery, negative lead first.

2. **CZ/12–lead generators:** Remove end bracket louvered panel by removing four support screws.

3. Remove four screws securing junction box side panel(s). See Figure 10–1. Remove side panel(s).

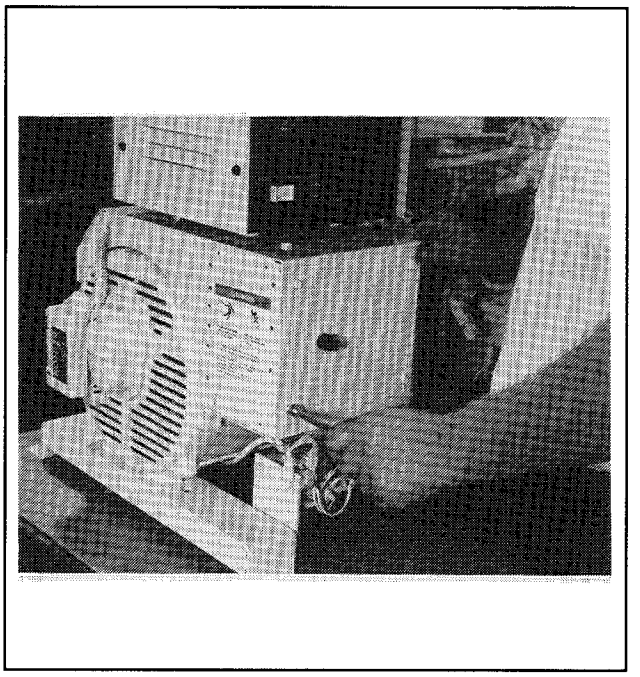


Figure 10–1. Removing Junction Box Side Panels

4. Remove four mounting screws securing controller cover. Remove cover.

5. Disconnect P5 connector on B1, B2 leads. Disconnect brush leads (CC models only) and stator leads from connections in controller and junction box. Remaining leads may remain connected.

6. Remove two bolts securing generator support bracket to end bracket. See Figure 10–2. Remove support bracket.

7. **On CC/4–lead generators**: Remove voltage regulator from end bracket by removing four mounting screws and disconnecting wiring harness (if regulator is being removed). See Figure 10–3.

8. Using a hoist attached to generator lifting eye, raise generator high enough to place support block beneath engine oil pan. See Figure 10–4. If end bracket will be removed, place additional support beneath stator assembly.

9. **CZ/12–lead generators:** Remove four bolts securing junction box to adapter. It will be necessary to remove voltage regulator and regulator mounting plate for access to junction box mounting bolts. After bolts are removed, controller and junction box can be swung to the side for remaining steps. See Figure 10–5. Remove overbolts securing end bracket to adapter.

10. **On CC/4–lead generators**: Remove brush cover from end bracket by removing four mounting screws. See Figure 10–6. Gently grasp brush leads and raise brushes from slip rings. Lock brushes in raised position by inserting a retaining wire in hole in brush holder. See Figure 10–7. Remove four overbolts securing controller and junction box panel to stator. After overbolts are removed, the controller/ junction box assembly can be moved to the side for remaining steps.

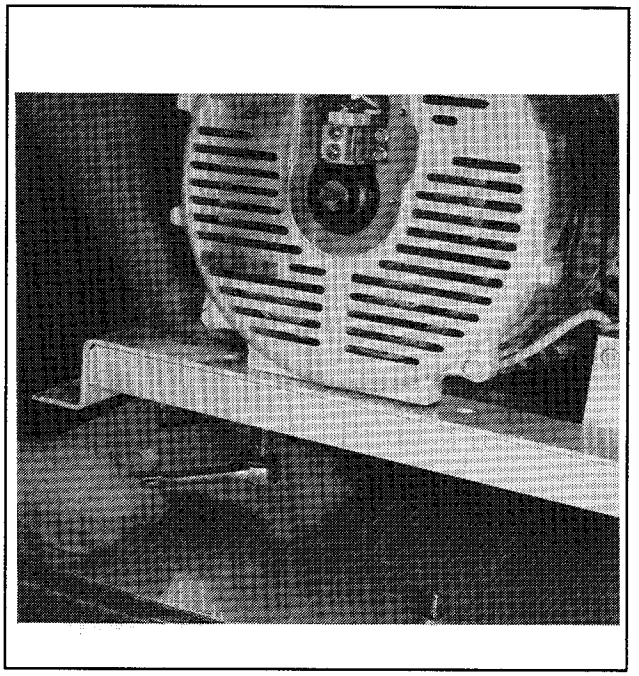


Figure 10–2. Removing Support Bracket

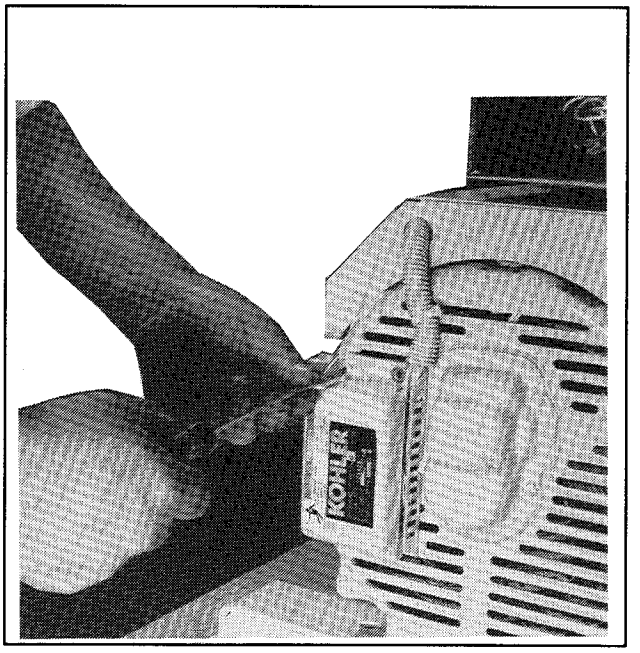


Figure 10–3. Voltage Regulator Removal (CC/4–Lead Generator Shown)

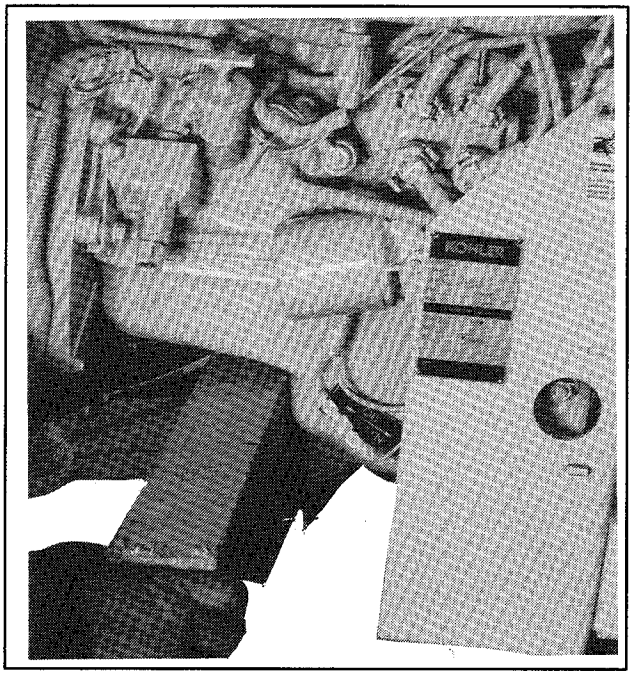


Figure 10–4. Inserting Support Blocks

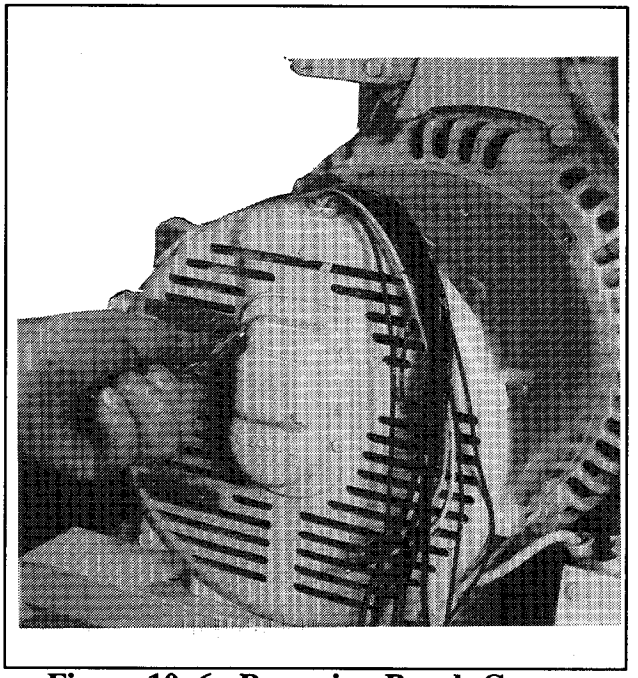


Figure 10–6. Removing Brush Cover (CC/4–Lead Generators Only)

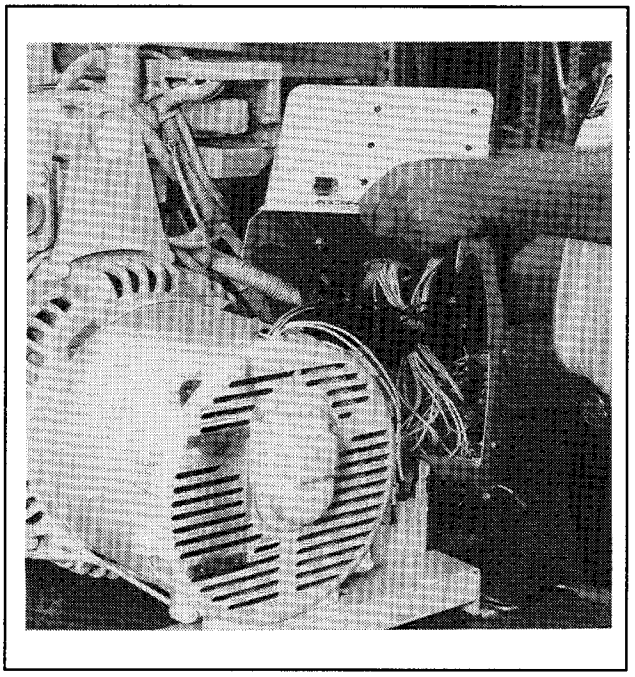


Figure 10–5. Junction Box Removal

Figure 10–7. Inserting Brush Retainer (CC/4–Lead Generators Only)

11. Using a mallet, gently tap end bracket away from stator. See Figure 10–8. Carefully pull stator leads through port in end bracket during end bracket removal.

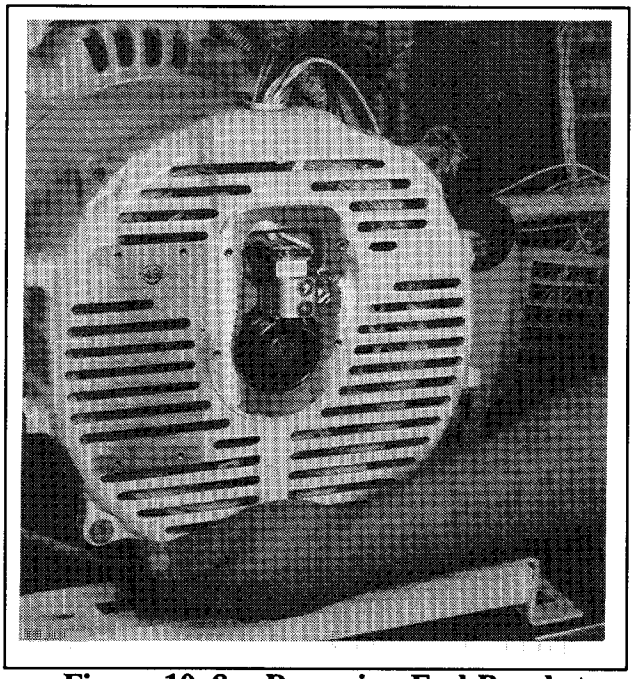


Figure 10–8. Removing End Bracket (CC/4–Lead Generator Shown)

12. Gently slide stator over rotor (armature). Be careful to avoid damaging rotor (armature) or stator during removal. See Figure 10–9.

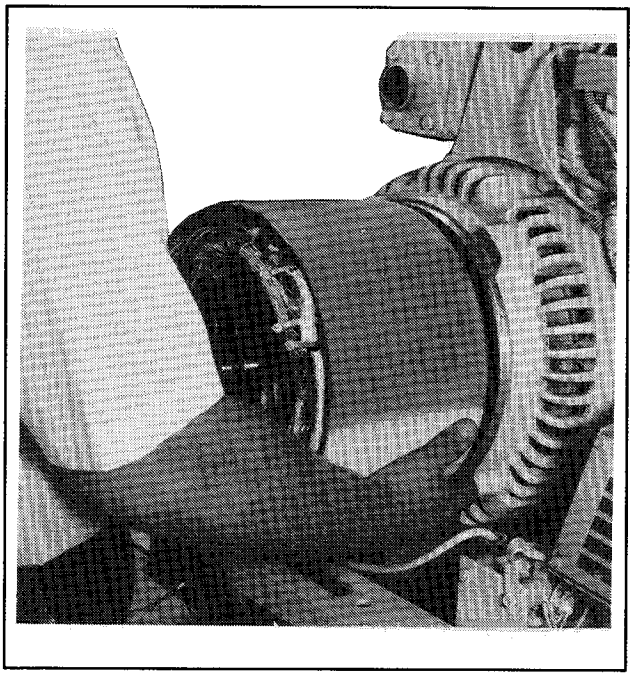


Figure 10–9. Removing Stator

13. Remove four bolts and lock washers securing adapter panel to adapter. See Figure 10–10.

Figure 10–10. Removing Adapter Panel

14. Remove three bolts and lock washers securing starter to adapter. See Figure 10–11. Remove remaining adapter support bolts near starter assembly.

15. Remove two bolts and lock washers securing fuel pump to adapter. See Figure 10–12. Move fuel pump away from adapter. (Do not disconnect fuel line.)

16. Remove two bolts securing lifting eye to adapter/engine. Remove lifting eye and adapter. See Figure 10–13.

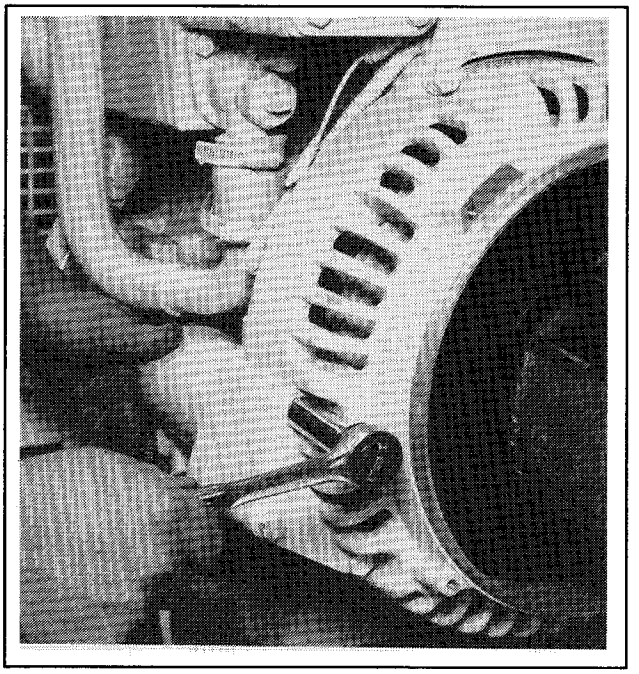


Figure 10–11. Removing Starter

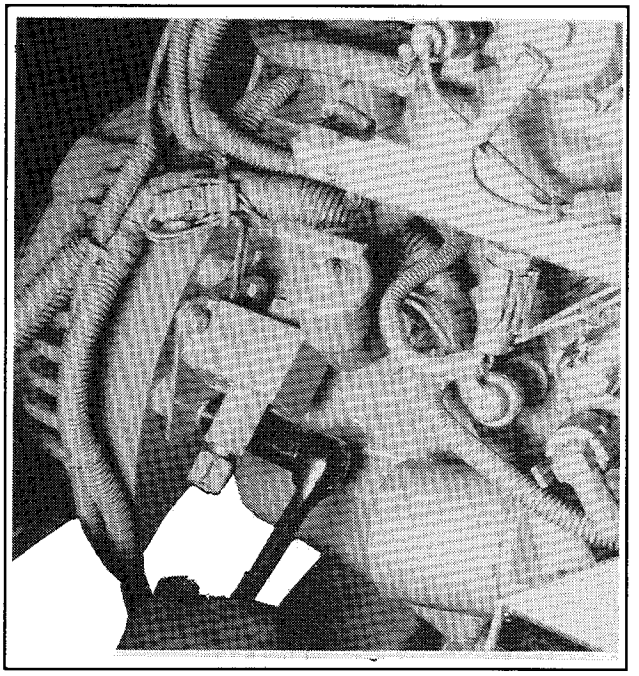


Figure 10–12. Fuel Pump Removal

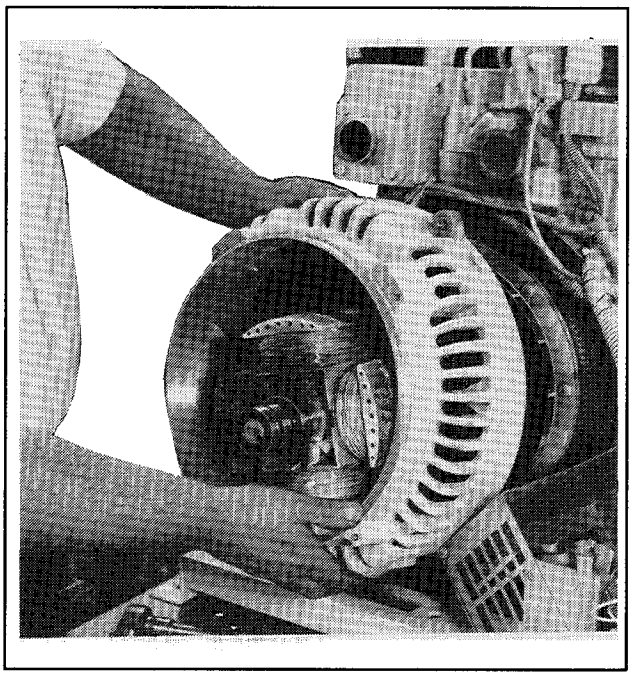


Figure 10–13. Removing Adapter

17. Remove eight nuts (with spacers) securing generator drive discs. (Support rotor during removal of hardware.) When nuts are removed, rotor and one drive disc can be removed. See Figure 10–14.

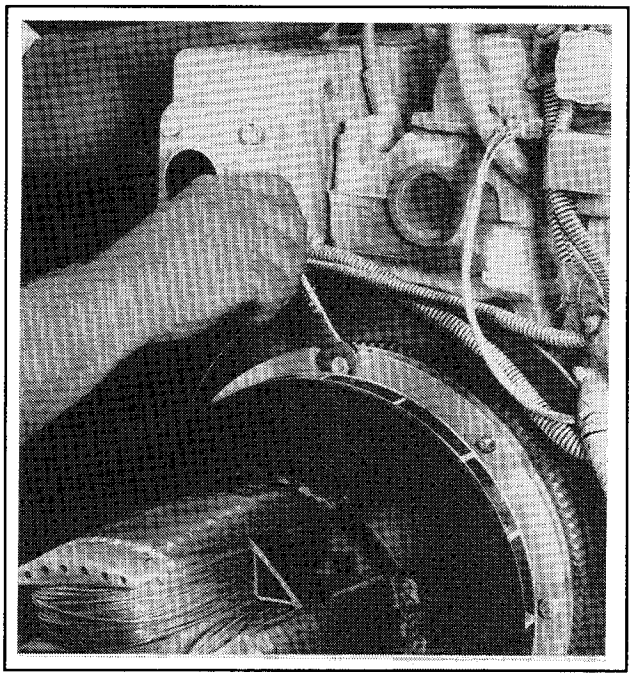


Figure 10–14. Removing Drive Disc and Rotor

18. Remove six bolts securing remaining drive disc to flywheel. Note position of spacers before removing drive disc. See Figure 10–15.

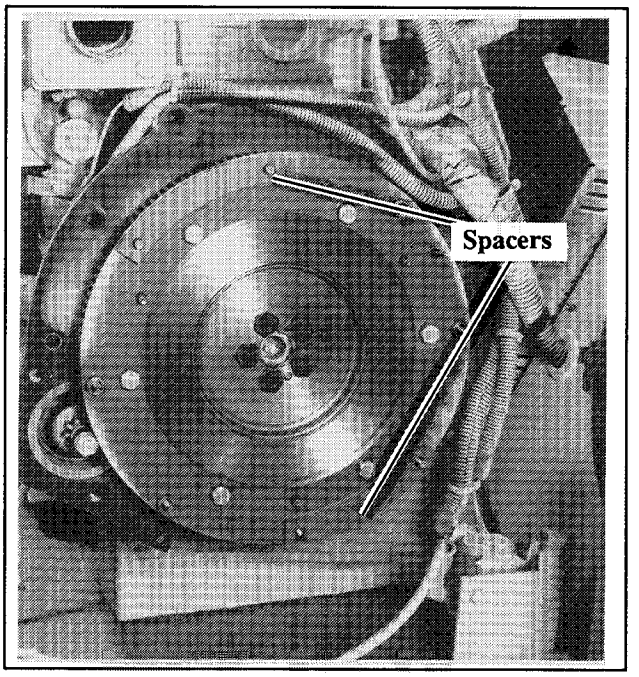


Figure 10–15. Engine Flywheel and Spacers

Reassembly

1. Secure drive disc to flywheel with six mounting bolts. Torque mounting bolts to 168 in. lbs. (19 Nm).

2. Position spacers on drive disc exactly as recorded during disassembly. Using eight nuts and spacers, reattach remaining drive disc and rotor (armature) to drive disc installed in previous step. See Figure 10–16. Torque mounting bolts to 70 in. lbs. (7.9 Nm).

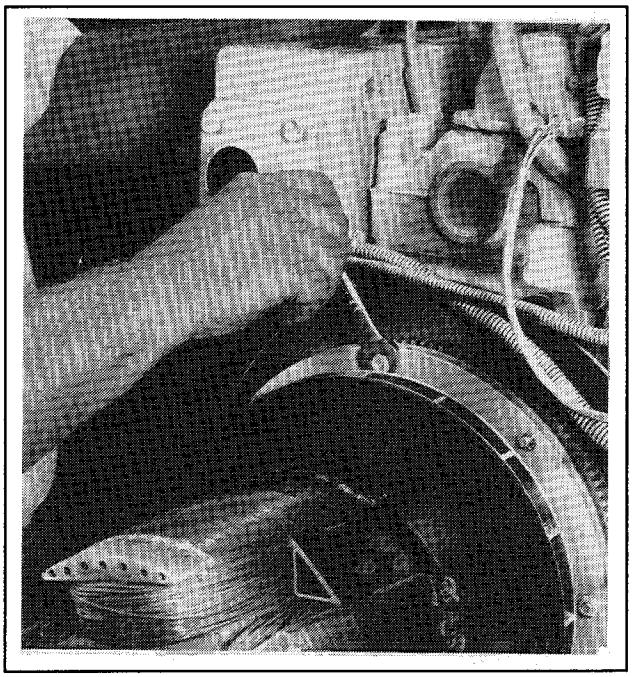


Figure 10–16. Replacing Drive Disc and Rotor

3. Position adapter on engine. Attach lifting eye to adapter/engine with two mounting bolts and lock washers. See Figure 10–17.

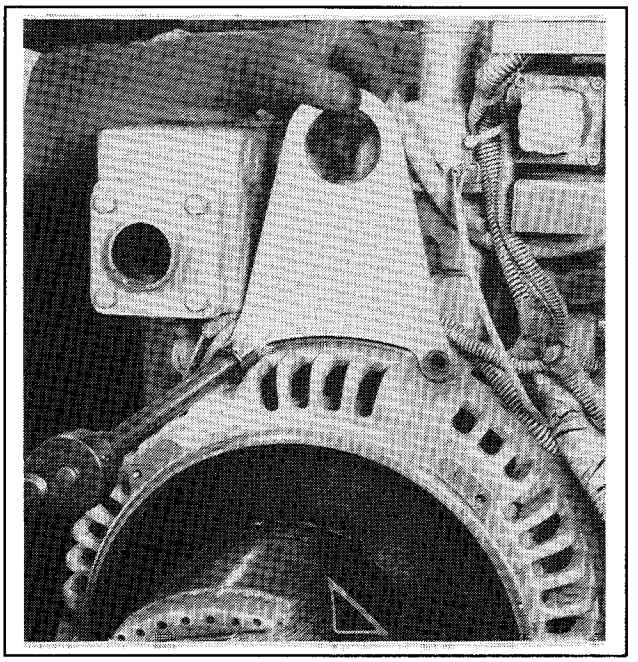


Figure 10–17. Attaching Lifting Eye

4. Attach fuel pump to adapter with two mounting screws.

5. Reconnect starter to adapter with three mounting screws and lock washers. Reinstall two adapter mounting bolts (and lock washers) in positions above starter.

6. Reattach adapter panel to adapter with four bolts and lock washers..

7. Using a hoist (if necessary) to support stator, gently slide stator over rotor (armature).

8. **CC/4–lead generators only:** Route stator leads through port in end bracket while positioning end bracket against stator. Use a mallet (if necessary) to gently tap end bracket into position. Position controller and junction box on stator. Install overbolts and tighten to 60 in. lbs. (6.8 Nm) to secure end bracket and controller/junction box assembly.

9. **CZ/12–lead generators only:** Position end bracket against stator. Use a mallet (if necessary) to gently tap end bracket into position against stator. Secure end bracket by replacing four overbolts (and lock washers) and torquing

to 216 in. lbs. (24.4 Nm). Position controller and junction box on stator. Reattach junction box/controller to adapter with four mounting screws. Reattach voltage regulator mounting bracket and voltage regulator. Reconnect voltage regulator harness (if disconnected during disassembly).

10. Reattach generator support bracket to end bracket with two mounting bolts. See Figure 10–18.

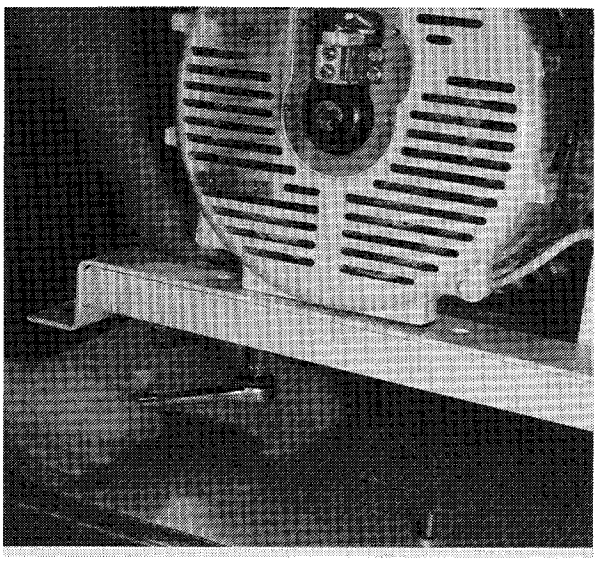


Figure 10–18. Replacing Support Bracket

11. **On CC/4–lead generators:** Remove retainer wire securing brushes in brush holder. Be sure brushes are properly positioned on rotor slip rings. See Section 8, "Brushes." Position brush cover on end bracket and secure with mounting screws.

13. Replace junction box side panels and secure with original hardware.

14. Using a hoist, raise generator high enough to remove support blocks from beneath oil pan.

15. **On CC/4–lead generators:** Reattach voltage regulator to end bracket and secure with screws and lock washer.

16. Reconnect wiring in controller and junction box disconnected during disassembly. Reference appropriate wiring diagram in Section 12.

17. Replace controller cover and secure with screws and lock washers.

18. **On CZ/12–lead generators:** Replace end bracket louvered panel and secure with screws and washers.

19. Reconnect fuel line, exhaust system, remote switch, and load leads. Reconnect battery, (negative lead last) and power to battery charger (if equipped. Reinstall generator set in trailer or enclosure (if applicable).

SECTION 11. STORAGE & SERVICE

Storage Procedure

If the generator set is to be out of service for a considerable length of time (three months or longer), perform the following steps before placing the set in storage.

1. Drain the oil (while hot) from the crankcase then refill with regular grade oil. See Section 3. "Oil Type" in this manual.

2. With the generator running (with no loads connected), treat upper cylinders by spraying recommended engine oil into the air intake for 10 to 15 seconds. Open throttle for a short burst of speed; shut off set and allow it to come to a stop while continuing to spray recommended oil into air intake.

3. Check engine coolant protection. See Section 3. "Cooling System" for additional information.

4. Disconnect battery (negative lead first) and place in storage.

5. Seal all openings in engine with nonhydroscopic adhesive tape. Mask off all areas to be used for electrical contact.

4. Clean exterior surface of the generator. Spread a light film of oil over unpainted metallic surfaces which could rust or corrode.

Service Assistance

See the Yellow Pages of your Telephone Directory under Generator – Electric for your closest Kohler Generator Dealer or distributor.

KOHLER CO., Kohler, Wisconsin 53044
Phone 414–565–3381, Telex 26888,
Fax 414–565–3648

For Sales & Service in U.S.A. & Canada
Phone 1–800–544–2444
Provide MODEL, SPECIFICATION, SERIAL, and ENGINE numbers from the generator nameplate to receive current parts and information for your generator set.

Service Manual Procurement

A service manual or parts catalog for your generator set may be obtained through an Authorized Service Dealer or Distributor. Record Model, Spec. and Serial numbers (from generator nameplate) in the spaces below. The dealer or distributor requires these numbers to obtain the proper literature for the generator.

Model No._____

Specification No._____

Serial No._____

Engine Specification No._____

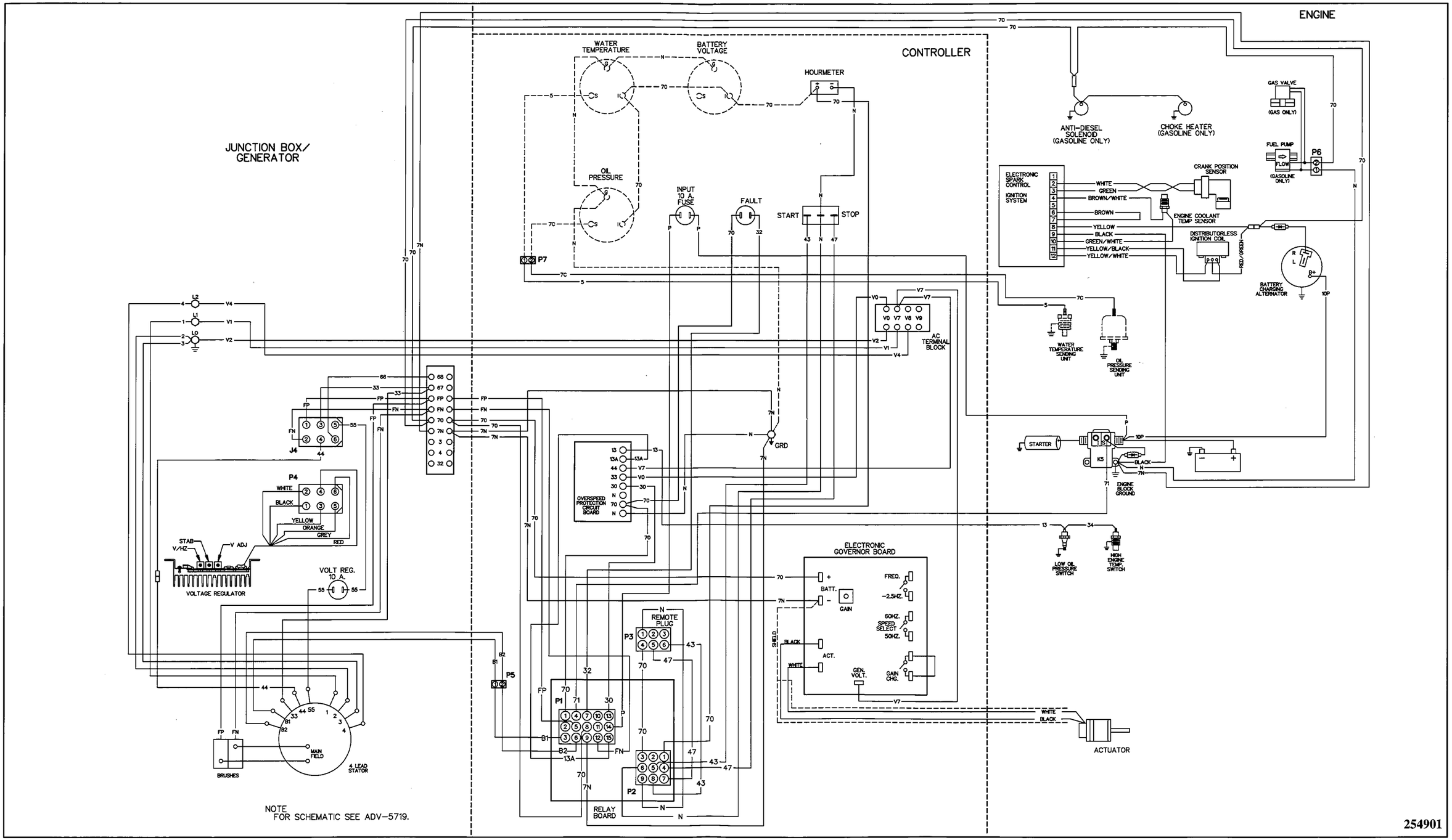


Figure 12–1. Wiring Diagram – 10CC, 12CC Mobile Generator Set

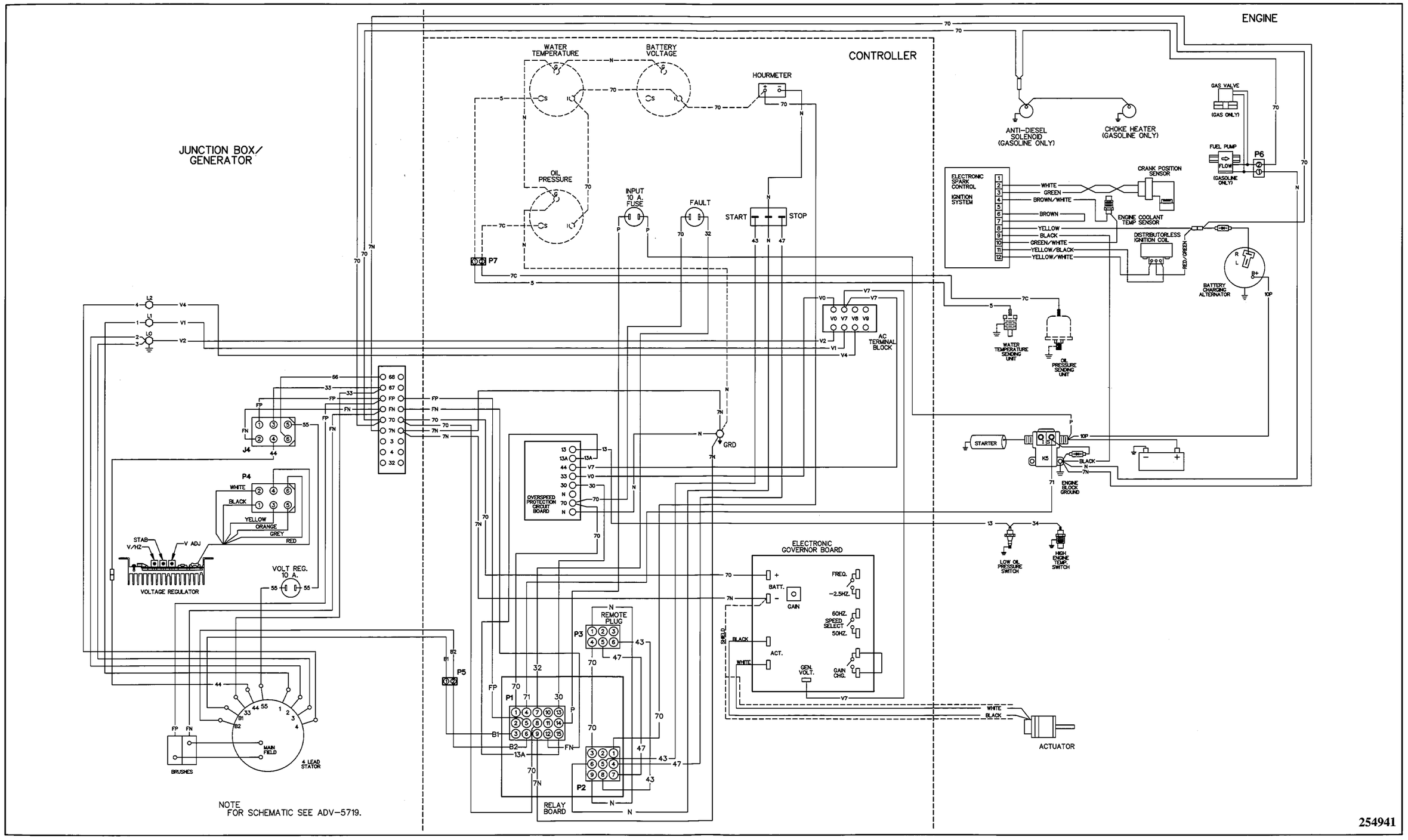


Figure 12–2. Wiring Diagram – 10CC, 12CC Mobile Generator w/Remote Controller

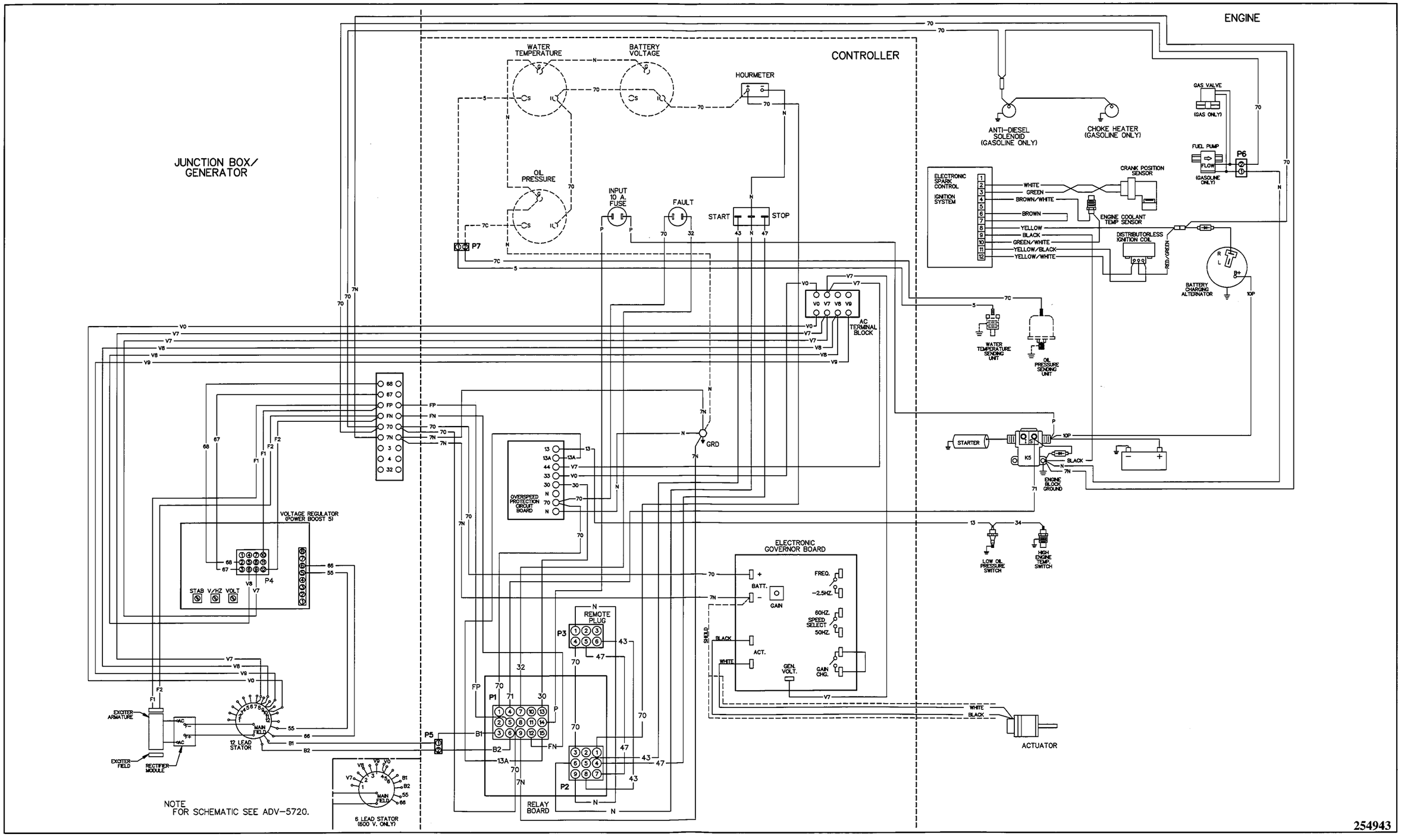


Figure 12–3. Wiring Diagram – 10CZ, 12CZ Mobile Generator Set

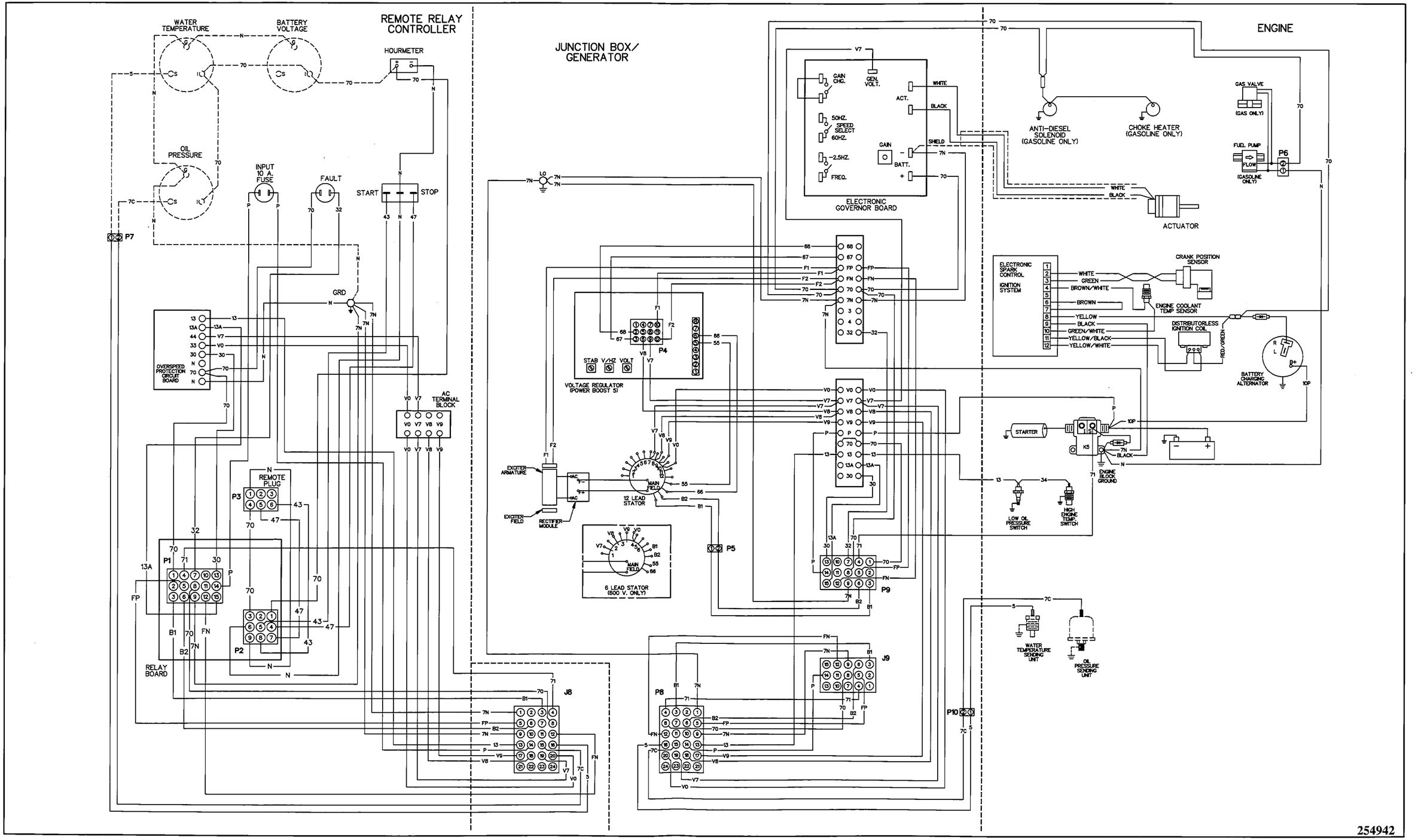


Figure 12–4. Wiring Diagram – 10CZ, 12CZ Mobile Generator w/ Remote Controller

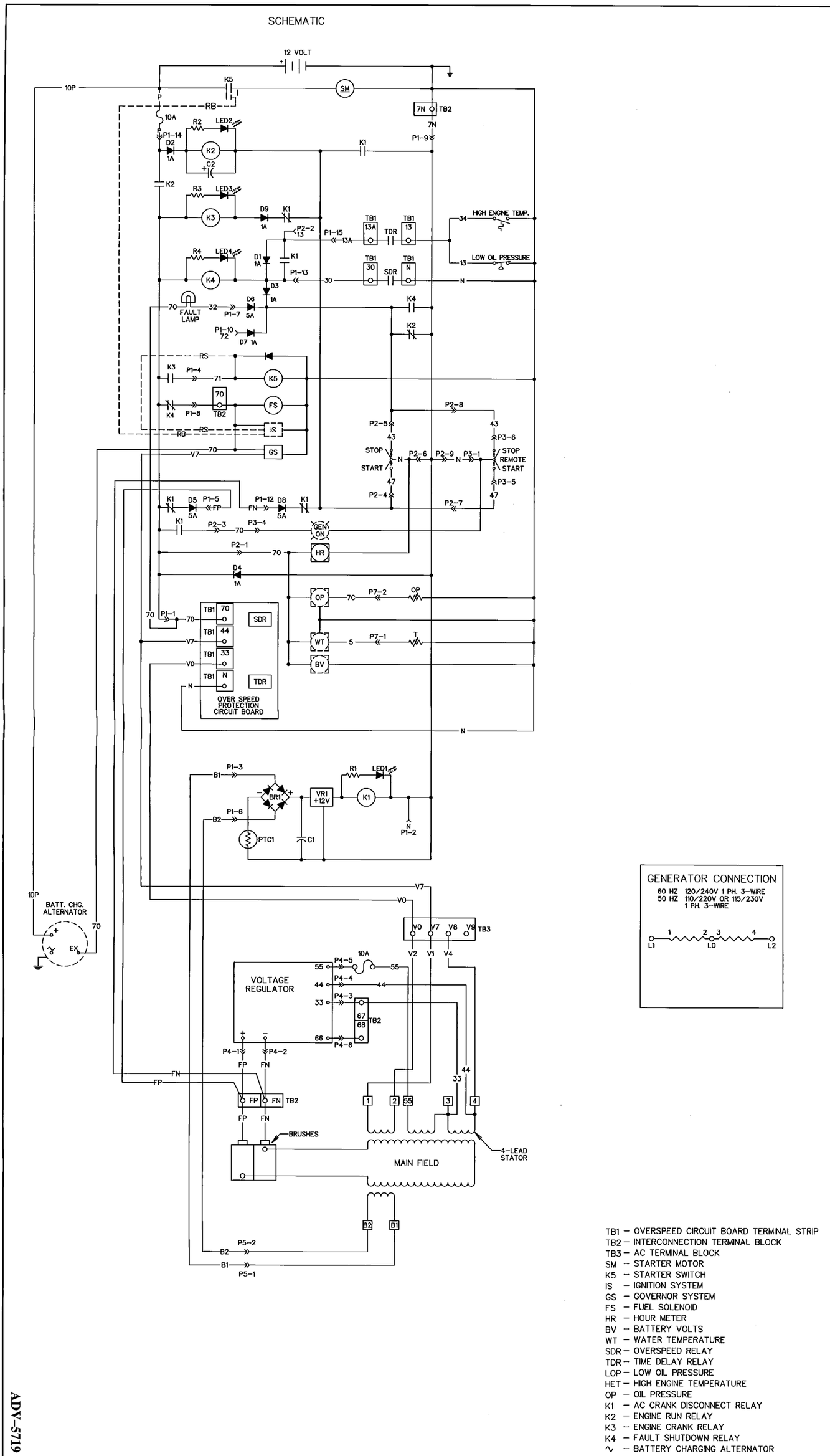


Figure 12–5. Wiring Schematic, 10CC, 12CC Generators (Single–Phase/4–lead)

ADV–5719

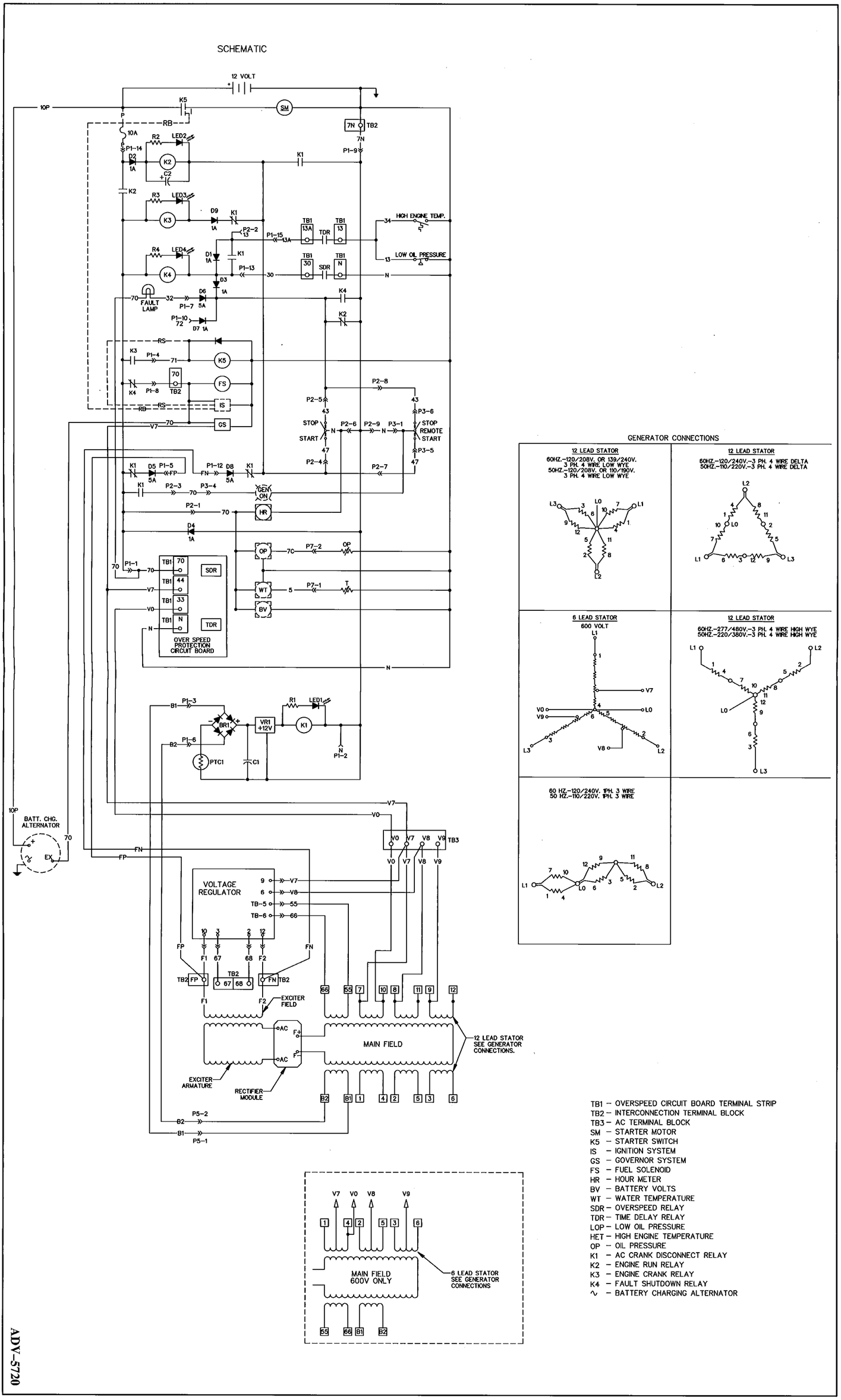


Figure 12-6. Wiring Schematic, 10CZ, 12CZ Generators (Three-Phase/12-Lead)

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