Service Manual

Mobile Generator Sets

Model:
7CCO61

KOHLER®
POWER SYSTEMS

ISO 9001
KOHLER GENERATORS
INTERNATIONALLY REGISTERED

TP-5822 10/96

Table of Contents

Safety Precautions and Instructions

A generator set, like any other electromechanical device, can pose potential dangers to life and limb if improperly maintained or operated. The best way to prevent accidents is to be aware of potential dangers and act safely. Please read and follow the safety precautions and instructions below to prevent harm to yourself and others. This manual contains several types of safety precautions and instructions which are explained below. SAVE THESE INSTRUCTIONS.

DANGER

Danger indicates the presence of a hazard that *will* cause *severe* personal injury, death, or substantial property damage.

WARNING

Warning indicates the presence of a hazard that *can* cause *severe* personal injury, death, or substantial property damage.

CAUTION

Caution indicates the presence of a hazard that *will* or *can* cause *minor* personal injury or property damage.

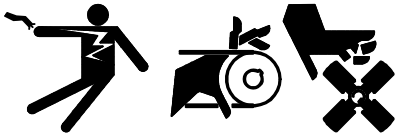
NOTICE

Notice communicates installation, operation, or maintenance information that is important but not hazard related.

Safety decals affixed to the generator set in prominent places advise the operator or service technician of potential hazards and how to act safely. The decals are reproduced in this publication to improve operator recognition. Replace missing or damaged decals.

Accidental Starting

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect battery cables before working on generator set (disconnect negative lead first and reconnect it last).

Disabling generator set. Accidental starting can cause severe injury or death. Disconnect battery cables (remove negative lead first and reconnect it last) to disable generator set before working on the generator set or connected equipment. The generator set can be started by the remote start/stop switch unless this precaution is followed.

Battery

⚠ WARNING

Sulfuric acid in batteries.
Can cause severe injury or death.

Use protective goggles and clothes. Battery acid can cause permanent damage to eyes, burn skin, and eat holes in clothing.

Battery acid. Sulfuric acid in batteries can cause severe injury or death. Sulfuric acid in battery can cause permanent damage to eyes, burn skin, and eat holes in clothing. Always wear splash-proof safety goggles when working near the battery. If battery acid is splashed in the eyes or on skin, immediately flush the affected area for 15 minutes with large quantities of clean water. Seek immediate medical aid in the case of eye contact. Never add acid to a battery after placing the battery in service, as this may result in hazardous spattering of battery acid.

Battery gases. Explosion can cause severe injury or death. 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 charging. Avoid touching terminals with tools, etc., to prevent burns and 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. Sparks could ignite battery gases or fuel vapors. Ventilate any compartment containing batteries to prevent accumulation of explosive gases. To avoid sparks, do not disturb battery charger connections while battery is being charged. Always turn battery charger off before disconnecting battery connections. Remove negative lead first and reconnect it last when disconnecting battery.

Engine Backfire/Flash Fire

⚠ WARNING

Fire.
Can cause severe injury or death.

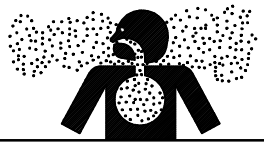
Do not smoke or permit flame or spark to occur near fuel or fuel system.

Servicing fuel system. A flash fire can cause severe injury or death. 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. Catch all fuel in a suitable container when removing fuel line or carburetor.

Servicing air cleaner. A sudden backfire can cause severe injury or death. Do not operate with air cleaner removed.

Exhaust System

⚠ WARNING



Carbon monoxide.
Can cause severe nausea, fainting, or death.

The exhaust system must be leakproof and routinely inspected.

Generator set operation. Carbon monoxide can cause severe nausea, fainting, or death. 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 a potentially occupied building or vehicle. Be careful when parking your vehicle to avoid obstructing the exhaust outlet. The exhaust gases must discharge freely to prevent carbon monoxide from deflecting 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 that can cause death if inhaled for even a short period of time.

Carbon monoxide symptoms. Carbon monoxide can cause severe nausea, fainting, or death. Carbon monoxide is a poisonous gas which is present in exhaust gases. Carbon monoxide poisoning symptoms include but are not limited to the following:

- Light-headedness, dizziness
- Physical fatigue, weakness in joints and muscles
- Sleepiness, mental fatigue, inability to concentrate or speak clearly, blurred vision
- Stomachache, vomiting, nausea

If experiencing any of these symptoms and carbon monoxide poisoning is possible, affected persons should seek fresh air immediately. They should remain active. They should not sit, lie down, or fall asleep. Alert others to the possibility of carbon monoxide poisoning. If the condition of affected persons does not improve within minutes of breathing fresh air, they should seek medical attention.

Copper tubing exhaust systems. Carbon monoxide can cause severe nausea, fainting, or death. Do not use copper tubing in diesel exhaust systems. Sulfur in diesel exhaust causes rapid deterioration of copper tubing exhaust systems resulting in exhaust leakage.

Installing exhaust tail pipe. Carbon monoxide can cause severe nausea, fainting, or death. Install exhaust system tail pipe so discharged exhaust gases will not be drawn into vehicle interior through windows, doors, air conditioners, etc. Do not use flexible tail piping because it could crack and allow lethal exhaust fumes to enter the vehicle.

Inspecting exhaust system. Carbon monoxide can cause severe nausea, fainting, or death. In addition to routine exhaust system inspection, install a carbon monoxide detector. Consult your coach builder or dealer for approved detector installation. Inspect your detector before each generator set use.

Fuel System

⚠ WARNING

Explosive fuel vapors.
Can cause severe injury or death.

Use extreme care when handling, storing, and using fuels.

Fuel system. Explosive fuel vapors can cause severe injury or death. All fuels are highly explosive in a vapor state. Use extreme care when handling and storing 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 sources of spilled fuel or fuel vapors. Keep fuel lines and connections tight and in good condition. Do not replace flexible fuel lines with rigid lines. Use flexible sections to avoid breakage caused by vibration. Do not operate generator set in the presence of fuel leaks, fuel accumulation, or sparks. Repair systems before resuming generator set operation

Draining fuel system. Explosive fuel vapors can cause severe injury or death. Spilled fuel can cause an explosion. Use a container to catch fuel when draining fuel system. Wipe up all spilled fuel after draining system.

Hazardous Noise

⚠ CAUTION

Hazardous noise.
Can cause loss of hearing.

Never operate generator set without a muffler or with a faulty exhaust system.

Hazardous Voltage/ Electrical Shock

⚠ WARNING

Hazardous voltage.

Moving rotor.

Can cause severe injury or death.

Operate generator set only with all guards and electrical enclosures in place.

⚠ WARNING

Hazardous voltage.
Backfeed to utility system can cause severe injury, death, or property damage.

Connect generator set to building electrical system only through an approved device and after building main switch is open.

Grounding generator set. Hazardous voltage can cause severe injury or death. Electrocution is possible whenever electricity is present. Open main circuit breakers of all power sources before servicing equipment. Configure the installation to electrically ground the generator set and electrical circuits when in use. Never contact electrical leads or appliances when standing in water or on wet ground, as the chance of electrocution is increased under such conditions.

Short circuits. Hazardous voltage can cause severe injury or death. 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 before servicing equipment.

Testing voltage regulator. Hazardous voltage can cause severe injury or death. High voltage is present at the voltage regulator heat sink. Do not touch voltage regulator heat sink when testing or electrical shock will occur.
(PowerBoost™, PowerBoost™ III, and PowerBoost™ V voltage regulator models only.)

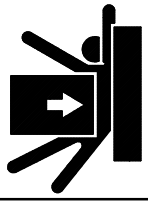
Engine block heater. Hazardous voltage can cause severe injury or death. Engine block heater can cause electrical shock. Remove engine block heater plug from electrical outlet before working on block heater electrical connections.

Electrical backfeed to utility. Hazardous backfeed voltage can cause severe injury or death. Connect generator set to building/campground electrical system only through an approved device and after building/campground main switch is open. Backfeed connections can cause serious injury or death to utility personnel working on power lines and/or personnel in the vicinity of the work area. Unauthorized connection to utility electrical system may be unlawful in some states and/or localities. Install a transfer switch to prevent interconnection of generator set power and other sources of power.

Servicing generator set. Hazardous voltage can cause severe injury or death. Do not touch electrical connections when flashing the generator set. Line voltage is present at the alligator clips when the pushbutton is pressed to flash the generator set.

Heavy Equipment

⚠ WARNING



Unbalanced weight.
Improper lift can cause severe injury or death and/or equipment damage.

Do not use lifting eyes.
Use slings under skid to balance and lift generator set.

Hot Parts

⚠ WARNING

Hot coolant and steam.
Can cause severe injury or death.

Before removing pressure cap, stop generator set and allow it to cool. Then loosen pressure cap to relieve pressure.

⚠ WARNING

Hot engine and exhaust system.
Can cause severe injury or death.

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

Checking coolant level. Hot coolant can cause severe injury or death. Allow engine to cool. Release pressure from cooling system before opening pressure cap. To release pressure, cover the pressure cap with a thick cloth; then slowly turn it counterclockwise to the first stop. Remove cap after pressure has been completely released and the engine has cooled. Check coolant level at tank if generator set is equipped with a coolant recovery tank.

Servicing exhaust system. Hot parts can cause severe injury or death. Do not touch hot engine parts. An engine becomes hot while running and exhaust system components become extremely hot.

Combustible materials. Fire can cause severe injury or death. Hot exhaust system can ignite adjacent combustible materials. Do not locate electrical wiring, fuel lines, or combustible material above the exhaust muffler. Exercise caution when parking your vehicle to prevent exhaust system and hot exhaust gases from starting grass fires.

Combustible materials. Fire can cause severe injury or death. Hot generator set can ignite debris in compartment. Keep the compartment and generator set clean and free of debris and combustible materials to minimize possibility of fire. Do not block fuel/oil drain opening in generator set mounting tray. Cut a corresponding hole in the subfloor for drain opening if subfloor is used.

Moving Parts

⚠ WARNING

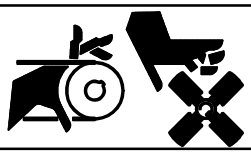
Hazardous voltage.

Moving rotor.

Can cause severe injury or death.

Operate generator set only with all guards and electrical enclosures in place.

⚠ WARNING



Rotating parts.
Can cause severe injury or death.

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

Tightening hardware. Flying projectiles can cause severe injury or death. Retorque all crankshaft and rotor hardware after servicing. Do not loosen crankshaft hardware or rotor thrubolt when making adjustments or servicing generator set. Rotate crankshaft manually in a clockwise direction only. Turning crankshaft bolt or rotor thrubolt counterclockwise can loosen hardware. Loose hardware can cause hardware or pulley to release from engine of generator set and can cause personal injury.

Servicing generator set when operating. Exposed moving parts can cause severe injury or death. Keep hands, feet, hair, clothing, and test leads away from belts and pulleys when generator set is running. Replace guards, screens, and covers before operating generator set.

Notice

NOTICE

This generator set has been rewired from its nameplate voltage to:

246242

NOTICE

Voltage reconnection! Affix notice to generator set after reconnecting to a voltage different than the nameplate. Order voltage reconnection decal 246242 from authorized service distributors/dealers.

NOTICE

Hardware damage! Engine and generator set may use both American Standard and metric hardware. Use the correct size tools to prevent rounding of bolt heads and nuts.

NOTICE

When replacing hardware, do not substitute with inferior grade hardware. Screws and nuts are available in different hardness ratings. American Standard hardware uses a series of markings and metric hardware uses a numeric system to indicate hardness. Check markings on bolt head and nuts for identification.

NOTICE

Canadian installations only:
For standby service connect output of generator set to a suitably rated transfer switch in accordance with Canadian Electrical Code, Part 1.

NOTICE

This generator set does 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.

Introduction

All information in this publication represents data available at time of print. Kohler Co. reserves the right to change this literature and the products represented without incurring obligation.

Read through this manual and carefully follow all procedures and safety precautions to ensure proper equipment operation and to avoid bodily injury. Read and follow the Safety Precautions and Instructions section at the beginning of this manual. Keep this manual with equipment for future reference.

Equipment service requirements are minimal but are very important to safe and efficient operation; therefore, inspect parts often and perform required service at the prescribed intervals. An authorized service distributor/dealer should perform required service to keep equipment in top condition.

Service Assistance

For sales and service in the U.S.A. and Canada, check the yellow pages of the telephone directory under the heading GENERATORS– ELECTRIC for an authorized service distributor/dealer or call 1-800-544-2444.

For sales and service outside the U.S.A. and Canada, contact your local distributor.

For further information or questions, contact the company directly at the following address or number:

KOHLER CO., Kohler, Wisconsin 53044 U.S.A.
Phone: 414-565-3381
Fax: 414-459-1646 (U.S.A. Sales)
414-459-1614 (International)

To ensure supply of correct parts or information, make note of the following identification numbers in the spaces provided:

GENERATOR SET

MODEL, SPEC, and SERIAL numbers are found on the nameplate attached to the generator set.

Model No. _____

Specification No. _____

Serial No. _____

GENERATOR SET ACCESSORIES

An alternate nameplate inside the junction box identifies factory-installed generator set accessories.

Accessory Nos. _____

_____

_____

_____

_____

_____

_____

_____

ENGINE

The engine serial number is found on the engine nameplate.

Engine Serial No. _____

Section 1. Specifications

General Specifications

	7CCO61 (In-line Radiator with Suction Fan)
Dimensions: Length x Width x Height– in. (mm)	34.68 (881) x 18.68 (475) x 25.96 (659)
Weight– lbs. (kg)	482 (219)
Air Requirements:	
Combustion– cfm (m^3/min.)	25 (0.71)
Cooling– cfm	1050 (29.7)
Fuel Inlet Size– in. (mm)	5/16 (8)
Fuel Return Size– in. (mm)	3/16 (5)

Fuel Consumption	**Diesel– gph (Lph)**			
Load	25%	50%	75%	100%
7CCO61	0.34 (1.3)	0.44 (1.7)	0.57 (2.2)	0.79 (3.0)

DERATION: All units are rated 1.0 power factor. The kilowatts of the generator set will decrease 3.5% for each 1,000 feet (305 meters) above 500 feet (152 meters) above sea level and 1% for each 10°F (5.5°C) above 85°F (30°C).

Engine

The chart below and on the following page includes some general engine specifications. Refer to the appropriate service section and the engine service manual for specific service details.

	7CCO61
Manufacturer	Kubota
Model	D905BG-2
Type	Water-cooled, 4-cycle diesel engine
Number Cylinders	3
Firing Order	1-2-3
Compression Ratio	22:1
Displacement– cu.in. (cu. cm.)	54.86 (898)
Rated Horsepower (60 Hz)	12.6
RPM (60 Hz)	1800
Direction of Rotation (as viewed from generator end)	Counterclockwise
Bore– in. (mm)	2.83 (72)
Stroke– in. (mm)	2.90 (73.6)
Combustion System	Indirect injection
Valve Clearance (cold)– in. (mm)	0.0057-0.0072 (0.145-0.185)
Cylinder Block Material	Cast iron
Cylinder Head Tightening Torque– ft. lbs (Nm)	47.0-50.6 (63.7-68.6)
Cylinder Head Material	Cast iron
Crankshaft Material	Alloy steel
Connecting Rod	Forged carbon steel
Piston Rings	2 compression/1 oil
Main Bearings	Replaceable sleeve
Governor	Mechanical
Lubrication System	Pressure
Oil Capacity (with filter)– qts. (L)	5.4 (5.1)
Oil Type (API)	MIL-L-2104C, or API classification CC, CD, or CE
Oil Pressure– psi (kPa)	25-64 (172-441)
Fuel Recommendation	Diesel fuel no. 2-D (ASTM D975)
Alternative Fuel Types*	JP8, Jet A, Jet A1, DF No. 1, JP5
Fuel System	Electric solenoid fuel shutoff
Fuel Injection Pump	Bosch MD
Fuel Injection Timing (BTDC)	16.5°-18.5°
Fuel Injection Pressure– psi (kgf/cm sq.)	1991-2133 (140-150)
Fuel Pump Lift (max.)– ft. (m)	3.28 (1.0)
Battery Voltage	12
Battery Ground	Negative
Battery Recommendation (min.)	800 cold cranking amps
Battery Charging Alternator (max.)	20 amps @ 12 volts
Belt Tension (force)– in. (mm)	0.28-0.35 (7-9) @ 22 lbs. (10 kg)
Alternator Overbolt Torque– in. lbs. (ft. lbs.)	300 (25)
Starter Motor	Gear-reduction type
Cooling System	Liquid
Cooling System Capacity– qts. (L)	2.44 (2.3)
Cooling Recovery Tank– qts. (L)	0.85 (0.8)
Pressure Cap Rating (On Radiator)– psi (kPa)	20-24 (138-165)
Pressure Cap Rating (On Coolant Fill)– psi (kPa)	13 (89)
Air Cleaner	Dry paper element

* Combined power loss may be as high as 15% from published H.P. curves.

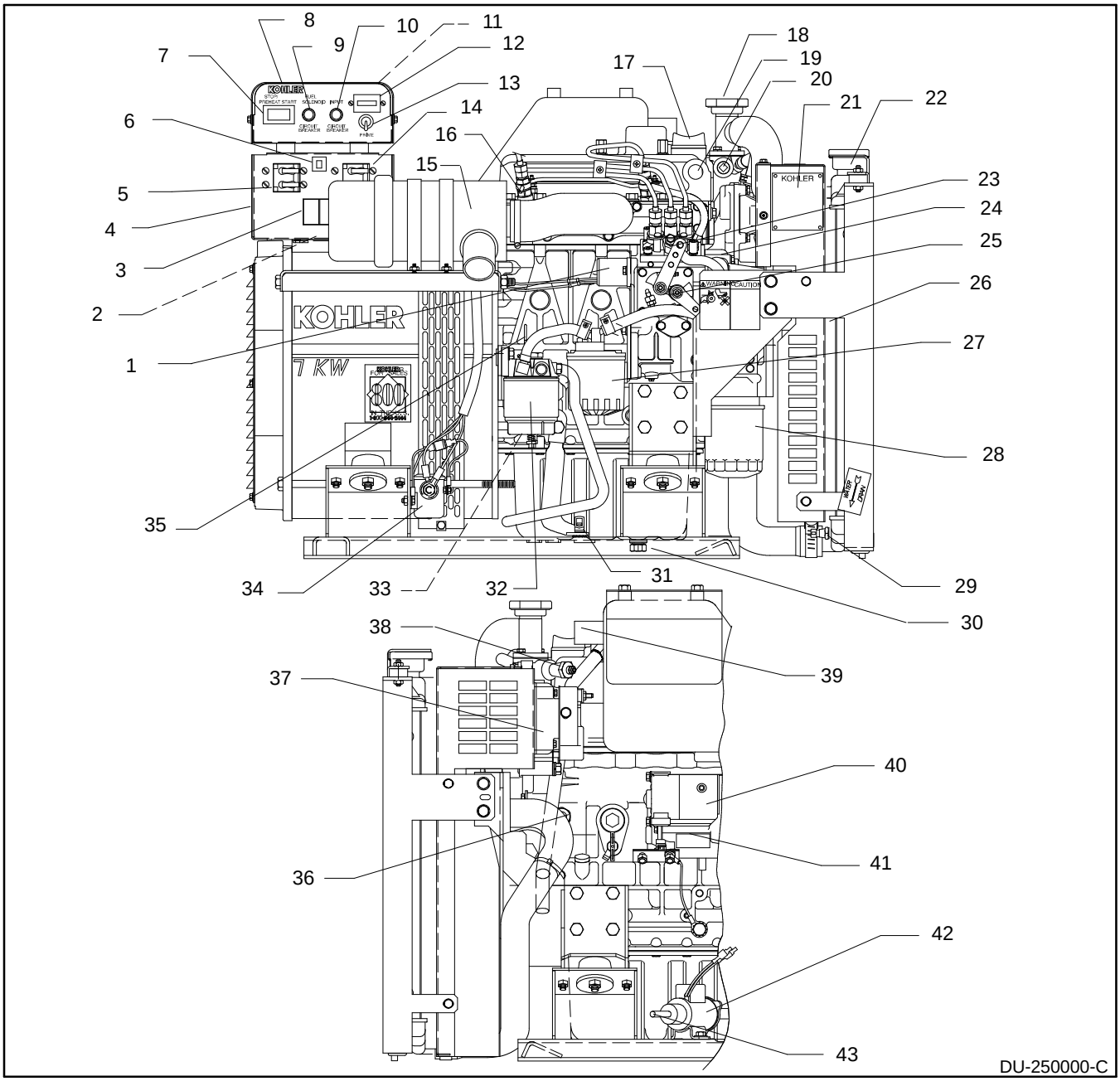
Engine (Continued)

	7CCO61
Cold Weather Starting Aids	Glow plugs
Air Restriction Limit:	
Initial– in. (mm) of water	7.9 (200)
After Use– in. (mm) of water	19.7 (500)
Back Pressure Limit (maximum)– in. (mm) of water at 1800 RPM	21.4 (544)
Angular Operation (max.)	20° (continuous)
In all directions	30° (10 minutes or less)

Generator

	7CCO61
Rated kW	7.0
Frequency– Hz	60
Rated Voltage	120/240 volt, 3 wire, single phase
Rated Amps (120/240 Volt)	29.2
Stator Resistance Cold (ohms)** Leads:	
1-2, 3-4, 33-44	0.13
55-33	1.60
B1-B2	0.08
Stator Output Voltages with Separately Excited Rotor Using 12-Volt Battery:	
1-2, 3-4, 33-44	105
33-55	125
B1-B2	12
Rotor Resistance Cold (ohms)**	3.9
Rotor Field Voltage/Current Readings at Rated Output Voltage (Hot):	
No Load (63 Hz)	16 v/2.5 amps
Full Load (60 Hz)	41 v/5.5 amps
Generator Type	Four pole, rotating field
Coupling Type	Flexible disc
Excitation Method	Static brush type
Overbolt Torque– ft. lbs. (in. lbs.)	25 (300)
Voltage Regulator Type	PowerBoostä IIIE
Voltage Regulation	±2%
Frequency Regulation	±5%
Insulation (Rotor and Stator)	Class 155, epoxy varnish, vacuum impregnated
Winding Material	Copper
Bearing (Number and Type)	1, replaceable ball
Circuit Protection:	
Controller	10-amp circuit breaker
AC Output	(2) 30-amp, 2-pole circuit breakers
Voltage Regulator	10-amp circuit breaker
Fuel Solenoid	10-amp circuit breaker
Customer-Supplied Receptacles (Ground Fault Circuit Interrupter)	30-amp circuit breaker

** Most ohmmeters will not give 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 (discoloration). Do not confuse a low resistance reading with a reading indicating a shorted winding.



1. Fuel solenoid
2. Voltage regulator (inside junction box)
3. Circuit breaker #3 (customer-supplied receptacles)
4. Junction box
5. Circuit breaker #1 (main)
6. Voltage regulator circuit breaker
7. Start/stop-preheat switch
8. Controller
9. Fuel solenoid circuit breaker
10. Input circuit breaker
11. Remote connection (at rear of controller)
12. Hourmeter
13. Fuel prime switch
14. Circuit breaker #2 (customer-supplied lights)
15. Air cleaner
16. Fuel return connection point
17. Oil fill
18. Coolant fill (initial)
19. Lifting eye
20. High water temperature switch
21. Generator nameplate
22. Pressure cap at radiator
23. Fuel injection pump
24. Oil fill
25. Mechanical governor
26. In-line radiator
27. Fuel filter
28. Oil filter
29. Coolant drain
30. Oil drain
31. Ground connection
32. Fuel/water separator
33. Negative battery connection (far side)
34. Glow plug relay
35. Oil check
36. Low oil pressure sender and switch
37. Battery charging alternator (behind guard)
38. High water temperature sender
39. Exhaust outlet
40. Starter
41. Positive battery connection
42. Fuel pump (located on non-service side)
43. Fuel inlet connection point

Figure 1-1. Service View of 7CCO61

Section 2. Operation

To ensure continued satisfactory operation, check the following items before each startup and at regular intervals.

Prestart Checklist

Air Cleaner. Keep air cleaner element clean. Install element to keep unfiltered air from entering engine.

Air Inlets. Keep clean and unobstructed.

Battery. Ensure tight battery connections. Maintain full battery electrolyte level.

Coolant Level. For cooling systems equipped with a coolant recovery tank, check coolant level at tank after the engine has cooled.

Do not add coolant to a hot engine. Wait until engine has cooled. Adding coolant to a hot engine can cause engine damage.

Drive Belts. Check belt condition and tension of radiator fan, water pump, and battery charging alternator belt(s).

Exhaust System. Keep exhaust outlet clear. Keep muffler and piping tight and in good condition.

Fuel Level. Keep tank(s) full to ensure adequate fuel supply.

Oil Level. Maintain oil level at or near full but not over.

Operating Area. Check for obstructions that could block the flow of cooling air. Keep the air intake area clean. Do not leave rags, tools, or debris on or near the generator set.

Exercising the Generator

Run the generator set under load once each week for one hour with an operator present.

Operator should perform all prestart checks before starting the exercise procedure. While the generator set is running, listen for a smooth-running engine and visually inspect the generator set to ensure there are no fluid or exhaust leaks.

Start the generator set according to the starting procedure in the controller section of this manual.

Controller

Depending on application, locate the controller at the set or at a location remote from the generator. Kohler Co. offers remote harnesses for the controller in 7.5- and 15-foot (2.3- and 4.6-meter) lengths. If the generator set has automatically stopped due to high water temperature (230°F/110°C) or low oil pressure (7 psi/48.3 kPa or less), correct the cause before restarting the set.

Refer to Figure 2-1 and the following descriptions to identify controller components.

1. **Generator Start/Stop-Preheat Switch** serves the dual function of generator operation and generator preheat. When pressed to the preheat position, the preheat switch aids in cold-weather starting. Refer to Start/Stop and Preheating procedures following.
2. **Fuel Solenoid Circuit Breaker (10 amp)** protects the fuel solenoid circuitry.
3. **Controller Circuit Breaker (10 amp)** protects the controller circuitry against damage if a short develops in the engine wiring system or the wiring to the remote start/stop switch.
4. **Remote Switch Connection** (located at rear of controller). Connect the remote start/stop switch to operate the generator set at a location remote from the set. Make controller connections through the plug connector at the rear of the unit.
5. **Hourmeter** records total generator set operating hours for reference in service schedule.
6. **Prime Switch** turns on electric fuel pump.

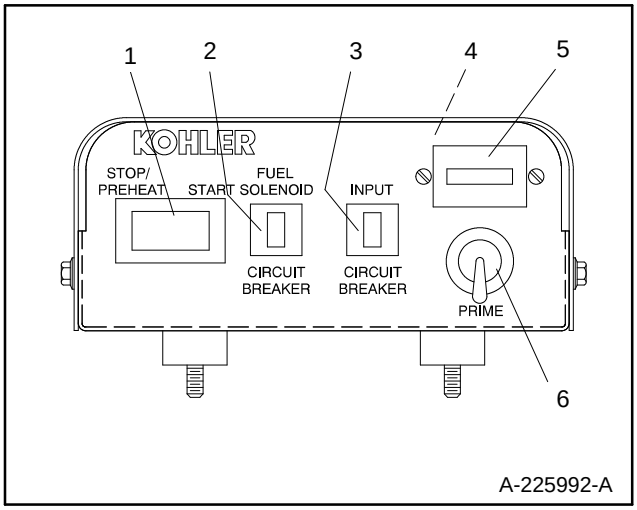
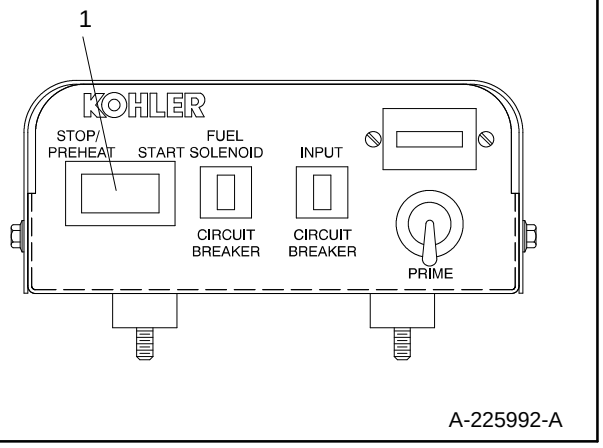


Figure 2-1. Controller

Starting Procedure

The generator includes a preheat feature. Place controller start switch in stop-preheat position for the amount of time shown in Figure 2-3 before attempting to start the generator set. This provides energizing of the glow plugs. Do not energize preheat feature for more than 20 seconds or damage may occur. See Figure 2-2 for location. Move the start/stop switch into the start position and hold in this position until the engine is running; then release. Do not crank engine continuously for more than 10 seconds at a time. Allow a 60-second cooldown period between cranking attempts if the engine does not start. If the unit fails to start after three attempts, contact an authorized service distributor/dealer for repair. Failure to follow these guidelines may result in damage to the starter motor.



1. Preheat switch

Figure 2-2. Preheat Switch Location

Ambient Temperature	Preheating Time
Above 23°F (–5°C)	Approx. 5 Seconds
Below 23°F (–5°C)	Approx. 10 Seconds
Limit of Continuous Use	20 Seconds

Figure 2-3. Preheating Time

NOTE

If the engine starts and then stops, allow the engine to come to a complete stop before making a restart attempt. If the flywheel ring gear is still rotating when the starter pinion gear is engaged, the pinion gear will clash which may damage the ring gear teeth.

See Figure 2-4 for cold-start procedure.

–25°F (–32°C) Cold Starting Procedure	
Preheat Time	20 Seconds
Crank Time	15 Seconds
Repeat preheat and crank cycle if necessary	

Note: Use arctic engine oil and fuel per engine manufacturer's recommendation. Do not operate the unit at elevated temperatures when using arctic oil and fuel.

Figure 2-4. Cold Starting Procedure

NOTE

Severe engine damage may occur on indirect fuel-injected engine if using ether or any other starting fluid to assist in starting the unit under cold conditions.

Stopping Procedure

Whenever possible, allow a brief cooling period by running the set at low or no load for a few minutes just prior to shutdown. To stop, push the switch into the Stop-Preheat position. If the generator set shuts down automatically, identify and correct the problem before attempting to restart.

NOTE

Do not place start/stop-preheat switch in stop-preheat position for more than 20 seconds or damage may occur to the preheat feature.

Coolant System Filling

The low-profile coolant system of the 7CCO61-Mobile generator set provides a compact design but requires a coolant recovery system to ensure that the system remains full of coolant. Also, fill the cooling system with fluid before placing the unit into service.

Because of the configuration of the system and its extremely low profile, fill the system with coolant *very slowly* to allow air to escape fully from the radiator and the engine block. After filling the coolant system, some air may still remain trapped in the system. Often, after starting the unit and running for approximately 10 to 15 minutes after filling, a shutdown may occur or the unit may continue to run but will not start at the next attempt. If either of these conditions occur, the shutdown may occur because of low coolant level in the radiator. As a remedy for this, add one to two cups of coolant to the radiator. Ensure connection of the coolant recovery tank to the system, as it is an integral and required part of the cooling system. Once the unit has been refilled after the initial fill, the coolant recovery system will replace the last small amounts of air, which remain trapped in the cooling system, with coolant.

Often, when troubleshooting the unit, many customers overlook the low coolant level and the low fuel level as possible causes for a shutdown. Any time a unit shuts down and customers cannot find any other cause, check for a low fuel or low coolant level condition. On a hot unit, remove the radiator pressure cap from the engine very slowly to release hot coolant into the coolant recovery tank.

⚠ WARNING

Hot coolant and steam.
Can cause severe injury or death.

Before removing pressure cap, stop generator set and allow it to cool. Then loosen pressure cap to relieve pressure.

Checking coolant level. Hot coolant can cause severe injury or death. Allow engine to cool. Release pressure from cooling system before opening pressure cap. To release pressure, cover the pressure cap with a thick cloth; then slowly turn it counterclockwise to the first stop. Remove cap after pressure has been completely released and the engine has cooled. Check coolant level at tank if generator set is equipped with a coolant recovery tank.

At the scheduled maintenance intervals, check the coolant while cold at the coolant recovery tank, as well as at the pressure cap prior to starting the unit for its maintenance. Add coolant at the pressure cap if it is not completely full. Add coolant to the recovery tank to bring the level up to the appropriate mark.

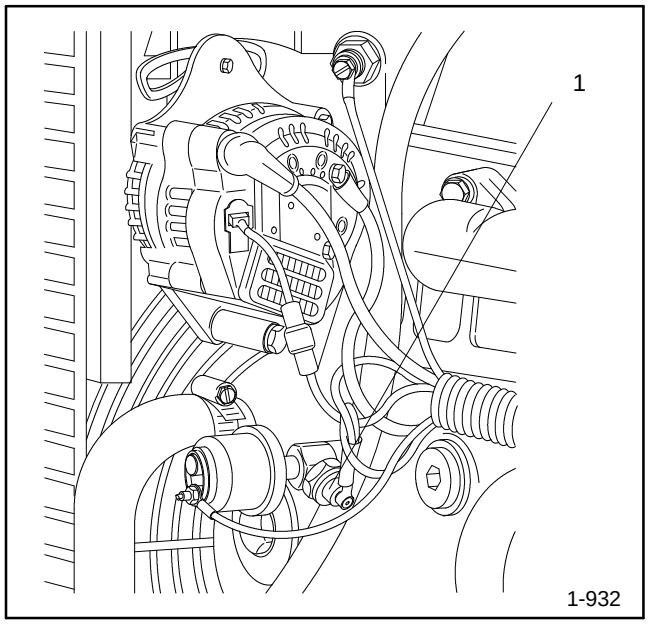
Fault Shutdowns

Low Oil Pressure Shutdown Switch

The low oil pressure (LOP) shutdown feature protects the engine against internal damage if the oil pressure drops below 7 psi (48.3 kPa) due to an 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.* Check the oil level regularly and add oil as needed to protect against running out of oil. Figure 2-5 shows the LOP shutdown switch.

NOTE

This is not a low oil *level* shutdown. Maintain correct oil level for the low oil pressure shutdown switch to function.



1. Low oil pressure switch

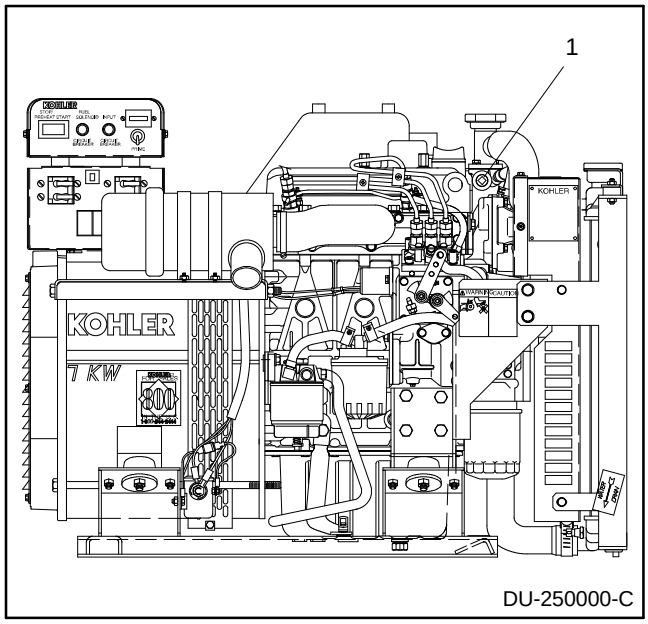
Figure 2-5. Low Oil Pressure Shutdown Switch

High Water Temperature Shutdown Switch

The generator set also contains a high water temperature (HWT) shutdown switch. See Figure 2-6. The unit will automatically shut down when the engine coolant temperature exceeds 230°F (110°C). Correct the cause of the shutdown before restarting the generator.

NOTE

This is not a low coolant level switch. Maintain correct coolant level for the high water temperature shutdown switch to function.



1. High water temperature switch

Figure 2-6. High Water Temperature Shutdown Switch

Section 3. Scheduled Maintenance

Schedule routine maintenance using the Service Schedule provided on the following pages and the hourmeter located on the generator controller. If subjecting the generator to extreme operating conditions, service the unit more frequently. The Operation/Installation Manual provides most of these instructions.

Perform items in the Service Schedule marked with an asterisk (*) more often if operating the generator set in dirty, dusty conditions. Items identified with asterisks (**) should only be performed by an authorized Kohler service distributor/dealer. Usually, tools and instruments required for these additional steps are not available to the generator set owner. For this reason, return the set periodically to an authorized service distributor/dealer for complete servicing and tune-up. Such service improves performance and provides continuous satisfactory operation during a long trouble-free service life.

NOTE

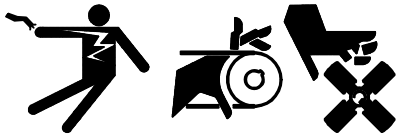
Perform the items listed in the Service Schedule at the designated intervals for the life of the generator. For example, an item serviced "Every 100 Hours or 3 Months" also requires servicing after 200 Hours or 6 Months, 300 Hours or 9 Months, etc. The generator will eventually accumulate enough hours 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 set problems. As part of a preventive 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.

NOTICE

Hardware damage! Engine and generator set may use both American Standard and metric hardware. Use the correct size tools to prevent rounding of bolt heads and nuts.

Refer to the Operation/Installation Manual (TP-5821) for basic service specifications/requirements not included in this manual.

⚠ WARNING

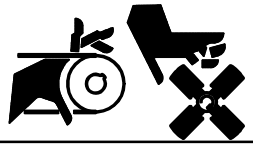


Accidental starting.
Can cause severe injury or death.

Disconnect battery cables before working on generator set (disconnect negative lead first and reconnect it last).

Disabling generator set. Accidental starting can cause severe injury or death. Disconnect battery cables (remove negative lead first and reconnect it last) to disable generator set before working on the generator set or connected equipment. The generator set can be started by the remote start/stop switch unless this precaution is followed.

⚠ WARNING



Rotating parts.
Can cause severe injury or death.

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

Servicing generator set when operating. Exposed moving parts can cause severe injury or death. Keep hands, feet, hair, clothing, and test leads away from belts and pulleys when generator set is running. Replace guards, screens, and covers before operating generator set.

Service Schedule

Perform Service at Intervals Indicated (X)	Before Starting	Every 1 Month or Hours as Noted	Every 3 Months or Hours as Noted	Every 6 Months or Hours as Noted	Yearly or Hours as Noted
FUEL SYSTEM					
Check the fuel level	X				
Fill the fuel tank	X				
Check the fuel pipes and clamps		X (50 Hrs)			
Remove sediment from the fuel tank				X (500 Hrs)	
Replace the fuel filter element (metal spin-on type)				X (500 Hrs)	
Remove sediment from the fuel/water separator		X (50 Hrs) Break-in period		X (Replace element at 600 Hrs)	
Check governor operation and adjust as necessary**					X (500 Hrs)
Check the nozzle injection pressure**					X (1000 Hrs)
Check and/or replace fuel filter (plastic in-line type)			X (100 Hrs)		
LUBRICATION SYSTEM					
Check the oil level in the crankcase	X				
Replace the oil in the crankcase*		X (50 Hrs) Break-in period	X (250 Hrs)		
Replace the oil filter element*		X (50 Hrs) Break-in period	X (250 Hrs)		
COOLING SYSTEM					
Check coolant level	X				
Check water pipes and clamps			X (100 Hrs)		
Adjust the tension of the water pump V-belt		X (50 Hrs) Break-in period	X (100 Hrs)		
Change coolant					X (1000 Hrs)
Clean radiator fins, inspect hoses			X (100 Hrs)		
AIR CLEANER, ETC.					
Replace the air cleaner element*				X (300 Hrs)	
Clean the breaker pipe*				X (300 Hrs)	

* Service more frequently if operated in dusty areas.

** Performed by an authorized service distributor/dealer.

Service Schedule (Continued)

Perform Service at Intervals Indicated (X)	Before Starting	Every 1 Month or Hours as Noted	Every 3 Months or Hours as Noted	Every 6 Months or Hours as Noted	Yearly or Hours as Noted
ELECTRICAL SYSTEM					
Check the electrolyte level in the battery			X (300 Hrs)		
Check the electrical connections			X (300 Hrs)		
Check the battery specific gravity			X (300 Hrs)		
Adjust battery charging alternator V-belt			X (100 Hrs)		
CYLINDER HEAD, ETC.					
Check for leakage of water and oil	X				
Retighten all major nuts and bolts		X (50 Hrs) Break-in period			X (500 Hrs)
Check mounting bolts and vibromounts for tightness					X (500 Hrs)
Retighten the cylinder head bolts**					X (1000 Hrs)
Adjust intake exhaust valve clearance**					X (800 Hrs)
GENERATOR					
Blow dust out of generator*					X (500 Hrs)
Clean slip rings and inspect brushes**					X (500 Hrs)

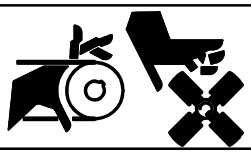
* Service more frequently if operated in dusty areas.

** Performed by an authorized service distributor/dealer.

Valve Adjustment

With poppet-type valve mechanism, each valve is spring-held in the closed position until forced open by the action of the rocker arm in contact with the push rod which is moved by the tappet which rides on a lobe of the camshaft. Rocker arms have adjusting screws with locknuts for adjusting the valve stem-to-rocker arm clearance. Check the intake/exhaust valve clearance at the interval specified in the Service Schedule. Valve clearance on both intake and exhaust valve is 0.006-0.007 in. (0.145-0.185 mm) with the engine cold.

⚠ WARNING



Rotating parts.
Can cause severe injury or death.

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

Tightening hardware. Flying projectiles can cause severe injury or death. Retorque all crankshaft and rotor hardware after servicing. Do not loosen crankshaft hardware or rotor thrubolt when making adjustments or servicing generator set. Rotate crankshaft manually in a clockwise direction only. Turning crankshaft bolt or rotor thrubolt counterclockwise can loosen hardware. Loose hardware can cause hardware or pulley to release from engine of generator set and can cause personal injury.

NOTE

The engine firing order is based on the number 1 piston being next to the crankshaft pulley, not the flywheel.

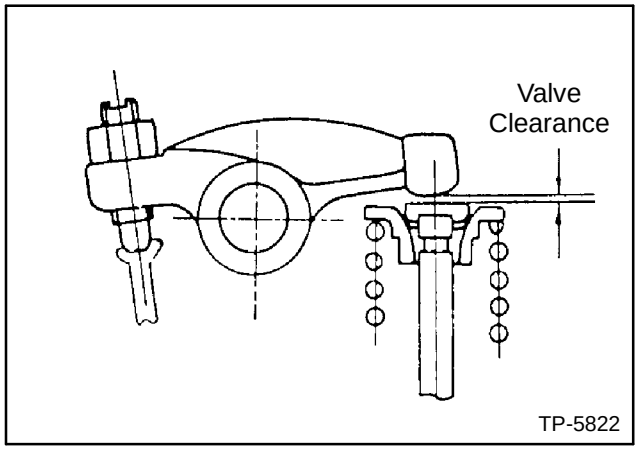


Figure 3-1. Valve Adjustment

1. Remove the rocker arm cover screws and breather hose at the rocker arm cover connection. Carefully remove the rocker arm cover from the cylinder head. Wipe excess oil from components using a clean rag.

NOTE

Be careful not to damage gasket or mating surfaces. Replace gasket if damaged.

2. Locate intake/exhaust valves of No. 1 cylinder. This is the first set of valves nearest the crankshaft pulley. Remove cooling fan and place three screws in the threaded holes of the pulley. Use a bar to rotate until reaching maximum clearance between intake/exhaust valves and rocker arms. 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 Top Dead Center (TDC), and both intake and exhaust valves will be closed.

3. Insert feeler gauge between rocker arm and exhaust valve. If necessary, loosen locknut and move adjusting screw so that very slight drag is felt on the feeler gauge as it is withdrawn. Tighten locknut on adjusting screw. Recheck clearance. See Figure 3-1. Repeat step for intake valve.

4. Repeat procedure to check and/or adjust each additional cylinder.

5. With mating surfaces clean and gasket properly aligned, install rocker arm cover and screws. Be careful that rocker arm cover gasket is properly seated in recessed hole.

Cylinder Head Retightening

Take the cylinder heads off the engine and service at the interval specified in the Service Schedule. Always use new cylinder head gaskets. Tighten head bolts in the correct sequence and to the torque value specified. See Figure 3-2.

1. Remove the cylinder head screws in descending order of 14 to 1 and remove the cylinder head.
2. Remove the cylinder head gasket and O-ring.
3. Replace the head gasket.
4. Install the cylinder head making sure not to damage the O-ring.
5. Tighten the cylinder head screws gradually in ascending order of 1 to 14 after applying engine oil.
6. Retighten the cylinder head screws after running the engine for 30 minutes.

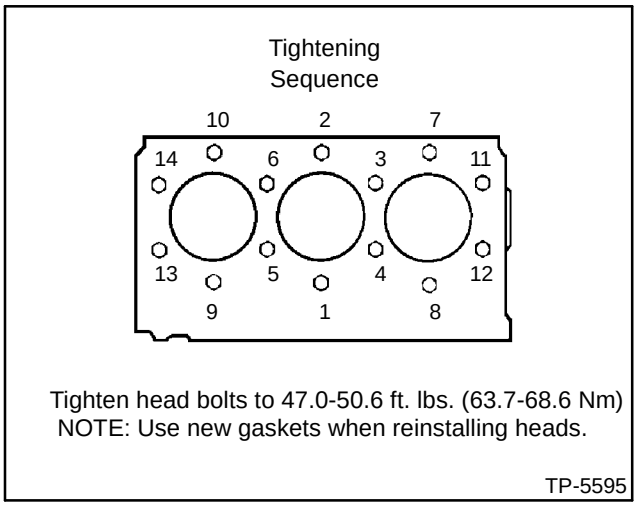


Figure 3-2. Cylinder Head Fastener, Tightening Sequence

Servicing Cooling System

For servicing the 7CCO61 generator set, refer to Figure 3-3 for coolant system disassembly and reassembly. During the reassembly procedure, follow the General Torque Specifications found in Appendix D. This generator set features a suction-type fan which is mounted to the hub, which is mounted to the crankshaft pulley. The suction fan draws air into the unit from the radiator inlet and then the air is discharged downward. See Figure 3-4.

Check and maintain the coolant level at the coolant recovery tank.

Observe the following recommendations for properly maintaining the generator set's coolant system:

- Never use dirty water or seawater as coolant.
- Tighten the pressure cap after using.
- Do not fill the coolant beyond the "HOT" mark on the coolant recovery tank.

Refer to Figure 3-5 for remote radiator specifications.

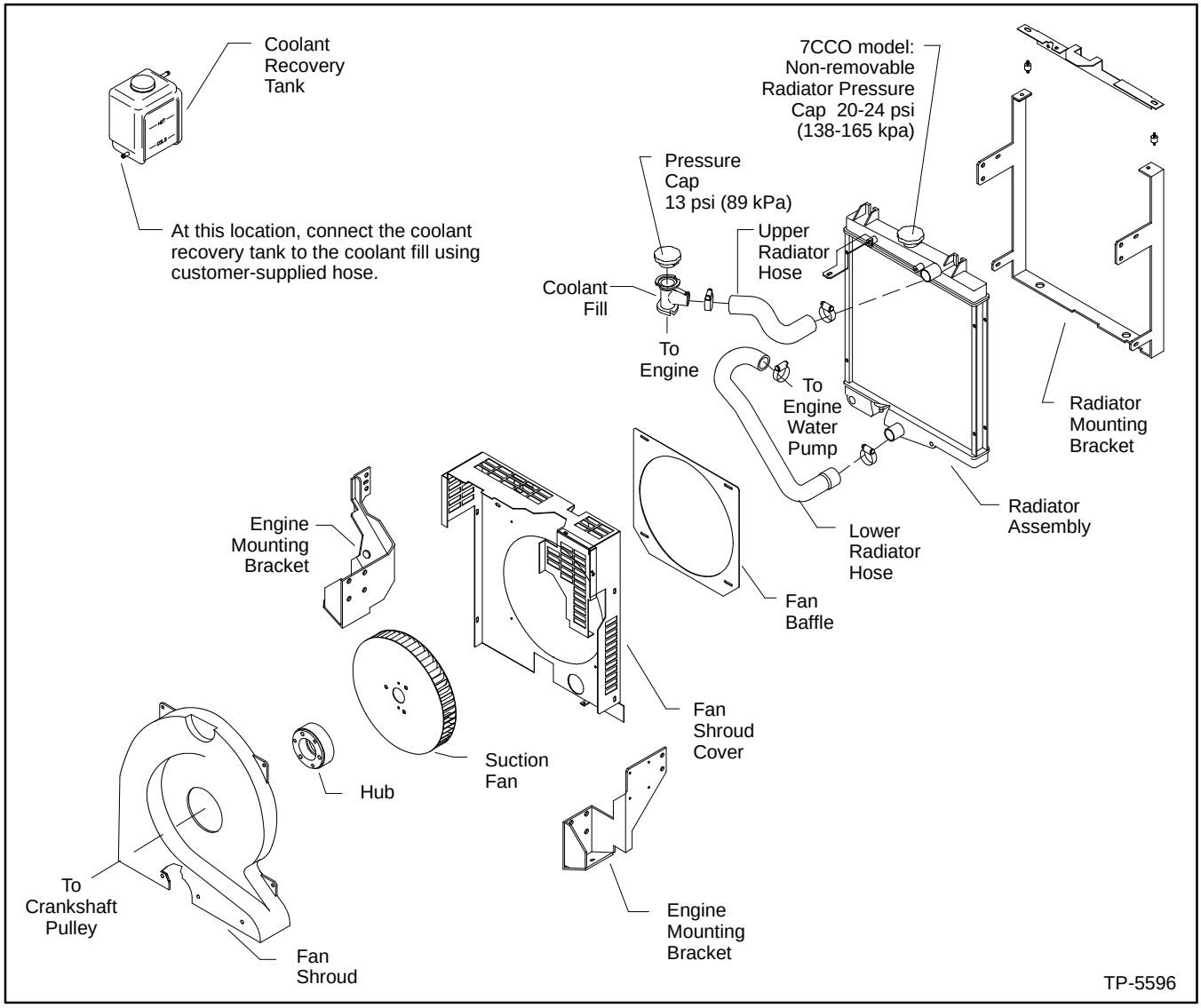


Figure 3-3. 7CCO61 Coolant System Exploded View

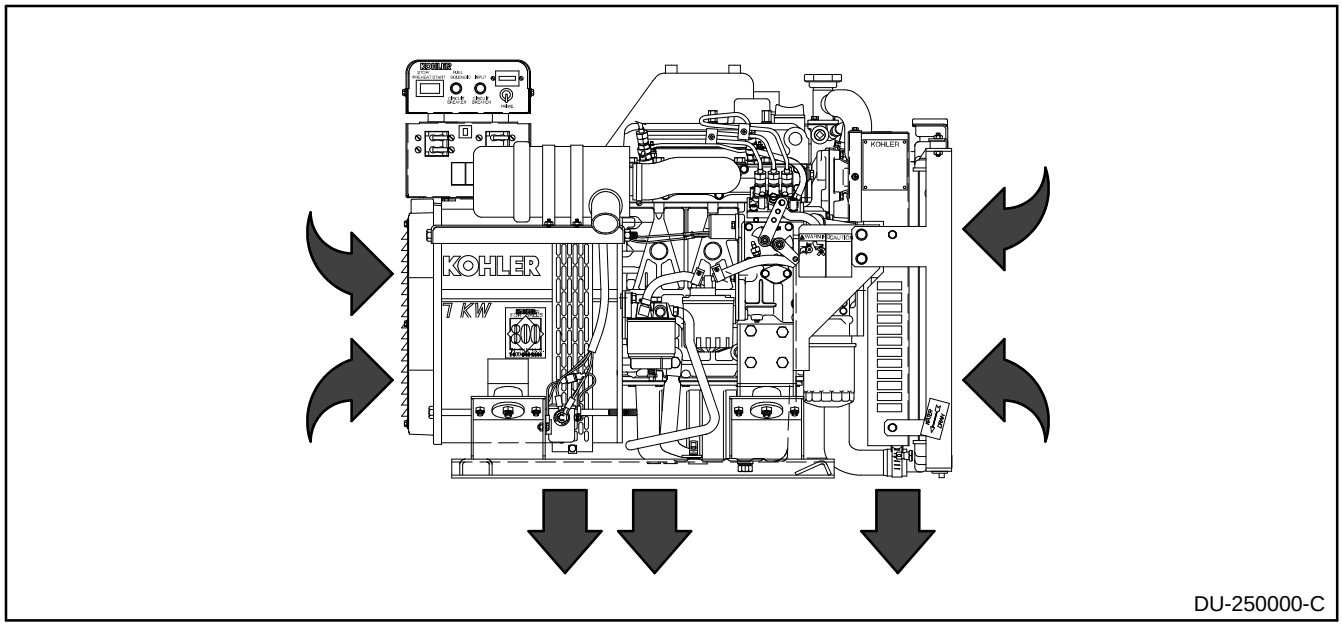


Figure 3-4. 7CCO61 Air Flow Direction Using Suction Fan

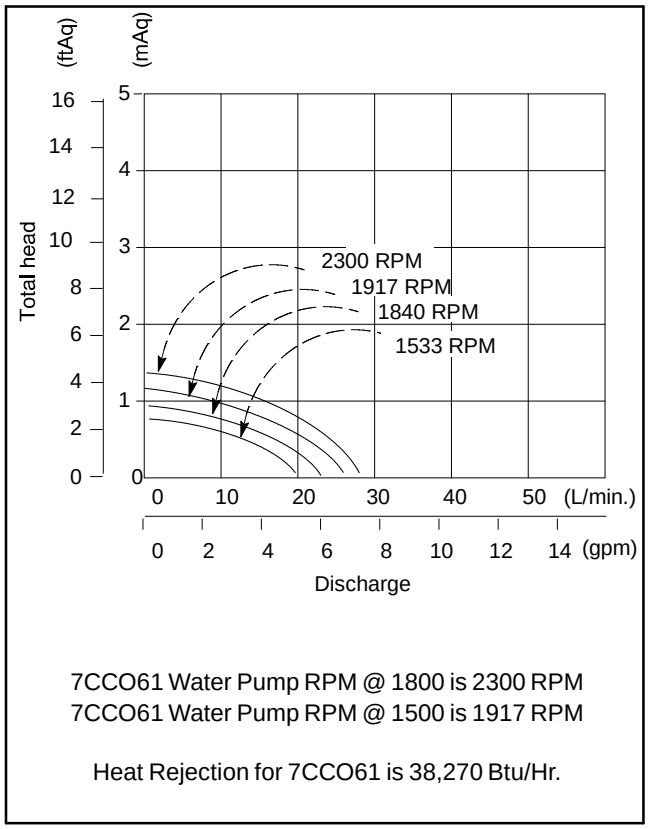


Figure 3-5. Water Pump Flow Rates and Engine Heat Rejection Values

Section 4. Troubleshooting

When troubles occur, don t overlook simple causes. An empty fuel tank can cause a starting problem. Keep all electrical connections secure. Remember the battery negative must have a good ground.

Corrective action and testing in many cases require knowledge of electrical and electronic circuits. Service should be performed only by authorized service distributors/dealers. Improper repair by unqualified personnel can lead to additional failures.

Use the following tables as a quick reference in troubleshooting individual problems. Generator set faults are listed by specific groups and include likely causes and remedies. Also listed is the reference information needed to correct a problem. These sources include various sections of this manual, the Operation and Installation Manual (O/I/M): TP-5821, and the Kubota Engine Service Manual: TP-5546.

Engine

Problem	Possible Cause	Corrective Action	Reference
Will not crank (dead)	Controller 10-amp circuit breaker tripped	Reset circuit breaker	
	Battery disconnected or improperly connected	Check connections	Section 9. Wiring Diagrams Section 3. Battery (O/I/M)
	Dead battery	Check electrolyte level and specific gravity (batteries with filler caps only). Perform load test.	Section 3. Battery (O/I/M)
	Corroded or loose battery connections	Clean or replace	Section 3. Battery (O/I/M)
	Open wiring, terminal, pin, foil, etc.	Check continuity	Section 7. Component Testing Section 9. Wiring Diagrams
	Defective starter	Service or replace	Engine Service Manual
	Defective starter relay	Check continuity of circuit. Bypass relay using jumper wire. If starter cranks, replace relay.	Section 7. Component Testing Section 9. Wiring Diagrams Engine Service Manual
	Defective start/stop switch	Check continuity	Section 7. Component Testing Section 9. Wiring Diagrams
	Defective K2, K3, or K25 relay	Check/replace defective relay	Section 7. Component Testing
	Remote start/stop switch not operating properly	Check wiring and connection to controller. If start/stop switch on controller functions, replace/repair remote switch and/or wiring.	Section 7. Component Testing Section 9. Wiring Diagrams

Problem	Possible Cause	Corrective Action	Reference
Will not start (cranks okay)	No fuel in tank	Replenish	
	Defective fuel solenoid	Check continuity	Section 7. Fuel Solenoid
	Defective fuel pump	Replace fuel pump. NOTE: Fuel pump is polarity sensitive and will fail if the lead connections are made in reverse.	Engine Service Manual Section 9. Wiring Diagrams
	Air cleaner clogged	Clean or replace element	Section 3. Air Cleaner Service (O/I/M)
	Air in fuel system	Bleed air	Section 3. Fuel System (O/I/M)
	Water, dirt in fuel system	Drain, flush fuel system	
	Improper type of fuel	Use proper type of fuel; consult fuel supplier	Section 3. Fuel System (O/I/M)
	Dirty or faulty injectors	Check injectors	Engine Service Manual
	Improper compression	Check compression	Engine Service Manual
	Improper type of crankcase lube oil	Use proper lube oil	Section 3. Lubrication System (O/I/M)
	Improper valve clearance	Check valve clearance	Section 3. Valve Adjustment Engine Service Manual
	Clogged fuel filter	Replace filter	Section 3. Fuel Filter (O/I/M) Engine Service Manual
	Open wiring, terminal, or pin (P2 connector)	Check continuity	Section 9. Wiring Diagrams
	K4 relay defective (K2 relay must be energized)	Check relay coil continuity	Section 7. Controller Circuit Board Section 9. Wiring Diagrams
	Weak or dead battery	Recharge battery. Check electrolyte level and specific gravity (batteries with filler caps only). Perform load test or replace battery.	Section 3. Battery (O/I/M)
	Defective glow plugs	Check/replace glow plugs	Engine Service Manual
	Defective glow plug relay	Check/replace glow plug relay	Section 7. Component Testing
Engine starts, but stops after start switch is released	Incorrect generator output voltage	Check AC output voltage	Section 7. Component Testing–Separate Excitation Section 9. Wiring Diagrams
	Open wiring (P1 or P2 connector)	Check continuity	Section 9. Wiring Diagrams
	K1 relay coil defective	Check continuity	Section 7. Controller Circuit Board Section 7. Stator Section 7. Component Testing Section 9. Wiring Diagrams
	If LED1 is not lit, K1 relay is not receiving power from stator B1/B2 winding		
	No/low oil pressure	Check oil pressure, oil pump, and low oil pressure (LOP) shutdown switch	Section 7. Component Testing Engine Service Manual
	High water temperature	Check engine cooling system	Engine Service Manual

Problem	Possible Cause	Corrective Action	Reference
Engine starts, but stops after start switch is released (continued)	Defective LOP shutdown	Disconnect lead from LOP switch and isolate terminal. If engine continues to run, replace LOP switch. LOP switch contacts close at approx. 7 psi (48.3 kPa). NOTE: Verify proper engine oil pressure before replacing LOP shutdown switch.	
	Circuit breaker tripped on voltage regulator circuit	Reset circuit breaker	
Hard starting	Stale or bad fuel	Replace	
	Air in fuel system	Bleed air	Section 3. Fuel System (O/I/M)
	Water, dirt in fuel system	Drain fuel system and/or replace fuel filters	
	Dirty or faulty injectors	Check injectors	Engine Service Manual
	Improper type of fuel	Use proper type of fuel; consult fuel supplier	Section 3. Fuel System (O/I/M)
	Air cleaner clogged	Clean or replace element	Section 3. Air Cleaner (O/I/M)
	Worn piston rings, valves, etc.	Check compression and oil consumption	Engine Service Manual
	Improper cooling (hot engine only)	Inspect cooling system	Section 3. Cooling System (O/I/M)
	Defective glow plugs	Check/replace glow plugs	Engine Service Manual
	Defective glow plug relay	Check/replace glow plug relay	Section 7. Component Testing
Generator set shuts down by itself	No fuel in tank	Replenish	
	Fuel line restriction	Inspect fuel lines and tank	
	Clogged fuel filter	Replace filter	Section 3. Fuel System (O/I/M)
	Defective fuel pump	Check fuel pump. NOTE: Fuel pump is polarity sensitive and will fail if the lead connections are made in reverse.	Engine Service Manual Section 9. Wiring Diagrams
	Air in fuel system	Bleed air	Section 3. Fuel System (O/I/M)
	Engine overloaded	Reduce electrical load	Section 3. Wattage Requirements (O/I/M)
	Engine overheated (hot engine only)	Check air intake, governor adjustment, oil level, etc.	Section 3. Scheduled Maintenance (O/I/M) Engine Service Manual
	Loss of generator output voltage to K1 relay (LED1 not lit)	Check AC voltage at rectifier (BR1). Check continuity of B1/B2 stator leads.	Section 7. Stator Section 9. Wiring Diagrams

Problem	Possible Cause	Corrective Action	Reference
Generator set shuts down by itself (continued)	Air cleaner clogged	Clean or replace element	Section 3. Air Cleaner Service (O/I/M)
	No/low oil pressure	Check oil level, oil pressure, oil pump, and LOP shutdown switch	Engine Service Manual
	High water temperature (HWT) shutdown	Check engine cooling system	Engine Service Manual
	Defective LOP shutdown switch	Disconnect lead from LOP switch and isolate terminal. If engine continues to run, replace LOP switch. LOP switch contacts close at approx. 7psi (48.3 kPa). NOTE: Verify proper engine oil pressure before replacing LOP shutdown switch.	
	Defective HWT shutdown switch	Disconnect lead from HWT switch and isolate terminal of lead. NOTE: Verify proper engine operating temperature before replacing HWT switch. If engine continues to run, replace HWT switch. HWT switch contacts close at approx. 230°F (110°C).	
Will not carry load or runs rough	Excessive load connected to generator	Reduce electrical load	Section 3. Wattage Requirements (O/I/M)
	Improper cooling (hot engine only)	Inspect cooling system	Section 3. Cooling System (O/I/M)
	Governor not properly adjusted or defective (engine not operating at rated rpm)	Check speed using tachometer or frequency meter. NOTE: Hz x 120/No. of rotor poles = rpm (Example: 60 x 120/4 = 1800)	Section 3. Governor (O/I/M)
	Engine in need of overhaul	Contact Kohler distributor	Engine Service Distributor
	Fuel line restriction	Inspect fuel lines and tank	
	Vent in fuel tank cap obstructed	Clean cap in solvent, blow dry	
	Dirty fuel filter	Replace fuel filter	Section 3. Fuel System (O/I/M)
	Improper type of fuel	Use proper type of fuel; consult fuel supplier	Section 3. Fuel System (O/I/M)
	Water, dirt, or air in fuel system	Drain, fill, and bleed air in the system. Replace fuel filters.	Section 3. Fuel System (O/I/M)
	Defective fuel pump	Check fuel pump. NOTE: Fuel pump is polarity sensitive and will fail if the lead connections are made in reverse.	Engine Service Manual Section 9. Wiring Diagrams

Problem	Possible Cause	Corrective Action	Reference
Will not carry load or runs rough (continued)	Fuel leak	Tighten fittings	Engine Service Manual
	Valves not seating	Compression test	Engine Service Manual
	Air cleaner clogged	Clean or replace element	Section 3. Air Cleaner Service (O/I/M)
	Incorrect fuel injection timing	Check injection timing	Engine Service Manual
	Dirty or faulty injectors	Check injectors	Engine Service Manual
	Improper cylinder top clearance	Check clearance	Engine Service Manual
	Defective piston or piston rings	Check components	Engine Service Manual
	Defective crankshaft bearing or piston pin bearing	Check components	Engine Service Manual
	Improper valve clearance	Adjust proper valve clearance	Engine Service Manual
	Excessive carbon build-up	Clean cylinder head	Engine Service Manual
	Improper compression	Check compression	Engine Service Manual
	Defective injection pump	Check injection pump	Engine Service Manual
	Improper lube oil	Use proper viscosity oil	Section 3. Lubrication System (O/I/M)
Lacks power	Governor not properly adjusted or defective (engine not operating at rpm)	Check engine speed using frequency meter or tachometer	Section 3. Governor (O/I/M)
	Air cleaner clogged	Clean or replace element	Section 3. Air Cleaner Service (O/I/M)
	Improper cooling	Inspect cooling system	Section 3. Cooling System (O/I/M)
	Engine overloaded	Reduce electrical load	Section 3. Wattage Requirements (O/I/M)
	Stale or bad fuel	Replace	
	Fuel line restriction	Check fuel lines and tank	
	Dirty fuel filter	Replace fuel filter	Section 3. Fuel System (O/I/M)
	Incorrect injection timing	Adjust injection timing	Engine Service Manual
	Uneven fuel injection	Repair/replace injectors and/or injection pump	Engine Service Manual
	Compression leak	Replace head gasket. Tighten cylinder head bolt, glow plug, and nozzle holder.	Engine Service Manual
	Carbon build-up	Clean carbon from cylinder heads	Engine Service Manual

Problem	Possible Cause	Corrective Action	Reference
Overheats	Low coolant	Replenish water coolant system	Section 3. Cooling System (O/I/M)
	Air cleaner clogged. Restricted air inlet.	Clean or replace element	Section 3. Air Cleaner Service (O/I/M)
	Fan belt broken or loose	Tighten/replace fan belt	Section 3. Drive Belt (O/I/M)
	Radiator clogged or dirty	Clean radiator (inside and outside)	
	Radiator cap defective	Replace radiator cap	
	Defective water pump	Check water pump	Engine Service Manual
	Engine malfunction	Troubleshoot engine	Engine Service Manual
	Improper cooling	Check cooling system. Check hoses for blockage and components for function.	Section 3. Cooling System (O/I/M)
Operates erratically	Air cleaner clogged	Clean or replace element	Section 3. Air Cleaner Service (O/I/M)
	Stale or bad fuel	Replace fuel	
	Governor not properly adjusted or defective (engine not operating at rated rpm)	Check engine speed using frequency meter or tachometer	Section 3. Governor (O/I/M)
	Fuel line restriction	Inspect fuel line and tank	
Unit is noisy	Exhaust system leak	Check and replace as necessary	Section 6. Exhaust System (O/I/M)
	Broken or damaged vibromounts	Check and replace as necessary	Section 8. Disassembly/Reassembly
	Loose or vibrating sheet metal/housing	Retighten screws	
	Inadequate compartment clearances	Check clearances	Section 6. Compartment Size (O/I/M)
	Exhaust piping or air inlets/outlets not securely installed	Inspect for loose parts	Section 6. Exhaust System (O/I/M)
	No compartment sound insulation	Install fireproof insulation	Section 6. Compartment Size (O/I/M)
	Excessive vibration– engine/ generator	Check rotor, crankshaft, bearing, etc. (Disassembly of engine and/or generator may be required)	Section 8. Disassembly/Reassembly Engine Service Manual Kohler Co. Distributor

Electrical System

Problem	Possible Cause	Corrective Action	Reference
Battery will not charge or goes dead	Loose or corroded connections	Clean and tighten connections	Section 3. Battery (O/I/M)
	Sulfated or worn-out battery	Check electrolyte level and specific gravity (batteries with filler caps only)	Section 3. Battery (O/I/M)
	Defective alternator	Test and replace if necessary	Section 7. Component Testing
	Loose or defective alternator belt	Adjust belt tension or replace belt	Section 3. Belt Tension (O/I/M)
	Defective alternator voltage regulator	Test and replace if necessary	Section 7. Component Testing
	Loose or corroded engine ground strap	Clean and tighten	Section 3. Battery (O/I/M)
Starter does not work properly	Loose or corroded connections	Clean and tighten loose connections	Section 3. Battery (O/I/M)
	Low battery output	Check electrolyte level and specific gravity (batteries with filler caps only)	Section 3. Battery (O/I/M)
	Defective starter relay	Check starter relay. Replace starter relay if necessary.	Section 7. Component Testing Engine Service Manual
	Defective start/stop switch	Replace switch	Section 7. Component Testing
	Defective wiring	Check wiring	Section 9. Wiring Diagrams
	Defective starter	Replace starter	Engine Service Manual
	Battery cables undersized	Select proper size cable	Section 6. Electrical System (O/I/M)
	Loose or corroded engine ground strap	Clean and tighten	Section 3. Battery (O/I/M)
Starter cranks slowly	Low battery output	Check electrolyte level and specific gravity (batteries with filler caps only)	Section 3. Battery (O/I/M)
	Too heavy viscosity oil	Use proper viscosity oil	Section 3. Lubrication System (O/I/M)
	Loose or corroded wiring	Clean and tighten loose connections	Section 3. Battery (O/I/M)
	High starter current draw	Repair/replace starter	
	Battery cable undersized	Section proper size cable	Section 6. Electrical System (O/I/M)

Generator

Problem	Possible Cause	Corrective Action	Reference
No generator output voltage	AC output circuit breaker open or defective	Check position of circuit breaker. Check AC voltage on generator side of circuit breakers.	Section 2. Relay Controller Section 9. Wiring Diagrams
	AC circuit breaker tripping because of overload on unit	Reduce load. Reset and attempt startup.	Section 3. Wattage Requirements (O/I/M)
	Short circuit in vehicle wiring causing circuit breaker to trip	Reset circuit breaker. If breaker trips again, check wiring.	Section 9. Wiring Diagrams
	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 tested with ohmmeter)	Section 7. Circuit Board Section 9. Wiring Diagrams
	K1 relay (normally closed) contacts open	Check continuity	Section 7. Circuit Board Section 9. Wiring Diagrams
	Defective rotor (open, grounded, or shorted windings)	Test and/or replace	Section 7. Rotor
	Defective stator (open, grounded, or shorted windings)	Test and/or replace	Section 7. Stator
	No battery voltage to terminal (+) and (–) of voltage regulator during cranking	Check for 12VDC at voltage regulator (+) and (–)	Section 9. Wiring Diagrams
	Circuit breaker tripped in voltage regulator circuit (lead 55)	Reset circuit breaker. If trips again, check voltage regulator and stator aux. windings.	Section 7. Voltage Regulator Section 9. Wiring Diagrams
	Open wiring, terminals, or pin in aux. winding circuit (field flashing)	Check continuity	Section 9. Wiring Diagrams
	AC circuit breakers in OFF position	Reset to ON position	
	No DC power to controller	Check battery connections	
	Defective voltage regulator. Misadjusted voltage regulator.	Excite (rotor) separately	Section 7. Separate Excitation Section 7. Voltage Regulator
	Brushes sticking in holder	Check alignment	Section 7. Brushes
	Rotor slip rings dirty or corroded	Check and/or service	Section 7. Brushes
	Broken, weak, or missing brush spring	Check condition	Section 7. Brushes

Problem	Possible Cause	Corrective Action	Reference
Low generator output voltage	Low engine rpm	Check engine speed using frequency meter or tachometer	Section 3. Governor Adjustments (O/I/M)
	Set overloaded	Make sure not to exceed capacity	Section 3. Wattage Requirements (O/I/M)
	Defective rotor	Test and/or replace	Section 7. Rotor
	Defective stator	Test and/or replace	Section 7. Stator
	Defective voltage regulator	Test and/or replace	Section 7. Voltage Regulator
	Improperly adjusted voltage regulator	Readjust	Section 7. Voltage Regulator
High generator output voltage	Defective voltage regulator	Test and/or replace	Section 7. Voltage Regulator
	Voltage regulator misadjusted	Readjust	Section 7. Voltage Regulator
	Open or poor splice connection at terminals 33-3 or 44-4 on stator (regulator sensing) or poor pin connection at voltage regulator; or grounded rotor.	Check continuity and clean connections	Section 7. Stator Section 9. Wiring Diagrams

Section 5. Controller Troubleshooting

The following section contains the controller sequence of operation when starting, running, stopping, or during fault shutdown of the set. Use this section as a starting point for controller fault identification. Refer to Figure 5-1 and Figure 5-2 for the accompanying wiring schematic. See Figure 5-3 for symbol descriptions.

Sequence of Operation

Starting

- Energize the preheat feature (by the amount of time shown on page 2-3) by closing the start/stop switch between leads 2 and 4. This energizes C1 relay. Normally open C1 contacts close to energize the glow plugs. Glow plugs remain energized during cranking. **NOTE:** Do not energize the preheat feature for more than 20 seconds or damage may occur.
- Close the start/stop switch between leads 3 and 4 (local or remote starting).
- K2 relay is energized (LED2 lights) and (–) field flashing current is energized. Normally open K2 contacts close to energize K3 relay (LED3 lights), K25 (fuel solenoid) relay, fuel pump, controller hourmeter, and (+) field flashing current.
- K3 relay normally open contacts close to energize K20 relay. K20 relay normally open contacts close to energize S relay (starter solenoid). S relay normally open contacts close to engage starter motor and energize "pull-in" coil of fuel solenoid.
- K25 normally open contacts close to energize "hold" coil of fuel solenoid.

Running

- When proper output is obtained from stator B1/B2 winding, K1 relay is energized (LED1 lights). After a 5-10 second time delay, K5 relay is energized (LED5 lights).

NOTE

Voltage to the K1 relay and K5 relay are rectified and regulated at 12-volts DC by BR1 and VR1.

- Stator winding 33-44 provides a voltage-sensing source to voltage regulator.

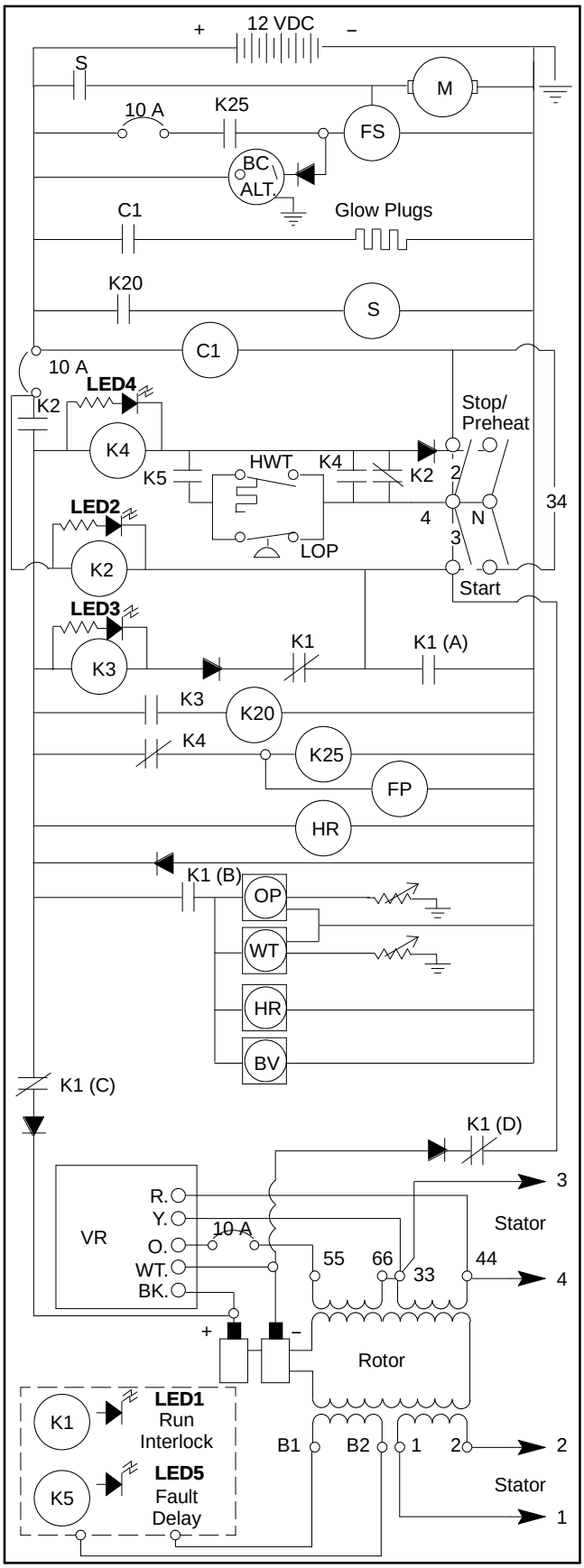


Figure 5-1. Sequence of Operation

- One set of normally open K1 (A) contacts close to maintain voltage to K2 relay (LED2 remains lit). Normally open K2 contacts remain closed to maintain voltage to fuel solenoid, fuel pump, and controller hourmeter.
- A second set of normally open K1 (B) contacts close to energize the (optional) remote hourmeter, battery voltmeter, oil pressure gauge, and water temperature gauge.
- One set of normally closed K1 (C) contacts open to disconnect (+) field flashing current.
- A second set of normally closed K1 (D) contacts open to disconnect (–) field flashing current. Another set of contacts also opens to de-energize K3 relay (LED 3 goes out) and prevents accidental reenergizing of starter motor. K3 contacts open to de-energize K20 relay. K20 relay contacts open to de-energize S relay. S relay contacts open to de-energize starter motor and the "pull-in" coil of the fuel solenoid.
- When the unit is running, start switch contacts 3 and 4 are opened by releasing start/stop rocker switch.
- Normally open K5 contacts close to permit engine high water temperature (HWT) and low oil pressure (LOP) switches to function. **NOTE:** LOP switch contacts open when engine develops proper oil pressure.

Stopping

NOTE

Keeping start/stop switch in the stop position too long will energize the glow plugs (see Section 2).

- Close start/stop switch between 2 and 4 (local or remote).
- K4 relay is energized (LED4 lights).
- Normally closed K4 contacts open to de-energize K25 relay and fuel pump relay. K25 normally open contacts open to de-energize fuel solenoid.
- Normally open K4 contacts close to maintain ground to K4 relay.
- As unit is shutting down, K1 relay is de-energized (LED1 goes out). Normally open K1 (A) contacts open to de-energize K2 relay (LED2 goes out). Normally closed K2 contacts close to ground circuit to K4 relay until unit comes to a complete stop.

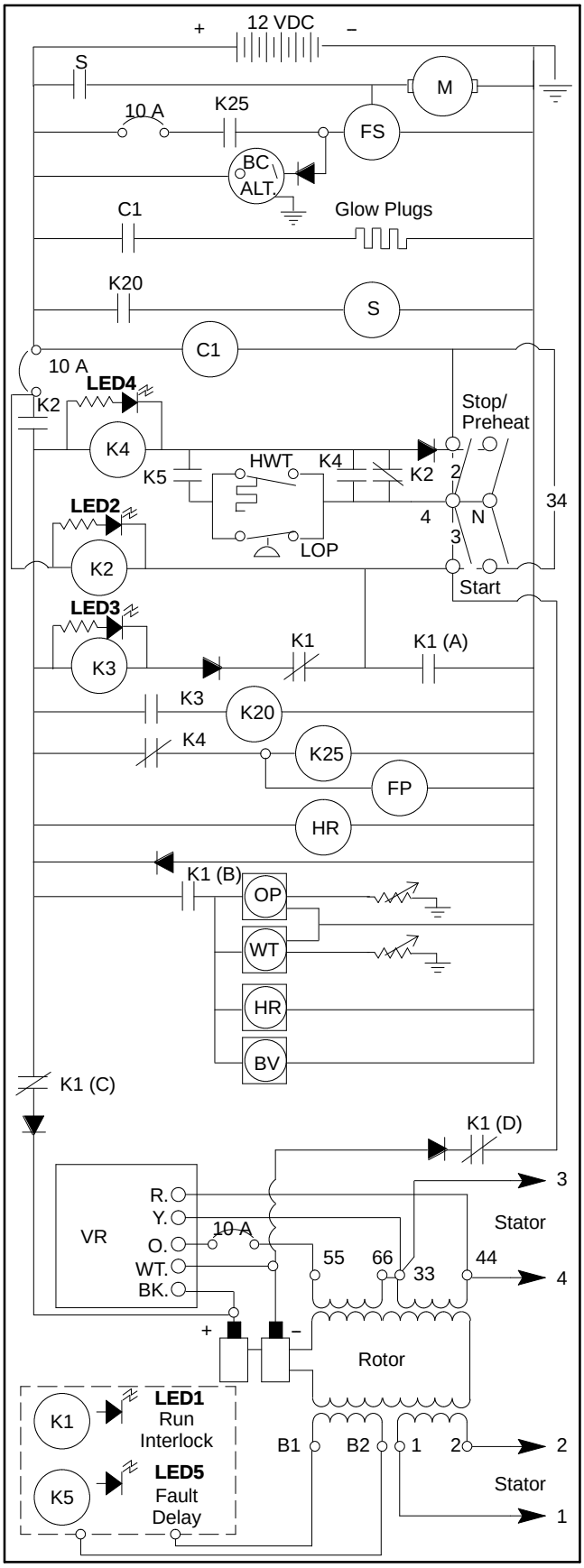


Figure 5-2. Sequence Of Operation

Engine Safety Shutdown Switches

Low Oil Pressure (LOP) Shutdown Switch

- When encountering low oil pressure, the LOP shutdown switch contacts close and energize K4 relay (LED4 lights).
  NOTE: During cranking low oil pressure shutdown switch is deactivated until K5 relay is energized. This allows the engine to reach normal operating oil pressure. Normally closed LOP contacts open when unit develops adequate oil pressure.
- Normally closed K4 contacts open to de-energize K25 relay and fuel pump relay. K25 normally open contacts open to de-energize fuel solenoid.
- Normally open K4 contacts close to maintain ground to K4 relay.
- As unit is shutting down, K1 relay is de-energized (LED1 goes out). Normally open K1 (A) contacts open to de-energize K2 relay (LED2 goes out). Normally closed K2 contacts close to ground circuit to K4 relay until unit comes to a complete stop.

High Water Temperature (HWT) Shutdown Switch

- When encountering high temperature, the shutdown switch contacts close and energize K4 relay (LED4 lights).
- Normally closed K4 contacts open to de-energize K25 relay and fuel pump relay. K25 normally open contacts open to de-energize fuel solenoid.
- Normally open K4 contacts close to maintain ground to K4 relay.
- As unit is shutting down, K1 relay is de-energized (LED1 goes out). Normally open K1 (A) contacts open to de-energize K2 relay (LED2 goes out). Normally closed K2 contacts close to ground circuit to K4 relay until unit comes to a complete stop.

A	Ampere rating (fuse or circuit breaker)
BC	Battery charging
BR1	Bridge rectifier (supply voltage)
BV	Battery volts
C1	Glow plug relay
CB	Circuit board
D	Diode
FP	Fuel pump
FS	Fuel solenoid
GRD	Ground
HR	Hourmeter
HWT	High water temperature switch
K1	AC crank disconnect relay (circuit board)
K2	Engine run control relay (circuit board)
K3	Engine crank control relay (circuit board)
K4	Fault shutdown relay (circuit board)
K5	Fault time relay (circuit board)
K20	Engine crank relay
K25	Fuel solenoid control relay
LED	Light emitting diode
LOP	Low oil pressure switch
M	Starter motor
OP	Oil pressure gauge
OPS	Oil pressure sender
PTC1	Positor
S	Starter relay
VR1	Voltage regulator
WT	Water temperature gauge
WTS	Water temperature sender

Figure 5-3. Wiring Diagram Legend

Section 6. Generator/Controller Troubleshooting

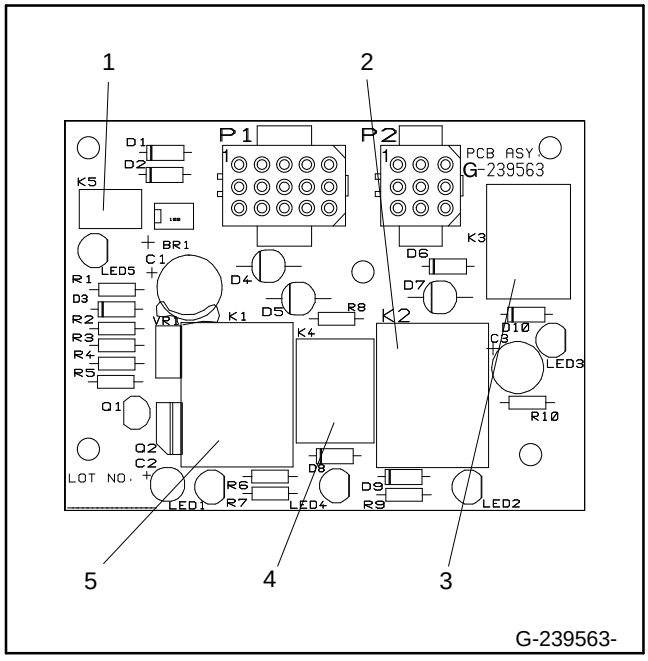
Use the following flowchart as a guide when troubleshooting the generator set, including the controller circuit board. Before beginning the troubleshooting procedures, read all safety precautions at the beginning of this manual. The test procedures include additional safety precautions; do not neglect these precautions.

Controller Circuit Board

The controller circuit board includes LEDs (light emitting diodes) to indicate the presence of relay coil power and aid in circuit board and generator fault detection. See Figure 6-1.

When K1, K2, K3, K4, or K5 relays are receiving power, the corresponding LED will light. The LED does not indicate whether the relay coil is energized. To determine the state of the relay coil, analyze the generator faults and perform a continuity test on the relay coil (see Section 7, Controller Circuit Board).

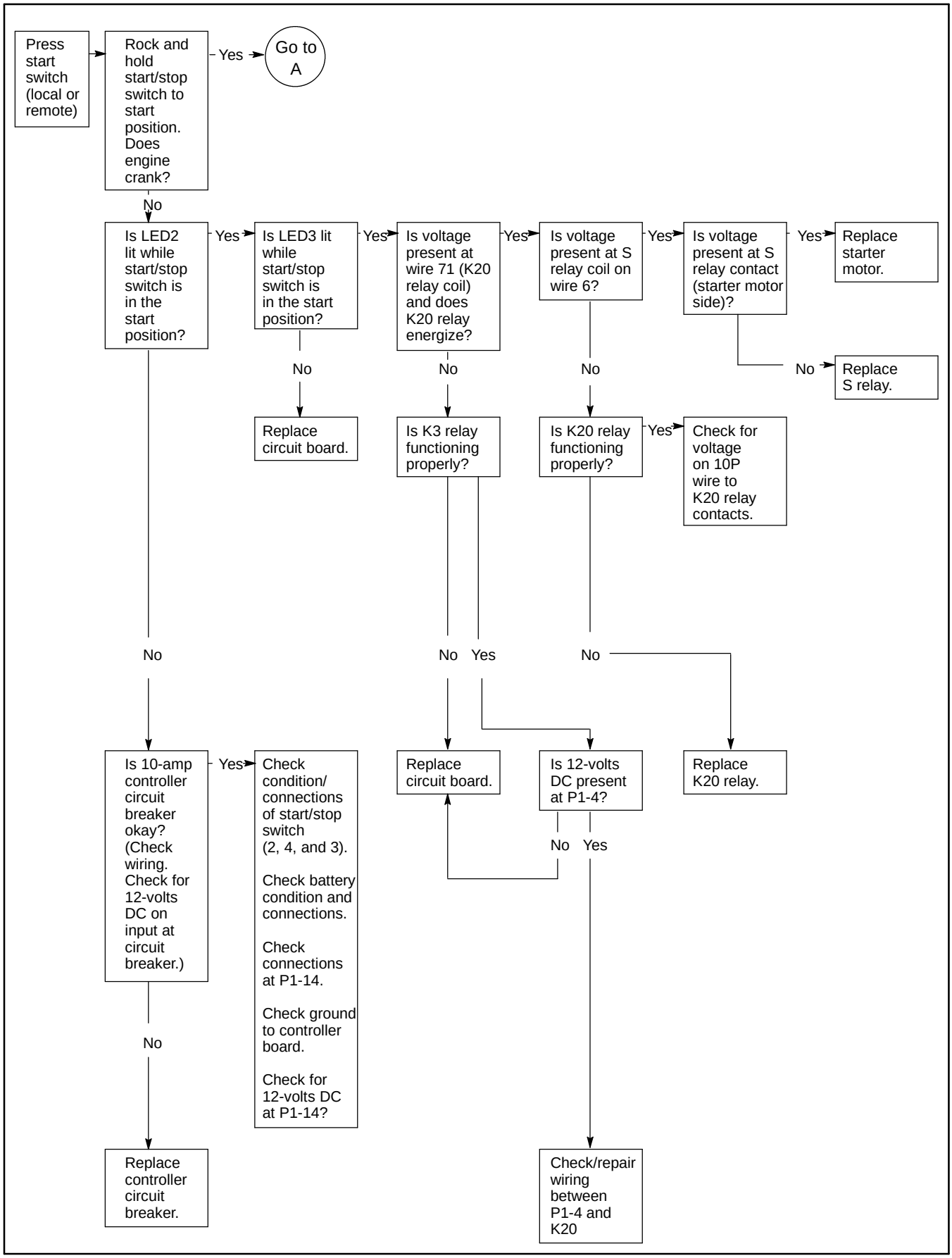
Where a check or test is referenced, go to that part of Section 7, Generator Testing and Adjustment for detailed instructions.

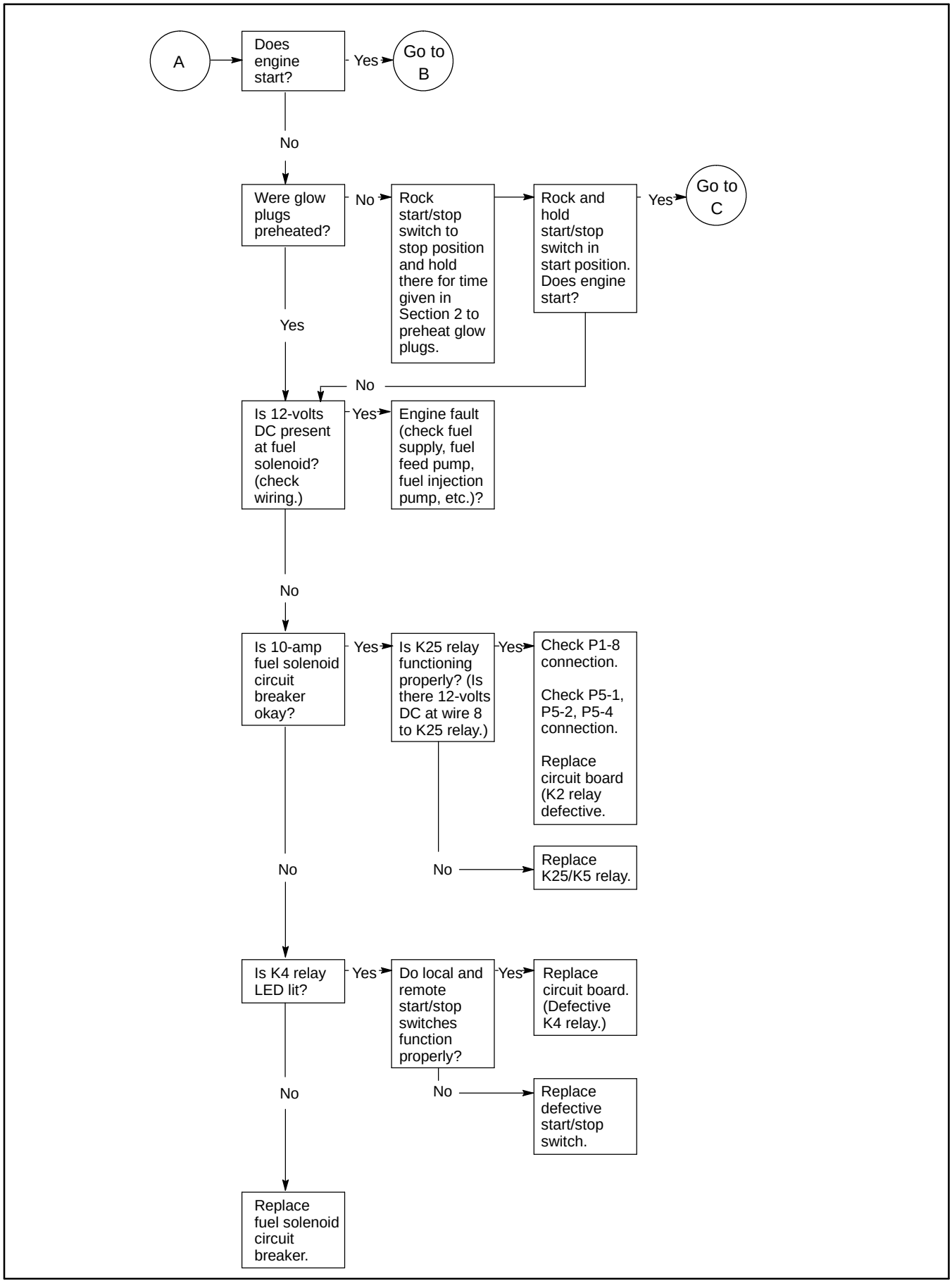


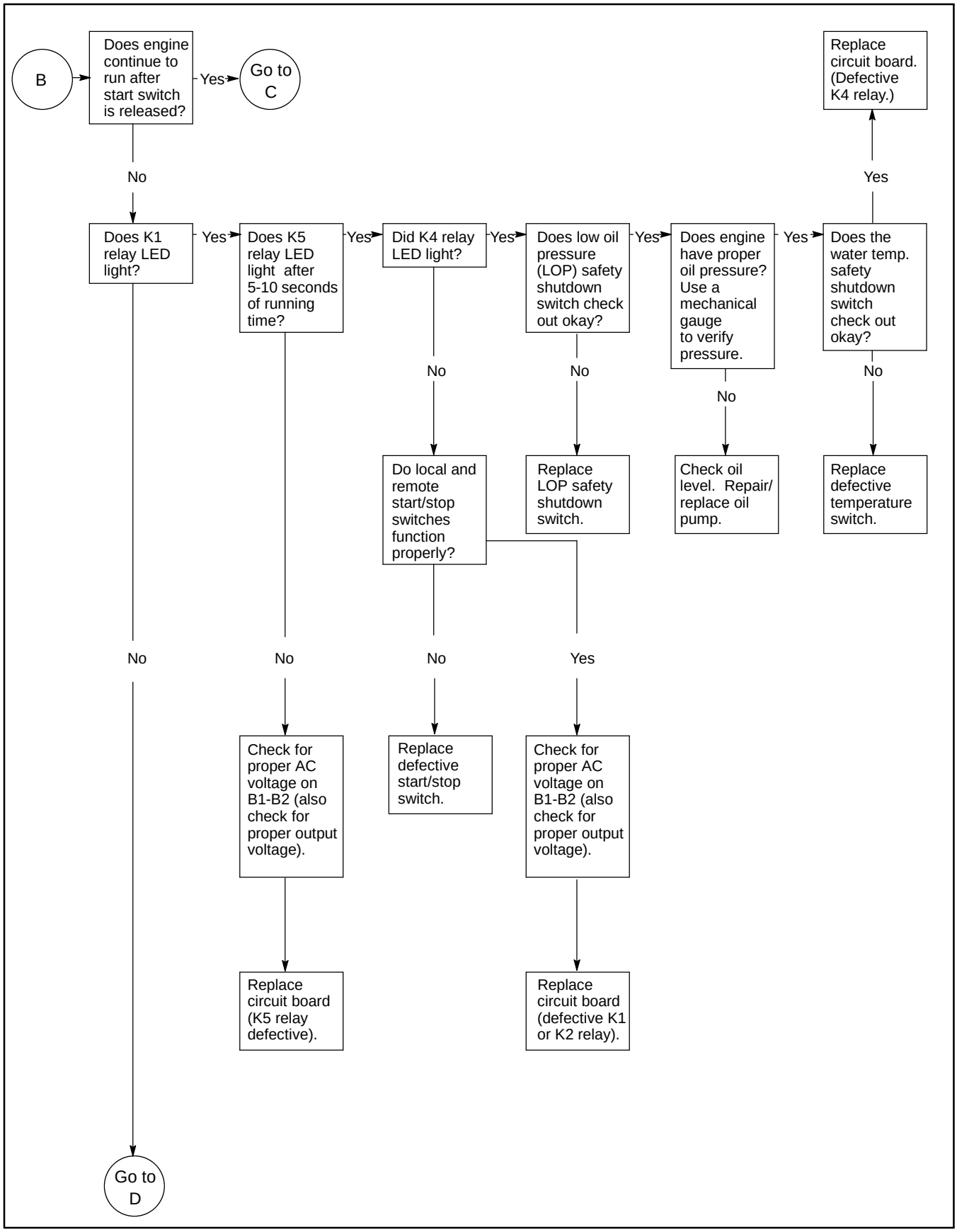
1. K5 relay (time delay)
2. K2 relay (engine run)
3. K3 relay (engine crank control)
4. K4 relay (fault shutdown)
5. K1 relay (AC crank disconnect)

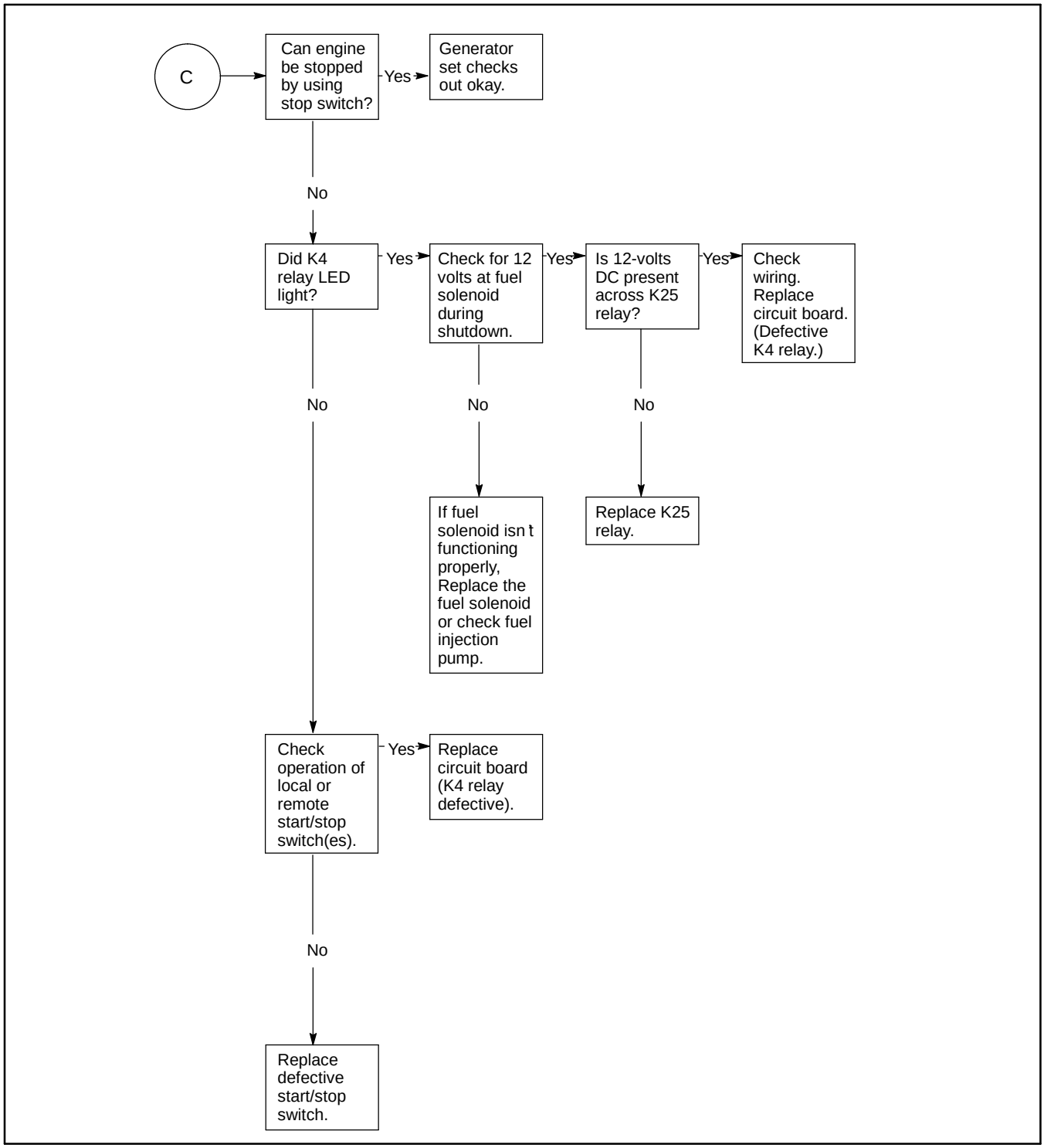
Figure 6-1. Controller Circuit Board G-239563

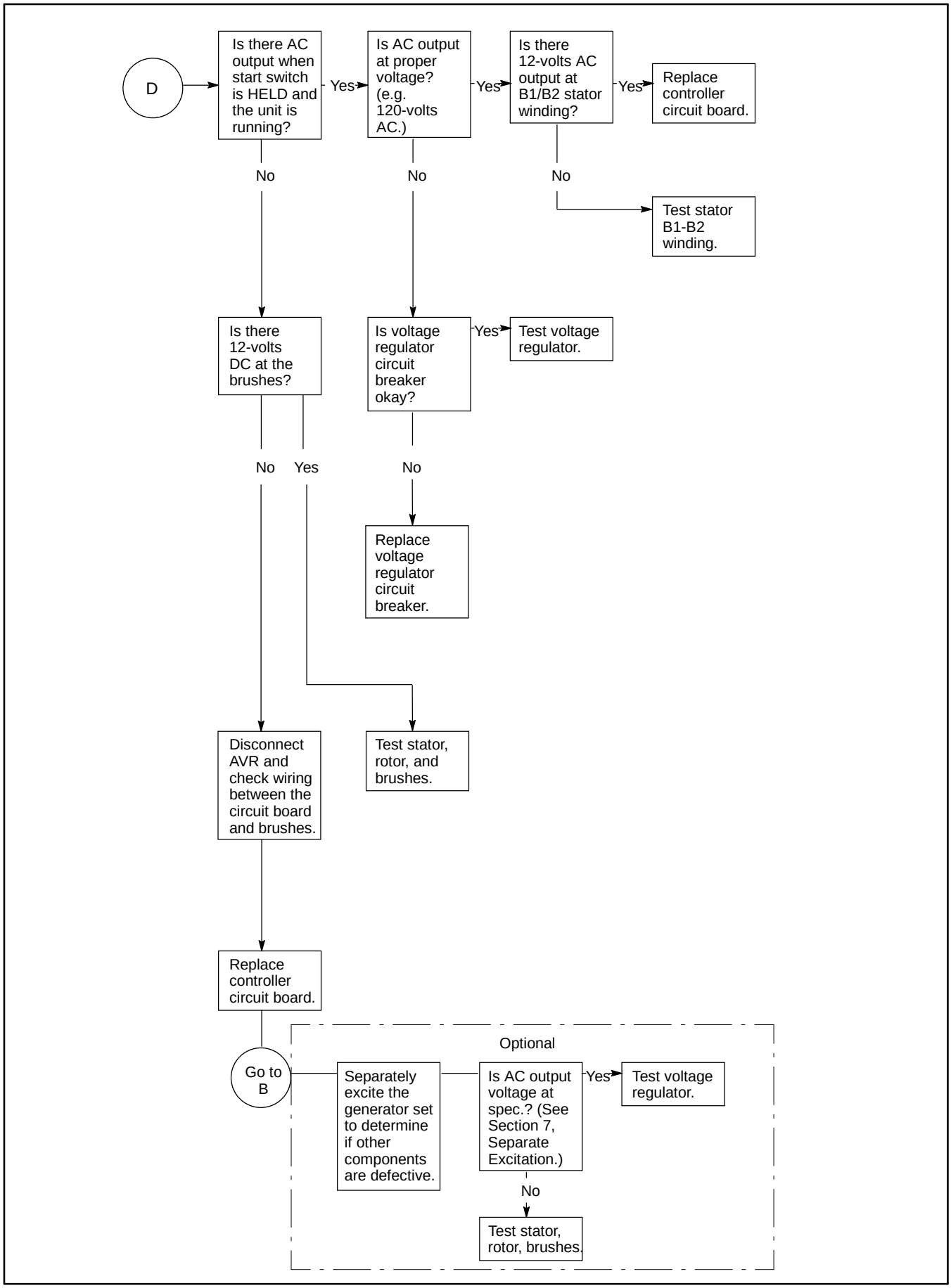
Generator/Controller Troubleshooting




A
Does engine start?
Yes
Go to B
No
Were glow plugs preheated?
No
Rock start/stop switch to stop position and hold there for time given in Section 2 to preheat glow plugs.
Rock and hold start/stop switch in start position. Does engine start?
Yes
Go to C
Yes
No
Is 12-volts DC present at fuel solenoid? (check wiring.)
Yes
Engine fault (check fuel supply, fuel feed pump, fuel injection pump, etc.)?
No
Is 10-amp fuel solenoid circuit breaker okay?
Yes
Is K25 relay functioning properly? (Is there 12-volts DC at wire 8 to K25 relay.)
Yes
Check P1-8 connection.
Check P5-1, P5-2, P5-4 connection.
Replace circuit board (K2 relay defective.
No
No
Replace K25/K5 relay.
Is K4 relay LED lit?
Yes
Do local and remote start/stop switches function properly?
Yes
Replace circuit board. (Defective K4 relay.)
No
No
Replace defective start/stop switch.
Replace fuel solenoid circuit breaker.


B
Does engine continue to run after start switch is released?
Yes
Go to C
No
Does K1 relay LED light?
Yes
Does K5 relay LED light after 5-10 seconds of running time?
Yes
Did K4 relay LED light?
Yes
Does low oil pressure (LOP) safety shutdown switch check out okay?
Yes
Does engine have proper oil pressure? Use a mechanical gauge to verify pressure.
Yes
Does the water temp. safety shutdown switch check out okay?
Yes
Replace circuit board. (Defective K4 relay.)
No
No
No
No
No
Do local and remote start/stop switches function properly?
Replace LOP safety shutdown switch.
Check oil level. Repair/ replace oil pump.
Replace defective temperature switch.
No
No
No
Yes
Check for proper AC voltage on B1-B2 (also check for proper output voltage).
Replace defective start/stop switch.
Check for proper AC voltage on B1-B2 (also check for proper output voltage).
Replace circuit board (K5 relay defective).
Replace circuit board (defective K1 or K2 relay).
Go to D


C
Can engine be stopped by using stop switch?
Yes
Generator set checks out okay.
No
Did K4 relay LED light?
Yes
Check for 12 volts at fuel solenoid during shutdown.
Yes
Is 12-volts DC present across K25 relay?
Yes
Check wiring. Replace circuit board. (Defective K4 relay.)
No
No
No
If fuel solenoid isn t functioning properly, Replace the fuel solenoid or check fuel injection pump.
Replace K25 relay.
Check operation of local or remote start/stop switch(es).
Yes
Replace circuit board (K4 relay defective).
No
Replace defective start/stop switch.


D
Is there AC output when start switch is HELD and the unit is running?
Yes
Is AC output at proper voltage? (e.g. 120-volts AC.)
Yes
Is there 12-volts AC output at B1/B2 stator winding?
Yes
Replace controller circuit board.
No
No
No
Test stator B1-B2 winding.
Is there 12-volts DC at the brushes?
Is voltage regulator circuit breaker okay?
Yes
Test voltage regulator.
No
Yes
No
Replace voltage regulator circuit breaker.
Disconnect AVR and check wiring between the circuit board and brushes.
Test stator, rotor, and brushes.
Replace controller circuit board.
Optional
Go to B
Separately excite the generator set to determine if other components are defective.
Is AC output voltage at spec.? (See Section 7, Separate Excitation.)
Yes
Test voltage regulator.
No
Test stator, rotor, brushes.

Section 7. Component Testing and Adjustment

This section is a guide for checking generator, controller, and some engine components for improper operation. 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.

Separate Excitation

To determine the cause of no AC output, separately excite the generator. The generator field (rotor) may be excited (magnetized) using an outside DC power source or 12-volt automotive battery and the following procedures. While 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). Centrifugal forces acting on the windings while rotating or insulation breakdown as temperatures increase may cause a fault.

⚠ WARNING

Hazardous voltage.

Moving rotor.

Can cause severe injury or death.

Operate generator set only with all guards and electrical enclosures in place.

Grounding generator set. Hazardous voltage can cause severe injury or death. Electrocution is possible whenever electricity is present. Open main circuit breakers of all power sources before servicing equipment. Configure the installation to electrically ground the generator set and electrical circuits when in use. Never contact electrical leads or appliances when standing in water or on wet ground, as the chance of electrocution is increased under such conditions.

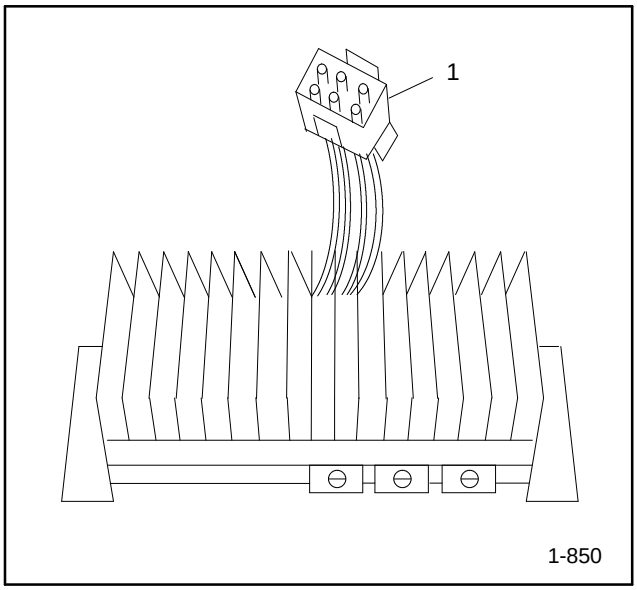
⚠ WARNING

Sulfuric acid in batteries.
Can cause severe injury or death.

Use protective goggles and clothes. Battery acid can cause permanent damage to eyes, burn skin, and eat holes in clothing.

Battery acid. Sulfuric acid in batteries can cause severe injury or death. Sulfuric acid in battery can cause permanent damage to eyes, burn skin, and eat holes in clothing. Always wear splash-proof safety goggles when working near the battery. If battery acid is splashed in the eyes or on skin, immediately flush the affected area for 15 minutes with large quantities of clean water. Seek immediate medical aid in the case of eye contact. Never add acid to a battery after placing the battery in service, as this may result in hazardous spattering of battery acid.

Battery gases. Explosion can cause severe injury or death. 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 charging. Avoid touching terminals with tools, etc., to prevent burns and 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. Sparks could ignite battery gases or fuel vapors. Ventilate any compartment containing batteries to prevent accumulation of explosive gases. To avoid sparks, do not disturb battery charger connections while battery is being charged. Always turn battery charger off before disconnecting battery connections. Remove negative lead first and reconnect it last when disconnecting battery.



1. Connector

Figure 7-1. PowerBoostä IIIE Voltage Regulator

1. Disconnect all leads from voltage regulator at the 6-pin connector. See Figure 7-1.

2. Connect an ammeter and a 12-volt automotive battery to the positive (+) and negative (–) brush leads. Include a 10-amp fuse to protect the circuit in case of a shorted rotor. Refer to Figure 7-2. Note and record the ammeter reading.

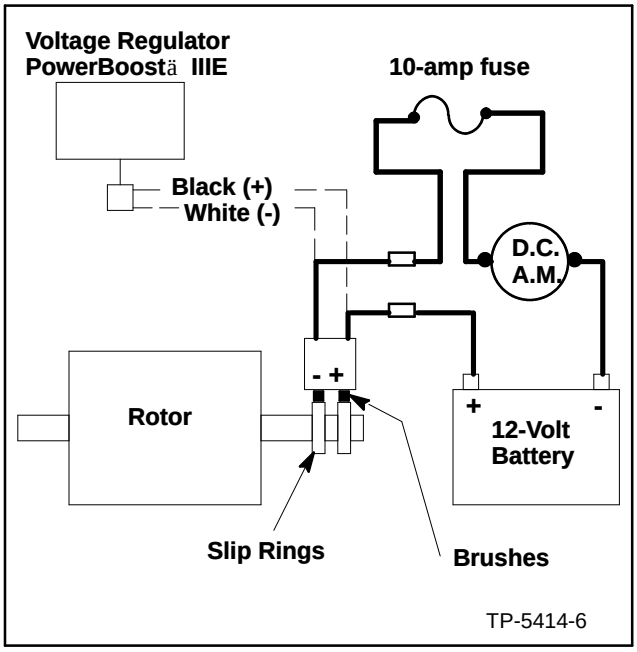


Figure 7-2. Separate Excitation Connections (PowerBoostä IIIE)

3. The approximate ammeter reading should be battery voltage divided by specified rotor resistance. For rotor resistance, see Section 1.

Example:

$$\frac{\text{12 Volts (Battery Voltage)}}{\text{3.9 Ohms (Rotor Resistance)}} = \text{3.1 Amps (Rotor Current)}$$

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 (see Section 7, Rotor). If ammeter is stable, proceed to Step 5.

5. Check for AC output across stator leads (see Section 7, Stator) and compare to readings in Section 1. If readings vary considerably from those in Section 1, a faulty stator is likely. Refer to Section 7, Component Testing for further information.

6. If rotor and stator test good in prior steps, the voltage regulator is probably defective. Refer to Section 7, Component Testing.

NOTE

Stator output voltages (with separately excited rotor) found in Section 1 are based on a battery voltage of 12 volts. Should actual battery voltage vary (11-14 volts), resulting values will also vary.

PowerBoost® IIIE Voltage Regulator Test

The voltage regulator monitors output voltage magnitude and frequency to supply current to the generator exciter field. 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)

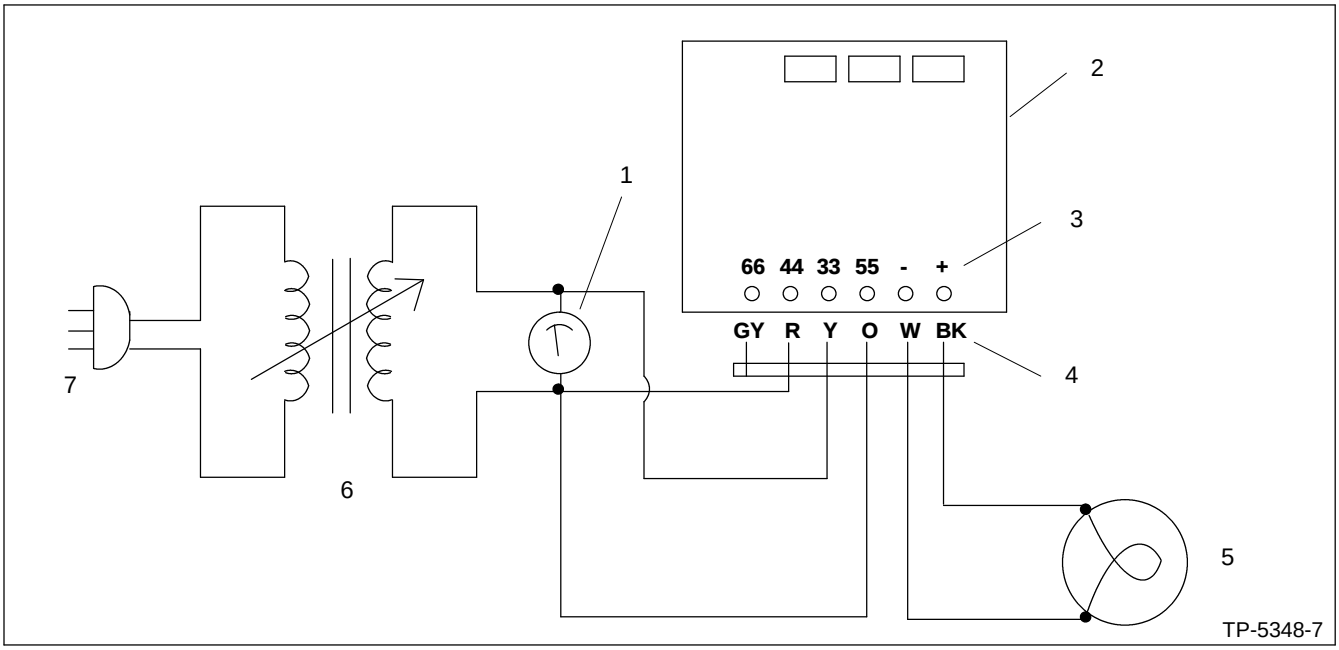
1. Connect components as shown in Figure 7-3.

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 between 30 to 40 volts up to 100 volts. If the lamp does not light, turn the voltage adjustment potentiometer (pot) clockwise. If the light still does not go on, the voltage regulator is defective and should be replaced. This would correspond to a low- or no-voltage 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, the voltage regulator is defective and should be replaced. This would correspond to a high-voltage output condition.

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



1. AC voltmeter
2. PowerBoostä IIIE voltage regulator
3. Stator/rotor connections (for reference only)
4. Lead color
5. 120-volt, 100-watt lamp
6. Variable transformer
7. 120-volts AC

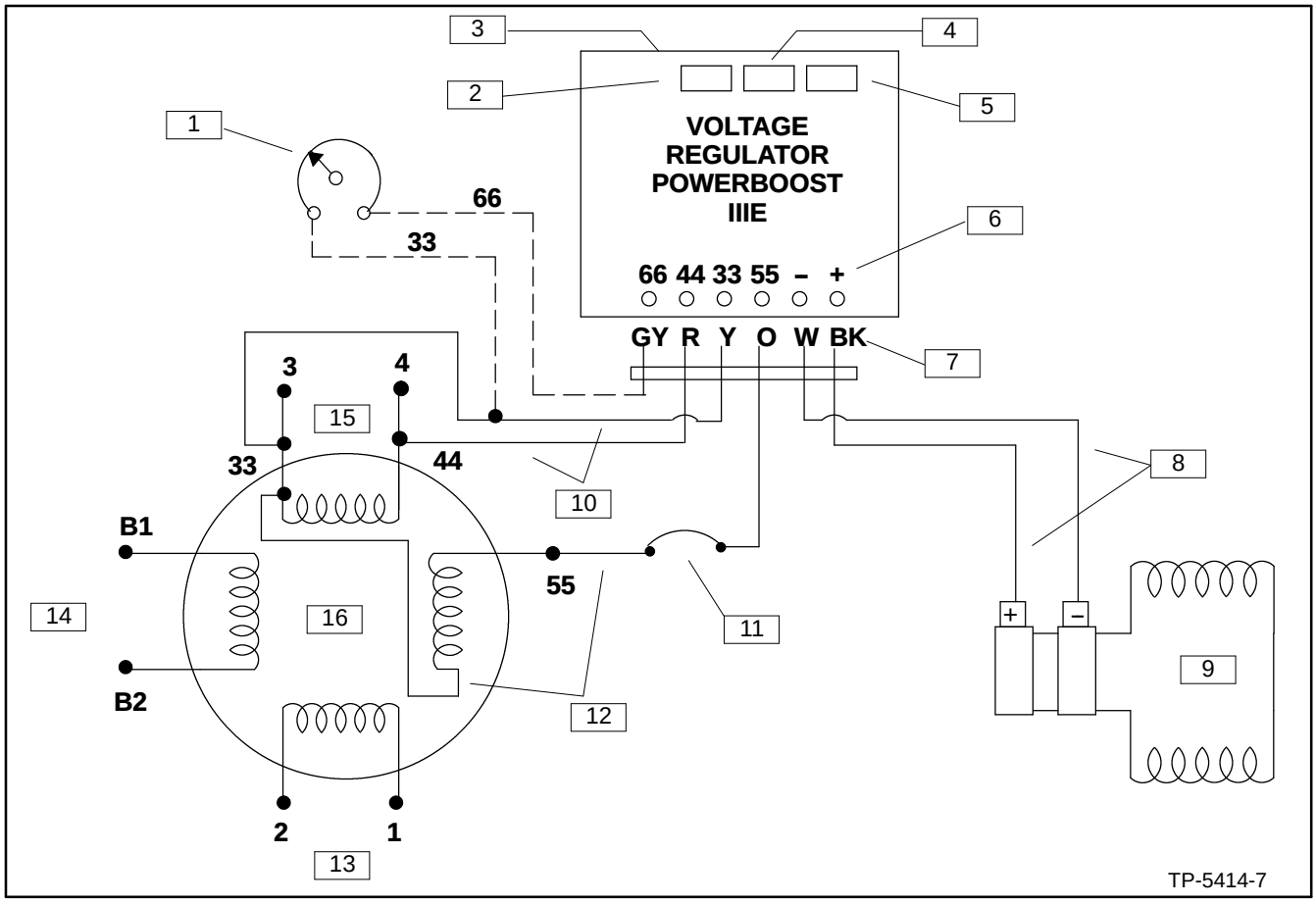
Figure 7-3. PowerBoostä IIIE Voltage Regulator Test

Voltage Regulator Adjustment

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. Figure 7-4 identifies voltage regulator components and the following paragraphs describe the components.

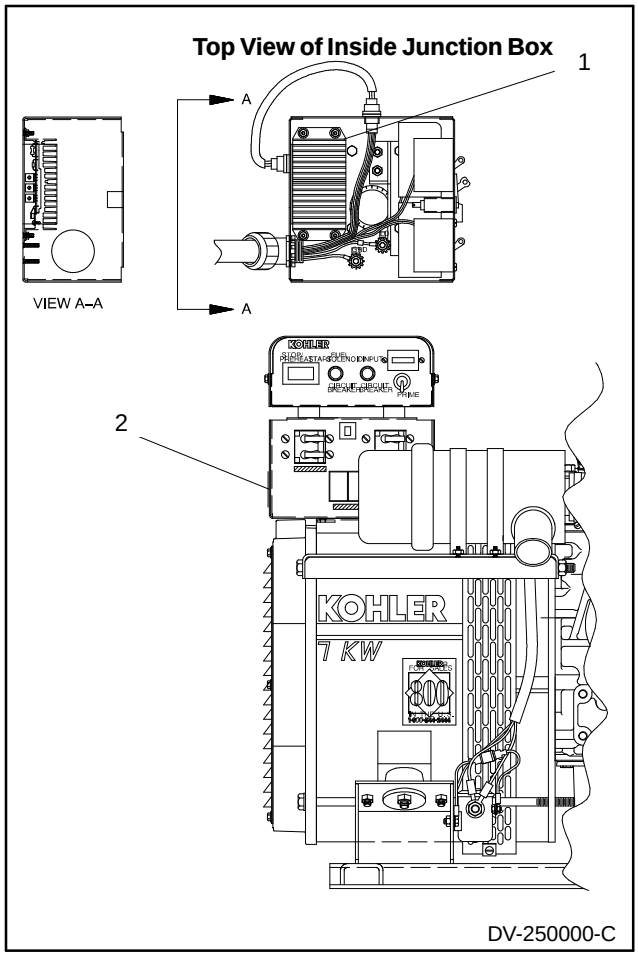
NOTE

The junction box contains the voltage regulator. Make regulator adjustments without removing the regulator from the junction box. See Figure 7-5.



1. Optional remote rheostat (see Note A on next page)
2. Voltage adjustment potentiometer
3. PowerBoostä IIIE voltage regulator
4. Stabilizer potentiometer
5. Volts/Hz potentiometer
6. Stator/rotor connections (for reference only)
7. Lead color
8. DC output
9. Rotor
10. Sensing
11. 10-amp circuit breaker
12. AC power input (aux.)
13. Main
14. Control
15. Main
16. Stator

Figure 7-4. PowerBoostä IIIE Voltage Regulator



1. Voltage regulator
2. Junction box

Figure 7-5. PowerBoostä IIIE Voltage Regulator Location

NOTE A

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.

Voltage Adjustment Potentiometer (Pot)– Adjusts generator voltage output within a range of approx. 100-130 volts.

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. *The 7CCO61 generator sets have the Volts/Hz feature disabled by turning the Volts/Hz pot out (fully counterclockwise).*

NOTE

For optimum results, apply full load when adjusting stability pot.

1. With generator set off, turn remote rheostat (if equipped) to midpoint. Turn **Voltage and Stability pots** fully counterclockwise. Connect voltmeter and frequency meter to AC circuit or an electrical outlet.
2. Start generator set. Rotate **voltage adjustment pot** clockwise to increase voltage (counterclockwise to decrease voltage) until achieving desired output voltage.
3. Rotate **stability pot** clockwise until obtaining minimum light flicker.
4. Readjust **voltage adjustment pot** (if necessary).
5. Readjust engine speed to normal (1800 rpm for 60 Hz or 1500 rpm for 50 Hz).
6. Readjust **voltage adjustment pot** (if necessary).
7. Readjust **stability pot** (if necessary).
8. Use optional remote rheostat (if equipped) to make final voltage adjustments. Stop generator set.

Rotor

The four-pole rotor creates the magnetic field needed to sustain 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 rotor bearing for noisy operation, excessive wear, and heat discoloration. Replace or repair these components if any of the above conditions exist.

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. Use very fine sandpaper (#00), applying light pressure to remove roughness. Do not use emery or carborundum paper or cloth. Clean out all carbon dust from the generator. If the rings appear black or pitted, remove the rotor and remove some of the surface material using a lathe.

Check the rotor for continuity and resistance. Measure the rotor resistance (ohms) between the two slip rings (Figure 7-6). See Section 1 for typical readings.

NOTE

Because ohmmeters vary in their accuracy, use values in Section 1 as a reference for approximate readings. Take readings at room temperature or about 70°F (21°C).

To check for rotor shorted to ground, adjust ohmmeter to zero ohms. Touch one ohmmeter lead to either slip ring and other lead to rotor poles or shaft. Meter should register no continuity.

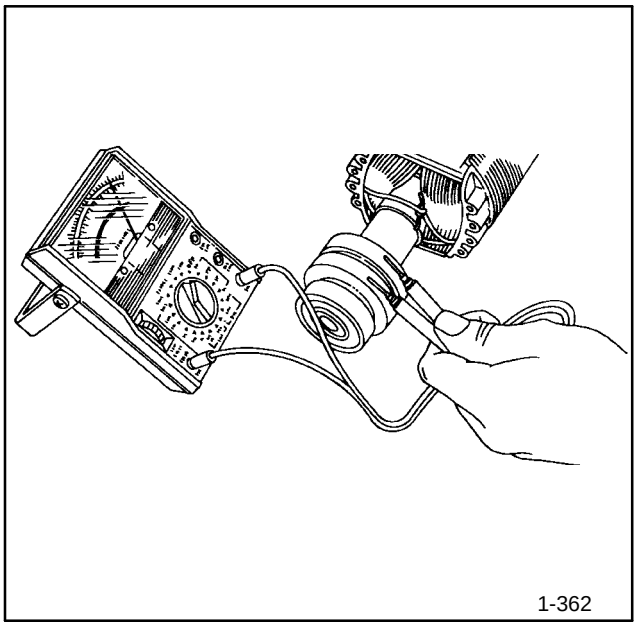


Figure 7-6. Rotor Resistance Check

NOTE

Rotor resistance will vary directly with increase in temperature.

NOTE

No need for disassembly to perform this check.

NOTE

When checking rotor resistance with rotor installed, brushes must not be in contact with rotor slip rings. Use brush retainer on brushes for accurate resistance readings.

Repair or replace the rotor if detecting any faults in the previous tests.

Stator

The stator consists of a series of coils of wire placed 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.

Checking Stator Continuity and Resistance

1. 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 7-7.

NOTE

Disconnect all stator leads prior to performing stator continuity tests.

- Leads 1, 2, 3, and 4 are the generator output leads. Leads 33 and 44 are the voltage regulator sensing leads. Leads 33 and 55 are the voltage regulator power supply leads. Leads B1 and B2 are the generator output interlock circuit for the controller. Refer to the schematic in Figure 7-8 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 33 and 55.
- There must be continuity between leads B1 and B2.
- There must be no continuity between lead 1 and leads 3, 4, 33, 44, and 55.
- There must be no continuity between lead 1 and leads B1 and B2.
- There must be no continuity between lead 4 and leads B1 and B2.
- There must be no continuity between any stator lead and ground on stator housing or frame laminations.

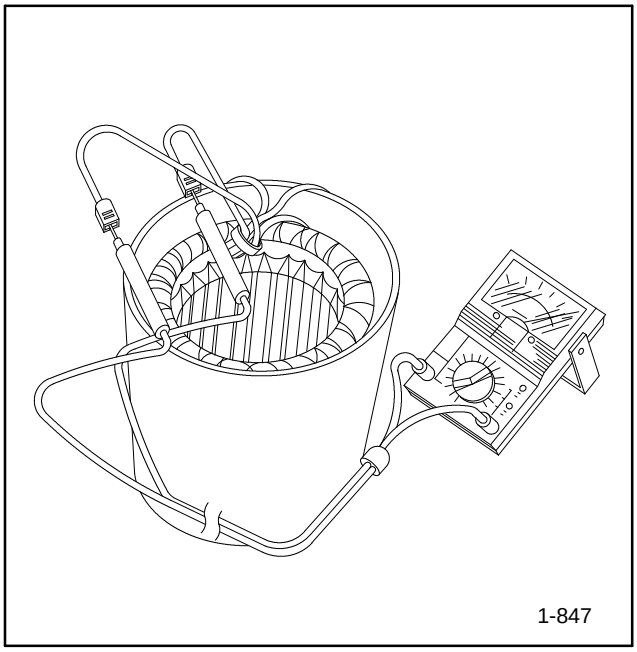


Figure 7-7. Stator Resistance Check

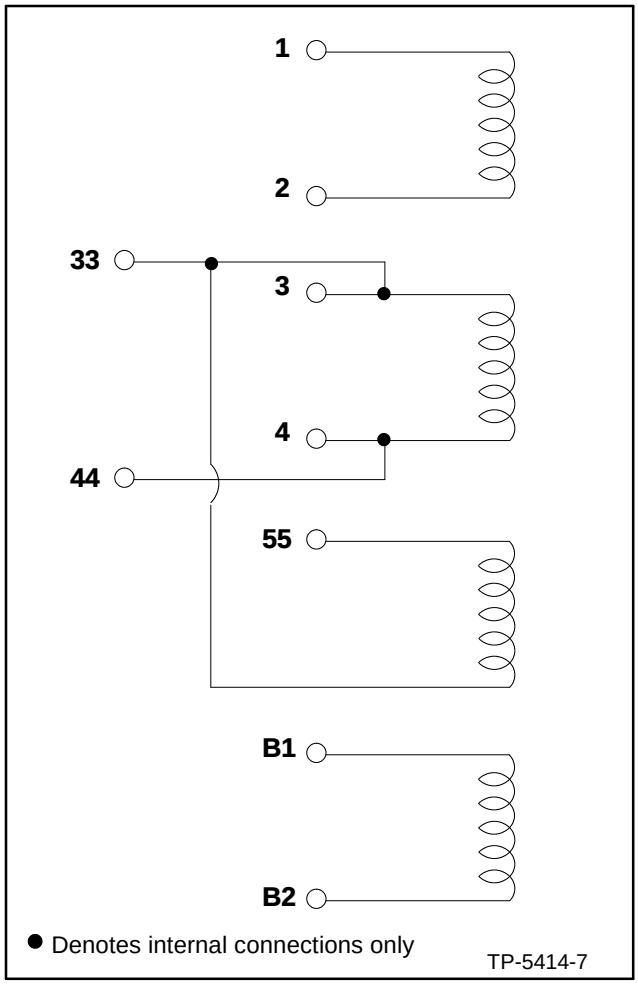


Figure 7-8. Generator Stator Leads

2. 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, 33 and 55, and B1 and B2. Find stator winding resistance readings in Section 1.

NOTE

Because ohmmeters vary in their accuracy, use data from Section 1 as a reference for approximate readings. Take ohmmeter readings at room temperature or about 70°F (21°C).

NOTE

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

NOTE

When taking an ohmmeter reading using lead 55, make connection prior to circuit breaker.

NOTE

Stator resistance will vary directly with increased temperature.

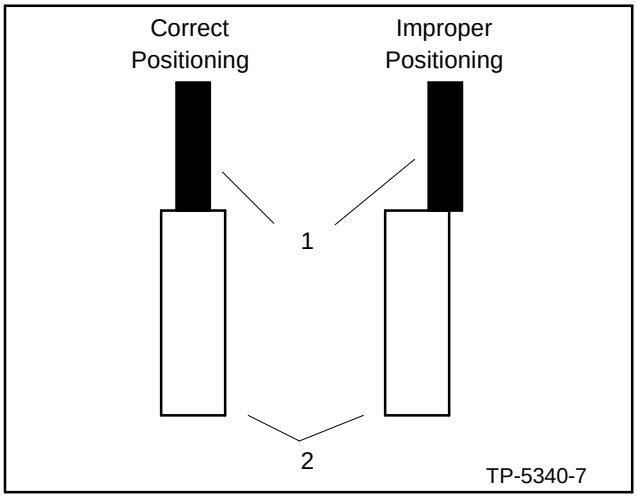
- Should any of the stator readings vary considerably during the previous checks, repair or replace the stator.

Brushes

The brushes transfer current from the voltage regulator to the slip rings. Because the brushes carry a low current, 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 due to dirt.

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 7-9 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.



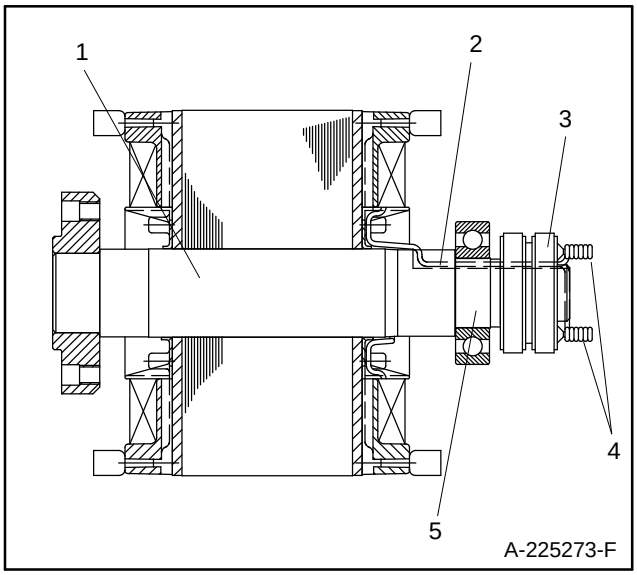
1. Brushes
2. Slip rings

Figure 7-9. Brush Positioning

Slip Ring Replacement

If slip ring replacement is necessary, have the rotor removed from the unit (follow the generator disassembly procedure found in Section 8). Using a soldering gun, heat the wires around the two terminal ends of the slip ring. Carefully unravel the wires to remove from each terminal. Pull off the slip ring using a gear puller and clean the rotor shaft surface.

Replace the new slip ring (Kohler part number 238134) onto the rotor shaft (with the terminal end pointing outward) using a press with a proper size fixture. Position slip ring onto the rotor shaft as far as the collar permits. Exhibit care in routing the rotor leads through the keyway (the lengthwise groove on the rotor shaft) so as not to pinch or cut through insulation. Rewrap the wires around each terminal on the slip ring and resolder. See Figure 7-10. Mount the rotor onto a lathe and turn the slip ring outer diameter to the dimension shown in Figure 7-11 with a surface finish of 64 micro-inch.



1. Rotor Shaft
2. Wires
3. Slip Ring
4. Terminals on Slip Ring
5. Ball Bearing

Figure 7-10. Slip Ring Replacement on Rotor Assembly

Slip ring size after being turned down on a lathe:	
Maximum size allowed	2.391 in.
Minimum size allowed	2.360 in.

Figure 7-11. Proper Slip Ring Size

Controller Circuit Board

Some controller circuit board components (relays) can be checked without removing the component from the board. Perform these checks prior to installing a new board and attempting startup. Section 4 references most of the tests. 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 terminals. Use the following chart and see the controller circuit board schematic on the following pages.

Component	Ohmmeter Connections	Results
K1 Relay Coil	K1 coil terminals (See relay schematic)	If good– approx. 160 ohms. Low resistance (continuity)– shorted coil. High resistance– open coil.
K2 Relay Coil	K2 coil terminals (See relay schematic)	If good– approx. 160 ohms. Low resistance (continuity)– shorted coil. High resistance– open coil.
K3 Relay Coil	K3 coil terminals (See relay schematic)	If good– approx. 400 ohms. Low resistance (continuity)– shorted coil. High resistance– open coil.
K4 Relay Coil	K4 coil terminals (See relay schematic)	If good– approx. 125 ohms. Low resistance (continuity)– shorted coil. High resistance– open coil.
K5 Relay Coil	K5 coil terminals (See relay schematic)	If good– approx. 510 ohms. Low resistance (continuity)– shorted coil. HIgh resistance– open coil.

Figure 7-12. G-239563 Circuit Board Component Testing

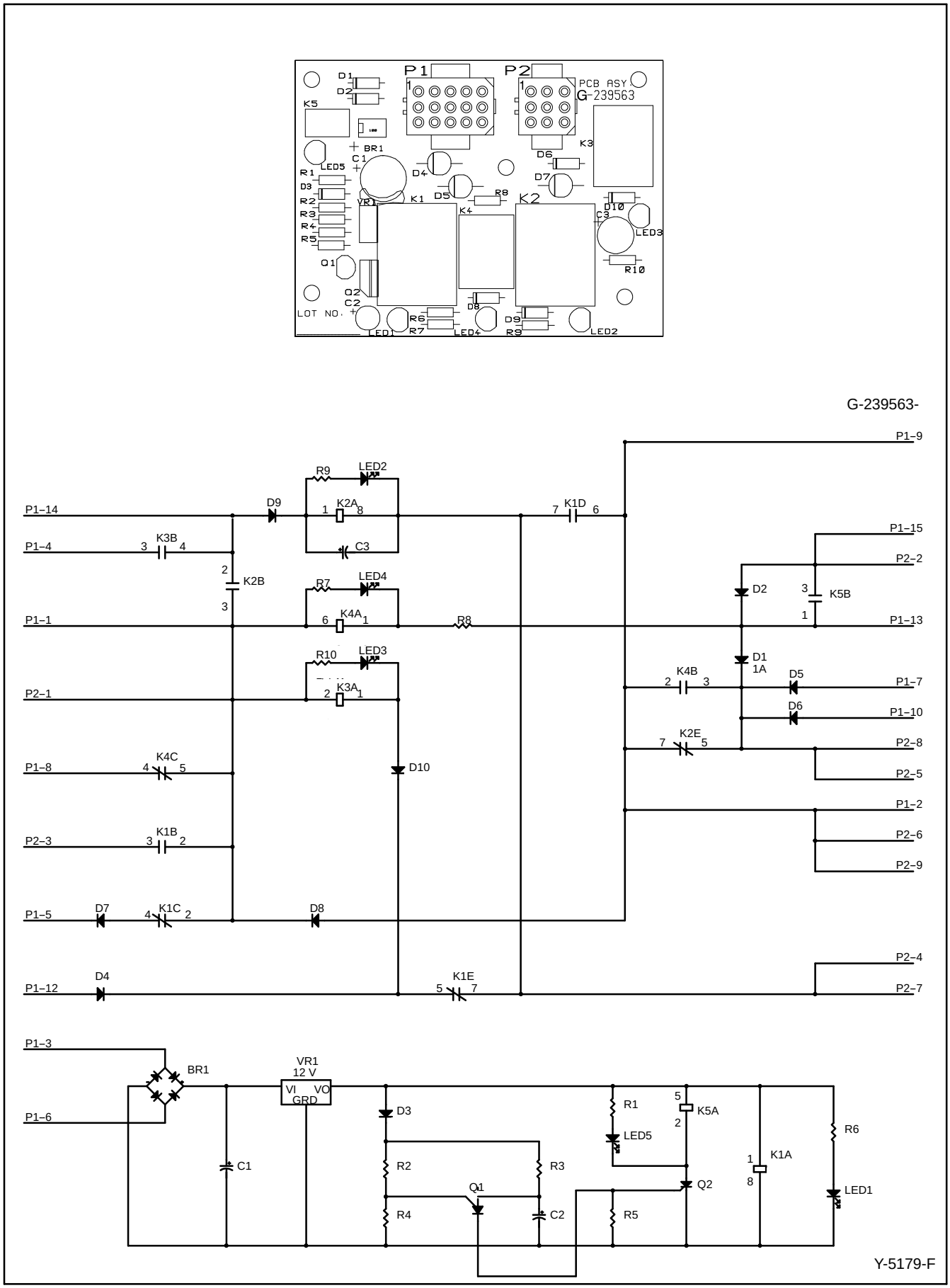


Figure 7-13. Controller Circuit Board Wiring

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 procedure will verify that the switches function and 12-volt DC is present at each component.

Component	Voltmeter Connections	Remarks	Results
Hourmeter and wiring	Red test clip to hourmeter (+) terminal. Back test clip to (–) terminal.	Voltmeter setting 12-volts DC reading indicates wiring harness is okay.	If good– 12-volts DC or greater. To determine if hourmeter is good, proceed to next step.
	None (See Remarks)	Disconnect hourmeter leads and apply 12-volts DC to hourmeter. NOTE: Hourmeter is polarity sensitive.	If good– hourmeter will operate.
B1/B2 stator auxiliary winding	Disconnect B1/B2 leads. Connect AC voltmeter to leads. NOTE: Voltage can only be measured momentarily because unit will not continue to run after stat switch is released. Stop generator.	Voltmeter setting 20-volts AC or greater. Start generator set and allow to reach proper speed.	Reading of 12-15 volts indicates B1/B2 winding is good.
Fuel solenoid	Red test clip to #6 lead of solenoid and black test clip to engine block (ground). Place controller switch to start position. Stop generator set.	Voltmeter setting 12 volts or greater. If lead cannot be disconnected, cut leads and crimp on fully insulated push-on terminals. To determine if fuel solenoid is good, proceed to next step.	If good– 12-volts DC reading indicates wiring is okay.
	None (see Remarks)	Push out leads #6 and P at the connector. Apply 12-volts DC to #6 lead and momentarily apply 12-volts DC to P lead. NOTE: Apply voltage only momentarily to P lead to prevent fuel solenoid damage. This coil draws 50 amps and is intended only to energize the solenoid.	If good– fuel solenoid plunger will energize when voltage is applied to P lead and remain held in after P lead is disconnected as long as #6 lead has voltage applied to it.

Figure 7-14. Engine/Generator Component Testing

⚠ WARNING

Sulfuric acid in batteries.
Can cause severe injury or death.

Use protective goggles and clothes. Battery acid can cause permanent damage to eyes, burn skin, and eat holes in clothing.

Battery gases. Explosion can cause severe injury or death. 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 charging. Avoid touching terminals with tools, etc., to prevent burns and 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. Sparks could ignite battery gases or fuel vapors. Ventilate any compartment containing batteries to prevent accumulation of explosive gases. To avoid sparks, do not disturb battery charger connections while battery is being charged. Always turn battery charger off before disconnecting battery connections. Remove negative lead first and reconnect it last when disconnecting battery.

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 charts and refer to the wiring diagram in Section 9.

NOTE

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

Component	Ohmmeter Connections	Remarks	Results
Controller switch	P2-6 and P2-4	Ohmmeter on R x 1 scale. Place rocker switch in start position.	If good, zero ohms (continuity). Any resistance other than zero or very low ohms– replace switch.
	P2-6 and P2-5	Ohmmeter on R x 1 scale. Place rocker switch in Stop position.	If good, zero ohms (continuity). Any resistance other than zero or very low ohms– replace switch.
K20 relay coil	P1-4 and P1-9	Ohmmeter on R x 1 scale.	If good, 85 ohms. Low resistance– shorted K20 relay coil and/or wiring. High resistance– open K20 relay and/or wiring.
K25 relay coil	P1-8 and P1-9	Ohmmeter on R x 1 scale.	If good, 85 ohms. Low resistance– shorted K25 relay coil and/or wiring. High resistance– open K25 relay and/or wiring.
Starter (S) relay	P4-4 and battery (–) cable. NOTE: Disconnect J4 and P4 to perform this test.	Ohmmeter on R x 1 scale.	If good, approx. 0.20-0.35 ohms at 80°F (27°C).
Controller 10-amp circuit breaker and wiring	P1-14 and battery (+) cable. NOTE: Connect J4 and P4 to perform this test.	Ohmmeter on R x 1 scale.	If good, zero or very low ohms. No reading (infinity)– open circuit or tripped circuit breaker.
Glow plug (C1) relay	P4-8 and P4-1	Ohmmeter on R x 1 scale.	If good, approx. 16-20 ohms at 80°F (27°C).
B1/B2 aux. stator windings	P1-3 and P1-6 NOTE: Connect J4 and P4 to perform this test.	Ohmmeter on R x 1 scale.	If good, see Section 1– Specifications. Low resistance– B1/B2 windings shorted. High resistance– B1/B2 windings open.
P1 ground connection	P1-9 and ground	Ohmmeter on R x 1 scale.	If good, zero ohms (continuity). Any other reading indicates a poor ground connection.
Low oil pressure (LOP) safety shutdown switch	P1-15 and engine block (ground). NOTE: Connect J4 and P4 to perform this test.	Ohmmeter on R x 1 scale. NOTE: This test is not conclusive until the temperature shutdown switches are checked.	If good, zero ohms (continuity). Then disconnect LOP switch lead and isolate terminal. Meter reading should show an open circuit.
High water temperature (HWT) safety shutdown switch	P1-15 and engine block (ground). NOTE: Remove and isolate LOP switch lead. NOTE: Connect J4 and P4 to perform this test.	Ohmmeter on R x 1 scale.	If good, open circuit. Any continuity suggests that temperature switch(es) are defective. Disconnect individual leads to determine which switch is defective.

Figure 7-15. Engine/Generator Component Testing

Fuel Solenoid

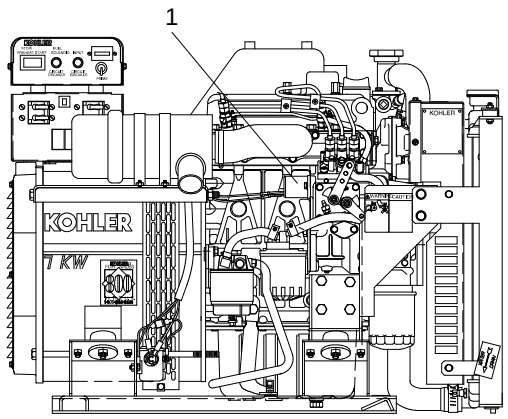
The fuel solenoid serves to pull the injector pump lever to the "fuel on" position when energized. The fuel solenoid is spring loaded to return the injector pump lever to the "fuel off" position when de-energized. See Figure 7-17 for fuel solenoid location.

The 7CCO61 model uses a three-lead fuel solenoid. This solenoid has a lead marked "P" which energizes the "pull" coil only during cranking. During operation the lead "6" energizes the "hold" coil and the lead marked "N" is the common ground.

Figure 7-16 shows current (amps) and resistance readings (ohms). Take resistance readings to determine if the solenoid windings are open or shorted. Perform these tests with the fuel solenoid disconnected from the engine wiring harness.

Fuel Solenoid	Reading
Pull current	31 amps
Hold current	0.8 amps
Plunger pull resistance	0.387 ohms
Plunger hold resistance	14.94 ohms

Figure 7-16. Fuel Solenoid Readings



1. Fuel Solenoid

Figure 7-17. Fuel Solenoid Location

Remote Start Panel

The remote panel incorporates a start/stop switch and four gauges. If encountering difficulty with remote operation, test the switch, gauges, and gauge senders for proper function. Prior to testing, disconnect the seven remote panel leads.

To test the water temperature sender, connect ohmmeter to controller socket P3-1 and P3-3. See Figure 7-18 for resistance by varying temperatures. Start generator set to change temperature. Stop generator set when test is complete.

To test the oil pressure sender, connect ohmmeter to controller socket P3-1 and P3-6. See Figure 7-19 for resistances by varying pressure. Start generator set to change pressure. Stop generator set when test is complete.

Generally, senders can be presumed good if they change their resistance values as their respective pressure/temperature changes. A defective sender will either be open or shorted.

Temperature	Resistance in Ohms
140°F (60°C)	134 ±10
194°F (90°C)	51.5 ±4
212°F (100°C)	38 ±3

Figure 7-18. Water Temperature Sender Resistance (in Ohms)

Pressure	Resistance in Ohms
0 psi (0 kPa)	10
25 psi (172 kPa)	45-47
50 psi (345 kPa)	80
80 psi (552 kPa)	115

Figure 7-19. Oil Pressure Sender Resistance (in Ohms)

Component	Ohmmeter Connections	Remarks	Results
Remote switch	P3-1 and P3-4 (plug side). Place remote rocker switch in start position.	If good, continuity.	Ohmmeter on R x 1 scale.
	P3-1 and P3-5 (plug side). Place remote rocker switch in stop position.	If good, continuity.	Ohmmeter on R x 1 scale.
Remote switch gauge lights, DC voltmeter, and hourmeter	Red test lead to P3-2 (socket side) and black test lead to P3-1 (socket side). Place controller start/stop switch to start position. Stop generator when test is completed.	If 12-volt DC is present and component does not function after P3 plug is connected to controller, replace.	Voltmeter setting 12 volts or greater. Generator set does not need to be running, just cranking for this test. NOTE: Hourmeter is not illuminated. To further test components, connect to 12-volt battery. NOTE: Hourmeter is polarity sensitive.
Water temperature gauge	Red test lead to P3-2 (socket side) and black test lead to P3-3 (socket side). Start generator set for test. Stop generator when test is completed.	If 0.5-12-volts DC is present and gauge does not function after P3 is connected to controller, replace gauge.	Voltmeter setting 12 volts or greater.
Oil pressure gauge	Red test lead to P3-2 (socket side) and black test lead to P3-6 (socket side). Start generator set for test. Stop generator when test is completed.	If 0.5-12-volts DC is present and gauge does not function after P3 plug is connected to controller, replace gauge.	Voltmeter setting 12 volts or greater.

Figure 7-20. Remote Start Panel Component Testing

Section 8. Disassembly/Reassembly

Prior to disassembly, unbolt the generator set from the vehicle compartment. Disconnect all external connections– battery cables at battery (negative lead first), AC output leads in controller, remote start panel at controller connector, fuel line at fuel pump filter inlet, and exhaust connections. Observe all safety precautions listed at the beginning of this manual during the disassembly/reassembly procedure.

NOTE

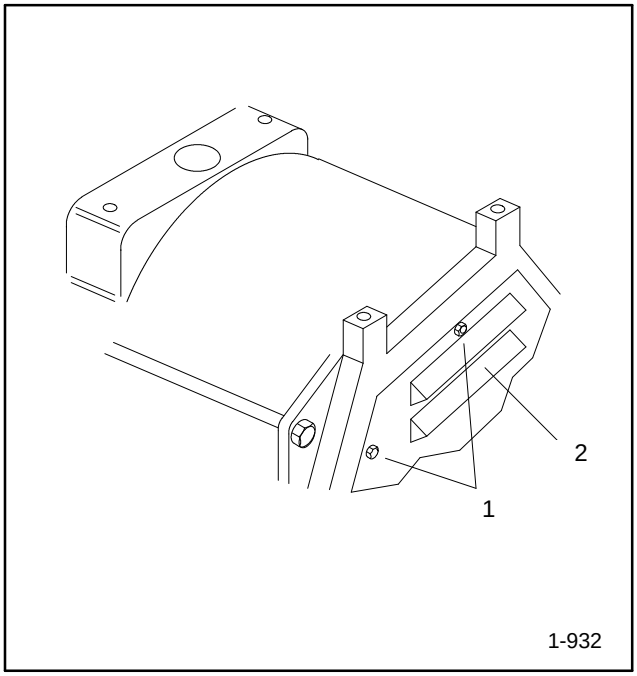
The voltage regulator is located in the junction box on these models. Adjustments are possible without removing the junction box or controller.

NOTICE

HARDWARE DAMAGE! Engine and generator may make use of both American Standard and metric hardware. Be sure to use the correct size tools to prevent rounding of bolt heads and nuts.

Disassembly

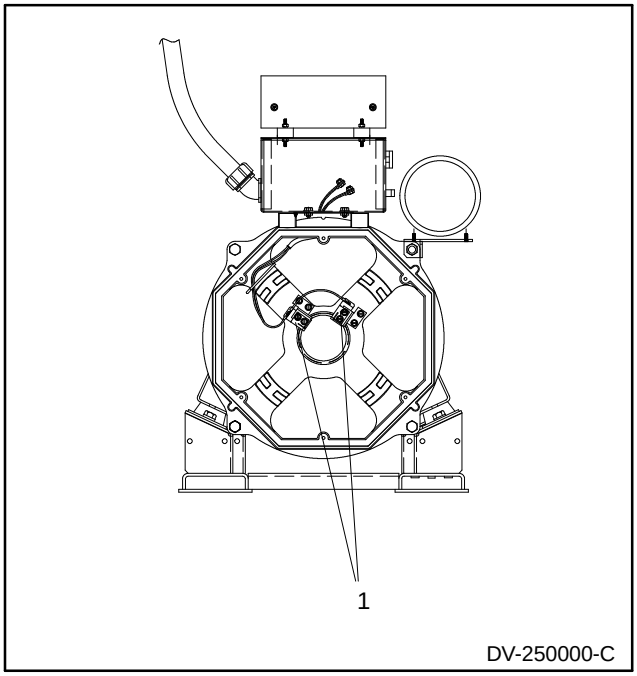
1. Remove the six screws securing the end bracket panel to the unit using a 5/16 in. nutdriver. Remove the panel to expose the end bracket assembly. See Figure 8-1.



1. Screws
2. End bracket panel

Figure 8-1. End Bracket Removal

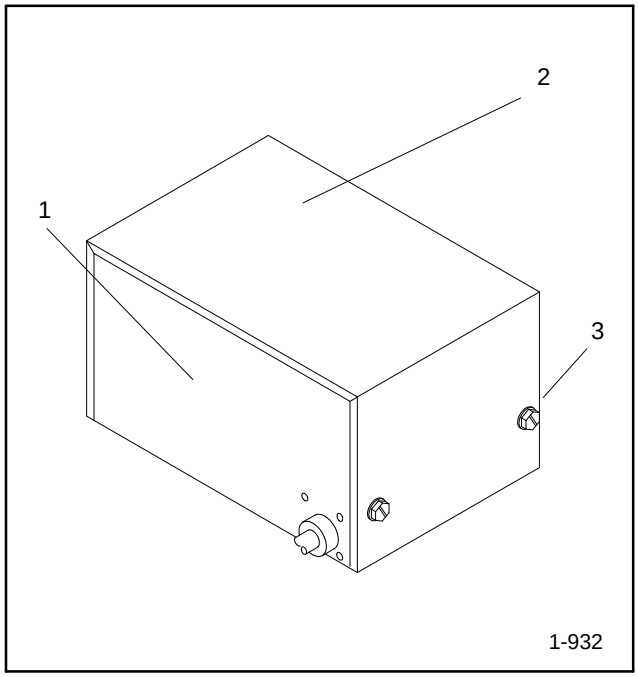
2. Raise brushes in holders (two sets) by pushing leads upward in the slots. Retain brushes by inserting a length of wire or a paper clip. See Figure 8-2 for brush location.



1. Brushes

Figure 8-2. Brush Location

3. Remove the mounting screws securing the controller cover. Separate the cover from the controller. See Figure 8-3.

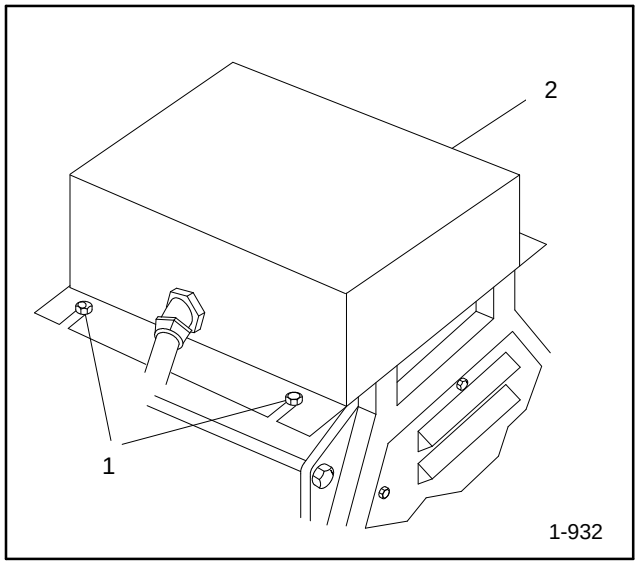


1. Controller
2. Controller cover
3. Screws

Figure 8-3. Removing the Controller Cover

4. Disconnect the controller harness (P4) located at the back of the controller.

5. Loosen the screws on the junction box cover using a 5/16 in. nutdriver or 5/16 in. wrench. See Figure 8-4.



1. Screws
2. Junction box

Figure 8-4. Removing the Junction Box Cover

6. Slide the junction box cover (and controller box) forward and lift to remove.

7. Inside the junction box, cut the cable tie and disconnect leads 9 and 20 at the white plastic connector.

8. Disconnect leads 33 and 44.

9. Disconnect the 6-pin connector (P10) to the voltage regulator.

10. Disconnect B1 and B2 leads.

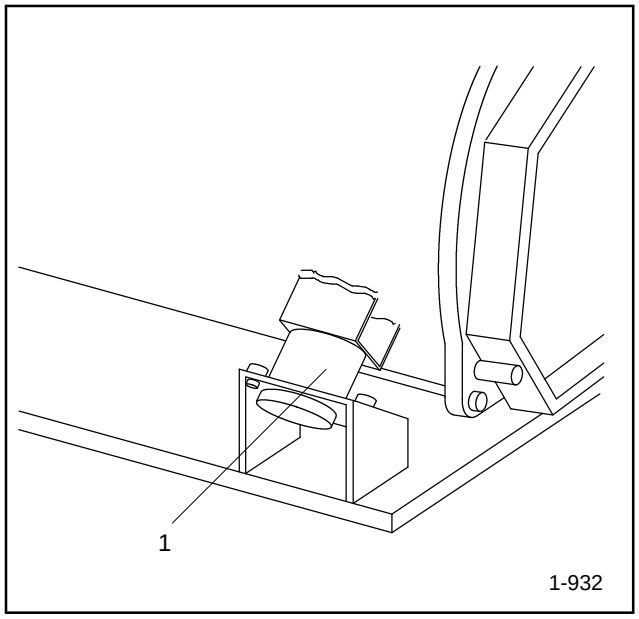
11. Disconnect lead 55 from the circuit breaker.

12. Remove the negative lead from the hazard ground stud using a 7/16 in. nutdriver.

13. Disconnect stator leads 1 and 4 from the line side of the circuit breaker using a 5/16 in. wrench. Disconnect stator leads 2 and 3 from LN ground stud using a 7/16 in. nutdriver.

14. Remove the four junction box mounting screws using a 7/16 in. ratchet to remove the junction box from the stator mounting bracket.

15. Remove the bolts from the two generator vibromounts. See Figure 8-5.



1. Vibromounts

Figure 8-5. Removing the Vibromounts

16. Place the hoist hook into the generator hoisting eye and raise generator end. Place a wood block under flywheel housing and lower generator until housing is supported by block. See Figure 8-6.

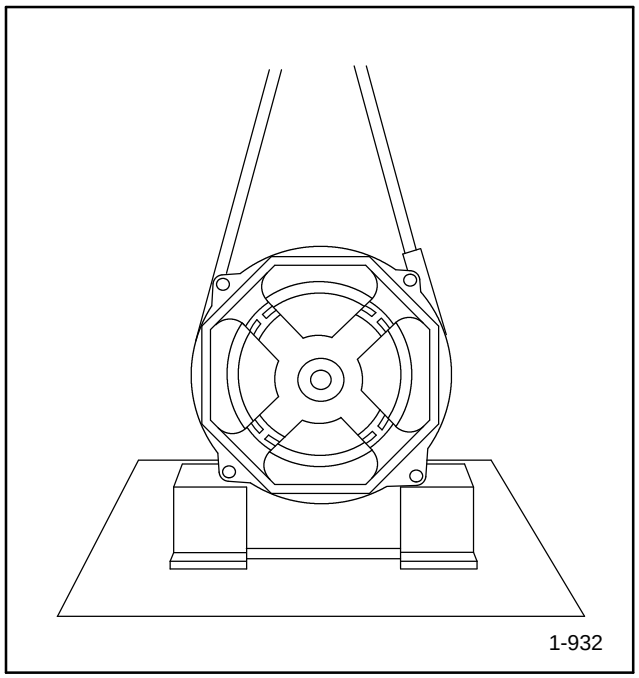
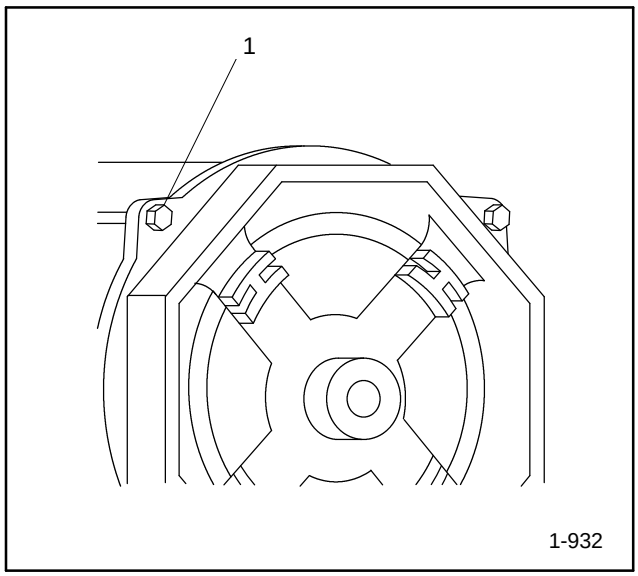


Figure 8-6. Using Hoist to Raise Generator Set

NOTE

Hoist capacity should be rated at one-half ton or greater.

17. Remove the four overbolts securing the end bracket using a 17-mm ratchet. See Figure 8-7.

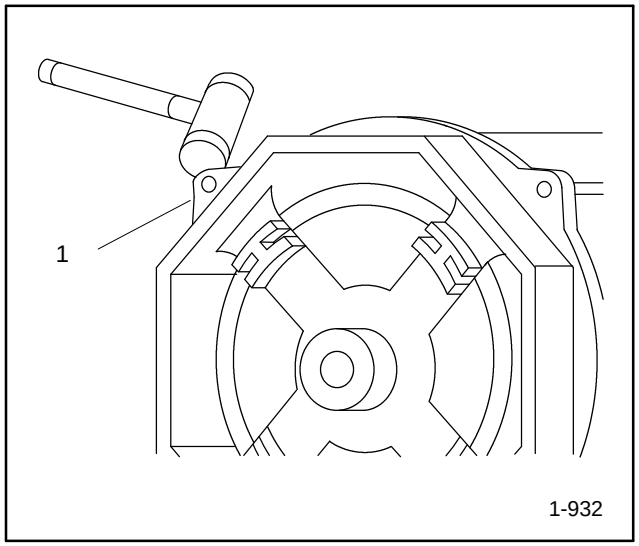


1. Overbolt

Figure 8-7. Removing the Overbolts

18. Pull the brush lead harness (containing leads 9 and 20) through hole in stator.

19. Remove the end bracket by bumping with a soft rubber mallet on end bracket flanges. See Figure 8-8.



1. End bracket flange

Figure 8-8. Removing the End Bracket

20. Carefully remove the stator by pulling the stator over the rotor assembly. See Figure 8-9.

NOTE

Because of the weight of the stator, place it on a hoist during removal to prevent damage to stator, rotor, and/or drive disks.

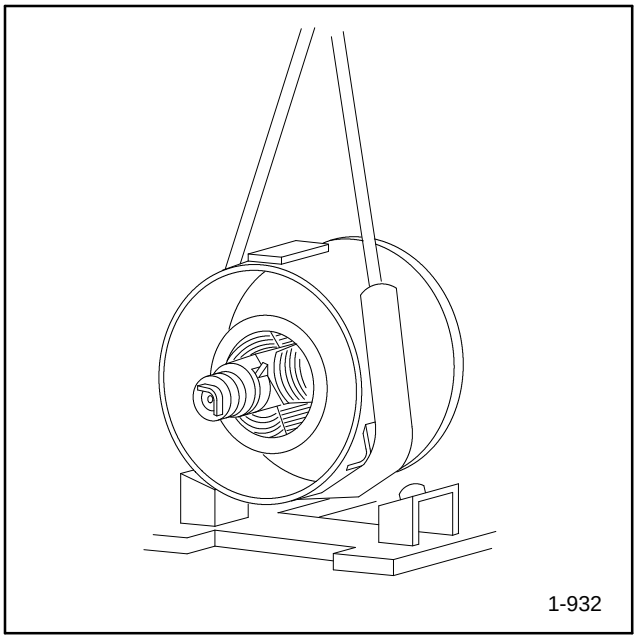
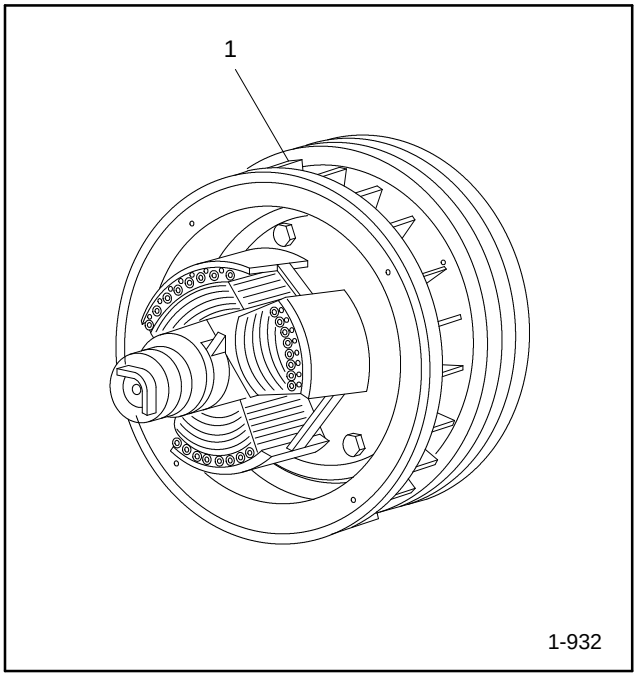


Figure 8-9. Removing the Stator

21. Remove the generator cooling fan by removing eight screws and four spacers. See Figure 8-10.

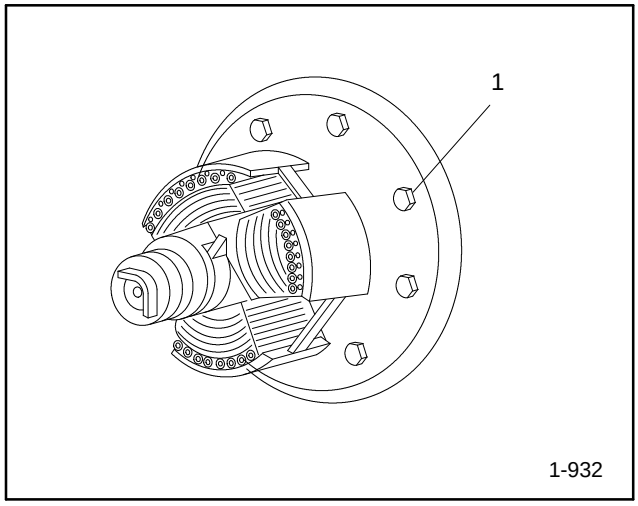


1. Cooling fan

Figure 8-10. Cooling Fan Location

22. Support the rotor with a strap and hoist. Remove eight bolts connecting the drive disk to the engine flywheel using a 13-mm ratchet.

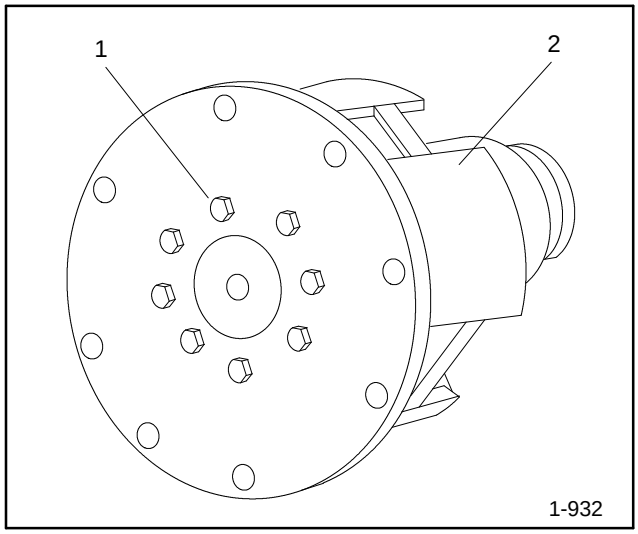
23. Remove the rotor drive disk from the engine flywheel. See Figure 8-11.



1. Bolts

Figure 8-11. Removing the Rotor

24. Remove the drive disk from the rotor by removing eight bolts using a torque wrench with a 9/16-in. socket. See Figure 8-12.



1. Drive disk bolts
2. Rotor

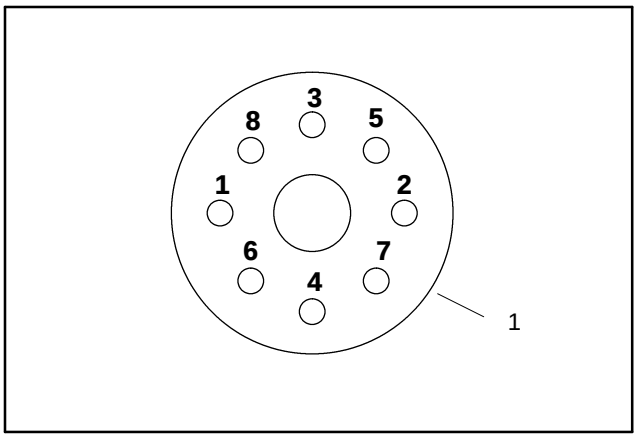
Figure 8-12. Removing the Drive Disk

Reassembly

1. Secure the drive disk to the rotor using eight bolts. Torque bolts to 28 ft. lbs. (338 in. lbs.). Be sure to follow the proper tightening sequence.

NOTE

Check condition of drive disks for flatness. If disks are uneven or bent, then replace. Bent disks can cause excessive vibration and premature wear.



1. Drive disk

Figure 8-13. Drive Disk Tightening Sequence

2. Position the rotor with the drive disk onto the engine flywheel using eight bolts. Torque bolts to 14 ft. lbs. (168 in. lbs.). Follow the tightening sequence as shown above.

3. Attach the generator cooling fan using eight screws and four spacers. Reassemble applying Loctite® #271 (or equivalent) to screws.

4. Reposition the stator over the rotor and onto the adapter lip. Be careful to avoid damaging the rotor. When the stator is properly positioned, the stator leads should be at the 12 o'clock position.

5. Route the stator leads through the opening in the end bracket. Use a rubber mallet to secure the end bracket onto the stator. Replace the overbolts securing the end bracket and stator to the generator adapter. Torque the overbolts to 25 ft. lbs. (300 in. lbs.).

6. Pull the brush lead harness and stator leads through the hole in the stator.

7. Use a hoist to raise the alternator end of the generator set. Remove the wood block(s) from underneath the alternator. Lower the generator set.

8. Replace the bolts securing the generator vibromounts to the stator mounting brackets.

9. Run the stator leads (1, 2, 3, 4, 55, B1, B2, 33, 44, 9, 20, and N) into the junction box through the hole in the bottom of the box.

10. Position the junction box onto the stator mounting bracket and secure using four mounting screws.

11. Inside the junction box, reconnect stator leads 1 and 4 to the line side of the circuit breaker and reconnect stator leads 2 and 3 to the LN ground stud.

12. Reconnect the negative lead to the hazard ground stud.

13. Reconnect lead 55 to the circuit breaker.

14. Reconnect B1 and B2 leads.

15. Reconnect the 6-pin connector (P10) to the voltage regulator.

16. Reconnect leads 33 and 44.

17. Reconnect the white plastic connector containing leads 9 and 20.

18. Reposition the junction box cover onto the junction box and secure.

19. Reconnect the 22-pin controller harness (P4) to the back of the controller.

20. Replace the mounting screws securing the controller cover to the controller.

21. Remove the retaining wires from the brush holders in the end bracket. Be sure that the brushes are centered on the slip rings. Improper brush position will cause premature wear.

22. Replace the six screws securing the end bracket panel.

Section 9. Wiring Diagrams

⚠ WARNING

Hazardous voltage.

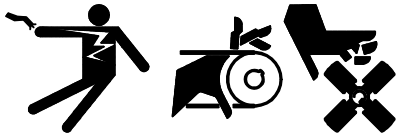
Moving rotor.

Can cause severe injury or death.

Operate generator set only with all guards and electrical enclosures in place.

Grounding generator set. Hazardous voltage can cause severe injury or death. Electrocution is possible whenever electricity is present. Open main circuit breakers of all power sources before servicing equipment. Configure the installation to electrically ground the generator set and electrical circuits when in use. Never contact electrical leads or appliances when standing in water or on wet ground, as the chance of electrocution is increased under such conditions.

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect battery cables before working on generator set (disconnect negative lead first and reconnect it last).

Disabling generator set. Accidental starting can cause severe injury or death. Disconnect battery cables (remove negative lead first and reconnect it last) to disable generator set before working on the generator set or connected equipment. The generator set can be started by the remote start/stop switch unless this precaution is followed.

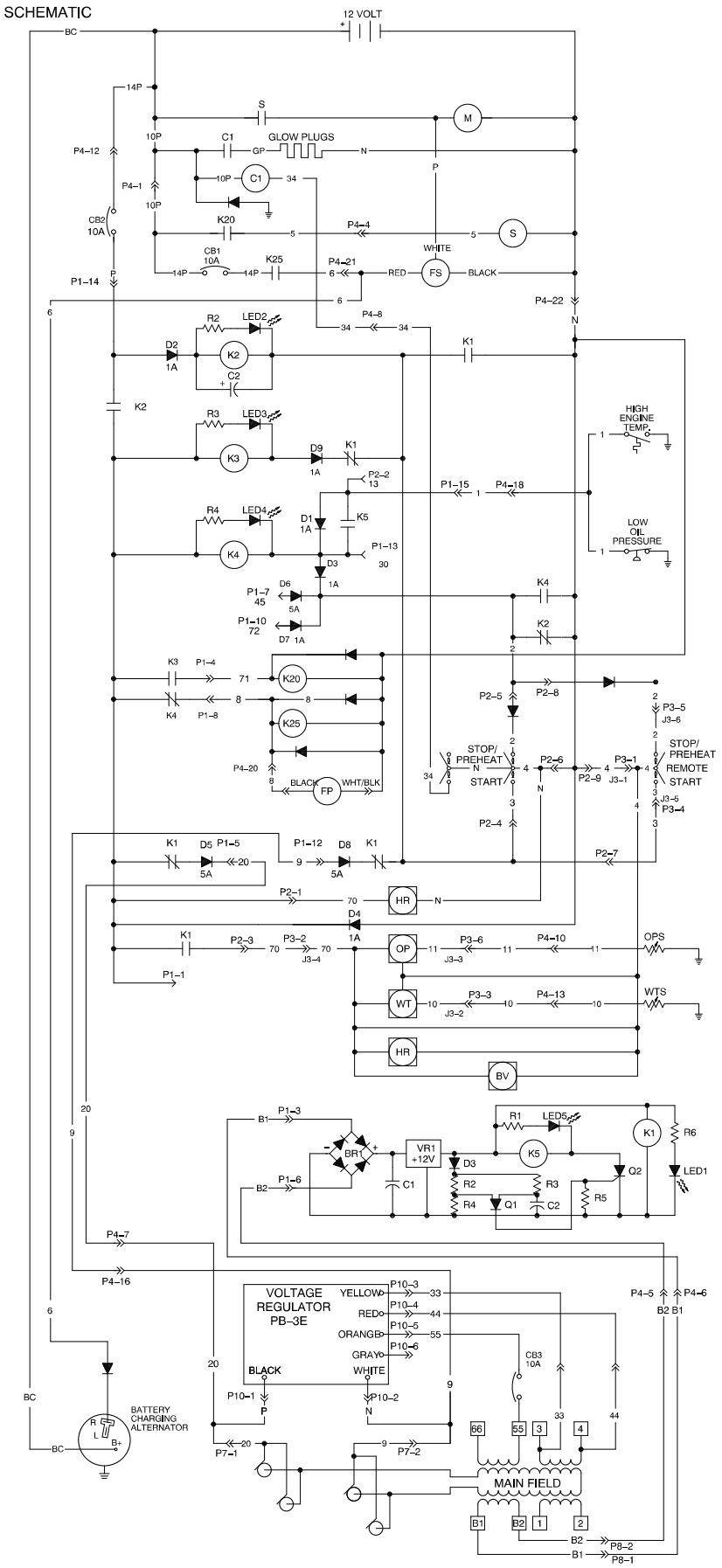


Figure 9-1. Wiring Diagram– Schematic 7CCO61 Single Phase.

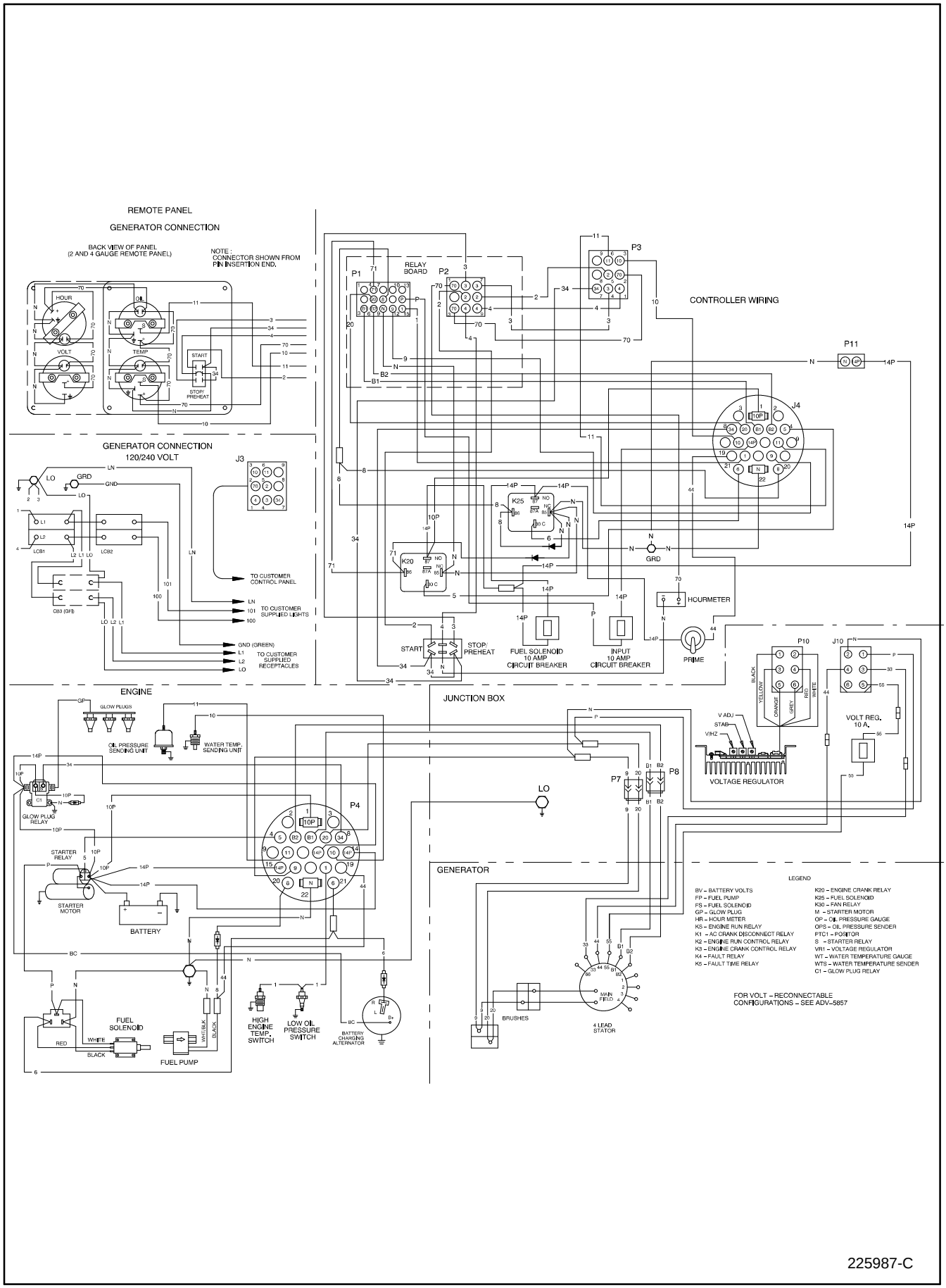


Figure 9-2. Wiring Diagram– Point-to-Point Wiring 7CCO61 Single Phase

Four-Lead (Single-Phase) Generator Sets where Generator Output can be 120/240 Volt, 60 Hz or 110/220 Volt, 50 Hz

Kohler Co. provides the following information to illustrate the connection of generator sets. In all cases, follow the National Electrical Code (NEC).

NOTE

When connecting a generator set to a voltage different than nameplate voltage, place a notice on the unit indicating this change. Authorized Kohler distributors/dealers supply a decal (part no. 246242) to indicate reconnected voltage.

120/240-Volt (or 110/220-Volt, 100/200-Volt) Configurations– Figure 9-3

Select a circuit breaker manufactured with a two-pole circuit breaker. Two single-pole circuit breakers do not conform to NEC requirements when supplying a 240-volt (or 220-volt) load. This is true even if they are mechanically attached together. Leads L1 and L2 are different phases; do not connect them together.

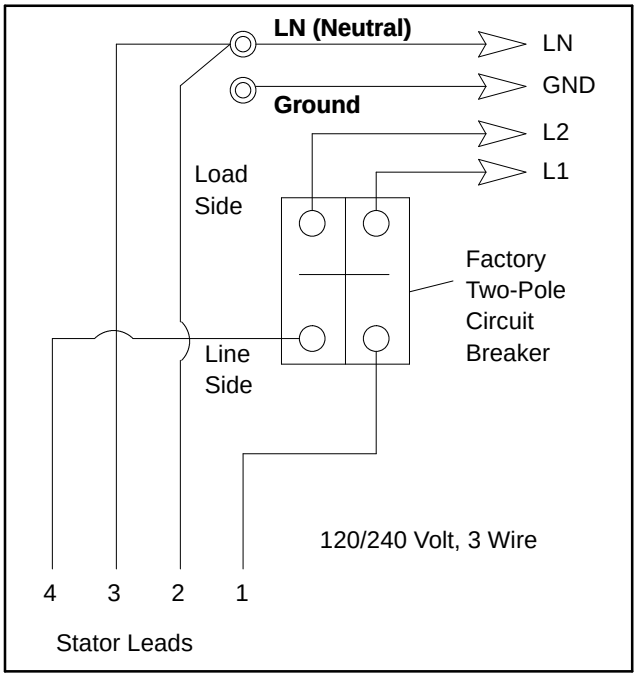
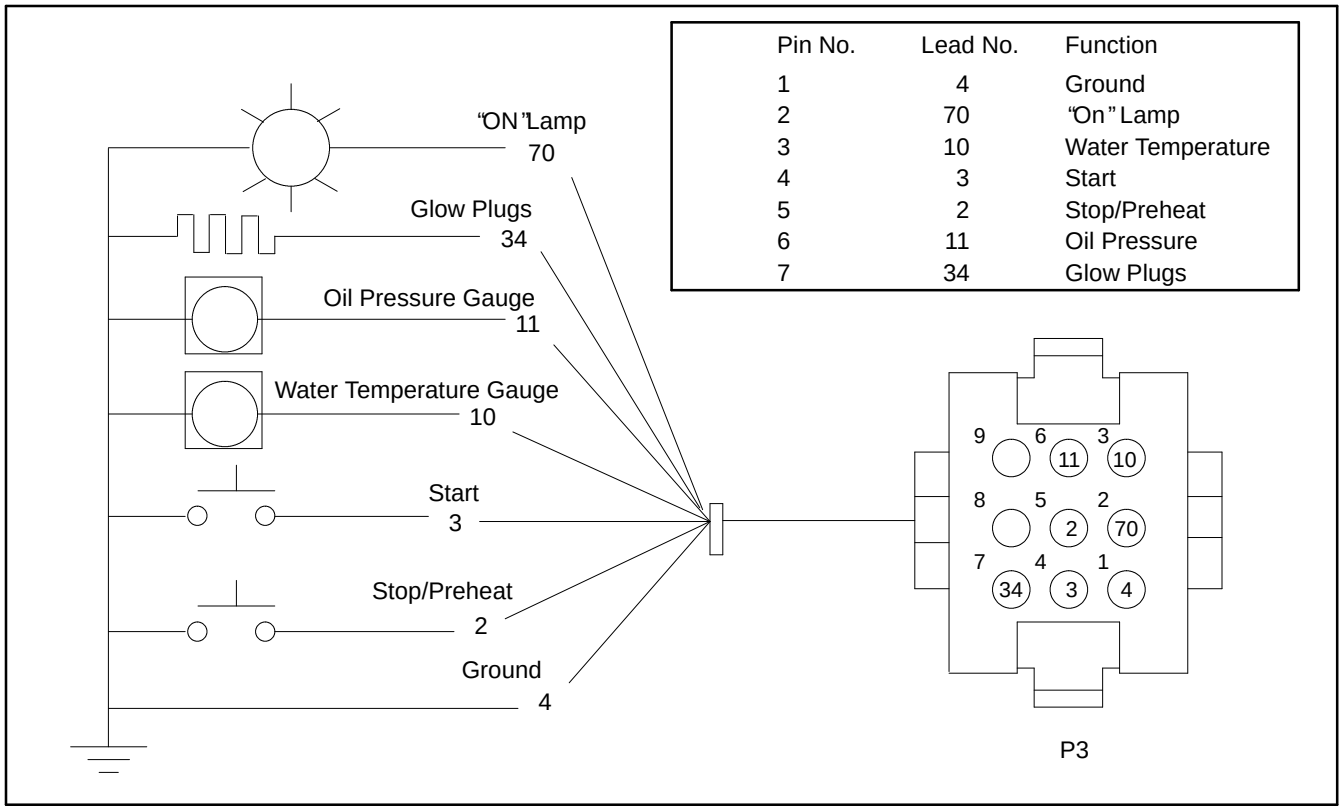


Figure 9-3.

Leads	60 Hz	50 Hz
L0-L1	120 volt	110 volt
L0-L2	120 volt	110 volt
L1-L2	240 volt	220 volt



Pin No.	Lead No.	Function
1	4	Ground
2	70	"On" Lamp
3	10	Water Temperature
4	3	Start
5	2	Stop/Preheat
6	11	Oil Pressure
7	34	Glow Plugs

Figure 9-4. Panel Wiring (P3 Wiring Harness)

Appendix A. Glossary of Abbreviations

Abbreviations are used throughout this manual. Normally they will appear in the text in complete form with the abbreviation following in parentheses the first time they are used. After that they will appear in the abbreviated form. The commonly used abbreviations are shown below. Some items may not apply to this application.

Abbreviation	Description
ABDC	after bottom dead center
AC	alternating current
AISI	American Iron and Steel Institute
AHWT	anticipatory high water temp.
ALOP	anticipatory low oil pressure
AM	amplitude modulation
amp	ampere
amps	amperes
ANSI	American National Standard Institute
API	American Petroleum Institute
approx.	approximate, approximately
A/R	as required, as requested
A/S	as supplied, as stated, as suggested
ASA	American Standards Association (former name of ANSI)
ASME	American Society of Mechanical Engineers
assy.	assembly
ASTM	American Society for Testing Materials
ATDC	after dead top center
aux.	auxiliary
A/V	audio–visual
AWG	American Wire Gage
AWM	appliance wiring material
BBDC	before bottom dead center
BDC	before dead center
BHP	brake horsepower
bmep	brake mean effective power
BTDC	before top dead center
Btu	British thermal unit
°C	Celsius degree
cc	cubic centimeter
CCA	cold cranking amps
CEC	Canadian Electrical Code
cfh	cubic feet per hour
cfm	cubic feet per minute
CID	cubic inch displacement
cm	centimeter, centimeters
cmm	cubic meters per minute
co.	company
cont'd.	continued
CPVC	chloropoly vinyl chloride
CRT	cathode ray tube
CSA	Canadian Standards Association
CT	current transformer
cu. in.	cubic inch (es)
CWC	city-water cooled
cyl.	cylinder
dB	decibel
dBA	decibels (A weighted)
DC	direct current
DCR	direct current resistance
deg.	degree
dept.	department
dia.	diameter
DIN	Deutsches Institut fur Normung e. V. (also Deutsche Industrie Normenausschuss)
e.g.	example given
EIA	Electronic Industries Association
EMI	electromagnetic interference
EPA	Environmental Protection Agency
etc.	et cetera (and so forth)
ext.	external
°F	Fahrenheit degree
fl. oz.	fluid ounce(s)
FM	frequency modulation
ft.	foot, feet
ft. lbs.	foot pound(s)
fs	full scale
ga.	gauge (meters wire size)
gal./gals.	gallon, gallons
gph	gallons per hour
gpm	gallons per minute
gr.	grade
grd.	ground
HCHT	high cylinder head temperature
HET	high exhaust temperature
Hg.	mercury (element)
H_2O	water
HP	horsepower
hr, hrs	hour, hours
HWT	high water temperature
Hz	hertz (cycles per second)
ID	inside diameter
IEEE	Institute of Electrical and Electronic Engineers
in.	inch, inches
inc.	incorporated
in. lbs.	inch pounds
int.	internal
int.-ext.	internal–external

Abbreviation	Description
ISO	International Standards Organization
J	joule, joules
JIS	Japanese Industry Standard
kg	kilogram, kilograms
kg/cm^2	kilograms per square centimeter
kgm	kilogram meter(s)
kJ	kilojoules (btu cal)
km	kilometer, kilometers
kPa	kiloPascal, kiloPascals
kph	kilometers per hour
kV	kilovolt
kVA	kilovolt amperes
kW	kilowatt, kilowatts
kWH	kilowatt hour
L	liter, liters
LxWxH	length x width x height
LED(s)	light emitting diode(s)
lb., lbs.	pound, pounds
L/hr.	liter per hour, liters per hour
L/min.	liter(s) per minute
LOP	low oil pressure
LP	liquified petroleum
LWT	low water temperature
m	meter, meters
m^3	cubic meter, cubic meters
max.	maximum
MCM	one thousand circular mils.
meggar	megohmmeter
MHz	megahertz
mi.	mile, miles
mil	one one−thousandth of an inch
min.	minimum
misc.	miscellaneous
mJ	milli joule(s)
MJ	mega joule(s)
mm	millimeter
m^3/min	cubic meters per minute
MPa	megaPascal
mpg	miles per gallon
mph	miles per hour
MS	military standard
mW	milliwatt(s)
MW	megawatt(s)
N/A	not available
NBS	National Bureau of Standards
N.C.	normally closed
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
Nm	Newton meter(s)
N.O.	normally open
no., nos.	number, numbers

Abbreviation	Description
NPT	National Standard taper pipe thread per general use
N/R	not required
OC	overcrank
OD	outside diameter
OEM	original equipment manufacturer
OS	overspeed
O/S	oversize
OSHA	Occupational Safety and Health Act
OV	overvoltage
oz.	ounce, ounces
PF	power factor
PMG	permanent magnet generator
pot	potentiometer
ppm	parts per million
psi	pounds per square inch
pt., pts.	pint, pints
PVC	polyvinyl chloride
qt., qts.	quart, quarts
qty.	quantity
ref.	reference
RFI	radio frequency interference
r.h.m.	round−head machine (screw)
rms	root means square
RPM	revolutions per minute
RTV	room temperature vulcanization
RV	recreational vehicle
SAE	Society of Automotive Engineers
SCR	silicon controlled rectifier
sec.	second, seconds
spec, specs	specification
sq.	square
sq. cm.	square centimeters
sq. in.	square inch(es)
tach	tachometer
TDC	top dead center
tech. pub.	technical publications
temp.	temperature
TIF	telephone influence factor
TP, TPs	technical publications
turbo	turbocharger
UHF	ultrahigh frequency
UNC	Unified coarse thread (was NC)
UNF	Unified fine thread (was NF)
UL	Underwriter ъ Laboratories, Inc.
U/S	undersize
U.S.A.	United States of America
V	volt, volts
vac	volts alternating current
vdc	volts direct current
VHF	very high frequency
W	watt, watts

Appendix B. Common Hardware Application Guidelines

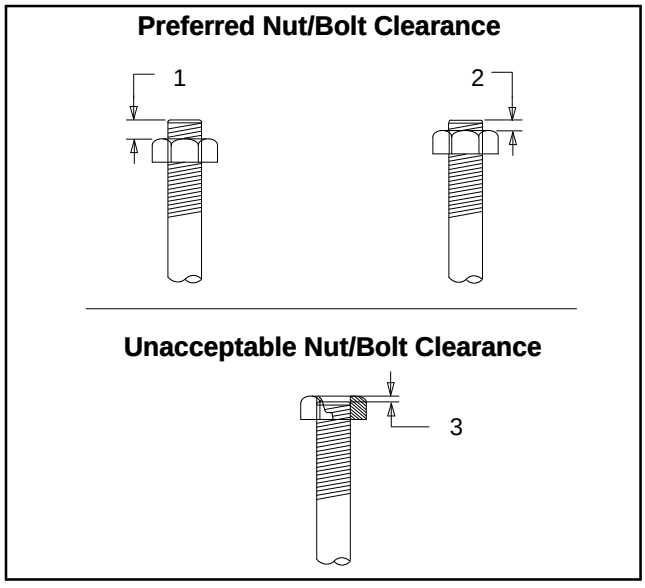
Many parts catalogs and service manuals will contain common hardware entries and hardware references instead of part numbers for common hardware.

This information gives common hardware application guidelines. Use the information below and on the following pages to identify proper fastening techniques when no specific reference for reassembly is made.

Bolt/Screw Length: When bolt/screw length is not given, use Figure B-1 as a guide. As a general rule, a minimum length of one thread beyond the nut and a maximum length of 1/2 the bolt/screw diameter beyond the nut is the preferred size.

Split Lock Washers: Split lock washers are no longer used as locking devices. For hardware up to 1/2 in. diameter a whiz nut (serrated flange) is used. The locking method used for hardware above 1/2 in. diameter will be SAE flat washers with preloading (torque) of the bolt/screw. See General Torque Specifications and other torque specifications in the service literature.

Common Hardware Entries: When hardware size (diameter and threads per inch) is given but no indication of type of additional hardware is shown, use the illustration in Figure B-2 as a guide.

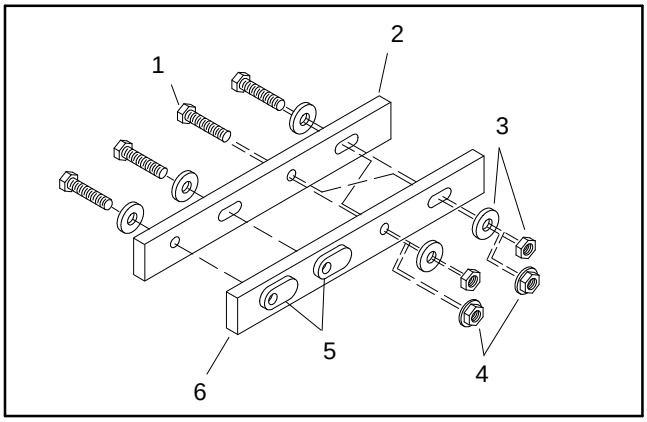


1. 1/2 in. bolt diameter
2. Min. 1 full thread beyond top of nut
3. Below top of nut

Figure B-1. Acceptable Bolt Lengths

Steps for common hardware application:

1. Determine entry hole type: round or slotted.
2. Determine exit hole type: fixed female thread (weld nut), round, or slotted. For round and slotted exit holes, determine if hardware is greater than 1/2 inch in diameter or 1/2 inch in diameter or less. Hardware that is *greater than 1/2 inch* in diameter takes a standard nut and SAE washer. Hardware *1/2 inch or less* in diameter uses a properly torqued whiz nut. See Figure B-2.
3. Follow these SAE washer rules after determining exit hole type:
   a. Always use a washer between hardware and a slot.
   b. Always use a washer under a nut (see Step 2 above for exception).
   c. Use a washer under a bolt when the female thread is fixed (weld nut).
4. Refer to the diagram below, which depicts the preceding hardware configuration possibilities.



1. Cap screw
2. Entry hole types
3. Standard nut and SAE washer: greater than 1/2 in. dia. hardware
4. Whiz nut: up to and including 1/2 in. dia. hardware
5. Weld nuts
6. Exit hole types

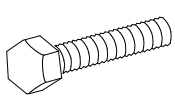
Figure B-2. Acceptable Hardware Combinations

Appendix C. Common Hardware Identification

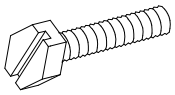
Common hardware has many different head, drive, and grade (hardness) styles. Some of the more common types are shown in Figure C-1 and Figure C-2. This is a guide for identification purposes. Not all generator hardware used is shown.

Screws/Bolts/Studs

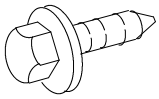
HEAD STYLES



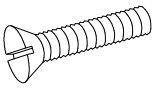
Hex. Head or Machine Head



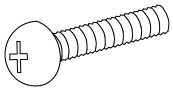
Hex. Head or Machine Head



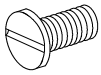
Hex. Head or Machine Head with Washer



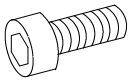
Flat Head



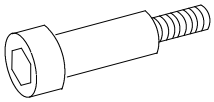
Round Head



Pan Head

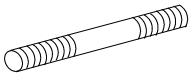


Socket Head Cap or Allenä Head Cap



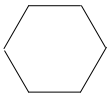
Socket Head or Allenä Head Shoulder Bolt

Sheet Metal Screw

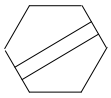


Stud

DRIVE STYLES



Hex.



Hex. and Slotted

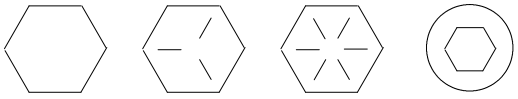
Phillips®

Slotted

Hex. Socket

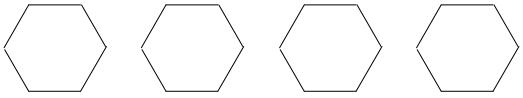
GRADE (HARDNESS)

American Standard



Grade 2 Grade 5 Grade 8 Grade 8/9

Metric



5.8 **8.8** **10.9** **12.9**

SAMPLE DIMENSIONS

American Standard

Major Thread Diameter In Fractional Inches Or Screw Number Size — 1/4-20 x 1 — Length In Inches

Threads Per Inch

Metric

Major Thread Diameter In Millimeters — M8-1.25 x 20 — Length In Millimeters

Distance Between Threads In Millimeters

Allenä is a trademark of Holo-Krome Co.
Phillips® is a registered trademark of the Phillips Screw Company.

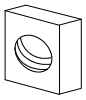
Figure C-1. Screws/Bolts/Studs

Nuts

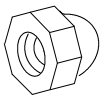
STYLES

Hex. Head

Lock Nut or
Nylock Nut



Square Nut

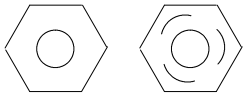


Cap Nut or
Acorn Nut

Wing Nut

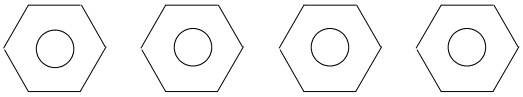
GRADE (HARDNESS)

American Standard



Grade 2 Grade 5

Metric



5.8 8.8 10.9 12.9

SAMPLE DIMENSIONS

American Standard

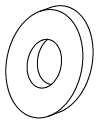
Major Thread Diameter In Fractional Inches Or Screw Number Size — 1/4-20 — Threads Per Inch

Metric

Major Thread Diameter In Millimeters — M8-1.25 — Distance Between Threads In Millimeters

Washers

STYLES

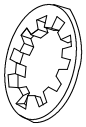


Plain
Washer

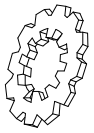
Split Lock
Washer or
Spring Washer

Spring Washer
or Wave Washer

External
Tooth Lock
Washer



Internal
Tooth Lock
Washer



Internal-External
Tooth Lock Washer

GRADE (HARDNESS)

There is no marking to identify hardness. Usually hardened washers have a black oxide or black phosphate finish rather than a zinc (silver-colored) finish.

SAMPLE DIMENSIONS

Plain Washers

Internal Dimension — 9/32 x 5/8 x 1/16 — Thickness

External Dimension

Lock Washers

5/8

Internal Dimension

Figure C-2. Nuts/Washers

Appendix D. General Torque Specifications

Use the following specifications for American Standard fasteners when no torque values are given elsewhere in this manual for a specified bolt. The values are based on new plated threads. Increase values by 20% if non-plated threads are used. Screws threaded into aluminum must have two diameters of threads engaged and may require 30% or more reduction in the torque.

American Standard

Size	Measurement	Assembled in Cast Iron or Steel						Assembled in Aluminum	
		Grade 2		Grade 5		Grade 8		Grade 2 or 5	
8-32	in. lbs. (Nm)	16	(2)	20	(2.3)	–		16	(1.8)
10-24	in. lbs. (Nm)	26	(3)	32	(3.6)	–		26	(2.9)
10-32	in. lbs. (Nm)	26	(3)	32	(3.6)	–		26	(2.9)
1/4-20	in. lbs. (Nm)	60	(7)	96	(10.8)	132	(14.9)	60	(6.8)
1/4-28	in. lbs. (Nm)	72	(8)	108	(12.2)	144	(16.3)	72	(8.1)
5/16-18	in. lbs. (Nm)	120	(14)	192	(21.7)	264	(29.8)	120	(13.6)
5/16-24	in. lbs. (Nm)	132	(15)	204	(23.1)	288	(32.5)	132	(14.9)
3/8-16	ft. lbs. (Nm)	18	(24)	28	(38)	39	(53)	18	(24)
3/8-24	ft. lbs. (Nm)	20	(27)	31	(42)	44	(60)	20	(27)
7/16-14	ft. lbs. (Nm)	29	(39)	44	(60)	63	(85)		
7/16-20	ft. lbs. (Nm)	32	(43)	50	(68)	70	(95)		
1/2-13	ft. lbs. (Nm)	44	(60)	68	(92)	96	(130)		
1/2-20	ft. lbs. (Nm)	49	(66)	76	(103)	108	(146)		
9/16-12	ft. lbs. (Nm)	60	(81)	98	(133)	138	(187)		
9/16-18	ft. lbs. (Nm)	67	(91)	108	(148)	154	(209)		
5/8-11	ft. lbs. (Nm)	83	(113)	135	(183)	191	(259)		
5/8-18	ft. lbs. (Nm)	94	(128)	153	(208)	216	(293)		
3/4-10	ft. lbs. (Nm)	147	(199)	240	(325)	338	(458)		
3/4-16	ft. lbs. (Nm)	164	(222)	268	(363)	378	(513)		
1-8	ft. lbs. (Nm)	191	(259)	532	(721)	818	(1109)		
1-12	ft. lbs. (Nm)	209	(283)	582	(789)	895	(1214)		

Metric

Size (mm)	Measurement	Assembled in Cast Iron or Steel						Assembled in Aluminum	
		5.8		8.8		10.9			
6 x 1.00	ft. lbs. (Nm)	5	(7)	6	(9)	9	(12)	5	(7)
8 x 1.25	ft. lbs. (Nm)	14	(19)	14	(20)	20	(37)	14	(19)
8 x 1.00	ft. lbs. (Nm)	16	(21)	17	(24)	23	(31)	16	(21)
10 x 1.50	ft. lbs. (Nm)	25	(35)	27	(37)	38	(51)	25	(35)
10 x 1.25	ft. lbs. (Nm)	29	(39)	34	(46)	45	(61)	29	(39)
12 x 1.75	ft. lbs. (Nm)	42	(57)	45	(61)	65	(89)		
12 x 1.50	ft. lbs. (Nm)	48	(65)	55	(75)	78	(106)		
14 x 2.00	ft. lbs. (Nm)	64	(86)	69	(94)	101	(137)		
14 x 1.50	ft. lbs. (Nm)	74	(100)	81	(110)	116	(157)		
16 x 2.00	ft. lbs. (Nm)	98	(133)	104	(141)	150	(204)		
16 x 1.50	ft. lbs. (Nm)	104	(141)	116	(157)	168	(228)		
18 x 2.50	ft. lbs. (Nm)	133	(181)	145	(196)	208	(283)		
18 x 1.50	ft. lbs. (Nm)	145	(196)	156	(212)	226	(306)		

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