Service

Residential/Commercial Generator Sets

Models:

14RES/RESL

20RES/RESL

Controllers:
RDC Residential Digital Control
DC Digital Control

ISO 9001 KOHLER POWER SYSTEMS NATIONALLY REGISTERED

KOHLER® Power Systems

TP-6735 7/17c

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IMPORTANT SAFETY INSTRUCTIONS. Electromechanical equipment, including generator sets, transfer switches, switchgear, and accessories, can cause bodily harm and pose life-threatening danger when improperly installed, operated, or maintained. To prevent accidents be aware of potential dangers and act safely. Read and follow all safety precautions and instructions. SAVE THESE INSTRUCTIONS.

This manual has several types of safety precautions and instructions: Danger, Warning, Caution, and Notice.

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***.

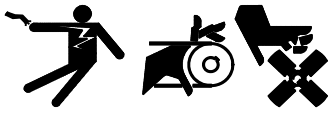
NOTICE

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

Safety decals affixed to the equipment in prominent places alert the operator or service technician to potential hazards and explain how to act safely. The decals are shown throughout this publication to improve operator recognition. Replace missing or damaged decals.

Accidental Starting

WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

Battery

WARNING

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

Wear protective goggles and clothing. Battery acid may cause blindness and burn skin.

WARNING

Explosion.
Can cause severe injury or death.
Relays in the battery charger cause arcs or sparks.

Locate the battery in a well-ventilated area. Isolate the battery charger from explosive fumes.

Battery electrolyte is a diluted sulfuric acid. Battery acid can cause severe injury or death. Battery acid can cause blindness and burn skin. Always wear splashproof safety goggles, rubber gloves, and boots when servicing the battery. Do not open a sealed battery or mutilate the battery case. If battery acid splashes in the eyes or on the 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 acid cleanup. Battery acid can cause severe injury or death. Battery acid is electrically conductive and corrosive. Add 500 g (1 lb.) of bicarbonate of soda (baking soda) to a container with 4 L (1 gal.) of water and mix the neutralizing solution. Pour the neutralizing solution on the spilled battery acid and continue to add the neutralizing solution to the spilled battery acid until all evidence of a chemical reaction (foaming) has ceased. Flush the resulting liquid with water and dry the area.

Battery gases. Explosion can cause severe injury or death. Battery gases can cause an explosion. Do not smoke or permit flames or sparks to occur near a battery at any time, particularly when it is charging. Do not dispose of a battery in a fire. To prevent burns and sparks that could cause an explosion, avoid touching the battery terminals with tools or other metal objects.

Remove all jewelry before servicing the equipment. Discharge static electricity from your body before touching batteries by first touching a grounded metal surface away from the battery. To avoid sparks, do not disturb the battery charger connections while the battery is charging. Always turn the battery charger off before disconnecting the battery connections. Ventilate the compartments containing batteries to prevent accumulation of explosive gases.

Battery short circuits. Explosion can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage. Disconnect the battery before generator set installation or maintenance. Remove all jewelry before servicing the equipment. Use tools with insulated handles. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery. Never connect the negative (-) battery cable to the positive (+) connection terminal of the starter solenoid. Do not test the battery condition by shorting the terminals together.

Engine Backfire/Flash Fire

⚠ WARNING

Risk of fire.
Can cause severe injury or death.

Do not smoke or permit flames or sparks near fuels or the fuel system.

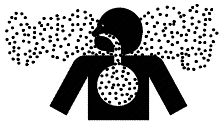
Servicing the fuel system. A flash fire can cause severe injury or death. Do not smoke or permit flames or sparks near the carburetor, fuel line, fuel filter, fuel pump, or other potential sources of spilled fuels or fuel vapors. Catch fuels in an approved container when removing the fuel line or carburetor.

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

Combustible materials. A fire can cause severe injury or death. Generator set engine fuels and fuel vapors are flammable and explosive. Handle these materials carefully to minimize the risk of fire or explosion. Equip the compartment or nearby area with a fully charged fire extinguisher. Select a fire extinguisher rated ABC or BC for electrical fires or as recommended by the local fire code or an authorized agency. Train all personnel on fire extinguisher operation and fire prevention procedures.

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. Carbon monoxide is an odorless, colorless, tasteless, nonirritating gas that can cause death if inhaled for even a short time. Avoid breathing exhaust fumes when working on or near the generator set. Never operate the generator set inside a building unless the exhaust gas is piped safely outside. Never operate the generator set where exhaust gas could accumulate and seep back inside a potentially occupied building.

Carbon monoxide detectors. Carbon monoxide can cause severe nausea, fainting, or death. Install carbon monoxide detectors on each level of any building adjacent to the generator set. Locate the detectors to adequately warn the building's occupants of the presence of carbon monoxide. Keep the detectors operational at all times. Periodically test and replace the carbon monoxide detectors according to the manufacturer's instructions.

Carbon monoxide symptoms. Carbon monoxide can cause severe nausea, fainting, or death. Carbon monoxide is a poisonous gas present in exhaust gases. Carbon monoxide is an odorless, colorless, tasteless, nonirritating gas that can cause death if inhaled for even a short time. 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, seek fresh air immediately and remain active. Do not sit, lie down, or fall asleep. Alert others to the possibility of carbon monoxide poisoning. Seek medical attention if the condition of affected persons does not improve within minutes of breathing fresh air.

Fuel System

⚠ WARNING

Explosive fuel vapors.
Can cause severe injury or death.

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

The fuel system. Explosive fuel vapors can cause severe injury or death. Vaporized fuels are highly explosive. Use extreme care when handling and storing fuels. Store fuels 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 because spilled fuel may ignite on contact with hot parts or from sparks. Do not smoke or permit flames or sparks to occur near sources of spilled fuel or fuel vapors. Keep the fuel lines and connections tight and in good condition. Do not replace flexible fuel lines with rigid lines. Use flexible sections to avoid fuel line breakage caused by vibration. Do not operate the generator set in the presence of fuel leaks, fuel accumulation, or sparks. Repair fuel systems before resuming generator set operation.

Gas fuel leaks. Explosive fuel vapors can cause severe injury or death. Fuel leakage can cause an explosion. Check the LPG vapor or natural gas fuel system for leakage by using a soap and water solution with the fuel system test pressurized to 6–8 ounces per square inch (10–14 inches water column). Do not use a soap solution containing either ammonia or chlorine because both prevent bubble formation. A successful test depends on the ability of the solution to bubble.

LPG liquid withdrawal fuel leaks. Explosive fuel vapors can cause severe injury or death. Fuel leakage can cause an explosion. Check the LPG liquid withdrawal fuel system for leakage by using a soap and water solution with the fuel system test pressurized to at least 90 psi (621 kPa). Do not use a soap solution containing either ammonia or chlorine because both prevent bubble formation. A successful test depends on the ability of the solution to bubble.

Hazardous Noise

⚠ CAUTION

Hazardous noise.
Can cause hearing loss.

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

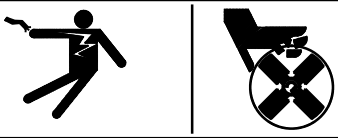
Hazardous Voltage/ Moving Parts

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

⚠ DANGER



Hazardous voltage. Moving parts.
Will cause severe injury or death.

Operate the generator set only when all guards and electrical enclosures are in place.

⚠ WARNING

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

If the generator set is used for standby power, install an automatic transfer switch to prevent inadvertent interconnection of standby and normal sources of supply.

⚠ CAUTION

Welding the generator set.
Can cause severe electrical equipment damage.

Never weld components of the generator set without first disconnecting the battery, controller wiring harness, and engine electronic control module (ECM).

Grounding electrical equipment. Hazardous voltage will cause severe injury or death. Electrocution is possible whenever electricity is present. Ensure you comply with all applicable codes and standards. Electrically ground the generator set, transfer switch, and related equipment and electrical circuits. Turn off the main circuit breakers of all power sources before servicing the equipment. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

Welding on the generator set. Can cause severe electrical equipment damage. Before welding on the generator set perform the following steps: (1) Remove the battery cables, negative (–) lead first. (2) Disconnect all engine electronic control module (ECM) connectors. (3) Disconnect all generator set controller and voltage regulator circuit board connectors. (4) Disconnect the engine battery-charging alternator connections. (5) Attach the weld ground connection close to the weld location.

High voltage test. Hazardous voltage will cause severe injury or death. Follow the instructions of the test equipment manufacturer when performing high-voltage tests on the rotor or stator. An improper test procedure can damage equipment or lead to generator set failure.

Connecting the battery and the battery charger. Hazardous voltage will cause severe injury or death. Reconnect the battery correctly, positive to positive and negative to negative, to avoid electrical shock and damage to the battery charger and battery(ies). Have a qualified electrician install the battery(ies).

Short circuits. Hazardous voltage/current will 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 making adjustments or repairs. Remove all jewelry before servicing the equipment.

Electrical backfeed to the utility. Hazardous backfeed voltage can cause severe injury or death. Install a transfer switch in standby power installations to prevent the connection of standby and other sources of power. Electrical backfeed into a utility electrical system can cause severe injury or death to utility personnel working on power lines.

Testing live electrical circuits. Hazardous voltage or current will cause severe injury or death. Have trained and qualified personnel take diagnostic measurements of live circuits. Use adequately rated test equipment with electrically insulated probes and follow the instructions of the test equipment manufacturer when performing voltage tests. Observe the following precautions when performing voltage tests: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Do not touch the enclosure or components inside the enclosure. (4) Be prepared for the system to operate automatically.
(600 volts and under)

Heavy Equipment

⚠ WARNING

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

Do not use lifting eyes.
Lift the generator set using lifting bars inserted through the lifting holes on the skid.

Hot Parts

⚠ WARNING

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

Do not work on the generator set until it cools.

Servicing the alternator. Hot parts can cause severe injury or death. Avoid touching the alternator field or exciter armature. When shorted, the alternator field and exciter armature become hot enough to cause severe burns.

Servicing the exhaust system. Hot parts can cause severe injury or death. Do not touch hot engine parts. The engine and exhaust system components become extremely hot during operation.

Servicing the engine heater. Hot parts can cause minor personal injury or property damage. Install the heater before connecting it to power. Operating the heater before installation can cause burns and component damage. Disconnect power to the heater and allow it to cool before servicing the heater or nearby parts.

Notice

NOTICE

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

NOTICE

Electrostatic discharge damage. Electrostatic discharge (ESD) damages electronic circuit boards. Prevent electrostatic discharge damage by wearing an approved grounding wrist strap when handling electronic circuit boards or integrated circuits. An approved grounding wrist strap provides a high resistance (about 1 megohm), *not a direct short*, to ground.

This manual provides troubleshooting and repair instructions for the generator set models listed on the front cover. This manual may also be supplied for similar models not listed on the front cover.

Information in this publication represents data available at the time of print. Kohler Co. reserves the right to change this publication and the products represented without notice and without any obligation or liability whatsoever.

Read 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 the equipment for future reference.

The equipment service requirements are very important to safe and efficient operation. Inspect the parts often and perform required service at the prescribed intervals. Maintenance work must be performed by appropriately skilled and suitably trained maintenance personnel familiar with generator set operation and service.

For engine service procedures not covered in this manual, refer to the Engine Service Manual.

Figure 1 Model 20RES

List of Related Materials

Separate manuals contain operation, installation, and parts information not provided in this manual. Separate engine operation and service manuals are also available. The following table lists the available manual part numbers.

Document Description	Part Number
Installation Manual	TP-6733
Operation Manual	TP-6734
Parts Catalog	TP-6736
Engine Service Manual, CH740	TP-2428
Engine Service Manual, CH1000	TP-2580
SiteTech™ Software Operation Manual	TP-6701
OnCue™ Software Operation Manual	TP-6796
OnCue™ Plus User Guide	TP-7006
OnCue™ Plus Technical Manual	TP-7007
OnCue™ Ethernet Option Board Instructions	TT-1566

Service Assistance

For professional advice on generator set power requirements and conscientious service, please contact your nearest Kohler distributor or dealer.

- Consult the Yellow Pages under the heading Generators—Electric.
- Visit the Kohler Power Systems website at KOHLERPower.com.
- Look at the labels and decals on your Kohler product or review the appropriate literature or documents included with the product.
- Call toll free in the US and Canada 1-800-544-2444.
- Outside the US and Canada, call the nearest regional office.

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East China Regional Office, Shanghai
Phone: (86) 21 6288 0500
Fax: (86) 21 6288 0550

India, Bangladesh, Sri Lanka
India Regional Office
Bangalore, India
Phone: (91) 80 3366208
(91) 80 3366231
Fax: (91) 80 3315972

Japan, Korea
North Asia Regional Office
Tokyo, Japan
Phone: (813) 3440-4515
Fax: (813) 3440-2727

1.1 Introduction

The specification sheets for each generator set provide specific generator and engine information. Refer to the generator set specification sheet for ratings and other data not supplied in this manual. Consult the generator set installation manual, engine operation manual, and engine service manual for additional specifications.

Consult the generator set nameplate for specific generator set ratings.

1.2 Controller Specifications

Model 14RES and 20RES generator sets are equipped with the Residential Digital Control (RDC). Model 14RESL and 20 RESL generator sets are equipped with the Digital Control (DC). For a specific description of the controller, see Section 2, Operation, in the operation manual.

Environmental Specification	All Models
Operating temperature	-30° to 70°C
Storage temperature	-40° to 85°C
Humidity	0-95% condensing
Power requirements:	
Voltage	12 VDC
Current (standby state)	250 mA @ 12 VDC

1.3 Engine Service

Generator sets covered in this manual are equipped with four-cycle, twin cylinder, air-cooled Kohler engines.

For engine service information and specifications not covered in this manual, see the engine service manual. See the List of Related Materials in the Introduction section.

1.4 Engine Specifications

Engine Specification	14RES/ RESL	20RES/ RESL
Manufacturer	Kohler	
Model	CH740	CH1000
Cycle	4	4
Number of cylinders	2	2
Compression ratio	9:1	8.8:1
Displacement, cc (cu. in.)	725 (44)	999 (61)
Rated power, propane fuel, kW (HP)	17.6 (23.6)	23.0 (30.9)
Rated power, natural gas, kW (HP)	15.3 (20.5)	20.2 (27.1)
Rpm, 60 Hz	3600	
Rpm, 50 Hz	3000	
Bore x stroke, mm (in.)	83 x 67 (3.27 x 2.64)	90 x 78.5 (3.54 x 3.1)
Valve material	Steel/Stellite®	
Cylinder block material	Aluminum w/cast iron liners	
Cylinder head material	Aluminum	
Piston rings	2 compression/ 1 oil	
Crankshaft material	Heat-treated ductile iron	
Main bearings: number, type	2, parent material	
Lubrication system	Full pressure	
Oil capacity (w/filter), L (qt.)	1.9 (2.0)	2.8 (3.0)
Oil pressure, kPa (psi)	172-241 (25-35)	
Fuel system	LP gas or natural gas	
Minimum fuel supply pressure, kPa (in. H_2O)	LP and NG: 1.2- 2.7 (5-11)	
Battery voltage	12 VDC	
Battery ground	Negative	
Spark plug gap, mm (in.)	0.76 (0.030)	
Ignition system	Capacitor discharge	
Starter motor	Electric, solenoid shift	
Cooling system	Air-cooled	

1.5 Alternator Specifications

Alternator Specification	14RES/RESL	20RES/RESL
Frequency Hz	50/60	50/60
Phase	Single-Phase	Single-Phase
Number of leads	4	4
Excitation method	Static Excited	Static Excited
Voltage regulator type	Digital	Digital
Coupling type	Direct	Direct
Insulation (rotor and stator)	Epoxy varnish, vacuum impregnated Class 180 (H)	
Winding material	Copper	Copper
Bearing, number and type	1, Sealed Ball	1, Sealed Ball
Circuit protection		
Battery charger inline fuse F1	10 amps	10 amps
Fuel solenoid/starter relay/throttle control fuse F2	7.5 amps	7.5 amps
Controller power, fuse F3	3 amps	3 amps
Aux. winding mini-breaker	20 amps	20 amps
Generator AC output line circuit breaker	70 amps	100 or 125 amps
Rotor resistance, ohms, cold	5.2	5.6
Stator resistance, ohms,* cold		
Single-Phase Leads 1-2, 3-4	0.06	0.02
11-44	0.13	0.04
55-66	0.60	0.44
Stator output voltage with separately excited rotor using 12-volt battery, minimum		
Leads: 1-2, 3-4	105 V	88 V
11-44	210 V	176 V
55-66	142 V	117 V
Rotor field voltage/current readings at rated output voltage, hot		
No load	19 V/3.2 A	19 V/3.9 A
Full load	48 V/7.2 A	53 V/7.4 A
Brush length, new	19.05 mm (0.75 in.)	19.05 mm (0.75 in.)

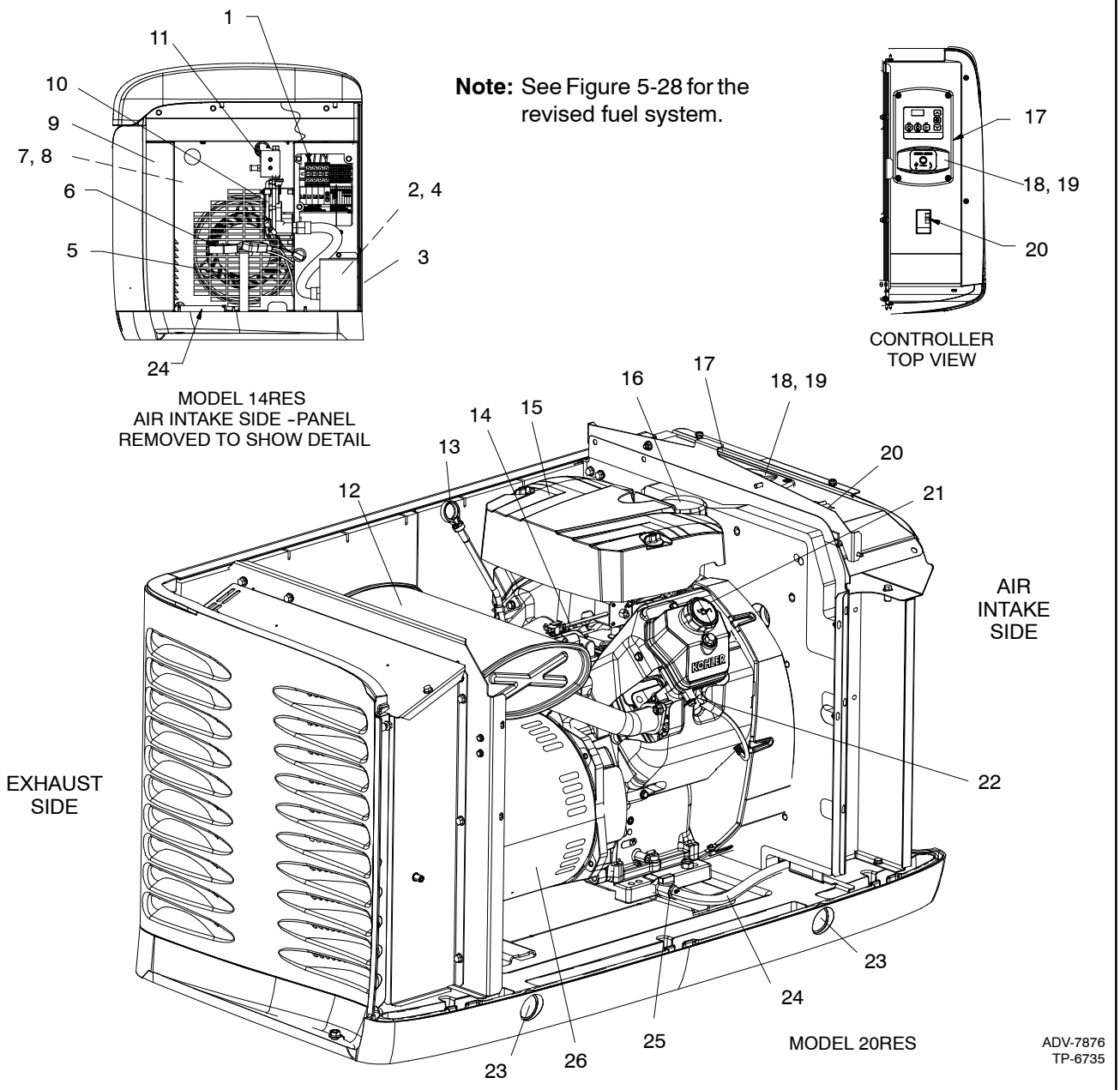
* Most ohmmeters do not give accurate readings when measuring less than 1 ohm. The stator can be considered good if a low resistance reading (continuity) is obtained and there is no evidence of shorted windings (discoloration). Do not confuse a low resistance reading with a reading indicating a shorted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

1.6 Torque Specifications

Torque Specifications, Nm (ft. lb.)	14/20RES/RESL
Alternator overbolts	15 (11)
Alternator thrubolt	85 (63)
Generator adapter screws	40 (28) *
Muffler flange bolts	24 (17.7)
Oil filter	3/4 to 1 turn after gasket contact
Spark plug	24.4–29.8 (18–22)

* Not applicable to the 20RES/RESL.

1.7 Service View

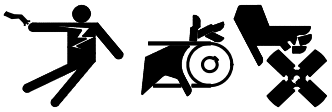


1. Field-connection terminal block
2. Digital spark advance ignition (DSAI) leads
3. Fuel inlet
4. Fuel solenoid valve
5. Engine starting battery location (battery purchased separately)
6. Battery cables
7. Battery charger location (charger not shown)
8. 120 VAC receptacles for battery charger and optional carburetor heater (not shown)
9. Nameplate location
10. Gas regulator assembly
11. Fuel block or LP orifice location (inside hose fitting)
12. Muffler (located below cover plate)
13. Oil check dipstick
14. Governor assembly
15. Air cleaner (Model 20RES shown)
16. Oil filter
17. RDC or DC controller
18. Fuses
19. USB connector (for firmware updates)
20. Line circuit breaker
21. Oil fill
22. Spark plugs
23. Lifting holes
24. Oil drain hose
25. Oil drain valve
26. Alternator

Figure 1-1 Generator Set Service View

Notes

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (–) lead first when disconnecting the battery. Reconnect the negative (–) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (–) lead first. Reconnect the negative (–) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

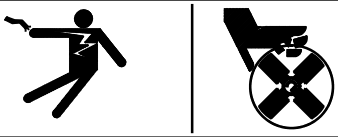
⚠ WARNING

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

Do not work on the generator set until it cools.

Servicing the exhaust system. Hot parts can cause severe injury or death. Do not touch hot engine parts. The engine and exhaust system components become extremely hot during operation.

⚠ DANGER



Hazardous voltage. Moving parts.
Will cause severe injury or death.

Operate the generator set only when all guards and electrical enclosures are in place.

See the Safety Precautions and Instructions at the beginning of this manual before attempting to service, repair, or operate the generator set. Have an authorized distributor/dealer perform generator set service.

Alternator Service. Under normal operating conditions the generator set alternator does not require scheduled service. Refer to the service schedule for items that require maintenance.

Engine Service. Perform generator set engine service at the intervals specified by the engine service literature. Contact an authorized Kohler® service distributor/ dealer to obtain engine service literature.

All generator sets have emission-certified engines. The carburetors on emission-certified engines are not adjustable.

Generator Set Service. See the Safety Precautions and Instructions at the beginning of this manual before attempting to service, repair, or operate the generator set. Have an authorized Kohler® service distributor/ dealer perform all generator service.

Routine Maintenance. Refer to the following generator set service schedule, the engine service schedule, and the runtime hours displayed on the generator set controller to determine when to schedule routine maintenance. Service the generator set more frequently if it is subject to extreme weather, long operating hours, or dusty or dirty conditions.

Service Schedule. Perform maintenance on each item in the service schedule at the designated interval for the life of the generator set.

Tools. Tools and instruments used to perform some maintenance items are not generally available to the generator set owner. Therefore, have service performed by an authorized distributor/dealer.

2.1 Service Schedule

Perform the items listed in the service schedule at the designated intervals for the life of the generator set. For example, an item serviced every 100 hours or 3 months must also be serviced after 200 hours or 6 months, 300 hours or 9 months, etc.

System Component or Procedure	See Section	Procedure				
		Visually Inspect	Check	Change	Clean	Test
Fuel						
Flexible lines and connections		Q		R		
Main tank supply level (LP)			W			
Fuel piping		Y				
Lubrication	2.2					
Oil level	2.2.2		8 or E			
Change oil	2.2.4			Y or 150		
Replace filter	2.2.4			Y or 150		
Crankcase breather hose		Y or 500				
Oil cooler	2.2.6	Y			Y or 100	
Cooling	2.5					
Air ducts, louvers			Y		Y	
Exhaust System	2.6					
Leakage		W	W			
Insulation, fire hazards		Y				
Obstructions or combustible materials near exhaust outlet		W				
DC Electrical System						
Battery charger operation, charge rate		M				
Remove corrosion, clean and dry battery and rack	2.8	Y			Y	
Clean and tighten battery terminals and inspect boots		Y	Y			
Tighten DC electrical connections			Y			
AC Electrical System						
Tighten control and power wiring connections			Y			
Remote control system, if equipped						M
Visible wear or damage		Q				
Wire abrasions where subject to motion		6 months	6 months			
Wire-cable insulation condition		3Y or 500				
Engine and Mounting						
Visible wear or damage		W				
Air cleaner service *	2.4		150	300		
Spark plugs	2.3		150	300		
Replace stepper motor coupling and bushing	2.7			500 (D)		
Generator						
Visible wear or damage		Q				
Exercise generator set						W
Brushes and collector ring	5.5, 5.6	Y (D)			Y (D)	
Measure and record resistance readings of windings with insulation tester (Megger®, with controller or rectifier and load leads disconnected)						3Y (D)
General Condition of Equipment						
Evidence of vibration, leakage, deterioration, unusual or excessive noise or temperature		W	W		W	
Interior of sound enclosure		Q			Q	

* Service more frequently under extremely dusty/dirty conditions.

Megger® is a registered trademark of Biddle Instruments.

E Each use
W Weekly
M Monthly
Q Quarterly
Y Yearly

Number = hours of operation
D Authorized distributor/dealer only
R Replace as necessary
S/M Service Manual

Figure 2-1 Service Schedule

2.2 Lubrication System

See Section 2.1, Service Schedule, for oil change and oil filter replacement intervals. See Section 1.7, Service View, for the oil drain, oil check, oil fill, and oil filter locations.

2.2.1 Low Oil Pressure Shutdown

The low oil pressure (LOP) shutdown feature protects the engine against internal damage if the oil pressure drops below a minimum pressure because of oil pump failure or other malfunction.

Note: The LOP shutdown feature does not protect against damage caused by operating when the oil level is low; it is not a low oil level shutdown. Check the oil level regularly, and add oil as needed.

2.2.2 Oil Check

The generator set is shipped with oil. Before operating the generator set, check the engine oil in the crankcase. See Figure 2-2 for the dipstick location.

Maintain the oil level at or near, not over, the full mark on the dipstick. Add 5W-30 synthetic oil when the oil level is low. See Section 2.2.3, Engine Oil Recommendation.

Check the oil level before each use. For extended operation, check the oil level every 8 hours. Do not check the oil level when the generator set is running. Shut down the generator set and wait several minutes before checking the oil.

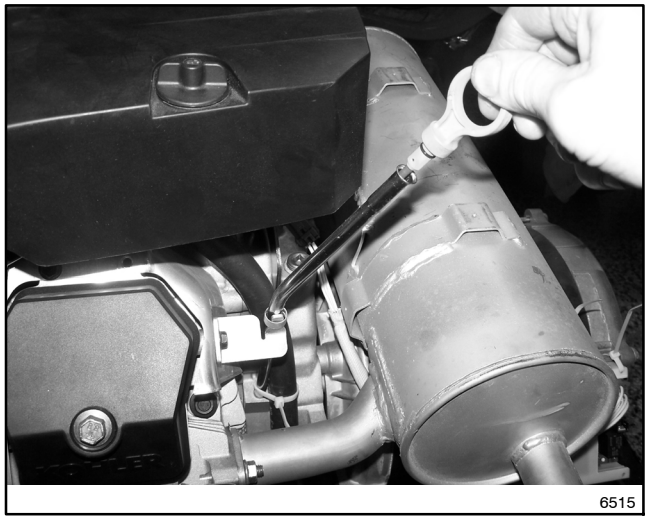


Figure 2-2 Oil Check

2.2.3 Engine Oil Recommendation

Use 5W-30 API (American Petroleum Institute) Service Class SG, SH, or SJ synthetic oil. Synthetic oil oxidizes and thickens less than other oils and leaves the engine intake valves and pistons cleaner.

Model	Oil Capacity, L (qt.)
14RES/RESL	1.9 (2.0)
20RES/RESL	2.8 (3.0)

Figure 2-3 Oil Capacity (approximate)

2.2.4 Oil Change Procedure

Note: Dispose of all waste materials (engine oil, fuel, filter, etc.) in an environmentally safe manner.

Drain the oil while it is still warm.

1. **Drain the oil.**

   a. Press the OFF button on the controller and remove the F3 fuse (located in the controller's service access area).

   b. Disconnect the power to the battery charger.

   c. Disconnect the generator set engine starting battery, negative (–) lead first.

   d. Remove the housing intake panel.

   e. Clean the area around the dipstick and oil fill cap.

   f. Remove the cap from the oil drain hose and lower the hose into an oil collection container.

   g. Open the oil drain valve on the engine.

   h. Remove the dipstick and oil fill cap. Allow time for the engine oil to drain completely.

   i. Close the oil drain valve. Replace the cap on the oil drain hose. Replace the oil drain hose in its retaining clip.

   j. Replace the dipstick.

2. **Replace the oil filter.**

   a. Clean the area around the oil filter. Remove the oil filter by rotating it counterclockwise with an oil filter wrench.

   b. Clean the gasket sealing surface of the oil filter adapter.

   c. Apply a light coat of clean oil to the rubber seal of the new oil filter.

d. Install the new oil filter following the instructions provided with the filter.

3. **Fill with oil.**

   a. Fill the engine to the F mark on the dipstick. Section 2.2.3, Engine Oil Recommendation, for oil selection. See Figure 2-3 for the engine oil capacity.

   b. Reinstall the dipstick and the oil fill cap.

   c. Check that the generator set is off (the OFF LED is on).

   d. Reconnect the generator set engine starting battery, negative (–) lead last.

   e. Reconnect the power to the battery charger.

   f. Reinstall the F3 fuse.

   g. Start and run the generator set for a minute to allow the oil pressure to reach operating range.

   h. Stop the generator set, wait 1 minute, and then recheck the oil level. Add oil to bring the level up to the F mark on the dipstick.

4. **Check for leaks.**

   a. Check for oil leaks.

   b. Fix leaks and recheck the oil level.

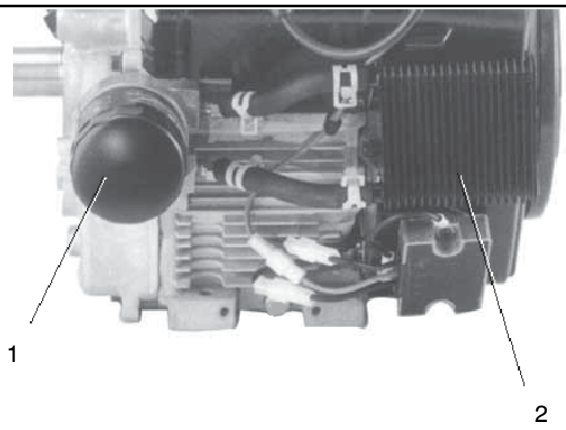
   c. Reinstall the housing side panel.

2.2.5 Oil Cooler, 14RES/RESL

Inspect and clean the oil cooler at the intervals shown in the Service Schedule. The oil cooler must be kept free of debris.

Remove the front enclosure panel to access the oil cooler. See Section 6.2 for instructions to remove the front panel.

See Figure 2-4 for the oil cooler location. Clean the outside of the oil cooler with a brush or compressed air. If it is necessary to clean the back of the oil cooler, remove the two screws holding the oil cooler unit to the blower hosing. Tilt the cooler and clean with a brush or compressed air as shown in Figure 2-5. After cleaning, reinstall the oil cooler and secure with the mounting screws.



1. Oil filter
2. Oil cooler

24 590 01-A

Figure 2-4 Oil Cooler Location, 14RES/RESL

24 590 01-A

Figure 2-5 Cleaning the Oil Cooler

2.2.6 Oil Cooler, 20RES/RESL

Inspect and clean the oil cooler at the intervals indicated in the service schedule. The oil cooler must be kept free of debris.

Remove the front enclosure panel to access the oil cooler. See Section 6.2 for instructions to remove the front panel.

See Figure 2-6 for the oil cooler location. The oil cooler is located under the No. 2 cylinder shroud. Remove the top mounting screw and loosen the two side screws, then lift off the cylinder shroud. Clean the outside of the oil cooler fins with a brush or with compressed air.

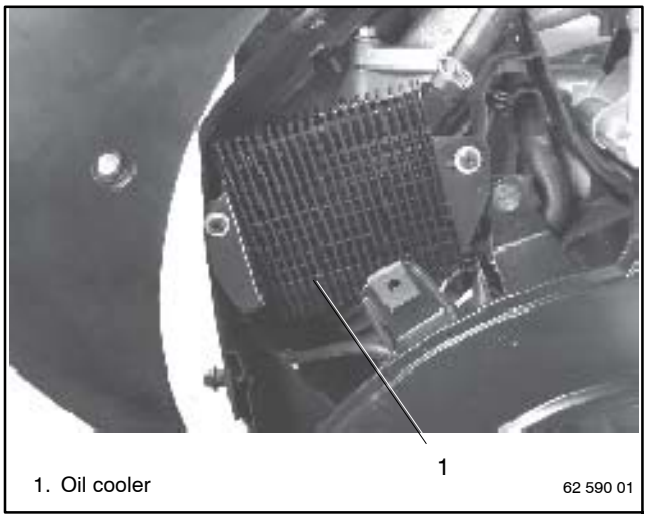


Figure 2-6 Oil Cooler Location, 20RES/RESL

2.3 Spark Plugs

Reset the spark plug gap or replace the plugs with new plugs as necessary.

1. Clean the area around the base of the spark plug to keep dirt and debris out of the engine.
2. Remove the spark plug and check its condition. Replace the spark plug if it is worn or if its reuse is questionable.
3. Check the spark plug gap using a wire feeler gauge. Adjust the gap to 0.76 mm (0.030 in.) by carefully bending the ground electrode. See Figure 2-7 and Figure 2-8.
4. Reinstall the spark plug into the cylinder head. Torque the spark plug to 24.4–29.8 Nm (18–22 ft. lb.)

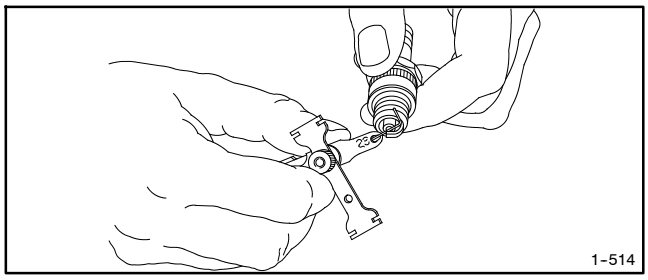


Figure 2-7 Checking the Spark Plug Gap

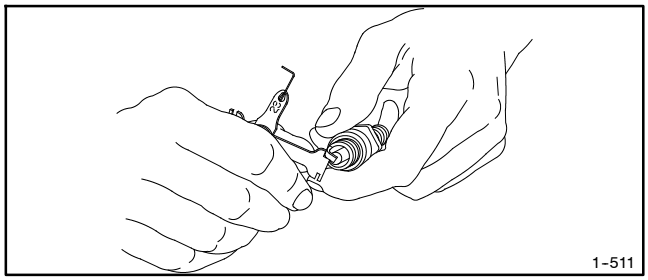
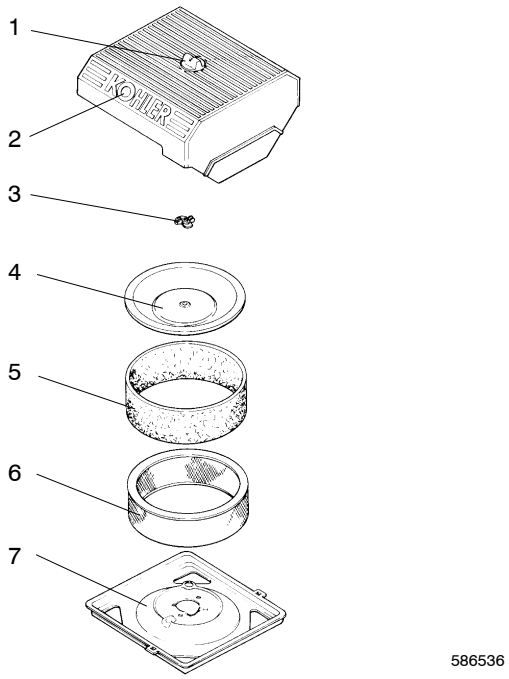


Figure 2-8 Adjusting the Spark Plug Gap

2.4 Air Cleaner Service

2.4.1 Air Cleaner, 14RES/RESL Models

The engine has a replaceable high-density paper air cleaner element with an oiled foam precleaner. See Figure 2-9.



1. Cover knob
2. Air cleaner cover
3. Element cover nut
4. Element cover
5. Foam precleaner
6. Air cleaner element
7. Air cleaner base

Figure 2-9 Air Cleaner Components, 14RES/RESL

Check for a buildup of dirt and debris around the air cleaner system. Keep this area clean. Also check for loose or damaged components. Replace all bent or damaged air cleaner components.

Note: Operating the engine with loose or damaged air cleaner components could allow unfiltered air into the engine causing premature wear and failure.

Precleaner Service

Use the following procedure to wash and reoil the precleaner as indicated in the service schedule. Wash and reoil the precleaner more often under extremely dusty or dirty conditions.

1. Press the OFF button on the generator set controller and remove the F3 fuse (located in the controller's service access area).
2. Disconnect the power to the battery charger.
3. Disconnect the battery, negative (–) lead first.
4. Loosen the cover retaining knob and remove the cover. Remove the precleaner from the paper element. Wash the precleaner in warm water with detergent. Rinse the precleaner thoroughly until all traces of detergent are eliminated. Squeeze out excess water (do not wring). Allow the precleaner to air dry.
5. Saturate the precleaner with new engine oil. Squeeze out all of the excess oil.
6. Reinstall the precleaner over the paper element.
7. Reinstall the air cleaner cover. Secure the cover with the cover retaining knob.
8. Reconnect the generator set engine starting battery, negative (–) lead last.
9. Reconnect the power to the battery charger.
10. Reinstall fuse F3.

Paper Element Service

Use the following procedure to replace the paper element at the intervals specified in the service schedule. Replace the paper element more often under extremely dusty or dirty conditions.

1. Press the OFF button on the generator set controller and remove the F3 fuse (located in the controller's service access area).
2. Disconnect the power to the battery charger.
3. Disconnect the generator set engine starting battery, negative (–) lead first.
4. Loosen the cover retaining knob and remove the cover.
5. Remove the element cover nut, element cover, and the paper element with precleaner.
6. Remove the precleaner from the paper element.

   Note: Do not wash the paper element or clean it with pressurized air, as this will damage the element.
7. Replace the element if it is dirty, bent, or damaged.
8. Check the air cleaner base. Make sure it is secure and not bent or damaged. Also check the element cover for damage and fit. Replace all damaged air cleaner components. Remove any loose dirt or

debris from the air cleaner base. Wipe the base carefully so that no dirt drops into the intake throat. Check the condition of the rubber seal on the air cleaner stud and replace the seal if necessary.

9. Reinstall the paper element, precleaner, element cover, element cover nut, and the air cleaner cover. Secure the cover with the cover retaining knob.

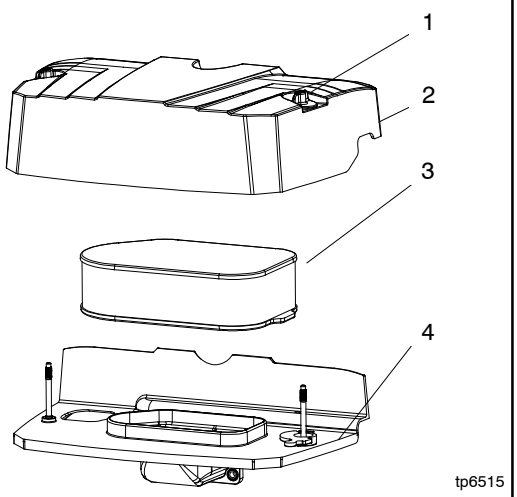
10. Reconnect the power to the battery charger.

11. Reconnect the generator set engine starting battery, negative (–) lead last.

12. Reinstall fuse F3.

2.4.2 Air Cleaner, 20RES/RESL Models

The engine is equipped with a replaceable, high density paper air cleaner element. See Figure 2-10.



1. Knobs (qty. 2)
2. Cover
3. Paper element
4. Base

Figure 2-10 Air Cleaner Components, 20RES/RESL

Check the air cleaner daily or before starting the engine. Check for a buildup of dirt and debris around the air cleaner system. Keep this area clean. Also check for loose or damaged components. Replace all bent or damaged air cleaner components.

Note: Operating the engine with loose or damaged air cleaner components could allow unfiltered air into the engine causing premature wear and failure.

Paper Element Service

Replace the paper element at the intervals indicated in the service schedule. See Figure 2-1 for the service schedule. See Figure 2-10 for the air cleaner components. When element replacement is necessary, order genuine Kohler parts.

1. Loosen the two cover retaining knobs and remove the cover.

2. Remove the paper element.

3. Do not wash the paper element or use pressurized air, as this will damage the element. Replace a dirty, bent, or damaged element. Handle new elements carefully; do not use if the sealing surfaces are bent or damaged.

4. When servicing the air cleaner, check the air cleaner base. Make sure it is secured and not bent or damaged. Also, check the element cover for damage or improper fit. Replace all damaged air cleaner components.

Note: If any loose dirt or debris fell on the air cleaner base when the element was removed, carefully remove it and wipe the base clean. Be careful that none of it drops into the intake throat.

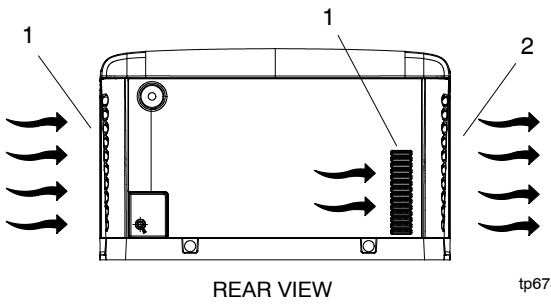
5. Reinstall the paper element onto the air cleaner base. Make sure the element is flat and properly seated.

6. Install the air cleaner cover and secure with the two retaining knobs.

2.5 Cooling System

The engine fan draws cooling air through the openings in the sides and end near the battery. The alternator fan draws cooling air through openings on the side walls of the enclosure. The cooling air mixes with the engine exhaust and is discharged at the exhaust outlet. See Figure 2-11. To prevent generator set damage caused by overheating, keep the housing cooling inlets and outlets clean and unobstructed at all times.

Note: Do not block the generator set cooling air inlets or mount other equipment above them. Overheating and severe generator damage may occur.



1. Air intake
2. Exhaust outlet

Figure 2-11 Cooling Air Intake and Exhaust

2.6 Exhaust System

Remove all combustible materials from the exhaust location. Combustible materials include building materials as well as natural surroundings. Keep dry field grass, foliage, and combustible landscaping material a minimum of 1.5 m (5 ft.) from the exhaust outlet.

Periodically inspect the exhaust system components for cracks, leaks, and corrosion.

- Check for corroded or broken metal parts and replace them as needed.
- Check that the exhaust outlet is clear.

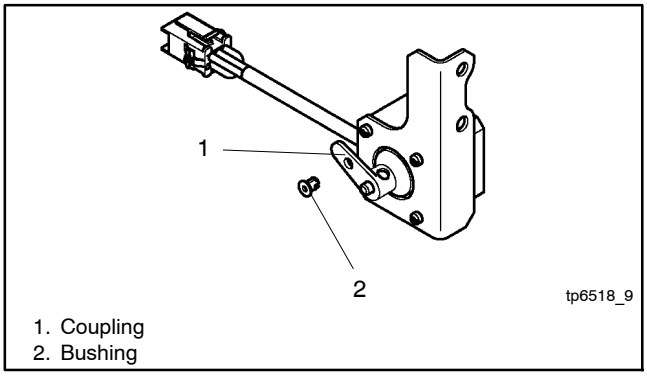
2.7 Stepper Motor Coupling

Replace the stepper motor coupling and bushings at the intervals shown in the service schedule. See the Parts Catalog for replacement part numbers.

Figure 2-12 shows the location of the coupling assembly under the air cleaner. Loosen the set screw to remove the coupling from the motor shaft.

1. Coupling and bushing

Figure 2-12 Stepper Motor Coupling



1. Coupling
2. Bushing

Figure 2-13 Stepper Motor Coupling and Bushing

2.8 Battery

⚠ WARNING

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

Wear protective goggles and clothing. Battery acid may cause blindness and burn skin.

Battery electrolyte is a diluted sulfuric acid. Battery acid can cause severe injury or death. Battery acid can cause blindness and burn skin. Always wear splashproof safety goggles, rubber gloves, and boots when servicing the battery. Do not open a sealed battery or mutilate the battery case. If battery acid splashes in the eyes or on the 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.

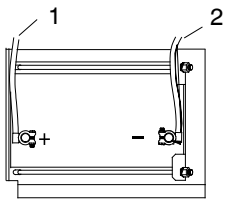
Battery acid cleanup. Battery acid can cause severe injury or death. Battery acid is electrically conductive and corrosive. Add 500 g (1 lb.) of bicarbonate of soda (baking soda) to a container with 4 L (1 gal.) of water and mix the neutralizing solution. Pour the neutralizing solution on the spilled battery acid and continue to add the neutralizing solution to the spilled battery acid until all evidence of a chemical reaction (foaming) has ceased. Flush the resulting liquid with water and dry the area.

Battery gases. Explosion can cause severe injury or death. Battery gases can cause an explosion. Do not smoke or permit flames or sparks to occur near a battery at any time, particularly when it is charging. Do not dispose of a battery in a fire. To prevent burns and sparks that could cause an explosion, avoid touching the battery terminals with tools or other metal objects. Remove all jewelry before servicing the equipment. Discharge static electricity from your body before touching batteries by first touching a grounded metal surface away from the battery. To avoid sparks, do not disturb the battery charger connections while the battery is charging. Always turn the battery charger off before disconnecting the battery connections. Ventilate the compartments containing batteries to prevent accumulation of explosive gases.

Battery short circuits. Explosion can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage. Disconnect the battery before generator set installation or maintenance. Remove all jewelry before servicing the equipment. Use tools with insulated handles. Remove the negative (–) lead first when disconnecting the battery. Reconnect the negative (–) lead last when reconnecting the battery. Never connect the negative (–) battery cable to the positive (+) connection terminal of the starter solenoid. Do not test the battery condition by shorting the terminals together.

This section contains general battery information and maintenance instructions. Also consult the battery manufacturer's instructions for battery maintenance.

All generator set models use a negative ground with a 12-volt engine electrical system. Consult the generator set nameplate for the engine electrical system voltage. Consult the generator spec sheet for battery capacity recommendations for replacement purposes. Wiring diagrams provide battery connection information. See Figure 2-14 for typical battery connections.



1. To positive (+) terminal on starter solenoid.
2. To ground (–) terminal on or near starter motor.

Figure 2-14 12-Volt Engine Electrical System Single Starter Motor, Typical Battery Connection

Clean the battery and cables and tighten battery terminals using the service schedule recommendations. To prevent corrosion, maintain tight, dry electrical connections at the battery terminals. To remove corrosion from battery terminals, disconnect the cables from the battery and scrub the terminals with a wire brush. Clean the battery and cables with a solution of baking soda and water. After cleaning, flush the battery and cables with clean water and wipe them with a dry, lint-free cloth.

After reconnecting the battery cables, coat the battery terminals with petroleum jelly, silicone grease, or other nonconductive grease.

2.9 Battery Charger

The generator set is equipped with a battery charger to maintain the engine starting battery. See Section 1.7, Service Views, for the battery charger location.

The charger's DC leads are factory-wired. Periodically tighten all connections. See the generator set operation manual for battery charger troubleshooting instructions.

2.10 Storage Procedure

Perform the following storage procedure before removing the generator set from service for three months or longer. Follow the engine manufacturer's recommendations for storage, if available.

Note: Run the generator set monthly whenever possible.

2.10.1 Lubricating System

1. Operate the generator set until it reaches operating temperature, or about 15 minutes.
2. Stop the generator set.
3. While the engine is still warm, drain the engine lubrication oil from the engine crankcase.
4. Refill the engine crankcase with oil. See Section 2.2.3 for oil recommendations.
5. Run the generator set for a few minutes to distribute the clean oil.
6. Stop the generator set.

2.10.2 Fuel System

1. Start the generator set.
2. With the generator set running, shut off the gas supply.
3. Run the generator set until the engine stops.
4. Press the OFF button on the controller.

2.10.3 Cylinder Lubrication

1. Remove the spark plugs.
2. Pour one tablespoon of engine oil into each spark plug hole. Install the spark plugs and *ground* the spark plug leads. *Do not connect the leads to the plugs.*
3. Press RUN and then OFF to crank the engine two or three revolutions to lubricate the cylinders.

2.10.4 Exterior Preparation

1. Clean the exterior surface of the generator set.
2. Seal all openings in the engine with nonabsorbent adhesive tape.
3. Mask all areas to be used for electrical contact.
4. Spread a light film of oil over unpainted metallic surfaces to prevent rust and corrosion.

2.10.5 Battery

Perform battery storage last.

1. Press the OFF button on the generator set controller.
2. Disconnect the battery, negative (–) lead first.
3. Clean the battery.
4. Place the battery in a warm, dry location.
5. Connect the battery to a float/equalize battery charger, or charge the battery monthly using a trickle charger. Follow the battery charger manufacturer's recommendations.

3.1 Introduction

Corrective action and testing in many cases requires knowledge of electrical systems and electronic circuits. Have an authorized distributor/dealer or trained service technician perform testing and service.

Refer to the engine service manual for engine service information. See the List of Related Materials for the document part number.

If the troubleshooting procedures in this section identify a failed part, refer to the parts catalog for replacement part numbers. See the List of Related Materials in the Introduction for the parts catalog number.

3.2 Initial Checks

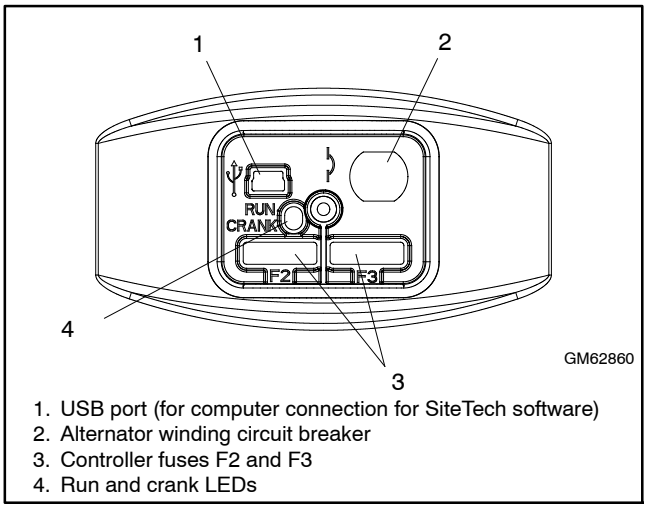
When troubleshooting, always check for simple problems first. Check for the following common problems before replacing parts:

- **Loose connections or damaged wiring.**
- **Dead battery.**
- **Fault shutdown.** Check for a fault code on the controller display. Section 4.8 describes the warning and shutdown fault codes. If a fault code is displayed, identify and correct the cause of the fault condition. Then reset the controller.
- **Blown fuses.** Two controller fuses are located in the controller's service access area. See Figure 3-1. A battery charger fuse is located in the positive battery lead. Always check for and replace any blown fuses before replacing other components. Identify and correct the cause of the blown fuse. See Section 5.14.2 for fuse part numbers.
- **Incorrect controller settings.** Always check the controller configuration settings before replacing the controller. Section 4.10 contains the instructions for checking and changing the controller configuration.
- **Inadequate fuel supply.** Check for damaged primary or secondary fuel regulators, loose connections to the fuel solenoid valve, a damaged or closed fuel shutoff valve, an empty LP fuel tank, or other problems with the fuel supply. Check the fuel supply pressure to the generator set. See Section 5.11, Fuel Systems.

3.3 Controller Service Access

The controller fuses and alternator winding circuit breaker are accessible from the front of the controller. Remove the service access door to reach the circuit breaker and fuses. See Figure 3-1.

Obtain replacement fuses from a Kohler authorized distributor/dealer.



1. USB port (for computer connection for SiteTech software)
2. Alternator winding circuit breaker
3. Controller fuses F2 and F3
4. Run and crank LEDs

Figure 3-1 Controller Service Access (cover removed)

3.4 OnCue Troubleshooting

See TP-6796, OnCue Software Operation Manual, for troubleshooting instructions for the OnCue Home Generator Management System.

- The OnCue Ethernet option board must be installed onto the RDC/DC controller for connection to the Internet. See TT-1566.
- RDC/DC firmware version 3.0 or higher is required for network communication.

3.5 Troubleshooting Chart

Use the following table as a reference in troubleshooting individual problems. Generator set faults are listed in groups and include likely causes and remedies. The simplest and most likely causes of the problem are listed first; follow the recommendations in the order shown. The reference column provides additional sources of information in this and related manuals regarding the problem and solution.

Problem	Possible Cause	Test	Corrective Action	Reference
Generator set engine does not crank	Battery connections	Check for reversed or poor battery connections.	Correct and tighten battery connections.	—
	Weak or dead battery	Test the battery voltage. Test battery according to battery manufacturer's recommendations.	Recharge or replace battery.	O/M
		If battery is weak or dead, check the battery charger. Check battery charger fuse and connections. Check 120VAC power supply to the charger. Test charger operation.	 Tighten connections and replace charger fuse if blown. Connect 120VAC power to charger. Replace charger if necessary.	O/M
	Open circuit in engine/controller connections	Check for loose connections. Check the wire harness continuity.	Tighten connections. Replace harness or harness leads if damaged.	Section 5.13 Section 7
	Blown controller fuse F3	Use a test lamp or meter to check fuse F3.	Replace fuse; if fuse blows again, check circuit and components.	Section 5.14.2 Section 7
	Blown fuse F2	Use a test lamp or meter to check fuse F2.	Replace fuse.	Section 5.14.2.
			If fuse blows again, disconnect the following leads. Reconnect one at a time and attempt to start to identify the cause of the blown fuse: Lead 70A at the fuel valve Lead IGN at the ignition module Lead 71A at the starter relay Leads FP and FN at the rotor Repair or replace the component causing the blown fuse.	Section 7
	Crank relay K3 on controller circuit board	Check connections to the controller.	Tighten connections. Replace wiring if damaged.	Section 4.12
		Check for a good ground connection.	Tighten/repair ground connection.	Section 7
		Check the crank LED to verify 12VDC to relay K3.	If the Crank LED is not lit, check for 12VDC to the board. If the Crank LED is lit but relay K3 does not operate, replace the controller circuit board.	Section 7 Section 4.12
	Poor ground (–) connection	Test ground connection.	Clean and retighten.	—
	Starter relay	Check connections to the starter relay.	Tighten connections. Replace wiring if damaged.	Section 1.7
		Check continuity of circuit.		Section 5.13 Section 7
		Check that the starter relay picks up when 12VDC is applied at lead 71A connection.	Replace starter relay.	Section 7

W/D = Wiring Diagram(s) (Section 7) S/S = Generator Set Specification Sheet O/M = Generator Set Operation Manual
I/M = Generator Set Installation Manual Engine S/M = Engine Service Manual

* RDC controller settings can be checked and adjusted using the controller user interface or using a personal computer running SiteTech software. DC controller settings can only be changed using SiteTech.

Problem	Possible Cause	Test	Corrective Action	Reference
Generator set engine does not crank, continued	Starter	Check starter connections.	Tighten connections. Replace wiring if damaged.	Section 1.7 Section 7
		Troubleshoot the starter. See the engine service manual for instructions.	Rebuild or replace starter.	Engine S/M
	Controller	Check the controller settings.	Adjust controller settings.	Section 4.10
		Test the controller as described in Section 3.6.	See Section 3.6.	Section 3.6
Cranks but does not start	No fuel	Verify that manual fuel valve is open. Check fuel supply tank (LP).	Open (turn on) manual fuel valve. Contact fuel supplier to add fuel to fuel supply tank (LP).	—
	Insufficient fuel pressure	Check fuel pressure to the generator set. Verify adequate fuel pressure and pipe size for the generator set plus all other gas appliances.	Contact fuel supplier to replace fuel supply lines with larger pipe and replace gas meter if fuel pressure is insufficient.	Section 5.11.3
	Fuel regulator/valve	Check regulator/valve operation.	Check regulator/valve operation.	Section 5.11 Section 4
	Spark plugs or spark plug connections	Check spark plug wires and connections. Check spark plugs.	Tighten connections. Replace spark plug wires if damaged. Replace or clean and regap spark plugs.	O/M
	Loose connection or open circuit	Check for loose or open connection at the fuel valve (lead 70A) and at the engine spark control module (leads IGN and 70A). Check controller/engine wiring continuity.	Tighten connections. Replace wiring if damaged.	Section 7
	Air cleaner clogged	Check for a dirty air cleaner element.	Replace air cleaner element. Check and replace air cleaner element at the intervals shown in the Service Schedule.	O/M
	Magnetic pickup	Check for 3.0 volts or higher from the magnetic pickup during cranking. Test magnetic pickup and check gap according to the procedure in Section 5.9.4.	Tighten loose connections or replace wiring as necessary. Adjust magnetic pickup air gap if necessary. Replace mag pickup if necessary after testing.	Section 5.9.4
		Measure the resistance across the magnetic pickup according to the procedure in Section 5.9.4.	Replace mag pickup if the resistance is too high (open circuit) or too low (short circuit).	Section 5.9.4
	Incorrect controller configuration	Check for correct engine configuration parameter (EC).	Enter the correct controller configuration parameters.	Section 4.10
	Ignition system spark control or ignition coil	Test according to instructions in the engine service manual.	Adjust or replace components as indicated in engine service manual.	Engine S/M
	Digital spark advance (DSAI) leads incorrectly connected or disconnected	Check DSAI leads. Check for loose connections.	Connect for natural gas. Disconnect for LP. Tighten connections. Replace wiring if damaged.	Section 5.11.2
	No engine rotation sensed (check for an overcrank fault shutdown)	Check mag pickup. See magnetic pickup, above.	See magnetic pickup, above.	Section 5.9.4

W/D = Wiring Diagram(s) (Section 7) S/S = Generator Set Specification Sheet O/M = Generator Set Operation Manual
I/M = Generator Set Installation Manual Engine S/M = Engine Service Manual

* RDC controller settings can be checked and adjusted using the controller user interface or using a personal computer running SiteTech software. DC controller settings can only be changed using SiteTech.

Problem	Possible Cause	Test	Corrective Action	Reference
Starts hard	Low battery voltage	Check battery voltage during cranking. Check battery charger connections, power supply, and operation.	Charge battery. Replace battery if necessary. Tighten loose connections.	O/M
	Air cleaner clogged	Check for a dirty air cleaner element.	Replace element.	O/M
	Fuel mixture adjustment incorrect	Use oxygen sensor to check fuel mixture.	Adjust fuel mixture.	Section 5.11
	DSAI leads incorrectly connected or disconnected	Check DSAI connection.	Connect for natural gas. Disconnect for LP.	Section 5.11.2
	Spark plug(s)	Check spark plug condition and gap.	Replace or regap spark plug(s).	O/M
	Spark plug wire(s)	Check spark plug wires and connections.	Tighten connections. Replace spark plug wires if damaged.	Engine S/M
	Ignition components (spark control or ignition module)	Test ignition components according to instructions in the engine service manual.	Replace ignition components if necessary.	Engine S/M
	Insufficient fuel pressure	Check fuel pressure to the generator set. Verify adequate fuel pressure and pipe size for the generator set plus all other gas appliances.	Contact fuel supplier to replace fuel supply lines with larger pipe and replace gas meter if fuel pressure is insufficient.	Section 5.11.3
	Worn piston rings, valves	Check compression. See the engine service manual.	See engine service manual.	Engine S/M
Starts but shuts down	Fault shutdown	Check for a fault shutdown code on the controller display. Identify the cause of the fault.	Correct the fault and then press the controller's OFF button to reset the controller.	Section 5.10

W/D = Wiring Diagram(s) (Section 7) S/S = Generator Set Specification Sheet O/M = Generator Set Operation Manual
I/M = Generator Set Installation Manual Engine S/M = Engine Service Manual

* RDC controller settings can be checked and adjusted using the controller user interface or using a personal computer running SiteTech software. DC controller settings can only be changed using SiteTech.

Problem	Possible Cause	Test	Corrective Action	Reference
Stops suddenly	Fault shutdown	Check for a fault shutdown code on the controller display. Identify the cause of the fault.	Correct the fault and then press the controller's OFF button to reset the controller.	Section 4.8 Section 5.10
	No fuel	Check fuel valves and fuel supply.	Open manual fuel valve. Contact fuel supplier to replenish fuel supply.	—
	Fuel line restriction	Inspect fuel lines.	Clear restriction.	—
	Fuel lines too long	Check fuel line length and pipe size.	Contact fuel supplier to replace fuel lines with larger pipe.	Generator set S/S, I/M
	Air cleaner clogged	Check for a dirty air cleaner element.	Replace air cleaner element.	O/M
	Blown fuse	Check fuses F2 and F3 on the controller.	Replace fuse. If fuse blows again, test generator components.	Section 5.14.2
	Spark plug(s)	Check spark plug(s).	Replace or regap plug(s).	O/M
	Engine overheated (hot engine only)	Check air intake and generator set enclosure air inlets and outlet. Use oxygen sensor to check fuel mixture. Check oil level.	Clear air intake and enclosure air inlets and outlets. Adjust fuel mixture. Add oil. Check and replace oil at the intervals shown in the Service Schedule.	O/M Section 5.11 O/M
	Low oil pressure (LOP) switch	Check oil pressure. Attempt startup. If unit shuts down, remove lead from LOP switch and reset controller. A successful restart attempt indicates a faulty LOP shutdown switch. **Note:** Check engine oil pressure before performing test and/or replacing LOP shutdown switch.	See engine S/M. Replace faulty LOP shutdown switch. **Note:** Check engine oil pressure before performing test and/or replacing LOP shutdown switch.	Engine S/M Section 5.10.2
	Fuel valve/fuel regulator	Check fuel valve connections. Check regulator/valve operation. Check fuel pressure.	Tighten fuel valve connections. Replace damaged wires. Replace regulator or valve .	Section 5.11
	Engine overloaded	Reduce electrical load and check operation.	Unplug some lights or appliances connected to the generator set.	—
	Magnetic pickup connections	Check for loose connections to the mag pickup.	Tighten connections to the mag pickup. Replace damaged wiring.	Section 5.9
	Ignition module	Test the ignition system according to the instructions in the engine service manual.	Service the ignition system according to the instructions in the engine service manual.	Engine S/M
	Loss of generator output voltage to controller	Check connections at P2 plug. Check continuity of AC sensing leads 11 and 44 (1 ph) or V7, V8, and V9 (3 ph). See Section 5 for alternator test procedures.	Tighten connections at P2 plug. Replace wiring if damaged. Repair or replace components if necessary, as indicated by tests in Section 5.	Section 7 Section 5.3 Section 5
Overheats	Inadequate cooling	Inspect engine and enclosure for air intake obstructions.	Clear any air intake obstructions.	O/M
	Fuel mixture adjustment incorrect	Use an oxygen sensor to check the fuel mixture.	Readjust fuel mixture. **Note:** Adjusting the fuel mixture may void the emission certification.	Section 5.11

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* RDC controller settings can be checked and adjusted using the controller user interface or using a personal computer running SiteTech software. DC controller settings can only be changed using SiteTech.

Problem	Possible Cause	Test	Corrective Action	Reference
Noisy operation	Exhaust system leaks	Check silencer and connections for leaks.	Replace gaskets and exhaust system components as necessary.	—
	Engine not running smoothly	See “Erratic operation,” this table.	See “Erratic operation,” this table.	—
	Broken or damaged vibromount(s)	Inspect vibromounts.	Replace as necessary.	Section 6
	Loose or vibrating sheet metal/housing	Check for loose screws and rivets.	Retighten screws, replace rivets.	—
	Exhaust piping or air inlets/outlets not securely installed	Inspect for loose parts.	Secure loose parts as necessary.	—
	Excessive engine/generator vibration	Check rotor, crankshaft, bearing, etc. (disassembly of engine and/or alternator may be required).	Check, rotor, crankshaft, bearing, etc. (disassembly of engine and/or alternator may be required).	Section 6 Engine S/M
Erratic operation	Air cleaner clogged	Check air filter element.	Replace element.	O/M
	Spark plug(s)	Check spark plug condition and gap.	Replace or regap plugs.	O/M
	Spark plug wire(s)	Check spark plug connections and wires.	Tighten connections. Replace damaged spark plug wires.	Engine S/M
	DSAM leads incorrectly connected or disconnected	Check DSAM/DSAI lead connection.	Connect for natural gas. Disconnect for LP.	Section 5.11.2
	Fuel line restriction	Check fuel lines. Check fuel pipe size.	Clear restricted fuel lines. Contact fuel supplier to install larger diameter pipe.	Section 5.11.3
	Fuel mixture adjustment incorrect	Use oxygen sensor to check fuel mixture.	Adjust fuel mixture.	Section 5.11
	Magnetic pickup connections	Check for loose connections to the mag pickup.	Tighten mag pickup connections. Replace damaged wiring.	Section 5.9
	Governor adjustment incorrect	Check governor operation. Check controller engine speed (frequency) adjustment. *	Adjust governor. Adjust controller engine speed. *	Section 5.9 Section 4.10 and Installation Man.
	Ignition system	Test ignition system according to instructions in engine service manual.	Service ignition system according to instructions in engine service manual.	Engine S/M
	Inadequate cooling (hot engine only)	Check air inlet and outlet.	Clear air inlet and outlet.	—
	Other engine service required	See engine service manual.	Service according to instructions in engine service manual.	Engine S/M
Light flicker	Voltage stability (gain) setting	Check the voltage stability (gain) setting using the RDC controller. *	Adjust the voltage stability (gain) setting using the RDC controller. *	Section 4.10.4

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* RDC controller settings can be checked and adjusted using the controller user interface or using a personal computer running SiteTech software. DC controller settings can only be changed using SiteTech.

Problem	Possible Cause	Test	Corrective Action	Reference
High output voltage	Incorrect controller configuration	Check the controller configuration parameters. *	Adjust the controller configuration parameters. *	Section 4.10.1
	Incorrect controller voltage settings	Check the controller voltage settings. *	Adjust the controller voltage settings. *	Section 4.10.4
	Loose voltage sensing connections	Check connections: stator leads 11 and 44 and P2 controller connection.	Tighten connections.	Section 7 W/D
	Controller	Check the controller settings.	Adjust controller settings.	Section 4.10
		Test the controller as described in Section 3.6.	See Section 3.6.	Section 3.6
Lacks power	Air intake restriction, inadequate cooling	Inspect air intakes and exhaust for obstructions. Check air cleaner.	Inspect air intakes and exhaust for obstructions. Check air cleaner.	O/M O/M
	Generator overloaded	Reduce electrical load and check operation.	Unplug some lights or appliances connected to the generator set.	—
	Spark plug(s)	Check spark plugs.	Regap and/or replace plug(s).	O/M
	Spark plug wire(s)	Check tightness and condition of spark plug wires.	Tighten or replace spark plug wires.	Engine S/M
	DSAI leads incorrectly connected or disconnected	Check DSAI leads. Connect for natural gas. Disconnect for LP.	Connect for natural gas. Disconnect for LP.	Section 5.11.2
	Insufficient fuel pressure	Check fuel pressure at carburetor outlet. Check for adequate fuel pipe size and meter capacity for generator set and all gas-fired appliances.	Contact fuel supplier to replace pipe and/or meter as required to provide sufficient fuel supply pressure for the generator set and all gas-fired appliances.	Section 5.11
	Fuel line restriction	Check fuel pipe size.	Contact fuel supplier to provide larger pipe.	Section 5.11
	Fuel regulator	Check function of fuel regulator.	Repair or replace fuel regulator.	Section 5.11
	Engine not running at rated rpm	Check controller setting for engine type (EC). * Check engine speed.	Reset controller setting for engine type (EC). * Adjust engine speed.	Section 4.10
	Engine power loss	Refer to the engine service manual for troubleshooting and repair instructions.	Refer to the engine service manual for troubleshooting and repair instructions.	Engine S/M
	Governor malfunction or misadjustment	Test governor.	Adjust governor.	Section 5.9
	Ignition system	See the engine service manual for service procedures.	See the engine service manual for service procedures.	Engine S/M

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* RDC controller settings can be checked and adjusted using the controller user interface or using a personal computer running SiteTech software. DC controller settings can only be changed using SiteTech.

Problem	Possible Cause	Test	Corrective Action	Reference
Low output or excessive drop in voltage	Generator overloaded	Reduce electrical load and check operation.	Unplug some lights or appliances connected to the generator set.	—
	Incorrect controller configuration	Check the controller configuration parameters. *	Adjust the controller configuration parameters. *	Section 4.10
	Incorrect controller voltage settings	Check the controller voltage settings. *	Adjust the controller voltage settings. *	Section 4.10.4
	Alternator or control system	Perform separate excitation procedure to isolate problem to the alternator or the control system.	Troubleshoot the alternator or control system as indicated by test results.	Section 5.2
	Controller	Check the controller settings.	Adjust controller settings.	Section 4.10
		Test the controller as described in Section 3.6.	See Section 3.6.	Section 3.6
	Rotor	Test rotor for open, grounded, or shorted windings.	Replace rotor if faulty windings are found.	Section 5.4
	Stator	Test stator for open, grounded, or shorted windings.	Replace stator if faulty windings are found.	Section 5.3
	Brush connection	Check for loose brush connections. Check for loose brush mounting. Check the resistance through the brushes. Resistance through the brushes should be low, 0.1–0.2 ohms without meter lead resistance.	Tighten loose brush connections. Tighten mounting screws. Replace brushes if they show uneven wear or are worn to one-half their original length.	Section 5.6
	Low engine speed causing voltage roll-off	Check system voltage/frequency (Uu) and engine type (Ec) parameters. * Check engine speed. Engine problem.	Change system voltage/frequency (Uu) and engine type (Ec) parameters if not correct. * Adjust engine speed. Troubleshoot the engine.	Section 4.10.1 Section 4.10.4 Engine S/M

W/D = Wiring Diagram(s) (Section 7) S/S = Generator Set Specification Sheet O/M = Generator Set Operation Manual
I/M = Generator Set Installation Manual Engine S/M = Engine Service Manual

* RDC controller settings can be checked and adjusted using the controller user interface or using a personal computer running SiteTech software. DC controller settings can only be changed using SiteTech.

Problem	Possible Cause	Test	Corrective Action	Reference
No output voltage	AC output circuit breaker open	Check for AC voltage on the generator side of circuit breaker. If there is AC voltage on the generator side of the breaker, then a problem in the load circuits is causing the line circuit breaker to trip.	Check for and correct short circuits or overloading on the load side before resetting the circuit breaker.	—
	Alternator or control system	Perform separate excitation procedure to isolate the problem to the alternator or the control system.	Troubleshoot the alternator or control system components as described below and elsewhere in this table.	Section 5.2
	Blown fuse	Check fuse F2.	Replace fuse F2.	Section 5.14.2
	Controller	Check the controller settings.	Adjust controller settings.	Section 4.10
		Test the controller as described in Section 3.6.	See Section 3.6.	Section 3.6
	Open wiring, terminal, or pin in buildup circuit	Check fuses and wiring.	Replace fuses or wiring as necessary.	Section 5.14.2 Section 7 W/D
	Brushes	Inspect brushes.	Replace brushes if worn.	Section 5.6
		Check for brushes sticking in brush holder or broken brush spring.	Replace brush spring or brush assembly.	Section 5.6
		Check that brush holder is securely mounted.	Tighten brush holder screws.	Section 5.6
	Rotor slip rings dirty or corroded	Check slip ring condition.	Clean slip rings as described in Section 5.5. Machine slip rings if necessary.	Section 5.5
	Rotor (open, grounded, or shorted windings)	Check voltage and continuity as described in Section 5.4.	Repair or replace rotor if indicated by the tests.	Section 5.4
	Stator (open, grounded, or shorted windings)	Check voltage and continuity as described in Section 5.3.	Repair or replace the stator if indicated by the test results.	Section 5.3
	Aux. winding circuit breaker tripped	Check the breaker in the service access area of the controller. If breaker trips again, check stator.	Reset breaker. If breaker trips again, check stator.	Figure 3-1 Section 5.3

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I/M = Generator Set Installation Manual Engine S/M = Engine Service Manual

* RDC controller settings can be checked and adjusted using the controller user interface or using a personal computer running SiteTech software. DC controller settings can only be changed using SiteTech.

3.6 Controller Troubleshooting

Refer to the controller troubleshooting table in this section when troubleshooting procedures in Section 3.5 indicate a possible controller problem. Always check the controller configuration settings before replacing the controller.

The RDC controller settings can be checked and adjusted through the controller user interface or using a personal computer and Kohler® SiteTech™ software. The generator set installation manual contains the instructions for checking and changing the controller configuration. The DC controller settings can only be changed using SiteTech™. See TP-6701, SiteTech Software Operation Manual. Kohler® SiteTech™ software is available to authorized distributors and dealers.

Also check the controller display for fault codes and refer to Section 4.8, Faults.

If the power to the controller is momentarily connected and disconnected (for example, when the battery is connected during installation or service), the controller parameters may reset to the default settings. The controller display shows NoEC to indicate that the engine configuration (Ec) parameter is not set. See Section 4.8.4, Fault Code NoEC.

The following RDC/DC controller functions require connection to a Kohler® Model RRT automatic transfer switch.

- Utility voltage display on the RDC or DC controller
- Automatic exercise initiated using the RDC down arrow button or the DC Exercise button, loaded or unloaded
- Ultra-quiet diagnostic test
- Loaded test initiated from the RDC or DC controller
- Engine cooldown
- Load control
- Automatic generator set startup and load transfer when utility power is lost (also available with other Kohler model transfer switches connected to engine start leads 3 and 4)

Check the connection to the Model RRT transfer switch when troubleshooting problems with the functions listed above. See Section 4.9 for more information about these operations. See Section 4.9.6 for connections.

Test	Corrective Action	Reference
Check controller settings. *	Adjust controller settings as required. *	Section 4.10
Check for power to the controller at lead P (connection P1-1).	Check/replace fuse F3. If fuse blows again, check the wiring harness for shorts to ground.	Section 5.14.2
	Check connections and wiring. Tighten connections and repair/replace wiring as needed.	Wiring diagrams, Section 7
	Check battery and battery charger.	Installation manual.
Check controller fuse F3.	Replace controller fuse. If fuse blows again, check the wiring harness for shorts to ground. If fuse F3 blows repeatedly in RUN mode, check the stepper motor.	Section 5.14.2 Section 7 Section 5.9.2
Check controller fuse F2.	Replace controller fuse. If fuse blows repeatedly, check the components listed in Section 4.12.2.	Section 4.12.2
Check controller wiring and connections.	Tighten connections and/or replace wiring.	Wiring diagrams, Section 7
Check RUN and CRANK LEDs and relays.	See Section 4.12 for instructions.	Section 4.12
* RDC controller settings can be checked and adjusted using the controller user interface or using a personal computer running SiteTech software. DC controller settings can only be changed using SiteTech. See TP-6701, SiteTech Software Operation Manual.		

Figure 3-2 Controller Troubleshooting

4.1 Introduction

This section covers operation, configuration, adjustment, and replacement of the RDC and DC controllers. See Section 3 for troubleshooting procedures.

See the service view in Section 1.7 for the controller location.

4.2 RDC and DC Generator Set/ Transfer Switch Controllers

The Residential Digital Control (RDC) and Digital Control (DC) control the power system generator set and Model RRT automatic transfer switch (ATS) (if equipped). The controller receives voltage sensing data from the ATS and operates the generator set and transfer switch to provide standby power when utility power is lost.

Models 14RES and 20RES are equipped with the RDC controller. The RDC controller is equipped with arrow buttons and a Select button, which allow controller configuration and voltage and frequency adjustments from the controller keypad.

Models 14RESL and 20RESL are equipped with the DC controller. The DC controller does not allow controller configuration and voltage and frequency adjustments from the controller keypad. A personal computer running Kohler® SiteTech™ software is required to configure the DC controller.

4.3 Controller Power

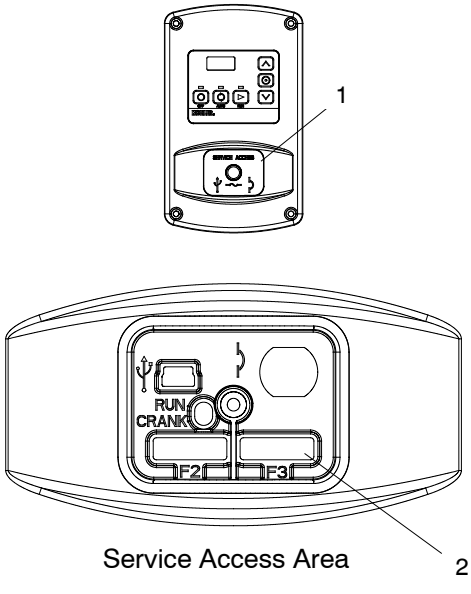
The RDC and DC controllers are powered by the generator set engine starting battery.

Note: The generator sets are equipped with factory-installed battery chargers to prevent battery discharge. The battery charger must be connected to utility power.

4.3.1 Connecting the Battery/Fuse F3

The controller parameters may reset to the default settings if the power to the controller is repeatedly connected and disconnected (for example, if momentary contact is made when the battery is connected during installation or service). If the parameters are reset, the controller display shows NoEC to indicate that the engine configuration (Ec) parameter is not set. See Section 4.8.4.

To prevent controller reset when connecting or disconnecting the battery, **remove controller fuse F3 before disconnecting or reconnecting the battery cables.** See Figure 4-1 for the F3 fuse location in the controller's service access area.

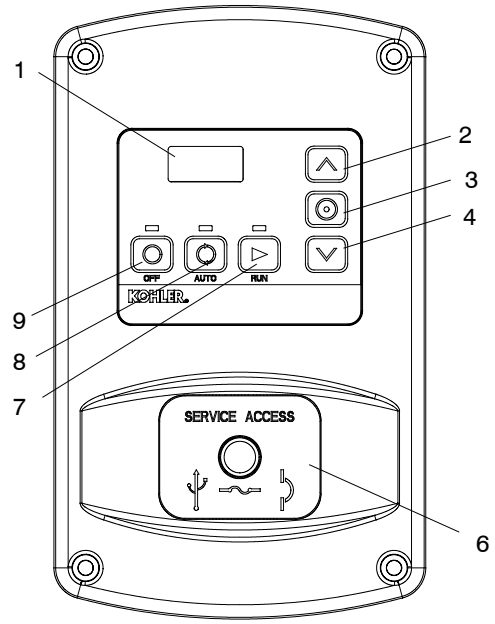


1. Controller's service access area (remove cover)
2. Controller fuse F3

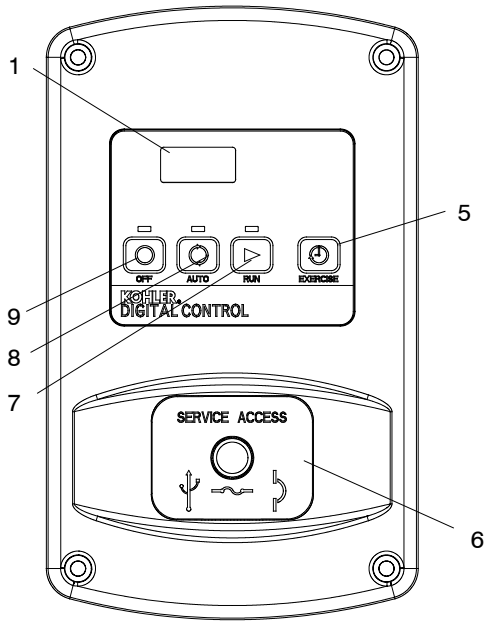
Figure 4-1 Fuse F3 Location (RDC shown)

4.4 Controls and Indicators

Figure 4-2 illustrates the RDC and DC controller user interfaces.



Residential Digital Controller (RDC)



Digital Controller (DC)

1. LED display
2. Up button (RDC only)
3. Select button (RDC only)
4. Down/Exercise button (RDC)
5. Exercise button (DC)
6. Service access (see Section 3.3)
7. RUN button and LED
8. AUTO button and LED
9. OFF button and LED

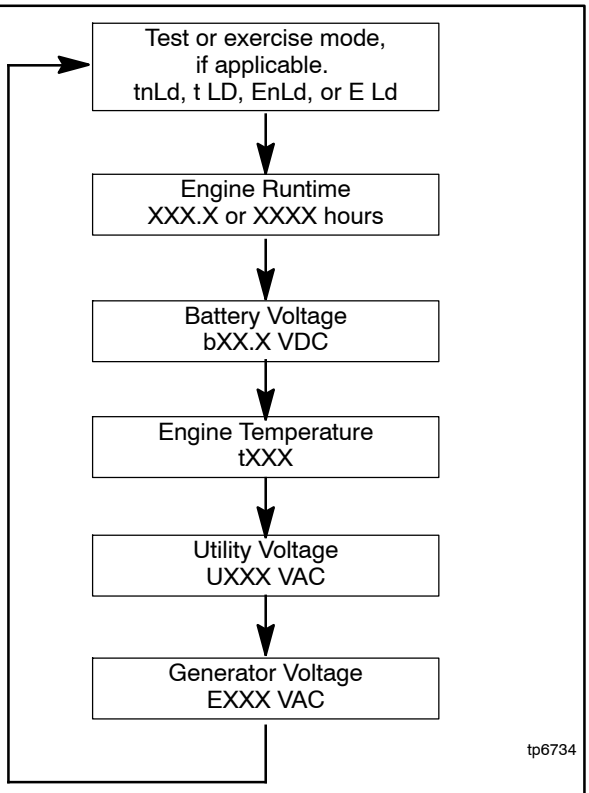
Figure 4-2 RDC and DC Controls and Indicators

4.4.1 LED Display

When the system is in AUTO and the generator set is not running, the LED display shows the engine run time hours. During cranking, the display shows the crank cycle information.

When the generator is running, the display steps through the status messages shown in Figure 4-3, as applicable. The generator set must be connected to a Model RRT transfer switch for the utility voltage display.

When a fault or warning condition exists, the controller will show the respective message. The following table shows the various generator conditions and expected display or messages.



- Generator set is running.
- Model RRT transfer switch is required for utility voltage display.
- Display steps through the parameters in sequence for 2 seconds each.

Figure 4-3 Data Displays, Generator Running

Display	Description
Blank (dark)	Controller is off.
u#.#	Controller software version number
XXX.X	Engine hours to 999.9
XXXX	Engine hours, 1000 to 9999
bXX.X	Battery voltage
tXX.X	Engine temperature
UXXX *	Utility voltage
EXXX	Generator voltage
tnLd *	Test, no load
t Ld *	Test, loaded
EnLd	Exercise, no load
E Ld *	Exercise, loaded
CC1, 2, or 3	Engine crank cycle 1, 2, or 3. Flashes during crank pause.
Fault code	Warning or fault. See Figure 4-8.
* Model RRT ATS is required for this display.	

Figure 4-4 RDC Controller Display

4.4.2 Controller Keypad

The Run, Off, Auto, and Down arrow or Exercise buttons control the generator set as described in Figure 4-5. See Section 4.5 for operation instructions.

RDC controller (RES models) only: The Select, Up, and Down buttons on the controller keypad are used to adjust the controller parameters. The system configuration and performance is factory-set and should not require changes under normal operating conditions. To prevent inadvertent changes, a pass code is required to access the controller parameter settings. See the generator set Installation Manual for controller configuration instructions. See Section 5.8 of this manual for performance adjustment instructions.

For the DC controller (RESL models), a personal computer with Kohler® SiteTech™ software is required for system configuration changes and performance adjustment.

Button Press	Response in AUTO or OFF Mode	Response during EXERCISE	Response during TEST
OFF	Stops the generator set and places the controller in OFF mode. The OFF LED turns ON and then flashes every 2 seconds. Pressing OFF during the engine crank cycle will stop the crank cycle. If a fault code is displayed, pressing OFF resets the controller. Press and hold the OFF button for 3 seconds to view the event history.	Immediately ends the exercise and shuts down the generator. The engine cooldown time delay is ignored. The AUTO LED turns OFF. The OFF LED turns ON and then flashes every 2 seconds.	Immediately ends the test and shuts down the generator. The engine cooldown time delay is ignored. The RUN LED turns OFF. The OFF LED turns ON and then flashes every 2 seconds.
AUTO	Places the controller in AUTO mode. AUTO LED turns ON. Generator set will respond to remote start/stop signals.	Places the controller in AUTO mode. Shuts down the engine through normal timing sequences if utility is available. AUTO LED turns ON. RUN LED turns OFF.	Places the controller in AUTO mode. Shuts down the engine through normal timing sequences if utility is available. AUTO LED turns ON. RUN LED turns OFF.
RUN	Starts the generator set in unloaded test mode. The generator set starts and the display indicates an unloaded test, **tnLd.** RUN LED turns on.	Ends the exercise time period but does not shut down the generator set. Engine ramps up to normal operating speed of 3600 RPM. RUN LED turns on, and AUTO LED turns off. Generator continues to run in test mode until stopped by the OFF or AUTO buttons.	No effect when a test is already running.
DOWN arrow/ EXERCISE	From AUTO mode: Press once to start an unloaded exercise. The engine starts and **EnLd** appears on the display. From OFF mode: No effect.	With RRT only: Press during an unloaded exercise to change to a loaded exercise. Engine ramps up to normal operating speed and the ATS transfers to the emergency source. Display changes to indicate a loaded exercise, **E Ld.** Future exercise periods will be loaded and will start at the time of the first button press. Pressing this button again during a loaded exercise run has no effect.	With RRT only: Press during an unloaded test to change to a loaded test, causing the ATS to transfer to the emergency source. The display indicates a loaded test, **t Ld.**
Select and UP Arrow Buttons (RDC only)	Used for RDC controller configuration and performance adjustment. See the generator set installation manual and Section 5.8 of this manual.		

Figure 4-5 Controller Pushbutton Operation

4.4.3 LED Indicators

LEDs above the RUN, OFF, and AUTO buttons indicate the mode of operation as shown in Figure 4-6.

Mode	LED Indication	Description
RUN	RUN LED is on	The generator set was started by pressing the RUN button. Generator set is running. Remote start and stop commands are ignored.
OFF	OFF LED lights for 2 seconds, then flashes every 2 seconds.	The OFF button was pressed. Generator set and controller are off. Remote start/stop commands have no effect.
AUTO	AUTO LED is on	Automatic mode. Generator set will respond to engine start and stop commands from an ATS or from Kohler® SiteTech™ software. Time delays operate as described in Section 4.5.

Figure 4-6 Operation Modes and LED Indicators

4.5 Generator Set Operation

4.5.1 Local Starting and Stopping

Start

Press the RUN button to immediately start the generator set. The engine start time delay will be ignored.

The controller attempts to start the generator set three times. If the generator set does not start in three attempts, the system shuts down on an overcrank fault. See Section 4.8.

Stop

1. Run the generator set with no load for at least 2 minutes to ensure adequate engine cooldown.
2. Press the OFF button. The engine stops.

Also see Section 4.7, Test.

4.5.2 Engine Start Crank Cycle

The controller attempts to start the generator set three times (three crank cycles, 15 seconds crank and 15 seconds off). See Figure 4-4 for display information during the crank cycle. If the generator set does not start in three attempts, the system shuts down on an overcrank fault. See Section 4.8.

Pressing the OFF button during the crank cycle stops the cranking. No other buttons are acknowledged during the crank cycle.

4.5.3 Engine Cooldown

The engine cooldown time delay allows the engine to run after the loads have been removed. COOL is displayed on the controller during engine cooldown.

The engine cooldown time delay is set to 5 minutes. The engine stops before the cooldown time delay expires if the temperature drops below the cooled-down temperature level, or if the temperature rises during the cooldown cycle.

If a transfer switch other than the Model RRT is used, an engine cooldown time delay may be programmed on the transfer switch. To allow the smart engine cooldown on the RDC/DC controller to operate most efficiently, set the cooldown time on the ATS controller to zero or the minimum time allowed. Refer to the instructions provided with the ATS for more information.

4.5.4 Automatic Operation with Model RRT Transfer Switch

The Model RRT transfer switch connects to the RDC/DC controller through the ATS interface board on the transfer switch. Also see Section 4.9, Model RRT Transfer Switch Operation.

The controller must be in AUTO mode. Press the AUTO button to put the controller into automatic mode.

Automatic Start

The RDC/DC controller receives utility source voltage sensing data from the Model RRT transfer switch.

1. If the utility source voltage falls below an acceptable level, the controller starts the engine start time delay.
2. If the utility source is not restored before the time delay expires, the generator set starts.
3. After the Normal-to-Emergency time delay, the ATS is signaled to transfer the load to the emergency source.

Automatic Stop with Engine Cooldown

1. When the utility source is restored, the Emergency-to-Normal time delay starts.
2. When the Emergency-to-Normal time delay expires, the load is transferred to the utility.
3. The controller runs the generator set for the cooldown time and then stops the generator set.

4.5.5 Automatic Operation with Model RDT or RSB Transfer Switches

If a Kohler® Model RDT or RSB transfer switch is used, the engine start contacts from the ATS must be connected to engine start leads 3 and 4 on the generator set.

The controller must be in AUTO mode to respond to remote start/stop signals from an ATS or remote switch. Press the AUTO button to put the controller into automatic mode.

Automatic Start. The engine start contacts on the ATS close to signal the generator set to start, and remain closed while the generator set is running.

Automatic Stop. Open the contact across engine start leads 3 and 4 to signal the generator set to stop.

4.6 Exercise

The RDC and DC controllers can be set to automatically run the generator set at the same time and day each week. Exercising the generator set weekly is required in order to keep the engine and alternator in good operating condition.

Follow the instructions in this section to start a 20-minute exercise run and set the exerciser to run at the same time every 7 days.

Note: RDC controllers with firmware version 2.08 or higher support the unloaded variable-speed exercise with Kohler Model RRT, RDT, and RSB transfer switches.

Note: With the RDT and RSB transfer switches, it is possible to have two exercise settings (one set at the generator set controller, and one set at the ATS controller). If the exercise times overlap, the ATS exercise setting takes priority.

Set the exercise at the RDC/DC controller or the ATS controller as shown in Figure 4-7. If a Model RDT or RSB transfer switch is used, refer to the instructions provided with the transfer switch to set an exercise at the ATS.

Transfer Switch Model	Exercise		
	Unloaded Variable Speed	Unloaded Full Speed	Loaded Full Speed
RRT	RDC/DC	N/A	RDC/DC
RDT	RDC/DC	ATS	ATS
RSB	RDC/DC	ATS	ATS

Figure 4-7 Setting the Exerciser

4.6.1 Unloaded Variable-Speed Exercise with Complete System Diagnostics

An unloaded exercise runs the generator set without signalling the transfer switch to transfer the electrical load from the utility source to the generator set.

In an unloaded exercise **with controller firmware versions prior to 2.08**, the generator runs at low speed for 20 minutes and then shuts down.

Note: If the engine temperature has risen to 104°C (219°F) or higher, the unit will run at full speed for 5 minutes to allow engine cooldown before shutting down.

With controller firmware version 2.08 or higher, the unloaded variable-speed exercise runs at low speed for 15 minutes, then ramps up to full speed during the last 5 minutes (firmware version 2.08 or higher).

The initial low-speed exercise allows generator set exercise at lower noise levels and fuel consumption while properly warming up the engine for longer life and better lubrication of critical components.

The full-speed portion of the exercise cycle provides the best test of engine and alternator power backup capability. Diagnostic tests at full speed can identify potential problems with the power output and alert the operator before an emergency event.

Procedure to Set Unloaded Variable-Speed Exercise

1. Verify that the control is in the AUTO mode with the AUTO LED ON and the Utility power available.
2. Press the down arrow button (RDC) or exercise button (DC) to initiate the engine start signal.
3. The generator begins its crank cycles. During the crank cycles **CCn** appears on the display. No button presses are acknowledged during the crank cycles.
4. The generator runs at low speed for 15 minutes. **EnLd** appears on the display. The AUTO LED is illuminated. The controller monitors the system during the unloaded exercise as described in Section 4.6.2, Diagnostics.
5. During the last 5 minutes, the engine ramps up to full speed and then shuts down. Generator output frequency and voltage diagnostics are active as described in Section 4.6.2, Diagnostics.

The exercise time is set to the time the down arrow or exercise button is pressed. An unloaded diagnostic exercise will occur at the same time every seven days.

4.6.2 Diagnostics

During the unloaded variable-speed exercise, the controller monitors the following data. The controller display indicates an unloaded exercise run (EnLd) during the diagnostics, unless a fault is detected as described below.

- **ATS connection.** The controller verifies that the ATS interface board, if connected, remains connected. An ATS fault is displayed if the connection is lost.
- **Battery voltage.** Battery voltage is checked before exercise to verify engine starting capability. Battery voltage provides a measurement of battery health. If

the controller detects low battery voltage, Lb (low battery) or LCb (low charging battery) is displayed and the exercise does not start.

- **Engine speed.** Engine speed is measured at low speed and full speed. An overspeed (OS) or underspeed (US) condition will result in a fault condition and shutdown. (Firmware version 2.08 or higher.)

- **Oil pressure.** Oil pressure is verified to ensure proper lubrication of critical engine components. Pressure is monitored at both low and full speeds. If the oil pressure is low, LOP (low oil pressure) is displayed and the generator set shuts down.

- **Generator output frequency and voltage.** Operating the generator at full speed allows the RDC/DC controller to check the output power for correct voltage, frequency, and stability. When the engine is running at full speed, the controller verifies that the voltage and frequency are within acceptable limits. UU (undervoltage), OU (overvoltage), UF (underfrequency), or OF (overfrequency) is displayed if the voltage or frequency is out of range. (Firmware version 2.08 or higher.)

4.6.3 Loaded Exercise (with RRT only)

A loaded exercise starts the generator set, ramps up to full speed, and then transfers the electrical load from the utility source to the generator set. The load is transferred back to the utility source before the generator set shuts down.

Procedure to Set a Loaded Exercise

1. Verify that the control is in the AUTO mode with the AUTO LED ON and the Utility power available.

2. Press the down arrow button (RDC) or the exercise button (DC) to initiate the engine start signal.

3. The generator begins its crank cycles. During the crank cycles **CCn** appears on the display. No button presses are acknowledged during the crank cycles.

4. When the generator is running, **EnLd** appears on the display and the AUTO LED is illuminated. The generator runs at low speed with no load.

5. Press the down arrow button (RDC) or exercise button (DC) a second time. The generator ramps up to normal operating speed (typically 3600 RPM) and the ATS transfers the load.

6. **E Ld** appears on the display and the AUTO LED is illuminated. The generator runs at normal operating speed for twenty minutes with load.

7. After 20 minutes, the ATS transfers the load back to utility power. The engine runs for 5 minutes or until cool, and then shuts down.

The exercise time is set to the time the down arrow button (RDC) or exercise button (DC) was initially pressed. A loaded, full-speed exercise will occur at the same time every seven days.

Other transfer switches: For a loaded exercise with a transfer switch other than a Kohler® Model RRT, refer to the transfer switch operation manual.

4.6.4 Power Failure During Exercise Cycle

If the utility power is lost during an unloaded exercise, the ATS transfers to the emergency source, the exercise is ended and the control remains in the AUTO mode.

If the utility power is lost during a loaded exercise, the exercise is ended. The ATS remains in the emergency position and the control goes into the AUTO mode.

The generator set continues to run and supply power to the load for the duration of the utility power outage. When Utility power is restored, the ATS will re-transfer to the utility source through normal timing sequences.

4.6.5 Exerciser Reset

To reset the exerciser to run at a different day and/or time, or to switch between a loaded and unloaded exercise, follow the procedures above to start an unloaded or loaded exercise on the desired day and time. The previous exercise setting is replaced by the new day, time, and loaded or unloaded condition.

4.6.6 Exercise Disable

Note: With the RDT and RSB transfer switches, it is possible to have two exercise settings (one set at the generator set controller, and one set at the ATS controller). If the exercise times overlap, the ATS exercise setting takes priority.

If a transfer switch other than the Model RRT is used and the exerciser is set at the transfer switch controller, you can disable the exercise on the RDC/DC controller.

To disable the exerciser on the RDC/DC controller, press and hold the OFF and DOWN arrow or EXERCISE buttons together for 3 seconds.

4.7 Test

An operator can use the buttons on the RDC/DC controller to test the generator set operation. Follow the instructions below to run an unloaded or loaded test.

4.7.1 Unloaded Test

An unloaded test runs the generator set at full speed without signaling the transfer switch to transfer the electrical load from the utility source to the generator set.

Unloaded Test Procedure

1. Press the RUN button to start an unloaded test. The engine cranks and starts.

   Note: Pressing the OFF button during the crank cycle stops the cranking. No other buttons are acknowledged during the crank cycle.

2. When the generator is running, **tnLd** appears on the display and the RUN LED is illuminated. The engine runs at normal operating speed (3600 RPM) during the test sequence.

3. There are two ways to end an unloaded test:

   a. Press the AUTO button to shut down the generator set and enter AUTO mode. OR

   b. Press the OFF button to shut down the generator set immediately. The cooldown time delay is ignored.

Figure 4-5 describes the effect of pressing the buttons during a test when there are no active faults.

4.7.2 Loaded Test (with RRT only)

A loaded test starts the generator set and then signals the Model RRT transfer switch to transfer the electrical load from the utility source to the generator set. The load is transferred back to the utility source before the generator set shuts down.

Note: If a Model RDT or RSB transfer switch is used, a *loaded* test cannot be initiated from the RDC or DC controller. To run a loaded test, refer to the instructions provided with the transfer switch.

Loaded Test Procedure

1. Press the RUN button to start an unloaded test as described in Section 4.7.1. When the generator is running at full speed, **tnLd** appears on the display.

2. Press the down arrow button (RDC) or the exercise button (DC) to signal the ATS to transfer the load. The display indicates a loaded test, **t Ld.**

3. To end the test, press the AUTO button to shut down the generator set through normal timing sequences. The generator set goes into Auto mode. The load is transferred to utility power, if available. The engine cooldown cycle runs before the generator set engine stops.

Immediate Shutdown During a Loaded Test

Press the OFF button to shut the generator set down immediately, if necessary. The cooldown time delay is ignored, and the controller goes to OFF mode. The controller signals the RRT transfer switch to transfer the load back to utility power.

Note: Running the generator set with no load for at least 2 minutes is recommended to ensure adequate engine cooldown. Use the OFF button to stop a loaded test only if necessary.

4.7.3 Power Failure During Test Cycle

If the utility power is lost during an unloaded test, the controller goes into the AUTO mode and the ATS transfers to the emergency source.

If the utility power is lost during a loaded test, the controller goes into the AUTO mode. The ATS remains in the emergency position.

The generator set continues to run and supply power to the load for the duration of the Utility power outage. When Utility power is restored, the ATS re-transfers to the utility source through normal timing sequences.

4.8 Faults

Fault codes and conditions are shown in the table on the following pages, Figure 4-8. Fault conditions are classified as warnings or shutdowns.

4.8.1 Warnings

The controller displays a fault code but the generator set does not shut down on a warning. The controller resets automatically after a warning condition is corrected.

4.8.2 Shutdowns

Under a fault shutdown condition, the generator set shuts down automatically and the controller displays a fault code. In some cases, the engine cooldown cycle runs before the engine shuts down.

Shutdown switches (such as the low oil pressure switch or high engine temperature switch) on the generator set will automatically reset when the problem is corrected. However, the fault condition at the controller does not clear until the controller is reset.

The generator set cannot be restarted until the fault condition is corrected and the controller is reset. See Section 4.8.5 to reset the controller after a fault shutdown.

4.8.3 ATS Communication Errors

An ATS fault can be caused by the following conditions.

- When a Model RRT transfer switch is used, an ATS fault indicates that communication with the interface board on the transfer switch has been lost. The generator set shuts down. Check the connection to the ATS interface board.
- If an RRT transfer switch is connected after the controller has powered up, the ATS warning is displayed. To clear the fault, disconnect and then reconnect battery power to the controller.

4.8.4 Fault Code NoEC

The RDC and DC controllers display the fault code NoEC (no engine configuration setting) when the controller parameters have been lost or reset to the default settings. **Do not replace the controller because of a NoEC fault.** Change the Ec parameter to the setting shown in Figure 4-12 for the generator set model. Also check the Uu setting and change it, if necessary. See Section 4.10 and Installation Manual TP-6733.

The controller parameters may reset to the default settings if the power to the controller is repeatedly connected and disconnected (for example, when the battery is connected or disconnected during installation or service). To prevent controller reset when connecting or disconnecting the battery, remove controller fuse F3 before disconnecting or reconnecting the battery cables. See Section 4.3.1.

A service replacement controller also displays NoEC and requires this procedure to set the parameters at installation. See TT-1568, provided with the replacement controller, for instructions.

Models 14/20RES: Use the RDC controller keypad or Kohler® SiteTech™ software to set the RDC controller parameters. Follow the instructions in generator set Installation Manual TP-6733 or see TP-6701, SiteTech Software Operation Manual.

Models 14/20RESL: Use Kohler® SiteTech™ software to set parameters on the DC controller. See TP-6701, SiteTech Software Operation Manual, for instructions.

4.8.5 Resetting the Controller after a Fault Shutdown

Always identify and correct the cause of a fault shutdown before resetting the controller. Check the fault code displayed on the controller and refer to Figure 4-8 to identify and correct the fault condition before proceeding. Contact an authorized distributor/dealer for service, if necessary.

Procedure to Reset the Controller after a Fault Shutdown

1. Press OFF to turn off the generator set.
2. Disconnect the generator set from the load using the line circuit breaker or ATS. See the safety precautions at the beginning of this manual before proceeding.
3. Identify and correct the cause of the fault shutdown. See the safety precautions at the beginning of this manual before proceeding. Refer to Section 3, Troubleshooting.
4. Start the generator set by pressing RUN. Check the generator set operation to verify that the cause of the shutdown has been corrected.
5. Press the OFF button to stop the generator set.
6. Reconnect the generator set to the load using the line circuit breaker or ATS.
7. Press AUTO to put the generator set into automatic mode.

4.8.6 Event History

The last ten controller faults can be viewed from the controller display when the controller is off. Each event is displayed with the fault code followed by the engine hours at which time the event occurred. During event history viewing, the OFF LED flashes once per second.

Procedure to View Event History

1. Press and hold the OFF button for 3 seconds. The first event appears on the screen. The OFF LED flashes once per second.
2. Press the OFF button to cycle through the engine hours and subsequent events. After cycling through all ten events, the control automatically turns off. The OFF LED flashes once every 2 seconds.

To stop viewing the event history before the last event, press the down arrow or exercise button. The controller will turn off.

Not in Auto: The code nIA (Not In Auto) may be shown in the event history but is not displayed on the controller when in run or off modes.

Code	Fault	W or SD*	Condition	Check	See Section
AC	Loss of AC sensing	W (1 s) SD (3 s) †	Generator output AC sensing is lost. Starts 10 seconds after crank disconnect.	Check for loose connections. Check all AC leads connected to the controller for continuity.	Wiring Diagrams
			Warning: after 1 second if no output detected after crank disconnect.	Alternator excitation failure: Inspect the brushes and check the FN and FP connections.	5.6
			Fault: after 3 seconds if voltage was present and then lost.	Voltage Regulator failure: check for voltage on the output leads.	Section 7, Wiring Diagrams
AF	Auxiliary fault input	SD †	An optional customer-connected input is closed.	Check customer-supplied equipment.	—
ATS	ATS communication error	SD †	RRT: Shutdown if ATS interface connection is lost.	Check connection to Model RRT transfer switch interface board.	Section 4.9.6 Section 7, Wiring Diagrams Section 4.8.3.
		W	Warning is displayed if RRT interface board is connected after controller is powered up.	Disconnect and then reconnect battery power to the controller.	
ESch	Exercise not scheduled	W	May appear under some conditions if the generator set exercise has been cleared or has not been set.	Press OFF to clear the warning. Set the exerciser at the RDC controller or at the transfer switch, if the Model RRT transfer switch is not used. NOTE: Exercise the generator set weekly.	Section 4.6
Hb	High battery voltage	W	Engine starting battery voltage rises above 125% of the battery voltage setting for more than 10 seconds when the engine is running. Not operative during the engine crank cycle. Clears when the battery voltage returns to an acceptable level.	Check the battery rating and condition.	Battery mfr's instructions
				Check the battery charger operation.	O/M
HE	High engine temperature	W or SD †	Engine coolant temperature exceeds the maximum temperature for more than 5 seconds. Function becomes active after crank disconnect. Warning at 300° F. Shutdown at 325° F.	Check for blocked air inlets and exhaust outlets.	1.7
Lb	Low battery voltage	W	Engine starting battery voltage falls below the battery voltage setting (typically 12 volts) for more than 90 seconds when the engine is not running. Not operative during the engine crank cycle. Clears when the battery voltage returns to an acceptable level.	Check the battery rating and condition. Check the battery charger operation. Charge or replace the battery.	Battery mfr's instructions O/M
LCb	Low cranking voltage	W	Battery voltage falls below 60% of system battery voltage for more than 6 seconds while the starter is engaged.	Charge or replace the battery.	—

* W = Warning; SD = Shutdown

† Engine cooldown runs before shutting down.

Engine S/M = Engine Service Manual
I/M = Generator Set Installation Manual
O/M = Generator Set Operation Manual

Code	Fault	W or SD*	Condition	Check	See Section
LOP	Low oil pressure	SD †	The LOP switch indicates low oil pressure for more than 5 seconds. Function becomes active 30 seconds after crank disconnect (30 second inhibit). **Note:** The low oil pressure shutdown does not protect against low oil level. Check the engine oil level regularly as recommended in the O/M.	Check for leaks in the lubrication system. Check the oil level and add oil if the level is low. Check low oil pressure switch connections and operation. Check the oil pump and lubrication system.	— O/M 5.10 Engine S/M
Lr	Locked rotor	SD	No engine rotation is sensed during cranking. Shuts down 3 seconds after the fault is detected.	Check mag pickup connections and operation. Check for a locked rotor.	5.9.4 5.4
LrC	Loss of voltage regulator communication	SD †	No communication between controller and voltage regulator.	Disconnect and then reconnect the battery to reset the controller. Replace the controller if LrC continues to appear.	4.13
NoEC	No Ec setting	SD	The engine configuration (Ec) parameter is not set. The Uu setting may also have been reset.	Use the controller keypad (RDC only) or a PC with SiteTech software to set the controller's Ec and Uu parameters.	4.8.4 4.10 I/M
OC	Overcrank	SD	Three unsuccessful starting attempts.	Check the fuel supply valves and pressure. Check spark plug and battery. See Troubleshooting Chart, generator set cranks but does not start.	5.11 I/M 3.5
OF	Over frequency	SD †	Governed frequency exceeds 110% of the system's frequency setpoint for more than 5 seconds. Function becomes active 10 seconds after engine start (10 second inhibit).	Check system frequency setting (parameter UU) on controller.	4.10
				Measure output frequency and adjust, if necessary.	5.9.5
				Check governor system condition and operation.	5.9
OS	Overspeed	SD †	Engine speed exceeds 115% of the normal running speed for more than 0.3 seconds.	Check governor settings and operation.	5.9
OU	Overvoltage	SD †	Output voltage exceeds 120% of the system nominal voltage for more than 2 seconds.	Check output voltage and adjust, if necessary (parameter 1P, voltage adjust).	5.8
				Check controller settings for system voltage (Parameter Uu).	I/M
				Check the calibration (SiteTech software required). Controller firmware version 2.04 or higher is required for calibration.	4.11
SS	Speed sensor failure	SD	Engine speed sensor has failed.	Check the mag pickup resistance, air gap, and operation.	5.9.4

* W = Warning; SD = Shutdown
† Engine cooldown runs before shutting down.

Engine S/M = Engine Service Manual
I/M = Generator Set Installation Manual
O/M = Generator Set Operation Manual

Code	Fault	W or SD*	Condition	Check	See Section
UF	Underfrequency	SD †	Governed frequency falls below 90% of the system frequency setting for more than 5 seconds, or 1 Hz below the system frequency setting for more than 60 seconds. Function becomes active 10 seconds after engine start. (10 second inhibit).	Reduce the load and restart the generator set.	—
				Check controller setting for system frequency.	I/M
				Check the engine governor settings, and adjust if necessary. (Parameter 4P, governor speed)	5.9.5
US	Underspeed	SD †	Engine speed drops below 85% of the normal running speed for more than 0.3 seconds.	Reduce the load.	—
				Check for throttle linkage obstruction.	5.9.2
				Check for a loose or disconnected governor stepper motor harness. Check for bad leads in the harness.	5.9.2
				Check the stepper motor operation.	5.9.2 5.9.4
UU	Under voltage	SD †	Output voltage falls below 80% of the nominal system voltage for more than 10 seconds.	Reduce the load and restart the generator set.	—
				Check wiring and connections.	7
				Check controller configuration, system voltage and frequency (parameter Uu).	4.10
				Check AC voltage and adjust, if necessary (parameter 1P, voltage adjust).	5.7
				Check the calibration (SiteTech software required). Controller firmware version 2.04 or higher is required for calibration.	4.11
				Separately excite unit.	5.2
				Check stator continuity.	5.3
* W = Warning; SD = Shutdown † Engine cooldown runs before shutting down.				Engine S/M = Engine Service Manual I/M = Generator Set Installation Manual O/M = Generator Set Operation Manual	

Figure 4-8 Controller Fault Codes

4.9 Model RRT Transfer Switch Operation

The RDC/DC generator set/transfer switch controller manages automatic transfer switch (ATS) functions when connected to a Kohler® Model RRT transfer switch through the ATS interface board.

4.9.1 Source Availability

The Model RRT transfer switch supplies voltage sensing data to the RDC/DC controller through the ATS interface board. If the source voltage falls below the undervoltage dropout setting, the source is considered to have failed. See Figure 4-9.

Item	Setting
Accuracy	±5%
Undervoltage Dropout	90% of Pickup
Undervoltage Pickup	90% of Nominal

Figure 4-9 Voltage Sensing Parameters

4.9.2 ATS Control Sequence of Operation

See Figure 4-10 for time delay settings.

Preferred Source Fails:

1. The load control contact opens.
2. The engine start time delay times out.
3. The generator set is signaled to start.
4. The generator starts and the emergency source becomes available.
5. The normal-to-emergency time delay times out.
6. The transfer switch transfers to the emergency source.
7. The load control contact time delay times out.
8. The load control contact closes.

Normal Source Returns:

1. The emergency-to-normal time delay times out.
2. The contactor transfers to the normal source.
3. The engine cooldown time delay times out.
4. The generator is signaled to stop.

4.9.3 Time Delays

Time delays are factory-set to the values shown in Figure 4-10. An authorized distributor/dealer can adjust time delays using a personal computer and Kohler® SiteTech™ software.

Time delays described in this section operate only when the controller is connected to a Kohler® Model RRT transfer switch.

Time Delay	Setting	Description
Engine Start	3 seconds	Time delay after utility source is lost until the engine start cycle begins. Guards against starting the generator set because of a brief change in the utility source.
Transfer, Normal to Emergency	3 seconds	Time delay after emergency source becomes available until transfer to emergency source.
Transfer, Emergency to Normal	2 minutes	Time delay after the utility source returns until transfer back to normal. Ensures that the the utility source is stable before transferring from the emergency source.
Load Control	5 minutes	Allows delayed connection of selected loads to the generator set. Prevents simultaneous starting of large motors after transfer to the emergency source. Recommended for delayed starting of air conditioners.

Figure 4-10 Time Delays

4.9.4 Engine and Transfer Time Delays

The engine start and transfer time delays prevent engine start and load transfer caused by brief variations in the utility power source.

4.9.5 Load Control Time Delay

The load control time delay allows delayed starting of large motor loads (such as air conditioners), preventing simultaneous starting of large motors after transfer to the generator set. The load control time delay is fixed at 5 minutes. It is not adjustable.

The load must be connected to the load control output on the interface board of the Model RRT transfer switch. See the transfer switch operation and installation manual for connection instructions.

4.9.6 Model RRT ATS Connection

See Figure 4-11 for Model RRT transfer switch connection to the generator set.

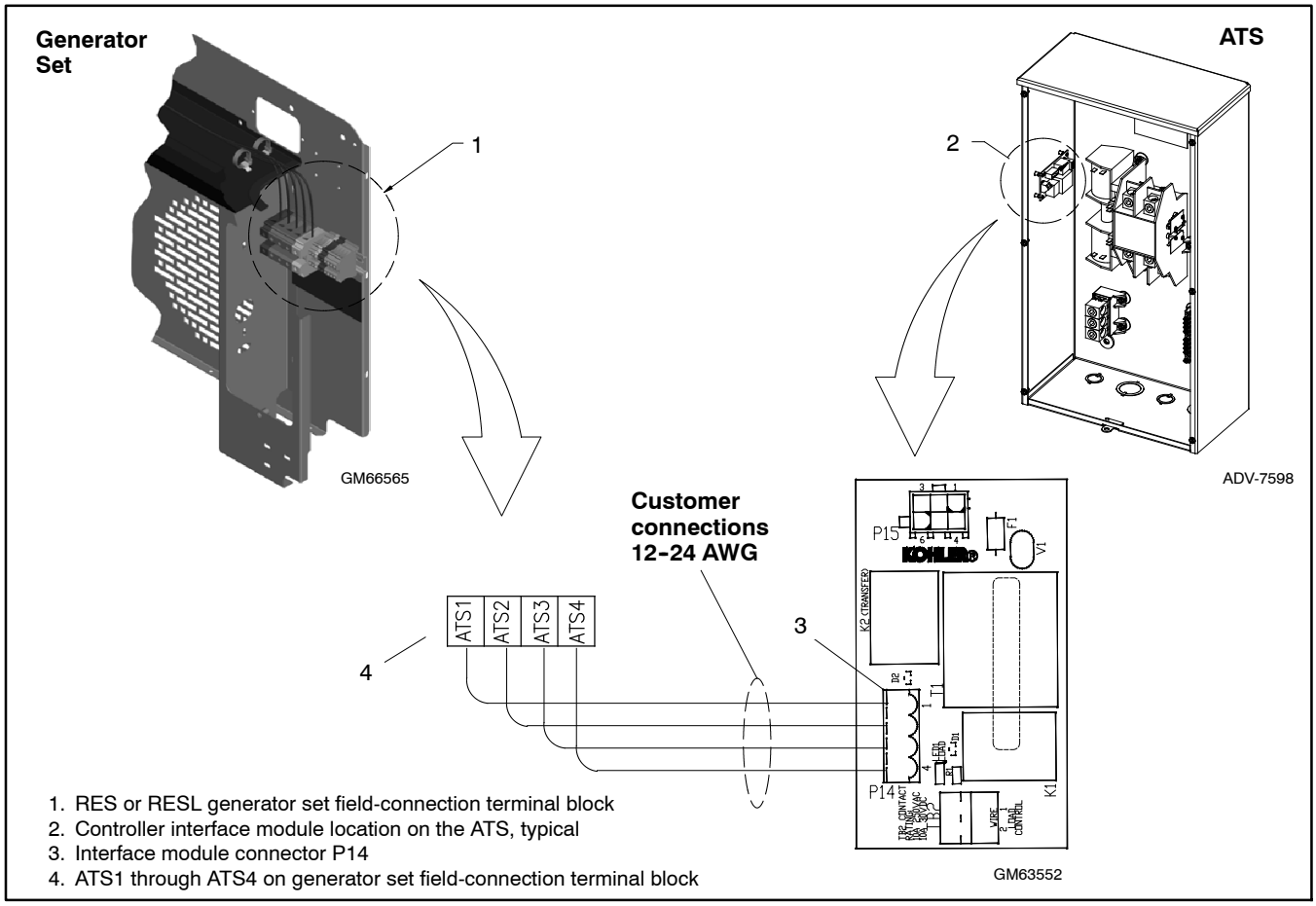


Figure 4-11 Model RRT Transfer Switch Connection to Generator Set Terminal Block

4.10 Controller Configuration and Adjustment

The first step in troubleshooting the controller is to verify that the controller is correctly configured for the generator set. The RDC controller's configuration modes allow selection of the system voltage and frequency and generator set configuration. Follow the instructions in the generator set installation manual to check the controller settings and change them, if necessary. A Kohler-authorized distributor or dealer can also check and adjust the RDC controller configuration and settings using a personal computer and Kohler® SiteTech™ software.

The DC controller configuration and settings cannot be viewed or adjusted at the controller. However, a Kohler-authorized distributor or dealer can check and adjust the DC controller configuration and settings using a personal computer and Kohler® SiteTech™ software.

4.10.1 Controller Configuration

The controller configuration for each generator Model is set at the factory. If the controller is replaced, check the configuration of the new controller and change the settings, if necessary. The configuration procedure is shown in Figure 5-15 of this manual. Refer to the generator set installation manual if more detailed instructions are needed.

See Figure 4-12 for the controller settings. Do not use settings Uu07–Uu22. These settings may appear as choices during configuration but do not apply to the 14RES/RESL or 20RES/RESL generator sets.

Parameter	Setting	Definition		
		Phases	Hz	VAC
System voltage and frequency *	Uu01	1	60	120/240
	Uu06	1	50	115/230
	Uu07	DO NOT USE		
	Uu11	DO NOT USE		
	Uu15	DO NOT USE		
	Uu16	DO NOT USE		
	Uu19	DO NOT USE		
	Uu21	DO NOT USE		
	Uu22	DO NOT USE		
Engine Configuration *	Ec13	14RES/RESL		
	Ec14	20RES/RESL		

Figure 4-12 Controller Configuration Settings

4.10.2 Controller Time Out

The controller will automatically exit the configuration mode without saving any changes after about 1 minute if no buttons are pressed. Start the configuration procedure again from the beginning if the controller exits the configuration mode before the settings have been saved.

Changes in voltage and speed adjustments are also lost if they are not saved before the generator set shuts down. The generator set continues to run with the new settings until it shuts down but then reverts to the previous settings at the next startup. Be sure to save your changes immediately after making adjustments.

4.10.3 Controller Firmware Version Number

The controller firmware version number is displayed on the LED screen during the key sequence to enter the configuration mode. Press and hold the Select and UP buttons together. After about 5 seconds, the firmware version number will be displayed on the controller display. For example, 01.10 will be displayed for firmware version 1.10.

The DC controller firmware version number is displayed during the first 2 seconds of the crank cycle.

4.10.4 Voltage and Frequency Adjustments

Voltage and/or frequency adjustments may be required after controller replacement or other service procedures. See Section 5.8 for instructions to adjust the generator set output voltage and frequency using the RDC controller. Use a personal computer and Kohler® SiteTech™ software to make adjustments on RESL models equipped with the DC controller.

The generator set must be running during these adjustments. Use a multimeter to measure generator set output voltage and frequency during adjustments. Refer to Sections 5.8, Voltage Adjustment, and 5.9.5, Frequency Adjustment, for instructions to measure and adjust the output voltage and frequency.

Note: Be sure to save your settings before exiting the configuration mode. The controller reverts to the last saved settings when turned off.

4.10.5 SiteTech Software

A personal computer running Kohler® SiteTech™ software can be used to configure and adjust the RDC and DC controllers. See TP-6701, SiteTech Software Operation Manual, for PC connection and software operation instructions.

See Figure 4-13 for the settings. Refer to TP-6701, SiteTech Software Operation Manual, for instructions.

Appendix F contains a list of controller parameters that can be viewed and adjusted using SiteTech. The Access column in the table shows which parameters can only be viewed (Read or Locked), and which parameters can be changed using the software (Write).

SiteTech software is also used to update the firmware on the RDC and DC controllers. See TP-6701 for instructions.

SiteTech can be used to calibrate the voltage. See Section 4.11.

4.11 Calibration

The controller can be calibrated for utility voltage using using a personal computer connected to the RDC/DC controller. Kohler® SiteTech™ software is required for calibration.

Note: Controller firmware version 2.04 or higher is required for calibration. See Section 4.10.3 for instructions to check the firmware version number.

4.11.1 Calibrate Function

The RDC/DC controller can be calibrated using SiteTech. Measure the actual utility voltage across L1 and L2, and enter the measured value into SiteTech as described in the following procedure. See Figure 4-14.

SiteTech Group	Parameter	Value	Equivalent RDC Parameter Setting	How to Enter
Genset System Configuration	Genset System Voltage	240	Uu01	Type in
		230	Uu06	Type in
	Genset System Frequency	60	Uu01	Drop-down box
		50	Uu06	Drop-down box
	Genset Voltage Phase Connection	Single Phase	Uu01 or Uu06	Drop-down box
Genset Info	Engine Model Number	CH-740* (14RES or 14RESL)	Ec13	Type in* Drop-down box
		CH-1000* (20RES or 20RESL)	Ec14	Type in* Drop-down box
	Genset Model Number	14RES 14RESL 20RES 20RESL	none	Type in
	Genset Serial Number	See nameplate	none	Type in
	Engine Serial number	See nameplate	none	Type in
* With SiteTech versions prior to 2.3, type in CH-740 or CH-1000 with capital letters and dash exactly as shown.				

Figure 4-13 Controller Setup Using SiteTech Software

Calibration Procedure

1. Measure the actual utility voltage across L1 and L2. Use a digital voltage meter and observe the safety precautions in the generator set installation manual.

2. Click on Calibrate in the ribbon at the top of the SiteTech screen. See Figure 4-14.

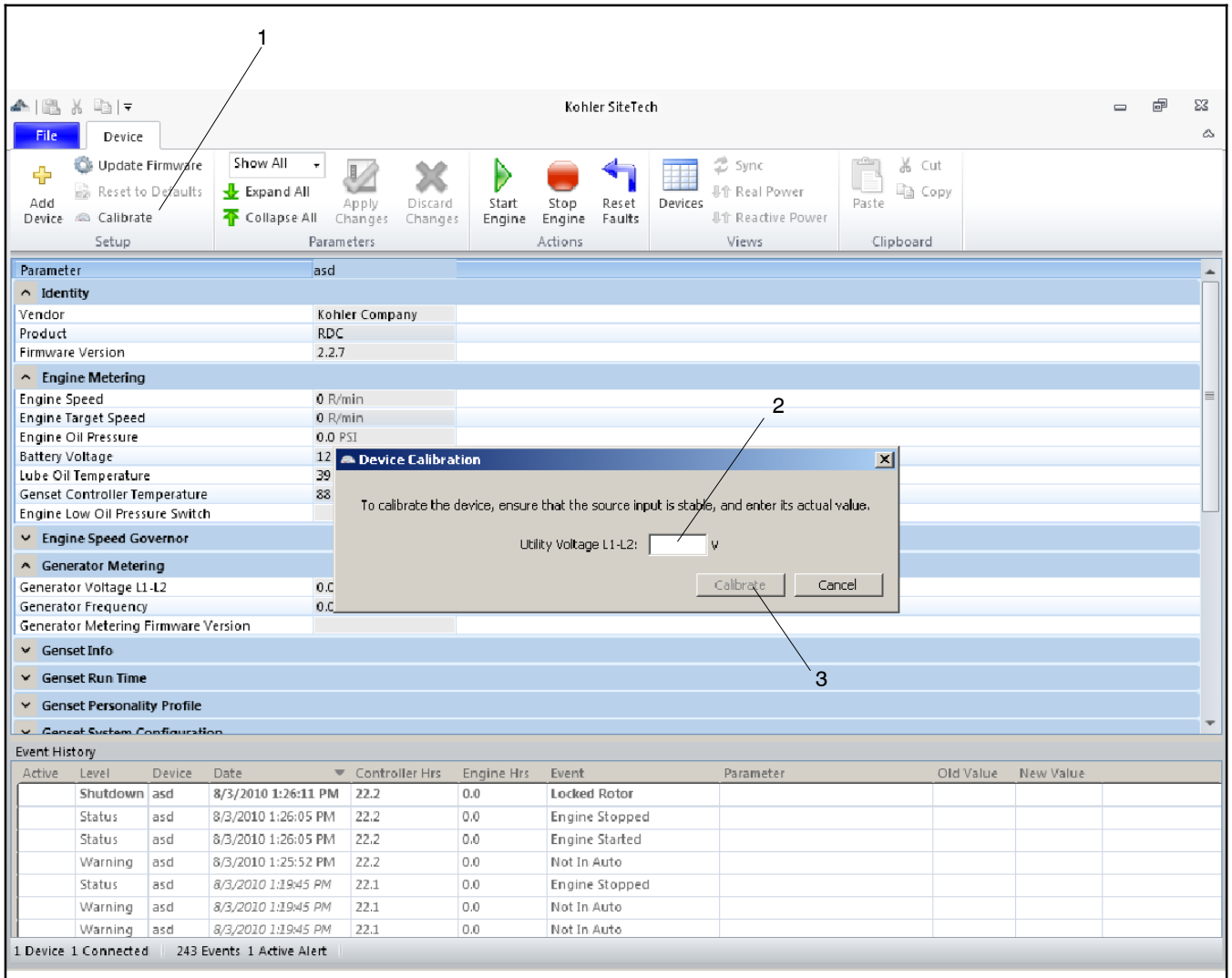
3. The Device Calibration window appears. Type the measured voltage into the space provided.

4. Click the Calibrate button in the Device Calibration Window.

After the calibration procedure, view the utility voltage in the Source 1 metering window. Voltage L1–L2 and average line-to-line voltage are displayed.

4.11.2 Calibration Factor

The Source 1 Calibration Factor Voltage L1–L2 parameter in SiteTech shows the ratio of measured voltage to the source 1 system voltage.



1. Click on Calibrate in the ribbon at the top of the screen.
2. Enter the measured voltage.
3. Click Calibrate in the Device Calibration window.

Figure 4-14 Calibration Using SiteTech Software

4.12 Controller Circuit Board

4.12.1 Relays and LEDs

The K1 flash, K2 crank, and K3 run (fuel) relays are located on the controller's logic board. The CRANK and RUN LEDs are associated with relays 2 and 3 and are visible in the service access area on the front of the controller assembly. See Figure 4-15.

The RUN and CRANK LEDs indicate power to the corresponding relay. If the LED is illuminated but the relay is not activated, the relay is faulty.

Power to the governor stepper motor is tied to the K3 run relay. If the stepper motor does not operate, check the K3 relay.

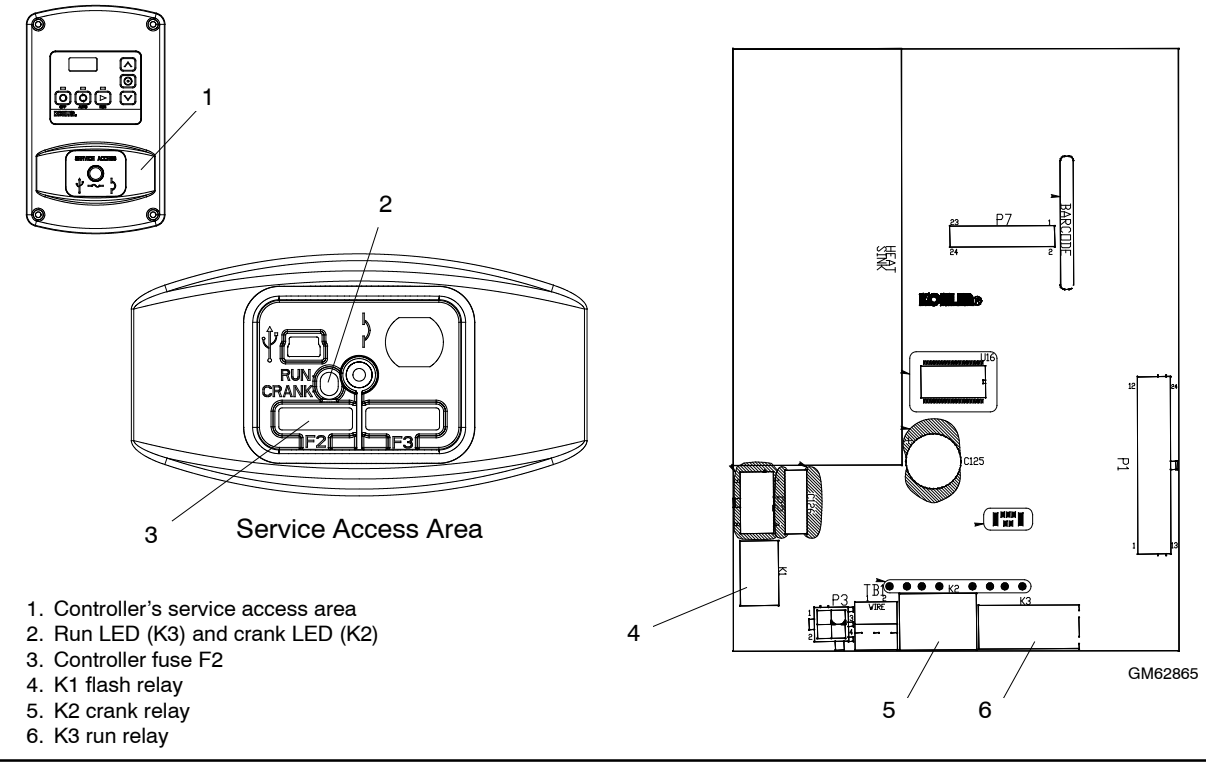
The individual relays are not replaceable. If one or more relays are faulty, replace the controller.

4.12.2 Controller Fuse F2

The controller board is protected by a 7.5-amp fuse (F2) located on the controller. If the fuse blows repeatedly, disconnect the following leads one at a time to identify the cause of the blown fuse:

- Lead 70A at the fuel valve
- Lead IGN at the ignition module
- Lead 71 at the starter relay
- Leads FP and FN at the rotor

Repair or replace the component causing the blown fuse.



1. Controller's service access area
2. Run LED (K3) and crank LED (K2)
3. Controller fuse F2
4. K1 flash relay
5. K2 crank relay
6. K3 run relay

Figure 4-15 Relays and LEDs on Controller Circuit Board

4.13 Controller Replacement

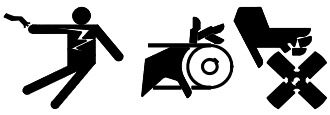
If the troubleshooting procedures in Section 3 identify a failed controller, use the procedure in this section for controller replacement. Always check the controller configuration, fuse, wiring, and connections before replacing the controller.

After replacing the controller, the installer must set the controller parameters. On the RDC controller, the installer can use the the controller keypad to set the Uu and Ec parameters, or use a personal computer running Kohler® SiteTech™ software. For the DC controller, the installer can use the key sequence described in these instructions or use SiteTech software to configure the controller. Distributors can obtain SiteTech software from the TechTools site on Kohlernet.

If SiteTech™ is used and the old controller is functional, you may be able to save the current controller settings to a file before the controller is removed. (Or the controller settings may have been saved to a file during the installation process.) Then use SiteTech™ to load the settings onto the new controller after it is installed. See TP-6701, SiteTech™ Software Operation Manual, for instructions to export and import settings.

Note: Export the old controller settings to the new controller only if you are certain that the settings are correct. Many controller operation problems can be traced to incorrect settings.

⚠ WARNING



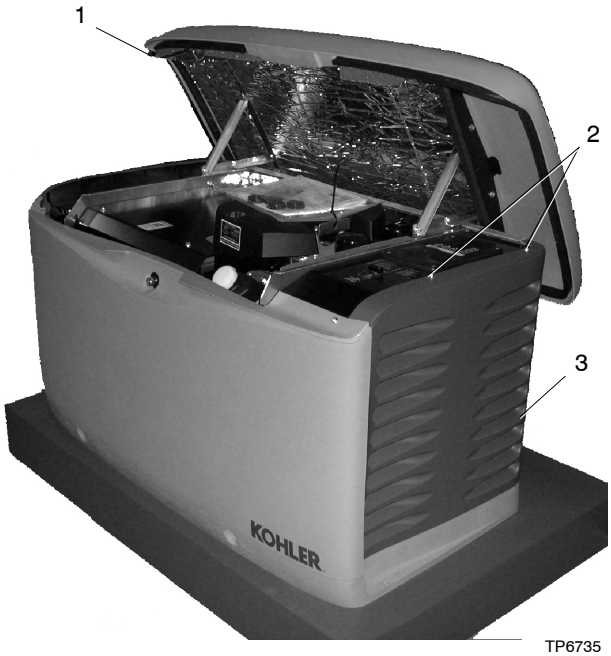
Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

Controller Replacement Procedure

1. Open the enclosure roof.
2. If desired, connect a laptop computer to the RDC controller and use SiteTech software to save the controller settings.
3. Press the OFF button on the RDC controller. Verify that the OFF LED is flashing.
4. Disconnect the utility power coming into the generator set by opening the circuit breaker in the essential loads panel. Verify that the power to the generator set is disconnected before proceeding.
5. Remove two (2) screws on the intake panel and remove the panel. See Figure 4-16.
6. Unplug the battery charger's power cord.
7. Disconnect the generator set engine starting battery(ies), negative (-) lead first.



1. Roof
2. Intake panel screws (2 ea.)
3. Intake panel

Figure 4-16 Enclosure Roof and Door

Replace the Controller

8. Remove the four (4) screws securing the controller and *carefully* lift the controller. See Figure 4-17.

   Note: Be careful of the leads and harness connected to the controller.

9. Note the connections on the back of the controller, and then disconnect P1, P2, P3, and leads 55 and 55F at the miniature circuit breaker. See Figure 4-18 or the wiring diagram.

10. Remove the old controller.

11. Reconnect P1, P2 and P3 to the new controller assembly GM62863-2 or GM62863-3. Connect leads 55 and 55F to the mini-breaker.

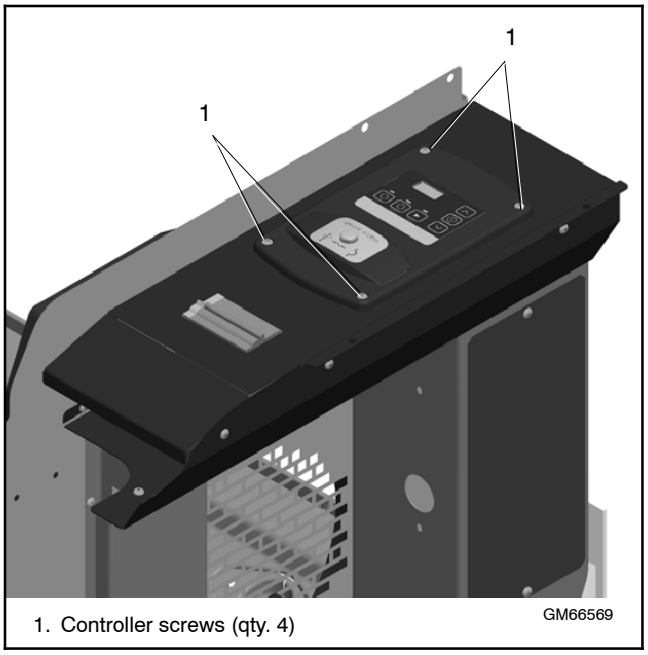
12. Mount the new controller assembly onto the junction box using the four (4) screws removed in step 8.

13. Reconnect the engine starting battery, negative (–) lead last.

14. Reconnect the utility power to the generator set by closing the circuit breaker in the essential loads panel.

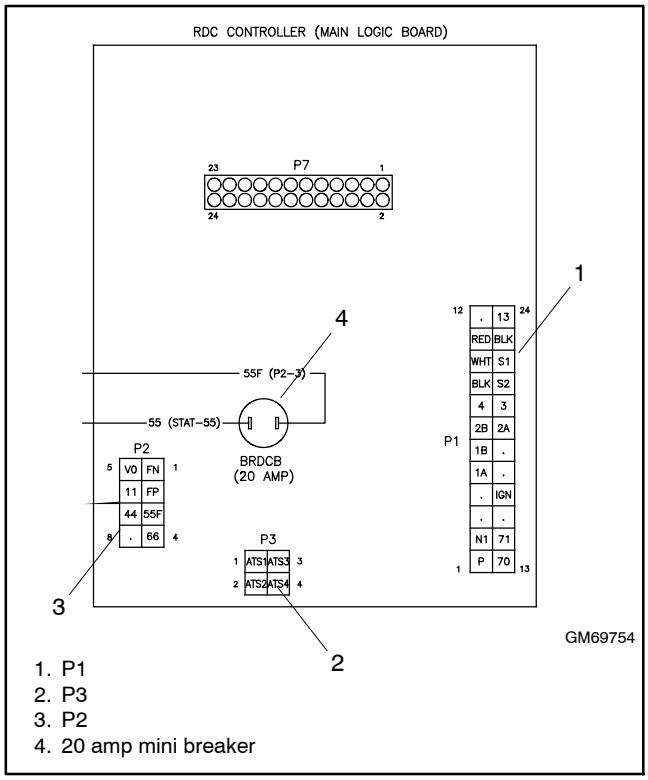
15. Plug the battery charger cord into the receptacle on the generator set.

16. Replace the air intake end panel and secure with two screws.



1. Controller screws (qty. 4)

Figure 4-17 Controller Mounting Screws



1. P1
2. P3
3. P2
4. 20 amp mini breaker

Figure 4-18 Controller Connections

Configure the Controller

17. Configure the controller. Choose one of the following options:

    a. Use the RDC controller keypad to set the new controller's voltage/frequency setting (Uu) and engine configuration setting (Ec). See Section 4.10 and TP-6733, Installation Manual.

    b. If a settings file for the controller is available, use a personal computer with Kohler® SiteTech™ software to load the settings onto the new controller. See TP-6701, SiteTech Software Operation manual, for instructions.

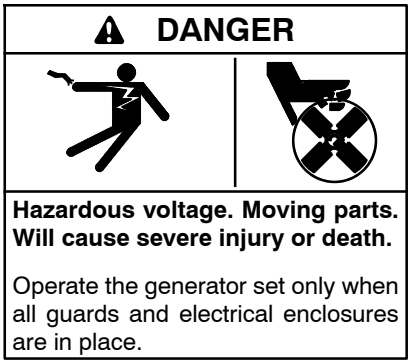
    c. Use a personal computer with SiteTech software to set the following parameters. See Section 4.10.5 and TP-6701, SiteTech Software Operation Manual.

    - Genset Model Number (14RESL or 20RESL)
    - Engine Model Number (enter CH–740 for the 14RESL or CH–1000 for the 20RESL)
    - Voltage (240)
    - Frequency (60 Hz)
    - Number of phases (Single phase)

18. Optional, except for use with OnCue™ software as noted below: Use Kohler® SiteTech™ software to enter the following generator set information into the new controller.

    - Genset Serial Number (from generator set nameplate; required for OnCue™ operation)
    - Engine Serial Number (from engine nameplate)

Check the Output Voltage and Frequency



Testing live electrical circuits. Hazardous voltage or current will cause severe injury or death. Have trained and qualified personnel take diagnostic measurements of live circuits. Use adequately rated test equipment with electrically insulated probes and follow the instructions of the test equipment manufacturer when performing voltage tests. Observe the following precautions when performing voltage tests: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Do not touch the enclosure or components inside the enclosure. (4) Be prepared for the system to operate automatically.
(600 volts and under)

19. Press the RUN button on the controller to start the generator set. Use a voltmeter to check the output voltage and frequency. If voltage or frequency adjustments are required, refer to Section 5.8, Voltage Adjustment, for instructions.

20. Press the AUTO button to stop the generator set through normal timing sequences and place the controller in automatic mode.

Set the Exerciser

21. Set the exerciser. The generator set will exercise weekly on the same day and time that the exerciser is started. See Section 4.6 for more information about unloaded and loaded exercise runs.

    a. Press the AUTO button. Check that the AUTO LED is illuminated.

    b. Press the down arrow (RDC) or EXERCISE (DC) button once to start an unloaded variable-speed exercise. After the engine starts, EnLd appears on the controller display.

    c. If the generator set is connected to a Kohler® Model RRT transfer switch: For a loaded exercise, press the down arrow or EXERCISE button again. The engine speed increases and E Ld appears on the controller display.

    d. The exercise runs for 20 minutes. Loaded exercises may run for up to 5 additional minutes during the engine cooldown cycle.

22. Close the roof and lock the enclosure.

5.1 Theory of Operation

The generator set utilizes a rotating-field alternator to produce AC voltage. See Figure 5-1. After the engine starts and reaches a predetermined speed (RPM), DC current from the battery magnetizes the rotor (field). When the magnetized rotor rotates inside the stator windings, an electrical voltage develops in the stator. The controller feeds rectified stator current to the rotor through the brushes and slip rings to change the strength of the rotor field as the load changes. As the rotor field strength increases, the generator power output increases (up to the rating shown on the nameplate). The controller monitors the generator output voltage through leads 11 and 44 and adjusts the DC current to the rotor to meet load requirements while maintaining the output voltage.

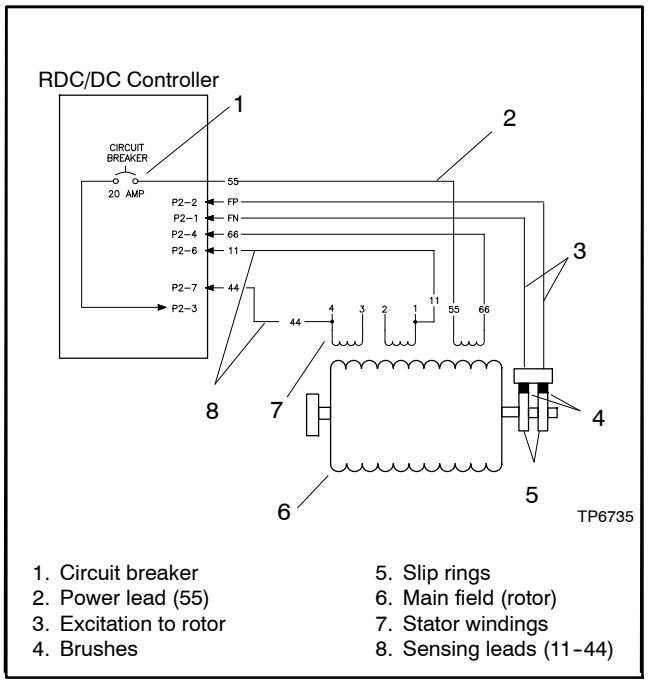


Figure 5-1 Single-Phase Generator Schematic

5.2 Separate Excitation

To determine the cause of no or low AC output, refer to the troubleshooting flowchart in Figure 5-2. Before beginning the test procedures, read all safety precautions at the beginning of this manual. Many of the test procedures include additional safety precautions.

Check the condition of the alternator circuit breaker before performing the separate excitation procedure. The circuit breaker is located in the service access area on the controller. See Figure 5-1. If the breaker is not tripped, use the following procedure to separately excite the generator using an external voltage source (a 12-volt automotive battery).

Separately exciting the generator can identify faulty voltage regulation by the controller or reveal a running fault in the rotor and/or stator. An external power source duplicates the role of the voltage regulator and excites the generator field (rotor). A generator component that appears to be in good condition while stationary may exhibit a running open or short circuit while moving. Centrifugal forces acting on the windings during rotation cause a broken circuit to open, or increasing temperatures cause the insulation to break down, resulting in a running fault. If this test shows that the rotor and stator are in good condition, test the voltage regulation using the tests in Section 5.7.

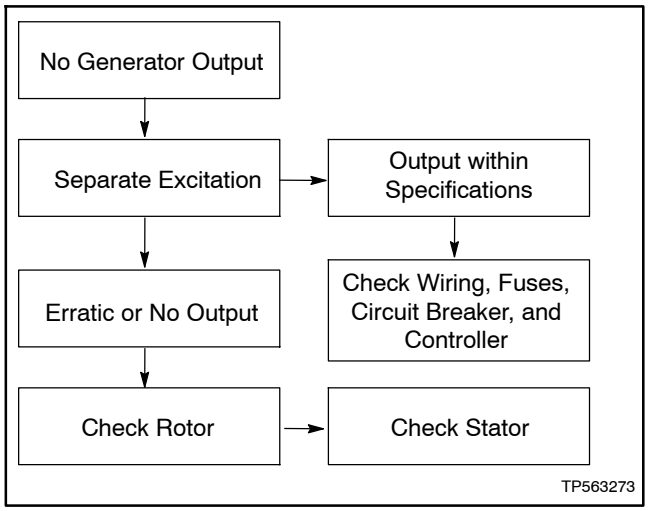
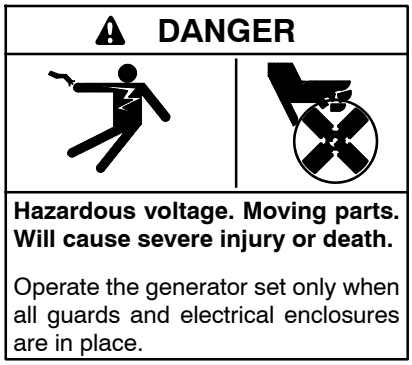


Figure 5-2 Generator Troubleshooting



Short circuits. Hazardous voltage/current will 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 making adjustments or repairs. Remove all jewelry before servicing the equipment.

Grounding electrical equipment. Hazardous voltage will cause severe injury or death. Electrocution is possible whenever electricity is present. Ensure you comply with all applicable codes and standards. Electrically ground the generator set, transfer switch, and related equipment and electrical circuits. Turn off the main circuit breakers of all power sources before servicing the equipment. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

Separate Excitation Procedure

Perform the following procedure to use an external voltage source to excite the main field (rotor).

1. Disconnect the black FN and FP leads from the alternator at the brush holder terminals.

2. Connect a DC ammeter, 10-amp fuse, and a 12-volt automotive battery to the positive (FP) and negative (FN) brush leads as shown in Figure 5-3. Note and record the ammeter reading.

   Note: The approximate ammeter reading should be the battery voltage divided by the specified rotor resistance. See Section 1, Specifications, for specified rotor resistance values.

   Example:

   $$\frac{\text{12 volts (battery voltage)}}{\text{4 ohms (rotor resistance)}} = \text{3 amps (rotor current)}$$

3. Start the engine and check that the ammeter reading remains stable. An increasing meter reading indicates a shorted rotor. A meter reading decreasing to zero or an unstable reading suggests a running open. Refer to Section 5.4, Main Field (Rotor), to test the rotor. If the ammeter reading is stable, proceed to step 4.

4. Check for AC output across the stator leads; see Section 5.3, Stator. Compare the readings to the AC output values shown in Section 1, Specifications. If the readings vary considerably, a faulty stator is likely. Refer to Section 5.3, Stator, for further information.

5. If this test shows that the rotor and stator are in good condition, check the wiring and fuses. Check the controller settings and connections. See Section 4, Controller.

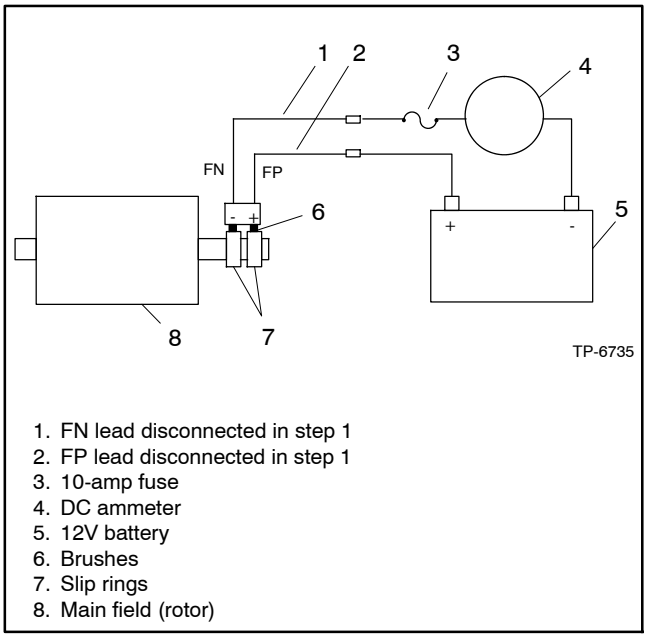


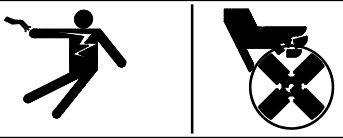
Figure 5-3 Separate Excitation Connections

5.3 Stator

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

Note: Disconnect all stator leads before performing all stator tests.

⚠ DANGER



Hazardous voltage. Moving parts. Will cause severe injury or death.

Operate the generator set only when all guards and electrical enclosures are in place.

High voltage test. Hazardous voltage will cause severe injury or death. Follow the instructions of the test equipment manufacturer when performing high-voltage tests on the rotor or stator. An improper test procedure can damage equipment or lead to generator set failure.

Short circuits. Hazardous voltage/current will 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 making adjustments or repairs. Remove all jewelry before servicing the equipment.

Stator Continuity and Resistance Tests

1. Press the OFF button on the controller to turn off the generator set and remove controller fuse F3.
2. Disconnect power to the battery charger.
3. Disconnect the generator set engine starting battery, negative (–) lead first.
4. Disconnect all stator leads before performing all stator tests.
5. To check for stator continuity, set the ohmmeter on R x 1 scale. First set the ohmmeter zero by holding the red and black meter leads together and setting the ohmmeter reading to zero. Then check the stator continuity by connecting the meter leads to the stator leads as shown in Figure 5-4.

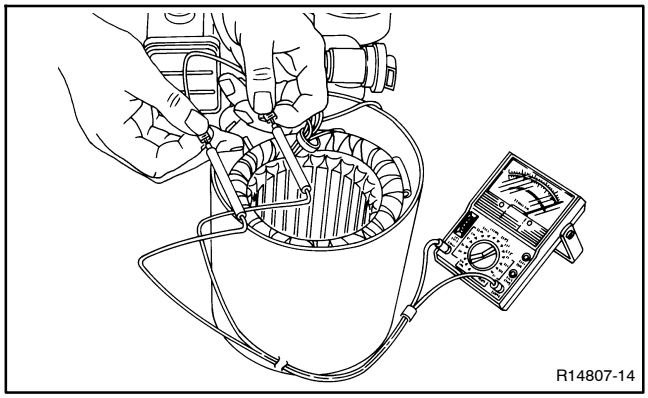


Figure 5-4 Testing Stator Windings

Note: For single-phase models. leads 1, 2, 3, and 4 are the generator output leads. Leads 11, 44, 55, and 66 are the controller sensing and supply leads. Refer to the schematic in Figure 5-5 when performing the following steps.

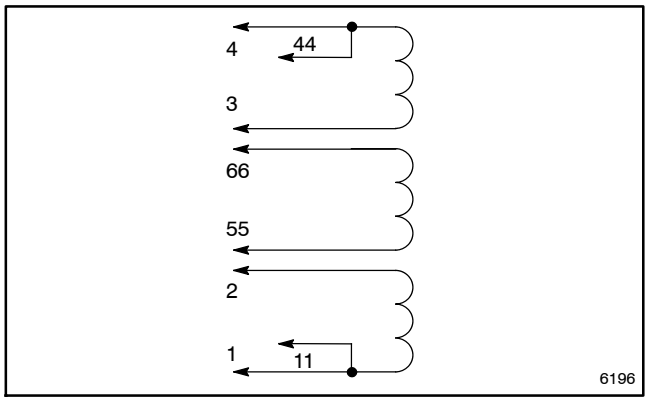


Figure 5-5 Single-Phase Alternator Stator Leads

6. Contact the ohmmeter leads and readjust the ohmmeter to read zero ohms.
7. Check the cold resistance of the stator windings by connecting the meter leads to stator leads 1-2, 3-4, and 55-66. See Section 1.5, Alternator Specifications, for stator winding resistances. Most ohmmeters do not provide accurate readings below 1 ohm. Low resistance readings (continuity) and no evidence of shorted windings (heat discoloration) indicate a stator in good condition. See Figure 5-6.

Leads	Continuity
1 and 2	Yes
1 and 11	
2 and 11	
3 and 4	
3 and 44	
4 and 44	
55 and 66	
1 and 3, 4, 44, 55, or 66	No
2 and 3, 4, 44, 55, or 66	
3 and 1, 2, 11, 55, or 66	
4 and 1, 2, 11, 55, or 66	
Any stator lead and ground on stator housing or frame laminations	

Figure 5-6 Continuity Test Results on a Good Stator (single-phase)

8. If the resistance test proves inconclusive, use a megohmmeter to test the stator as described in the next step.

   Note: Because ohmmeter accuracy varies, resistance readings are approximate readings. Take readings of the rotor and stator at room temperature.

   Note: Make sure that all stator leads are disconnected before running the megohmmeter test.

9. Use a megohmmeter to determine whether the stator is shorted to ground.

   a. Apply 500 volts DC to any stator lead and the stator frame. Perform the megohmmeter test following the instructions of the megohmmeter manufacturer.

   b. Repeat the test on the other stator leads until each coil is tested.

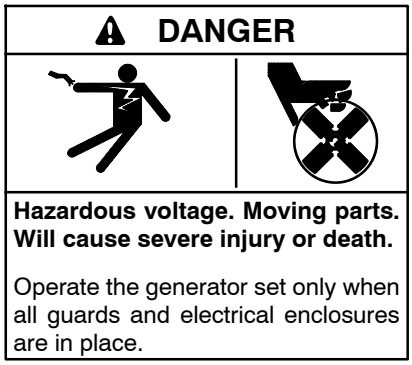
      Note: A reading of approximately 500 kOhms (1/2 megohm) and higher indicates a good stator.

   c. Repair or replace the stator if any reading is less than approximately 500 kOhms. A reading of less than 500 kOhms indicates deterioration of the winding insulation and possible current flow to ground.

5.4 Main Field (Rotor)

The two-pole rotor creates the magnetic field needed to produce alternating current in the stator windings. Before testing, inspect the rotor for visible damage to pole shoes, insulation, exposed coil windings, and slip ring surfaces. Rotate the bearing to check for wear, heat discoloration, or noise.

5.4.1 Rotor Continuity and Resistance Tests



High voltage test. Hazardous voltage will cause severe injury or death. Follow the instructions of the test equipment manufacturer when performing high-voltage tests on the rotor or stator. An improper test procedure can damage equipment or lead to generator set failure.

Grounding electrical equipment. Hazardous voltage will cause severe injury or death. Electrocution is possible whenever electricity is present. Ensure you comply with all applicable codes and standards. Electrically ground the generator set, transfer switch, and related equipment and electrical circuits. Turn off the main circuit breakers of all power sources before servicing the equipment. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

Rotor Test Procedure

1. Press the OFF button on the controller to turn off the generator set and remove controller fuse F3.
2. Disconnect power to the battery charger.
3. Disconnect the generator set engine starting battery, negative (–) lead first.
4. Remove the brush cover from the alternator end bracket.
5. Check the rotor for continuity and resistance. Raise the brushes from the slip rings while performing ohmmeter tests. Measure the rotor resistance (ohms) between the two slip rings; see Figure 5-7. See Section 1.5 for rotor resistance readings. If the resistance readings are low, perform a megohmmeter test on rotor as described in the next step.

   Note: Because ohmmeter accuracy varies, resistance readings are approximate. Take readings at room temperature.

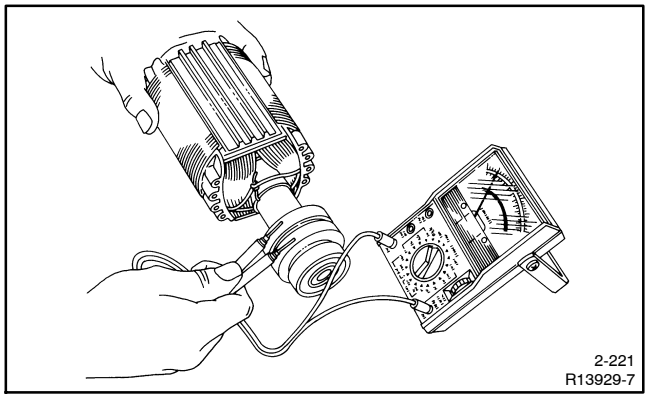


Figure 5-7 Rotor Resistance Check

6. Perform a megohmmeter test to determine whether the rotor is shorted to ground.

   a. Raise and secure the brushes away from the slip rings by inserting a retaining wire in the brush holder hole.

   b. Using a megohmmeter, apply 500 volts DC to one rotor slip ring and the rotor poles or shaft. Follow the instructions of the megohmmeter manufacturer when performing this test.

      Note: A reading of approximately 500 kOhms (1/2 megohm) or higher indicates a good rotor.

   c. Repair or replace the rotor if the reading is less than approximately 500 kOhms. A reading of less than 500 kOhms indicates deterioration of the winding insulation and possible current flow to ground.

   d. Following the test, remove the retainer wire from the brush holder and check the brush positions on the slip rings. See Section 5.6, Brushes.

   e. Reinstall the brush cover on the end bracket.

5.5 Slip Rings

Slip rings acquire a glossy brown finish in normal operation. Do not attempt to maintain a bright, newly-machined appearance on the slip rings. Cleaning with a dry, lint-free cloth is usually sufficient. Use very fine sandpaper (#00) and apply light pressure to remove roughness. Do not use emery or carborundum paper or cloth. Clean all carbon dust from the generator after sanding the slip rings. If the rings are black or pitted, remove the rotor and use a lathe to remove some of the slip ring surface material.

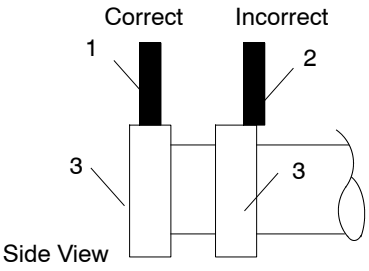
5.6 Brushes

The brushes transfer current to the slip rings. The brushes should last the life of the generator. However, abrasive dust on the slip ring can shorten the life of the brushes.

Excessive arcing at the brushes could damage the controller. Weak springs, damaged slip rings, sticking brushes, a loose brush holder, or poor brush contact causes arcing.

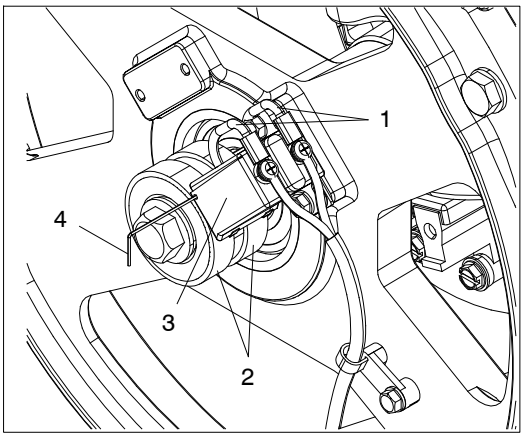
The brush holder assemblies are illustrated in Figure 5-9 and Figure 5-10. The brushes must be free to move within the holder and be held in contact with the slip rings by the springs. When correctly positioned, spring pressure on the brush surface causes the brush to wear evenly. The entire brush must ride on the ring or arcing occurs and causes burned rings or voltage regulator failure. Figure 5-8 shows the correct positioning of the brushes. Add or remove shims as necessary to center the brushes on the slip rings. Replace the brushes if they show uneven wear or are worn to one half their original length.

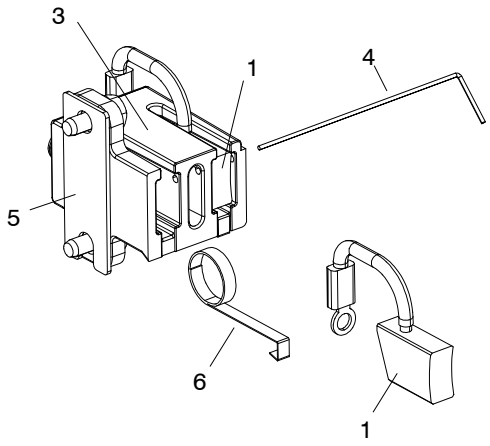
Check the resistance through the brushes. Resistance through the brushes should be low, 0.1–0.2 ohms without meter lead resistance.

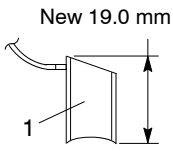


1. Correctly positioned brush
2. Incorrectly positioned brush
3. Slip rings

Figure 5-8 Brush Position



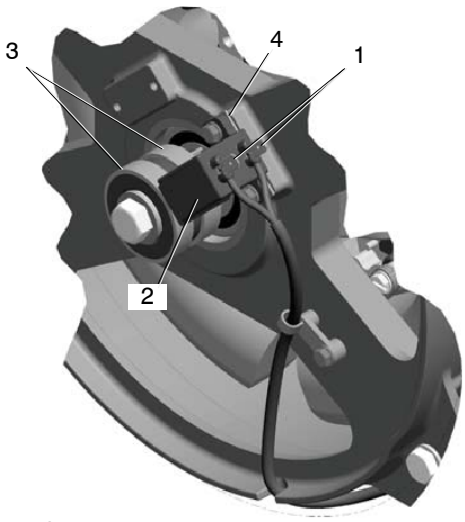




GM67344

1. Brush(es)
2. Slip rings
3. Brush holder
4. Retainer wire (for service only)
5. Shim
6. Spring

Figure 5-9 Brush Assembly



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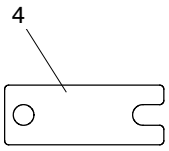

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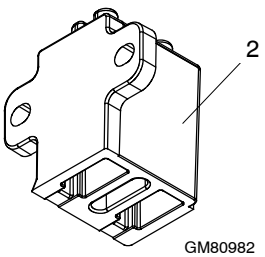

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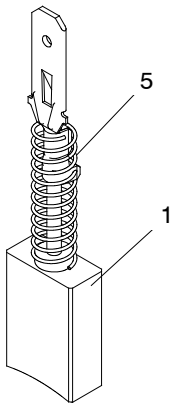
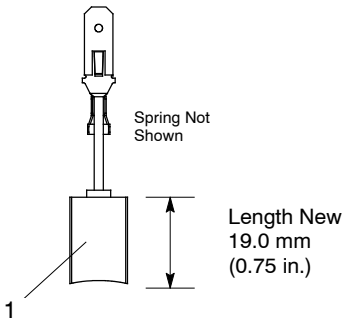




GM80981

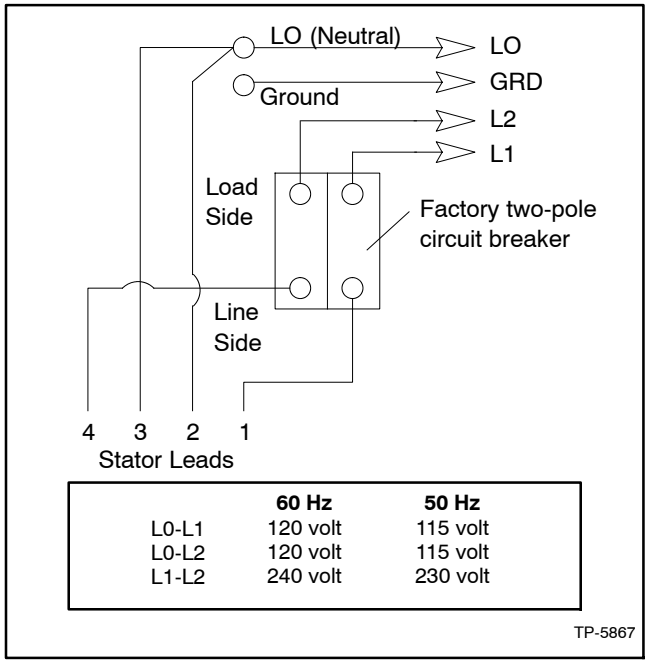
1. Brush(es)
2. Brush holder
3. Slip rings
4. Shim
5. Spring

Figure 5-10 Revised Brush Assembly

5.7 Voltage Connections

5.7.1 Voltage Connections, Single-Phase Models

Single-phase generator sets are available from the factory connected for 115/230 volt 50 Hz or 120/240 volt 60 Hz. See Figure 5-11 for the factory connections. Generator sets are not reconnectable.



	60 Hz	50 Hz
L0-L1	120 volt	115 volt
L0-L2	120 volt	115 volt
L1-L2	240 volt	230 volt

Figure 5-11 115/230 and 120/240 Volt, 3-Wire Configurations

5.7.2 Voltage Regulation

Voltage regulation is performed by the controller. The controller monitors generator output voltage and adjusts the excitation current to the rotor.

5.8 Voltage Adjustment

The factory sets the voltage for correct generator operation under a variety of load conditions. Usually, the voltage needs no further adjustment.

Adjust the voltage when necessary according to the following procedure. The adjustment procedure requires a meter that can measure voltage and frequency.

Use the RDC controller keypad or a personal computer running Kohler® SiteTech™ software to adjust the voltage, gain, and volts/Hz.

When using the RDC controller keypad, the controller will time out and exit the adjustment mode after approximately 1 minute if no buttons are pressed. Any unsaved changes are discarded if the controller times out before the settings are saved. See Figure 5-15 for instructions to save your settings.

The DC controller is not equipped with a keypad. A personal computer running Kohler SiteTech software is required for all adjustments to the DC controller. SiteTech software is available to Kohler authorized distributors and dealers (through their distributor).

Voltage Adjustment. Adjusts generator output between 100 and 130 volts.

Gain (Stability) Adjustment. Fine tunes regulator circuitry to reduce light flicker.

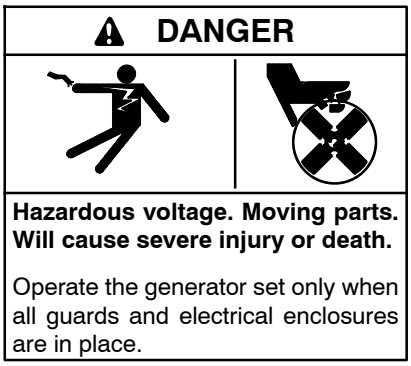
Volts/Hz Adjustment (voltage droop). Determines frequency (Hz) at which generator output voltage begins to drop. The controller maintains generator output at the specified voltage under load until the generator engine speed drops to a preset level (see Figure 5-14 for cut-in frequencies). Then the controller allows the generator voltage and current to drop. The voltage/current drop enables the engine to pick up the load. When the generator speed returns to normal (60 Hz or 50 Hz) as load is accepted, the generator output also returns to normal. See Section 5.8.2 for instructions to adjust the voltage droop. (SiteTech software required.)

Voltage and Frequency Adjustments Using SiteTech

When the voltage and frequency adjustment procedures require adjusting a voltage or speed parameter, use the SiteTech parameters shown in Figure 5-12 to adjust voltage and gain, or engine speed and gain as necessary.

SiteTech Group	Parameter
Engine Speed Governor	Engine Speed Adjustment
	Engine Speed Gain Adjustment
Voltage Regulator	Average Voltage Adjustment
	Volts per Hertz Slope
	Volts per Hertz Cut-in Frequency
	Voltage Regulator Gain

Figure 5-12 Adjustments Using SiteTech Software



Short circuits. Hazardous voltage/current will 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 making adjustments or repairs. Remove all jewelry before servicing the equipment.

Grounding electrical equipment. Hazardous voltage will cause severe injury or death. Electrocution is possible whenever electricity is present. Ensure you comply with all applicable codes and standards. Electrically ground the generator set, transfer switch, and related equipment and electrical circuits. Turn off the main circuit breakers of all power sources before servicing the equipment. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

5.8.1 Voltage Adjustment Procedure

Refer to Figure 5-15 during the adjustment procedure.

1. Connect a digital voltmeter to measure output voltage across L1 or L2 and L0. Set the meter to measure AC volts.

2. Start the generator set.

3. Follow the controller instructions in Figure 5-15 to enter the adjustment mode. Increase or decrease voltage (parameter 1P) until the output reaches the desired voltage. See Figure 5-13.

Models	Voltage Measurement	Approximate Voltage, VAC
1 phase, 60 Hz	L – L0	120
	L - L	240
1 phase, 50 Hz	L – L0	115
	L - L	230

Figure 5-13 Voltage Measurement

4. Follow the controller instructions to step to the voltage gain (parameter 2P) adjustment menu. Adjust the voltage gain (2P) until the light flicker minimizes. Save the settings. See Figure 5-15.

5. Check and readjust the voltage if necessary.

6. Save the settings. Refer to Figure 5-15 for instructions.

   Note: The controller will revert to the previous settings at the next startup if the changes are not saved.

7. Stop the generator set.

5.8.2 Volts per Hertz (Hz) Adjustments (Droop)

The volts per hertz (droop) setting can only be adjusted using a personal computer running Kohler® SiteTech™ software. Follow the instructions in this section and refer to TP-6701, SiteTech Software Operation Manual, to adjust the Voltage Regulator Volts per Hertz Slope parameter.

When the frequency falls below the cut-in frequency (see Figure 5-14), output voltage is reduced to relieve the engine. The magnitude of the voltage reduction is set by the voltage regulator volts per hertz slope. To determine whether droop adjustment is required, monitor engine speed and output voltage as loads are applied, and watch for the following conditions.

- If there is excessive droop in engine speed and little droop in voltage, increase the volts per hertz value.

- If there is little engine speed droop but excessive voltage droop, decrease the volts per hertz value.

- Readjust the voltage stability (2P) and voltage (1P) parameters after adjusting the volts/Hz setting, if necessary.
- Remember to save your settings.

Frequency	Cut-In Frequency
60 Hz	57.5 Hz
50 Hz	47.5 Hz

Figure 5-14 Cut-In Frequencies

Volts/Hz Adjustment Procedure

1. Set the voltmeter to measure frequency. Adjust the engine speed to the cut-in frequency shown in Figure 5-14 by adjusting the engine governor speed.
2. Set the voltmeter to measure voltage. Adjust the volts/Hz until the voltage level measured by the voltmeter begins to drop. When set, the generator (as load is applied) attempts to maintain normal output until the engine speed drops below the cut-in frequency.
3. Set the voltmeter to measure frequency. Adjust the engine speed to the operating frequency (50 or 60 Hz) by adjusting the engine governor speed.
4. Readjust the voltage gain until the light flicker minimizes, if necessary.
5. Check the voltage. Readjust the voltage, if necessary.
6. Stop the generator set.

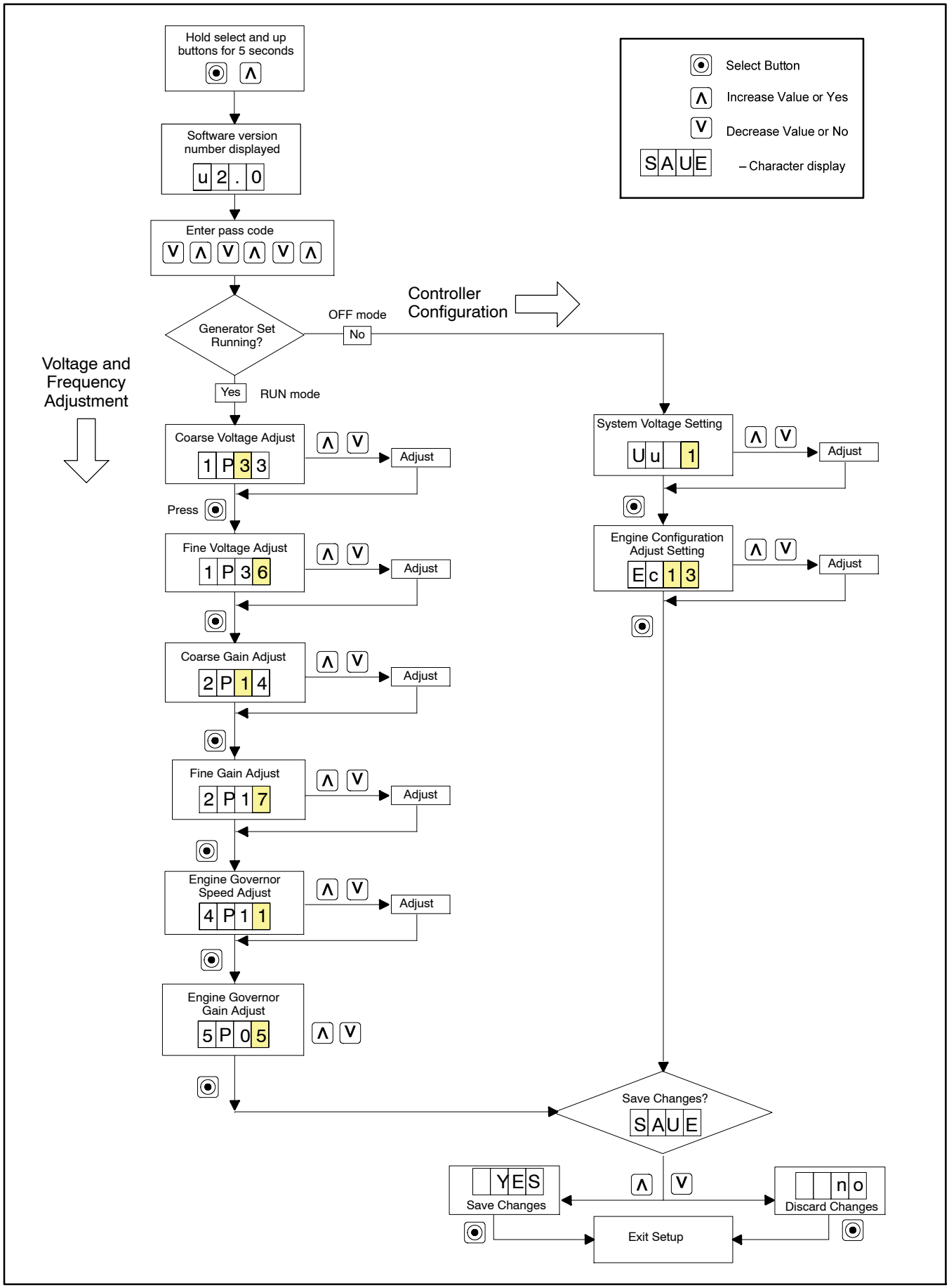


Figure 5-15 RDC Controller Adjustment

5.9 Governor System

The governor system consists of an electromechanical stepper motor (actuator) and a magnetic pickup. The RDC/DC controller controls the governor system operation. See Section 7, Wiring Diagrams, for the governor connections.

5.9.1 Operation

The frequency of the alternator output is determined by the speed of the engine. A two-pole alternator must be driven at 3600 rpm to provide 60 Hertz. (A 50 Hz model must be driven at 3000 rpm.) The engine speed is maintained by an electronic governor system that consists of a magnetic pickup and electric actuator (stepper motor). The governor system is controller by the generator set controller.

The magnetic pick-up, which monitors the speed of the flywheel ring gear, provides the speed reference signal to the controller. The controller provides regulated power to the bidirectional stepper motor actuator, which is linked to the carburetor throttle arm.

At cranking speed a properly adjusted pick-up should produce a minimum of 3.0 VAC. The magnetic pick-up air gap is factory-set to 0.5 mm (0.020 in.). Failure or loss of the input speed signal from the magnetic pick-up will result in erratic speed.

A setting on the RDC controller allows adjustment of the engine speed. See Section 5.9.3.

A gain adjustment may be required if an unstable (hunting/surging) condition occurs. Adjusting the gain may require readjustment of the engine speed. See Section 5.9.3.

5.9.2 Initial Checks

The factory sets the electronic governor. Under normal circumstances the electronic governor requires no further adjustment. Verify that the governor stepper motor moves smoothly and steadily during operation. If the engine operates erratically check the following connections and conditions *before* adjusting the governor.

- Power to the governor stepper motor is tied to the K3 run relay. If the stepper motor does not operate, check the K3 relay. See Section 4.12.1.
- Verify that the electrical connections are clean and tight.
- Check the magnetic pickup connections. Poor connections may cause an erratic signal or an overspeed condition. An erratic signal causes the generator set to govern poorly but not shut down.
- Check the resistance across the magnetic pickup. See Section 5.9.4.
- Verify that the battery connections are clean and tight.
- Check for dirt buildup on the magnetic pickup. Metal filings or caked-on dirt or grease decreases the output signal of the magnetic pickup.
- Check for a loose or worn stepper motor/throttle shaft coupling. Replace the shaft and bushing every 500 hours of engine operation.
- Check the carburetor for dirt, grime, or misadjustment. Check for a loose mixer assembly.
- Check the idle-adjustment screw. The screw should not prevent the throttle plate from closing completely.
- Check the throttle linkage for any binding, dirt, damage, or other visible problems.
- Observe the stepper motor operation. The stepper motor should open the throttle fully before cranking, and pull back after the crank disconnect.
- Check for electronic governor faults. The fuel shutoff solenoid deenergizes and the generator set shuts down under the following conditions:
  - Closed throttle
  - Engine overspeed
  - Broken fuel shutoff solenoid lead
  - Broken stepper motor leads (erratic performance)
  - Failed actuator linkage (erratic performance)

5.9.3 Hunting/Surging

Often hunting/surging problems thought to be caused by the governor are actually caused by engine or carburetor problems. Check engine speed stability using the following procedure before testing the governor.

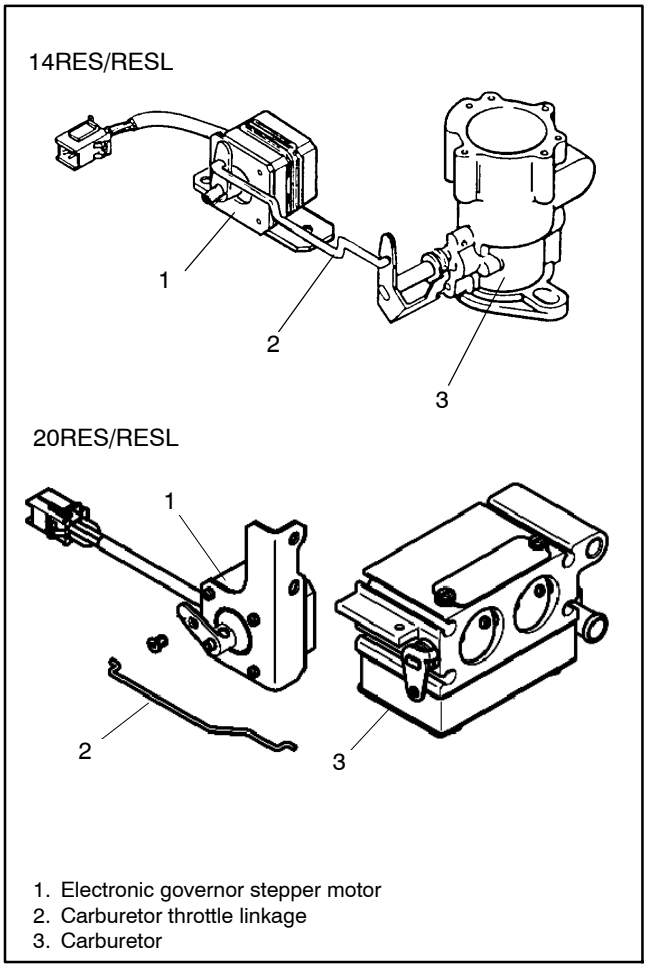
⚠ WARNING

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

Do not work on the generator set until it cools.

Servicing the exhaust system. Hot parts can cause severe injury or death. Do not touch hot engine parts. The engine and exhaust system components become extremely hot during operation.

1. Open the generator set line circuit breaker.
2. Start the generator set.
3. Hold the throttle linkage steady while the engine is running. See Figure 5-16. If the engine runs at a steady speed with no hunting or surging when the throttle is held steady, then the hunting/surging problems during operation are probably caused by the governor. Proceed to Section 5.9.4.
4. If the engine speed hunts or surges while the throttle is held steady, check the carburetor and engine operation. Refer to the engine service manual for engine diagnostic and service information.



1. Electronic governor stepper motor
2. Carburetor throttle linkage
3. Carburetor

Figure 5-16 Stepper Motor and Carburetor

5.9.4 Governor System/Magnetic Pickup Operation Test

If the engine continues to operate erratically after the previous checks, test the governor system operation using the following procedure. The procedure is summarized in the flowchart in Figure 5-17.

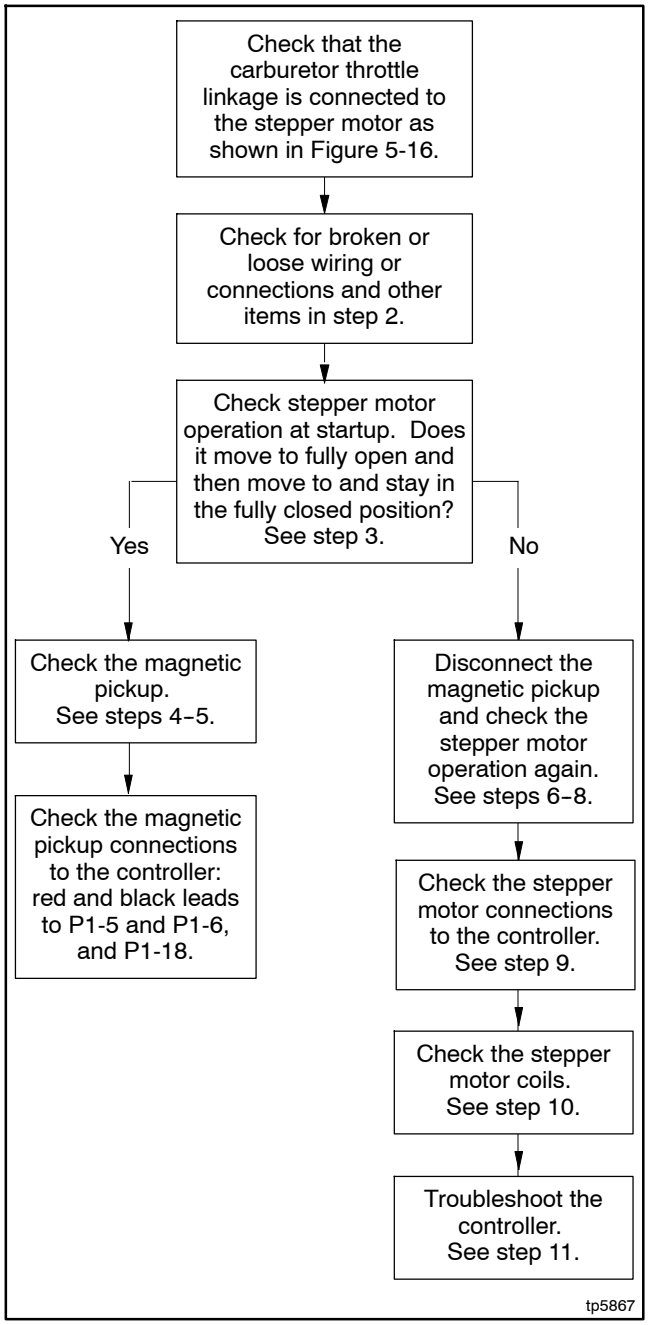
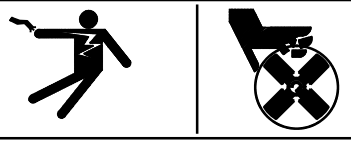


Figure 5-17 Governor System Operation Test Procedure Summary (Section 5.9.4)

⚠ DANGER



Hazardous voltage. Moving parts. Will cause severe injury or death.

Operate the generator set only when all guards and electrical enclosures are in place.

Short circuits. Hazardous voltage/current will 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 making adjustments or repairs. Remove all jewelry before servicing the equipment.

⚠ WARNING

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

Do not work on the generator set until it cools.

Governor System Operation Test Procedure

1. Verify that the carburetor throttle linkage is connected to the stepper motor as shown in Figure 5-16.

2. Look for broken or loose wiring or plug connections if the stepper motor moves erratically. Check the condition of the throttle linkage, and verify that the throttle plate closes completely.

3. Check the operation of the stepper motor at startup.

   a. If the throttle moves to the fully open throttle position and then steps to and remains in the fully closed position, the engine speed input is probably missing. The engine starts and then shuts down on an overspeed fault. Proceed to step 4 to check the magnetic pickup.

   b. If the throttle linkage moves erratically or not at all at during startup, proceed to step 6 to check the stepper motor.

4. Stop the engine and check the resistance of the magnetic pickup.

   a. Stop the generator set. Remove housing panels as required to gain access to the front of the engine.

   b. Remove the engine blower housing.

   c. Disconnect the magnetic pickup at QCON1 and QCON2. The magnetic pickup must be isolated from the generator controller to allow an accurate resistance measurement.

   d. Measure the electrical resistance through the magnetic pickup at QCON1 and QCON2. See Figure 5-19.

   e. Compare the resistance measurement to the value shown in Figure 5-18. If the resistance is significantly higher (open circuit) or lower (short circuit), replace the magnetic pickup.

   f. Reconnect QCON1 and QCON2.

Magnetic Pickup Resistance	
Resistance across QCON1 and QCON2	1.6 kΩ

Figure 5-18 Magnetic Pickup Resistance

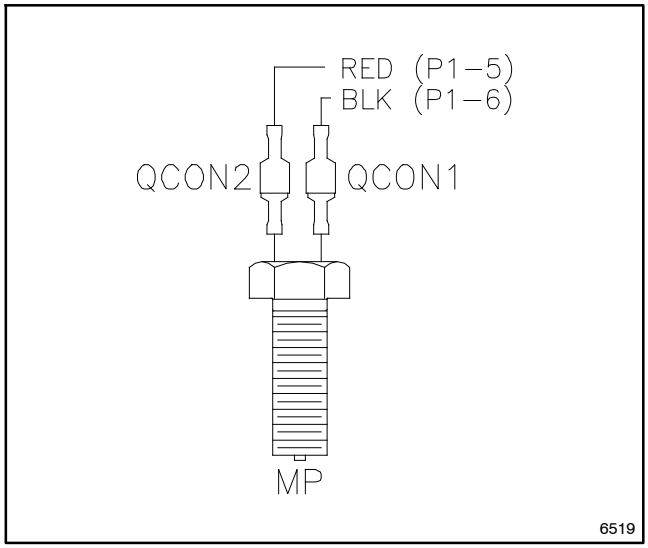
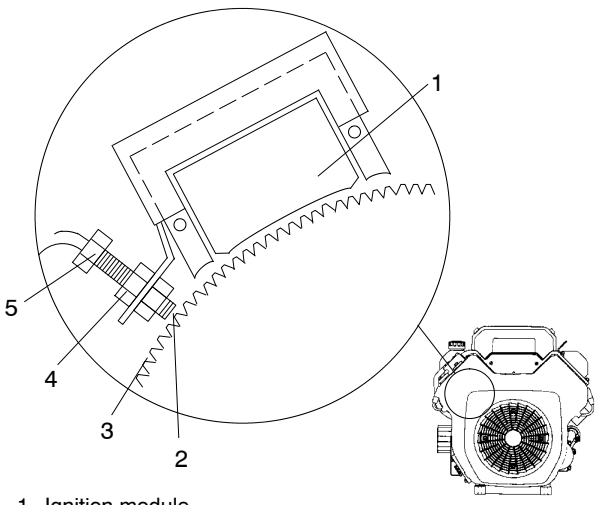


Figure 5-19 Magnetic Pickup Leads

5. Verify the operation of the magnetic pickup by connecting a voltmeter to the magnetic pickup leads. See Figure 5-19. The voltage should be 3.0 volts AC RMS minimum during engine cranking.

   If the voltmeter displays less than 3.0 volts AC, check the air gap as described in the following steps before replacing the sensor. Verify that the magnetic pickup air gap is 0.5 mm (0.020 in.). Measure the air gap at 3 or 4 places to get an accurate reading. See Figure 5-20.



1. Ignition module
2. Air gap, 0.5 mm (0.020 in.)
3. Top of flywheel ring gear tooth
4. Locknut
5. Magnetic pickup

Figure 5-20 Magnetic Pickup Air Gap

   a. Use a feeler gauge to check the gap. The gap should be 0.5 mm (0.020 in.).

   b. Adjust the air gap, if necessary, by loosening the locknut and turning the pickup. See Figure 5-20.

   c. Hold the pickup in position and retighten the locknut.

   d. Verify the magnetic pickup air gap after tightening the locknut.

   e. Reinstall the engine blower housing.

   f. Reinstall the junction box and housing panels removed to gain access to the front of the engine.

   g. After adjusting the air gap, check the voltage again as described in step 5. If the voltage does not measure 3.0 VAC minimum, replace the magnetic pickup.

6. To test controller's governing function, disconnect the magnetic pickup leads and open the generator set circuit breaker.

7. Manually move the throttle shaft/governor stepper motor fully counterclockwise (closed throttle).

8. Start the generator set. The stepper motor should step clockwise to the wide open throttle position. The stepper motor should remain in the clockwise (throttle fully open) position. If the stepper motor does not operate as described here, proceed to the next steps to check the governor and stepper motor.

9. Stop the generator set by pressing the OFF button on the controller. Check the stepper motor connections to the controller. See the wiring diagrams in Section 7.

10. Check the stepper motor coil resistance across pins 2 and 3 and across pins 1 and 4. Only two stepper motor leads of each coil group are used (BLK-YEL and RED-WHT). See Figure 5-21. The resistance per half coil is 38.5 ohms. If one of the coils has a significantly higher resistance or is shorted, replace the stepper motor.

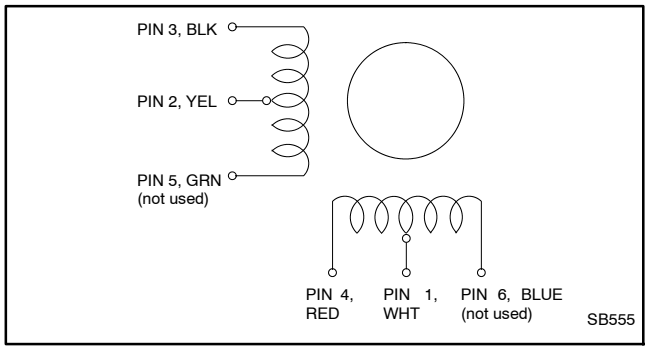
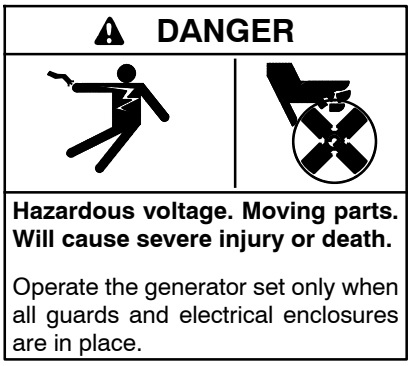


Figure 5-21 Actuator Coil Group

11. If there is power and a good ground connection to the controller and the stepper motor coil resistances are good, but the stepper motor does not operate as described in step 8, the problem is with the controller. Check controller connections, fuses, wiring, and settings. Refer to the troubleshooting procedures in Section 3.

5.9.5 Frequency Adjustment



Short circuits. Hazardous voltage/current will 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 making adjustments or repairs. Remove all jewelry before servicing the equipment.

The engine speed determines the generator output frequency; 60 Hz units operate at 3600 rpm and 50 Hz units run at 3000 rpm. Adjust the engine governor to change the output frequency using the following procedure.

The RDC controller can be adjusted using the controller keypad or using a personal computer running Kohler SiteTech software. The DC controller has no keypad, and must be adjusted using SiteTech software.

Note: See Figure 5-15 for instructions to adjust engine governor speed (frequency) and gain.

Frequency Adjustment Procedure

1. Open the generator set line circuit breaker.
2. Attach a frequency meter to the AC output leads.
3. Start and run the generator set until it reaches normal operating temperature (at least 10 minutes).
4. Use the RDC controller to adjust the electronic governor speed (parameter 4P) to obtain a frequency reading of 60 Hz (or 50 Hz on 50 Hz models). See Figure 5-15.

   Note: Often hunting/surging problems thought to be caused by the governor are actually caused by engine or carburetor problems. If the generator set speed is unstable, hunts, or surges, check for the cause using the procedure in Section 5.9.3 before proceeding.

5. Check stability with the generator set running and with no load applied. If the generator set speed is unstable, hunts, or surges, decrease the gain (parameter 5P) until the generator set becomes stable with no hunting or surging. Observe the frequency reading.
6. Repeat steps 4 and 5 to obtain the rated frequency and stable operation.
7. Save the settings. Refer to Section 5.8 for instructions.

   Note: The controller will revert to the previous settings at the next startup if the changes are not saved within one minute after the last change.

8. Apply rated load to the generator set and observe the frequency reading. The no load and full load frequencies should be within 0.4 Hz of the rated generator frequency; if not, check that the carburetor throttle plate opens completely without sticking and check the carburetor adjustment. If these procedures do not correct the problem, replace the controller.
9. Check for hunting and surging at full load. Increase the gain (parameter 5P) until the engine hunts and surges. Then decrease the gain in small steps using the governor gain fine adjust parameter until the engine operation stabilizes. Save the controller changes.
10. Remove the load and observe the frequency. The frequency should return to the value stated in step 4. Gain adjustment may affect the generator set speed/frequency. If the frequency has changed, repeat step 4.

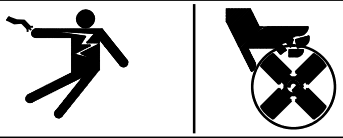
    Note: Speed adjustments have no effect on gain adjustments. It is not necessary to repeat the gain adjustments (steps 5 and 8) after adjusting the engine speed.

Check the overspeed shutdown operation when investigating a shutdown problem. See Section 5.10.1 for the overspeed shutdown test procedure.

5.10 Fault Shutdown Tests

Verify the operation of the generator set overspeed, overcrank, and low oil pressure shutdowns by performing the following tests. If these tests are inconclusive, test individual shutdown circuit components (wiring harness, switch, etc.) as described elsewhere in this section.

⚠ DANGER



Hazardous voltage. Moving parts. Will cause severe injury or death.

Operate the generator set only when all guards and electrical enclosures are in place.

Short circuits. Hazardous voltage/current will 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 making adjustments or repairs. Remove all jewelry before servicing the equipment.

⚠ WARNING

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

Do not work on the generator set until it cools.

Servicing the exhaust system. Hot parts can cause severe injury or death. Do not touch hot engine parts. The engine and exhaust system components become extremely hot during operation.

5.10.1 Controller Fault Shutdown Functions

Check the operation of the fault functions programmed in the controller by performing the following tests. If the controller does not operate as described, check the controller configuration settings; see Section 4.10.1. Also check the controller wiring and connections.

Overspeed Shutdown

The overspeed setting is factory-set and is not adjustable. Verify that the following controller configuration parameters are set correctly for your unit. See the generator set installation manual for the settings.

- System voltage/frequency parameter (UU)
- Engine configuration parameter (EC)

Open the generator set output circuit breaker before beginning the test. (See Figure 1-1 for the circuit breaker location.)

Connect a digital voltmeter (DVM) to measure the output frequency. Start the generator set and manually adjust the engine speed by moving the throttle linkage.

Note: Be careful not to touch the hot silencer when reaching in to adjust the throttle linkage.

Increase the engine speed (parameter 4P) to at least 115% of the rated engine speed, 69 Hz on 60 Hz models or 58 Hz on 50 Hz models. Verify that the generator set shuts down on an overspeed fault (OS). If the overspeed shutdown does not operate, the generator set should shut down on an overfrequency fault (OF) after approximately 5 seconds.

If the controller does not indicate an overspeed fault (OS), check the wiring to the magnetic pickup (red and black leads, P1-5 and P1-6). Check the magnetic pickup resistance, air gap and voltage output; see Section 5.9.4.

Low Oil Pressure (LOP) Shutdown

Connect a jumper wire from the LOP switch (lead 13) to the generator set ground. Start the generator set. Verify that the generator set shuts down after approximately 25–35 seconds of operation. Remove the jumper wire from the LOP switch and ground. Start the generator set and run it for at least 25–35 seconds to verify that the generator set does not shut down.

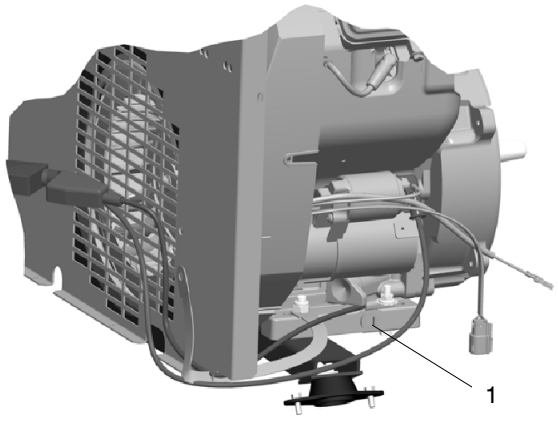
Overcrank Shutdown

Disconnect the starter motor lead at the starter solenoid terminal and the fuel solenoid valve. Press the RUN button on the controller. Observe that the generator set simulates cranking for 15 seconds and then rests for 15 seconds. Check that the generator set shuts down after the third crank/rest cycle.

High Engine Temperature Shutdown

Disconnect the harness (connector P5) at the engine temperature sensor (CTS). See Figure 5-22 for the CTS location. Connect a jumper wire across the temperature sensor (CTS) connections in connector P5. See Figure 5-23. Press RUN to start the generator set. After 5 seconds, verify that the controller display shows HE, indicating a high engine temperature fault. If a Model RRT transfer switch is connected, the generator set will run for 5 minutes in engine cooldown mode. The display will alternate HE and COOL.

Press the OFF button on the controller and remove the jumper wire. Start the generator set and verify that the generator set does not enter the engine cooldown cycle or shut down on an HE fault. Reconnect P5 to the CTS.



1. CTS location

Figure 5-22 Temperature Sensor CTS Location

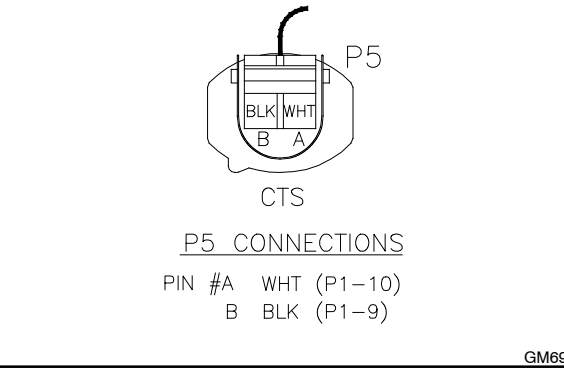
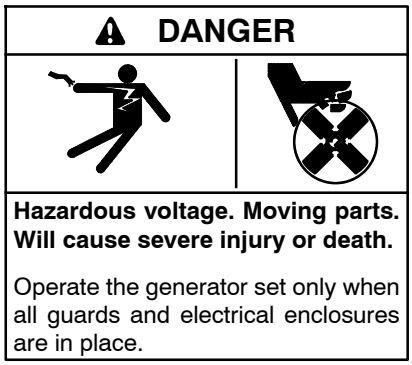


Figure 5-23 Temperature Sensor Connector P5

5.10.2 Fault Shutdown Switches

Check the low oil pressure and high engine temperature shutdown switches on the engine by performing the following tests. If the sensor does not function as described, replace it.



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

Short circuits. Hazardous voltage/current will 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 making adjustments or repairs. Remove all jewelry before servicing the equipment.

Temperature Sensor (CTS)

The temperature sensor (CTS) is used to monitor engine temperature for the high engine temperature fault shutdown (HE). See Figure 5-22 for the coolant temperature sensor location. Press the OFF button on the controller to stop the generator set and allow the generator set to cool. Disconnect the CTS and use an ohmmeter to measure the resistance across the sensor. The sensor resistance varies with temperature and should be within the values shown in Figure 5-24. If the resistance is very low (indicating a short circuit) or very high (indicating an open circuit), replace the CTS.

Note: The CTS is located in the engine oil pan. Drain the engine oil before removing the switch.

Temperature, °C (°F)	Resistance, Ohms
30 (86)	2100–2400
100 (212)	180–200

Figure 5-24 Temperature Sensor CTS Resistance Readings

Low Oil Pressure (LOP) Switch

The low oil pressure (LOP) switch is located under the engine air cleaner. See Figure 5-25.

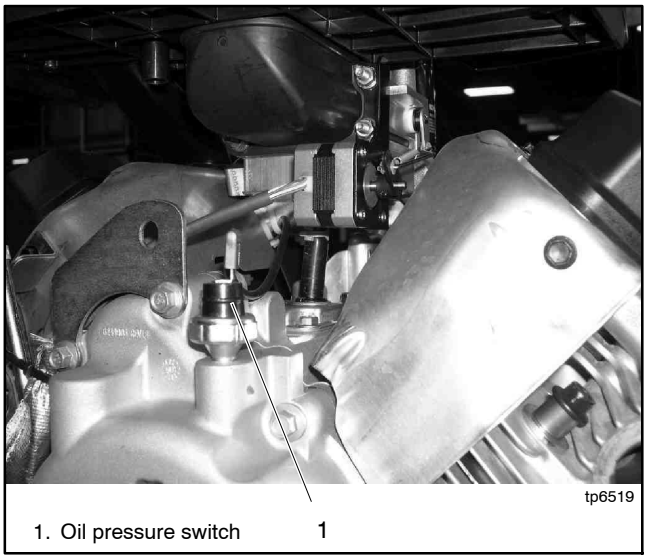


Figure 5-25 Oil Pressure Switch Location (under the air cleaner)

Remove the LOP switch and install an oil pressure gauge to verify that the engine oil pressure is within the range specified in Section 1, Specifications, before testing or replacing the LOP switch. To test the LOP switch, reinstall the switch and start the generator set. If the unit shuts down, disconnect lead 13 from the LOP switch and reset the controller. Restart the generator set and verify that it does not shut down. A successful restart indicates a faulty LOP switch. Replace switch.

5.11 Fuel Systems

⚠ WARNING

Explosive fuel vapors.
Can cause severe injury or death.

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

The fuel supplier provides and maintains manual shut-off valves and the primary regulator. See the generator set installation manual for fuel pipe size recommendations. Verify that the fuel system capacity is adequate to supply the generator set plus all other gas appliances.

A factory-installed secondary regulator and 12 VDC solenoid valve are located in the front air intake compartment. The controller energizes the fuel solenoid valve to open at startup and deenergizes the valve to close at shutdown. The secondary fuel regulator reduces fuel pressure for delivery to the fuel block. The fuel flows from the fuel block to the carburetor in a gaseous state. The carburetor mixes the fuel with intake air for consumption by the engine.

Refer to the troubleshooting instructions in Section 3, Troubleshooting, to identify generator set operation problems that may be caused by an inadequate fuel supply, incorrect adjustments, or damaged fuel system components. Then use the instructions in this section to check fuel system components.

5.11.1 Fuel Solenoid Valve

A solenoid valve upstream of the regulator and the flexible fuel connector provides automatic fuel on/off control. See Figure 5-27 or Figure 5-28. The engine starting battery powers the solenoid valve and the engine starting controls open the valve when the engine cranks or runs.

Fuel Valve Operation Test Procedure

1. Disconnect the positive (+) battery lead from the gas valve terminal.
2. Apply 12 VDC to the gas valve terminal and listen for an audible click, indicating that the valve actuates.
3. Replace the gas valve if it does not actuate in step 2.

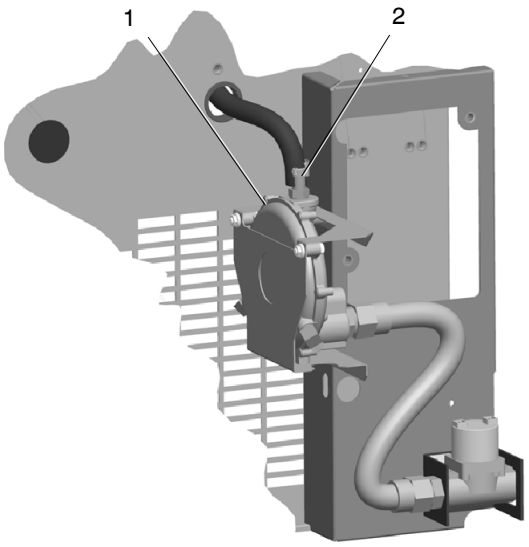
5.11.2 Digital Spark Advance Ignition (DSAI) Timing

The digital spark advance ignition (DSAI) optimizes the engine timing for the selected fuel, natural gas or LP. The DSAI timing leads are located near the fuel solenoid valve. See Figure 5-27 or Figure 5-28. Connect the DSAI leads together for natural gas fuel. Disconnect the leads if LP is used. See Figure 5-26.

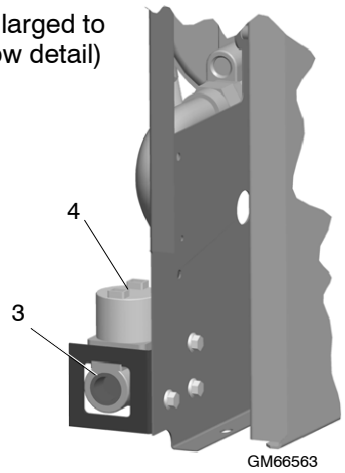
See the engine service manual for ignition system service information.

DSAI Timing Lead Connection	
Natural Gas	Connect
LP	Disconnect

Figure 5-26 DSAI Lead Connection

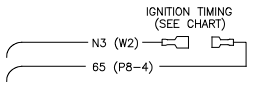


(Enlarged to show detail)



GM66563

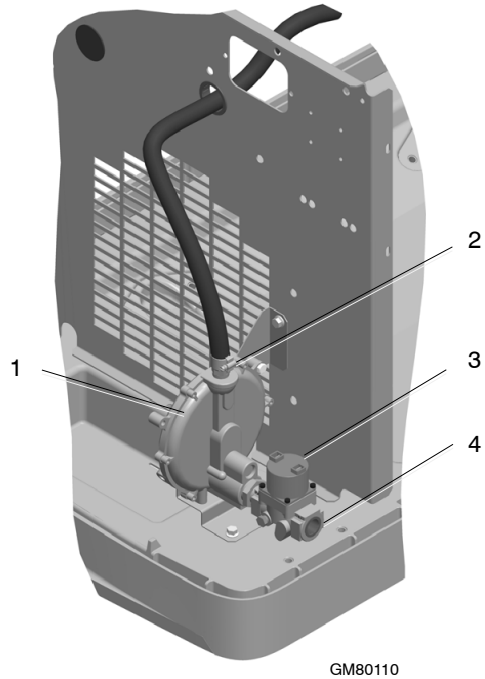
IGNITION TIMING	
FUEL TYPE	CH980
NATURAL GAS	CONNECT 65 TO N
LP GAS	DO NOT CONNECT



DSAI Lead Connection

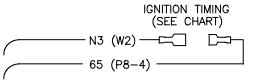
1. Regulator
2. Fuel block (not shown) or LP orience location (see Figure 5-29)
3. Fuel inlet, 1/2 in. NPT female
4. Fuel solenoid valve and digital spark advance ignition (DSAI) leads

Figure 5-27 Fuel System



GM80110

IGNITION TIMING	
FUEL TYPE	CH980
NATURAL GAS	CONNECT 65 TO N
LP GAS	DO NOT CONNECT



DSAI Lead Connection

1. Regulator
2. Fuel block (not shown; see Figure 5-32) or LP orifice location (see Figure 5-30)
3. Fuel solenoid valve and digital spark advance ignition (DSAI) leads
4. Fuel inlet, 1/2 in. NPT female

Figure 5-28 Revised Fuel System

5.11.3 Fuel Regulators

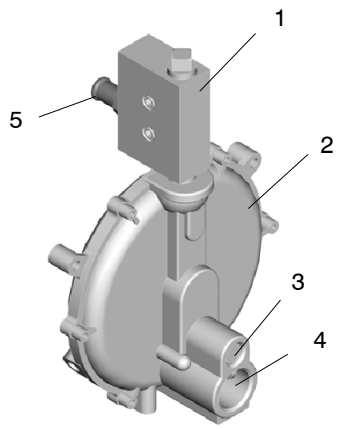
The typical gaseous fuel system uses two regulators. The primary regulator reduces the line pressure to an allowable inlet pressure for the secondary regulator. The fuel supplier provides and maintains the primary regulator. The secondary regulator is factory-installed on the generator set and is designed for a maximum inlet pressure of 2.7 kPa (6 oz./in.^{2}) or 280 mm (11 in.) water column.

Note: Do not attempt to adjust the fuel mixture or engine speed by adjusting the regulators.

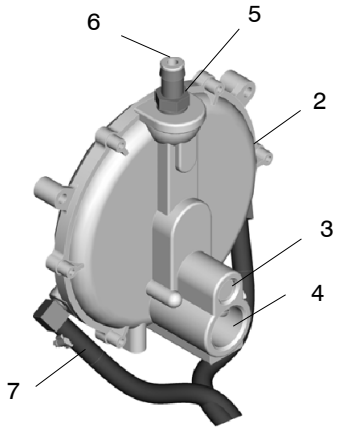
The fuel lockoff prevents fuel flow when the engine is not operating. See Figure 5-29. Do not try to adjust the fuel pressure, fuel mixture, or engine speed using the fuel lockoff.

Checking the Fuel Pressure

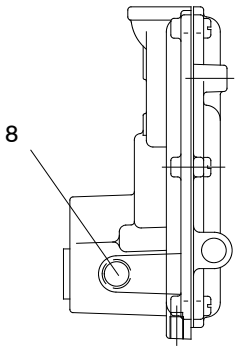
Use a gauge or manometer to check the fuel pressure at the secondary regulator inlet. See Figure 5-29. Measure the fuel pressure with the generator set running at rated load. The fuel pressure should be 5–11 in. water column or 1.2–2.7 kPa. Contact the fuel supplier if the inlet pressure is not within the specified range.



14RES/RESL



20RES/RESL



Regulator, side view

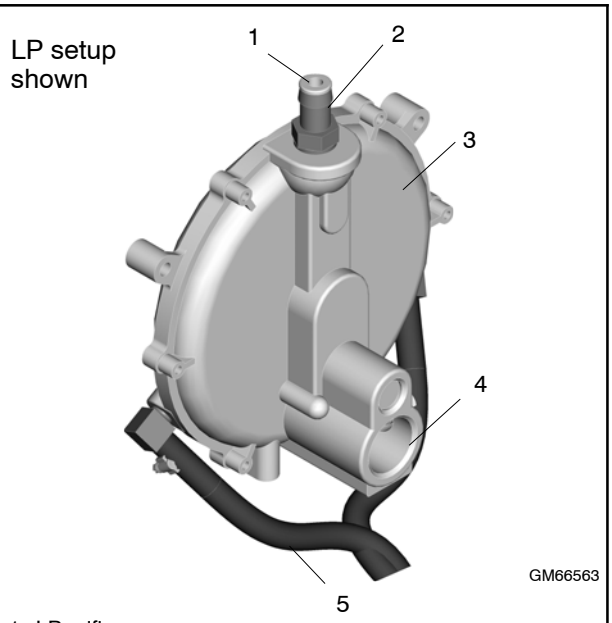
TP-6735

1. Fuel block (14RES/RESL)
2. Secondary regulator
3. Fuel lockoff *(do not adjust)*
4. Fuel inlet, 1/2 in. NPT
5. Hose fitting
6. LP orifice fits inside hose fitting (20RES/RESL)
7. Regulator vent hose (20RES/RESL only)
8. Inlet pressure check location

Figure 5-29 Fuel Regulators

5.11.4 Fuel Conversion, 20RES/RESL

For LP vapor fuel, an orifice is used in the fuel line. The unit is typically shipped set up for natural gas, with the loose orifice tied near the fuel solenoid valve. To convert to LP vapor, install the orifice and disconnect the spark advance leads as described below. See Figure 5-27 for the fuel system component locations.



1. LP orifice
2. Hose fitting
3. Regulator
4. Fuel inlet, 1/2 in. NPT female
5. Vent hose

Figure 5-30 Fuel Regulator and LP Orifice, 20RES/RESL

Procedure to Convert from NG to LP, 20RES/RESL

1. Press the OFF button on the generator set controller and remove controller fuse F3.
2. Disconnect the power to the battery charger.
3. Disconnect the generator set engine starting battery, negative (–) lead first.
4. Turn off the fuel supply.
5. Remove the hose clamp and fuel hose from the hose fitting. See Figure 5-30.
6. Insert the orifice into the hose fitting. See Figure 5-30.
7. Slide the hose onto the hose fitting and secure it with the clamp.
8. Disconnect digital spark-advance module (DSAI) leads 65 and N5 for LP. See Figure 5-33 and Figure 5-31.
9. Connect and turn on the new fuel supply.
10. Reconnect the generator set engine starting battery leads, negative (–) lead last.
11. Reinstall controller fuse F3.
12. Reconnect power to the battery charger.
13. Start the generator set by pressing the RUN button on the generator set controller.
14. Check for leaks using a gas leak detector.
15. Run the generator set and check the operation. Use the controller to adjust the output and stability if necessary.
16. Press the OFF button to shut down the generator set.

To convert from LP vapor to natural gas, remove the fuel orifice and connect the DSAI leads together.

Fuel	DSAI Leads 65 and N
Natural Gas	Connect lead 65 to N
LP	Disconnect

Figure 5-31 DSAI Connections

5.11.5 Fuel Conversion, 14RES/RESL

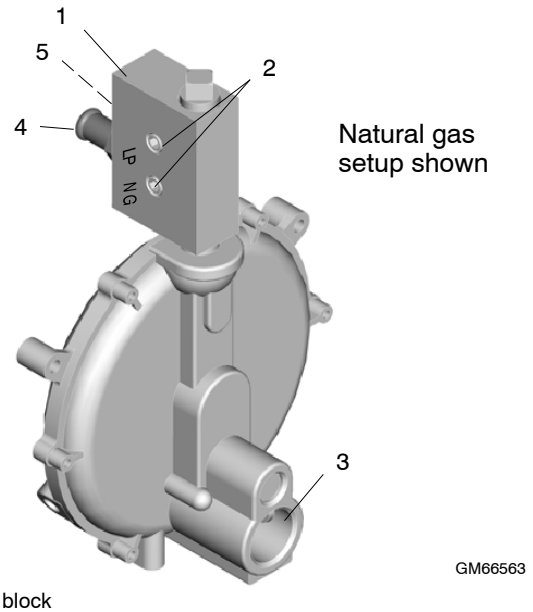
Two fuel connections on the fuel block allow field-conversion between natural gas and LP vapor. The fuel metering valves are factory-set and sealed to comply with applicable emission standards and to provide the best possible hot and cold starting.

Note: Do not adjust the factory-sealed fuel-metering adjustments on the fuel block. Changing the fuel-metering adjustments may violate federal or state laws.

Use the following procedure to convert from natural gas (NG) to LP vapor, moving the fuel connection from the natural gas to the LP port, plugging the natural gas port, and disconnecting the leads for the digital spark advance ignition (DSAI). See Figure 5-27 for the fuel system component locations.

Procedure to convert from NG to LP, 14RES/RESL

1. Press the OFF button on the generator set controller and remove controller fuse F3.
2. Disconnect the power to the battery charger.
3. Disconnect the generator set engine starting battery, negative (–) lead first.
4. Turn off the fuel supply.
5. Remove the hose clamp and fuel hose from the hose fitting in the fuel block. See Figure 5-32.



1. Fuel block
2. Fuel metering valves—*factory-sealed, do not adjust*
3. Fuel inlet, 1/2 in. NPT
4. Hose fitting
5. Plug

Figure 5-32 Fuel Block, 14RES/RESL

6. Remove the hose fitting from the natural gas outlet port in the fuel block. See Figure 5-32.
7. Remove the plug from the LP port in the fuel block. See Figure 5-32.
8. Clean the plug with a dry cloth or brush, apply fresh pipe sealant, and install the plug into the natural gas outlet port.
9. Clean the hose fitting with a dry cloth or brush, apply fresh pipe sealant to the threads, and install the fitting into the LP port.

   Note: Do not adjust the fuel metering valves.
10. Slide the hose onto the hose fitting and secure it with the clamp.
11. Disconnect the DSAI leads for LP. See Figure 5-27 for the location of the DSAI leads.

Fuel	DSAI Leads 65 and N
Natural Gas	Connect lead 65 to N
LP	Disconnect

Figure 5-33 DSAI Connection

12. Connect and turn on the new fuel supply.
13. Check that the generator set is off. Check that the OFF LED on the controller is flashing.
14. Reconnect the generator set engine starting battery leads, negative (–) lead last.
15. Reinstall controller fuse F3.
16. Reconnect power to the battery charger.
17. Start the generator set by pressing the RUN button on the generator set controller.
18. Check for leaks using a gas leak detector.
19. Run the generator set and check the operation. Use the controller to adjust the output and stability if necessary.
20. Press the OFF button to to shut down the generator set.

To convert from LP vapor to natural gas, follow the same fuel conversion procedure, moving the hose fitting to the natural gas port and plugging the LP port. Connect the DSAI leads for natural gas. See Figure 5-33.

5.11.6 Fuel Metering Valve Adjustment, 14RES/RESL Only

The fuel system is factory-adjusted to comply with applicable emission standards and to provide the best possible hot and cold starting. The fuel metering valves are sealed to prevent field adjustments. If the fuel metering valve requires adjustment, do not break the seals on the factory-installed fuel metering valve. Obtain a new fuel metering valve to replace the factory-installed valve, and adjust the fuel mixture according to the instructions in this section. See Figure 5-32 for the fuel metering valve location. Refer to the generator set Parts Catalog for the fuel metering valve part number.

Note: Adjusting the factory-installed fuel metering valves on emissions-certified generator sets will void the emission certification.

Use an exhaust gas oxygen sensor to check the fuel mixture after replacing the fuel regulator, carburetor, or silencer. Use the following procedure to check the fuel mixture after the engine has reached normal operating temperature.

Only trained, authorized service technicians may adjust the new fuel metering valve. The adjustment procedure requires a digital voltmeter (DVM), oxygen sensor service kit GM58035, and a load bank capable of the rated kW for the fuel being used. Always use an oxygen sensor when adjusting the fuel metering valves.

Observe the following safety precautions while performing the procedure.

⚠ WARNING

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

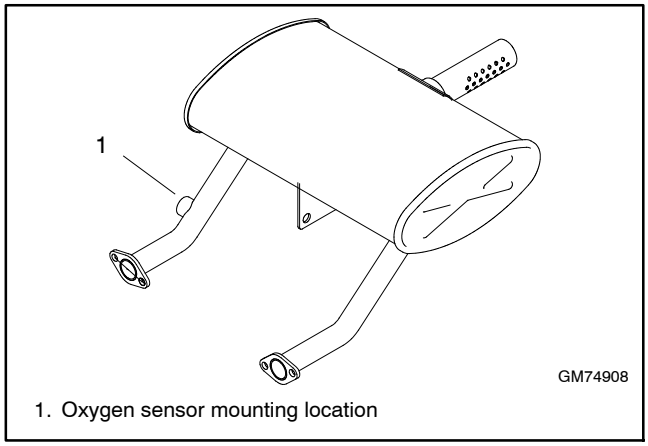
Do not work on the generator set until it cools.

Servicing the exhaust system. Hot parts can cause severe injury or death. Do not touch hot engine parts. The engine and exhaust system components become extremely hot during operation.

Note: The oxygen sensor gets very hot during operation. DO NOT touch the oxygen sensor, during or after operation, until cool.

Fuel Mixture Check/Fuel Metering Valve Adjustment Procedure

1. Follow the instructions provided with the oxygen sensor kit to perform the initial programming and setup of the air/fuel (A/F) reader. See SB-675, provided with the oxygen sensor kit.
2. Press the OFF button on the RDC/DC controller.
3. Disconnect power to the battery charger.
4. Remove the oxygen sensor plug from the exhaust manifold and install the oxygen sensor. See Figure 5-34 for location.



1. Oxygen sensor mounting location

Figure 5-34 Oxygen Sensor Mounting Location on the 14RES/RESL

5. Follow the instructions provided with the oxygen sensor kit to connect the oxygen sensor to the power supply and A/F reader.
6. Reconnect power to the battery charger.
7. Press the RUN button on the controller to start the generator set.
8. Allow the generator set to run until the engine reaches normal operating temperature.
9. With the generator set at normal operating temperature, apply rated load.

10. After several minutes, note the air/fuel ratio meter measurements and compare to the λ (lambda) values in Figure 5-35.

Fuel system	Air/Fuel Mixture λ Values	UEGO Sensor Reading, VDC*
Original (Figure 5-27)	0.944–0.966	2.70 ± 0.05
Revised (Figure 5-28)	0.923–0.944	2.60 ± 0.05
* UEGO sensor readings shown for reference		

Figure 5-35 Acceptable Oxygen Sensor Readings, 14RES/RESL

11. Adjust the fuel metering valve as required to obtain the output from the oxygen sensor specified in Figure 5-35.

12. When the fuel mixture is correct, use thread sealant to seal the metering valve adjustment screws.

13. Remove the load and allow the generator set to run unloaded to cool for at least 5–10 minutes.

14. Stop the generator set by pressing the OFF button on the controller and remove controller fuse F3.

15. Disconnect the generator set engine starting battery, negative (-) lead first.

16. Allow the generator set exhaust system to cool.

17. Disconnect the DVM leads from the oxygen sensor.

18. After the sensor has cooled, remove the oxygen sensor from exhaust manifold.

19. Apply a small amount of antiseize compound to exhaust plug and reinstall the plug into the exhaust manifold.

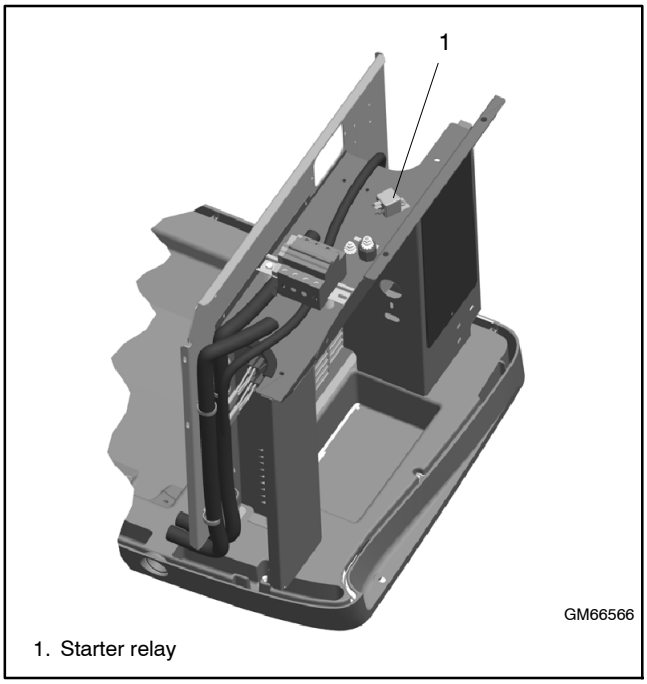
20. Reconnect the generator set engine starting battery, negative (-) lead last.

21. Reinstall controller fuse F3.

22. Reconnect power to the battery charger.

5.12 Starter Relay

The starter relay is located under the controller. See Figure 5-36.



1. Starter relay

Figure 5-36 Starter Relay Location

The starter relay contains an internal diode across the relay coil. See Figure 5-37. Continuity checks across the coil terminals will show continuity (low resistance) in one direction and an open circuit in the other.

Figure 5-38 shows the starter relay connections.

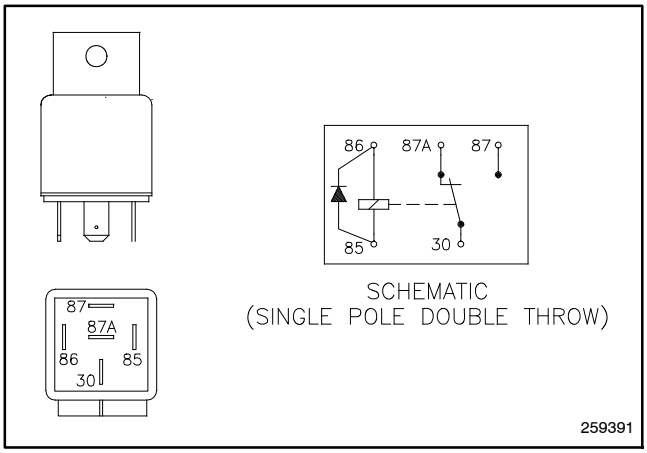
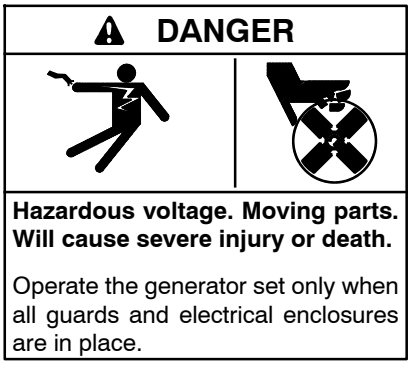


Figure 5-37 Starter Relay

Relay Terminal	Lead
30	14P
85	N7
86	71
87	14S
87A	NC

Figure 5-38 Starter Relay Connections

5.13 Continuity Checks



Short circuits. Hazardous voltage/current will 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 making adjustments or repairs. Remove all jewelry before servicing the equipment.

To further check generator set components, disconnect the battery and remove wiring harness plugs from the controller circuit board. Use an ohmmeter to check the continuity of the components listed in Figure 5-39. Also see Section 7, Wiring Diagrams.

Figure 5-39 gives resistance readings for functional components. A zero reading on the ohmmeter indicates continuity. No ohmmeter reading indicates very high resistance or an open circuit. A measurement that varies significantly from the value shown in the table indicates a faulty component; replace faulty components.

Note: Disconnect the generator set battery before performing continuity checks to prevent damage to the ohmmeter.

For rotor and stator resistance and continuity checks, see Section 5.3, Stator, and Section 5.4, Main Field (Rotor).

Component	Ohmmeter Connections	Ohmmeter Scale	Generator Set State	Ohmmeter Readings for Operative Components
P1 wiring harness	P1-2 and ground	R x 1	OFF	Zero ohms (continuity) Any other reading indicates a poor ground connection.
	P2-6 and P2-7 (stator leads 11 and 44)	R x 1	OFF	Zero ohms (continuity). If no continuity, check wiring.
	P2-3 and P2-4 (stator leads 55 and 66)	R x 1	OFF	Zero ohms (continuity). If no continuity, check fuse F1 and wiring.
Controller fuse and wiring	P1-1 and battery positive (+)	R x 100	OFF	Zero ohms (continuity). If no continuity is found, check fuse F3 and wiring.
Auxiliary winding breaker (20-amps)	P2-3 and stator lead 55	R x 100	OFF	Zero ohms (continuity). If no continuity is found, check for an open circuit and/or a blown fuse.
Low oil pressure (LOP) switch *	Lead 13 and ground (engine block)	R x 100	OFF	Zero ohms (continuity). No continuity indicates a faulty switch and/or wiring.
Temperature sensor (CTS) *	P1-9 and P1-10	R x 1000	OFF	180–2500 ohms, depending on engine temperature. See Section 5.10.2. Zero ohms or an open circuit indicates faulty wiring or a faulty switch.
Magnetic pickup	QCON1 and QCON2	R x 1000	OFF	1.6 kohms. Zero ohms or an open circuit indicates a faulty pickup; replace the magnetic pickup.
* See Section 5.10.2, Fault Shutdown Switches				

Figure 5-39 Continuity Checks

5.14 Circuit Protection

If the generator set circuit breaker trips or the fuses blow repeatedly, see Section 3, Troubleshooting, for possible causes.

5.14.1 Line Circuit Breaker

A line circuit breaker interrupts the generator output in the event of a fault in the wiring between the generator and the load. The line circuit breaker location is shown in Figure 1-1. If the circuit breaker trips, reduce the load and switch the breaker back to the ON position. With the breaker in the OFF position the generator set runs but the generator output is disconnected from the load.

5.14.2 Fuses and Mini-Breaker

Two fuses and a mini-breaker protect the alternator and electrical controls. The fuses and breaker are located in the service access area of the RDC/DC controller. A battery charger fuse is located in the positive battery lead. Check for and replace any blown fuses or reset the breaker before replacing other components.

See Figure 5-40 for fuse part numbers. Always identify and correct the cause of a blown fuse before restarting the generator set. Refer to Section 3, Troubleshooting, for conditions that may indicate a blown fuse. Replace blown fuses with identical replacement parts.

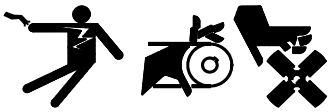
Fuse/Breaker	Rating, Amps	Label	Part Number
Auxiliary winding	20	BRDCB	Resettable mini-breaker
Starter/Fuel/Flash (Violet)	7.5	F2	GM66129
Controller (Brown)	3	F3	GM66128
Battery charger	10	—	AGS 10

Figure 5-40 Circuit Protection

This section provides instructions for the disassembly and reassembly of the generator set alternator. Before beginning the generator disassembly or reassembly procedure, carefully read all safety precautions at the beginning of this manual.

The engine and generator set may use both American Standard and metric hardware. Use the correct size tools to prevent rounding of the bolt heads and nuts.

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

⚠ WARNING

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

Do not work on the generator set until it cools.

6.1 Initial Steps

Perform the following steps before disassembling the generator set.

1. Disconnect AC power to the generator set by opening the upstream circuit breaker. (AC power is connected to the generator set for AC-powered accessories.)

2. Shut off the fuel supply. Disconnect the fuel system if necessary to tilt the generator set. Ventilate the area to clear fumes.

3. Allow the generator set and engine to cool.

4. Verify that any hoists or lifting devices used in the disassembly or reassembly procedure are rated for the weight of the generator set, which is approximately 227 kg (500 lb.).

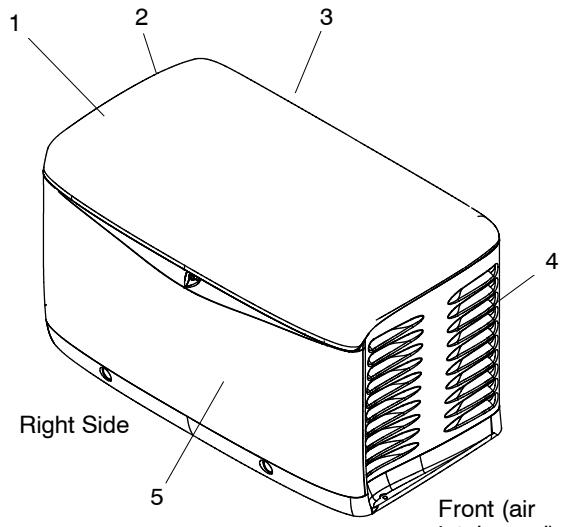
6.2 Disassembly

The disassembly procedure explains how to disassemble the generator set enclosure and other parts in order to access the alternator for service. The procedure provides important information to minimize disassembly time and indicates where special configurations exist which may require taking notes.

Remove enclosure

Remove the generator set enclosure as described in the following steps. See Figure 6-1.

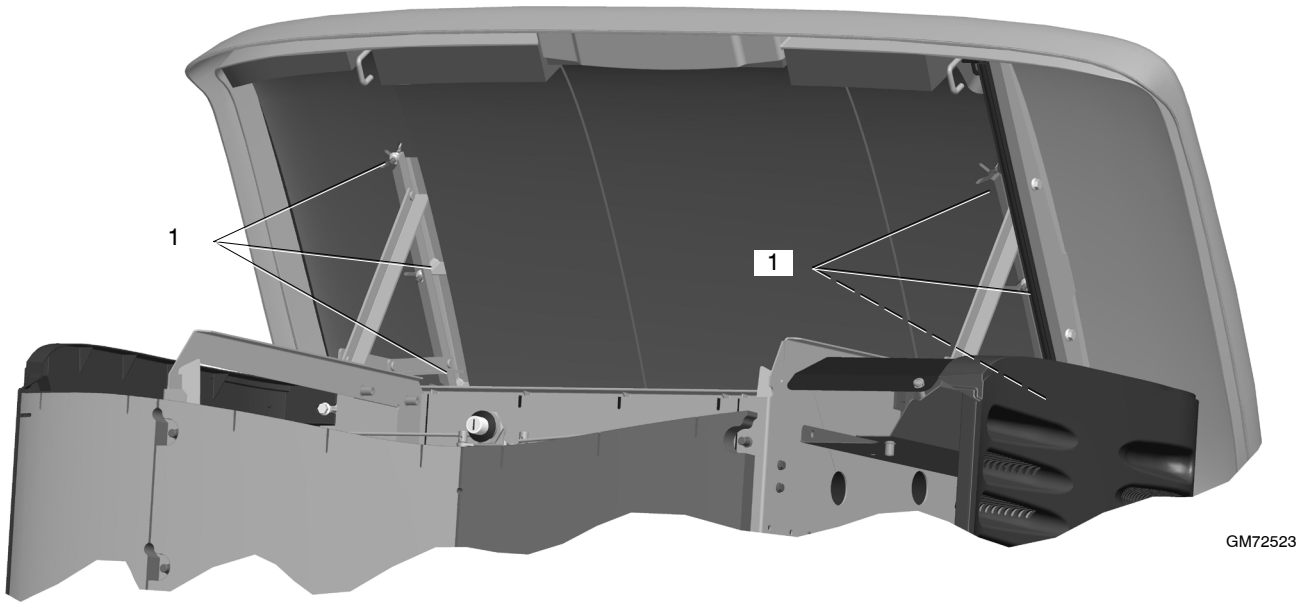
1. Open the enclosure roof.
2. Press the OFF button on the controller and remove fuse F3 (located in the controller's service access area). See Figure 4-1.
3. Remove 6 nuts and remove the roof. See Figure 6-2.



1. Roof
2. Rear panel (exhaust end)
3. Left side panel
4. Front panel (air intake end)
5. Right side panel

ADV7341

Figure 6-1 Enclosure



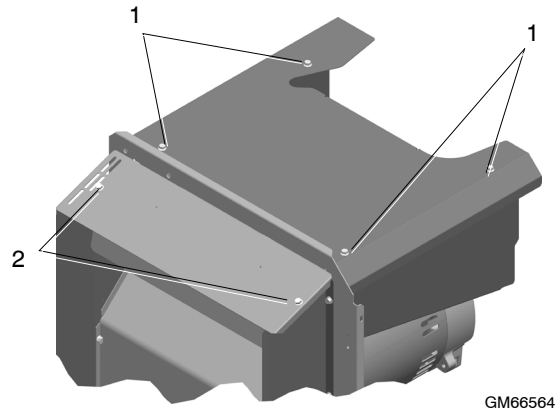
1. Remove three nuts on each side

Figure 6-2 Roof Removal

4. Original design, see Figure 6-3. Remove the exhaust duct panel over the muffler:

   a. Remove four screws. See Figure 6-3.

   b. Remove the top exhaust panel.



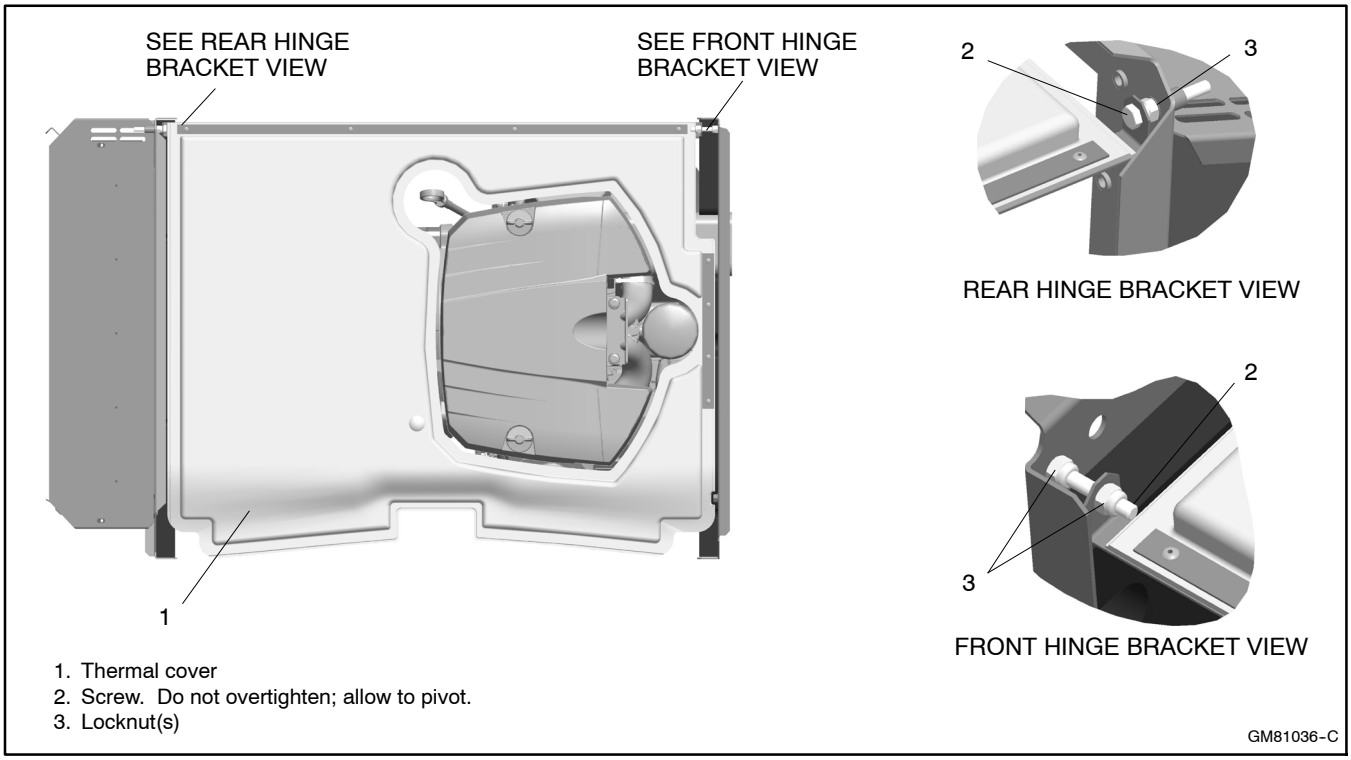
1. Exhaust duct panel. Remove 4 screws
2. Top exhaust panel. Remove 2 screws.

Figure 6-3 Heat Shield (original)

5. Revised design with thermal cover, see Figure 6-4. Remove the thermal cover:

   a. Loosen and remove the locknuts from the front and rear hinge brackets.

   b. Remove the thermal cover.



1. Thermal cover
2. Screw. Do not overtighten; allow to pivot.
3. Locknut(s)

Figure 6-4 Thermal Cover (revised design)

6. Original Design: Disconnect the latch assembly:

   a. Disconnect the latch rods at the red plastic connectors. See Figure 6-5.

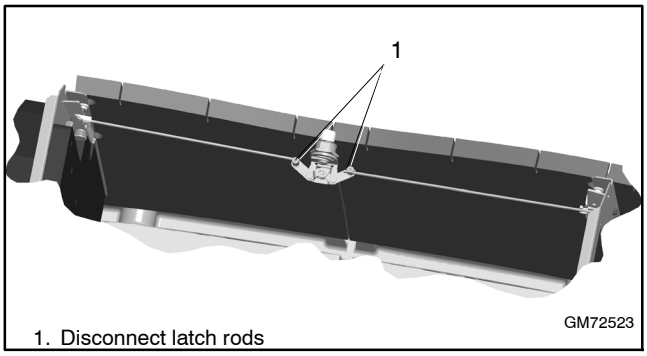
   b. Reach inside the enclosure to move each latch hinge aside.

   Note: With the revised latch design, no latch disassembly is required.

7. See Figure 6-6. Remove two nuts on each side (total of four nuts).

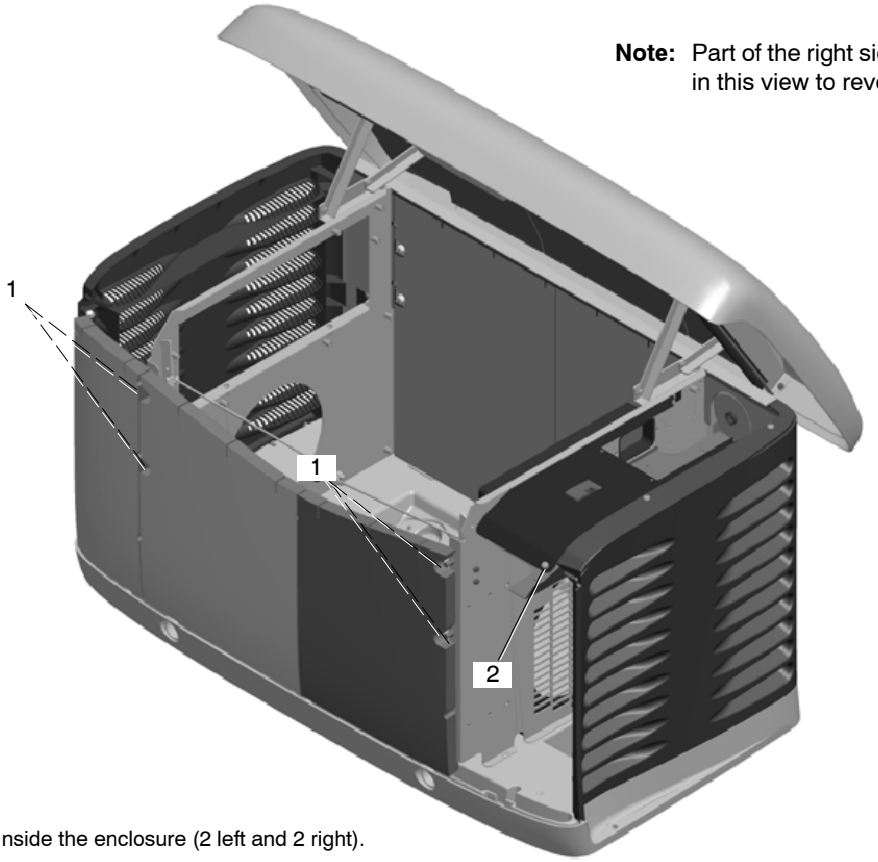
8. Remove one screw near the controller area.

9. Pull the right side panel up and off.



1. Disconnect latch rods

Figure 6-5 Door Latch Detail (original design)



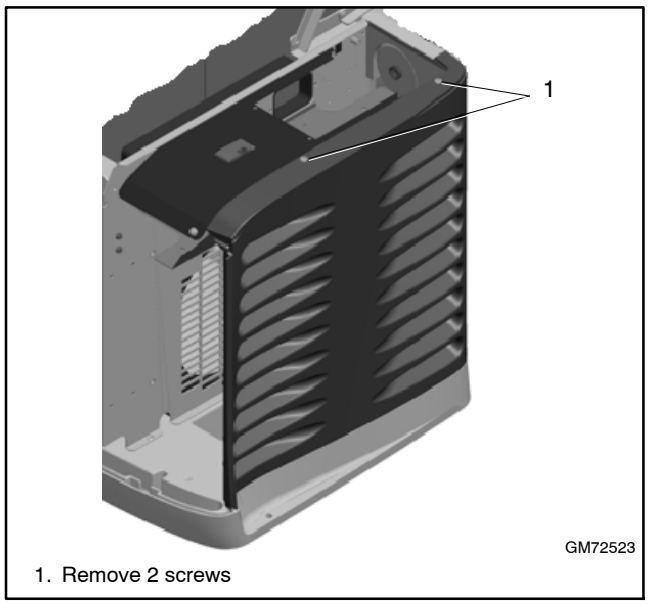
Note: Part of the right side panel is cut away in this view to reveal the fasteners.

1. Remove 4 nuts inside the enclosure (2 left and 2 right).
2. Remove screw.

GM72523

Figure 6-6 Right Side Panel

10. Remove two screws and remove the front panel. See Figure 6-7.



1. Remove 2 screws

Figure 6-7 Front Panel (air intake end panel)

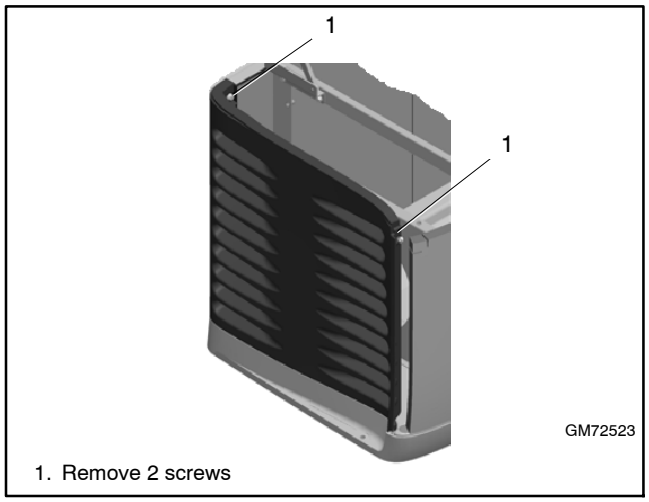
11. Unplug the carburetor heater (if equipped) from the 120VAC receptacle.

12. Unplug the battery charger from the 120VAC receptacle.

13. Disconnect the generator set engine starting battery, negative (-) lead first.

14. Disconnect output leads or load circuit cables at the field-connection terminal block.

15. Remove two nuts and lift off the exhaust end panel. See Figure 6-8.

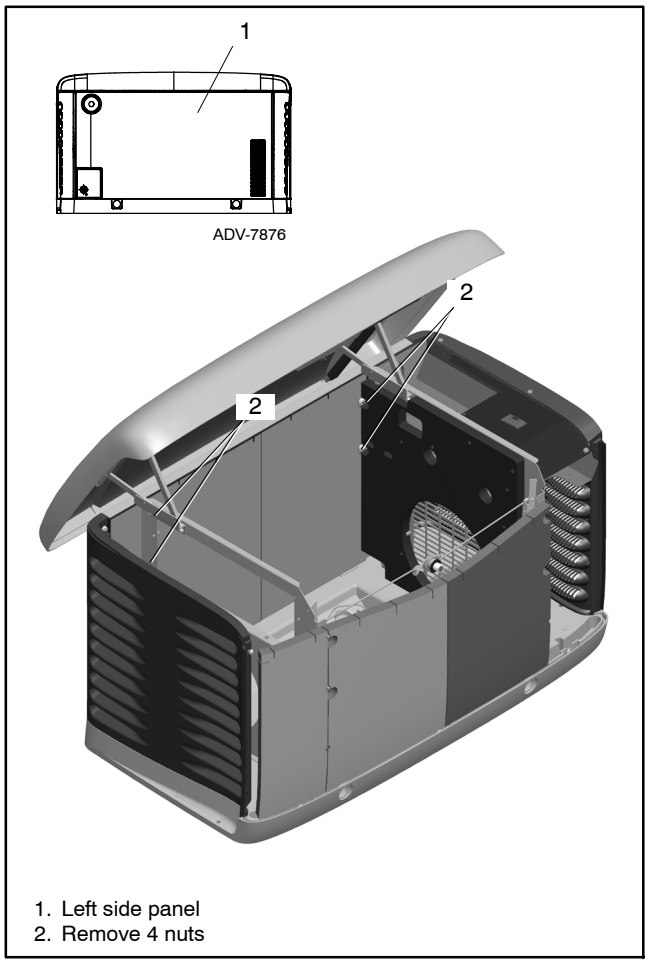


1. Remove 2 screws

Figure 6-8 Rear Panel (exhaust end panel)

16. From the inside of the enclosure, remove four nuts securing the left side panel. See Figure 6-9.

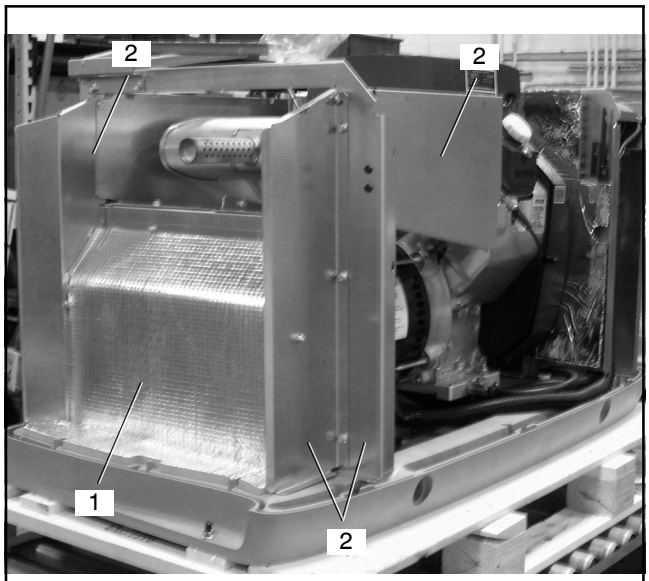
17. Pull the panel up and off.



1. Left side panel
2. Remove 4 nuts

Figure 6-9 Left Side Panel

18. Remove the remaining exhaust duct panels and alternator air inlet duct. See Figure 6-10.

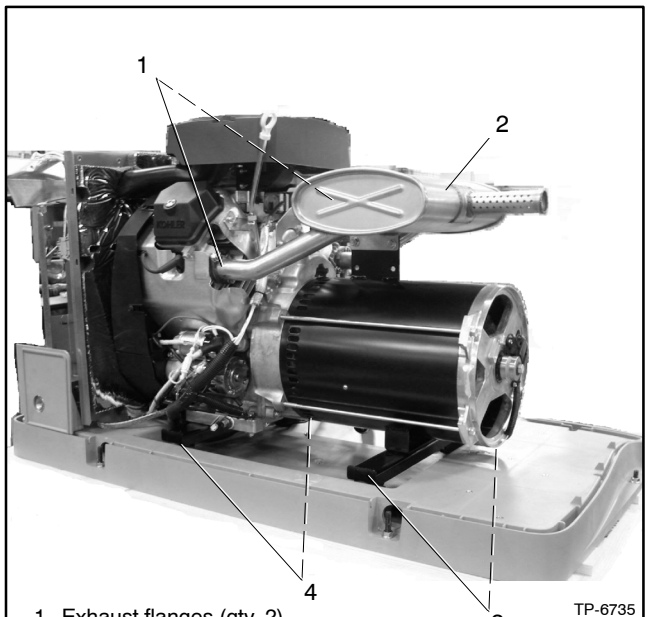


1. Alternator duct
2. Exhaust duct panels

Figure 6-10 Exhaust and Alternator Ducts

19. Disconnect the muffler from the engine at the two flange connections and remove the muffler. See Figure 6-11.

    Note: Use new exhaust gaskets when re-installing the muffler.



1. Exhaust flanges (qty. 2)
2. Muffler
3. Alternator vibromounts (qty. 2)
4. Engine vibromounts (qty. 2)

Figure 6-11 Muffler and Vibromounts

Generator Disassembly

20. Disconnect the following alternator wiring inside the controller junction box. See the wiring diagrams in Section 7.

    a. Disconnect lead 55 from the mini-breaker on the controller.

    b. Disconnect P2 from the controller.

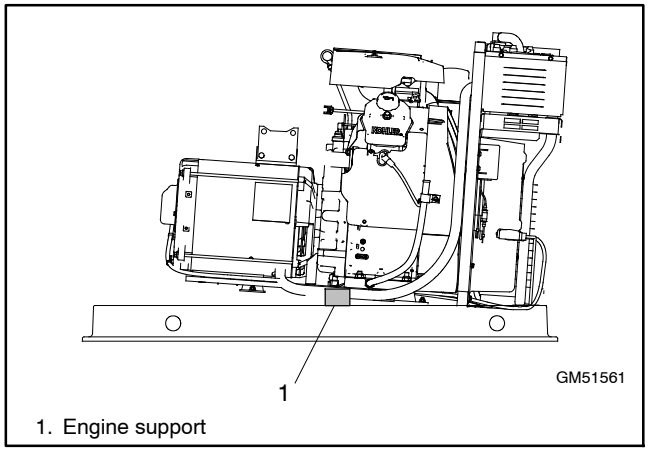
    c. Disconnect leads 2 and 3 from neutral stud L0.

    d. Disconnect leads 1 and 4 from the circuit breaker.

21. Remove the bolts securing the two alternator end vibromounts to the skid. Loosen the two engine vibromounts. See Figure 6-11.

22. Raise the alternator end of the generator set enough to place a wood support beneath the rear of the engine. The wood support must be long enough to span the opening in the base. See Figure 6-12.

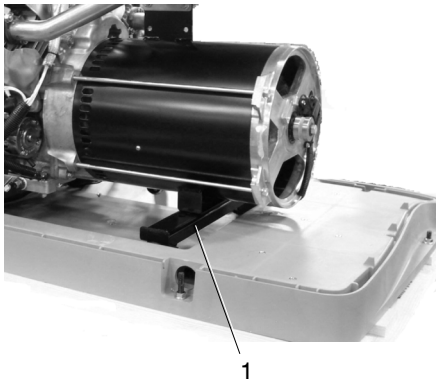
    Note: Use a hoist or lifting device that is rated for the weight of the generator set. See Section 6.1.



1. Engine support

Figure 6-12 Wood Support

23. Remove the alternator support bracket from the alternator shell. See Figure 6-13.



1. Alternator support bracket

Figure 6-13 Alternator Support Bracket

24. Remove the cable tie that attaches the brush leads to the end bracket. See Figure 6-14 or Figure 6-15.

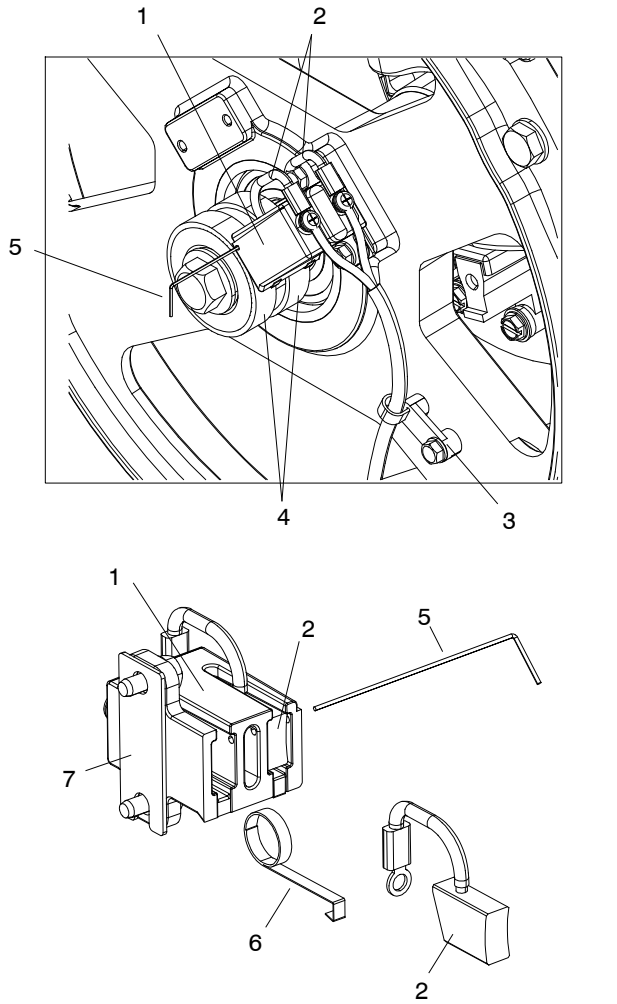
25. Check the brushes. See Figure 6-14 or Figure 6-15.

    Note: The brushes are spring-loaded. Be sure to insert a retaining wire to hold the brushes as described below.

    a. Raise the brushes in the brush holder and insert a small piece of wire into the brush holder retainer wire hole.

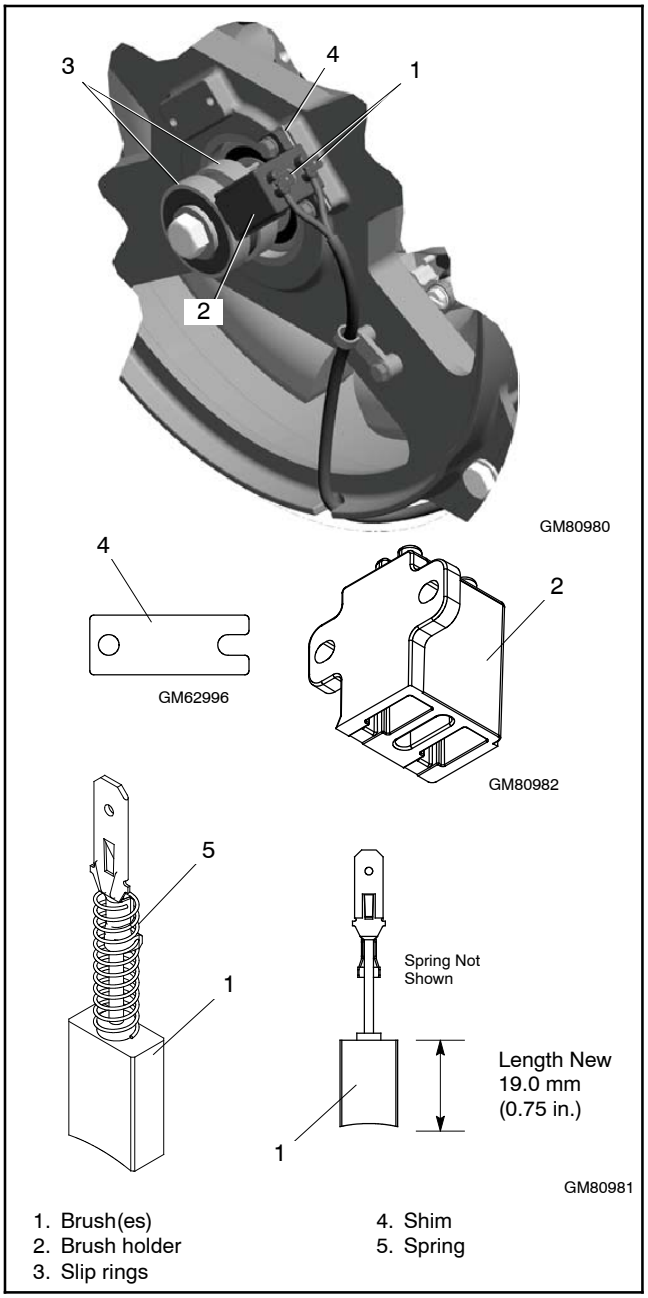
    b. Remove the brush holder from the end bracket.

    c. Inspect the brushes. Replace brushes if they show uneven wear or when they are worn to half of their original size. See Section 5.6, Brushes.



1. Brush holder
2. Brush(es)
3. Cable tie
4. Slip rings
5. Retainer wire
6. Spring
7. Shim

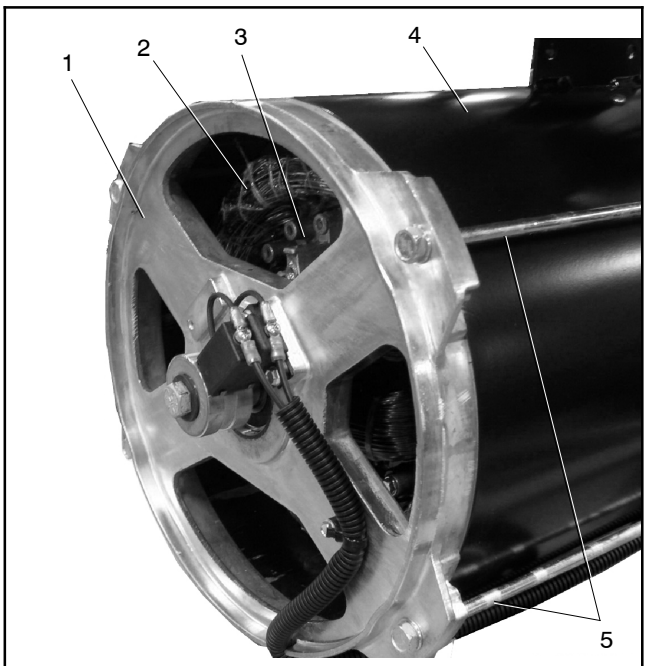
Figure 6-14 Alternator End Bracket and Brush Assembly (original)



1. Brush(es)
2. Brush holder
3. Slip rings
4. Shim
5. Spring

Figure 6-15 Revised Brush Assembly

26. Remove the alternator overbolts and centering washers. See Figure 6-16.



1. End bracket (brush assembly shown attached)
2. Stator windings (outer)
3. Rotor (inner). Also see Figure 6-17.
4. Stator shell
5. Overbolts (qty. 4)

Figure 6-16 Alternator Assembly

27. Using a soft-faced hammer, strike the sides of the end bracket with medium-force blows to remove the end bracket from the stator or remove the end bracket from the stator using a puller. Set the end bracket assembly aside.

28. The stator leads are routed through the bulkhead and into the controller junction box. Carefully pull the leads out of the junction box. Pull the leads and conduit out through the bulkhead to free the alternator for removal.

29. Carefully pull the stator from the rotor. See Figure 6-16.

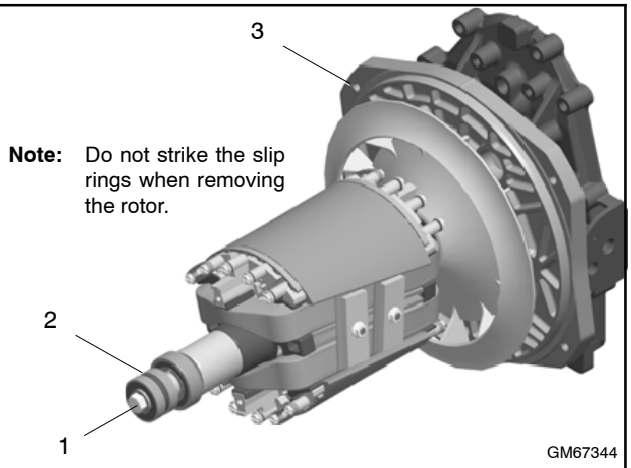
30. Remove the rotor as follows:

    a. Loosen but do not remove the rotor thrubolt. Use a strap wrench on the rotor to keep the rotor from turning during loosening, if necessary. See Figure 6-17.

    b. Loosen the rotor assembly by striking the side of the rotor with a soft-faced hammer to loosen it from the tapered crankshaft fitting. See Figure 6-17. Rotate the rotor and strike it on alternate sides until it can be rocked slightly back and forth.

    Note: Do not strike the slip rings.

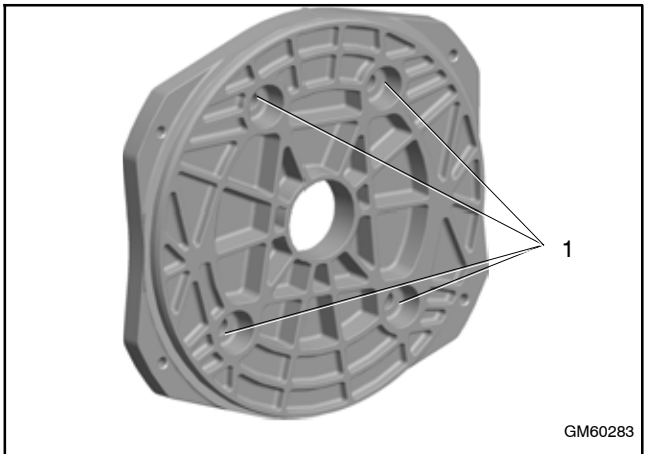
    c. Remove the thrubolt and the rotor. Set the rotor assembly aside.



1. Rotor thrubolt
2. Slip rings
3. Generator adaptor (14RES/RESL only)

Figure 6-17 Rotor Assembly with Thrubolt

31. 14RES/RESL only: Remove the four generator adapter mounting bolts to remove the generator adapter, if necessary. See Figure 6-18.



1. Adapter mounting holes

Figure 6-18 Generator Adapter (14RES/RESL)

6.3 Reassembly

1. 14RES/RESL only: Reinstall the generator adapter onto the engine, if necessary.

   a. Attach the generator adapter to the engine using four 7/16-14 x 1.0 in. hex cap bolts and washers. See Figure 6-18.

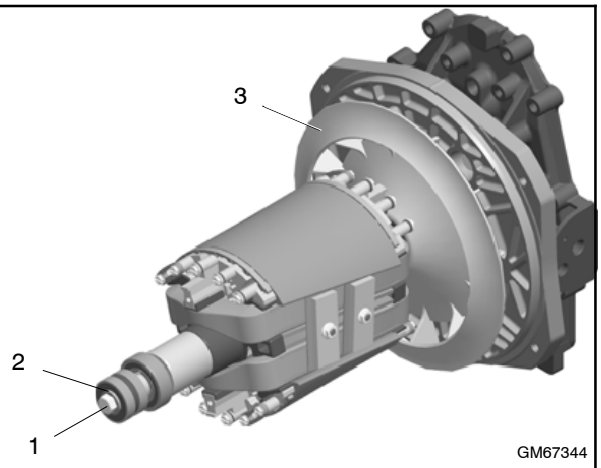
   b. Torque the bolts to 40 Nm (28 ft. lb.).

2. Install the rotor. See Figure 6-19.

   a. Clean the crankshaft stub and mating surface on the fan hub. Do not use antiseize compound when reassembling the rotor.

   b. Install the rotor onto the engine crankshaft.

   c. Thread the thrubolt with hardened washer through the actuator and rotor into the crankshaft. Do not tighten the thrubolt at this time.

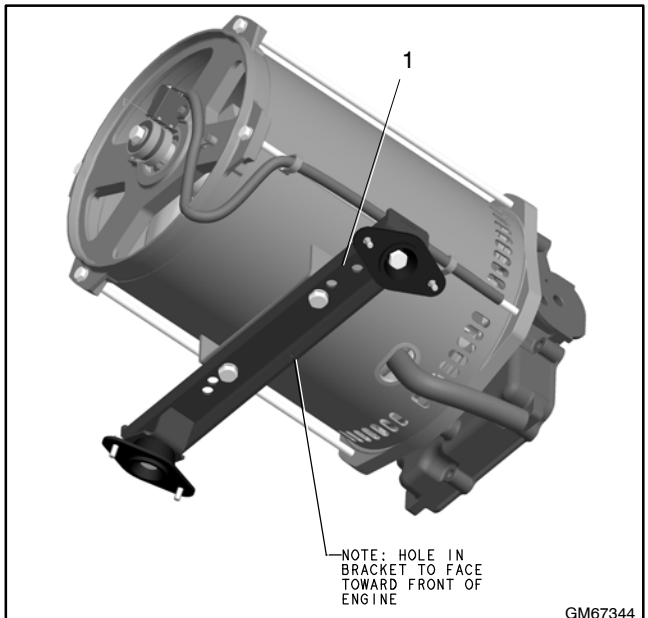


1. Rotor thrubolt
2. Hardened washer
3. Fan

Figure 6-19 Rotor Assembly

3. Install the stator and end bracket.

   a. Re-attach the alternator support bracket to the alternator shell. The hole in the bracket must face the engine. See Figure 6-20.



1. Alternator support bracket

Figure 6-20 Alternator Support Bracket

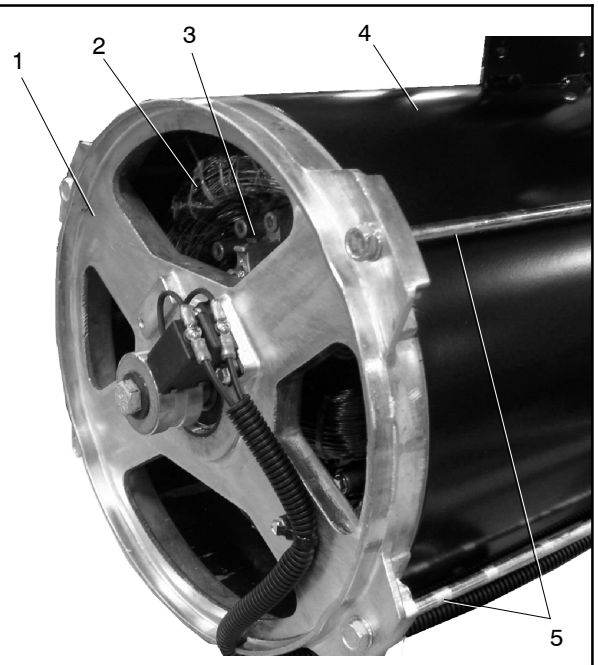
   b. Align the stator so that the alternator support bracket is at the bottom. Install the stator assembly around the rotor.

   c. Align the alignment mark on the top of the stator with the center of the slot in the generator adapter.

   d. Route the leads connected to the alternator end bracket through the opening in the base of the alternator frame.

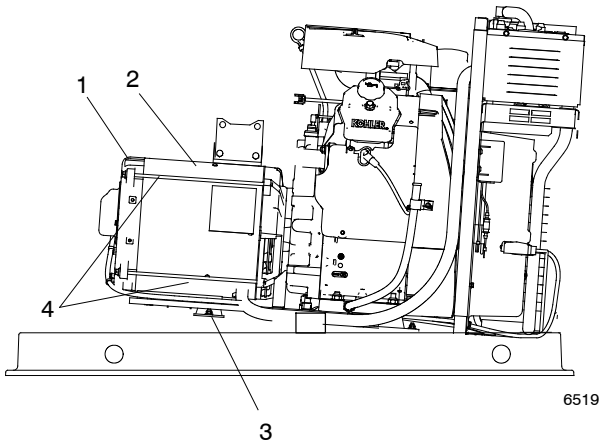
e. Place the end bracket onto the stator assembly, lining up the alignment marks on the top of the stator and end bracket. See Figure 6-21.

f. Thread the four overbolts with locating washers through the end bracket and into the generator adapter. See Figure 6-21 and Figure 6-22. Position the locating tab of each washer to the outer edge of the oblong (OBROUND) hole on the end bracket. The overbolts should be parallel to the outside of the alternator. If the overbolts are slanted, rotate the locating washer 1/2 turn. Do not final tighten the overbolts at this time.



1. End bracket (brush assembly shown attached)
2. Stator windings (outer)
3. Rotor (inner). Also see Figure 6-17.
4. Stator shell
5. Overbolts (qty. 4)

Figure 6-21 End Bracket and Brush Assembly



1. End bracket
2. Alternator
3. Alternator frame vibromount
4. Overbolts

Figure 6-22 Generator Set, Right Side

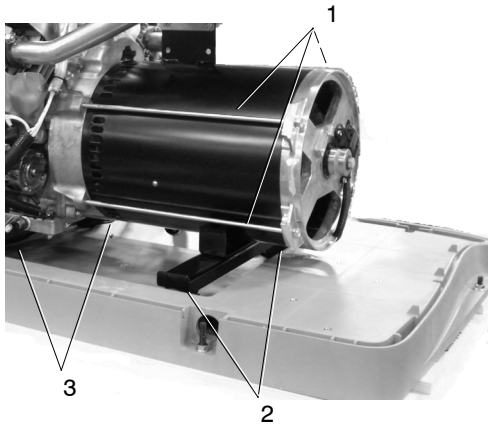
4. Secure the generator set to the skid.

   a. Raise the alternator end of the generator set and remove the wood support block(s).

   b. Lower the end of the generator set and reinstall the screws and washers that secure the vibromounts to the skid. Tighten all four vibromounts (for the alternator and engine) to 5.4 Nm (4 ft. lbs.). Do not overtighten. See Figure 6-23.

5. Tighten the four alternator assembly overbolts to 14.9 Nm (11 ft. lb.). See Figure 6-23.

6. Tighten the rotor thrubolt to 85 Nm (63 ft. lb.). It may be necessary to keep the engine flywheel from turning while torquing the rotor thrubolt.



1. Alternator overbolts (qty. 4)
2. Alternator vibromounts (qty. 2)
3. Engine vibromounts (qty. 2)

Figure 6-23 Vibromounts and Overbolts

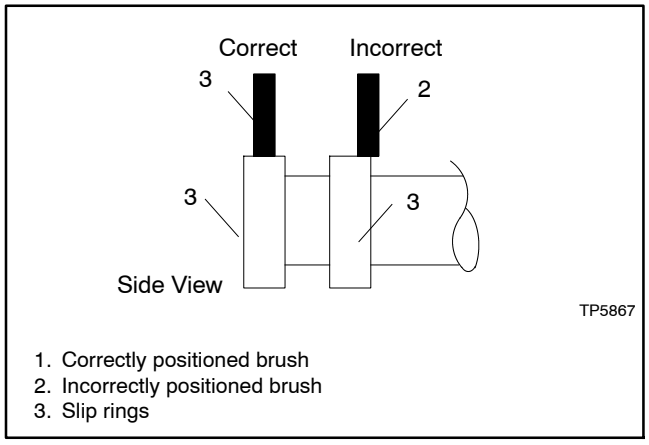
7. Reinstall the end bracket components.

   a. Inspect the brushes. If brushes show uneven wear or are worn to less than half their original length, replace them. See Section 5.6.

   b. Install the brush holder with shim onto the end bracket. Verify that the brushes are not sticking in the holder.

   c. Verify that the brushes are centered on the slip rings. If required, insert spacers between the mounting surface and brush holder to center the brushes on the slip rings. See Figure 6-25 or Figure 6-26. See Section 5.6, Brushes, for more information.

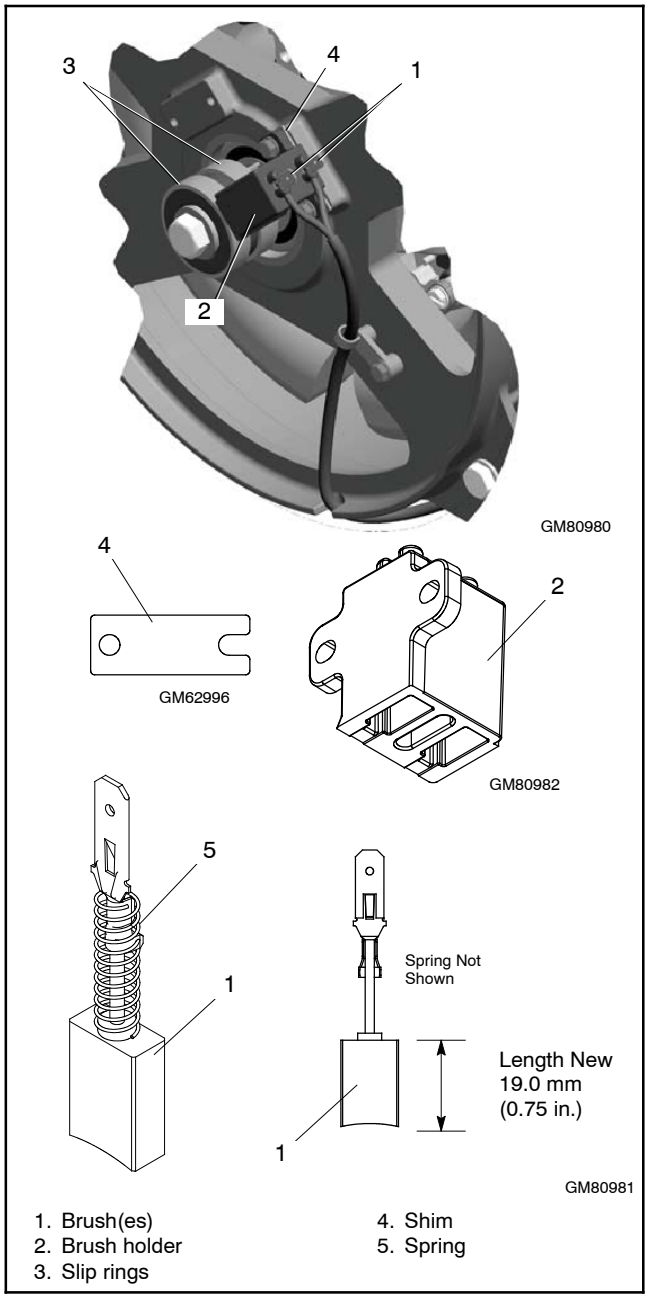
   d. Use the cable tie to secure the brush leads to the end bracket.



1. Correctly positioned brush
2. Incorrectly positioned brush
3. Slip rings

Figure 6-24 Brush Position

Figure 6-25 Brush Assembly (original)



1. Brush(es)
2. Brush holder
3. Slip rings
4. Shim
5. Spring

Figure 6-26 Brush Assembly (revised)

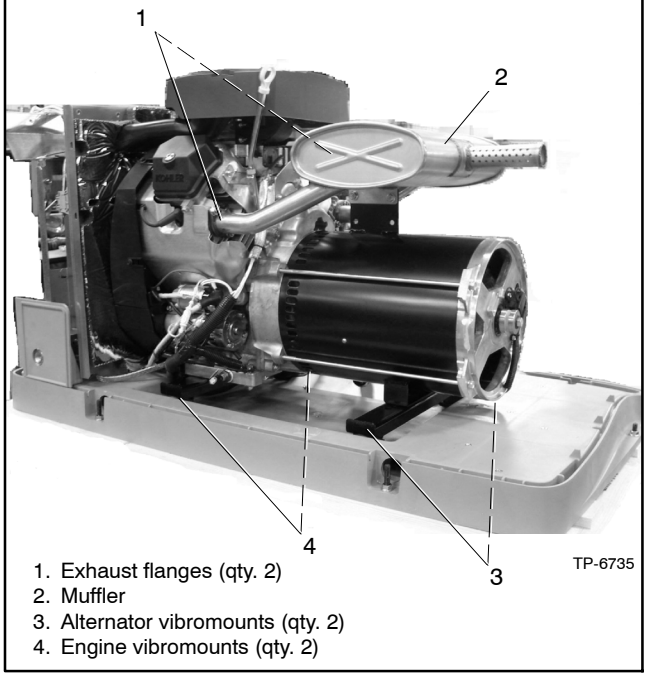
8. Install the exhaust system. See Figure 6-27.

   a. Install the heat shield onto the alternator exhaust support.

   b. Using new gaskets, connect the engine exhaust muffler to the engine at the flanges. Do not final tighten the mounting hardware.

   c. Secure the muffler mounting tab to the heat shield.

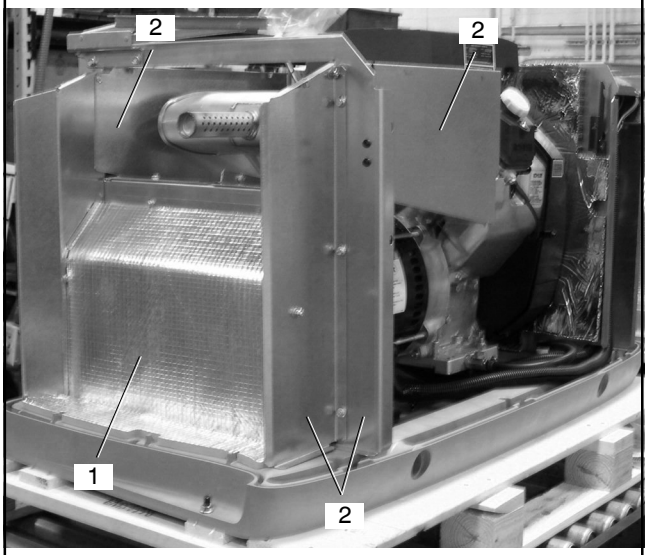
   d. Torque the nuts securing the engine muffler flange to the engine to 24 Nm (17.7 ft. lb.).



1. Exhaust flanges (qty. 2)
2. Muffler
3. Alternator vibromounts (qty. 2)
4. Engine vibromounts (qty. 2)

Figure 6-27 Exhaust System

9. Reinstall the alternator and exhaust duct panels shown in Figure 6-28.



1. Alternator duct
2. Exhaust duct panels

Figure 6-28 Alternator and Exhaust Ducts

10. Reconnect the following alternator wiring inside the controller junction box. See the wiring diagrams in Section 7.

    a. Reconnect lead 55 to the mini-breaker on the controller.

    b. Reconnect P2 to the controller.

    c. Reconnect leads 2 and 3 to neutral stud L0.

    d. Reconnect leads 1 and 4 to the circuit breaker.

    e. Reconnect any other controller connections that were removed during disassembly.

11. Press the OFF button on the generator set controller.

12. Reconnect the generator set engine starting battery, negative (–) lead last.

13. Reinstall fuse F3.

14. Reconnect the carburetor heater (if equipped) to the 120VAC receptacle.

15. Reconnect the battery charger to the 120VAC receptacle.

16. Reconnect output leads or load circuit cables at the field-connection terminal block.

17. Reinstall the enclosure panels in reverse order of removal. See Figure 6-29 and refer to the disassembly instructions, if necessary.

    a. Install the left side panel.

    b. Install the exhaust end panel.

    c. Install the front panel.

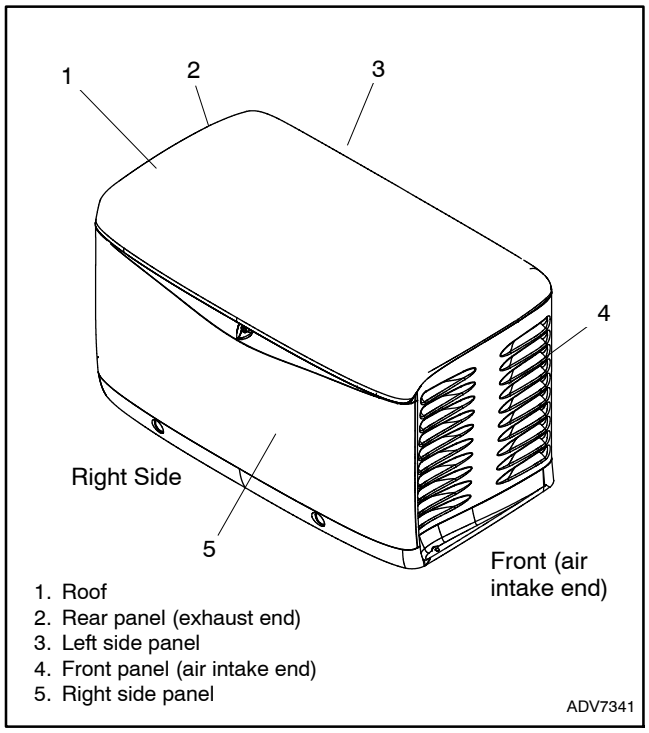
    d. Install the right side panel and reconnect the door latch rods (original latch design only). See Figure 6-30.

    e. Install the exhaust panels shown in Figure 6-31 or the thermal cover shown in Figure 6-32.

    Note: On units with the thermal cover, do not overtighten the locknuts. Verify that the hinge bracket is allowed to pivot.

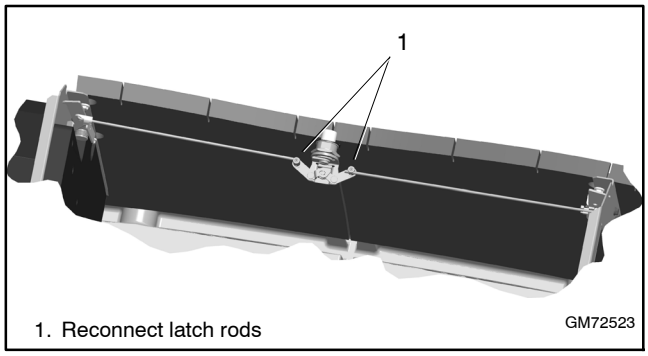
    f. Install the front panel.

    g. Install the generator set housing roof.



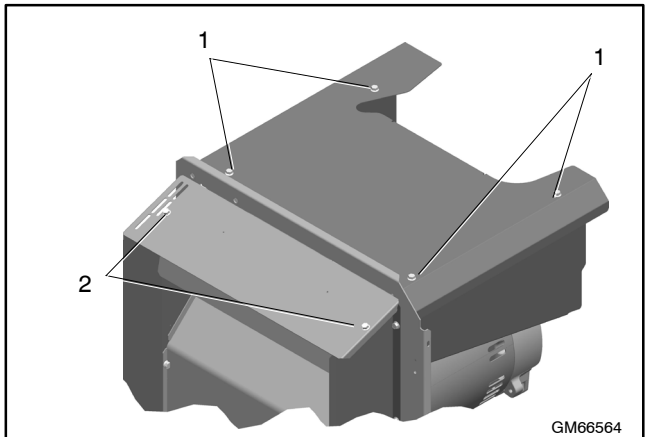
1. Roof
2. Rear panel (exhaust end)
3. Left side panel
4. Front panel (air intake end)
5. Right side panel

Figure 6-29 Generator Set Enclosure



1. Reconnect latch rods

Figure 6-30 Door Latch Detail



1. Exhaust duct panel (4 screws)
2. Top exhaust panel (2 screws)

Figure 6-31 Exhaust Duct Top Panels (original)

18. Re-apply the 120VAC power supply to the generator set by closing the upstream circuit breaker.

19. Turn on the fuel supply. Press RUN to start the generator set and check for leaks with the engine running.

20. Press OFF to turn off the generator set. Then press AUTO if an automatic transfer switch or remote start/stop switch is used.

21. Lower and secure the roof.

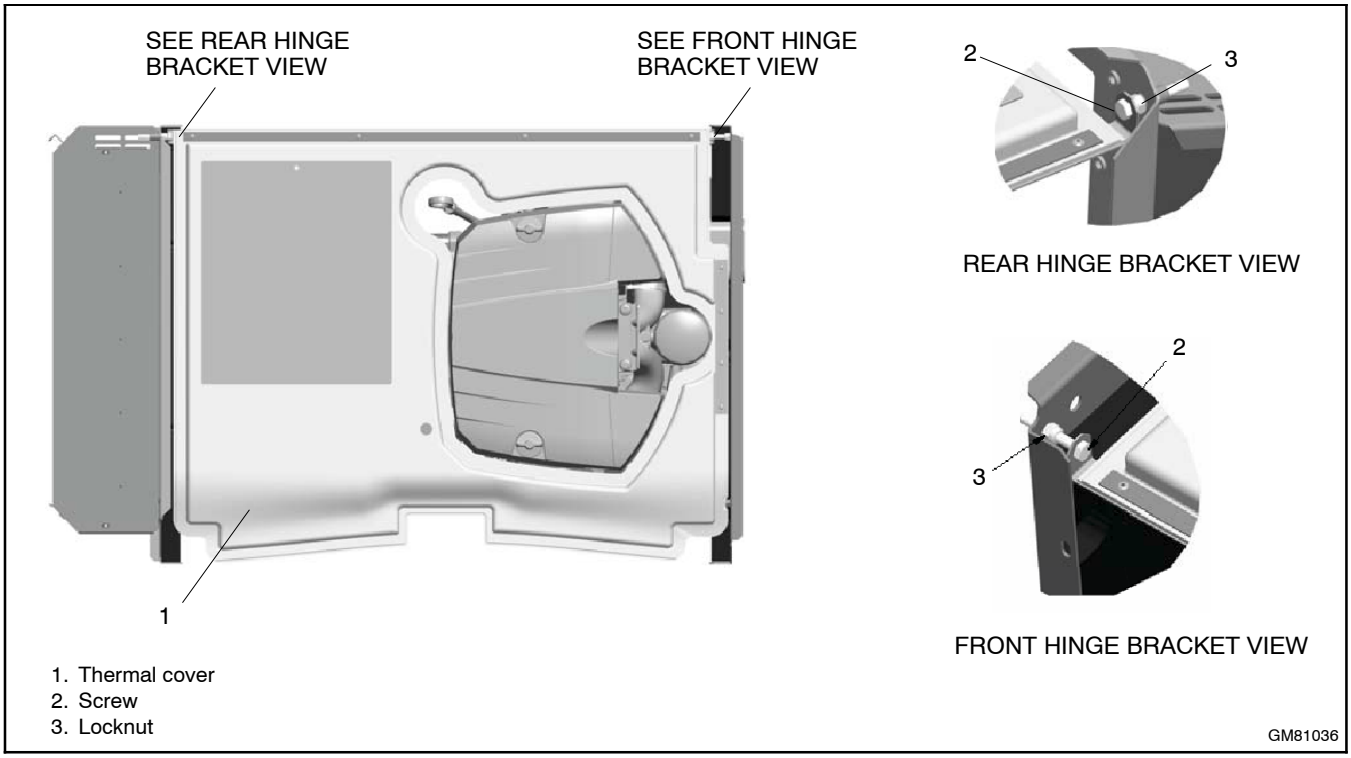
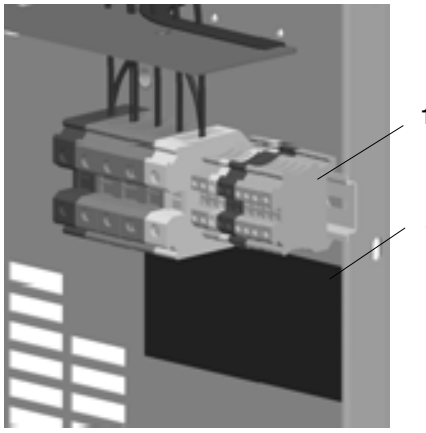


Figure 6-32 Thermal Cover (revised design)

Notes

Figure 7-3 lists the wiring diagram numbers and page numbers.

The original design uses the field-connection terminal block layout shown in Figure 7-1.



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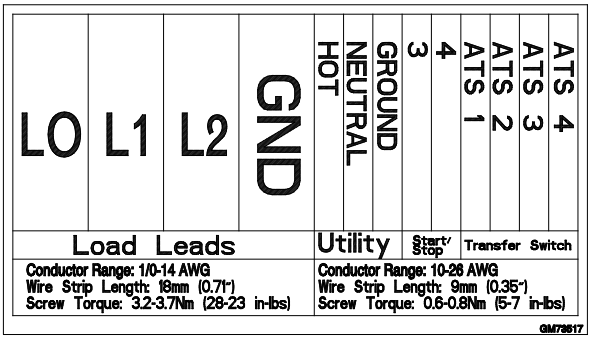
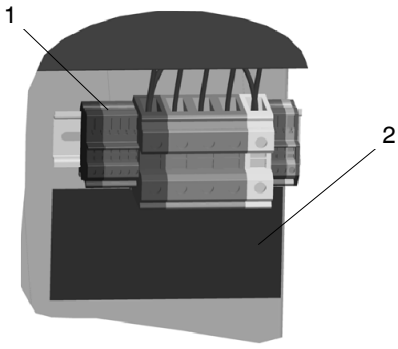


1. Field-connection terminal block (note location of ATS1-4 connections)
2. Connection decal

Figure 7-1 Original Field-Connection Terminal Block

The revised design uses the revised fuel system and the revised field-connection terminal block layout shown in Figure 7-2.



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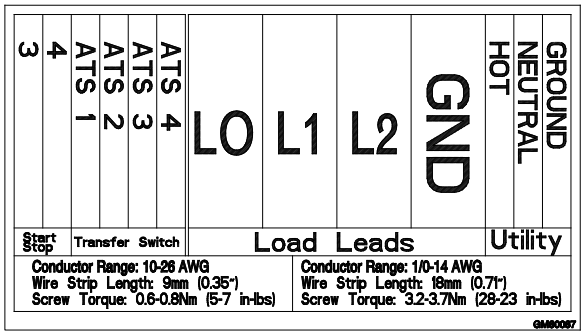


1. Terminal block (note location of ATS1-4 connections)
2. Connection decal

Figure 7-2 Revised Terminal Block

Wiring Diagram Description	Original Design (see Figure 7-1)		Revised Design (see Figure 7-2)	
	Drawing Number	Page	Drawing Number	Page
Schematic Diagram	ADV-7697	104	ADV-8033	105
Point-to-Point Wiring Diagram	GM69754	106	GM79591	107

Figure 7-3 Wiring Diagrams and Schematics

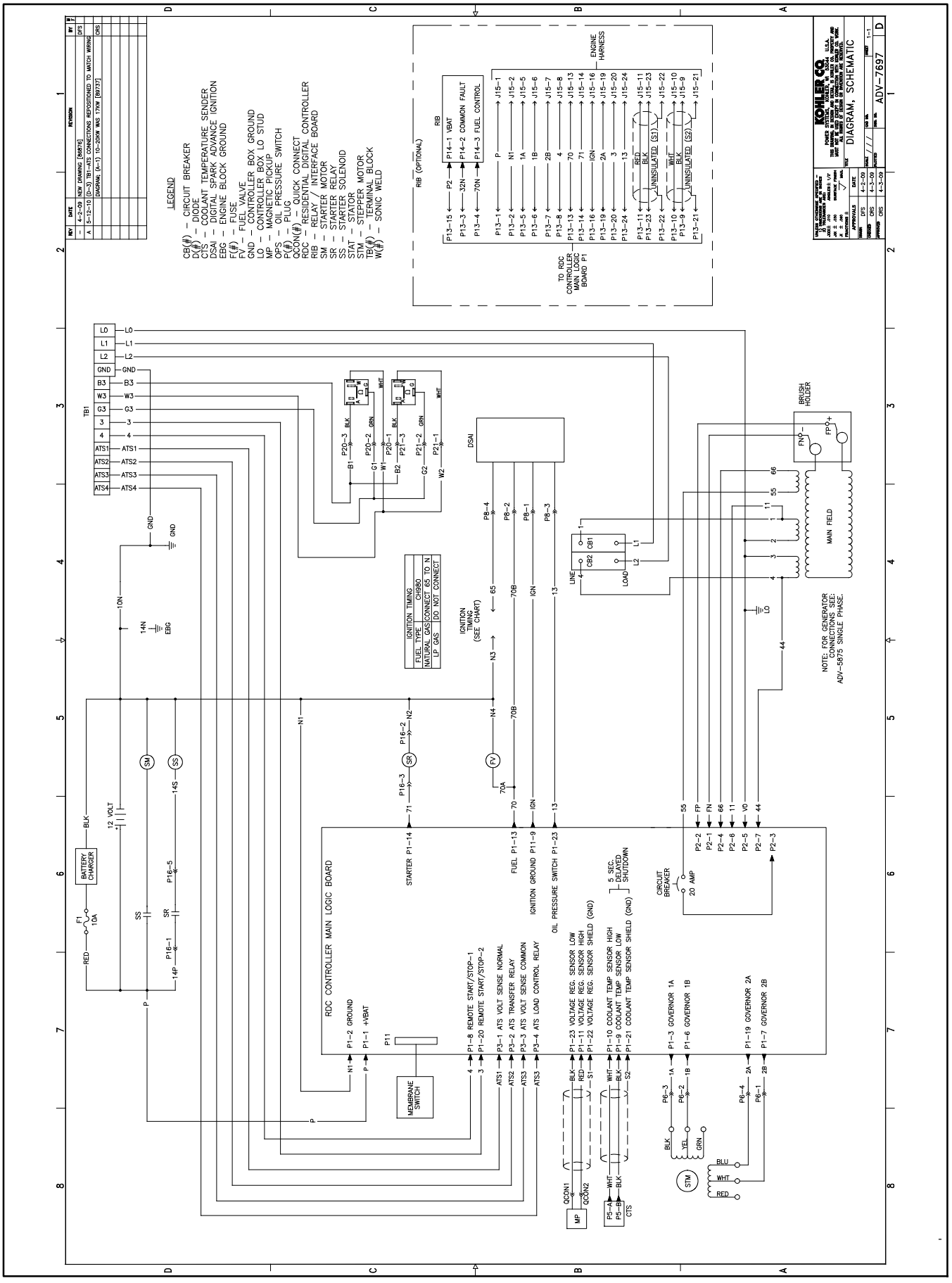


Figure 7-4 Schematic Diagram, ADV-7697 (original design)

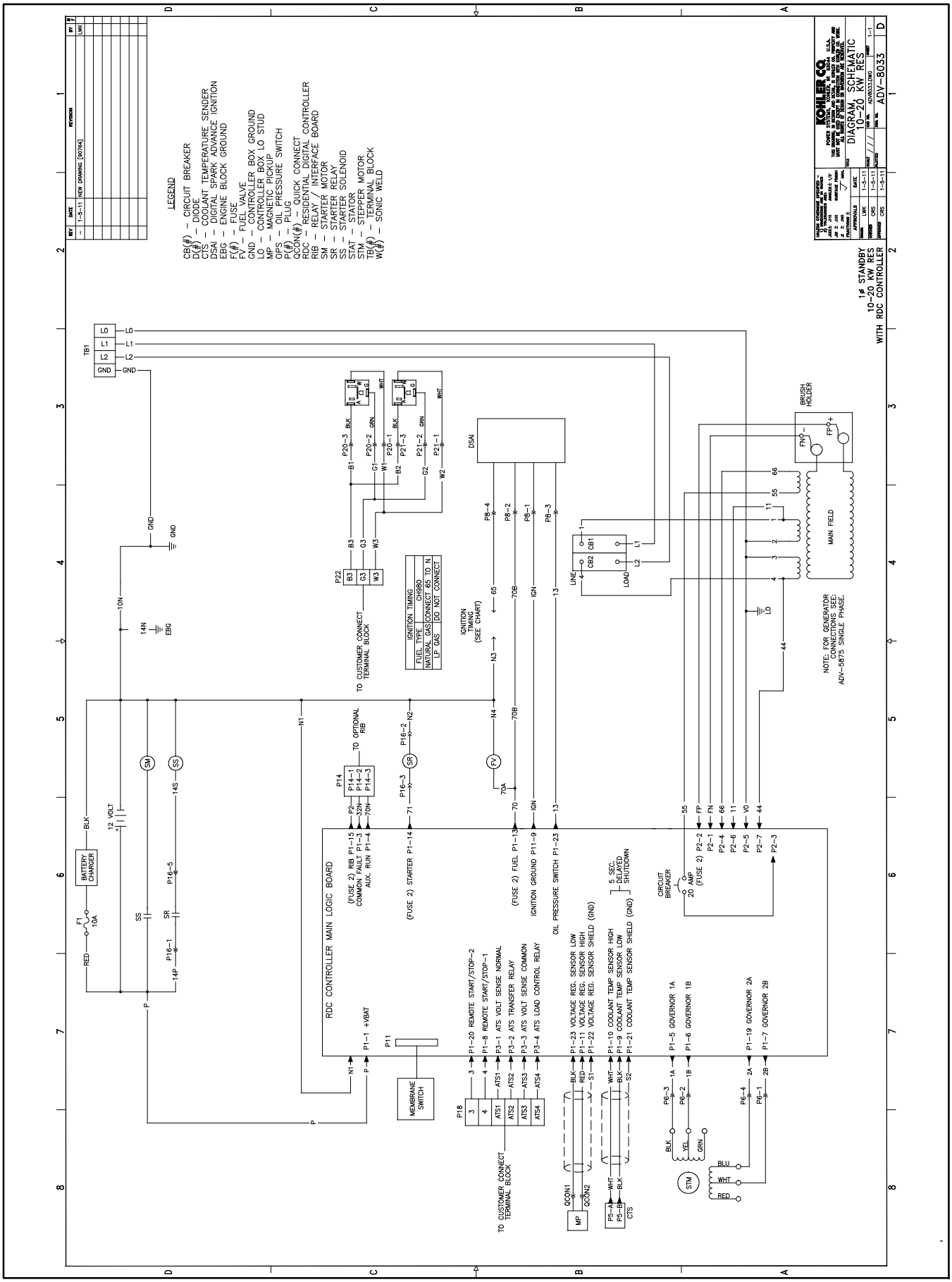


Figure 7-5 Schematic Diagram, ADV-8033 (revised design)

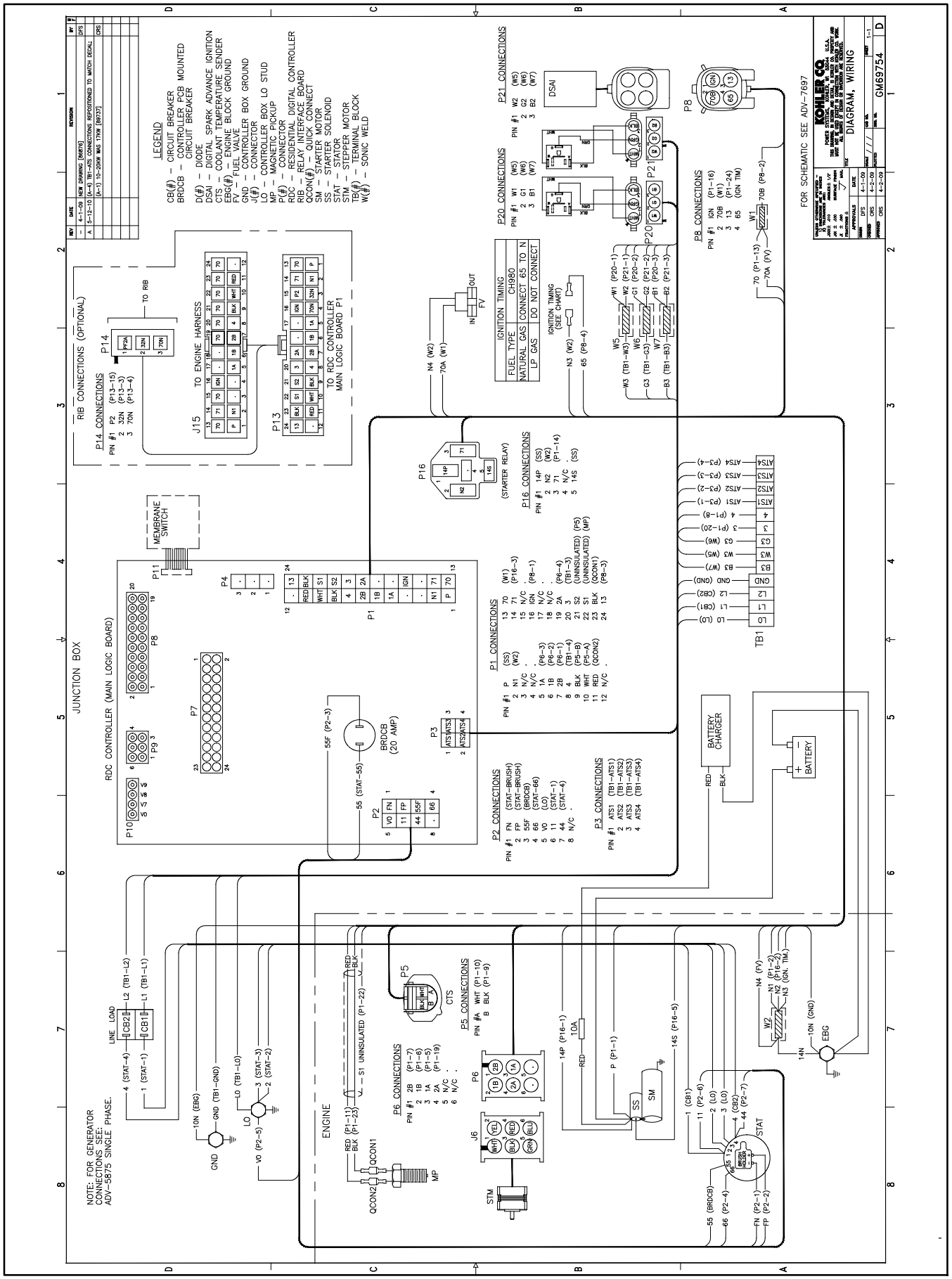


Figure 7-6 Point-to-Point Wiring Diagram, GM69754 (original design)

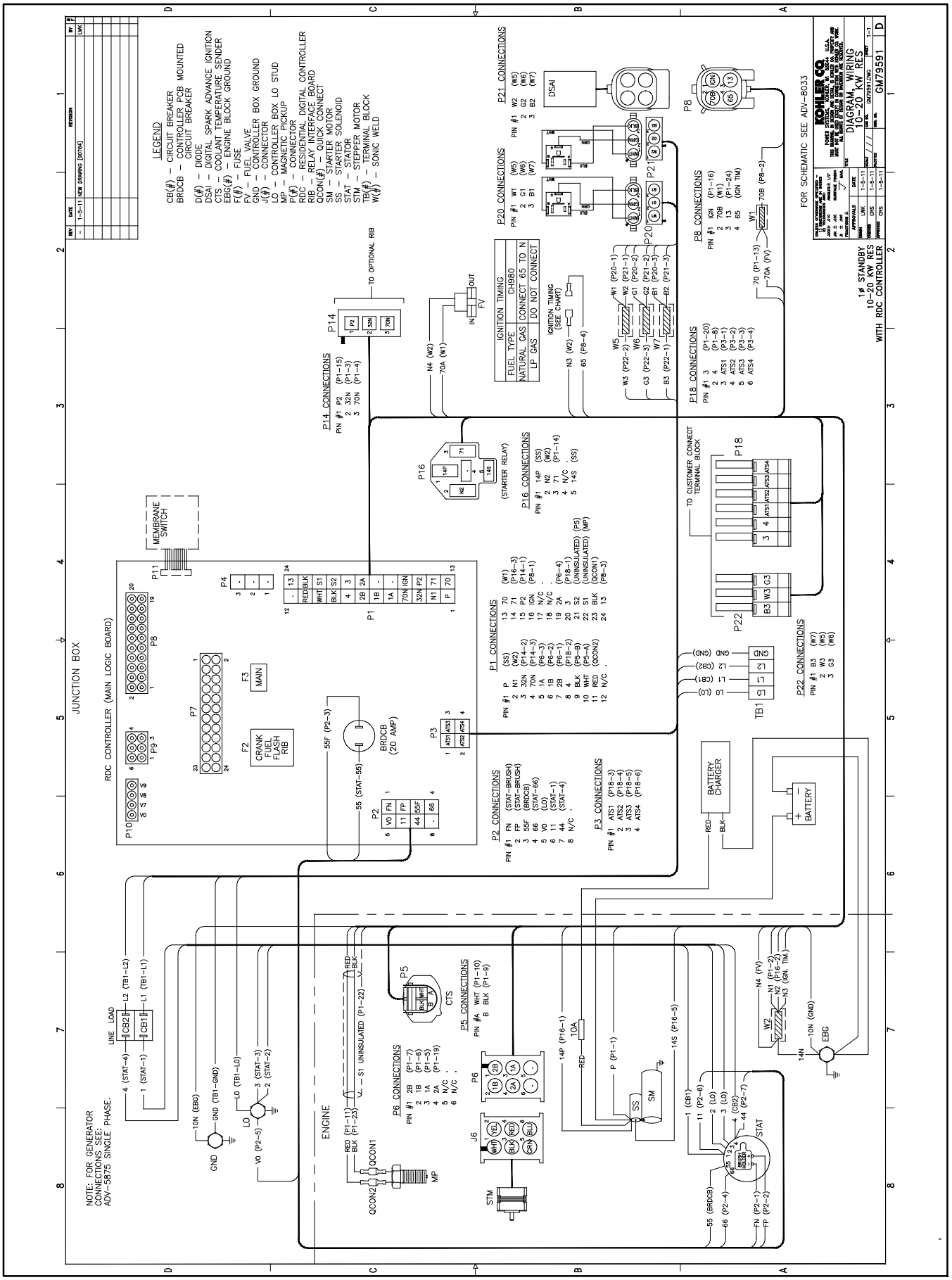


Figure 7-7 Point-to-Point Wiring Diagram, GM79591 (revised design)

Notes

Appendix A Abbreviations

The following list contains abbreviations that may appear in this publication.

A, amp	ampere
ABDC	after bottom dead center
AC	alternating current
A/D	analog to digital
ADC	advanced digital control; analog to digital converter
adj.	adjust, adjustment
ADV	advertising dimensional drawing
Ah	amp-hour
AHWT	anticipatory high water temperature
AISI	American Iron and Steel Institute
ALOP	anticipatory low oil pressure
alt.	alternator
Al	aluminum
ANSI	American National Standards Institute (formerly American Standards Association, ASA)
AO	anticipatory only
APDC	Air Pollution Control District
API	American Petroleum Institute
approx.	approximate, approximately
AQMD	Air Quality Management District
AR	as required, as requested
AS	as supplied, as stated, as suggested
ASE	American Society of Engineers
ASME	American Society of Mechanical Engineers
assy.	assembly
ASTM	American Society for Testing Materials
ATDC	after top dead center
ATS	automatic transfer switch
auto.	automatic
aux.	auxiliary
avg.	average
AVR	automatic voltage regulator
AWG	American Wire Gauge
AWM	appliance wiring material
bat.	battery
BBDC	before bottom dead center
BC	battery charger, battery charging
BCA	battery charging alternator
BCI	Battery Council International
BDC	before dead center
BHP	brake horsepower
blk.	black (paint color), block (engine)
blk. htr.	block heater
BMEP	brake mean effective pressure
bps	bits per second
br.	brass
BTDC	before top dead center
Btu	British thermal unit
Btu/min.	British thermal units per minute
C	Celsius, centigrade
cal.	calorie
CAN	controller area network
CARB	California Air Resources Board
CB	circuit breaker
cc	cubic centimeter
CCA	cold cranking amps
ccw.	counterclockwise
CEC	Canadian Electrical Code
cert.	certificate, certification, certified
cfh	cubic feet per hour
cfm	cubic feet per minute
CG	center of gravity
CID	cubic inch displacement
CL	centerline
cm	centimeter
CMOS	complementary metal oxide substrate (semiconductor)
cogen.	cogeneration
com	communications (port)
coml	commercial
Coml/Rec	Commercial/Recreational
conn.	connection
cont.	continued
CPVC	chlorinated polyvinyl chloride
crit.	critical
CRT	cathode ray tube
CSA	Canadian Standards Association
CT	current transformer
Cu	copper
cUL	Canadian Underwriter's Laboratories
CUL	Canadian Underwriter's Laboratories
cu. in.	cubic inch
cw.	clockwise
CWC	city water-cooled
cyl.	cylinder
D/A	digital to analog
DAC	digital to analog converter
dB	decibel
dB(A)	decibel (A weighted)
DC	direct current
DCR	direct current resistance
deg., °	degree
dept.	department
DFMEA	Design Failure Mode and Effects Analysis
dia.	diameter
DI/EO	dual inlet/end outlet
DIN	Deutsches Institut fur Normung e. V. (also Deutsche Industrie Normenausschuss)
DIP	dual inline package
DPDT	double-pole, double-throw
DPST	double-pole, single-throw
DS	disconnect switch
DVR	digital voltage regulator
E, emer.	emergency (power source)
ECM	electronic control module, engine control module
EDI	electronic data interchange
EFR	emergency frequency relay
e.g.	for example (*exempli gratia)*
EG	electronic governor
EGSA	Electrical Generating Systems Association
EIA	Electronic Industries Association
EI/EO	end inlet/end outlet
EMI	electromagnetic interference
emiss.	emission
eng.	engine
EPA	Environmental Protection Agency
EPS	emergency power system
ER	emergency relay
ES	engineering special, engineered special
ESD	electrostatic discharge
est.	estimated
E-Stop	emergency stop
etc.	et cetera (and so forth)
exh.	exhaust
ext.	external
F	Fahrenheit, female
fglass.	fiberglass
FHM	flat head machine (screw)
fl. oz.	fluid ounce
flex.	flexible
freq.	frequency
FS	full scale
ft.	foot, feet
ft. lb.	foot pounds (torque)
ft./min.	feet per minute
ftp	file transfer protocol
g	gram
ga.	gauge (meters, wire size)
gal.	gallon
gen.	generator
genset	generator set
GFI	ground fault interrupter
GND, ⏚	ground
gov.	governor
gph	gallons per hour
gpm	gallons per minute
gr.	grade, gross
GRD	equipment ground
gr. wt.	gross weight
H x W x D	height by width by depth
HC	hex cap
HCHT	high cylinder head temperature
HD	heavy duty
HET	high exhaust temp., high engine temp.
hex	hexagon
Hg	mercury (element)
HH	hex head
HHC	hex head cap
HP	horsepower
hr.	hour
HS	heat shrink
hsg.	housing
HVAC	heating, ventilation, and air conditioning
HWT	high water temperature
Hz	hertz (cycles per second)
IC	integrated circuit
ID	inside diameter, identification
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IMS	improved motor starting
in.	inch
in. H_2O	inches of water
in. Hg	inches of mercury
in. lb.	inch pounds
Inc.	incorporated
ind.	industrial
int.	internal
int./ext.	internal/external
I/O	input/output
IP	iron pipe
ISO	International Organization for Standardization
J	joule
JIS	Japanese Industry Standard

k	kilo (1000)
K	kelvin
kA	kiloampere
KB	kilobyte (2^{10} bytes)
KBus	Kohler communication protocol
kg	kilogram
kg/cm^2	kilograms per square centimeter
kgm	kilogram-meter
kg/m^3	kilograms per cubic meter
kHz	kilohertz
kJ	kilojoule
km	kilometer
kOhm, kΩ	kilo-ohm
kPa	kilopascal
kph	kilometers per hour
kV	kilovolt
kVA	kilovolt ampere
kVAR	kilovolt ampere reactive
kW	kilowatt
kWh	kilowatt-hour
kWm	kilowatt mechanical
kWth	kilowatt-thermal
L	liter
LAN	local area network
L x W x H	length by width by height
lb.	pound, pounds
lbm/ft^3	pounds mass per cubic feet
LCB	line circuit breaker
LCD	liquid crystal display
ld. shd.	load shed
LED	light emitting diode
Lph	liters per hour
Lpm	liters per minute
LOP	low oil pressure
LP	liquefied petroleum
LPG	liquefied petroleum gas
LS	left side
L_{wa}	sound power level, A weighted
LWL	low water level
LWT	low water temperature
m	meter, milli (1/1000)
M	mega (10^6 when used with SI units), male
m^3	cubic meter
m^3/hr.	cubic meters per hour
m^3/min.	cubic meters per minute
mA	milliampere
man.	manual
max.	maximum
MB	megabyte (2^{20} bytes)
MCCB	molded-case circuit breaker
MCM	one thousand circular mils
meggar	megohmmeter
MHz	megahertz
mi.	mile
mil	one one-thousandth of an inch
min.	minimum, minute
misc.	miscellaneous
MJ	megajoule
mJ	millijoule
mm	millimeter
mOhm, mΩ	milliohm
MOhm, MΩ	megohm
MOV	metal oxide varistor
MPa	megapascal
mpg	miles per gallon
mph	miles per hour
MS	military standard
ms	millisecond
m/sec.	meters per second
MTBF	mean time between failure
MTBO	mean time between overhauls
mtg.	mounting
MTU	Motoren-und Turbinen-Union
MW	megawatt
mW	milliwatt
µF	microfarad
N, norm.	normal (power source)
NA	not available, not applicable
nat. gas	natural gas
NBS	National Bureau of Standards
NC	normally closed
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
Nm	newton meter
NO	normally open
no., nos.	number, numbers
NPS	National Pipe, Straight
NPSC	National Pipe, Straight-coupling
NPT	National Standard taper pipe thread per general use
NPTF	National Pipe, Taper-Fine
NR	not required, normal relay
ns	nanosecond
OC	overcrank
OD	outside diameter
OEM	original equipment manufacturer
OF	overfrequency
opt.	option, optional
OS	oversize, overspeed
OSHA	Occupational Safety and Health Administration
OV	overvoltage
oz.	ounce
p., pp.	page, pages
PC	personal computer
PCB	printed circuit board
pF	picofarad
PF	power factor
ph., ∅	phase
PHC	Phillips® head Crimptite® (screw)
PHH	Phillips® hex head (screw)
PHM	pan head machine (screw)
PLC	programmable logic control
PMG	permanent magnet generator
pot	potentiometer, potential
ppm	parts per million
PROM	programmable read-only memory
psi	pounds per square inch
psig	pounds per square inch gauge
pt.	pint
PTC	positive temperature coefficient
PTO	power takeoff
PVC	polyvinyl chloride
qt.	quart, quarts
qty.	quantity
R	replacement (emergency) power source
rad.	radiator, radius
RAM	random access memory
RDO	relay driver output
ref.	reference
rem.	remote
Res/Coml	Residential/Commercial
RFI	radio frequency interference
RH	round head
RHM	round head machine (screw)
rly.	relay
rms	root mean square
rnd.	round
ROM	read only memory
rot.	rotate, rotating
rpm	revolutions per minute
RS	right side
RTU	remote terminal unit
RTV	room temperature vulcanization
RW	read/write
SAE	Society of Automotive Engineers
scfm	standard cubic feet per minute
SCR	silicon controlled rectifier
s, sec.	second
SI	*Systeme international d'unites,* International System of Units
SI/EO	side in/end out
sil.	silencer
SN	serial number
SNMP	simple network management protocol
SPDT	single-pole, double-throw
SPST	single-pole, single-throw
spec	specification
specs	specification(s)
sq.	square
sq. cm	square centimeter
sq. in.	square inch
SS	stainless steel
std.	standard
stl.	steel
tach.	tachometer
TD	time delay
TDC	top dead center
TDEC	time delay engine cooldown
TDEN	time delay emergency to normal
TDES	time delay engine start
TDNE	time delay normal to emergency
TDOE	time delay off to emergency
TDON	time delay off to normal
temp.	temperature
term.	terminal
THD	total harmonic distortion
TIF	telephone influence factor
TIR	total indicator reading
tol.	tolerance
turbo.	turbocharger
typ.	typical (same in multiple locations)
UF	underfrequency
UHF	ultrahigh frequency
UL	Underwriter's Laboratories, Inc.
UNC	unified coarse thread (was NC)
UNF	unified fine thread (was NF)
univ.	universal
US	undersize, underspeed
UV	ultraviolet, undervoltage
V	volt
VAC	volts alternating current
VAR	voltampere reactive
VDC	volts direct current
VFD	vacuum fluorescent display
VGA	video graphics adapter
VHF	very high frequency
W	watt
WCR	withstand and closing rating
w/	with
w/o	without
wt.	weight
xfmr	transformer

Appendix B 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 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 method.

Washers and Nuts: Use split lock washers as a bolt locking device where specified. Use SAE flat washers with whiz nuts, spiralock nuts, or standard nuts and preloading (torque) of the bolt in all other applications.

See Appendix C, General Torque Specifications, and other torque specifications in the service literature.

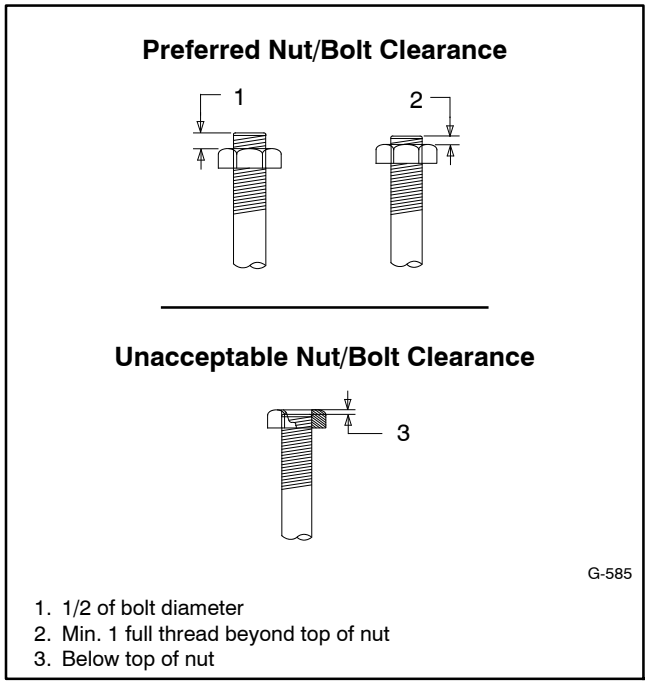


Figure 1 Acceptable Bolt Lengths

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 can take a properly torqued whiz nut or spiralock nut. See Figure 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 2 above for exception).
   c. Use a washer under a bolt when the female thread is fixed (weld nut).
4. Refer to Figure 2, which depicts the preceding hardware configuration possibilities.

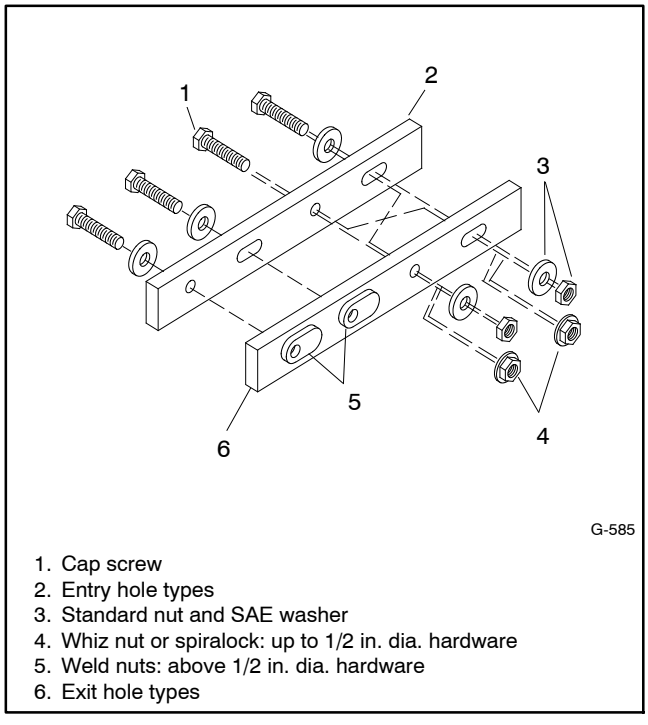


Figure 2 Acceptable Hardware Combinations

Appendix C General Torque Specifications

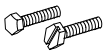
American Standard Fasteners Torque Specifications									
Size	Torque Measurement	Assembled into Cast Iron or Steel						Assembled into Aluminum Grade 2 or 5
		Grade 2		Grade 5		Grade 8		
8-32	Nm (in. lb.)	1.8	(16)	2.3	(20)	—		See Note 3
10-24	Nm (in. lb.)	2.9	(26)	3.6	(32)	—		
10-32	Nm (in. lb.)	2.9	(26)	3.6	(32)	—		
1/4-20	Nm (in. lb.)	6.8	(60)	10.8	(96)	14.9	(132)	
1/4-28	Nm (in. lb.)	8.1	(72)	12.2	(108)	16.3	(144)	
5/16-18	Nm (in. lb.)	13.6	(120)	21.7	(192)	29.8	(264)	
5/16-24	Nm (in. lb.)	14.9	(132)	23.1	(204)	32.5	(288)	
3/8-16	Nm (ft. lb.)	24.0	(18)	38.0	(28)	53.0	(39)	
3/8-24	Nm (ft. lb.)	27.0	(20)	42.0	(31)	60.0	(44)	
7/16-14	Nm (ft. lb.)	39.0	(29)	60.0	(44)	85.0	(63)	
7/16-20	Nm (ft. lb.)	43.0	(32)	68.0	(50)	95.0	(70)	
1/2-13	Nm (ft. lb.)	60.0	(44)	92.0	(68)	130.0	(96)	
1/2-20	Nm (ft. lb.)	66.0	(49)	103.0	(76)	146.0	(108)	
9/16-12	Nm (ft. lb.)	81.0	(60)	133.0	(98)	187.0	(138)	
9/16-18	Nm (ft. lb.)	91.0	(67)	148.0	(109)	209.0	(154)	
5/8-11	Nm (ft. lb.)	113.0	(83)	183.0	(135)	259.0	(191)	
5/8-18	Nm (ft. lb.)	128.0	(94)	208.0	(153)	293.0	(216)	
3/4-10	Nm (ft. lb.)	199.0	(147)	325.0	(240)	458.0	(338)	
3/4-16	Nm (ft. lb.)	222.0	(164)	363.0	(268)	513.0	(378)	
1-8	Nm (ft. lb.)	259.0	(191)	721.0	(532)	1109.0	(818)	
1-12	Nm (ft. lb.)	283.0	(209)	789.0	(582)	1214.0	(895)	

Metric Fasteners Torque Specifications, Measured in Nm (ft. lb.)								
Size (mm)	Assembled into Cast Iron or Steel						Assembled into Aluminum Grade 5.8 or 8.8
	Grade 5.8		Grade 8.8		Grade 10.9		
M6 x 1.00	6.2	(4.6)	9.5	(7)	13.6	(10)	See Note 3
M8 x 1.25	15.0	(11)	23.0	(17)	33.0	(24)	
M8 x 1.00	16.0	(11)	24.0	(18)	34.0	(25)	
M10 x 1.50	30.0	(22)	45.0	(34)	65.0	(48)	
M10 x 1.25	31.0	(23)	47.0	(35)	68.0	(50)	
M12 x 1.75	53.0	(39)	80.0	(59)	115.0	(85)	
M12 x 1.50	56.0	(41)	85.0	(63)	122.0	(90)	
M14 x 2.00	83.0	(61)	126.0	(93)	180.0	(133)	
M14 x 1.50	87.0	(64)	133.0	(98)	190.0	(140)	
M16 x 2.00	127.0	(94)	194.0	(143)	278.0	(205)	
M16 x 1.50	132.0	(97)	201.0	(148)	287.0	(212)	
M18 x 2.50	179.0	(132)	273.0	(201)	390.0	(288)	
M18 x 1.50	189.0	(140)	289.0	(213)	413.0	(305)	

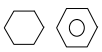
Notes:

1. The torque values above are general guidelines. Always use the torque values specified in the service manuals and/or assembly drawings when they differ from the above torque values.
2. The torque values above are based on new plated threads. Increase torque values by 15% if non-plated threads are used.
3. Hardware threaded into aluminum must have either two diameters of thread engagement or a 30% or more reduction in the torque to prevent stripped threads.
4. Torque values are calculated as equivalent stress loading on American hardware with an approximate preload of 90% of the yield strength and a friction coefficient of 0.125.

Appendix D Common Hardware Identification

Screw/Bolts/Studs	
Head Styles	
Hex Head or Machine Head	
Hex Head or Machine Head with Washer	
Flat Head (FHM)	
Round Head (RHM)	
Pan Head	
Hex Socket Head Cap or Allen™ Head Cap	
Hex Socket Head or Allen™ Head Shoulder Bolt	
Sheet Metal Screw	
Stud	
Drive Styles	
Hex	
Hex and Slotted	
Phillips®	
Slotted	
Hex Socket	

Nuts	
Nut Styles	
Hex Head	
Lock or Elastic	
Square	
Cap or Acorn	
Wing	
Washers	
Washer Styles	
Plain	
Split Lock or Spring	
Spring or Wave	
External Tooth Lock	
Internal Tooth Lock	
Internal-External Tooth Lock	

Hardness Grades	
American Standard	
Grade 2	
Grade 5	
Grade 8	
Grade 8/9 (Hex Socket Head)	
Metric	
Number stamped on hardware; 5.8 shown	

Allen™ head screw is a trademark of Holo-Krome Co.

Phillips® screw is a registered trademark of Phillips Screw Company.

Sample Dimensions

American Standard (Screws, Bolts, Studs, and Nuts)

1/4-20 x 1

- 1 — Length In Inches (Screws and Bolts)
- 20 — Threads Per Inch
- 1/4 — Major Thread Diameter In Fractional Inches Or Screw Number Size

Metric (Screws, Bolts, Studs, and Nuts)

M8-1.25 x 20

- 20 — Length In Millimeters (Screws and Bolts)
- 1.25 — Distance Between Threads In Millimeters
- M8 — Major Thread Diameter In Millimeters

Plain Washers

9/32 x 5/8 x 1/16

- 1/16 — Thickness
- 5/8 — External Dimension
- 9/32 — Internal Dimension

Lock Washers

5/8

- 5/8 — Internal Dimension

Appendix E Common Hardware List

The Common Hardware List lists part numbers and dimensions for common hardware items.

American Standard

Part No.	Dimensions
Hex Head Bolts (Grade 5)	
X-465-17	1/4-20 x .38
X-465-6	1/4-20 x .50
X-465-2	1/4-20 x .62
X-465-16	1/4-20 x .75
X-465-18	1/4-20 x .88
X-465-7	1/4-20 x 1.00
X-465-8	1/4-20 x 1.25
X-465-9	1/4-20 x 1.50
X-465-10	1/4-20 x 1.75
X-465-11	1/4-20 x 2.00
X-465-12	1/4-20 x 2.25
X-465-14	1/4-20 x 2.75
X-465-21	1/4-20 x 5.00
X-465-25	1/4-28 x .38
X-465-20	1/4-28 x 1.00
X-125-33	5/16-18 x .50
X-125-23	5/16-18 x .62
X-125-3	5/16-18 x .75
X-125-31	5/16-18 x .88
X-125-5	5/16-18 x 1.00
X-125-24	5/16-18 x 1.25
X-125-34	5/16-18 x 1.50
X-125-25	5/16-18 x 1.75
X-125-26	5/16-18 x 2.00
230578	5/16-18 x 2.25
X-125-29	5/16-18 x 2.50
X-125-27	5/16-18 x 2.75
X-125-28	5/16-18 x 3.00
X-125-22	5/16-18 x 4.50
X-125-32	5/16-18 x 5.00
X-125-35	5/16-18 x 5.50
X-125-36	5/16-18 x 6.00
X-125-40	5/16-18 x 6.50
X-125-43	5/16-24 x 1.75
X-125-44	5/16-24 x 2.50
X-125-30	5/16-24 x .75
X-125-39	5/16-24 x 2.00
X-125-38	5/16-24 x 2.75
X-6238-2	3/8-16 x .62
X-6238-10	3/8-16 x .75
X-6238-3	3/8-16 x .88
X-6238-11	3/8-16 x 1.00
X-6238-4	3/8-16 x 1.25
X-6238-5	3/8-16 x 1.50
X-6238-1	3/8-16 x 1.75
X-6238-6	3/8-16 x 2.00
X-6238-17	3/8-16 x 2.25
X-6238-7	3/8-16 x 2.50
X-6238-8	3/8-16 x 2.75
X-6238-9	3/8-16 x 3.00
X-6238-19	3/8-16 x 3.25
X-6238-12	3/8-16 x 3.50
X-6238-20	3/8-16 x 3.75
X-6238-13	3/8-16 x 4.50
X-6238-18	3/8-16 x 5.50
X-6238-25	3/8-16 x 6.50

Part No.	Dimensions
Hex Head Bolts, cont.	
X-6238-14	3/8-24 x .75
X-6238-16	3/8-24 x 1.25
X-6238-21	3/8-24 x 4.00
X-6238-22	3/8-24 x 4.50
X-6024-5	7/16-14 x .75
X-6024-2	7/16-14 x 1.00
X-6024-8	7/16-14 x 1.25
X-6024-3	7/16-14 x 1.50
X-6024-4	7/16-14 x 2.00
X-6024-11	7/16-14 x 2.75
X-6024-12	7/16-14 x 6.50
X-129-15	1/2-13 x .75
X-129-17	1/2-13 x 1.00
X-129-18	1/2-13 x 1.25
X-129-19	1/2-13 x 1.50
X-129-20	1/2-13 x 1.75
X-129-21	1/2-13 x 2.00
X-129-22	1/2-13 x 2.25
X-129-23	1/2-13 x 2.50
X-129-24	1/2-13 x 2.75
X-129-25	1/2-13 x 3.00
X-129-27	1/2-13 x 3.50
X-129-29	1/2-13 x 4.00
X-129-30	1/2-13 x 4.50
X-463-9	1/2-13 x 5.50
X-129-44	1/2-13 x 6.00
X-129-51	1/2-20 x .75
X-129-45	1/2-20 x 1.25
X-129-52	1/2-20 x 1.50
X-6021-3	5/8-11 x 1.00
X-6021-4	5/8-11 x 1.25
X-6021-2	5/8-11 x 1.50
X-6021-1	5/8-11 x 1.75
273049	5/8-11 x 2.00
X-6021-5	5/8-11 x 2.25
X-6021-6	5/8-11 x 2.50
X-6021-7	5/8-11 x 2.75
X-6021-12	5/8-11 x 3.75
X-6021-11	5/8-11 x 4.50
X-6021-10	5/8-11 x 6.00
X-6021-9	5/8-18 x 2.50
X-6239-1	3/4-10 x 1.00
X-6239-8	3/4-10 x 1.25
X-6239-2	3/4-10 x 1.50
X-6239-3	3/4-10 x 2.00
X-6239-4	3/4-10 x 2.50
X-6239-5	3/4-10 x 3.00
X-6239-6	3/4-10 x 3.50
X-792-1	1-8 x 2.25
X-792-5	1-8 x 3.00
X-792-8	1-8 x 5.00

Part No.	Dimensions	Type
Hex Nuts		
X-6009-1	1-8	Standard
X-6210-3	6-32	Whiz
X-6210-4	8-32	Whiz
X-6210-5	10-24	Whiz
X-6210-1	10-32	Whiz
X-6210-2	1/4-20	Spiralock
X-6210-6	1/4-28	Spiralock
X-6210-7	5/16-18	Spiralock
X-6210-8	5/16-24	Spiralock
X-6210-9	3/8-16	Spiralock
X-6210-10	3/8-24	Spiralock
X-6210-11	7/16-14	Spiralock
X-6210-12	1/2-13	Spiralock
X-6210-15	7/16-20	Spiralock
X-6210-14	1/2-20	Spiralock
X-85-3	5/8-11	Standard
X-88-12	3/4-10	Standard
X-89-2	1/2-20	Standard

Washers

Part No.	ID	OD	Thick.	Bolt/ Screw
X-25-46	.125	.250	.022	#4
X-25-9	.156	.375	.049	#6
X-25-48	.188	.438	.049	#8
X-25-36	.219	.500	.049	#10
X-25-40	.281	.625	.065	1/4
X-25-85	.344	.687	.065	5/16
X-25-37	.406	.812	.065	3/8
X-25-34	.469	.922	.065	7/16
X-25-26	.531	1.062	.095	1/2
X-25-15	.656	1.312	.095	5/8
X-25-29	.812	1.469	.134	3/4
X-25-127	1.062	2.000	.134	1

Metric

Hex head bolts are hardness grade 8.8 unless noted.

Part No.	Dimensions
Hex Head Bolts (Partial Thread)	
M931-05055-60	M5-0.80 x 55
M931-06040-60	M6-1.00 x 40
M931-06055-60	M6-1.00 x 55
M931-06060-60	M6-1.00 x 60
M931-06060-SS	M6-1.00 x 60
M931-06070-60	M6-1.00 x 70
M931-06070-SS	M6-1.00 x 70
M931-06075-60	M6-1.00 x 75
M931-06090-60	M6-1.00 x 90
M931-06145-60	M6-1.00 x 145
M931-06150-60	M6-1.00 x 150
M931-08035-60	M8-1.25 x 35
M931-08040-60	M8-1.25 x 40
M931-08045-60	M8-1.25 x 45
M931-08050-60	M8-1.25 x 50
M931-08055-60	M8-1.25 x 55
M931-08055-82	M8-1.25 x 55*
M931-08060-60	M8-1.25 x 60
M931-08070-60	M8-1.25 x 70
M931-08070-82	M8-1.25 x 70*
M931-08075-60	M8-1.25 x 75
M931-08080-60	M8-1.25 x 80
M931-08090-60	M8-1.25 x 90
M931-08095-60	M8-1.25 x 95
M931-08100-60	M8-1.25 x 100
M931-08110-60	M8-1.25 x 110
M931-08120-60	M8-1.25 x 120
M931-08130-60	M8-1.25 x 130
M931-08140-60	M8-1.25 x 140
M931-08150-60	M8-1.25 x 150
M931-08200-60	M8-1.25 x 200
M931-10040-82	M10-1.25 x 40*
M931-10040-60	M10-1.50 x 40
M931-10045-60	M10-1.50 x 45
M931-10050-60	M10-1.50 x 50
M931-10050-82	M10-1.25 x 50*
M931-10055-60	M10-1.50 x 55
M931-10060-60	M10-1.50 x 60
M931-10065-60	M10-1.50 x 65
M931-10070-60	M10-1.50 x 70
M931-10080-60	M10-1.50 x 80
M931-10080-82	M10-1.25 x 80*
M931-10090-60	M10-1.50 x 90
M931-10090-82	M10-1.50 x 90*
M931-10100-60	M10-1.50 x 100
M931-10110-60	M10-1.50 x 110
M931-10120-60	M10-1.50 x 120
M931-10130-60	M10-1.50 x 130
M931-10140-60	M10-1.50 x 140
M931-10180-60	M10-1.50 x 180
M931-10235-60	M10-1.50 x 235
M931-10260-60	M10-1.50 x 260
M960-10330-60	M10-1.25 x 330
M931-12045-60	M12-1.75 x 45
M960-12050-60	M12-1.25 x 50
M960-12050-82	M12-1.25 x 50*
M931-12050-60	M12-1.75 x 50
M931-12050-82	M12-1.75 x 50*
M931-12055-60	M12-1.75 x 55
M931-12060-60	M12-1.75 x 60
M931-12060-82	M12-1.75 x 60*
M931-12065-60	M12-1.75 x 65
M931-12075-60	M12-1.75 x 75
M931-12080-60	M12-1.75 x 80
M931-12090-60	M12-1.75 x 90
M931-12100-60	M12-1.75 x 100
M931-12110-60	M12-1.75 x 110

Part No.	Dimensions
Hex Head Bolts (Partial Thread), continued	
M960-16090-60	M16-1.50 x 90
M931-16090-60	M16-2.00 x 90
M931-16100-60	M16-2.00 x 100
M931-16100-82	M16-2.00 x 100*
M931-16120-60	M16-2.00 x 120
M931-16150-60	M16-2.00 x 150
M931-20065-60	M20-2.50 x 65
M931-20090-60	M20-2.50 x 90
M931-20100-60	M20-2.50 x 100
M931-20120-60	M20-2.50 x 120
M931-20140-60	M20-2.50 x 140
M931-20160-60	M20-2.50 x 160
M931-22090-60	M22-2.50 x 90
M931-22120-60	M22-2.50 x 120
M931-22160-60	M22-2.50 x 160
M931-24090-60	M24-3.00 x 90
M931-24120-60	M24-3.00 x 120
M931-24160-60	M24-3.00 x 160
M931-24200-60	M24-3.00 x 200
Hex Head Bolts (Full Thread)	
M933-04006-60	M4-0.70 x 6
M933-05030-60	M5-0.80 x 30
M933-05035-60	M5-0.80 x 35
M933-05050-60	M5-0.80 x 50
M933-06010-60	M6-1.00 x 10
M933-06012-60	M6-1.00 x 12
M933-06014-60	M6-1.00 x 14
M933-06016-60	M6-1.00 x 16
M933-06020-60	M6-1.00 x 20
M933-06025-60	M6-1.00 x 25
M933-06030-60	M6-1.00 x 30
M933-06040-60	M6-1.00 x 40
M933-06050-60	M6-1.00 x 50
M933-07025-60	M7-1.00 x 25
M933-08010-60	M8-1.25 x 10
M933-08012-60	M8-1.25 x 12
M933-08016-60	M8-1.25 x 16
M933-08020-60	M8-1.25 x 20
M933-08025-60	M8-1.25 x 25
M933-08030-60	M8-1.25 x 30
M933-08030-82	M8-1.25 x 30*
M933-10012-60	M10-1.50 x 12
M961-10020-60	M10-1.25 x 20
M933-10020-60	M10-1.50 x 20
M933-10025-60	M10-1.50 x 25
M961-10025-60	M10-1.25 x 25
M933-10025-82	M10-1.50 x 25*
M961-10030-60	M10-1.25 x 30
M933-10030-60	M10-1.50 x 30
M933-10030-82	M10-1.50 x 30*
M961-10035-60	M10-1.25 x 35
M933-10035-60	M10-1.50 x 35
M933-10035-82	M10-1.50 x 35*
M961-10040-60	M10-1.25 x 40

Part No.	Dimensions
Hex Head Bolts (Full Thread), continued	
M933-12016-60	M12-1.75 x 16
M933-12020-60	M12-1.75 x 20
M961-12020-60F	M12-1.50 x 20
M933-12025-60	M12-1.75 x 25
M933-12025-82	M12-1.75 x 25*
M961-12030-60	M12-1.25 x 30
M933-12030-82	M12-1.75 x 30*
M961-12030-82F	M12-1.50 x 30*
M933-12030-60	M12-1.75 x 30
M933-12035-60	M12-1.75 x 35
M961-12040-82	M12-1.25 x 40*
M933-12040-60	M12-1.75 x 40
M933-12040-82	M12-1.75 x 40*
M961-14025-60	M14-1.50 x 25
M933-14025-60	M14-2.00 x 25
M961-14050-82	M14-1.50 x 50*
M961-16025-60	M16-1.50 x 25
M933-16025-60	M16-2.00 x 25
M961-16030-82	M16-1.50 x 30*
M933-16030-82	M16-2.00 x 30*
M933-16035-60	M16-2.00 x 35
M961-16040-60	M16-1.50 x 40
M933-16040-60	M16-2.00 x 40
M961-16045-82	M16-1.50 x 45*
M933-16045-82	M16-2.00 x 45*
M933-16050-60	M16-2.00 x 50
M933-16050-82	M16-2.00 x 50*
M933-16060-60	M16-2.00 x 60
M933-16070-60	M16-2.00 x 70
M933-18035-60	M18-2.50 x 35
M933-18050-60	M18-2.50 x 50
M933-18060-60	M18-2.50 x 60
M933-20050-60	M20-2.50 x 50
M933-20055-60	M20-2.50 x 55
M933-24060-60	M24-3.00 x 60
M933-24065-60	M24-3.00 x 65
M933-24070-60	M24-3.00 x 70
Pan Head Machine Screws	
M7985A-03010-20	M3-0.50 x 10
M7985A-03012-20	M3-0.50 x 12
M7985A-04010-20	M4-0.70 x 10
M7985A-04016-20	M4-0.70 x 16
M7985A-04020-20	M4-0.70 x 20
M7985A-04050-20	M4-0.70 x 50
M7985A-04100-20	M4-0.70 x 100
M7985A-05010-20	M5-0.80 x 10
M7985A-05012-20	M5-0.80 x 12
M7985A-05016-20	M5-0.80 x 16
M7985A-05020-20	M5-0.80 x 20
M7985A-05025-20	M5-0.80 x 25
M7985A-05030-20	M5-0.80 x 30
M7985A-05080-20	M5-0.80 x 80
M7985A-05100-20	M5-0.80 x 100
M7985A-06100-20	M6-1.00 x 100
Flat Head Machine Screws	
M965A-04012-SS	M4-0.70 x 12
M965A-05012-SS	M5-0.80 x 12
M965A-05016-20	M5-0.80 x 16
M965A-06012-20	M6-1.00 x 12

* This metric hex bolt's hardness is grade 10.9.

Metric, continued

Part No.	Dimensions	Type
Hex Nuts		
M934-03-50	M3-0.50	Standard
M934-04-50	M4-0.70	Standard
M934-04-B	M4-0.70	Brass
M934-05-50	M5-0.80	Standard
M934-06-60	M6-1.00	Standard
M934-06-64	M6-1.00	Std. (green)
M6923-06-80	M6-1.00	Spiralock
M982-06-80	M6-1.00	Elastic Stop
M934-08-60	M8-1.25	Standard
M6923-08-80	M8-1.25	Spiralock
M982-08-80	M8-1.25	Elastic Stop
M934-10-60	M10-1.50	Standard
M934-10-60F	M10-1.25	Standard
M6923-10-80	M10-1.50	Spiralock
M6923-10-62	M10-1.50	Spiralock†
M982-10-80	M10-1.50	Elastic Stop
M934-12-60	M12-1.75	Standard
M934-12-60F	M12-1.25	Standard
M6923-12-80	M12-1.75	Spiralock
M982-12-80	M12-1.75	Elastic Stop
M982-14-60	M14-2.00	Elastic Stop
M6923-16-80	M16-2.00	Spiralock
M982-16-80	M16-2.00	Elastic Stop
M934-18-80	M18-2.5	Standard
M982-18-60	M18-2.50	Elastic Stop
M934-20-80	M20-2.50	Standard
M982-20-80	M20-2.50	Elastic Stop
M934-22-60	M22-2.50	Standard
M934-24-80	M24-3.00	Standard
M982-24-60	M24-3.00	Elastic Stop
M934-30-80	M30-3.50	Standard

Washers

Part No.	ID	OD	Thick.	Bolt/ Screw
M125A-03-80	3.2	7.0	0.5	M3
M125A-04-80	4.3	9.0	0.8	M4
M125A-05-80	5.3	10.0	1.0	M5
M125A-06-80	6.4	12.0	1.6	M6
M125A-08-80	8.4	16.0	1.6	M8
M125A-10-80	10.5	20.0	2.0	M10
M125A-12-80	13.0	24.0	2.5	M12
M125A-14-80	15.0	28.0	2.5	M14
M125A-16-80	17.0	30.0	3.0	M16
M125A-18-80	19.0	34.0	3.0	M18
M125A-20-80	21.0	37.0	3.0	M20
M125A-24-80	25.0	44.0	4.0	M24

† This metric hex nut's hardness is grade 8.

Appendix F Controller Parameters (SiteTech)

The following table lists controller parameters that can be viewed and adjusted using Kohler® SiteTech™ software. The Access column in the table shows which parameters can only be viewed (Read or Locked), and which parameters can be changed using the software (Write).

Parameters are factoy-set according to the generator set model. Use SiteTech to change settings if necessary during service or after controller replacement.

Group	Parameter	Access	Units	Adjustment Range	Default Setting
Identity	Vendor	Read		—	Kohler Company
	Product	Read		—	RDC (38)
	Firmware Version	Read		—	—
Engine Metering	Engine Speed	Read	R/min	—	—
	Engine Target Speed	Read	R/min	—	—
	Battery Voltage	Read	V	—	—
	Lube Oil Temperature	Read	°C	—	—
	Genset Controller Temperature	Read	°C	—	—
Engine Speed Governor	Engine Speed Adjustment	Write		0–99	50
	Engine Speed Gain Adjustment	Write		0–99	50
Generator Metering	Generator Voltage L1-L2	Read	V	—	—
	Generator Frequency	Read	Hz	—	—
	Generator Metering Firmware Version	Read		—	—
Genset Info	Genset Model Number	Write		—	*
	Genset Serial Number	Write		—	*
	Alternator Part Number	Write		—	*
	Engine Part Number	Write		—	*
	Engine Model Number	Write		—	*
	Engine Serial Number	Write		—	*
	Genset State	Read		—	Off (0)
Genset Run Time	Genset Controller Total Operation Time	Read	h	—	—
	Engine Total Run Time	Read	h	—	—
	Engine Total Run Time Loaded	Read	h	—	—
	Engine Total Number Of Starts	Read		—	—
Genset Personality Profile	Engine Number Of Flywheel Teeth	Locked		—	—
	Engine Cooled Down Temperature	Locked	°C	—	65
	Engine Crank Disconnect Speed	Read	R/min	—	—
	Engine Run Speed	Locked	R/min	—	—
Genset System Configuration	Genset System Voltage	Write	V	110–600	*
	Genset System Frequency	Write	Hz	50/60	60
	Genset Voltage Phase Connection	Write		0–3	*
	Genset System Battery Voltage	Locked	V	12/24	12
	Measurement System	Write		English (0) Metric (1)	English (0)

* Factory set. Enter these numbers on a new controller after controller replacement.

Group	Parameter	Access	Units	Adjustment Range	Default Setting
Voltage Regulator	Voltage Regulator Average Voltage Adjustment	Write	V	108–660	*
	Voltage Regulator Volts Per Hertz Slope	Write	%	1–10	5
	Voltage Regulator Volts Per Hertz Cut In Frequency	Write	Hz	42–62	57.5
	Voltage Regulator Gain	Write		1–255	128
	Voltage Regulator Firmware Version	Read		—	—
Engine Timing	Engine Start Delay	Write	s	0–300	0
	Engine Cool Down Delay	Write	s	0–600	300
	Engine Crank On Delay	Write	s	10–30	15
	Engine Crank Pause Delay	Write	s	1–60	15
	Engine Number Of Crank Cycles	Write		1–6	3
Genset Protection	After Crank Disconnect Fault Inhibit Delay	Read	s	—	30
	Genset Low Battery Voltage Warning Delay	Read	s	—	90
	Genset High Battery Voltage Warning Delay	Read	s	—	10
	Genset Low Battery Voltage Warning Limit	Write	%	80–105	100
	Genset High Battery Voltage Warning Limit	Write	%	110–135	125
	Genset Battery Low Cranking Voltage Warning Delay	Read	s	—	6
	Genset Battery Low Cranking Voltage Warning Limit	Read	%	—	60
Engine Protection	Engine High Oil Temperature Shutdown Delay	Read	s	—	5
	Engine Low Oil Pressure Shutdown Delay	Read	s	—	5
	Engine Locked Rotor Shutdown Delay	Write	s	1–5	5
	Genset Low Engine Speed Shutdown Limit	Write	%	75–95	85
	Genset High Engine Speed Shutdown Limit	Write	%	105–120	115
Generator Protection	Loss Of AC Sensing Shutdown Delay	Read	s	—	3
	Genset Low Voltage Shutdown Delay	Write	s	5–30	10
	Genset High Voltage Shutdown Delay	Write	s	2–10	2
	Genset Low Voltage Shutdown Limit	Write	%	70–95	80
	Genset High Voltage Shutdown Limit	Write	%	105–135	120
	Genset Short Term Low Frequency Shutdown Delay	Read	s	—	10
	Genset Long Term Low Frequency Shutdown Delay	Read	s	—	60
	Genset High Frequency Shutdown Delay	Read	s	—	10
	Genset Low Frequency Shutdown Limit	Write	%	80–95	90
	Genset High Frequency Shutdown Limit	Write	%	102–140	110

* Factory set. Enter these numbers on a new controller after controller replacement.

Group	Parameter	Access	Units	Adjustment Range	Default Setting
ATS Metering Summary	ATS Contactor Position	Read		—	—
	ATS Sources Available	Read		—	—
Source 1 Metering	Source 1 Voltage L1-L2	Read	V	—	—
	Source 1 Voltage Average Line To Line	Read	V	—	—
ATS Connection Configuration	ATS Source	Read		—	—
Source 1 System Configuration	Source 1 System Voltage	Write	V	110–600	240
	Source 1 System Frequency	Write	Hz	48–62	60
	Source 1 Voltage Debounce Delay	Write	s	0.1–9.9	0.5
	Source 1 Low Voltage Pickup	Write	%	85–100	90
	Source 1 Low Voltage Dropout	Write	%	75–98	90
Source 1 Calibration	Source 1 Calibration Factor Voltage L1-L2	Write		0.65–1.5	1.0
Source 2 System Configuration	Source 2 Voltage Debounce Delay	Write	s	0.1–9.9	0.5
	Source 2 Low Voltage Pickup	Write	%	85–100	90
	Source 2 Low Voltage Dropout	Write	%	75–98	90
ATS Exercise	Exercise Interval	Write		Weekly (5) 2 Weeks (6)	Weekly (5)
	Exercise Run Duration	Write	min	10–30	20
	Exercise Mode	Write		Unloaded (1) Economy (2) Loaded (3)	Unloaded (1)
ATS Delays	ATS Transfer From Preferred Delay	Write	s	1–10	3
	ATS Transfer From Standby Delay	Write	s	1–600	120
	ATS Source 2 Engine Start Delay	Write	s	1–10	3
Network Configuration (for OnCue)	DHCP Enabled	Write		True/False	
	Static IP Address	Write		—	0.0.0.0
	Static Subnet Mask	Write			0.0.0.0
	Static Default Gateway	Write			0.0.0.0
	Static DNS Server 1	Write			0.0.0.0
	Static DNS Server 2	Write			0.0.0.0
	Server Host Name	Write			oncue.kohler.com
Network Status (for OnCue)	IP Address	Read			0.0.0.0
	Subnet Mask	Read			0.0.0.0
	Default Gateway	Read			0.0.0.0
	DNS Server 1	Read			0.0.0.0
	DNS Server 2	Read			0.0.0.0
	MAC Address	Read			—
	Connected Server IP Address	Read			0.0.0.0
	Network Connection Established	Read			—

Notes

Notes

Notes

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