Service

Residential/Light Commercial Generator Sets

Models:

38RCL
48RCL
48RCLA
60RCL

Controller:
RDC2

ISO 9001
KOHLER POWER SYSTEMS
NATIONALLY REGISTERED

KOHLER®
Power Systems

TP-6811 7/16d

Kohler strongly recommends that only factory-authorized distributors or dealers install and service the generator.

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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***.

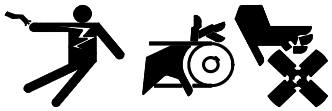
NOTICE

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) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

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.

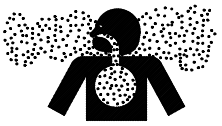
Combustible materials. A fire can cause severe injury or death. Generator set engine fuels and fuel vapors are flammable and explosive. Handle these materials carefully to minimize the risk of fire or explosion. Equip the compartment or nearby area with a fully charged fire extinguisher. Select a fire 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.

Engine Fluids and Chemical Products

Leaking or accumulated engine fluids. A fire can cause severe injury or death. Clean up engine fluids including fuel, oil, grease, and coolant. Determine the source of engine leaks and correct before starting the generator set. Keep the generator set area clean and remove combustible materials.

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. Never operate the generator set where exhaust gas could seep inside or be drawn into a potentially occupied building through windows, air intake vents, or other openings.

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.

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

⚠ WARNING

Hazardous voltage. Moving parts.
Can 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.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

This equipment must be installed and serviced by qualified electrical personnel.

⚠ 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 can 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.

Disconnecting the electrical load. Hazardous voltage can cause severe injury or death. Disconnect the generator set from the load by turning off the line circuit breaker or by disconnecting the generator set output leads from the transfer switch and heavily taping the ends of the leads. High voltage transferred to the load during testing may cause personal injury and equipment damage.

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

High voltage test. Hazardous voltage can 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 can 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).

Servicing the generator set when it is operating. Exposed moving parts can 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 can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage**.** Do not contact electrical connections with tools or jewelry while 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.

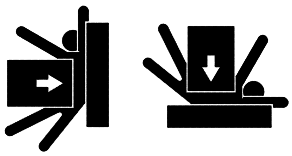
Welding on the generator set. Can cause severe electrical equipment damage. Before welding on the generator set perform the following steps: (1) Remove the battery cables, negative (–) lead first. (2) Disconnect all engine electronic control module (ECM) connectors. (3) Disconnect all generator set controller 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.

Testing live electrical circuits. Hazardous voltage or current can 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)

Testing the photo transistor circuit board. Hazardous voltage can cause severe injury or death. When the end cover is removed, do not expose the photo transistor circuit board mounted on the generator set end bracket to any external light source, as exposure to light causes high voltage. Keep foreign sources of light away from the photo transistor circuit board during testing. Place black electrical tape over the LED on the circuit board before starting the generator set.

Heavy Equipment

⚠ WARNING



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

Do not lift the generator set from the engine or alternator eyes. Never stand under a unit being lifted. Always maintain a safe distance from the unit being lifted.
See the lifting instructions in the installation manual that was provided with the unit.

Hot Parts

⚠ WARNING

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

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

⚠ 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.

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.

Notes

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 48RCL

List of Related Materials

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

Literature Type	Part Number
Specification Sheet, 38RCL	G4-214
Specification Sheet, 48RCL	G4-211
Specification Sheet, 48RCLA	G4-263
Specification Sheet, 60RCL	G4–233
Installation Manual, Generator Set	TP-6809
Operation Manual, Engine	TP-6101
Operation Manual, Generator Set	TP-6810
Service Manual, 38RCL Engine Mechanical	TP-6103
Service Manual, 48RCL/48RCLA/60RCL Engine Mechanical	TP-6104
Service Manual, Engine ECM Diagnostics	TP-6724
Service Manual, Alternator, 38RCL	TP-6353
Service Manual, Alternator, 48RCL/48RCLA/60RCL	TP-6783
Parts Catalog, 38RCL Engine	TP-6730
Parts Catalog, 48RCL/48RCLA/60RCL Engine	TP-6731
Parts Catalog, Generator Set	TP-6812
Installation Instructions, Programmable Interface Module (PIM)	TT-1584
Installation Instructions, Block Heaters	TT-1587
Instructions, Load Shed Kit	TT-1609
Instructions, Firmware Update Using USB Utility	TT-1636
Operation/Installation Manual, RXT ATS	TP-6807
Operation/Installation Manual, RDT ATS	TP-6345
User Guide, OnCue® Plus Program	TP-7006
Technical Manual, OnCue® Plus Program	TP-7007

Figure 2 Related Literature

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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North China Regional Office, Beijing
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(86) 10 6518 7952
Fax: (86) 10 6518 7955

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

The generator sets covered in this manual are equipped with the RDC2 controller. For a specific description of the controller, see the generator set operation manual.

Environmental Specifications	RDC2 Controller
Operating temperature	-30° to 70°C
Storage temperature	-40° to 85°C
Humidity	5–95% condensing
Voltage Requirements	
Controller operation	12 VDC
Built-in battery charger	120 VAC

1.3 Engine Service

Model 38RCL generator sets are equipped with 4-cycle, six-cylinder, liquid-cooled General Motors engines.

Model 48RCL, 48RCLA, and 60RCL generator sets are equipped with 4-cycle, eight-cylinder, liquid-cooled General Motors engines.

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

1.4 Engine Specifications

Selected engine specifications are shown on the generator set specification sheets. For additional engine specifications, refer to the engine Service Manuals. See the List of Related Materials in the Introduction section.

1.5 Alternator Specifications

Selected alternator specifications are shown on the generator set specification sheets and also shown in the table below. Consult the alternator service manual for additional specifications. See the List of Related Materials in the Introduction section.

Alternator Specifications	38RCL	48RCL 48RCLA	60RCL
Manufacturer	Kohler		
Exciter type	Brushless, Permanent Magnet	Brushless, Rare-Earth Permanent Magnet	Brushless, Rare-Earth Permanent Magnet
Alternator type:			
4 leads, 120/240 VAC	4Q5	4Q7BX	4Q10X
12 leads, Reconnectable	4P5	4P7BX	4P10X
Voltage regulator	Solid State, Volts/Hz		
Insulation:	NEMA MG1		
Material	Class H		
Temperature rise	130°C, Standby		
Bearing: quantity, type	1, Sealed		
Coupling	Flexible Disc		
Amortisseur windings	Full		
Voltage regulation, no-load to full-load	±1% RMS		
Unbalanced load capability	100% of Rated Standby Current		
One-step load acceptance	100% of Rating		

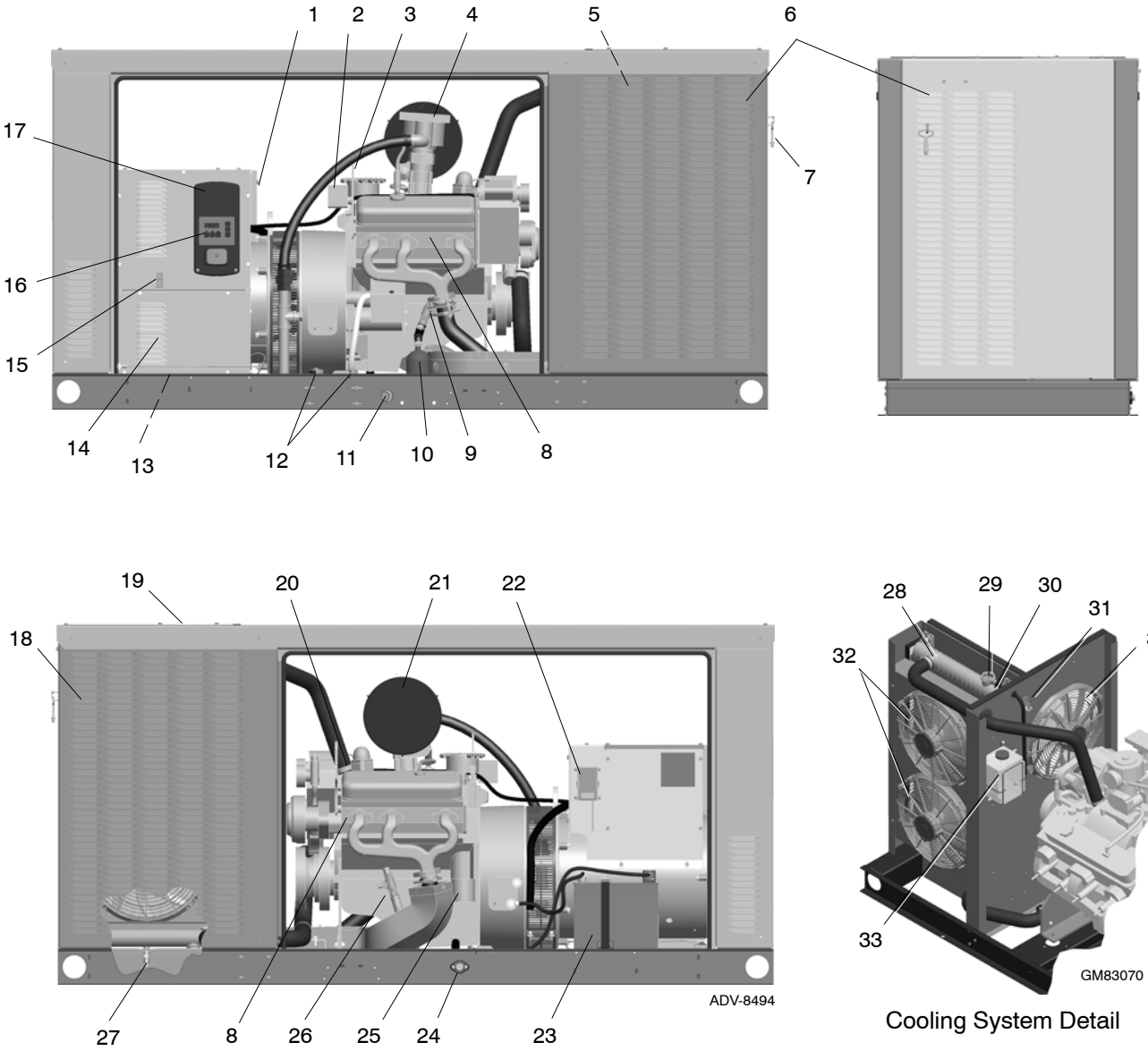
1.6 Torque Specifications

For alternator assembly torque specifications, refer to the alternator service manual.

For engine assembly torque specifications, refer to the engine service manual.

See the List of Related Materials in the Introduction section for document part numbers.

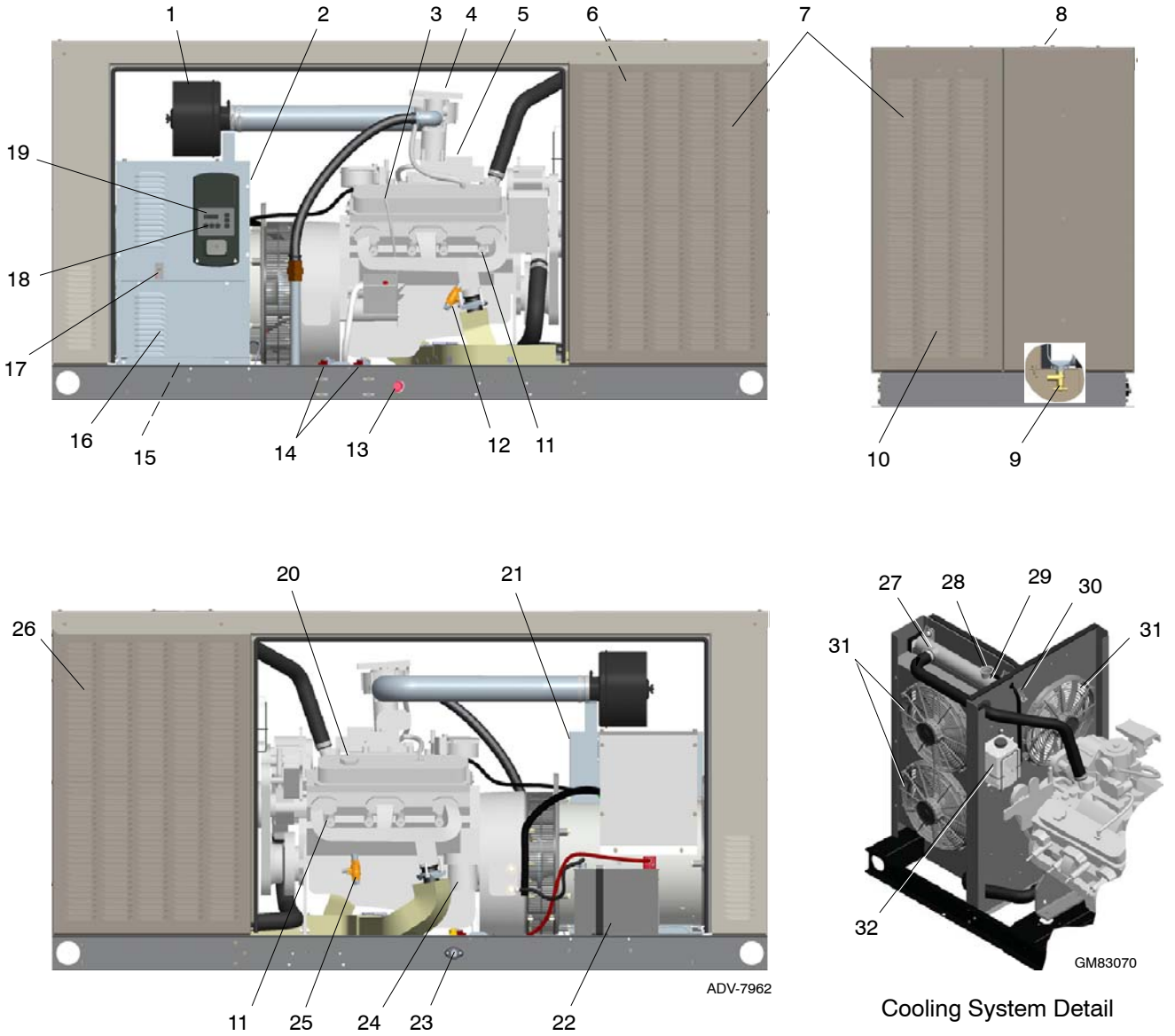
1.7 Service Views



Cooling System Detail

1. Nameplate location
2. Engine fuses
3. Oil check (dipstick)
4. Engine ECM and EPR (electronic fuel pressure regulator)
5. See cooling system detail
6. Exhaust outlet
7. Enclosure locking key (shipping location only)
8. Spark plugs
9. Block heater connection valve
10. Block heater (optional)
11. Fuel inlet (1 in. NPT)
12. Fuel solenoid valves (two required for UL 2200)
13. Customer load lead access
14. Customer connection access panel
15. Line circuit breaker
16. Generator set master control buttons (on RDC2 controller)
17. RDC2 controller
18. Cooling air inlet (remove this panel to access coolant drain)
19. Access to coolant fill
20. Oil fill (on valve cover)
21. Air cleaner
22. Fan fuses
23. Battery
24. Oil drain valve
25. Lube oil filter
26. Block heater connection valve
27. Coolant drain
28. Radiator
29. Pressure cap (engine coolant fill)
30. Coolant overflow tube
31. Engine compartment temperature sensor
32. Fans (qty. 3)
33. Coolant overflow bottle

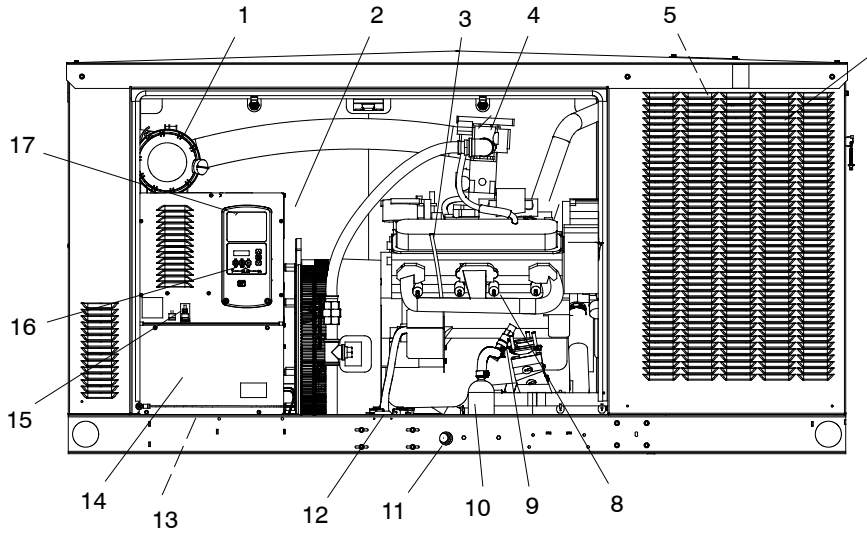
Figure 1-1 Service Views, Model 38RCL



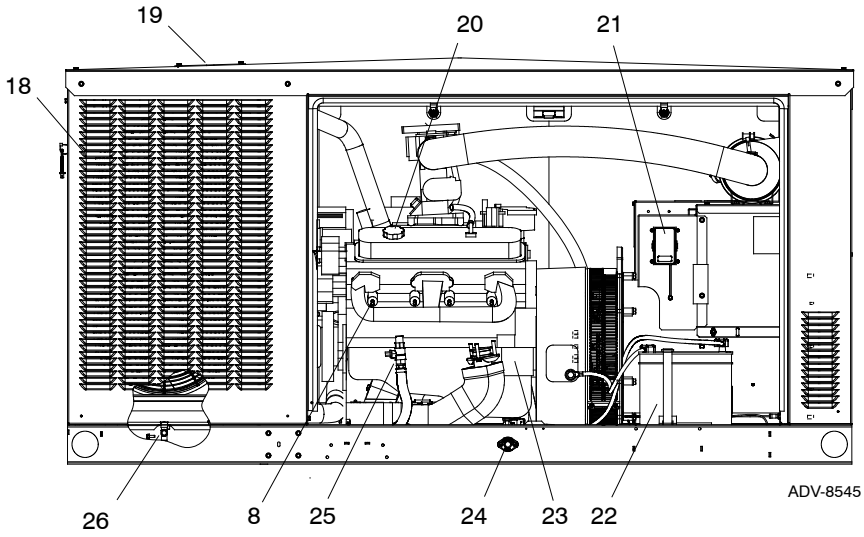
Cooling System Detail

1. Air cleaner
2. Nameplate location
3. Oil check (dipstick)
4. Engine ECM and EPR (electronic fuel pressure regulator)
5. Engine fuses
6. See cooling system detail
7. Exhaust outlet
8. Coolant fill access
9. Coolant drain
10. Coolant drain access panel
11. Spark plugs
12. Block heater connection valve
13. Fuel inlet (1 in. NPT)
14. Fuel solenoid valves (two required for UL 2200)
15. Customer load lead access
16. Customer connection access panel
17. Line circuit breaker
18. Generator set master control buttons (on RDC2 controller)
19. RDC2 controller
20. Oil fill (on valve cover)
21. Fan fuses
22. Battery
23. Oil drain valve
24. Lube oil filter
25. Block heater connection valve
26. Cooling air inlet
27. Radiator
28. Pressure cap (engine coolant fill)
29. Coolant level sensor location
30. Engine compartment temperature sensor
31. Fans (qty. 3)
32. Coolant overflow bottle

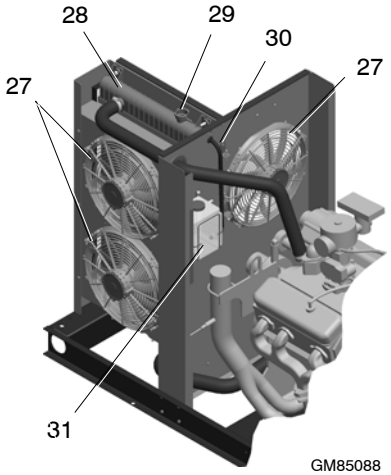
Figure 1-2 Service Views, Model 48RCL



SERVICE SIDE



NON-SERVICE SIDE



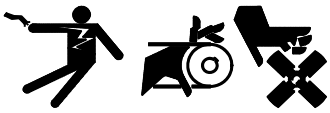
Cooling System Detail

1. Air cleaner
2. Nameplate location
3. Oil check (dipstick)
4. Engine ECM and EPR (electronic fuel pressure regulator)
5. See cooling system detail
6. Exhaust outlet
7. Enclosure locking key (shipping location only)
8. Spark plugs (4 on each side)
9. Block heater connection valve
10. Block heater (optional)
11. Fuel inlet (1 in. NPT)
12. Fuel solenoid valves (two required for UL 2200)
13. Customer load lead access
14. Customer connection access panel
15. Load circuit breaker
16. Generator set master control buttons (on RDC2 controller)
17. RDC2 controller
18. Cooling air inlet (remove this panel to access coolant drain)
19. Access to coolant fill
20. Oil fill (on valve cover)
21. Fan fuses
22. Battery
23. Lube oil filter
24. Oil drain valve
25. Block heater connection valve
26. Coolant drain
27. Fans (qty. 3)
28. Radiator
29. Pressure cap (engine coolant fill)
30. Coolant overflow tube
31. Coolant overflow bottle

Figure 1-3 Service Views, Models 48RCLA and 60RCL

2.1 General Maintenance

⚠ 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 connected equipment, 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.

⚠ WARNING

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

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

Servicing the generator set when it is operating. Exposed moving parts can 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.

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.

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 distributor/dealer perform generator set service.

Engine Service. Perform generator set engine service at the intervals specified by the engine operation manual.

Generator Set Service. Perform generator set service at the intervals specified by the generator set operation manual.

Routine Maintenance. Refer to the following generator set service schedule, the engine service schedule, and the runtime hours shown on the RDC2 controller to determine when to schedule routine maintenance. Service generator sets that are subject to extreme weather or dusty or dirty conditions more frequently.

Maintenance and Service Parts. Obtain maintenance and service parts from an authorized Kohler distributor/dealer.

2.2 Service Schedule

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

Operation	Daily	Every 100 Hr.	Every 150 Hr.	Every 400 Hr.	Every 1000 Hr.	Every 1500 Hr.	Every 2000 Hr.	As Req'd
GENERAL MAINTENANCE								
Check for fluid leaks	X							
Check coolant level *	X							
Check engine oil level	X							
Check all bolts and nuts for tightness ‡	X						X	X
Change engine oil and filter †			X					
Check fuel system for leaks ‡							X	
Check belts and belt tension					X			
Inspect wiring for cuts, abrasions, or corrosion							X	
Inspect vacuum lines and fittings							X	
AIR INTAKE SYSTEM								
Inspect and clean air cleaner element †			X					X
Replace air cleaner element †				X				X
Check air induction for leaks					X			
Check intake manifold for vacuum leaks					X			
COOLING SYSTEM								
Inspect and clean radiator exterior ‡		X						X
Replace engine coolant §					X			
Inspect coolant hoses					X			
ELECTRICAL SYSTEM								
Check battery charge and fluid level ‡		X						X
Inspect electrical system							X	
Clean battery cables ‡								X
EXHAUST SYSTEM								
Inspect exhaust manifold for leaks							X	
Inspect exhaust piping for leaks							X	
Check HEGO (oxygen) sensor connections and wires							X	
FUEL SYSTEM								
Check fuel shutoff valve for leaks and function							X	
Check fuel regulator pressure							X	
Test fuel lines for leaks							X	
Inspect/drain vaporizer for oil buildup							X	
IGNITION SYSTEM								
Check spark plug wires for cuts, abrasions, or hardening					X			
Clean secondary ignition coil wires					X			
Replace distributor cap and rotor							X	
Replace spark plugs				X		X		
Replace spark plug wires							X	

* Check engine coolant condition and protection, hoses, and clamps annually (prior to cold weather).
† More frequent intervals may be required in dusty or dirty operating conditions.
‡ Seasonal or as required.
§ Long-life coolant is recommended. When long-life coolant is used, the change interval is 5000 hours or 5 years. Do not mix coolant types.

2.3 Lubrication System

2.3.1 Oil Specifications

Use oil that displays the American Petroleum Institute (API) Starburst certification mark FOR GASOLINE ENGINES on the container. Do not use straight-weight oils recommended for industrial or stationary engines. CC or CD classification oils, even when labeled Heavy Duty or For Natural Gas Engines are not acceptable.

Multi-viscosity oils are recommended. Figure 2-1 shows the recommended Society of Automotive Engineers (SAE) viscosity designation for a given operating temperature.

Ambient Temperature	Engine Oil Type
–18°C (0°F) and above	SAE 10W-30
Below –18°C (0°F)	SAE 5W-30

Figure 2-1 Engine Oil Selection

2.3.2 Oil Check

Check the oil level in the crankcase every 24 hours of operation or before the engine is started each day. Do not check the oil level while operating the unit. Stop the generator set and keep the generator set level to get an accurate reading. To check the oil level, remove the dipstick and wipe the end clean. Reinsert the dipstick and wait at least 30 seconds. Remove the dipstick and check the level. Maintain the oil level between the Full and Add marks on the dipstick, as shown in Figure 2-2. See Section 1, Service Views for the dipstick location.

Note: Do not operate the set if the oil level is below the Add mark or above the Full mark on the dipstick.

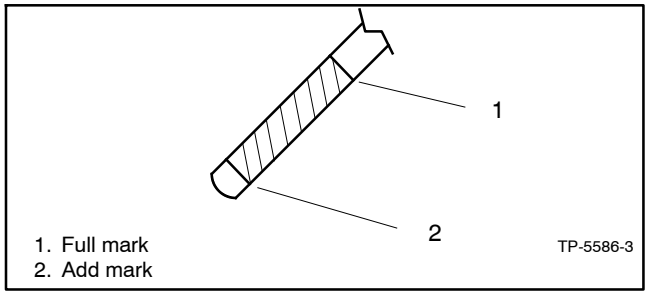


Figure 2-2 Oil Level Check

2.3.3 Oil Additions

Adding some oil between oil changes is normal. The amount varies with generator set usage. Open the oil fill cap and pour in a small amount of oil using a funnel or other suitable pouring device. See Section 1, Service Views, for the oil check and oil fill locations.

2.3.4 Oil and Filter Change

Change the oil according to the service schedule or before generator set storage. Change the oil more frequently if the generator set operates under dirty, dusty conditions. Change the oil while the engine is still warm. See Section 1, Service Views, for oil fill, oil check, and oil filter locations.

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

Note: Reset the maintenance timer on the RDC2 controller after changing the oil.

Oil Change Procedure

Whenever possible, drain the oil while it is still warm.

1. **Drain the oil.**
   a. Press the OFF button on the RDC2 generator set controller.
   b. Disconnect the power for the battery charger.
   c. Disconnect the generator set engine starting battery, negative (–) lead first.
   d. Remove the housing side panel.
   e. Remove the plug from the oil drain fitting and install a drain hose.
   f. Open the oil drain valve on the engine.
   g. Allow time for the engine oil to drain completely.
   h. Close the oil drain valve.
   i. Replace the oil drain plug.
2. **Replace the oil filter.**
   a. Remove the oil filter by rotating it counterclockwise with an oil filter wrench.
   b. Clean the contact 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.** See Figure 2-1 for oil selection and Figure 2-3 for oil capacity.

Model	Oil Capacity, L (qt.)
38/48/60RCL and 48RCLA	4.7 (5.0)

Figure 2-3 Oil Capacity

4. **Check for leaks.**

   a. Press the OFF button on the RDC2 generator set controller.

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

   c. Reconnect the power for the battery charger.

   d. Start the generator set and check for leaks around the oil filter.

   e. Stop the generator set and tighten the oil filter to stop any leaks.

   f. Reinstall the housing side panel.

5. **Stop the generator set.** Check the oil level. Add oil, as necessary, to bring the level up to the Full mark.

   Note: Too high an oil level causes high oil consumption and engine carbonizing. Too low a level damages the engine.

6. **Reset the maintenance timer on the RDC2.**

   a. In the Overview menu, step down to the Next Maintenance screen.

   b. Press the Select button.

   c. Press the Up arrow button so that Reset Maint Timer? Yes is displayed.

   d. Press the Select button. The next maintenance interval and date will be displayed.

2.4 Air Cleaner

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

At the interval specified in the service schedule, inspect and clean or replace the air cleaner element. Clean the element more frequently in dirty, dusty conditions. Check the element for accumulated oil or dirt that could cause poor performance. Replace a damaged air cleaner element. Follow the procedure described below.

Air Cleaner Service Procedure

A dry-type air cleaner silences and filters the intake air. The air intake silencer assembly connects to the intake manifold via a rubber hose. Refer to Figure 2-4 during this procedure.

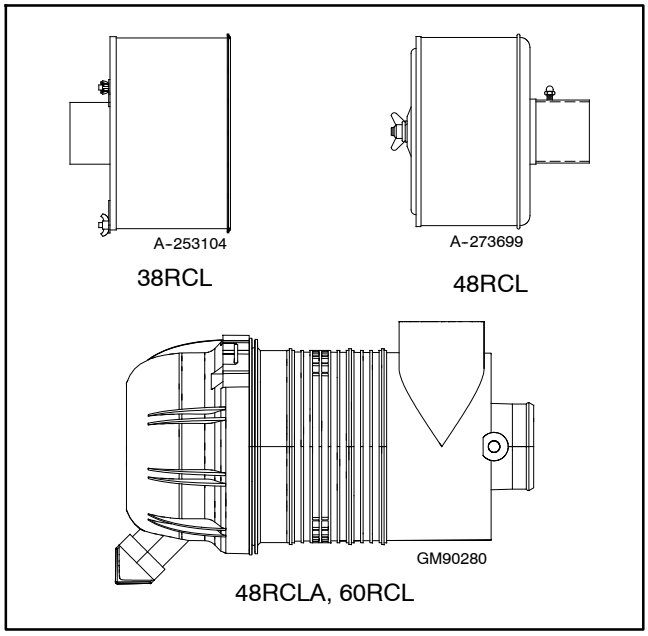


Figure 2-4 Air Cleaners

1. Remove the cover from the air cleaner housing.

2. Remove the air cleaner element.

3. Examine the element and housing for damage. Replace the element and housing if damaged.

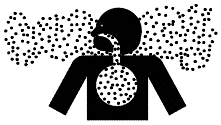
4. Tap the element lightly against a flat surface to dislodge loose surface dirt. Do not clean the element in any liquid or use compressed air as these will damage the filter element. Replace the element and precleaner at the intervals shown in the service schedule.

5. Wipe the cover and housing with a clean rag to remove dirt. Make sure the sealing surfaces fit correctly.

6. Replace the air cleaner cover.

2.5 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. Never operate the generator set where exhaust gas could seep inside or be drawn into a potentially occupied building through windows, air intake vents, or other openings.

Carbon monoxide detectors. Carbon monoxide can cause severe nausea, fainting, or death. Install carbon monoxide detectors on each level of the building. 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.

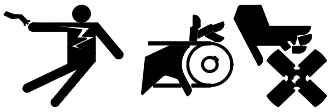
At the interval specified in the service schedule, inspect the exhaust system components (exhaust manifold, exhaust outlet, exhaust line, exhaust clamps, and muffler) for cracks, leaks, and corrosion.

Exhaust System Inspection Points

- Check for corroded or broken metal parts and replace them as needed.
- Check that the exhaust outlet is unobstructed.
- Check the exhaust gas color. If the exhaust is blue or black, contact your local authorized Kohler distributor/dealer.
- Visually inspect for exhaust leaks *(blowby)*. Check for carbon or soot residue on exhaust components. Carbon and soot residue indicates an exhaust leak. Seal leaks as needed.
- Check that all covers and doors are undamaged, in place, and locked.
- Check for the installation and operation of carbon monoxide (CO) detectors on each level of any building near the generator set.

2.6 Ignition System

⚠ 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 connected equipment, 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.

Service the spark plugs at the interval specified in the service schedule using the following procedure.

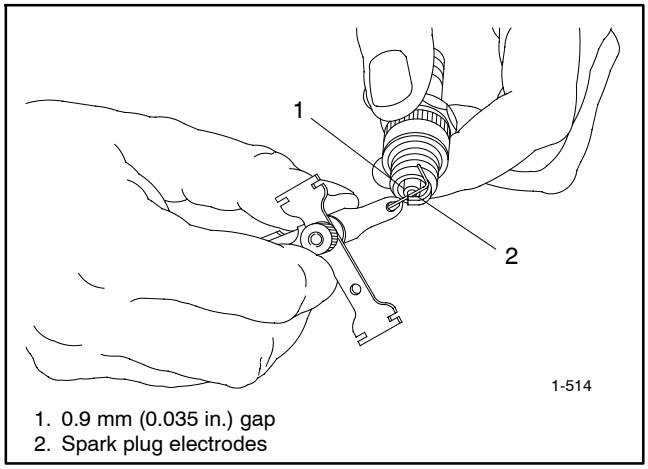
1. Press the OFF button on the RDC2 controller.
2. Disconnect the power to the battery charger.
3. Disconnect the generator set engine starting battery, negative (-) lead first.
4. Remove spark plug wires by grasping the spark plug boot and turning slightly while pulling. Do not pull the wire. Pulling on the wire rather than the boot may damage the wire or terminal.
5. Loosen the spark plug with a ratchet and 5/8-in. spark plug socket with a rubber insert to prevent spark plug damage.
6. Use compressed air to remove dirt from around each spark plug to prevent dirt particles from falling into the combustion chamber.
7. Remove spark plugs, one at a time, and examine. Identify a normal spark plug in good operating condition by observing a light tan or gray deposit on firing tip. See Figure 2-7 to evaluate engine condition by color/condition of a problem spark plug.
8. Clean spark plugs by wiping them with a rag. File the center electrode to keep it parallel to the side electrode.

   Note: Do not sandblast, wire brush, scrape, or otherwise service spark plugs in poor condition. Obtain a new plug for best results.

9. Check the spark plug gap before installing any spark plug. See Figure 2-5 and Figure 2-6. Attain a correct gap when the feeler (or wire) passes between the spark plug electrode. It should pass easily but with some resistance or drag; otherwise adjust as necessary.

Model	Spark plug gap
38/48/60RCL and 48RCLA	0.9 mm (0.035 in.)

Figure 2-5 Recommended Spark Plug Gap



1. 0.9 mm (0.035 in.) gap
2. Spark plug electrodes

Figure 2-6 Spark Plug Gap Inspection

10. Use a gapping tool to gently bend the side electrode closer to or farther from the center electrode to set the correct gap. See Figure 2-8. Position the side electrode directly over the center electrode.

Problem/Condition	Means of Identification	Possible Cause/Solution
Gap-bridged spark plug	Built-up deposits and gap between electrodes closing.	Oil or carbon fouling. Clean and regap the spark plug.
Oil-fouled spark plug	Wet, black deposits on the insulator shell, bore, and electrodes.	Excessive oil entering combustion chamber through worn rings and pistons, excessive clearance between valve guides and stems, or worn or loose bearings. Replace the spark plug.
Carbon-fouled spark plug	Black, dry, fluffy carbon deposits on insulator tips, exposed shell surfaces and electrodes.	Incorrect spark plug, weak ignition, clogged air intake, overrich fuel mixture, or excessive no-load operation. Clean and regap the spark plug.
Lead-fouled spark plug	Dark gray, black, yellow, or tan deposits; or a glazed coating on the insulator tip.	Caused by highly leaded fuel. Replace the spark plug.
Pre-ignition damaged spark plug	Melted electrodes and possibly blistered insulator. Metallic deposits on insulator suggest internal engine damage.	Wrong type of fuel, incorrect timing or advance, too hot a plug, burned valves, or engine overheating. Replace the spark plug.
Overheated spark plug	White or light gray insulator with small black or gray/brown spots with bluish (burned) appearance on electrodes.	Engine overheating, wrong type of fuel, loose spark plugs, too hot a plug, low fuel pressure or incorrect ignition timing. Replace the spark plug.
Worn spark plug	Severely eroded or worn electrodes.	Caused by normal wear and failure to replace spark plug at prescribed interval. Replace the spark plug.

Figure 2-7 Engine Evaluation Using Spark Plug Condition

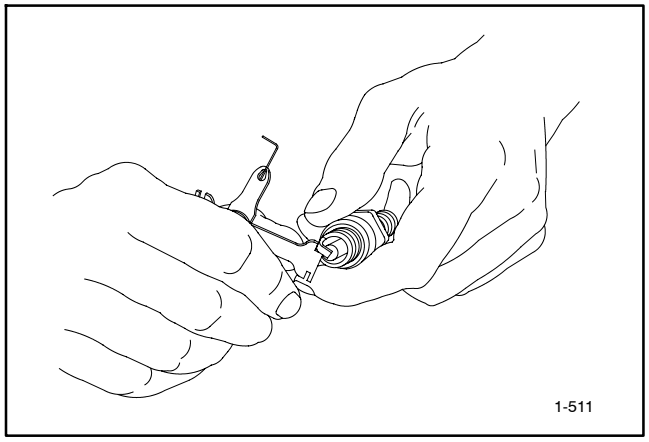


Figure 2-8 Spark Plug Gap Adjustment

11. Reinstall the spark plug. Do not bump the electrode against the cylinder head. Rotate the spark plug clockwise until you feel resistance.

12. Use a torque wrench to torque each spark plug to 15 Nm (11 ft. lbs.). Otherwise, hand-tighten the spark plug until you feel resistance.

13. Use a ratchet wrench to final tighten an additional 1/4 turn. Do not overtighten, as doing so may strip the threads or alter the electrode gap setting.

14. Check the spark plug wire connector in the boot for accumulated dirt, grease, and other debris, and clean as necessary.

15. Firmly push the spark plug boot onto the spark plug.

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

17. Reconnect the power for the battery charger.

2.7 Battery

Consult the battery manufacturer's instructions regarding battery care and maintenance.

⚠ 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.

2.7.1 Checking Electrolyte Level

Check the electrolyte level of batteries with filler caps monthly. Remove filler caps and verify that electrolyte level reaches bottom of filler holes. Refill as necessary with distilled water. DO NOT add fresh electrolyte. Tighten all filler caps. If water is added during freezing temperatures, run the generator set for 20–30 minutes to mix the electrolyte and water to prevent battery damage from freezing.

2.7.2 Checking Specific Gravity

Use a battery hydrometer to check the specific gravity of the electrolyte in each battery cell. While holding the hydrometer vertically, read the number on the glass bulb at the top of the electrolyte level or the number adjacent to the pointer. If the hydrometer used does not have a correction table, use the correction factors in Figure 2-11. Determine specific gravity and electrolyte temperature of battery cells. Locate temperature in Figure 2-11 and adjust the specific gravity by the amount shown.

The battery is fully charged if the specific gravity is 1.260 at an electrolyte temperature of 80°F (26.7°C). The difference between specific gravities of each cell should not exceed ±0.01. Charge the battery if the specific gravity is below 1.215 at an electrolyte temperature of 80°F (26.7°C). See Figure 2-9.

Specific Gravity, Corrected to 80°F (26.7°C)	Battery Condition
Below 1.215	Needs charging
1.260	Fully charged

Figure 2-9 Specific Gravity Interpretation

Some battery testers have four or five beads in the test tube. Draw electrolyte into the tube as performed with the battery hydrometer described previously. Use the manufacturer's instructions. Figure 2-10 interprets typical test results.

Number of Floating Beads	Battery Condition
5	Overcharged
4	Fully charged
3	Good charge
1 or 2	Low charge
0	Dead battery

Figure 2-10 Bead-Type Test Interpretation

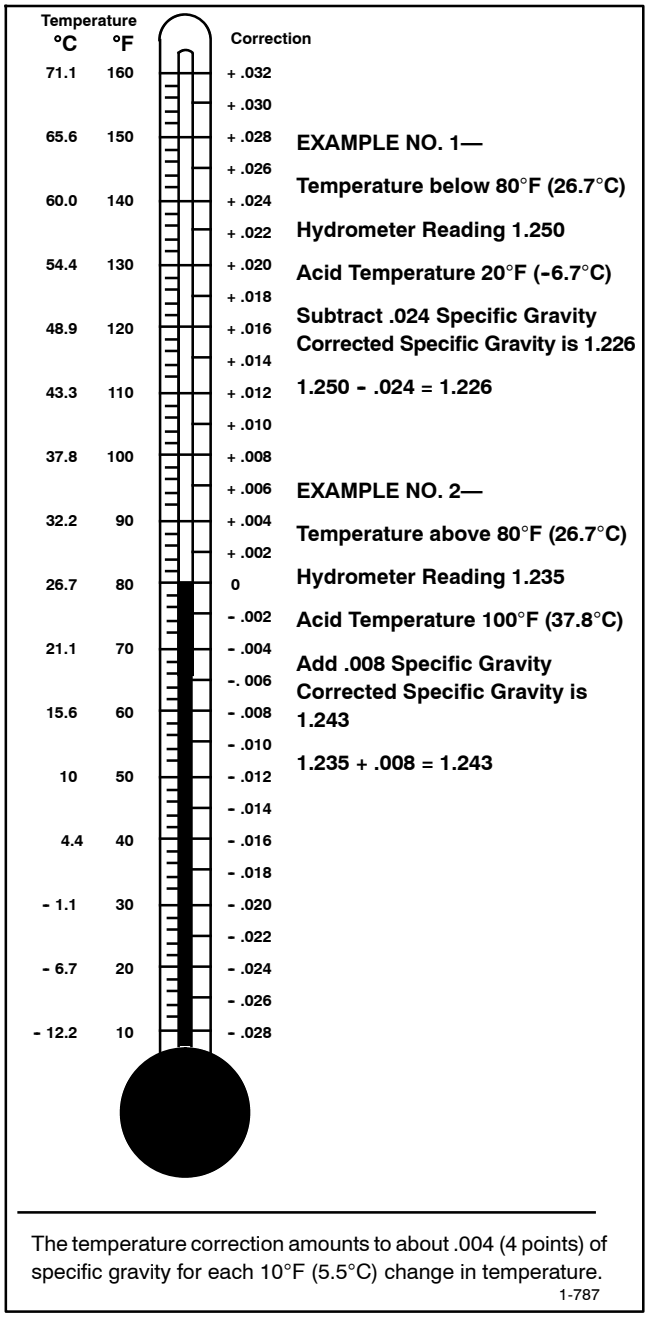


Figure 2-11 Specific Gravity Temperature Correction

2.8 Fuel System Maintenance

⚠ 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.

Routine service items include draining water/sediment from piping at petcock or pipe end cap, checking for fuel leakage at pipe connections, checking flexible sections for cracking or chafing, and keeping components clean including fuel regulator vent holes.

A grease or wax residue tends to accumulate in the piping and fuel regulators over time. If fuel system problems persist, disassemble the fuel system components and check for residue buildup. Remove any residue with a brush and mild detergent.

3.1 Introduction

The RDC2 controller manages the operation of the generator set, a Model RXT transfer switch (if equipped), an optional Programmable Interface Module (PIM) and an optional load management device. See the generator set Operation Manual for controller operation instructions.

This section covers adjustment and replacement of the RDC2 controller. See Section 5 for troubleshooting procedures.

See the service view and Figure 3-3 for the controller location.

3.2 SiteTech Software

Many procedures in this manual require the use of a personal computer (or laptop) with Kohler® SiteTech™ software to change controller settings or update firmware. SiteTech software is available to Kohler-authorized distributors and dealers. See the SiteTech Operation Manual, TP-6701, for general software operation instructions.

Use a USB cable to connect the personal computer directly to the device. See Figure 3-2. The USB cable must have a male USB A connector on one end and a male mini-B connector on the other and must be less than 5 m (16.4 ft.) long. See Figure 3-1.

Figure 3-1 USB Cable

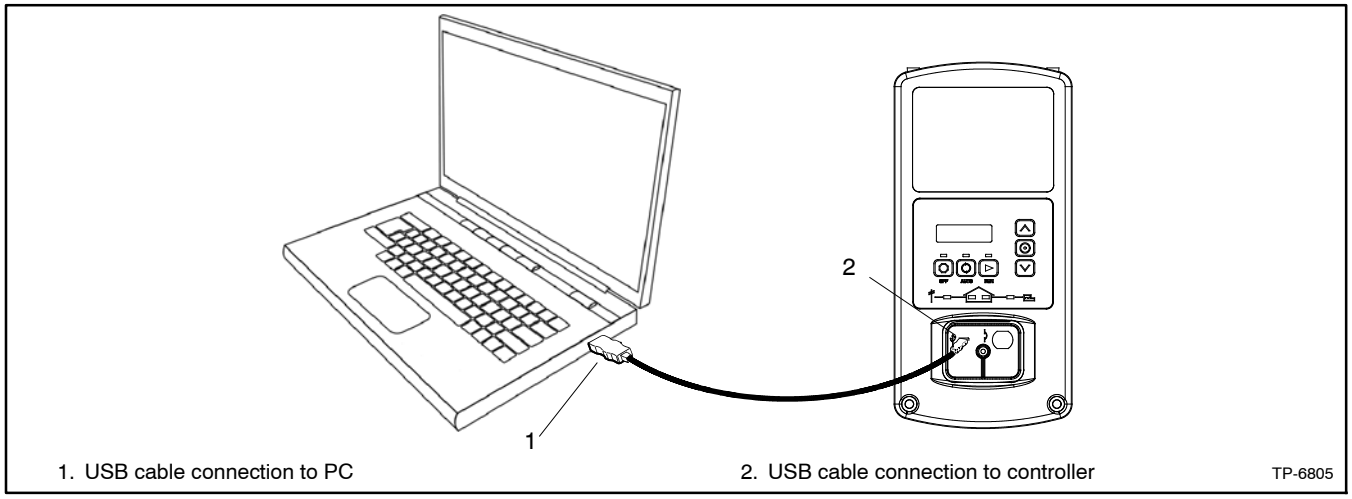
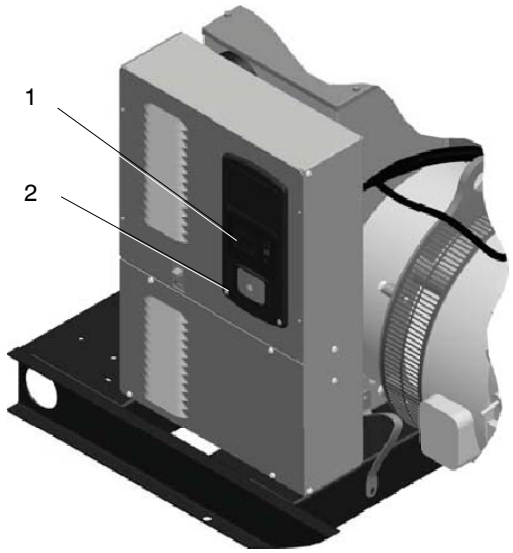


Figure 3-2 USB Connection (RDC2 controller shown)

3.3 Controller Parameters

Adjustable parameter settings can be changed using a personal computer (or laptop) with Kohler® SiteTech™ software. See Section 3.2, SiteTech Software, for USB connection information. See the SiteTech Operation Manual, TP-6701, for general software operation instructions.

Some settings can also be changed at the controller. See the generator set operation manual for instructions to navigate through the controller menus and change settings.



1. Controller
2. Controller mounting screws (qty. 2)

Figure 3-3 Controller Location

3.3.1 Controller Parameters Table

The table on the following pages lists controller parameters that are visible in SiteTech. Settings marked Read Only are not user-adjustable.

Some parameters that are visible in SiteTech do not apply to all models. Those parameters are marked in the last column, and the line in the table is shaded gray.

The table indicates the following:

- Factory default settings
- Adjustment range for adjustable settings

  Note: Some settings are not user-adjustable.
- Units for the setting (e.g. RPM)
- The group in SiteTech that contains the parameter.

3.3.2 Notes on Selected Parameters

Genset Info

Model numbers and serial numbers are factory-set for each unit. If the controller is replaced, the genset model number and serial number will need to be entered by the installer. For the genset model number, select 38RCL, 48RCL, 48RCLA, or 60RCL from the dropdown list. Find the generator set serial number on the nameplate and enter it using SiteTech. See Section 3.5, Controller Replacement, for information about other setup required on a replacement controller.

Changing the genset model number will update the engine model number automatically. Select the genset model number and then click Apply Changes in SiteTech to see the updated engine model number.

Genset Fuel Type

The Genset Fuel Type setting is located in the Genset System Configuration group in SiteTech. Generator set power and current ratings are different for different fuel types (natural gas or LP). The fuel type setting is available with controller firmware versions 4.5 and higher.

Changing the Genset Fuel Type setting automatically updates the Genset Power Rating and Genset Rated Current settings. The power rating is used to determine setpoints for the optional load management device. If a load management device is connected and the generator set is converted to a different fuel, use SiteTech to change the Genset Fuel Type setting.

ECM Model

Do not change the ECM Model setting (located in the Genset Personality Profile group). Changing the ECM model to the wrong setting can damage the controller.

Genset Voltage Phase Connection

The Genset Voltage Phase Connection setting appears in the Genset System Configuration group in SiteTech. A dropdown list allows selection of one of four possible configurations:

- Single phase
- Single phase dogleg
- Three phase wye
- Three phase delta

If the alternator is reconnected to a different voltage/phase configuration than the original factory setup, select the appropriate new configuration from the dropdown list. See the generator set Installation Manual for reconnection instructions.

Digital Inputs and Outputs

Digital inputs and outputs are available only if the optional Programmable Interface Module (PIM) is connected to the RDC2 controller. One PIM provides two digital inputs and 6 digital outputs.

Dropdown menus allow selection of the digital input and output events. Be sure to select Digital Inputs B1–B2 and Digital Outputs B1–B6 in SiteTech. Digital Inputs A1–A2 and Digital Outputs A1–A2 do not apply to the PIM. Digital outputs B7–B12 are reserved for the load management device and cannot be changed by the user. These outputs will display LCM relay status.

Refer to Installation Instruction Sheet TT-1584, provided with the PIM, for information about the input and output events.

RBUS Devices

A maximum of three RBUS devices, including one Model RXT transfer switch, one programmable interface module (PIM), and/or one load management device, can be connected to the generator set. RBUS devices 4 through 8 appear in SiteTech but do not apply to the generator set models covered in this manual at the time of publication.

RBUS devices are numbered according to the device serial numbers, which are read by the RDC2 controller. RBUS Device B1 is the RXT transfer switch, PIM or load management device with the lowest serial number. Look at the RBUS device type to determine which device is B1, B2, or B3.

Temperature Settings

In SiteTech, all temperature settings are shown in degrees F but stored as degrees C. When you highlight a parameter value (click it), the °F value changes to the equivalent °C value. Enter temperature settings in °F. The new setting is calculated from a conversion equation, so the final value may include some rounding that makes the setting higher or lower by 1 degree.

SiteTech Group	Parameter	Units	Adjustment Range *	Default Setting	Notes †
Identity	Vendor		Read Only	Kohler Company	
Identity	Product		Read Only	RDC 2	
Identity	Firmware Version		Read Only	N/A	
Engine Metering	Engine Speed	R/min	Read Only	N/A	
Engine Metering	Engine Target Speed	R/min	Read Only	N/A	
Engine Metering	Engine Oil Pressure	kPa	Read Only	N/A	
Engine Metering	Engine Coolant Temperature	°C	Read Only	N/A	
Engine Metering	Battery Voltage	V	Read Only	N/A	
Engine Metering	Lube Oil Temperature	°C	Read Only	N/A	
Engine Metering	Genset Controller Temperature	°C	Read Only	N/A	
Engine Metering	Engine Low Oil Pressure Switch		Read Only	N/A	
Engine Metering	Engine Compartment Temperature	°C	Read Only	N/A	
Engine Speed Governor	Engine Speed Adjustment		0 – 99 See Section 3.3.2.	50	
Engine Speed Governor	Engine Speed Gain Adjustment		No effect.	50	N/A
Generator Metering	Generator Rotation Actual		Read Only	N/A	
Generator Metering	Generator Current Lead/Lag L1		Read Only	N/A	
Generator Metering	Generator Current Lead/Lag L2		Read Only	N/A	
Generator Metering	Generator Current Lead/Lag L3		Read Only	N/A	
Generator Metering	Generator Current Total Lead/Lag		Read Only	N/A	
Generator Metering	Generator Power Factor L1		Read Only	N/A	
Generator Metering	Generator Power Factor L2		Read Only	N/A	
Generator Metering	Generator Power Factor L3		Read Only	N/A	
Generator Metering	Generator Total Power Factor		Read Only	N/A	
Generator Metering	Generator Apparent Power L1	VA	Read Only	N/A	
Generator Metering	Generator Apparent Power L2	VA	Read Only	N/A	
Generator Metering	Generator Apparent Power L3	VA	Read Only	N/A	
Generator Metering	Generator Total Apparent Power	VA	Read Only	N/A	
Generator Metering	Generator Reactive Power L1	VAR	Read Only	N/A	
Generator Metering	Generator Reactive Power L2	VAR	Read Only	N/A	
Generator Metering	Generator Reactive Power L3	VAR	Read Only	N/A	
Generator Metering	Generator Total Reactive Power	VAR	Read Only	N/A	
Generator Metering	Generator True Power L1	W	Read Only	N/A	
Generator Metering	Generator True Power L2	W	Read Only	N/A	
Generator Metering	Generator True Power L3	W	Read Only	N/A	
Generator Metering	Generator True Total Power	W	Read Only	N/A	
Generator Metering	Generator True Percent Of Rated Power	%	Read Only	N/A	
Generator Metering	Generator Voltage L1-L2	V	Read Only	N/A	
Generator Metering	Generator Voltage L2-L3	V	Read Only	N/A	
Generator Metering	Generator Voltage L3-L1	V	Read Only	N/A	
Generator Metering	Generator Voltage Average Line To Line	V	Read Only	N/A	

***** Read Only = Not adjustable

§ Load management device (LCM, load shed kit, or RXT with combined interface/load management board).

† Notes indicate applicability to genset or accessories. N/A = Not applicable to the models covered in this manual.

‡ See TT-1584 for more information about digital inputs and outputs.

Grayed rows are visible in SiteTech but do not apply to all models.

SiteTech Group	Parameter	Units	Adjustment Range *	Default Setting	Notes †
Generator Metering	Generator Current L1	A	Read Only	N/A	
Generator Metering	Generator Current L2	A	Read Only	N/A	
Generator Metering	Generator Current L3	A	Read Only	N/A	
Generator Metering	Generator Current Average	A	Read Only	N/A	
Generator Metering	Generator Frequency	Hz	Read Only	N/A	
Genset Info	Genset Model Number Select		38RCL, 48RCL, 48RCLA, or 60RCL (Dropdown list)	Factory set per unit. See Section 3.3.2	
Genset Info	Genset Serial Number		0–20 characters		
Genset Info	Alternator Part Number		0–20 characters		N/A
Genset Info	Genset Controller Serial Number		1–10 characters		
Genset Info	Engine Part Number		0–20 characters		N/A
Genset Info	Engine Model Number		GM 5.0 (Auto select with genset model)		
Genset Info	Engine Serial Number		0–10 characters		N/A
Genset Info	Genset State	N/A	Read Only		
Genset Run Time	Genset Controller Clock Time		Read Only	N/A	
Genset Run Time	Genset Controller Total Operation Time	h	Read Only	N/A	
Genset Run Time	Engine Total Run Time	h	Read Only	N/A	
Genset Run Time	Engine Total Run Time Loaded	h	Read Only	N/A	
Genset Run Time	Engine Total Number Of Starts		Read Only	N/A	
Genset Run Time	Genset Date Time Of Last Maintenance		Read Only (See Section 2.3.4, step 6, Reset the Maintenance Timer on the RDC2)	1/1/01 12:00:00 AM	
Genset Run Time	Engine Run Time Until Maintenance	h	Read Only	200.0	
Genset Run Time	Genset Controller Date Format		MM/DD/YYYY or DD/MM/YYYY	MM/DD/ YYYY	
Genset Run Time	Genset Controller Time Format		12 or 24 hr	12 Hr	
Genset Run Time	Genset Date Time of Next Maintenance		Read Only	N/A	
Genset Run Time	Maintenance Period In Days	days	Read Only	365	
Genset Run Time	Maintenance Period Remaining	s	Read Only	31536000	
Genset Run Time	Genset Controller Clock Time Zone Offset		Read Only	1/1/01 12:00:00 AM	
Genset Personality Profile	ECM Model		Auto select with genset model **DO NOT CHANGE**	GM ECM	
Genset Personality Profile	Maximum Alternator Current	A	Read Only	920	
Genset Personality Profile	Engine Number Of Flywheel Teeth		Locked	1	
Genset Personality Profile	Engine Warmed Up Temperature	°C/F	77 – 140 °C	32°C (90°F)	See note in Section 3.3.2.
Genset Personality Profile	Engine Cooled Down Temperature	°C/F	Locked	79°C (174°F)	

***** Read Only = Not adjustable

§ Load management device (LCM, load shed kit, or RXT with combined interface/load management board).

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SiteTech Group	Parameter	Units	Adjustment Range *	Default Setting	Notes †
Genset Personality Profile	Engine Crank Disconnect Speed	RPM	300 –1000	750	
Genset Personality Profile	Engine Idle Speed	RPM	600 – 3000	1350	
Genset Personality Profile	Engine Run Speed	RPM	1000 – 3900	1800	
Genset Personality Profile	Engine Coolant Temperature Protectives Enabled		No effect.		N/A
Genset Personality Profile	Engine Coolant Temperature Sensor		No effect.		N/A
Genset Personality Profile	Engine High Coolant Temperature Inhibit Delay	s	No effect.		N/A
Genset Personality Profile	Engine Low Coolant Temperature Warning Delay	s	No effect.		N/A
Genset Personality Profile	Engine High Coolant Temperature Warning Delay	s	No effect.		N/A
Genset Personality Profile	Engine Low Coolant Temperature Shutdown Delay	s	No effect.		N/A
Genset Personality Profile	Engine High Coolant Temperature Shutdown Delay	s	No effect.		N/A
Genset Personality Profile	Engine Low Coolant Temperature Warning Limit	°C	No effect.		N/A
Genset Personality Profile	Engine High Coolant Temperature Warning Limit	°C	No effect.		N/A
Genset Personality Profile	Engine High Coolant Temperature Shutdown Limit	°C	No effect.		N/A
Genset Personality Profile	Engine Coolant Temperature Deadband	°C	No effect.		N/A
Genset Personality Profile	Personality Alternator Manufacturer		No effect.		N/A
Genset Personality Profile	Personality Alternator Toc Time Constant	s	No effect.		N/A
Genset Personality Profile	Personality Alternator Number Of Poles		No effect.		N/A
Genset Personality Profile	Personality Alternator Type		No effect.		N/A
Genset Personality Profile	Personality Fixed Voltage 50 Hz	V	No effect.		N/A
Genset Personality Profile	Personality Power Rating Single Phase 50 Hz 10 PF	kW	No effect.		N/A
Genset Personality Profile	Personality Power Rating Single Phase 50 Hz 8 PF	kW	No effect.		N/A
Genset Personality Profile	Personality Power Rating Fixed Volt 50 Hz	kW	No effect.		N/A
Genset Personality Profile	Personality Power Rating 50 Hz 220 440	kW	No effect.		N/A
Genset Personality Profile	Personality Power Rating 50 Hz 208 415	kW	No effect.		N/A
Genset Personality Profile	Personality Power Rating 50 Hz 200 400	kW	No effect.		N/A
Genset Personality Profile	Personality Power Rating 50 Hz 190 380	kW	No effect.		N/A

* Read Only = Not adjustable

§ Load management device (LCM, load shed kit, or RXT with combined interface/load management board).

† Notes indicate applicability to genset or accessories. N/A = Not applicable to the models covered in this manual.

‡ See TT-1584 for more information about digital inputs and outputs.

Grayed rows are visible in SiteTech but do not apply to all models.

SiteTech Group	Parameter	Units	Adjustment Range *	Default Setting	Notes †
Genset Personality Profile	Personality Power Rating 50 Hz 173 346	kW	No effect.		N/A
Genset Personality Profile	Personality Power Rating 50 Hz Delta	kW	No effect.		N/A
Genset Personality Profile	Personality Fixed Voltage 60 Hz	V	No effect.		N/A
Genset Personality Profile	Personality Power Rating Single Phase 60 Hz 10 PF	kW	No effect.		N/A
Genset Personality Profile	Personality Power Rating Single Phase 60 Hz 8 PF	kW	No effect.		N/A
Genset Personality Profile	Personality Power Rating Fixed Volt 60 Hz	kW	No effect.		N/A
Genset Personality Profile	Personality Power Rating 60 Hz 240 480	kW	No effect.		N/A
Genset Personality Profile	Personality Power Rating 60 Hz 230 460	kW	No effect.		N/A
Genset Personality Profile	Personality Power Rating 60 Hz 220 440	kW	No effect.		N/A
Genset Personality Profile	Personality Power Rating 60 Hz 208 416	kW	No effect.		N/A
Genset Personality Profile	Personality Power Rating 60 Hz 190 380	kW	No effect.		N/A
Genset Personality Profile	Personality Power Rating 60 Hz Delta	kW	No effect.		N/A
Genset Personality Profile	Personality Installed Options		Locked	None	N/A
Genset System Configuration	Genset System Voltage	V	110 – 600	240.0	
Genset System Configuration	Genset System Frequency	Hz	50/ 60	60.0	
Genset System Configuration	Genset Voltage Phase Connection		0–3	Single Phase	
Genset System Configuration	Genset Power Rating	kW	10– 5000	48	
Genset System Configuration	Genset Rated Current	A	Read Only	200	
Genset System Configuration	Genset System Battery Voltage	V	12 / 24	12	
Genset System Configuration	Prime Power Application		Standby or prime	Standby	
Genset System Configuration	Current Transformer Ratio		Locked	400	N/A
Genset System Configuration	Local Start Mode		Read Only	Off	
Genset System Configuration	Measurement System		English or metric	English	
Genset System Configuration	ECM Power		On or Off	Off	
Genset System Configuration	Display Contrast		0 – 100	50	
Genset System Configuration	Genset System Language		No effect.		N/A

* Read Only = Not adjustable

§ Load management device (LCM, load shed kit, or RXT with combined interface/load management board).

† Notes indicate applicability to genset or accessories. N/A = Not applicable to the models covered in this manual.

‡ See TT-1584 for more information about digital inputs and outputs.

Grayed rows are visible in SiteTech but do not apply to all models.

SiteTech Group	Parameter	Units	Adjustment Range *	Default Setting	Notes †
Genset System Configuration	Genset Maximum Percent Capacity	%	0 – 120	70.0	
Genset System Configuration	Generator Overloaded Percent	%	0 – 120	85.0	
Genset System Configuration	Under Frequency Shed Level	Hz	0 – 5	0.5	
Genset System Configuration	Base Load Add Time	s	10 – 2400	60	
Genset System Configuration	Base Over Load Shed Time	s	2 – 30	30	
Genset System Configuration	Base Under Frequency Shed Time	s	1 – 20	5	
Genset System Configuration	Genset Fuel Type		Natural Gas or LP (pulldown)	Natural Gas	
Genset System Configuration	Automatic Start Minimum Voltage	V	15 – 60	51	
Genset System Configuration	Automatic Stop Minimum Percent Load	%	0 – 100	20	
Genset System Configuration	Automatic Start Minimum Voltage Delay	s	1 – 3600	180	
Genset System Configuration	Automatic Stop Minimum Load Delay	s	1 – 3600	180	
Genset System Configuration	ECM Powered Mode		On or Off	Off	
Genset Calibration	Genset Calibration Factor Voltage L1-L2		0.9 – 1.1	1.0063	
Genset Calibration	Genset Calibration Factor Voltage L2-L3		0.9 – 1.1	0.9909	
Genset Calibration	Genset Calibration Factor Voltage L3-L1		0.9 – 1.1	0.9427	
Genset Calibration	Genset Calibration Factor Current L1 – N		0.9 – 1.1	1.000000	
Genset Calibration	Genset Calibration Factor Current L1		0.9 – 1.1	1.000000	
Genset Calibration	Genset Calibration Factor Current L2		0.9 – 1.1	1.000000	
Genset Calibration	Genset Calibration Factor Current L3		0.9 – 1.1	1.04	
Genset Calibration	Current Transformer Calibration At No Load		0 – 100	3.5	
Genset Calibration	Current Transformer Calibration At Full Load		0 – 400	121.5	
Advanced Speed Control	Proportional Gain		No effect.		N/A
Advanced Speed Control	Transient Integral Gain		No effect.		N/A
Advanced Speed Control	Derivative Gain		No effect.		N/A
Advanced Speed Control	Slow Correction Integral Gain		No effect.		N/A
Advanced Speed Control	Diagnostic Derivative Gain		No effect.		N/A
Advanced Speed Control	Diagnostic Transient Integral Gain		No effect.		N/A
Voltage Regulator	Voltage Regulator Average Voltage Adjustment	V	108 – 660	240.0 (System voltage)	

* Read Only = Not adjustable

§ Load management device (LCM, load shed kit, or RXT with combined interface/load management board).

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SiteTech Group	Parameter	Units	Adjustment Range *	Default Setting	Notes †
Voltage Regulator	Voltage Regulator Volts Per Hertz Slope	%	1– 10	4	
Voltage Regulator	Voltage Regulator Volts Per Hertz Cut In Frequency	Hz	42 – 62	59	
Voltage Regulator	Voltage Regulator Gain		1 – 255	16	
Engine Timing	Engine Start Delay	s	0 – 300	0	
Engine Timing	Engine Cool Down Delay	s	300 – 600	300	
Engine Timing	Engine Crank On Delay	s	10 – 30	15	
Engine Timing	Engine Crank Pause Delay	s	1 – 60	15	
Engine Timing	Engine Number Of Crank Cycles		1 – 6	3	
Genset Protection	Genset Low Battery Voltage Warning Delay	s	Read Only	90	
Genset Protection	Genset High Battery Voltage Warning Delay	s	Read Only	10	
Genset Protection	Genset Low Battery Voltage Warning Limit	%	80 – 100	100	
Genset Protection	Genset High Battery Voltage Warning Limit	%	110 – 135	125	
Genset Protection	Genset Battery Low Cranking Voltage Warning Delay	s	Read Only	6	
Genset Protection	Genset Battery Low Cranking Voltage Warning Limit	%	Read Only	60	
Engine Protection	Engine Locked Rotor Shutdown Delay	s	3	3	
Engine Protection	Genset Low Engine Speed Shutdown Limit	%	75 – 95	85	
Engine Protection	Genset High Engine Speed Shutdown Limit	%	No effect.		N/A
Engine Protection	Engine Low Oil Pressure Warning Limit	kPa	No effect.		N/A
Engine Protection	Engine High Oil Pressure Shutdown Limit	kPa	No effect.		N/A
Generator Protection	Loss Of AC Sensing Shutdown Delay	s	Read Only	3	
Generator Protection	Genset Low Voltage Shutdown Delay	s	Read Only	10	
Generator Protection	Genset High Voltage Shutdown Delay	s	Read Only	2	
Generator Protection	Genset Low Voltage Shutdown Limit	%	Read Only	80	
Generator Protection	Genset High Voltage Shutdown Limit	%	Read Only	120	
Generator Protection	Genset Short Term Low Frequency Shutdown Delay	s	Read Only	10	
Generator Protection	Genset Long Term Low Frequency Shutdown Delay	s	Read Only	60	
Generator Protection	Genset High Frequency Shutdown Delay	s	Read Only	10	
Generator Protection	Genset Low Frequency Shutdown Limit	%	Read Only	90	
Generator Protection	Genset High Frequency Shutdown Limit	%	Read Only	110	

***** Read Only = Not adjustable

§ Load management device (LCM, load shed kit, or RXT with combined interface/load management board).

† Notes indicate applicability to genset or accessories. N/A = Not applicable to the models covered in this manual.

‡ See TT-1584 for more information about digital inputs and outputs.

Grayed rows are visible in SiteTech but do not apply to all models.

SiteTech Group	Parameter	Units	Adjustment Range *	Default Setting	Notes †
Digital Input A1	Digital Input A1 Value		Read Only	False	N/A
Digital Input A1	Digital Input A1 Enabled		True or False	True	N/A
Digital Input A1	Digital Input A1 Event		See dropdown list in SiteTech. ‡	Fuel Pressure Low Warning	N/A
Digital Input A2	Digital Input A2 Value		Read Only	False	N/A
Digital Input A2	Digital Input A2 Enabled		True or False	True	N/A
Digital Input A2	Digital Input A2 Event		See dropdown list in SiteTech. ‡	Auxiliary Input Warning	N/A
Digital Input B1	Digital Input B1 Value		Read Only	False	PIM
Digital Input B1	Digital Input B1 Enabled		True or False	False	PIM
Digital Input B1	Digital Input B1 Event		See dropdown list in SiteTech. ‡	None (0)	PIM
Digital Input B2	Digital Input B2 Value		Read Only	False	PIM
Digital Input B2	Digital Input B2 Enabled		True or False	False	PIM
Digital Input B2	Digital Input B2 Event		See dropdown list in SiteTech. ‡	None (0)	PIM
Digital Output A1	Digital Output A1 Value		Read Only	False	N/A
Digital Output A1	Digital Output A1 Event		See dropdown list in SiteTech. ‡	NFPA 110 Alarm Active	N/A
Digital Output A2	Digital Output A2 Value		Read Only	N/A	N/A
Digital Output A2	Digital Output A2 Event		See dropdown list in SiteTech. ‡	N/A	N/A
Digital Output B1	Digital Output B1 Value		Read Only	False	PIM
Digital Output B1	Digital Output B1 Event		See dropdown list in SiteTech. ‡	Generator Running	PIM
Digital Output B2	Digital Output B2 Value		Read Only	False	PIM
Digital Output B2	Digital Output B2 Event		See dropdown list in SiteTech. ‡	Common Fault	PIM
Digital Output B3	Digital Output B3 Value		Read Only	False	PIM
Digital Output B3	Digital Output B3 Event		See dropdown list in SiteTech. ‡	Low Battery Voltage Warning	PIM
Digital Output B4	Digital Output B4 Value		Read Only	False	PIM
Digital Output B4	Digital Output B4 Event		See dropdown list in SiteTech. ‡	Not In Auto Warning	PIM
Digital Output B5	Digital Output B5 Value		Read Only	False	PIM
Digital Output B5	Digital Output B5 Event		See dropdown list in SiteTech. ‡	Engine Cool Down Active	PIM
Digital Output B6	Digital Output B6 Value		Read Only	False	PIM
Digital Output B6	Digital Output B6 Event		See dropdown list in SiteTech. ‡	Normal Source Failure	PIM
Digital Output B7	Digital Output B7 Value		Read Only	False	Load Mgmnt§
Digital Output B7	Digital Output B7 Event		Read Only	65004	Load Mgmnt§
Digital Output B8	Digital Output B8 Value		Read Only	False	Load Mgmnt§
Digital Output B8	Digital Output B8 Event		Read Only	65007	Load Mgmnt§

* Read Only = Not adjustable

§ Load management device (LCM, load shed kit, or RXT with combined interface/load management board).

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SiteTech Group	Parameter	Units	Adjustment Range *	Default Setting	Notes †
Digital Output B9	Digital Output B9 Value		Read Only	False	Load Mgmnt§
Digital Output B9	Digital Output B9 Event		Read Only	65003	Load Mgmnt§
Digital Output B10	Digital Output B10 Value		Read Only	False	Load Mgmnt§
Digital Output B10	Digital Output B10 Event		Read Only	65005	Load Mgmnt§
Digital Output B11	Digital Output B11 Value		Read Only	False	Load Mgmnt§
Digital Output B11	Digital Output B11 Event		Read Only	65006	Load Mgmnt§
Digital Output B12	Digital Output B12 Value		Read Only	False	Load Mgmnt§
Digital Output B12	Digital Output B12 Event		Read Only	65008	Load Mgmnt§
ATS Metering Summary	ATS Contactor Position		Read Only	N/A	RXT
ATS Metering Summary	ATS Sources Available		Read Only	N/A	RXT
Source 1 Metering	Source 1 Rotation Actual		Read Only	N/A	RXT
Source 1 Metering	Source 1 Voltage L1-L2	V	Read Only	N/A	RXT
Source 1 Metering	Source 1 Voltage L2-L3	V	Read Only	N/A	RXT
Source 1 Metering	Source 1 Voltage L3-L1	V	Read Only	N/A	RXT
Source 1 Metering	Source 1 Voltage Average Line To Line	V	Read Only	N/A	RXT
Source 1 Metering	Source 1 Frequency	Hz	Read Only	N/A	RXT
Source 2 Metering	Source 2 Rotation Actual		Read Only	N/A	RXT
Source 2 Metering	Source 2 Voltage L1-L2	V	Read Only	N/A	RXT
Source 2 Metering	Source 2 Voltage L2-L3	V	Read Only	N/A	RXT
Source 2 Metering	Source 2 Voltage L3-L1	V	Read Only	N/A	RXT
Source 2 Metering	Source 2 Voltage Average Line To Line	V	Read Only	N/A	RXT
Source 2 Metering	Source 2 Frequency	Hz	Read Only	N/A	RXT
ATS Connection Configuration	ATS Source		Read Only	N/A	RXT
Source 1 System Configuration	Source 1 System Voltage	V	110.0 – 600.0	Genset System Voltage	RXT
Source 1 System Configuration	Source 1 System Frequency	Hz	48.0 – 62.0	Genset System Frequency	RXT
Source 1 System Configuration	Source 1 Voltage Debounce Delay	s	1 – 99	0.5	RXT
Source 1 System Configuration	Source 1 Low Voltage Pickup	%	85 – 100	90	RXT
Source 1 System Configuration	Source 1 Low Voltage Dropout	%	75 – 98	90	RXT
Source 1 Calibration	Source 1 Calibration Factor Voltage L1-L2		Read Only	1	RXT
Source 1 Calibration	Source 1 Calibration Factor Voltage L2-L3		Read Only	1	RXT

* Read Only = Not adjustable

§ Load management device (LCM, load shed kit, or RXT with combined interface/load management board).

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SiteTech Group	Parameter	Units	Adjustment Range *	Default Setting	Notes †
Source 1 Calibration	Source 1 Calibration Factor Voltage L3-L1		Read Only	1	RXT
Source 2 System Configuration	Source 2 System Voltage	V	110.0 – 600.0	240.0	RXT
Source 2 System Configuration	Source 2 System Frequency	Hz	48.0 – 62.0	60.0	RXT
Source 2 System Configuration	Source 2 Voltage Debounce Delay	s	0.1 – 9.9	0.5	RXT
Source 2 System Configuration	Source 2 Low Voltage Pickup	%	85 – 100	90	RXT
Source 2 System Configuration	Source 2 Low Voltage Dropout	%	75 – 98	90	RXT
Source 2 Calibration	Source 2 Calibration Factor Voltage L1-L2		Read Only	1	RXT
Source 2 Calibration	Source 2 Calibration Factor Voltage L2-L3		Read Only	1	RXT
Source 2 Calibration	Source 2 Calibration Factor Voltage L3-L1		Read Only	1	RXT
ATS Exercise	Exercise Interval		Weekly or Every Other Week	Weekly	RXT
ATS Exercise	Exercise Run Duration	min	10 – 30	20	RXT
ATS Exercise	Exercise Mode		Pulldown See List	Unloaded Cycle (2)	RXT
ATS Exercise	Exercise Warning Enabled		True or False	True	RXT
ATS Delays	ATS Transfer From Preferred Delay	s	1 – 10	3	RXT
ATS Delays	ATS Transfer From Standby Delay	s	1 – 600	120	RXT
ATS Delays	ATS Source 2 Engine Start Delay	s	1 – 10	3	RXT
Modbus	Is Modbus Master		0 – 1	0	
Network Configuration	DHCP Enabled		True or False	True	OnCue Plus
Network Configuration	Static IP Address		0.0.0.0 – 255.255.255.255	0.0.0.0	OnCue Plus
Network Configuration	Static Subnet Mask		0.0.0.0 – 255.255.255.255	0.0.0.0	OnCue® Plus
Network Configuration	Static Default Gateway		0.0.0.0 – 255.255.255.255	0.0.0.0	OnCue Plus
Network Configuration	Static DNS Server 1		0.0.0.0 – 255.255.255.255	0.0.0.0	OnCue Plus
Network Configuration	Static DNS Server 2		0.0.0.0 – 255.255.255.255	0.0.0.0	OnCue Plus
Network Configuration	Server Host Name		devices.kohler.com	devices.kohler.com	OnCue Plus
Network Status	IP Address		Read Only	0.0.0.0	OnCue® Plus
Network Status	Subnet Mask		Read Only	0.0.0.0	OnCue Plus
Network Status	Default Gateway		Read Only	0.0.0.0	OnCue Plus

***** Read Only = Not adjustable

§ Load management device (LCM, load shed kit, or RXT with combined interface/load management board).

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SiteTech Group	Parameter	Units	Adjustment Range *	Default Setting	Notes †
Network Status	DNS Server 1		Read Only	0.0.0.0	OnCue Plus
Network Status	DNS Server 2		Read Only	0.0.0.0	OnCue Plus
Network Status	MAC Address		Read Only	N/A	OnCue Plus
Network Status	Connected Server IP Address		Read Only	0.0.0.0	OnCue Plus
Network Status	Network Connection Established		Read Only	False	OnCue Plus
Network Status	Media Connected		Read Only	False	OnCue Plus
RBUS Network	RBUS Active		Read Only	False	
RBUS Network	RBUS Connection Count		Read Only	0	
RBUS Network	RBUS Net Cycle Time	ms	Read Only	100	
RBUS Network	RBUS Timeouts		Read Only	0	
RBUS Network	RBUS Errors		Read Only	0	
RBUS Devices B1	RBUS Devices B1 Serial Number		Read Only	N/A	RXT, PIM, or Load Mgmnt§
RBUS Devices B1	RBUS Devices B1 Type		Read Only (RXT, PIM, or Load Mgmnt§)	N/A	
RBUS Devices B1	RBUS Devices B1 Communication Errors		Read Only	N/A	
RBUS Devices B1	RBUS Devices B1 Communication Timeouts		Read Only	N/A	
RBUS Devices B1	RBUS Devices B1 Modbus Id		Read Only	N/A	
RBUS Devices B1	RBUS Devices B1 Last Connection Date		Read Only	N/A	
RBUS Devices B1	RBUS Devices B1 Firmware Version		Read Only	N/A	
RBUS Devices B1	RBUS Devices B1 Connected		Read Only	N/A	
RBUS Devices B2	RBUS Devices B2 Type		Read Only (RXT, PIM, or Load Mgmnt§)	N/A	
RBUS Devices B2	RBUS Devices B2 Communication Errors		Read Only	N/A	RXT, PIM, or Load Mgmnt§
RBUS Devices B2	RBUS Devices B2 Communication Timeouts		Read Only	N/A	
RBUS Devices B2	RBUS Devices B2 Modbus Id		Read Only	N/A	
RBUS Devices B2	RBUS Devices B2 Last Connection Date		Read Only	N/A	

* Read Only = Not adjustable

§ Load management device (LCM, load shed kit, or RXT with combined interface/load management board).

† Notes indicate applicability to genset or accessories. N/A = Not applicable to the models covered in this manual.

‡ See TT-1584 for more information about digital inputs and outputs.

Grayed rows are visible in SiteTech but do not apply to all models.

SiteTech Group	Parameter	Units	Adjustment Range *	Default Setting	Notes †
RBUS Devices B2	RBUS Devices B2 Firmware Version		Read Only	N/A	RXT, PIM, or Load Mgmnt§
RBUS Devices B2	RBUS Devices B2 Connected		Read Only	N/A	
RBUS Devices B3	RBUS Devices B3 Serial Number		Read Only	N/A	
RBUS Devices B3	RBUS Devices B3 Type		Read Only (RXT, PIM, or Load Mgmnt§)	N/A	
RBUS Devices B3	RBUS Devices B3 Communication Errors		Read Only	N/A	
RBUS Devices B3	RBUS Devices B3 Communication Timeouts		Read Only	N/A	RXT, PIM, or Load Mgmnt§
RBUS Devices B3	RBUS Devices B3 Modbus Id		Read Only	N/A	
RBUS Devices B3	RBUS Devices B3 Last Connection Date		Read Only	N/A	RXT, PIM, or Load Mgmnt§
RBUS Devices B3	RBUS Devices B3 Firmware Version		Read Only	N/A	RXT, PIM, or Load Mgmnt§
RBUS Devices B3	RBUS Devices B3 Connected		Read Only	N/A	
RBUS Devices B4	RBUS Devices B4 Serial Number		Read Only	N/A	N/A
RBUS Devices B4	RBUS Devices B4 Type		Read Only	N/A	N/A
RBUS Devices B4	RBUS Devices B4 Communication Errors		Read Only	N/A	N/A
RBUS Devices B4	RBUS Devices B4 Communication Timeouts		Read Only	N/A	N/A
RBUS Devices B4	RBUS Devices B4 Modbus Id		Read Only	N/A	N/A
RBUS Devices B4	RBUS Devices B4 Last Connection Date		Read Only	N/A	N/A
RBUS Devices B4	RBUS Devices B4 Firmware Version		Read Only	N/A	N/A
RBUS Devices B4	RBUS Devices B4 Connected		Read Only	N/A	N/A
RBUS Devices B5	RBUS Devices B5 Serial Number		Read Only	N/A	N/A
RBUS Devices B5	RBUS Devices B5 Type		Read Only	N/A	N/A
RBUS Devices B5	RBUS Devices B5 Communication Errors		Read Only	N/A	N/A
RBUS Devices B5	RBUS Devices B5 Communication Timeouts		Read Only	N/A	N/A
RBUS Devices B5	RBUS Devices B5 Modbus Id		Read Only	N/A	N/A
RBUS Devices B5	RBUS Devices B5 Last Connection Date		Read Only	N/A	N/A
RBUS Devices B5	RBUS Devices B5 Firmware Version		Read Only	N/A	N/A
RBUS Devices B5	RBUS Devices B5 Connected		Read Only	N/A	N/A

* Read Only = Not adjustable

§ Load management device (LCM, load shed kit, or RXT with combined interface/load management board).

† Notes indicate applicability to genset or accessories. N/A = Not applicable to the models covered in this manual.

‡ See TT-1584 for more information about digital inputs and outputs.

Grayed rows are visible in SiteTech but do not apply to all models.

3.4 Controller Firmware

The manufacturer may release new versions of controller firmware. Kohler® distributors can download the latest software from the Kohler Power Resource Center website. Controller firmware is also available for download on the Kohler dealer portal.

A personal computer (laptop), a USB cable, and Kohler® SiteTech™ or USB Utility are required for firmware updates (updating controller firmware is not available with OnCue Plus). Use a USB cable to connect the computer to the controller's USB port. See Section 3.2 for USB connection information.

The firmware version number is shown in the controller's Overview menu. See SW Version in Figure 3-4. The firmware version number is also displayed in SiteTech™ and OnCue® Plus software under parameters. In SiteTech, the firmware version number is shown in the Identity Group, which is the first group displayed. Refer to the SiteTech™ and OnCue® Plus software manuals for specific instructions.

Firmware version numbers: Preceding zeroes may be dropped from firmware version numbers. For example, version number 4.03 is the same as version 4.3. The version number displayed in SiteTech or OnCue® Plus may show a third number. For example, SiteTech may display version 4.3.5 for software version 4.3.

For instructions about loading new firmware onto the controller, refer to the SiteTech Software Operation Manual or the USB Utility Instructions.

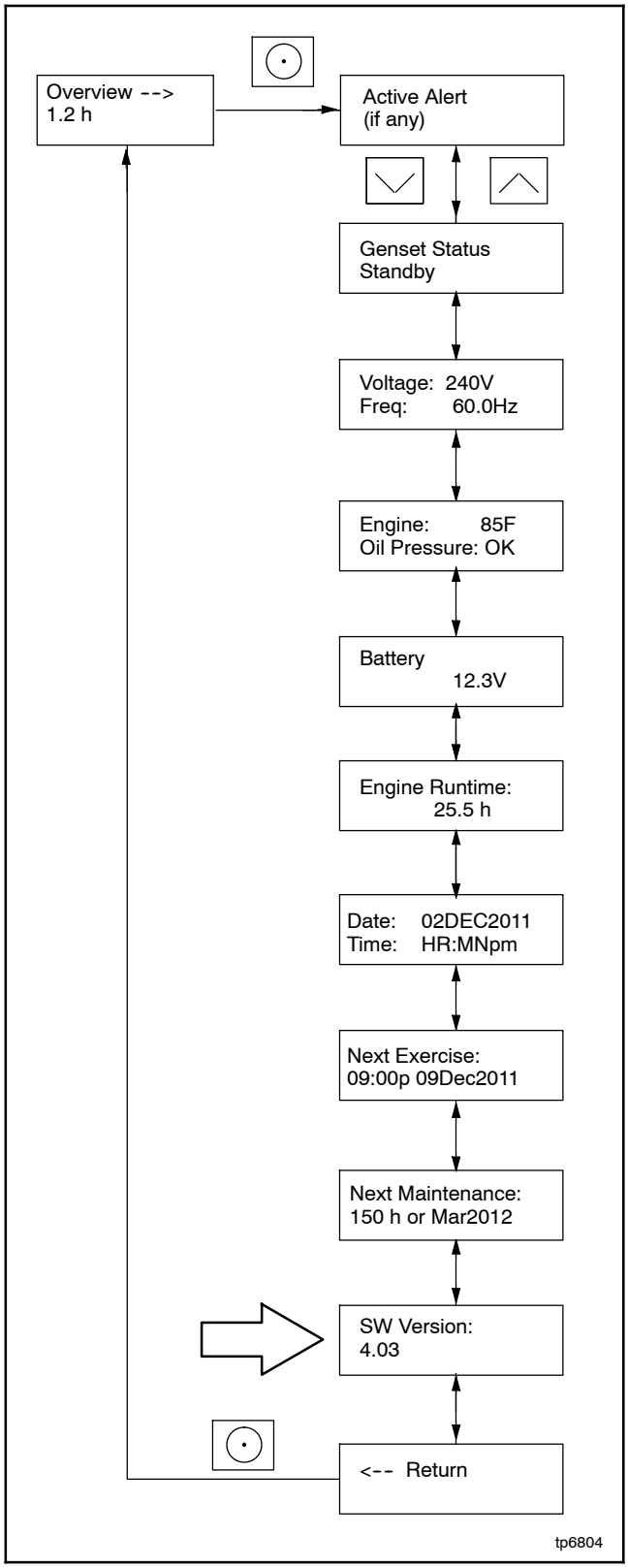


Figure 3-4 Firmware (SW) Version Number in Overview Menu

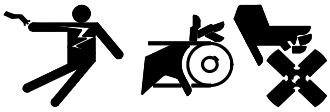
3.5 Controller Replacement

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

This equipment must be installed and serviced by qualified electrical personnel.

⚠ 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) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

If the troubleshooting procedures in Section 5 identify a failed controller, use the procedure in this section for controller replacement. Always check the controller settings, wiring, and connections before replacing the controller.

Some setup is required after the new controller is installed. There are several ways to set up the controller:

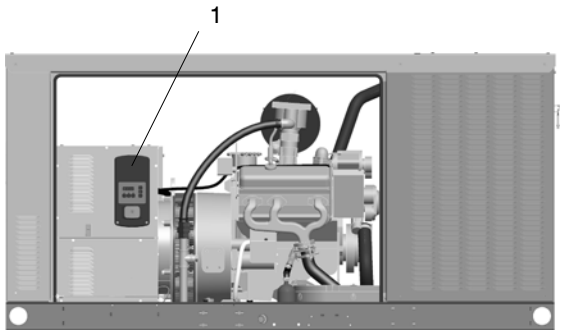
- The controller can be set up using the buttons on the controller.
- The controller can be set up using a personal computer and Kohler® SiteTech™ software.
- If a controller settings file was created at installation or at some other time when the controller was known to be operating correctly, a personal computer (laptop) with Kohler SiteTech software can be used to load the settings onto the new controller.

Note: Load the old controller settings onto the new controller only if you are certain that the settings are correct. Many controller operation problems can be caused by incorrect settings.

In some cases, the Kohler Generator Service Department may provide a settings file to load onto the controller for testing or troubleshooting. See TP-6701, SiteTech Software Operation Manual, for instructions to export and import settings after controller replacement.

Controller Replacement Procedure

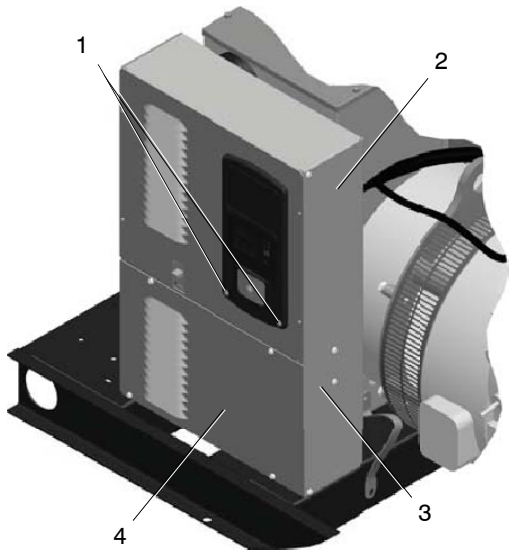
1. Using the enclosure locking key provided with the generator set, open and remove the enclosure door on the service side of the generator set. See Figure 3-5.
2. Press the OFF button on the controller.
3. Disconnect utility power to the generator set by opening the circuit breaker in the distribution panel.
4. Disconnect the generator set engine starting battery, negative (-) lead first.



ADV-7962

1. RDC2 controller

Figure 3-5 Controller Location



1. Controller screws (qty. 2)
2. Nameplate location
3. Utility power entry point
4. Customer connection access panel

Figure 3-6 Controller and Access Panel

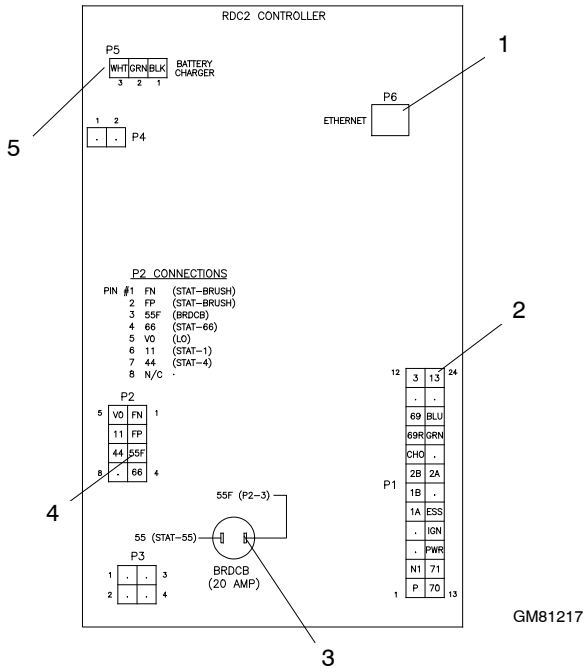
5. Remove the customer connection access panel and use a voltmeter to confirm that utility power has been disconnected. See Figure 3-6.

6. Remove the two (2) screws securing the controller to the junction box and *carefully* lift the bottom edge of the controller. See Figure 3-6.

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

7. Note the connections on the back of the controller, and then disconnect P1, P2, P4, P5, and P6. See Figure 3-7 or the wiring diagram.

   Note: The auxiliary winding mini-breaker on the RDC2 controller is not connected.



1. P6 Ethernet connection for OnCue® Plus
2. P1
3. Field circuit breaker (Not connected). Note: Newer RDC2 controllers to not have a field circuit breaker.
4. P2
5. P5

Figure 3-7 Controller Connections

8. Remove the old controller.

9. Reconnect all harnesses to the new controller assembly. See Figure 3-7 or the wiring diagram.

10. Install the controller onto the junction box using the two (2) screws removed in step 6.

11. Replace the access panel and secure with the screws.

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

13. Reconnect the utility power to the generator set by closing the circuit breaker in the distribution panel.

14. Check the firmware version on the controller, and update to the latest released version, if necessary. See Section 3.4 and TP-6701, SiteTech Software Operation Manual, for instructions.

15. The controller will prompt you to set the date and time, and then to set the exerciser. See the generator set Operation Manual for instructions, if necessary.

16. Set up the controller as instructed in Section 3.6, Controller Setup.

17. Calibrate the voltage. See Section 3.7, Voltage Calibration.

18. If OnCue® Plus is used to monitor this generator set, reset the OnCue password on the controller and note the new password. See Section 3.8, Setting the OnCue® Plus Password. Then connect with OnCue® Plus and enter the new password.

19. Verify that OnCue® Plus can communicate with the generator set over the Internet before leaving the job site.

3.6 Controller Setup

Controller setup is required after installation. Follow the instructions in this section to set the necessary parameters.

Controller Setup Notes:

- Some of the required information can be found on the generator set nameplate. See Figure 3-6 for the nameplate location.
- The Engine Model Number is automatically selected when the Genset Model Number is selected and the change is applied.
- The Fuel Type parameter is available with controller firmware versions 4.5 or higher. The fuel type setting affects the generator set power rating, which is used to determine setpoints for the optional load management device. Setting the Fuel Type is recommended if the generator set is connected to a load management device.

Controller Setup Procedure

1. Use one of the methods listed below to set the parameters shown in Figure 3-9.
   a. Use the buttons on the controller to navigate through the controller menus and change the settings. See the required controller menus in Figure 3-10 and Figure 3-11. See the generator set operation manual for additional instructions, if necessary.
   b. Use a personal computer and Kohler® SiteTech™ software to change the settings. See Figure 3-12. Refer to TP-6701, SiteTech Software Operation Manual, for instructions if necessary.
2. Check the voltage calibration and adjust, if necessary. See Section 3.7, Voltage Calibration.

Exporting Settings from a File

If a personal computer (laptop) and Kohler® SiteTech™ software were used to create a controller settings file at the time of generator set installation (when the controller was known to be operating correctly), then SiteTech software can be used to load the saved settings onto the new controller. See TP-6701, SiteTech Software Operation Manual, for instructions to export and import controller settings.

Note: Load the old controller settings to the new controller only if you are certain that the settings are correct. Many generator set operation problems can be caused by incorrect settings.

System Voltage	Phases	Phase Connection
120/240	1	Single Phase
120/208	3	Three-Phase Wye
127/220	3	Three-Phase Wye
120/240	3	Three-Phase Delta
277/480	3	Three-Phase Wye
220/380	3	Three-Phase Wye
230/400	3	Three-Phase Wye
240/416	3	Three-Phase Wye

Figure 3-8 Voltage and Phase Connections

Parameter	Controller Menu	SiteTech Group	Settings
Genset Model Number	Genset Information	Genset Info	38RCL, 48RCL, 48RCLA, or 60RCL
Genset Serial Number			From nameplate; see Figure 3-6.
Fuel Type †	Genset System	Genset System Configuration	Natural Gas or Liquid Propane (LP)
Phase Connection			See Figure 3-8
Genset System Voltage			From nameplate; see Figure 3-6.
Genset System Frequency			50 or 60 Hz
† Fuel Type is available with controller firmware versions 4.5 or higher.			

Figure 3-9 Controller Setup

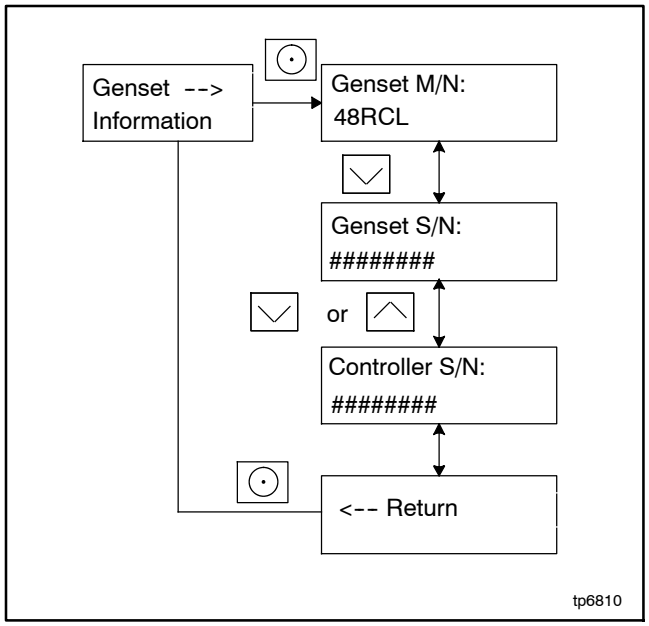
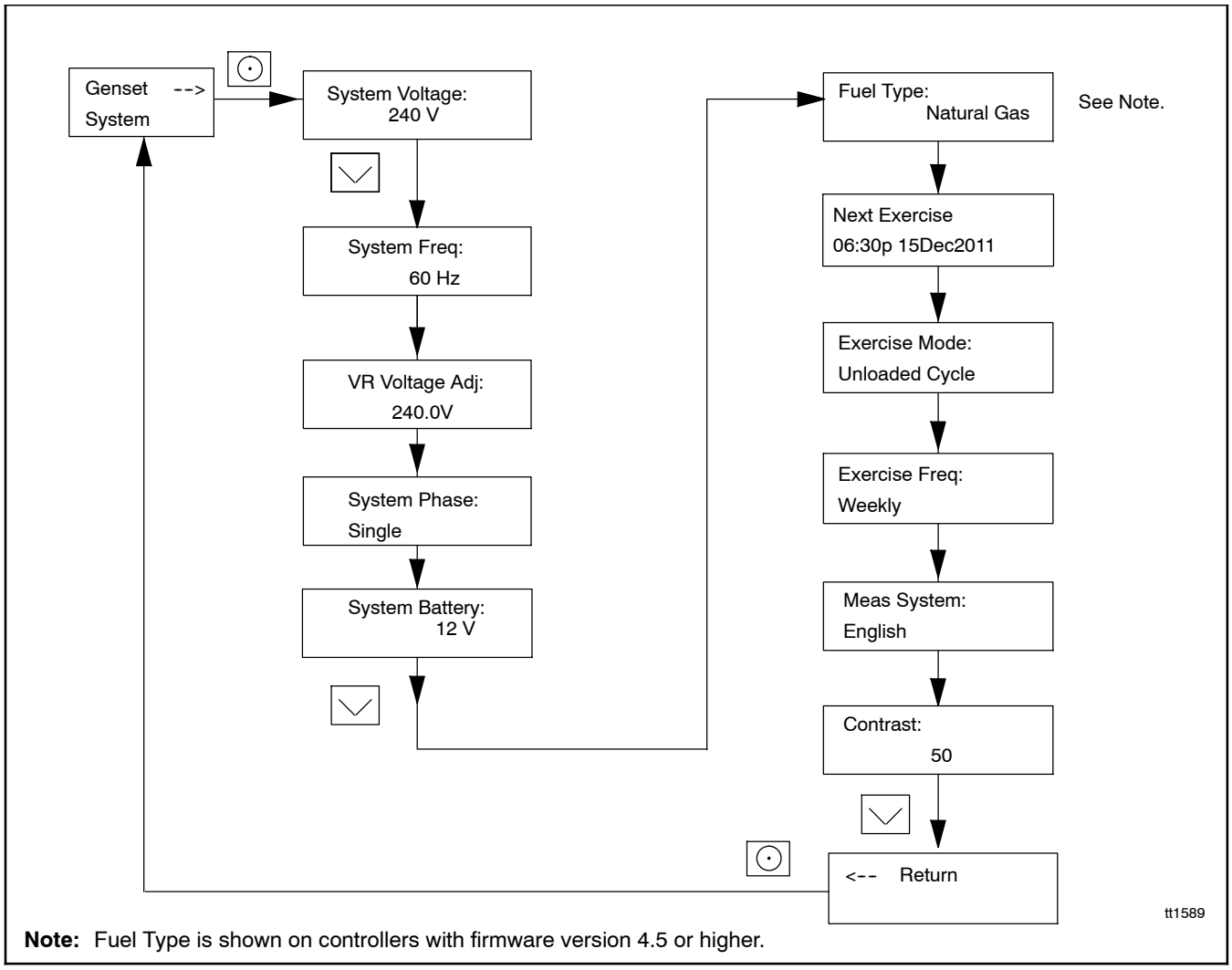
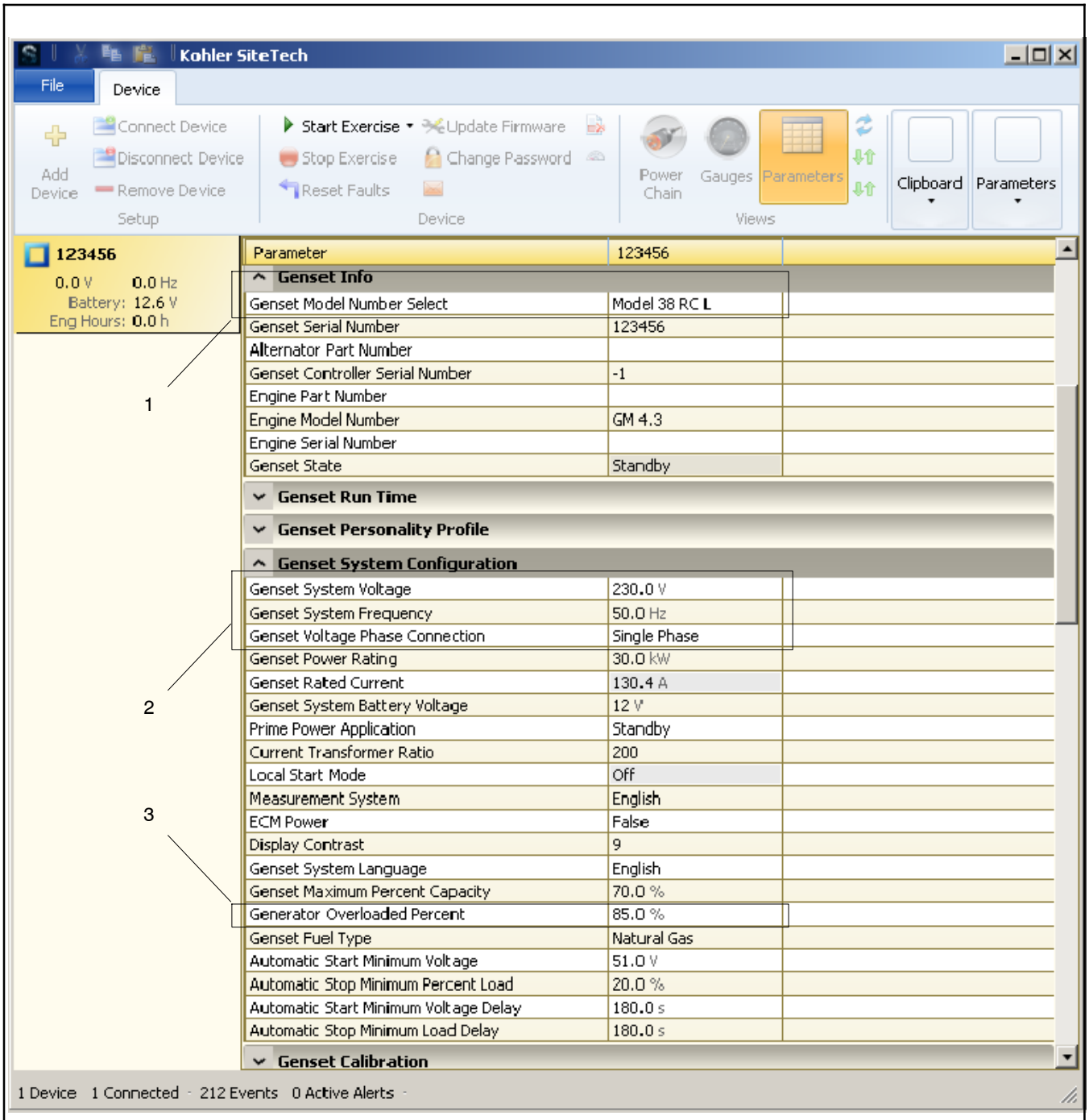


Figure 3-10 Generator Set Information Menu, RDC2



Note: Fuel Type is shown on controllers with firmware version 4.5 or higher.

Figure 3-11 Genset System Menu, RDC2



1. Genset model and serial numbers
2. System settings
3. Fuel type (controller firmware version 3.5 or higher)

Figure 3-12 Controller Setup Using SiteTech™

3.7 Voltage Calibration

⚠ WARNING

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

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

Testing live electrical circuits. Hazardous voltage or current can 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)

Servicing the generator set when it is operating. Exposed moving parts can 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 can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage**.** Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

Correct voltage calibration is necessary for proper generator set operation. Check the voltage calibration after controller replacement or generator set reconnection, and adjust if necessary.

The RDC2 controller can be calibrated using the controller keypad and menus, or using a personal computer with Kohler® SiteTech™ software.

3.7.1 Calibration using the RDC2 Controller Keypad and Menus

The controller's voltage calibration can be adjusted using the controller keypad. See Figure 3-13 and follow the procedure below.

Note: A digital voltmeter is required for these adjustments.

1. With the generator set off, connect a digital multimeter to measure output voltage across L1 and L2. Set the meter to measure AC volts.
2. Start the generator set by pressing the RUN button on the RDC2 controller.
3. On the RDC2 controller, press the Select button and then use the arrow buttons to navigate to the Generator Metering menu on the RDC2 controller.
4. Press the Select button to display Volts L1-L2. Compare the number displayed with the voltmeter reading.
5. If the correct voltage is not displayed, follow these steps to adjust it:
   a. Press the Select button. The voltage will flash.
   b. Press the up or down arrow button to adjust the voltage to match the voltmeter reading.
   c. Press Select to save the voltage setting. The voltage stops flashing.
   d. Wait for the voltmeter reading to stabilize. This may take 30 to 60 seconds.
6. For three-phase models, press the Down arrow button and repeat the calibration procedure for voltage across L2–L3 and L3–L1.
7. Use the arrow buttons to step down to the Return screen. Press Select to exit the Generator Metering menu.
8. Press OFF to stop the generator set.

Reset Calibration

Pressing the select button when "Reset Calibration? Yes" is displayed will discard the changes and reset the calibration to the original settings. See Figure 3-13.

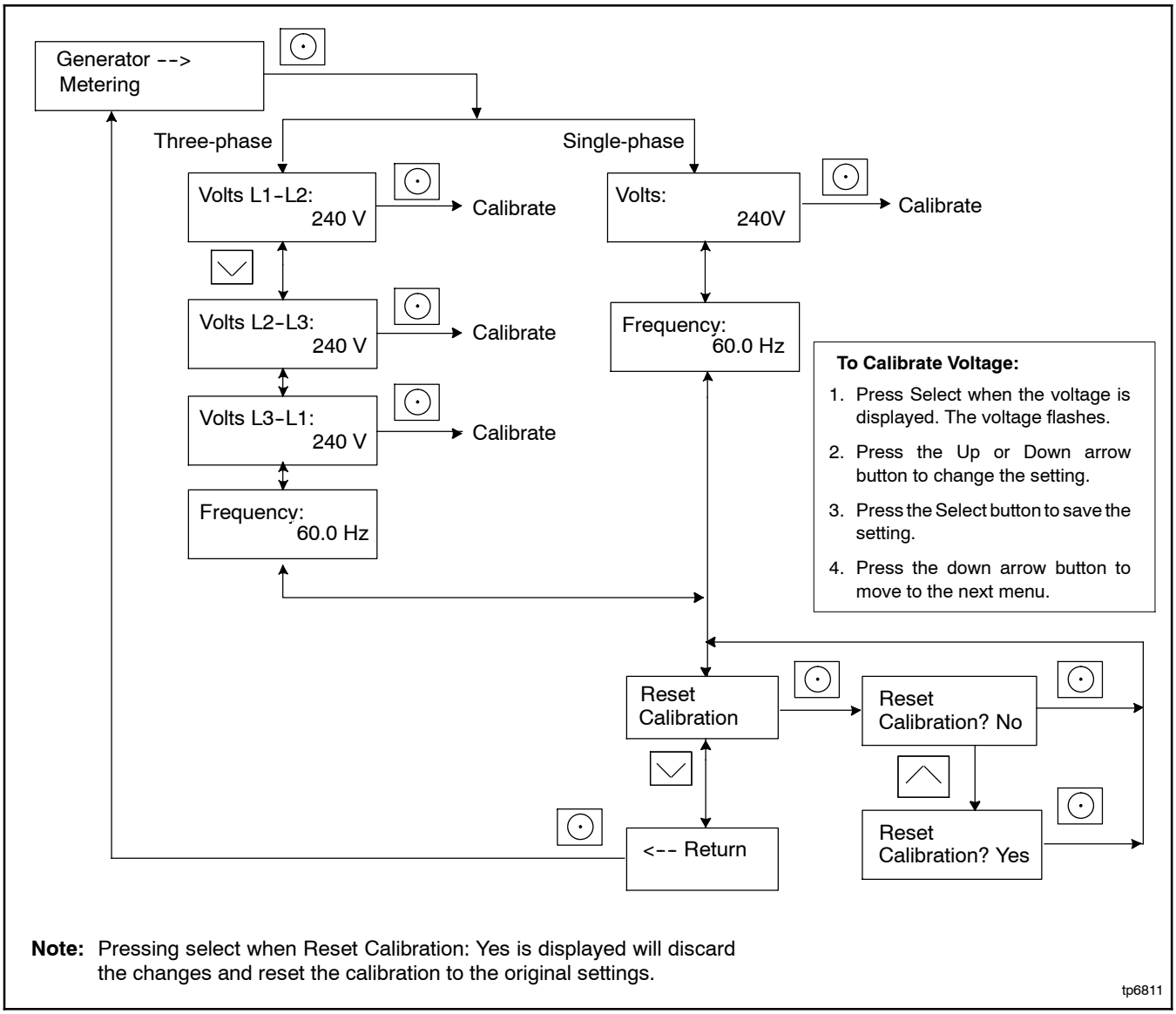


Figure 3-13 Voltage Calibration

3.7.2 Calibration Using SiteTech

Voltage calibration factors can be adjusted using SiteTech software to calibrate the RDC2 controller. Connect a personal computer (laptop) to the controller using a USB cable and follow this procedure to use Kohler® SiteTech™ software to calibrate the controller.

The voltage calibration factors are located in the Genset Calibration group in SiteTech™. Find the parameter labelled Genset Calibration Factor Voltage, L1–L2. See Figure 3-15.

Note: A digital voltmeter is required for these adjustments.

1. With the generator set off, connect a digital multimeter to measure output voltage across L1 and L2. Set the meter to measure AC volts.
2. Start the generator set by pressing the RUN button on the RDC2 controller.
3. Compare the voltage reading on the digital voltmeter to the voltage displayed by the controller.
4. If the voltage displayed on the controller does not match the measured voltage, use the equation in Figure 3-14 to calculate a new value for Genset Calibration Factor Voltage, L1–L2.
5. Type the new value for Genset Calibration Factor Voltage, L1–L2 into SiteTech and click on Apply Changes. See Figure 3-15.
6. Allow a few seconds for the controller to adjust to the new factor and then compare the voltmeter reading with the voltage displayed on the controller.
7. If the voltage readings do not match, check your calculations. Check the calibration factor and both voltage readings again. Repeat the procedure using the new values, if necessary.

Note: If you would like to simplify the calculation, set the calibration factor to 1.0000 and then repeat the calibration procedure from step 3.

8. Press OFF to stop the generator set.
9. Repeat the procedure for voltage across L2–L3 and L3–L1, if necessary. (Three-phase only.)

$$(V_{meter} \div V_{control}) \times F_{old} = F_{new}$$

V_{meter} = Voltmeter reading

$V_{control}$ = Voltage displayed on controller

F_{old} = Genset Calibration Factor Voltage, L1–L2, from SiteTech before calibration

F_{new} = New value to enter for Genset Calibration Factor Voltage, L1–L2, in SiteTech

Example:

Voltmeter reading: 241.2

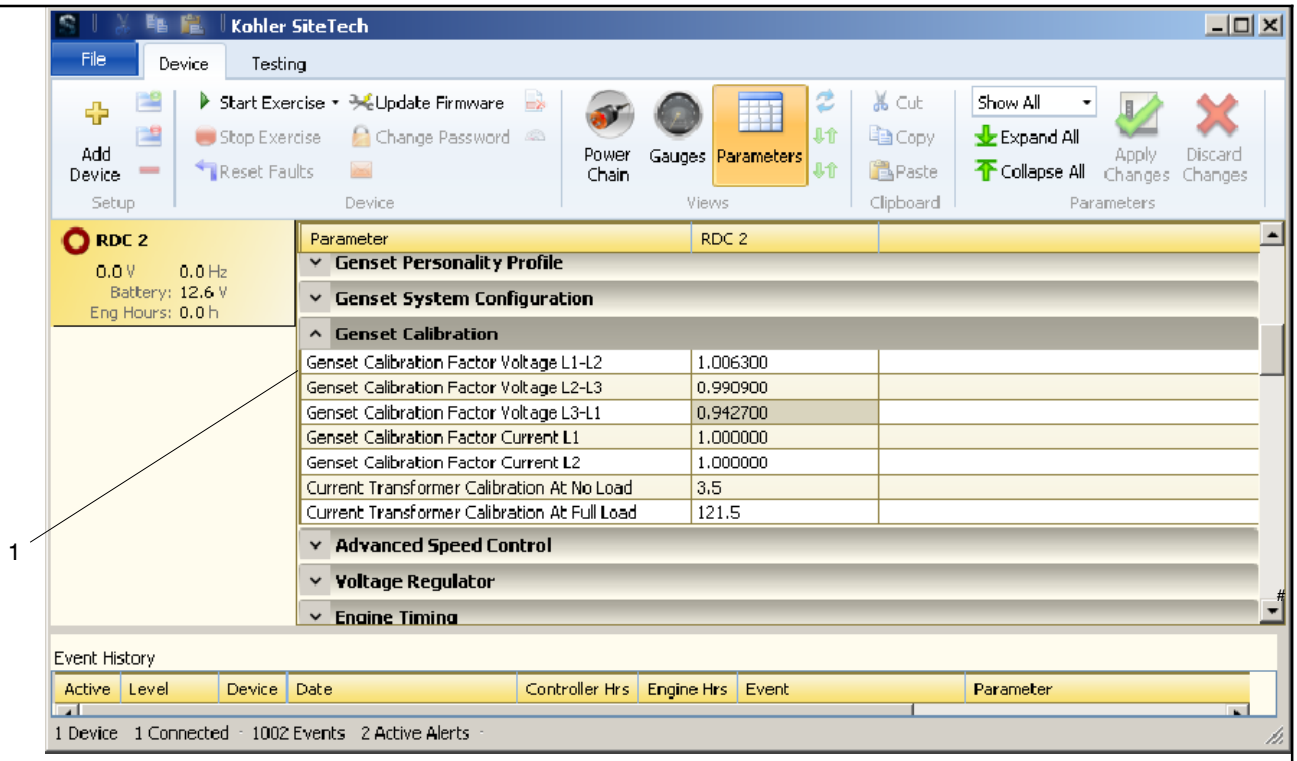
Controller display: 240

Old calibration factor (from SiteTech): 1.0063

New calibration factor:

(241.2 ÷ 240) x 1.0063 = **1.0113**

Figure 3-14 Voltage Calibration Factor



1. Voltage calibration factor

Figure 3-15 Voltage Calibration Factor in SiteTech™

3.8 Setting the OnCue Password

If the Kohler® OnCue® Plus Generator Management System is used to monitor the generator set, reset the OnCue password as described below.

Refer to Figure 3-16 during this procedure.

1. Press Select and then press the down arrow button to navigate to the networking Information menu.
2. Press Select. Networking Status is displayed.
3. Press the Down arrow button. Networking Configuration is displayed.
4. Press Select. Reset OnCue Password is displayed.
5. Press and HOLD the Select button until Reset OnCue Password? No appears. The word No will flash.
6. Press the Up arrow button to change the word No to Yes.
7. Press Select to reset the password. The generator set serial number and new password are displayed for 10 seconds. Be sure to write down the new password for entry into the OnCue Plus program.

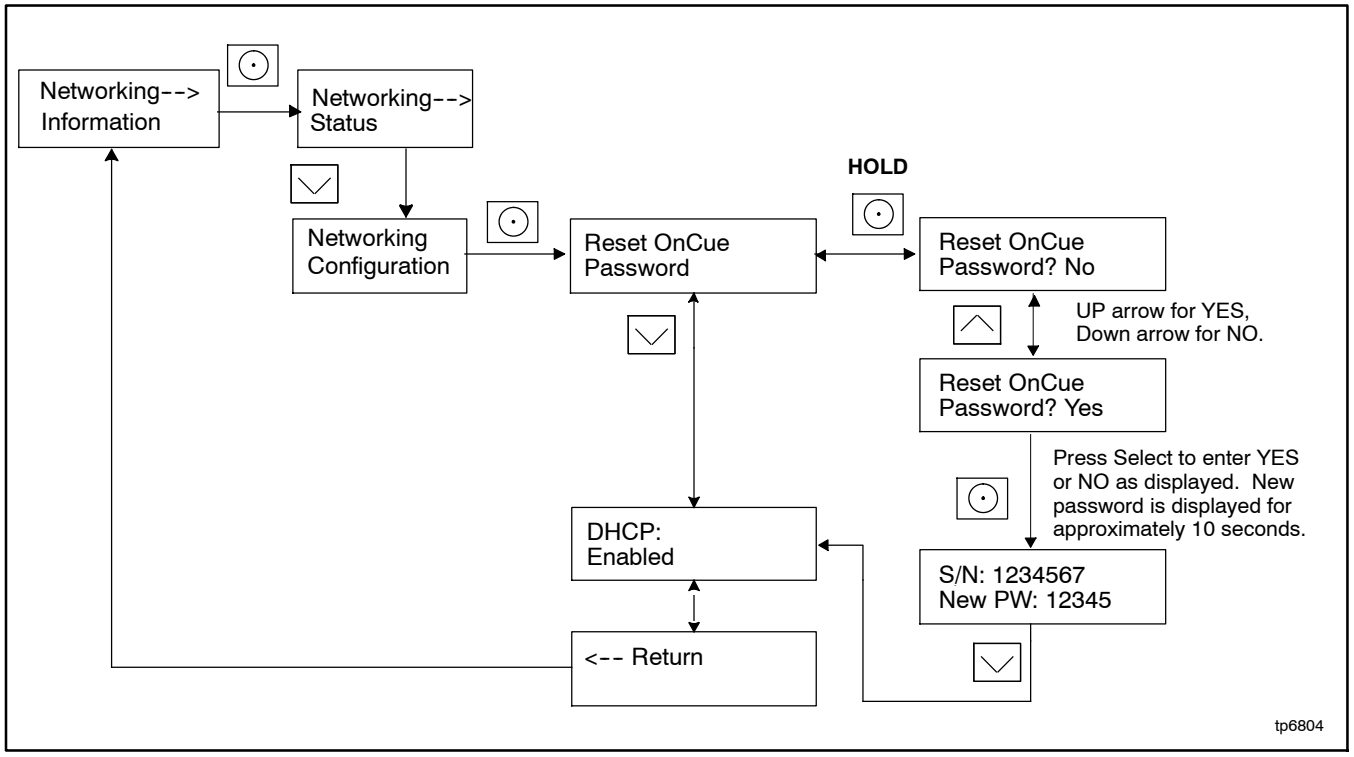
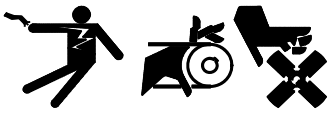


Figure 3-16 Setting the OnCue® Plus Password, RDC2

Notes

4.1 General

⚠ 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) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (–) lead first. Reconnect the negative (–) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

The generator set engine is water cooled. The cooling system includes the radiator and cooling fans. Components of the cooling system are shown in Figure 4-3. Cooling fans are described in Section 4.10.

The closed-loop engine cooling system includes the engine water pump, which circulates the cooling water, and the engine thermostat which opens and closes the cooling water flow to maintain a constant engine temperature. Refer to the engine service manual for thermostat and water pump service information.

⚠ WARNING

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

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

Before servicing, allow the engine to cool. Release pressure from the cooling system before removing the pressure cap. To release pressure, cover the pressure cap with a thick cloth and then slowly turn the cap counterclockwise to the first stop. Remove the cap after pressure has been completely released and the engine has cooled. Check the coolant level at the overflow bottle.

Note: Block heater damage. The block heater will fail if the energized heater element is not immersed in coolant. Fill the cooling system before turning on the block heater. Run the engine until it is warm and refill the radiator to purge the air from the system before energizing the block heater.

4.2 Clean Radiator Fins and Inspect Hoses

To prevent generator set from shutting down or becoming damaged due to overheating, keep the cooling air inlets clean and unobstructed at all times. Inspect the exterior of the radiator for obstructions; remove all dirt and foreign material with a soft brush or cloth (to avoid damaging radiator fins). Check all hoses and connections for leaks and replace any hoses that are cracked, frayed, or feel spongy. When coolant level checks are made, check the condition of the radiator cap rubber seal; replace if cracked or deteriorating. Remove dirt and other debris from the radiator cap and filler neck.

4.3 Engine Thermostat

See Figure 4-1 for the location of the engine thermostat. The thermostat rating is shown in Figure 4-2. Refer to the engine service manual for thermostat and water pump service information.

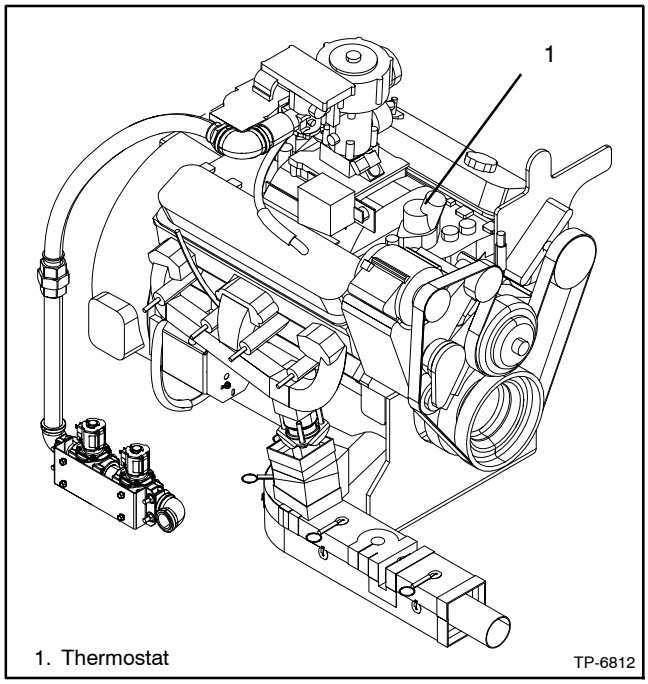


Figure 4-1 Thermostat Location on the Engine (48RCL shown)

Item	Rating
Thermostat	71°C (160°F)

Figure 4-2 Thermostat Rating

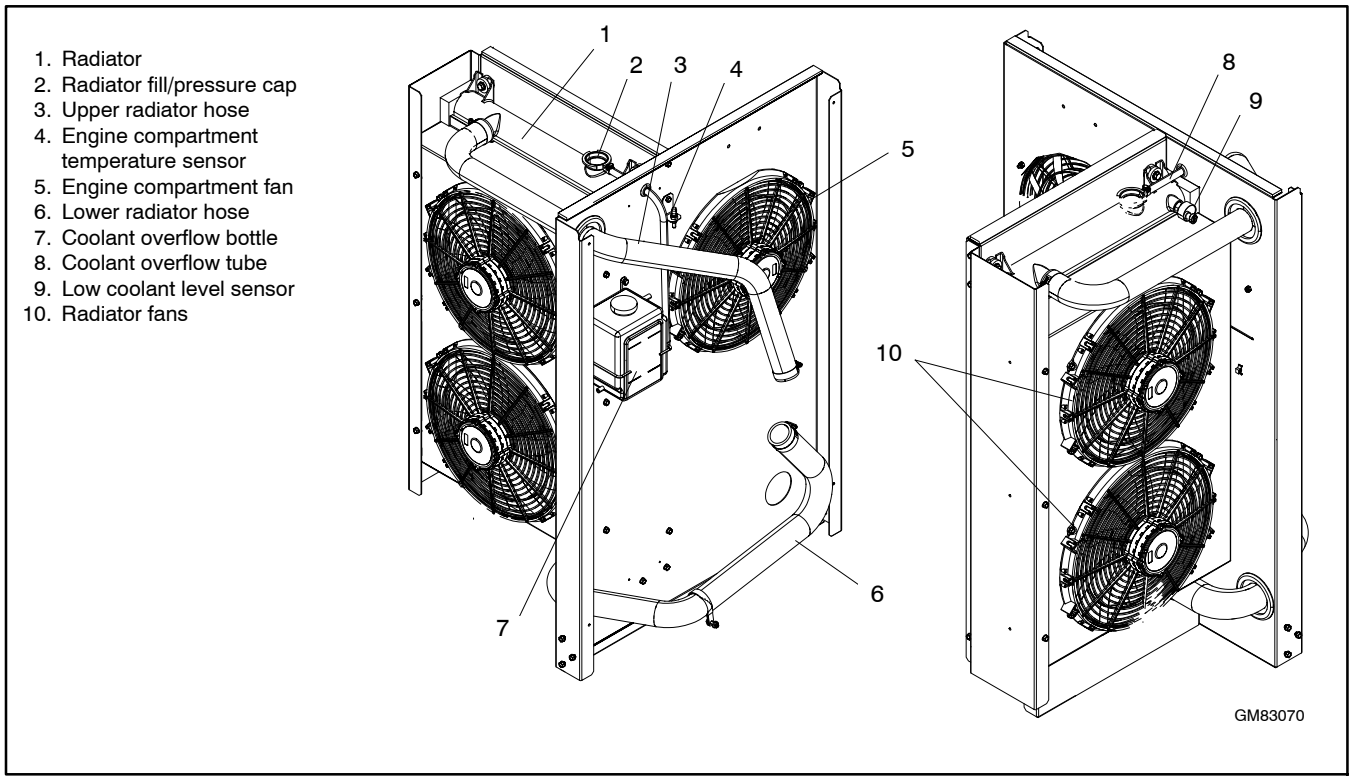


Figure 4-3 Cooling System Components

4.4 Cooling System Inspection

To prevent generator shutdown or damage because of overheating:

- Keep the cooling air inlets clean and unobstructed.
- Inspect the radiator's exterior for obstructions and remove dirt and foreign material with a soft brush or cloth to avoid damaging the radiator fins.
- Check the hoses and connections for leaks and replace any cracked, frayed, or spongy hoses.
- Check the condition and tension of the radiator water pump belt(s).
- Check the rubber seal of the radiator's pressure cap. Remove dirt and other debris from the pressure cap and filler neck. Replace a cracked or deteriorated cap.

4.5 Checking and Filling Coolant

Maintain the coolant level in the coolant overflow bottle between the High and Low markings. See Section 1, Service Views, for the coolant overflow bottle location.

Note: Periodically check the coolant level by removing the radiator's pressure cap. Do not rely solely on the level in the coolant overflow bottle.

Add fresh coolant until the level is just below the overflow tube opening. Use a coolant mixture of 50% ethylene glycol and 50% clean, softened water to inhibit rust/corrosion and prevent freezing.

A coolant solution of 50% ethylene glycol provides freezing protection to –37°C (–34°F) and overheating protection to 129°C (265°F). A coolant solution with less than 50% ethylene glycol may not provide adequate freezing and overheating protection. A coolant solution with more than 50% ethylene glycol can cause engine or component damage. Do not use alcohol or methanol antifreeze or mix them with the specified coolant.

4.6 Draining Cooling System

The radiator contains a coolant drain valve to drain the cooling system. When draining the coolant, remove the radiator's pressure cap, which will allow the entire system to drain and will prevent air pockets from forming and restricting coolant passage to the block.

1. De–energize the block heater, if equipped.
2. Remove the pressure cap to allow the entire system to drain and prevent air pockets from restricting coolant flow through the engine block.
3. Open the coolant drain valve and allow the system to drain.
4. If the inside of the radiator has mineral deposits or the used coolant contains dirt or grease, go to Section 4.7, Flushing and Cleaning. If the cooling system does not have mineral deposits, refill the cooling system as instructed in Section 4.8, Filling Cooling System.

4.7 Flushing and Cleaning

For optimum protection, drain, flush, and refill the cooling system at the interval listed in the service schedule.

Flushing and Cleaning Procedure

1. Flush the system with clean water.
2. Drain, clean, and flush the coolant overflow bottle.
3. Refill the cooling system as instructed in Section 4.8.

4.8 Filling Cooling System

Model	Coolant Capacity, L (gal.)	
	Generator Set	With Block Heater
38RCL	15 (4.0)	15.6 (4.2)
48RCL	17 (4.5)	17.6 (4.7)
48RCLA	20.8 (5.5)	21.4 (5.7)
60RCL	20.8 (5.5)	21.4 (5.7)

Figure 4-4 Coolant Capacity

Note: Do not add coolant to a hot engine. Adding coolant to a hot engine can cause the cylinder block or cylinder head to crack. Wait until engine has cooled.

1. Close the radiator's coolant drain valve and tighten the hose clamps.
2. Fill the radiator with the recommended coolant mixture of 50% ethylene glycol and 50% clean, softened water to inhibit rust/corrosion and prevent freezing. The coolant capacity is shown in Figure 4-4.
3. Operate the engine with the radiator cap removed until the thermostat opens and the upper radiator hose becomes hot.
4. Stop the engine and allow it to cool.
5. Add coolant to the radiator to just below the overflow tube on the filler neck. See Section 1, Service Views, for the overflow tube location.
6. Replace the radiator's pressure cap.
7. Maintain the coolant level in the coolant overflow bottle between the High and Low markings. See Section 1, Service Views, for the coolant overflow bottle location.
8. Re-energize the block heater, if equipped.

4.9 Pressure Cap

The pressure cap raises the boiling point of the coolant, enabling higher operating temperatures. If the cap leaks, replace it with the same rating type of cap. The pressure cap typically has the pressure rating stamped on the cap body. Find the pressure cap rating in Figure 4-5.

Item	Rating
Pressure cap	97 kPa (14 psi)

Figure 4-5 Pressure Cap Rating

4.10 Cooling Fans

4.10.1 Fan Operation

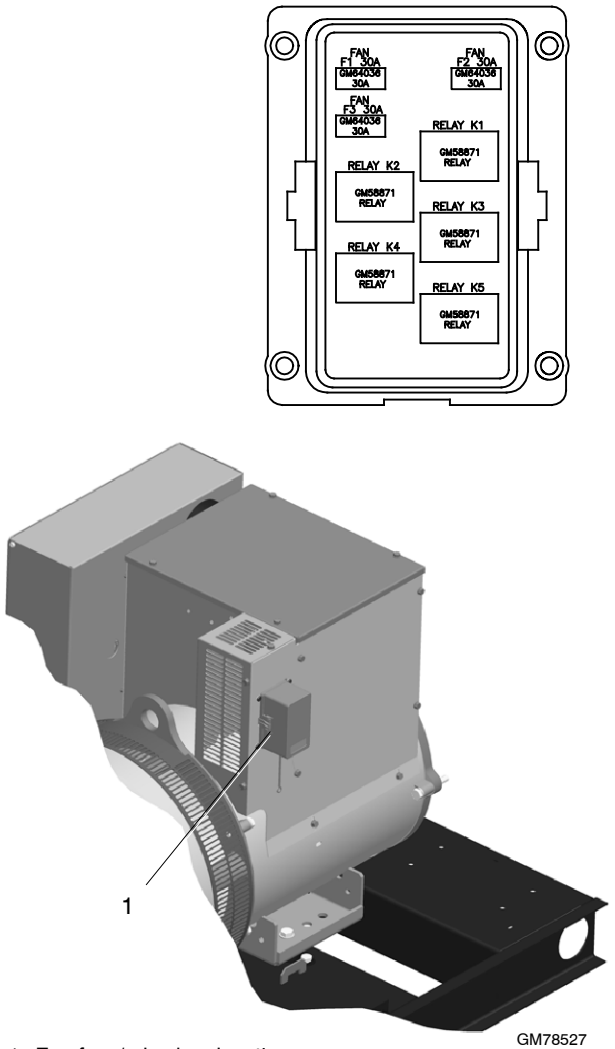
The generator cooling system includes three electric fans to provide cooling air flow. See Figure 4-3 for the fan locations. Two fans are mounted on the radiator assembly to cool the engine jacket water circuit. The third fan draws air through the generator enclosure to remove heat generated by the alternator and radiant heat from the engine.

The electric fans are powered by the 12 VDC starting battery and engine-mounted battery charging alternator. Each fan is protected by a 30 amp fuse. The fans are operated in high-speed and low-speed modes based on genset operating temperatures. The fan operating speeds are driven by five relays controlled by the RDC2 controller. The fuses and relays are housed in the fuse/relay terminal block. See Figure 4-6.

The radiator fans are operated in low-speed mode by configuring the relays to connect the two radiator fans in series across the 12-volt battery supply system, supplying each fan approximately one-half the supply voltage. For high-speed fan operation, the fans are connected in parallel across the power supply, supplying each fan the full 12-volt battery supply. The RDC2 controls operating speed based on engine coolant temperature. The fans are set to low-speed mode on generator set startup (for a minimum of the first 10 seconds of operation). High-speed operation is selected when the coolant temperature exceeds 93°C (200°F). If the coolant temperature returns to an operating temperature below 79°C (175°F), the fans return to low-speed operation.

The engine compartment fan is operated in low-speed mode by configuring the relays to connect the fan in series with a power resistor which is housed within protective covers behind the fuse/relay terminal block. For high-speed fan operation, the fan is connected directly across the 12 VDC battery supply. The RDC2 controls operating speed based on engine compartment temperature, as measured by the engine compartment temperature sensor located on the bulkhead wall adjacent to the engine compartment fan. The fan is set to low-speed mode on engine startup (for a minimum of the first 10 seconds of operation). High-speed operation is selected when engine compartment temperature exceeds 57°C (135°F). If the engine compartment temperature returns to an operating temperature below 46°C (115°F), the fan returns to low-speed operation.

Note: The engine compartment fan continues to run for 2 minutes after the engine stops to evacuate residual engine and exhaust system heat.



1. Fan fuse/relay box location

Figure 4-6 Fan Fuses and Relays

Sensor	Temperature, °C (°F)	
	High Speed	Low Speed
Coolant	93 (200)	79 (175)
Engine Compartment	57 (135)	46 (115)

Figure 4-7 Fan Operating Temperatures

4.10.2 Fan Troubleshooting Guide

Symptom	Corrective Action
All electric fans are not operating	Check fan fuses. Check that fan system positive power supply is properly connected to the positive (+) battery terminal.
Individual fan is not operating	Check fan fuses. Check fan for obstruction. Check that the fan blades rotate freely. Check fan motor for open coil (continuity). Check harnesses from fuse/relay terminal block to fans and controller for damaged leads or terminations. Evaluate relays for functionality. Check for transition at threshold temperatures noted in Figure 4-7.
Overheating: Fan does not transition to high-speed at threshold temperature	Check sensor function. Check harnesses from fuse/relay terminal block to fans and controller for damaged leads or terminations. Evaluate relays for functionality. Check continuity of the coil. Check for transition at threshold temperatures noted above.
Fans operate in high-speed mode continuously	Check radiator and enclosure openings for air flow blockage. Check sensor function. Check harnesses from fuse/relay terminal block to fans and controller for damaged leads or terminations. Evaluate relays for functionality. Check continuity of the coil. Check for transition at threshold temperatures noted above.

5.1 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 manuals 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.

5.2 Theory of Operation, Electronic Start Sequence

The following steps trace the electronic system as wires and components are energized and fuel, ignition, and engine crank are added during the start sequence. Use the steps below and refer to the wiring schematics in section 8 to assist with troubleshooting and to check for loose connections or damaged wires.

1. Fuel

   a. When the Run button is pressed, the RDC2 controller energizes lead 70 and 71.

      (1) Lead 70 energizes leads 70A, 701A, and 70B.

      (2) Lead 71 supplies power to the R1 power relay. See step 2, engine crank.

   b. Lead 70A supplies power to fuel valve 1 and fuel valve 2.

   c. Lead 70B energizes the VSWITCH on the ECM.

   d. When the ECM receives the VSWITCH signal, the ECM provides a ground to fuel valve 1, fuel valve 2, and R1 power relay.

      (1) The fuel valves open allowing fuel to flow to the air–fuel mixer and throttle body.

2. Engine Crank

   a. When the ECM provides a ground to the R1 power relay, the R1 power relay closes the R1 contact.

   b. R1 contact energizes the starter solenoid and provides cranking power to the engine.

3. Ignition

   a. When the crank position sensor detects engine rotation, the ECM energizes the R2 power relay.

   b. The R2 power relay closes the R2 contact.

   c. The R2 contact energizes the ignition coil and ignition module and the engine starts.

   d. When the RDC2 controller senses that the engine has reached 750 RPM, the RDC2 controller will drop power to lead 71 ending the start sequence.

5.3 Initial Checks

Note: Read all safety precautions at the beginning of this publication before performing any work on the generator set.

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

- **Loose connections or damaged wiring.**
- **Blown fuses.** See Section 5.4.2.
- **Dead battery.**
- **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 6.8, Fuel Systems.
- **Fault shutdown.** Check for a fault message on the controller display. Section 5.7 describes the warning and shutdown fault messages. If a fault message is displayed, identify and correct the cause of the fault condition. Then reset the controller.
- **Incorrect controller settings.** Always check the controller settings before replacing the controller. See Section 3.3.1 for controller settings. Refer to the operation manual for instructions to check and change the controller settings from the controller

keypad, or use a personal computer and Kohler® SiteTech™ software.

5.4 Circuit Protection

If the generator set circuit breaker trips or the fuses blow repeatedly, contact an authorized Kohler distributor/dealer for service.

5.4.1 Line Circuit Breaker

The line circuit breaker interrupts the generator output in the event of an overload condition or a fault in the wiring between the generator and the load. If the circuit breaker trips, reduce the load and check the wiring.

5.4.2 Fuses

Always identify and correct the cause of a blown fuse before restarting the generator set. Refer to Figure 5-5, Troubleshooting Chart, for conditions that may indicate a blown fuse. Obtain replacement parts and service from an authorized Kohler distributor/dealer.

Fan Fuses. Three 30 amp fan fuses are located in the fan fuse and relay box. See Section 1.7, Service Views, for location.

Engine Fuses. Engine fuses are located in the engine fuse box. See the service views in Section 1.7 for the fuse box location.

- Fuse F1, 5 amps
- Fuse F2, ECM 10 amps
- Fuse M3, battery charging alternator, 70 amps
- Fuse F4, ignition,15 amps.
- Fuse F6, starter, 20 amps.

5.4.3 Controller Internal Circuit Protection

The controller is equipped with internal circuit protection for accessory and main power overload conditions. Press OFF to reset.

5.5 Fuel System Troubleshooting

⚠ 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.

Most problems with gas fuels involve either fuel pressure or fuel regulator function. Basic troubleshooting consists of verifying fuel pressures and checking each fuel system component.

Check the following items:

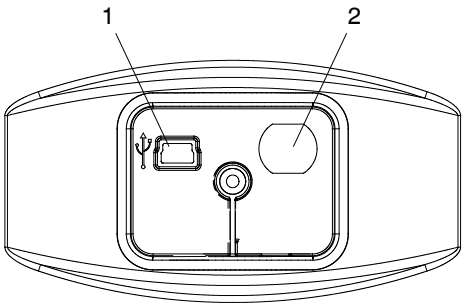
- Check primary fuel regulator outlet pressure. This is the line pressure.
- Check primary fuel regulator vent for obstructions.
- Check fuel shutoff inlet pressure.
- Check secondary fuel regulator inlet pressure.
- Check fuel inlet pressure at the gas mixer.
- Verify that fuel supply lines and meters are sized to support all gas appliances.
- Perform fuel system maintenance if necessary. See Section 2.8, Fuel System Maintenance.

5.6 Controller Service Access

Section 3.3.1 lists controller settings. Some settings can be changed from the controller keypad. All other adjustable settings require a personal computer (laptop) with Kohler® SiteTech™ software for changes.

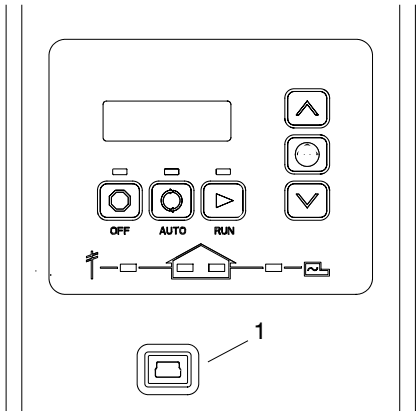
A USB port is located in the controller's service access area. Remove the service access door to access the USB port. Use a USB cable with a mini-B connector to connect the controller to your PC. See Figure 5-1 and Figure 5-2.

See TP-6701, SiteTech™ Software Operation Manual, for software operation instructions.



1. USB port (for service)
2. Mini-breaker, not connected

Figure 5-1 Service Access for Older Controllers (cover removed)



1. USB port (for service)

Figure 5-2 Service Access for Newer Controllers

5.7 Fault Messages

Note: Read all safety precautions at the beginning of this publication before performing any work on the generator set.

The RDC2 controller displays fault messages to aid in troubleshooting. Fault messages, descriptions, and recommended checks are listed in Figure 5-3.

Some fault conditions are reported to the RDC2 controller by the engine ECM. Refer to the Engine Service Manuals for more information.

Identify and correct the cause of the fault condition. Then press the OFF button to reset the controller after a fault shutdown.

Fault Message	Action	Description/ Comments	Check
AC Sens Loss Shutdwn (Loss of AC sensing shutdown)	Shutdwn	The controller shut down the generator because there was less than 5% of rated voltage measured on Phase A (or B or C if 3 Phase) for 3 seconds, only in AUTO, only after acceptable voltage (> 5% of UV setting) has been detected.	Check for loose wiring and connections. Check all AC leads. Troubleshoot alternator.
AC Sens Loss Warning (Loss of AC sensing warning)	Warning	The controller has measured less than 5% of rated voltage on Phase A (or B or C on 3 Phase), for 1 second, 10 seconds after crank disconnect.	Check for loose wiring and connections. Check all AC leads. Troubleshoot alternator.
Accy PwrOver Warning	W	Accessory Power Overload. An over current fault (short circuit) on the accessory controller power output.	Check wiring to accessories. Troubleshoot the accessories. Refer to the documentation provided with the accessories.
Alt Protect Shtdwn	SD	High generator current has been detected. The generator set shuts down to protect the alternator from damage caused by overheating the windings. (38RCL only)	Reduce the load by disconnecting non-essential equipment. Check wiring and troubleshoot connected equipment. Check for phase imbalance. Check for very high power factor loads.
ATS ComError Warning (ATS communication error)	Warning	The controller has lost communications with the RXT ATS that had previously been communicating properly.	Check connection to ATS module.
ATS Fail Xfr Warning (ATS fail to transfer)	Warning	The RXT ATS has reported a fail to transfer, the digital output for ATS Fail To Transfer (PIM) is active (contacts closed).	Consult ATS manual for troubleshooting.
ATS PhaseRot Warning (ATS phase rotation)	Warning	The RXT ATS has reported a Phase Rotation Mismatch (3 phase only) and the ATS will not transfer.	Check wiring to ATS. Consult ATS manual for troubleshooting.
Aux Input Shutdwn * (Auxiliary input shutdown)	Shutdown	The controller shut down the generator because the digital input for a custom shutdown (AuxiliaryInputShutdown - PIM) was activated (low).	Check customer equipment connected to the PIM module.
Aux Input Warning * (Auxiliary input warning)	Warning	The digital input for a custom warning (AuxiliaryInputWarning - PIM) is active (low).	Check customer equipment connected to the PIM module.
Batt Chg Flt Warning * (Battery charger fault warning)	Warning	The digital input for Battery Charger Fault Warning (PIM) is active (low). For an external battery charger only, not applicable to the RDC2 built-in battery charging.	Check customer equipment connected to the PIM module.
Battery High Warning	Warning	The controller has measured battery voltage that is above the high warning setting for 10 seconds or more. Operates during exercise and normal operation.	Check cranking battery.
Battery Low Shutdwn	Shutdown	Battery voltage dropped to 11 VDC or less for 30 seconds or more. Operates after the generator set has been running for at least one minute.	Check cranking battery. Check battery charger DC output voltage from RDC2 on lead CHO to the battery.
Battery Low Warning †	Warning	The controller has measured battery voltage that is below the low warning setting for 90 seconds or more. The battery voltage is checked before allowing an exercise to start.	Check cranking battery. Check battery charger DC output voltage from RDC2 on lead CHO to the battery.

* Programmable Interface Module (PIM) required

§ Load management device (LCM, load shed kit, or RXT with combined interface/load management board).

† Applies during exercise runs and normal operation.

Fault Message	Action	Description/ Comments	Check
CAN Shutdown	Shutdown	The ECM shut down the engine and reported an unknown fault code.	Troubleshoot engine operation per the engine service manual.
Chk DateTime Warning (Check date and time warning)	Warning	DC power to the controller has been interrupted and the date and time may not be correct. Event history may not have accurate time/date stamps.	Verify the time and date settings to ensure proper operation of scheduled operations and for event history logging.
Compartmnt Temp Shutdwn	Shutdown	The controller shutdown the generator because engine compartment air temperature has exceeded 174°F (79°C).	Troubleshoot fan circuit failure and/or temperature sensor circuit. Check for blockage of intake or exhaust vents.
Compartmnt Temp Warning	Warning	The controller has detected engine compartment temperature that is above 167°F (75°C).	Troubleshoot fan circuit failure and/or temperature sensor circuit. Check for blockage of intake or exhaust vents.
Coolant Level Low Shutdwn	Shutdown	The controller shutdown the engine because the coolant level sensor indicated low coolant for 5 seconds or more.	Check coolant level and fill as needed. Check for air in cooling system. Check the coolant level sensor operation.
Coolant Temp High Shutdwn	Shutdown	The ECM shutdown the engine and reported high coolant temperature as the fault.	Check engine cooling system. Check radiator fans for proper operation. Check for blockage of inlet and exhaust vents.
Coolant Temp High Warning	Warning	The ECM is reporting high coolant temperature.	Check engine cooling system. Check radiator fans for proper operation. Check for blockage of inlet and exhaust vents.
Coolant Temp Low Warning	Warning	The ECM is reporting low coolant temperature.	Check cooling system.
Coolant Temp No Sig Shutdwn	Shutdown	The ECM shutdown the engine and reported no coolant temperature signal as the fault.	Check cooling system and coolant level sensor circuit.
Default Pars Warning (Default Parameters)	Warning	The controller has been loaded with default parameters.	Configure settings as needed or as required for desired operation.
ECM Addr Err Shutdwn	Shutdown	The controller shut down the generator because there is a conflict in addressing on the ECM CAN bus.	Verify no other devices connected and broadcasting on the CAN bus.
ECM Comm Err Shutdwn	Shutdown	The controller shut down the generator because communication with the ECM was lost, for 4 or more seconds.	Check CAN communication wiring between controller and ECM.
ECM Mismatch Shutdwn	Shutdown	The controller shut down the generator because the ECM does not match any of the supported models.	Verify controller configuration using SiteTech. Consult local service technician.
Emerg Stop Shutdwn	Shutdown	The controller shut down the generator because the emergency stop circuit was tripped (open circuit).	Check E-stop circuit for open switches, broken wires, disconnected wires, etc.
Engine Speed High Shutdwn	Shutdown	The controller shut down the generator because engine speed, as calculated from AC frequency, was above the high speed setting for 0.3 seconds or more; or the ECM shut down the engine and reported overspeed as the fault code.	Troubleshoot engine operation per the engine service manual.

* Programmable Interface Module (PIM) required

§ Load management device (LCM, load shed kit, or RXT with combined interface/load management board).

† Applies during exercise runs and normal operation.

Fault Message	Action	Description/ Comments	Check
Engine Speed Low Shutdwn	Shutdown	The controller shut down the generator, after crank disconnect, because engine speed, as calculated from AC frequency, was below the low speed setting for 3 seconds or more.	Troubleshoot engine operation per the engine service manual.
Exer Not Sch Warning	Warning	There is no exercise scheduled.	Set the exercise schedule.
Frequency High Shutdwn	Shutdown	The controller shut down the generator because the frequency measured on Phase A exceeded the high frequency setting for 10 seconds, 10 seconds or more after crank disconnect.	Troubleshoot engine operation per the engine service manual.
Frequency Low Shutdwn †	Shutdown	The controller shut down the generator because the frequency measured on Phase A was less than the low limit for 10 seconds or the measured frequency was 10 Hz or more less than rated for 60 seconds or more, 10 seconds or more seconds after crank disconnect.	Troubleshoot engine operation per the engine service manual.
Fuel Leak Shutdwn *	Shutdown	The controller shut down the generator because the digital input for Fuel Tank Leak Shutdown (PIM) was activated (low).	Check customer equipment connected to the PIM module.
Fuel Leak Warning *	Warning	The digital input for Fuel Tank Leak Warning (PIM) is active (low).	Check customer equipment connected to the PIM module.
Fuel Level CrHi Warning *	Warning	The digital input for Critically High Fuel Level Warning (PIM) is active (low).	Check customer equipment connected to the PIM module.
Fuel Level High Warning *	Warning	The digital input for High Engine Fuel Level Warning (PIM) is active (low).	Check customer equipment connected to the PIM module.
Fuel Level Low Shutdwn *	Shutdown	The controller shut down the generator because the digital input for Low Fuel Level Shutdown (PIM) was activated (low).	Check customer equipment connected to the PIM module.
Fuel Level Low Warning *	Warning	The digital input for Low Fuel Level Warning (PIM) is active (low).	Check customer equipment connected to the PIM module.
GenBrkerOpen Warning (Generator Circuit Breaker Open)	Warning	There is voltage at the generator set but no voltage measured on the emergency side of the ATS (Model RXT transfer switch).	Check line circuit breaker. Check for and correct short circuits or overloading on the load side before resetting the circuit breaker.
Ground Fault Warning *	Warning	The digital input for Ground Fault Warning (PIM) is active (low).	Check customer equipment connected to the PIM module.
Lo Crank Vlt Warning	Warning	During cranking, the controller measured battery voltage less than 60% (7.2V or 14.4V) for 6 seconds or more during cranking.	Check cranking battery.
Locked Rotor Shutdwn	Shutdown	The controller shut down the generator because no rotation of the engine or alternator was detected, for 3 seconds or more, during cranking.	Check cranking circuit. Troubleshoot the engine. See Engine Service Manuals. Check alternator connections to controller and auxiliary winding circuit breaker. Troubleshoot the alternator.
MainPwrOverL Shutdwn	Shutdown	The internal current limit circuit has tripped, indicating an overcurrent condition on the DC power supply circuit.	Check crank, run, and flash relay circuits for short circuits.

* Programmable Interface Module (PIM) required

§ Load management device (LCM, load shed kit, or RXT with combined interface/load management board).

† Applies during exercise runs and normal operation.

Fault Message	Action	Description/ Comments	Check
Maint Req'd Warning	Warning	Engine run time, or calendar days, has exceeded the maintenance reminder setting.	Change the oil and perform other service according to the service schedule in Section 2.2. Reset the maintenance timer after service. See Section 2.3.4, step 6.
Not In Auto Warning	Warning	The RDC2 controller is not in AUTO. The generator will not start from an ATS or remote device. The digital output for Not In Auto (PIM) is active (contacts closed).	Press the Auto button to ensure automatic system operation.
OB1 CommLoss (PIM, load management device§, or RXT)	Warning	Communications with option board #1 has been lost.	Check RBUS wiring to inoperative option board.
OB2 CommLoss (PIM, load management device§, or RXT)	Warning	Communications with option board #2 has been lost.	Check RBUS wiring to inoperative option board.
OB3 CommLoss (PIM, load management device§, or RXT)	Warning	Communications with option board #3 has been lost.	Check RBUS wiring to inoperative option board.
OB4 CommLoss (PIM, load management device§, or RXT)	Warning	Communications with option board #4 has been lost.	Check RBUS wiring to inoperative option board.
Oil Level Low Shutdwn *	Shutdown	The controller shut down the generator because the digital input for Low Oil Level Shutdown (PIM) was activated (low).	Check customer equipment connected to the PIM module.
Oil Level Low Warning *	Warning	The digital input for Low Oil Level Warning (PIM) is active (low).	Check customer equipment connected to the PIM module.
Oil Pressure Low Shutdwn	Shutdown	The ECM shutdown the engine and reported low oil pressure as the fault.	Check for oil leaks. Check the oil level and add oil if low. Check the oil pressure sensor; see Engine Service Manuals.
Oil Pressure Low Warning	Warning	The ECM is reporting a low oil pressure warning.	
Oil Pressure No Sig Warning	Warning	The ECM shutdown the engine and reported no oil pressure signal as the fault.	Check engine oil pressure sensor and wiring to the ECM. Troubleshoot engine.
Oil Pressure No Sig Shutdwn	Shutdown	The ECM shutdown the engine and reported no oil pressure signal as the fault.	Check engine oil pressure sensor and wiring to the ECM. Troubleshoot engine.
Over Crank Shutdwn	Shutdown	The controller shut down the generator, and ceased cranking, because the engine was not successfully started after the completion of the last of the crank cycles setting delay 15 seconds.	Check fuel supply. Check cranking circuit. Check cranking battery. Troubleshoot engine; see Engine Service Manuals.
RBUS ComError Warning	Warning	The controller has lost communications with a PIM or load management device§ that had previously been communicating properly.	Check connection to the PIM or load management device§.
Spd Sens Flt Shutdwn (Speed sensor fault)	Shutdown	The controller, or the ECM, shutdown the generator because the speed signal was lost.	Check speed sensor and circuitry to ECM.

* Programmable Interface Module (PIM) required

§ Load management device (LCM, load shed kit, or RXT with combined interface/load management board).

† Applies during exercise runs and normal operation.

Fault Message	Action	Description/ Comments	Check
Total Power High ShtDwn	SD	Measured load is greater than 102% of the generator set power rating for more than 1 minute. (38RCL only)	Reduce the load by disconnecting non-essential equipment. Check wiring and troubleshoot connected equipment. Check for phase imbalance. Check for very high power factor loads.
Volts L1-L2 High Shutdwn †	Shutdown	The controller shut down the generator because the voltage measured from Phase A to Phase B exceeded the high limit for a time greater than the delay setting 2 seconds.	Troubleshoot alternator; see alternator service manual.
Volts L1-L2 Low Shutdwn †	Shutdown	The controller shut down the generator because the voltage measured from Phase A to Phase B was greater 5% of rated, but less than the low voltage setting for a time greater than the delay setting 10 seconds.	Troubleshoot alternator; see alternator service manual.
Volts L2-L3 High Shutdwn †	Shutdown	The controller shut down the generator because the voltage measured from Phase B to Phase C exceeded the high limit for a time greater than the delay setting 2 seconds.	Troubleshoot alternator; see alternator service manual.
Volts L2-L3 Low Shutdwn †	Shutdown	The controller shut down the generator because the voltage measured from Phase B to Phase C was greater 5% of rated, but less than the low voltage setting for a time greater than the delay setting (default 10 seconds).	Troubleshoot alternator; see alternator service manual.
Volts L3-L1 High Shutdwn †	Shutdown	The controller shut down the generator because the voltage measured from Phase C to Phase A exceeded the high limit for a time greater than the delay setting. (default delay time is 2 seconds.)	Troubleshoot alternator; see alternator service manual.
Volts L3-L1 Low Shutdwn †	Shutdown	The controller shut down the generator because the voltage measured from Phase C to Phase A was greater 5% of rated, but less than the low voltage setting for a time greater than the delay setting.	Troubleshoot alternator; see alternator service manual.

***** Programmable Interface Module (PIM) required

§ Load management device (LCM, load shed kit, or RXT with combined interface/load management board).

† Applies during exercise runs and normal operation.

Figure 5-3 Fault Messages Displayed on the RDC2 Controller

5.8 Status Messages

The following messages are displayed to show system status. Notices are displayed in the Event History in SiteTech when active but do not appear on the controller display. Some status messages are displayed when a digital input is activated; the optional Programmable Interface Module (PIM) is required for display of those messages as noted in the table.

Status Message	Action	Description/ Comments	Check
Always Off *	Notice	The OnCue® Plus Power Chain view has been used to control this digital output. The digital output is no longer controlled by the generator set. Applies to digital outputs B3 through B6 on the PIM only.	Click on the output in the OnCue® Plus Power Chain view to turn the output on or off. See the OnCue® Plus Operation Manual. To reset the digital output to a function controlled by the generator set, use SiteTech software to re-assign the output event.
Always On *	Notice		
Auto Locked * (Chicago Code Active)	Notice	The digital output for Chicago Code Active (PIM) is active (contacts closed), indicating the digital input for Chicago Code Active (PIM) is active (low) and thus master switch is locked in the AUTO position.	Check customer equipment connected to the PIM module.
Common Fault	Notice	The digital output for Common Fault (PIM) is active (contacts closed), indicating the generator is shutdown for any (all) fault.	Check for faults and troubleshoot any/all fault conditions individually.
Common Warng	Notice	The digital output for Common Warning (PIM) is active (contacts closed), indicating the any (all) warning is active.	Check for warnings and troubleshoot any/all warning conditions individually.
Emerg Pwr On (Emergency Power System Supplying Load)	Notice	The digital output for EPS Supplying Load (PIM) is active (contacts closed), indicating there is current output (>5%) from the alternator, only if CT's are installed.	Nothing to check.
Eng Cooldown	Notice	The digital output for Engine Cooldown Active (PIM) is active (contacts closed), indicating the generator is running in cooldown. (delay 5 min.)	Check remote start circuit if it was expected that the generator should be running. Consult ATS operations manual.
Fuel Spill *	Notice	The digital output for Fuel Spill (PIM) is active (contacts closed), indicating any of the digital inputs for Fuel Tank Leak Warning, Fuel Tank Leak Shutdown, Engine Fuel Level Warning or Engine Fuel Level Critically High (PIM) is active (low).	Check customer equipment connected to the PIM module.
Gen Running	Notice	The digital output for Generator Running (PIM) is active (contacts closed), indicating the generator is running.	Check controller front panel buttons for potential RUN command. If in AUTO, check remote start lines. Consult ATS operation manual for events that may cause the generator to start.
Low Fuel *	Notice	The digital output for Low Fuel (PIM) is active (contacts closed), indicating any of the digital inputs for Low Fuel Pressure Warning, Low Fuel Level Warning or Low Fuel Level Shutdown (PIM) is active (low).	Check customer equipment connected to the PIM module.

* Programmable Interface Module (PIM) required

† Load management device required (LCM, load shed kit, or RXT with combined interface/load management board).

Status Message	Action	Description/ Comments	Check
Minor Fault	Notice	The digital output for Minor Fault (PIM) is active (contacts closed), indicating either the digital input for Ground Fault Indicator Warning (PIM) is active (low) or the controller detected Low Cranking Voltage.	Check customer equipment connected to the PIM module. Check cranking battery condition.
NFPA Alarm	Notice	The digital output for NFPA Alarm Active (PIM) is active (contacts closed), indicating that at least one of the NFPA faults or warnings is active.	Check for faults and troubleshoot any/all fault conditions individually.
NormSrcUnavl (RXT required)	Notice	The normal power source (source1) is disconnected, unavailable or unacceptable.	Check for utility source power outage. Check wiring and connections to the ATS.
OB1 CommLoss (PIM, load management device†, or RXT)	Notice	Communications with option board #1 has been lost.	Check RBUS wiring to inoperative option board.
OB2 CommLoss (PIM, load management device†, or RXT)	Notice	Communications with option board #2 has been lost.	Check RBUS wiring to inoperative option board.
OB3 CommLoss (PIM, load management device†, or RXT)	Notice	Communications with option board #3 has been lost.	Check RBUS wiring to inoperative option board.
OB4 CommLoss (PIM, load management device†, or RXT)	Notice	Communications with option board #4 has been lost.	Check RBUS wiring to inoperative option board.
Rmt StartCmd	Notice	The controller has received a remote start signal while the master switch is in AUTO, and will go to normal running.	Verify remote start signal. Consult ATS operations manual for cause of generator start.
Run Btn Ack (Run Button Acknowledged)	Notice	The RUN button on the controller has been pushed.	NA
Start Delay	Notice	The digital output for Engine Start Delay (PIM) is active (contacts closed), indicating the engine is in between active cranking cycles.	NA
System Ready	Notice	The digital output for System Ready (PIM) is active (contacts closed), indicating the generator has no active faults or warnings.	NA
VSpdStartCmd (Variable Speed Start Command Issued)	Notice	A diagnostic exercise request has been received by the controller.	Check for a remote exercise command from OnCue® Plus.
Load Shed 1 Status Info †	Notice	The digital output for LoadPriority1Shed is active (contacts closed), indicating the 1st priority load shed (load management device †) has been activated.	Remove loads as required. Check building wiring for proper load distribution. Check engine fuel supply.
Load Shed 2 Status Info †	Notice	The digital output for LoadPriority2Shed is active (contacts closed), indicating the 2nd priority load shed (load management device †) has been activated.	Remove loads as required. Check building wiring for proper load distribution. Check engine fuel supply.
Load Shed 3 Status Info †	Notice	The digital output for LoadPriority3Shed is active (contacts closed), indicating the 3rd priority load shed (load management device †) has been activated.	Remove loads as required. Check building wiring for proper load distribution. Check engine fuel supply.
Load Shed 4 Status Info †	Notice	The digital output for LoadPriority4Shed is active (contacts closed), indicating the 4th priority load shed (load management device †) has been activated.	Remove loads as required. Check building wiring for proper load distribution. Check engine fuel supply.

***** Programmable Interface Module (PIM) required

† Load management device required (LCM, load shed kit, or RXT with combined interface/load management board).

Status Message	Action	Description/ Comments	Check
Load Shed 5 Status Info †	Notice	The digital output for LoadPriority5Shed is active (contacts closed), indicating the 5th priority load shed (load management device †) has been activated.	Remove loads as required. Check building wiring for proper load distribution. Check engine fuel supply.
Load Shed 6 Status Info †	Notice	The digital output for LoadPriority6Shed is active (contacts closed), indicating the 6th priority load shed (load management device †) has been activated.	Remove loads as required. Check building wiring for proper load distribution. Check engine fuel supply.

* Programmable Interface Module (PIM) required

† Load management device required (LCM, load shed kit, or RXT with combined interface/load management board).

Figure 5-4 Status Messages Displayed on the RDC2 Controller

5.9 Generator Set Troubleshooting

The following tables contain generator set troubleshooting, diagnostic, and repair information. Check for loose connections and incorrect controller settings before replacing parts.

For problems with engine starting, operation, speed/governing, or stopping, refer to the engine service manuals. For issues with generator output voltage, refer to the alternator service manual in addition to the items mentioned in the tables below. See the List of Related Materials in the Introduction section of this manual for engine and alternator service manual part numbers.

Problem	Possible Cause	Corrective Action	Reference
Generator set engine does not crank.	Weak or dead battery.	Recharge or replace the battery.	—
	Weak or dead battery due to battery charging malfunction.	Check for DC voltage on lead CHO to the battery. Check for 120 VAC on the black and white leads to controller P5-1 and P5-3 for battery charging. Check 120 VAC utility power connection to the generator set.	W/D Section 8
	Reversed or poor battery connections.	Check the battery connections and ground connection.	
	Inoperative controller.	Check power to the controller.	W/D Section 8
		Troubleshoot the controller.	Section 5.10
	Controller's internal circuit protection has tripped.	Press the OFF button to reset the controller.	—
	Open circuit in engine or controller connections.	Check for loose connections. Check the wire harness continuity.	W/D Section 8
	Poor ground (–) connection.	Clean and tighten.	W/D Section 8
	Generator set is OFF.	Press the RUN button to start the engine or press AUTO to allow remote starting.	
	Engine problem.	Troubleshoot/service the engine.	Engine S/M
Generator set engine cranks but does not start.	Air cleaner clogged.	Clean and/or replace the air cleaner.	Section 2.4
	Weak battery.	Recharge or replace the battery.	
		Check for DC voltage on lead CHO to the battery. Check for 120 VAC on the black and white leads to controller P5-1 and P5-3 for battery charging. Check 120 VAC utility power connection to the generator set.	W/D Section 8
	Poor battery connection.	Clean and tighten the battery connections.	
	Spark plugs.	Check the spark plugs. Regap or replace if necessary.	Section 2.6
	Spark plug connections.	Tighten connections. Replace spark plug wires if necessary.	Section 2.6
	No fuel or low fuel pressure.	Check the fuel supply, regulators, fuel supply lines, and valves.	Section 5.5
	Loose connections or faulty wiring.	Check connections to fuel solenoid valves.	Section 6.8, Fuel System
		Check the engine/controller connections and wiring.	W/D Section 8
	No engine rotation sensed.	Check for locked rotor shutdown.	Section 5.7 and Alternator S/M
	Engine fuse blown.	Replace the fuse. If the fuse blows again, troubleshoot/service the engine.	Engine S/M
	Engine problem.	Troubleshoot/service the engine.	Engine S/M

Note: I/M = generator set installation manual; O/M = generator set Operation Manual; S/M = service manual; W/D = wiring diagram.

Problem	Possible Cause	Corrective Action	Reference
Generator set engine starts hard.	Air cleaner clogged.	Clean and/or replace the air cleaner.	Generator set operation manual
	Weak battery.	Recharge or replace the battery.	
		Check for DC voltage on lead CHO to the battery. Check for 120 VAC on the black and white leads to controller P5-1 and P5-3 for battery charging. Check 120 VAC utility power connection to the generator set.	W/D Section 8
	Poor battery connection.	Clean and tighten the battery connections.	
	Spark plugs..	Regap or replace spark plugs.	Section 2.6
	Spark plug wire connection loose.	Tighten the spark plug connections. Replace wires if necessary.	
	Low fuel pressure.	Check the fuel supply. Verify that fuel supply lines and meters are sized to support all gas appliances.	Section 5.5
	Engine problem.	Troubleshoot/service the engine.	Engine S/M
Generator set stops suddenly.	Low oil pressure shutdown.	Check for oil leaks. Check the oil level and add oil if necessary.	
	No fuel or inadequate fuel pressure.	Check fuel supply. Check fuel lines for restrictions or leaks. Verify that fuel system is sized to supply all gas appliances.	Section 5.5
	Fault shutdown.	Identify and correct the cause of the fault shutdown. Then press OFF to clear the fault.	Section 5.7, Fault Messages
	Air cleaner clogged.	Clean and/or replace the air cleaner.	Generator set operation manual
	Engine overheated (hot engine).	Check air intake, oil level, air outlets.	Generator set operation manual
		Check the coolant level. Check the cooling fan fuses, relays, and operation.	Section 4, Cooling System
		Check temperature sensors.	Section 6.7 and Engine S/M
	Engine overloaded.	Reduce the load. If the system is equipped with a load management device, troubleshoot the load management device.	— Load management device documentation
	Blown engine fuse(s).	Replace the fuse. If engine fuses blow repeatedly, troubleshoot/service the engine.	Engine service manuals
	Remote stop command received from a remote switch, ATS, or OnCue® Plus.	Check the remote switch position. Check the ATS/OnCue® Plus.	
	Loss of generator output voltage to controller.	Check controller connections. Check continuity of AC sensing leads 7 and 8 (1-phase) or 7–8–9 (3-phase).	W/D, Section 8
	Engine problem.	Troubleshoot/service the engine.	Engine service manuals

Note: I/M = generator set installation manual; O/M = generator set Operation Manual; S/M = service manual; W/D = wiring diagram.

Problem	Possible Cause	Corrective Action	Reference
Generator set operates erratically	Air cleaner clogged	Replace element.	Section 2.4
	Inadequate cooling (hot engine only)	Inspect air inlet and outlet.	—
		Check the coolant level. Check the cooling fan fuses, relays, and operation. Check temperature sensors.	Section 4, Cooling System
	Engine fuel system problem	Refer to the engine service manual for troubleshooting and repair information.	Engine S/M
Generator set overheats	Inadequate cooling	Inspect cooling system for obstructions.	—
		Check the coolant level. Check the cooling fan fuses, relays, and operation. Check temperature sensors.	Section 4, Cooling System
	Air cleaner clogged	Replace element.	O/M
Generator set is noisy	Exhaust system leaks	Check and repair as necessary.	—
	Engine not running smoothly	See “Generator set operates erratically” in this table.	See “Generator set operates erratically” in this table
	Broken or damaged vibromount(s)	Check and replace as necessary.	—
	Loose or vibrating sheet metal/housing	Retighten screws, replace rivets.	—
	Exhaust piping or air inlets/outlets not securely installed	Inspect for loose parts and secure if necessary.	—
	Excessive engine/generator vibration	Check, rotor, crankshaft, bearing, etc. (disassembly of engine and/or alternator may be required).	See the Alternator S/M and Engine S/M
High generator output voltage	Incorrect controller settings	Check and adjust the controller configuration parameters.	Section 3.6
	Incorrect controller voltage settings	Check and adjust the controller voltage settings and voltage calibration.	Sections 3.6, 3.7, and 6.5
	Loose voltage sensing connections	Check connections: stator leads 7 and 8 (for 1-phase models) or leads 7, 8, and 9 (for 3-phase models) and P2 controller connection.	W/D, Section 8
	Controller	Check wiring and connections.	W/D, Section 8
Generator set lacks power	Air intake restriction	Inspect air intakes and exhaust for obstructions. Check the air cleaner.	Section 2.4
	Low fuel pressure.	Check the fuel supply, regulators, fuel lines, and valves.	
	Inadequate cooling	Check the coolant level. Check the cooling fan fuses, relays, and operation. Check temperature sensors.	Section 4, Cooling System
	Spark plugs.	Check the spark plugs. Regap or replace if necessary.	Section 2.6
	Spark plug connections.	Tighten connections. Replace spark plug wires if necessary.	Section 2.6
	Engine overloaded	Reduce load.	Generator Set I/M
		If the system is equipped with a load management device, troubleshoot the load management device.	Load management device documentation
	Engine not running at rated rpm	Check controller settings for engine speed and generator set frequency.	Section 6.6

Note: I/M = generator set installation manual; O/M = generator set Operation Manual; S/M = service manual; W/D = wiring diagram.

Problem	Possible Cause	Corrective Action	Reference
	Engine power loss	Refer to the Engine Service Manual for troubleshooting and repair instructions.	Engine S/M
Low output or excessive drop in voltage.	Generator set overloaded	Reduce the load. If the system is equipped with the load management device, troubleshoot the load management device.	— Load management device documentation
	Incorrect controller settings	Check system voltage, frequency, and engine model settings.	Section 3.6
	Incorrect voltage settings	Check and adjust the voltage settings and voltage calibration on the RDC2 controller.	Sections 3.6, 3.7, and 6.5
	Alternator or control system	Perform separate excitation procedure to isolate problem to the alternator or the control system.	Alternator S/M
	Controller	Check the controller settings. Check the controller wiring and connections.	Section 3.6 W/D, Section 8
	Rotor (open, grounded, or shorted windings)	Test and/or replace.	Alternator S/M
	Stator (open, grounded, or shorted windings)	Test and/or replace.	Alternator S/M
	Low engine speed causing voltage roll-off	Check system voltage, frequency and engine model settings. Troubleshoot the engine.	Section 3.6 Engine S/M
No AC output voltage.	AC circuit breaker tripping because of short circuit	Check for AC voltage on the generator side of the 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.	—
	AC circuit breaker tripping because of overload	Reduce the load on the generator set. If the system is equipped with the load management device, troubleshoot the load management device.	— Load management device documentation
	Controller settings incorrect	Check and adjust the controller settings.	Section 3.6
	Controller connections	Check for loose connections. Check the generator set wiring.	W/D, Section 8
	Alternator or control system	Perform separate excitation procedure to isolate the problem to the alternator or the control system. Then troubleshoot the alternator or control system components as follows.	Alternator S/M
	Alternator excitation failure	Perform separate excitation procedure from alternator service manual.	Alternator S/M
	Rotor (open, grounded, or shorted windings)	Check voltage and continuity.	Alternator S/M
	Stator (open, grounded, or shorted windings)	Check voltage and continuity.	Alternator S/M

Note: I/M = generator set installation manual; O/M = generator set Operation Manual; S/M = service manual; W/D = wiring diagram.

Figure 5-5 General Troubleshooting Chart

5.10 Controller Troubleshooting

Figure 5-6 contains basic troubleshooting information for the RDC2 controller.

Problem	Possible Cause	Corrective Action	Reference
Controller LCD display is off.	Low or no battery voltage	Check controller connections. Check DC power to the RDC2 controller. Check generator set battery connections and condition. Check utility power connection to the generator set terminal block (power for battery charging).	W/D, Section 8
Controller display backlight is off.	Backlight turns off after about 1 minute with no activity	Backlight will turn on when a button is pressed or the generator set starts.	—
Loss of communication to accessory modules.	Bad connections	Check wiring and connections. Verify that cable size and length of run comply with the instructions in the Installation manual.	Generator set Installation Manual or accessory module documentation.
	Low or no battery voltage	Check generator set battery connections and condition. See “Low or no battery voltage” above.	—
Load management relays do not operate (if equipped).	Bad connections	Check wiring and connections. Verify that cable size and length of run comply with specifications.	Generator set Installation Manual or load management device documentation.
	Low or no battery voltage	Check generator set battery connections and condition. See “Low or no battery voltage” above.	—
Date is flashing.	Controller power was disconnected and then reconnected	Check battery connections. Check controller connections. Check utility power connection to the generator set terminal block. Reset the time, date, and exercise schedule.	 W/D, Section 8 Generator set Operation Manual

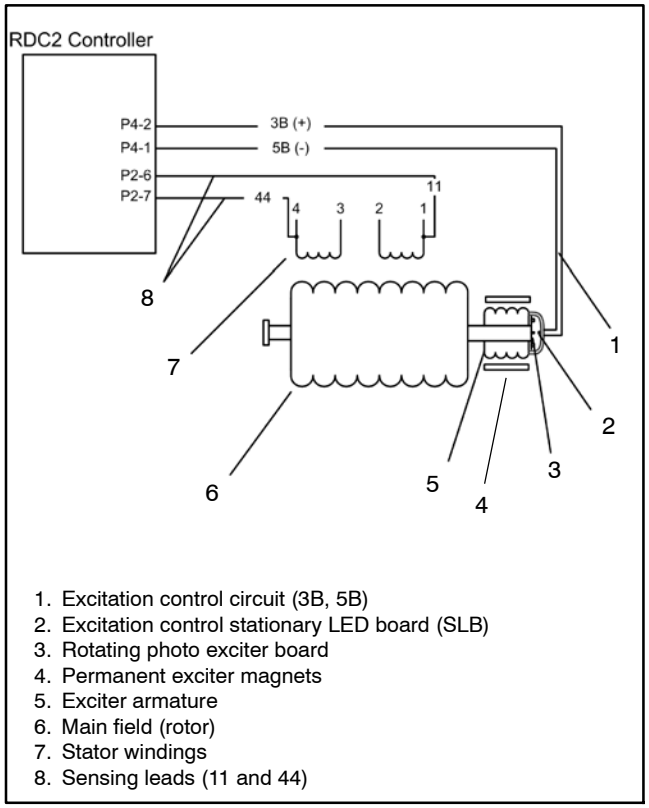
Figure 5-6 RDC2 Troubleshooting Chart

6.1 Theory of Operation

The generator set utilizes a rotating-field alternator to produce AC voltage. There are two types of alternator available: single phase (see Figure 6-1) and three phase (see Figure 6-2). The alternator is excited by a permanent magnet brushless exciter, providing superior motor starting capability, fault current, transient performance, and longevity.

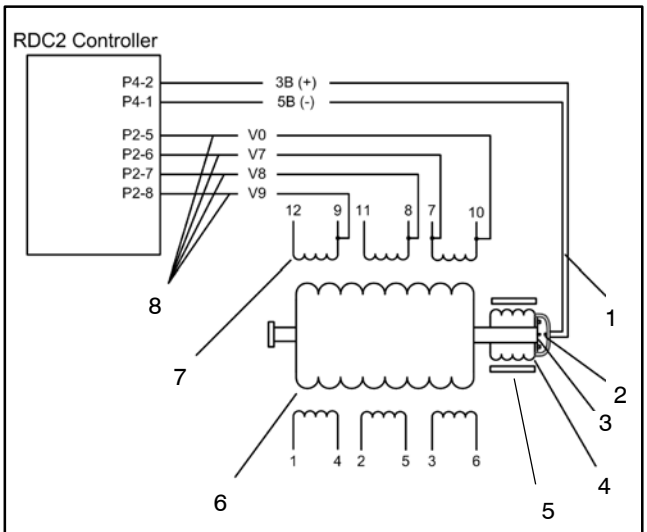
The generator set produces AC voltage by rotating a magnetic field inside the stator windings. This magnetic field is produced by current in the rotor windings (or field). The current is generated in the exciter armature by rotating in the fixed magnetic field produced by permanent magnets attached to the rotor bearing assembly on the back of the alternator.

The field current is controlled by the RDC2 controller using a PWM (pulse-width modulated) signal which drives an LED on the stationary LED board (SLB) (mounted under the end cover on the alternator) varying the intensity of the light to the rotating exciter board. The rotating exciter board controls the field current in the rotor based on the intensity of the light received by the photo-detector.



1. Excitation control circuit (3B, 5B)
2. Excitation control stationary LED board (SLB)
3. Rotating photo exciter board
4. Permanent exciter magnets
5. Exciter armature
6. Main field (rotor)
7. Stator windings
8. Sensing leads (11 and 44)

Figure 6-1 Single-Phase Generator Schematic



1. Excitation control circuit (3B, 5B)
2. Excitation control stationary LED board (SLB)
3. Rotating photo exciter board
4. Exciter armature
5. Permanent exciter magnets
6. Main field (rotor)
7. Stator windings
8. Sensing leads

Figure 6-2 Three-Phase Generator Schematic

6.2 Alternator Excitation Troubleshooting

⚠ WARNING

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

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

Servicing the generator set when it is operating. Exposed moving parts can 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.

6.2.1 Low to No Voltage Operation

This section covers the operation of the alternator excitation and troubleshooting information for low or no voltage output. Before beginning the test procedures, read all safety precautions at the beginning of this manual. Many of the test procedures include additional safety precautions.

The spinning exciter and exciter board make measurement of the field voltage and current difficult while the generator is running. However, the alternator and rotating exciter board can be analyzed relatively accurately while the generator is not running. For advanced troubleshooting procedures for the alternator, please refer to the alternator service manual. See the List of Related Materials in the Introduction to this manual for document numbers.

Before beginning the troubleshooting steps in this section, verify that the controller is trying to excite the field on the generator. This can be determined by observing that the generator set is in one of the following states:

- Running
- Unloaded full speed exercise
- Unloaded cycle diagnostic mode (only during the 3 minute full speed portion of the test)

If the generator state is in one of the following states, the controller is deliberately not exciting the alternator field and no voltage is produced:

- Cooldown
- Unloaded cycle diagnostic mode (except during the 3 minute full speed portion of the test)

To further isolate the cause of low or no output voltage:

1. Verify that the generator frequency is above the cut-in frequency for the volts/Hz curve. See Section 6.5.3.
2. Verify that the RDC2 controller is configured to output the correct voltage and that it is metering accurately. Check the system voltage setting and the voltage calibration.
3. Open the line circuit breaker to see if the voltage recovers (the generator may be feeding a short circuit).
4. To isolate a controller/voltage regulator problem from an internal alternator problem, perform the alternator manual excitation procedure described in Section 6.2.4.
5. If the alternator is able to produce greater than rated voltage while manually excited, the problem most likely lies in the stationary portion of the alternator excitation control system. If not, proceed with advanced troubleshooting of the alternator. See the alternator service manual. See the List of Related Materials in the Introduction to this manual for document numbers.
6. Check the wiring from the controller to the stationary LED board (SLB) on the back of the alternator.
7. Start the generator set and measure the DC voltage between P4–2 (+) and P4–1 (–) on the RDC2 controller while P4 is connected. If this voltage exceeds 3 VDC, remove the end cover and measure the voltage between 3B (+) and 5B (–) at the SLB with the SLB connected. If this is greater than 3 VDC and the generator does not output any voltage with the SLB in the correct position and the line circuit breaker open, the SLB may not be working correctly.
8. With the generator set running, disconnect P4 from the RDC2 controller and measure the voltage between pins P4–2 (+) and P4–1 (–). If this voltage is greater than 3 VDC, connect an ammeter between pins P4–2 (+) and P4–1 (–) and measure the current that the RDC2 controller can provide. If the current is greater than 50 mA, check the wiring between the RDC2 and the SLB for short circuits or damaged wiring.
9. Reconnect P4 to the RDC2 controller. Disconnect the plug from the SLB and measure the voltage between wire 3B (+) and 5B (–). If this voltage is greater than 3 VDC, connect an ammeter between wire 3B (+) and 5B (–) and measure the current that the RDC2 controller can provide. If this is greater than 50 mA and the generator does not output any voltage with the SLB connected and in the correct position and the line circuit breaker open, the SLB may not be working correctly.
10. If the RDC2 controller is not able to source greater than 3 VDC when P4 is disconnected or is not able to source greater than 50 mA to an ammeter, and the generator is shutting down on undervoltage after starting (indicating that the controller is trying to excite the field), it is possible that the RDC2 controller is damaged. Investigate the wiring from the controller to the SLB and check the SLB carefully to determine the cause of the controller failure.

6.2.2 Erratic Voltage Regulation

Dramatic variations in the alternator voltage (more than 5 VAC) while the generator is operating at a steady load may cause flicker. Connect a flicker lamp to the generator output to determine if the generator is producing flicker. If flicker is observed, it can be caused by any of the following:

- Load Fluctuation
- Engine speed fluctuation. Refer to Section 6.6 and the engine service manual for troubleshooting.
- Rotating exciter board failure (single SCR or diode failure) indicated by erratic voltage regulation being load-dependent.
- Alternator fault. Refer to the alternator service manual for troubleshooting.
- Outer loop gain (Voltage Regulator Gain Adjust) too high. Try decreasing to 1 to see if erratic fluctuations stop. See Section 6.5.4.
- Incorrect cut-in frequency or slope for the Volts/Hz curve. Verify that the settings match the factory defaults. See Section 6.5.3, Volts/Hz and Cut-In Frequency.
- Loose connection(s) in wiring to the stationary LED board (SLB) or RDC2 controller.

6.2.3 Overvoltage Condition

The alternator field can be overexcited, causing excessive output voltage. If this failure is observed, ensure that the line circuit breaker is open and that no customer loads can be damaged by continued testing of this condition. Do not run the generator set for extended periods of time in an overvoltage condition.

To further isolate the cause of an overvoltage condition:

1. Remove the connector from P4 on the RDC2 controller. If the overvoltage conditions clears (the voltage should decay to a few volts), check the voltage sensing wiring and verify the configuration and metering accuracy of the RDC2 controller. Check the system voltage setting and the voltage calibration.
2. If the configuration in the controller is correct and the voltage is being metered accurately (shuts down for overvoltage) the RDC2 controller may be damaged. Check the wiring and the SLB to determine the cause of the controller failure.
3. If the overvoltage condition persists with P4 unplugged, check for both AC and DC voltage between 3B (+) and 5B (-) of the disconnected P4. If voltage is found, check the wiring to the SLB.
4. If no voltage is found between 3B (+) and 5B (-), verify that the back cover from the alternator is intact and that no light is reaching the photoreceptor on the rotating exciter board.
5. Refer to the Alternator Service Manual for additional troubleshooting procedures.

6.2.4 LED Optic Board Test Procedure

This procedure is also included in the alternator service manual.

The following procedure provides information on testing the alternator's LED optic board. Certain steps require that the generator set be running. When the generator set is not running, disable the generator set. See the safety precautions listed below. Disconnect all load from the generator set during this test.

⚠ WARNING

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

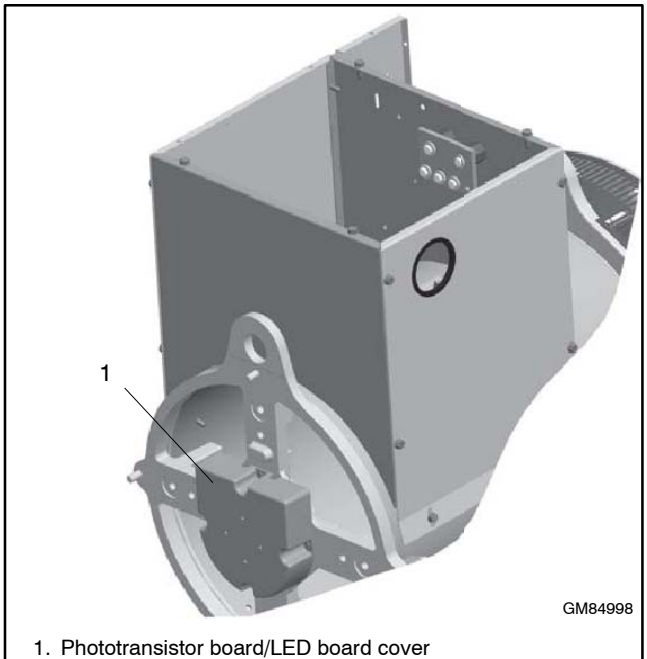
Operate the generator set only when all guards and electrical enclosures are in place.

Disconnecting the electrical load. Hazardous voltage can cause severe injury or death. Disconnect the generator set from the load by turning off the line circuit breaker or by disconnecting the generator set output leads from the transfer switch and heavily taping the ends of the leads. High voltage transferred to the load during testing may cause personal injury and equipment damage.

Testing the photo transistor circuit board. Hazardous voltage can cause severe injury or death. When the end cover is removed, do not expose the photo transistor circuit board mounted on the generator set end bracket to any external light source, as exposure to light causes high voltage. Keep foreign sources of light away from the photo transistor circuit board during testing. Place black electrical tape over the LED on the circuit board before starting the generator set.

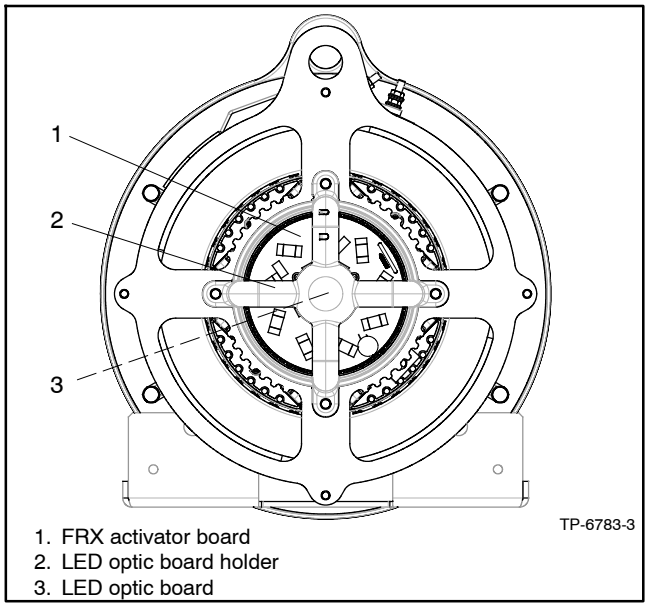
Note: A flashlight is required for this test of the LED optic board.

1. Remove the junction box panels from the generator end of unit and remove the phototransistor board cover (38RCL) or the LED optic board and holder (48RCL, 48RCLA, and 60RCL). See Figure 6-3 or Figure 6-4.



1. Phototransistor board/LED board cover

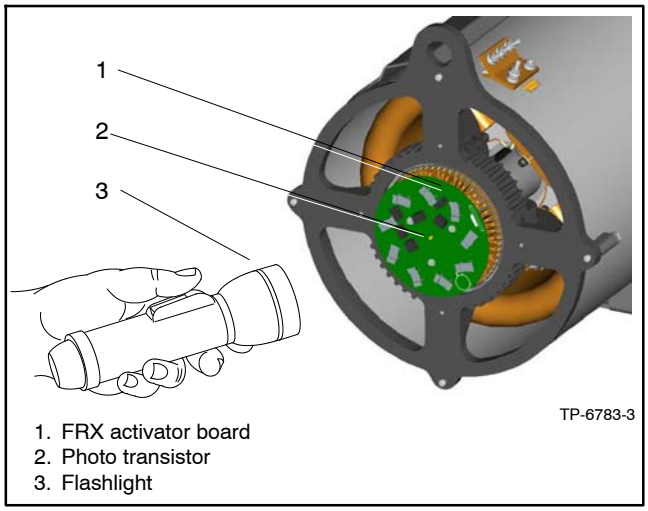
Figure 6-3 Phototransistor Board Cover (38RCL)



1. FRX activator board
2. LED optic board holder
3. LED optic board

Figure 6-4 FRX Activator Board with LED Optic Board Installed (48RCL, 48RCLA, and 60RCL)

2. Refer to the respective generator set controller operation manual for starting/stopping procedures. With the generator set running at no load, shine a flashlight at the exposed photo transistor on the photo transistor board or FRX activator board. See Figure 6-5.



1. FRX activator board
2. Photo transistor
3. Flashlight

Figure 6-5 LED Flashlight Test (48RCL shown)

3. Observe the AC output voltage controller display or connect a voltmeter to the output leads. High AC output voltage indicates the SCR assembly and phototransistor board (38RCL) or the FRX activator board (48RCL, 48RCLA, and 60RCL) are functioning properly. The fault is likely in the wiring, controller with voltage regulator, or LED optic board as the output voltage should drop to low level when the flashlight is removed. If no output is observed, check the SCR assembly and

phototransistor board (38RCL) or the FRX activator board (48RCL, 48RCLA, and 60RCL). See the alternator service manual for further instructions.

4. If high output voltage exists with the flashlight off, stop the generator set and place a small piece of black electrical tape over the photo transistor. Restart the unit.

   If the output voltage is reduced, there is a source of external light contamination. STOP the generator set. Find the external light source and eliminate it or block it from reaching the photo transistor.

   If the output voltage remains high, there is a failure in the SCR assembly and phototransistor board (38RCL) or the FRX activator board (48RCL, 48RCLA, and 60RCL).

5. With the generator set running at no load, approximately 1–2 volts DC should be observed at 3B (+) and 5B (–) at the LED optic board. See Figure 6-6.

6. Shine the flashlight on the photo transistor. The DC voltage reading should drop, showing that the controller with voltage regulator is functioning.

   If voltages are not observed, check the F3 fuse in the controller and refer to the the following sections for further information regarding the voltage regulator adjustment and troubleshooting.

7. STOP the generator set.

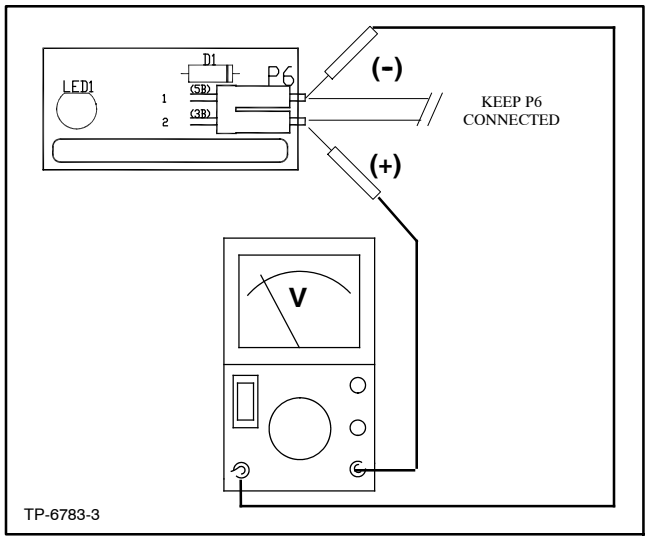


Figure 6-6 Checking LED Optic Board Voltage

6.3 Voltage Connections

Generator sets equipped with a 12-lead alternator are reconnectable to the following configurations: Delta, Low Wye, High Wye, Dogleg. See the generator set Installation Manual, TP-6809, for reconnection instructions and diagrams. Generator sets equipped with a 4-lead alternator are not reconnectable.

Setting the system voltage above 300 VAC will cause the controller to automatically switch from a low wye to a high wye configuration. Use Kohler® SiteTech™ Software or the controller keypad to update the System Voltage and Phase Connection when the alternator voltage connections are changed.

6.4 Additional Alternator Service Information

Refer to the alternator service manual for additional alternator testing and service information.

6.5 Voltage Adjustments

⚠ WARNING

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

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

Testing live electrical circuits. Hazardous voltage or current can 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)

Short circuits. Hazardous voltage/current can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage**.** Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

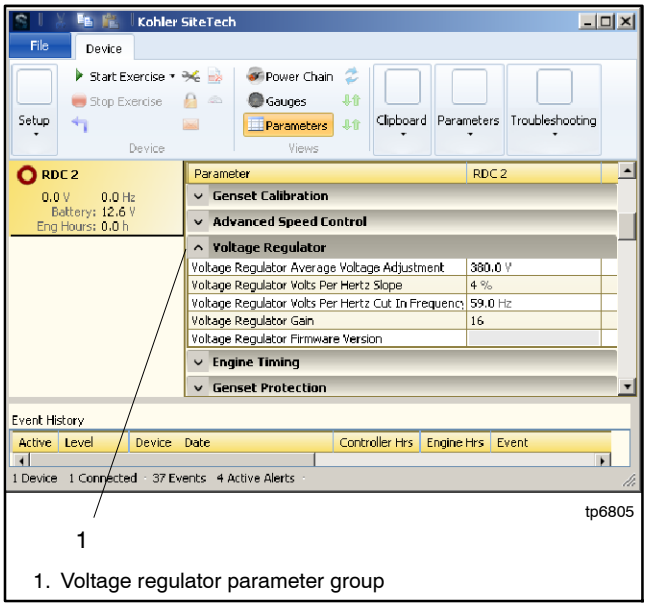
Note: For voltage calibration instructions, see Section 3.7.

6.5.1 Voltage Adjustments Using SiteTech

The SiteTech parameters used to adjust the voltage in the following procedures are shown in Figure 6-7 and Figure 6-8.

SiteTech Group	Parameter
Genset System Configuration	Genset System Voltage
Voltage Regulator	Average Voltage Adjustment
	Volts per Hertz Slope
	Volts per Hertz Cut-in Frequency
	Voltage Regulator Gain

Figure 6-7 SiteTech Parameters for Voltage



1. Voltage regulator parameter group

Figure 6-8 Voltage Regulator Parameter Group in SiteTech

6.5.2 Voltage Regulator Average Voltage Adjustment

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

Excitation current control is performed by the patented Kohler Hybrid Voltage Regulator. This regulator consists of a fast-reacting analog inner loop and a slower digital outer loop. The inner loop regulates the average output voltage to a setpoint which is controlled by the outer loop, allowing the voltage to recover very quickly during transient conditions. The outer loop measures the RMS magnitude of the voltage and adjusts the setpoint for the inner loop until the RMS voltage amplitude matches the Voltage Regulator Average Voltage Adjustment setpoint.

The Hybrid Voltage Regulator regulates to the average RMS voltage of all three phases on a three-phase generator set.

The Hybrid Regulator should require no voltage adjustment, as it regulates the RMS output voltage to the configured output voltage. The Voltage Regulator Average Voltage Adjustment setpoint may require alteration to more closely match the utility voltage at a particular location or to compensate for voltage drop on wiring between the generator and the ATS.

The Voltage Regulator Average Voltage Adjustment can be adjusted from the Voltage Regulator menu on the RDC2 controller, or adjusted using SiteTech. See Figure 6-8 and Figure 6-9.

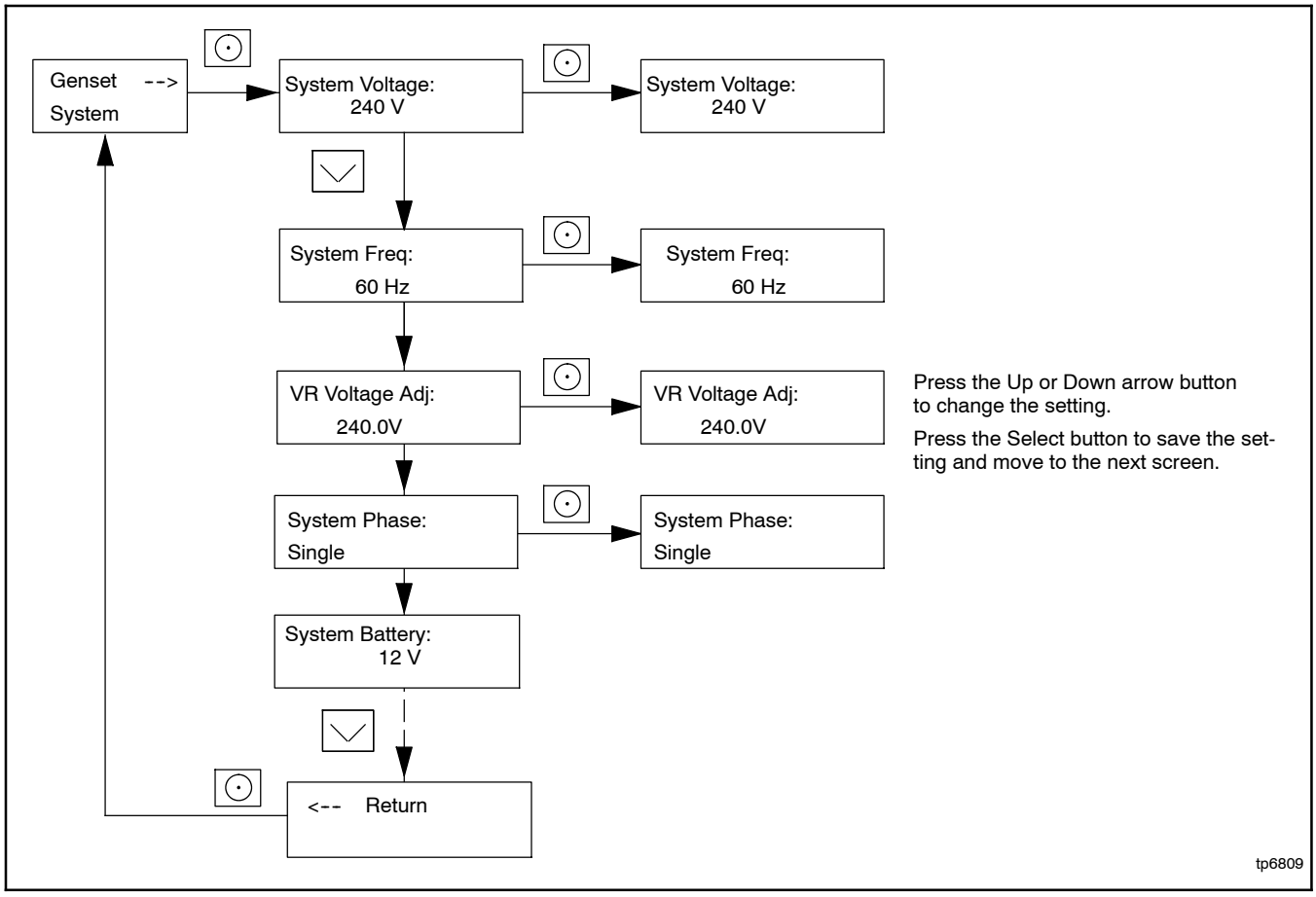


Figure 6-9 Voltage Regulator Voltage Adjustment Using RDC2 Controller4 Menus and Keypad

6.5.3 Volts/Hz Slope and Cut-In Frequency

The Volts/Hz setting for the voltage regulator performs the following functions on the generator:

- Serves as a method for unloading the engine to allow recovery during a sharp increase in load
- Serves as a means of protection for the alternator to avoid saturating the field (rotor heating) at low frequencies

The slope and cut-in frequency of the volts/Hz curve are set at the factory to allow the generator to meet factory performance standards. They should not be adjusted except under unique circumstances and under direction from a Kohler factory representative.

If the slope of the Volts/Hz curve is set too low, the engine will not be unloaded quickly enough to recover from a quick load increase. If the slope is set too high, the voltage will dip dramatically with a quick load increase, which will cause temporary brownouts.

The cut-in frequency is typically set to 1 Hz below system frequency so that normally small frequency variations do not cause the voltage to vary. Setting the cut-in frequency further from rated frequency may adversely affect the generator's ability to recover frequency after a sharp load increase.

See Figure 6-10 for an illustration of the volts/Hz curves for 50 and 60 Hz.

6.5.4 Voltage Regulator Gain

The gain of the inner loop of the hybrid regulator is set at the factory and is not adjustable in the field. The Voltage Regulator Gain listed in SiteTech is for the outer loop. The outer loop is responsible for correcting the setpoint to the inner loop to ensure that the generator output is regulated to the RMS regulator setpoint. The outer loop thus corrects for wave-shape distortion, temperature variations in the inner loop circuitry, inter-board metering variations, etc. Typically the outer loop only adjusts the setpoint to the inner loop on initial startup (battery is first plugged in) and after calibration has changed.

At a gain setting of 1, it will take 128 seconds to adjust the voltage output 1%. At a gain setting of 255, the voltage adjustment rate is related to the difference between the target voltage and the measured voltage, but could vary up to 3.1% per second.

At lower gains, the voltage may reach the target value very slowly, but the chance of overshoot from the two controller loops fighting is minimal. At higher gains, there is a chance that the outer loop will change the setpoint faster than the inner loop can accommodate, resulting in unstable output voltage. This may show up as slight flicker on a light bulb.

Note: The RMS correction outer loop is not active when the controller is in Volts/Hz mode; the last known correction factor, or inner loop setpoint, is used.

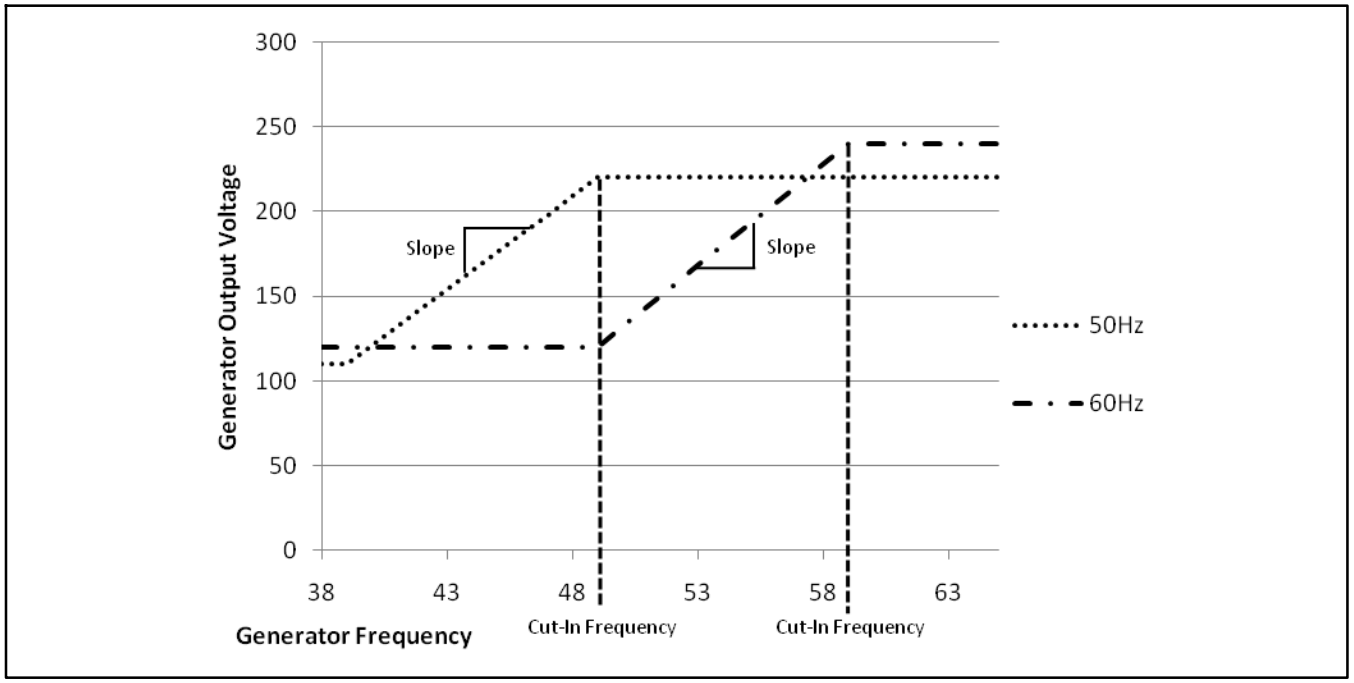


Figure 6-10 Volts/Hz Curves

6.6 Frequency Adjustment

The engine speed determines the generator output frequency; 60 Hz units operate at 1800 RPM and 50 Hz units run at 1500 RPM. The engine speed is maintained by the engine ECM, which controls the speed to a target speed set by the RDC2 controller.

The operating frequency of the generator is set by changing the Genset System Frequency using the front panel or Kohler® SiteTech ™ Software. See Figure 6-11 for engine speed and frequency parameters in SiteTech.

6.6.1 Engine Speed Governor Settings

The default setting for the engine speed adjustment is 50. This gives engine speeds of 1800 RPM for 60 Hz models, and 1500 RPM for 50 Hz models. The setting can be adjusted from 0 to 99. Changing the setting will change the engine speed according to the following formula:

(System Frequency x 30) + (Setting – 50) = RPM

Examples:

System frequency of 60 Hz, changing the setting to 40:

(60 x 30) + (40 – 50) = 1790 RPM

System frequency of 50 Hz, changing the setting to 60:

(50 x 30) + (60 – 50) = 1510 RPM

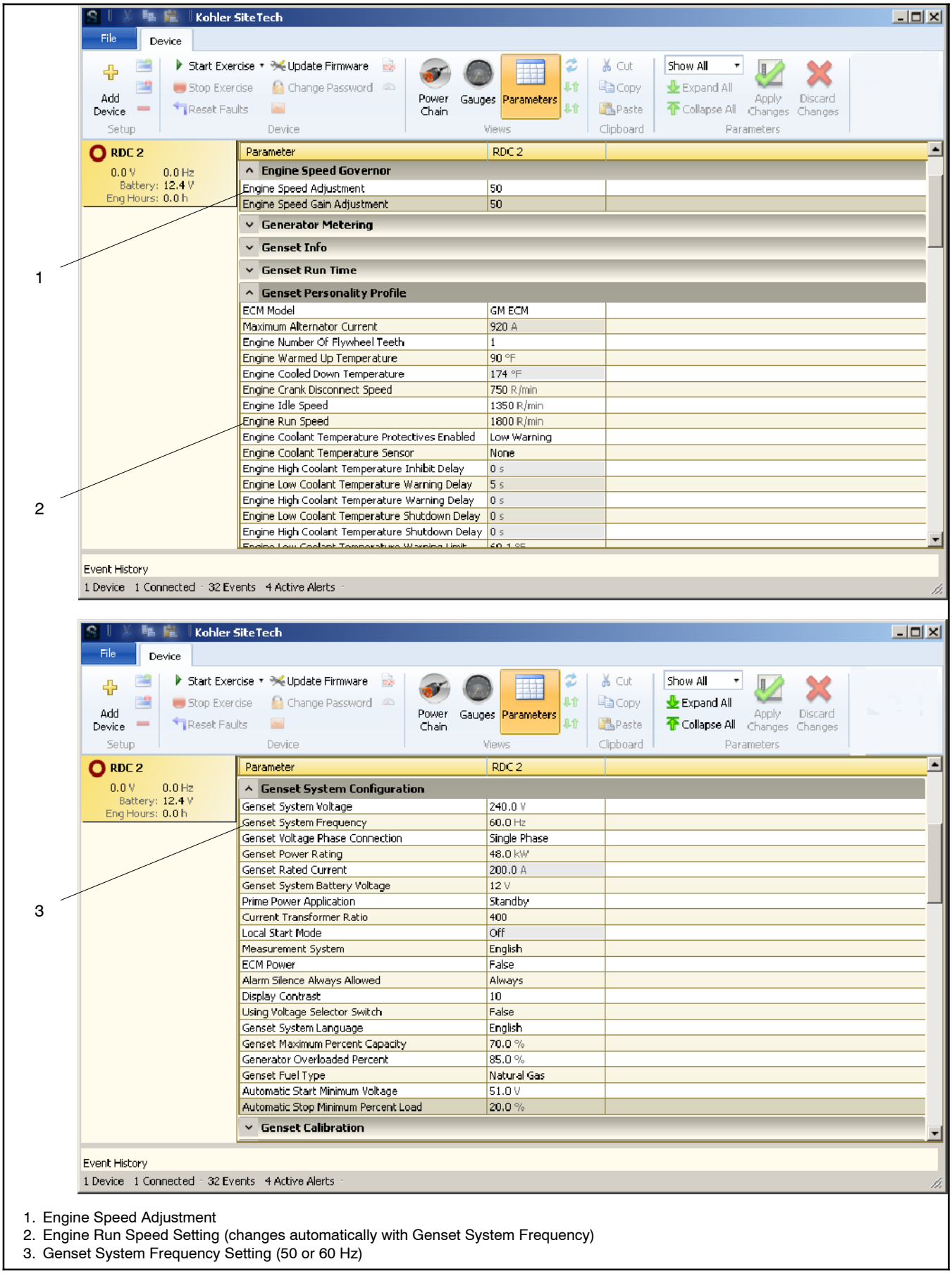
The engine speed gain adjustment has no effect. The engine speed is controlled by the engine ECM.

6.6.2 Hunting/Surging

The engine speed regulation gains reside in the engine ECU and are not adjustable. Most Hunting or surging problems are caused by fuel supply pressures that are out of spec, dirty air filters, air intake restriction, etc. If Hunting or surging occurs, verify the following:

- The load is stable (not changing significantly).
- The fuel pressure is within the acceptable range both at no-load and full load.
- The air cleaner is clean and dry.
- There is not a buildup of leaves, etc. blocking the airflow in or out of the engine compartment.

If the hunting/surging persists, refer to the engine service manual for additional troubleshooting procedures. See the List of Related Materials in the Introduction of this manual for the engine service manual part numbers.



1. Engine Speed Adjustment
2. Engine Run Speed Setting (changes automatically with Genset System Frequency)
3. Genset System Frequency Setting (50 or 60 Hz)

Figure 6-11 Engine Speed and Frequency Adjustments in SiteTech

6.7 Generator Set Switches

⚠ 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.

⚠ WARNING

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

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

Servicing the generator set when it is operating. Exposed moving parts can 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 can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage**.** Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

6.7.1 Engine Compartment Air Temperature Sensor

The temperature sensor is used to monitor engine compartment air temperature for the cooling fan operation. See the service views in Section 1.7 for the air temperature sensor location. The cooling fan operation is temperature-dependent. See Section 4.10 for information about fan operation.

Check the high engine compartment temperature sensor by performing the following test procedure. If the sensor does not function as described, replace it.

Temperature Sensor Test Procedure

1. Press the OFF button on the controller to stop the generator set and allow the generator set to cool.
2. Disconnect the temperature sensor 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 6-12.
3. If the resistance is very low (indicating a short circuit) or very high (indicating an open circuit), replace the sensor.

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

Figure 6-12 Temperature Sensor CTS Resistance Readings

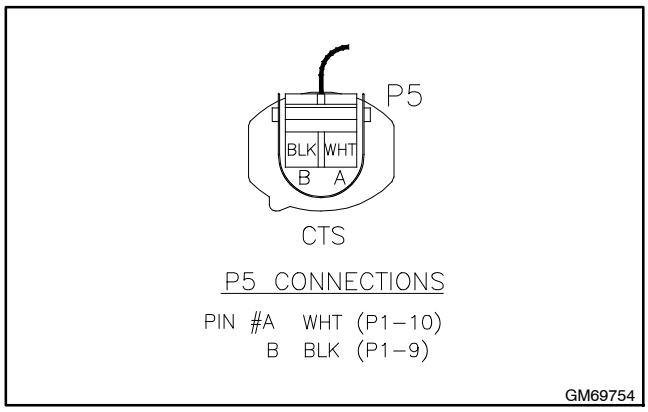


Figure 6-13 Temperature Sensor Connector P5

6.7.2 Other Switches and Sensors

Other switches and sensors, such as the low oil pressure sensor, are installed on the engine and communicate with the engine ECM. Refer to the engine service manuals for troubleshooting and service information.

6.8 Fuel Systems

⚠ 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.

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.

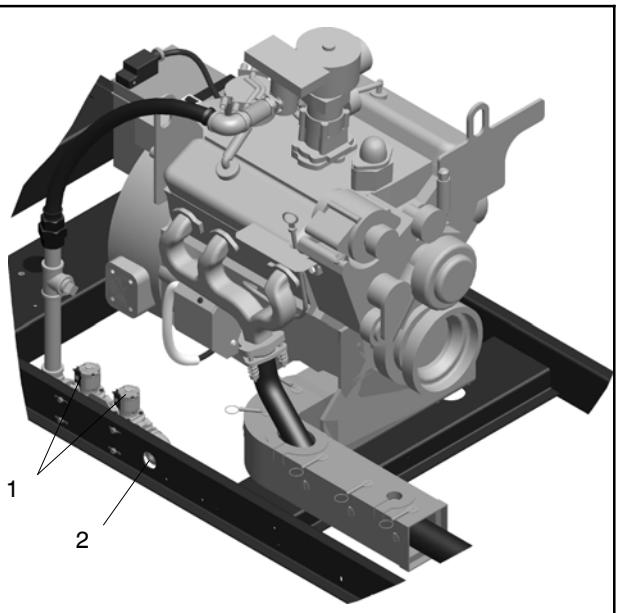
The typical gaseous fuel system uses two regulators. The primary regulator reduces the line pressure to an allowable inlet pressure for the secondary regulator. The secondary regulator is factory-installed on the generator set engine and is designed for a maximum inlet pressure of 2.7 kPa (6 oz./in.^{2})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

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

The fuel system on the engine includes the electronic fuel pressure regulator and mixer. Refer to the engine service manuals for troubleshooting and repair of the engine's fuel system.

Note: The Integrated Electronic Pressure Regulator (IEPR) and air/fuel mixer are specially calibrated emission-control devices. Do not adjust the IEPR or the air/fuel mixer.

Refer to the troubleshooting instructions in Section 5, Troubleshooting, to identify generator set operation problems that may be caused by an inadequate fuel supply, incorrect adjustments, or damaged fuel system components.



1. Fuel solenoid valves (2)
2. Fuel inlet connection

Figure 6-14 Fuel System

6.8.1 Fuel Solenoid Valves

Two 12 VDC solenoid valves are mounted upstream of the engine on the generator set skid. See Figure 6-14. The fuel solenoid valves provide automatic fuel on/off control. See Figure 6-14. The engine starting battery powers the solenoid valve and the engine starting controls open the valves 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.

6.8.2 Checking the Fuel Pressure

Connect a pressure gauge or manometer to the port on the bottom of the second (downstream) fuel solenoid valve to measure the fuel pressure to the engine. See Figure 6-14 and Figure 6-15.

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.

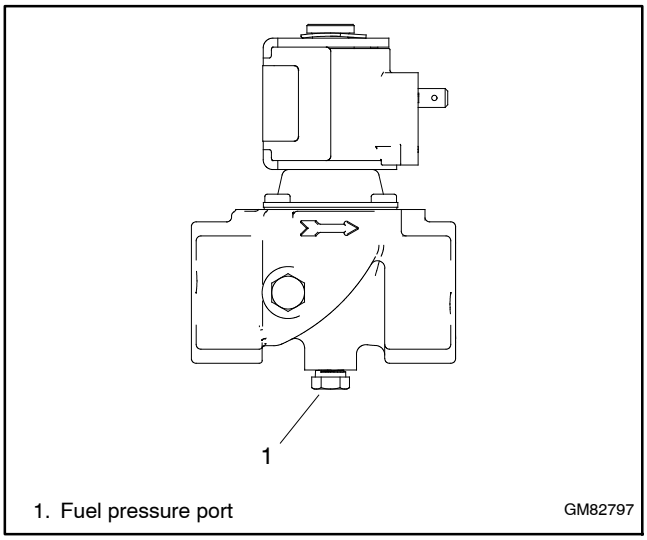


Figure 6-15 Fuel Solenoid Valve

6.8.3 Fuel Conversion Procedures

Note: The Integrated Electronic Pressure Regulator (IEPR) and air/fuel mixer are specially calibrated emission-control devices. Do not adjust the IEPR or the air/fuel mixer.

Check the connections to the fuel solenoid valves to verify that the fuel system is set up for the type of fuel that will be used. See Figure 6-14 for the location of the fuel solenoid valves.

To change the fuel type, change the connection to the fuel solenoid valves as described below and shown in Figure 6-16.

LP Connections:

- Disconnect lead 73A from the fuel valve.
- Connect lead 73B to the fuel valve.
- Connect lead 65 to lead N3 (ground).

Natural Gas Connections:

- Disconnect lead 65 from N3.
- Disconnect lead 73B from the fuel valve.
- Connect lead 73A to the fuel valve.

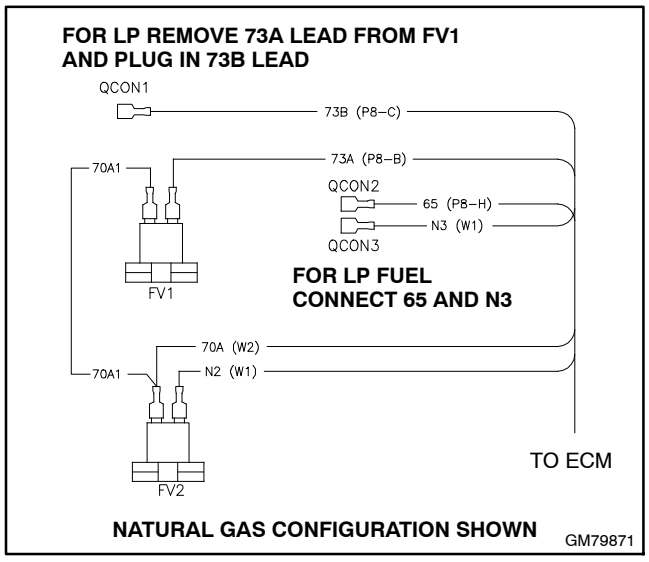


Figure 6-16 Fuel Type Connections

Nameplate

Converting the fuel will change the generator set rating. See the generator set specification sheet for ratings with natural gas and LP. Order a new nameplate with the updated rating and fuel information from an authorized distributor/dealer, if necessary. Provide the following information from the original nameplate:

- Model Number
- Spec Number
- Serial Number
- Fuel (original and new)
- kW
- kVA
- Amps
- Volts
- Hz

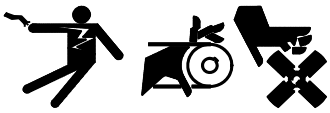
Fuel Type Setting

Change the fuel type setting on the RDC2 controller to match the new fuel type. The fuel type setting affects the generator set power rating setting in the controller, which in turn affects the load add and load shed settings for the optional load management device.

Use the RDC2 controller menus or a personal computer (laptop) with Kohler SiteTech software to change the fuel type. On controllers with firmware version 4.5 or higher, the fuel type is located in the Genset System menu. In SiteTech, the fuel type is located in the Genset System Configuration group.

7.1 Introduction

⚠ 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) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

This section provides information about removing the enclosure and other components to gain access to the alternator. Refer to the alternator service manual for instructions to disassemble and reassemble the alternator.

Refer to the engine service manual for engine disassembly and assembly procedures. See the List of Related Materials in the Introduction Section for document part numbers.

Before beginning the disassembly procedure, carefully read all safety precautions at the beginning of this manual.

7.2 Initial Steps

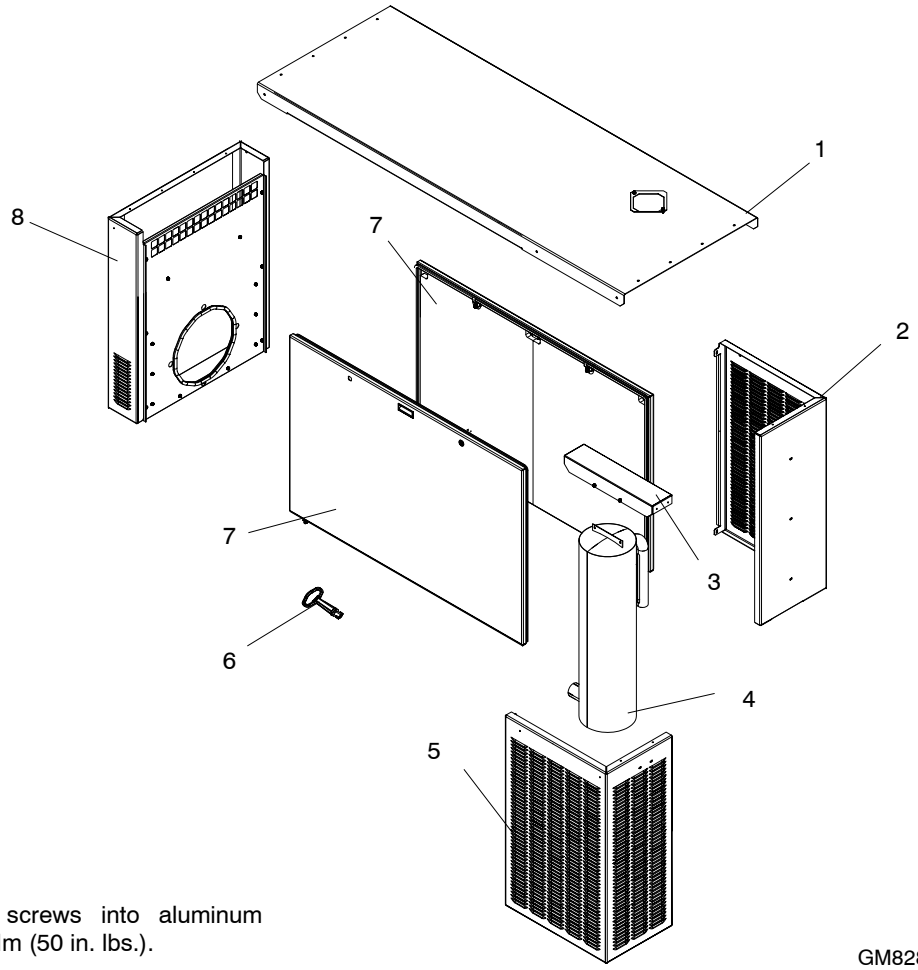
Perform the following steps before disassembling the generator set.

1. Disconnect AC power to the generator set by opening the upstream circuit breaker. Disconnect the engine starting battery, negative (-) lead first.
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.

7.3 Enclosure

See Figure 7-1 or Figure 7-2 for an illustration of enclosure parts. Remove enclosure panels as necessary to access the alternator.

Note: When reassembling the enclosure, do not over-tighten the screws into the aluminum enclosure panels.



1. Roof
2. Front panel
3. Exhaust mounting bracket
4. Silencer
5. Front panel
6. Key, latch opening
7. Door
8. End panel assembly

Note: Maximum torque for screws into aluminum enclosure panels: 5.7 Nm (50 in. lbs.).

Figure 7-1 Enclosure, 48RCL specification number GM78521-GA1

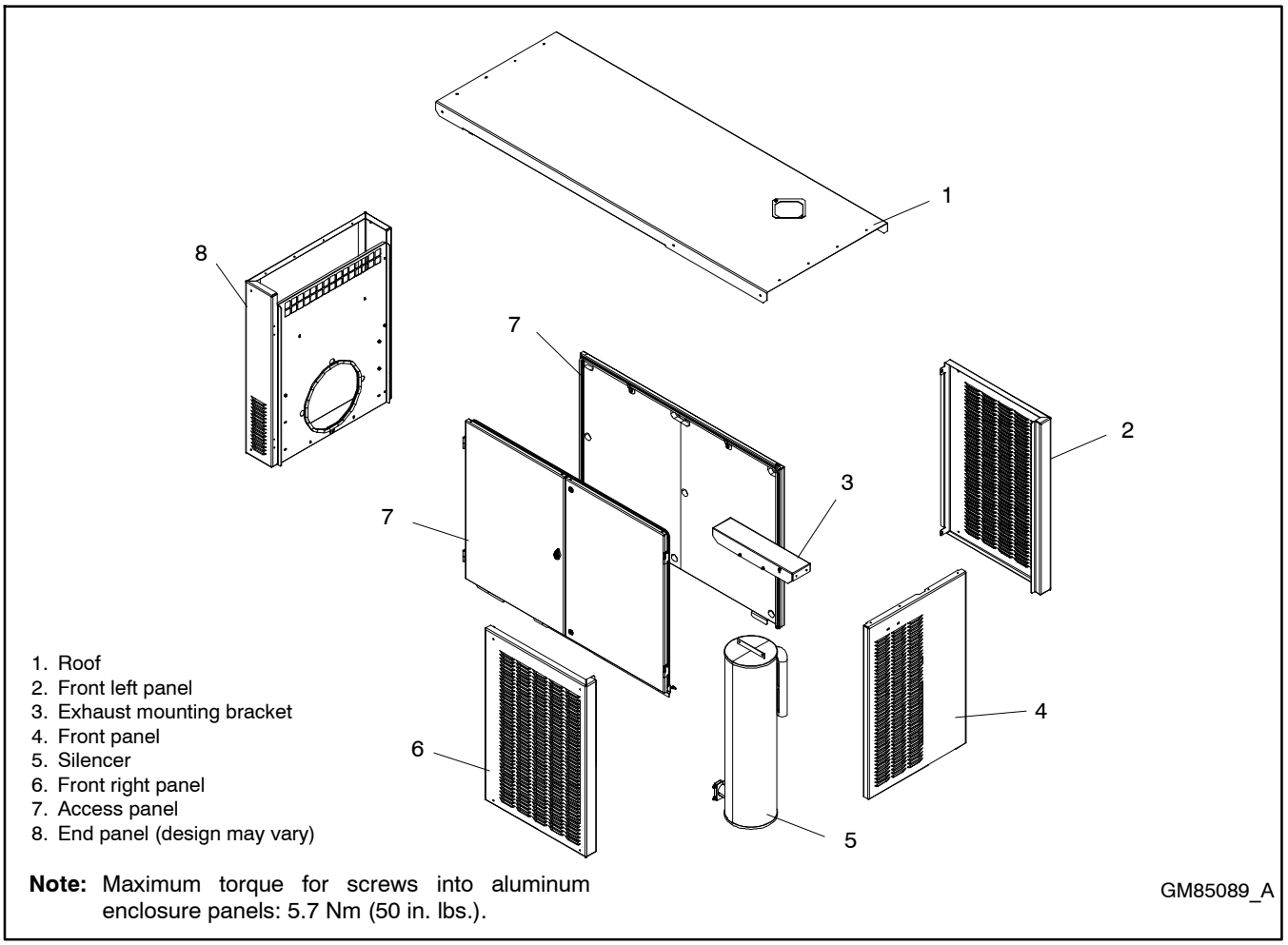
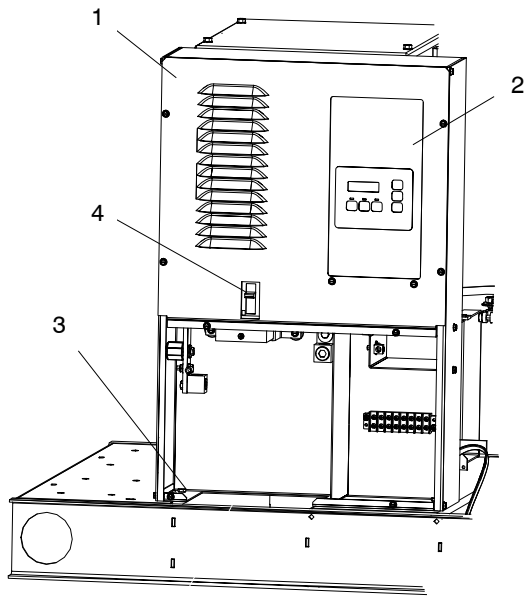


Figure 7-2 Enclosure, 38RCL, 48RCL, 48RCLA, and 60RCL (except 48RCL specification number GM78521-GA1; see Figure 7-1)

7.4 Connection Box

Remove the connection box before removing the alternator. See Figure 7-3.

1. Remove the lower access panel.
2. Remove the controller mounting bolts, lift the controller carefully, and disconnect harnesses to the controller. Then remove the controller.
3. Remove the upper panel.
4. Label and disconnect the load leads to the circuit breaker and other leads as necessary.
5. Remove four bolts at the base of the box and carefully lift the box off the skid.



Lower access panel removed. tp6809

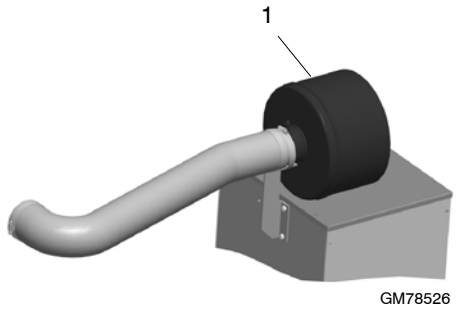
1. Connection box
2. RDC2 controller
3. Mounting bolts, qty. 4
4. Circuit breaker

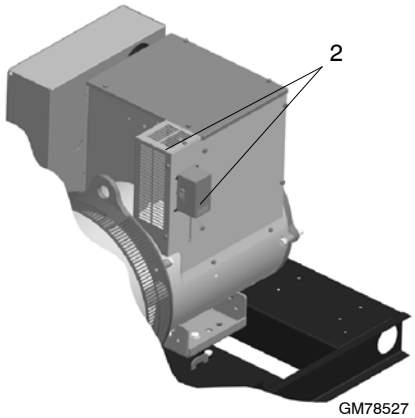
Figure 7-3 Connection box

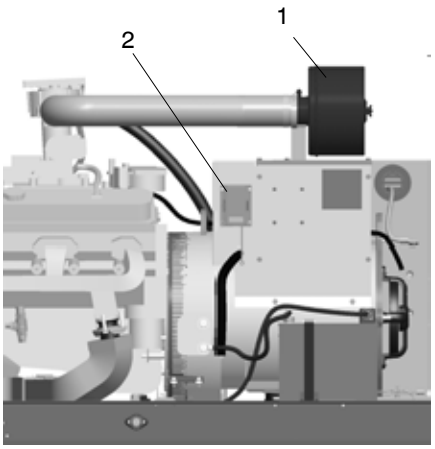
7.5 Other Components

Figure 7-4 shows components mounted to the exterior of the alternator junction box. Disconnect and remove as needed before disassembling the alternator.

Note: The air cleaner is mounted above the engine on some models.







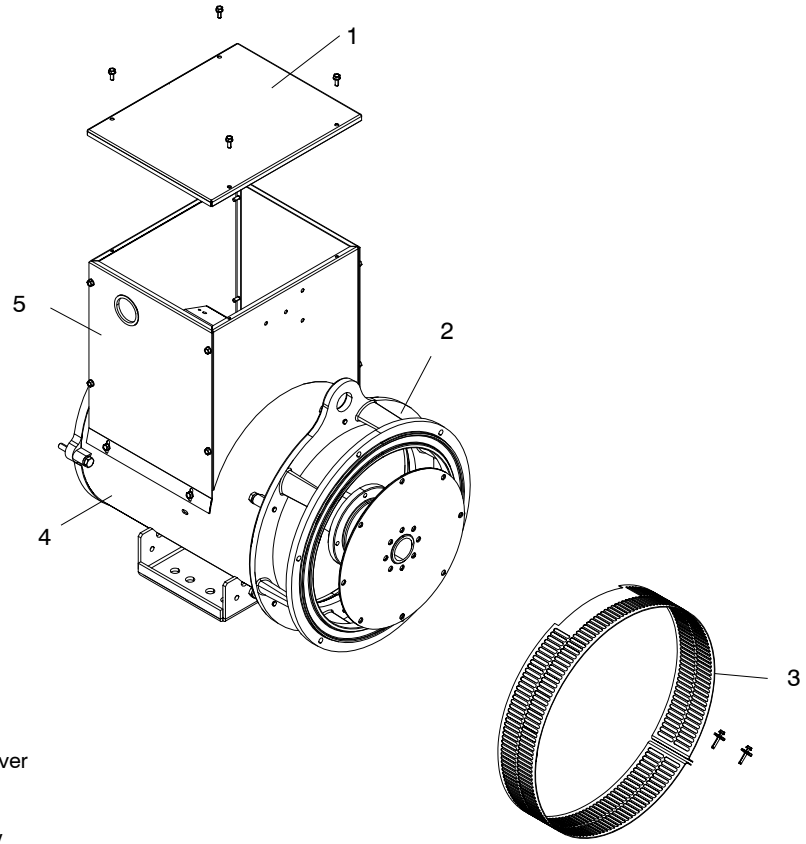
1. Air cleaner assembly (some models have the air cleaner mounted above the engine). Disconnect and remove if necessary.
2. Cooling fan relay/fuse box and resistor. Disconnect as needed.

Figure 7-4 Components Mounted to Alternator Junction Box

7.6 Alternator

The alternator is shown in Figure 7-5.

Note: Refer to the alternator service manual for instructions to disassemble and reassemble the alternator.



1. Junction box top cover
2. Alternator adapter
3. Fan guard
4. Alternator assembly
5. Junction box

Figure 7-5 Alternator Components (see alternator Service Manual for details)

Section 8 Diagrams

This section contains wiring diagrams and schematics for the enclosed generator set. Figure 8-1 lists the drawing numbers and page numbers.

Also see Section 1.7, Service Views, for drawings of the generator set.

Drawing Description	Drawing Number	Page
Schematic Diagram:		
Sheet 1	ADV-8484, 1 of 3	96
Sheet 2	ADV-8484, 2 of 3	97
Sheet 3	ADV-8484, 3 of 3	98
Wiring Diagram:		
Sheet 1	GM85226, 1 of 2	99
Sheet 2	GM85226, 2 of 2	100

Figure 8-1 Drawing Numbers and Locations

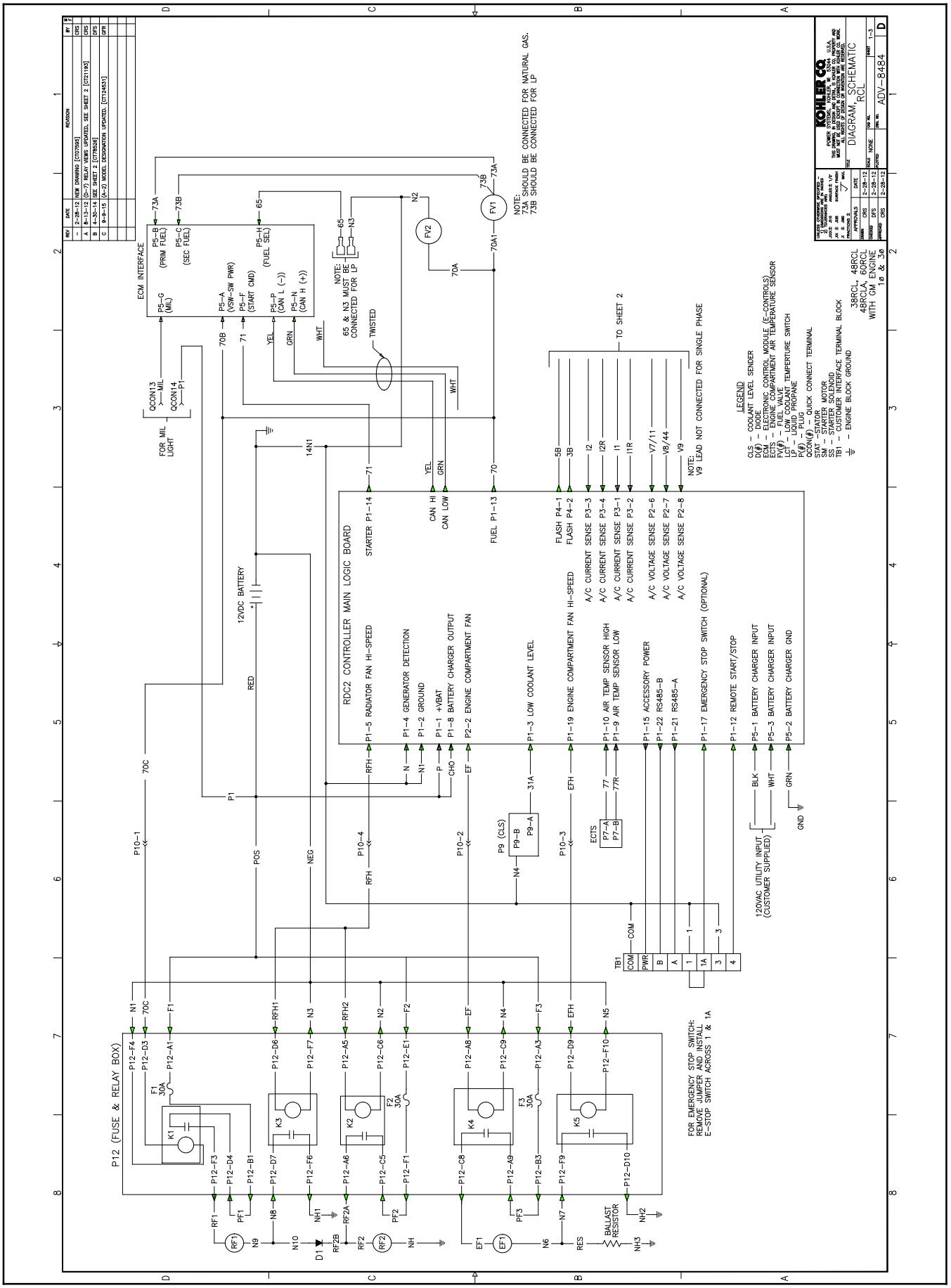


Figure 8-2 Schematic Diagram, ADV-8484, Sheet 1 of 3

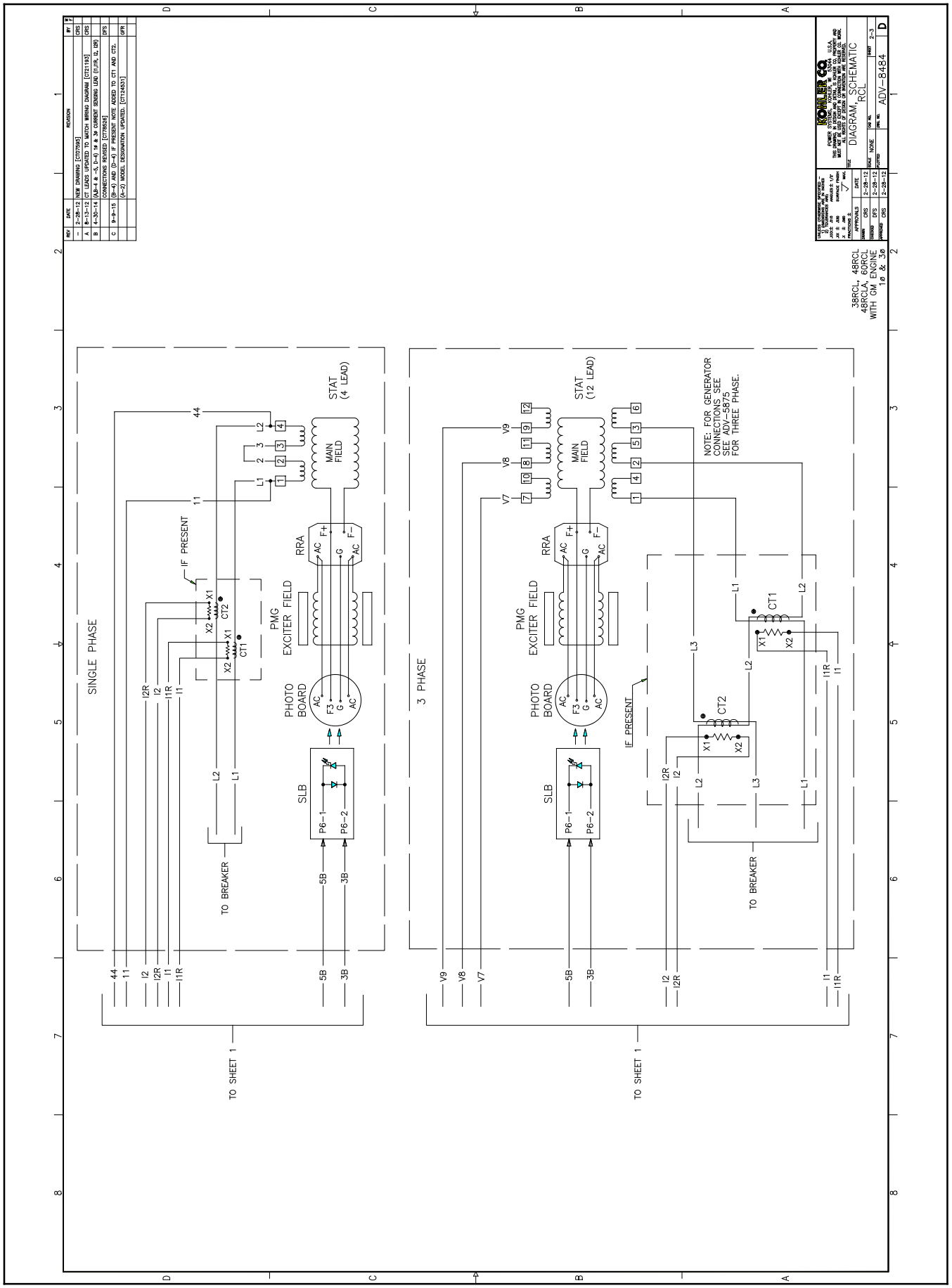


Figure 8-3 Schematic Diagram, ADV-8484, Sheet 2 of 3

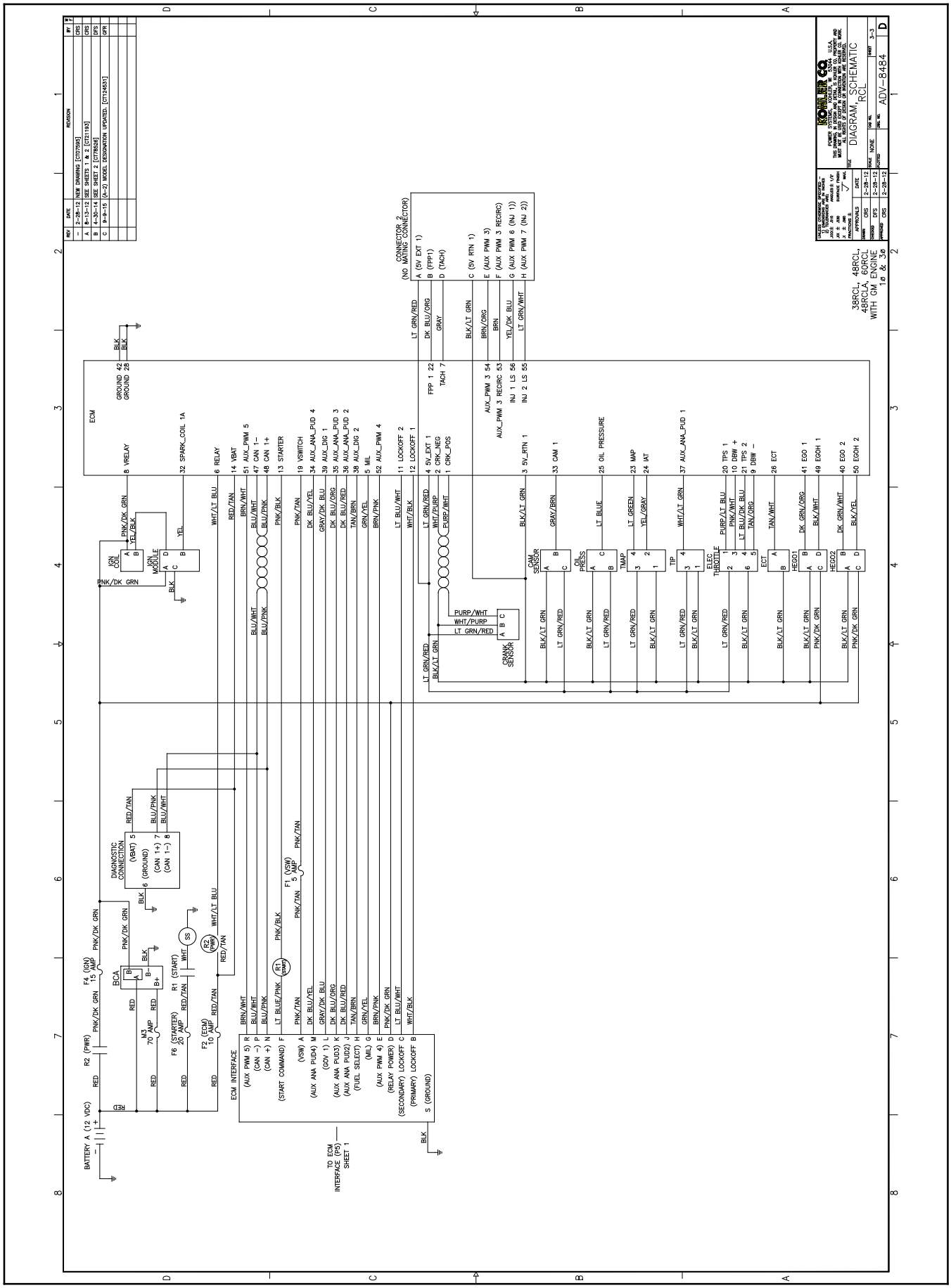


Figure 8-4 Schematic Diagram, ADV-8484, Sheet 3 of 3

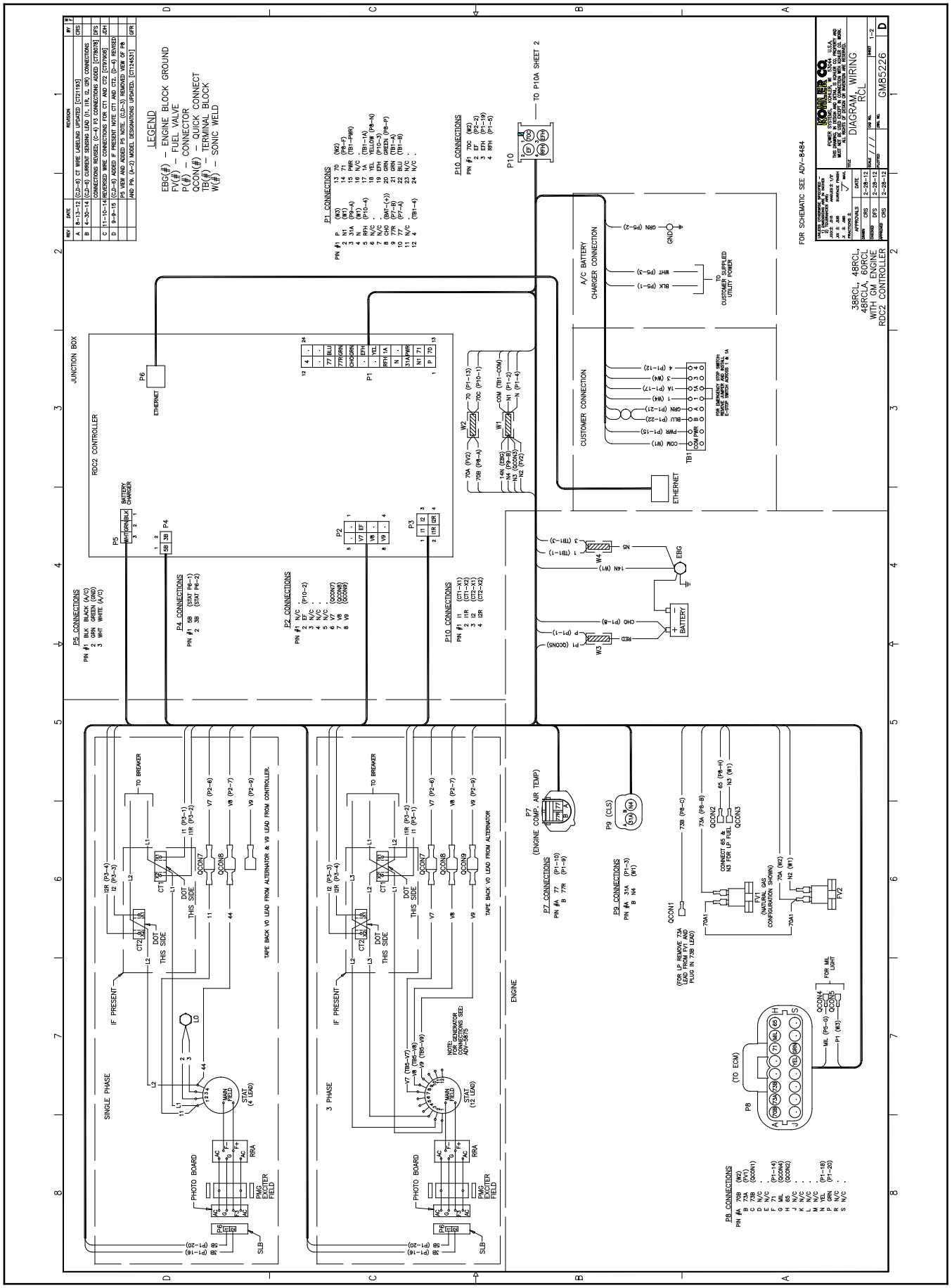


Figure 8-5 Wiring Diagram, GM85226, Sheet 1 of 2

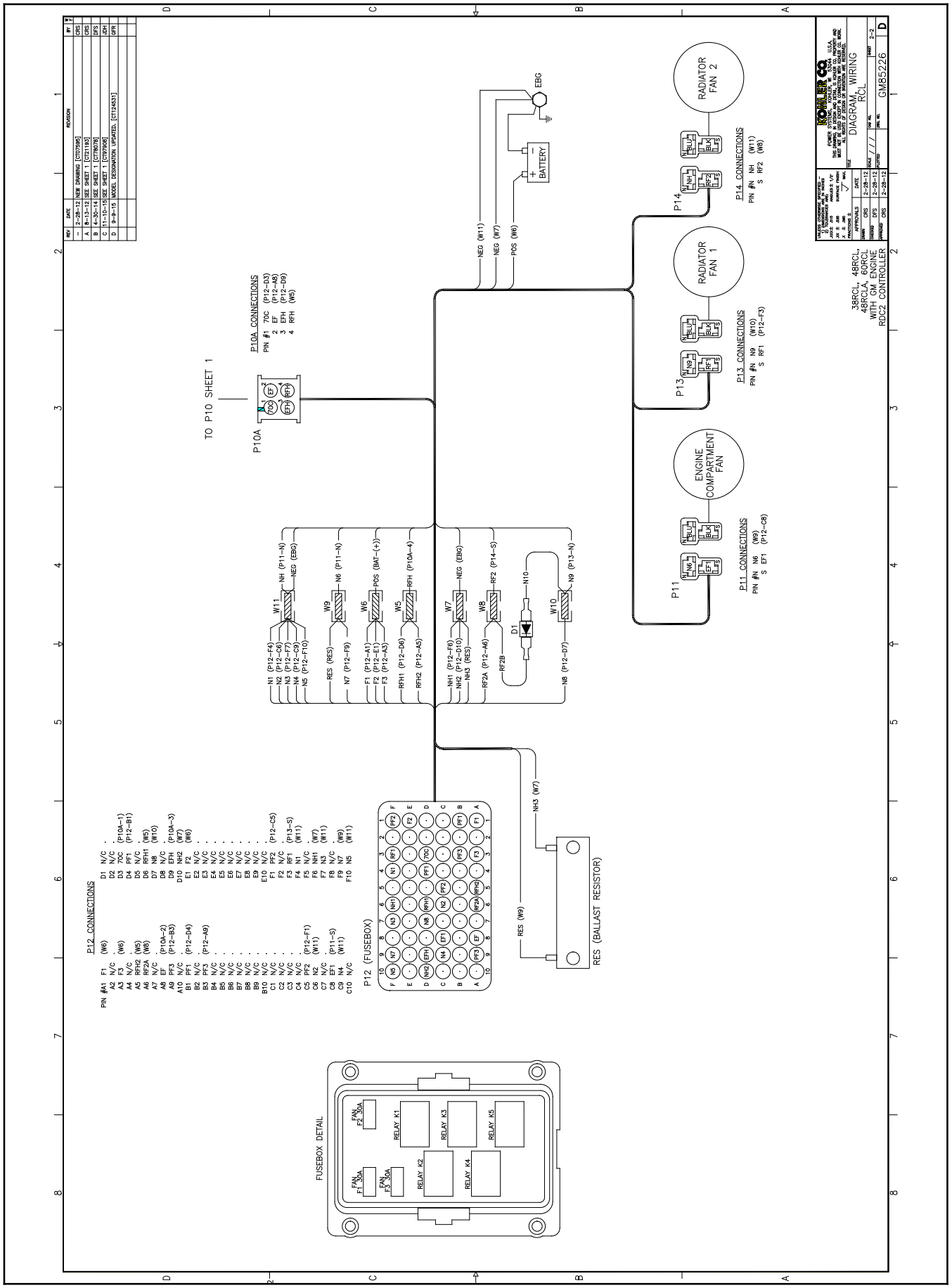


Figure 8-6 Wiring Diagram, GM85226, Sheet 2 of 2

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.

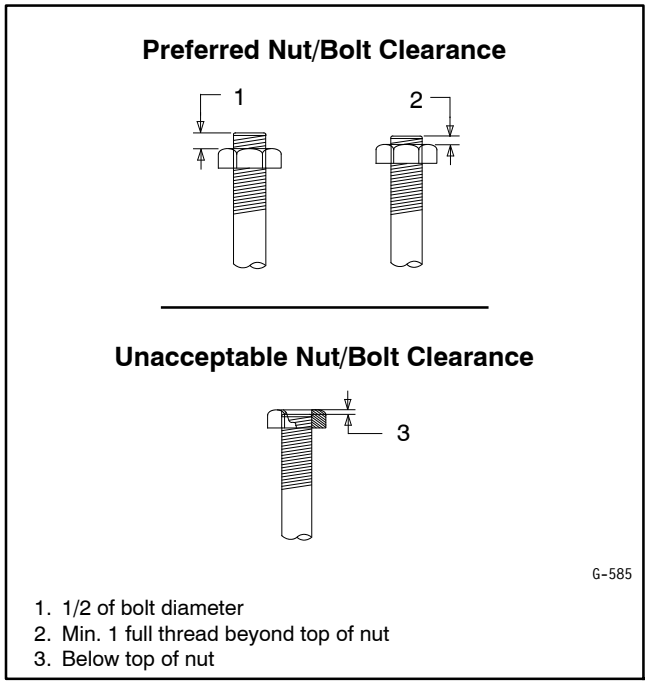


Figure 1 Acceptable Bolt Lengths

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.

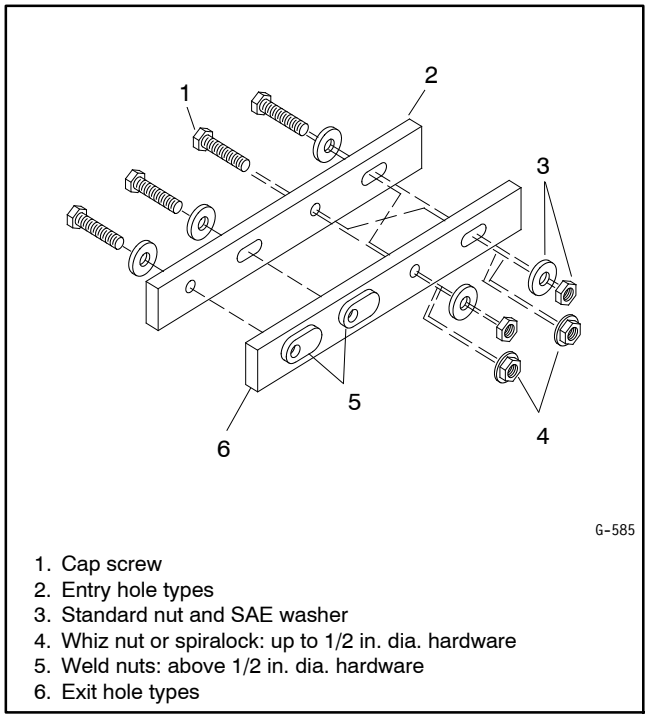


Figure 2 Acceptable Hardware Combinations

Appendix C General Torque Specifications

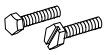
American Standard Fasteners Torque Specifications								
Size	Torque Measurement	Assembled into Cast Iron or Steel						Assembled into Aluminum Grade 2 or 5
		Grade 2		Grade 5		Grade 8		
8-32	Nm (in. lb.)	1.8	(16)	2.3	(20)	—		See Note 3
10-24	Nm (in. lb.)	2.9	(26)	3.6	(32)	—		
10-32	Nm (in. lb.)	2.9	(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)	

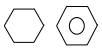
Notes:

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.

Hex Head Bolts (Partial Thread)

Part No.	Dimensions
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

Hex Head Bolts (Partial Thread), continued

Part No.	Dimensions
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

Hex Head Bolts (Full Thread), continued

Part No.	Dimensions
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.

Notes

Notes

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