Operation

Commercial Mobile Generator Sets

Model:

10ERG
13ERG
15ERG

ISO 9001 KOHLER POWER SYSTEMS NATIONALLY REGISTERED

KOHLER® POWER SYSTEMS

TP-6334 9/04

California Proposition 65

⚠ WARNING

Engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

Product Identification Information

Product identification numbers determine service parts. Record the product identification numbers in the spaces below immediately after unpacking the products so that the numbers are readily available for future reference. Record field-installed kit numbers after installing the kits.

Generator Set Identification Numbers

Record the product identification numbers from the generator set nameplate(s).

Model Designation _____

Specification Number _____

Serial Number _____

Accessory Number	Accessory Description

Engine Identification

Record the product identification information from the engine nameplate.

Manufacturer _____

Model Designation _____

Serial Number _____

x:in:007:001

Table of Contents

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***.

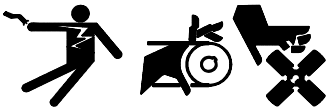
NOTICE

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 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.

Battery

WARNING

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

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

Battery electrolyte is a diluted sulfuric acid. Battery acid can cause severe injury or death. Battery acid can cause blindness and burn skin. Always wear splashproof safety goggles, rubber gloves, and boots when servicing the battery. Do not open a sealed battery or mutilate the battery case. If battery acid splashes in the eyes or on the skin, immediately flush the affected area for 15 minutes with large quantities of clean water. Seek immediate medical aid in the case of eye contact. Never add acid to a battery after placing the battery in service, as this may result in hazardous spattering of battery acid.

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

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

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

Engine Backfire/Flash Fire

⚠ WARNING

Fire.
Can cause severe injury or death.

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

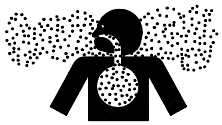
Servicing the fuel system. A flash fire can cause severe injury or death. Do not smoke or permit flames or sparks near the carburetor, fuel line, fuel filter, fuel pump, or other potential sources of spilled fuels or fuel vapors. Catch fuels in an approved container when removing the fuel line or carburetor.

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

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

Exhaust System

⚠ WARNING



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

The exhaust system must be leakproof and routinely inspected.

Generator set operation. Carbon monoxide can cause severe nausea, fainting, or death. Carbon monoxide is an odorless, colorless, tasteless, nonirritating gas that can cause death if inhaled for even a short time. Avoid breathing exhaust fumes when working on or near the generator set. Never operate the generator set inside a building unless the exhaust gas is piped safely outside. Never operate the generator set where exhaust gas could accumulate and seep back inside a potentially occupied building or vehicle. Do not obstruct the exhaust outlet when parking your vehicle. The exhaust gases must discharge freely to prevent carbon monoxide from deflecting into the vehicle.

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

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

If experiencing any of these symptoms and carbon monoxide poisoning is possible, 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.

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

Inspecting the exhaust system. Carbon monoxide can cause severe nausea, fainting, or death. For the safety of the vehicle's occupants, install a carbon monoxide detector. Consult the coach builder or dealer for approved detector location and installation. Inspect the detector before each generator set use. In addition to routine exhaust system inspection, test the carbon monoxide detector per the manufacturer's instructions and keep the detector operational at all times.

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.

Explosive fuel vapors can cause severe injury or death. Take additional precautions when using the following fuels:

Gasoline—Store gasoline only in approved red containers clearly marked GASOLINE.

Propane (LP)—Adequate ventilation is mandatory. Because propane is heavier than air, install propane gas detectors low in a room. Inspect the detectors per the manufacturer's instructions.

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

LP gas fuel leaks. Explosive fuel vapors can cause severe injury or death. Fuel leakage can cause an explosion. Check the LP vapor 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.

Engine noise. Hazardous noise can cause hearing loss. Generator sets not equipped with sound enclosures can produce noise levels greater than 105 dBA. Prolonged exposure to noise levels greater than 85 dBA can cause permanent hearing loss. Wear hearing protection when near an operating generator set.

Hazardous Voltage/ Electrical Shock

⚠ WARNING

Hazardous voltage. Moving rotor.
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 severe injury, death, or property damage.

Connect the generator set to the building's electrical system only through an approved device and after the building's main switch is opened.

⚠ 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. Open the main circuit breakers of all power sources before servicing the equipment. Configure the installation to electrically ground the generator set, transfer switch, and related equipment and electrical circuits to comply with applicable codes and standards. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

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

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.

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.

Electrical backfeed to the utility. Hazardous backfeed voltage can cause severe injury or death. Connect the generator set to the building/campground electrical system only through an approved device and after the building/campground main switch is opened. Backfeed connections can cause severe injury or death to utility personnel working on power lines and/or personnel near the work area. Some states and localities prohibit unauthorized connection to the utility electrical system. Install a transfer switch to prevent interconnection of the generator set power and other sources of power.

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.

Checking the coolant level. Hot coolant can cause severe injury or death. 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 tank if the generator set has a coolant recovery tank.

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.

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

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

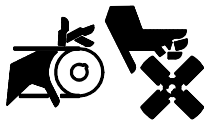
Moving Parts

⚠ WARNING

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

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

⚠ WARNING



Rotating parts.
Can cause severe injury or death.

Operate the generator set only when all guards, screens, and covers are in place.

⚠ WARNING

Airborne particles.
Can cause severe injury or blindness.

Wear protective goggles and clothing when using power tools, hand tools, or compressed air.

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

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.

Notice

NOTICE

Voltage reconnection. Affix a notice to the generator set after reconnecting the set to a voltage different from the voltage on the nameplate. Order voltage reconnection decal 246242 from an authorized service distributor/dealer.

NOTICE

Hardware damage. 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.

NOTICE

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

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.

NOTICE

This generator set does not comply with United States Coast Guard (USCG) requirements and must not be used for marine applications. For marine installations use only generator sets specified for marine use. USCG Regulation 33CFR183 requires that a generator set must be ignition protected when used in a gasoline-fueled environment.

Notes

Introduction

This manual provides operation instructions for 10/13/15ERG model generator sets.

Refer to the engine operation manual for generator set engine scheduled maintenance information.

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. Obtain service from an authorized service distributor/dealer to keep equipment in top condition.

Before installing a mobile generator set, obtain the most current installation manual from your local distributor/dealer. Only qualified persons should install the generator set.

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Service Assistance

For professional advice on generator 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 KohlerPowerSystems.com
- Look at the labels and stickers 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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Tokyo, Japan
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Latin America
Latin America Regional Office
Lakeland, Florida, USA
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Fax: (863) 701-7131

Maintenance and Service Parts/Related Literature

Maintenance and Service Parts

Figure 1 identifies maintenance and service parts for your generator set. Obtain a complete list of maintenance and service parts from your authorized generator distributor/dealer.

Part Description	Part Number
Air Cleaner Element	GM16944
Belt	GM28353
Fuel Filter (gasoline)	GM34570
Fuse, Auxiliary Winding (F1) 10 amp	358337
Fuse, Relay Interface Board (F2) 10 amp	223316
Fuse, Controller (F3) 10 amp	223316
Oil Filter	GM28351
Spark Plug	GM35826
Spray Paint (Black)	221292

Figure 1 Maintenance and Service Parts

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List of Related Literature

Figure 2 identifies related literature available for the generator sets covered in this manual. Only trained and qualified personnel should install or service the generator set.

Literature Type	Part Number
Installation Manual	TP-6335
Operation Manual (Generator)	TP-6334
Operation Manual (Engine)	TP-6326
Parts Catalog*	TP-6337
Service Manual (Generator)	TP-6336
Service Manual (Engine)	TP-6327

* One manual combines Generator and Engine information.

Figure 2 Generator Set Literature

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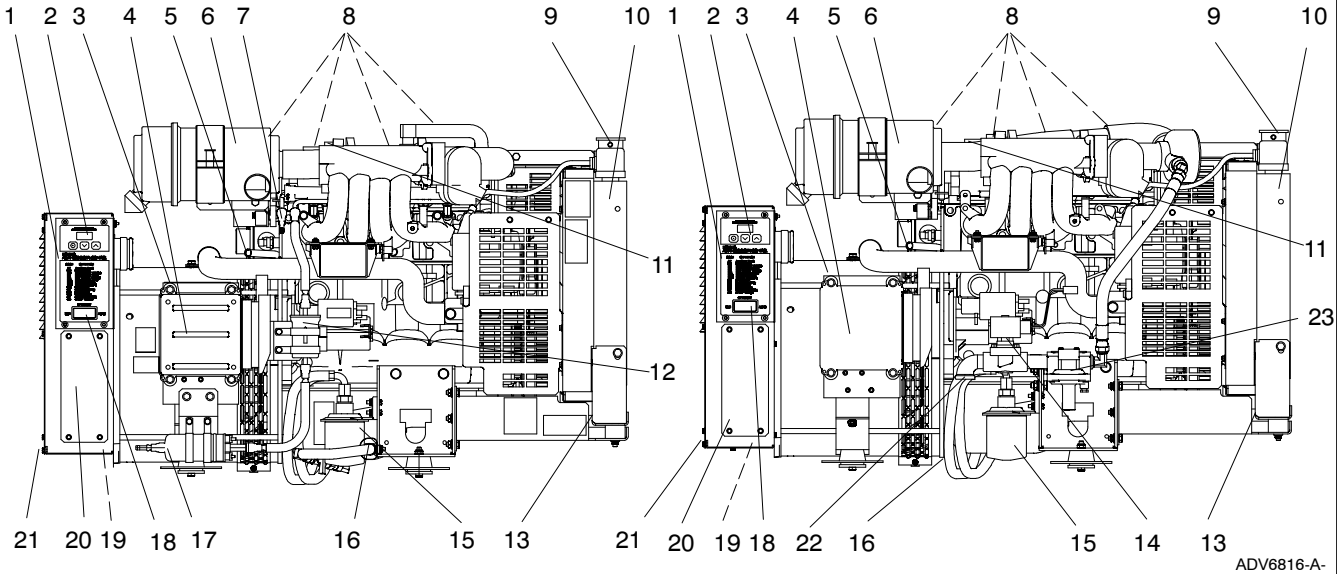

SERVICE-SIDE VIEW (Gasoline Models)

SERVICE-SIDE VIEW (LP Models)

1. Advanced Digital Control (ADC 2100)
2. Runtime hour display
3. Nameplate
4. Electronic Control Module (ECM)
5. Oil check
6. Air cleaner
7. Fuel return connection point
8. Spark plugs (located on non-service side)
9. Coolant fill (coolant fill location after draining coolant)
10. Radiator
11. Oil fill (on valve cover)
12. Fuel filter (gasoline models)
13. Coolant drain
14. Fuel solenoid (LP models only)
15. Lube oil filter
16. Oil drain valve
17. Fuel feed pump (fuel inlet) (gasoline models)
18. Generator set master switch
19. Remote customer interface connector (non-service side)
20. AC circuit breaker panel
21. Customer load lead access
22. Fuel inlet (LP models)
23. LP gas fuel regulator

Note: Consult your distributor/dealer or the service manual for items not shown.

Figure 1-1 Service Views

Notes

2.1 Prestart Checklist

To ensure continued satisfactory operation perform the following checks or inspections before or at each startup, as designated, and at the intervals specified in the service schedule. In addition, some checks require verification after the unit starts.

Air Cleaner. Check for a clean and installed air cleaner element to prevent unfiltered air from entering the engine.

Air Inlets. Check for clean and unobstructed air inlets.

Air Shrouding. Check for securely installed and positioned air shrouding.

Battery. Check for tight battery connections. Consult the battery manufacturer's instructions regarding battery care and maintenance.

Coolant Level. Check the coolant level according to the cooling system maintenance information.

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.

Drive Belt(s). Check the belt condition of the water pump and battery charging alternator belt(s).

Exhaust System. Check for exhaust leaks and blockages. Check the muffler and piping condition and check for tight exhaust system connections.

Inspect the exhaust system components for cracks and corrosion (exhaust manifold, exhaust line, exhaust clamps, and muffler).

- Check for corroded or broken metal parts and replace them as needed.
- Check for loose, corroded, or missing clamps and hangers. Tighten or replace the exhaust clamps and/or hangers as needed.
- Check that the exhaust outlet is unobstructed.
- Check the exhaust gas color. If the exhaust is blue or black, contact your local 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.
- Ensure that the carbon monoxide detector is (1) in the vehicle, (2) functional, and (3) energized whenever the generator set operates.

Note: Never operate the generator set without a functioning carbon monoxide detector.

Fuel Level. Check the fuel level and keep the tank(s) full to ensure adequate fuel supply.

Oil Level. Maintain the oil level at or near, not over, the full mark on the dipstick.

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

2.2 Angular Operation

See Figure 2-1 for angular operation limits for units covered in this manual.

Continuous	Intermittent— 3 minutes or less
25°	30°
Maximum value for all directions	

Figure 2-1 Angular Operation

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2.3 Exercising the Generator Set

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

The operator should perform all of the prestart checks before starting the exercise procedure. Start the generator set according to the starting procedure in the controller section of this manual. While the generator set is operating, listen for a smooth-running engine and visually inspect the generator set for fluid or exhaust leaks.

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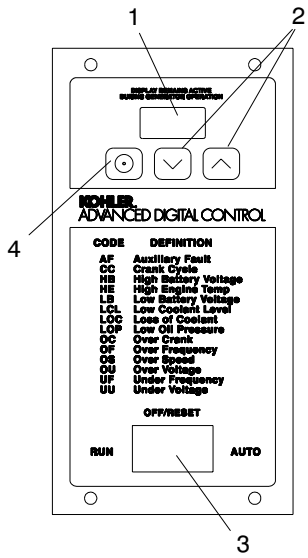
2.4 Advanced Digital Control Operation

Figure 2-2 illustrates the user interface on the Advanced Digital Control (ADC 2100).

Note: Have setup and adjustments of the ADC 2100 performed only by an authorized Kohler distributor/dealer. The setup and adjustments are password protected.



1. LED display
2. Up and down arrow buttons (use for setup and adjustment only)
3. Generator set master switch
4. Select button (use for setup and adjustment only)

Figure 2-2 ADC 2100 Control

2.4.1 Controls and Indicators

Figure 2-3 describes the controls and indicators located on the controller. The LED display indicates generator set status as shown in Figure 2-3. The display is active when the master switch is in the RUN or AUTO position and remains active until the generator set master switch is moved to the OFF/RESET position or the power to the controller is removed. If the factory-installed continuous power mode jumper has been disconnected, the LED display turns off 48 hours after the generator set shutdown. See Section 2.4.6.

The buttons on the controller keypad are used only for system configuration and adjustment. The controller is factory-set and should not require configuration or adjustment under normal operating conditions. If the generator set is reconnected to a different voltage and/or frequency, refer to an authorized Kohler distributor/dealer for system configuration and adjustment instructions.

Control or Indicator	Item	Description
LED display	Runtime hours	Displays total generator set runtime hours.
	Crank indication	Displays CC_1, CC_2, or CC_3 to indicate the first, second or third attempt to start the engine. The last digit flashes during the crank cycle rest periods.
	Fault codes	Flashes a 2- or 3-letter fault code to indicate various fault conditions. See Section 2.4.4.
	Software version	See TP-6335, Generator Set Installation Manual.
Keypad	Select and arrow buttons	The keypad is used for controller setup and adjustment only. Have setup and adjustments performed only by an authorized distributor/dealer. The setup and adjustment functions are password-protected.
Generator set master switch	Three-position switch	Switch functions as the generator set operation and controller reset switch.

Figure 2-3 ADC 2100 Controls and Indicators

2.4.2 Starting the Generator Set

The following procedures describe the actions required to start the generator set.

Step	Action
1	**Fuel shut-off valve.** Open the manual fuel shut-off valve, if equipped.
2	**Starting.** Place the generator set master switch in the RUN position.

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

Local Starting.

Move the generator set master switch to the RUN position. The ADC 2100 attempts to start the generator set in three crank cycles (crank cycle time is pre-programmed).

Auto (Automatic) Starting.

Move the generator set master switch to the AUTO position to allow startup by the ATS, remote start/stop switch or remote digital gauge. A remote start/stop switch or digital gauge can be connected to the customer interface connection (P21 connector, leads 3 and 4). See the wiring diagram in Section 5.

Note: The ADC 2100 allows three crank cycle attempts before the overcrank shutdown occurs.

2.4.3 Stopping the Generator Set

The following procedures describe the actions required to stop the generator set.

Local Stopping

1. Run the generator set at no load for at least 2 minutes to ensure adequate engine cooldown.
2. Move the generator set master switch to the OFF/RESET position. The engine stops.

2.4.4 Fault Shutdowns

The generator set shuts down automatically under the fault conditions listed in Figure 2-4 and the controller displays a fault code. The generator set cannot be restarted until the fault condition is corrected and the controller is reset. See Section 2.4.5 to reset the controller after a fault shutdown. The controller resets automatically after a battery voltage fault condition is corrected.

Shutdown switches on the generator set automatically reset when the problem is corrected. The high engine temperature switch automatically resets when the generator set cools. However, the fault does not clear until the controller is reset.

The controller displays a fault code but the generator set does not shut down under the conditions shown in Figure 2-5.

Code	Fault	Description	Check
AF	Auxiliary fault input shutdown	Input from a customer-supplied switch that closes when the fault is active. Shutdown occurs 0.3 seconds after the fault is detected and will not start when the fault is active (input is grounded). This protection becomes active 3-seconds after crank disconnect.	Check the cause of the auxiliary fault.
HE	High engine temperature shutdown	Shutdown occurs if the engine coolant temperature exceeds the maximum temperature for more than 5 seconds. This protection becomes active after the engine reaches the crank disconnect speed. **Note:** The high engine temperature shutdown functions only when the coolant level is in the operating range.	Check for a low engine coolant level.
LOP	Low oil pressure shutdown	Shutdown occurs if a low oil pressure condition exists for more than 5 seconds. This protection becomes active 30 seconds after the engine has reached crank disconnect speed (30 second inhibit). **Note:** The low oil pressure shutdown does not protect against low oil level. Check the oil level at the engine.	Check for leaks in the lubrication system. Check the oil level and add oil if the level is low.
OC	Overcrank shutdown	Shutdown occurs after 3 unsuccessful starting attempts. The crank cycle is set for three starting attempts.	Check the fuel supply and battery. If there is no output voltage, check the line circuit breaker. Also check for loose connections. Contact an authorized distributor/dealer for service if problem continues.
OF	Overfrequency shutdown	Shutdown occurs when the governed frequency exceeds 110% of the system's frequency setpoint for more than 5 seconds. This protection becomes active 10 seconds after engine start (10 second inhibit).	Contact an authorized distributor/dealer for service if problem continues.
OS	Overspeed shutdown	Shutdown occurs if the engine speed exceeds 115% of the normal running speed for more than 0.3 seconds.	Contact an authorized distributor/dealer for service if problem continues.
OU	Overvoltage shutdown	Shutdown occurs if the voltage exceeds 120% of the voltage regulator setpoint for more than 2 seconds.	Contact an authorized distributor/dealer for service if problem continues.
UF	Underfrequency shutdown	Shutdown occurs when the governed frequency falls below 90% of the system's frequency setpoint for more than 5 seconds. This protection becomes active 10 seconds after engine start (10-second inhibit).	Reduce the load and restart the generator set. Contact an authorized distributor/dealer for service if problem continues.
UU	Undervoltage shutdown	Shutdown occurs if the voltage falls below 80% of the voltage regulator setpoint for more than 10 seconds.	Reduce the load and restart the generator set. Contact an authorized distributor/dealer for service if problem continues.
SCF0	Controller error	Indicates a software or communication problem within the ADC 2100.	Contact an authorized distributor/dealer for service if problem continues.

Figure 2-4 ADC 2100 Fault Shutdown Codes

Code	Fault	Description	Check
HB	High battery voltage warning	Fault code is displayed if the engine starting battery voltage rises above 16 VDC for a 12 VDC system or above 30 VDC for a 24 VDC system for more than 2 seconds when the engine is not running. This fault condition does not inhibit engine starting. The fault condition clears when the battery voltage returns to a voltage within the limits for more than 2 seconds.	Check the battery rating and condition.
LB	Low battery voltage warning	Fault code is displayed if the engine starting battery voltage falls below 9.5 VDC for a 12 VDC system or below 16 VDC for a 24 VDC system for more than 2 seconds when the engine is not running. This fault condition does not inhibit engine starting. The fault condition clears when the battery voltage returns to a voltage within the limits for more than 2 seconds.	Check the battery rating and condition. Charge or replace the battery.

Figure 2-5 ADC 2100 Fault Warning Codes

2.4.5 Resetting the Controller after a Fault Shutdown

Always identify and correct the cause of a fault shutdown before resetting the controller. Use the following procedure to reset the generator set controller after a fault shutdown.

1. Move the generator set master switch to the OFF/RESET position.
2. Disconnect the generator set from the load using the line circuit breaker or ATS. See the safety precautions at the beginning of this manual before proceeding.
3. Identify and correct the cause of the fault shutdown. See the safety precautions at the beginning of this manual before proceeding. Refer to Section 4, Troubleshooting.
4. Start the generator set by moving the generator set master switch to RUN. Test operate the generator set to verify that the cause of the shutdown has been corrected.
5. Shut the generator off by moving the generator set master switch to the OFF/RESET position.
6. Reconnect the generator set to the load using the line circuit breaker or ATS.
7. Move the generator set master switch to the AUTO position for startup by remote transfer switch, remote start/stop switch, or remote digital gauge.

Opening and closing the remote start/stop contact also resets the controller.

2.4.6 Continuous Power Mode

The controller is powered by the generator set engine starting battery. A jumper on the back of the controller maintains power to the controller at all times. Controllers are shipped with the jumper connected.

Note: Remote communications require an active (powered-up) controller. Be advised that the ADC 2100 consumes 250 mA when the master switch is in the AUTO position with the jumper connected. If you do not plan to use your generator set for a long period of time, Kohler recommends moving the master switch to the OFF/RESET position (0 mA draw).

Disconnecting the jumper allows the controller to power down automatically 48 hours after the generator set shuts down if the generator set master switch is in the AUTO position. A remote start signal (from a transfer switch or a remote start/stop switch connected to P21 connector, leads 3 and 4) or moving the generator set master switch to the RUN position turns the controller back on. See the Installation Manual for instructions to disconnect the jumper.

Note: For remote starting using the digital gauge, the continuous power mode jumper must be connected.

2.5 Circuit Protection

If the generator set circuit breaker trips or the fuses blow repeatedly, see Section 4, Troubleshooting, for possible causes.

2.5.1 Line Circuit Breaker

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

2.5.2 Fuses

The engine harness contains three 10-amp inline fuses. Always identify and correct the cause of a blown fuse before restarting the generator set. Refer to section 4, Troubleshooting, for conditions that may indicate a blown fuse. Obtain service from an authorized distributor/dealer.

Controller Fuse. A replaceable 10-amp fuse protects the controller circuitry. If the controller display is dark, check the battery and battery connections and then check the controller fuse. Replace the fuse if it is blown.

Relay Fuse. A replaceable 10-amp fuse protects the engine relays. If the generator set does not crank, check the battery and battery connections and then check the relay fuse. Replace the fuse if it is blown.

Auxiliary Winding Fuse. A replaceable 10-amp fuse protects the alternator.

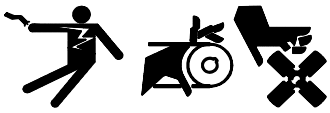
Fuse	Label	Part Number	Location
Auxiliary Winding	F1	358337	Lead 55
Relay Interface Board	F2	223316	Lead PF2
Controller	F3	223316	Lead PF3

Figure 2-6 Fuses

Notes

3.1 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.

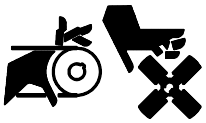
⚠ WARNING

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



Rotating parts.
Can cause severe injury or death.

Operate the generator set only when all guards, screens, and covers 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.

NOTICE

Hardware damage. 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 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.

If the generator set operates under dusty or dirty conditions, use *dry* compressed air to blow dust out of the alternator. With the generator set running, direct the stream of air in through the cooling slots at the alternator end.

Routine Maintenance. Refer to the following generator set service schedule, the engine service schedule, and the runtime hours shown on the ADC2100 to determine when to schedule routine maintenance. Service more frequently generator sets that are subject to extreme weather or dusty or dirty conditions.

Service Log. Use the Operating Hour Service Log located in the back of this manual to document performed services.

Service Schedule. Perform maintenance on each item in the service schedule at the designated intervals for the life of the generator set. For example, an item requiring service every 100 hours or 3 months also requires service after 200 hours or 6 months, 300 hours or 9 months, and so on.

3.2 Service Schedule

Perform Service at Intervals Indicated (X)	Reference Section	Before Starting	After 50 Hrs or 1 Month	Every 100 Hrs or 3 Months	Every 300 Hrs or 6 Months	Every 500 Hrs or Yearly
FUEL SYSTEM						
Check the fuel level and fill as necessary	2.1	X				
Replace the gasoline fuel filter *					X (400 hrs)	
Check the solenoid valve operation (LP vapor) *		X (Weekly)				
Check the fuel lines and replace as necessary *					X	
LUBRICATION SYSTEM						
Check the crankcase oil level and add oil as necessary	3.3.2	X				
Replace the oil in the crankcase	3.3.4			X (200 hrs)		
Replace the lube oil filter element	3.3.5			X (200 hrs)		
COOLING SYSTEM						
Check the coolant level and fill as necessary	3.8.1	X				
Inspect the radiator and hoses	3.8.1	X (Weekly)				
Check the belt tension and condition *	3.11			X		
Check the coolant protection and tighten the hose clamps *	3.8.1					X (400 hrs)
Flush the cooling system *	3.8.4					X (800 hrs)
IGNITION SYSTEM						
Clean and regap the spark plugs	3.9				X	
Replace the spark plugs	3.9					X (800 hrs)

* Consult your local distributor/dealer for service.

Service Schedule, continued

Perform Service at Intervals Indicated (X)	Reference Section	Before Starting	After 50 Hrs or 1 Month	Every 100 Hrs or 3 Months	Every 300 Hrs or 6 Months	Every 500 Hrs or Yearly
INTAKE/EXHAUST SYSTEM						
Inspect the exhaust system components *	3.7	X				
Check the exhaust gas condition	3.7	X (during operation)				
Inspect and clean the air cleaner element	3.6		X (Weekly)			
Replace the air cleaner element	3.6				X	
Inspect the complete exhaust system ‡	3.7					X
ELECTRICAL SYSTEM						
Keep the battery charged and in good condition ⊕	3.10	X				
Check and tighten electrical connections			X			
Clean the battery cables *		As required				
ENGINE AND MOUNTING						
Check for water, fuel, coolant, and oil leakage *†		X				
Retighten all nuts and bolts		As required				
Check tightness of mounting bolts/vibromounts				X (200 hrs)		
REMOTE CONTROL SYSTEM						
Check the remote control operation			X (break-in period)			X
GENERATOR						
Test run the generator set	2.3		X (weekly)			
Blow dust out of the generator *	3.1					X
Clean slip rings and inspect brushes *						X (1000 hrs)

* Consult your local distributor/dealer for service.

† Read WARNING found at the beginning of manual regarding moving parts.

‡ Should be performed by your local distributor/dealer.

⊕ Consult battery manufacturer's instructions.

3.3 Lubrication System

3.3.1 Oil Specifications

Use oil that displays the American Petroleum Institute (API) “Starburst” certification mark for gasoline engines on the container. Using unsuitable oil or neglecting an oil change may result in engine damage that is not covered by the engine warranty. Figure 3-1 shows the recommended Society of Automotive Engineers (SAE) viscosity designation for a given operating temperature.

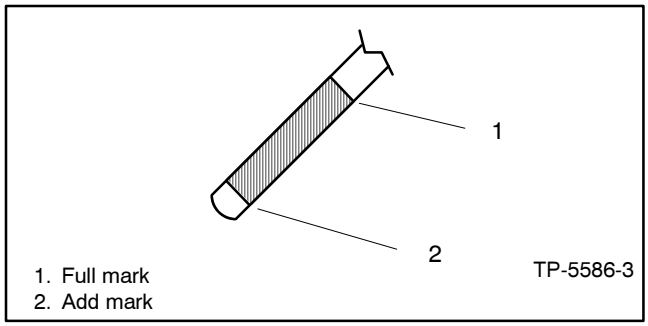
Do not mix different oil brands. Incompatibility could cause a breakdown of lubricating ingredients and reduce engine protection.

Model	SAE Viscosity Grade for	
	–18°C (0°F) or above	**below –18°C (0°F)**
10/13/15ERG	10W-30	5W-30

Figure 3-1 Engine Oil Selection

3.3.2 Oil Check

Check the oil level in the crankcase daily or before each startup to ensure that the level is in the safe range. 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 and remove. Maintain the oil level between the Full and Add marks on the dipstick, as shown in Figure 3-2. See Section 1, Service Views for the dipstick location.



1. Full mark
2. Add mark

Figure 3-2 Oil Level Check

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

3.3.3 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.

3.3.4 Oil 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 Figure 3-3 for oil capacity. See Section 1, Service Views for oil fill, oil check, and oil filter locations.

Model	L (Qts.)
All models	3.5 (3.7)

Figure 3-3 Oil Capacity (with Filter)

Oil Change Procedure

1. Stop the generator set.
2. To drain the oil, open the oil-drain valve. See Section 1 for the valve location.
3. Drain the oil into a suitable container.
4. Allow ample time for all oil to drain.
5. Close the oil-drain valve.
6. Remove the oil-fill cap.
7. Replace the engine oil filter according to the service schedule and the procedure in Section 3.3.5.
8. Fill crankcase with oil. Section 1 shows the oil fill location. See Figure 3-1 for oil selection and Figure 3-3 for oil capacity. Replace the oil-fill cap.
9. Start the generator set and check for oil leaks.
10. 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.

Note: Do not pollute the environment. Dispose of used engine oil and other contaminants in a safe, approved manner.

3.3.5 Oil Filter Change

Replace the oil filter at the interval specified in the service schedule. Change the oil filter more frequently if the generator set operates under dirty, dusty conditions. Refer to the following procedure. See Section 1 for oil filter location.

Oil Filter Change Procedure

1. Loosen the oil filter by turning it counterclockwise. Remove the oil filter and use rags to clean up spilled oil. Dispose of the oil filter in an approved manner.
2. Clean the contact surface of the oil filter adapter.
3. Lightly lubricate the gasket surface of the new filter with fresh engine oil. Thread the filter on the adapter until the gasket makes contact and hand-tighten the filter an additional one-half turn. Wash hands after any contact with engine oil.

   Note: If also performing an oil change, skip steps 4 and 5 and go back to oil change procedure.

4. Start the generator set and check for oil leaks.
5. Stop the generator set. Check oil level. Add oil, as necessary, to bring level up to Full mark.

3.4 Gasoline Fuel System

3.4.1 Fuel Specifications

Use a clean, good-quality unleaded fuel with an octane number of 87 or 89. Use fresh gasoline to ensure it is blended for the season and to reduce the possibility of the formation of gum deposits that could clog the fuel system. Do not use gasoline left over from the previous season.

Kohler Co. recommends unleaded fuel because it leaves fewer combustion chamber deposits. Never mix oil with fuel.

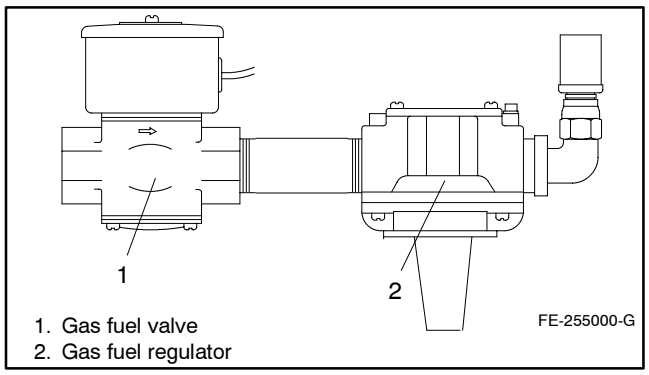
Note: Consult the engine owner's manual for oxygenated fuel recommendations.

3.4.2 Fuel Filter (Gasoline)

Clean/replace the gasoline fuel filter at the interval specified in the service schedule. Service more frequently if rough operation suggests a clogged fuel filter. Some models use an in-line fuel filter which cannot be cleaned and requires replacement. Other models have a fuel pump with an integral fuel filter which requires cleaning at the specified interval.

3.5 Gaseous Fuel System

The gaseous fuel system utilizes a fuel valve (with solenoid) to control the fuel flow to the fuel regulator. The generator-mounted regulator reduces fuel pressure as fuel passes to the carburetor. See Figure 3-4. The carburetor controls the ratio of fuel to air under varying loads and speed conditions. Because the carburetor receives fuel in a gaseous state, it does not have to provide vaporization of the fuel.



1. Gas fuel valve
2. Gas fuel regulator

Figure 3-4 Fuel Regulator and Valve

3.5.1 Carburetor (LP Vapor)

Generator sets are equipped with an emission certified engine. No adjustments can be made. Contact an authorized service distributor/dealer about adjustments for altitude performance on emission certified engines.

3.6 Air Cleaner

At the interval specified in the service schedule, inspect, 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

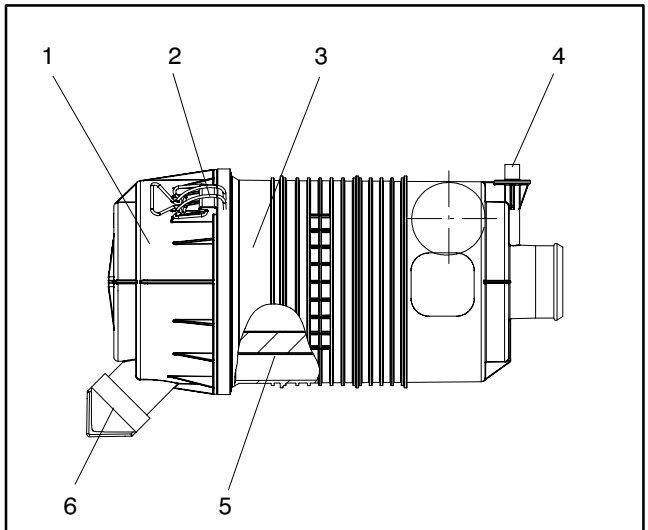
A dry-type air cleaner silences and filters the intake air. The air intake silencer assembly connects to the intake manifold via a flexible hose. Refer to Figure 3-5 during this procedure.

1. Release the spring clips to open the housing and remove the air silencer element.

2. 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.

3. Examine the element and housing for damage. Replace the element or housing if necessary.

4. Wipe the cover and base with a clean rag to remove dirt. Make sure the sealing surfaces fit correctly and reattach the spring clips.

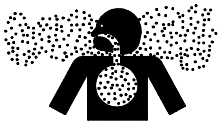


1. Cover
2. Spring clip(s)
3. Housing
4. Pressure tap, (1/8-27 NPT)
5. Element
6. Dust ejector

Figure 3-5 Air Cleaner

3.7 Exhaust System

⚠ WARNING



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

The exhaust system must be leakproof and routinely inspected.

Inspecting the exhaust system. Carbon monoxide can cause severe nausea, fainting, or death. For the safety of the craft's occupants, install a carbon monoxide detector. Consult the boat builder or dealer for approved detector location and installation. Inspect the detector before each generator set use. In addition to routine exhaust system inspection, test the carbon monoxide detector per the manufacturer's instructions and keep the detector operational at all times.

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 for loose, corroded, or missing clamps and hangers. Tighten or replace the exhaust clamps and/or hangers as needed.
- Check that the exhaust outlet is unobstructed.
- Check the exhaust gas color. If the exhaust is blue or black, contact your local 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.
- Ensure that the carbon monoxide detector is (1) in the vehicle, (2) functional, and (3) energized whenever the generator set operates.

3.8 Cooling System

⚠ 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.

Checking the coolant level. Hot coolant can cause severe injury or death. 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 tank if the generator set has a coolant recovery tank.

3.8.1 Checking the Cooling System

See Figure 3-6 for coolant capacity See Figure 3-7 for thermostat and pressure cap ratings.

To prevent generator shutdown or damage because of overheating, keep the cooling air inlets clean and unobstructed at all times. 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. When checking the coolant level, also check the rubber seal of the radiator's pressure cap and replace a cracked or deteriorated 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. Find the pressure cap rating in Figure 3-7. Remove dirt and other debris from the pressure cap and filler neck. See Figure 3-6 for the coolant capacity.

Model	L (Qts.)
All models	7.6 (8.0)

Figure 3-6 Coolant Capacity

Model	10/13/15EG
Pressure Cap Rating	96.5 kPa (14 psi)
Thermostat Rating	91°C (195°F)

Figure 3-7 Pressure Cap and Thermostat Rating

3.8.2 Draining the Cooling System

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

Note: Pay special attention to the coolant level. After the coolant drains, allow time for complete refill of the engine water jacket. Check the coolant level as described earlier.

3.8.3 Filling the Cooling System

1. Close the radiator's coolant drain valve and tighten the hose clamps.

   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.

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.

   Note: 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. Consult the engine manufacturer's operation manual for engine coolant specifications.

3. Replace the radiator's pressure cap.

4. Operate the engine until the thermostat opens and the radiator upper hose becomes hot.

5. Stop the engine and allow it to cool.

6. Remove the radiator's pressure cap.

7. Add coolant to the radiator to just below the overflow tube on the filler neck.

8. Replace the radiator's pressure cap.

9. Maintain the coolant level in the coolant overflow bottle between the High and Low markings.

   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.

3.8.4 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. Remove the pressure cap and open the radiator's coolant drain valve and let the system drain completely. Remove the pressure cap to simplify draining.

2. Drain, clean, and flush the coolant overflow bottle.

3. Flush the system with clean water.

4. Close the radiator's coolant drain valve.

5. Fill the system with the recommended coolant.

6. Replace the pressure cap.

3.8.5 Pressure Cap

The cooling system utilize a pressure cap to raise the boiling point of the coolant, enabling higher operating temperatures. If the cap leaks, replace it with a cap of the same rating. Find the pressure cap rating in Figure 3-7.

3.9 Ignition System

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

Spark Plug Service Procedure

1. 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.

2. Loosen the spark plug with a ratchet and 5/8-in. spark plug socket with a rubber insert to prevent spark plug damage.

3. Use compressed air to remove dirt from around each spark plug to prevent dirt particles from falling into the combustion chamber.

4. 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 the firing tip. See Figure 3-8 to evaluate engine condition by color/condition of a problem spark plug.

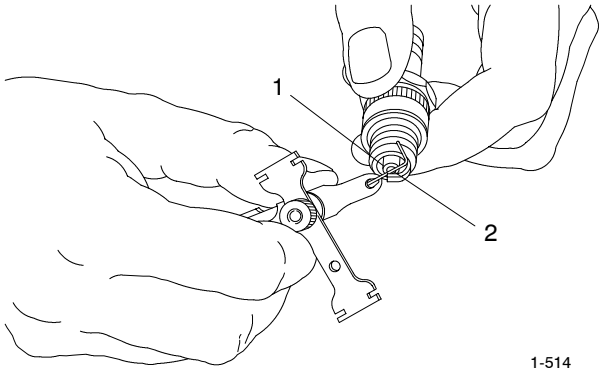
Problem/Condition	Means of Identification	Possible Cause/Solution
Gap-bridged spark plug	Built-up deposits and gap between electrodes closing.	Oil or carbon fouling. Clean and regap the spark plug.
Oil-fouled spark plug	Wet, black deposits on the insulator shell, bore, and electrodes.	Excess oil entering 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, defective fuel pump, 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.
Preignition 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 pump 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 3-8 Engine Evaluation Using Spark Plug Condition

5. 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 plug in poor condition. Obtain a new plug for best results.

6. Check the spark plug gap before installing any spark plug. See Figure 3-9. 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. The correct gap is 0.8-0.9 mm (0.031-0.035 in.).



1. 0.8-0.9 mm (0.031-0.035 in.) gap
2. Spark plug electrodes

Figure 3-9 Spark Plug Gap Inspection

7. 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 3-10. Position the side electrode directly over the center electrode.

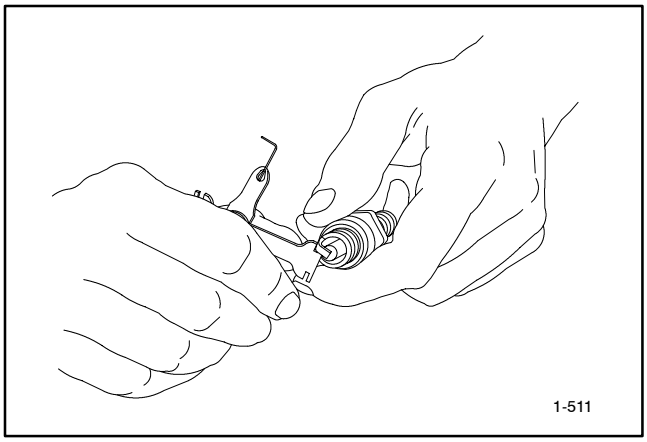


Figure 3-10 Spark Plug Gap Adjustment

8. Reinstall the spark plug. Do not bump the electrode against the cylinder head. Rotate the spark plug clockwise until feeling resistance.

9. Use a torque wrench to torque each spark plug to 25 Nm (18 ft. lbs.). Otherwise, hand-tighten the spark plug until feeling resistance.

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

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

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

3.10 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.

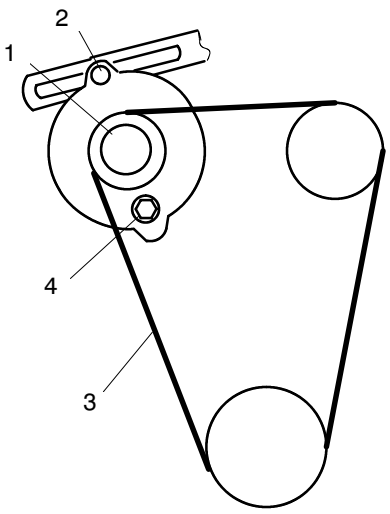
Battery electrolyte is a diluted sulfuric acid. Battery acid can cause severe injury or death. Battery acid can cause blindness and burn skin. Always wear splashproof safety goggles, rubber gloves, and boots when servicing the battery. Do not open a sealed battery or mutilate the battery case. If battery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

3.11 Belt Check

Check the belt tension at the intervals specified in the service schedule. If the tension is not within specification, adjust as necessary using the following procedure.

Adjust the tension of the alternator/fan belt so that the belt can be depressed about 12.7 mm (0.5 in.) when applying finger pressure. Use the following procedure to adjust the belt.



1. Battery charging alternator pulley
2. Adjusting screw
3. Check the alternator belt tension here
4. Alternator pivot screw

Figure 3-11 Belt Tension

Belt Tensioning Procedure

1. Disconnect the battery, negative lead first.
2. Loosen the pivot and adjusting screws.
3. While prying the battery charging alternator outward, tighten the adjusting screw.
4. Tighten the pivot screw.
5. Recheck and adjust as necessary.
6. Reconnect the battery, negative lead last.

Note: Also check the fan belt for cracks or tears and replace the belt if necessary.

3.12 Generator Storage Procedure

Follow the procedure below when storing your generator set for a long period (3 months or more).

1. Start and run the generator set until it reaches operating temperature or about 15 minutes.
2. Stop the generator set.
3. Change the oil and oil filter; see Section 3.3.4—Oil Change and Section 3.3.5—Oil Filter Change.
4. Drain the fuel completely from the fuel tank to prevent accumulated moisture from mixing with the fuel.
5. Check the engine coolant protection; see Section 3.8.

   Note: Use antifreeze capable of withstanding the lowest possible temperatures.

6. Keep spark plugs in their holes or seal spark plug holes with suitable threaded metal plugs.
7. Clean the exterior of the generator set and spread a light film of oil or silicon spray over any exposed surfaces that may be subject to rust or corrosion.
8. Seal the air inlet, exhaust pipe, and fuel tank cap with tape.
9. Disconnect and remove the battery. Place the battery in a warm, dry location for the storage period. Recharge the battery once a month to maintain a full charge.
10. Select a well-ventilated (not humid or dusty) location to store the generator.
11. Cover the entire unit with a dust cover.

    Note: Run the generator set once a month whenever possible.

Section 4 Troubleshooting

This section contains generator set troubleshooting, diagnostic, and repair information.

Use the following chart as a quick troubleshooting reference. The table groups generator set faults and suggests likely causes and remedies. The table also refers you to more detailed information including sections of this manual, the generator set service manual (S/M), the generator set installation manual (I/M), and the engine service manual (Engine S/M) to correct the indicated problem.

Corrective action and testing often require knowledge of electrical and electronic circuits. To avoid additional problems caused by incorrect repairs, have an authorized service distributor/dealer perform service.

Maintain a record of repairs and adjustments performed on the equipment. If the procedures in this manual do not explain how to correct the problem, contact an authorized distributor/dealer. Use the record to help describe the problem and repairs or adjustments made to the equipment.

x:gt:001:002a:

Trouble Symptoms										Probable Causes	Recommended Actions	Section or Publication Reference*
Does not crank	Cranks but does not start	Starts hard	No or low output voltage	Stops suddenly	Lacks power	Overheats	Low oil pressure	High fuel consumption	Excessive or abnormal noise			
Controller												
x				x						Generator set master switch in the OFF position	Move the generator set master switch to the correct position (RUN or AUTO).	Section 2
x				x						The controller fuse (F3) blown	Replace the blown controller fuse. If the fuse blows again, troubleshoot the controller.†	Section 2, W/D
x				x						The relay interface board fuse (F2) blown	Replace the blown relay interface board fuse. If the fuse blows again, troubleshoot the controller.†	Section 2, W/D
				x						The auxiliary winding fuse (F1) blown	Replace the blown auxiliary winding fuse. If the fuse blows again, troubleshoot the controller.†	Section 2, W/D
x				x						Controller circuit breaker tripped	Reset the controller circuit breaker.	Section 2
x										Controller master or start/stop switch inoperative	Replace the controller master or start/stop switch.	—
				x						Controller fault	Troubleshoot the controller.†	Gen. S/M
				x						Remote stop command received from a remote switch or ATS	Check the remote switch position.	—
Cooling System												
						x		x		Air openings clogged	Clean the air openings.	—
				x						High temperature shutdown	Allow the engine to cool down. Then troubleshoot the cooling system.	Sec. 3, Eng. O/M
				x						Low coolant level shutdown, if equipped	Restore the coolant to normal operating level.	Section 3
						x				Coolant level low	Restore the coolant to normal operating level.	Section 3
						x				Thermostat inoperative	Replace the thermostat.	Eng. S/M
						x				Cooling water pump inoperative	Replace the belt. Replace the water pump.	Eng. O/M or S/M

* Sec./Section—numbered section of this manual; ATS—Automatic Transfer Switch; Eng.—Engine; Gen.—Generator Set; I/M—Installation Manual; O/M—Operation Manual; S/M—Service Manual; S/S—Spec Sheet; W/D—Wiring Diagram

† Have an authorized service distributor/dealer perform this service.

Trouble Symptoms										Probable Causes	Recommended Actions	Section or Publication Reference*
Does not crank	Cranks but does not start	Starts hard	No or low output voltage	Stops suddenly	Lacks power	Overheats	Low oil pressure	High fuel consumption	Excessive or abnormal noise			
Electrical System (DC circuits)												
x	x									Battery connections loose, corroded, or incorrect	Verify that the battery connections are correct, clean, and tight.	Section 3
x	x									Battery weak or dead	Recharge or replace the battery. The spec sheet provides recommended battery CCA rating.	Section 3, S/S
x				x						Engine harness connector(s) not locked tight	Disconnect the engine harness connector(s) then reconnect it to the controller.	W/D
				x						Fault shutdown	Reset the controller.	Section 2
x	x									Starter/starter solenoid inoperative	Replace the starter or starter solenoid.	Eng. S/M
	x									Faulty ground connection	Clean and retighten the connection.	—
Engine												
	x	x			x			x		Air cleaner/backfire flame arrestor clogged	Clean or replace the filter element.	Section 2
	x	x				x		x	x	Compression weak	Check the compression.†	Eng. S/M
			x		x	x		x	x	Engine overload	Reduce the electrical load. See the generator set installation manual for wattage specifications.	I/M
									x	Exhaust system leak	Inspect the exhaust system. Replace the inoperative exhaust system components.†	Section 3, I/M
									x	Exhaust system not securely installed	Inspect the exhaust system. Tighten the loose exhaust system components.†	Section 3, I/M
				x						Overspeed shutdown	Reset the controller. If the overspeed fault occurs again, contact the distributor/dealer.†	Section 2
					x				x	Valve clearance incorrect	Adjust the valves.†	Eng. S/M
									x	Vibration excessive	Tighten all loose hardware.	—
	x	x			x					Ignition system inoperative (gas/gasoline only)	Check the ignition system (ignition module, spark plugs, spark plug wires, etc.).	Eng. O/M

* Sec./Section—numbered section of this manual; ATS—Automatic Transfer Switch; Eng.—Engine; Gen.—Generator Set; I/M—Installation Manual; O/M—Operation Manual; S/M—Service Manual; S/S—Spec Sheet; W/D—Wiring Diagram

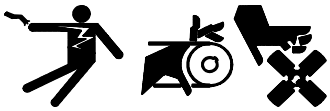
† Have an authorized service distributor/dealer perform this service.

Trouble Symptoms										Probable Causes	Recommended Actions	Section or Publication Reference*
Does not crank	Cranks but does not start	Starts hard	No or low output voltage	Stops suddenly	Lacks power	Overheats	Low oil pressure	High fuel consumption	Excessive or abnormal noise			
Fuel System												
	x			x						Fuel tank empty or fuel valve shut off	Add fuel and move the fuel valve to the ON position.	—
	x	x		x	x					Fuel line restriction	Check the fuel lines and fuel tank.	Eng. O/M
	x	x		x	x					Fuel filter restriction	Replace the fuel filter.	Eng. O/M
		x								Fuel vapor lock	See an authorized service distributor/dealer.†	—
	x	x			x					Fuel or fuel injectors dirty or faulty	Clean, test, and/or replace the inoperative fuel injector.†	Eng. S/M
	x	x			x			x		Fuel injection timing out of adjustment	See an authorized service distributor/dealer.†	Eng. S/M
	x	x			x					Stale or bad fuel. Incorrect type of fuel	Replace fuel.	Sec. 3, Eng S/M
	x				x			x		Fuel feed or injection pump inoperative (gasoline only)	Rebuild or replace the pump(s).†	Eng. S/M
	x				x					Fuel pressure insufficient (gas only)	Check the fuel supply.†	S/S
	x									Fuel solenoid inoperative (gas only)	Troubleshoot the fuel solenoid.†	S/M
Generator												
			x							AC output circuit breaker open	Reset the breaker and check for AC voltage at the generator side of the circuit breaker.	—
				x						Overcrank shutdown	Reset the controller. If the overcrank fault occurs again, contact the distributor/dealer.	—
x										Transfer switch test switch in the OFF position	Move the transfer switch test switch to the AUTO position.	ATS O/M
			x							Wiring, terminals, or pin in the exciter field open	Check for continuity.	Gen. S/M, W/D
			x							Main field (rotor) inoperative (open or grounded)	Test and/or replace the rotor.†	Gen. S/M
			x							Stator inoperative (open or grounded)	Test and/or replace the stator.†	Gen. S/M
									x	Vibration excessive	Tighten loose components.†	—
Lube System												
						x	x		x	Oil level low	Restore the oil level. Inspect the generator set for oil leaks.	Eng. O/M
				x						Low oil pressure shutdown	Check the oil level.	Eng. O/M
	x	x					x		x	Crankcase oil type incorrect for ambient temperature	Change the oil. Use oil with a viscosity suitable for the operating climate.	Eng. O/M

* Sec./Section—numbered section of this manual; ATS—Automatic Transfer Switch; Eng.—Engine; Gen.—Generator Set; I/M—Installation Manual; O/M—Operation Manual; S/M—Service Manual; S/S—Spec Sheet; W/D—Wiring Diagram

† Have an authorized service distributor/dealer perform this service.

⚠ WARNING

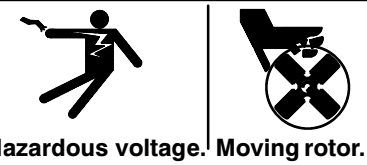


Accidental starting.
Can cause severe injury or death.

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



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

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

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

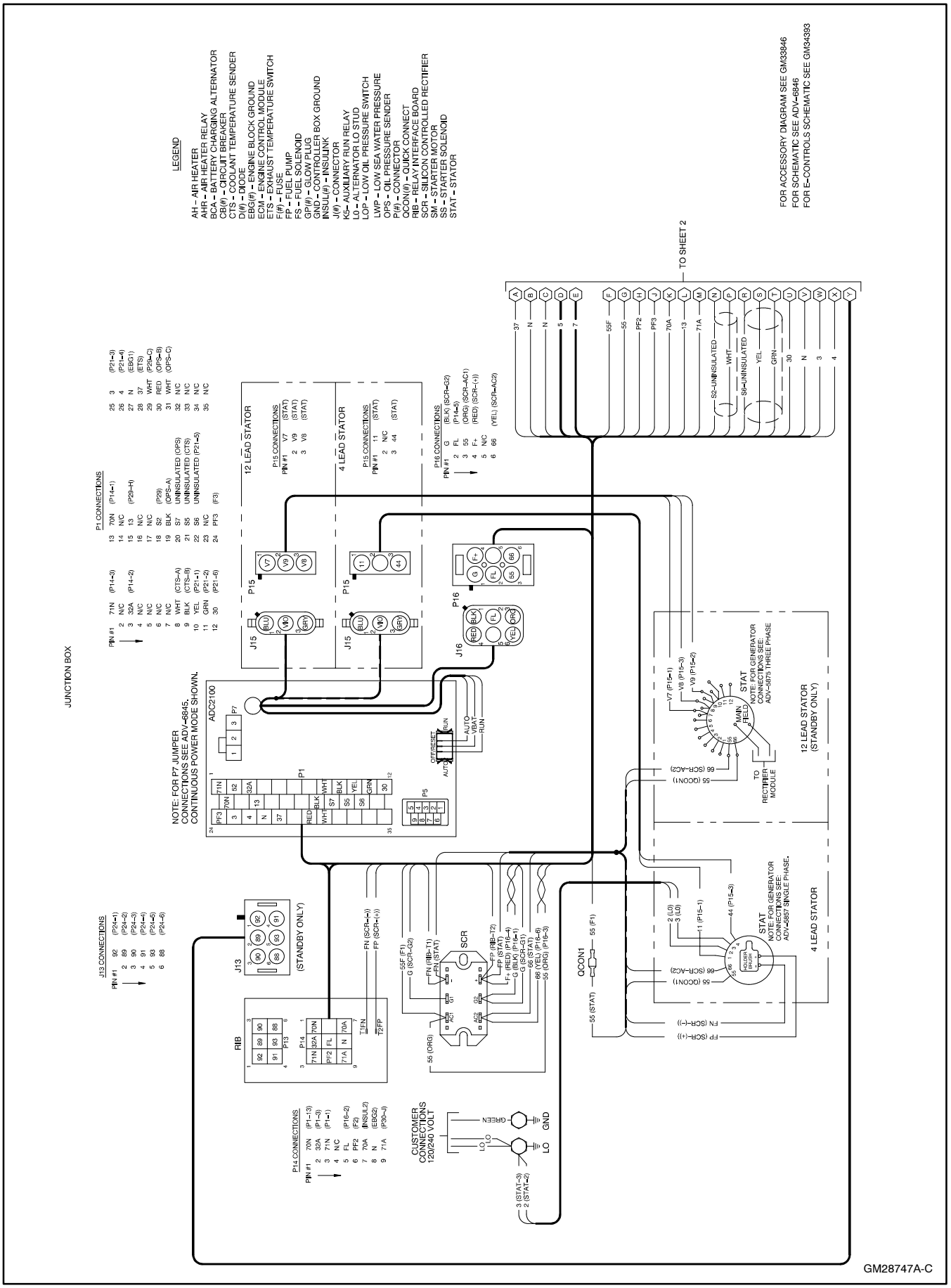


Figure 5-1 Wiring Diagram (Sheet 1 of 2)

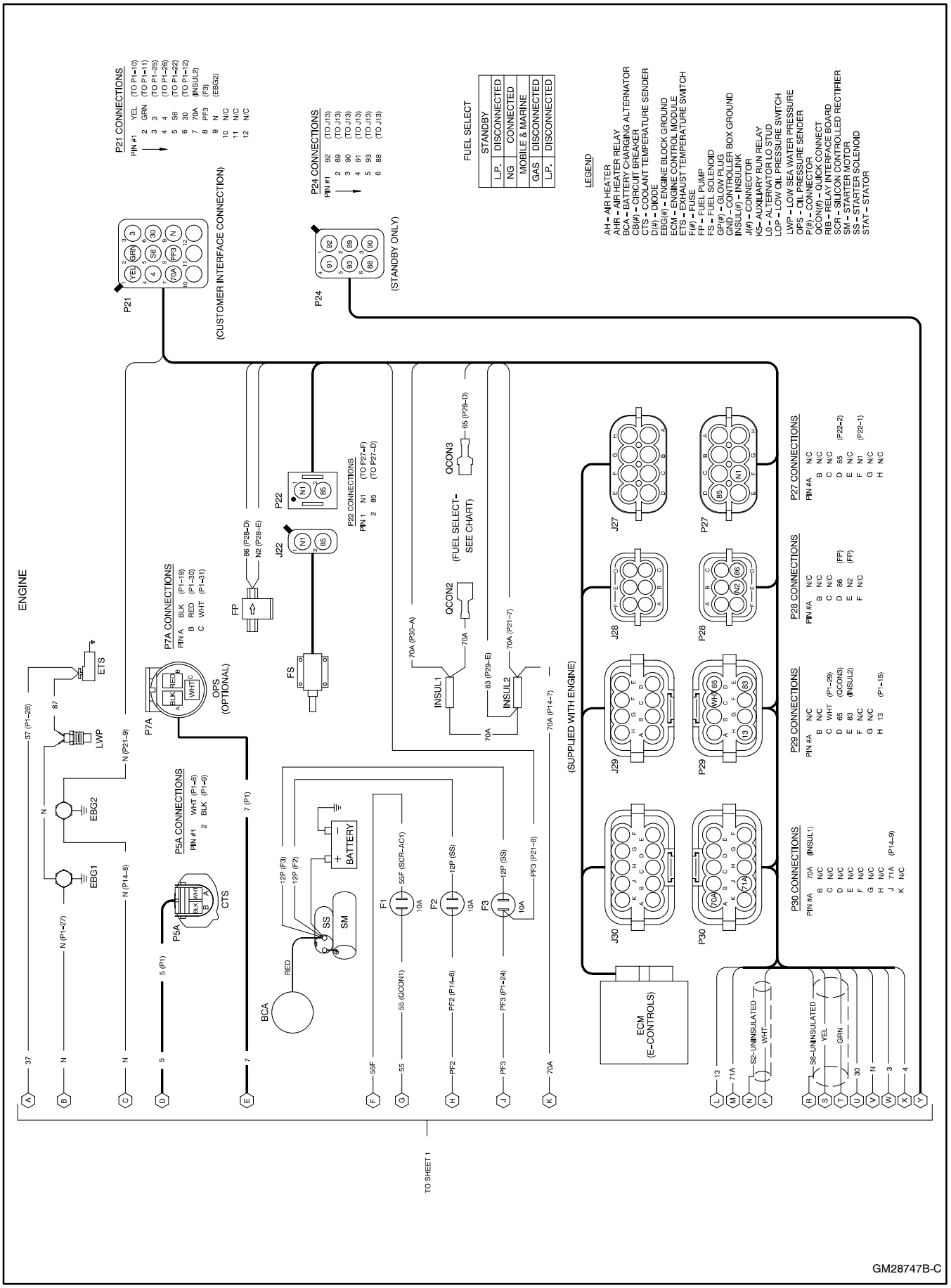


Figure 5-2 Wiring Diagram (Sheet 2 of 2)

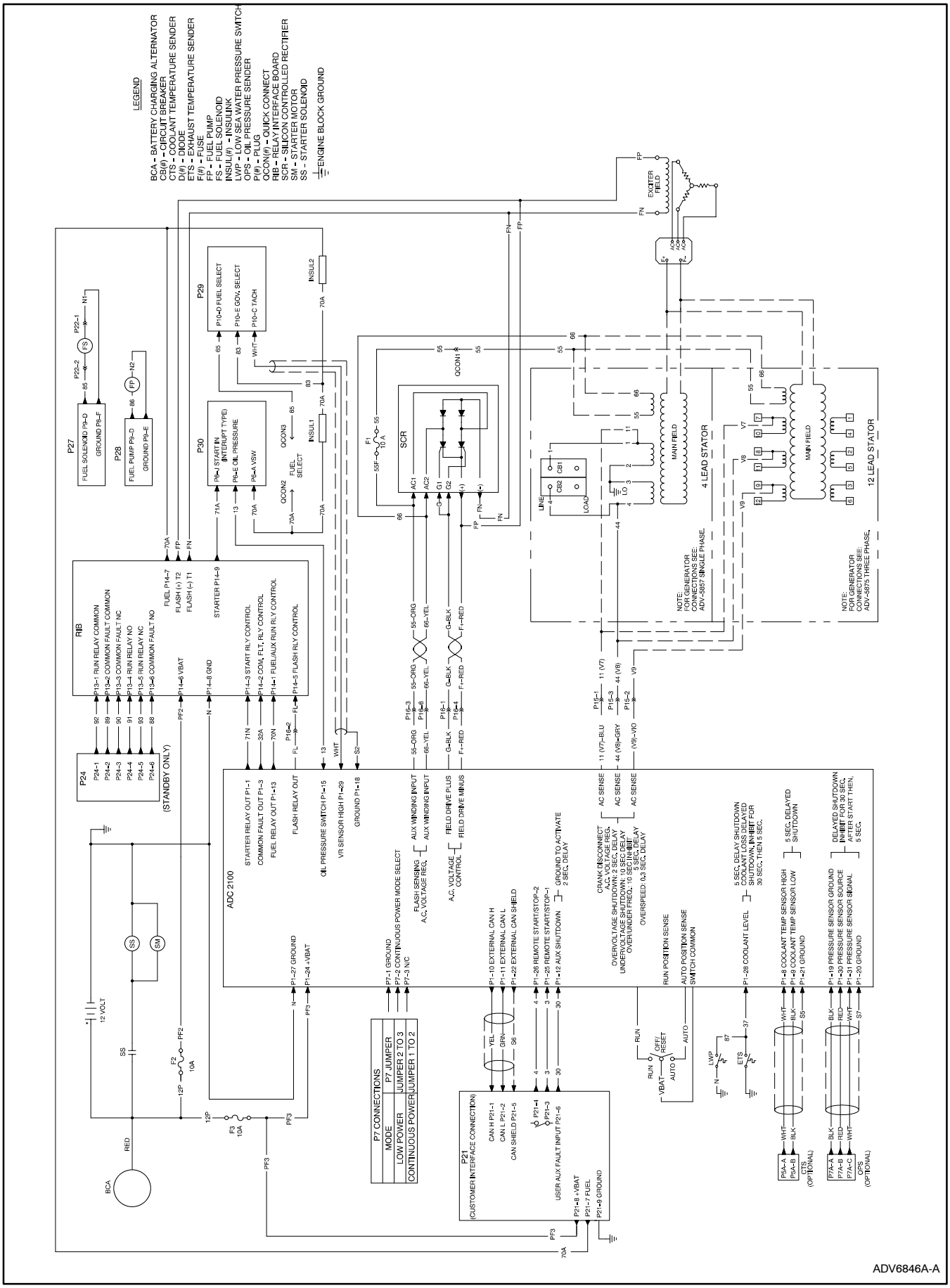
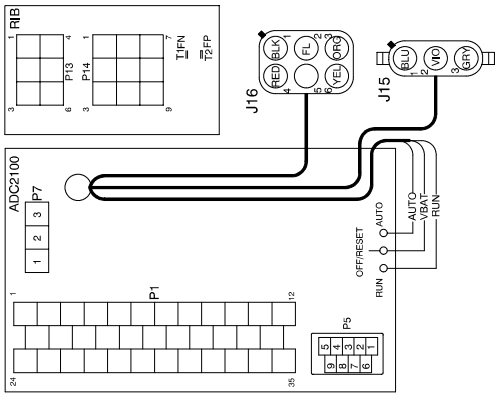


Figure 5-3 Schematic Diagram (Sheet 1 of 2)



ADC 2100 CONTROLLER

P1 CONNECTIONS
P1–1 STARTER RELAY OUT
P1–2 SIGNAL TO AIR HEATER/RELAY COIL (–)
P1–3 COMMON FAULT
P1–4 GOVERNOR 1B
P1–5 GOVERNOR 1A
P1–6 GOVERNOR 2A
P1–7 GOVERNOR 2B
P1–8 COOLANT TEMP SENSOR HIGH
P1–9 COOLANT TEMP SENSOR LOW
P1–10 EXTERNAL CAN H
P1–11 EXTERNAL CAN L
P1–12 AUX SHUTDOWN
P1–13 FUEL RELAY OUT
P1–14 TACH OUT
P1–15 OIL PRESSURE SWITCH
P1–16 GROUND
P1–17 VR SENSOR LOW
P1–18 GROUND
P1–19 PRESSURE SENSOR GROUND
P1–20 GROUND
P1–21 GROUND
P1–22 GROUND
P1–23 GROUND
P1–24 VBAT +
P1–25 REMOTE START/STOP 1
P1–26 REMOTE START/STOP 2
P1–27 GROUND
P1–28 COOLANT LEVEL/LOSS HIGH
P1–29 VR SENSOR HIGH
P1–30 PRESSURE SENSOR SOURCE
P1–31 PRESSURE SENSOR SIGNAL
P1–32 GROUND
P1–33 VBAT ON
P1–34 GROUND
P1–35 RS232 TXD

P5 CONNECTIONS
P5–1 N/C
P5–2 RS232 RXD
P5–3 RS232 TXD
P5–4 N/C
P5–5 GROUND
P5–6 N/C
P5–7 N/C
P5–8 N/C
P5–9 N/C

P7 CONNECTIONS
P7–1 N/C
P7–2 CONTINUOUS POWER MODE SELECT
P7–3 GROUND

J16 CONNECTIONS
P16–1 FIELD DRIVE PLUS (G)
P16–2 FLASH RELAY OUT
P16–3 AUX WINDING INPUT (55)
P16–4 FIELD DRIVE MINUS (F+)
P16–5 N/C
P16–6 AUX WINDING INPUT (66)

J15 CONNECTIONS
J15–1 AC INPUT (V7/11)
J15–2 AC INPUT (V9)
J15–3 AC INPUT (V8/44)

RELAY INTERFACE BOARD

P13 CONNECTIONS
P13–1 RUN RELAY COMMON
P13–2 COMMON FAULT COMMON
P13–3 COMMON FAULT NC
P13–4 RUN RELAY NO
P13–5 RUN RELAY NC
P13–6 COMMON FAULT NO

P14 CONNECTIONS
P14–1 FUEL/AUX RUN RELAY CONTROL
P14–2 COMMON FAULT RELAY CONTROL
P14–3 STARTER RELAY CONTROL
P14–4 IGNITION NEGATIVE
P14–5 FLASH RELAY CONTROL
P14–6 VBAT
P14–7 FUEL (70A)
P14–8 GROUND
P14–9 STARTER (71A)

ADV6846B-A

Figure 5-4 Schematic Diagram (Sheet 2 of 2)

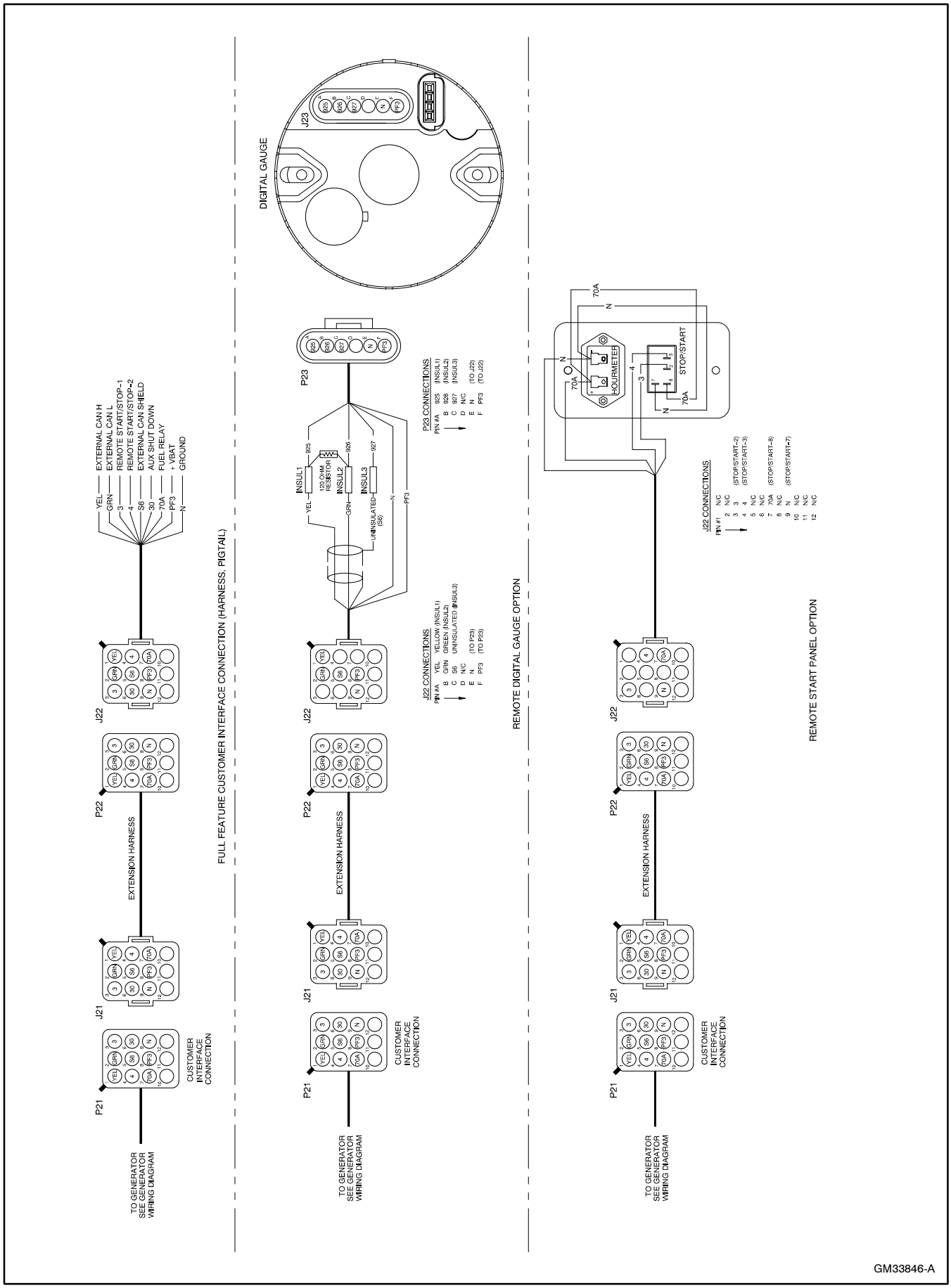


Figure 5-5 Accessory Wiring Diagram

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	analog to digital converter
adj.	adjust, adjustment
ADV	advertising dimensional drawing
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
API	American Petroleum Institute
approx.	approximate, approximately
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
A/V	audiovisual
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
CARB	California Air Resources Board
CB	circuit breaker
cc	cubic centimeter
CCA	cold cranking amps
ccw.	counterclockwise
CEC	Canadian Electrical Code
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)
conn.	connection
cont.	continued
CPVC	chlorinated polyvinyl chloride
crit.	critical
CRT	cathode ray tube
CSA	Canadian Standards Association
CT	current transformer
Cu	copper
cu. in.	cubic inch
cw.	clockwise
CWC	city water-cooled
cyl.	cylinder
D/A	digital to analog
DAC	digital to analog converter
dB	decibel
dBA	decibel (A weighted)
DC	direct current
DCR	direct current resistance
deg., °	degree
dept.	department
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)
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. lbs.	foot pounds (torque)
ft./min.	feet per minute
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 temperature
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. lbs.	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)

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
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/min.	cubic meters per minute
mA	milliampere
man.	manual
max.	maximum
MB	megabyte (2^{20} bytes)
MCM	one thousand circular mils
MCCB	molded-case circuit breaker
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
m/sec.	meters per second
MTBF	mean time between failure
MTBO	mean time between overhauls
mtg.	mounting
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
pt.	pint
PTC	positive temperature coefficient
PTO	power takeoff
PVC	polyvinyl chloride
qt.	quart
qty.	quantity
R	replacement (emergency) power source
rad.	radiator, radius
RAM	random access memory
RDO	relay driver output
ref.	reference
rem.	remote
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
RTV	room temperature vulcanization
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
SPDT	single-pole, double-throw
SPST	single-pole, single-throw
spec, 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
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

Use the log below to keep a cumulative record of operating hours on your generator set and the dates required services were performed. Enter hours to the nearest quarter hour.

	OPERATING HOURS		SERVICE RECORD	
DATE RUN	HOURS RUN	TOTAL HOURS	SERVICE DATE	SERVICE

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POWER SYSTEMS

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