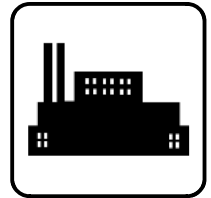


# Operation

## Industrial Generator Sets



Models:

**10/15/20REOD/REOZD**

Controller:

ADC 2100 Advanced Digital Control

**KOHLER**<sup>®</sup>  
POWER SYSTEMS

**ISO 9001**  
**KOHLER**  
POWER SYSTEMS  
NATIONALLY REGISTERED

TP-6392 8/05

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**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.

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## Product Identification Information

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### Generator Set Identification Numbers

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

Model Designation \_\_\_\_\_

Specification Number \_\_\_\_\_

Serial Number \_\_\_\_\_

<b>Accessory Number</b>	<b>Accessory Description</b>
-------------------------	------------------------------

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
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_____	_____
_____	_____

### Controller Identification

Record the controller description from the generator set operation manual, spec sheet, or sales invoice.

Controller Description \_\_\_\_\_ ADC 2100 \_\_\_\_\_

### Engine Identification

Record the product identification information from the engine nameplate.

Manufacturer \_\_\_\_\_ Yanmar \_\_\_\_\_

Model Designation \_\_\_\_\_

Serial Number \_\_\_\_\_

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# Safety Precautions and Instructions

IMPORTANT SAFETY INSTRUCTIONS. Electromechanical equipment, including generator sets 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.**

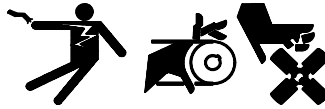
## NOTICE

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.

### 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

 <b>WARNING</b>

<b>Fire.</b> <b>Can cause severe injury or death.</b> 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 fuel injection system, 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 fuel system.


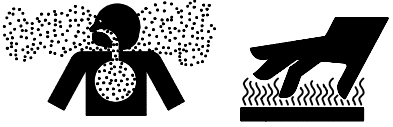
**Servicing the air cleaner. A sudden backfire can cause severe injury or death.** Do not operate the generator set with the air cleaner removed.


**Servicing the air cleaner on a turbocharged engine. A sudden engine backfire or turbocharger compressor failure can cause severe injury or death.** Do not operate the generator set with the air cleaner removed. Burns from hot turbocharger components may occur. Foreign objects sucked into the turbocharger can cause mechanical damage and the potential for high velocity projectiles.

**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.

**Using engine starting fluid. A sudden backfire can cause severe injury or death.** Do not use starting fluid or similar agents to start an engine equipped with air preheating (glow plugs/starter element). The starter element may cause an explosion in the inlet manifold.

## Engine Fluids and Chemical Products

 <b>WARNING</b>

<b>Handling caustic engine fluids and chemical products.</b> <b>Can cause severe chemical burns, nausea, fainting, or death.</b> Most chemicals such as used engine oil, antifreeze/coolant, rustproofing agent, inhibiting oil, degreasing agent, spray paint, and adhesives are hazardous to health. Read and follow the user information found on the packaging. Avoid inhalation and skin contact. Use only in well-ventilated areas and use a protective mask when spraying. Store engine fluids and chemical products in a locked cabinet. Contact your local recycling center for disposal information and locations.

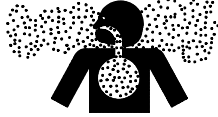
<b>⚠ WARNING</b>

<p><b>Flammable engine solvents and cleaners.</b>  <b>Can cause severe injury or death.</b></p> <p>Do not smoke or permit flames or sparks near flammable engine solvents and cleaners. Read and follow the user information found on the packaging. Use only in well-ventilated areas. Never use gasoline or low flash-point solvents as cleaning agents.</p>

**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.

**Used engine oil. Contact with used engine oil may cause severe skin irritation. Repeated and prolonged skin exposure may have other health risks.** Used engine oil is a suspected carcinogen. Avoid contact with skin. Thoroughly wash your hands and nails with soap and water shortly after handling used engine oil. Wash or dispose of clothing or rags containing used engine oil. Dispose of used engine oil in a responsible manner. Contact your local recycling center for disposal information and locations.

**Fire-damaged or burned O-rings may cause the formation of hydrofluoric acid. Contact with hydrofluoric acid may cause severe skin irritation and chemical burns.** O-rings and other fluoroelastomer seals exposed to fire or temperatures above 316°C (600°F) (i.e., during welding) may decompose forming hydrofluoric acid. Avoid inhalation or skin contact. Do not incinerate O-rings. Dispose of O-ring waste material in a responsible manner.

## Exhaust System

<b>⚠ WARNING</b>

<p><b>Carbon monoxide.</b>  <b>Can cause severe nausea, fainting, or death.</b></p> <p>The exhaust system must be leakproof and routinely inspected.</p>

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


**Carbon monoxide 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.

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

## Fuel System

<b>⚠ WARNING</b>

<p><b>Explosive fuel vapors.</b>  <b>Can cause severe injury or death.</b></p> <p>Use extreme care when handling, storing, and using fuels.</p>

<b>⚠ WARNING</b>

<p><b>Avoid high pressure fluids.</b>  <b>Can cause severe injury or death.</b></p> <p>Do not work on high pressure fuel or hydraulic systems without protective gloves. Avoid the hazard by relieving pressure before disconnecting fuel injection pressure lines. Search for leaks using a piece of cardboard. Always protect hands and body from high pressure fluids. If an accident occurs, seek medical attention immediately. Any fluid injected in the skin tissues must be surgically removed within a few hours or gangrene may result.</p>

**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.

**Fuel tanks. Explosive fuel vapors can cause severe injury or death.** Gasoline and other volatile fuels stored in day tanks or subbase fuel tanks can cause an explosion. Store only diesel fuel in tanks.

**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.

## 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

 <b>WARNING</b>	
	
<b>Hazardous voltage. Moving rotor. Can cause severe injury or death.</b>	
Operate the generator set only when all guards and electrical enclosures are in place.	

 <b>WARNING</b>	
	
<b>Hazardous voltage. Backfeed to the utility system can cause property damage, severe injury, or death.</b>	
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.	

 <b>CAUTION</b>	
	
<b>Welding the generator set. Can cause severe electrical equipment damage.</b>	
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.** Electrocutation 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 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.

**Installing the battery charger. Hazardous voltage can cause severe injury or death.** An ungrounded battery charger may cause electrical shock. Connect the battery charger enclosure to the ground of a permanent wiring system. As an alternative, install an equipment grounding conductor with circuit conductors and connect it to the equipment grounding terminal or the lead on the battery charger. Install the battery charger as prescribed in the equipment manual. Install the battery charger in compliance with local codes and ordinances.



**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 day tank. Hazardous voltage can cause severe injury or death.** Service the day tank electrical control module (ECM) as prescribed in the equipment manual. Disconnect the power to the day tank before servicing. Press the day tank ECM OFF pushbutton to disconnect the power. Notice that line voltage is still present within the ECM when the POWER ON light is lit. Ensure that the generator set and day tank are electrically grounded. Do not operate the day tank when standing in water or on wet ground because these conditions increase the risk of electrocution.

**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.** 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.


## Heavy Equipment

<b>⚠ WARNING</b>

<p><b>Unbalanced weight. Improper lifting can cause severe injury or death and equipment damage.</b></p> <p>Do not use lifting eyes. Lift the generator set using lifting bars inserted through the lifting holes on the skid.</p>

## Hot Parts

<b>⚠ WARNING</b>

<p><b>Hot coolant and steam. Can cause severe injury or death.</b></p> <p>Before removing the pressure cap, stop the generator set and allow it to cool. Then loosen the pressure cap to relieve pressure.</p>



<b>⚠ WARNING</b>

<p><b>Hot engine and exhaust system. Can cause severe injury or death.</b></p> <p>Do not work on the generator set until it cools.</p>



<b>⚠ WARNING</b>

<p><b>Hot engine oil. Can cause severe injury or death.</b></p> <p>Avoid skin contact with hot oil. Do not start or operate the generator set with the engine oil filler cap removed, as hot oil can spray out. Ensure that the lubrication system is not under pressure when servicing. Do not work on the generator set until it cools.</p>


**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.

## Moving Parts

<b>⚠ WARNING</b>	
	
<b>Hazardous voltage. Moving rotor. Can cause severe injury or death.</b>	
Operate the generator set only when all guards and electrical enclosures are in place.	


<b>⚠ WARNING</b>	
	
<b>Rotating parts. Can cause severe injury or death.</b>	
Operate the generator set only when all guards, screens, and covers are in place.	

<b>⚠ WARNING</b>	
	
<b>Airborne particles. Can cause severe injury or blindness.</b>	
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 throbolt when making adjustments or servicing the generator set. Rotate the crankshaft manually in a clockwise direction only. Turning the crankshaft bolt or rotor throbolt 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

<b>NOTICE</b>	
<b>This generator set has been rewired from its nameplate voltage to</b>	
	
246242	

### 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.

This manual provides operation instructions for Model 10/15/20REOD/REOZD 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.

## List of Related Literature

Figure 1 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-6393
Operation Manual (Generator)	TP-6392
Operation Manual (Engine)	TP-6412
Parts Catalog*	TP-6395
Service Manual (Generator)	TBD
Service Manual (Engine)	TP-6293

\* One manual combines Generator and Engine information.

**Figure 1** Generator Set Literature

xin:001:005

## Maintenance and Service Parts

Figure 2 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 for: 10REOD/REOZD 15REOD/REOZD	GM42265
Air Cleaner Element for: 20REOD/REOZD	GM42266
Belt	GM42428
Fuel Filter Element	GM32359
Fuel/Water Separator Element	225259
Fuse, Auxiliary Winding (F1): 20 amp for 12 lead generator sets 10 amp for 4 lead generator sets	GM39266 223316
Fuse, Relay Interface Board (F2) 10 amp	223316
Fuse, Controller (F3) 10 amp	223316
Oil Filter	252834
Spray Paint (Black)	221292

**Figure 2** Maintenance and Service Parts

xin:001:004

# Service Assistance

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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](http://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

## **Headquarters Europe, Middle East, Africa (EMEA)**

Kohler Power Systems  
ZI Senia 122  
12, rue des Hauts Flouviars  
94517 Thiais Cedex  
France  
Phone: (33) 1 41 735500  
Fax: (33) 1 41 735501

## **Asia Pacific**

Power Systems Asia Pacific Regional Office  
Singapore, Republic of Singapore  
Phone: (65) 6264-6422  
Fax: (65) 6264-6455

## **China**

North China Regional Office, Beijing  
Phone: (86) 10 6518 7950  
(86) 10 6518 7951  
(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

## **Latin America**

Latin America Regional Office  
Lakeland, Florida, USA  
Phone: (863) 619-7568  
Fax: (863) 701-7131

## 1.1 Specifications

The spec sheets for each generator set provide specific alternator and engine information. The controller spec sheet provides specifications particular to the controller. Refer to the respective spec sheet for data not supplied in this manual. Consult the generator set service manual, generator set installation manual, engine operation manual, and engine service manual for additional specifications.

## 1.2 Alternator Features

The Model REOD alternator is equipped with Kohler's PowerBoost™ voltage regulation system which provides instant response to load changes.

PowerBoost™ is a unique system that ensures reliable motor starting and consistent voltage levels.

PowerBoost™ utilizes a voltage excitation system that employs a winding independent of the main output windings to provide excitation voltage.

## 1.3 Advanced Digital Control

The generator set is equipped with the Kohler® Advanced Digital Control (ADC 2100). Controller features include the following:

- Compact controller
- Integrally mounted to the generator set
- LED display:
  - Runtime hours
  - Crank cycle status
  - Diagnostics
- LED display communicates faults:
  - High battery voltage
  - High engine temperature
  - Low battery voltage
  - Low oil pressure
  - Overcrank safety
  - Overspeed
  - Overfrequency
  - Overvoltage
  - Underfrequency
  - Undervoltage
- Membrane keypad for configuration and adjustment:
  - Password-protected user access to menus
  - System configuration
  - Voltage adjustment
- Master control switch: Run/Off-Reset/Auto
- Remote two-wire start/stop capability
- Superior electronics protection from corrosion and vibration:
  - Potted electronics
  - Sealed connections
- Digital voltage regulation:  $\pm 1.5\%$  RMS no-load to full-load
- Automatic start for programmed cranking cycle

# 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 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 and tension 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.
- 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.

**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 Exercising the Generator Set

Operate the generator set without load once each week for 20 minutes. If the generator set does not have a programmed exercise mode or an automatic transfer switch (ATS) with an exercise option, exercise the unit in the presence of an operator.

The operator should perform all of the prestart checks before starting the exercise procedure. Start the generator set according to the starting procedure in Section 2.3.2 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. Check the air inlets and outlets and remove any items restricting the air flow.

## 2.3 Generator Set Operation

Figure 2-1 illustrates the user interface on the Advanced Digital Control (ADC 2100) generator set controller.

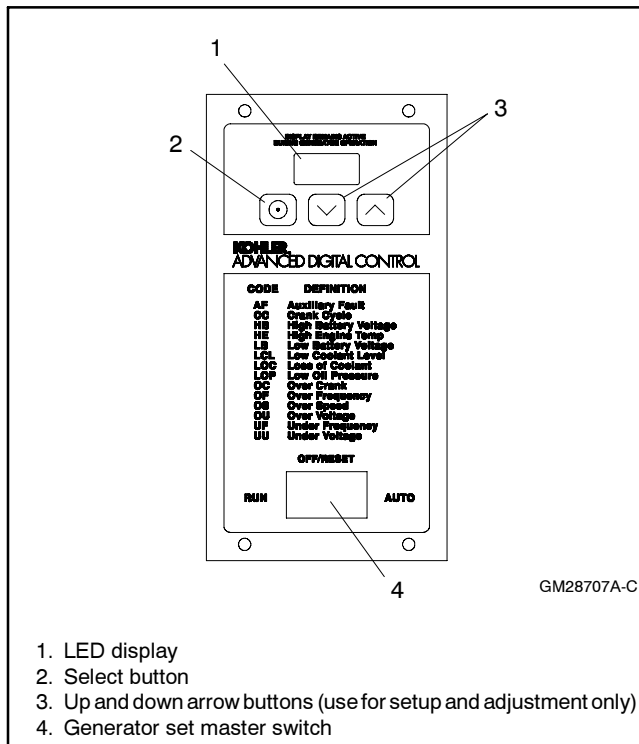


Figure 2-1 ADC 2100 User Interface

### 2.3.1 ADC 2100 Controls and Indicators

Figure 2-2 describes the controls and indicators located on the ADC 2100.

The LED display indicates generator set status. The LED display is activated when the generator set master

switch is moved to the RUN or AUTO position and remains active until the master switch is moved to the OFF/RESET position or power to the controller is removed. The LED display turns off 48 hours after generator set shutdown. See Section 2.3.6.

The buttons on the controller keypad are used only for system configuration and adjustment. The system configuration is factory-set and should not require changes under normal operating conditions. Contact an authorized distributor/dealer or service technician if adjustments are required.

### 2.3.2 Local Operation

#### Local Starting

Move the generator set master switch to the RUN position to start the generator set.

The controller attempts to start the generator set three times (three crank cycles, 15 seconds crank and 15 seconds off). If the generator set does not start in three attempts, the system shuts down on an overcrank fault.

#### 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.

**Note:** There is no engine cooldown time delay on the ADC 2100 controller.

Control or Indicator	Item	Description
LED display	Runtime hours	Displays total generator set runtime hours while the generator set is running and when no other codes are displayed.
	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 2.3.4.
	Fuel	Displays FUEL during fuel pump priming procedure. See Section 3.5.4.
	Software version number	See Section 2.3.7.
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 2-2 ADC 2100 Controls and Indicators



### 2.3.3 Remote/Automatic Operation

A remote switch or an automatic transfer switch (ATS) can be used to start and stop the generator set.

Connect the remote start/stop switch or the ATS engine start contacts to ADC 2100 engine start leads 3 and 4. Move the generator set master switch to the AUTO position.

#### Automatic Starting

With the generator set master switch in the AUTO position, close the remote start contact connected to engine start leads 3 and 4 to signal the generator set to start.

The controller attempts to start the generator set three times (three crank cycles, 15 seconds crank and 15 seconds off). If the generator set does not start in three attempts, the system shuts down on an overcrank fault.

#### Automatic Stopping

With the generator set master switch in the AUTO position, open the remote switch or contact to stop the generator set.

If the generator set was started by a start signal from a remote start/stop switch or ATS, moving the generator set master switch on the ADC 2100 to the OFF/RESET position also stops the generator set.

**Note:** There is no engine cooldown time delay on the ADC 2100 controller.

### 2.3.4 Faults

Figure 2-3 lists fault codes displayed by the ADC 2100. If the generator set shuts down on a fault condition, it cannot be restarted until the fault condition is corrected and the controller is reset. See Section 2.3.5 to reset the controller after a fault shutdown. The controller resets automatically after a battery voltage fault condition is corrected.

The 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 high and low battery voltage warning conditions.

### 2.3.5 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 OFF/RESET.
2. Disconnect the generator set from the load using the line circuit breaker or ATS. See the safety precautions at the beginning of this section before proceeding.
3. Identify and correct the cause of the fault shutdown. See the safety precautions at the beginning of this section 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. Move the generator set master switch to OFF/RESET.
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 or remote start/stop switch.

**Note:** The controller's LED display remains off until an engine start command is received.

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

Code	Fault	Description	Check
AF	Auxiliary fault input shutdown	Input from a customer-supplied contact that closes on a fault condition. The generator set shuts down 2 seconds after the fault is detected and will not start when the fault is active (input is grounded).	Check the condition and operation of customer-supplied equipment connected to the auxiliary fault input P21-6 on the customer interface connector.
HE	High engine temperature shutdown	Shutdown occurs if the engine coolant temperature exceeds the maximum temperature for more than 5 seconds. This protective becomes active after the engine reaches the crank disconnect speed.	Check for blocked air inlets and exhaust outlets.
LCL	Low coolant level	Not used.	—
LOC	Loss of coolant	Not used.	—
LOP	Low oil pressure shutdown	Shutdown occurs if a low oil pressure condition exists for more than 5 seconds. This protective becomes active 30 seconds after the engine has reached crank disconnect speed (30 second inhibit). <b>Note:</b> 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 of 15 seconds cranking and 15 seconds rest.  The generator set also shuts down if no engine rotation is sensed during cranking. Shuts down 1 second after the fault is detected.	Check the fuel supply, spark plug, and battery. 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 protective 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 system nominal voltage 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 nominal system frequency for more than 5 seconds. This protective 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 nominal system voltage for more than 10 seconds.	Reduce the load and restart the generator set. Contact an authorized distributor/dealer for service if problem continues.
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 10 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 10 seconds.	Check the battery rating and condition. Check the battery charger operation.
LB	Low battery voltage warning	Fault code is displayed if the engine starting battery voltage falls below 8 VDC for a 12 VDC system or below 16 VDC for a 24 VDC system for more than 10 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 10 seconds.	Check the battery rating and condition. Check the battery charger operation. Charge or replace the battery.

**Figure 2-3** ADC 2100 Fault Codes

### 2.3.6 Power Down

The controller is powered by the generator set engine starting battery.

If the ADC 2100 is not configured for the optional Remote Digital Gauge (communication setting Cn00), the controller powers down after 48 hours of no activity when the master switch is in the AUTO position. (See the Installation Manual for more information about ADC 2100 controller settings.) A start signal from a remote start/stop switch or a transfer switch connected to engine start leads 3 and 4 energizes the controller and initiates the crank cycle. Moving the generator set master switch to the RUN position also turns the controller back on.


If the ADC 2100 is configured for the optional Remote Digital Gauge (communications setting Cn01), the controller remains active at all times when the generator set master switch is in the AUTO position.

**Note:** The ADC 2100 consumes 250 mA when the master switch is in the AUTO position with the Remote Digital Gauge connected. Exercise the generator set weekly and consider using a battery charger to maintain the battery.

### 2.3.7 Controller Software Version Number

The application software for controller operation is factory-loaded onto the Advanced Digital Control. At times, it may be necessary to check the software version number for troubleshooting purposes. Use the following procedure.

#### Displaying the Software Version Number

1. Press and *hold* the Select button  on the ADC 2100.
2. Move the generator set master switch to the Run position. The generator set will not start.
3. After approximately five seconds, the software version number is shown on the ADC 2100 display.

For example, 01.18 will be displayed for software version 1.18.

4. Move the generator set master switch to the OFF/RESET position and release the Select button.

## 2.4 Circuit Protection

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

### 2.4.1 Line Circuit Breaker

A 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 3-1. If the circuit breaker trips, reduce the load and switch the breaker back to the ON position.

### 2.4.2 Fuses

The junction box contains three 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.

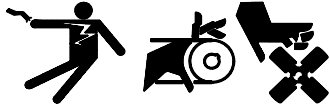
**Auxiliary Winding Fuse.** A replaceable 10-amp fuse for 4 lead generator sets (20-amp fuse for 12 lead generator sets) protects the alternator.

# Notes

## Section 3 Scheduled Maintenance

### 3.1 General Maintenance

#### WARNING

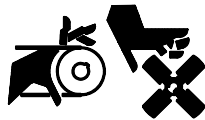


#### **Accidental starting.** **Can cause severe injury or death.**

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



#### **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 Exercise.** Operate the generator set without load once each week for 20 minutes. If the transfer switch does not have an exercise option, exercise the unit in the presence of an operator.

**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 ADC 2100 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.

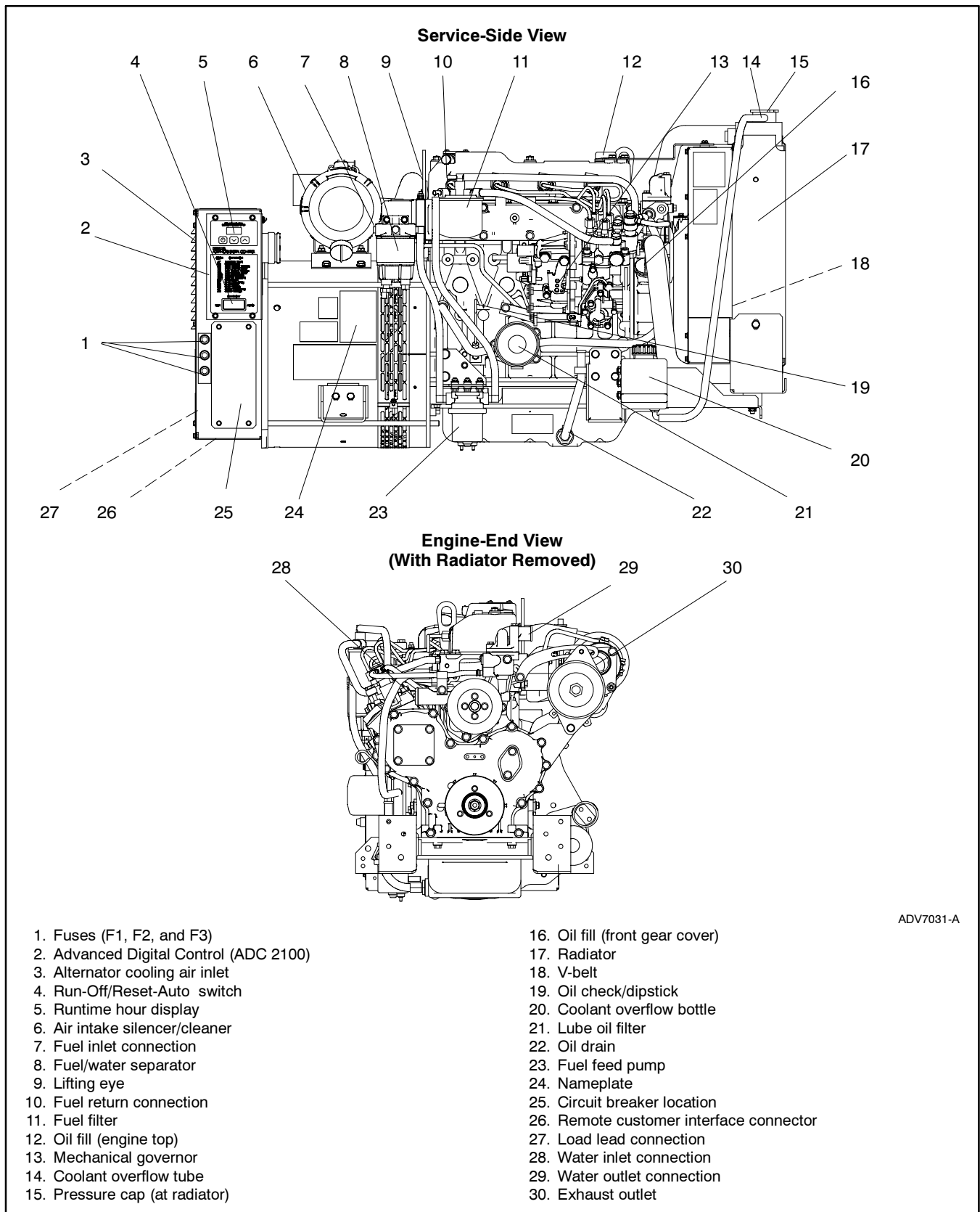
**Service Schedule.** Perform maintenance on each item in the service schedule at the designated intervals for the life of the generator set. For example, an item requiring service every 100 hours or 3 months also requires service after 200 hours or 6 months, 300 hours or 9 months, and so on.

### 3.2 Service Schedule

System—Component	Procedure				Reference Section
	Check	Change	Clean	Test	
<b>FUEL</b>					
Day tank level	W				
Flexible lines and connections	W	R			
Main tank supply level	W				
Fuel/water separator	M (drain)		S		3.5
Filter(s)		Q			3.5
Drain tank and replace fuel		50 or M			
Fuel piping	Q				
Tank vents and return lines for obstructions	Q				
Fuel injection system	Y			Y	Eng. S/M
<b>LUBRICATION</b>					
Oil level	W				3.4
Crankcase breather †	1500				Eng. S/M
Change oil		First 50, then 250			3.4
Replace filter(s)*					3.4
<b>COOLING</b>					
Block heater operation	W				
Coolant level	W				3.8
Flexible hoses and connectors	W				
Water pump(s)	W				
Fan and alternator belts	M	R			3.9
Air ducts, louvers *	Y		Y		
Louver motors and controls	Y		Y	Y	
Radiator exterior *			Y		3.8
<b>EXHAUST SYSTEM</b>					
Drain condensate trap	W				I/M
Leakage	W				3.7
Insulation, fire hazards	Q				3.7
Flexible connector(s)	W				3.7
Excessive back pressure				Y	I/M
Hangers and supports	Y				3.7
<b>DC ELECTRICAL SYSTEM</b>					
Battery charger operation, charge rate	M				Battery charger instructions
Recharge after engine start	M				
Battery electrolyte level	M				Battery manufacturer's instructions
Battery specific gravity, charge state				M	
Remove corrosion, clean and dry battery and rack	S		S		
Clean and tighten battery terminals	Q				
Tighten DC electrical connections	S				
* Service more frequently if operated in dusty areas. † Consult your local distributor/dealer for service. § Do not break manufacturer's seals or internally inspect these devices.	D: Daily, before operation Y: Yearly 2Y: Every 2 years or 2000 hours R: Replace as necessary Number: Hours of operation		W: Weekly M: Monthly Q: Quarterly S: Six months		

System—Component	Procedure				Reference Section
	Check	Change	Clean	Test	
<b>AC ELECTRICAL SYSTEM</b>					
General Inspection	W				
Circuit breakers, fuses §	M	R	M	M	
Wire abrasions where subject to motion	Q				
Tighten control and power wiring connections	Y				
Wire-cable insulation breakdown	3Y or 500			3Y or 500	
<b>ENGINE AND MOUNTING</b>					
General inspection (check for leaks)	W				
Air cleaner service *	S	S			3.6
Valve clearance	3 Y or 500				Eng. S/M
Bolt torque	3 Y or 500			3 Y or 500	Eng. S/M
<b>REMOTE CONTROL SYSTEM, ETC.</b>					
Compartment condition *	W		W		
Remote control				M	
<b>GENERATOR</b>					
General inspection	W				
Rotor and stator †	Y		Y		S/M
Bearing condition †	Y	R			S/M
Exciter †	Y		X		S/M
Measure and record resistance readings of windings with insulation tester (Megger, with SCR assembly or rectifier disconnected) †				Y	S/M
Blow dust out of generator*	2 Y or 300		2 Y or 300		3.1
<b>GENERAL CONDITION OF EQUIPMENT</b>					
Any condition of vibration, leakage, unusual noise, temperature, or deterioration	W		W		
Run generator set (exercise)				W	2.2, 2.3
Ensure that system is set for automatic operation	W				2.3
Interior of equipment room or outdoor weather housing *	W		W		
* Service more frequently if operated in dusty areas. † Consult your local distributor/dealer for service. § Do not break manufacturer's seals or internally inspect these devices.	D: Daily, before operation Y: Yearly 2Y: Every 2 years or 2000 hours R: Replace as necessary Number: Hours of operation		W: Weekly M: Monthly Q: Quarterly S: Six months		

### 3.3 Service Views




**Figure 3-1** Service Views



### 3.4 Lubrication System

See Figure 3-1 for the oil drain, oil check, oil fill, and oil filter locations.

**⚠ WARNING**



**Handling caustic engine fluids and chemical products. Can cause severe chemical burns, nausea, fainting, or death.**

Most chemicals such as used engine oil, antifreeze/coolant, rustproofing agent, inhibiting oil, degreasing agent, spray paint, and adhesives are hazardous to health. Read and follow the user information found on the packaging. Avoid inhalation and skin contact. Use only in well-ventilated areas and use a protective mask when spraying. Store engine fluids and chemical products in a locked cabinet. Contact your local recycling center for disposal information and locations.

**Used engine oil. Contact with used engine oil may cause severe skin irritation. Repeated and prolonged skin exposure may have other health risks.** Used engine oil is a suspected carcinogen. Avoid contact with skin. Thoroughly wash your hands and nails with soap and water shortly after handling used engine oil. Wash or dispose of clothing or rags containing used engine oil. Dispose of used engine oil in a responsible manner. Contact your local recycling center for disposal information and locations.

#### 3.4.1 Oil Specifications

Use oil that meets the American Petroleum Institute (API) classification of CD or CF. Using an unsuitable oil or neglecting an oil change may result in damage and a shorter engine life. Figure 3-2 shows the recommended Society of Automotive Engineers (SAE) viscosity designation for given operating temperature ranges.

**Note:** Failure to observe the oil specifications may cause inadequate lubrication/oil pressure and cold-starting difficulties.

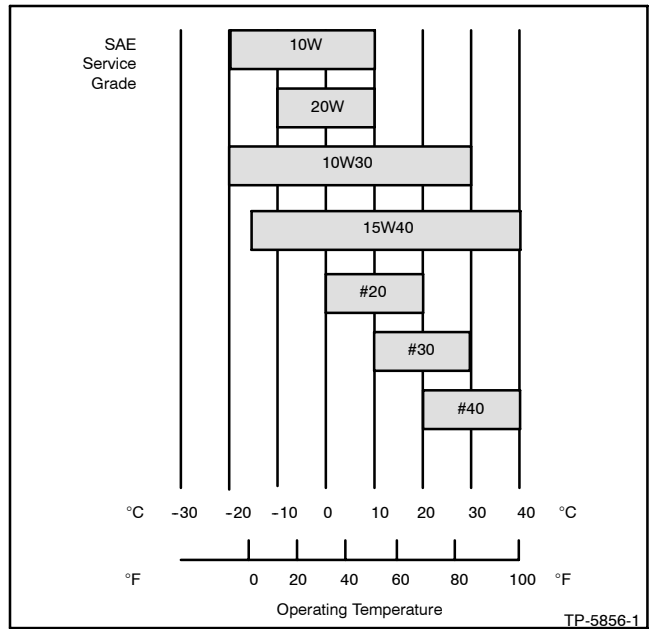


Figure 3-2 Engine Oil Selection

#### 3.4.2 Oil Check

Check the oil level in the crankcase daily or before each startup to ensure that the level is in the safe range. To check the oil level, remove the dipstick and wipe the end clean, reinsert as far as possible, and remove. Maintain the oil level between the Min and Max marks on the dipstick, as shown in Figure 3-3. See Figure 3-1 for dipstick location.

**Note:** Do not operate the set if the oil level is below the Min mark or above the Max mark.

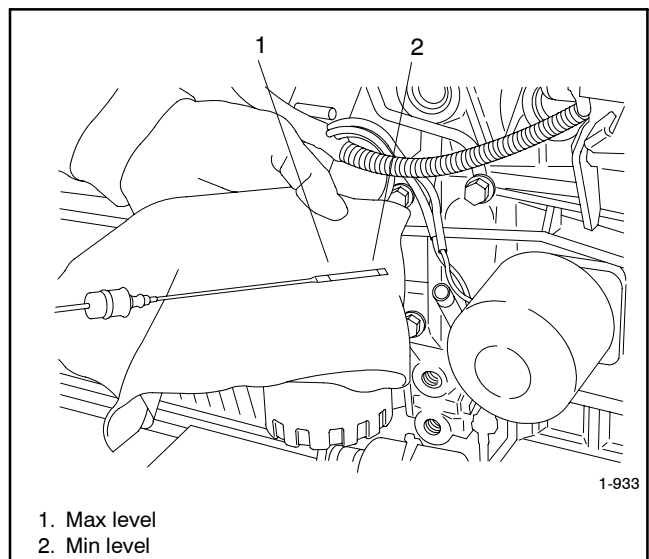


Figure 3-3 Oil Level Check

### 3.4.3 Oil Change

See the Service Schedule in Section 3.2 for oil change and oil filter replacement intervals. Change the oil more frequently if the generator operates under dirty, dusty conditions. See Figure 3-4 for oil capacities.

Model	L	(Qts.)
10REOD/REOZD	3.6	(3.8)
15REOD/REOZD	4.7	(5.0)
20REOD/REOZD	5.8	(6.1)

**Figure 3-4** Oil Capacities

#### Oil Change Procedure

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

##### 1. Drain the oil.

- a. Place the generator set master switch in the OFF position.
- b. Disconnect the power to the battery charger, if equipped.
- c. Disconnect the generator set engine starting battery, negative (-) lead first.
- d. Place an oil collection container below the oil drain and remove the oil drain plug.
- e. Allow time for the engine oil to drain completely.
- f. 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. Apply a light coat of clean oil to the rubber seal of the new oil filter.
- c. Install the new oil filter following the instructions provided with the filter.

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

##### 3. Fill with oil.

Add new oil of the weight, grade, and quantity specified in Section 3.4.

##### 4. Check for leaks.

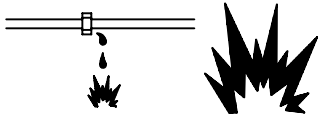
- a. Check that the generator set master switch is in the OFF position.
- b. Reconnect the generator set engine starting battery, negative (-) lead last.
- c. Reconnect the power to the battery charger, if equipped.
- d. Start the generator set and check for leaks around the oil filter.
- e. Stop the generator set and tighten the oil filter to stop any leaks.

x:sm:001:003:

## 3.5 Fuel System

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### WARNING



**Explosive fuel vapors.  
Can cause severe injury or death.**

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

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**Fuel tanks. Explosive fuel vapors can cause severe injury or death.** Gasoline and other volatile fuels stored in day tanks or subbase fuel tanks can cause an explosion. Store only diesel fuel in tanks.

**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.

### 3.5.1 Fuel Specifications

Use a clean, good quality diesel fuel oil with a cetane number of 45 or greater. Clean fuel prevents the diesel fuel injectors and pumps from clogging.

Fuel Recommendations	
United States	ISO 8217 DMA, BS 2869 A1 or A2
United Kingdom	BS 2869-1983, Part 2 Class A2
Germany	DIN 51 601-1978
Japan	JIS. No. K2204-2

**Note:** Never store diesel fuel in galvanized containers; diesel fuel and the galvanized coating react chemically to produce flaking that quickly clogs filters or causes fuel pump or injector failure.

**Note:** Avoid storing fuel for more than one month. Take special precautions to keep all dirt, water, and other contaminants out of fuel to prevent the growth of microbes. Microbes form slime that clogs the fuel filter and lines.

**Note:** Do not run the generator set out of fuel because the fuel lines will draw in air and necessitate priming the fuel system before restarting the unit.

### 3.5.2 Fuel Filter

The quality and condition of the fuel largely determine the filter's useful life. Replace the fuel filter element as listed in the service schedule. Figure 3-1 shows the typical location of a fuel filter. Use the applicable procedure below to replace the fuel filter.

#### Fuel Filter Cleaning/Replacement Procedure

1. Close the fuel supply valve.
2. Loosen the fuel filter by turning it counterclockwise. Remove the fuel filter and use rags to clean up spilled fuel oil. Dispose of the fuel filter in an approved manner.
3. Clean the contact surface of the fuel oil filter adapter.
4. Lightly lubricate the gasket surface of the new fuel filter with fresh fuel oil. Thread the filter on the adapter until the gasket makes contact; hand-tighten the filter an additional one-half turn. Wash hands after any contact with fuel oil.
5. Open the fuel supply valve.
6. Prime the fuel system. See Section 3.5.4, Priming the Fuel System.

### 3.5.3 Fuel/Water Separator

These generator set models include a fuel/water separator. The fuel/water separator helps to remove water and sediment from the fuel system.

#### Fuel/Water Separator Draining Procedure

At the interval specified in the service schedule, drain the water from the fuel/water separator. Hold a suitable container beneath the fuel/water separator and push up on the drain valve. See Figure 3-5. Release the valve when fuel (free of water) flows from the fuel/water separator.

#### Fuel/Water Separator's Element Replacement Procedure

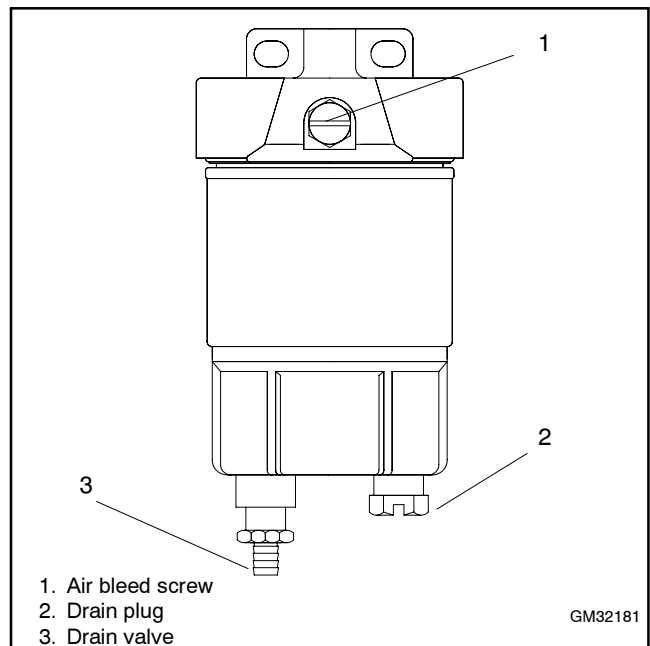
At the interval specified in the service schedule, replace the fuel/water separator element.

1. Close the fuel valve at the nearest point to the water filter inlet or at the fuel tank.
2. Remove the water drain plug (or push up the drain valve) and allow water and fuel to flow into a suitable container.

**Note:** Depending upon the location of the fuel valve, a considerable amount of fuel may drain out.

3. Remove the separator's element from the mounting head by twisting in a counterclockwise direction.
4. Remove the bowl from the fuel/water separator element. Wipe the excess fuel from the bowl and the O-ring. Do not discard the bowl or O-ring.
5. Inspect the components for wear or damage. Replace parts as necessary.
6. Lubricate the O-ring with clean diesel fuel and replace it in the bowl.

7. Install the bowl onto a new fuel/water separator filter element.
8. Lubricate the bowl/element assembly with clean fuel. Install the bowl/element onto the filter mounting head.
9. Replace the water drain plug (if removed) and close the vent.
10. Remove the air bleed screw from the fuel/water separator.
11. Open the fuel supply valve.
12. After fuel fills the water separator, allow fuel to flow from the air bleed hole until all air is displaced (fuel flows free of air bubbles).
13. Replace the air bleed screw.



**Figure 3-5** Fuel/Water Separator

### 3.5.4 Priming the Fuel System


Prime the fuel system under the following conditions:

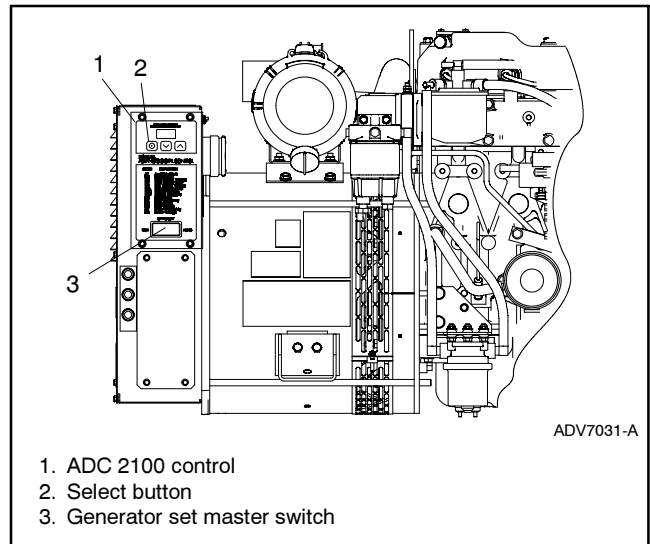
- Before starting the engine for the first time
- After running out of fuel and adding fuel to the tank
- After fuel system maintenance such as changing the fuel filter, draining the fuel/water separator, or replacing a fuel system component

**Note:** Do not open the air vent valve while priming the fuel system. The fuel filter has an internal air bleed port.

Do not crank the engine to prime the fuel system. Use the following procedure.

#### Fuel System Priming Procedure

1. Press and hold the Select button  located on the ADC 2100. See Figure 3-1 and Figure 2-1.
2. Move the generator set master switch to the RUN position. The controller displays the engine runtime.
3. Continue to hold the Select button. After 10 seconds, the ADC 2100 will display "Fuel" and the fuel priming pump will start.
4. Continue to hold the Select button for as long as you want the fuel priming pump to function (typically 10 seconds).
5. Release the Select button and move the Master switch to the OFF/RESET position.
6. Place the Master switch to the RUN position to start the unit.



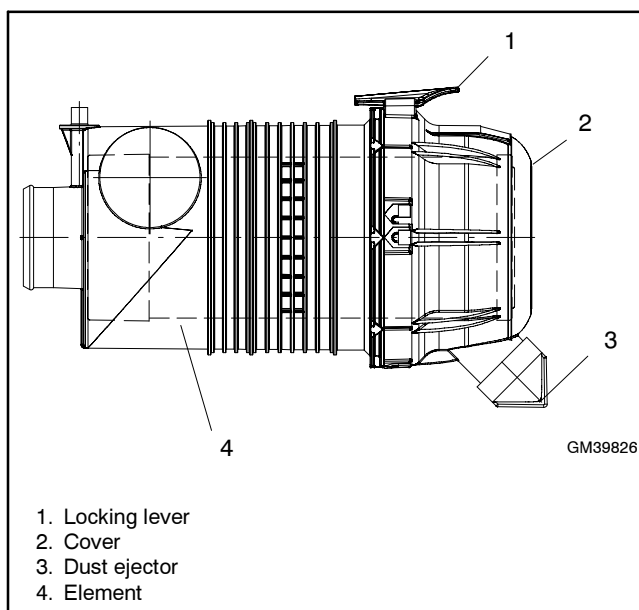
**Figure 3-6** ADC 2100 Control

## 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 if the generator operates 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. At the time of service, clean the air cleaner breather pipe and remove all dust and foreign matter from the air cleaner housing.

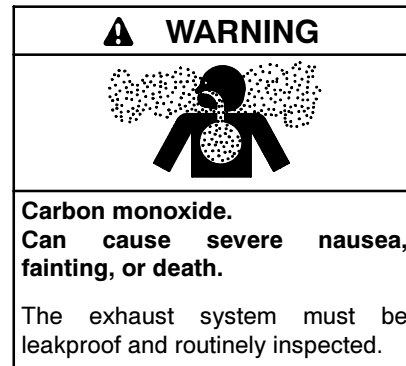
### Air Cleaner Element Cleaning or Replacement Procedure

1. Lift the locking lever and rotate the air cleaner cover counterclockwise to remove it. See Figure 3-7.
2. Slide the air cleaner element from the tube.
3. 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.
4. Wipe the cover and base with a clean rag to remove any dirt.
5. Ensure tight clamps at the inlet/outlet connections.
6. Slide the air cleaner element into the tube.
7. Position the cover with the dust ejector pointing down. Rotate the cover clockwise until the locking lever snaps into place.



**Figure 3-7** Air Cleaner Components

## 3.7 Exhaust System



**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.

At the interval specified in the service schedule, inspect the exhaust system.

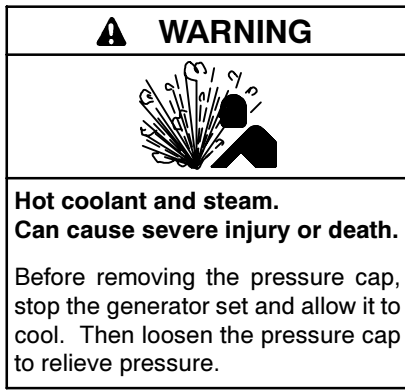
### Inspection Points

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.

## 3.8 Cooling System



**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

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. Replace a cracked or deteriorated cap. See Section 3.8.5. Remove dirt and other debris from the pressure cap and filler neck.

See Figure 3-8 for the thermostat rating.

Thermostat Rating	
All Models	82°C (179°F)

**Figure 3-8** 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. Remove the radiator's pressure cap.
2. Close the radiator's and/or engine block's coolant drain valve(s) 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.

3. Fill the radiator with the recommended coolant mixture of 50% ethylene glycol and 50% clean, softened water to inhibit rust/corrosion and prevent freezing. See Figure 3-9 for coolant capacities.

**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.

4. Replace the radiator's pressure cap.
5. Operate the engine until the thermostat opens and the radiator upper hose becomes warm.

Model	Engine, L (Qts.)	Engine & Unit-Mounted Radiator, L (Qts.)
10REOD/REOZD	1.8 (1.9)	4.1 (4.3)
15REOD/REOZD	2.0 (2.1)	9.1 (9.6)
20REOD/REOZD	2.7 (2.8)	9.3 (9.8)

**Figure 3-9** Coolant Capacities

6. Stop the engine and allow it to cool.
7. Remove the radiator's pressure cap.
8. Add coolant to the radiator to just below the overflow tube on the filler neck.
9. Replace the radiator's pressure cap.
10. 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 utilizes 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. See Figure 3-10.

Pressure Cap Rating	
10REOD/REOZD	97 kPa (14 psi)
15REOD/REOZD 20REOD/REOZD	83-110 kPa (12-16 psi)

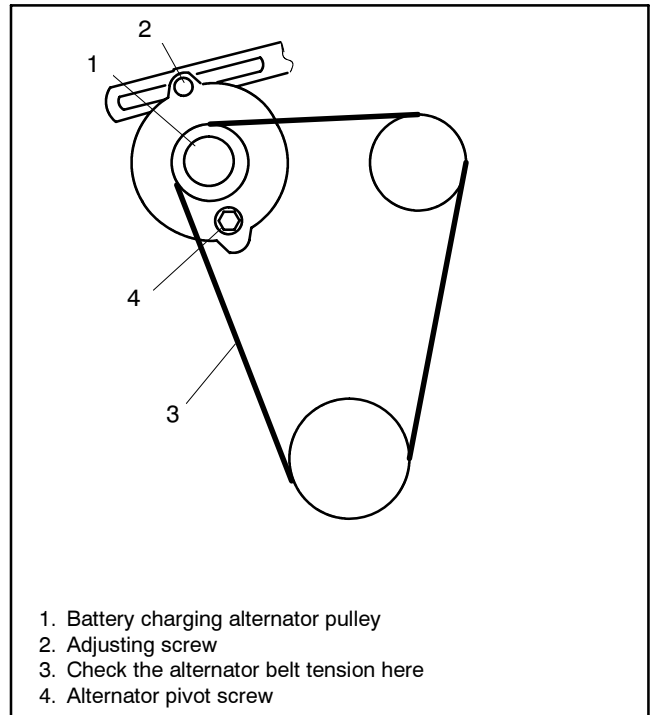
**Figure 3-10** Pressure Cap Rating  
(for inline radiator models)

## 3.9 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.

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

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.



**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.



### 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.

<b>⚠ WARNING</b>

<b>Explosion. Can cause severe injury or death. Relays in the battery charger cause arcs or sparks.</b>  Locate the battery in a well-ventilated area. Isolate the battery charger from explosive fumes.

**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 Storage Procedure

Perform the following storage procedure before taking a generator set out of service for three months or longer. Follow the engine manufacturer's recommendations, if available, for fuel system and internal engine component storage.

x.sm:002:001

### 3.11.1 Lubricating System

Prepare the engine lubricating system for storage as follows:

1. Run the generator set for a minimum of 15 minutes to bring it to normal operating temperature.
2. Stop the generator set.
3. With the engine still warm, drain the oil from the crankcase.
4. Remove and replace the oil filter.
5. Refill the crankcase with oil suited to the climate.
6. Run the generator set for two minutes to distribute the clean oil.
7. Stop the generator set.
8. Check the oil level and adjust, if needed.

x.sm:002:002

### 3.11.2 Cooling System

Prepare the cooling system for storage as follows:

1. Check the coolant freeze protection using a coolant tester.
2. Add or replace coolant as necessary to ensure adequate freezing protection. Use the guidelines included in the engine operation manual.
3. Run the generator set for 10–15 minutes to redistribute added coolant.

x.sm:002:003

### 3.11.3 Fuel System

Prepare the fuel system for storage as follows:

#### Diesel-Fueled Engines

1. Fill the fuel tank with #2 diesel fuel.
2. Condition the fuel system with compatible additives to control microbial growth.
3. Change the fuel filter/separator and prime the fuel system.

x.sm:002:004

### 3.11.4 Exterior

Prepare the exterior for storage as follows:

1. Clean the exterior surface of the generator set.
2. Seal all engine openings except for the air intake with nonabsorbent adhesive tape.
3. To prevent impurities from entering the air intake and to allow moisture to escape from the engine, secure a cloth over the air intake.
4. Mask electrical connections.
5. Spread a light film of oil over unpainted metallic surfaces to inhibit rust and corrosion.

x.sm:002:006a

### 3.11.5 Battery

Perform battery storage after all other storage procedures.

1. Place the generator set master switch in the OFF position.
2. Disconnect the battery(ies), negative (-) lead first.
3. Clean the battery. Refer to the battery manufacturer for the battery cleaning procedure.
4. Place the battery in a cool, dry location.
5. Connect the battery to a float/equalize battery charger or charge it monthly with a trickle battery charger. Refer to the battery charger manufacturer's recommendations.

Maintain a full charge to extend battery life.

# Section 4 Troubleshooting

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

Use the following charts 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:

Problem	Possible Cause	Corrective Action
Controller LED display is off	No power to the controller: The controller automatically powers down if the generator set has not run for 48 hours or longer (if the optional Remote Digital Display is not connected). Controller fuse (F3) is blown. Low or no battery voltage.	Controller display will automatically activate when a remote start command is received or the generator set master switch is moved to the RUN position. Replace the fuse. If the fuse blows again, contact the distributor/dealer. Check connections. Check generator set battery.
	Generator set master switch is in the OFF/RESET position.	Move generator set master switch to the AUTO or RUN position.
	Generator set master switch in AUTO but no start command has been received since last controller reset.	No action required. Controller display will activate when a remote start command is received or the generator set master switch is moved to the RUN position. Use the remote switch to start generator set and activate the controller display, if desired.

**Figure 4-1** Controller Troubleshooting Chart

## 4.1 Fault Codes

The Advanced Digital Control displays fault codes to aid in troubleshooting. Fault codes, descriptions, and recommended actions are listed in Figure 2-3.

Identify and correct the cause of the fault condition. Then reset the controller after a fault shutdown. See Section 2.3.5.

## 4.2 Controller Troubleshooting

Figure 4-1 contains troubleshooting, diagnostic, and repair information for the Advanced Digital Control.

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			
<b>Controller</b>												
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						Controller fuse (F3) blown	Replace the blown controller fuse. If the fuse blows again, troubleshoot the controller.†	Section 2, W/D
X				X						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						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 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.	
<b>Cooling System</b>												
						X		X		Air openings clogged	Clean the air openings.	—
				X						High temperature shutdown	Allow the engine to cool down. Then troubleshoot the cooling system.	Section 3.8, and Eng. O/M
				X						Low coolant level shutdown	Restore the coolant to normal operating level and reset the controller.	Sections 3.8 and 2.3.5
						X				Coolant level low	Restore the coolant to normal operating level.	Section 3.8
						X				Thermostat inoperative	Replace the thermostat.	Eng. S/M
						X				Cooling water pump inoperative	Tighten or 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			
<b>Electrical System (DC circuits)</b>												
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	Check the fault code. Correct the fault condition and then reset the controller.	Section 2
x	x									Starter/starter solenoid inoperative	Replace the starter or starter solenoid.	Eng. S/M
<b>Engine</b>												
	x	x			x			x		Air cleaner clogged	Clean or replace the filter element.	Section 2
	x	x				x		x		Compression weak	Check the compression. †	Eng. S/M
			x		x			x		Engine overload	Reduce the electrical load. See the generator set specification sheet for ratings.	S/S
									x	Exhaust system leak	Inspect the exhaust system. Replace any leaking 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.	
					x				x	Valve clearance incorrect	Adjust the valves. †	Eng. S/M
									x	Vibration excessive	Tighten all loose hardware.	—

\* 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			
<b>Fuel System</b>												
	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 filter restriction	Clean or replace the fuel filter.	Section 3.5
	X									Fuel solenoid inoperative	Troubleshoot the fuel solenoid. †	Eng. S/M
	X	X			X					Air in fuel system (diesel only)	Prime the diesel fuel system.	Section 3.5.4
	X	X			X					Fuel or fuel injectors dirty or faulty (diesel only)	Clean, test, and/or replace the inoperative fuel injector. †	Eng. S/M
	X	X			X			X		Fuel injection timing out of adjustment (diesel only)	Adjust the fuel injection timing. †	Eng. S/M
	X				X			X		Fuel feed or injection pump inoperative (diesel only)	Rebuild or replace the injection pump. †	Eng. S/M
<b>Generator</b>												
			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. †	—
<b>Lube System</b>												
						X	X		X	Oil level low	Restore the oil level. Inspect the generator set for oil leaks.	Section 3.4
				X						Low oil pressure shutdown	Check the oil level.	Section 3.4
	X	X					X		X	Crankcase oil type incorrect for ambient temperature	Change the oil. Use oil with a viscosity suitable for the operating climate.	Section 3.4

\* 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.

# Section 5 Reconnection/Adjustments

## 5.1 Four-Lead Reconnection

The following information illustrates the reconnection of four-lead generator sets. In all cases, conform to the National Electrical Code (NEC).

### 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.

### 5.1.1 100-120-Volt Configurations

If the installation requires a factory two-pole circuit breaker, do not connect the load-side terminals of the circuit breaker together; see Figure 5-1. If the installation requires a 100-120-volt, 2-wire system, use a single-pole circuit breaker. See Figure 5-2. When connecting stator phase leads together, size the output lead (L1) to handle the amperage. Use a jumper lead on the *line* side of the circuit breaker to balance the load of the generator set.

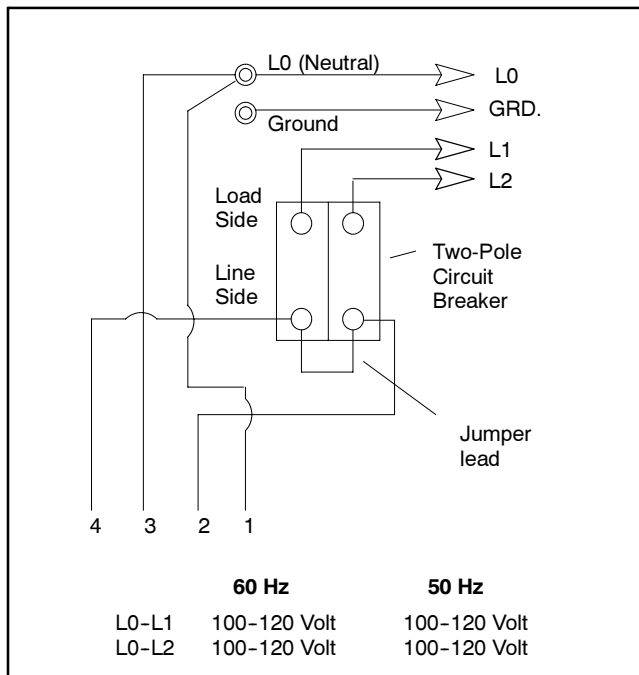


Figure 5-1 100-120-Volt, 3-Wire Configuration

### 5.1.2 100-120/200-240-Volt Configurations

The 100-120/200-240-volt configuration does not use a jumper lead. If the unit was originally wired for straight 100-120 volt, 3-wire, remove the jumper lead (see Figure 5-1 for location). Select a two-pole circuit breaker. Application of two single-pole circuit breakers does not conform to NEC requirements for supplying a 200-240-volt load, even if the breakers are mechanically attached together. Leads L1 and L2 are for different phases; *never* connect them together.

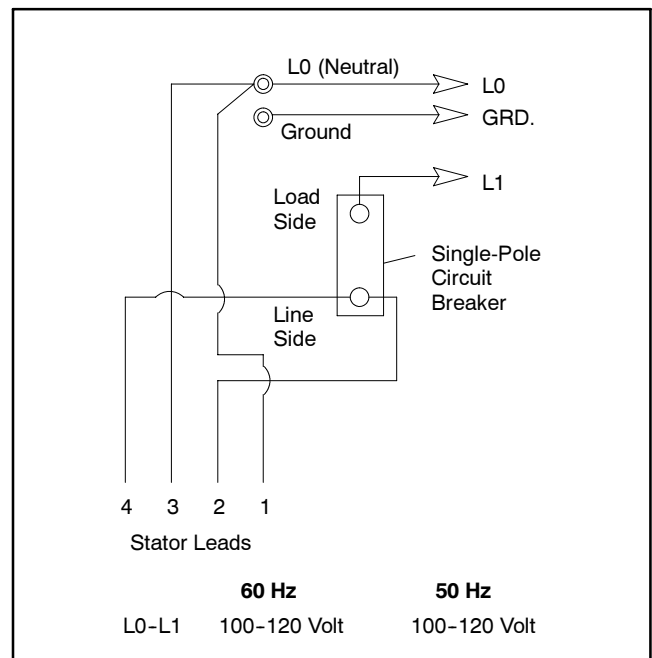
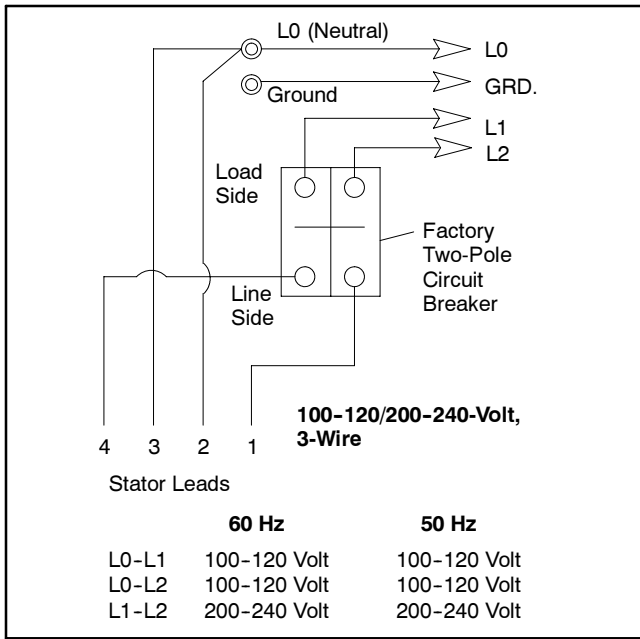


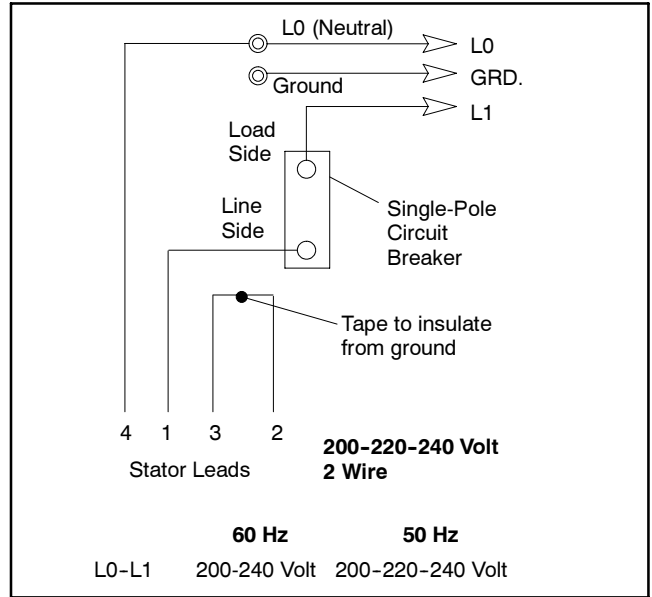
Figure 5-2 100-120 Volt, 2-Wire Configuration



**Figure 5-3** 100-120/200-240-Volt, 3-Wire Configuration

### 5.1.3 200-240-Volt Configurations

The 200-240-volt configuration does not use a jumper lead. If the unit was originally wired for straight 100-120 volt, 3-wire, remove the jumper lead (see Figure 5-1 for location). See Figure 5-4.



**Figure 5-4** 200-220-240-Volt, 2-Wire Configuration



## 5.2 Twelve-Lead Reconnection

The reconnection procedure that follows details voltage reconnections only. If the generator set requires frequency changes, adjust the governor and voltage regulator. See the generator set service manual for information regarding frequency adjustment.

In all cases, follow National Electrical Code (NEC) guidelines.

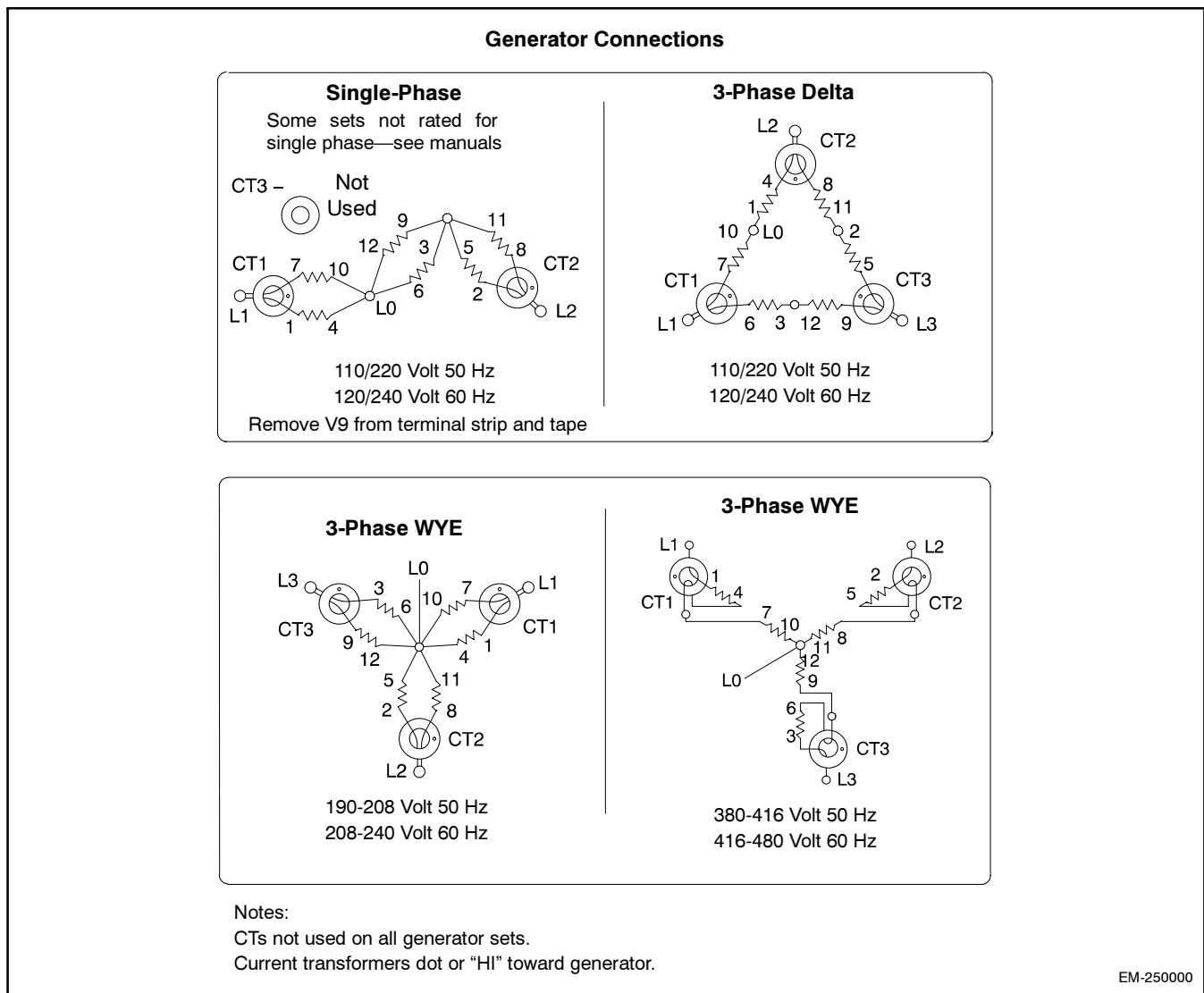
Reconnect the stator leads of the generator set to change output phase or voltage. Refer to the following procedure and connection schematics. Follow all safety precautions at the front of this manual and in the text during reconnection procedure.

### 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.

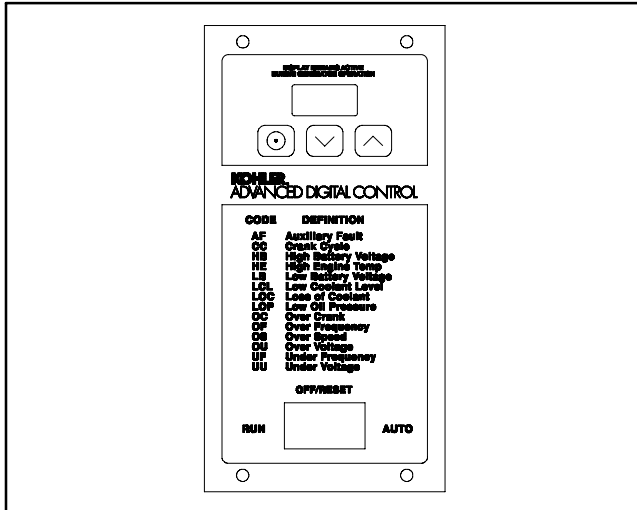
### Twelve-Lead Reconnection Procedure

1. Move generator set start/stop switch to the STOP position.
2. Disconnect engine starting battery, negative (-) lead first. Disconnect power to battery charger, if equipped.
3. Use Figure 5-5 to determine generator set voltage configuration. Note original voltage and reconnect as needed.



**Figure 5-5** 12-Lead Generator Reconnection

## 5.3 ADC 2100 Adjustment after Reconnection



**Figure 5-6** Advanced Digital Control (ADC 2100)

The controller is factory-set for the generator set voltage and frequency and normally does not require adjustment. If adjustment is necessary, follow the procedures in this section to set the system voltage and frequency parameter (Uu) and then adjust the output voltage.

**Note:** The unit configuration (UC), engine type (EC), and engine data input type (ED) are factory set and should only be changed by an authorized Kohler dealer/distributor. Incorrect settings will make your unit non-functional.

### 5.3.1 Configuration Mode Time Out

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

### 5.3.2 Configuration Mode

Follow the instructions in Figure 5-10 to enter the configuration mode. The settings are shown in Figure 5-7. An X in the Display column in Figure 5-10 indicates a number from 0 to 9.

Press the Select button to step through to the Save mode as shown in Figure 5-12. When SAVE is displayed, press the up arrow to save the new settings or the down arrow to discard the changes and exit the configuration mode without saving.

Pressing the Select button when SAVE is displayed returns to the first parameter, system voltage/frequency (Uu).

Parameter	Setting	Definition
Unit's system voltage and frequency Also see Figure 5-8	Uu01	Single phase, 60 Hz, 120/240 VAC
	Uu03	Three phase, 50 Hz, 115/230 or 200/400 VAC
	Uu04	Three phase, 60 Hz, 138/277 or 240/480 VAC
	Uu06	Single phase, 50 Hz, 115/230 VAC
Unit configuration	Uc01 *	Standby generator set
Engine type	Ec02 *	10/15/20REOD/REOZD
Engine data input types	Ed01 *	Units with standard oil pressure switch
	Ed02	Units with optional oil pressure sender installed (i.e. for Remote Digital Gauge)
Battery Voltage	Bt12 *	Battery voltage 12 VDC
Communications	Cn00 *	No CAN communications
	Cn01	J1939 (use for Remote Digital Gauge)

\* Factory settings.

**Figure 5-7** Controller Parameters

Voltage Connection	VAC	Voltage Part #	ADC 2100 Setting
60 Hz, Single phase	120/240	333702	Uu01
60 Hz, Three phase	120/208	333700	Uu04
	127/220	333701	
	120/240	333703	
	139/240	333704	
	220/380	333705	
	277/480	333708	
50 Hz, Single phase	110/220	333803	Uu06
50 Hz, Three phase	110/190	333800	Uu03
	110/220	333802	
	220/380	333805	
	230/400	333806	
	240/416	333807	

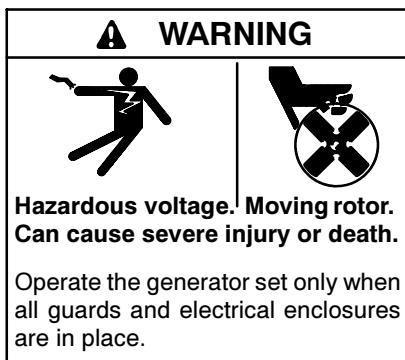
**Figure 5-8** Uu Parameter Settings for Available Voltage Connections

### 5.3.3 Voltage Adjustment

After setting the system voltage parameter Uu, check the output voltage and adjust, if necessary, using the following procedures. Follow the instructions in Figure 5-13 to adjust the voltage, gain, and volts/Hz while the engine is running. An X in the Display column in Figure 5-13 indicates a number from 0 to 9. Use the up arrow to increase a setting or the down arrow to decrease the setting.

Pressing the Select button when SAVE is displayed returns to the first parameter, voltage adjust (1P).

**Note:** A digital multimeter that measures voltage and frequency is required for these adjustments.



**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.

**Grounding electrical equipment. Hazardous voltage can cause severe injury or death.** Electrocutation 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.

### Voltage Adjustment Procedure

1. With the generator set off, connect a digital voltmeter to the output leads or an electrical outlet on the load side of the generator set. Set the meter to measure voltage.
2. Start the generator set by moving the generator set master switch to the RUN position.
3. Use the ADC controller to adjust the voltage (parameter 1P) until the output voltage reaches the desired value. See Figure 5-9.

Measured Voltage, VAC	Approximate Voltage Change per Step, VAC	
	Coarse Adjust	Fine Adjust
85-132	5	0.5
180-251	7	0.7

**Figure 5-9** Voltage Adjustment

4. Adjust the voltage stability (gain, parameter 2P) to minimize light flicker.
5. Readjust the voltage, if necessary.
6. Adjust the volts/Hz (parameter 3P) until the voltage level measured by the voltmeter begins to drop. When the volts/Hz is set correctly, the generator (as load is applied) attempts to maintain normal output until the engine speed drops below the cut-in frequency.
7. Readjust the voltage stability (gain, parameter 2P), if necessary.
8. Readjust the voltage (parameter 1P), if necessary.
9. Stop the generator set.

## Controller Configuration Mode (Use with Figure 5-7, Controller Parameters):

Hold the Select button:

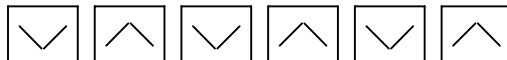


Move the generator set master switch to the RUN position. (The generator set engine will not start.)

Display:

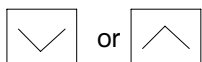
Wait about 5 seconds until the display shows the program version number. (The number may be different than the one shown here.)

Press the down arrow key and then the up arrow key 3 times to enter the configuration mode. (This is the controller "password.")



Now release the Select button.

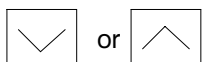
Press:



To set the voltage/frequency setting for 60 Hz or 50 Hz models.



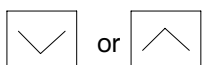
To step to the next parameter, unit configuration Uc.



To set the unit configuration setting, if necessary.



To step to the next parameter, engine type Ec.



To set the engine type, if necessary.



To step to the next parameter, advanced configuration mode or save mode selection.

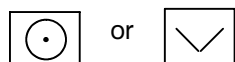
Now either save your settings or enter the Advanced Configuration Mode to set the engine data inputs, battery voltage, and communications.

Press:



To enter advanced configuration mode.  
Go to Figure 5-11.

OR:





To proceed to the save mode without entering the advanced configuration mode.  
Go to Figure 5-12.


**Note:** Shaded boxes show which number in the controller display changes when the up or down arrow key is pressed. "x" denotes any number from 0 to 9.



**Figure 5-10** Configuration Mode (system voltage/frequency, unit configuration, and engine type parameters)


**Pressing the up arrow key at the Adnc display (See Figure 5-10) puts you into the Advanced Configuration Mode.**



**Press:**


 or  To set the engine data input type. **E d 0 x**

 To enter battery voltage selection mode.

 or  To toggle between 12 and 24 VDC. **12-volt models B t 1 2**

 To enter communications selection mode.

 or  To set the communications parameter. **C n 0 x**


 To enter SAVE mode. **Go to Figure 5-12.** **S A V E**

**Note:** Shaded boxes show which number in the controller display changes when the up or down arrow key is pressed. “x” denotes any number from 0 to 9.


**Figure 5-11** Advanced Configuration Mode (engine data input types, battery voltage, and engine communications)

**There are 3 options when the display says SAVE:**


**Press:**

 To return to the first parameter, system voltage/frequency Uu, to check or change settings before saving. See Figure 5-10.

**or**

 To save changes.

**or**

 To discard changes without saving.

**S A V E**

**U u 0 x**

**Y E S**

**n o**

**“Yes” or “no” flashes when the up or down arrow is pressed and then the controller exits the configuration mode. The display returns to the runtime hours.**

**x x x x**

**Note:** Be sure to save your settings before exiting the configuration mode. The controller reverts to the last *saved* settings when the master switch is moved to the OFF/RESET position.

\* x in the runtime hours display above denotes any number from 0 to 9.

**Now move the master switch to OFF/RESET.**

**Figure 5-12** Save Mode (after configuring generator set parameters)

## Output Voltage Adjustment Mode:

Move the generator set master switch to the RUN position. The generator set engine starts and the controller display shows the engine runtime hours.

Display :\*

X X X X

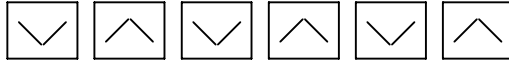
Hold:



Wait about 5 seconds until the display changes from runtime hours to the program version number.

X.XX

Press the down arrow key and then the up arrow key 3 times to enter the adjustment mode. (This is the controller "password.")



1 P X X

The controller is now in the voltage coarse adjustment mode.

Press:



or



To raise or lower the voltage in large increments (approximately 5-7 volts per step).

1 P X X



To enter fine voltage adjustment mode.

1 P X X



or



To raise or lower the voltage in smaller increments (approximately 0.5-0.7 volts per step).



To enter coarse voltage stability (gain) adjustment mode.

2 P X X



or



To raise or lower the voltage stability (gain) in large increments.



To enter fine voltage stability (gain) adjustment mode.

2 P X X



or



To raise or lower the voltage stability (gain) in smaller increments.



To enter volts/Hz adjustment mode.

3 P 0 X



or



To raise or lower the volts/Hz: 00=low; 09= high

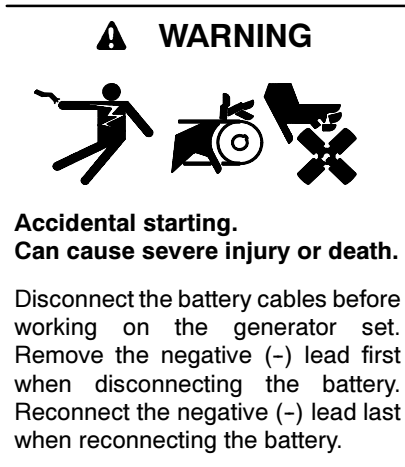
**See Figure 5-12 to save.**

\* Shaded boxes show which character in the controller display changes for each adjustment. "X" in the examples above denotes any number from 0 to 9. The actual values may vary from model-to-model.

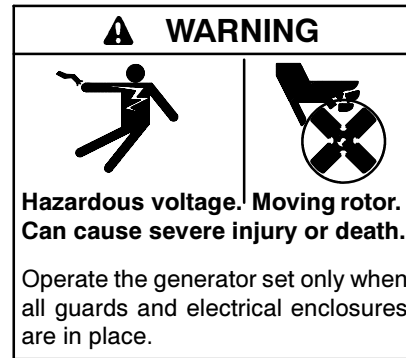
TP6196

**Figure 5-13** Output Voltage Adjustments

## Section 6 Wiring Diagrams



**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.



**Grounding electrical equipment. Hazardous voltage can cause severe injury or death.** Electrocutation 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.

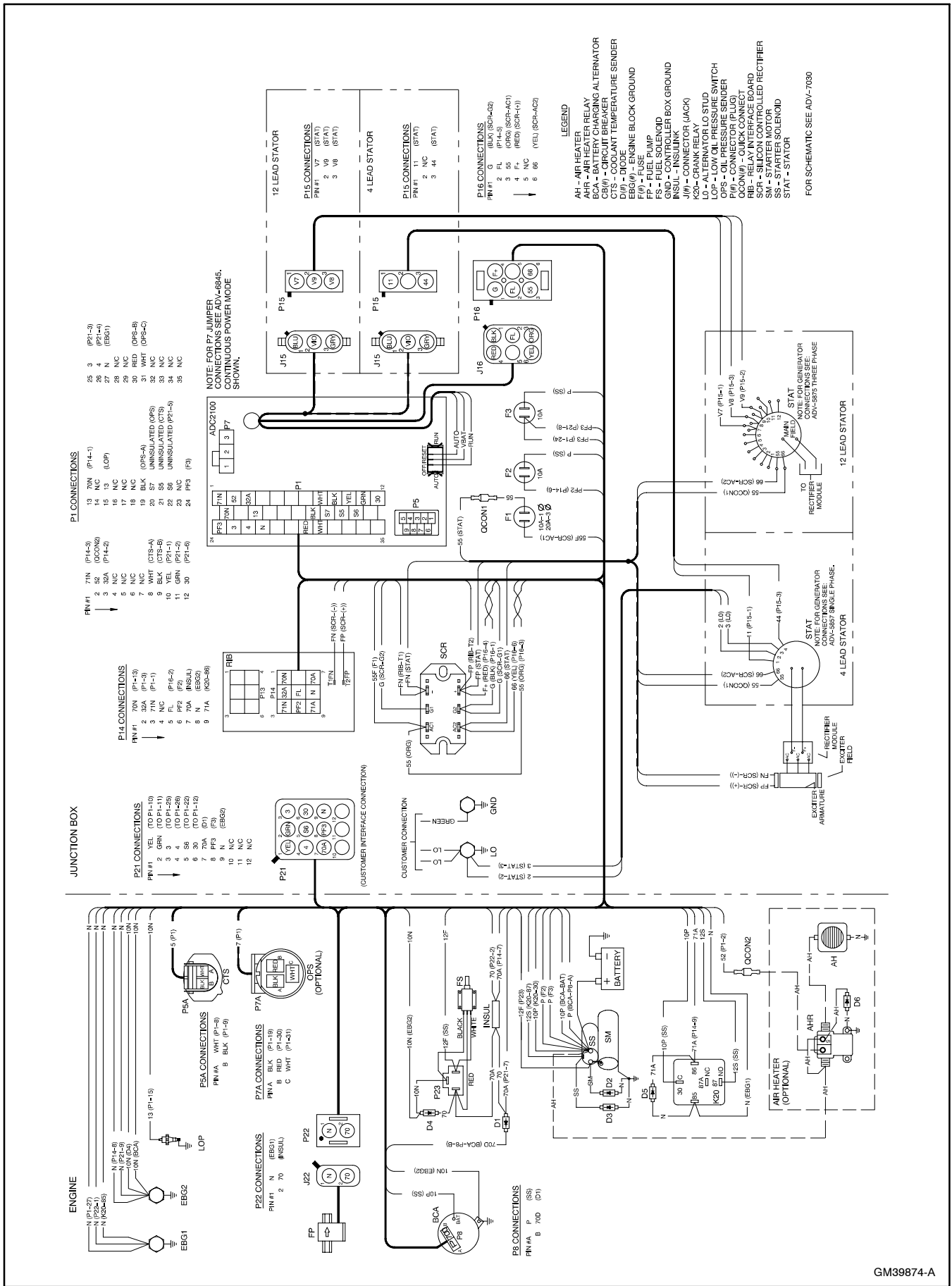


Figure 6-1 Wiring Diagram, GM39874-A



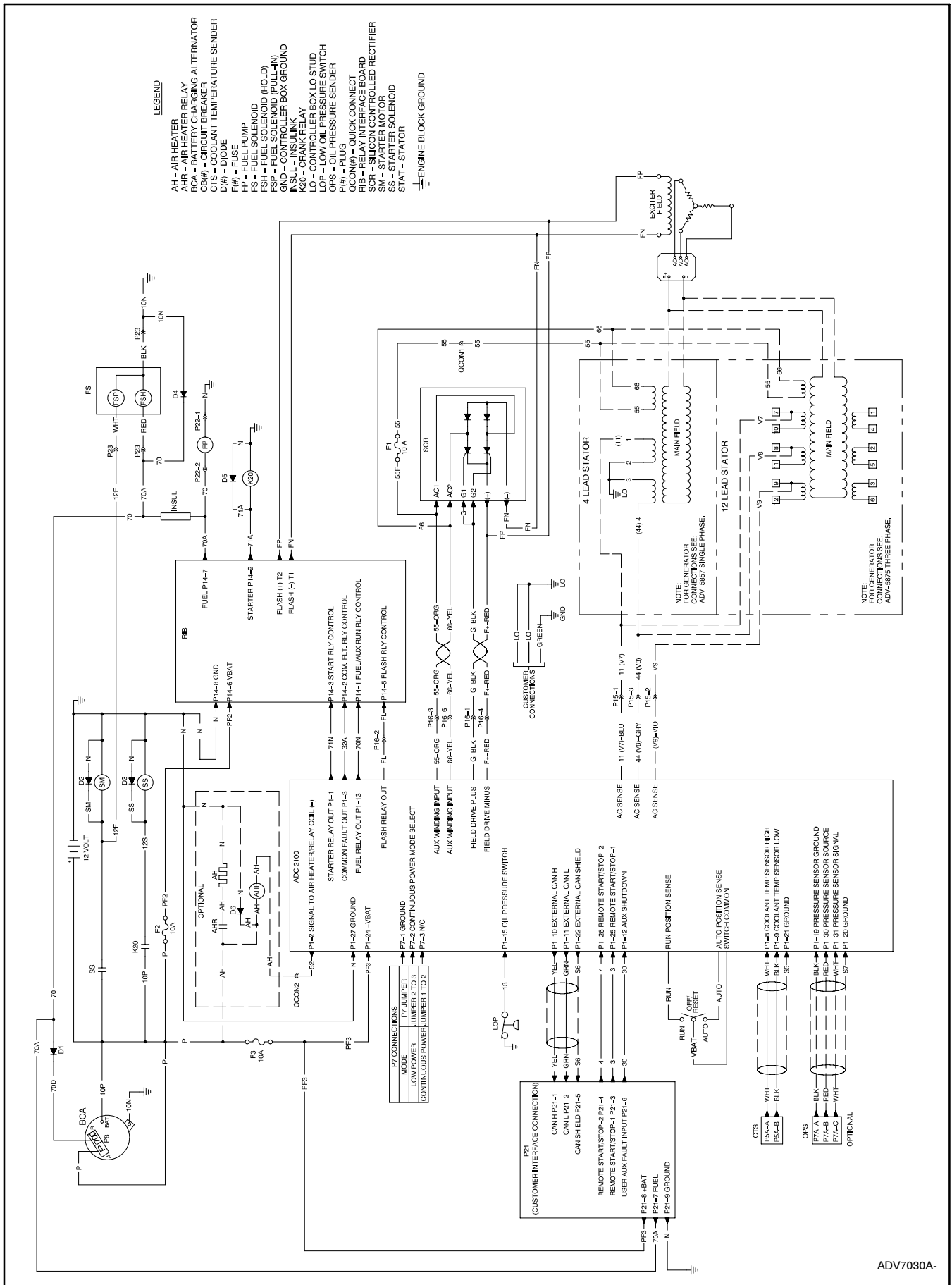
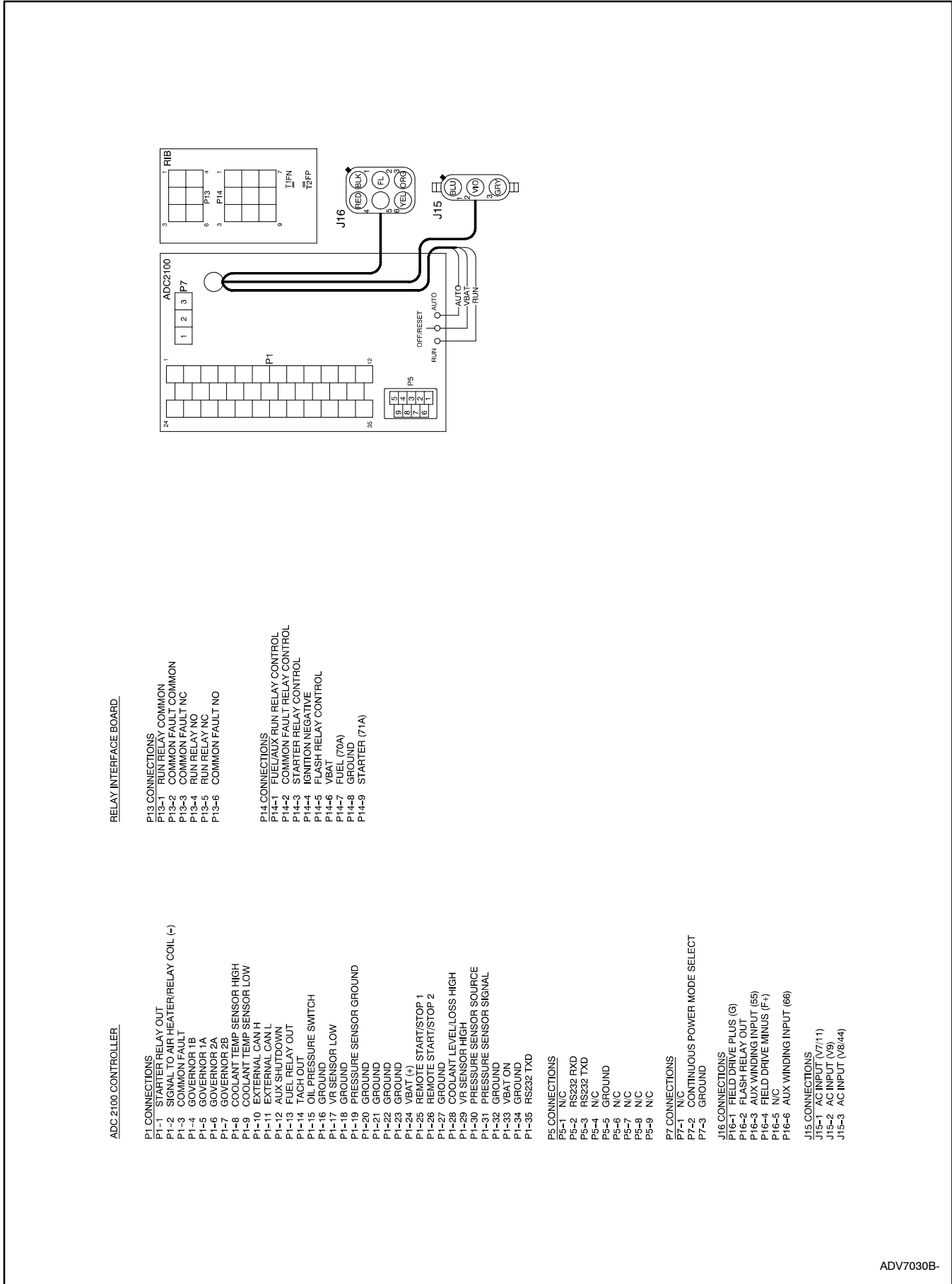


Figure 6-2 Schematic, ADV-7030, Sheet 1



ADV7030B-

Figure 6-3 Schematic, ADV-7030, Sheet 2

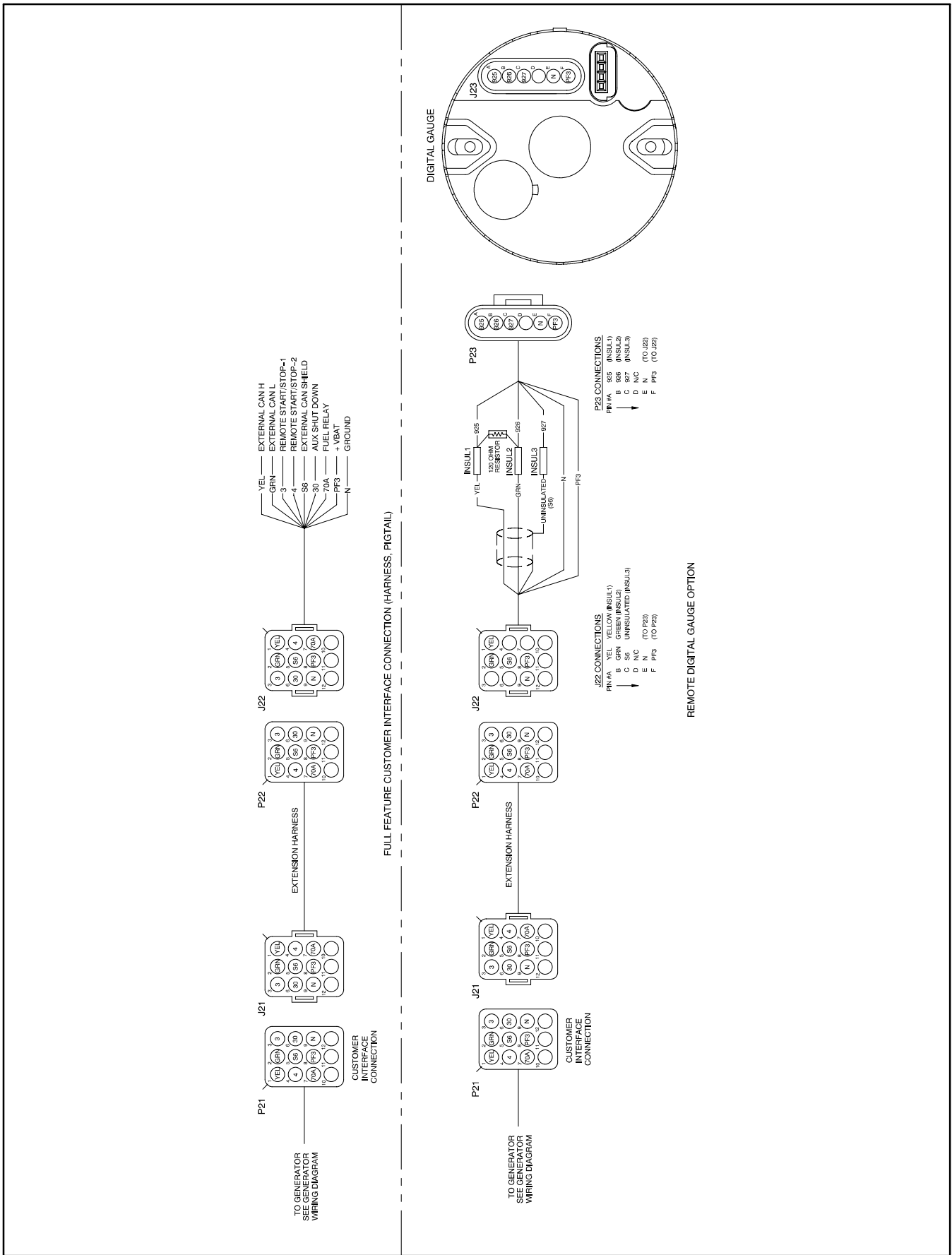


Figure 6-4 Accessory Connection, GM33846-A

# Notes

# Appendix A Abbreviations

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

A, amp	ampere	cfm	cubic feet per minute	ext.	external
ABDC	after bottom dead center	CG	center of gravity	F	Fahrenheit, female
AC	alternating current	CID	cubic inch displacement	fglass.	fiberglass
A/D	analog to digital	CL	centerline	FHM	flat head machine (screw)
ADC	analog to digital converter	cm	centimeter	fl. oz.	fluid ounce
adj.	adjust, adjustment	CMOS	complementary metal oxide substrate (semiconductor)	flex.	flexible
ADV	advertising dimensional drawing	cogen.	cogeneration	freq.	frequency
AHWT	anticipatory high water temperature	com	communications (port)	FS	full scale
AISI	American Iron and Steel Institute	coml	commercial	ft.	foot, feet
ALOP	anticipatory low oil pressure	Coml/Rec	Commercial/Recreational Association	ft. lb.	foot pounds (torque)
alt.	alternator	conn.	connection	ft./min.	feet per minute
Al	aluminum	cont.	continued	g	gram
ANSI	American National Standards Institute (formerly American Standards Association, ASA)	CPVC	chlorinated polyvinyl chloride	ga.	gauge (meters, wire size)
AO	anticipatory only	crit.	critical	gal.	gallon
API	American Petroleum Institute	CRT	cathode ray tube	gen.	generator
approx.	approximate, approximately	CSA	Canadian Standards Association	genset	generator set
AR	as required, as requested	CT	current transformer	GFI	ground fault interrupter
AS	as supplied, as stated, as suggested	Cu	copper	GND, ⊕	ground
ASE	American Society of Engineers	cu. in.	cubic inch	gov.	governor
ASME	American Society of Mechanical Engineers	cw.	clockwise	gph	gallons per hour
assy.	assembly	CWC	city water-cooled	gpm	gallons per minute
ASTM	American Society for Testing Materials	cyl.	cylinder	gr.	grade, gross
ATDC	after top dead center	D/A	digital to analog	GRD	equipment ground
ATS	automatic transfer switch	DAC	digital to analog converter	gr. wt.	gross weight
auto.	automatic	dB	decibel	H x W x D	height by width by depth
aux.	auxiliary	dBA	decibel (A weighted)	HC	hex cap
A/V	audiovisual	DC	direct current	HCHT	high cylinder head temperature
avg.	average	DCR	direct current resistance	HD	heavy duty
AVR	automatic voltage regulator	deg., °	degree	HET	high exhaust temperature, high engine temperature
AWG	American Wire Gauge	dept.	department	hex	hexagon
AWM	appliance wiring material	dia.	diameter	Hg	mercury (element)
bat.	battery	DI/EO	dual inlet/end outlet	HH	hex head
BBDC	before bottom dead center	DIN	Deutsches Institut für Normung e. V. (also Deutsche Industrie Normenausschuss)	HHC	hex head cap
BC	battery charger, battery charging	DIP	dual inline package	HP	horsepower
BCA	battery charging alternator	DPDT	double-pole, double-throw	hr.	hour
BCI	Battery Council International	DPST	double-pole, single-throw	HS	heat shrink
BDC	before dead center	DS	disconnect switch	hsg.	housing
BHP	brake horsepower	DVR	digital voltage regulator	HVAC	heating, ventilation, and air conditioning
blk.	black (paint color), block (engine)	E, emer.	emergency (power source)	HWT	high water temperature
blk. htr.	block heater	EDI	electronic data interchange	Hz	hertz (cycles per second)
BMEP	brake mean effective pressure	EFR	emergency frequency relay	IC	integrated circuit
bps	bits per second	e.g.	for example ( <i>exempli gratia</i> )	ID	inside diameter, identification
br.	brass	EG	electronic governor	IEC	International Electrotechnical Commission
BTDC	before top dead center	EGSA	Electrical Generating Systems Association	IEEE	Institute of Electrical and Electronics Engineers
Btu	British thermal unit	EIA	Electronic Industries Association	IMS	improved motor starting
Btu/min.	British thermal units per minute	EI/EO	end inlet/end outlet	in.	inch
C	Celsius, centigrade	EMI	electromagnetic interference	in. H <sub>2</sub> O	inches of water
cal.	calorie	emiss.	emission	in. Hg	inches of mercury
CARB	California Air Resources Board	eng.	engine	in. lb.	inch pounds
CB	circuit breaker	EPA	Environmental Protection Agency	Inc.	incorporated
cc	cubic centimeter	EPS	emergency power system	ind.	industrial
CCA	cold cranking amps	ER	emergency relay	int.	internal
ccw.	counterclockwise	ES	engineering special, engineered special	int./ext.	internal/external
CEC	Canadian Electrical Code	ESD	electrostatic discharge	I/O	input/output
cert.	certificate, certification, certified	est.	estimated	IP	iron pipe
cfh	cubic feet per hour	E-Stop	emergency stop	ISO	International Organization for Standardization
		etc.	et cetera (and so forth)	J	joule
		exh.	exhaust	JIS	Japanese Industry Standard
				k	kilo (1000)
				K	kelvin

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



# Notes



# Notes

# Notes



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