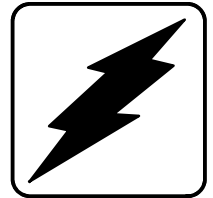


Operation

Residential Generator Sets



Models:

15RES

30RES

Controller:

Advanced Digital Control (ADC 2100)



KOHLER[®]
POWER SYSTEMS

TP-6344 4/09c

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Notes

Safety Precautions and Instructions

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

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

DANGER

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

WARNING

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

CAUTION

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

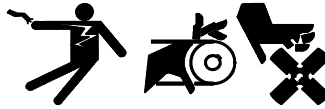
NOTICE

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

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

Accidental Starting

WARNING



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

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

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

Battery

WARNING



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

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

WARNING



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

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

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

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


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

metal surface away from the battery. To avoid sparks, do not disturb the battery charger connections while the battery is charging. Always turn the battery charger off before disconnecting the battery connections. Ventilate the compartments containing batteries to prevent accumulation of explosive gases.

Battery short circuits. Explosion can cause severe injury or death.

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

Engine Backfire/Flash Fire

⚠ WARNING

Fire. Can cause severe injury or death.
Do not smoke or permit flames or sparks near fuels or the fuel system.

Servicing the fuel system. A flash fire can cause severe injury or death.


Do not smoke or permit flames or sparks near the carburetor, fuel line, fuel filter, fuel pump, or other potential sources of spilled fuels or fuel vapors. Catch fuels in an approved container when removing the fuel line or carburetor.

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

Combustible materials. A fire can cause severe injury or death. Generator set engine fuels and fuel vapors are flammable and explosive. Handle these materials carefully to

minimize the risk of fire or explosion. Equip the compartment or nearby area with a fully charged fire extinguisher. Select a fire extinguisher rated ABC or BC for electrical fires or as recommended by the local fire code or an authorized agency. Train all personnel on fire extinguisher operation and fire prevention procedures.

Exhaust System

⚠ WARNING

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

Generator set operation. Carbon monoxide can cause severe nausea, fainting, or death.

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

Carbon monoxide symptoms. Carbon monoxide can cause severe nausea, fainting, or death.

Carbon monoxide is a poisonous gas present in exhaust gases. Carbon monoxide is an odorless, colorless, tasteless, nonirritating gas that can cause death if inhaled for even a short time. Carbon monoxide poisoning symptoms include but are not limited to the following:

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

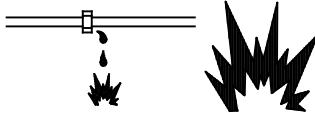
If experiencing any of these symptoms and carbon monoxide poisoning is possible, seek fresh air immediately and remain active. Do not sit, lie down, or fall asleep. Alert others to the

possibility of carbon monoxide poisoning. Seek medical attention if the condition of affected persons does not improve within minutes of breathing fresh air.

Carbon monoxide detectors.

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

Fuel System

⚠ WARNING

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

The fuel system. Explosive fuel vapors can cause severe injury or death.

Vaporized fuels are highly explosive. Use extreme care when handling and storing fuels. Store fuels in a well-ventilated area away from spark-producing equipment and out of the reach of children. Never add fuel to the tank while the engine is running because spilled fuel may ignite on contact with hot parts or from sparks. Do not smoke or permit flames or sparks to occur near sources of spilled fuel or fuel vapors. Keep the fuel lines and connections tight and in good condition. Do not replace flexible fuel lines with rigid lines. Use flexible sections to avoid fuel line breakage caused by vibration. Do not operate the generator set in the presence of fuel leaks, fuel accumulation, or sparks. Repair fuel systems before resuming generator set operation.

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

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

Natural Gas—Adequate ventilation is mandatory. Because natural gas rises, install natural gas detectors high in a room. Inspect the detectors per the manufacturer's instructions.

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

Hazardous Noise

CAUTION



Hazardous noise. Can cause hearing loss.

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

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/ Moving Parts

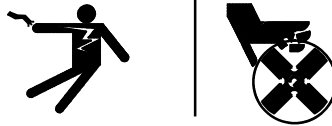
DANGER



Hazardous voltage. Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

WARNING



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

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

WARNING



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

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

CAUTION



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

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

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

Disconnecting the electrical load. Hazardous voltage can cause severe injury or death. Disconnect the generator set from the load by turning off the line circuit breaker or by disconnecting the generator set output leads from the transfer switch and heavily taping the ends of the leads. High voltage transferred to the load during testing may cause personal injury and equipment damage. Do not use the safeguard circuit breaker in place of the line circuit breaker. The safeguard circuit breaker does not disconnect the generator set from the load.

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).

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.

⚠ WARNING



Airborne particles. Can cause severe injury or blindness.

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

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.

Heavy Equipment

⚠ WARNING



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

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

Hot Parts

⚠ WARNING



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

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

⚠ WARNING
Hot engine and exhaust system. Can cause severe injury or death.
Do not work on the generator set until it cools.

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

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

Notice

NOTICE

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

NOTICE

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

This manual provides operation instructions for 15 and 30 kW residential generator set models listed on the front cover.

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

This generator set is approved for use in stationary applications in locations served by a reliable utility power source. Have the generator set installed by an authorized Kohler distributor/dealer or service technician. Refer to the Installation Manual for installation instructions. See the List of Related Literature, below.

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 Kohler distributor/dealer or service technician, 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, 15/30 kW	TP-6341
Parts Catalog*	TP-6319
Service Manual (Engine)	TP-6362
Service Manual (Generator Set)	TP-6198
Wiring Diagram Manual (Generator Set)	TP-6437
* One Parts Catalog combines generator and engine information.	

Figure 1 Generator Set Literature

Service Assistance

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

- Consult the Yellow Pages under the heading Generators—Electric.
- Visit the Kohler Power Systems website at KohlerPower.com.
- Look at the labels and 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
3 rue de Brennus
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Asia Pacific

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Singapore, Republic of Singapore
Phone: (65) 6264-6422
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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

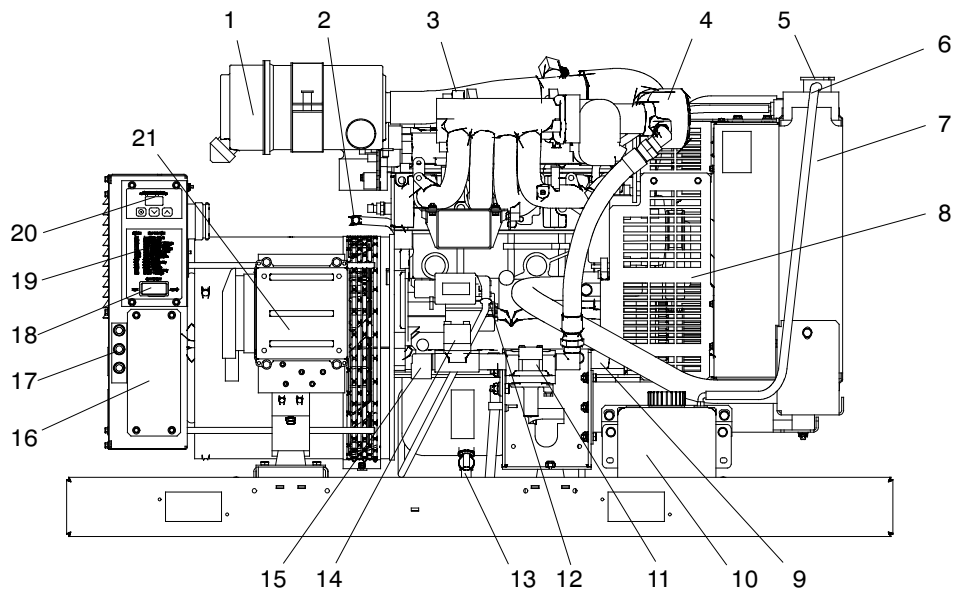
Japan, Korea

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

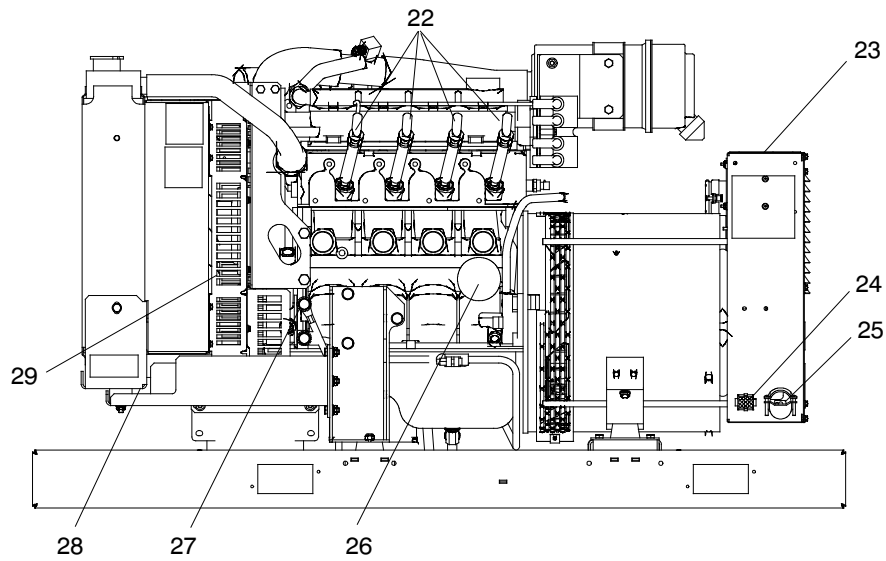
Latin America

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

Section 1 Service Views



Service-Side View



Nonservice-Side View


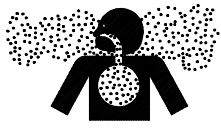
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- | | |
|---|---|
| 1. Air cleaner | 16. AC circuit breaker panel |
| 2. Oil check | 17. Fuses |
| 3. Oil fill (on valve cover) | 18. Generator set master switch |
| 4. Fuel/air mixer | 19. Advanced Digital Control, ADC 2100 |
| 5. Pressure cap (engine coolant fill) | 20. Runtime hour display |
| 6. Coolant overflow tube | 21. Engine control module (ECM) |
| 7. Radiator | 22. Spark plugs |
| 8. Belt guard | 23. Nameplate |
| 9. LOP switch location | 24. Remote customer interface connector |
| 10. Coolant overflow bottle | 25. Customer load lead access |
| 11. Secondary fuel regulator | 26. Lube oil filter |
| 12. Positive (+) battery connection point | 27. Negative (-) battery connection point |
| 13. Oil drain valve | 28. Coolant drain |
| 14. Fuel solenoid valves (two required for UL 2200) | 29. Cooling air inlet |
| 15. Fuel inlet | |

Figure 1-1 Service Views (shown without enclosure)

Notes

2.1 Operating Area

 WARNING

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

Carbon monoxide symptoms. Carbon monoxide can cause severe nausea, fainting, or death. Carbon monoxide is a poisonous gas present in exhaust gases. Carbon monoxide is an odorless, colorless, tasteless, nonirritating gas that can cause death if inhaled for even a short time. Carbon monoxide poisoning symptoms include but are not limited to the following:

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

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

Keep the generator set area clear. Maintain at least 1.5 m (5 ft.) of clearance on all sides of the generator set. Verify that there are no windows, air vents, or other openings in the building within 1.5 m (5 ft.) of the generator set exhaust outlet in any direction.

<p>Notice</p>
<p>Do not locate patios, decks, play areas, or animal shelters near the generator set. Keep items such as lawn furniture, toys, sports equipment, and all combustible materials away from the generator set exhaust outlet. Remind family members, children, and visitors to use caution near the generator set.</p> <p>Generator sets connected to automatic transfer switches start automatically during exercise periods and power outages. Some generator set components become hot when the generator set is running and remain hot for a time after the generator set shuts down.</p>

2.2 Prestart Checklist

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

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

Air Inlets. Check for 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.

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

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

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

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

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

Inspect the exhaust system components for cracks and corrosion (exhaust manifold, exhaust pipe, exhaust clamps, and silencer).

- Check for corroded or broken metal parts and replace them as needed.
- Check that there are no combustible materials near the exhaust outlet.
- Check that the exhaust outlet is unobstructed.

Carbon Monoxide Detectors. Check for the installation and operation of carbon monoxide (CO) detectors on each level of any building near the generator set.

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

2.3 Exercising Generator Set

Operate the generator set under load once each week for 20 minutes.

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

2.4 Advanced Digital Control Operation

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

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

2.4.1 Controls and Indicators

Figure 2-2 describes the controls and indicators located on the controller. The LED display indicates generator set status as shown in Figure 2-2. The display is active when the master switch is in the RUN or AUTO position and remains active until the generator set master switch is moved to the OFF/RESET position or the power to the controller is removed. Depending on the controller configuration, the LED display may turn off after a period of inactivity when the master switch is in AUTO. See Section 2.4.6.

The buttons on the controller keypad are used only for system configuration and adjustment. The ADC 2100 is factory-set and should not require configuration or adjustment under normal operating conditions. If the generator set is reconnected to a different voltage and/or frequency, refer to an authorized Kohler distributor/dealer for system configuration and adjustment instructions.

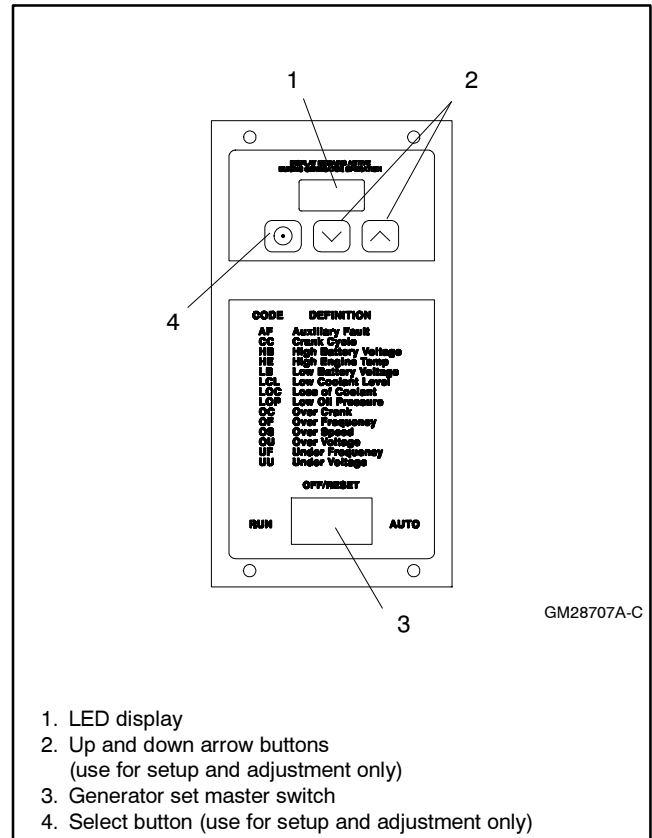


Figure 2-1 ADC 2100 Controls

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

Figure 2-2 ADC 2100 Controls and Indicators

2.4.2 Local Operation

Starting. Move the generator set master switch to the RUN position. The ADC 2100 attempts to start the generator set three times. If the generator set does not start in three attempts, the system shuts down on an overcrank fault.

The crank cycle time is preprogrammed and not adjustable.

Stopping. Run the generator set with no load for at least 2 minutes to allow the engine to cool down. Move the generator set master switch to the OFF/RESET position. The engine stops.

2.4.3 Automatic Operation

The generator set can be connected to an automatic transfer switch (ATS), remote start/stop switch or remote digital gauge. Move the generator set master switch to the AUTO position to allow starting and stopping by one of these devices.

Refer to the instructions provided with the ATS, remote start/stop switch or remote digital gauge for operation instructions.

Note: Have an authorized Kohler distributor/dealer install and connect the ATS, remote start/stop switch, or remote digital gauge.

Automatic Starting. The generator set crank cycle starts when the remote switch or engine start contacts on the ATS close. The ADC 2100 attempts to start the generator set three times. If the generator set does not start in three attempts, the system shuts down on an overcrank fault.

The crank cycle time is preprogrammed and not adjustable.

Automatic Stopping. With the generator set master switch in the AUTO position, the generator set stops when the remote start/stop switch contacts or engine start contacts on the ATS open.

2.4.4 Fault Warnings and Shutdowns

Warnings. The controller displays a fault code but the generator set does not shut down under the high battery voltage (HB) and low battery voltage (LB) warning conditions shown in Figure 2-3. The controller resets automatically after a battery voltage fault condition is corrected.

Shutdowns. The generator set shuts down automatically under the conditions listed in Figure 2-4 and the controller displays a fault code. Correct the fault condition and then reset the controller before restarting the generator set. See Section 2.4.5 to reset the controller after a fault shutdown.

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

LOP Shutdown. The oil pressure switch shuts down the generator set if the oil pressure drops below a preset level, providing some protection from major engine damage due to insufficient oil pressure. However, the low oil pressure switch is not a low oil level indicator. Check the oil regularly as described in the service schedule and add oil as required to keep the oil level at or near the full mark on the dipstick or optional gauge.

Code	Fault	Description	Check
HB	High battery voltage warning	Fault code is displayed if the engine starting battery voltage rises above 16 VDC for a 12 VDC system or above 30 VDC for a 24 VDC system for more than 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.
LB	Low battery voltage warning	Fault code is displayed if the engine starting battery voltage falls below 9.5 VDC for a 12 VDC system or below 16 VDC for a 24 VDC system for more than 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. Charge or replace the battery.

Figure 2-3 ADC 2100 Fault Warning Codes

Code	Fault	Description	Check
AF	Auxiliary fault input shutdown	Input from a customer-supplied switch that closes when the fault is active. The generator set shuts down 0.3 seconds after the fault is detected and will not start when the fault is active (input is grounded). This protection becomes active 3 seconds after crank disconnect.	Check the cause of the auxiliary fault.
HE	High engine temperature shutdown	Shutdown occurs if the engine coolant temperature exceeds the maximum temperature for more than 5 seconds. This 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).	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 Kohler 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 Kohler 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 Kohler 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 Kohler 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 or below 59 Hz for more than 60 seconds. This protective becomes active 10 seconds after engine start. (10 second inhibit).	Reduce the load and restart the generator set. Contact an authorized Kohler 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 Kohler distributor/dealer for service if problem continues.
SCF0	Software Communication Fault 0	Indicates a software or communication problem within the ADC 2100.	Replace the controller.

Figure 2-4 ADC 2100 Fault Shutdown Codes

2.4.5 Resetting Controller After a Fault Shutdown

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

1. Move the generator set master switch to the OFF/RESET position.
2. Disconnect the generator set from the load using the line circuit breaker or ATS. See the safety precautions at the beginning of this manual before proceeding.
3. Identify and correct the cause of the fault shutdown. 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. Stop the generator set by moving the generator set master switch to the OFF/RESET position.
6. Reconnect the generator set to the load using the line circuit breaker or ATS.
7. If the generator set is connected to a transfer switch, remote start/stop switch, or remote digital gauge, move the generator set master switch to the AUTO position.

Note: Opening and closing the remote start/stop contact also resets the controller. Always identify and correct the cause of the fault shutdown before restarting the generator set.

2.4.6 Controller Power Down

The ADC 2100 is powered by the generator set's engine starting battery.

When the generator set master switch is in the AUTO position, the controller may power down after a period of inactivity. The controller's communication parameter (Cn) setting determines the power down mode. See the installation manual, TP-6341, for controller configuration information.

48-hour power down (default setting). If the ADC 2100 communication parameter is set to Cn00, the controller automatically powers down after 48 hours of inactivity. A remote start signal (from a transfer switch or a remote start/stop switch connected to P21 connector, leads 3 and 4) or moving the generator set master switch to the RUN position turns the controller back on.

Continuous power mode. If the ADC 2100 communication parameter is set to Cn01, the controller will not power down. The controller remains powered at all times to maintain CANbus communication and to allow remote start commands from a remote CAN gauge. A battery charger is recommended to maintain the engine starting battery.

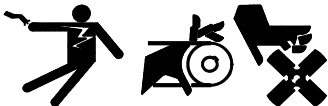
Note: The ADC 2100 draws 250 mA when the master switch is in the AUTO position and the unit is configured for CAN communication.

1-hour power down. Setting the communications parameter to Cn06 will cause the controller to power down after 1 hour of inactivity. In this mode, a remote digital gauge using CAN communication will not be able to activate the controller after power down. A remote start signal (from a transfer switch or a remote start/stop switch connected to P21 connector, leads 3 and 4) or moving the generator set master switch to the RUN position turns the controller back on. Controller application code version 1.21 or higher is required for the 1-hour power down option.

Notes

3.1 General Maintenance

⚠ WARNING




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

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

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

⚠ WARNING




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

Do not work on the generator set until it cools.

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

⚠ WARNING



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

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

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

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

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

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

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

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 generator sets that are subject to extreme weather or dusty or dirty conditions more frequently.

3.2 Service Schedule

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

Perform Service at Intervals Indicated (X)	Reference Section	Before Starting	Weekly	100 Hr. (3 Mo.)	300 Hr. (6 Mo.)	400 Hr. (Yearly)
Fuel System						
Check the fuel level and fill as necessary (LP).		X				
Check the solenoid valve operation.*			X			
Check flexible fuel lines and connections. Replace as necessary.*				X		
Check the fuel piping.*					X	
Lubrication System						
Check the oil level and add oil as necessary.	3.4.2	X (24 hr.)				
Change the oil.	3.4.5			X (200 hr.)		
Replace the oil filter.	3.4.5			X (200 hr.)		
Intake/Exhaust System						
Inspect and clean the air cleaner element.	3.6			X		
Replace the air cleaner element.	3.6				X	
Check and clear the exhaust outlet area.	3.7	X				
Inspect the exhaust system components.*	3.7	X				
Check the installation and operation of CO detectors.	3.7	X				
Check the exhaust gas condition during operation.	3.7	X				
Cooling System						
Check the coolant level and fill as necessary.	3.8.1	X				
Inspect the radiator and hoses.	3.8.1	X				
Check the belt tension and condition.*	3.11			X		
Check the coolant protection and tighten the hose clamps.*	3.8.1					X
Flush the cooling system.*	3.8.4					X (800 hr.)
Ignition System						
Clean and regap the spark plugs.	3.10				X	
Replace the spark plugs.	3.10					X (800 hr.)
Electrical System						
Keep the battery charged and in good condition.‡	3.9	X				
Check and tighten electrical connections.*			X			
Clean the battery cables as required.‡		X				
Engine And Mounting						
Check for fuel, coolant, and oil leakage.*†		X				
Retighten all nuts and bolts as required.		X				
Check for visible wear or damage.			X			
Remote Control System						
Check the remote control operation.			X			X
Generator Set						
Exercise the generator set.	2.3		X			
Check and clean the interior of the enclosure.	3.1					X
Clean collector ring and inspect brushes.*						X (1000 hr.)
* Contact your local authorized Kohler distributor/dealer for service.						
† Read WARNING found at the beginning of manual regarding moving parts.						
‡ Consult battery manufacturer's instructions.						

3.3 Maintenance and Service Parts

Obtain maintenance and service parts from an authorized Kohler distributor/dealer. See Section 4.3.2 for fuse part numbers.

3.4 Lubrication System

3.4.1 Oil Specifications

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

Ambient Temperature	SAE Viscosity Grade
-18°C (0°F) or above	10W-30
Below -18°C (0°F)	5W-30

Figure 3-1 Engine Oil Selection

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

3.4.2 Oil Check

Check the oil level in the crankcase every 24 hours of operation or before each startup. Do not check the oil level while operating the unit. Stop the generator set and keep the generator set level to get an accurate reading. To check the oil level, remove the dipstick and wipe the end clean, reinsert and remove. Maintain the oil level between the Full and Add marks on the dipstick, as shown in Figure 3-2. See Section 1, Service Views for the dipstick location.

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

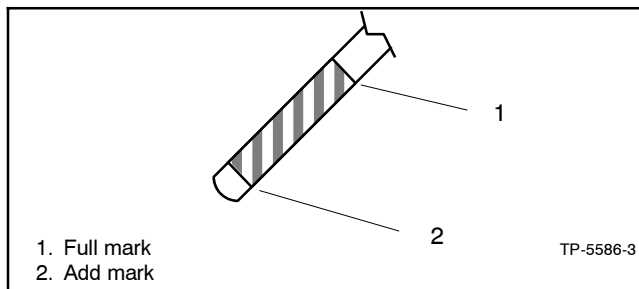


Figure 3-2 Oil Level Check

3.4.3 Optional Oil Makeup/Low Level Shutdown Kit

On generator sets equipped with the optional oil makeup/low level shutdown kit, check the oil level in the oil reservoir and at the sight gauge. Refer to the instructions provided with the kit for more information.

3.4.4 Oil Additions

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

3.4.5 Oil and Filter Change

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

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. Remove the housing side panel.
- e. Place an oil collection container below the oil drain and remove the oil drain plug.
- f. Open the oil drain valve on the engine.
- g. Allow time for the engine oil to drain completely.
- h. Close the oil drain valve.
- i. Replace the oil drain plug. Replace the cap on the oil drain hose. Replace the oil drain hose in its retaining clip.

2. Replace the oil filter.

- Remove the oil filter by rotating it counterclockwise with an oil filter wrench.
- Clean the contact surface of the oil filter adapter.
- Apply a light coat of clean oil to the rubber seal of the new oil filter.
- 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.

See Figure 3-1 for oil selection and Figure 3-3 for oil capacity.

Model	Oil Capacity, L (qt.)
15/30RES	3.5 (3.7)
15/30RES with oil makeup kit	5.4 (5.7)

Figure 3-3 Oil Capacity

4. Check for leaks.

- Check that the generator set master switch is in the OFF position.
 - Reconnect the generator set engine starting battery, negative (-) lead last.
 - Reconnect the power to the battery charger, if equipped.
 - Start the generator set and check for leaks around the oil filter.
 - Stop the generator set and tighten the oil filter to stop any leaks.
 - Reinstall the housing side panel.
5. Stop the generator set. Check the oil level. Add oil, as necessary, to bring the level up to the Full mark.

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

3.5 Gaseous Fuel System

The gaseous fuel system uses two solenoid valves to control the fuel flow to the fuel regulator. The generator-mounted regulator reduces fuel pressure as fuel passes to the mixer. See Figure 3-4. The mixer controls the ratio of fuel to air under varying loads and speed conditions. Because the mixer receives fuel in a gaseous state, it does not need to vaporize the fuel.

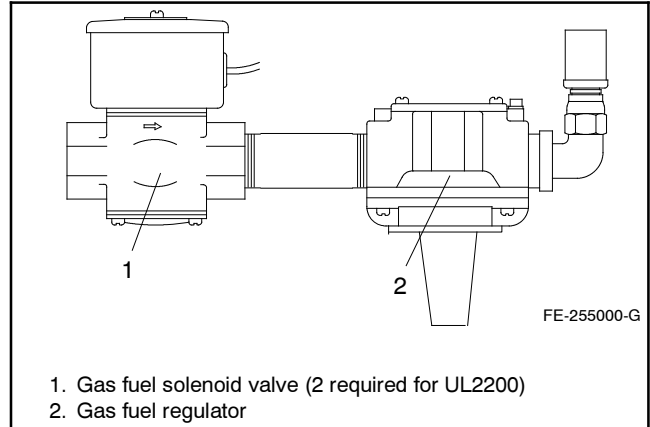


Figure 3-4 Fuel Regulator and Valve

Fuel regulators are compatible with both natural gas and LP gas. See Figure 3-5. Read and follow the instructions found on the hang tag attached to the generator set. If the set operates on LP gas, follow the instructions in the Installation Manual to remove the internal spring from the gas regulator and adjust the fuel mixture. See the List of Related Literature in the Introduction to this manual for the document number.

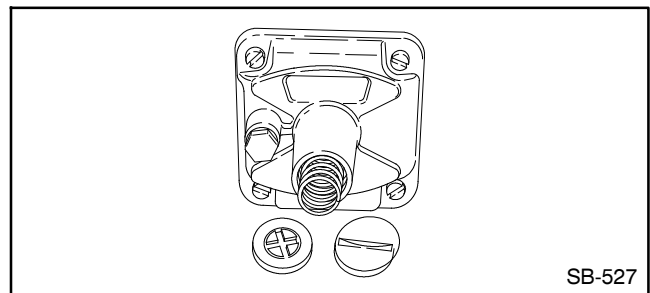


Figure 3-5 Gas Fuel Regulator

3.6 Air Cleaner

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

Air Cleaner Service Procedure

A dry-type air cleaner silences and filters the intake air. The air intake silencer assembly connects to the intake manifold via a flexible hose. Refer to Figure 3-6 during this procedure.

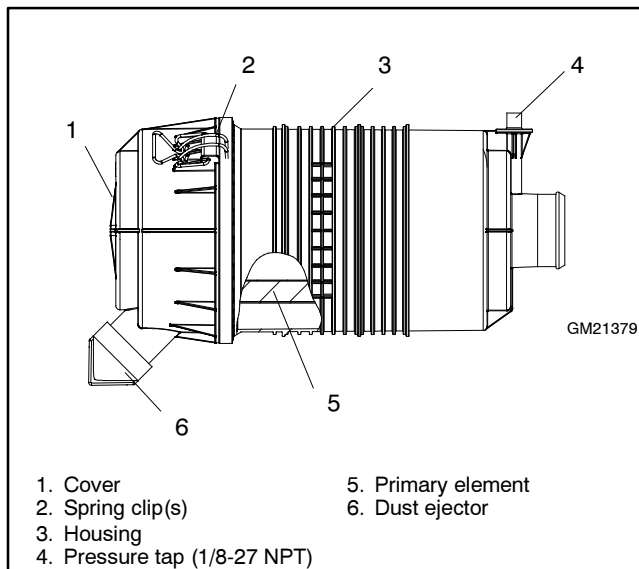
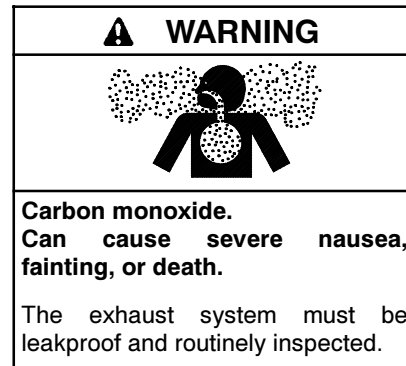


Figure 3-6 Air Cleaner

1. Release the spring clips to open the housing and remove the air silencer element.
2. Tap the element lightly against a flat surface to dislodge loose surface dirt. Do not clean the element in any liquid or use compressed air as these will damage the filter element.
3. Examine the element and housing for damage. Replace the element or housing if necessary.
4. Wipe the cover and housing with a clean rag to remove dirt. Make sure the sealing surfaces fit correctly and reattach the spring clips.

3.7 Exhaust System



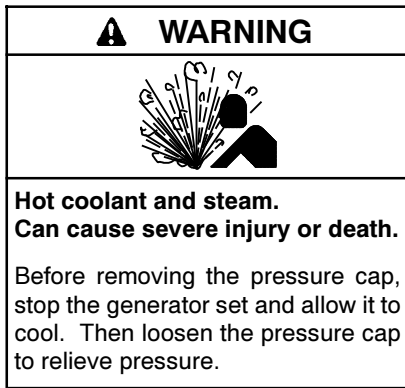
Carbon monoxide detectors. Carbon monoxide can cause severe nausea, fainting, or death. Install carbon monoxide detectors on each level of the building. Locate the detectors to adequately warn the building's occupants of the presence of carbon monoxide. Keep the detectors operational at all times. Periodically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

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

Exhaust System Inspection Points

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

3.8 Cooling System



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 and Filling Coolant

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

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

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

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.

When checking the coolant level, also check the rubber seal of the radiator's pressure cap and replace a cracked or deteriorated cap. The pressure cap raises the boiling point of the coolant, enabling higher operating temperatures. If the cap leaks, replace it with the same rating type of cap. Find the pressure cap rating in Figure 3-7. Remove dirt and other debris from the pressure cap and filler neck.

Item	Rating
Pressure cap	97 kPa (14 psi)
Thermostat	91°C (195°F)

Figure 3-7 Pressure Cap and Thermostat Rating

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.

3.8.2 Draining Cooling System

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

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 Cooling System

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

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

2. Fill the radiator with the recommended coolant mixture of 50% ethylene glycol and 50% clean, softened water to inhibit rust/corrosion and prevent freezing. The coolant capacity is shown in Figure 3-8.

Model	Coolant Capacity, L (Qt.)
15RES	11.5 L (3.0 qt.)
30RES	11.5 L (3.0 qt.)

Figure 3-8 Coolant Capacity

3. Operate the engine with the radiator cap removed until the thermostat opens and the upper radiator hose becomes hot.
4. Stop the engine and allow it to cool.

5. Add coolant to the radiator to just below the overflow tube on the filler neck. See Section 1, Service Views, for the overflow tube location.
6. Replace the radiator's pressure cap.
7. Maintain the coolant level in the coolant overflow bottle between the High and Low markings. See Section 1, Service Views, for the coolant overflow bottle location.

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. Find the pressure cap rating in Figure 3-7.

3.9 Battery

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

⚠ WARNING



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

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

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

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

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

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

3.10 Ignition System

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

Spark Plug Service Procedure

1. Place the generator set master switch in the OFF position.
2. Disconnect the power to the battery charger, if equipped.

3. Disconnect the generator set engine starting battery, negative (-) lead first.
4. Remove spark plug wires by grasping the spark plug boot and turning slightly while pulling. Do not pull the wire. Pulling on the wire rather than the boot may damage the wire or terminal.
5. Loosen the spark plug with a ratchet and 5/8-in. spark plug socket with a rubber insert to prevent spark plug damage.
6. Use compressed air to remove dirt from around each spark plug to prevent dirt particles from falling into the combustion chamber.
7. Remove spark plugs, one at a time, and examine. Identify a normal spark plug in good operating condition by observing a light tan or gray deposit on firing tip. See Figure 3-9 to evaluate engine condition by color/condition of a problem spark plug.

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

Figure 3-9 Engine Evaluation Using Spark Plug Condition

8. Clean spark plugs by wiping them with a rag. File the center electrode to keep it parallel to the side electrode.

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

9. Check the spark plug gap before installing any spark plug. See Figure 3-10. Attain a correct gap when the feeler (or wire) passes between the spark plug electrode. It should pass easily but with some resistance or drag; otherwise adjust as necessary. The correct gap is 0.8-0.9 mm (0.031-0.035 in.).

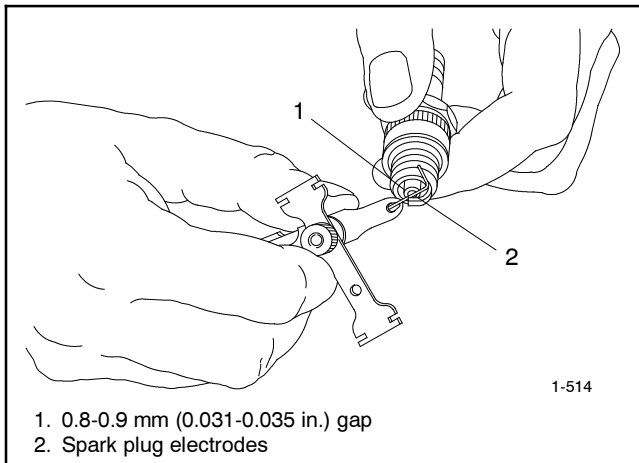


Figure 3-10 Spark Plug Gap Inspection

10. Use a gapping tool to gently bend the side electrode closer to or farther from the center electrode to set the correct gap. See Figure 3-11. Position the side electrode directly over the center electrode.

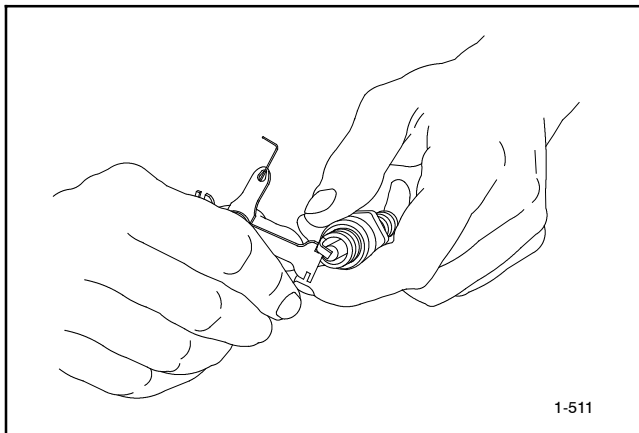


Figure 3-11 Spark Plug Gap Adjustment

11. Reinstall the spark plug. Do not bump the electrode against the cylinder head. Rotate the spark plug clockwise until you feel resistance.
12. Use a torque wrench to torque each spark plug to 25 Nm (18 ft. lbs.). Otherwise, hand-tighten the spark plug until you feel resistance.
13. Use a ratchet wrench to final tighten an additional 1/4 turn. Do not overtighten, as doing so may strip the threads or alter the electrode gap setting.
14. Check the spark plug wire connector in the boot for accumulated dirt, grease, and other debris, and clean as necessary.
15. Firmly push the spark plug boot onto the spark plug.
16. Check that the generator set master switch is in the OFF position.
17. Reconnect the generator set engine starting battery, negative (-) lead last.
18. Reconnect the power to the battery charger, if equipped.

3.11 Belt Check

Check the belt tension at the intervals specified in the service schedule. If the tension is not within specification, adjust as necessary using the following procedure. See Figure 3-12.

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.

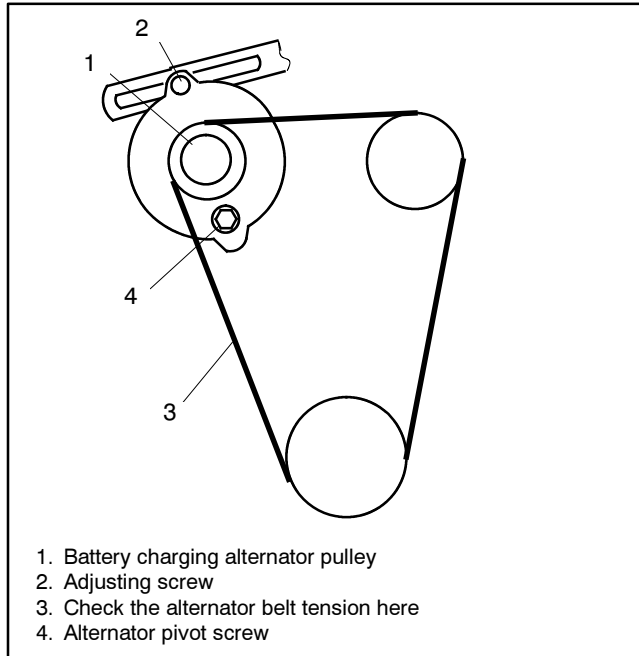


Figure 3-12 Belt Tension

Belt Tensioning Procedure

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

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

3.12 Storage Procedure

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

1. Start and run the generator set until it reaches operating temperature or about 15 minutes.
2. Stop the generator set.
3. Change the oil and oil filter; see Section 3.4.5, Oil and Filter Change.
4. Drain the fuel completely from the fuel tank to prevent accumulated moisture from mixing with the fuel.
5. Check the engine coolant protection; see Section 3.8.

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

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

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

Section 4 Troubleshooting

4.1 Introduction

Use the troubleshooting charts in this section to diagnose and correct common problems. First check for simple causes such as a dead engine starting battery, loose connections, or an open circuit breaker. The charts include a list of common problems, possible causes of the problem, and recommended corrective actions.

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

4.2 Fault Codes

The Advanced Digital Control displays fault codes to aid in troubleshooting. Fault codes, descriptions, and recommended checks are listed in Figure 2-4.

Identify and correct the cause of the fault condition. Then reset the controller after a fault shutdown. See Section 2.4.5.

4.3 Circuit Protection

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

4.3.1 Line Circuit Breaker

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

4.3.2 Fuses

Three 10-amp fuses are located on the junction box near the circuit breaker panel. Four additional fuses are located inside the junction box. See the service views in Section 1 for the fuse locations and Figure 4-1 for replacement fuse part numbers.

Always identify and correct the cause of a blown fuse before restarting the generator set. Refer to Figure 4-2, Troubleshooting Chart, for conditions that may indicate a blown fuse. Obtain service from an authorized Kohler distributor/dealer.

F1 Auxiliary Winding Fuse. A replaceable 10-amp fuse protects the alternator.

F2 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.

F3 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.

F4-F7 Engine Fuses. See Figure 4-1 and the Generator Set Wiring Diagram Manual, TP-6437.

Fuse	Description	Part Number
F1	10 Amp Auxiliary Winding	358337
F2	10 Amp Relay Interface Board	223316
F3	10 Amp Controller	223316
F4	15 Amp Battery Charging Alternator	283645
F5	Not used	—
F6	20 Amp Main Power Relay	GM39266
F7	5 Amp ECM Power, Switched	239298

Figure 4-1 Fuses

4.4 Generator Set Troubleshooting

Figure 4-2 contains generator set troubleshooting, diagnostic, and repair information. Check for loose connections before replacing parts.

Problem	Possible Cause	Corrective Action
The generator set does not crank.	Battery weak or dead.	Recharge or replace the battery.
	Battery connections reversed or poor.	Check the connections.
	Controller fuse (F3) blown.	Replace the fuse. Contact an authorized Kohler distributor/dealer for service if fuse blows repeatedly.
	Relay interface board fuse (F2) blown.	
	Engine fuses F4 or F6 blown.	Move the master switch to the RUN position.
Generator set master switch in the OFF position.		
The generator set cranks but does not start, starts hard, lacks power, or operates erratically.	Air cleaner clogged.	Clean and/or replace the air cleaner.
	Battery weak or dead.	Recharge or replace the battery.
	Battery connection poor.	Clean and tighten the battery connections.
	Spark plug wire connection loose.	Check the spark plug wires.
	Low oil pressure shutdown.	Check the oil level.
	Fuel pressure insufficient.	Check the fuel supply and valves.
	Engine fuse F4, F6, or F7 blown.	Replace the fuse. If the fuse blows again, contact an authorized Kohler distributor/dealer.
	Engine malfunction.	Contact an authorized Kohler distributor/dealer.
No AC output.	AC circuit breaker in the OFF position.	Place the circuit breaker in the ON position.
	AC circuit breaker tripping because of overload.	Reduce the load on the generator set.
	AC circuit breaker tripping because of short circuit.	Contact an authorized Kohler distributor/dealer for service.
	Auxiliary winding fuse (F1) blown.	Replace the fuse. Contact an authorized Kohler distributor/dealer for service if fuse blows repeatedly.
	Engine fuses F6 or F7 blown.	
Low output or excessive drop in voltage.	Generator set overloaded.	Reduce the load.
Generator set stops suddenly.	Low oil pressure shutdown.	Check the oil level. Check for oil leaks.
	Out of fuel.	Check fuel supply.
	Overcrank shutdown.	Reset the controller. If the overcrank fault occurs again, contact an authorized Kohler distributor/dealer.
	Controller fuse (F3) blown.	Replace the fuse. If the fuse blows again, contact an authorized Kohler distributor/dealer.
	Engine fuse F6 or F7 blown.	
	Auxiliary winding fuse (F1) blown.	Replace the fuse. Contact an authorized Kohler distributor/dealer for service if fuse blows repeatedly.
	Overspeed shutdown.	Reset the controller. If the overspeed fault occurs again, contact an authorized Kohler distributor/dealer.
	Generator set master switch in the OFF/RESET position.	Move the switch to the correct position (RUN or AUTO).
	Remote stop command received from a remote switch, remote digital gauge, or ATS.	Check the remote switch position.
Engine malfunction.	Contact an authorized Kohler distributor/dealer.	

Figure 4-2 General Troubleshooting Chart

4.5 Controller Troubleshooting

Figure 4-3 contains troubleshooting information for the Advanced Digital Control.

Problem	Possible Cause	Corrective Action
Controller LED display is off.	No power to the controller: Controller powers down if the generator set has not run for 48 hours or longer. 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. See Figure 4-1. If the fuse blows again, contact an authorized Kohler distributor/dealer. Check connections. Check generator set battery. See Figure 4-2.
	Generator set master switch is in the OFF/RESET position.	Move generator set master switch to the AUTO or RUN position.

Figure 4-3 ADC 2100 Troubleshooting Chart

Notes

Appendix A Abbreviations

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

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

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

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