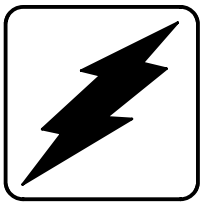
Operation

Commercial Generator Sets



Models:

15RYG
30RYG

Controller:
Advanced Digital Control (ADC 2100)

ISO 9001
KOHLER POWER SYSTEMS
NATIONALLY REGISTERED

KOHLER®
POWER SYSTEMS

TP-6197 3/06c

California Proposition 65

⚠ WARNING

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

Product Identification Information

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

Generator Set Identification Numbers

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

Model Designation _____

Specification Number _____

Serial Number _____

Accessory Number	Accessory Description

Controller Identification

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

Controller Description _____

Engine Identification

Record the product identification information from the engine nameplate.

Manufacturer _____

Model Designation _____

Serial Number _____

Table of Contents

Notes

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***.

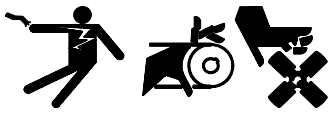
NOTICE

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.

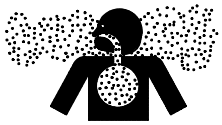
Servicing the fuel system. A flash fire can cause severe injury or death. Do not smoke or permit flames or sparks near the carburetor, fuel line, fuel filter, fuel pump, or other potential sources of spilled fuels or fuel vapors. Catch fuels in an approved container when removing the fuel line or carburetor.

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:

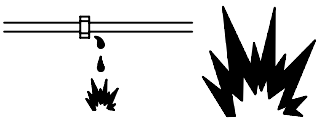
- Light-headedness, dizziness
- Physical fatigue, weakness in joints and muscles
- Sleepiness, mental fatigue, inability to concentrate or speak clearly, blurred vision
- Stomachache, vomiting, nausea

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

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

This generator set has been rewired from its nameplate voltage to

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

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

NOTICE

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

Notes

This manual provides operation instructions for model 15/30RYG commercial generator sets.

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 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 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, 15/30RYG	TP-6329
Wiring Diagram Manual	TP-6437
Operation Manual Supplement (Engine)	TP-6101
Parts Catalog*	TP-6319
Service Manual (Engine)	TP-6327
Service Manual (Generatot Set)	TP-6198
* 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 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
93200 Saint Denis
France
Phone: (33) 1 49 178300
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Power Systems Asia Pacific Regional Office
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Phone: (65) 6264-6422
Fax: (65) 6264-6455

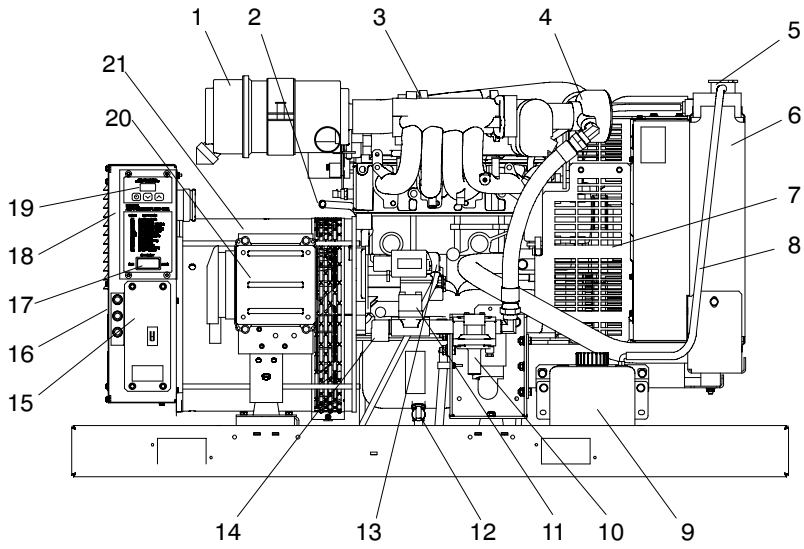
China
North China Regional Office, Beijing
Phone: (86) 10 6518 7950
(86) 10 6518 7951
(86) 10 6518 7952
Fax: (86) 10 6518 7955

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



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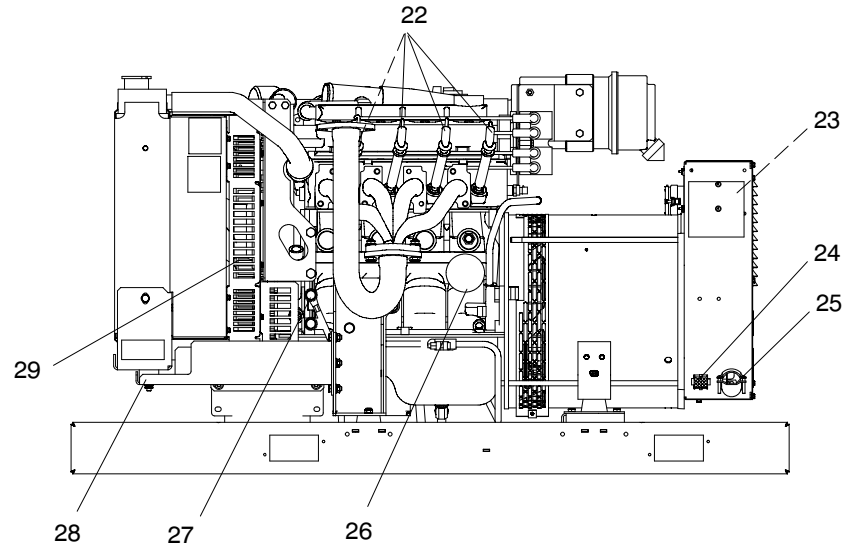
SERVICE-SIDE VIEW



GM39949D-G

NONSERVICE-SIDE VIEW

1. Air cleaner
2. Oil check
3. Oil fill (on valve cover)
4. Fuel/air mixer
5. Pressure cap (Engine water fill)
6. Radiator
7. Belt guard
8. Coolant overflow tube
9. Coolant overflow bottle (daily coolant check/fill location)
10. Secondary fuel regulator
11. Fuel solenoid valve (UL-listed models have 2 valves)
12. Oil drain valve
13. Positive (+) battery connection point
14. Fuel inlet
15. AC circuit breaker panel
16. Fuses F1-F3
17. Generator set master switch
18. Advanced Digital Control, ADC 2100
19. Runtime hour display
20. Engine control module (ECM)
21. Nameplate
22. Spark plugs
23. Fuses F4-F7 (inside junction box)
24. Remote customer interface connector
25. Customer load lead access
26. Lube oil filter
27. Negative (-) battery connection point
28. Coolant drain
29. Cooling air inlet

Figure 1-1 Service Views

Notes

2.1 Prestart Checklist

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

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

Air Inlets. Check for clean and unobstructed air inlets.

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 line, exhaust clamps, and silencer).

- 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.

Carbon Monoxide Detectors. Check the installation and operation of carbon monoxide (CO) detectors.

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 Generator Set

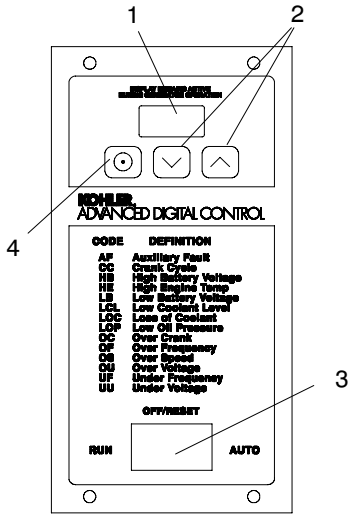
Operate the generator set under load once each week for 20 minutes.

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.

2.3 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 Kohler distributor/dealer. The setup and adjustments are password protected.



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

Figure 2-1 ADC 2100 Control

2.3.1 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. If the factory-installed continuous power mode jumper has been disconnected, the LED display turns off 48 hours after the generator set shutdown. See Section 2.3.6.

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.

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 2.3.4.
	Software version	See TP-6329, Generator Set Installation Manual.
Keypad	Select and arrow buttons	The keypad is used for controller setup and adjustment only. Have setup and adjustments performed only by an authorized distributor/dealer. The setup and adjustment functions are password-protected.
Generator set master switch	Three-position switch	Switch functions as the generator set operation and controller reset switch.

Figure 2-2 ADC 2100 Controls and Indicators

2.3.2 Starting Generator Set

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

Local Starting.

Move the generator set master switch to the RUN position. The ADC 2100 attempts to start the generator set in three crank cycles (crank cycle time is pre-programmed). If the generator set does not start in three attempts, the system shuts down on an overcrank fault.

Auto (Automatic) Starting.

Move the generator set master switch to the AUTO position to allow startup by an automatic transfer switch (ATS), remote start/stop switch or remote digital gauge. A remote start/stop switch or digital gauge can be connected to the customer interface connection (P21 connector, leads 3 and 4). The generator set crank cycle starts when the remote switch or engine start contacts on the ATS contacts close.

The ADC 2100 attempts to start the generator set in three crank cycles (crank cycle time is preprogrammed). If the generator set does not start in three attempts, the system shuts down on an overcrank fault.

2.3.3 Stopping Generator Set

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

Local Stopping

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

Auto (Automatic) Stopping

With the generator set master switch in the AUTO position, open the remote start/stop switch contacts or engine start contacts on the ATS to signal the generator set to stop.

2.3.4 Fault Warnings and Shutdowns

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 generator set shuts down automatically under the conditions listed in Figure 2-4 and the controller displays a fault code. The generator set cannot be restarted until the fault condition is corrected and the controller is reset. See Section 2.3.5 to reset the controller after a fault shutdown. The controller resets automatically after a battery voltage fault condition is corrected.

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

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). **Note:** The low oil pressure shutdown does not protect against low oil level. Check the oil level at the engine.	Check for leaks in the lubrication system. Check the oil level and add oil if the level is low.
OC	Overcrank shutdown	Shutdown occurs after 3 unsuccessful starting attempts. The crank cycle is set for three starting attempts 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 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 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.
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

2.3.5 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. See the safety precautions at the beginning of this manual before proceeding. Refer to Section 4, Troubleshooting.

4. Start the generator set by moving the generator set master switch to RUN. Test operate the generator set to verify that the cause of the shutdown has been corrected.

5. Shut the generator off by moving the generator set master switch to the OFF/RESET position.

6. Reconnect the generator set to the load using the line circuit breaker or ATS.

7. Move the generator set master switch to the AUTO position for startup by remote transfer switch, remote start/stop switch, or remote digital gauge.

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.

2.3.6 Controller Power Down

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

When the generator set master switch is in the AUTO position, the controller automatically powers down 48 hours after the generator set stops if not configured for CANbus communication with a remote gauge. 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.

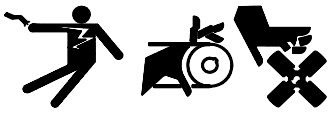
If the ADC 2100 is configured for CANbus communication (e.g. for the remote digital gauge, see the Installation Manual for controller configuration information), the controller will **not** power down when in AUTO. Remote communications require an active (powered-up) controller.

Note: The ADC 2100 draws 250 mA when the master switch is in the AUTO position and the unit is configured for CANbus communication. Exercise the generator set regularly as recommended in Section 2.2 and use a battery charger to maintain the engine starting battery.

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.

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 distributor/dealer perform generator set service.

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

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

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

Routine Maintenance. Refer to the following generator set service schedule, the engine service schedule, and the runtime hours shown on the ADC2100 to determine when to schedule routine maintenance. Service 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)	2.1	X				
Check the solenoid valve operation *			X			
Check the fuel lines and replace as necessary *					X	
Lubrication System						
Check the crankcase oil level and add oil as necessary	3.4.2	X 8 hr.				
Replace the oil in the crankcase	3.4.4			X 200 hr.		
Replace the lube oil filter element	3.4.5			X 200 hr.		
Cooling System						
Check the coolant level and fill as necessary	3.8.1	X				
Inspect the radiator and hoses		X				
Check the belt tension and condition *	3.11			X		
Check the coolant protection and tighten hose clamps *	3.8.1					X
Flush the cooling system *	3.8.4					X 800 hr.
Ignition System						
Clean and regap the spark plugs	3.9				X	
Replace the spark plugs	3.9					X 800 hr.
Intake/Exhaust System						
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				
Inspect and clean the air cleaner element	3.6			X		
Replace the air cleaner element	3.6				X	
Inspect the complete exhaust system ‡	3.7					X
Electrical System						
Keep the battery charged and in good condition §	3.10	X				
Check and tighten electrical connections			X			
Clean the battery cables as required *		X				
Engine and Mounting						
Check for fuel, coolant, and oil leakage *†		X				
Retighten all nuts and bolts as required		X				
Check tightness of mounting bolts/vibromounts				X		
Remote Control System						
Check the remote control operation			X			X
Generator						
Test run the generator set	2.2		X			
Blow dust out of the generator *	3.1					X
Clean collector ring and inspect brushes *						X 1000 hr.

* Consult your local distributor/dealer for service
† Read WARNING found at the beginning of manual regarding moving parts
‡ Should be performed by your local distributor/dealer.
§ Consult battery manufacturer's instructions.

3.3 Maintenance and Service Parts

Figure 3-1 identifies maintenance and service parts for your generator set. See Section 4.3 for fuse part numbers. Obtain a complete list of maintenance and service parts from your authorized generator distributor/dealer.

Part Description	Part Number
Maintenance Kit (includes air cleaner element, belt, and oil filter):	
15RYG	GM35030-KP1
30RYG	GM35030-KP2
Air Cleaner Element	GM16944
Belt	
15RYG	GM28353
30RYG	GM28352
Oil Filter	GM28351
Spark Plug	GM35826

Figure 3-1 Maintenance and Service Parts

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 3-2 shows the recommended Society of Automotive Engineers (SAE) viscosity designation for a given operating temperature.

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

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. 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 3-3. See Section 1, Service Views for the dipstick location.

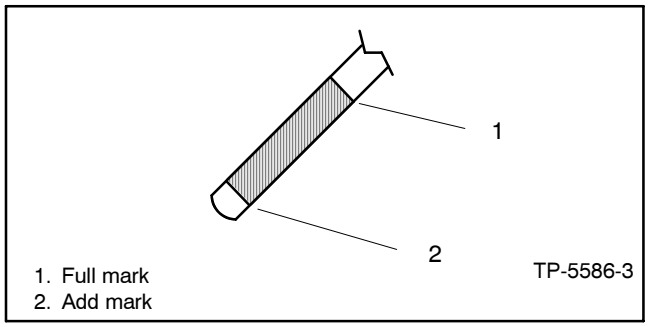
Note: Do not operate the set if the oil level is below the Add mark on the dipstick or above the Full mark on the dipstick.

3.4.3 Oil Additions

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

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

Figure 3-2 Engine Oil Selection



1. Full mark
2. Add mark

Figure 3-3 Oil Level Check

3.4.4 Oil Change

Change the oil according to the service schedule or before generator set storage. Change the oil more frequently if the generator set operates under dirty, dusty conditions. Change the oil while the engine is still warm. See Figure 3-4 for oil capacity. See Section 1, Service Views, for oil fill, oil check, and oil filter locations.

Oil Change Procedure

1. Stop the generator set.
2. To drain the oil, open the oil-drain valve. See Section 1 for the valve location.
3. Drain the oil into a suitable container.
4. Allow ample time for all oil to drain.
5. Close the oil-drain valve.
6. Remove the oil-fill cap.
7. Replace the engine oil filter according to the service schedule and the procedure in Section 3.4.5.
8. Fill crankcase with oil. Section 1 shows the oil fill location. See Figure 3-2 for oil selection and Figure 3-4 for oil capacity. Replace the oil-fill cap.
9. Start the generator set and check for oil leaks.

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

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

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

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

Figure 3-4 Oil Capacity (with Filter)

3.4.5 Oil Filter Change

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

Oil Filter Change Procedure

1. Loosen the oil filter by turning it counterclockwise. Remove the oil filter and use rags to clean up spilled oil. Dispose of the oil filter in an approved manner.

2. Clean the contact surface of the oil filter adapter.

3. Lightly lubricate the gasket surface of the new filter with fresh engine oil. Thread the filter on the adapter until the gasket makes contact and hand-tighten the filter an additional one-half turn. Wash hands after any contact with engine oil.

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

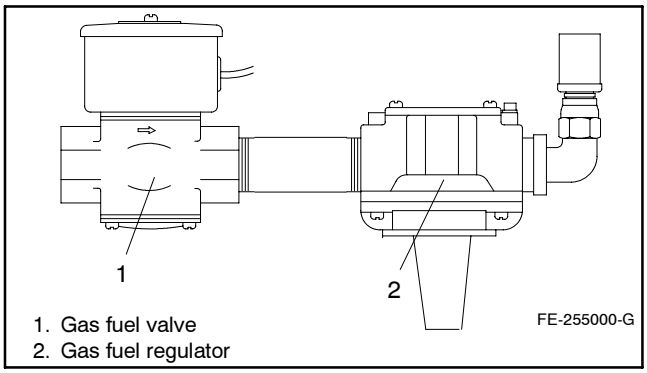
4. Start the generator set and check for oil leaks.

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

3.5 Gaseous Fuel System

The gaseous fuel system utilizes a fuel valve (with solenoid) to control the fuel flow to the fuel regulator. The generator-mounted regulator reduces fuel pressure as fuel passes to the mixer. See Figure 3-5. 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.

Fuel regulators are compatible with both natural gas and LP gas. See Figure 3-6. 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.



1. Gas fuel valve
2. Gas fuel regulator

Figure 3-5 Fuel Regulator and Valve

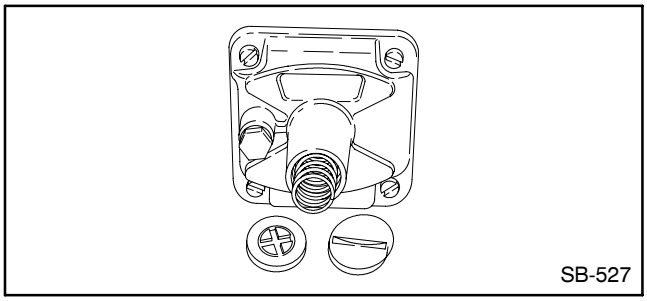


Figure 3-6 Gas Fuel Regulator

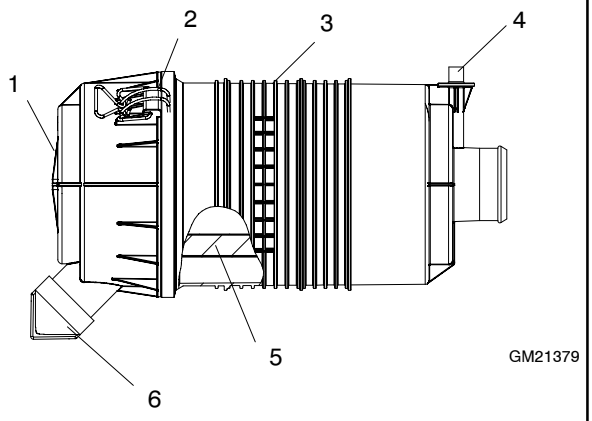
3.6 Air Cleaner

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 3-7 during this procedure.

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

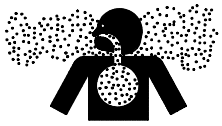


1. Cover
2. Spring clip(s)
3. Housing
4. Pressure tap (1/8-27 NPT)
5. Primary element
6. Dust ejector

Figure 3-7 Air Cleaner

3.7 Exhaust System

⚠ WARNING



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

The exhaust system must be leakproof and routinely inspected.

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 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.
- Check the installation and operation of carbon monoxide (CO) detectors.

3.8 Cooling System

⚠ WARNING

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

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

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.

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 3-9. Remove dirt and other debris from the pressure cap and filler neck.

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: 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 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. See Figure 3-8 for coolant capacity

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

3. Replace the radiator's pressure cap.

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

5. Stop the engine and allow it to cool.

Model	L (Qt.)
All models	11.5 (3.0)

Figure 3-8 Coolant Capacity

6. Remove the radiator's pressure cap.

7. 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.

8. Replace the radiator's pressure cap.

9. 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 utilize a pressure cap to raise the boiling point of the coolant, enabling higher operating temperatures. If the cap leaks, replace it with a cap of the same rating. Find the pressure cap rating in Figure 3-9.

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

Figure 3-9 Pressure Cap and Thermostat Rating

3.9 Ignition System

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

Spark Plug Service Procedure

1. Remove spark plug wires by grasping the spark plug boot and turning slightly while pulling. Do not pull the wire. Pulling on the wire rather than the boot may damage the wire or terminal.

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

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

4. Remove spark plugs, one at a time, and examine. Identify a normal spark plug in good operating condition by observing a light tan or gray deposit on the firing tip. See Figure 3-10 to evaluate engine condition by color/condition of a problem spark plug.

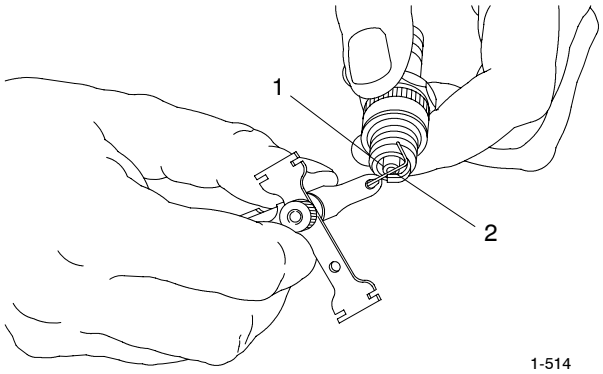
Problem/Condition	Means of Identification	Possible Cause/Solution
Gap-bridged spark plug	Built-up deposits and gap between electrodes closing.	Oil or carbon fouling. Clean and regap the spark plug.
Oil-fouled spark plug	Wet, black deposits on the insulator shell, bore, and electrodes.	Excessive oil entering 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.
Preignition damaged spark plug	Melted electrodes and possibly blistered insulator. Metallic deposits on insulator suggest internal engine damage.	Wrong type of fuel, incorrect timing or advance, too hot a plug, burned valves, or engine overheating. Replace the spark plug.
Overheated spark plug	White or light gray insulator with small black or gray/brown spots with bluish (burned) appearance on electrodes.	Engine overheating, wrong type of fuel, loose spark plugs, too hot a plug, low fuel 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 3-10 Engine Evaluation Using Spark Plug Condition

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

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

6. Check the spark plug gap before installing any spark plug. See Figure 3-11. Attain a correct gap when the feeler (or wire) passes between the spark plug electrode. It should pass easily but with some resistance or drag; otherwise adjust as necessary. The correct gap is 0.8-0.9 mm (0.031-0.035 in.).



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

Figure 3-11 Spark Plug Gap Inspection

7. Use a gapping tool to gently bend side electrode closer to or farther from the center electrode to set the correct gap. See Figure 3-12. Position the side electrode directly over the center electrode.

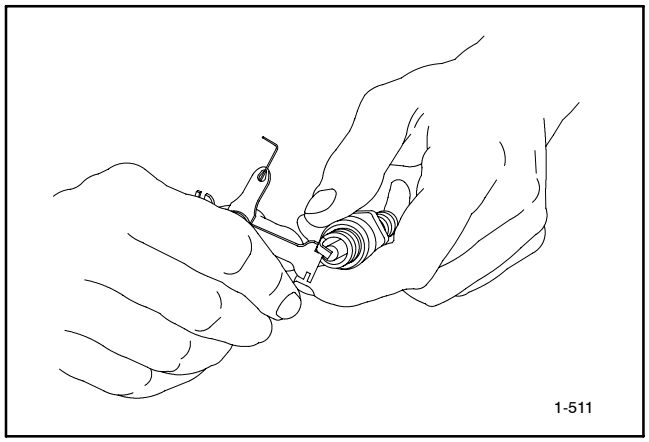


Figure 3-12 Spark Plug Gap Adjustment

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

9. 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.

10. 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.

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

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

3.10 Battery

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

⚠ WARNING

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

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

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

Battery 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.

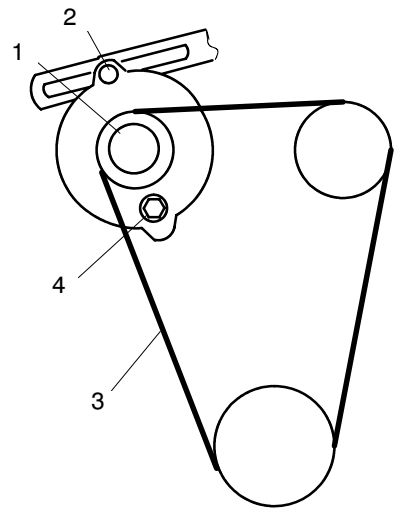
Battery gases. Explosion can cause severe injury or death. Battery gases can cause an explosion. Do not smoke or permit flames or sparks to occur near a battery at any time, particularly when it is charging. Do not dispose of a battery in a fire. To prevent burns and sparks that could cause an explosion,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

3.11 Belt Check

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

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



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

Figure 3-13 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 3.4.4—Oil Change and Section 3.4.5—Oil Filter Change.
4. Drain the fuel completely from the fuel tank to prevent accumulated moisture from mixing with the fuel.
5. Check the engine coolant protection; see Section 3.8.

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

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

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

4.1 Introduction

Use the following charts 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 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 the equipment.

4.2 Generator Set Troubleshooting

Figure 4-1 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 distributor/dealer for service if fuse blows repeatedly.
	Relay interface board fuse (F2) blown	Replace the fuse. Contact an authorized distributor/dealer for service if fuse blows repeatedly.
	Generator set master switch in the OFF position	Move the master switch to the RUN 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 malfunction	Contact the 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 distributor/dealer for service.
	Auxiliary winding fuse (F1) blown	Replace the fuse. Contact an authorized distributor/dealer for service if fuse blows repeatedly.
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.
	Out of fuel	Check fuel supply.
	Overcrank shutdown	Reset the controller. If the overcrank fault occurs again, contact the distributor/dealer.
	Controller fuse (F3) blown	Replace the fuse. If the fuse blows again, contact the distributor/dealer.
	Overspeed shutdown	Reset the controller. If the overspeed fault occurs again, contact the 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 the distributor/dealer.
	Auxiliary winding fuse (F1) blown	Replace the fuse. Contact an authorized distributor/dealer for service if fuse blows repeatedly.

Figure 4-1 General Troubleshooting Chart

4.3 Circuit Protection

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

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

The engine harness contains three 10-amp inline fuses. Four additional fuses are located inside the junction box. See the service views in Section 1 for the fuse locations and Figure 4-2 for replacement fuse part numbers.

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.

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 4-2 and the wiring diagrams.

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 *	N/A *	N/A *
F6	20 Amp Main Power Relay	GM39266
F7	5 Amp ECM Power, Switched	239298

* The F5 fuse is not used on the models covered by this document.

Figure 4-2 Fuses

4.4 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 2.3.5.

4.5 Troubleshooting

Figure 4-3 contains troubleshooting, diagnostic, and repair information for the Advanced Digital Control.

Problem	Possible Cause	Corrective Action
Controller LED display is off	No power to the controller:	
	Continuous power mode jumper is disconnected and the generator set has not run for 48 hours or longer.	Controller display will automatically activate when a remote start command is received or the generator set master switch is moved to the RUN position. See Section 2.3.6. Connect the jumper to maintain continuous power to the controller, if desired.
	Controller fuse (F3) is blown.	Replace the fuse. If the fuse blows again, contact the distributor/dealer.
	Low or no battery voltage.	Check connections. Check generator set battery. See Figure 4-1.
	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

Appendix A Abbreviations

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

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

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

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