Installation

Residential/Commercial Generator Sets



Models:

14/20RESA 14/20RESAL

> Controllers: RDC2 DC2



KOHLER.
Power Systems _____

TP-6803 1/15j

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

Generator Set Identification Numbers	Engine Identification				
Record the product identification numbers from the generator set nameplate(s).	Record the product identification information from the engine nameplate.				
Model Designation	Manufacturer				
Specification Number	Model Designation				
Serial Number	Serial Number				
Accessory Number	Controller Identification				
	Record the controller description from the generator set operation manual, spec sheet, or sales invoice.				
	Controller Description				

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

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



DANGER

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



WARNING

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



CAUTION

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

NOTICE

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

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

Accidental Starting

A

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 Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

Battery



WARNING



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

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

WARNING



Explosion.

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

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

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

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

Battery gases. Explosion can cause severe injury or death. Battery gases can cause an explosion. Do not smoke or permit flames or sparks to occur near a battery at any time, particularly when it is charging. Do not dispose of a battery in a fire. To prevent burns and sparks that could cause an explosion, avoid touching the battery terminals with tools or other metal objects. Remove all iewelry 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 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. 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



Fire.
Can cause severe injury or death.

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

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

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.

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 electrical fires or BC for recommended by the local fire code or an authorized agency. Train all personnel on fire extinguisher operation and fire prevention procedures.

Exhaust System



Carbon monoxide.

Can cause severe nausea, fainting, or death.

The exhaust system must be leakproof and routinely inspected.

Generator set operation. Carbon monoxide can cause severe nausea, fainting, or death. Carbon monoxide is an odorless, colorless, tasteless, nonirritating gas that can cause death if inhaled for even a short time. Avoid breathing exhaust fumes when working on or near the generator set. Never operate the generator set inside a building. Never operate the generator set where exhaust gas could seep inside or be drawn into a potentially occupied building through windows, air intake vents, or other openings.

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

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

- Light-headedness, dizziness
- Physical fatigue, weakness in joints and muscles
- Sleepiness, mental fatigue, inability to concentrate or speak clearly, blurred vision
- Stomachache, vomiting, nausea If experiencing any of these symptoms and carbon monoxide poisoning is possible, seek fresh air immediately and remain active. Do not sit, lie down, or fall asleep. Alert others to the possibility of carbon monoxide poisoning. Seek medical attention if the condition of affected persons does not improve within minutes of breathing fresh air.

Fuel System



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 Gas fuel leaks. vapors can cause severe injury or death. Fuel leakage can cause an explosion. Check the LPG vapor or natural gas fuel system for leakage by using a soap and water solution with the fuel system test pressurized to 6-8 ounces per square (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.

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

Propane (LPG)—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.

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



Hazardous voltage. Will cause severe injury or death.

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

▲ 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.

Welding on the generator set. Can cause severe electrical equipment Before welding on the damage. 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 batteryalternator connections. (5) Attach the weld ground connection close to the weld location.

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.

Electrical backfeed to the utility. Hazardous backfeed voltage can cause severe injury or death. Install a transfer switch in standby power installations to prevent the connection of standby and other sources of power. Electrical backfeed into a utility electrical system can cause severe injury or death to utility personnel working on power lines.

Heavy Equipment



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



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 engine heater. Hot parts can cause minor personal injury or property damage. Install the heater before connecting it to power. Operating the heater before installation can cause burns and component damage. Disconnect power to the heater and allow it to cool before servicing the heater or nearby parts.

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.

This manual provides installation instructions for Residential/Commercial Model generator sets. See Figure 1. Refer to TP-6804, Operation Manual, for generator set operation and maintenance instructions.

The generator set is approved for use in stationary applications in locations served by a reliable utility power source.

Have a Kohler® authorized distributor/dealer install the generator set outdoors according to the instructions in this manual. The generator set installation must comply with the National Electrical Code (NEC) and local code requirements. Do not install this generator set indoors.

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.



Figure 1 14/20RESA/RESAL Generator Set

List of Related Literature

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

Literature Type	Part Number
Operation Manual, 14/20RESA/RESALGenerator Set	TP-6804
Operation/Installation Manual, Model RXT Automatic Transfer Switch	TP-6807
Service Manual, 14/20RESA/RESAL Generator Set	TP-6735
Operation Manual, OnCue Plus	TP-6928
Operation/Installation Manual, Model RDT Transfer Switch	TP-6345
Installation Manual, Model RSB Transfer Switch	TP-6486
Operation Manual, Model RSB Transfer Switch	TP-6487
Installation Instructions, Load Control Module (LCM)	TT-1574
Installation Instructions, Programmable Interface Module (PIM)	TT-1584
Installation Instructions, Concrete Mounting Pads	TT-1619

Figure 2 Related Literature

Startup and Registration

When the generator set is installed, complete the startup and installation checklists supplied with the startup notification form. Complete and sign the startup notification form and register the unit using the Kohler online Warranty Processing System.

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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.

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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

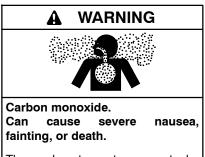
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1.1 Introduction



Hazardous voltage. Will cause severe injury or death.

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



The exhaust system must be leakproof and routinely inspected.

Generator set operation. Carbon monoxide can cause severe nausea, fainting, or death. Carbon monoxide is an odorless, colorless, tasteless, nonirritating gas that can cause death if inhaled for even a short time. Avoid breathing exhaust fumes when working on or near the generator set. Never operate the generator set inside a building. Never operate the generator set where exhaust gas could seep inside or be drawn into a potentially occupied building through windows, air intake vents, or other openings.

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

Have the generator set installed by an authorized Kohler distributor/dealer or authorized representative. For all locations, ensure that the installation complies with applicable national and local codes. In the United States, the installation must comply with the National Electrical Code (NEC) and local codes. For Canadian installations, refer to the Canadian Electrical Code (CEC).

The generator set must be installed outdoors. The exhaust systems on enclosed units are designed for outdoor installation only.

Note: DO NOT install these generator sets inside a building.

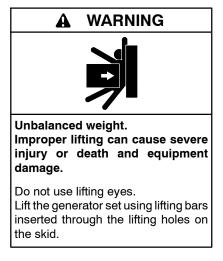
Note: Install carbon monoxide (CO) detector(s) on each level of any building adjacent to a generator set. Locate the detectors to adequately warn the building's occupants of the presence of carbon monoxide.

Obtain a building permit and contact your local utility companies to mark the locations of underground pipes and cables.

Read and follow the safety precautions in this manual and observe the decals on the equipment. Refer to the diagrams and drawings in this manual for dimensions and electrical connections during the installation procedure. Read the entire installation procedure and obtain the accessories and tools needed before beginning installation. Perform the steps in the order shown.

To install optional accessories, follow the instructions provided with each kit.

1.2 Lifting



Model	Weight, kg (lb.)
14RESA/RESAL	191 (420)
20RESA/RESAL	243 (535)

Figure 1-1 Approximate Weights

Approximate generator set weights are shown in Figure 1-1. Use lifting bars inserted through the holes in the skid to lift the unit. See the dimension drawings in Section 2 for lifting hole locations.

1.3 Generator Set Inspection

Complete a thorough inspection of the generator set. Check for the following:

- 1. Inspect the generator set for loose or damaged parts or wires. Repair or tighten any loose parts before installation.
- Check the engine oil. Fill, if necessary, with the recommended viscosity and grade of oil. Use synthetic oil, API (American Petroleum Institute) Service Class SG or higher. See TP-6804, Operation Manual, for additional information.

1.4 Location and Mounting

Install the generator set outdoors near the incoming gas service. The generator set location must allow easy access for maintenance and service. The recommended distance from a structure is dependent on state and local codes. See the dimension drawing in Section 2 for the recommended clearance from structures and non-combustible materials.

Locate the generator set so that the hot exhaust does not blow on plants or other combustible materials. No plants, shrubs, or other combustible materials are allowed within 1.2 m (4 ft.) of the exhaust end of the generator set.

Do not install the generator set where exhaust gas could accumulate and seep inside or be drawn into a potentially occupied building. Furnace and other similar intakes must be at least 3 m (10 ft.) from the exhaust end of the generator set.

Notice

DO NOT locate the generator set near patios, decks, play areas, or animal shelters. 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. 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.

1.4.1 Mounting Area

The generator set is shipped on an engineered composite mounting pad. Prepare a flat, level mounting area covered with a weed barrier and gravel or a concrete mounting pad. Set the composite mounting pad directly on the gravel or concrete.

Do not install the composite mounting pad directly on grass, wood, or other combustible materials. Clear all combustible materials, including plants and shrubs, building materials, and lawn furniture, from an area at least 1.2 m (4 ft.) beyond the exhaust end of the generator set. See the dimension drawing in Section 2.

1.4.2 Concrete Mounting Pads

Kohler Co. offers optional concrete mounting pads that are custom-designed for Model 14RESA/RESAL and 20RESA/RESAL generator sets. Three-inch and four-inch thick pads are available. Four-inch pads are recommended for storm-prone areas. See TT-1619 for instructions to install the mounting pad, if necessary.

1.4.3 Exhaust Requirements

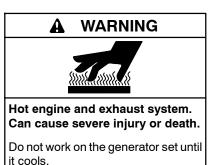


Figure 1-2 gives the exhaust temperature at rated load. The engine exhaust mixes with the generator set cooling air at the exhaust end of the enclosure. Mount the generator set so that the hot exhaust does not blow on plants or other combustible materials. Maintain the clearances shown in the dimension drawing in Section 2.

Exhaust	Temperature, °C (°F)
Exhaust gas exiting the enclosure at rated kW, °C (°F)	260 (500)

Figure 1-2 Exhaust Flow and Temperature

The generator set requires correct air flow for cooling and combustion. The inlet and outlet openings in the sound enclosure provide the cooling and combustion air. Figure 1-3 shows the locations of the cooling air intake and exhaust vents. Inspect the air inlet and outlet openings inside and outside the enclosure to ensure that the air flow is not blocked.

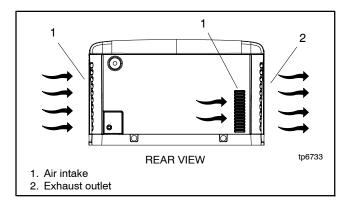


Figure 1-3 Cooling Air Intake and Exhaust

The generator set is designed to operate with all enclosure panels and internal baffling in place. If during installation, maintenance or repair the unit must be operated without the complete enclosure and baffling as shipped from the factory make sure the exhaust panel is removed as well.

1.5 Dimension Drawings

See the dimension drawings in Section 2 for the generator set dimensions, fuel and electric inlet locations, and recommended clearance.

1.6 Access the Air Intake Area

The battery, fuel system, and electrical connections are located in the air intake area. Raise the roof and remove the enclosure panel to access the air intake area during installation as described below.

- Remove two screws from the top of the air intake panel. Pull the the panel up and off. See Figure 1-4.
- 2. To make the electrical connections, you will also need to remove the cover panel over the terminal block as shown in Section 1.9.3.
- Reinstall the panels after all electrical connections are complete and the battery is installed and connected.



Figure 1-4 Removing the Air Intake Panel

1.7 Fuel Requirements

The generator set operates using natural gas or LPG fuel. The generator set is EPA-certified for both natural gas and LPG fuels.

The fuel system installation must comply with the NEC and local codes.



Explosive fuel vapors.
Can cause severe injury or death.

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

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

Propane (LPG)—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.

1.7.1 Fuel Supply

Because of variable climates and geographical considerations, contact the local fuel supplier for fuel system planning and installation. Figure 1-5 lists the recommended fuel ratings and other fuel supply information for natural gas and LPG fuels.

Verify that the output pressure from the primary gas utility pressure regulator is within the range shown in Figure 1-5 and that the utility gas meter flow rate is sufficient to supply the generator set at rated load plus all other gas-consuming appliances. For LPG tanks, verify that the output pressure is as shown in Figure 1-5. See Figure 1-6 for fuel consumption. Contact the fuel supplier for flow rate information or a gas meter upgrade, if necessary.

Fuel type	Natural Gas	LPG		
Fuel supply inlet	1/2 NPT			
Fuel supply pressure, kPa (in. H ₂ O)	1.3-2.7 1.7-2. (5-11) (7-11			
Fuel flow rate, maximum, Btu/hr.:				
14RESA/RESAL	193,000	203,000		
20RESA/RESAL	281,000	340,000		
Nominal Fuel Rating, Btu/ft. ³				
Natural gas	1000			
LPG	2500			

Figure 1-5 Fuel Supply

		Fuel Consumption, m ³ /hr. (cfh)								
	% Load	14RESA/RESAL				20RESA/RESAL				
Fuel Type		60	Hz	50	Hz	60	Hz	50	Hz	
	100%	5.4	(193)	4.9	(175)	8.0	(281)	6.4	(225)	
	75%	4.7	(163)	4.2	(148)	6.9	(243)	5.4	(189)	
Natural Gas	50%	3.5	(124)	3.1	(108)	4.6	(161)	3.9	(139)	
	25%	2.6	(93)	2.4	(84)	3.6	(127)	2.9	(103)	
	100%	2.3	(81)	2.1	(74)	3.9	(136)	2.9	(102)	
	75%	2.1	(75)	1.9	(68)	3.1	(109)	2.4	(85)	
LPG	50%	1.8	(60)	1.5	(53)	2.3	(82)	1.8	(63)	
	25%	1.2	(45)	1.1	(40)	1.7	(59)	1.3	(47)	
LPG conversion fa 8.58 ft. ³ = 1 lb. 0.535 m ³ = 1 k		Nominal fue Natural LPG:	gas: 37 M	J/m ³ (1000 J/m ³ (2500	Btu/ft. ³)		·			

Figure 1-6 Fuel Consumption

 $36.39 \text{ ft.}^3 = 1 \text{ gal.}$

1.7.2 Fuel Pipe Size

Ensure that the fuel pipe size and length meet the specifications in Figure 1-7. Measure the pipe length from the primary gas pressure regulator to the pipe connection on the generator set fuel inlet. Add 2.4 m (8 ft.) to the measured length for each 90 degree elbow. Compare the total pipe length with the chart in Figure 1-7 to find the required pipe size.

Contact local LPG provider for LPG installation information.

Mi	Minimum Gas Pipe Size Recommendation, in. NPT					
	14RESA/RESAL 20RESA/RESAL			/RESAL		
Len	ipe ngth, (ft.)	Natural Gas (193,000 Btu/hr.)	LPG (203,000 Btu/hr.)	Natural Gas (281,000 Btu/hr.)	LPG (340,000 Btu/hr.)	
8	(25)	3/4	3/4	1	3/4	
15	(50)	1	3/4	1	1	
30	(100)	1	1	1 1/4	1	
46	(150)	1 1/4	1	1 1/4	1 1/4	
61	(200)	1 1/4	1	1 1/4	1 1/4	

Figure 1-7 Fuel Pipe Size Recommendations

1.7.3 Connecting the Fuel Supply

The dimension drawing in Section 2 shows the location of the fuel inlet connection. Have the fuel supplier install rigid gas piping and a manual fuel shut-off valve. The fuel supply line should line up with the generator set fuel inlet and end about 12 inches away to allow connection with a section of flexible fuel line. Use flexible sections to prevent fuel line breakage caused by vibration.

Note: Do not bend the flexible fuel line to make up for misalignment of the fuel supply line and the generator set fuel inlet.

Apply pipe sealant that is approved for fuel connections. Hold the fuel solenoid valve with a wrench when tightening the fuel connections.

Note: Do not hold the fuel solenoid valve coil when tightening the fuel connections. See Figure 1-8 for the recommended wrench locations.

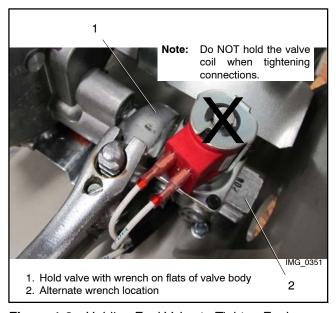


Figure 1-8 Holding Fuel Valve to Tighten Fuel Connections

Open the manual fuel valves and test all fuel connections using soapy water. If a leak is found, close the fuel valves, clean the fittings, and apply fresh sealant. Check for fuel leaks again with the generator set running.

Protect all fuel lines from machinery or equipment contact, adverse weather conditions, and environmental damage.

1.8 Fuel Conversion

The multi-fuel system allows conversion from natural gas to LPG (or vice-versa) in the field while maintaining emissions-standard compliance. A trained technician or an authorized distributor/dealer can convert the fuel system.

After converting the fuel system, change the Fuel Type setting on the controller. See the Operation Manual for instructions to change settings at the controller, or use a personal (laptop) computer and Kohler® SiteTech $^{\text{M}}$ software to change the setting.

Rating Change

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

- Model Number
- Spec Number
- Serial Number
- Fuel (original and new)
- L\\\

- kVA
- Amps
- Amps
- Volts
- Hz

Attach the new nameplate over the old one. Do NOT cover the UL listing information on the old nameplate.



Accidental starting.
Can cause severe injury or death.

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

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.



Explosive fuel vapors.
Can cause severe injury or death.

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

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

Propane (LPG)—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.

1.8.1 Fuel Conversion, 14RESA/RESAL Equipped with Fuel Block

Note: Model 14RESA/RESAL generator sets built before June 26, 2014 use a fuel block for the fuel type selection. See Figure 1-9 and use the instructions in this section for fuel conversion.

Model 14RESA/RESAL generators built June 26, 2014, or later are not equipped with the fuel block. These units use fuel orifice fittings installed in the hose fitting at the fuel regulator. See Section 1.8.2 for fuel conversion instructions.

Two fuel connections on the fuel block allow field-conversion between natural gas and LPG. The fuel metering valves are factory-set and sealed to comply with applicable emission standards and to provide the best possible hot and cold starting.

Note: Do not adjust the factory-sealed fuel-metering adjustments on the fuel block. Changing the fuel-metering adjustments may violate federal or state laws.

Use the following procedure to convert from natural gas (NG) to LPG. See Figure 1-9 for the fuel system component locations.

Procedure to convert from NG to LPG, 14RESA/RESAL with fuel block

- 1. Press the OFF button on the generator set controller.
- 2. Disconnect the power to the battery charger.
- 3. Disconnect the generator set engine starting battery, negative (-) lead first.
- 4. Turn off the fuel supply.
- 5. Remove the hose clamp and fuel hose from the hose fitting in the fuel block. See Figure 1-9.
- 6. Remove the hose fitting from the natural gas outlet port in the fuel block. See Figure 1-9.
- 7. Remove the plug from the LP port in the fuel block. See Figure 1-9.
- 8. Clean the plug with a dry cloth or brush, apply fresh pipe sealant, and install the plug into the natural gas outlet port.
- 9. Clean the hose fitting with a dry cloth or brush, apply fresh pipe sealant to the threads, and install the fitting into the LP port.

Note: Do not adjust the fuel metering valves.

- 10. Slide the hose onto the hose fitting and secure it with the clamp.
- Disconnect digital spark-advance ignition (DSAI) leads 65 and N3 for LPG. The DSAI leads are located near the fuel solenoid valve. See Figure 1-9.
- 12. Connect and turn on the new fuel supply.
- 13. Reconnect the generator set engine starting battery leads, negative (-) lead last.
- 14. Reconnect power to the battery charger.
- 15. Start the generator set by pressing the RUN button on the generator set controller.
- 16. Check for leaks using a gas leak detector.
- 17. Run the generator set and check the operation.
- 18. Press the OFF button to to shut down the generator set.

Conversion from LPG to Natural Gas

To convert from LPG to natural gas, follow the fuel conversion procedure above, moving the hose fitting to the natural gas port and plugging the LP port. Connect the DSAI leads for natural gas. See Figure 1-9.

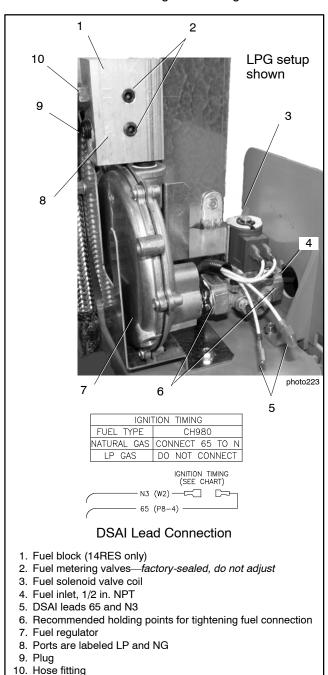


Figure 1-9 Fuel System, 14RESA/RESAL Equipped with Fuel Block (built before June 26, 2014)

1.8.2 Fuel Conversion, 14RESA/RESAL Equipped with Fuel Orifice Fittings

Note: Model 14RESA/RESAL generator sets built before June 26, 2014, use a fuel block for the fuel type selection. See Figure 1-9 and use the instructions Section 1.8.1 for fuel conversion.

Model 14RESA/RESALgenerators built June 26, 2014, or later are not equipped with the fuel block. These units use fuel orifice fittings installed in the hose fitting at the fuel regulator. See Figure 1-11 and use the instructions in this section for fuel conversion.

For natural gas and LPG fuel, orifice fittings are used in the fuel line. See Figure 1-10. The natural gas orifice fitting is silver in color and stamped NG. The LPG fitting is gold in color and stamped LPG. The fittings are threaded. A straight-blade screwdriver is required to remove and replace the fittings.

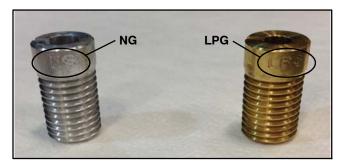


Figure 1-10 NG and LPG Fuel Orifice Fittings

The unit is typically shipped set up for natural gas, with the LPG fitting tied near the fuel solenoid valve. To convert to LPG, remove the NG fitting and install the LPG fitting as described below. See Figure 1-11 for the fuel system component locations.

Procedure to Convert from NG to LPG, 14RESA/RESAL with fuel orifice fittings

- 1. Press the OFF button on the generator set controller.
- 2. Disconnect the utility power to the generator.
- 3. Disconnect the generator set engine starting battery, negative (-) lead first.
- 4. Turn off and disconnect the fuel supply.
- 5. Remove the hose clamp and fuel hose from the hose fitting. See Figure 1-11.

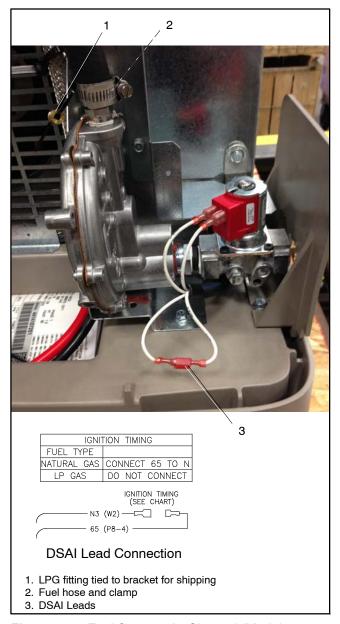


Figure 1-11 Fuel System, As Shipped (Model 14RESA/RESAL built after June 26, 2014)

- 6. Use a straight-blade screwdriver to remove the NG orifice from the hose fitting. See Figure 1-12.
- 7. Insert the LPG orifice into the hose fitting. Use a straight-blade screwdriver to tighten the fitting until it is snug.
- 8. Slide the hose onto the hose fitting and secure it with the clamp.
- Disconnect digital spark-advance ignition (DSAI) leads 65 and N3 for LPG. The DSAI leads are

located near the fuel solenoid valve. See Figure 1-11.

- 10. Connect and turn on the new fuel supply.
- 11. Reconnect the generator set engine starting battery leads, negative (-) lead last.
- 12. Reconnect the utility power to the generator.
- 13. Start the generator set by pressing the RUN button on the generator set controller.
- 14. Check for leaks using a gas leak detector.

- 15. Run the generator set and check the operation.
- 16. Press the OFF button to shut down the generator

Conversion from LPG to Natural Gas

To convert from LPG to natural gas, repeat the steps above, removing the LPG fuel orifice and installing the NG fitting. Connect DSAI leads 65 and N3 together for natural gas.

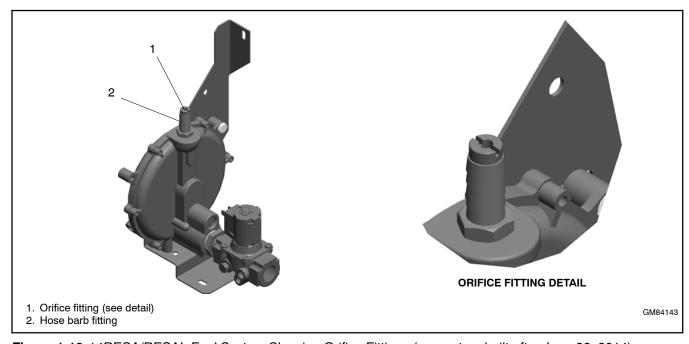


Figure 1-12 14RESA/RESAL Fuel System Showing Orifice Fittings (generators built after June 26, 2014)

1.8.3 Fuel Conversion, 20RESA/RESAL

For LPG fuel, an orifice is used in the fuel line. The unit is typically shipped set up for natural gas, with the loose orifice tied near the fuel solenoid valve. To convert to LPG, install the LPG orifice as described below. See Figure 1-13 for the fuel system component locations.

Note: The generator set harness may contain a pair of DSAI leads near the fuel solenoid valve. Connecting or disconnecting these leads has no effect on the 20RESA/RESAL operation.

Procedure to Convert from NG to LPG, 20RESA/RESAL

- Press the OFF button on the generator set controller.
- 2. Disconnect the power to the battery charger.
- 3. Disconnect the generator set engine starting battery, negative (-) lead first.
- 4. Turn off the fuel supply.
- 5. Remove the hose clamp and fuel hose from the hose fitting. See Figure 1-13.
- 6. Insert the LPG orifice into the hose fitting. See Figure 1-13.
- 7. Slide the hose onto the hose fitting and secure it with the clamp.
- 8. Connect and turn on the new fuel supply.
- 9. Reconnect the generator set engine starting battery leads, negative (-) lead last.
- 10. Reconnect power to the battery charger.
- 11. Start the generator set by pressing the RUN button on the generator set controller.
- 12. Check for leaks using a gas leak detector.
- 13. Run the generator set and check the operation.
- Press the OFF button to shut down the generator set.

Conversion from LPG to Natural Gas

To convert from LPG to natural gas, repeat the steps above to remove the LPG fuel orifice.

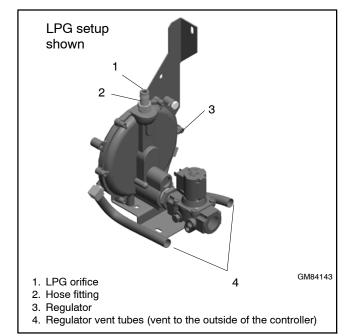


Figure 1-13 Fuel Regulator and LPG Orifice, 20RESA/RESAL

1.8.4 Regulator Vent Hose

Model 20RESA/RESAL generators are equipped with fuel regulator vent hoses. Drill or punch two holes in the enclosure at the locations shown on the template in Appendix B. It may be convenient to cut openings for the electrical leads at the same time as shown on the template and in Section 1.9.2.

Insert the open ends of the hoses through the holes to the outside of the enclosure as shown in Figure 1-14.

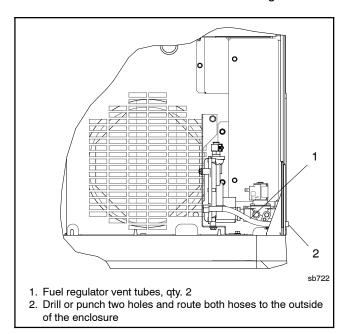


Figure 1-14 Fuel Regulator Vent Hoses

1.9 Electrical Connections



Hazardous voltage.
Will cause severe injury or death.

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

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.

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.

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.

Have an authorized distributor/dealer or a licensed electrician make the following electrical connections. The electrical installation must comply with the National Electrical Code® (NEC) class 1 wire designation and all applicable local codes. Canadian installations must comply with the Canadian Electrical Code (CEC) and applicable local codes.

AC circuit protection. All AC circuits must include circuit breaker or fuse protection. The circuit breaker must be rated for a maximum of 125% of the rated generator set output current. The circuit breaker must open all ungrounded connectors. The generator set is equipped with a factory-installed circuit breaker.

For customer-supplied wiring, select the wire temperature rating in Figure 1-15 based upon the following criteria:

- Select row 1, 2, 3, or 4 if the circuit rating is 110 amperes or less or requires #1 AWG (42.4 mm²) or smaller conductors.
- Select row 3 or 4 if the circuit rating is greater than 110 amperes or requires #1 AWG (42.4 mm²) or larger conductors.

Row	Temp. Rating	Copper (Cu) Only	Cu/Aluminum (Al) Combinations	Al Only
1	60°C (140°F) or 75°C (167°F)	Use No. * AWG, 60°C wire or use No. * AWG, 75°C wire	Use 60°C wire, either No. * AWG Cu, or No. * AWG AI or use 75°C wire, either No. * AWG Cu or No. * AWG AI	Use 60°C wire, No. * AWG or use 75°C wire, No. * AWG
2	60°C (140°F)	Use No. * AWG, 60°C wire	Use 60°C wire, either No. * AWG Cu or No. * AWG AI	Use 60°C wire, No. * AWG
3	75°C (167°F)	Use No. *† AWG, 75°C wire	Use 75°C wire, either No. *† AWG Cu or No. *† AWG AI	Use 75°C wire, No.*† AWG
4	90°C (194°F)	Use No. *† AWG, 90°C wire	Use 90°C wire, either No. *† AWG Cu or No. *† AWG AI	Use 90°C wire, No.*† AWG

^{*} The wire size for 60°C (140°F) wire is not required to be included in the marking. If included, the wire size is based on ampacities for the wire given in Table 310-16 of the National Electrical Code®, in ANSI/NFPA 70, and on 115% of the maximum current that the circuit carries under rated conditions. The National Electrical Code® is a registered trademark of the National Fire Protection Association, Inc.

Figure 1-15 Terminal Markings for Various Temperature Ratings and Conductors

The National Electrical Code® is a registered trademark of the National Fire Protection Association, Inc.

[†] Use the larger of the following conductors: the same size conductor as that used for the temperature test or one selected using the guidelines in the preceding footnote.

1.9.1 Grounding

Ground the generator set. **The grounding method must comply with NEC and local codes.** Connect the grounding cable to the generator set ground terminal GND on the field-connection terminal block.

Generator sets are shipped with the generator neutral bonded (connected) to the generator ground in the junction box. The requirement for having a bonded (grounded) neutral or ungrounded neutral is determined by the type of installation. At installation, the neutral can be grounded at the generator set or lifted from the ground stud and isolated if the installation requires an ungrounded neutral connection at the generator. The generator set will operate properly with the neutral either bonded to ground or isolated from ground at the generator.

Various regulations and site configurations including the National Electrical Code (NEC), local codes, and the type of transfer switch used in the application determine the grounding of the neutral at the generator. NEC Section 250 is one example that has a very good explanation of the neutral grounding requirements for generators.

1.9.2 Electrical Lead Entry

Drill or punch holes in the enclosure for the electrical conduit in the locations shown in Figure 1-16. A full-scale dimensioned template for the hole locations is printed in Appendix B. See page 57.

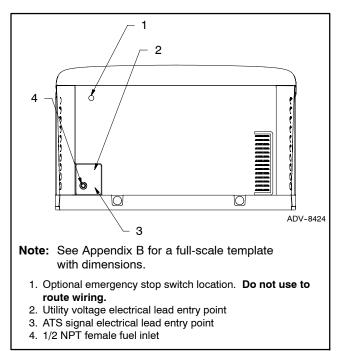


Figure 1-16 Electrical Lead Entry Locations

1.9.3 Field-Connection Terminal Block

The generator set is equipped with a field-connection terminal block located in the air intake area near the junction box. Leads have been factory-installed from the junction box to the terminal block for easy field wiring.

See Figure 1-17 for the terminal block location. Remove the cover panel for access to the field connections.

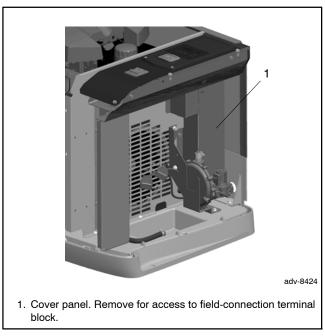


Figure 1-17 Field-Connection Terminal Block Location

See Figure 1-18 for terminal block details. Refer to the terminal block decal shown in Figure 1-19 for connections and cable sizes. Also see the wiring diagram in Section 2.

Route AC leads through flexible conduit. Ensure that the leads and conduit do not interfere with the operation of the generator set or obstruct the service areas. Route low-voltage communication leads through separate conduit.

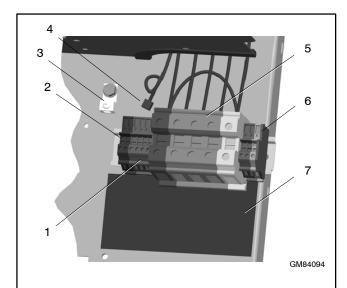
Procedure

- Drill holes for the conduit fittings. See Figure 1-16 and Appendix B for the recommended electrical inlet locations. Feed the cables through the openings.
- Connect the leads from the transfer switch emergency source lugs to the L1, L2, and L3 connections on the generator set terminal block as applicable for single or three-phase applications. See Figure 1-18 and Figure 1-19.
- Connect the neutral (L0) and ground (GRD) leads from the ATS and the main panel to the corresponding connection points on the terminal block. See Section 1.9.1, Grounding.
- 4. Connect AC power source leads to the terminal block connections labeled LINE, NEUTRAL and GROUND. Connect the circuit to the load side of the transfer switch. See Section 1.9.4 for more information about the AC power requirement.

Note: AC power must be connected to maintain the charge on the engine starting battery.

- 5. For connection of optional transfer switches, the programmable interface module (PIM), and/or a load control module (LCM) or load shed kit, see Section 1.10.1.
- 6. If the OnCue® Plus Generator Management System will be used with the generator set, run category 5E network cable from the generator set to the customer's router or modem.
 - Note: The OnCue Plus Wireless kit allows connection of the generator controller to the customer's wireless router without running a network cable from the generator to the customer's router or modem. If the OnCue Plus Wireless is used, follow the instructions provided with the kit to install and set up the wireless kit and proceed to step 7.

- a. Route the network cable with other low-voltage signal wiring (for example, the RBUS communication leads or engine start leads to the transfer switch), in separate conduit from the AC load leads. If the network cable is longer than 100 meters (328 ft.), use a repeater or switch.
- b. Use an RJ45 inline coupler to connect the Ethernet cable to the cable in the customer connection box. See Figure 1-18. The inline coupler is included with the OnCue Plus kit.
- 7. When connections to the terminal block are complete, replace the cover plate.



Note: The number of terminals varies for 1-phase and 3-phase models. See Figure 1-19.

- Low voltage RBUS communication to RXT ATS, PIM, LCM or load shed kit, and/or APM.
- 2. Engine start connections from transfer switches other than the RXT, if used.
- 3. Ground connection for communication cable shield
- 4. Ethernet cable for optional OnCue Plus connection
- 5. AC load connections
- AC power connections required for battery charging and accessories
- 7. Connection decal; see Figure 1-19.

Figure 1-18 Field Connection Terminal Blocks

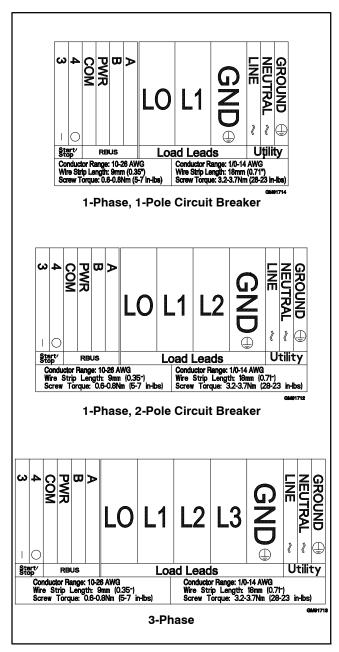


Figure 1-19 Terminal Block Connection Decals

1.9.4 AC Power Supply

The installer must connect AC power for the battery charger (which is integral to the RDC2 controller) and the optional accessories shown in Figure 1-20. The power source must comply with state and local codes. The power to the battery charger and accessories must be backed up by the generator so that power is available at all times.

Be sure to disconnect power at the distribution panel before making the connections. Connect power leads to the AC power connection points labeled LINE, NEUTRAL, and GROUND on the field-connection terminal block. Connect the circuit to the load side of the transfer switch so that it is backed up by the generator. See Figure 1-18 and the wiring diagrams in Section 2 for connection details.

	Power Requirement, Max.				
Equipment	Watts	Volts at 50/60 Hz			
Battery charger	50	100-120 VAC			
(standard)	50	200-250 VAC			
Carburetor heater	37	100-120 VAC			
(optional)	37	200-250 VAC			
Battery heater (optional)	50	100-120 VAC			
	50	200-250 VAC			
Fuel regulator heater	60	100-120 VAC			
(optional; available for 20RESA/RESAL only)	100	200-250 VAC			

Figure 1-20 Power Requirements

1.10 ATS and Accessory Connections

The following sections cover electrical connections of the automatic transfer switches and RBUS accessories, including the programmable interface module (PIM) and the load control module (LCM) or load shed kit.

1.10.1 Transfer Switch Connection

Connect the ATS or remote start/stop switch. Connect the load leads from the generator set to the Emergency source lugs on the ATS. Route low-voltage communication leads through separate conduit from the AC power and load leads. All connections must comply with applicable state and local codes.

Note: Do not use the Kohler® Model RRT transfer switch with the 14/20RESA or 14/20RESAL generator set.

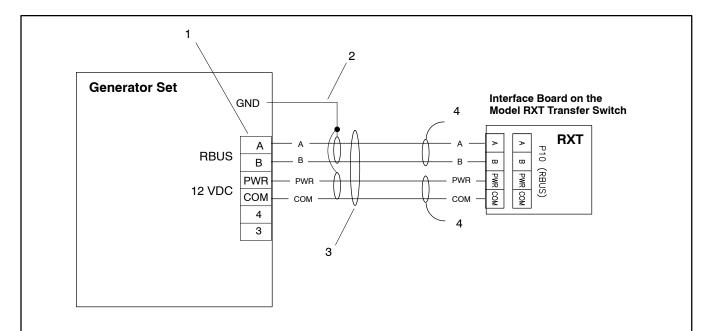
Communication connections for a Kohler® Model RXT transfer switch

One Model RXT transfer switch can be connected to the generator set. See Figure 1-21. Use shielded, twisted-pair communication cable to connect P10-1 through P10-4 on the transfer switch interface module to the generator set terminal block connections A, B, PWR, and COM. See Section 1.10.2 for the communication cable recommendations and maximum cable length.

Note: Connections 3 and 4 on the generator set are not used with the Model RXT transfer switch.

Engine start connection for other transfer switches or a remote start/stop switch

Connect the engine start leads from the transfer switch or remote start switch to terminals 3 and 4 on the terminal block. See Figure 1-22. Route the engine start leads through separate conduit from the AC power and load leads.



Note: Generator set terminal block connections 3 and 4 are NOT USED with the Model RXT ATS.

- 1. Generator set terminal block. See Figure 2-4 for location. Check the decal on the generator set for terminal block connections.
- 2. Connect one end of each cable shield to GROUND at the generator set.
- 3. Communication cable Belden #9402 or equivalent 20 AWG shielded, twisted-pair cable. See Section 1.10.2, Cable Specifications.
- 4. Leave one end of each cable shield disconnected. If accessory modules (PIM, LCM or load shed kit) are connected, see Section 1.10.3.

Figure 1-21 Model RXT Transfer Switch Communication Connection to Generator Set Terminal Block

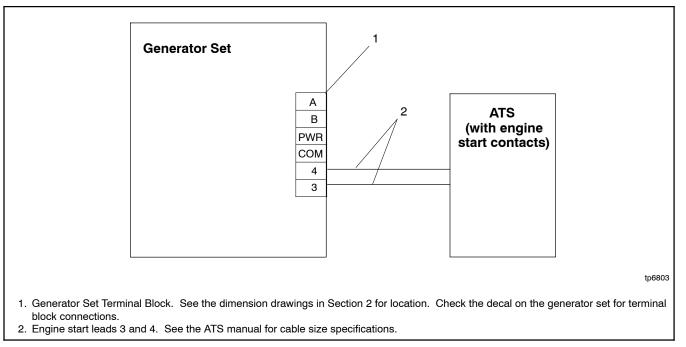


Figure 1-22 Engine Start Connections with Transfer Switch Models other than Model RXT

1.10.2 Communication Cable Specifications

RBUS Connections A and B

For the RBUS communication connections A and B to the Model RXT transfer switch, optional PIM and/or optional LCM or load shed kit, use 20 AWG shielded, twisted-pair communication cable. Belden #9402 (two-pair) or Belden #8762 (single-pair) or equivalent cable is recommended.

For outdoor installations, including those with buried cables and/or conduit, use outdoor-rated Belden #1075A or equivalent 20 AWG shielded, twisted-pair communication cable.

PWR and COM Connections

For the PWR and COM connections, the cable size and maximum cable length depends on the number of modules connected. See Figure 1-23.

 For short cable runs shown in the first two rows of Figure 1-23, use one pair in the two-pair communication cable for the A and B connections, and use the second pair for the PWR and COM connections.

 For the longer cable runs shown in the last two rows of Figure 1-23, use 12 or 14 AWG cable for PWR and COM, and use the 20 AWG communication cable specified above for the A and B connections only. In this case, single-pair communication cable such as Belden #8762 can be used for the A and B connections.

1.10.3 System Connections with Accessory Modules

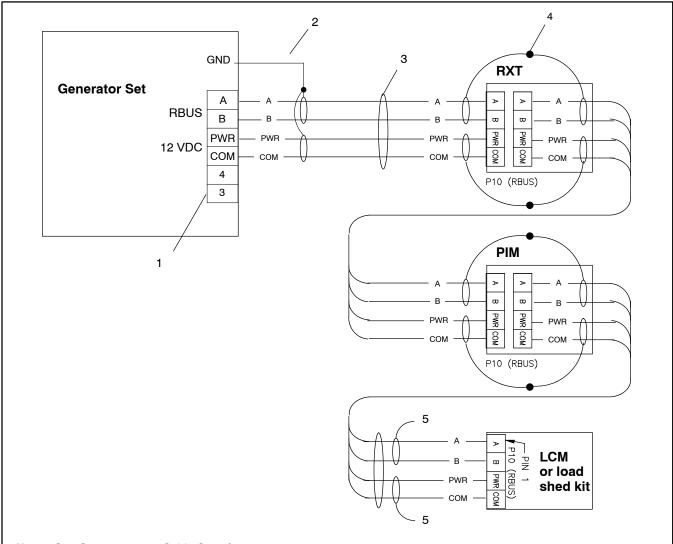
See Figure 1-24 through Figure 1-28 for connection options with accessory modules. Accessory modules can include one Model RXT transfer switch, one programmable interface module (PIM) and/or one load control module (LCM) or load shed kit. Note the cable shield connections shown in Figure 1-24.

The maximum cable length depends on the number of optional modules connected. See Figure 1-23 for the maximum cable lengths with 1, 2, or 3 modules per cable run.

		Maximum length per run, meters (ft.)					
	Indoor or Outdoor		Num	ber of Mo	dules pei	r Run	
Cable Size for PWR and COM Connections	Installation	1 Mo	dule	2 Mod	dules	3 Mod	dules
20 AWG Belden #9402 or equivalent, two-pair	Indoor	61	(200)	31	(100)	21	(67)
20 AWG Belden #1075A or equivalent, two-pair	Outdoor	61	(200)	31	(100)	21	(67)
14 AWG *	_	152	(500)	152	(500)	122	(400)
12 AWG *	_	152	(500)	152	(500)	152	(500)

^{*} Use 12 or 14 AWG cable for PWR and COM connections only. For RBUS connections A and B, use shielded, twisted pair communication cable specified in Section 1.10.2.

Figure 1-23 Total Cable Lengths for PWR and COM Connections



Note: See Section 1.10.2, Cable Specifications.

- 1. Generator set terminal block. See Figure 2-4 for location. Check the decal on the generator set for terminal block connections.
- 2. Connect one end of each cable shield to GROUND at the generator set.
- 3. Communication cable Belden #9402 or equivalent 20 AWG shielded, twisted-pair cable.
- 4. Connect shields together as shown.
- 5. Leave one end of each cable shield disconnected at the last device.

Figure 1-24 Accessory Module Communication Connection Details

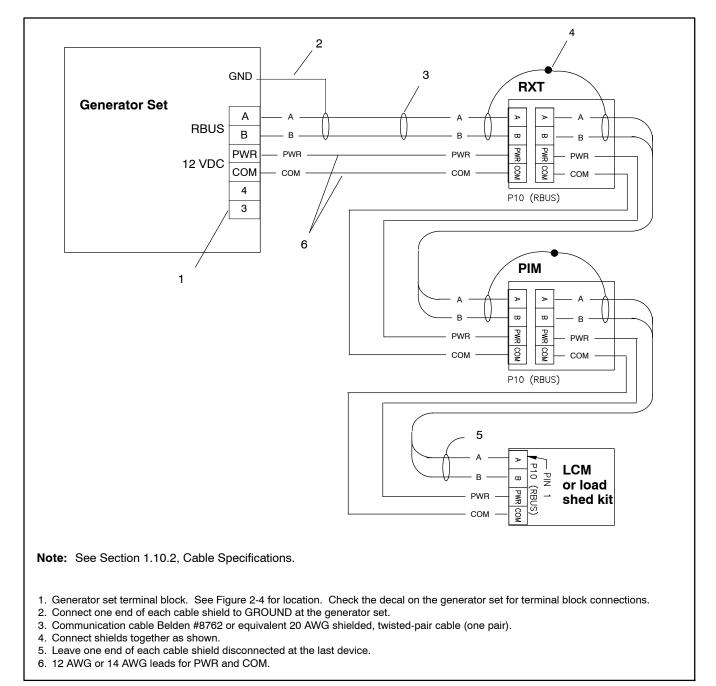


Figure 1-25 Accessory Module Connections with 12-14 AWG Power Leads

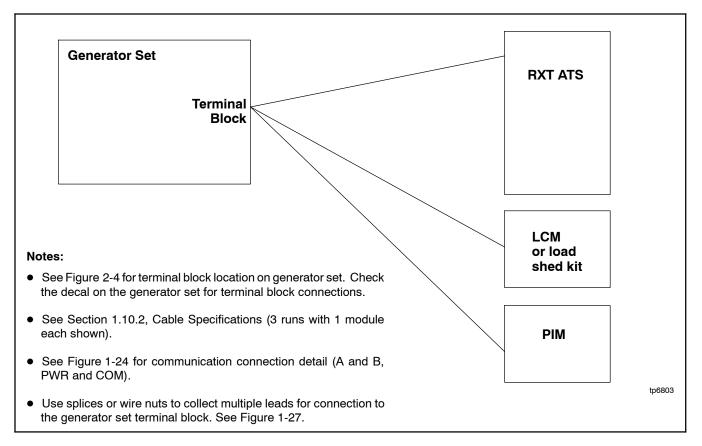


Figure 1-26 Accessory Module Connections (three cable runs with one module each)

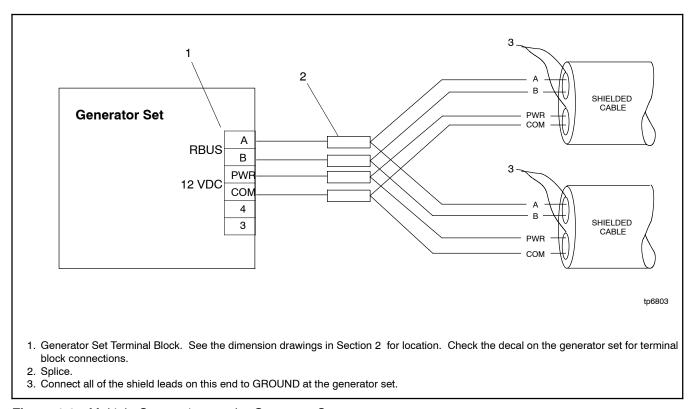


Figure 1-27 Multiple Connections to the Generator Set

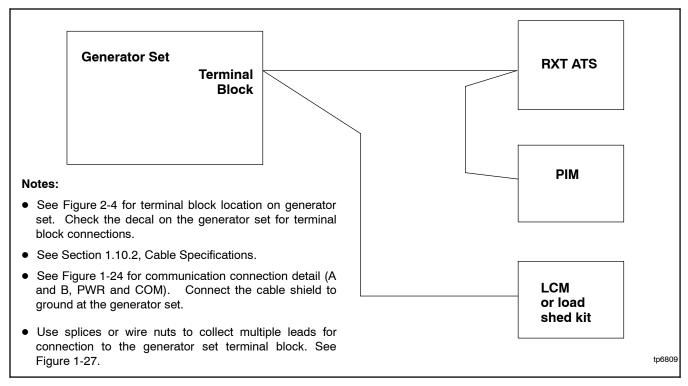


Figure 1-28 Accessory Module Connections (two cable runs with one and two modules shown)

1.11 Battery



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.

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).

Starting batteries are usually the lead-acid type. Use a 12-volt group 51 battery with a minimum rating of 500 cold cranking amps at 0°F. The generator set uses a negative ground with a 12-volt engine electrical system. See Figure 1-29 for battery connections. Make sure that the battery is correctly connected and the terminals are tight.

Note: The generator set will not start and circuit board damage may occur if the battery is connected in reverse.

See the dimension drawing in Section 2 for the engine starting battery location on the air intake side of the generator set. Standard battery cables provide easy connection to the battery.

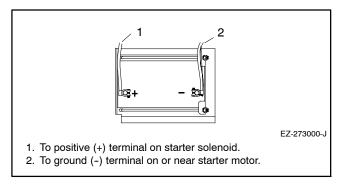


Figure 1-29 Typical Battery Connection

Use the following procedure to install and connect the battery.

Battery Installation Procedure

- 1. Ensure that the starting battery is fully charged before placing the battery in service.
- Clean the battery posts and/or adapters if necessary.
- 3. Install the battery post adapters, if needed.
- 4. Place the battery in the housing.
- 5. Connect the positive (+) lead to the engine starting battery.
- 6. Connect the negative (-) lead to the engine starting battery.

Refer to the generator set operation manual and the battery manufacturer's instructions for battery maintenance instructions.

When power is applied to the RDC2/DC2 controller (that is, when the battery is connected), you will be prompted to set the date and time, and then to set the exerciser. See Section 1.14 and the generator set operation manual for instructions.

If the battery is disconnected for service or replacement, the exercise settings on the RDC2/DC2 controller are lost. Set the exerciser after installing and connecting the battery. See Section 1.14, Set Exerciser.

1.12 Generator Set Accessories

This section describes some of the accessories that are available for the generator sets. Have accessories installed by an authorized distributor/ dealer or a licensed electrician. This document does not contain installation instructions for accessories. Follow the installation instructions provided with each kit.

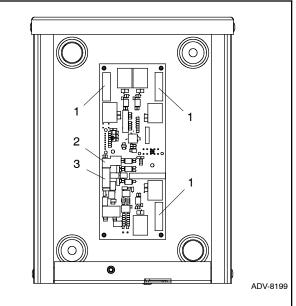
Use separate conduit for AC and DC leads to reduce the possibility of electrical interference. Verify that the leads and conduit do not interfere with the operation of the generator set or obstruct the service areas. Verify that the electrical installation complies with the National Electrical Code (NEC) and all applicable local codes. See the wiring diagrams in Section 2 for more information regarding generator set electrical connections.

1.12.1 Programmable Interface Module (PIM)

The optional programmable interface module (PIM) provides two programmable inputs and six dry contact outputs, four of which are programmable. See TT-1584 for PIM installation and connection instructions. Also see Section 1.10 of this manual for connection to the generator set.

The default settings for the inputs and outputs are shown in Figure 1-31. To change the input and output settings, use a personal computer running Kohler SiteTech® software. See TP-6701, SiteTech Software Operation Manual, for instructions.

Kohler OnCue® Plus can be used to actively control PIM outputs. See the OnCue Plus Operation Manual for instructions.



- 1. Output connections (3 terminal blocks, 6 outputs)
- 2. Input connections (2 inputs)
- RBUS communication connection to generator set terminal block TB2

Figure 1-30 Optional PIM

PIM Connection	Factory Default Setting
Input 1	None
Input 2	None
Output 1 (Relay 1)	Run
Output 2 (Relay 2)	Common Fault
Output 3 (Relay 3)	Low Battery Voltage (Programmable)
Output 4 (Relay 4)	Not in Auto (Programmable)
Output 5 (Relay 5)	Cooldown (Programmable)
Output 6 (Relay 6)	Normal Source Failure (Programmable)

Figure 1-31 PIM Inputs and Outputs

1.12.2 Load Control Module (LCM)

The optional Load Control Module (LCM) is available for **single-phase** generator sets only. The LCM provides an automatic load management system to comply with Section 702.5 of NEC 2008. The installer is responsible for ensuring that the power system installation complies with all applicable state and local codes.

With the Load Control Module (LCM), less critical appliances can be powered by the generator set when the more important appliances are not running, allowing the use of a smaller generator set than would be needed to run all of the building's electrical equipment at the same time.

The LCM receives commands from the RDC2 or DC2 generator controller and energizes or de-energizes the appropriate load relays to add or shed non-critical loads according to their priority.

Note: Connect only non-essential loads to the load control module.

The load control module automatically manages up to six residential loads:

- Four power relays are provided for management of non-essential secondary loads. 120 VAC power must be provided for operation of the power relays.
- Two relays are available to control two independent air conditioner loads.

The LCM is available with either a prewired harness for load relay connection, or a terminal block. The prewired harness requires installation of the LCM within 0.6 meters (2 feet) of the distribution panel. The load control module with the optional wire harness is shown in Figure 1-32. If the harness is not used, connect to the terminal blocks inside the LCM enclosure. Figure 1-33 shows the load control module without the optional harness.

Refer to TT-1574, provided with the LCM, for installation and connection instructions.



Figure 1-32 Optional Load Control Module (LCM) (shown with optional pre-wired harness)

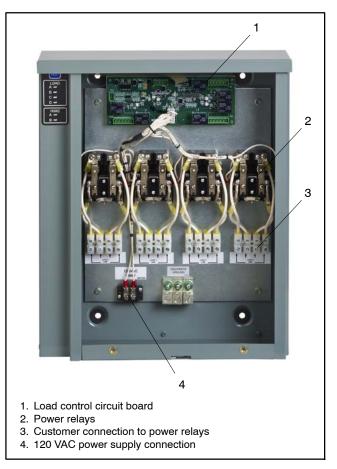


Figure 1-33 Load Control Module (cover removed to show field-connection terminal blocks)

1.12.3 Load Shed Kit

An optional load shed kit can be used on **single-phase** systems that include a Model RDT or RXT transfer switch. The load shed kit mounts inside the Model RDT or RXT transfer switch enclosure. Figure 1-34 shows the load shed assembly.

The load shed kit provides an automatic load management system to comply with Section 702.5 of NEC 2008. The installer is responsible for ensuring that the power system installation complies with all applicable state and local codes.

Note: Do not install both a load shed kit and a load control module (LCM) on the same system.

The load shed kit provides the same load shed and add functions as the load control module (LCM). See Section 1.12.2.

Note: Connect only non-essential loads to the load shed kit.

The load shed kit automatically manages up to six residential loads:

- Up to four customer-supplied power relays can be connected through normally open relay contacts on the circuit board. See TT-1609 for relay coil voltage specifications.
- Two relays are included to control two independent heating, ventilation, and air conditioning (HVAC) loads.

An adequate electrical supply is required for operation of the customer-supplied power relays connected to the load shed kit. Check the electrical requirements of the customer-provided equipment prior to installation to determine the wire size and circuit protection required. Verify that customer-provided equipment complies with applicable local and national electrical codes.

See TT-1609, provided with the kit, for detailed installation and connection instructions.

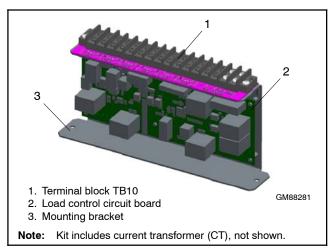


Figure 1-34 Load Shed Assembly GM88281-1 (mounts inside the transfer switch enclosure)

1.12.4 Regulator Heater



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

Do not work on the generator set until it cools.

Servicing the engine heater. Hot parts can cause minor personal injury or property damage. Install the heater before connecting it to power. Operating the heater before installation can cause burns and component damage. Disconnect power to the heater and allow it to cool before servicing the heater or nearby parts.

The optional regulator heater kit is designed for Model 20RESA and 20RESAL generator sets. The regulator heater kit is recommended in addition to the carburetor heater for reliable engine starting in temperatures below –18°C (0°F). See Figure 1-35 for heater specifications. Order the 120 V or 240 V kit as appropriate for your application. See specification sheet G6-126 for kit details.

	120 V Kit	240 V Kit
Heater rating	120 VAC, 60 W	240 V, 100W
	50/60 Hz	50/60 Hz
Thermostat	4°C/13°C (40°F/55°F) Snap action	
Pad diameter	127 mm (5 in.)	
Cord length	610 mm (24 in.)	

Figure 1-35 Regulator Heater Specifications

The fuel regulator heater is a 127 mm (5 in.) diameter round heating pad with a snap action thermostat and a power cord. Figure 1-37 and Figure 1-36 show the heater installed on the fuel regulator, which is located on the air intake side of the generator set. To install the regulator heater kit, follow the instructions in TT-1569, provided with the kit.

The fuel regulator heater requires a source of AC power. Verify that AC power is connected to the generator set as described in Section 1.9. The circuit must be backed up by the generator set to provide power at all times.

120 VAC generator sets are equipped with one or two 120 VAC receptacles. A receptacle adapter is included in the 120 volt heater kit to allow more than one accessory to be plugged into the receptacle.

240 volt heater kits use a 3-pin power connector. Generator sets built after 10/9/2013 with serial numbers SGM327VFJ or later have a knockout under the controller for the 240 VAC power connector. 240 volt fuel regulator heater kits include an adapter harness to allow connection of two AC accessories.

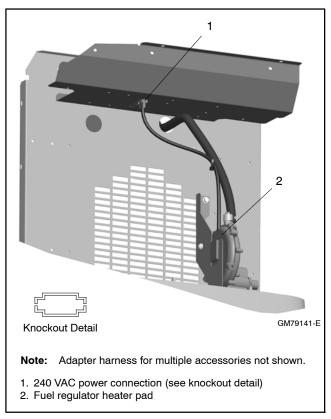


Figure 1-36 Model 20RESA/RESAL 240 Volt Kit Power Connection

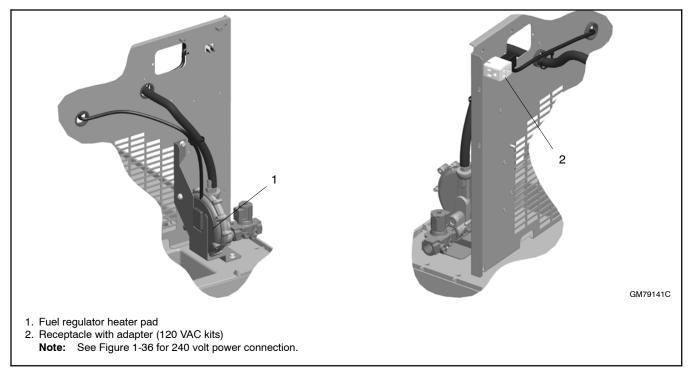
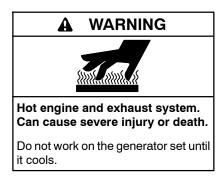


Figure 1-37 Installed Regulator Heater Kit (for 20RESA/RESAL)

1.12.5 Carburetor Heater



Servicing the engine heater. Hot parts can cause minor personal injury or property damage. Install the heater before connecting it to power. Operating the heater before installation can cause burns and component damage. Disconnect power to the heater and allow it to cool before servicing the heater or nearby parts.

A carburetor heater is recommended for improved cold starting in locations where the ambient temperature drops below 0°C (32°F). The carburetor heater prevents condensation and carburetor icing. The heater turns on when the temperature at the thermostat falls below approximately 4°C (40°F) and turns off when the temperature rises above approximately 16°C (60°F). The carburetor heaters are shown in Figure 1-39.

To install the carburetor heater, follow the instructions provided with the kit. Figure 1-40 shows the installed carburetor heater kit installed for a 14 kW generator set. Figure 1-41 shows the location for the carburetor heater kit on a 20 kW generator set.

Verify that AC power is connected to the generator set as described in Section 1.9. The circuit must be backed up by the generator set to provide power at all times.

The heater thermostat is installed in the cord. Figure 1-39 shows the location of the thermostat on the power cord. The heater power cord and thermostat are located in the generator set housing air intake area/battery compartment.

For 120 volt models, plug the carburetor heater into one of the 120 VAC receptacles provided.

240 volt kits use a 3-pin power connector. Generator sets built after 10/9/2013 have a knockout in the bulkhead for the 240 VAC power connector. See Figure 1-42.

Kit Number	120 Volt Kits	240 Volt Kits		
Voltage	120 VAC 50/60 Hz	240 VAC/60 Hz 230 VAC/50 Hz		
Thermostat ON	4 ± 4°C (40 ± 7°F) 16 ± 3°C (60 ± 5°F)			
Thermostat OFF				

Figure 1-38 Carburetor Heater Specifications

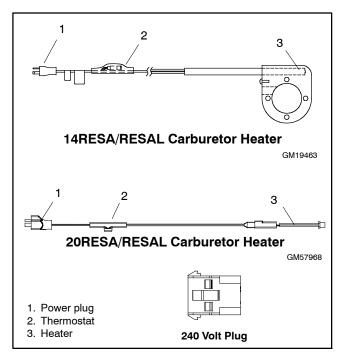
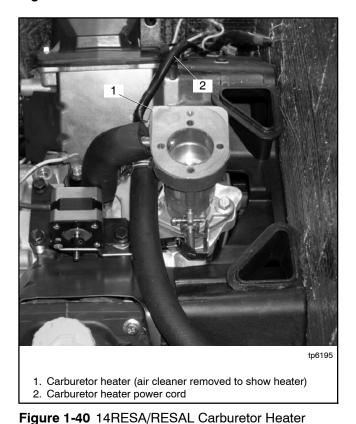


Figure 1-39 Carburetor Heaters



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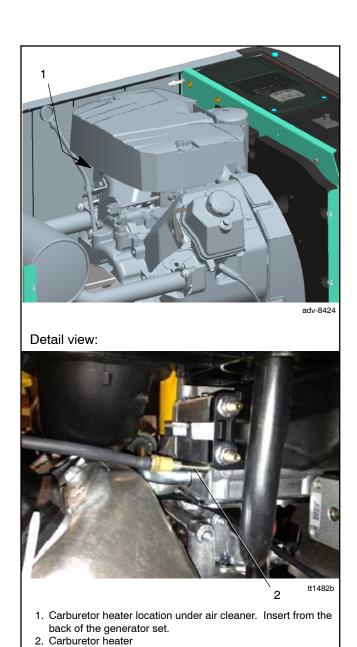


Figure 1-41 20RESA/RESAL Carburetor Heater Location on Engine

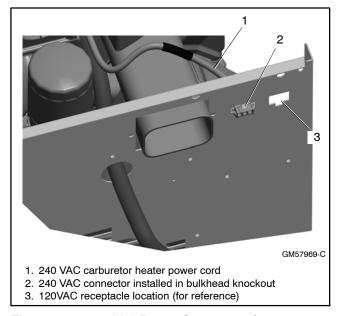
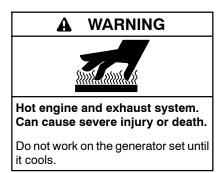


Figure 1-42 240 Volt Power Connection for Carburetor Heaters

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1.12.6 Battery Heater



Servicing the engine heater. Hot parts can cause minor personal injury or property damage. Install the heater before connecting it to power. Operating the heater before installation can cause burns and component damage. Disconnect power to the heater and allow it to cool before servicing the heater or nearby parts.

Optional 120 VAC and 240 VAC battery heater kits are available. The heater is thermostatically controlled. See Figure 1-43.

Wrap the heater around the battery and secure the cord using cable ties. See Figure 1-44. Plug the power cord into an AC receptacle.

For 120 volt models, plug the carburetor heater into one of the 120 VAC receptacles on the generator set.

240 volt kits use a 3-pin power connector. Generator sets built after 10/9/2013 have a knockout in the bulkhead for the 240 VAC power connector. The 240 volt battery heater kit includes an adapter harness that allows connection of up to three accessories.

Battery Heater Specifications				
Heater wrap voltage	100-120 VAC or			
	200-240 VAC			
	50/60 Hz			
Heater wrap rating, Watts	50			
Thermostat temperatures:				
On	18°C (65°F)			
Off	27°C (80°F)			
Battery wrap length, mm (in.)	711 (28)			
Power cord length, mm (in.)	1829 (72)			

Figure 1-43 Battery Heater Specifications

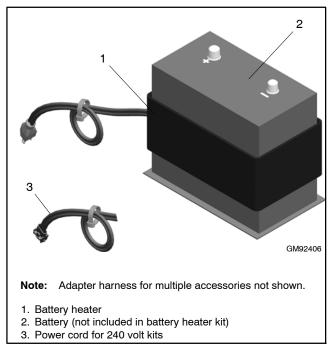


Figure 1-44 Battery Heater

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1.12.7 OnCue Plus Generator Management System

The OnCue® Plus Generator Management System allows monitoring and control of your generator set from a personal computer, smart phone, or tablet. OnCue Plus can also be configured to send email or text message notifications in the event of a generator set fault. Both a network cable connection version (OnCue Plus) and a wireless version (OnCue Plus Wireless) are available. See TP-6928, OnCue Plus Operation Manual, for instructions.

Note: Wireless connection of the generator is only available with the purchase of OnCue Plus Wireless.

OnCue Plus

OnCue Plus is available separately as a loose kit. Use category 5E network cable to connect the RDC2 controller to the customer-supplied Ethernet router or modem. Route the cable with other low-voltage signal wiring (for example, the RBUS communication leads or engine start leads to the transfer switch), in separate conduit from the AC load leads. If the network cable is longer than 100 meters (328 ft.), use a repeater or switch.

Recommended: Use a laptop computer to verify the network connection before connecting to the generator set.

Checking the network connection

- 1. Check for and turn OFF any wireless connections to the laptop.
- 2. Connect the network cable to the laptop. Connect the other end of the network cable to the customer's router or modem.
- Verify the Internet connection by opening your web browser and going to www.kohlerpower.com or any known website.
- After verifying the connection through the network cable, disconnect the network cable from the laptop and turn the laptop wireless connections back on.

Connect to the Ethernet cable in the customer connection area of the generator set. See Figure 1-45. Use an RJ45 inline coupler, provided with the OnCue Plus kit, to connect the customer's Ethernet cable to the cable in the customer connection box.

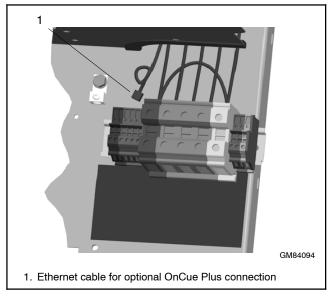


Figure 1-45 Network Connection for OnCue Plus

OnCue Plus Wireless

The OnCue Plus Wireless kit allows connection of the generator set to the Internet through the customer's wireless router without running a network cable from the generator to the customer's Ethernet router. The OnCue Plus Wireless kit includes OnCue Plus and a wireless access point that mounts inside the generator enclosure. Follow the instructions in TT-1618, provided with the kit, to install and set up the wireless access point.

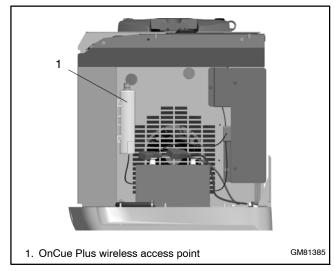


Figure 1-46 Typical OnCue Plus Wireless Access
Point Installation

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1.13 Prestart Installation Check



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

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



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

The exhaust system must be leakproof and routinely inspected.

Generator set operation. Carbon monoxide can cause severe nausea, fainting, or death. Carbon monoxide is an odorless, colorless, tasteless, nonirritating gas that can cause death if inhaled for even a short time. Avoid breathing exhaust fumes when working on or near the generator set. Never operate the generator set inside a building. Never operate the generator set where exhaust gas could seep inside or be drawn into a potentially occupied building through windows, air intake vents, or other openings.

Carbon monoxide 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.

Review the entire installation section. Inspect all wiring and connections to verify that the generator set is ready for operation. Check all items in the following Prestart Checklist.

Prestart Checklist

Air Cleaner. Check that a clean air cleaner element is installed to prevent unfiltered air from entering the engine. See the generator set operation manual for instructions

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.

Enclosure. Check that all enclosure panels and internal baffling are in place.

Exhaust System. Check for exhaust leaks and blockages. Check the muffler condition.

- Inspect the exhaust system components for cracks, leaks, and corrosion. Check for tight exhaust system connections.
- Check for corroded or broken metal parts and replace them as needed.
- Check that the exhaust outlet is unobstructed.

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.

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1.14 Set the Exerciser

Set the exerciser to automatically run the generator set on the desired day and time every week or every two weeks. See the generator set Operation Manual for detailed descriptions of the exercise operation.

1.14.1 RDC2 Controller

When power is applied to the RDC2 controller (when the battery or the utility power for the battery charger is connected), you will be prompted to set the date and time, and then to set the exerciser.

The first setting will flash. Press the Up and Down arrow buttons to change the setting. Press Select to save the setting and move on to the next. Repeat until the date, time, and exercise are set and the controller display shows the main menu. See the generator set Operation Manual for more detailed instructions to set the date and time and set the exerciser.

Press AUTO to place the generator set controller into automatic mode.

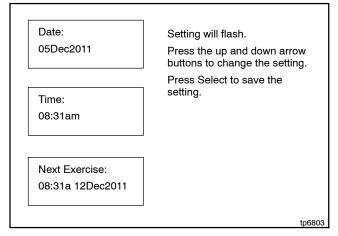


Figure 1-47 Set Time, Date, and Exercise (RDC2)

1.14.2 DC2 Controller

To set the exerciser on the DC2 controller, first press AUTO to place the controller into automatic (standby) mode. Then press and hold the Exercise button. The generator set will start and run a 20-minute unloaded cycle exercise. The generator set will run automatically for 20 minutes at the same time every 7 days. See the generator set Operation Manual for more information.

1.14.3 Loaded Exercise

In order to set a loaded exercise using the RDC2 or DC2 controller, a Kohler® Model RXT transfer switch must be connected. See the generator set operation manual for instructions to set a loaded exercise.

To set a loaded exercise on a generator set connected to a transfer switch other than a Model RXT, use the transfer switch controller to set the exercise. Refer to the transfer switch operation manual for instructions.

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Section 2 Drawings and Diagrams

Figure 2-1 lists the drawing numbers and page numbers.

Dimension Drawing	Drawing Number	Page
Dimension Drawing	ADV-8424-H	
Dimensions	Sheet 1	44
Maintenance item locations	Sheet 2	45
Maintenance item locations	Sheet 3	46
Location and clearance requirements, single unit	Sheet 4	47
Location and clearance requirements, parallel units	Sheet 5	48
Wiring Diagrams		
Schematic Diagram	ADV-8706-C	
1 phase, 2 pole circuit breaker	Sheet 1	49
1 phase, 1 pole circuit breaker	Sheet 2	50
3 phase, 3 pole circuit breaker	Sheet 3	51
Wiring Diagram	GM93298-C	
1 phase, 2 pole circuit breaker	Sheet 1	52
1 phase, 1 pole circuit breaker	Sheet 2	53
3 phase, 3 pole circuit breaker	Sheet 3	54

Figure 2-1 Drawings and Diagrams

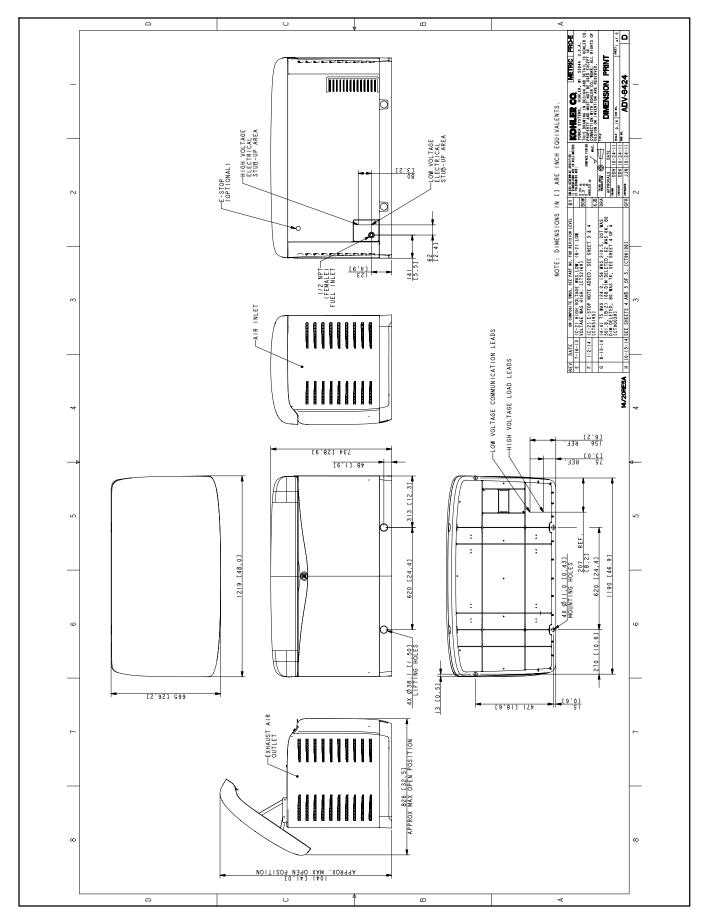


Figure 2-2 Dimension Drawing ADV-8424, Sheet 1 of 5

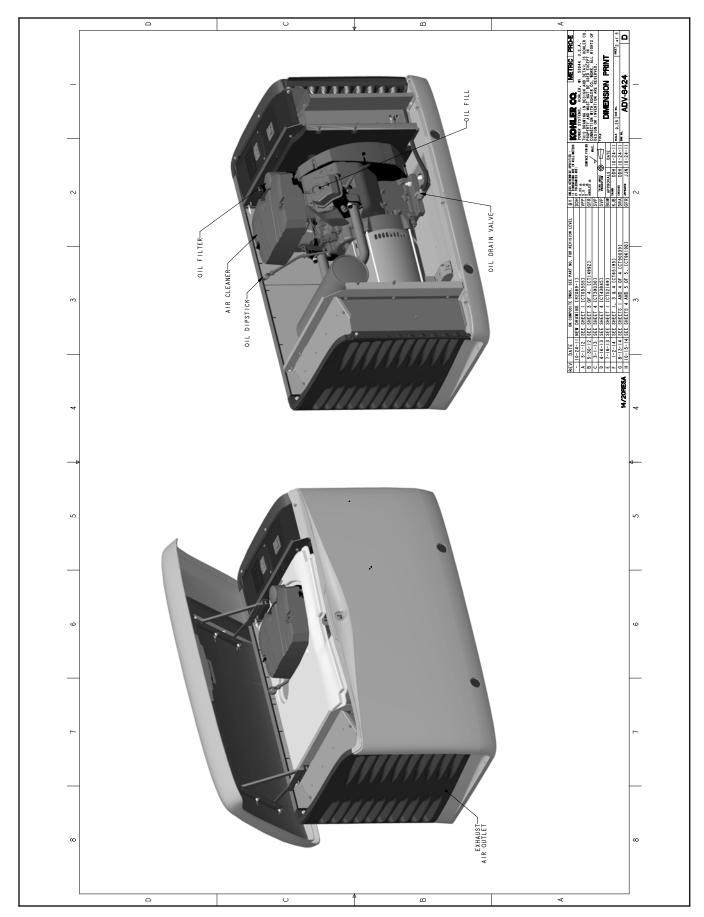


Figure 2-3 Dimension Drawing ADV-8424, Sheet 2 of 5

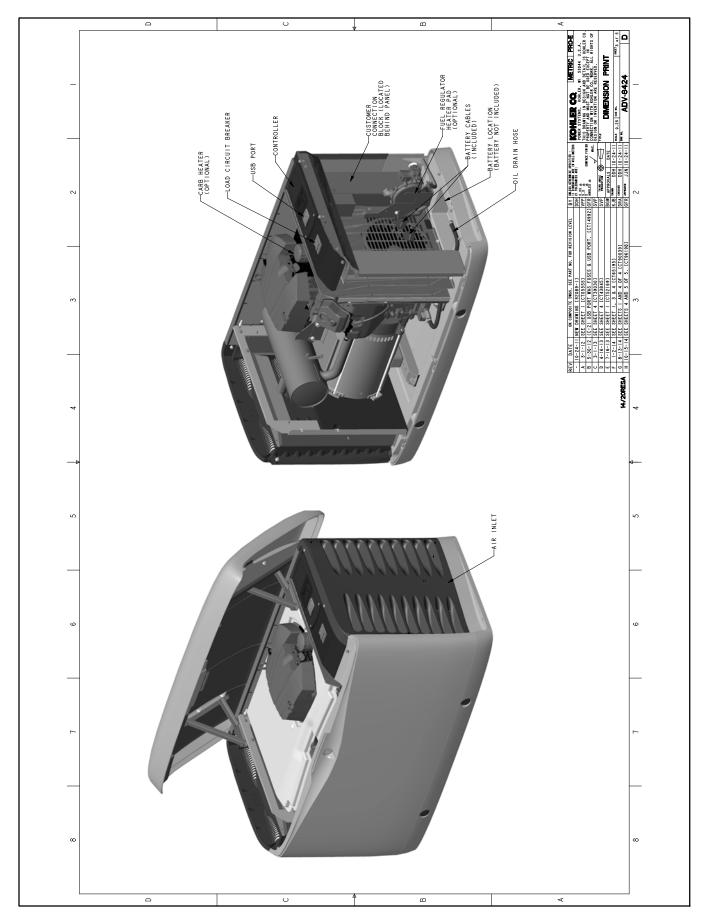
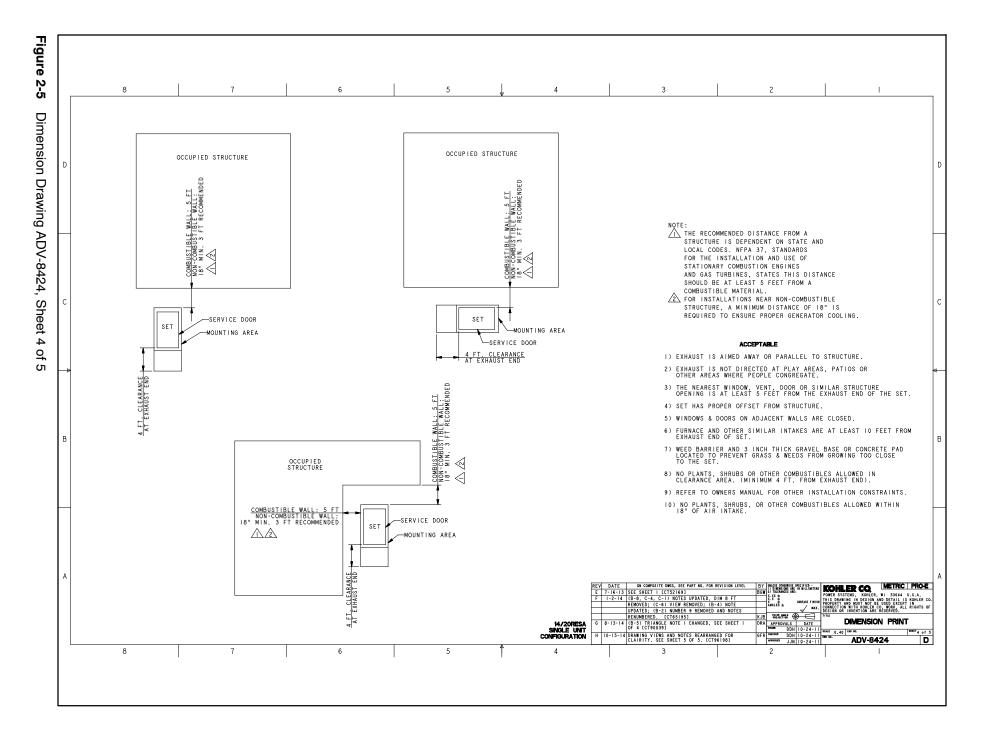
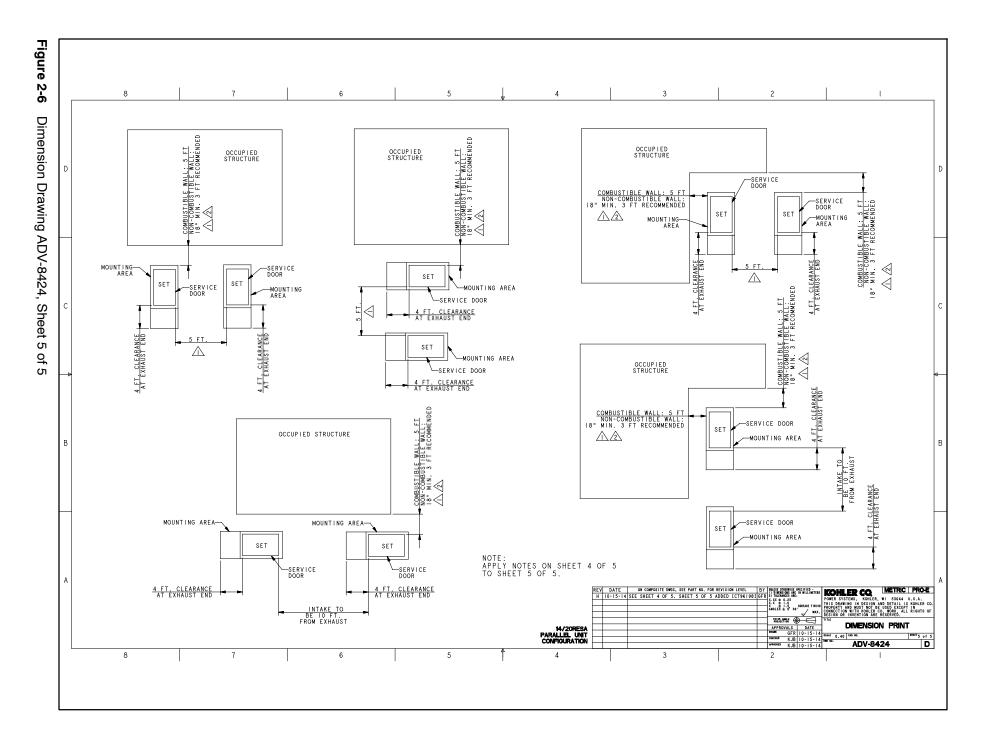


Figure 2-4 Dimension Drawing ADV-8424, Sheet 3 of 5

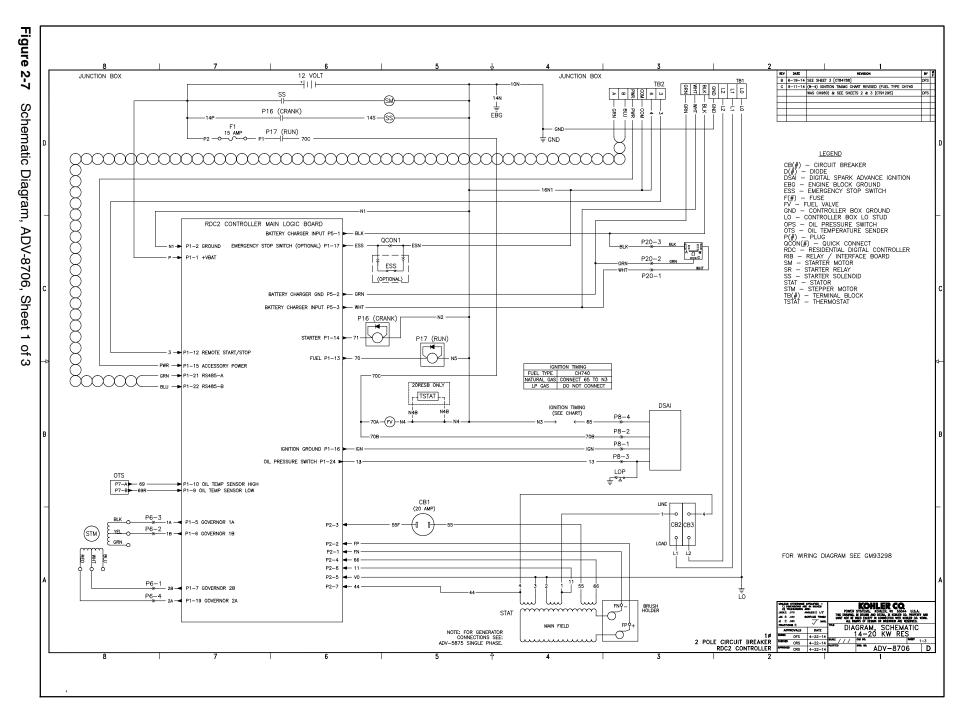
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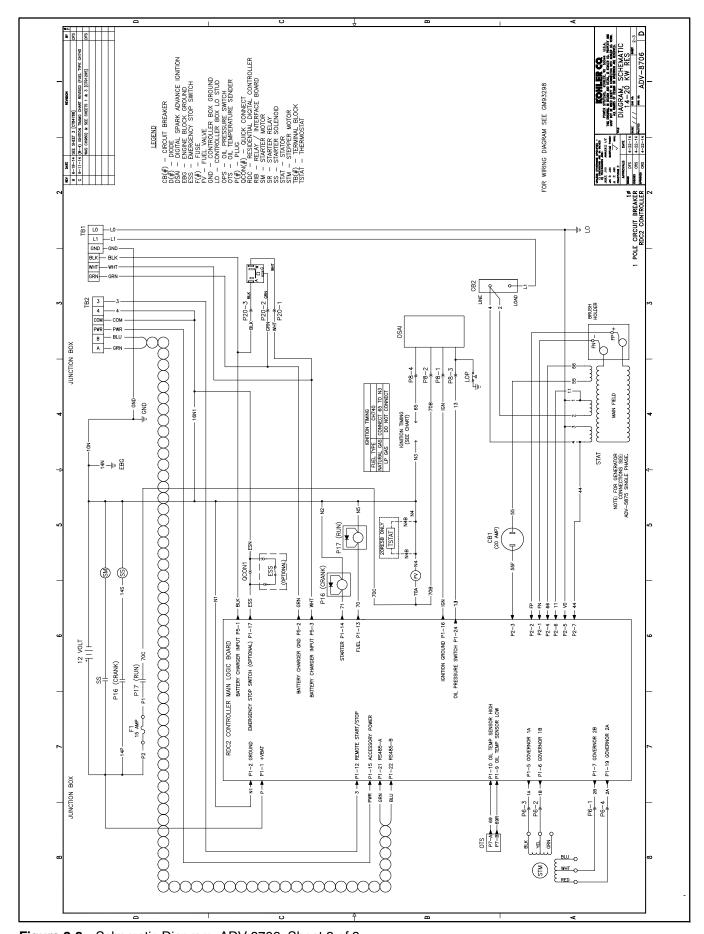


Figure 2-8 Schematic Diagram, ADV-8706, Sheet 2 of 3

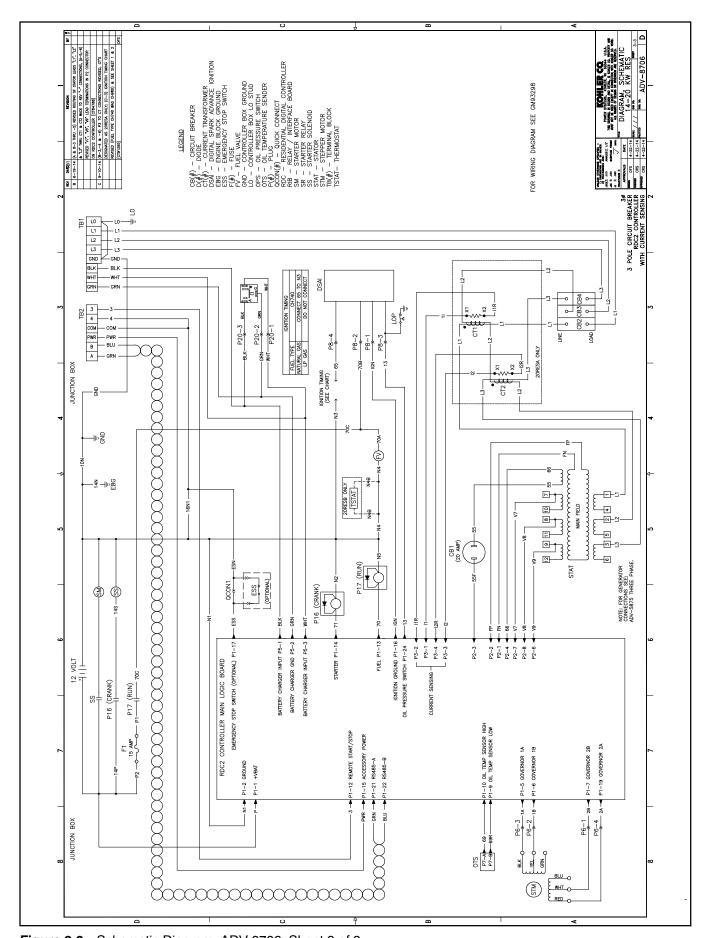


Figure 2-9 Schematic Diagram, ADV-8706, Sheet 3 of 3

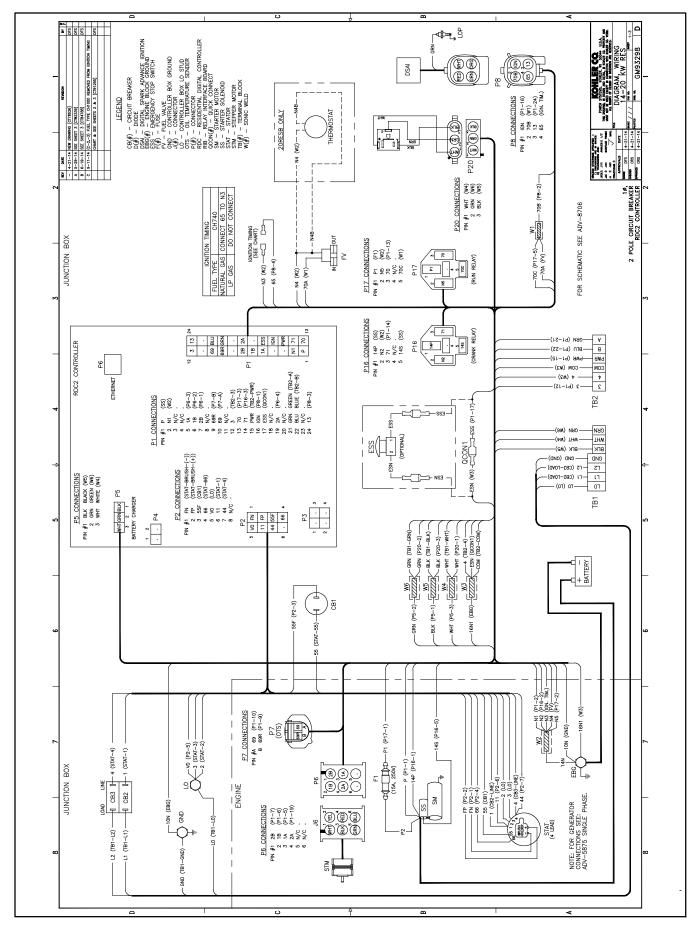


Figure 2-10 Point-to-Point Wiring Diagram, GM93298, Sheet 1 of 3

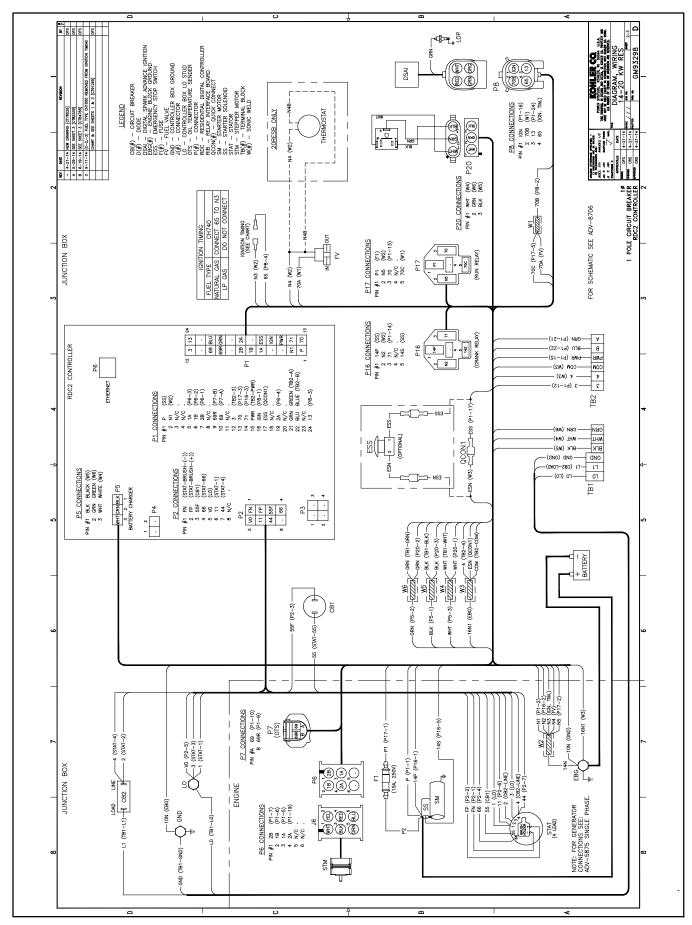


Figure 2-11 Point-to-Point Wiring Diagram, GM93298, Sheet 2 of 3

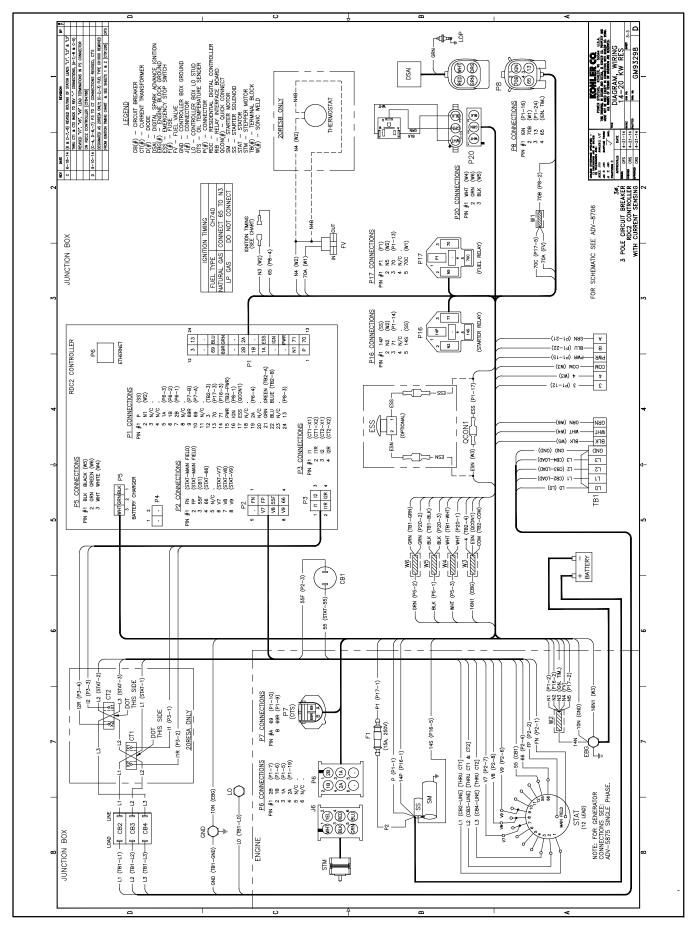


Figure 2-12 Point-to-Point Wiring Diagram, GM93298, Sheet 3 of 3

Appendix A Abbreviations

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

	- · · · · · · · · · · · · · · · · · · ·	,	, appear a pasa		
A, amp ABDC	ampere	cfm CG	cubic feet per minute	exh.	exhaust
AC	after bottom dead center alternating current	CID	center of gravity cubic inch displacement	ext. F	external Fahrenheit, female
A/D	analog to digital	CL	centerline	г FHM	flat head machine (screw)
ADC	advanced digital control;	cm	centimeter	fl. oz.	fluid ounce
ADC	analog to digital converter	CMOS	complementary metal oxide	flex.	flexible
adj.	adjust, adjustment	CIVIOS	substrate (semiconductor)	_	_
ADV	advertising dimensional	com	communications (port)	freq. FS	frequency full scale
715 (drawing	coml	commercial	ft.	foot, feet
Ah	amp-hour		Commercial/Recreational	ft. lb.	foot pounds (torque)
AHWT	anticipatory high water	conn.	connection	ft./min.	feet per minute
	temperature	cont.	continued	ftp	file transfer protocol
AISI	American Iron and Steel	CPVC	chlorinated polyvinyl chloride	g	gram
	Institute	crit.	critical	ga.	gauge (meters, wire size)
ALOP	anticipatory low oil pressure	CSA	Canadian Standards	gal.	gallon
alt.	alternator		Association	gen.	generator
Al	aluminum	CT	current transformer	genset	generator set
ANSI	American National Standards	Cu	copper	GFI	ground fault interrupter
	Institute (formerly American Standards Association, ASA)	cUL	Canadian Underwriter's	GND, ⊕	ground
AO	anticipatory only		Laboratories		governor
APDC	Air Pollution Control District	CUL	Canadian Underwriter's	gov.	gallons per hour
API	American Petroleum Institute		Laboratories	gph gpm	gallons per minute
approx.	approximate, approximately	cu. in.	cubic inch	gr.	grade, gross
APU	Auxiliary Power Unit	CW.	clockwise	GRD	equipment ground
AQMD	Air Quality Management District	CWC	city water-cooled	gr. wt.	gross weight
AR	as required, as requested	cyl.	cylinder		height by width by depth
AS	as supplied, as stated, as	D/A	digital to analog	HC	hex cap
, 10	suggested	DAC dB	digital to analog converter decibel	HCHT	high cylinder head temperature
ASE	American Society of Engineers	dB(A)	decibel (A weighted)	HD	heavy duty
ASME	American Society of	DC	direct current	HET	high exhaust temp., high
	Mechanical Engineers	DCR	direct current resistance		engine temp.
assy.	assembly	deg., °	degree	hex	hexagon
ASTM	American Society for Testing	deg., dept.	department	Hg	mercury (element)
	Materials	dept. dia.	diameter	НĤ	hex head
ATDC	after top dead center	DI/EO	dual inlet/end outlet	HHC	hex head cap
ATS	automatic transfer switch	DIN	Deutsches Institut fur Normung	HP	horsepower
auto.	automatic	Diii	e. V. (also Deutsche Industrie	hr.	hour
aux.	auxiliary		Normenausschuss)	HS	heat shrink
avg.	average	DIP	dual inline package	hsg.	housing
AVR	automatic voltage regulator	DPDT	double-pole, double-throw	HVAC	heating, ventilation, and air
AWG	American Wire Gauge	DPST	double-pole, single-throw		conditioning
AWM	appliance wiring material	DS	disconnect switch	HWT	high water temperature
bat. BBDC	battery	DVR	digital voltage regulator	Hz	hertz (cycles per second)
BC	before bottom dead center battery charger, battery	E ² PROM,		IBC	International Building Code
ьс	charging		electrically-erasable	IC	integrated circuit
BCA	battery charging alternator		programmable read-only memory	ID IEC	inside diameter, identification
BCI	Battery Council International	E, emer.	emergency (power source)	IEC	International Electrotechnical Commission
BDC	before dead center	ECM	electronic control module,	IEEE	Institute of Electrical and
BHP	brake horsepower	LOW	engine control module		Electronics Engineers
blk.	black (paint color), block	EDI	electronic data interchange	IMS	improved motor starting
	(engine)	EFR	emergency frequency relay	in.	inch
blk. htr.	block heater	e.g.	for example (exempli gratia)	in. H ₂ O	inches of water
BMEP	brake mean effective pressure	EĞ	electronic governor	in. Hg	inches of mercury
bps	bits per second	EGSA	Electrical Generating Systems	in. lb.	inch pounds
br.	brass		Association	Inc.	incorporated
BTDC	before top dead center	EIA	Electronic Industries	ind.	industrial
Btu	British thermal unit		Association	int.	internal
Btu/min.	British thermal units per minute	EI/EO	end inlet/end outlet	int./ext.	internal/external
С	Celsius, centigrade	EMI	electromagnetic interference	I/O	input/output
cal.	calorie	emiss.	emission	IP	internet protocol
CAN	controller area network	eng.	engine	ISO	International Organization for
CARB	California Air Resources Board	EPA	Environmental Protection		Standardization
CAT5	Category 5 (network cable)	EPS	Agency	J	joule
CB	circuit breaker	ER	emergency power system emergency relay	JIS	Japanese Industry Standard
CC	crank cycle	ES	engineering special,	k	kilo (1000)
CCA	cubic centimeter	_0	engineered special	K	kelvin
CCA	cold cranking amps	ESD	electrostatic discharge	kA KB	kiloampere
CCW.	counterclockwise	est.	estimated	KB	kilobyte (2 ¹⁰ bytes)
CEC	Canadian Electrical Code	E-Stop	emergency stop	kg	kilogram
cert. cfh	certificate, certification, certified cubic feet per hour	etc.	et cetera (and so forth)		
OIII	oable leet per flour				

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kg/cm ²	kilograms per square	NC	normally closed	RTU	remote terminal unit
-	centimeter	NEC	National Electrical Code	RTV	room temperature vulcanization
kgm	kilogram-meter	NEMA	National Electrical	RW	read/write
kg/m ³	kilograms per cubic meter		Manufacturers Association	SAE	Society of Automotive
kHz	kilohertz	NFPA	National Fire Protection	OAL	Engineers
		NIIA	Association	oofm	
kJ	kilojoule	NIm		scfm	standard cubic feet per minute
km	kilometer	Nm	newton meter	SCR	silicon controlled rectifier
kOhm, kΩ	kilo-ohm	NO	normally open	s, sec.	second
kPa	kilopascal	no., nos.	number, numbers	SI	Systeme international d'unites,
kph	kilometers per hour	NPS	National Pipe, Straight		International System of Units
kV	kilovolt	NPSC	National Pipe, Straight-coupling	SI/EO	side in/end out
kVA	kilovolt ampere	NPT	National Standard taper pipe	sil.	silencer
	kilovolt ampere reactive		thread per general use	SMTP	simple mail transfer protocol
kVAR	•	NPTF	National Pipe, Taper-Fine	SN	
kW	kilowatt	NR	1 ' 1		serial number
kWh	kilowatt-hour		not required, normal relay	SNMP	simple network management
kWm	kilowatt mechanical	ns	nanosecond		protocol
kWth	kilowatt-thermal	OC	overcrank	SPDT	single-pole, double-throw
L	liter	OD	outside diameter	SPST	single-pole, single-throw
LAN	local area network	OEM	original equipment	spec	specification
	length by width by height		manufacturer	specs	specification(s)
		OF	overfrequency	sq.	square
lb.	pound, pounds	opt.	option, optional	•	square centimeter
lbm/ft ³	pounds mass per cubic feet	OS	oversize, overspeed	sq. cm	•
LCB	line circuit breaker		•	sq. in.	square inch
LCD	liquid crystal display	OSHA	Occupational Safety and Health	SMS	short message service
LED	light emitting diode	0) /	Administration	SS	stainless steel
Lph	liters per hour	OV	overvoltage	std.	standard
Lpm	liters per minute	oz.	ounce	stl.	steel
LOP		p., pp.	page, pages	tach.	tachometer
	low oil pressure	PC	personal computer	TB	terminal block
LP	liquefied petroleum	PCB	printed circuit board		
LPG	liquefied petroleum gas	pF	picofarad	TCP	transmission control protocol
LS	left side	PF	•	TD	time delay
L _{wa}	sound power level, A weighted		power factor	TDC	top dead center
LWL	low water level	ph., \varnothing	phase	TDEC	time delay engine cooldown
LWT	low water temperature	PHC	Phillips® head Crimptite®	TDEN	time delay emergency to
	•		(screw)		normal
m	meter, milli (1/1000)	PHH	Phillips® hex head (screw)	TDES	time delay engine start
M	mega (10 ⁶ when used with SI	PHM	pan head machine (screw)	TDNE	time delay normal to
0	units), male	PLC	programmable logic control	IDINE	emergency
m ³	cubic meter	PMG	permanent magnet generator	TDOE	time delay off to emergency
m ³ /hr.	cubic meters per hour				
m ³ /min.	cubic meters per minute	pot	potentiometer, potential	TDON	time delay off to normal
mA	milliampere	ppm	parts per million	temp.	temperature
man.	manual	PROM	programmable read-only	term.	terminal
			memory	THD	total harmonic distortion
max.	maximum	psi	pounds per square inch	TIF	telephone influence factor
MB	megabyte (2 ²⁰ bytes)	psig	pounds per square inch gauge	tol.	tolerance
MCCB	molded-case circuit breaker	pt.	pint	turbo.	turbocharger
MCM	one thousand circular mils	PTC	positive temperature coefficient		
meggar	megohmmeter	PTO	•	typ.	typical (same in multiple
MHz	megahertz		power takeoff		locations)
mi.	mile	PVC	polyvinyl chloride	UF	underfrequency
mil	one one-thousandth of an inch	qt.	quart, quarts	UHF	ultrahigh frequency
		qty.	quantity	UIF	user interface
min.	minimum, minute	Ŕ	replacement (emergency)	UL	Underwriter's Laboratories, Inc.
misc.	miscellaneous		power source	UNC	unified coarse thread (was NC)
MJ	megajoule	rad.	radiator, radius	UNF	unified fine thread (was NF)
mJ	millijoule	RAM	random access memory		,
mm	millimeter	RBUS	RS-485 proprietary	univ.	universal
mOhm, mΩ	Pmilliohm	проз		URL	uniform resource locator
MOhm, MS		DDO	communications		(web address)
MOV	•	RDO	relay driver output	US	undersize, underspeed
	metal oxide varistor	ref.	reference	UV	ultraviolet, undervoltage
MPa	megapascal	rem.	remote	V	volt
mpg	miles per gallon	Res/Coml	Residential/Commercial	VAC	volts alternating current
mph	miles per hour	RFI	radio frequency interference	VAR	voltampere reactive
MS	military standard	RH	round head	VDC	•
ms	millisecond	RHM	round head machine (screw)		volts direct current
m/sec.	meters per second			VFD	vacuum fluorescent display
	·	rly.	relay	VGA	video graphics adapter
mtg.	mounting	rms	root mean square	VHF	very high frequency
MTU	Motoren-und Turbinen-Union	rnd.	round	W	watt
MW	megawatt	RO	read only	WCR	withstand and closing rating
mW	milliwatt	ROM	read only memory	w/	with
μF	microfarad	rot.	rotate, rotating	W/ WO	
N, norm.	normal (power source)	rpm	revolutions per minute		write only
NA	not available, not applicable		•	w/o	without
	natural gas	RS DTD-	right side	wt.	weight
nat. gas NBS	National Bureau of Standards	RTDs	Resistance Temperature	xfmr	transformer
טחוו	National Dureau Of Standards		Detectors		

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Use the full-scale drawing in Figure 1 to mark the openings for the electrical conduit, if desired. See Section 1.9.2 for more information.

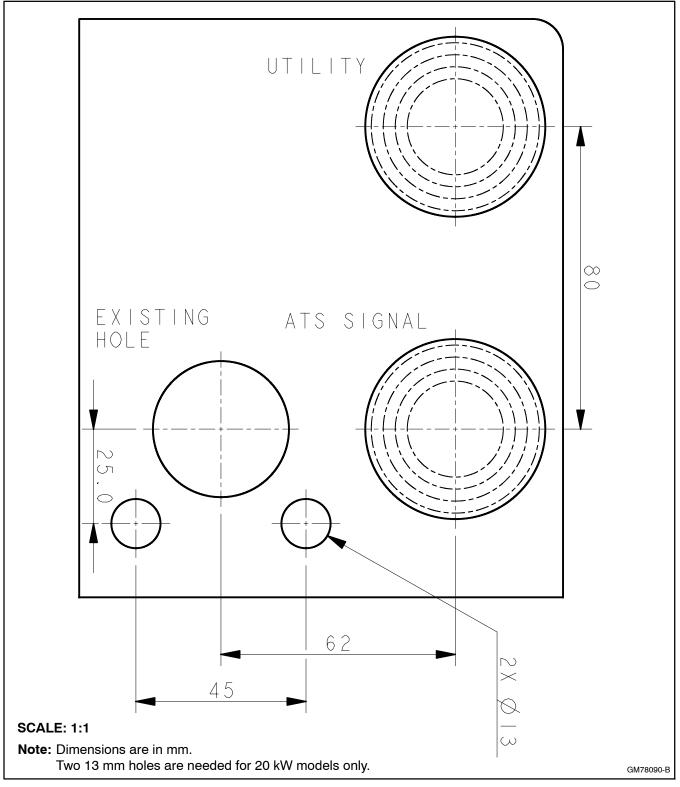


Figure 1 Template, Drilled or Punched Openings for Regulator Vent Tubes (20 kW only) and Electrical Conduit

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Notes

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