

Installation

Residential/Commercial Generator Sets



Models:

8.5/12/17/18RES

12/18TRES

Controller:

Advanced Digital Control ADC-RES



KOHLER[®]
Power Systems

TP-6514 3/13g

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

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

Model Designation _____

Specification Number _____

Serial Number _____

Accessory Number	Accessory Description
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_____	_____
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_____	_____
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_____	_____
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_____	_____
-------	-------

_____	_____
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Engine Identification

Record the product identification information from the engine nameplate.

Manufacturer _____

Model Designation _____

Serial Number _____

Controller Identification

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

Controller Description _____

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Notes

Safety Precautions and Instructions

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

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

DANGER

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

WARNING

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

CAUTION

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

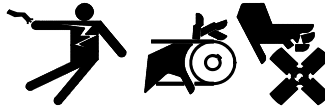
NOTICE

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

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

Accidental Starting

WARNING



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

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

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

Battery

WARNING



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

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

WARNING



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

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


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

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

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

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

Engine Backfire/Flash Fire

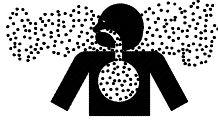
⚠ WARNING

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

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

Exhaust System

⚠ WARNING

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

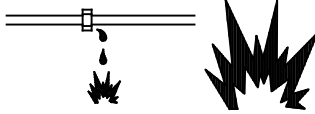
Generator set operation. Carbon monoxide can cause severe nausea, fainting, or death. Carbon monoxide is an odorless, colorless, tasteless, nonirritating gas that can cause death if inhaled for even a short time. Avoid breathing exhaust fumes when working on or near the generator set. Never operate the generator set inside a building. 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.

Fuel System

⚠ WARNING

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

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

Hazardous Noise

⚠ CAUTION



Hazardous noise.
Can cause hearing loss.

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

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

Hazardous Voltage/ Moving Parts

⚠ WARNING



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

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

⚠ WARNING



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

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

⚠ CAUTION



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

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

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

Welding on the generator set. Can cause severe electrical equipment damage. Before welding on the generator set perform the following steps: (1) Remove the battery cables, negative (-) lead first. (2) Disconnect all engine electronic control module (ECM) connectors. (3) Disconnect all generator set controller and voltage regulator circuit board connectors. (4) Disconnect the engine battery-charging alternator connections. (5) Attach the weld ground connection close to the weld location.

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.

⚠ WARNING



Airborne particles.
Can cause severe injury or blindness.

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

Heavy Equipment



⚠ WARNING



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

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

Hot Parts

 WARNING

Hot 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 listed on the front cover. Refer to TP-6515, 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 an 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.

See Figure 1 and Figure 2 for generator set component locations.

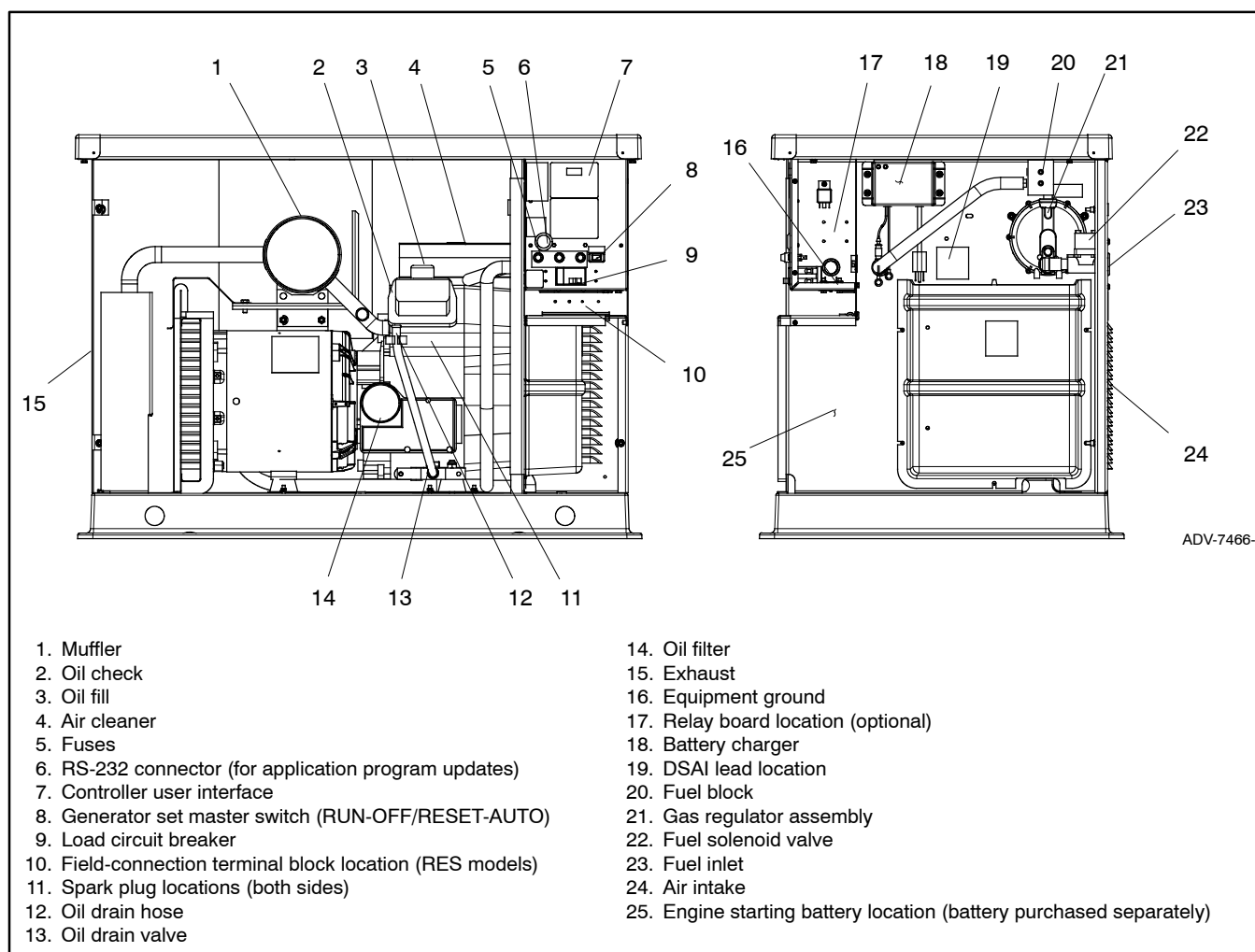


Figure 1 Generator Set Component Locations, 8.5/12 kW Models

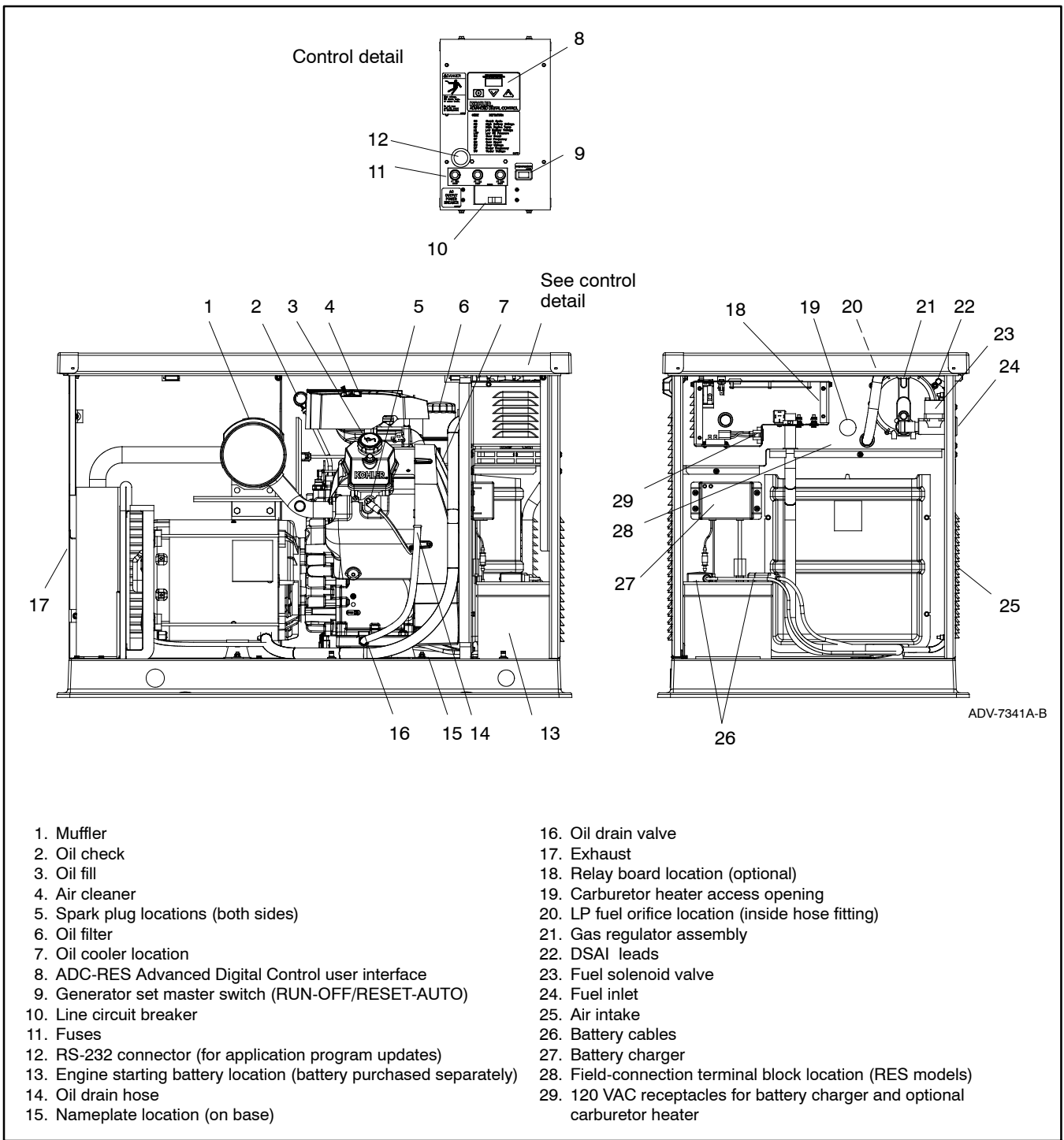


Figure 2 Generator Set Component Locations, 17/18 kW Models

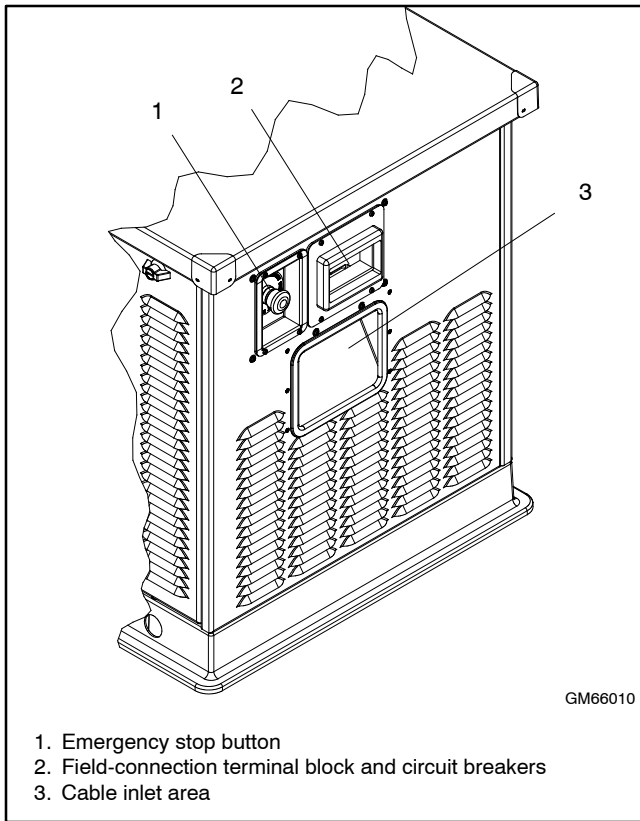


Figure 3 Additional Components, TRES (3-phase) Models

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 KOHLEPower.com.
- Look at the labels and decals 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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Japan, Korea

North Asia Regional Office
Tokyo, Japan
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Latin America

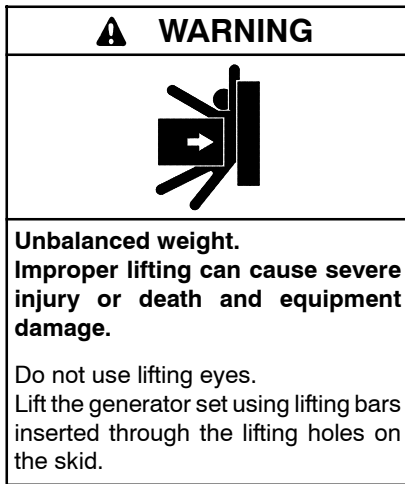
Latin America Regional Office
Lakeland, Florida, USA
Phone: (863) 619-7568
Fax: (863) 701-7131

1.1 General

Have an authorized distributor/dealer install the generator set outdoors according to the instructions in this manual. Do not install this generator set indoors.

Use the specifications provided here only in the initial planning. Use the generator set and transfer switch dimension drawings and wiring diagrams for installation.

1.2 Lifting



Model	Weight, kg (lb.)
8.5 kW	180 (400)
12 kW	186 (410)
17/18 kW	227 (500)

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 on the following pages 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.
2. 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-6515, Operation Manual, for additional information.

1.4 Location and Mounting

See the dimension drawings on the following pages for the generator set dimensions and fuel and electric inlet locations. The drawing dimensions are shown in millimeters, with inches in brackets.

Install the generator set outdoors. Provide the minimum clearance around the generator set shown in the clearance drawings on the following pages. Locate the generator set so that the hot exhaust does not blow on plants or other combustible materials. Do not install the generator set where exhaust gas could accumulate and seep inside or be drawn into a potentially occupied building.

The generator set is shipped on a plastic mounting pad. Prepare a flat, level mounting area covered with a weed barrier and gravel as shown in the generator set clearance drawing. Set the plastic mounting pad directly on the gravel. Do not install the mounting pad directly on grass.

See Figure 1-4 for the high wind mounting detail for the 8.5/12 kW model.

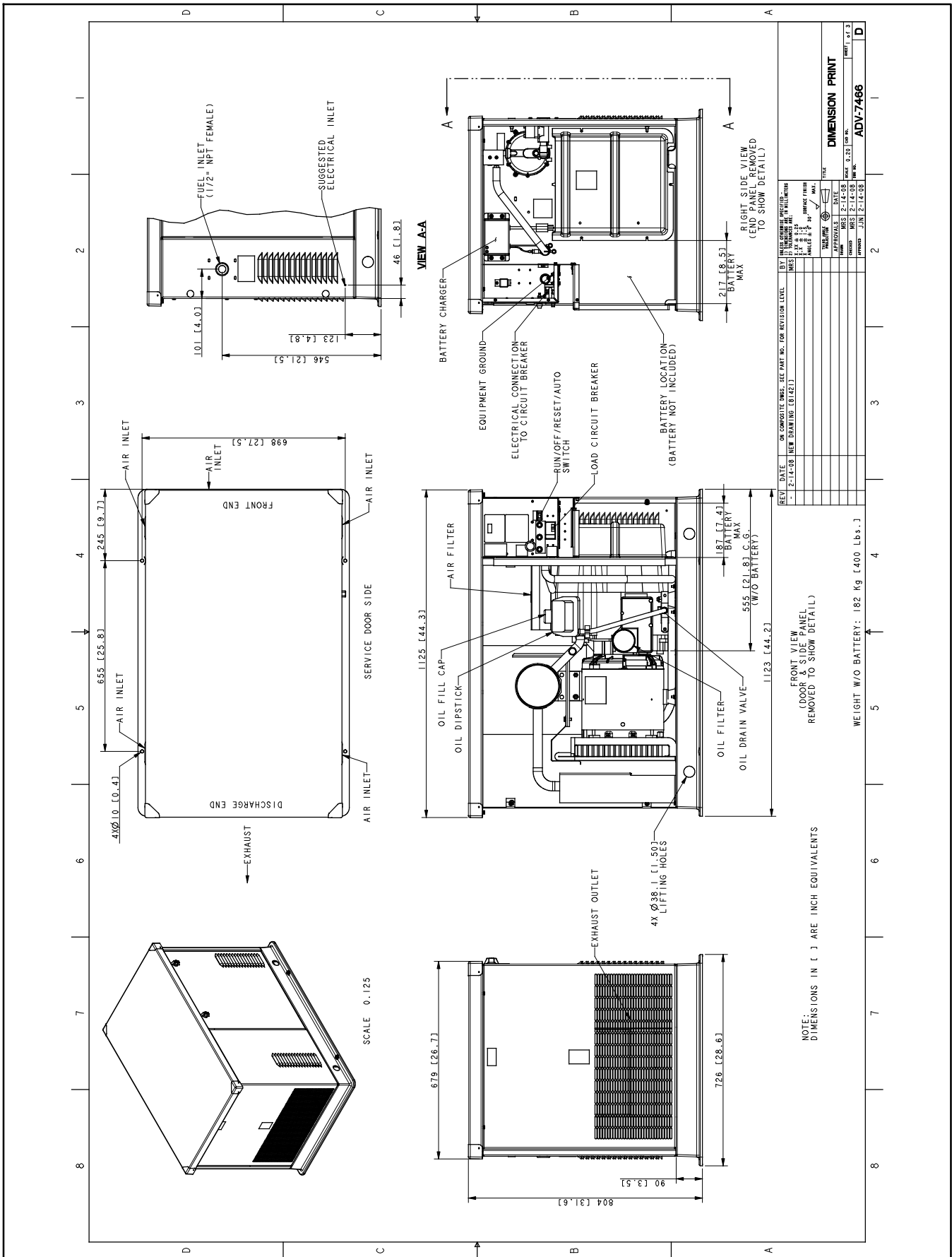


Figure 1-2 Generator Set Mounting Details and Dimensions, 8.5RES, 12RES, and 12TRES (3-phase), ADV-7466, Sheet 1

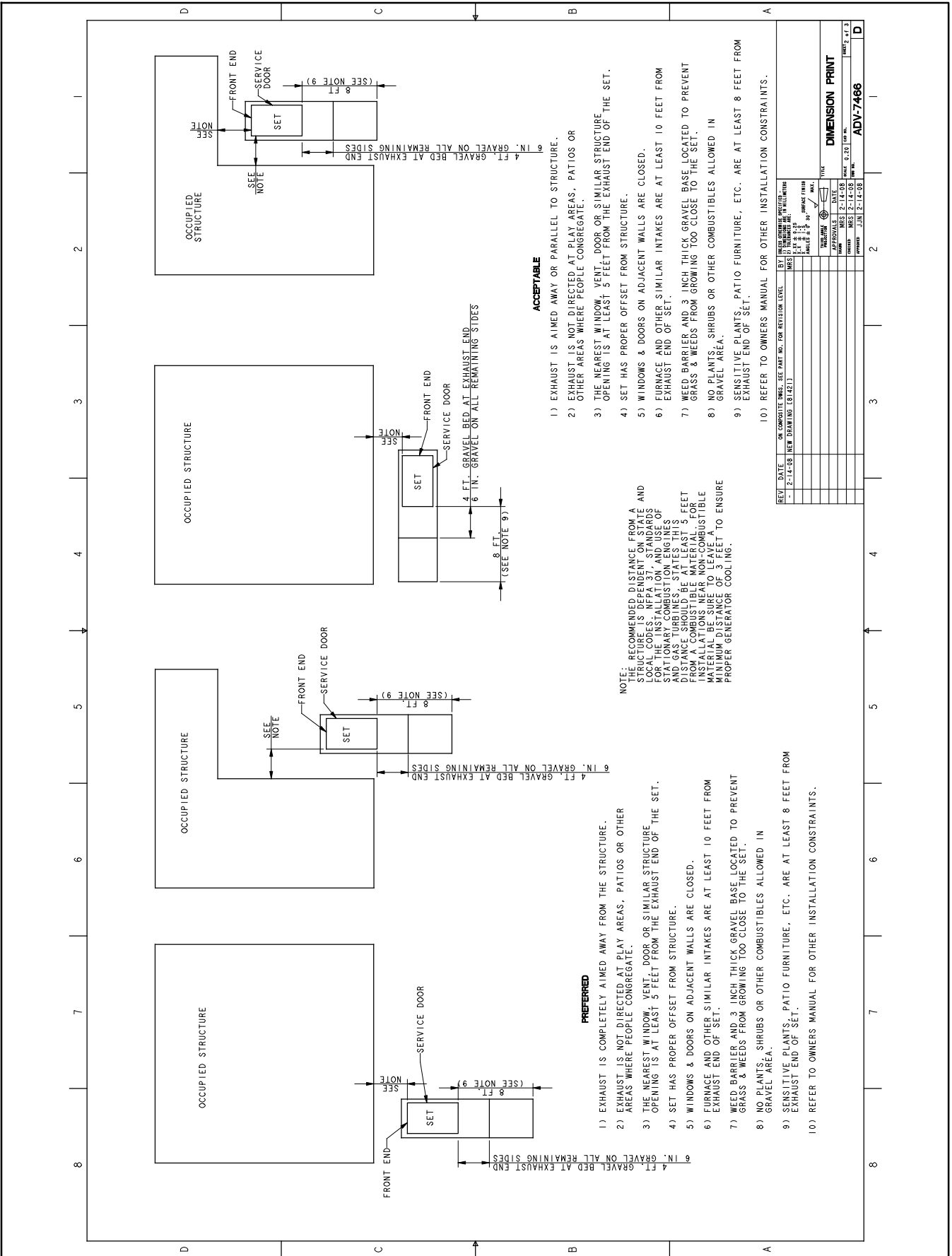


Figure 1-3 Generator Set Clearances, 8.5RES, 12RES, and 12TRES (3-phase), ADV-7466, Sheet 2

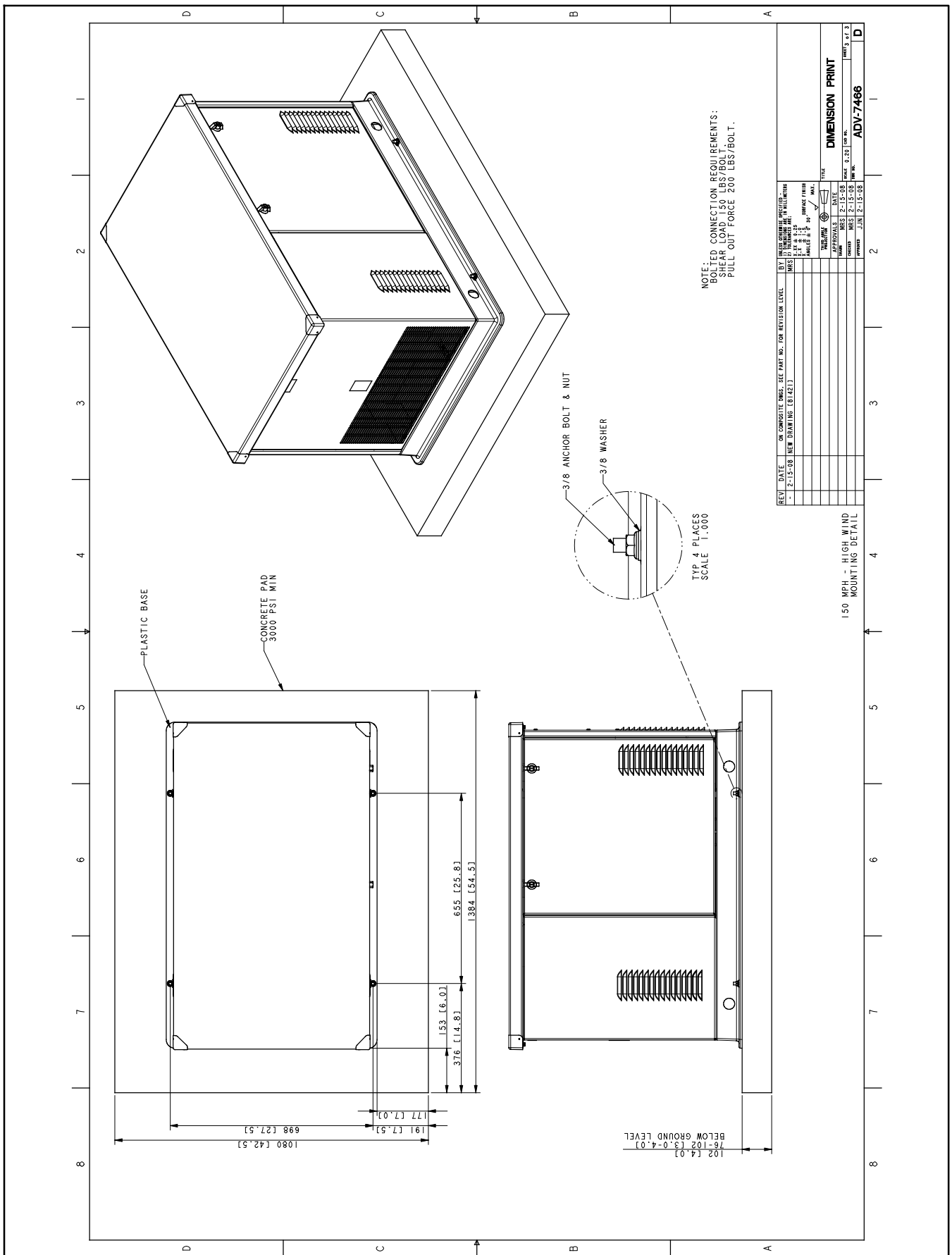


Figure 1-4 High Wind Mounting Detail, 8.5RES, 12RES, and 12TRES (3-phase), ADV-7466, Sheet 3

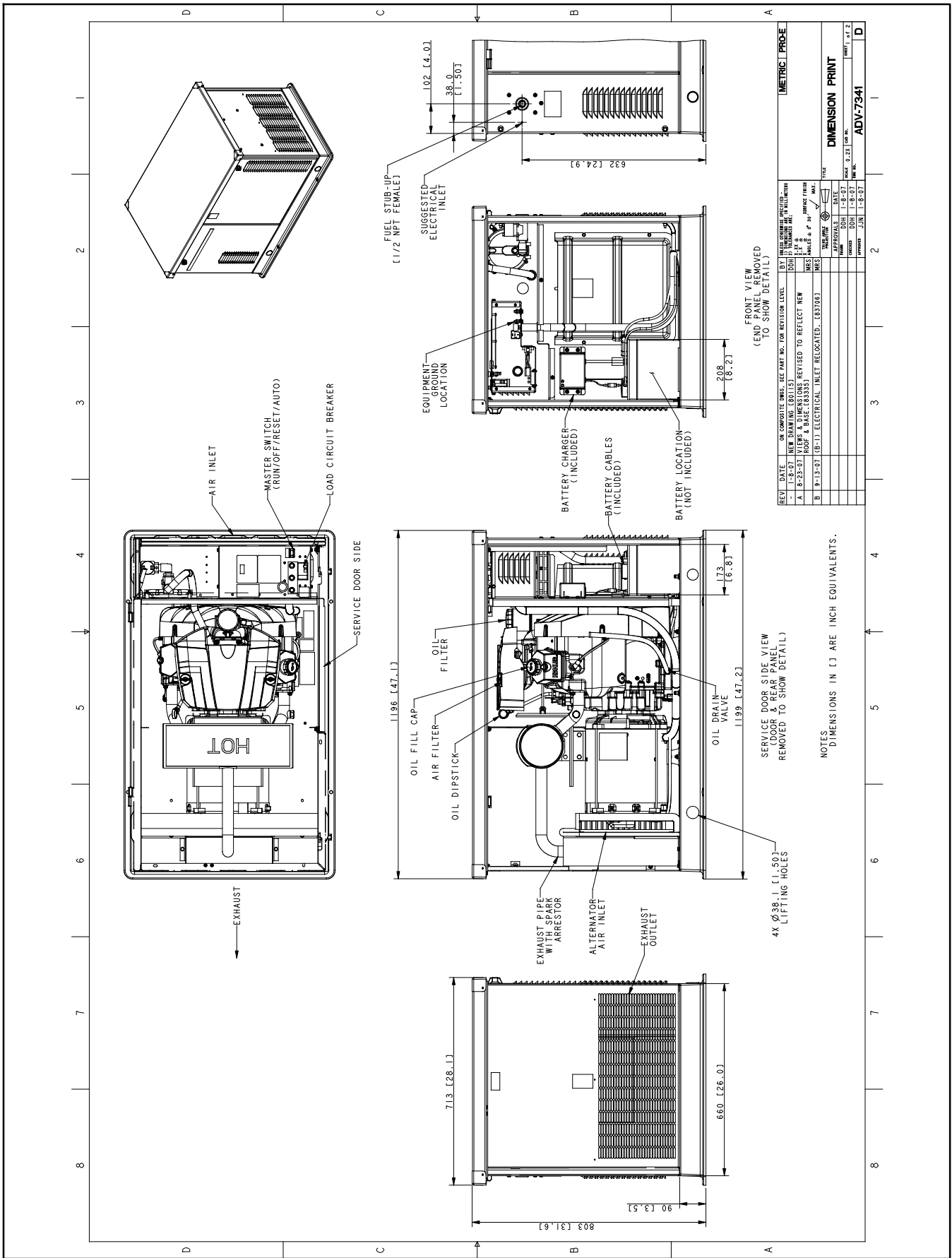


Figure 1-5 Generator Set Mounting Details and Dimensions, 17RES and 18RES, ADV-7341-B, Sheet 1

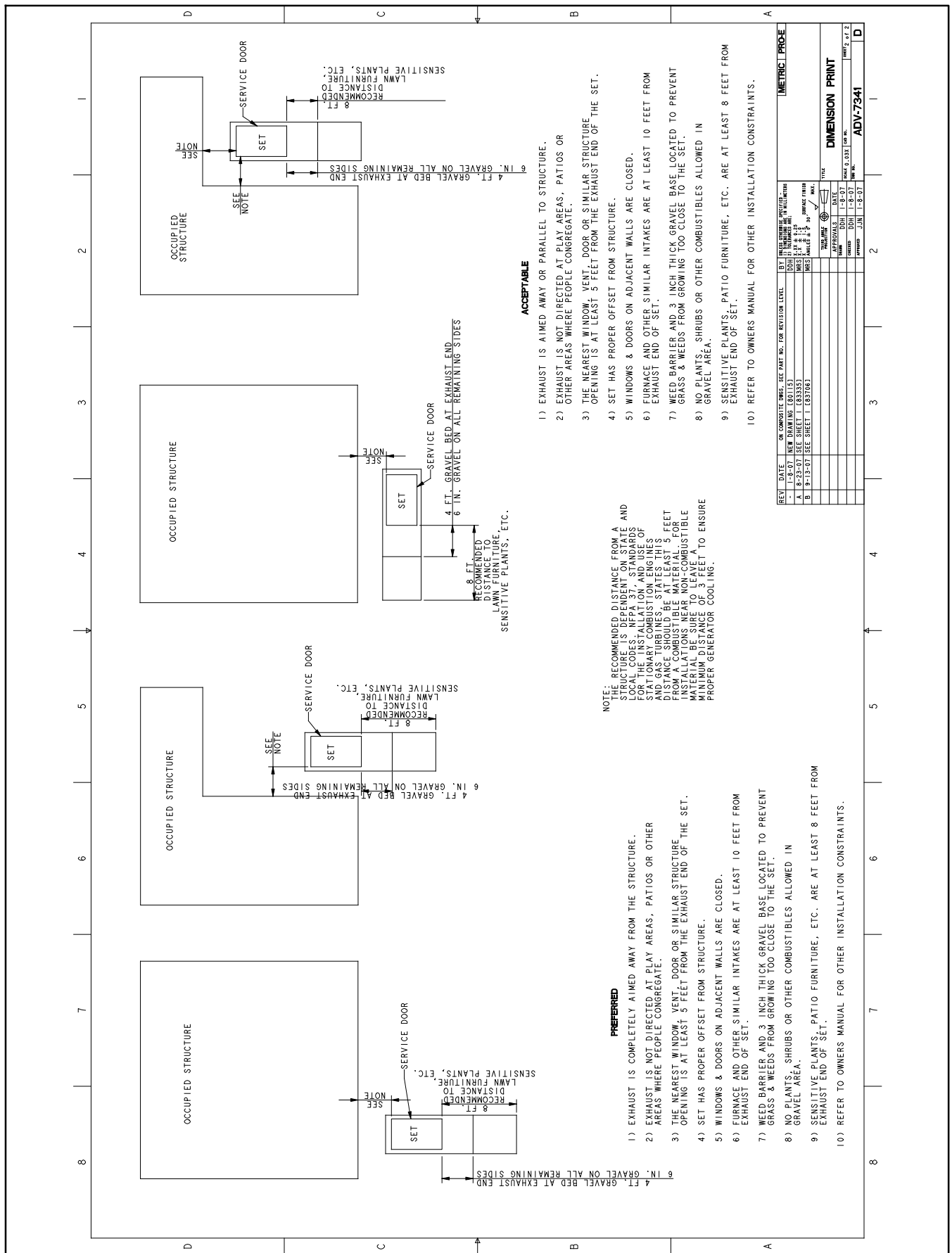


Figure 1-6 Generator Set Clearances, 17RES and 18RES, ADV-7341-B, Sheet 2

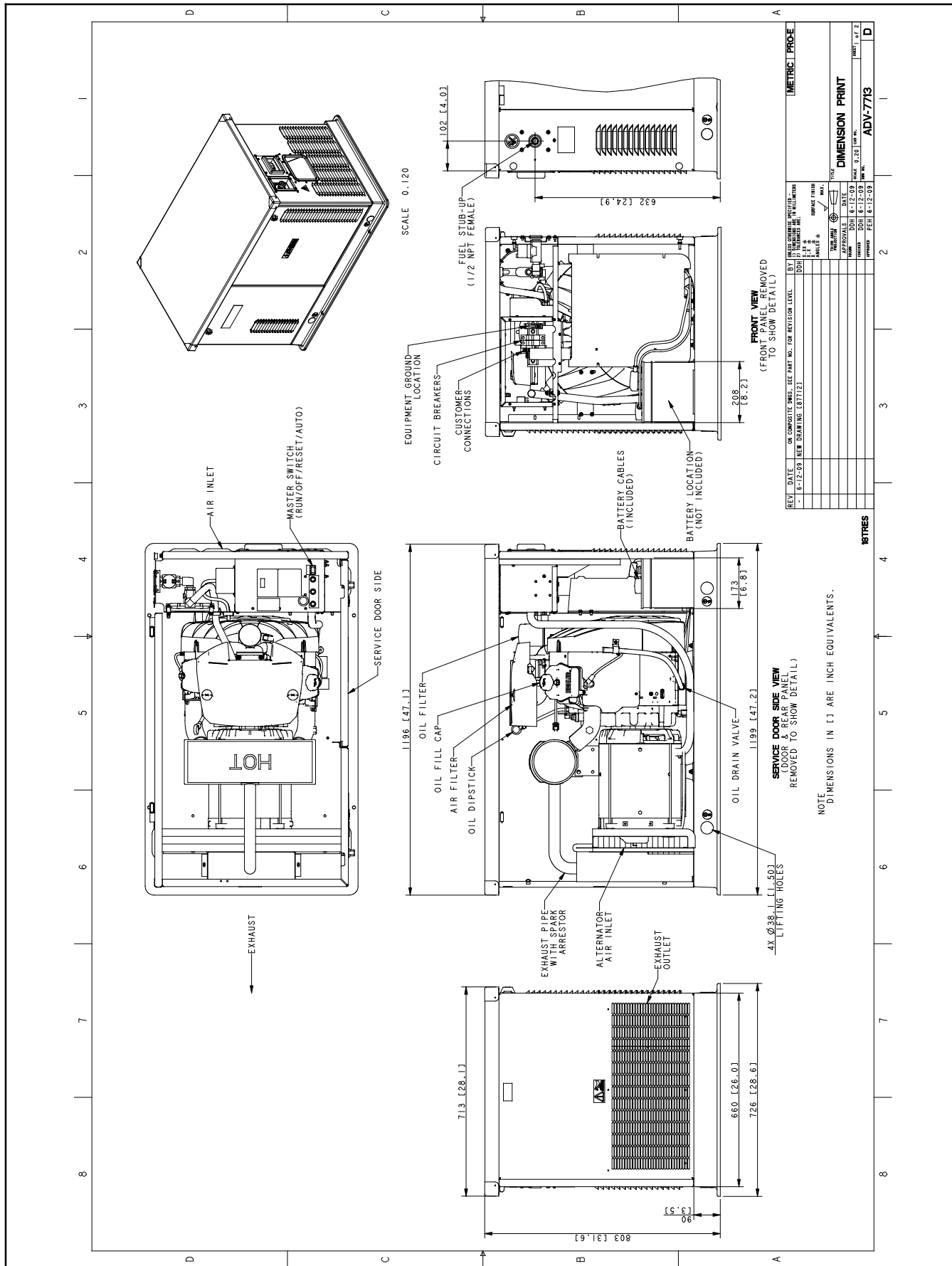


Figure 1-7 Generator Set Mounting Details and Dimensions, 18TRES (3-phase), ADV-7713, Sheet 1

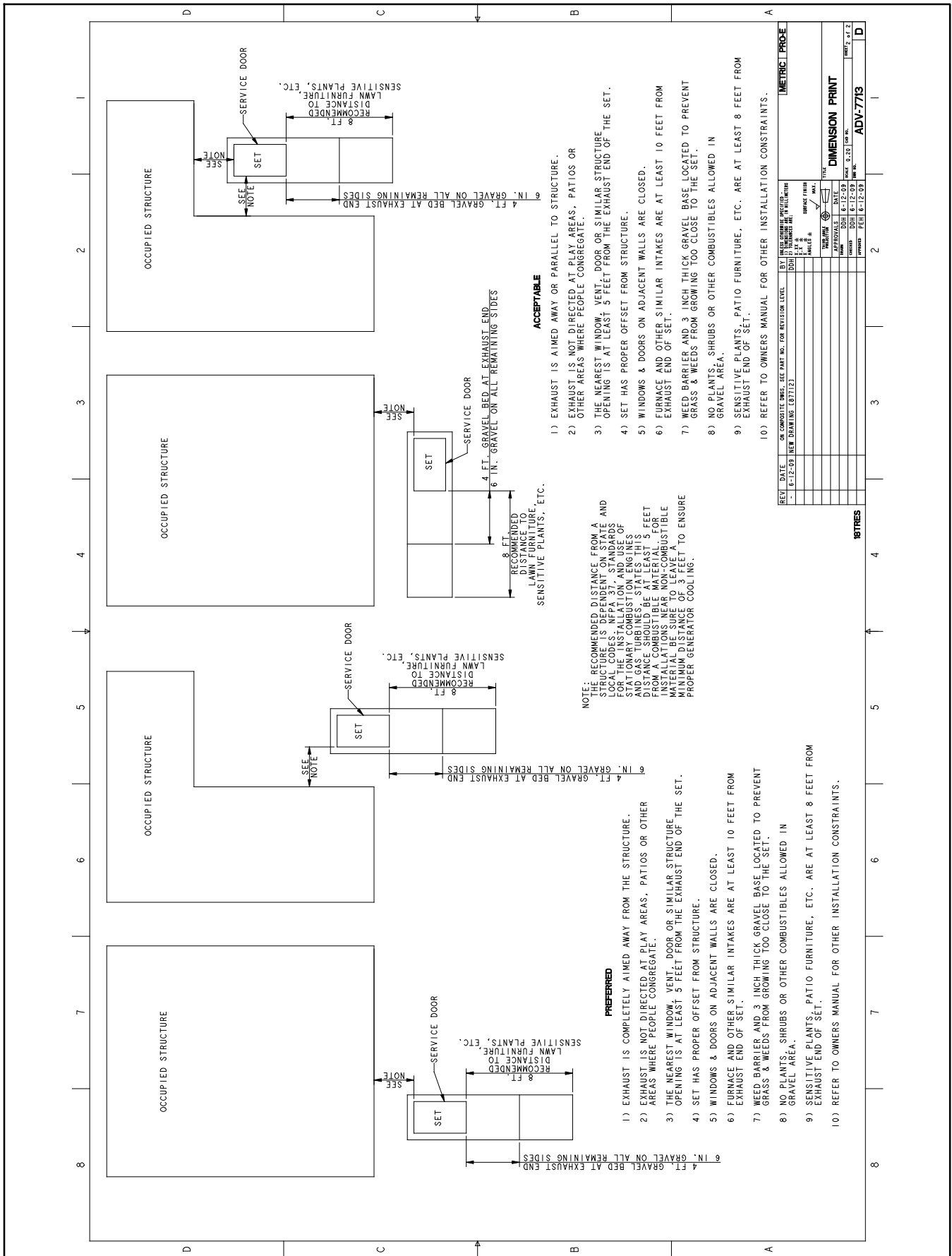
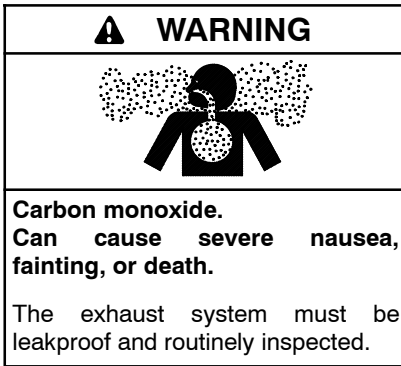


Figure 1-8 Generator Set Clearances, 18TRES (3-phase), ADV-7713, Sheet 2

1.4.1 Exhaust Requirements



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.

The exhaust system is complete for generator sets installed outdoors. Do not install this generator set indoors.

Figure 1-9 gives the exhaust flow and 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 Figure 1-3 or Figure 1-6.

Exhaust System	60 Hz	50 Hz
Exhaust flow at rated kW, m ³ /min. (cfm)		
8.5 kW	3.3 (115)	2.7 (96)
12 kW	3.8 (135)	3.2 (113)
17/18 kW	5.3 (187)	4.4 (155)
Exhaust gas exiting the enclosure at rated kW, °C (°F)	216 (420)	

Figure 1-9 Exhaust Flow and Temperature

1.4.2 Air Requirements

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 1-10 shows the locations of the cooling air intake and exhaust vents. Inspect the air inlet and outlet openings inside and outside the housing to ensure that the air flow is not blocked.

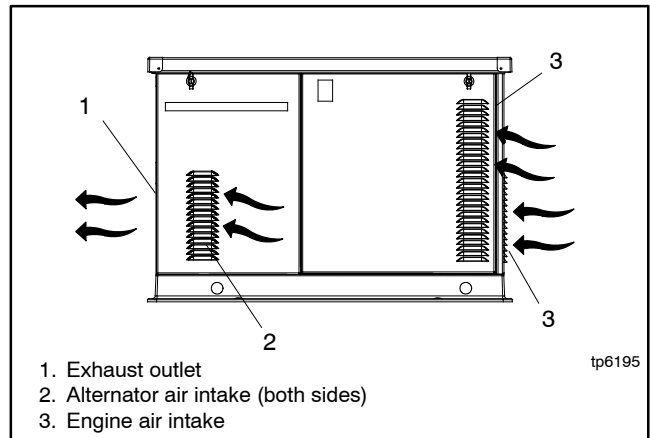


Figure 1-10 Cooling Air Intake and Exhaust, Typical

Air Requirements, m ³ /min. (cfm)				
Model	Hz	Cooling Air	Combustion Air	Total Inlet Air
8.5 kW	60	26.9 (950)	0.94 (33.4)	27.8 (980)
	50	22.4 (790)	0.8 (28.0)	23.2 (820)
12 kW	60	26.9 (950)	1.1 (39.2)	28.0 (990)
	50	22.4 (790)	0.9 (32.6)	23.4 (825)
17/18 kW	60	28.0 (989)	1.62 (57.3)	29.6 (1045)
	50	22.6 (798)	1.42 (50.1)	24.0 (848)

Figure 1-11 Air Requirements

1.5 Power Supply

Power must be supplied from a source that is GFCI protected to the generator set location for the battery charger and the optional accessories shown in Figure 1-12.

Connect power from a circuit on the essential loads panel to the utility power connection points on the terminal block. See Section 1.8 and the wiring diagrams in Section 2 for connection details. See Figure 1-12 or Figure 1-13 for the power requirements for the battery charger and accessories.

Equipment	Power Requirement, Max.		
	Watts	Amps	Volts
Battery charger (standard)	192	1.6	120
Carburetor heater (optional)	37	0.33	
Battery heater (optional)	110	0.92	

Figure 1-12 Power Requirements, RES Models

Equipment	Power Requirement, Max.		
	Watts	Amps	Volts
Battery charger	60	0.26	230
Carburetor heater	37	0.16	

Figure 1-13 Power Requirements, TRES (3-phase) Models

1.6 Fuel Requirements

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

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

1.6.1 Fuel Supply

Because of variable climates and geographical considerations, contact the local fuel supplier for fuel system planning and installation. Figure 1-14 lists the recommended fuel ratings and other fuel supply information for natural gas and LP vapor fuels.

Fuel type	Natural Gas	LP Vapor
Fuel supply inlet	1/2 NPT	
Fuel supply pressure, kPa (in. H ₂ O) 8.5/12 kW	1.3-2.7 (5-11)	1.7-2.7 (7-11)
Fuel supply pressure, kPa (in. H ₂ O), 17/18 kW	1.7-2.7 (7-11)	
Fuel flow rate, Btu/hr.		
8.5 kW	132000	180000
12 kW	193000	203000
17/18 kW	242000	280000
Nominal Fuel Rating, Btu/ft.³		
Natural gas	1000	
LP vapor	2500	

Figure 1-14 Fuel Supply

Verify that the output pressure from the primary gas utility (or LP tank) pressure regulator is 1.7-2.7 kPa (7-11 in. water column) and that the utility gas meter flow rate is sufficient to supply the generator set at rated load plus all other gas-consuming appliances. See Figure 1-15, Figure 1-16, or Figure 1-17 for fuel consumption. Contact the fuel supplier for flow rate information or a gas meter upgrade.

Figure 1-2 or Figure 1-5 shows the location of the fuel inlet connection. Use flexible sections to prevent fuel line breakage caused by vibration. Hold the fuel solenoid valve with a wrench when tightening the fuel connections. Protect all fuel lines from machinery or equipment contact, adverse weather conditions, and environmental damage.

Fuel Consumption, at % load, m ³ /hr. (cfh)	60 Hz	50 Hz
Natural Gas, m ³ /hr. (cfh)		
100%	3.7 (132)	3.3 (118)
75%	3.2 (113)	2.9 (101)
50%	2.6 (93)	2.3 (83)
25%	2.2 (77)	1.9 (69)
LP Vapor, m ³ /hr. (cfh)		
100%	2.0 (72)	1.7 (61)
75%	1.3 (45)	1.1 (38)
50%	1.0 (36)	0.9 (31)
25%	0.8 (29)	0.7 (25)
LP vapor conversion factors: 8.58 ft. ³ = 1 lb. 0.535 m ³ = 1 kg 36.39 ft. ³ = 1 gal.		
Nominal fuel rating: Natural gas: 37 MJ/m ³ (1000 Btu/ft. ³) LP vapor: 93 MJ/m ³ (2500 Btu/ft. ³)		

Figure 1-15 Fuel Consumption, 8.5 kW

Fuel Consumption, at % load, m ³ /hr. (cfh)	60 Hz	50 Hz
Natural Gas, m ³ /hr. (cfh)		
100%	6.9 (242)	5.7 (203)
75%	5.8 (204)	4.7 (167)
50%	4.4 (155)	3.8 (133)
25%	3.4 (120)	2.9 (103)
LP Vapor, m ³ /hr. (cfh)		
100%	3.2 (112)	2.7 (94)
75%	2.7 (96)	2.2 (79)
50%	2.1 (74)	1.7 (62)
25%	1.6 (57)	1.4 (50)
LP vapor conversion factors: 8.58 ft. ³ = 1 lb. 0.535 m ³ = 1 kg 36.39 ft. ³ = 1 gal.		
Nominal fuel rating: Natural gas: 37 MJ/m ³ (1000 Btu/ft. ³) LP vapor: 93 MJ/m ³ (2500 Btu/ft. ³)		

Figure 1-17 Fuel Consumption, 17/18 kW

Fuel Consumption, at % load, m ³ /hr. (cfh)	60 Hz	50 Hz
Natural Gas, m ³ /hr. (cfh)		
100%	5.9 (209)	4.9 (175)
75%	4.8 (168)	4.0 (141)
50%	3.6 (127)	3.0 (106)
25%	2.4 (85)	2.0 (71)
LP Vapor, m ³ /hr. (cfh)		
100%	3.1 (108)	2.5 (89)
75%	2.5 (87)	2.0 (72)
50%	1.9 (65)	1.5 (53)
25%	1.2 (44)	1.0 (36)
LP vapor conversion factors: 8.58 ft. ³ = 1 lb. 0.535 m ³ = 1 kg 36.39 ft. ³ = 1 gal.		
Nominal fuel rating: Natural gas: 37 MJ/m ³ (1000 Btu/ft. ³) LP vapor: 93 MJ/m ³ (2500 Btu/ft. ³)		

Figure 1-16 Fuel Consumption, 12 kW

1.6.2 Fuel Pipe Size

Ensure that the natural gas pipe size and length meet the specifications in Figure 1-18, Figure 1-19, or Figure 1-20. 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 1-18, Figure 1-19, or Figure 1-20 to find required pipe size.

Contact local LP provider for LP installation information.

Pipe Size, in. NPT	Maximum Pipe Length m (ft.)
3/4	18.3 m (60 ft.)
1	61 m (200 ft.)
1 1/4	91.5 m (300 ft.)

Figure 1-18 Fuel Pipe Size, Natural Gas, 8.5 kW

Pipe Size, in. NPT	Maximum Pipe Length, m (ft.)
3/4	9.2 m (30 ft.)
1	30 m (100 ft.)
1 1/4	68.6 m (225 ft.)

Figure 1-19 Fuel Pipe Size, Natural Gas, 12 kW

Minimum Gas Pipe Size Recommendation, in. NPT		
Pipe Length, m (ft.)	Natural Gas (242,000 Btu/hr.)	LP Vapor (280,000 Btu/hr.)
8 m (25 ft.)	1	3/4
15 m (50 ft.)	1	1
30 m (100 ft.)	1 1/4	1
46 m (150 ft.)	1 1/4	1 1/4
61 m (200 ft.)	1 1/4	1 1/4

Figure 1-20 Fuel Pipe Size, 17/18 kW

1.7 Fuel Conversion

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

WARNING



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

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

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

WARNING



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

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

1.8.2 Remote Start Connection

Connect terminals 3 and 4 to the automatic transfer switch's engine start terminals or to an optional remote start/stop switch. Route the engine start leads through separate conduit from the AC power and load leads.

1.8.3 Grounding

Ground the generator set. The grounding method must comply with NEC and local codes. Connect the grounding strap to the generator set ground lug, terminal GND inside the controller compartment.

Generator sets are shipped with the generator neutral attached to the generator in the junction box. 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 2002 Section 250.20 is one example that has a very good explanation of the neutral grounding requirements for generators.

1.8.4 Battery Charger

A battery charger is factory-installed in the battery compartment to keep the starting battery fully charged. The battery charger's DC leads are factory-connected to the battery. Supply power to the generator set for the battery charger and carburetor heater as described in Sections 1.5 and 1.8.1.

RES models: Plug the battery charger's power cord into the receptacle on the bottom of the controller junction box.

TRES (3-phase) models: The battery charger's power cord is factory-connected.

Refer to the generator set operation manual for battery charger operation information.

Connect customer equipment to terminal strip TB1 on the relay board, following the markings on the board. Connect to each relay's normally open or normally closed contacts depending on the application. Use size 14 AWG maximum wire for connections to TB1. See Figure 1-35 and Figure 1-36.

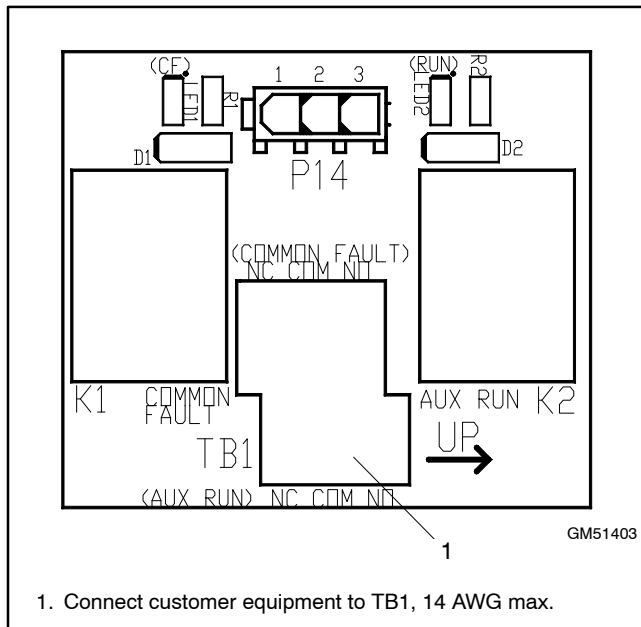


Figure 1-35 Relay Board Connections

Terminal Label	Description
COMMON FAULT NC	Common fault relay normally closed contact. Opens on a fault.
COMMON FAULT COM	Common fault relay common
COMMON FAULT NO	Common fault relay normally open contact. Closes on a fault.
AUX RUN NC	Auxiliary run relay normally closed contact. Open when generator set is running.
AUX RUN COM	Auxiliary run relay common
AUX RUN NO	Auxiliary run relay normally open contact. Closed when generator set is running.

Note: Use maximum 14 AWG wire for TB1 connections.

Figure 1-36 Common Fault and Run Relay Board Harness Connections

1.10.2 Carburetor Heater

An optional 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). See Figure 1-37 through Figure 1-39.

The heater thermostat is installed in the cord. Figure 1-40 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. See Figure 1-33.

Note: Do not place the heater thermostat inside the generator set engine compartment. The thermostat must be exposed to the ambient air.

The heater requires a continuous source of power.

Single-phase (RES) models: Plug the carburetor heater into an outlet that supplies continuous 120 VAC power.

Three-phase (TRES) models: The carburetor heater power is factory-connected to the battery charger.



Figure 1-37 8.5/12 kW Carburetor Heater Location

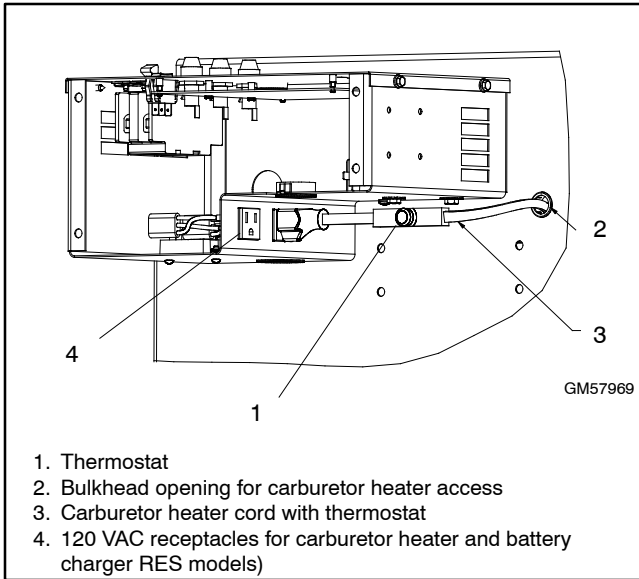


Figure 1-38 17/18 kW Carburetor Heater Location (air intake side of generator set)

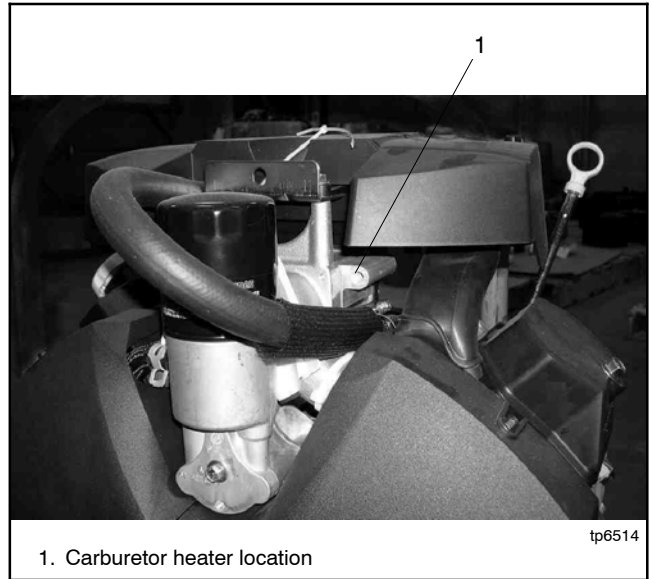


Figure 1-39 17/18 kW Carburetor Heater Location on Engine (bulkhead removed to show heater location)

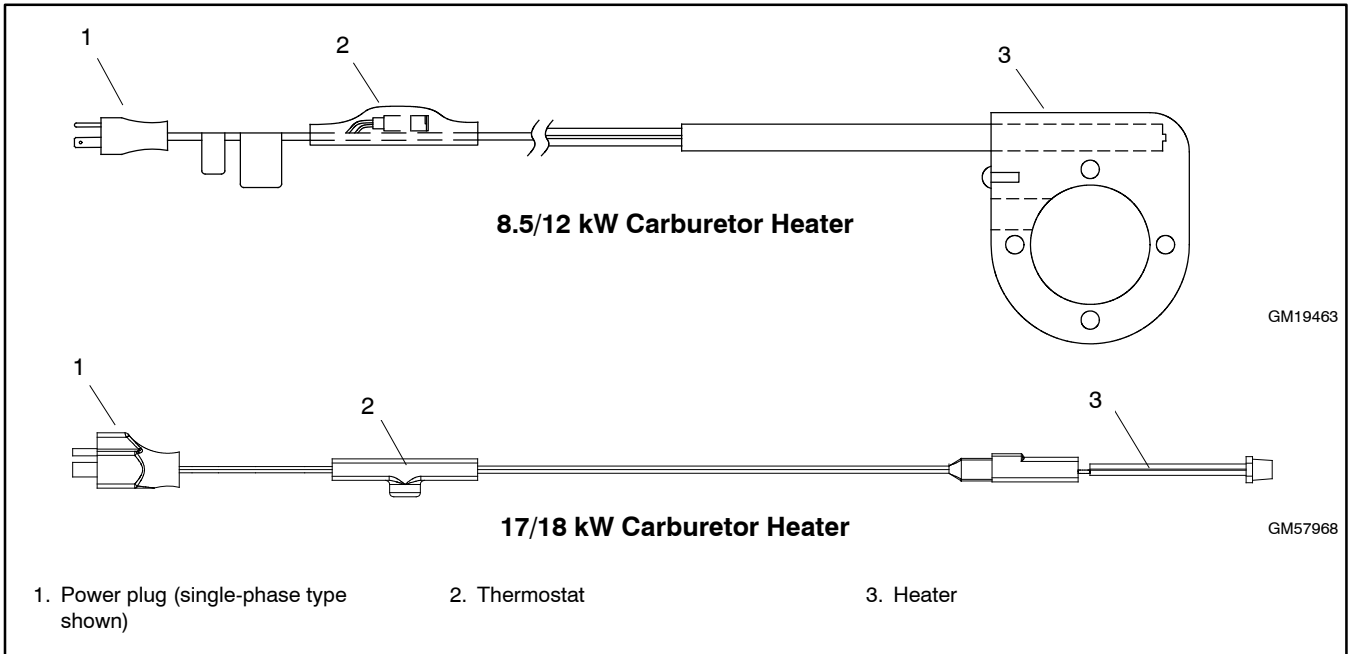


Figure 1-40 Carburetor Heaters

1.11 Prestart Installation Check

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.

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.

1.12 Startup Notification

Complete the startup and installation checklists supplied with the startup notification form. Complete and sign the startup notification form and submit copies to Kohler Co. and the distributor/dealer as instructed on the form.

Standby systems not registered within 60 days of startup are automatically registered using the manufacturer's ship date as the startup date.

1.13 Controller Configuration

1.13.1 System Parameters

The controller configuration for each generator model is set at the factory and should not normally require changes. The controller's configuration mode allows adjustment of the system parameters listed in this section. Use the instructions in this section to check the configuration after installation and change them to match the settings shown in Figure 1-41, if necessary.

Parameter	Setting	Definition
Unit's system voltage and frequency	Uu01	Single phase, 60 Hz, 120/240 VAC
	Uu03	Three-phase, 50 Hz, 230/400 VAC (TRES)
	Uu06	Single phase, 50 Hz, 115/230 VAC
Controller type‡	Uc01	ADC-RES (distributor)
	Uc05 †	DC-RET (retail)
Engine type	Ec00	8.5/12 kW
	Ec12	17/18 kW
Communication setting *	Cn00	No J1939 communication. Sleep mode enabled (48-hour power down in AUTO).
	Cn01 †	J1939 communication enabled. Sleep mode disabled (no power down in AUTO).
* Controller application code version 1.13 or higher.		
† Default setting for application code version 1.13 or higher.		
‡ Controller type is set once during controller installation (or replacement) and cannot be changed again.		

Figure 1-41 Controller Configuration Parameters

Follow the instructions in Figure 1-42 to enter the configuration mode while the engine is not running and then step through the following parameters. Use the up (Λ) and down (∇) arrow buttons to select the appropriate setting for the application.

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

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

Voltage/frequency setting (Uu). Select the system voltage and frequency from the table in Figure 1-41.

Note: The Uu parameter sets the system's rated voltage and frequency. To adjust the output (measured) voltage and frequency, see Section 1.14, Voltage and Frequency Adjustments.

Controller type (Uc). The Uc setting is used during initial controller installation in the factory or controller replacement in the field. The Uc setting can be changed only once. The default setting for service replacement controllers is Uc05, controller type DC-RET (retail model). Changing it to Uc01 sets the controller type to ADC-RES (distributor model).

Engine configuration (Ec). The engine configuration must match the generator set engine type.

Communication/Sleep Mode Setting (Cn). (Available on controllers with application code version 1.13 or higher.) The communication setting enables or disables J1939 communication, and also disables or enables the sleep mode. When J1939 communication is enabled, the sleep mode is turned off to allow uninterrupted communication with a personal computer running remote monitoring software. If remote monitoring is not used, the communication can be turned off, enabling the sleep mode which causes the controller to power down after 48 hours of inactivity. The generator set master switch must be in AUTO for the sleep mode to function.

The default setting for controllers with application code version 1.13 or higher is Cn01, communication on/sleep mode off. Controllers with earlier application code versions have communication disabled and the sleep mode enabled. The Cn setting is not adjustable on these earlier versions.

1.13.2 Application Code Version

To check the application code version number, HOLD the select button while moving the generator set master switch to RUN. (The engine will not start when the select button is held.) Wait about 5 seconds for the application code version number to appear on the display. See Figure 1-42.

Controller Configuration Mode:

Display:

Hold the Select button:

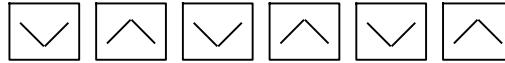


Move the generator set master switch to the RUN position. (The generator set engine will not start.)

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

v 1 1 3

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



U u 0 1

Now release the Select button.

Press:



or



To change the voltage/frequency setting, if necessary. See Figure 1-41.

U u 0 x



To enter setting and step to the next parameter, controller type Uc.



or



To change the controller type. This setting is used during controller replacement and can be changed only once. See Figure 1-41.

ADC-RES U c 0 1

DC-RET U c 0 5



To enter setting and step to the next parameter, engine type Ec.



or



To change the engine type, if necessary.

8.5/12 kW

E c 0 0

17/18 kW

E c 1 2



To enter setting and step to the next parameter, communication setting Cn.



or



To change the communication setting, if necessary. See Figure 1-41.

C n 0 x



To enter setting and step to SAVE.

S A V E

Press:



To **SAVE CHANGES**.

Y E S

OR



To **DISCARD CHANGES** without saving.

n o

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

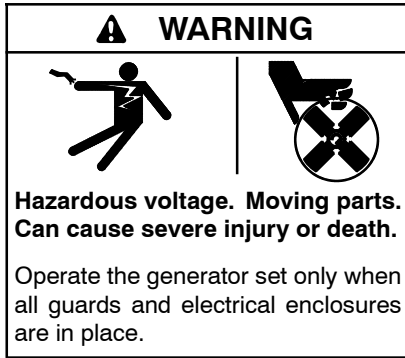
x x x x

Now move the master switch to OFF/RESET.

Note: Shaded boxes show which number in the controller display changes when the up or down arrow key is pressed. X in the runtime hours display above denotes any number from 0 to 9.

Figure 1-42 Configuration Mode (system voltage/frequency, engine type, and communication parameters)

1.14 Voltage and Frequency Adjustments



Short circuits. Hazardous voltage/current can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage. Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

The controller's adjustment mode allows adjustment of the output voltage and frequency, if necessary. Have adjustments performed by an authorized distributor/dealer or service technician.

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

Use a digital multimeter to check the output voltage and frequency. If output voltage or frequency is not within specifications, use the ADC controller to adjust the output voltage and engine speed (frequency) while the generator set is running. See Figure 1-43. The flowcharts in Figure 1-46 through Figure 1-48 outline the adjustment procedures.

Note: Be sure to save your changes as instructed in Figure 1-48 before exiting configuration mode.

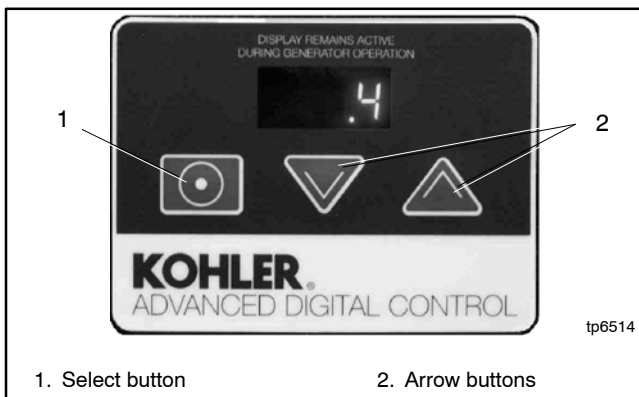


Figure 1-43 Advanced Digital Control

Changes in voltage and speed adjustments are lost if not saved before the generator set shuts down. The generator set continues to run with the new settings until it shuts down but then reverts to the previous settings at the next startup if the changes have not been saved.

1.14.1 Voltage Adjustment

Note: Refer to the flowcharts in Figure 1-46 through Figure 1-48 during the following procedure.

Voltage Adjustment Procedure

1. With the generator set off, connect a digital multimeter to the output leads or an electrical outlet on the load side of the generator set. Set the meter to measure AC voltage.
2. Start the generator set by moving the generator set master switch to the RUN position.
3. Use the ADC controller to adjust the voltage (parameter 1P) until the output voltage reaches the desired value. Refer to the flowcharts in Figure 1-46 through Figure 1-48 for instructions to adjust the output voltage. See Figure 1-44 for the approximate change in voltage per step.

Measured Voltage, VAC	ADC Display	Voltage Change per Step, VAC	
		Coarse	Fine
85-132	1P00-99	5	0.5
180-251	1P00-99	7	0.7

Figure 1-44 Voltage Adjustment (approximate)

4. Adjust the voltage stability (gain, parameter 2P) to minimize light flicker.
5. Readjust the voltage, if necessary.
6. Set the multimeter to measure frequency.
7. Adjust the engine speed to the cut-in frequency shown in Figure 1-45 by adjusting the engine governor speed (parameter 4P).

Frequency	Cut-In Frequency
60 Hz	57.5 Hz
50 Hz	47.5 Hz

Figure 1-45 Cut-In Frequencies

8. Adjust the volts/Hz (parameter 3P) until the voltage level measured by the multimeter begins to drop. When the volts/Hz is set correctly, the generator (as load is applied) attempts to maintain normal output until the engine speed drops below the cut-in frequency set in step 7.
9. Reset the engine speed to the operating frequency (50 or 60 Hz) by adjusting the engine governor speed (parameter 4P).
10. Readjust the voltage stability (gain, parameter 2P), if necessary.
11. Readjust the voltage (parameter 1P), if necessary.
12. Save settings. See Figure 1-48.
13. Stop the generator set.

1.14.2 Frequency Adjustment

The engine speed determines the generator output frequency; 60 Hz units operate at 3600 rpm and 50 Hz units run at 3000 rpm. Adjust the engine governor speed and gain to set the output frequency and stability using the following procedure.

Note: Refer to the flowcharts in Figure 1-46 through Figure 1-48 during the following procedure.

Frequency Adjustment Procedure

Note: Refer to the flowcharts in Figure 1-46 through Figure 1-48 during the following procedure.

1. Attach a frequency meter to the AC output leads or an electrical outlet on the load side of the generator set.
2. Start and run the generator set until it reaches normal operating temperature (at least 10 minutes).
3. Adjust electronic governor speed (parameter 4P) to obtain a frequency reading of 60 Hz (or 50 Hz if appropriate). Each step changes the engine speed about 3.6 rpm, which changes the output frequency about 0.06 Hz.
4. Check stability with the generator set running and with no load applied. If the generator set speed is unstable, hunts, or surges, adjust the governor stability (gain, parameter 5P) until the generator set becomes stable with no hunting or surging. (Increasing the gain slows the governor response.)
5. Check the frequency reading. Repeat steps 3 and 4 if necessary to obtain the rated frequency and stable operation.
6. Save settings. See Figure 1-48.

Output Voltage and Frequency Adjustment Mode:

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

Display :*

X X X X

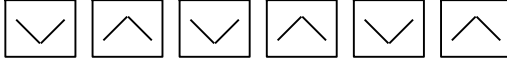
Hold:



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

X.XX

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



1 P X X

The controller is now in the voltage coarse adjustment mode.

Press:



or



To raise or lower the voltage in large increments (approximately 5–7 volts per step). (Parameter 1P)

1 P X X



To enter fine voltage adjustment mode.



or



To raise or lower the voltage in smaller increments (approximately 0.5–0.7 volts per step). (Parameter 1P)

1 P X X



To enter coarse voltage stability (gain) adjustment mode.



or



To raise or lower the voltage stability (gain) in large increments. (Parameter 2P)

2 P X X



To enter fine voltage stability (gain) adjustment mode.



or



To raise or lower the voltage stability (gain) in smaller increments. (Parameter 2P)

2 P X X



To enter volts/Hz adjustment mode. (Parameter 3P)



or



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

3 P X X

Continued on Figure 1-47.

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

TP6196

Figure 1-46 Output Voltage and Frequency Adjustments

Continued from Figure 1-46:

Display : *

Press:



To enter engine governor speed coarse adjustment mode. (Parameter 4P)

4 P x x



or



To raise or lower the engine speed in large increments.



To enter engine governor speed fine adjustment mode. (Parameter 4P)

4 P x x



or



To raise or lower the engine speed in smaller increments.



To enter engine governor stability (gain) coarse adjustment mode. (Parameter 5P)

5 P x x



or



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



To enter engine governor stability (gain) fine adjustment mode. (Parameter 5P)

5 P x x



or



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



To enter SAVE mode. Go to Figure 1-48.

S A V E

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

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

Figure 1-47 Output Voltage and Frequency Adjustments, Continued

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

S A V E

Press:



To return to the first parameter, coarse voltage adjustment, to check or change settings before saving. See Figure 1-46.

1 P x x

or



To save changes.

Y E S

or



To discard changes without saving.

n o

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

X X X X

Now move the master switch to OFF/RESET.

Figure 1-48 Save Mode

Section 2 Wiring Diagrams

Figure 2-1 lists the wiring diagram numbers and locations.

Wiring Diagram Description	Drawing Number	Page
8.5/12RES Schematic Diagram	ADV-7325	44
8.5/12RES Point-to-Point Wiring Diagram	GM51414	45
17/18RES Schematic Diagram	ADV-7353	46
17/18RES Point-to-Point Wiring Diagram	GM52541	47
12TRES (3-phase) Schematic Diagram	ADV-7623	48
12TRES (3-phase) Point-to-Point Wiring Diagram	GM63546	49
18TRES (3-phase) Schematic Diagram	ADV-7637	50
18TRES (3-phase) Point-to-Point Wiring Diagram	GM65661	51

Figure 2-1 Wiring Diagrams and Schematics

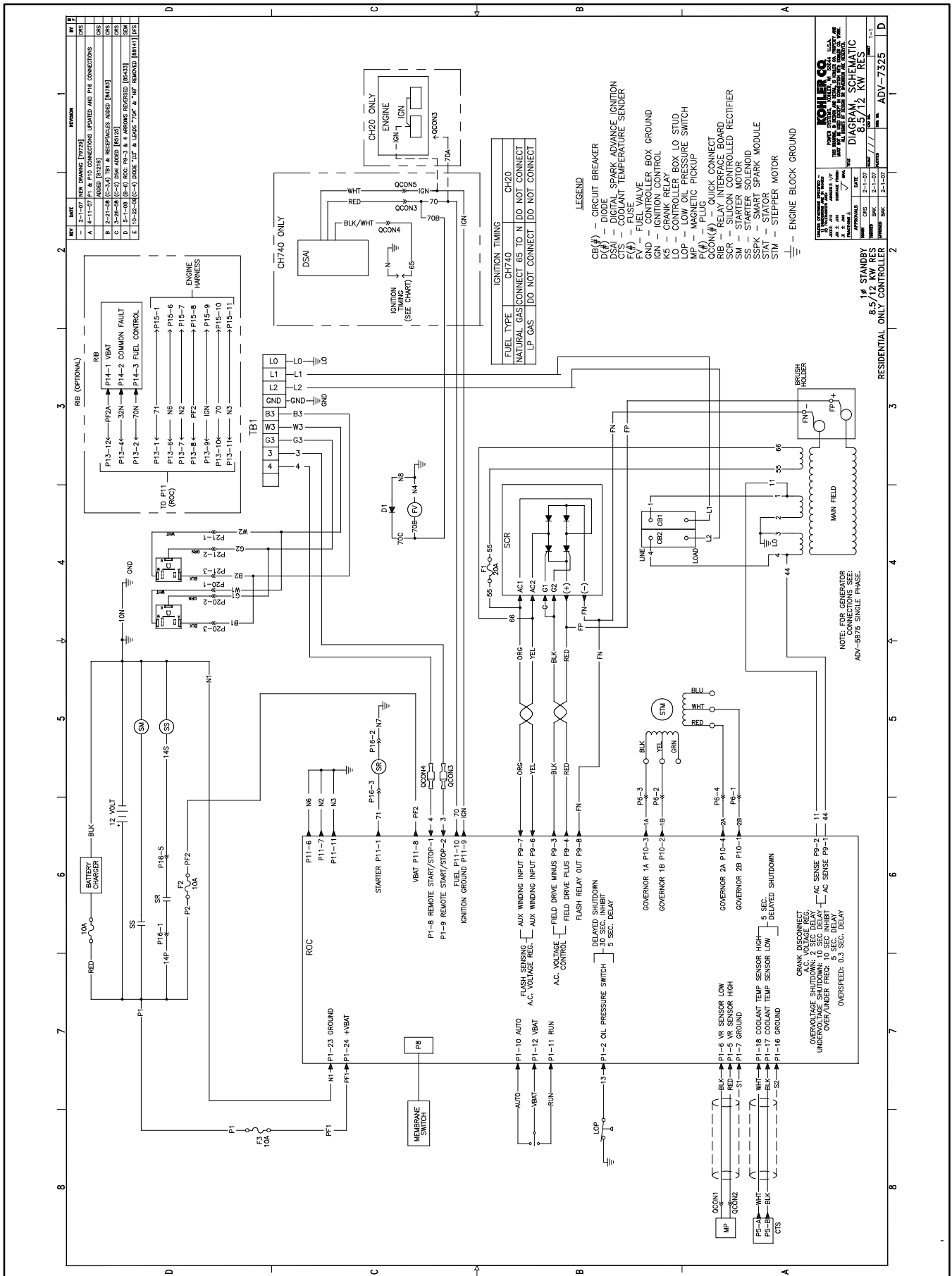


Figure 2-2 Schematic Diagram, 8.5/12RES Single Phase, ADV-7325-E

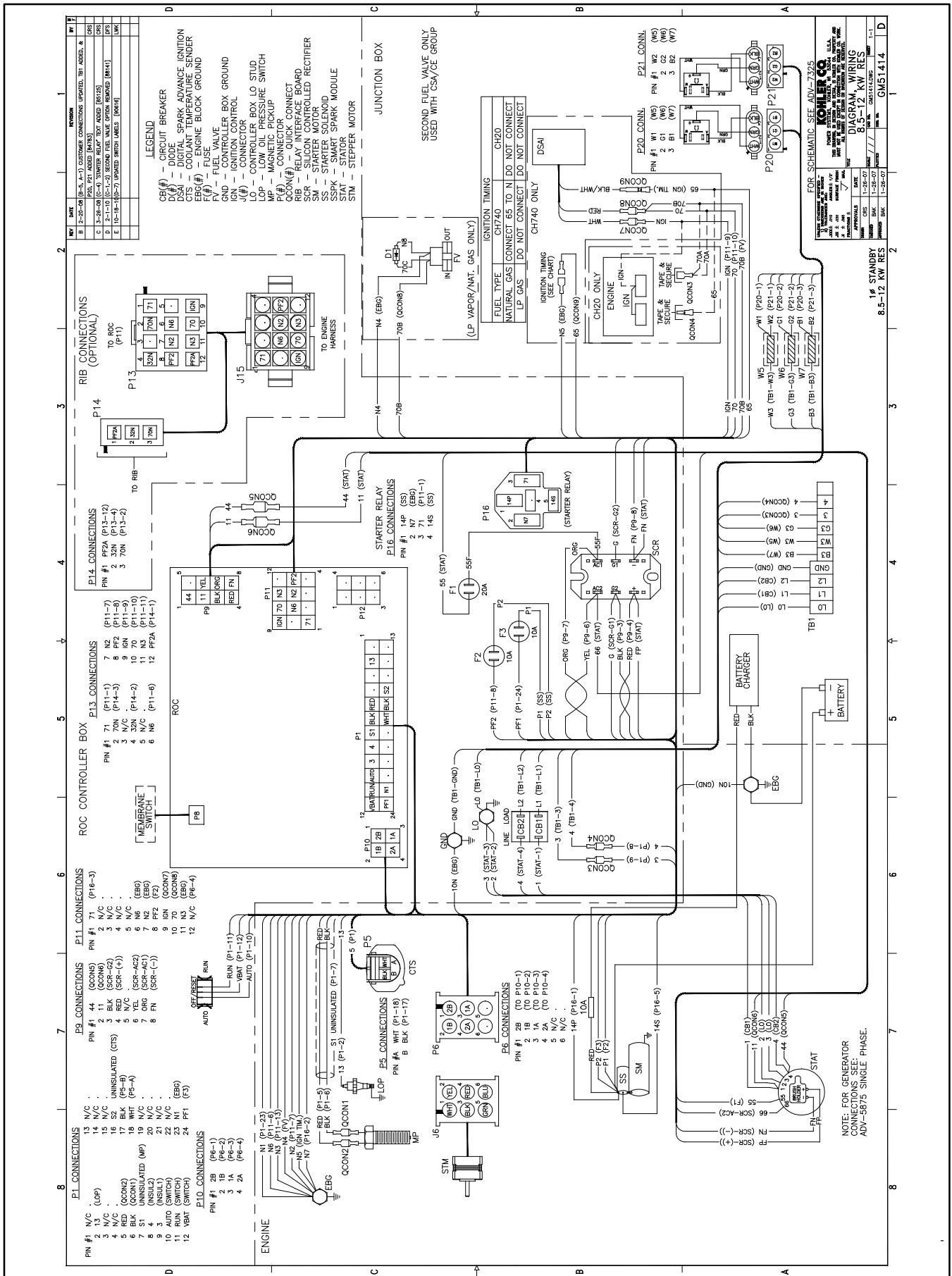


Figure 2-3 Point-to-Point Wiring Diagram, 8.5/12RES Single Phase, GM51414-E

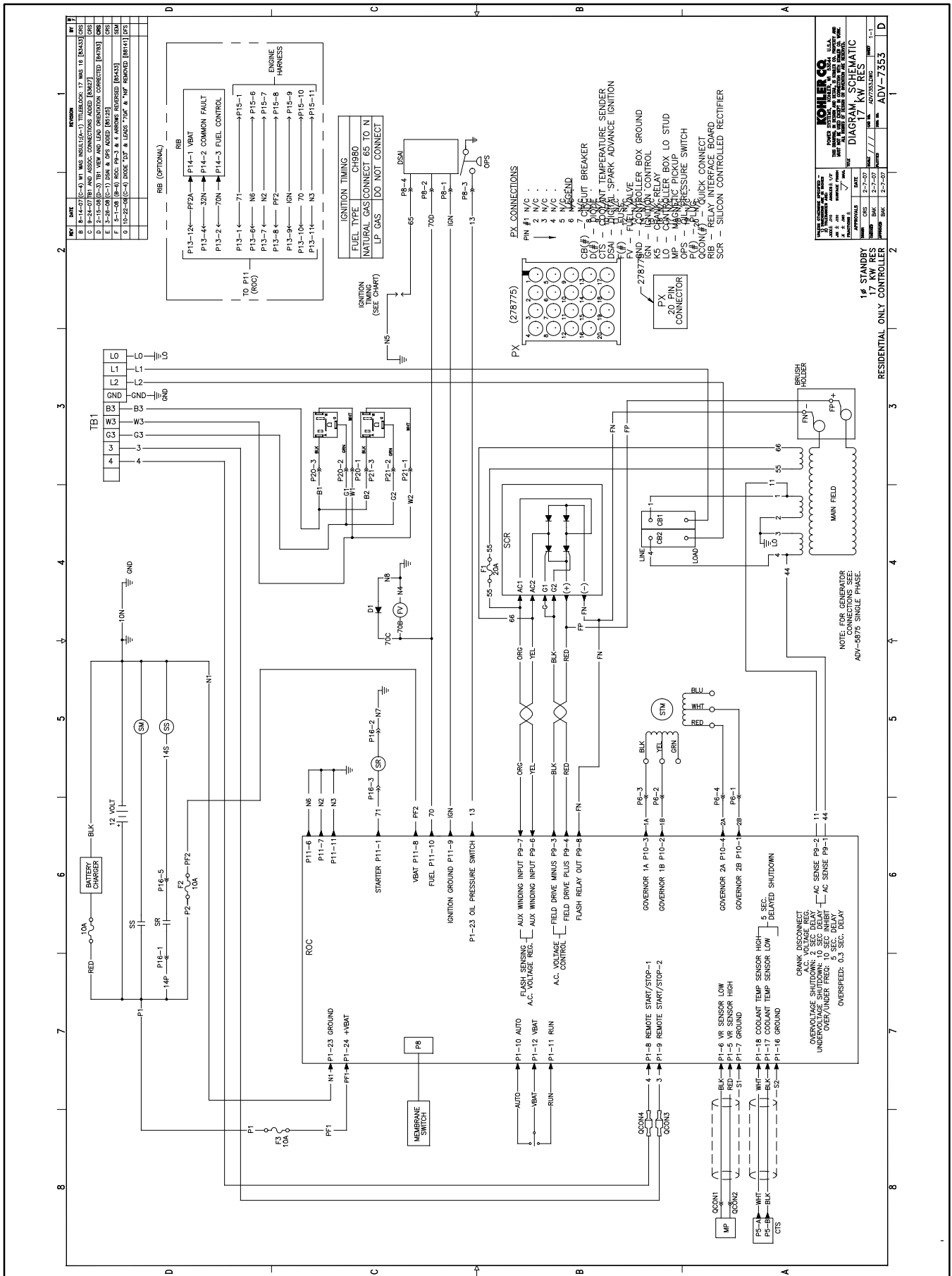


Figure 2-4 Schematic Diagram, 17/18RES Single Phase, ADV-7353-G

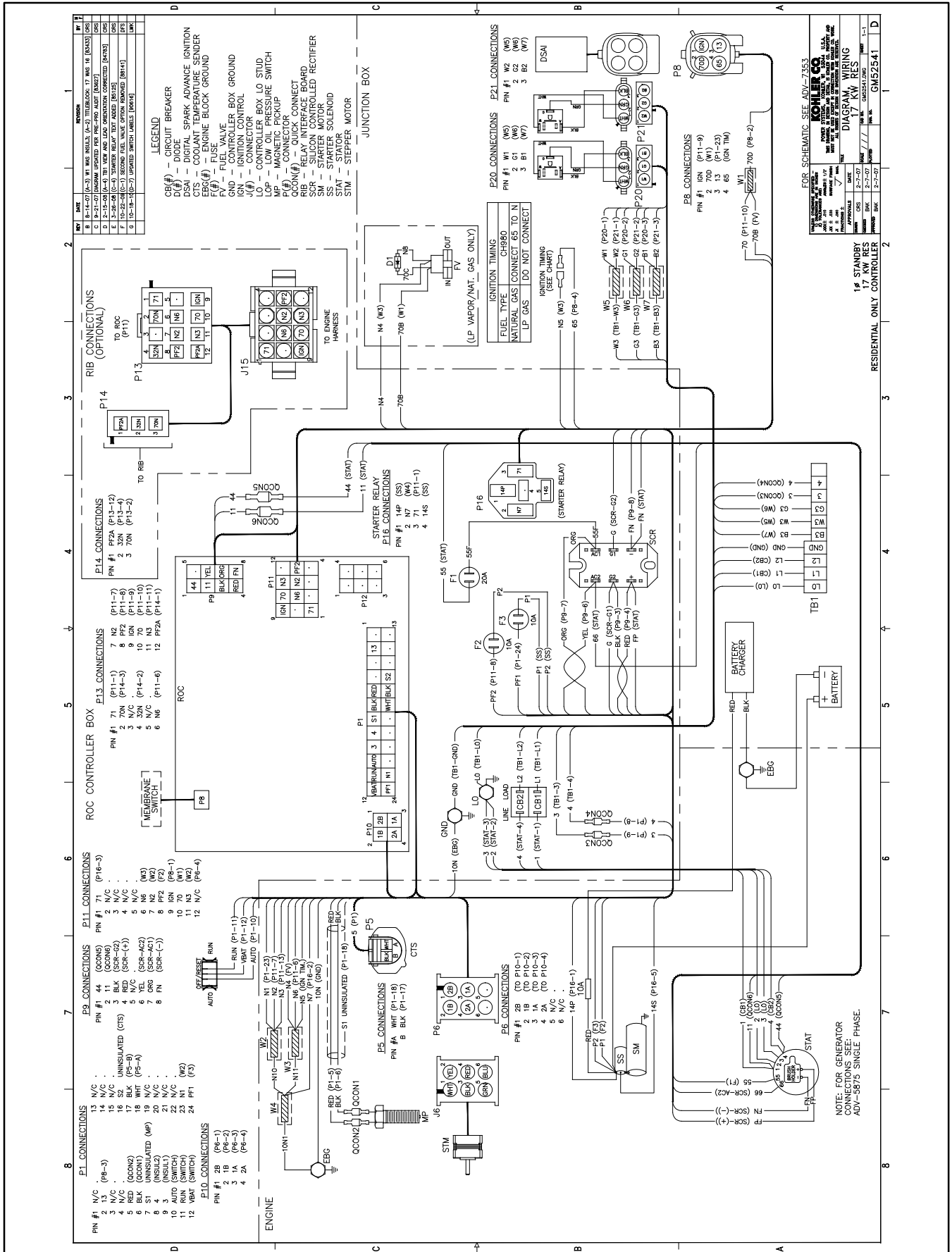


Figure 2-5 Point-to-Point Wiring Diagram, 17/18RES Single Phase, GM52541-G

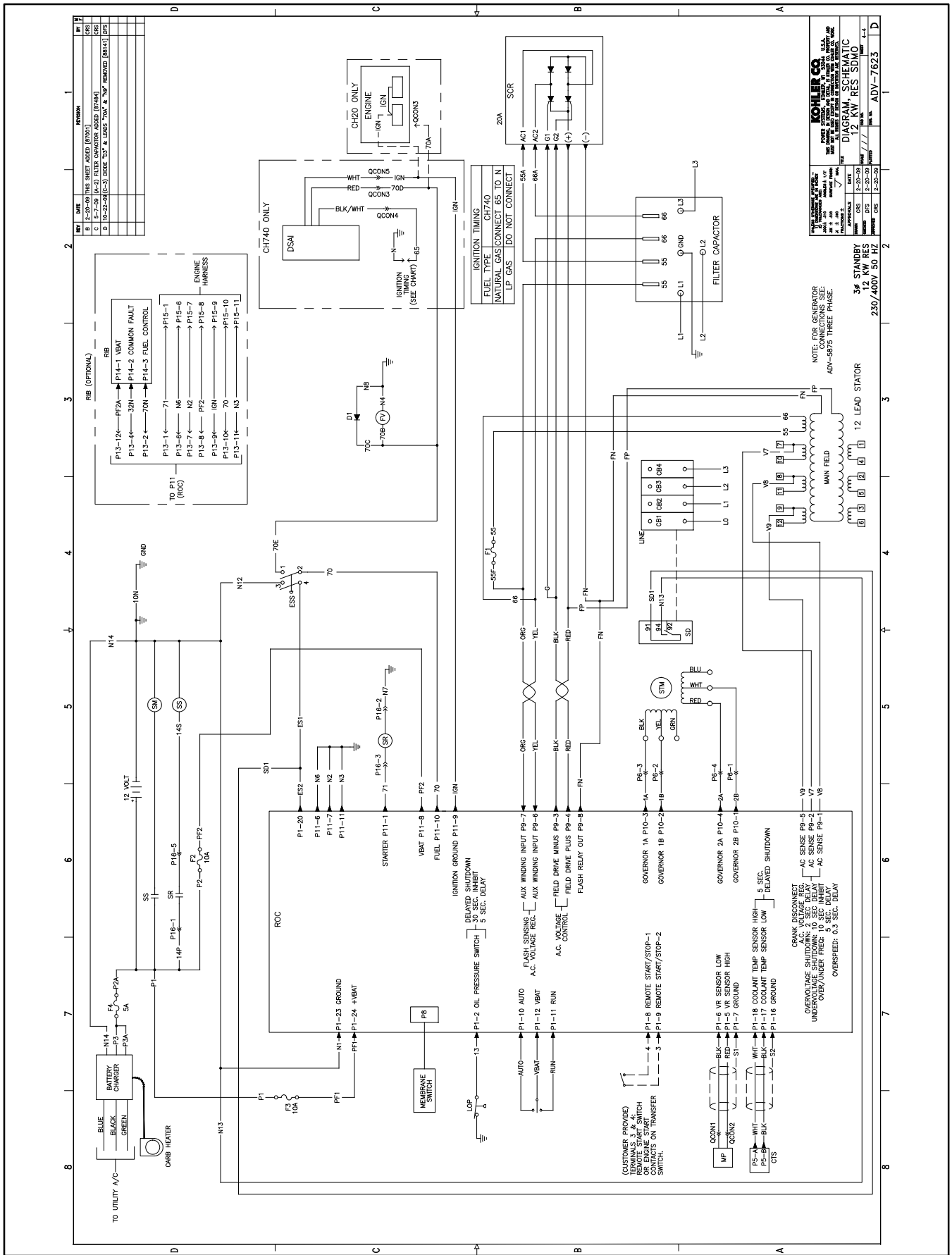


Figure 2-6 Schematic Diagram, 12TRES Three-Phase, ADV-7623D-D

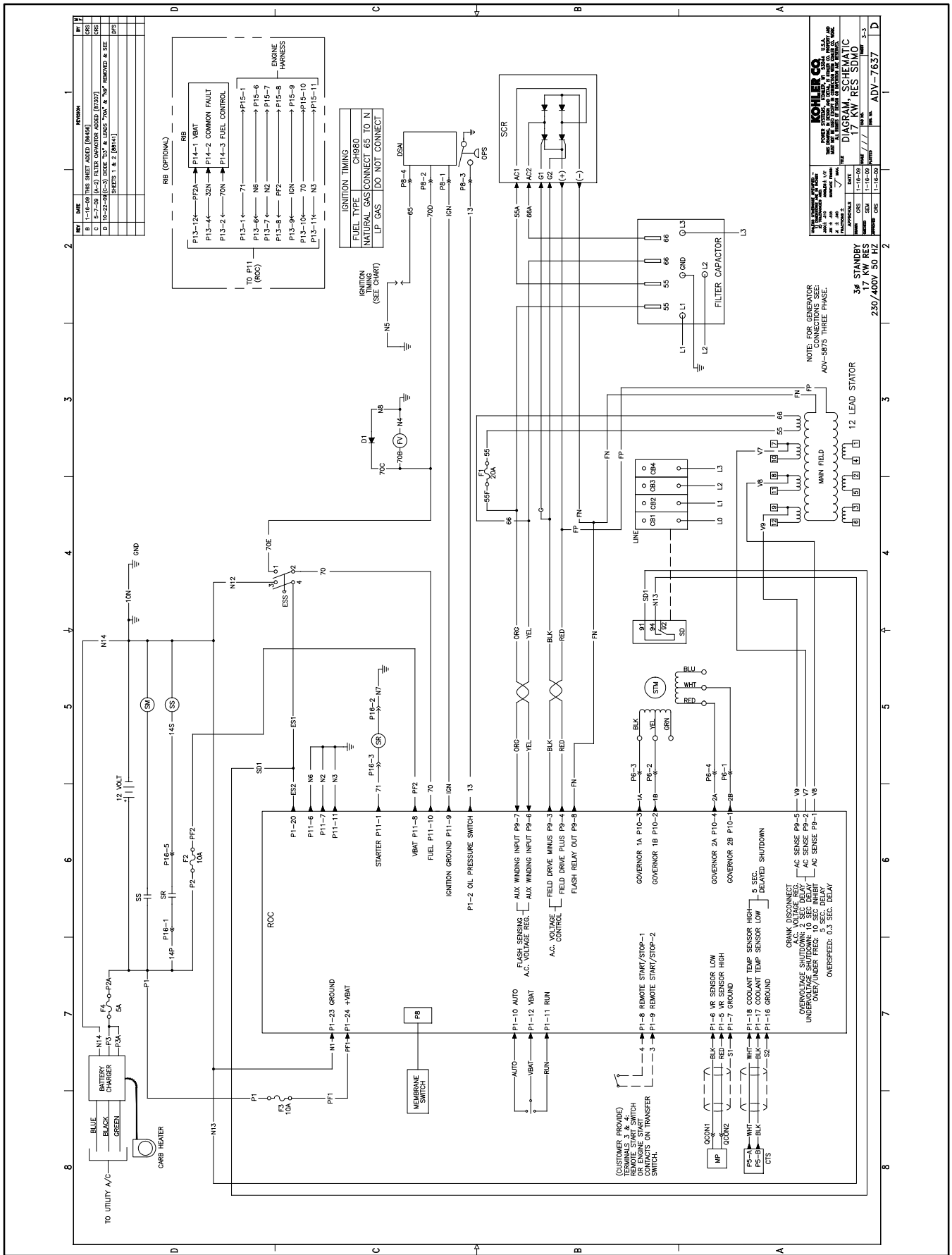


Figure 2-8 Schematic Diagram, 18TRES Three-Phase, ADV-7637C-D

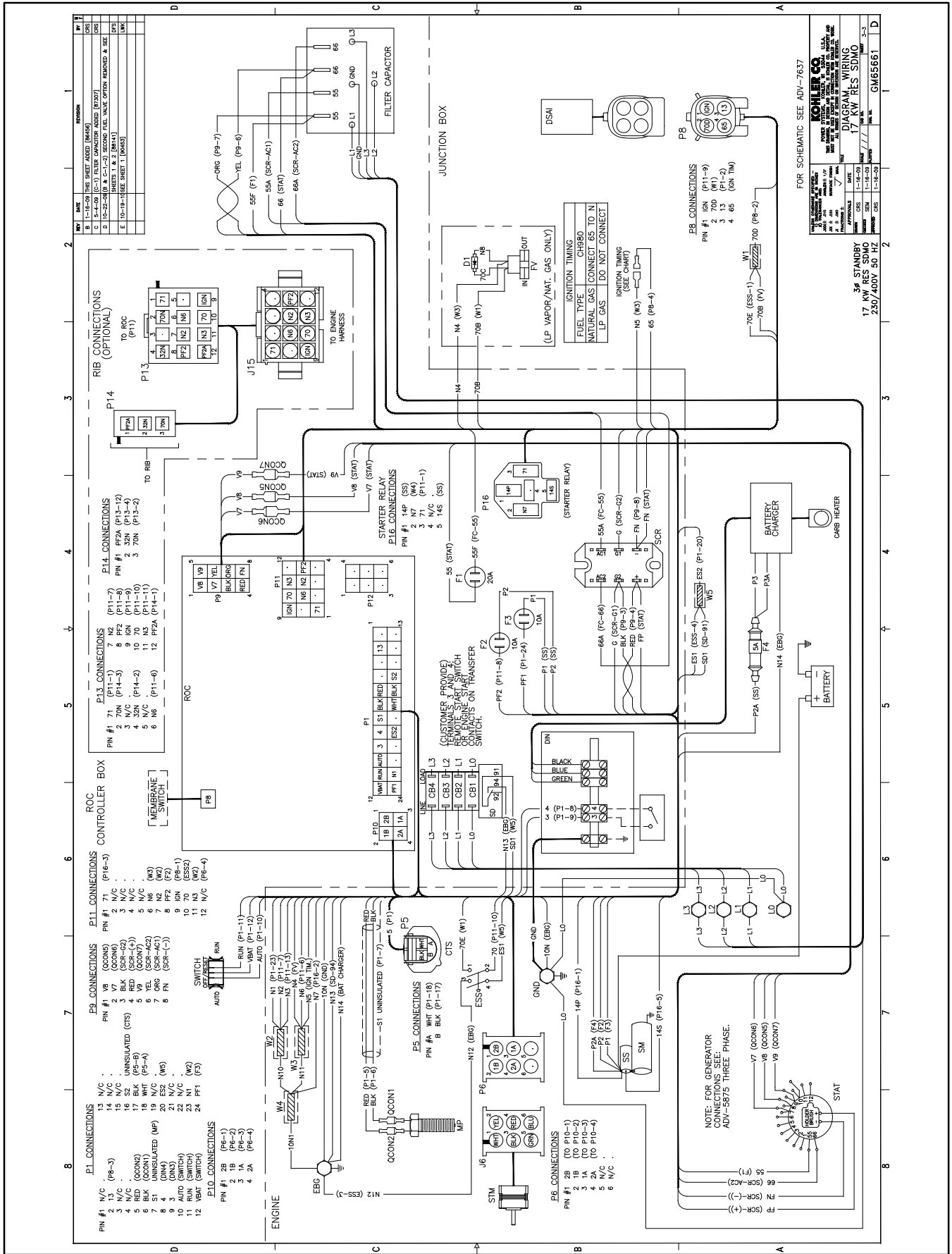


Figure 2-9 Point-to-Point Wiring Diagram, 18TRES Three-Phase, GM65661C-E

Notes

Appendix A Abbreviations

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

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

kg/cm ²	kilograms per square centimeter	NBS	National Bureau of Standards	RTU	remote terminal unit
kgm	kilogram-meter	NC	normally closed	RTV	room temperature vulcanization
kg/m ³	kilograms per cubic meter	NEC	National Electrical Code	RW	read/write
kHz	kilohertz	NEMA	National Electrical Manufacturers Association	SAE	Society of Automotive Engineers
kJ	kilojoule	NFPA	National Fire Protection Association	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	<i>Systeme international d'unites</i> , International System of Units
kph	kilometers per hour	NPS	National Pipe, Straight	SI/EO	side in/end out
kV	kilovolt	NPSC	National Pipe, Straight-coupling	sil.	silencer
kVA	kilovolt ampere	NPT	National Standard taper pipe thread per general use	SMTP	simple mail transfer protocol
kVAR	kilovolt ampere reactive	NPTF	National Pipe, Taper-Fine	SN	serial number
kW	kilowatt	NR	not required, normal relay	SNMP	simple network management protocol
kWh	kilowatt-hour	ns	nanosecond	SPDT	single-pole, double-throw
kWm	kilowatt mechanical	OC	overcrank	SPST	single-pole, single-throw
kWth	kilowatt-thermal	OD	outside diameter	spec	specification
L	liter	OEM	original equipment manufacturer	specs	specification(s)
LAN	local area network	OF	overfrequency	sq.	square
L x W x H	length by width by height	opt.	option, optional	sq. cm	square centimeter
lb.	pound, pounds	OS	oversize, overspeed	sq. in.	square inch
lbm/ft ³	pounds mass per cubic feet	OSHA	Occupational Safety and Health Administration	SMS	short message service
LCB	line circuit breaker	OV	overvoltage	SS	stainless steel
LCD	liquid crystal display	oz.	ounce	std.	standard
LED	light emitting diode	p., pp.	page, pages	stl.	steel
Lph	liters per hour	PC	personal computer	tach.	tachometer
Lpm	liters per minute	PCB	printed circuit board	TB	terminal block
LOP	low oil pressure	pF	picofarad	TCP	transmission control protocol
LP	liquefied petroleum	PF	power factor	TD	time delay
LPG	liquefied petroleum gas	ph., ∅	phase	TDC	top dead center
LS	left side	PHC	Phillips® head Crimptite® (screw)	TDEC	time delay engine cooldown
L _{wa}	sound power level, A weighted	PHH	Phillips® hex head (screw)	TDEN	time delay emergency to normal
LWL	low water level	PHM	pan head machine (screw)	TDES	time delay engine start
LWT	low water temperature	PLC	programmable logic control	TDNE	time delay normal to emergency
m	meter, milli (1/1000)	PLG	programmable logic control	TDOE	time delay off to emergency
M	mega (10 ⁶ when used with SI units), male	pot	potentiometer, potential	TDON	time delay off to normal
m ³	cubic meter	ppm	parts per million	temp.	temperature
m ³ /hr.	cubic meters per hour	PROM	programmable read-only memory	term.	terminal
m ³ /min.	cubic meters per minute	psi	pounds per square inch	THD	total harmonic distortion
mA	milliampere	psig	pounds per square inch gauge	TIF	telephone influence factor
man.	manual	pt.	pint	tol.	tolerance
max.	maximum	PTC	positive temperature coefficient	turbo.	turbocharger
MB	megabyte (2 ²⁰ bytes)	PTO	power takeoff	typ.	typical (same in multiple locations)
MCCB	molded-case circuit breaker	PVC	polyvinyl chloride	UF	underfrequency
MCM	one thousand circular mils	qt.	quart, quarts	UHF	ultrahigh frequency
meggarr	megohmmeter	qty.	quantity	UIF	user interface
MHz	megahertz	R	replacement (emergency) power source	UL	Underwriter's Laboratories, Inc.
mi.	mile	rad.	radiator, radius	UNC	unified coarse thread (was NC)
mil	one one-thousandth of an inch	RAM	random access memory	UNF	unified fine thread (was NF)
min.	minimum, minute	RDO	relay driver output	univ.	universal
misc.	miscellaneous	ref.	reference	URL	uniform resource locator (web address)
MJ	megajoule	rem.	remote	US	undersize, underspeed
mJ	millijoule	Res/Coml	Residential/Commercial	UV	ultraviolet, undervoltage
mm	millimeter	RFI	radio frequency interference	V	volt
mOhm, mΩ	milliohm	RH	round head	VAC	volts alternating current
MOhm, MΩ	megohm	RHM	round head machine (screw)	VAR	voltampere reactive
MOV	metal oxide varistor	rly.	relay	VDC	volts direct current
MPa	megapascal	rms	root mean square	VFD	vacuum fluorescent display
mpg	miles per gallon	rnd.	round	VGA	video graphics adapter
mph	miles per hour	RO	read only	VHF	very high frequency
MS	military standard	ROM	read only memory	W	watt
ms	millisecond	rot.	rotate, rotating	WCR	withstand and closing rating
m/sec.	meters per second	rpm	revolutions per minute	w/	with
mtg.	mounting	RS	right side	WO	write only
MTU	Motoren-und Turbinen-Union	RTDs	Resistance Temperature Detectors	w/o	without
MW	megawatt			wt.	weight
mW	milliwatt			xfrm	transformer
μF	microfarad				
N, norm.	normal (power source)				
NA	not available, not applicable				
nat. gas	natural gas				

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