

Installation Manual

QSJ2.4 Engine with PowerCommand® 1.1 Control

C20 N6 (Spec A), C22 N6 (Spec A)

C25 N6 (Spec A), C30 N6 (Spec A)

C36 N6 (Spec A), C40 N6 (Spec A)

C30 N6H (Spec A), C36 N6H (Spec A)

C40 N6H (Spec A), C45 N6H (Spec A)

C50 N6H (Spec A), C60 N6H (Spec A)

California Proposition 65 Warning

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

Table of Contents

1.	IMPORTANT SAFETY INSTRUCTIONS	1
	1.1 Warning, Caution, and Note Styles Used in This Manual	1
	1.2 General Information	1
	1.3 General Precautions	2
	1.4 Generator Set Voltage Is Deadly	5
	1.5 Engine Exhaust Is Deadly	6
	1.6 Fuel and Fumes Are Flammable	6
	1.7 Batteries Can Explode	6
	1.8 Moving Parts Can Cause Severe Personal Injury or Death	7
	1.9 The Hazards of Carbon Monoxide	8
2	INTRODUCTION	ç
۷.	2.1 About This Manual	ç
	2.2 Icons	ç
	2.3 Related Literature	10
	2.4 Before Installation	11
	2.5 Model Specifications	12
	2.6 Transfer Switch Requirements	16
	2.0 Transier Owiton requirements	10
3.	PRE-INSTALLATION CONSIDERATIONS	19
	3.2 Installation Codes and Standards for Safety	20
	3.3 Required Items for Installation	21
	3.4 Transfer Switch Mounting	23
4.	INSTALLATION	25
	4.1 Site Assessment and Preparation	25
	4.2 Fuel Selection and Fuel System Connection	29
	4.3 Engine Exhaust	37
	4.4 Electrical Connections	38
5.	STARTUP AND CONFIGURATION	51
	5.1 Exercise Settings	51
	5.2 Time Setup	55
	5.3 Brightness and Contrast	59
	5.4 History and About Menu	61
	5.5 Installation Checklist	63
	5.6 Startup	64
	5.7 InPower Service Tool	65
ΑF	PENDIX A. FUEL LINE SELECTION	67
	A.0 Fuel System Pipe Sizing Introduction	68
	A.1 Gas Pipe Sizing	69
ΑF	PENDIX B. OUTLINE AND SYSTEM DRAWINGS	81

Table of Contents 2-2016

APPENDIX C. SEISMIC REQUIREMENTS	101
C.1 Seismic Installation Instructions	103

1 Important Safety Instructions

SAVE THESE INSTRUCTIONS.

This manual contains important instructions for the generator set. Follow these instructions during installation, operation, and maintenance of the generator set and batteries.

Thoroughly read the Operator Manual before operating the generator set. Safe operation and top performance can only be obtained when the equipment is properly operated and maintained.

1.1 Warning, Caution, and Note Styles Used in This Manual

The following safety styles and symbols found throughout this manual indicate potentially hazardous conditions to the operator, service personnel, or equipment.

▲ DANGER

Indicates a hazardous situation that, if not avoided, will result in death or serious injury.

↑ WARNING

Indicates a hazardous situation that, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

NOTICE

Indicates information considered important, but not hazard-related (e.g., messages relating to property damage).

1.2 General Information

This manual should form part of the documentation package supplied by Cummins Power Generation with specific generator sets. In the event that this manual has been supplied in isolation please contact your authorized dealer.

NOTICE

It is in the operator's interest to read and understand all warnings and cautions contained in the documentation relevant to the generator set operation and daily maintenance.

1.3 General Precautions

- Keep ABC fire extinguishers accessible.
- Make sure that all fasteners are secure and torqued properly.
- Keep the generator set and its compartment clean. Do not store any items in the generator set compartment.
- Before working on the generator set, make sure the generator set is shut down and disabled.
 - 1. Press the generator set's "O" (Off) button to stop the generator set. Allow the generator set to thoroughly cool to the touch.
 - 2. If applicable, turn off and disconnect the battery charger from the AC source before disconnecting the battery cables.
 - 3. Disconnect the negative (–) cable from the battery and secure it from contacting the battery terminals to prevent accidental starting.
- Use caution when making adjustments when the generator set is running, hot, or when parts are electrically live, as all situations may cause personal injury or death.
- Used engine oil has been identified by some state and federal agencies as causing cancer or reproductive toxicity. Do not ingest, inhale, or come into contact with used oil or its vapors.
- Do not work on the generator set when mentally or physically fatigued or after consuming alcohol or drugs.

NOTICE

Only trained and authorized personnel shall maintain or service the generator set.

NOTICE

The installation of the generator set shall provide enough ventilation to ensure that gases generated by vented batteries during charging, or caused by equipment malfunction, are removed.

General Safety Precautions

⚠ WARNING

Hot Pressurized Liquid

Contact with hot liquid can cause severe burns.

Do not open the pressure cap while the engine is running. Let the engine cool down before removing the cap. Turn the cap slowly and do not open it fully until the pressure has been relieved.

⚠ WARNING

Moving Parts

Moving parts can cause severe personal injury.

Use extreme caution around moving parts. All guards must be properly fastened to prevent unintended contact.

⚠ WARNING

Toxic Hazard

Used engine oils have been identified by some state and federal agencies to cause cancer or reproductive toxicity.

Do not ingest, breathe the fumes, or contact used oil when checking or changing engine oil. Wear protective gloves and face guard.

⚠ WARNING

Electrical Generating Equipment

Incorrect operation can cause severe personal injury or death.

Do not operate equipment when fatigued, or after consuming any alcohol or drug.

⚠ WARNING

Toxic Gases

Substances in exhaust gases have been identified by some state and federal agencies to cause cancer or reproductive toxicity.

Do not breathe in or come into contact with exhaust gases.

⚠ WARNING

Combustible Liquid

Ignition of combustible liquids is a fire or explosion hazard which can cause severe burns or death.

Do not store fuel, cleaners, oil, etc., near the generator set.

⚠ WARNING

High Noise Level

Generator sets in operation emit noise, which can cause hearing damage. Wear appropriate ear protection at all times.

⚠ WARNING

Hot Surfaces

Contact with hot surfaces can cause severe burns.

Wear appropriate PPE when working on hot equipment and avoid contact with hot surfaces.

⚠ WARNING

Electrical Generating Equipment

Incorrect operation and maintenance can result in severe personal injury or death

Make sure that only suitably trained and experienced service personnel perform electrical and/or mechanical service.

⚠ WARNING

Toxic Hazard

Ethylene glycol, used as an engine coolant, is toxic to humans and animals. Wear appropriate PPE. Clean up coolant spills and dispose of used coolant in accordance with local environmental regulations.

⚠ WARNING

Combustible Liquid

Ignition of combustible liquids is a fire or explosion hazard which can cause severe burns or death.

Do not use combustible liquids like ether.

⚠ WARNING

Automated Machinery

Accidental or remote starting of the generator set can cause severe personal injury or death.

Isolate all auxiliary supplies and use an insulated wrench to disconnect the starting battery cables (negative [–] first).

⚠ WARNING

Fire Hazard

Materials drawn into the generator set are a fire hazard. Fire can cause severe burns or death.

Make sure the generator set is mounted in a manner to prevent combustible materials from accumulating under the unit.

⚠ WARNING

Fire Hazard

Accumulated grease and oil are a fire hazard. Fire can cause severe burns or death.

Keep the generator set and the surrounding area clean and free from obstructions. Repair oil leaks promptly.

⚠ WARNING

Fire Hazard

Materials drawn into the generator set are a fire hazard. Fire can cause severe burns or death.

Keep the generator set and the surrounding area clean and free from obstructions.

NOTICE

Keep multi-class ABC fire extinguishers handy. Class A fires involve ordinary combustible materials such as wood and cloth. Class B fires involve combustible and flammable liquid fuels and gaseous fuels. Class C fires involve live electrical equipment. (Refer to NFPA No. 10 in applicable region.)

NOTICE

Before performing maintenance and service procedures on enclosed generator sets, make sure the service access doors are secured open.

NOTICE

Stepping on the generator set can cause parts to bend or break, leading to electrical shorts, or to fuel, coolant, or exhaust leaks. Do not step on the generator set when entering or leaving the generator set room.

1.4 Generator Set Voltage Is Deadly

• Generator set output connections must be made by a trained and experienced electrician in accordance with all applicable codes.

• This generator set and the public utility may only be connected to house circuits by means of the automatic transfer switch.

CAUTION

Improper connections can lead to electrocution of utility workers and damage to equipment. Make sure that the connections are installed properly by a trained technician.

• Use caution when working on live electrical equipment. Remove jewelry, and make sure clothing and shoes are dry. Stand on a dry wooden platform.

1.5 Engine Exhaust Is Deadly

- See <u>The Hazards of Carbon Monoxide</u> to learn the symptoms of Carbon Monoxide poisoning.
- Locate the generator set away from doors, windows, other openings into the house, and where exhaust gases will disperse away from the house.

1.6 Fuel and Fumes Are Flammable

Fire, explosion, and personal injury or death can result from improper practices.

- Do not fill fuel tanks while the engine is running unless the tanks are outside the engine compartment. Fuel contact with hot engine or exhaust is a potential fire hazard.
- Do not permit any flame, cigarette, pilot light, spark, arcing equipment, or other ignition source near the generator set or fuel tank.
- Fuel lines must be adequately secured and free of leaks. Fuel connection at the engine should be made with an approved flexible line. Do not use copper piping on flexible lines as copper will become brittle if continuously vibrated or repeatedly bent.
- Make sure all fuel supplies have a positive shutoff valve.
- Make sure the battery area has been well-ventilated prior to servicing near it. Lead-acid batteries emit a highly explosive hydrogen gas that can be ignited by arcing, sparking, smoking, etc.

1.7 Batteries Can Explode

Batteries can explode, causing severe skin and eye burns and can release toxic electrolytes.

⚠ WARNING

Combustible Gases

Batteries can explode, causing severe skin and eye burns, and can release toxic electrolytes.

Do not dispose of the battery in a fire, because it is capable of exploding. Do not open or mutilate the battery.

⚠ WARNING

Electric Shock Hazard

Batteries present the risk to high short circuit current.

Remove watches, rings, or other metal objects. Use tools with insulated handles.

NOTICE

Servicing of batteries is to be performed or supervised by personnel knowledgeable of batteries and the required precautions. Keep unauthorized personnel away from batteries.

- Wear safety glasses.
- Do not smoke.
- To prevent arcing when disconnecting the battery:
 - 1. Press the Stop switch.
 - 2. Disconnect AC power from any battery chargers.
 - 3. Remove the negative (-) battery cable to prevent starting.
- To prevent arcing when reconnecting the battery:
 - 1. Reconnect the positive (+) cable.
 - 2. Reconnect the negative (-) cable.
 - 3. Reconnect the battery charger to AC power supply.
- When replacing the generator set battery, always replace it with a battery as specified in this manual.

1.8 Moving Parts Can Cause Severe Personal Injury or Death

- Do not wear loose clothing or jewelry near moving parts, such as fans.
- Keep hands away from moving parts.
- Keep guards in place over fans.

1.9 The Hazards of Carbon Monoxide

Carbon monoxide (CO) is an odorless, colorless, tasteless and non-irritating gas. You cannot see it or smell it. Red blood cells, however, have a greater affinity for CO than for oxygen. Therefore, exposure even to low levels of CO for a prolonged period can lead to asphyxiation (lack of oxygen) resulting in death. Mild effects of CO poisoning include eye irritation, dizziness, headaches, fatigue and the inability to think clearly. More extreme symptoms include vomiting, seizures and collapse.

Engine-driven generator sets produce harmful levels of carbon monoxide that can injure or kill you.

Special Risks of CO Near the Home

⚠ WARNING

Toxic Gases

Carbon monoxide (CO) gas can cause nausea, fainting, or death. Residents can be exposed to lethal levels of CO when the generator set is running. Depending on air temperature and wind, CO can accumulate in or near the home.

To protect yourself and others from the dangers of CO poisoning, it is recommended that reliable, approved, and operable CO detector alarms are installed in proper locations in the home as specified by their manufacturer.

Protecting Yourself from CO Poisoning

- Locate the generator set in an area where there are no windows, doors, or other access points into the home.
- Make sure all CO detectors are installed and working properly.
- Pay attention for signs of CO poisoning.
- Check the exhaust system for corrosion, obstruction, and leaks every time you start the generator set and every eight hours when you run it continuously.

2 Introduction

This generator set is intended for stationary installation for emergency use only.

2.1 About This Manual



This manual is a guide for the installation of the generator set models listed on the front cover. Proper installation is essential for top performance, reliable operation, and safety. Read through this manual before starting the installation. This manual covers outdoor applications only. For other applications, such as indoor applications, contact your local Cummins dealer or reference the Application Manual at the following link:

http://www.cumminspower.com/www/literature/applicationmanuals/t030.pdf

NOTICE

The installation must comply with all applicable building codes.



See the generator set Operator Manual (A045R242) for operation and maintenance and the Service Manual (A045R243) for service.

NOTICE

Manuals are updated from time to time to reflect changes in the equipment and its specifications. The most up-to-date version of this manual is found on the QuickServe website

(https://quickserve.cummins.com/info/index.html).

2.2 Icons

The following symbols may have been used in this manual to help communicate the intent of the instructions. They are defined below.

Icon	Description
	Clean the part or assembly.
8	
	Indicates an electrical measurement.
	Indicates that an inspection is required.

2. Introduction 2-2016

Icon	Description
	Indicates an installation or assembly procedure.
	Lubricate the part or assembly.
?	Indicates a mechanical or time measurement.
	Refer to another publication for additional information.
	Indicates a removal or disassembly step.
	Tighten to a specific torque.
1	Indicates parts or tools required.
	Indicates that the component is heavy (50 lb or 23 kg or more). To reduce the possibility of personal injury, use a hoist or get assistance to lift.

2.3 Related Literature



The literature provided with the generator set is as follows:

- Installation Manual (A045R241)
- Operator Manual (A045R242)

⚠ CAUTION

A generator set must be operated and maintained properly if you are to expect safe and reliable operation. The Operator Manual includes a maintenance schedule and a troubleshooting guide.

The Health and Safety Manual must be read in conjunction with this manual for the safe operation of the generator set:

- Health and Safety Manual (0908-0110)
- Warranty Statement (A040H442)
- Emissions Component Defect Warranty Statement (A028X278)

2-2016 2. Introduction

The relevant manuals appropriate to your generator set are also available. The documents below are in English:

- Service Manual (A045R243)
- Parts Manual (A046Z094)
- EControls, Inc. Service Manual (A035C596)
- Global Control Platform (GCP) Engine Display Interface Software (EDIS) Training Manual (A035C608)
- RA Series Transfer Switch Owner Manual (A046S594) (if applicable)
- PowerCommand® 1302 Controller Owner's Manual (900-0661)
- Standard Repair Times (SRT) Manual (A046Z674)
- Application Manual T-030 for application information (A040S369)
- Service Tool Manual (A043D529)

2.4 Before Installation

Before beginning the installation of the generator set, verify that the unit was correctly selected. Check the following features:

- Model
- Specifications
- Options
- Fuel Supply
 - The gas supplied to the generator set must be of acceptable quality.
 - The gas supply must have sufficient pressure. Care must be taken to be sure that the gas supply at the generator set, not just at the source, is of proper pressure for operation. The specified pressure must be available while the generator set is starting and running at full load.
 - The gas must be supplied to the generator set in sufficient volume to support operation of the generator set. This is normally a matter of selecting fuel line size to be large enough to transport the volume of fuel needed. For liquid propane vapor-withdrawal fuel systems the size and temperature of the fuel tank also affects this requirement.

2. Introduction 2-2016

2.5 Model Specifications

TABLE 1. 2.4L MODEL VARIATIONS

Models	Description
C20 N6, C22 N6, C25 N6, C30 N6, C36 N6, C40 N6	60 Hz, 1800 RPM
C30 N6H, C36 N6H, C40 N6H, C45 N6H, C50 N6H, C60 N6H	60 Hz, 3600 RPM

TABLE 2. COLD WEATHER SPECIFICATIONS (ALL MODELS)

Temperature	Description	Battery Type	Group
Above 40 °F (4 °C)	No starting aids required. Standard		26
O to 40 °F (-17 to 4 °C) Additional coolant heater and battery charger recommended for starting. Factory options available.		Standard	26
Below 0 °F (-17 °C)	All starting aides (battery heater, coolant heater, battery		34

NOTICE

For NFPA 110 applications, a coolant heater is required. A factory option is available.

TABLE 3. FUEL SPECIFICATIONS 60 HZ, 1800 RPM

	C20 N6	C22 N6	C25 N6	C30 N6	C36 N6	C40 N6
Full Load (Propane)	105.1 scfh 265,000 BTU/hr	112.7 scfh 285,000 BTU/hr	125.4 scfh 315,000 BTU/hr	164.1 scfh 410,000 BTU/hr	182.7 scfh 460,000 BTU/hr	193.6 scfh 490,000 BTU/hr
Full Load (Natural Gas)	259.6 scfh 270,000 BTU/hr	278.8 scfh 290,000 BTU/hr	309.5 scfh 320,000 BTU/hr	380.9 scfh 395,000 BTU/hr	472.3 scfh 490,000 BTU/hr	519 scfh 540,000 BTU/hr

2-2016 2. Introduction

	C20 N6	C22 N6	C25 N6	C30 N6	C36 N6	C40 N6	
Fuel Dressure	6 - 12 inch water column (1.5 - 3.0 kPa)						
Fuel Pressure	Maximum pressure under any condition: 13 inch water column (3.2 kPa)						

TABLE 4. FUEL SPECIFICATIONS 60 HZ, 3600 RPM

	C30 N6H	C36 N6H	C40 N6H	C45 N6H	C50 N6H	C60 N6H		
Full Load (Propane)	195.5 scfh 490,000 BTU/hr	219.6 scfh 550,000 BTU/hr	236.2 scfh 595,000 BTU/hr	256.9 scfh 645,000 BTU/hr	289.5 scfh 725,000 BTU/hr	324.6 scfh 820,000 BTU/hr		
Full load (Natural Gas)	476.1 scfh 495,000 BTU/hr	533.3 scfh 555,000 BTU/hr	573.2 scfh 595,000 BTU/hr	623.0 scfh 645,000 BTU/hr	704.7 scfh 730,000 BTU/hr	814.2 scfh 840,000 BTU/hr		
Fuel Pressure	6 - 12 inch water column (1.5 - 3.0 kPa) Maximum pressure under any condition: 13 inch water column (3.2 kPa)							

TABLE 5. ENGINE SPECIFICATIONS (ALL MODELS)

	Specification
Engine	4 cylinder-in-line, SOHC, liquid-cooled, 4-stroke, spark ignited
Displacement	144 in ³ (2351 cc)
Spark Plug Gap	0.040 inch (1.0 mm) (NA) 0.030 inch (0.76 mm) (T/TAA)
Spark Plug Torque	15 ft-lb (20 Nm)
Oil Capacity	4.3L (4.54 quarts)
Oil Recommendation	5W30 API SM
Coolant	50/50 coolant solution (50% pure water and 50% anti-freeze)

TABLE 6. GENERATOR SET SIZE SPECIFICATIONS

Propane Vapor and Natural Gas	Size with Sound Level 1 Enclosure (L x W x H)		
20-25 kW 1800 RPM and 30 kW 3600 RPM	72 x 34 x 45.2 in	1830 x 864 x 1152 mm	
30-40 kW 1800 RPM and 36-60 kW 3600 RPM	94 x 34 x 45.2 in	2384 x 864 x 1152 mm	

2. Introduction 2-2016

TABLE 7. GENERATOR SET WEIGHT (POUNDS) 60 HZ, 1800 RPM

	C20 N6	C22 N6	C25 N6	C30 N6	C36 N6	C40 N6
Sound Level 1 (Wet)	1109	1109	1147	1279	1356	1424

TABLE 8. GENERATOR SET WEIGHT (POUNDS) 60 HZ, 3600 RPM

	C30 N6H	C36 N6H	C40 N6H	C45 N6H	C50 N6H	C60 N6H
Sound Level 1 (Wet)	1134	1249	1399	1399	1399	1429

TABLE 9. GENERATOR SPECIFICATIONS 60 HZ, 1800 RPM

	C20 N6	C22 N6	C25 N6	C30 N6	C36 N6	C40 N6	
Generator	Brushless, 4-pole rotating field, single bearing						
Power (kVA) 1 Phase/3 Phase	20/25	22/27.5	25/31.3	30/37.5	36/45	40/50	
	120/240, 1 Ph						
	120/240, 3 Ph						
Rated Voltages (V)	120/208, 3 Ph						
	277/480, 3 Ph						
	347/600, 3 Ph						

TABLE 10. GENERATOR SPECIFICATIONS 60 HZ, 3600 RPM

	C30 N6H	C36 N6H	C40 N6H	C45 N6H	C50 N6H	C60 N6H	
Generator		Brushless, 2-pole rotating field, single bearing					
Power (kVA) 1 Phase/3 Phase	30/37.5	36/45	40/50	45/56.3	50/62.5	60/75	
Rated Voltages (V)	120/240, 1 Ph						
120/240, 3 Ph							
120/208, 3 Ph							
		277/48	0, 3 Ph				

	NOTICE	
Maximum $I_2 = 8\%$.	_	

2-2016 2. Introduction

TABLE 11. GENERATOR SET DERATING GUIDELINES

		Engine Power A	vailable Up To	Dera	ate At
Model	Fuel	Elevation	Ambient Temperature	Elevation	Temperature
C20 N6	NG, LP	3300 ft (1005 m)	104 °F (40 °C)		
C22 N6	NG	2200 ft (670.5 m)	104 °F (40 °C)		2% per 18 °F (10
C22 N6	LP	3300 ft (1005 m)	104 °F (40 °C)		°C) above 104 °F (40 °C)
C25 N6	NG	0 ft (0 m)	77 °F (25 °C)		, ,
C25 N6	LP	375 ft (114 m)	77 °F (25 °C)		2% per 18 °F (10 °C) above 77 °F (25 °C)
C30 N6	NG	2500 ft (762 m)	104 °F (40 °C)		
C30 N6	LP	3300 ft (1005 m)	104 °F (40 °C)		
C30 N6H	NG, LP	3100 ft (945 m)	104 °F (40 °C)		
C36 N6	NG, LP	3300 ft (1005 m)	104 °F (40 °C)		
C36 N6H	NG, LP	3300 ft (1005 m)	104 °F (40 °C)	4% per 1000 ft	2% per 18 °F (10 °C)
C40 N6	NG, LP	375 ft (114 m)	104 °F (40 °C)	(305 m)	above 104 °F (40 °C)
C40 N6H	NG, LP	3300 ft (1005 m)	104 °F (40 °C)		0)
C45 N6H	LP	3300 ft (1005 m)	104 °F (40 °C)		
C45 N6H	NG, LP	3000 ft (914 m)	104 °F (40 °C)		
C50 N6H	NG, LP	375 ft (114 m)	77 °F (25 °C)		2% per 18 °F (10 °C) above 77 °F (25 °C)
C60 N6H	NG, LP	375 ft (114 m)	104 °F (40 °C)		2% per 18 °F (10 °C) above 104 °F (40 °C)

2. Introduction 2-2016

TABLE 12. CONTROL SPECIFICATIONS (ALL MODELS)

	Specification
Control	Integrated microprocessor based engine, generator, transfer switch control

TABLE 13. DC SYSTEM SPECIFICATIONS (ALL MODELS)

	Specification
Nominal Battery Voltage	12 VDC
Battery Group	26 standard, 34 high capacity (a high capacity battery requires an accessory battery tray)
Battery Type	Maintenance free
Minimum Cold Crank Amps	545 standard, 850 high capacity (a high capacity battery requires an accessory battery tray)

2.6 Transfer Switch Requirements

A transfer switch must be a part of every generator set installation. Transfer switches transfer loads to the generator set during power outages.

NOTICE

Cummins offers a variety of transfer switches, including residential and light commercial options.

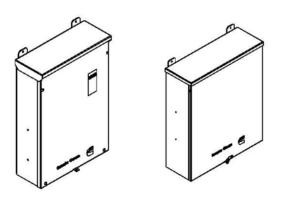


FIGURE 1. CUMMINS TRANSFER SWITCH (RA SERIES)

Before beginning the installation of the transfer switch, verify that the unit was correctly selected. Check the following features:

- Specifications (voltage, amperage, frequency, poles, and phases)
- Enclosure (indoor vs. outdoor)
- Model

2-2016 2. Introduction

Refer to the RA Series Transfer Switch Owner Manual (A046S594) for more detailed information. The RA Series transfer switch is the recommended ATS for use with these generators.

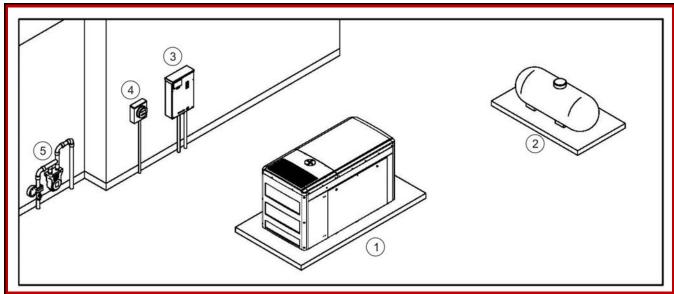
2. Introduction 2-2016

This page is intentionally blank.

3 Pre-Installation Considerations

Before installation begins, certain items must be considered. Prior coordination reduces delays and the amount of time power has to be interrupted.

Areas of consideration:



No.	Description	No.	Description
1	Generator Set	4	Electrical Meter
2	Propane Tank	5	Natural Gas Meter
3	Transfer Switch		

FIGURE 2. SITE PREPARATION EXAMPLE

- Location of the generator set this is one of the first decisions to be made, as it affects all other aspects of the installation, such as:
 - · Length of electric wiring
 - Length of gas lines (natural gas or propane both must be inspected by the gas utility inspectors and building inspectors)
 - Site preparation:
 - Access to the site
 - Trenches
 - Site preparation materials needed
- Fuel supply pressure
- Automatic transfer switch location and connections
- Tools and materials required

- Minimum distance from the propane tank fill (verify the legal minimum distance with local code officials)
- Accessories required (if any) for the customer's application (utility power may be required at the generator set; make plans accordingly)

NOTICE

Depending on the locality and use of the generator set, it may be necessary to obtain an air quality emissions permit before installation begins. Check with local pollution control or air quality authority to determine permit requirements.

3.2 Installation Codes and Standards for Safety

NOTICE

The generator set installer bears sole responsibility for following all applicable local codes and regulations.

The following list of codes and standards may apply to the installation and operation of the generator set. This list is for reference only and not intended to be inclusive of all applicable codes and standards. The address of each agency is listed so that copies of the codes may be obtained for reference. Installation codes and recommendations are subject to change, and may vary by location or over time.

TABLE 14. INSTALLATION CODES AND STANDARDS FOR SAFETY RECOMMENDATIONS

Code or Standard	Organization
NFPA 70 - National Electrical Code NFPA 37 - Installation and Use of Stationary Combustion Engines and Gas Turbines NFPA 54 - National Fuel Gas Code NFPA 58 - Storage and Handling of Liquefied Petroleum Gases NFPA 110 - Standard for Emergency and Standby Power Systems	National Fire Protection Association 470 Atlantic Avenue Boston, MA 02210
CSA Electrical Bulletin CSA 22.1 Canadian Electrical Code CSA B149 CSA C22.2 No. 100 CSA C22.2 No. 14	Canadian Standards Association Housing and Construction Materials Section 178 Rexdale Blvd. Rexdale, Ontario, Canada M9Q 1R3

Code or Standard	Organization
California Administrative Code - Title 25 Chapter 3	State of California
	Documents Section
	P.O. Box 1015
	North Highlands, CA 95660

3.3 Required Items for Installation

Tools and materials are used for the installation of this generator set. These items are identified in the following sections. Please refer to local codes and standards, because they may affect the materials required.

Materials Required

NOTICE

Refer to local codes and standards, which may affect material requirements.

NOTICE

If a 100% rated breaker is used, 90 °C wire must be used for L1, L2, and L3 with the wire size determined by the 75 °C ampacity tables.

NOTICE

A UL-listed grounding electrode terminal within its ratings and suitable for the application must be installed and labeled "Grounding Electrode Terminal".

Electrical Materials:

NOTICE

Class 1 wiring methods must be used for connecting the generator set.

- Four code compliant AC power wires will be needed: L1, L2, N and Gnd (add another wire for 3-phase for a total of 5 AC wires)
- For RA switches, 4 DC control wires will be needed from the generator to the transfer switch.
- Wire sizes (DC control and power and AC sense only):
 - DC control or AC sense wires under 1000 feet circuit length => 18-14 AWG of the insulation type below

- DC control or AC sense wires 1000-2000 feet circuit length => 16-14 AWG of the insulation type below
- All AC and DC wires and cables shall be rated 75 °C minimum, stranded copper, and rated for wet locations.
 - For wire sizes 14 AWG and larger, use insulation types including but not limited to: RHW, RHW-2, THHW, THW, THW-2, THWN, THWN-2, XHHW, XHHW-2, USE-2, ZW-2
 - For wire sizes 16 and 18 AWG, use insulation types including but not limited to: FFH-2, KFF-2, PAFF, PFF, PGFF, PTFF, RFH-2, RFHH-3, SFF-2, TFF, TFFN, ZFF
- Code compliant 20 A, 120 VAC, GFCI protected circuit for alternator heaters, battery charger, coolant heater, oil heater, and/or battery heater (if equipped)
- Code compliant conduit for all wires

Mounting Materials:

· Four base tie-down bolts

NOTICE

Seismic zone installations require compliance to specific mounting configurations.

Fuel Materials:

- Flexible fuel line (provided with generator)
- UL listed pipe thread sealant
- Fuel line (natural gas and propane: 6 12 inch water column [1.5 3.0 kPa] fuel pressure) at generator set
- Fuel pressure regulator (as required)
- Manual fuel shut-off at generator set ahead of automatic valves on generator set fuel system

Loose Parts Shipped with the Generator Set

The following loose parts are shipped with the generator set:

- Two enclosure keys
- Generator set mounting spacers
- Circuit breaker cover and screw
- Chassis plugs
- Terminal block jumper
- Literature (Operator Manual, Quick Start Operator Guide, Installation Manual, Quick Start Installation Guide, Health and Safety Manual, and Warranty Statements)

3.4 Transfer Switch Mounting

- 1. Consider the location before mounting the transfer switch.
 - Consider the proximity to the utility service entrance and breaker panel.
 There must be a service disconnect (circuit breaker or fuses) in the power
 line ahead of the transfer switch, unless a service entrance rated automatic
 transfer switch is being used.
 - Keep safety concerns in mind. Never mount the transfer switch near hazardous chemicals or gases.
 - Avoid high humidity areas or areas prone to excessive heat or dust.
- 2. Make sure that the wall is stable and able to support the weight of the transfer switch.
- 3. Make sure that the transfer switch is mounted according to all applicable building code requirements.
- 4. Mount the transfer switch per the instructions in the RA Series Transfer Switch Owner Manual.

NOTICE

Seismic zone installations require compliance to specific mounting configurations.

This page is intentionally blank.

4 Installation

NOTICE

The installer is responsible for complying with all applicable installation codes and safety requirements. See the Installation Codes and Standards for Safety section of this manual for more information.

The following sections cover a step-by-step overview of a typical generator set installation.

Review these sections to become familiar with specific procedures and important safety precautions before beginning the installation.

4.1 Site Assessment and Preparation

Proper component location and site preparation have a very important impact on completing a successful installation. The major components and sources of power needed for installation include the following items:

- Generator set
- Transfer switch
- Electrical utility
- Fuel source: natural gas or propane vapor
- Accessories (may be required under certain conditions)

Picking a Location

⚠ WARNING

Exhaust gas is deadly. Locate the generator set away from doors, windows, and other openings to the house and where exhaust gases will disperse away from the house.

4. Installation 2-2016

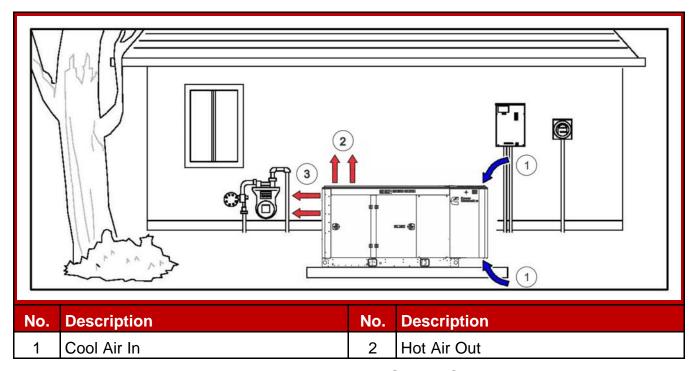


FIGURE 3. GENERATOR SET LOCATION

Generator set location is critical for safety and performance. Follow the guidelines below:

- Must comply with applicable codes (NFPA, NEC, IBC, etc.).
- Install outdoors only. For other applications, contact your local Cummins dealer or reference the Application Manual at the following link: http://www.cumminspower.com/www/literature/applicationmanuals/t030.pdf
- Consider access to utilities (electric/gas meters, transfer switch, remote fuel tank location, etc.).
- Call the local utilities to mark the locations of buried utility services (gas, electric, or telephone) before digging.
- Verify the locations of any other buried components (gas, electric or telephone) with the homeowner before digging.

Clearances:

- The exhaust side of the generator set must be located 5 feet from combustible materials (NFPA 37).
- The exhaust side of the generator must be located 5 feet from any opening in a wall (window, door, vent, etc.).
- The generator must be located such that the exhaust is not able to accumulate in an occupied area.
- The generator must have enough room for installation, service, and maintenance.
- The generator must be located to ensure ventilation openings are not blocked.

2-2016 4. Installation

Position the generator set so that cooling air is free to enter and leave the area.

• Locate and position the generator set so that prevailing winds carry exhaust gases and potential fuel leaks away from the house or occupied area.

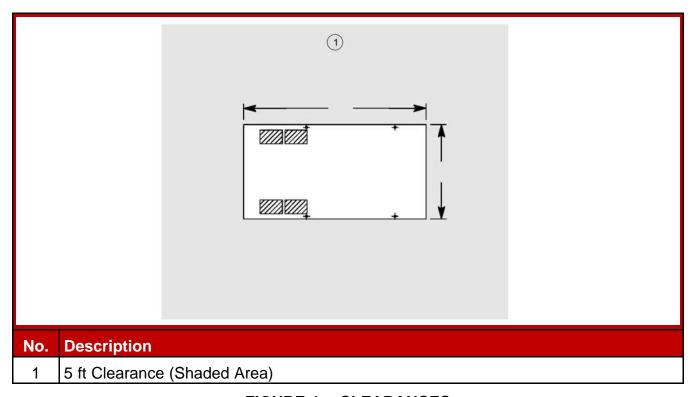


FIGURE 4. CLEARANCES

Laying the Foundation

When laying the foundation:

- 1. Clear obstructions, and make sure that there is adequate clearance for access.
- 2. Level the ground, and make sure that the ground is compact and settled. Ensure that it is stable ground, not subject to flooding.
- Prepare the concrete pad.
 - The pad should be constructed of reinforced concrete with a 28-day compressive strength of at least 2500 psi (17,237 kPa).
 - The pad should be at least 5 inches (127 mm) deep and extend at least 6 inches (150 mm) beyond the skid on all sides.

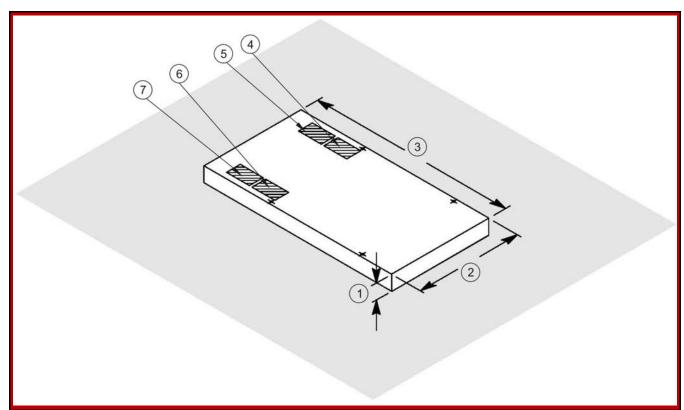
NOTICE

Seismic installation may require a different pad and securing devices.

NOTICE Local codes and standards may have different requirements.

4. Installation 2-2016

4. Lift the generator set onto the pad, and secure it.



No.	Description	No.	Description
1	Pad Thickness (Minimum 5 in)	5	Accessory 120 VAC, 20A Max Wire Stub-Up
2	Pad Width (Must Extend Minimum 6 in Beyond Skid)	6	Circuit Breaker 2 Stub-Up (Dual Circuit Breaker)
3	Pad Length (Must Extend Minimum 6 in Beyond Skid)	7	Circuit Breaker 1 Stub-Up (Standard)
4	Generator Set Control Wire Stub-Up (DC)		

FIGURE 5. CONCRETE PAD PREPARATION

Lifting and Moving the Generator Set

⚠ WARNING

Heavy Load

The generator set is heavy. Handle with care.

Use appropriate lifting techniques to move the generator set. Do not use the lifting eyes on the engine and alternator to lift the entire generator set. Dropping the generator set can cause severe personal injury or death. Keep feet and hands clear when lifting the generator set.

2-2016 4. Installation

⚠ CAUTION

The generator set is shipped with oil in the engine crankcase. Keep the generator set upright.

Mounting the Generator Set

Positioning of cast-in bolts can be problematic since even small errors in location can cause time consuming redrilling of the skid base. Some generator set designs allow use of concrete anchor bolts.

Mount the generator set on a substantial and level base such as a concrete pad. A non-combustible material must be used for the pad. Verify that the mounting pad is level lengthwise, widthwise, and diagonally.

NOTICE

Seismic installation may require specific anchorage.

4.2 Fuel Selection and Fuel System Connection

For fuel specifications (such as BTU/hr), see the Model Specifications section.

NOTICE

This generator set has a convertible fuel system. The generator may run on natural gas or propane, depending on the preferences of the owner. All generator sets come preconfigured from the factory for natural gas fuel. For more information on converting the fuel system type, reference the Service Manual (A045R243).

NOTICE

Fuel systems must be installed by qualified service technicians. Improper installation presents hazards of fire and improper operation, resulting in severe personal injury or property damage.

⚠ WARNING

Gaseous fuels are flammable, explosive, and can cause severe personal injury or death. Do not smoke if you smell gas, are near fuel tanks for fuel-burning equipment, or are in an area sharing ventilation with such equipment. Keep flames, sparks, pilot lights, electrical arcs, arc-producing equipment and all other sources of ignition well away. Keep a type ABC fire extinguisher handy.

4. Installation 2-2016

In all fuel system installations, cleanliness is extremely important.

- Make every effort to prevent fuel contamination from:
 - Moisture
 - Dirt
 - Excess thread sealant
 - Contaminants of any kind
- Clean all fuel system components before installing.

Gaseous-fuel supply system design, materials, components, fabrication, assembly, installation, testing, inspection, operation, and maintenance must comply with the applicable codes. See NFPA Standards No. 37, 54, and 58. For seismic installation, refer to IBC codes and standards. Where seismic installation is required, there may be specific anchorage requirements for the generator set and other installed components.

Most codes require a manual shutoff valve ahead of a flexible fuel hose. The manual valve should be of the indicating type. The generator set has electric (battery-powered) shutoff valves included.

NOTICE

It is recommended that a shutoff valve be located near the generator set for emergency shut off or servicing the generator set. Follow applicable codes.

Until the generator set is connected, cap the fuel line stub-up at the generator set to prevent dirt from entering and gas from discharging if the gas supply shutoff valve is opened accidentally.

To determine the required capacity, add generator set consumption to the gas consumed for heating, cooking, clothes drying, etc. A typical natural gas installation might require a 400,000 BTU meter. Consideration should also be given to utilizing high pressure gas supply if available. This reduces the required size and cost of gas piping, especially if the location of the generator set requires a long supply line.

Natural Gas Fuel System

Requirements for a natural gas generator set are as follows:

TABLE 15. NATURAL GAS GENERATOR SET REQUIREMENTS

Component	Description
Gas	Pipeline quality
Fuel Supply	Adequate fuel supply to operate correctly and run at full load
Shutoff Valve	Manual

2-2016 4. Installation

Component	Description
Fuel Pipe Size	The length of the fuel supply pipe from the gas service entrance to the generator set must be known to determine the correct fuel pipe size. Refer to the charts in the <u>Fuel Line Selection</u> appendix. Iron pipe must be a minimum of schedule 40 subject to the authority having jurisdiction.
Flexible Fuel Line	Protects the fuel system from vibration, expansion, and contraction.

⚠ WARNING

Fuel leaks can lead to explosive accumulations of gas. Prevent gas leaks and the accumulation of gaseous fuel in the event of a leak.

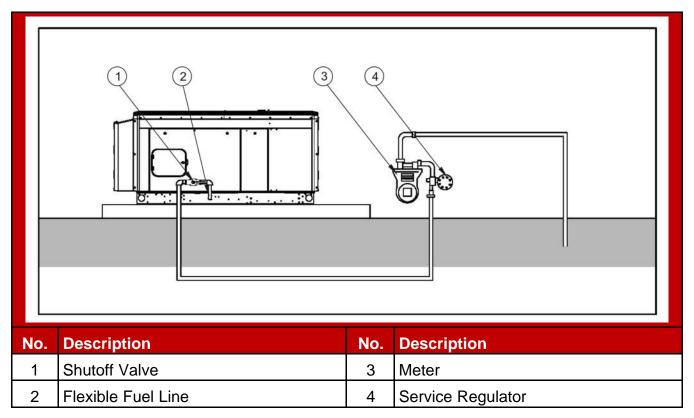


FIGURE 6. TYPICAL NATURAL GAS INSTALLATION

Natural Gas Supply Line Size

The natural gas supply meter may need to be exchanged for a higher capacity meter to supply the additional gas consumed by the generator set.

4. Installation 2-2016

Use the total load requirement of the generator set to determine the size of the fuel supply pipe. Use the tables and charts in the <u>Fuel Line Selection</u> appendix to determine the correct pipe size.

An older site might require upgrading and repair of the gas supply system. Schedule an upgrade or repair to minimize power and gas supply interruptions.

Make sure the full load fuel supply pressure at the inlet to the generator fuel shutoff valves is set at 6 - 12 inch water column (1.5 - 3.0 kPa) for all operating loads (no load to full load). (The maximum pressure under any condition is 13 inch water column [3.2 kPa].) Refer to the Model Specifications section.

Propane Fuel System

Propane vapor can be used as a primary fuel source or as a backup fuel source for the generator sets with two independent fuel sources connected to the generator set.

⚠ WARNING

Fuel leaks can lead to explosive accumulations of gas. Propane sinks in air and can accumulate inside housings, basements, and other below-grade spaces. Prevent gas leaks and the accumulation of gaseous fuel in the event of a leak.

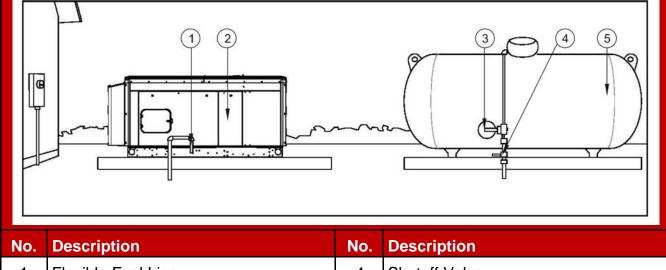
NOTICE

NFPA Standard No. 58 requires all persons handling and operating propane to be trained in proper handling and operating procedures.

The required components in a propane vapor fuel system are as follows:

Component	Description
Propane Tank	Make sure to identify and utilize the correct tank size based on fuel flow requirements and the lowest average temperature for your region. If the tank is sized incorrectly, the generator set could run out of fuel. Refer to the Minimum LPG Tank Size figure in the Fuel Line Selection appendix.
Shutoff Valve	Useful during installation or in the event of a leak (may be required to meet local codes).
Primary Regulator	Located at the tank outlet, the primary regulator reduces the tank pressure to the working pressure in the fuel supply line. Primary and secondary regulators must be properly matched for a safe and functional system. Consult with your propane supplier to ensure that the regulators are properly sized.

Component	Description
Secondary Regulator	Located near the generator set, the secondary regulator reduces the higher line pressure to a working pressure of 6 - 12 inch water column (1.5 - 3.0 kPa). Higher pressure before the secondary regulator is necessary to ensure that there is enough fuel available at the secondary regulator for a fully loaded generator set.
Fuel Line	Connects to the fuel supply. It must be sized properly using the propane fuel line sizing charts (see the Fuel Line Selection appendix). Installation must comply with all national, state, and local codes.
Cummins Flexible Fuel Line	Protects the fuel system from vibration, expansion, and contraction.



No.	Description	No.	Description
1	Flexible Fuel Line	4	Shutoff Valve
2	Generator Set	5	Propane Tank
3	Service Regulator		

FIGURE 7. TYPICAL PROPANE INSTALLATION

Propane Fuel

⚠ WARNING

Propane presents the hazard of fire or explosion that can cause severe personal injury or death. Do not permit any flame, spark, arc-producing equipment, switch, pilot light, cigarette, or other ignition source near the fuel system. Keep an ABC type fire extinguisher nearby.

⚠ WARNING

Fuel leaks can lead to explosive accumulations of gas. Propane sinks in air and can accumulate inside housings, basements and other below-grade spaces. Prevent gas leaks and the accumulation of gaseous fuel in the event of a leak.

Use clean, fresh HD-5 grade propane or equivalent product consisting of at least 90% propane.

NOTICE

NFPA Standard No. 58 requires all persons handling and operating propane to be trained in proper handling and operating procedures.

NOTICE

Commercial propane may contain more than 2.5% butane, which can result in poor fuel vaporization and low tank pressure, resulting in poor engine starting and operation in below 32 °F (O °C) temperatures.

Propane Tank Size

When propane is used, size the tank correctly to ensure successful generator set operation.

Considerations when figuring the proper propane tank size:

- Temperature is a critical factor that affects the size of the tank.
 - Ambient temperatures can affect how quickly liquid is converted to gas.
 - Generator set fuel consumption is the same regardless of the surrounding temperatures.
 - Colder weather climates require larger fuel tanks. Larger tanks have greater surface area, allowing more liquid propane to vaporize and maintain the required fuel rate.
 - Propane is stored as liquid. Keep the fuel tank at least 50% full to operate properly. Fuel tanks that are less than 50% full may not have the capacity to vaporize enough propane to operate the generator set and other LP appliances.
- Propane tanks are sized by their internal volume in gallons, not the amount of fuel they can hold (which is less).
- Propane tanks are generally filled to only 80% of their capacity.
 Therefore, a 500-gallon (1892-liter)tank results in 400-gallon (1514-liter) tank capacity.
- Low ambient temperatures affect the amount of fuel available from the propane tank.

 Approximately 60% of the fuel (in gallons) filled in the tank can be effectively used. Therefore, a 500-gallon (1892-liter) tank results in 240gallon (908-liter) usable capacity.

To assist in the proper installation of the propane tank, follow the guidelines below.

- Consult your tank and propane supplier for assistance in all aspects of determining tank size, selection of components and installation requirements.
- Fit the propane tanks with a pressure reducing regulator before connection to the generator set to prevent fuel system damage.
- Locate the propane tanks and all other fuel system components at least 10 feet (3 meters) from any source of combustion (including the generator set). The fuel supplier or local code may require a larger distance between the tank and source of combustion.
- Install the propane tanks according to all national and local codes and standards, and as required by the fuel tank and fuel supplier.

Refer to the Fuel Line Selection appendix for propane figures and tables.

Sizing Fuel Lines

Incorrect fuel line size may cause the generator set to not run or provide full power output. Fuel line sizes for installations typically range from 1/4 to 2 or more inches in diameter.

To determine the optimal fuel line size, the following information is needed:

Category	Description
Fuel Flow Requirements for the Generator Set	Fuel flow requirements have a large impact on fuel line size.
Fuel Source (Natural Gas or Propane Vapor)	Fuel sources can affect fuel line size. Natural gas installations generally require a higher fuel flow rate compared to propane vapor installations, since propane has a higher energy content.
Fuel Line Length (Including Fittings)	Factor in the equivalent lengths of all of the fittings (elbows, tees, valves) in the installation in addition to the fuel line length. Longer lengths require larger diameters.
Fuel Line Type (e.g., Copper Tubing or Iron Pipe)	Most fuel line types are iron pipe or copper tubing. Be sure to use the sizing chart for the fuel line type when sizing the fuel line.

There are some basic but very important steps all installers must follow to make sure that fuel lines are sized correctly:

1. Verify adequate fuel flow, quality, and pressure available from utility connection.

2. Determine fuel requirements at full load. See the Model Specifications section to determine the fuel flow requirements.

- Determine equivalent length of fuel line fittings required. See the NFPA Pipe Fittings table in the <u>Fuel Line Selection</u> appendix to determine the equivalent lengths for elbows, tees, and valves. Add this length to fuel line length to determine total equivalent length.
- 4. Determine required fuel line size at full load. See the **Fuel Line Selection** appendix to determine the fuel line size.

To calculate the minimum pipe size:

- 1. Make a list of all the fittings and valves in a proposed system and add their equivalent lengths.
- 2. Add all lengths of straight pipe to arrive at a total equivalent length to the fittings/valves total.
- 3. Choose the applicable table based on the fuel system and fuel line material.
- 4. Obtain the maximum fuel requirements for the specific generator set from the Model Specifications section.
- 5. Refer to the fuel line sizing charts in the <u>Fuel Line Selection</u> appendix. Locate the equivalent length of pipe (or next larger equivalent length) in the left hand column. Move across the row to where the maximum capacity number is as large or larger than the maximum fuel consumption (or next larger). At the top of that column is the minimum nominal pipe size or tubing size required for the system as designed.

Installing Fuel Lines

The basic components required for fuel line installation are as follows:

- Flexible connection
- Fuel line
- Shutoff valve
- Fuel supply

To install the fuel lines:

- 1. Connect a flexible fuel line to the fuel connection ports on the generator set.
- 2. Connect the opposite end of the flexible fuel line to the fuel source line near the shutoff valve.

NOTICE

A shutoff valve is recommended and often required by local and state codes.

Testing the Fuel System for Leaks

After assembly and before initial operation, all of the fuel system components must be tested and proven free of any leaks.

⚠ WARNING

Fuel presents the hazard of explosion or fire which can result in severe personal injury or death. Do not use an open flame to check for leaks. Do not smoke or allow any flame, spark, pilot light, arc-producing equipment, switch or other ignition sources around fuel or fuel components. Keep multi-class ABC fire extinguishers handy.

NOTICE

Follow any local codes and standards, as they may require a different method or documentation of a leak test.

After assembly, and before initial operation, all fuel system connections, hose, valves, regulators and fittings must be tested and proven free of leaks using a soap-and-water (or equivalent) solution while the system is under gas or air pressure of at least 1.5 times the supply pressure or 3 psi (20.7 kPa) minimum.

- 1. [Copied from GSBB Manual] **Energize the fuel solenoid from a separate 12 VDC source before testing the fuel system.**
- 2. Pressurize the system to a minimum of one and a half times the required fuel supply pressure.
- 3. Spray the soap-and-water solution on all of the joints.
- 4. Inspect all of the joints and monitor the line pressure. If bubbles appear, there is a leak.
- 5. If a leak is found, tighten the joints, recheck for leaks, and repair or replace component(s) as needed.

4.3 Engine Exhaust

The exhaust system for this generator set is complete and was designed specifically for this generator set. Do not modify or add to the exhaust system of this generator set.

⚠ WARNING

Exhaust gas is deadly. Make sure that the exhaust system terminates away from building vents, windows, doors, and sheltered spaces that may not have ample fresh air ventilation.

⚠ WARNING

Engine discharge air and exhaust carry carbon monoxide gas (odorless and invisible) which can cause asphyxiation and death. Never use engine discharge air or exhaust for heating a room or enclosed space.

4.4 Electrical Connections

⚠ WARNING

Improper installation can lead to electrocution and damage to property. Electrical connections must be made by a licensed electrician.

⚠ WARNING

Automatic startup of the generator set during installation can cause severe personal injury or death. Make sure the generator set is shut down and disabled:

- 1. Press the generator set's "O" (Off) button to stop the generator set.

 Allow the generator set to thoroughly cool to the touch.
- 2. Turn off and disconnect the battery charger from the AC source before disconnecting the battery cables.
- 3. Disconnect the negative (–) cable from the battery and secure it from contacting the battery terminals to prevent accidental starting.

NOTICE

Refer to regional codes and the National Electrical Code (NFPA 70) for all electrical installation requirements.

NOTICE

Class 1 wiring methods must be used for connecting the generator set.

AC Connections

⚠ WARNING

Automatic startup of the generator set during installation can cause severe personal injury or death. Push the control switch OFF and disconnect the negative (–) cable from the battery and prevent the cable (any electrical connection) from contacting the battery B-terminal to keep the generator set from starting.

NOTICE

If a 100% rated breaker is used, 90 °C wire must be used for L1, L2, and L3 with the wire size determined by the 75 °C ampacity tables.

NOTICE

When using a circuit breaker with an adjustable, electronic trip unit, the amperage and trip curve settings may need adjustment to match the generator set load wiring, or downstream loads and circuit breakers. An accessory seal kit (part number A026M166 is available to tamper-proof the adjustable settings.

For grounding and neutral connections, look for the following symbols on the generator set circuit breaker box.

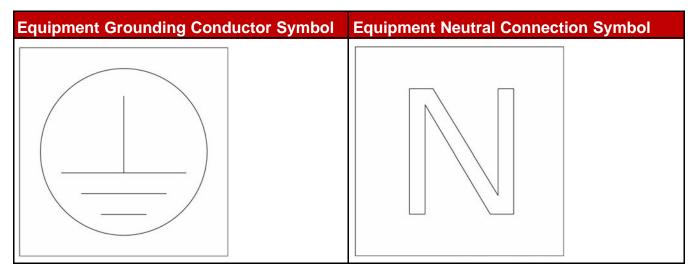


FIGURE 8. SYMBOLS ON CIRCUIT BREAKER BOX

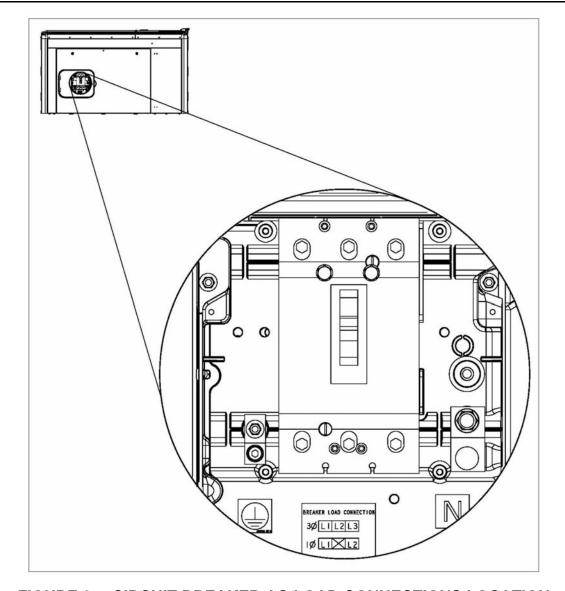


FIGURE 9. CIRCUIT BREAKER AC LOAD CONNECTIONS LOCATION

For connection to the generator set, AC load connections are made in the circuit breaker box. To access:

- 1. Remove the enclosure side panel to gain access to main circuit breaker box.
- 2. Place the circuit breaker handle in the OFF position.
- 3. Remove the four bolts holding the circuit breaker cover.
- 4. Install the conductors to the circuit breaker load-side terminals, neutral lug, and equipment grounding lug.
- 5. Torque the circuit breaker terminals per specifications on the circuit breaker label.
- 6. Torque the neutral lug to 275 inch-pounds (31.1 Nm).
- 7. Torque the equipment grounding lug to 120 inch-pounds (13.8 Nm).

8. Fill in the stub-up openings with an approved duct seal or mastic tape to keep out insects and rodents.

9. Install the circuit breaker cover.

Automatic Transfer Switch AC Connections

⚠ WARNING

Failure to use an approved transfer switch can lead to the electrocution of personnel working on the utility lines, damage to equipment, fire, or personal injury. An approved switching device must be used to prevent interconnection to the public utility.

Install the transfer switch in accordance with the RA Series Transfer Switch Owner Manual.

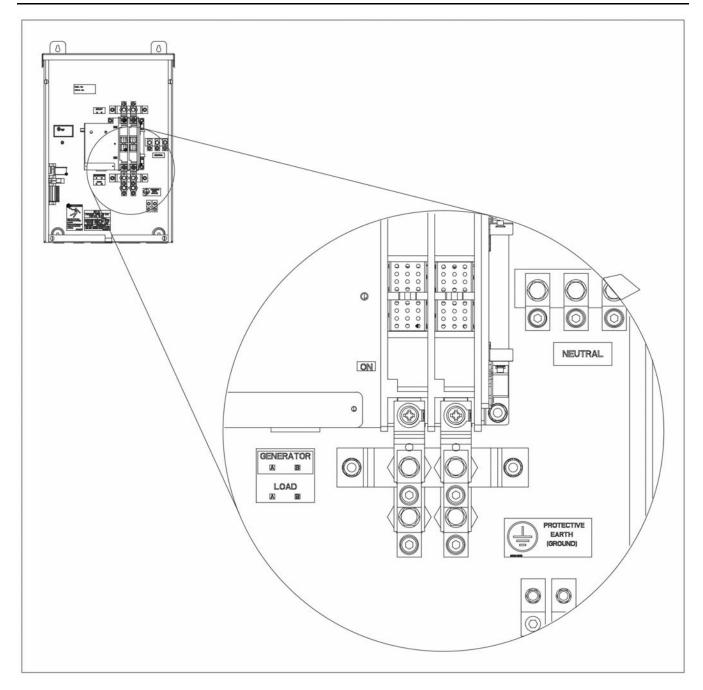


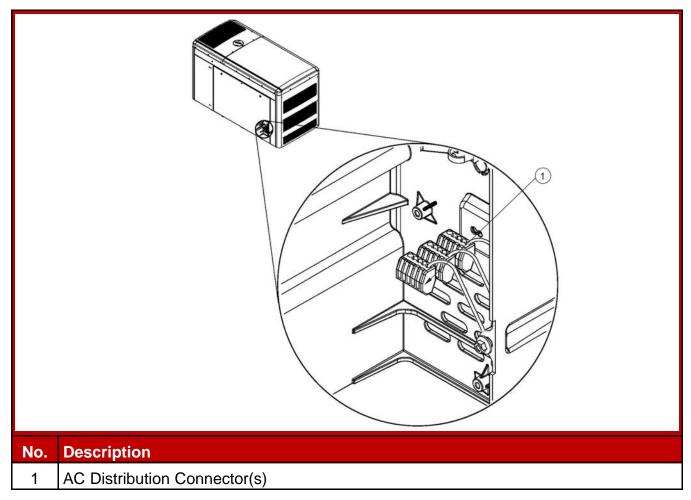
FIGURE 10. RA SERIES TRANSFER SWITCH AC CONNECTIONS LOCATION
Factory Option and Accessory Connections

	NOTICE
Use copper conductors only.	

AC powered options or accessories available:

- Battery charger
- Engine coolant heater

- · Alternator heater
- · Battery warmer
- CCV heater



The battery charger, engine coolant heater, alternator heater, CCV heater, and battery warmer require power from a 120 VAC, 20 amp protected circuit from the Main Distribution Panel. Use 12 AWG 167 °F (75 °C) conductors to make connection to the generator set AC distribution connector.

FIGURE 11. AC ACCESSORY CONNECTIONS

DC Connections

NOTICE

When selecting and installing conduit to the generator set, account for any needed accessories, such as a remote display, etc.

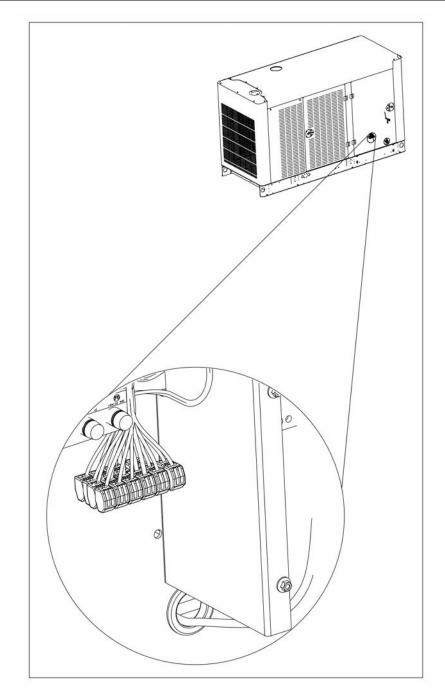


FIGURE 12. DC CUSTOMER CONNECTIONS
Automatic Transfer Switch DC Connections

⚠ WARNING

Failure to use an approved transfer switch can lead to the electrocution of personnel working on the utility lines, damage to equipment, fire, or personal injury. An approved switching device must be used to prevent interconnection to the public utility.

Install the transfer switch in accordance with the RA Series Transfer Switch Owner Manual. The following image shows the location of the Cummins RA Series Transfer Switch customer connections.

NOTICE

Class 1 wiring methods should be used for connecting the generator set and transfer switch signal wiring.

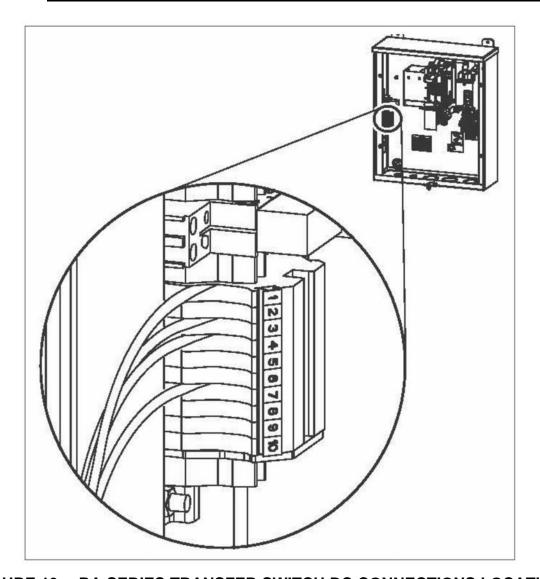


FIGURE 13. RA SERIES TRANSFER SWITCH DC CONNECTIONS LOCATION

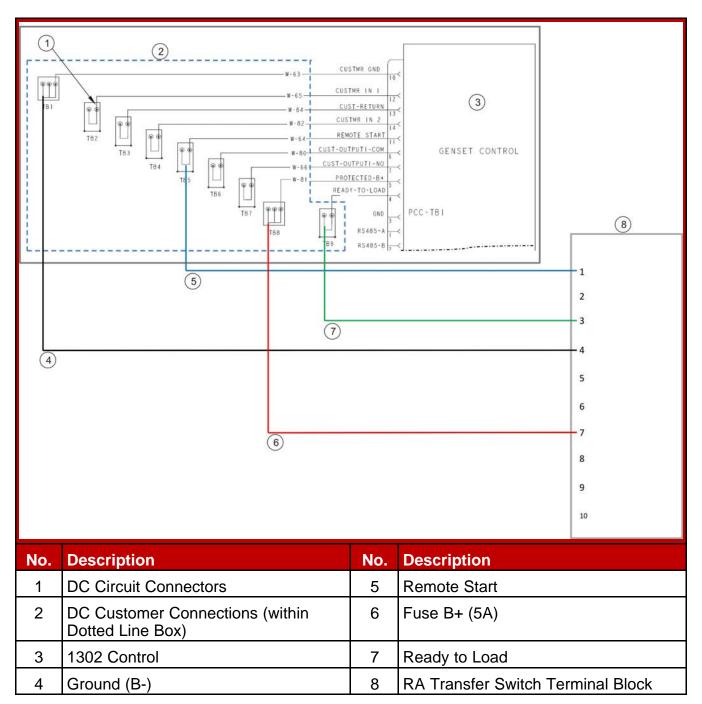


FIGURE 14. GENERATOR SET TO RA TRANSFER SWITCH DC CUSTOMER CONNECTIONS

Drilling Locations for Electrical Connections

Preferred routing of electrical leads is vertically through conduit that is installed in the mounting pad that terminates in the electrical connection areas. Refer to the generator set Foundation Outline drawing in the Appendix for location of electrical connection areas. In some cases, it may be necessary to route electrical leads horizontally in conduits that pass through the generator set chassis. Refer to the

figure below for available drilling space for conduit holes in the side of the chassis. Holes up to 3 (7.6 cm) inches in diameter can be made in the chassis in the areas shown. Exceeding 3 (7.6 cm) inches in diameter may cause failure of the chassis. Comply with NEC and local codes and standards for installation of wires for electrical circuits. Refer to NEC standards for required wire bend radius and ampacity of load leads.

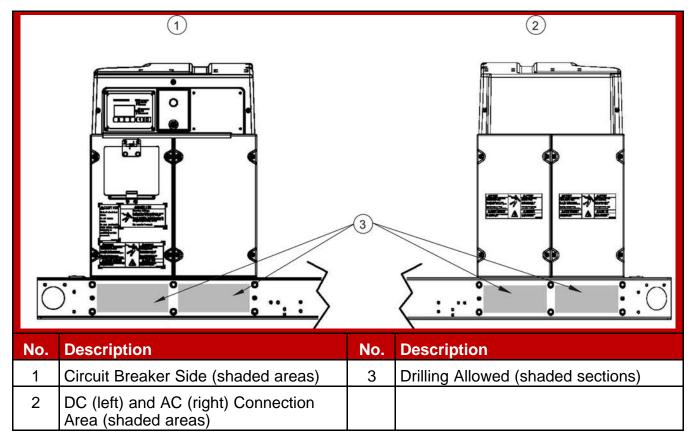


FIGURE 15. DRILLING LOCATIONS FOR SIDE ELECTRICAL CONNECTIONS

47

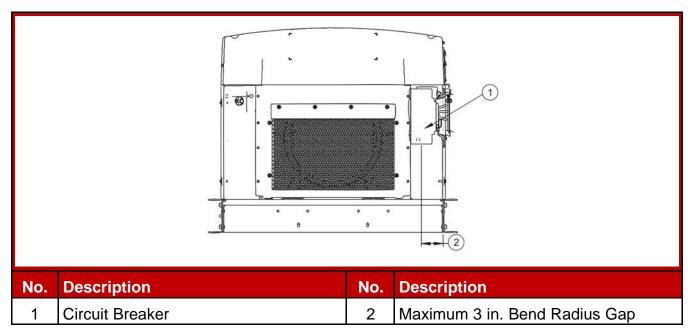


FIGURE 16. CABLING ROOM FOR CIRCUIT BREAKER

Grounding

NOTICE

The generator set is shipped from the factory with the neutral and equipment ground not bonded together.

Refer to local codes and standards for grounding procedures.

Battery

The generator set requires a 12V battery (negatively grounded) for engine cranking and powering the electronic control system. When the generator set is running, the battery is charged from the engine-driven battery alternator. When the set is not running, an AC powered battery charger is needed to keep the battery charged.

As part of the installation, make sure that the battery is secured to the battery tray with the strap provided.

To connect the battery:

- 1. Connect the positive battery terminal.
- 2. Connect the negative battery terminal.
- 3. Make sure that the black and red battery cable boots are in place.

Refer to the Model Specifications section for battery specifications.

An optional thermostatically controlled battery heater is available for more reliable starting in ambient temperatures down to -40 °F (-40 °C).

To prevent injury due to accidental startup:

 Do not connect the battery cables to the battery until the installation has been completed;

- Make sure tools, rags, and body parts are kept away from any rotating parts or electrically live parts; and
- Make sure it is time to start the generator set.

NOTICE

Ensure that the AC power to the battery charger is disconnected when installing the battery.

NOTICE

Wear proper safety protection when working around batteries. Keep open flames and sparks away from the equipment.

NOTICE

Only personnel knowledgeable of batteries and required precautions should perform or supervise battery servicing.

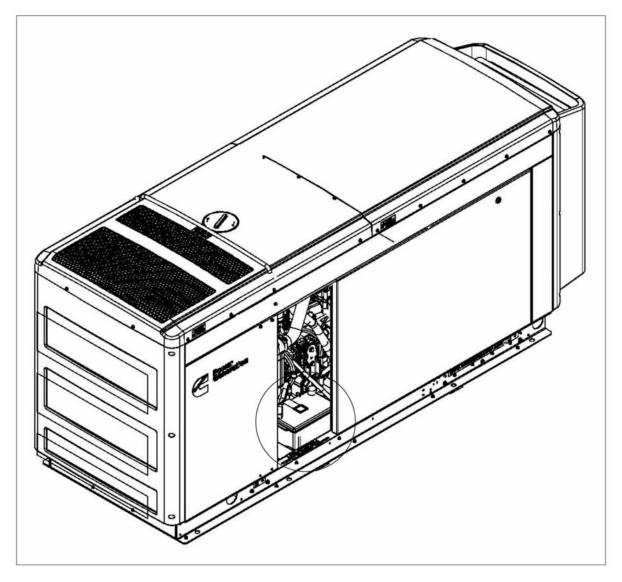


FIGURE 17. BATTERY LOCATION

5 Startup and Configuration

5.1 Exercise Settings

NOTICE

When battery power is lost, these settings must be reset.

NOTICE

Not applicable without a single phase RA series transfer switch.

To access the Clock/Exerciser Menu:

- 1. From any Information Menu, hold down the up and down arrows simultaneously for two seconds. The Service Menu appears.
- 2. Navigate through the screens to find and select **Clock/Excr** in the Service Menu.

NOTICE

The following screens represent the standard operator panel (that is, HMI211). If using an in-home operator panel, which may be additionally purchased as an option, the screens may look slightly different. This procedure applies to both operator panels.

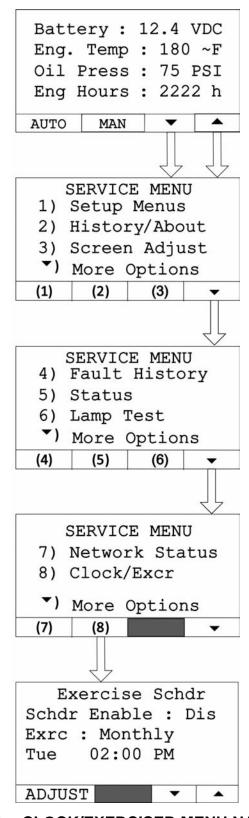


FIGURE 18. CLOCK/EXERCISER MENU NAVIGATION

Updating Exercise Frequency

NOTICE

Not applicable without a single phase RA series transfer switch.

To update the exercise frequency and dates on the Clock/Exerciser Menu:

- 1. From any Information Menu, hold down the up and down arrows simultaneously for two seconds. The Service Menu appears.
- Access the Time Setup screen by selecting Clock Exerciser on the Genset Service Menu.
- Press the down key on the Time Setup screen to access the Daylight Saving Adjust screen.
- 4. Select Adjust.
- 5. Press the down key on the Daylight Saving Adjust Start screen.
- Select Adjust.
- 7. Press **Exercise Schdr** on the Daylight Saving Adjust End screen.
- 8. Press Adjust.

- The horizontal right arrow key is used to select successive blocks for editing settings on the screen.
- Use the + or keys to edit the following settings:
 - Schdr Enable: Enable or Disable
 - Exercise Schedule: Semi-Annual (every six months), Quarterly, Monthly, Bi-Monthly (the first and third week of every month based on the time set when the Bi-Monthly option is selected), or Weekly
 - · Exercise Schedule: Day, Hours, Minutes, AM/PM
- Press Save to save any changes. After saving, the Save button changes to the Adjust button.

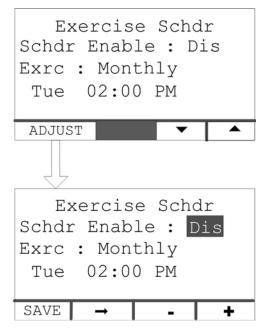


FIGURE 19. EXERCISE FREQUENCY NAVIGATION

Updating Exercise Duration

NOTICE

Not applicable without a single phase RA series transfer switch.

To update the exercise duration on the Clock/Exerciser Menu:

- 1. From any Information Menu, hold down the up and down arrows simultaneously for two seconds. The Service Menu appears.
- Access the Time Setup screen by selecting Clock Exerciser on the Genset Service Menu.
- 3. Press the down key on the Time Setup screen to access the Daylight Saving Adjust screen.
- 4. Select **Adjust**.
- 5. Press the down key on the Daylight Saving Adjust Start screen.
- Select Adjust.
- 7. Press **Exercise Schdr** on the Daylight Saving Adjust End screen.
- 8. Press the down key on the Exercise Schdr Menu.
- 9. Press Adjust.

- The horizontal right arrow key is used to select the duration block for editing exercise duration.
- Use the + or keys to edit the exercise duration minutes.

 Press Save to save any changes. After saving, the Save button changes to the Adjust button.

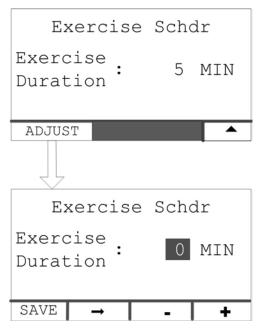


FIGURE 20. EXERCISE DURATION NAVIGATION

5.2 Time Setup

NOTICE

When battery power is lost, these settings must be reset.

NOTICE

Not applicable without a single phase RA series transfer switch.

To set up the generator set clock for the current date and time:

- 1. From any Information Menu, hold down the up and down arrows simultaneously for two seconds. The Service Menu appears.
- 2. Access the Time Setup screen by selecting **Clock Exerciser** on the Genset Service Menu.
- Select Adjust.

- The horizontal right arrow key is used to select successive blocks for editing settings on the screen.
- Select the left arrow to return to the previous screen.
- Adjust values by using the + or keys on the Adjust Menu of the Time Setup screen.

 Press Save to save any changes. After saving, the Save button changes to the Adjust button.

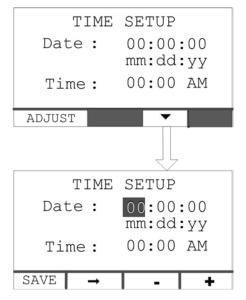


FIGURE 21. TIME SETUP SCREEN

Updating Daylight Saving Adjust Screen

To update the Time and Adjustment on the Daylight Saving Adjust screen:

- 1. From any Information Menu, hold down the up and down arrows simultaneously for two seconds. The Service Menu appears.
- Access the Time Setup screen by selecting Clock Exerciser on the Genset Service Menu.
- Press the down key on the Time Setup screen to access the Daylight Saving Adjust screen.
- Select Adjust.

- The horizontal right arrow key is used to select successive blocks for editing settings on the screen.
- Select the left arrow to return to the previous screen.
- Adjust values by using the + or keys on the Adjust screen of the Daylight Saving Adjust screen.
- Press Save to save any changes. After saving, the Save button changes to the Adjust button.

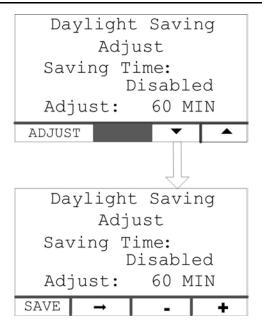


FIGURE 22. DAYLIGHT SAVING ADJUST SCREEN NAVIGATION

To access and update the Daylight Saving Adjust Start screen:

- 1. Press the down key on the Daylight Saving Adjust screen.
- 2. Press Adjust.

- The horizontal right arrow key is used to select successive blocks for editing settings on the screen.
- Use the + or keys to edit the following settings:
 - Month
 - Week
 - Day
 - Hour
- Press Save to save any changes. After saving, the Save button changes to the Adjust button.

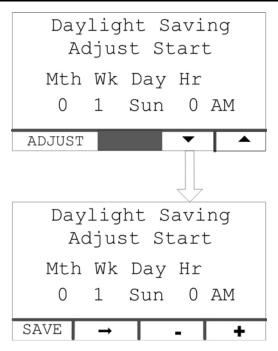


FIGURE 23. DAYLIGHT SAVING ADJUST START SCREEN

To access and update the Daylight Saving Adjust End screen:

- 1. Press the down key on the Daylight Saving Adjust Start screen.
- 2. Press Adjust.

- The horizontal right arrow key is used to select successive blocks for editing settings on the screen.
- Use the + or keys to edit the following settings:
 - Month
 - Week
 - Day
 - Hour
- Press Save to save any changes. After saving, the Save button changes to the Adjust button.

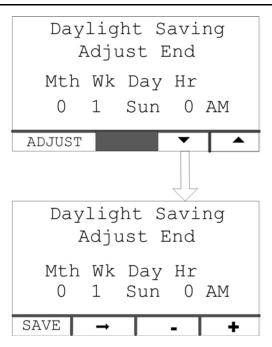


FIGURE 24. DAYLIGHT SAVING ADJUST END SCREEN

5.3 Brightness and Contrast

The Screen Adjust screen allows the contrast, brightness, and units to be set. To access the Screen Adjust screen:

- 1. From any Information screen, hold down the up and down arrows simultaneously for two seconds to gain access to the Service Menu screen.
- 2. Select Screen Adjust.

To adjust the contrast, brightness, or units from the Screen Adjust screen:

- 1. From the Screen Adjust screen, select Adjust to access the screen variables.
- 2. Press the right arrow to move between the variables.
- 3. Adjust settings, and press **Save** to save any changes.

- The horizontal right arrow key is used to select successive blocks for editing settings on the screen.
- Select the left arrow to return to the previous screen.
- Adjust values by using the + or keys on the Adjust screen of the Display Setup screen.
- Press Save to save any changes. After saving, the Save button changes to the Adjust button.

NOTICE

The following screens represent the standard operator panel (HMI211). If using an in-home operator panel, which may be additionally purchased as an option, the screens may look slightly different. This procedure applies to both operator panels.

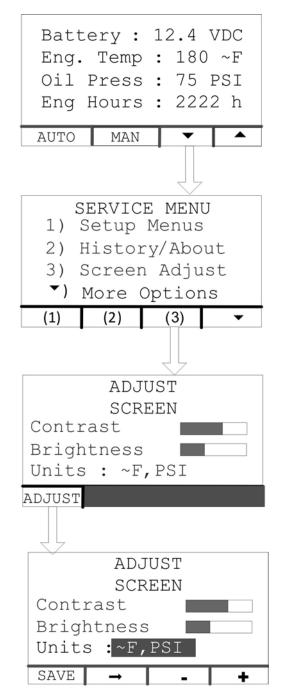


FIGURE 25. BRIGHTNESS AND CONTRAST SCREEN NAVIGATION

NOTICE

Adjusting the brightness on the operator panel adjusts the brightness of both the LCD backlight and the LEDs on the display. The contrast should never be 0 or 100% on any of the screens. The default value for Brightness is 50%.

5.4 History and About Menu

To access the History/About screen:

- 1. From any Information Menu, hold down the up and down arrows simultaneously for two seconds. The Service Menu appears.
- 2. Select History/About.
- 3. Advance through the screens to view information about the generator set, control, and display.

NOTICE

The following screens represent the standard operator panel (HMI211). If using an in-home operator panel, which may be additionally purchased as an option, the screens may look slightly different. This procedure applies to both operator panels.

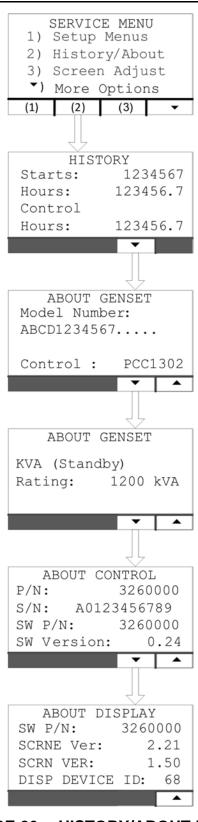


FIGURE 26. HISTORY/ABOUT MENU

5.5 Installation Checklist

Tick	Item	
	General	
	Generator set wattage capacity is sufficient to handle maximum anticipated load.	
	At least 5 feet of clearance to combustible materials is provided. At least 3 feet of clearance is provided around the entire generator set for service and ventilation.	
	The generator set is located in an area not subject to flooding.	
	All installers have read and are familiar with the Generator Set Installation manual and the Health and Safety manual.	
	All installers have been thoroughly briefed on preventive maintenance procedures.	
	All installers have read and understand all important safety instructions.	
	Generator Set Support	
	The floor, roof or earth on which the generator set rests is strong enough and will not allow shifting or movement. Local codes for soil bearing capacity were followed.	
	The generator set is properly supported and secured to an approved base.	
	The supporting base is of non-combustible material and extends 6 inches all around the generator set.	
	Natural Gas and LP Vapor Fuel System	
	Fuel line size has been verified for generator set fuel consumption and pressure.	
	Approved flexible fuel line is installed between main fuel supply and the generator set's fuel system near the generator set	
	Fuel lines are properly installed, supported and protected against damage.	
	Fuel supply shutoff valves are installed to turn off fuel flow in case of leaks.	
	No leaks are found in fuel supply line as a result of leak testing fuel systems.	
	The inside of all fuel supply lines is free of contaminants.	
	Fuel pressure is at 6 - 12 inch water column (1.5 - 3.0 kPa). Maximum pressure under any condition: 13 inch water column (3.2 kPa).	
	Fuel pressure maintains at least 6 inches water column (1.5 kPa) when the generator set is at rated load.	
	The installation is compliant with all state and local codes and regulations.	
	AC and DC Wiring	
	Wire sizes, wire types, insulation, conduits and connection methods all meet applicable codes.	
	AC and DC wires are separated in their own conduit to prevent electrical induction.	

Tick	Item	
	All load, line and generator connections are well made and correct.	
	Generator Set Pre-Start	
	A safety check was performed just before starting.	
	The generator set engine is properly serviced with oil and coolant.	
	The battery is properly installed, serviced and charged.	
	The battery charger and engine coolant heater are connected and operational, if applicable.	
	All generator set covers and safety shields are installed correctly.	
	The fuel supply is turned on.	
	All fuel shutoff valves are operational.	
	The date and time have been set in the generator set control.	
	The generator set operating mode has been selected.	

5.6 Startup

⚠ WARNING

Automatic startup of the generator set during installation can cause severe personal injury or death. Push the control switch OFF and disconnect the negative (–) cable from the battery to keep the generator set from starting.

After verifying that the installation was completed correctly, start and test the system. Make sure to connect the battery cables to the battery with the positive (+) cable first.

Read through the Operator Manual and perform the maintenance and pre-start checks as instructed. The generator set is shipped from the factory with the proper level of engine oil and coolant, but should be checked before it is started. Start and operate the generator set following all the instructions and precautions in the Operator Manual. Ensure that the bonding bolts are installed into the service panels before leaving the site.

NOTICE

Before leaving the site, if the generator set is ready to be placed in service, set the control switch to the AUTO position to provide automatic standby power.

NOTICE

Contact your local Cummins service representative if you encounter a fault code.

5.7 InPower Service Tool

The InPower[™] service tool can be used in troubleshooting to perform tests, verify control inputs and outputs, and test protective functions. Refer to the InPower User's Guide, provided with the InPower software for test procedures.

Disabling the AMF Feature

NOTICE

This procedure must be performed by a qualified technician.

On single-phase units, the control is shipped with the Automatic Mains Failure (AMF) feature enabled. This feature has logic to control the RA Automatic Transfer Switch (ATS), including a 5-minute retransfer to utility delay. If you are not using an RA ATS, you can eliminate the 5-minute retransfer to utility delay by disabling the AMF feature using the instructions below.

NOTICE

This procedure is optional. If you do not disable the AMF feature, the generator set will just run for an additional 5 minutes after the utility has been restored.

NOTICE

These steps cannot be performed with the HMI211; they can only be performed with the InPower service tool.

- 1. Connect to the PCC1302 via InPower.
- 2. Navigate to the Adjustments->Features->Automatic Transfer Switch folder.
- 3. Select the Auto Mains Failure Enable parameter.
- 4. Double-click on Enabled in the Value field.
- 5. A pop-up will appear with available choices. Select Disabled.
- 6. Select Device->Save Adjustments from the top menu bar.
- 7. A pop-up will appear asking if the change is to be saved. Click the Save button.
- 8. After a pop-up appears confirming that the change has been saved, disconnect InPower from the PCC1302.

This page is intentionally blank.

Appendix A. Fuel Line Selection

Table of Contents

Table 18. Equivalent Lengths of Pipe Fittings and Valves in Feet (Meters)	69
Table 20. Natural Gas Schedule 40 Metallic Pipe Sizing	71
Table 22. Natural Gas Semirigid Copper Tubing Sizing	73
Table 24. Propane Vapor Schedule 40 Metallic Pipe Sizing	75
Table 26. Propane Vapor Semirigid Copper Tubing Sizing	76
Table 28. Propane Schedule 40 Iron Pipe Sizing, Liquid Withdrawal (Maximum Capacity of Pipe in Cubic Feet of Gas per Hour)*	
Figure 27. Minimum LPG Tank Size (50% Full) Required to Maintain 5 PSIG at Specific Withdrawal	ደበ

A.0 Fuel System Pipe Sizing Introduction

Incorrect fuel line size may cause the generator set to not run or provide full power output.

Tables are included in this section to help calculate pipe sizing for natural gas and propane vapor withdrawal under specified conditions. Consult NFPA 54 or other applicable codes for other operating conditions or other fuel system installation requirements.

Refer to the *Engineering Application Manual T-030: Liquid Cooled Generator Sets* manual (A040S369) for more information.

To determine the optimal fuel line size, the following information is needed:

Category	Description
Fuel Flow Requirements for the Generator Set	Fuel flow requirements have a large impact on fuel line size.
Fuel Source (Natural Gas or Propane Vapor)	Fuel sources can affect fuel line size. Natural gas installations generally require a higher fuel flow rate compared to propane vapor installations, since propane has a higher energy content.
Fuel Line Length (Including Fittings)	As fuel line lengths increase, they may require larger diameter fuel lines. Be sure to consider the equivalent length of all of the fittings (elbows, tees, valves) in the installation in addition to the straight pipe length.
Fuel Line Type (e.g., Copper Tubing or Iron Pipe)	Most fuel line types are iron pipe or copper tubing. Be sure to use the sizing chart for the fuel line type when sizing the fuel line.

NOTICE

NFPA 54 has selection tables for other approved fuel lines. Verify with the authorities having jurisdiction the allowed fuel line type for the generator set installation.

A.1 Gas Pipe Sizing

NOTICE

The following tables in this section are reprinted with permission from NFPA 54-2015, *National Fuel Gas Code*, Copyright © 2014, National Fire Protection Association.

- Natural Gas Schedule 40 Metallic Pipe Sizing
- Natural Gas Semirigid Copper Tubing Sizing
- Propane Vapor Schedule 40 Iron Pipe Sizing
- Propane Vapor Semirigid Copper Tubing Sizing
- Propane Schedule 40 Iron Pipe Sizing, Liquid Withdrawal (Maximum Capacity of Pipe in Cubic Feet of Gas per Hour)

This reprinted material is not the complete and official position of the NFPA on the referenced subject, which is represented only by the standard in its entirety.

Sizing of gas piping for proper fuel delivery, both flow and pressure, can become quite complex. A simplified method is to convert all fittings, valves, etc. to equivalent lengths of pipe in the diameter(s) being considered. The total equivalent length can then be related to flow capacity. Equivalent lengths of pipe fittings and valves can be found in the table below.

TABLE 18. EQUIVALENT LENGTHS OF PIPE FITTINGS AND VALVES IN FEET (METERS)

TVDE 05			NOI	MINAL IN	ICH (MIL	LIMETER) PIPE S	ZE	
TYPE OF	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4
FITTING	(15)	(20)	(25)	(32)	(40)	(50)	(65)	(80)	(100)
90° Std. Elbow or Tee Reduced ½.	1.6	2.0	2.6	3.3	4.0	5.0	6.0	7.5	10.0
	(0.5)	(0.6)	(0.8)	(1.0)	(1.2)	(1.5)	(1.8)	(2.3)	(3.1)
90° Long Radius Elbow or Straight Run Tee	1.0 (0.3)	1.4 (0.4)	1.7 (0.5)	2.3 (0.7)	2.6 (0.8)	3.3 (1.0)	4.1 (1.3)	5.0 (1.5)	6.7 (2.0)
45° Elbow	0.8	0.9	1.3	1.7	2.1	2.6	3.2	4.0	5.2
	(0.2)	(0.3)	(0.4)	(0.5)	(0.6)	(0.8)	(1.0)	(1.2)	(1.6)
180° Std. Bend	2.5	3.2	4.1	5.6	6.3	8.2	10.0	12.0	17.0
	(0.8)	(1.0)	(1.2)	(1.7)	(1.9)	(2.5)	(3.1)	(3.7)	(5.2)
TEE, Side Inlet or	3.0	4.0	5.0	7.0	8.0	10.0	12.0	15.0	21.0
Outlet	(0.9)	(1.2)	(1.5)	(2.1)	(2.4)	(3.0)	(3.7)	(4.6)	(6.4)

Foot Valve and	3.7	4.9	7.5	8.9	11.0	15.0	18.0	22.0	29.0
Strainer	(1.1)	(1.5)	(2.3)	(2.7)	(3.4)	(4.6)	(5.5)	(6.7)	(8.8)
Swing Check Valve, Fully Open	6.0 (1.8)	8.0 (2.4)	10.0 (3.0)	14.0 (4.3)	16.0 (4.9)	20.0 (6.1)	25.0 (7.6)	30.0 (9.1)	40.0 (12.2)
Globe Valve,	18.0	22.0	29.0	38.0	43.0	55.0	69.0	84.0	120.0
Fully Open	(5.5)	(6.7)	(8.8)	(11.6)	(13.1)	(16.8)	(21.0)	(25.6)	(36.6)
Angle Valve, Fully	7.0	9.0	12.0	15.0	18.0	24.0	29.0	35.0	47.0
Open	(2.1)	(2.7)	(3.7)	(4.6)	(5.5)	(7.3)	(8.8)	(10.7)	(14.3)
Gate Valve, Fully	0.7	0.9	1.0	1.5	1.8	2.3	2.8	3.2	4.5
Open	(0.2)	(0.3)	(0.3)	(0.5)	(0.5)	(0.7)	(0.9)	(1.0)	(1.4)

The remaining tables in this section show maximum gas capacity for equivalent lengths of various pipe sizes.

Here are some basic but very important steps that all installers must follow to make sure that fuel lines are sized correctly:

- 1. Verify adequate fuel flow, quality, and pressure available from the natural gas utility connection or the propane system.
- Obtain the maximum fuel consumption requirements at full load for the specific generator set from the Model Specifications section and for all gas appliances attached to the pipe system.
- 3. Make a list of all the fittings and valves in the proposed system used in this generator set installation.
- 4. Determine the equivalent length of all fuel line fittings (elbows, tees, and valves). (See the NFPA Pipe Fittings table in this appendix to determine the equivalent lengths for all fuel line fittings.)
- 5. Add the equivalent length of the fuel line fittings to the lengths of straight pipe to determine the total equivalent length of the system.
- 6. Choose the applicable table in this appendix based on the fuel type (natural gas, propane vapor or liquid propane) and fuel line material.
- 7. Determine the fuel line size at full load:
 - a. Locate the equivalent length of pipe (or next larger equivalent length) in the left hand column.
 - b. Move across the row to where the maximum flow capacity number is as large or larger than the maximum fuel consumption.
 - c. Move to the top of that column to where the minimum nominal pipe size or tubing size required *for the system as designed* is shown.

TABLE 20. NATURAL GAS SCHEDULE 40 METALLIC PIPE SIZING

Gas:				Natura	al									
Inlet I	Press	ure:		Less t	than 2	psi								
Press	ure D	rop:		0.5 in	. W.C.									
Speci	fic G	ravity	/ :	0.60										
							Pipe	Size (i	n.)					
Nominal :	1/2	3⁄4	1	11⁄4	11/2	2	21/2	3	4	5	6	8	10	12
Actual ID:	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	4.026	5.047	6.065	7.981	10.020	11.938
Length (ft)					Capac	ity in	Cubic	Feet c	of Gas	per H	our			
10	172	360	678	1,39 0	0 0 0 0 00 00 00 00 000 000									
20	118	247	466	957	957 1,43 2,76 4,40 7,78 15,9 28,7 46,5 95,5 173, 27									275, 000
30	95	199	374	768	768 1,15 2,22 3,53 6,25 12,7 23,0 37,3 76,7 139, 2									220, 000
40	81	170	320	657	985	1,90 0	3,02 0	5,35 0	10,9 00	19,7 00	31,9 00	65,6 00	119, 000	189, 000
50	72	151	284	583	873	1,68 0	2,68 0	4,74 0	9,66 0	17,5 00	28,3 00	58,2 00	106, 000	167, 000
60	65	137	257	528	791	1,52 0	2,43 0	4,29 0	8,76 0	15,8 00	25,6 00	52,7 00	95,7 00	152, 000
70	60	126	237	486	728	1,40 0	2,23 0	3,95 0	8,05 0	14,6 00	23,6 00	48,5 00	88,1 00	139, 000
80	56	117	220	452	677	1,30 0	2,08 0	3,67 0	7,49 0	13,6 00	22,0 00	45,1 00	81,9 00	130, 000
90	52	110	207	424	635	1,22 0	1,95 0	3,45 0	7,03 0	12,7 00	20,6 00	42,3 00	76,9 00	122, 000
100	50	104	195	400	600	1,16 0	1,84 0	3,26 0	6,64 0	12,0 00	19,5 00	40,0 00	72,6 00	115, 000
125	44	92	173	355	532	1,02 0	1,63 0	2,89 0	5,89 0	10,6 00	17,2 00	35,4 00	64,3 00	102, 000
150	40	83	157	322	482	928	1,48 0	2,61 0	5,33 0	9,65 0	15,6 00	32,1 00	58,3 00	92,3 00
175	37	77	144	296	443	854	1,36 0	2,41 0	4,91 0	8,88 0	14,4 00	29,5 00	53,6 00	84,9 00

71

200	34	71	134	275	412	794	1,27	2,24	4,56	8,26	13,4	27,5	49,9	79,0
200	J 4	7 1	134	213	412	734	0	0	0	0	00	00	00	00
250	30	63	119	244	366	704	1,12 0	1,98 0	4,05 0	7,32 0	11,9 00	24,3 00	44,2 00	70,0 00
300	27	57	108	221	331	638	1,02 0	1,80 0	3,67 0	6,63 0	10,7 00	22,1 00	40,1 00	63,4 00
350	25	53	99	203	305	587	935	1,65 0	3,37 0	6,10 0	9,88 0	20,3 00	36,9 00	58,4 00
400	23	49	92	189	283	546	870	1,54 0	3,14 0	5,68 0	9,19 0	18,9 00	34,3 00	54,3 00
450	22	46	86	177	266	512	816	1,44 0	2,94 0	5,33 0	8,62 0	17,7 00	32,2 00	50,9 00
500	21	43	82	168	251	484	771	1,36 0	2,78 0	5,03 0	8,15 0	16,7 00	30,4 00	48,1 00
550	20	41	78	159	239	459	732	1,29 0	2,64 0	4,78 0	7,74 0	15,9 00	28,9 00	45,7 00
600	19	39	74	152	228	438	699	1,24 0	2,52 0	4,56 0	7,38 0	15,2 00	27,5 00	43,6 00
650	18	38	71	145	218	420	669	1,18 0	2,41 0	4,36 0	7,07 0	14,5 00	26,4 00	41,8 00
700	17	36	68	140	209	403	643	1,14 0	2,32 0	4,19 0	6,79 0	14,0 00	25,3 00	40,1 00
750	17	35	66	135	202	389	619	1,09 0	2,23 0	4,04 0	6,54 0	13,4 00	24,4 00	38,6 00
800	16	34	63	130	195	375	598	1,06 0	2,16 0	3,90 0	6,32 0	13,0 00	23,6 00	37,3 00
850	16	33	61	126	189	363	579	1,02 0	2,09 0	3,78 0	6,11 0	12,6 00	22,8 00	36,1 00
900	15	32	59	122	183	352	561	992	2,02 0	3,66 0	5,93 0	12,2 00	22,1 00	35,0 00
950	15	31	58	118	178	342	545	963	1,96 0	3,55 0	5,76 0	11,8 00	21,5 00	34,0 00
1,00	14	30	56	115	173	333	530	937	1,91 0	3,46 0	5,60 0	11,5 00	20,9 00	33,1 00
1,10 0	14	28	53	109	164	316	503	890	1,81 0	3,28 0	5,32 0	10,9 00	19,8 00	31,4 00
1,20 0	13	27	51	104	156	301	480	849	1,73 0	3,13 0	5,07 0	10,4 00	18,9 00	30,0 00

1,30 0	12	26	49	100	150	289	460	813	1,66 0	3,00	4,86 0	9,98	18,1 00	28,7 00
1,40 0	12	25	47	96	144	277	442	781	1,59 0	2,88 0	4,67 0	9,59 0	17,4 00	27,6 00
1,50 0	11	24	45	93	139	267	426	752	1,53 0	2,78 0	4,50 0	9,24 0	16,8 00	26,6 00
1,60 0	11	23	44	89	134	258	411	727	1,48 0	2,68 0	4,34 0	8,92 0	16,2 00	25,6 00
1,70 0	11	22	42	86	130	250	398	703	1,43 0	2,59 0	4,20 0	8,63 0	15,7 00	24,8 00
1,80 0	10	22	41	84	126	242	386	682	1,39 0	2,52 0	4,07 0	8,37 0	15,2 00	24,1 00
1,90 0	10	21	40	81	122	235	375	662	1,35 0	2,44 0	3,96 0	8,13 0	14,8 00	23,4 00
2,00	NA	20	39	79	119	229	364	644	1,31 0	2,38 0	3,85 0	7,91 0	14,4 00	22,7 00

NA: Applies to a flow of less than 10 cfh.

Note: All table entries are rounded to 3 significant digits.

TABLE 22. NATURAL GAS SEMIRIGID COPPER TUBING SIZING

Coci						Natural					
Gas:						Naturai					
Inlet Pre	ssure:				Le	ss than 2	psi				
Pressure	e Drop:				().5 in. w.c	: .				
Specific	Gravity:					0.60					
			Tube Size (in.)								
Nominal	1/4	3⁄8	1/2	5⁄8	3⁄4	1	11⁄4	11/2	2		
K & L:											
Nominal ACR:	3/8	1/2	5⁄8	3/4	7/8	11/8	13⁄8	_	-		
Outside:	0.375	0.500	0.625	0.750	0.875	1.125	1.375	1.625	2.125		
Inside:*	0.305	0.402	0.527	0.652	0.745	0.995	1.245	1.481	1.959		
Length (ft.)			Сарас	ity in Cul	bic Feet o	of Gas pe	r Hour				
10	27	27 55 111 195 276 590 1,060 1,680 3,490									
20	18	38	77	134	190	406	730	1,150	2,400		
30	15	30	61	107	152	326	586	925	1,930		

40	13	26	53	92	131	279	502	791	1,650
50	11	23	47	82	116	247	445	701	1,460
60	10	21	42	74	105	224	403	635	1,320
70	NA	19	39	68	96	206	371	585	1,220
80	NA	18	36	63	90	192	345	544	1,130
90	NA	17	34	59	84	180	324	510	1,060
100	NA	16	32	56	79	170	306	482	1,000
125	NA	14	28	50	70	151	271	427	890
150	NA	13	26	45	64	136	245	387	806
175	NA	12	24	41	59	125	226	356	742
200	NA	11	22	39	55	117	210	331	690
250	NA	NA	20	34	48	103	186	294	612
300	NA	NA	18	31	44	94	169	266	554
350	NA	NA	16	28	40	86	155	245	510
400	NA	NA	15	26	38	80	144	228	474
450	NA	NA	14	25	35	75	135	214	445
500	NA	NA	13	23	33	71	128	202	420
550	NA	NA	13	22	32	68	122	192	399
600	NA	NA	12	21	30	64	116	183	381
650	NA	NA	12	20	29	62	111	175	365
700	NA	NA	11	20	28	59	107	168	350
750	NA	NA	11	19	27	57	103	162	338
800	NA	NA	10	18	26	55	99	156	326
850	NA	NA	10	18	25	53	96	151	315
900	NA	NA	NA	17	24	52	93	147	306
950	NA	NA	NA	17	24	50	90	143	297
1,000	NA	NA	NA	16	23	49	88	139	289
1,100	NA	NA	NA	15	22	46	84	132	274
1,200	NA	NA	NA	15	21	44	80	126	262
1,300	NA	NA	NA	14	20	42	76	120	251
1,400	NA	NA	NA	13	19	41	73	116	241
1,500	NA	NA	NA	13	18	39	71	111	232

1,600	NA	NA	NA	13	18	38	68	108	224
1,700	NA	NA	NA	12	17	37	66	104	217
1,800	NA	NA	NA	12	17	36	64	101	210
1,900	NA	NA	NA	11	16	35	62	98	204
2,000	NA	NA	NA	11	16	34	60	95	199

NA: A flow of less than 10 cfh.

Note: All table entries are rounded to 3 significant digits.

TABLE 24. PROPANE VAPOR SCHEDULE 40 METALLIC PIPE SIZING

Gas:					Undi	iluted Pro	pane					
Inlet Pre	ssure:				1	1.0 in. w.	C.					
Pressure	e Drop:				(0.5 in. w.d).					
Specific	Gravity:					1.50						
INTE	ENDED U	JSE: Pipe	Sizing Between Single- or Second-Stage (Low-Pressure) Regulator and Appliance									
			Pipe Size (in.)									
Nominal Inside:	1/2	3⁄4	1	11⁄4	11/2	2	21/2	3	4			
Actual:	0.622	0.622 0.824 1.049 1.380 1.610 2.067 2.469 3.068 4.0										
Length (ft.)			Capaci	ity in Tho	ousands o	of BTU pe	er Hour					
10	291	608	1,150	2,350	3,520	6,790	10,800	19,100	39,000			
20	200	418	787	1,620	2,420	4,660	7,430	13,100	26,800			
30	160	336	632	1,300	1,940	3,750	5,970	10,600	21,500			
40	137	287	541	1,110	1,660	3,210	5,110	9,030	18,400			
50	122	255	480	985	1,480	2,840	4,530	8,000	16,300			
60	110	231	434	892	1,340	2,570	4,100	7,250	14,800			
80	101	212	400	821	1,230	2,370	3,770	6,670	13,600			
100	94	197	372	763	1,140	2,200	3,510	6,210	12,700			
125	89	185	349	716	1,070	2,070	3,290	5,820	11,900			
150	84	84 175 330 677 1,010 1,950 3,110 5,500 11,200										
175	74	155	292	600	899	1,730	2,760	4,880	9,950			

^{*}Table capacities are based on Type K copper tubing inside diameter (shown), which has the smallest inside diameter of the copper tubing products.

200	67	140	265	543	814	1,570	2,500	4,420	9,010	
250	62	129	243	500	749	1,440	2,300	4,060	8,290	
300	58	120	227	465	697	1,340	2,140	3,780	7,710	
350	51	107	201	412	618	1,190	1,900	3,350	6,840	
400	46	97	182	373	560	1,080	1,720	3,040	6,190	
450	42	89	167	344	515	991	1,580	2,790	5,700	
500	40	83	156	320	479	922	1,470	2,600	5,300	
550	37	78	146	300	449	865	1,380	2,440	4,970	
600	35	73	138	283	424	817	1,300	2,300	4,700	
650	33	70	131	269	403	776	1,240	2,190	4,460	
700	32	66	125	257	385	741	1,180	2,090	4,260	
750	30	64	120	246	368	709	1,130	2,000	4,080	
800	29	61	115	236	354	681	1,090	1,920	3,920	
850	28	59	111	227	341	656	1,050	1,850	3,770	
900	27	57	107	220	329	634	1,010	1,790	3,640	
950	26	55	104	213	319	613	978	1,730	3,530	
1,000	25	53	100	206	309	595	948	1,680	3,420	
1,100	25	52	97	200	300	578	921	1,630	3,320	
1,200	24	50	95	195	292	562	895	1,580	3,230	
1,300	23	48	90	185	277	534	850	1,500	3,070	
1,400	22	46	86	176	264	509	811	1,430	2,930	
1,500	21	44	82	169	253	487	777	1,370	2,800	
1,600	20	42	79	162	243	468	746	1,320	2,690	
1,700	19	40	76	156	234	451	719	1,270	2,590	
1,800	19	39	74	151	226	436	694	1,230	2,500	
1,900	18	38	71	146	219	422	672	1,190	2,420	
2,000	18	37	69	142	212	409	652	1,150	2,350	
Note: All table entries are rounded to 3 significant digits.										

TABLE 26. PROPANE VAPOR SEMIRIGID COPPER TUBING SIZING

Gas:	Undiluted Propane
Inlet Pressure:	11.0 in. w.c.

Pressure	e Drop:				().5 in. w.c).							
Specific	Gravity:					1.50								
INTE	NDED U	SE: Tube			Single- or nd Applia		-Stage (L	ow-Press	sure)					
				Tu	be Size (i	in.)								
Nominal K & L:	1/4	3/8	1/2	5/8	3/4	1	11⁄4	11/2	2					
Nominal ACR:	3/8	1/2	5⁄8	3/4	7/8	11/8	13⁄8	_	_					
Outside:	0.375	0.500	0.625	0.750	0.875	1.125	1.375	1.625	2.125					
Inside:*	0.305	0.402	0.527	0.652	0.745	0.995	1.245	1.481	1.959					
Length (ft.)		Capacity in Thousands of BTU per Hour												
10	45													
20	31	64	129	226	321	685	1,230	1,950	4,050					
30	25	51	104	182	258	550	991	1,560	3,250					
40	21	44	89	155	220	471	848	1,340	2,780					
50	19	39	79	138	195	417	752	1,180	2,470					
60	17	35	71	125	177	378	681	1,070	2,240					
70	16	32	66	115	163	348	626	988	2,060					
80	15	30	61	107	152	324	583	919	1,910					
90	14	28	57	100	142	304	547	862	1,800					
100	13	27	54	95	134	287	517	814	1,700					
125	11	24	48	84	119	254	458	722	1,500					
150	10	21	44	76	108	230	415	654	1,360					
175	NA	20	40	70	99	212	382	602	1,250					
200	NA	18	37	65	92	197	355	560	1,170					
250	NA	16	33	58	82	175	315	496	1,030					
300	NA	15	30	52	74	158	285	449	936					
350	NA	14	28	48	68	146	262	414	861					
400	NA	13	26	45	63	136	244	385	801					
450	NA	12	24	42	60	127	229	361	752					
500	NA	11	23	40	56	120	216	341	710					
550	NA	11	22	38	53	114	205	324	674					

600	NA	10	21	36	51	109	196	309	643
650	NA	NA	20	34	49	104	188	296	616
700	NA	NA	19	33	47	100	180	284	592
750	NA	NA	18	32	45	96	174	274	570
800	NA	NA	18	31	44	93	168	264	551
850	NA	NA	17	30	42	90	162	256	533
900	NA	NA	17	29	41	87	157	248	517
950	NA	NA	16	28	40	85	153	241	502
1,000	NA	NA	16	27	39	83	149	234	488
1,100	NA	NA	15	26	37	78	141	223	464
1,200	NA	NA	14	25	35	75	135	212	442
1,300	NA	NA	14	24	34	72	129	203	423
1,400	NA	NA	13	23	32	69	124	195	407
1,500	NA	NA	13	22	31	66	119	188	392
1,600	NA	NA	12	21	30	64	115	182	378
1,700	NA	NA	12	20	29	62	112	176	366
1,800	NA	NA	11	20	28	60	108	170	355
1,900	NA	NA	11	19	27	58	105	166	345
2,000	NA	NA	11	19	27	57	102	161	335

NA: A flow of less than 10,000 BTU/hr.

Note: All table entries are rounded to 3 significant digits.

TABLE 28. PROPANE SCHEDULE 40 IRON PIPE SIZING, LIQUID WITHDRAWAL (MAXIMUM CAPACITY OF PIPE IN CUBIC FEET OF GAS PER HOUR)*

Emphysical	Schedule 40 Iron Pipe Size (in.): Nominal (Inside Diameter)								
Equivalent Length of Pipe (ft.)	1/2 (0.622)	3/4 (0.824)	1 (1.049)	1 1/4 (1.38)		2 (2.067)	3 (3.068)	3 1/2 (3.548)	4 (4.026)
30	733	1,532	2,885	5,924	8,876	17,094	48,16 4	70,519	98,23 8
40	627	1,311	2,469	5,070	7,597	14,630	41,22 2	60,355	84,07 9

^{*}Table capacities are based on Type K copper tubing inside diameter (shown), which has the smallest inside diameter of the copper tubing products.

End of the	Sc	hedule	40 Iron P	ipe Siz	e (in.):	Nominal	(Inside	Diamete	r)
Equivalent Length	1/2	3/4	1	1 1/4	1 1/2	2	3	3 1/2	4
of Pipe (ft.)	(0.622)	(0.824	(1.049)	(1.38)	(1.61)	(2.067)	(3.068	(3.548)	(4.026
50	556	1,162	2,189	4,494	6,733	12,966	36,53 4	53,492	74,51 8
60	504	1,053	1,983	4,072	6,100	11,748	33,10 3	48,467	67,51 9
70	463	969	1,824	3,746	5,612	10,808	30,45 4	44,589	62,11 6
80	431	901	1,697	3,484	5,221	10,055	28,33 1	41,482	57,78 7
90	404	845	1,593	3,269	4,899	9,434	26,58 3	38,921	54,22 0
100	382	798	1,504	3,088	4,627	8,912	25,11 0	36,764	51,21 6
150	307	641	1,208	2,480	3,716	7,156	20,16 4	29,523	41,12 8
200	262	549	1,034	2,122	3,180	6,125	17,25 8	25,268	35,20 0
250	233	486	916	1,881	2,819	5,428	15,29 5	22,395	31,19 8
300	211	441	830	1,705	2,554	4,919	13,85 9	20,291	28,26 7
350	194	405	764	1,568	2,349	4,525	12,75 0	18,667	26,00 6
400	180	377	711	1,459	2,186	4,209	11,86 1	17,366	24,19
450	169	354	667	1,369	2,051	3,950	11,12 9	16,295	22,70 0
500	160	334	630	1,293	1,937	3,731	10,51 2	15,391	21,44
600	145	303	571	1,172	1,755	3,380	9,525	13,946	19,42 8
700	133	279	525	1,078	1,615	3,110	8,763	12,830	17,87 3
800	124	259	488	1,003	1,502	2,893	8,152	11,936	16,62 8

Embolout	Schedule 40 Iron Pipe Size (in.): Nominal (Inside Diameter)								
Equivalent Length of Pipe (ft.)	1/2 (0.622)	3/4 (0.824)	1 (1.049)	1 1/4 (1.38)	1 1/2 (1.61)	2 (2.067)	3 (3.068)	3 1/2 (3.548)	4 (4.026)
900	116	243	458	941	1,409	2,715	7,649	11,199	15,60 1
1000	110	230	433	889	1,331	2,564	7,225	10,579	14,73 7
1500	88	184	348	713	1,069	2,059	5,802	8,495	11,83 4
2000	76	158	297	611	915	1,762	4,966	7,271	10,12 8
*Pipe size recommendations are based on schedule 40 black iron pipe.									

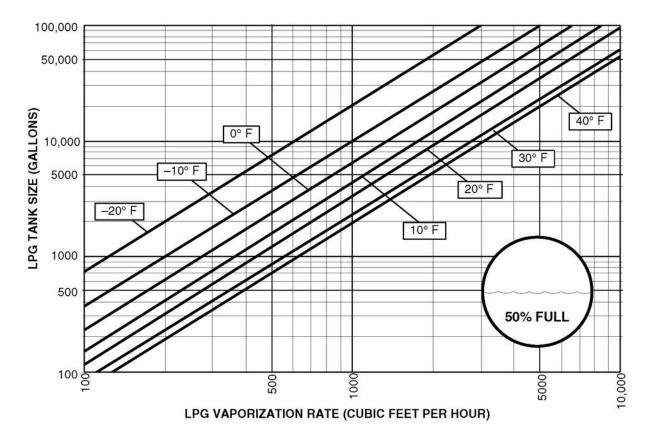


FIGURE 27. MINIMUM LPG TANK SIZE (50% FULL) REQUIRED TO MAINTAIN 5 PSIG AT SPECIFIC WITHDRAWAL RATE AND MINIMUM EXPECTED WINTER TEMPERATURE

Table of Contents

igure 28. Generator Set Outline, 20-25 kW 1800 RPM, 30 kW 3600 RPM (Sheet 1 of 2)	83
igure 29. Generator Set Outline, 20-25 kW 1800 RPM, 30 kW 3600 RPM (Sheet 2 of 2)	84
igure 30. Generator Set Outline, 30-40 kW 1800 RPM, 36-60 kW 3600 RPM (Sheet 1 of 2)	85
igure 31. Generator Set Outline, 30-40 kW 1800 RPM, 36-60 kW 3600 RPM (Sheet 2 of 2)	86
igure 32. Foundation Outline, 20-25 kW 1800 RPM, 30 kW 3600 RPM (Sheet 1 of 1)	87
igure 33. Foundation Outline, 30-40 kW 1800 RPM, 36-60 kW 3600 RPM (Sheet 1 of 1)	88
igure 34. Enclosure Outline, 20-25 kW 1800 RPM, 30 kW 3600 RPM (Sheet 1 of 2)	89
igure 35. Enclosure Outline, 20-25 kW 1800 RPM, 30 kW 3600 RPM (Sheet 2 of 2)	90
igure 36. Enclosure Outline, 30-40 kW 1800 RPM, 36-60 kW 3600 RPM (Sheet 1 of 2)	91
igure 37. Enclosure Outline, 30-40 kW 1800 RPM, 36-60 kW 3600 RPM (Sheet 2 of 2)	92
igure 38. Circuit Breaker Outline (Sheet 1 of 1)	93
igure 39. Wiring Diagram (Sheet 1 of 7)	94
igure 40. Wiring Diagram (Sheet 2 of 7)	
igure 41. Wiring Diagram (Sheet 3 of 7)	96
igure 42. Wiring Diagram (Sheet 4 of 7)	97
igure 43. Wiring Diagram (Sheet 5 of 7)	98
igure 44. Wiring Diagram (Sheet 6 of 7)	99
igure 45. Wiring Diagram (Sheet 7 of 7)	00

This page is intentionally blank.

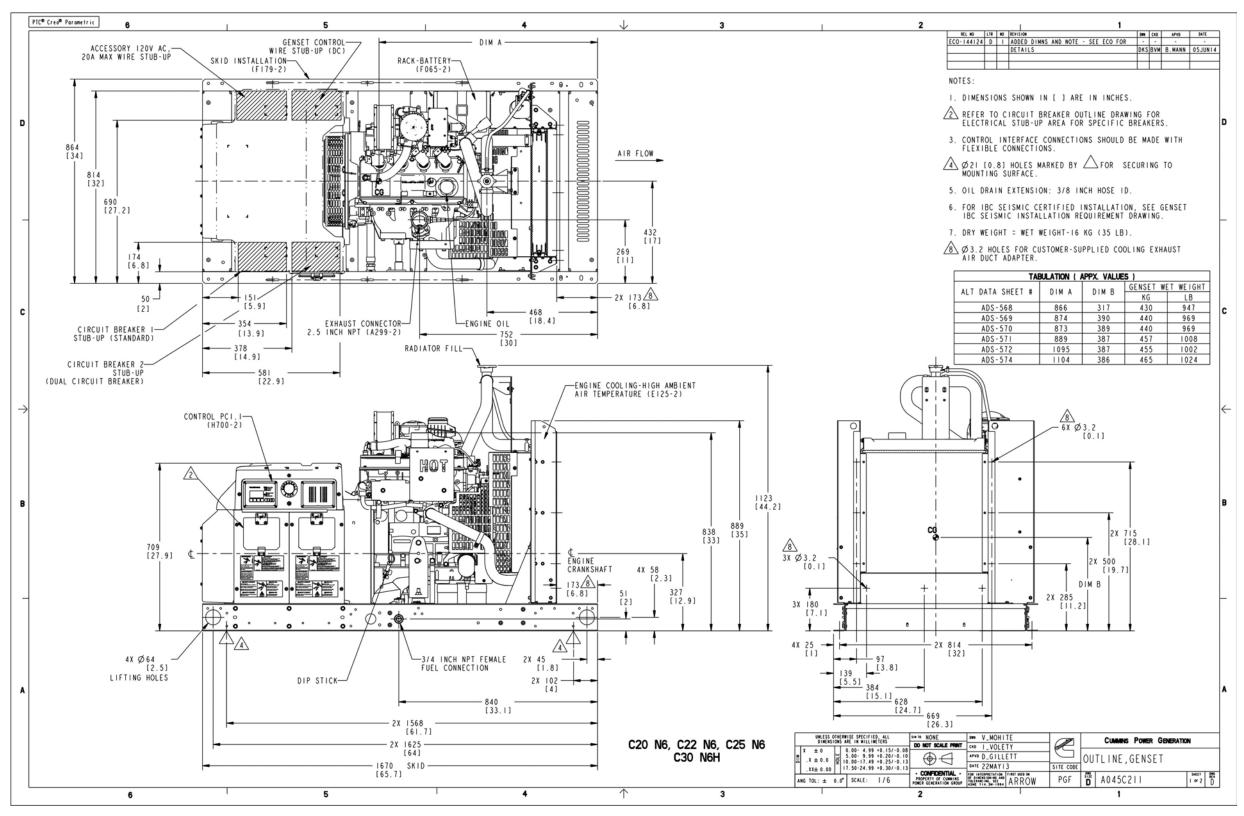


FIGURE 28. GENERATOR SET OUTLINE, 20-25 KW 1800 RPM, 30 KW 3600 RPM (SHEET 1 OF 2)

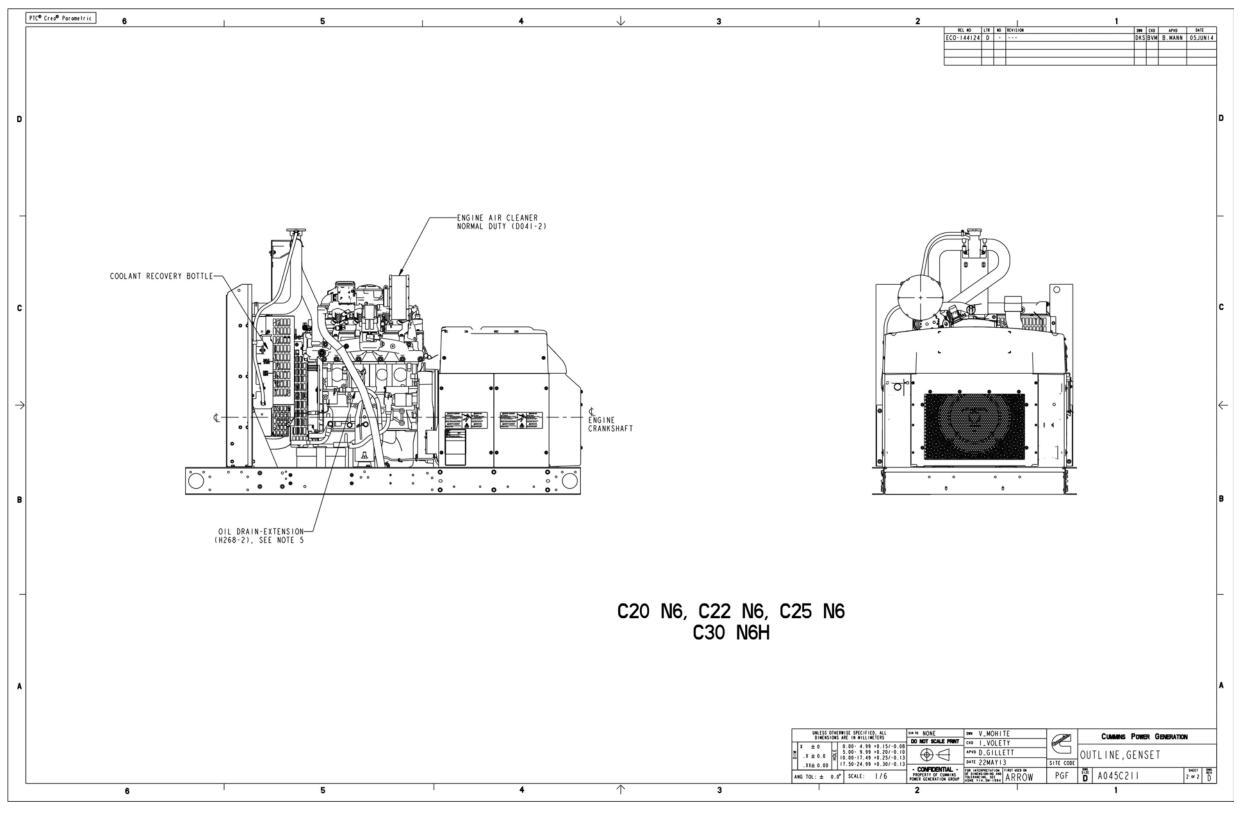


FIGURE 29. GENERATOR SET OUTLINE, 20-25 KW 1800 RPM, 30 KW 3600 RPM (SHEET 2 OF 2)

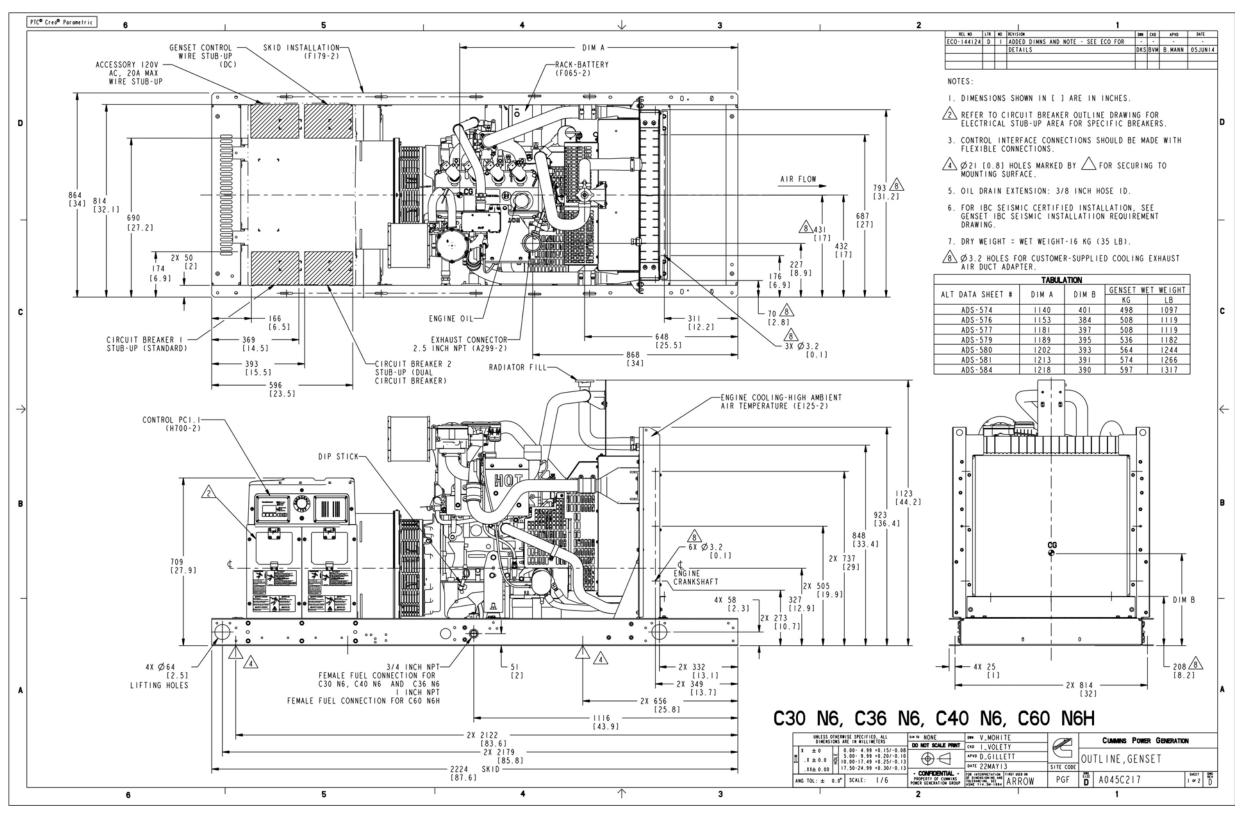


FIGURE 30. GENERATOR SET OUTLINE, 30-40 KW 1800 RPM, 36-60 KW 3600 RPM (SHEET 1 OF 2)

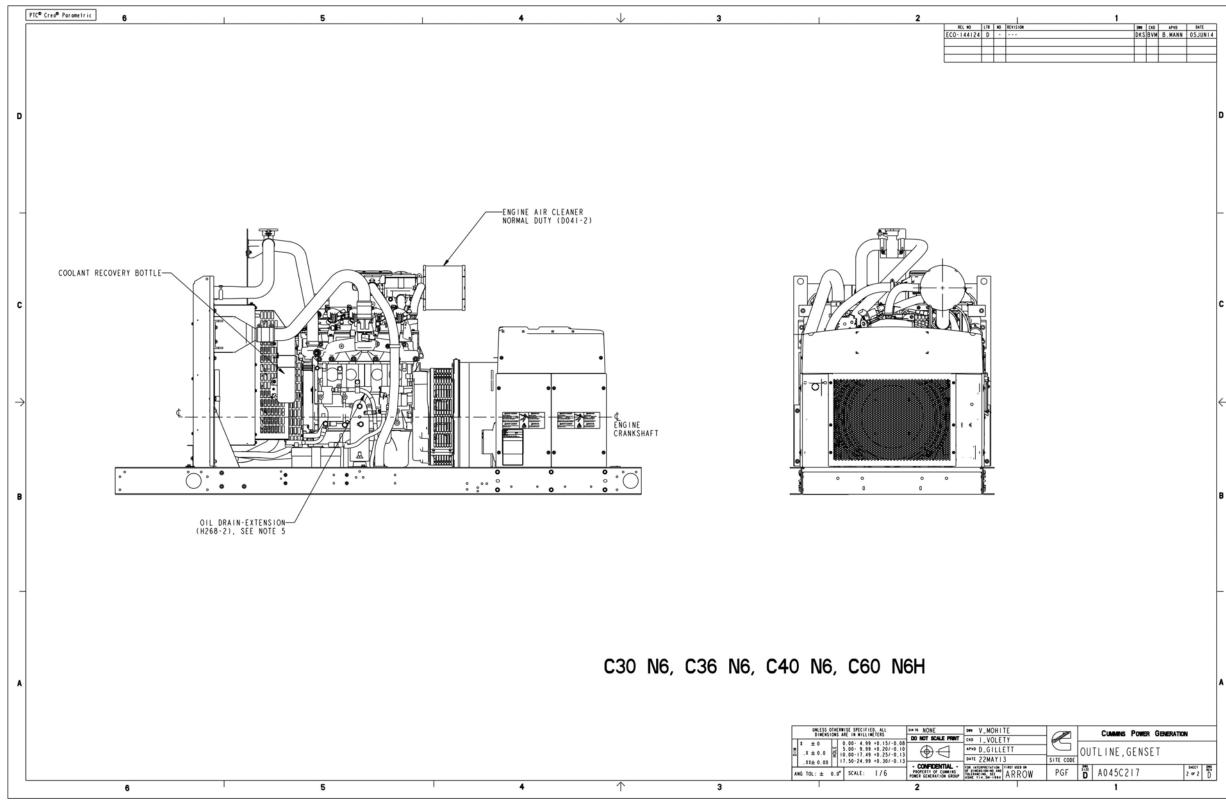


FIGURE 31. GENERATOR SET OUTLINE, 30-40 KW 1800 RPM, 36-60 KW 3600 RPM (SHEET 2 OF 2)

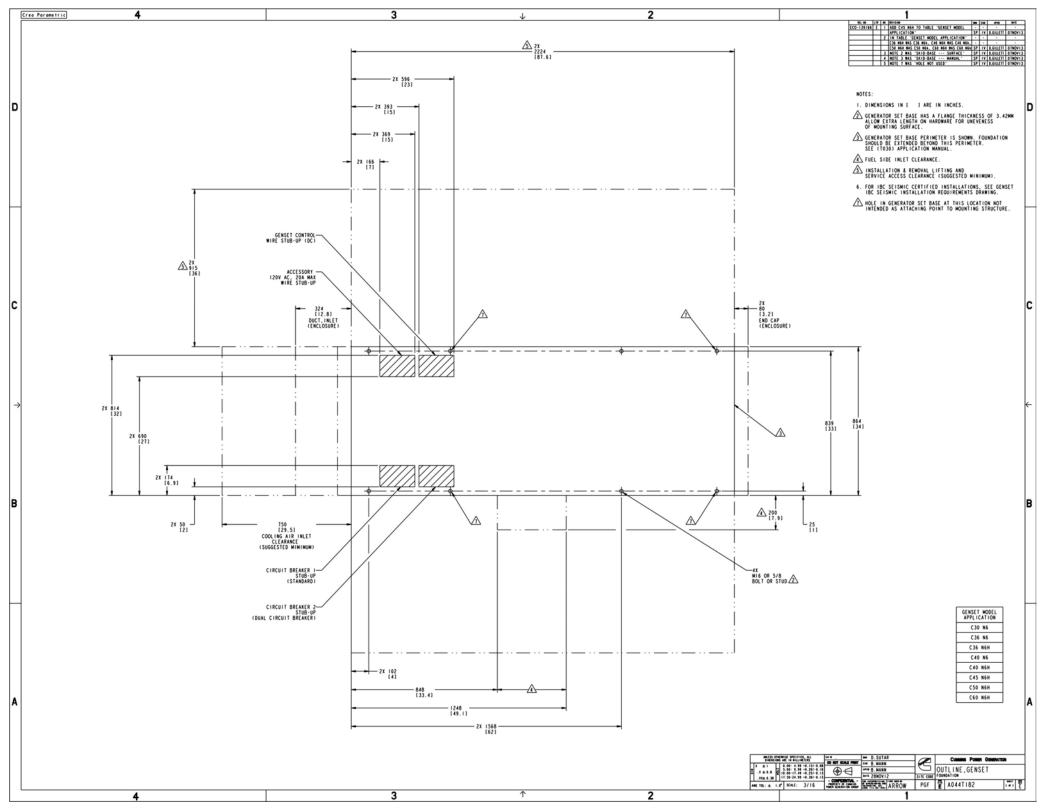


FIGURE 32. FOUNDATION OUTLINE, 20-25 KW 1800 RPM, 30 KW 3600 RPM (SHEET 1 OF 1)

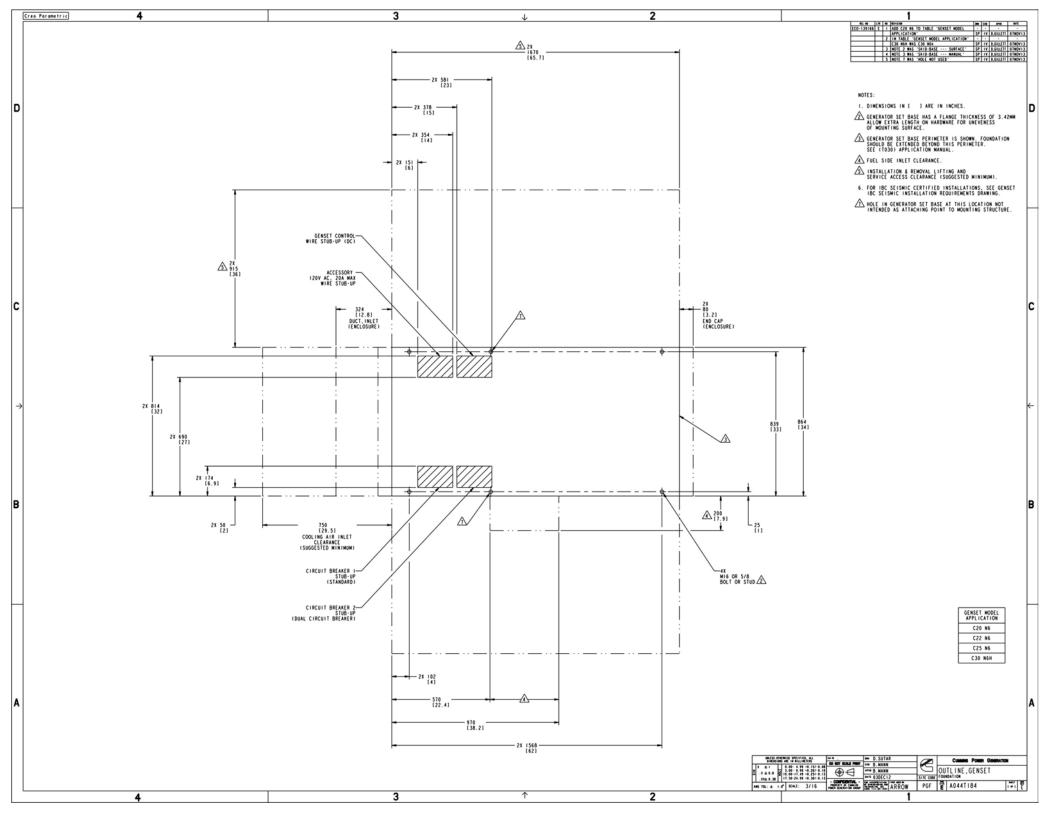


FIGURE 33. FOUNDATION OUTLINE, 30-40 KW 1800 RPM, 36-60 KW 3600 RPM (SHEET 1 OF 1)

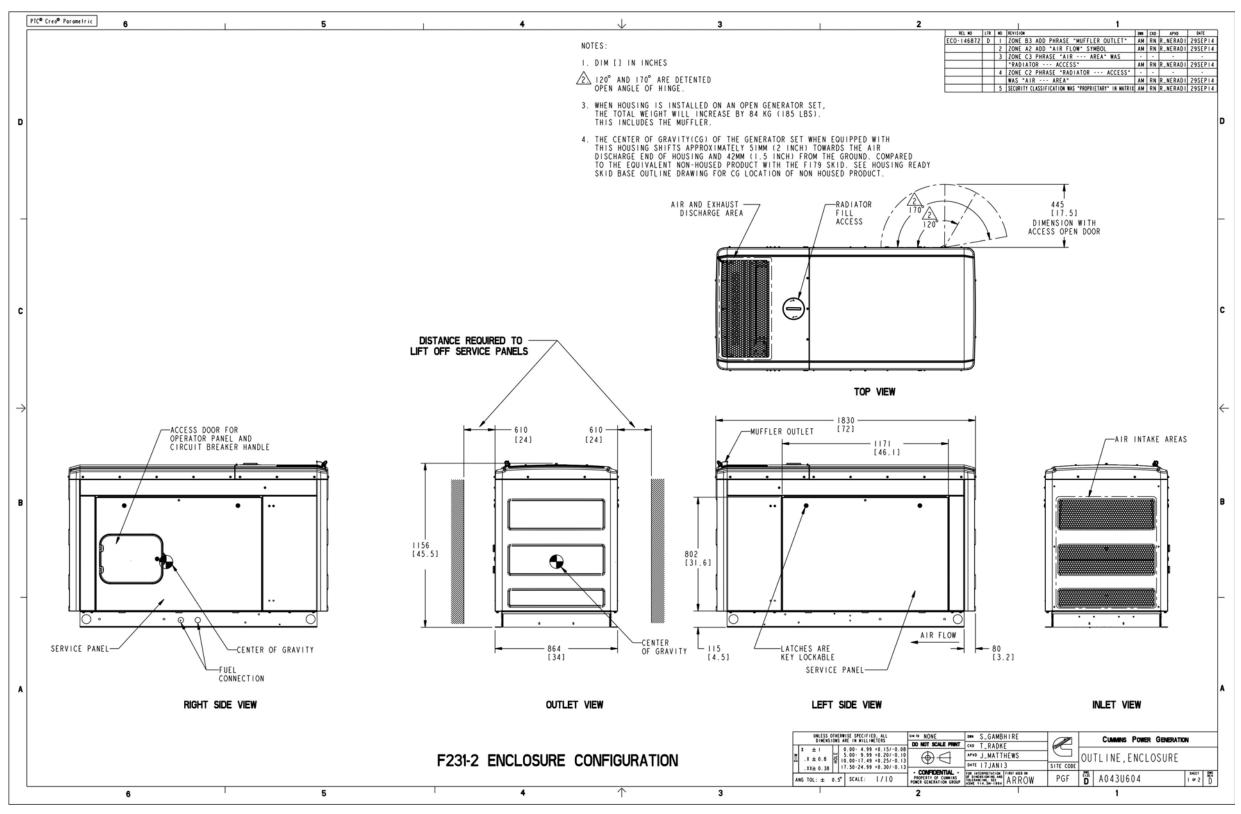


FIGURE 34. ENCLOSURE OUTLINE, 20-25 KW 1800 RPM, 30 KW 3600 RPM (SHEET 1 OF 2)

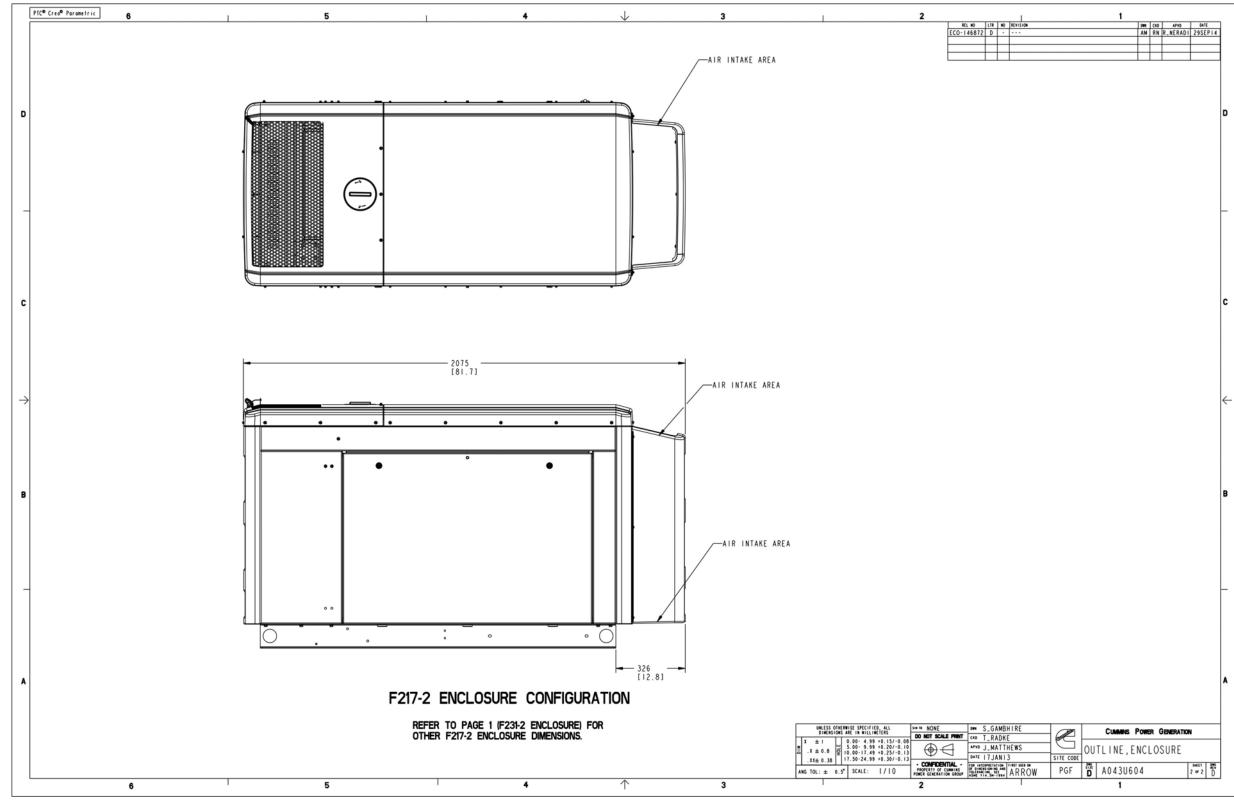


FIGURE 35. ENCLOSURE OUTLINE, 20-25 KW 1800 RPM, 30 KW 3600 RPM (SHEET 2 OF 2)

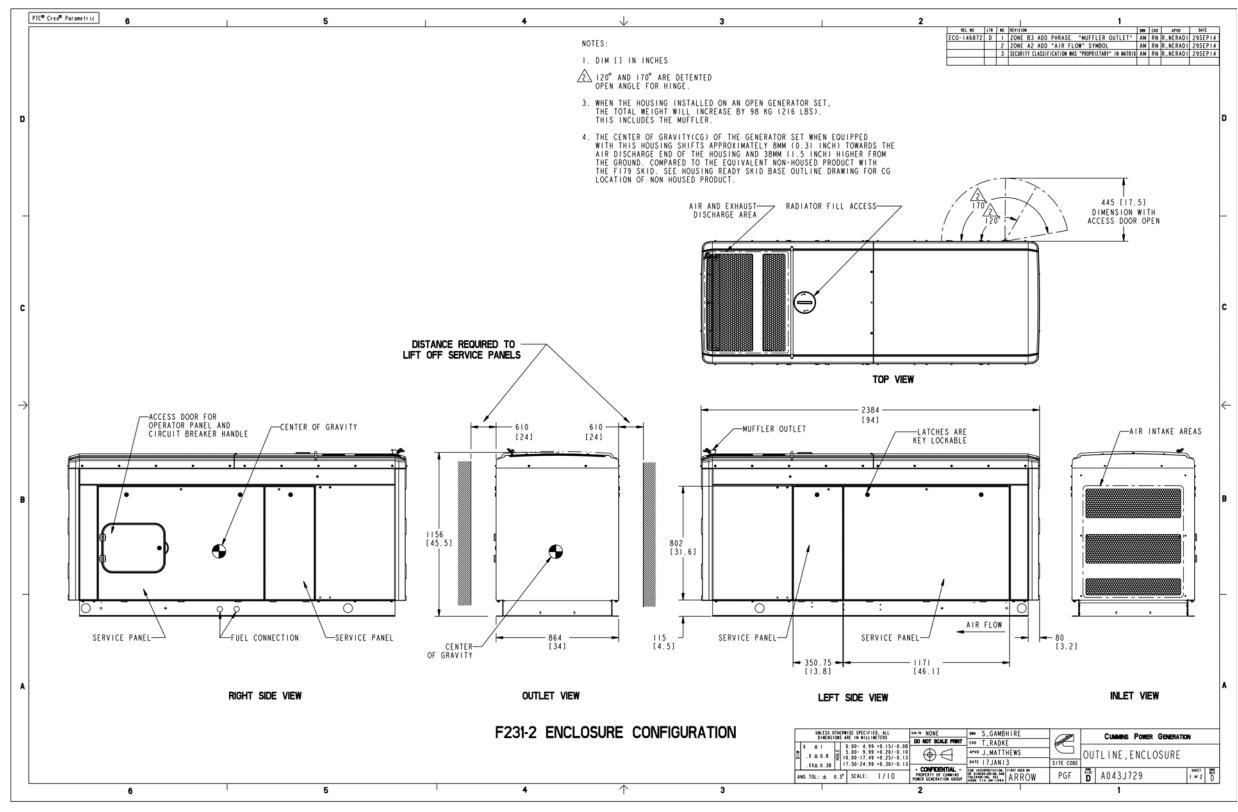


FIGURE 36. ENCLOSURE OUTLINE, 30-40 KW 1800 RPM, 36-60 KW 3600 RPM (SHEET 1 OF 2)

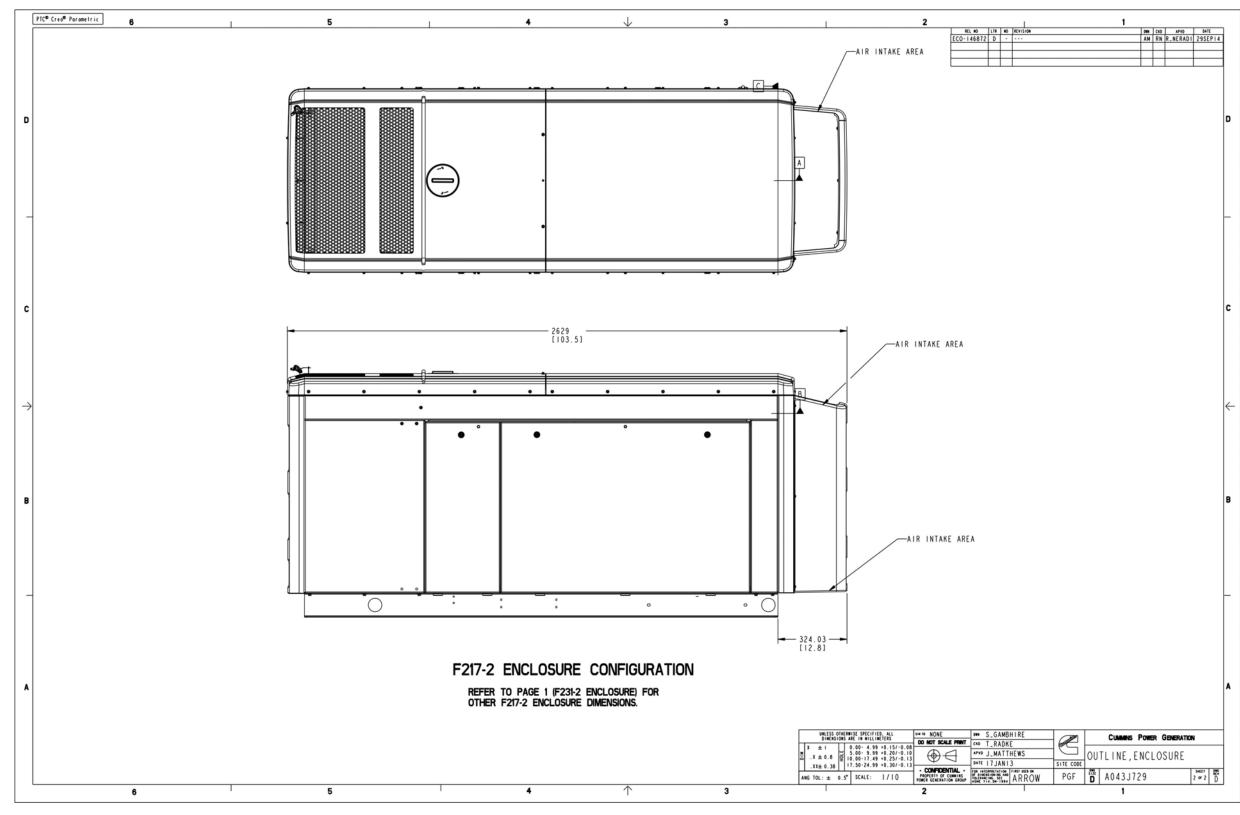


FIGURE 37. ENCLOSURE OUTLINE, 30-40 KW 1800 RPM, 36-60 KW 3600 RPM (SHEET 2 OF 2)

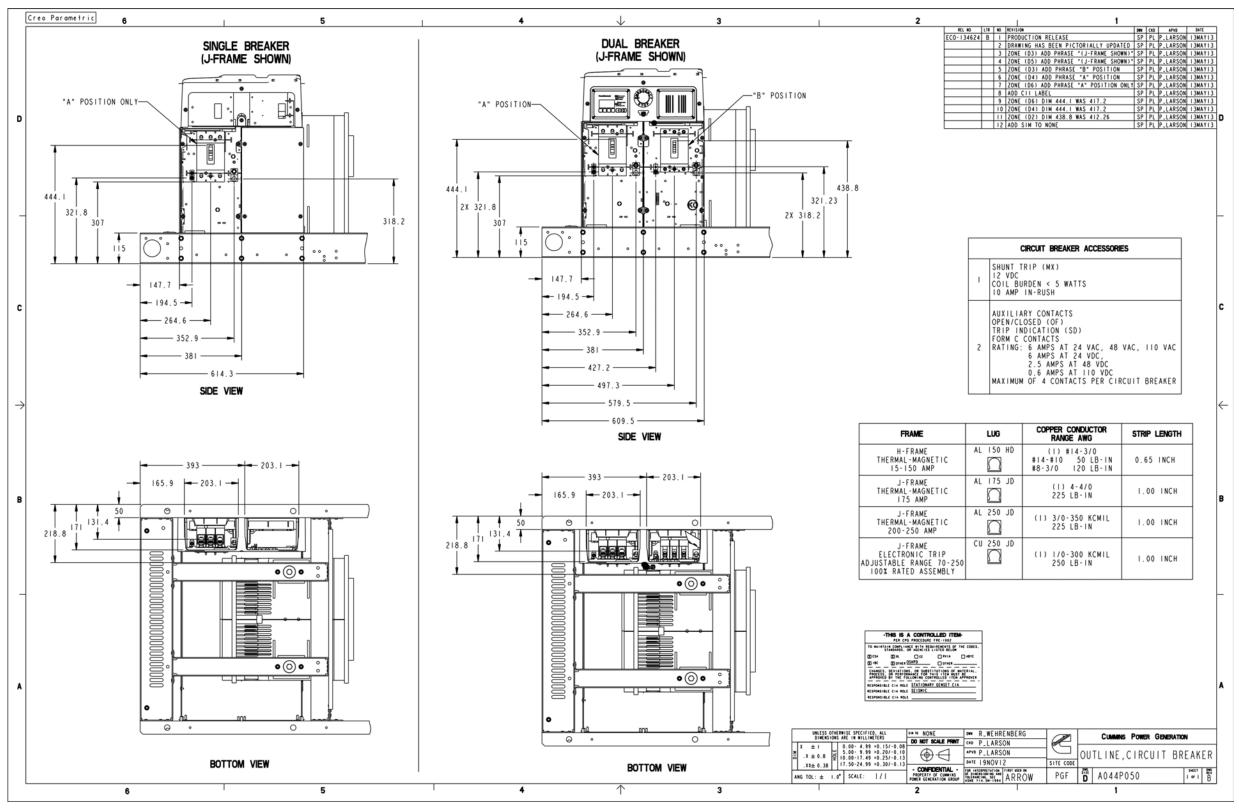


FIGURE 38. CIRCUIT BREAKER OUTLINE (SHEET 1 OF 1)

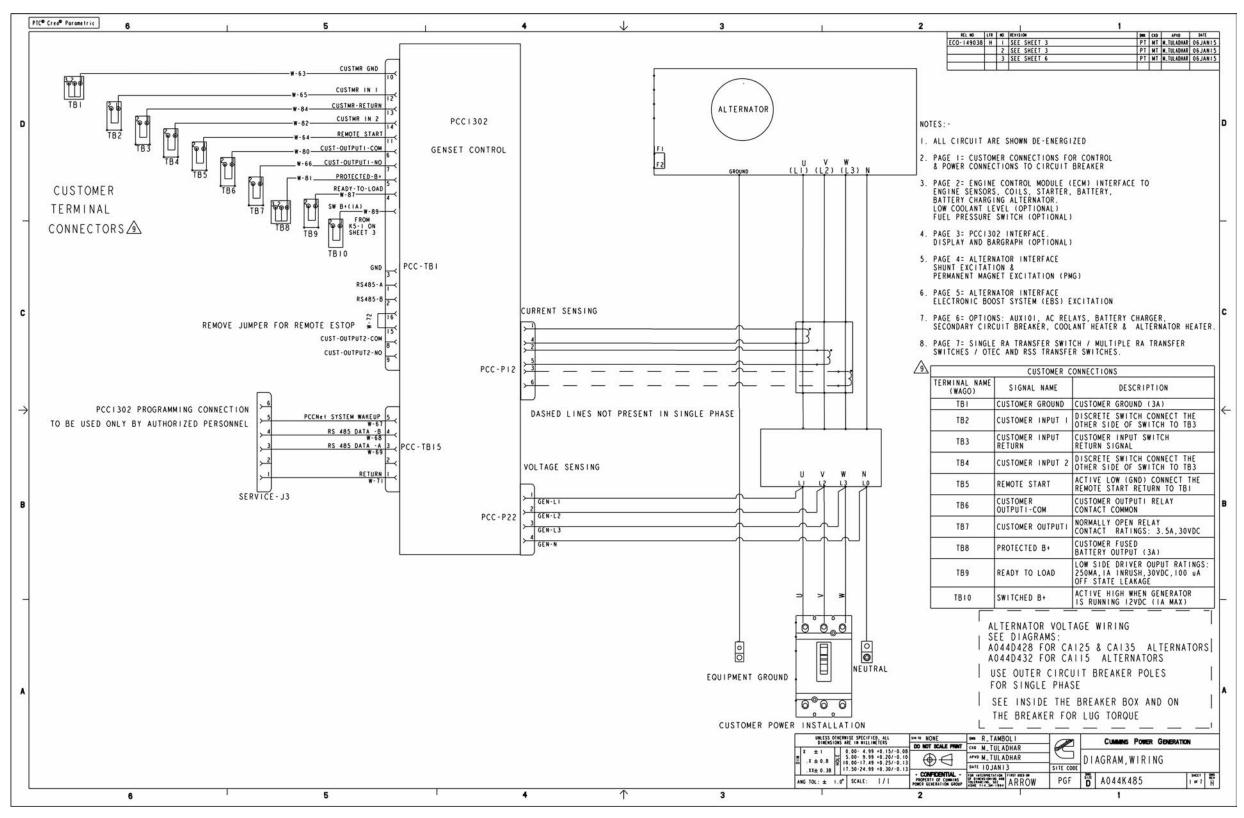


FIGURE 39. WIRING DIAGRAM (SHEET 1 OF 7)

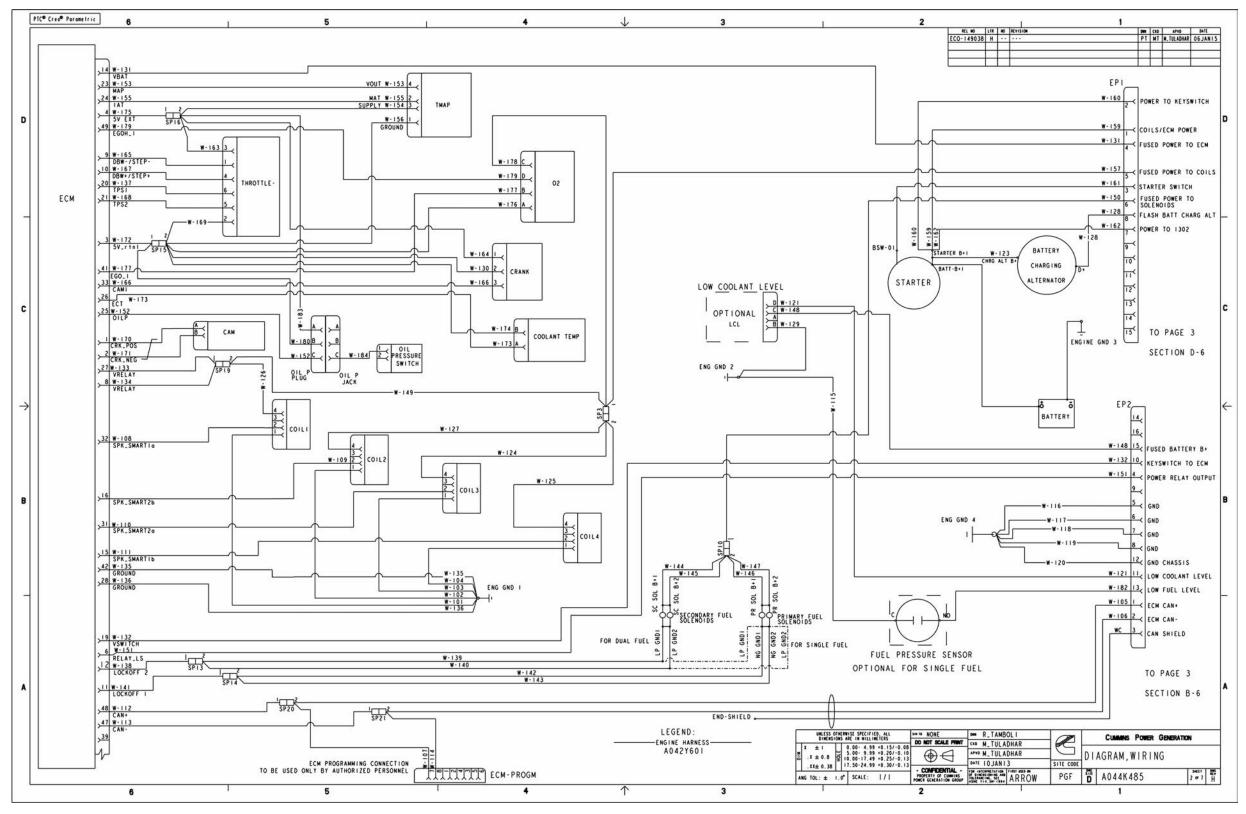


FIGURE 40. WIRING DIAGRAM (SHEET 2 OF 7)

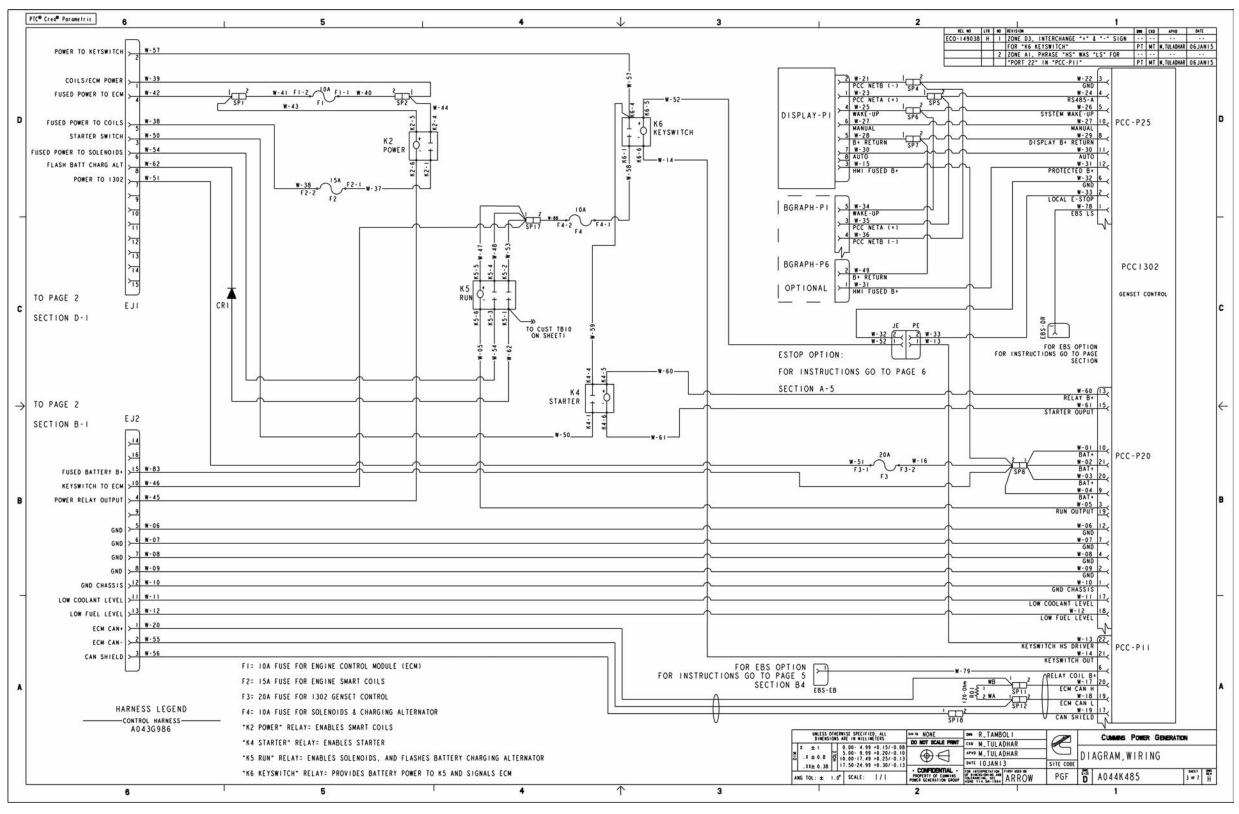


FIGURE 41. WIRING DIAGRAM (SHEET 3 OF 7)

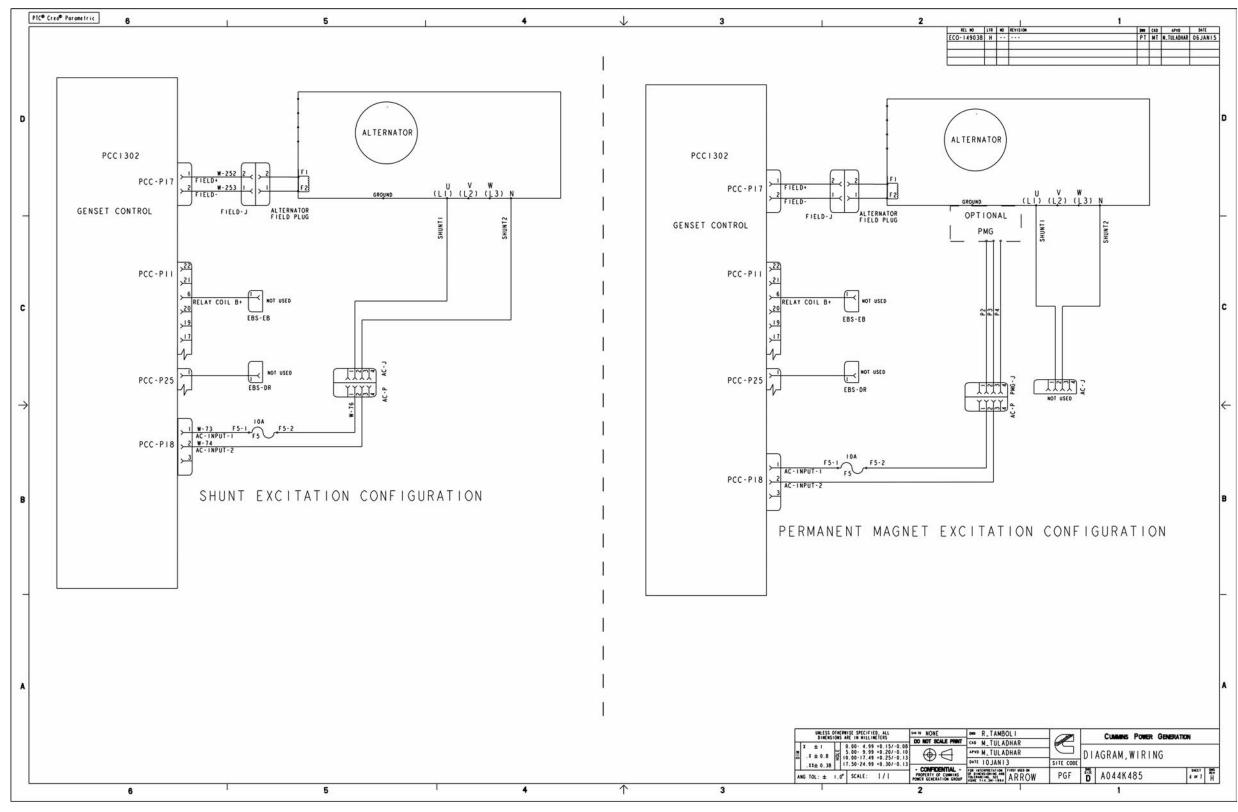


FIGURE 42. WIRING DIAGRAM (SHEET 4 OF 7)

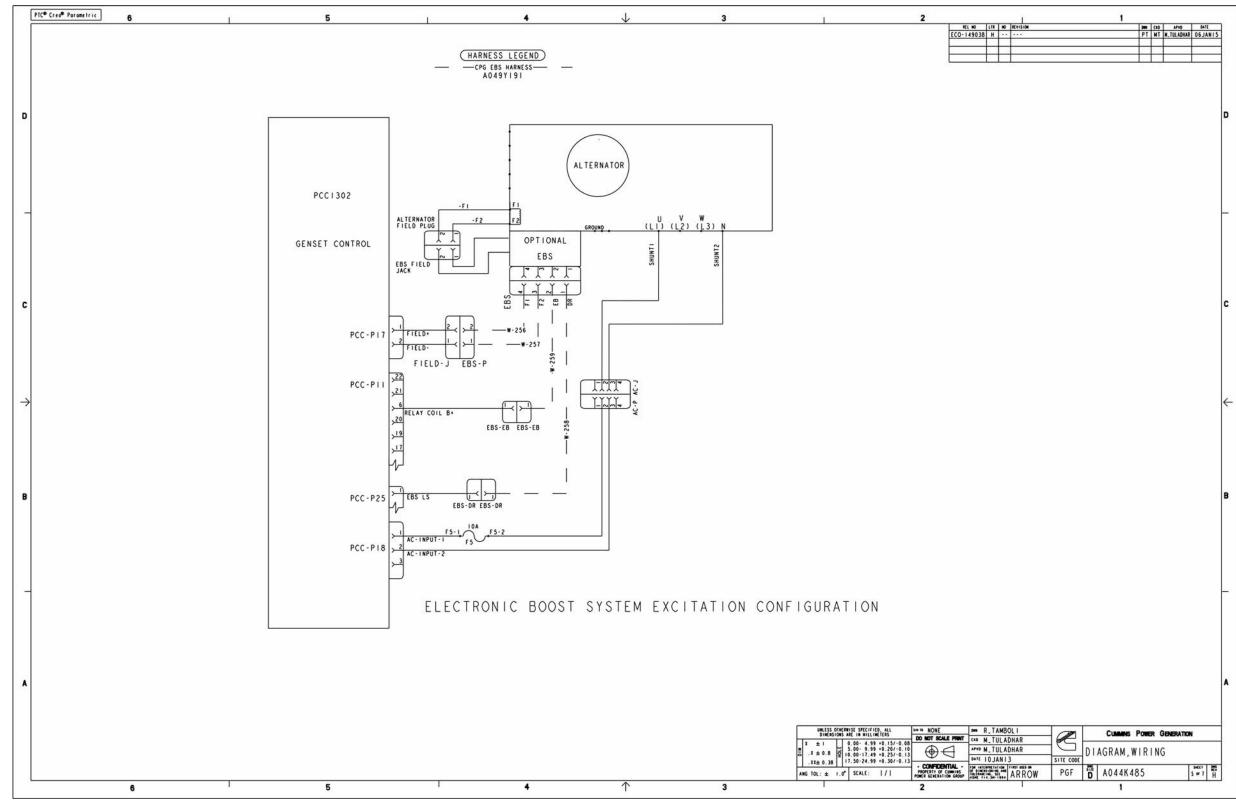


FIGURE 43. WIRING DIAGRAM (SHEET 5 OF 7)

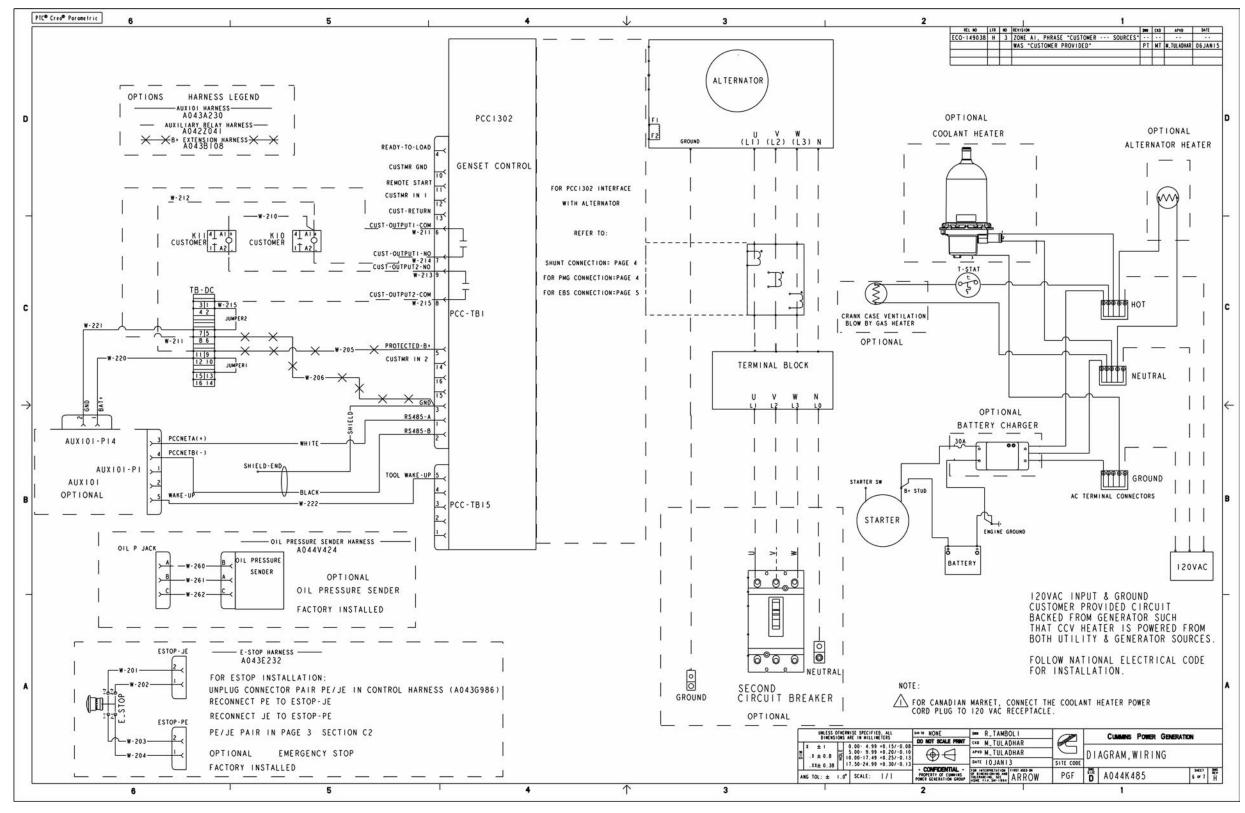


FIGURE 44. WIRING DIAGRAM (SHEET 6 OF 7)

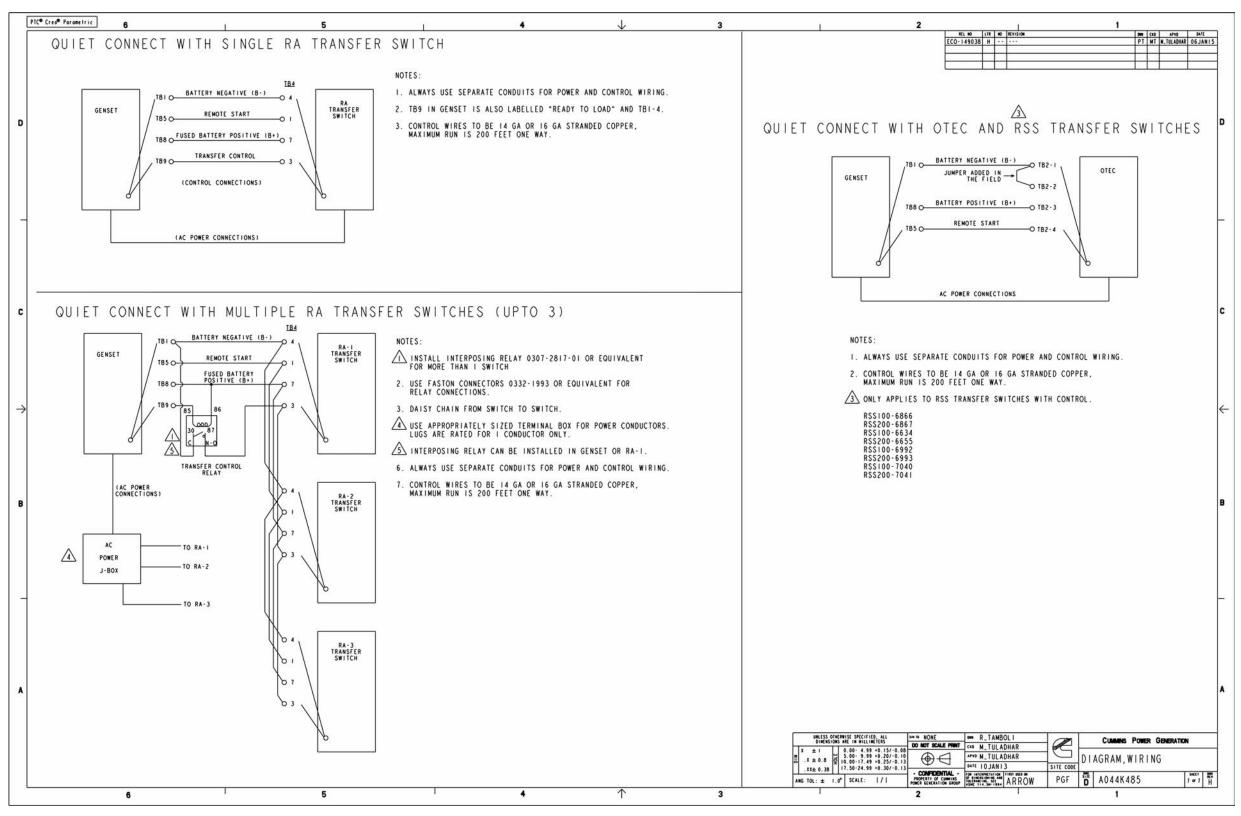


FIGURE 45. WIRING DIAGRAM (SHEET 7 OF 7)

Appendix C. Seismic Requirements

Table of Contents

Figure 46. Seismic Installation Specifications	103
Figure 47. Seismic Installation Notes	104
Figure 48. Seismic Installation Requirements	105

The drawings included in this section are representative. For current complete information, refer to the drawing package that was shipped with the unit.

2-2016 Appendix C. Seismic Requirements

C.1 Seismic Installation Instructions

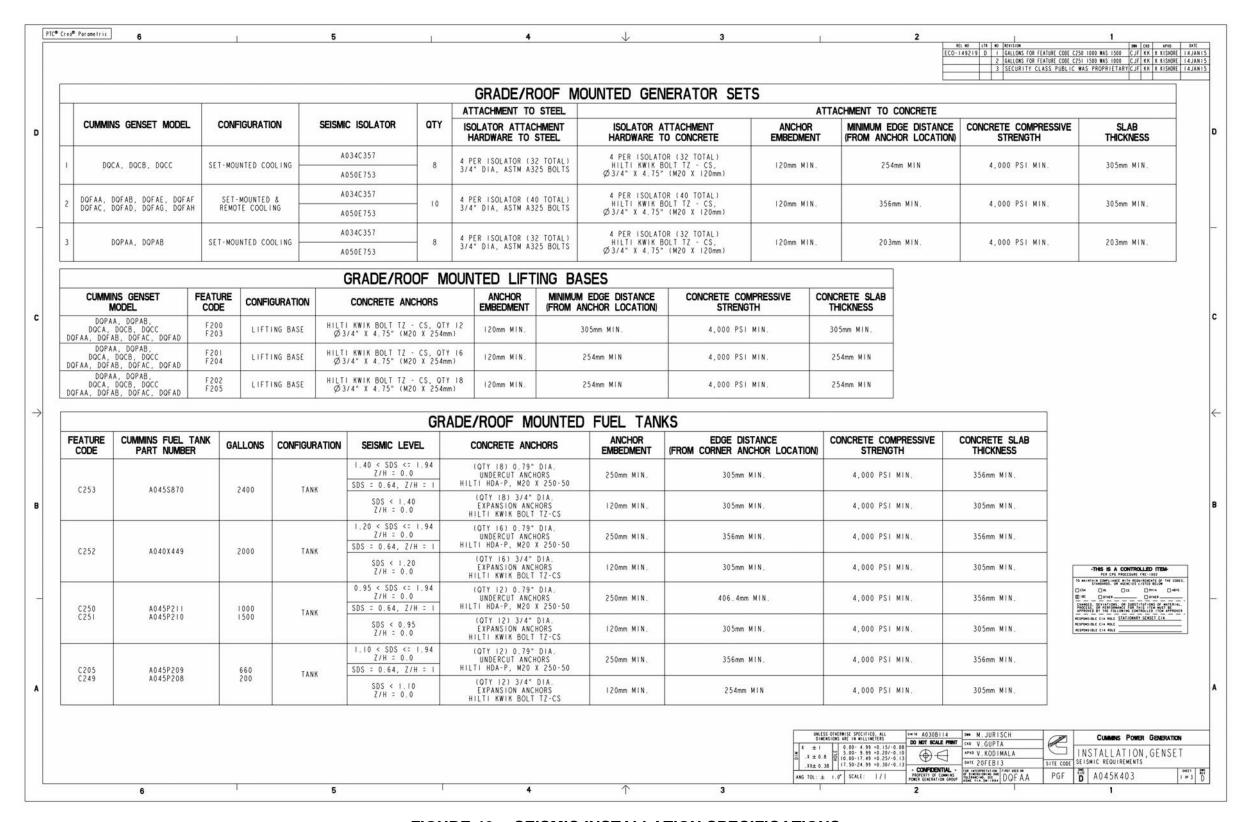


FIGURE 46. SEISMIC INSTALLATION SPECIFICATIONS

Appendix C. Seismic Requirements 2-2016

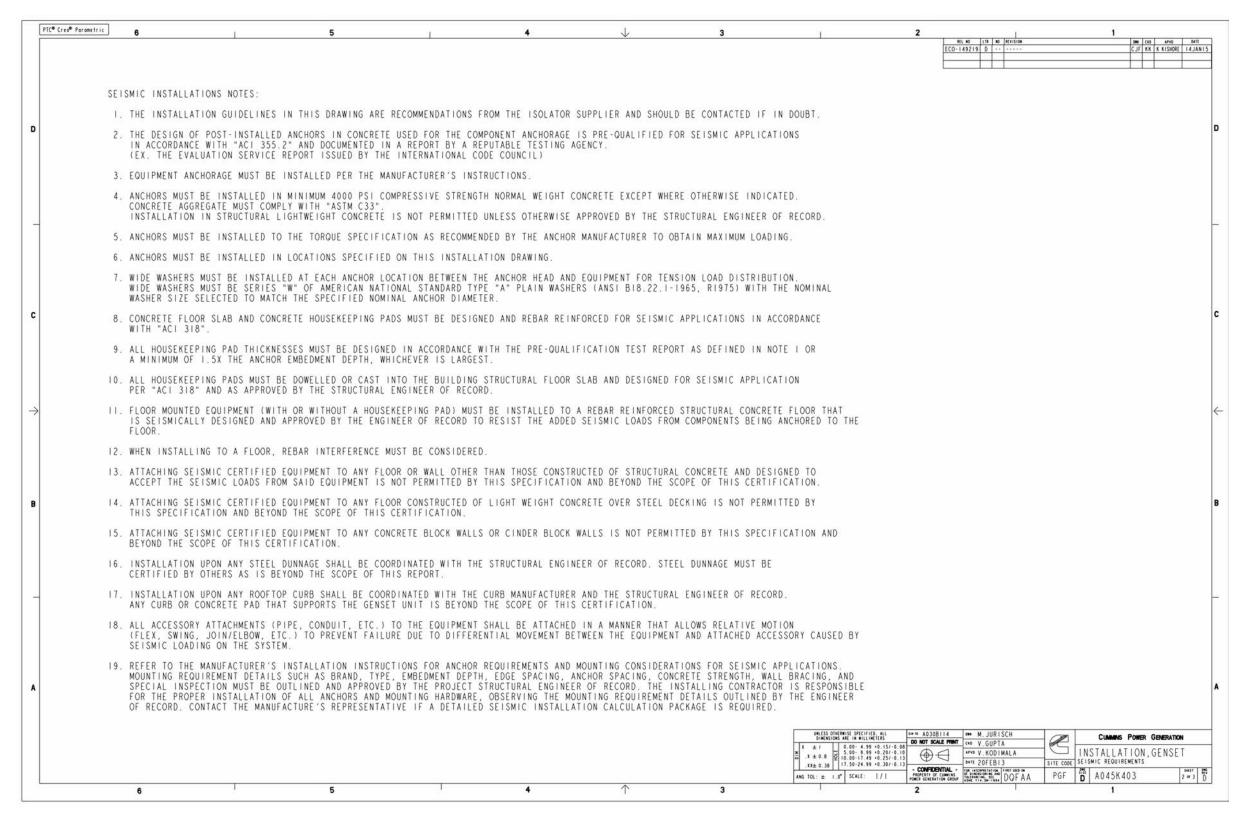


FIGURE 47. SEISMIC INSTALLATION NOTES

2-2016 Appendix C. Seismic Requirements

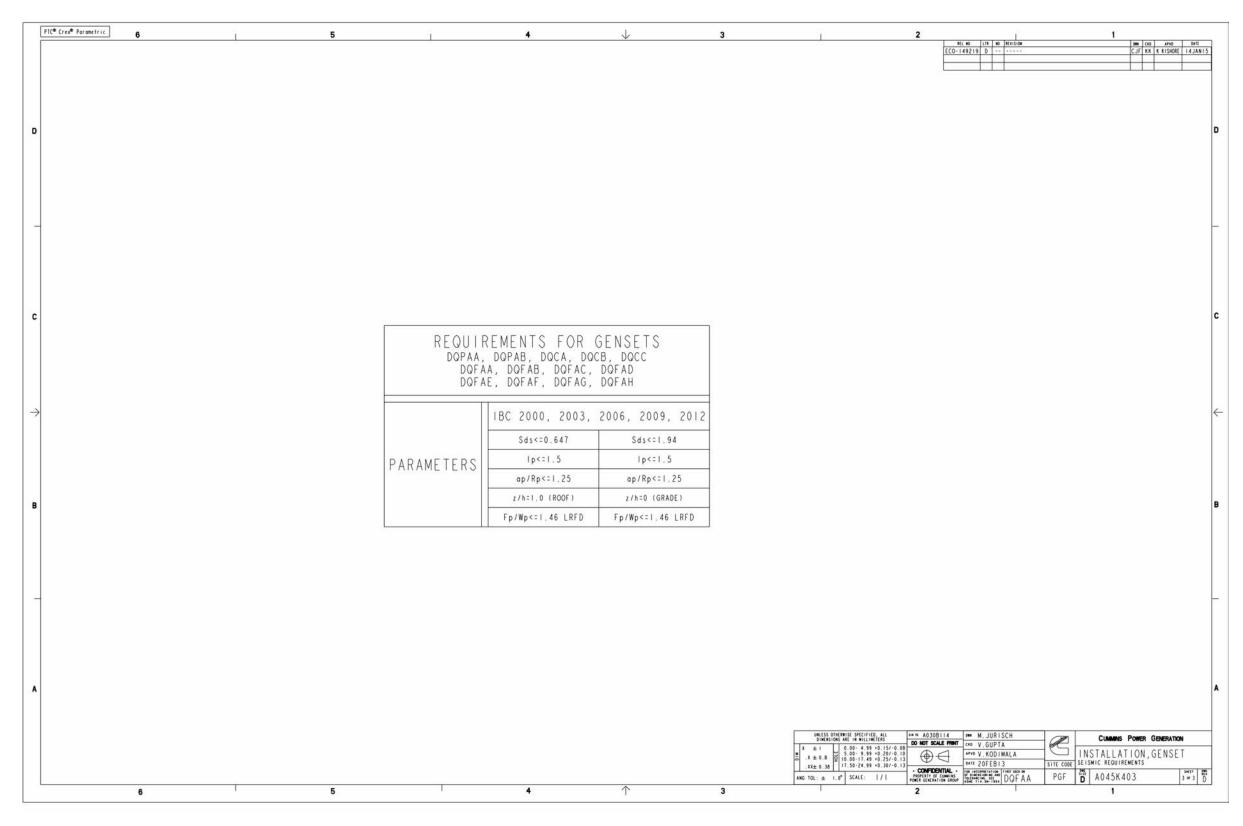


FIGURE 48. SEISMIC INSTALLATION REQUIREMENTS

Appendix C. Seismic Requirements

This page is intentionally blank.

Copyright © 2016 Cummins Inc. All rights reserved.

power.cummins.com

Cummins Power Generation, the "C" logo, and Cummins are trademarks of Cummins Inc.

PowerCommand, AmpSentry, InPower, and "Our energy working for you." are trademarks of Cummins Power Generation Inc.

Other company, product, or service names may be trademarks or service marks of others.

Specifications are subject to change without notice.

