Installation Manual

Generator Set

QSJ8.9G Engine with PowerCommand® 2.3/3.3 Control

C125 N6 (Spec B)
C150 N6 (Spec B)

English
Original Instructions

8-2019

A062T541 (Issue 2)

Table of Contents

1 IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS. This manual contains important instructions that should be followed during installation and maintenance of the generator set and batteries.

Safe and efficient operation can be achieved only if the equipment is properly operated and maintained. Many accidents are caused by failure to follow fundamental rules and precautions.

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 Save These Instructions

This manual contains important instructions for the generator set that should be followed 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 equipment is properly operated and maintained.

The following symbols in this manual alert you to potential hazards to the operator, service person and equipment.

⚠ DANGER

Alerts you to an immediate hazard that will result in severe personal injury or death.

⚠ WARNING

Alerts you to a hazard or unsafe practice that can result in severe personal injury or death.

⚠ CAUTION

Alerts you to a hazard or unsafe practice that can result in personal injury or equipment damage.

1.3 General Information

This manual should form part of the documentation package supplied by Cummins with specific generator sets. If 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.

1.4 General Precautions

- Keep multi-type 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 or the red STOP button on the local display (whichever is applicable) 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 (–) cables 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 and maintenance can result in severe personal injury or death.

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

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

⚠ 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

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.

The unit is to be installed so that the risk of hot surface contact by people is minimized. Wear appropriate PPE when working on hot equipment and avoid contact with hot surfaces.

⚠ 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 store fuel, cleaners, oil, etc., near the generator set. Do not use combustible liquids like ether.

⚠ WARNING

Combustible Gases

Generator sets in operation have combustible gases under pressure, which if ignited can cause eye and ear damage.

Wear appropriate eye and ear protection at all times.

⚠ WARNING

Combustible Gases

Generator sets in operation have combustible gases under pressure, which if ignited can cause severe injury.

Do not operate the generator set with any doors open.

⚠ WARNING

Fire Hazard

Materials drawn into the generator set, as well as 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. Make sure the generator set is mounted in a manner to prevent combustible materials from accumulating under the unit.

⚠ 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).

NOTICE

Keep multi-type ABC fire extinguishers close by. 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 the 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 leaks, coolant leaks, or exhaust leaks. Do not step on the generator set when entering or leaving the generator set room.

1.5 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.

1.6 Fuel and Fumes Are Flammable

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

- DO NOT permit any flame, cigarette, pilot light, spark, arcing equipment, or other ignition source near the generator set or fuel system.
- 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 because copper will become brittle if continuously vibrated or repeatedly bent.
- Be sure all fuel supplies have a positive shutoff valve.
- Be 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 Starting Batteries

⚠ WARNING

Toxic Hazard

The electrolyte in starting batteries is a dilute sulfuric acid that is harmful to the skin and eyes. It is also electrically conductive and corrosive.

Always:

1. ***Wear full eye protection and protective clothing;***
2. ***If the electrolyte contacts the skin, wash it off immediately with water;***
3. ***If the electrolyte contacts the eyes, flush them thoroughly and immediately with water and seek medical attention; and***
4. ***Wash spilled electrolyte down with an acid neutralizing agent. A common practice is to use a solution of one pound (500 grams) bicarbonate of soda (also known as baking soda or sodium bicarbonate) to one gallon (4 liters) of water.***
5. ***Continue to add the bicarbonate of soda solution until the evidence of reaction (that is, foaming) has stopped.***
6. ***Flush the resulting liquid with water and dry the area.***

1.8 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. Do not charge frozen batteries.

⚠ WARNING

Electric Shock Hazard

Batteries present the risk of high short circuit current.

When servicing the generator set:

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

NOTICE

Servicing of batteries must 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.
- Do not charge frozen batteries.
- To prevent arcing when disconnecting the battery:
  1. Press the Off switch from the display and then press the E-Stop button (if equipped).
  2. Disconnect AC power from any battery chargers.
  3. Remove the negative (-) battery cables to prevent starting.
- To prevent arcing when reconnecting the battery:
  1. Reconnect the positive (+) cables.
  2. Reconnect the negative (-) cables.
  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.

1.9 Vented Batteries

⚠ WARNING

Toxic Hazard

The electrolyte in vented batteries is a dilute sulfuric acid that is harmful to the skin and eyes. It is also electrically conductive and corrosive.

Always:

1. ***Wear full eye protection and protective clothing;***
2. ***If the electrolyte contacts the skin, wash it off immediately with water;***
3. ***If the electrolyte contacts the eyes, flush them thoroughly and immediately with water and seek medical attention; and***
4. ***Wash spilled electrolyte down with an acid neutralizing agent. A common practice is to use a solution of one pound (500 grams) bicarbonate of soda (also known as baking soda or sodium bicarbonate) to one gallon (4 liters) of water.***
5. ***Continue to add the bicarbonate of soda solution until the evidence of reaction (that is, foaming) has stopped.***
6. ***Flush the resulting liquid with water and dry the area.***

1.10 Moving Parts Can Cause Severe Personal Injury or Death

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

1.11 Exhaust Gases Are Deadly

- Provide an adequate exhaust system to properly expel discharged gases away from enclosed or sheltered areas, and areas where individuals are likely to congregate. Visually and audibly inspect the exhaust system daily for leaks per the maintenance schedule. Make sure that exhaust manifolds are secured and not warped. Do not use exhaust gases to heat a compartment.
- Make sure the unit is well ventilated.

Exhaust Precautions

⚠ WARNING

Hot Exhaust Gases

Contact with hot exhaust gases can cause severe burns.

Wear personal protective equipment when working on equipment.

⚠ WARNING

Hot Surfaces

Contact with hot surfaces can cause severe burns.

The unit is to be installed so that the risk of hot surface contact by people is minimized. Wear appropriate PPE when working on hot equipment and avoid contact with hot surfaces.

⚠ WARNING

Toxic Gases

Inhalation of exhaust gases can cause asphyxiation and death.

Pipe exhaust gas outside and away from windows, doors, or other inlets to buildings. Do not allow exhaust gas to accumulate in habitable areas.

⚠ WARNING

Fire Hazard

Contaminated insulation is a fire hazard. Fire can cause severe burns or death.

Remove any contaminated insulation and dispose of it in accordance with local regulations.

The exhaust outlet may be sited at the top or bottom of the generator set. Make sure that the exhaust outlet is not obstructed. Personnel using this equipment must be made aware of the exhaust position. Position the exhaust away from flammable materials - in the case of exhaust outlets at the bottom, make sure that vegetation is removed from the vicinity of the exhaust.

The exhaust pipes may have some insulating covers fitted. If these covers become contaminated they must be replaced before the generator set is run.

To minimize the risk of fire, make sure the following steps are observed:

- Make sure that the engine is allowed to cool thoroughly before performing maintenance or operation tasks.
- Clean the exhaust pipe thoroughly.

1.12 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

2.1 About This Manual

⚠ WARNING

Improper installation can result in severe personal injury, death and damage to equipment. The installation must comply with all applicable building codes (including project permits and inspections). The installer should be properly trained and licensed to perform electrical and mechanical equipment installations (including gaseous fuel installation).

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).

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 installations, refer to the *T-030: Liquid-Cooled Generator Set Application* manual available from your Cummins distributor.

NOTICE

The installation must comply with all applicable building codes.

See the generator set's specific operator manual for operation and maintenance and specific service manual for service.

Refer to the Model Specifications section for specific information about the system and its components.

Refer to the Outline and System Drawings appendix and the Wiring Diagrams appendix for specific information about installation and wiring connections.

2.2 Schedule of Abbreviations

This list is not exhaustive. For example, it does not identify units of measure or acronyms that appear only in parameters, event/fault names, or part/accessory names.

Abbr.	Description	Abbr.	Description
AC	Alternating Current	LED	Light-Emitting Diode
AMP	AMP, Inc. (part of Tyco Electronics)	MFM	Multifunction Monitor
ANSI	American National Standards Institute	Mil Std	Military Standard
ASOV	Automatic Shut Off Valve	MPU	Magnetic Pickup
ASTM	American Society for Testing and Materials (ASTM International)	NC	Normally Closed
ATS	Automatic Transfer Switch	NC	Not Connected
AVR	Automatic Voltage Regulator	NFPA	National Fire Protection Agency
AWG	American Wire Gauge	NO	Normally Open
CAN	Controlled Area Network	NWF	Network Failure
CB	Circuit Breaker	OEM	Original Equipment Manufacturer
CE	Conformité Européenne	OOR	Out Of Range
CCA	Cold Cranking Ampere	OORH/ ORH	Out Of Range High
CFM	Cubic Feet per Minute	OORL/ORL	Out Of Range Low
CGT	Cummins Generator Technologies	PB	Push Button
CMM	Cubic Meters per Minute	PCC	PowerCommand® Control
CT	Current Transformer	PGI	Power Generation Interface
DC	Direct Current	PGN	Parameter Group Number
DEF	Diesel Exhaust Fluid	PI	Proportional/Integral
DPF	Diesel Particulate Filter	PID	Proportional/Integral/ Derivative
EBS	Excitation Boost System	PLC	Programmable Logic Controller
ECM	Engine Control Module	PMG	Permanent Magnet Generator

Abbr.	Description	Abbr.	Description
ECS	Engine Control System	PPE	Personal Protective Equipment
EMI	Electromagnetic Interference	PT	Potential Transformer
EN	European Standard	PTC	Power Transfer Control
EPS	Engine Protection System	PWM	Pulse-Width Modulation
E-Stop	Emergency Stop	RFI	Radio Frequency Interference
FAE	Full Authority Electronic	RH	Relative Humidity
FMI	Failure Mode Identifier	RMS	Remote Monitoring System
FSO	Fuel Shutoff	RMS	Root Mean Square
Genset	Generator Set	RTU	Remote Terminal Unit
GCP	Generator Control Panel	SAE	Society of Automotive Engineers
GND	Ground	scfh	Standard Cubic Feet of gas per Hour
HMI	Human-Machine Interface	SCR	Selective Catalytic Reduction
IC	Integrated Circuit	SPN	Suspect Parameter Number
ISO	International Organization for Standardization	SW_B+	Switched B+
LBNG	Lean-Burn Natural Gas	UL	Underwriters Laboratories
LCD	Liquid Crystal Display	UPS	Uninterruptible Power Supply
LCT	Low Coolant Temperature		

2.3 Related Literature

Before any attempt is made to operate the generator set, the operator should take time to read all of the manuals supplied with the generator set and familiarize themselves with the warnings and operating procedures.

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 the Operator manual for the safe operation of the generator set.

The following documents are shipped with the generator set:

- Installation Manual for QSJ8.9G Engine with PowerCommand 2.3/3.3 Control (A062T541)
- Operator Manual for QSJ8.9G Engine with PowerCommand 2.3 Control (A062T543)

  or

  Operator Manual for QSJ8.9G Engine with PowerCommand 3.3 Control (A062T544)
- Health and Safety Manual (0908-0110-00)
- Global Commercial Warranty Statement (A040H442)
- Emission Warranty Statement (Federal Emissions EPA Title 40 CFR Part 1048 Component Warranty) (A028X279)

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

- Generator Set Service Manual for QSJ8.9G Engine with PowerCommand 2.3 Control (A062T546)

  or

  Generator Set Service Manual for QSJ8.9G Engine with PowerCommand 3.3 Control (A062T547)
- Controller Service Manual for PowerCommand 2.3 Controller (0900-0666)

  or

  Controller Service Manual for PowerCommand 3.3 Controller (0900-0670)
- Recommended Spares List (RSL) for each model:
  - C125 N6 (A057P648)
  - C150 N6 (A057P650)
- Parts Manual for QSJ8.9G Engine with PowerCommand 2.3 and 3.3 Control (A056K402)
- Universal Annunciator Owner Manual (0900-0301)
- Standard Repair Times - IB Family (A057P652)
- Service Tool Manual (A043D529)
- Failure Code Manual (F1115C)
- Engineering Application Manual T-030: Liquid Cooled Generator Sets (A040S369)

2.4 Model Specifications

NOTICE
Damage caused by failure to follow the manufacturer's recommendation will not be covered by the warranty. Please contact your authorized distributor.

TABLE 1. 8.9L MODEL VARIATIONS

Models	Description
C125 N6, C150 N6	60 Hz, 1800 RPM

TABLE 2. COLD WEATHER SPECIFICATIONS (ALL MODELS)

Temperature	Description of Components	Battery Quantity	Group
Above 4 °C (40 °F)	Battery charger, oil heater	1	34
–17 - 4 °C (0 to 40 °F)	Battery charger, coolant heater (1500 W), CCV heater*, oil heater	1	34
Below –17 °C (0 °F)	Battery charger, coolant heater (2000 W), battery heater, CCV heater*, oil heater	2	34
*CCV heaters are provided as part of the cold and extreme cold coolant heater packages.			

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

TABLE 3. FUEL SPECIFICATIONS 60 HZ, 1800 RPM

Type	Unit	C125 N6	C150 N6
Natural Gas Full Load	scfh	1665.6	1915.3
	BTU/hr	1,590,182	1,828,620
Liquid Propane Full Load	scfh	674.1	783.0
	BTU/hr	1,598,738	1,857,009
Fuel Pressure	1.5 - 3.2 kPa (6 to 13 inches of water column) under any condition		

TABLE 4. ENGINE SPECIFICATIONS (ALL MODELS)

Type	Specification
Engine	6 cylinder in-line, single-cam, liquid-cooled, 4-stroke, spark ignited
Bore	114 mm (4.49 in)
Stroke	145 mm (5.69 in)
Displacement	8.9 L (543.1 in^3)
Compression Ratio	8.5:1
Firing Order	1-5-3-6-2-4
Spark Plug Gap	0.40 mm (.016 in)
Spark Plug Torque	38 Nm (28 ft-lb)
Crankshaft Rotation (Viewed from the Front of the Engine)	Clockwise
Engine Weight (Dry, Long Block Only)	693 kg (1527.8 lb)
Valve Clearance (Intake)	0.355 mm (0.014 in)
Valve Clearance (Exhaust)	0.6604 mm (0.026 in)
Coolant	• 50/50 coolant solution (50% pure water and 50% anti-freeze) • 11 L (2.9 gal) capacity
Oil Capacity	22 L (5.81 gal)
Oil Standards	• Must adhere to Cummins® Engineering Standard (CES) 20074 • Use of improper oils can result in engine damage. Use only the required oils: ◦ 5W-40 (all ambient temperatures) ◦ 15W-40 (***above*** 4 °C [40 °F] ambient temperature) (use of GEO 15W-40 oil in ambient temperatures ***below*** 4 °C (40 °F] could result in engine turbocharger damage) • A sulfated ash limit of 0.6% mass has been placed on all engine lubricating oils recommended for use in Cummins® B, natural gas engines. Higher ash oils can cause valve and/or piston damage, cause spark plug fouling, and lead to excessive oil consumption and degradation of the catalyst.

TABLE 5. LUBRICATING OIL SYSTEM SPECIFICATIONS

Type	Specification
Lubricating Oil Pressure at Idle (Minimum)	69 kPa (10 psi)
Lubricating Oil Pressure at Rated Speed (Minimum)	138 kPa (20 psi)
Filter Bypass Valve-Opening Pressure	345 kPa (50 psi)
Pressure Regulator Valve-Opening Pressure	417 kPa (60 psi)
Lubricating Oil Capacity (Standard Sump):	
--High	19 L (20 qt)
--Low	15 L (16 qt)
--Total System	20.8 L (22 qt)

TABLE 6. GENERATOR SET SIZE SPECIFICATIONS

Enclosure Type	Size (L x W x H)
Open/Weather	2867 x 1016 x 1666 mm (113 x 40 x 65.6 in); does not include exhaust discharge elbow
Sound Level 1	3621 x 1016 x 1666 mm (143 x 40 x 65.6 in)
Sound Level 2	4061 x 1016 x 1666 mm (160 x 40 x 65.6 in)

TABLE 7. GENERATOR SET WET WEIGHT (ALL MODELS) (60 HZ, 1800 RPM)

Configuration	lbs	kg
Open	3475	1576
Weather	3801	1724
Sound Level 1	3907	1772
Sound Level 2	3940	1787

NOTICE
Weights are approximate and can be affected by selected options. Refer to outline drawings for specific weight information.

TABLE 8. ALTERNATOR SPECIFICATIONS 60 HZ, 1800 RPM

Type	C125 N6	C150 N6
Generator	Brushless, 4-pole rotating field, single bearing	
Power (kVA) 1 Phase	125	150
Power (kVA) 3 Phase	156.25	187.5
Rated Voltages (V)	120/240, 1 Ph (Reconnectable)	
	227/480, 3 Ph WYE	
	347/600, 3 Ph WYE	
	120/240, 3 Ph DELTA	
	120/208, 3 Ph WYE	
	127/220, 3 Ph WYE	

NOTICE
Maximum I_2 = 8%. Generator set load unbalance must not exceed 25% between any phases.

TABLE 9. GENERATOR SET DERATING GUIDELINES

Model	Phase	Engine Power Available Up To...		Derate At...	
		Elevation	Ambient Temperature	Elevation	Temperature
C125 N6	1 & 3	1800 m (5900 ft)	40 °C (104 °F)	4.25% per 300 m (985 ft)	2% per 10 °C (18 °F)
C150 N6	1 & 3	775 m (2540 ft)			

TABLE 10. CONTROL SPECIFICATIONS (ALL MODELS)

Control	Purpose
PowerCommand 2.3	Generator Set
PowerCommand 3.3	Generator Set
Enovation 4G LDI	Engine (125, 150 kW Generator Sets)

TABLE 11. DC SYSTEM SPECIFICATIONS (ALL MODELS)

Type	Specification
Nominal Battery Voltage	12 VDC
Battery Group	34 (1 standard; 2 optional)
Battery Type	Lead acid, maintenance-free
Minimum Cold Crank Amps	850 standard, 1080 high capacity

TABLE 12. FUSE SPECIFICATIONS

Fuse	Amps	Volts	Comment
F1	20	32	¼" x 1¼" cylindrical glass cartridge, fast acting
F2	10		
F3	20		
F4	5		
F5	20		
F6	10		
F7	10	600	Class G size-rejecting, current limiting
F8	10		

2.5 Before Installation

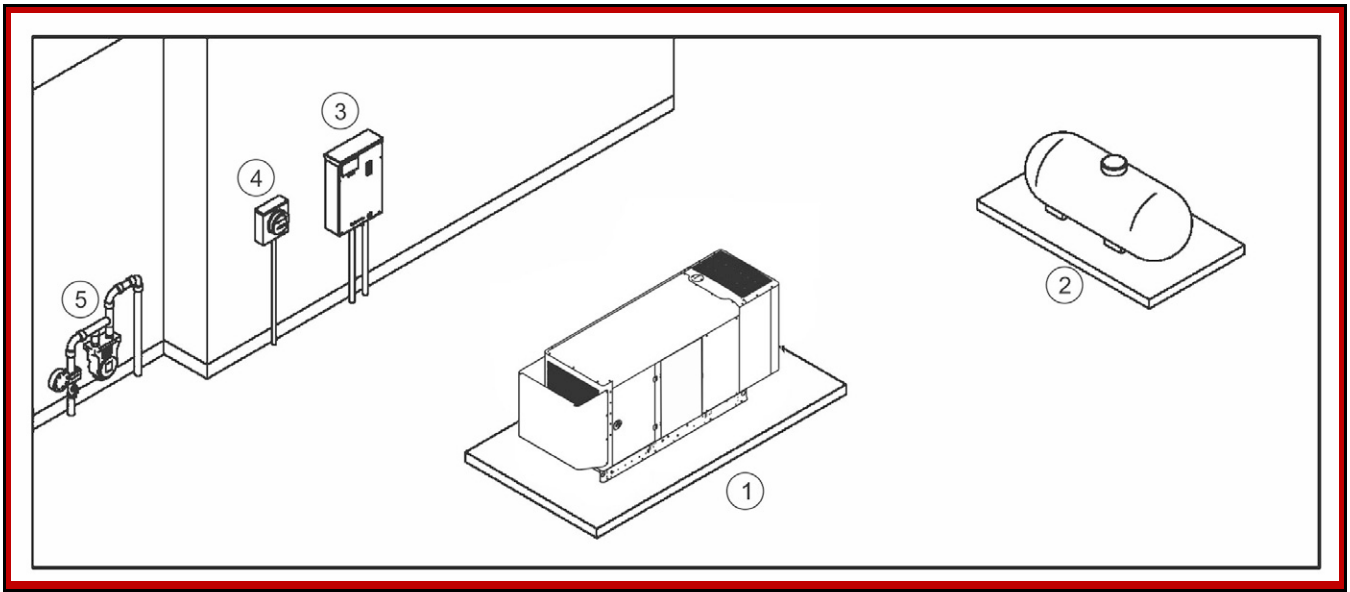
Before beginning the installation of the generator set, verify that the unit was correctly selected. Check the following features:

- 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.

This page is intentionally blank.

3 Pre-Installation Considerations

Areas of consideration:



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

FIGURE 1. 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 13. INSTALLATION CODES AND STANDARDS FOR SAFETY RECOMMENDATIONS

Type	Code or Standard	Title	Organization
US	Code	NFPA 70 - National Electrical Code	National Fire Protection Association 470 Atlantic Avenue Boston, MA 02210
	Code	NFPA 37 - Installation and Use of Stationary Combustion Engines and Gas Turbines	
	Code	NFPA 54 - National Fuel Gas Code	
	Code	NFPA 58 - Storage and Handling of Liquefied Petroleum Gases	
	Code	NFPA 110 - Standard for Emergency and Standby Power Systems	
Canada	Code	CSA Electrical Bulletin	Canadian Standards Association Housing and Construction Materials Section 178 Rexdale Blvd. Rexdale, Ontario, Canada M9Q 1R3
	Code	CSA 22.1 Canadian Electrical Code	
	Code	CSA B149 Installation Code for Gas Burning Appliances and Equipment	
	Standard	CSA C22.2 No. 100 Motors and Generators	
	Standard	CSA C22.2 No. 14 Industrial Control Equipment	
	Code	CSA C282 Emergency Electrical Power Supply for Buildings	
	Code	CSA Z32 Electrical Safety in Health Care Facilities	
California	Code	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 (194 °F) wire must be used with the wire size determined by the 75 °C (167 °F) ampacity tables. Aluminum wire is not allowed with 100% rated breakers.

NOTICE
If required, 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.

- Use code compliant AC wiring for phase, neutral, and ground connections.
- Wire sizes (DC control and power and AC sense only):
  - Control wires under 305 m (1000 feet) circuit length => 18-14 AWG of the insulation type below
  - Control wires 305 - 610 m (1000 - 2000 feet) circuit length => 16-14 AWG of the insulation type below
- All control wires and cables must be rated 75 °C (167 °F) minimum, stranded copper, and rated for wet locations.
  - For wire sizes 14 AWG and larger, use insulation types: 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: FFH-2, KFF-2, PAFF, PFF, PGFF, PTFF, RFH-2, RFHH-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)

NOTICE
The optional high wattage coolant heater operates at 240 VAC.

- Code-compliant conduit for all wires
- Circuit breaker wire binding screws: 3/16”, 5/16”, ½”, 6 mm, 8 mm hex bit
- Customer connections to auxiliary I/O boards and relays
- Pozidriv screwdriver #2 and #3

NOTICE
Seismic zone installations require compliance to specific mounting configurations.

Fuel Materials:

- Flexible fuel line
- UL listed pipe thread sealant
- Fuel line at generator set (natural gas and propane fuel pressure: 1.5–3.2 kPa (6–13 inches water column))
- Fuel pressure regulator (as required)
- Manual fuel shut-off at generator set ahead of automatic valves on generator set fuel system

Tools Required

Use appropriate lifting techniques to position the generator set in place.

Loose Parts Shipped with the Generator Set

The following loose parts are shipped with the generator set:

- One enclosure key (where applicable)
- Battery tie-down
- Sound level 2 baffle (where applicable)
- Weather enclosure exhaust elbow (where applicable)
- Literature (operator manual, installation manual, health and safety manual, and warranty statements)

This page is intentionally blank.

4 Installation

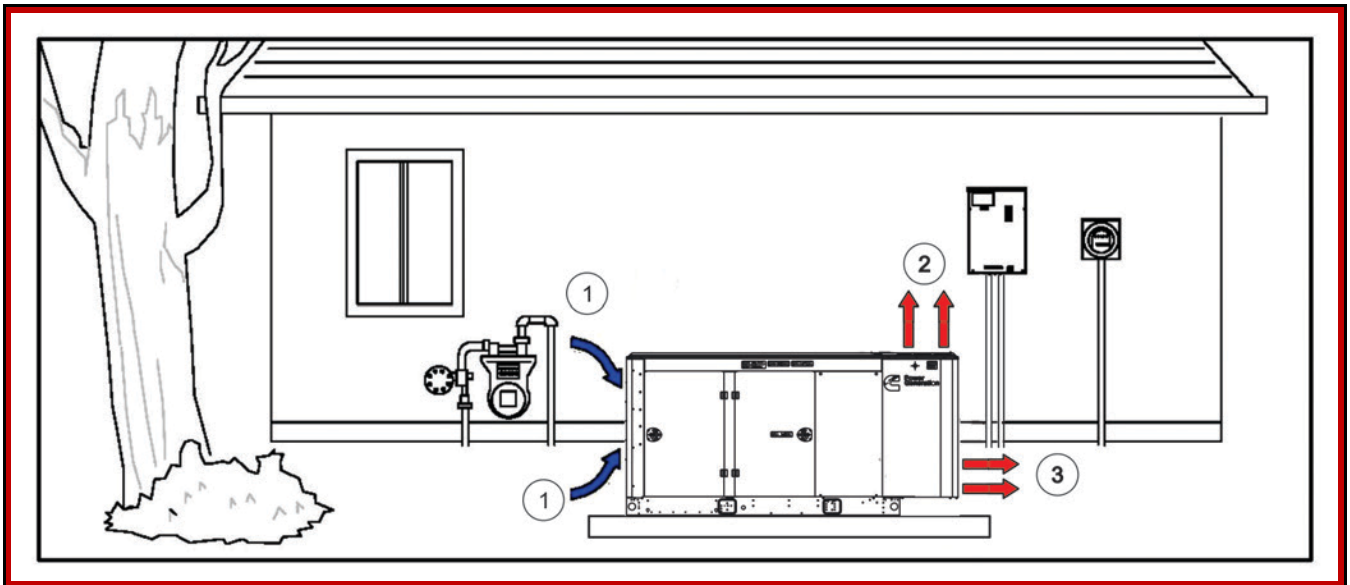
4.1 Site Assessment and Preparation

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
- 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.



No.	Description	No.	Description
1	Cool Air In	3	Hot Air Out (Weather Enclosure)
2	Hot Air Out (Sound Level Enclosure)		

FIGURE 2. GENERATOR SET LOCATION

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

- Must comply with applicable codes (NFPA, NEC, IBC, etc.).
- This manual only covers outdoor installations with Cummins factory installed enclosures. For other installation types, 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 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.

Follow the clearance guidelines below:

- 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.
- 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.

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.
3. Prepare the concrete pad.
    - The pad should be constructed of reinforced concrete with a 28-day compressive strength of at least 17,237 kPa (2500 psi).
    - The pad should be at least 127 mm (5 in) deep and extend at least 150 mm (6 in) beyond the skid on all sides.

NOTICE
Refer to the foundation drawing for stub-up dimensions.

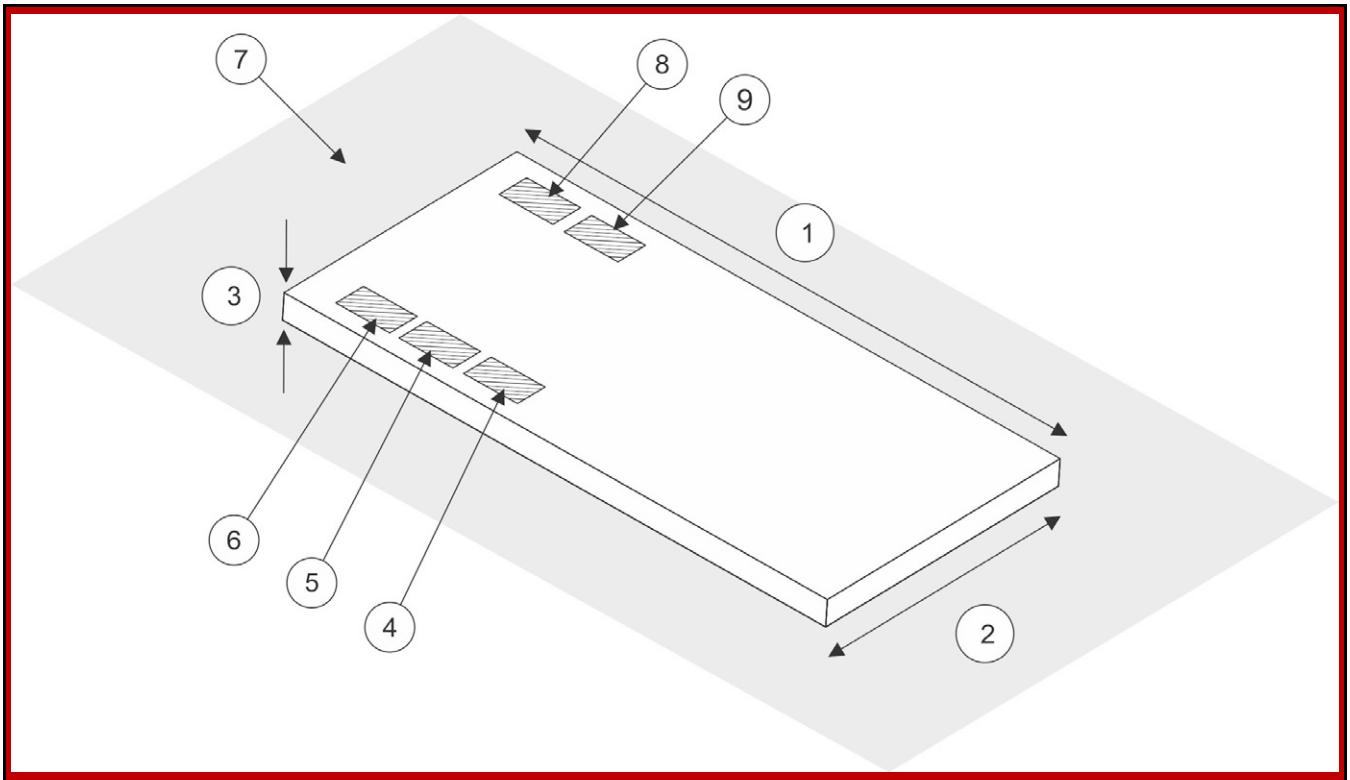
NOTICE

Seismic installation may require a different pad and securing devices.

NOTICE

Local codes and standards may have different requirements.

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



No.	Description	No.	Description
1	Pad Length (Must Extend Minimum 152 mm/6 in Beyond Skid)	6	Circuit Breaker 3 Stub-Up (Optional)
2	Pad Width (Must Extend Minimum 152 mm/6 in Beyond Skid)	7	1.5 m/5 ft Clearance (Shaded Area)
3	Pad Thickness (Minimum 127 mm/5 in)	8	Accessory 120 VAC, 20A Max Wire Stub-Up (240 VAC, 15A for High Wattage Coolant Heater)
4	Circuit Breaker 1 Stub-Up	9	Generator Set Control Wire Stub-Up (DC)
5	Circuit Breaker 2 Stub-Up (Optional)		

FIGURE 3. CONCRETE PAD PREPARATION

Lifting and Moving the Generator Set

⚠ WARNING

Heavy Load

The generator set is heavy. Handle with care.

Dropping the generator set can cause severe personal injury or death. Use appropriate lifting techniques to move the generator set. Keep feet and hands clear when lifting the generator set.

⚠ CAUTION

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

Mounting the Generator Set

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 by length, by width, 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, refer to the Service Manual.

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.

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 the seismic label. 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, refer to the Fuel Line Selection section.

Natural Gas Fuel System

Requirements for a natural gas generator set are as follows:

- Adequate fuel supply to operate correctly and run at full load
- Pipeline quality gas
- 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 **Fuel Line Selection** charts)

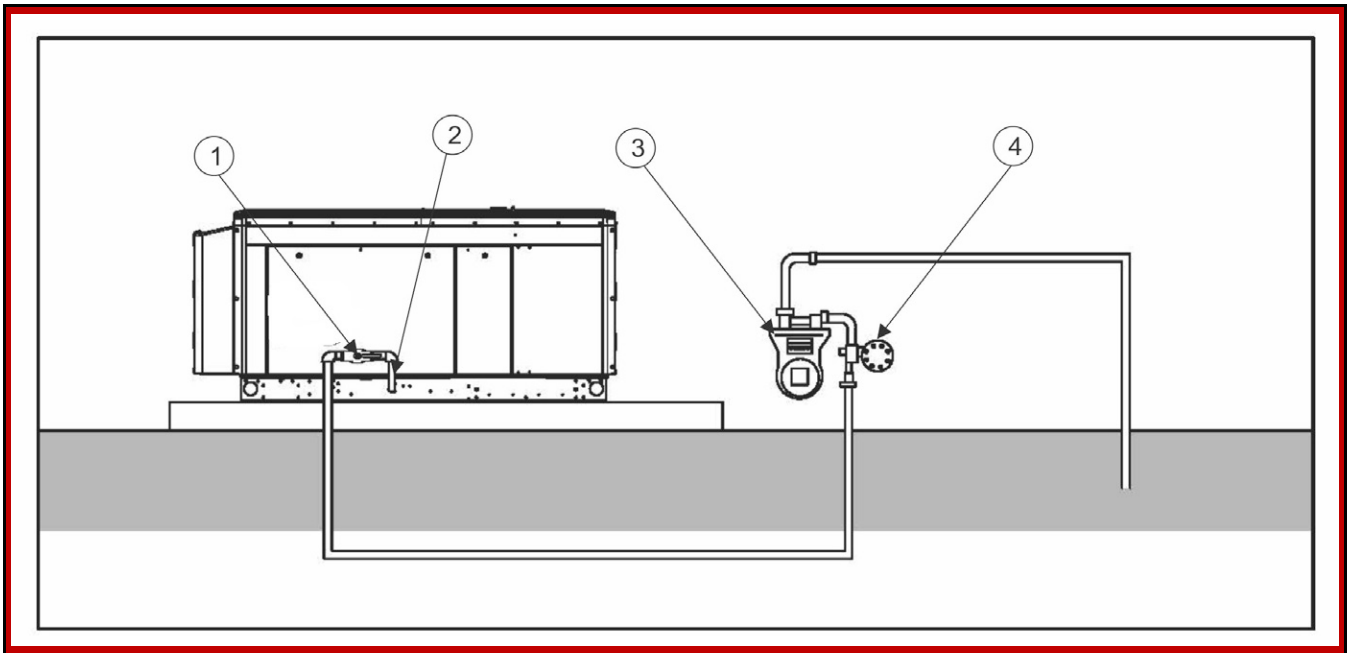
NOTICE

Iron pipe must be a minimum of schedule 40 subject to the authority having jurisdiction.

- Flexible fuel line to protect the fuel system from vibration, expansion, and contraction
- Manual shutoff valve

⚠ 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.



No.	Description	No.	Description
1	Shutoff Valve	3	Meter
2	Flexible Fuel Line	4	Service Regulator

FIGURE 4. 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.

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 Fuel Line Selection 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 matches the requirements in 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

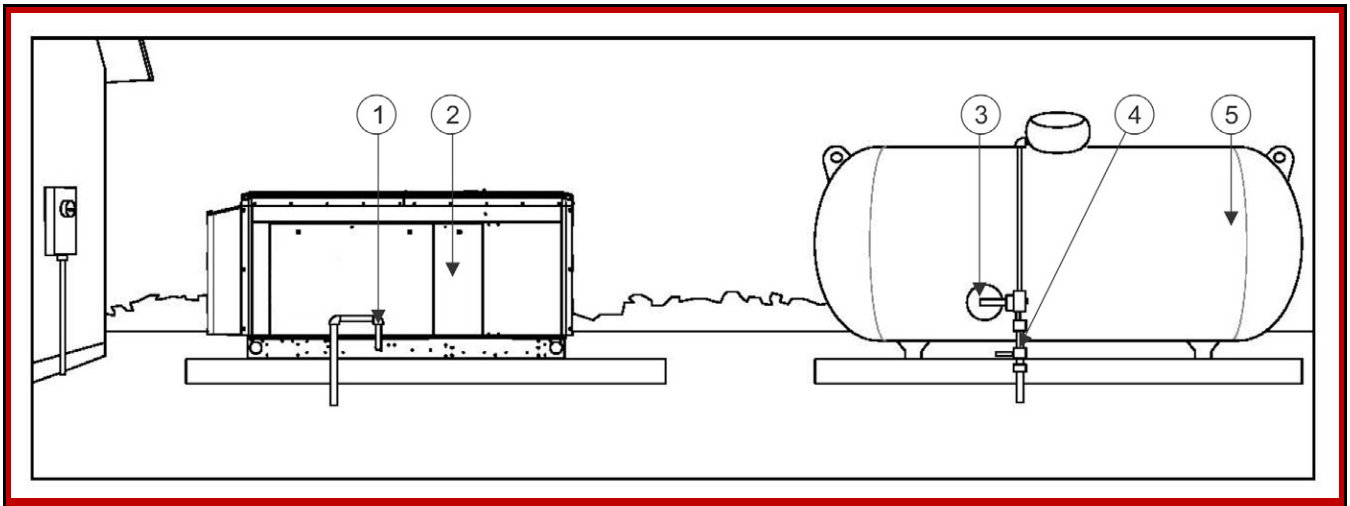
Fuel leaks can lead to explosive accumulations of gas. Propane sinks in air and can accumulate inside housings, basements, and other below-grade spaces. Prevent gas leaks and the accumulation of gaseous fuel in the event of a leak.

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.
Secondary Regulator	Located near the generator set, the secondary regulator reduces the higher line pressure to a working pressure of 6-13 inches of water column (1.5 - 3.2 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.
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 5. TYPICAL PROPANE INSTALLATION

Propane Fuel Requirements

⚠ 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 L) tank results in 400-gallon (1514 L) 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 L) tank results in 240-gallon (908 L) 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.
3. Determine equivalent length of fuel line fittings required. See the NFPA Pipe Fittings table in the Fuel Line Selection 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 Fuel Line Selection 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 fuel line
- 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-type ABC fire extinguishers close by.

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

Perform the following fuel piping system leak check:

1. After assembly and before initial operation of generator set, test all fuel system components as required per the National Fuel Gas Code (NFPA 54).

2. The National Fuel Gas Code requires that the generator set be isolated from the *piping* system by disconnecting it and capping the outlet prior to test. The test pressure required is the greater of 1.5 times the supply pressure or 3 psi (20.7 kPa) minimum.
3. After successfully completing the previous step, connect the generator set to the fuel piping system.
4. To verify that all connections from the fuel piping system to the generator set are free of leaks, conduct a bubble test using an approved leak detection solution (or equivalent method) with the system pressure of 0.8 to 1.0 psi (5.5 to 7.0 kPa).
5. Spray the bubble solution on all of the joints.
6. Inspect all of the joints and monitor the line pressure. If bubbles appear, there is a leak.
7. If any leaks are found, repair the joint or replace components as needed.
8. Verify the leak has been fixed.

NOTICE
The leak detection solution (that is, bubble solution) must be non-corrosive and be free of ammonia and chlorine.

4.3 Engine Exhaust

If the exhaust system for this generator set ships with a silencer, no further installation is needed. Do not modify any factory connections.

If the generator set is shipped with an NPT exhaust connection, the installer must add a silencer. Exhaust pressures must be verified for proper generator set operation.

⚠ **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.

Electrical Preparations

Connect the conduits to the generator set. Refer to the specific outline drawing in the Outline and System Drawings appendix.

NOTICE

Be sure to account for any needed accessories, such as a remote display, etc.

AC Connections

⚠ 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 (–) cable first.

NOTICE

If a 100% rated breaker is used, 90 °C (194 °F) wire must be used with the wire size determined by the 75 °C (167 °F) 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.

1. Make sure the generator set is shut down and disabled:
   a. Press the Off switch from the display and then press the E-Stop button to stop the generator set. Allow the generator set to thoroughly cool to the touch.
   b. Turn off and disconnect the battery charger from the AC source before disconnecting the battery cables.
   c. Disconnect the negative (–) cable from the battery and secure it from contacting the battery terminals to prevent accidental starting.
2. Open the enclosure side panel to access the main circuit breaker box.
3. Place the circuit breaker handle in the OFF position.
4. Remove the bolts holding the circuit breaker cover.
5. Connect the conductors to the circuit breaker load-side terminals, neutral lug, and equipment grounding lug. For grounding and neutral connections, look for the symbols on the generator set circuit breaker box (shown below, and in the next image at the bottom).

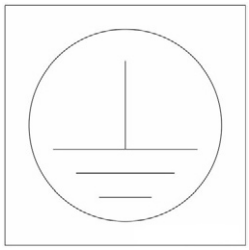
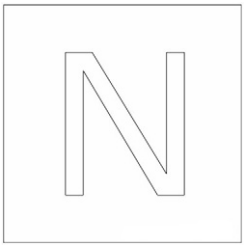
Equipment Grounding Conductor Symbol	Equipment Neutral Connection Symbol
	

FIGURE 6. SYMBOLS ON CIRCUIT BREAKER BOX

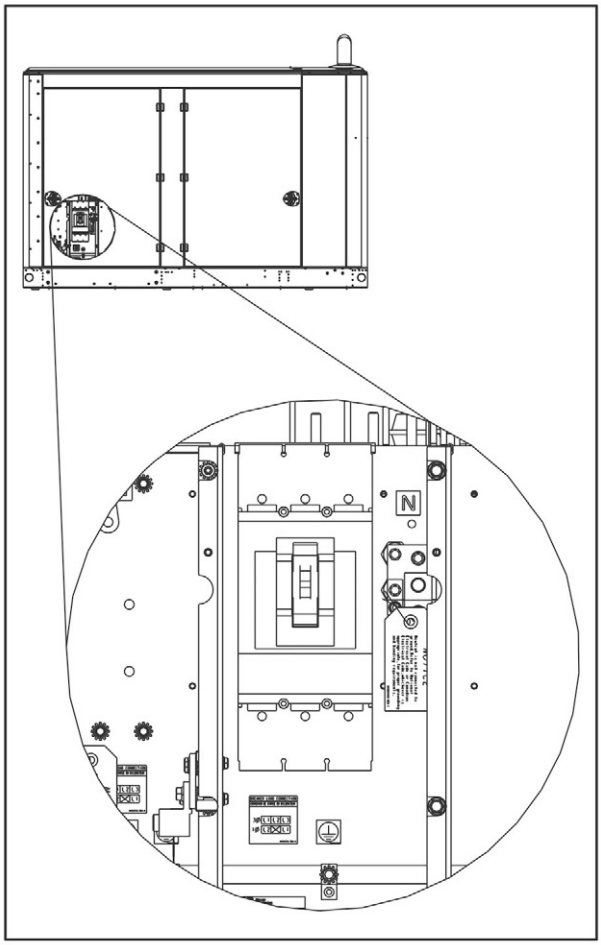


FIGURE 7. CIRCUIT BREAKER AC LOAD CONNECTIONS LOCATION (SYMBOLS SHOWN AT BOTTOM)

6. Torque the circuit breaker terminals per specifications on the circuit breaker label.
7. Torque the neutral lug per the table below:

TABLE 14. TORQUE VALUES

Wire Size	in-lb	Nm
#14 - #10	50	6
#8 - 3/0	120	14
4/0 - 350	225	26
500-600	442	50

8. Torque the equipment grounding lug per Table 14.
9. Fill in the stub-up openings with an approved duct seal or mastic tape to keep out insects and rodents.
10. Install the circuit breaker cover.

Factory Option and Accessory Connections

NOTICE
Use copper conductors only.

Here are the AC powered options or accessories available:

- Alternator heater
- Battery charger
- Battery warmer
- CCV heater
- Engine coolant heater
- Oil heater

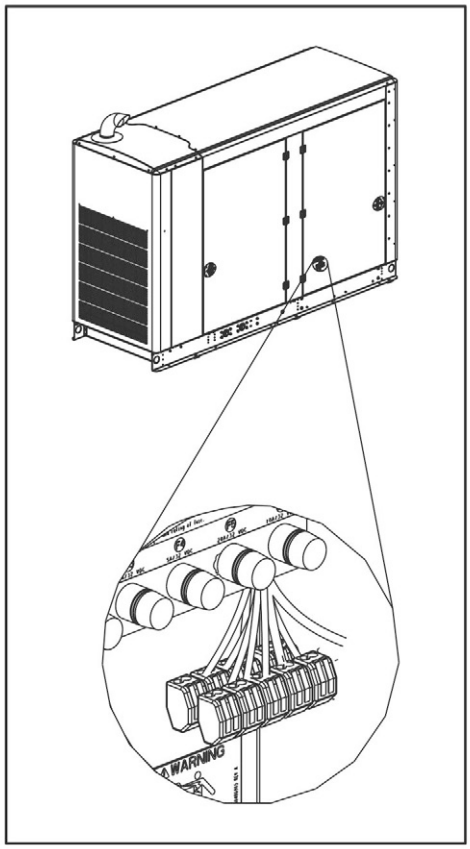


FIGURE 8. AC ACCESSORY CONNECTIONS

The alternator heater, battery charger, battery warmer, CCV heater, engine coolant heater, and oil heater require power from a 120 VAC, 20 Amp protected circuit from the main distribution panel. The high wattage coolant heater operates at 240 VAC, 15 Amp circuit. Use 12 AWG 75 °C (167 °F) conductors to make connection to the generator set AC distribution connector.

DC Connections

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

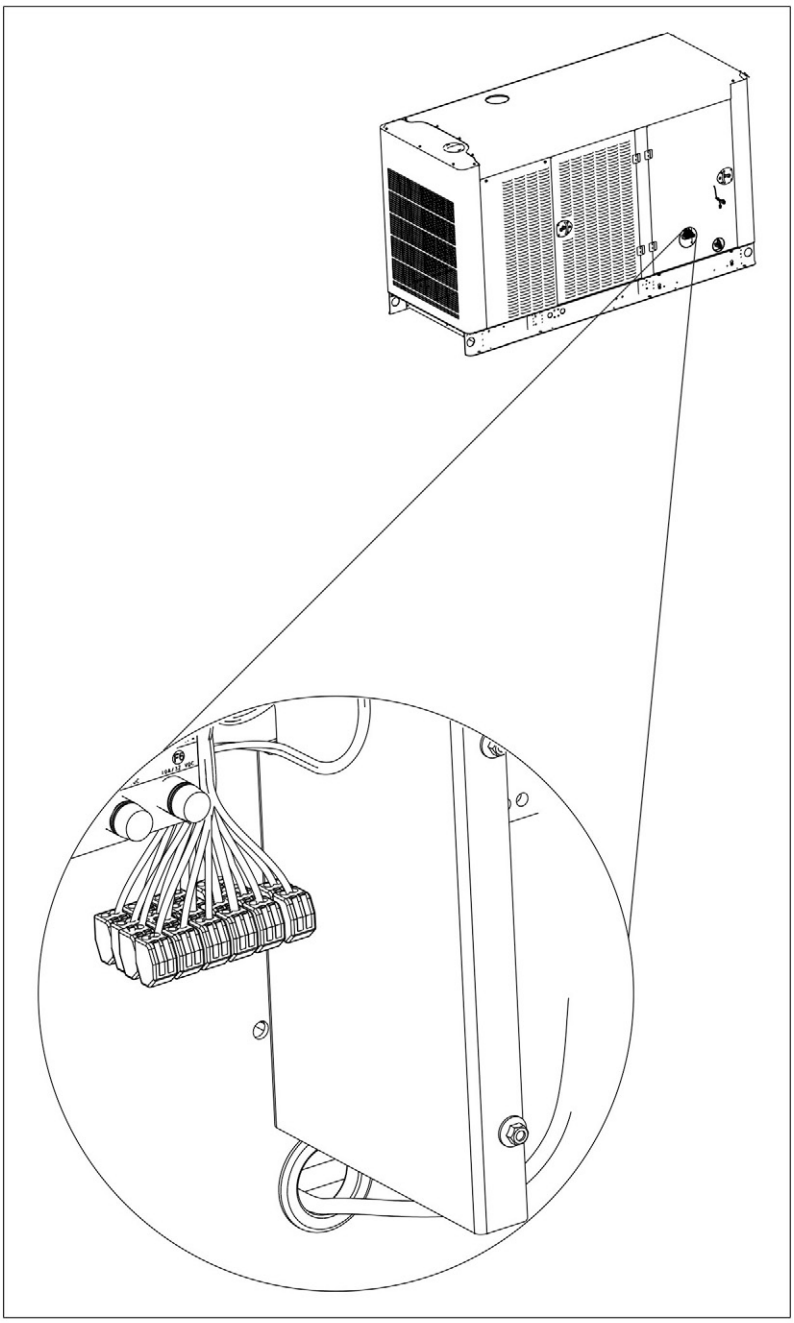


FIGURE 9. DC CUSTOMER CONNECTIONS

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.

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

⚠ CAUTION
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. Keep unauthorized personnel away from batteries.

To connect the battery:

1. Connect the positive battery terminal.
2. Connect the negative battery terminal.
3. Make sure that the battery is secured to the battery tray with the strap provided.
4. Make sure that the black and red battery cable boots are in place.

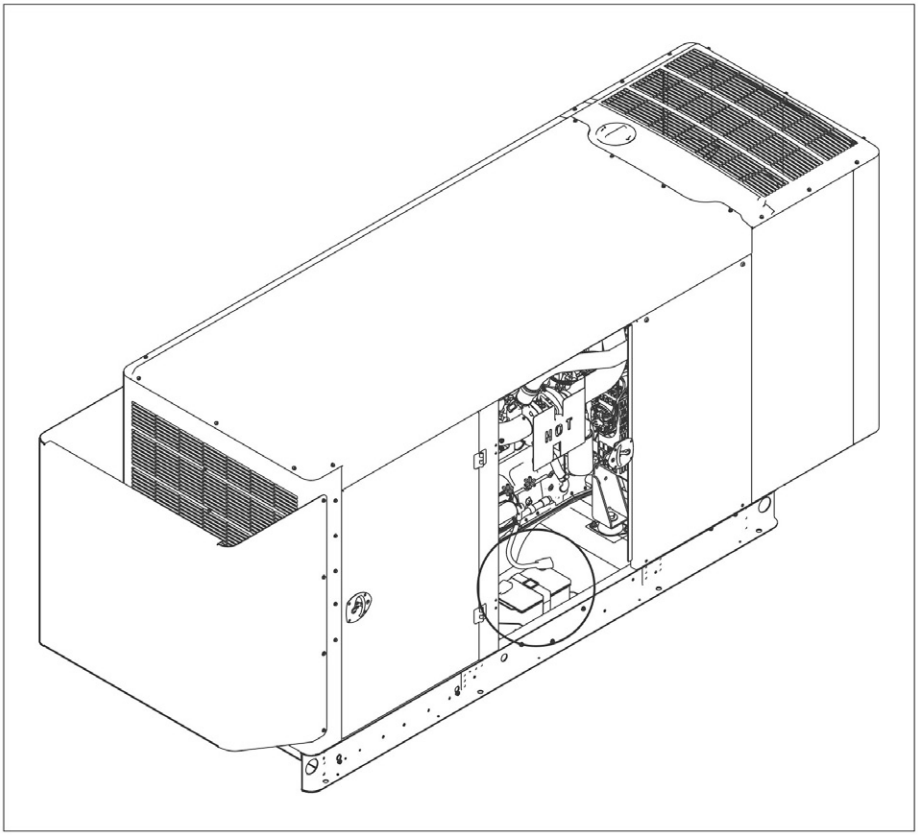


FIGURE 10. BATTERY LOCATION

Refer to the Model Specifications section for battery specifications.

An optional thermostatically controlled battery heater is available for more reliable starting in ambient temperatures below –18 °C (0 °F).

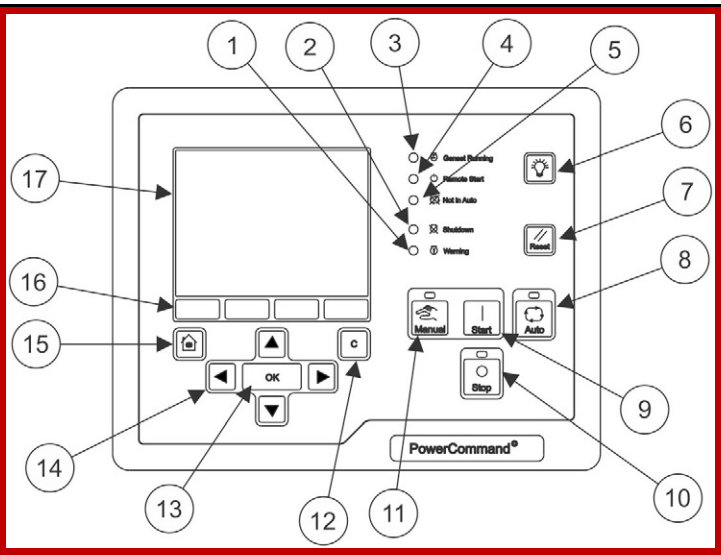
To prevent injury due to accidental startup, do not connect the battery cables to the battery until the installation has been completed; tools, rags, and body parts are away from any rotating parts or electrically live parts; and it is time to start the set.

This page is intentionally blank.

5 Startup and Configuration PCC 2.3

5.1 Operator Panel

The figure below shows the features of the front panel. It includes five lamp indicators; the graphical display with four menu select and seven menu navigation buttons; and six control mode buttons. This display panel enables the operator to look at the status, adjust the settings, and start and stop the generator set.



No.	Description	No.	Description
1	Indicator Lamp – Warning	10	Stop Button
2	Indicator Lamp – Shutdown	11	Manual Button
3	Indicator Lamp – Genset Running	12	Previous Menu Button (or Clear)
4	Indicator Lamp – Remote Start	13	Item Select Button (OK)
5	Indicator Lamp – Not in Auto	14	Menu Navigation Buttons (Up, Down, Left, Right)
6	Lamp Test Button/Panel Lamp On-Off	15	Home Button
7	Reset Button	16	Menu Select Buttons (for use with Item 17)
8	Auto Mode Button	17	Graphical Display
9	Start Button		

FIGURE 11. OPERATOR PANEL

Operator Panel - Initial Operator Menu

Figure 12 on page 49 shows the initial menu which is displayed over two pages. Use the soft-key buttons below the up and down arrows (▲ and ▼) to toggle between the two pages.

Use the soft-key buttons below Genset, Alternator, or Engine to short-cut to those menus.

Pressing the **Home** button  from any screen will return the display to the main menu screens.

Initial Menu Data

This menu displays the information available through the menus.

TABLE 15. INITIAL DATA MENU

Name	Description	
History/About	Use this screen to view historical information about your generator set.	
Faults:	If there are no active Faults, these screens will not be available.	
	Active Shutdowns	Use this screen to view active Shutdown faults.
	Active Warning	Use this screen to view active Warning faults.
	History	Use this screen to view faults that have been cleared.
Genset Data	Use this screen to view the status of the generator set.	
Alternator Data	Use this screen to view the status of the alternator.	
Engine Data	Use this screen to view the status of the engine.	
Advanced Status:	---	
	Genset	Use this screen to view power, energy, phase difference, and other detailed generator set information.
	Controller	Use this screen to view sequences of operation, configurable inputs and outputs, and other detailed controller information.
	Engine	Use this screen to view pressures, voltages, temperatures, and other detailed engine information.
Help	Use this screen to obtain more information regarding the operator panel.	

Name	Description
Adjust	The use of these screens is restricted to authorized personnel only.
Genset Setup	
Paralleling Basic Setup	
OEM Setup	
PCCnet Setup	
Modbus Setup	
Display Options	
Clock Setup	
Configurable IO	
Calibration	
Save/Reserve	

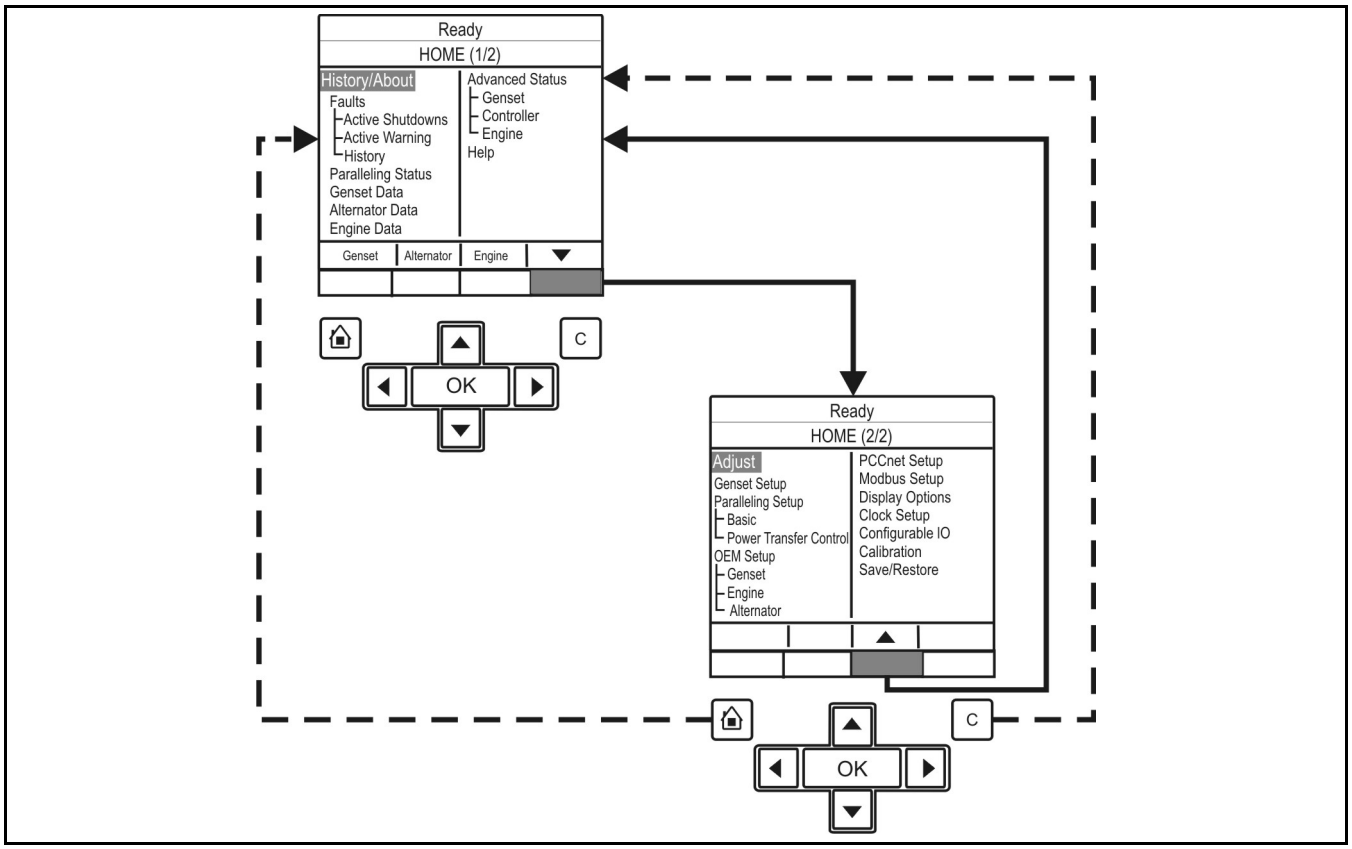


FIGURE 12. INITIAL OPERATOR MENU

- Press the **Home** Button to return to the main menu at any time.

- Press the **C** Button [C] to return to the previous menus. Settings will not be saved when this button is pressed.

Operator Panel - Engine Data Operator Menu

The Engine Data Menu - Typical Data figure shows a block representation of a typical Engine Data menu. To navigate from the Home menu (HOME [1/2]), press the soft-key button below the function button indicating Engine. This will take you directly to the Engine menu.

The Engine Data menu is displayed on one page.

Engine Data Menu

Use this menu to look at the status of the engine.

TABLE 16. ENGINE DATA MENU

Name	Description	Allowed Values
Pressure		
Oil	Monitor point for Oil Pressure	0 - ~993 kPa (0 - ~145 psi)
Boost	Monitor point for Boost Absolute Pressure	0 - ~1014 kPa (0 - ~148 psi)
Fuel Rail	Monitor point for Fuel Outlet Pressure	0 - ~249364 kPa (0 - ~36404 psi)
Fuel Inlet	Monitor point for Fuel Supply Pressure	0 - ~993 kPa (0 - ~145 psi)
Coolant	Monitor point for Coolant Pressure	0 - ~993 kPa (0 - ~145 psi)
Crankcase	Monitor point for Crankcase Pressure	–244 - ~260 kPa (–35.67 - ~38 psi)
Ambient	Monitor point for Barometric Absolute Pressure	0 - ~253 kPa (0 - ~37 psi)
Temperature		
Coolant	Monitor point for Coolant Temperature	N/A
Oil	Monitor point for Oil Temperature	–40 - ~210 °C (–40 - ~410 °F)
Manifold	Monitor point for Intake Manifold Temperature—	–40 - ~210 °C (–40 - ~410 °F)
Fuel Inlet	Monitor point for Fuel Temperature	–40 - ~210 °C (–40 - ~410 °F)
Aftercooler	Monitor point for Aftercooler Temperature	–40 - ~210 °C (–40 - ~410 °F)
Other		
Engine Hrs	Total engine run time	
Engine Speed	Monitor point for Average Engine Speed	

Name	Description	Allowed Values
Batt Voltage	Battery voltage value	

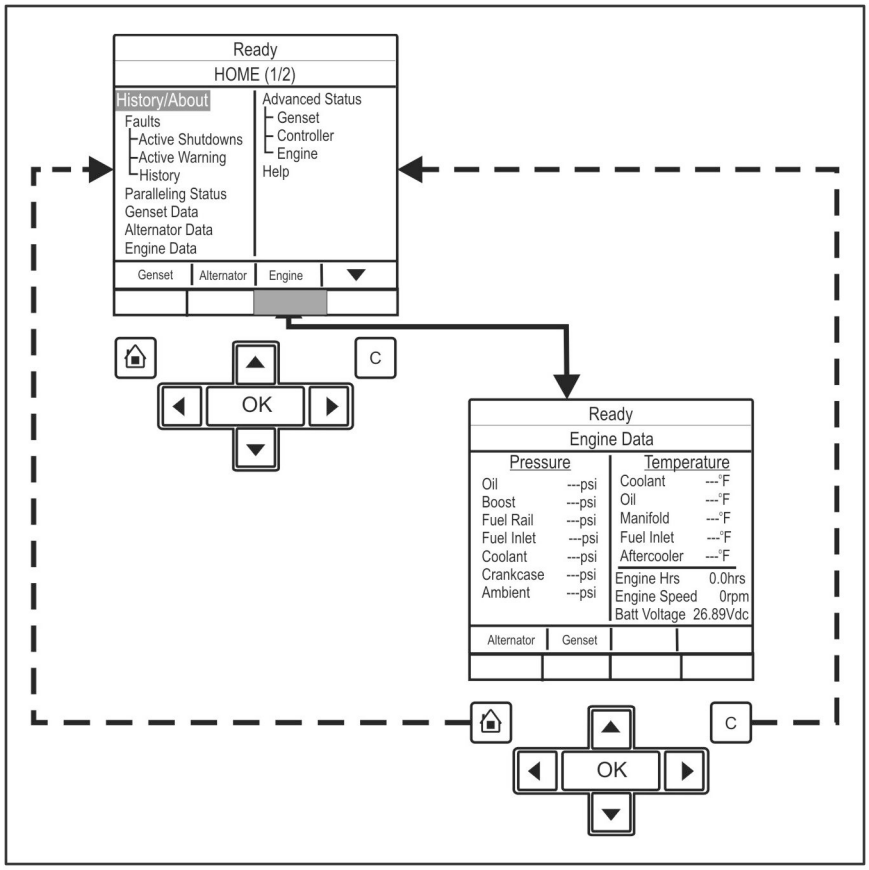


FIGURE 13. ENGINE DATA MENU - TYPICAL DATA

- Press the **Home** Button to return to the main menu at any time.
- Press the **C** Button to return to the previous menus. Settings will not be saved when this button is pressed.

History/About Menu

Figure 14 on page 53 shows a block representation of a typical History/About menu.

To navigate from the Home menu, toggle down until the History/About line of text is highlighted, and press the OK button. This information is displayed over three pages. Use the two soft-key buttons below the up and down arrows (▲ and ▼) to toggle between the pages.

This screen displays the historical information about the generator set.

TABLE 17. HISTORY/ABOUT MENU

Name	Description
Starts	Total number of start attempts.
Runs	Total number of generator set runs.
Engine Hours	Total engine run time.
Control Hours	Controller ON time in seconds. Upper limit is 136 years.
Kw Hours	Generator set total net kWh accumulation.
Gen Mod #	Number identifying the model of the generator set. (Password level: 2)
Gen Ser #	Serial number identifying the generator set.
Nominal Voltage	Generator set nominal Line-to-Line voltage.
Wye/Delta	Delta or Wye for Generator set connection.
Rating Select	Selects Standby/Prime/Base application rating.
Contr Type	Used by the PC tool.
Firmware Ver	Version of software loaded into the control. Obtained from PowerCommand® 2.3 Filename.
Calib Part	The unique calibration part number loaded into the control.
Calib Date	The revision date of the calibration part number loaded into the control.
ECM Code	The calibration coded the ECM is sending.
HMI Firm Ver	Parameter: HMI Local Parameter.
HMI Boot Ver	Parameter: HMI Local Parameter.
50 Hz Load Profile*	This shows how long the generator set has been running (50 Hz operation) at various percentages of its rated load.
60 Hz Load Profile*	This shows how long the generator set has been running (60 Hz operation) at various percentages of its rated load.
* When using the Load Profile Graph table (for 50 Hz or 60 Hz), the upper line's value indicates 100% of table.	

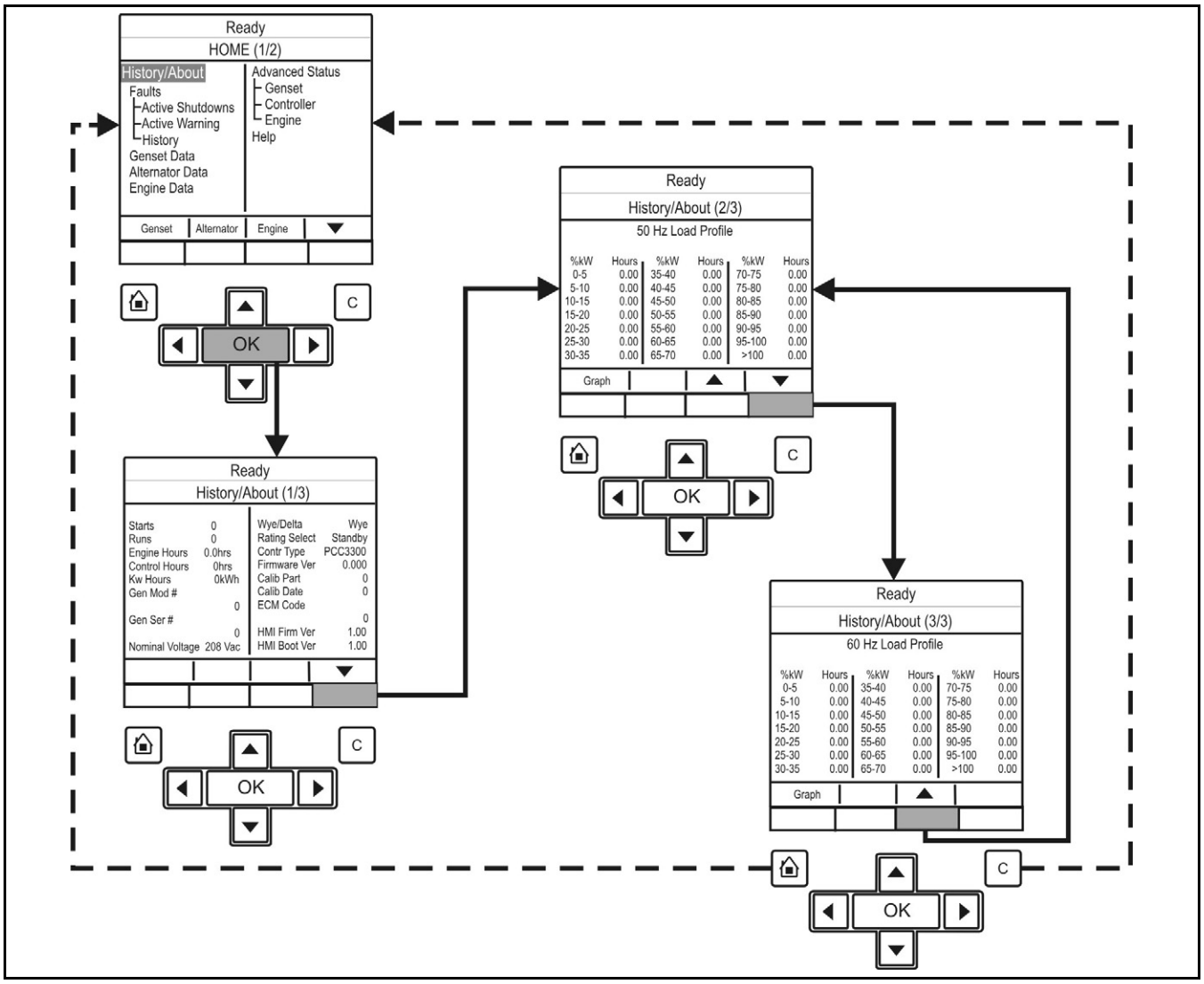


FIGURE 14. HISTORY/ABOUT MENU - TYPICAL DATA

- Press the **Home** Button to return to the main menu at any time.
- Press the **C** Button to return to the previous menus. Settings will not be saved when this button is pressed.

Contrast

The Display Options screen allows the contrast to be set.

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 **Display Options**.
3. From the Display Options screen, select **Adjust** to access the screen variables.
4. Press the right arrow to move to the Contrast variable.

5. Adjust the setting and press **Save** to save any changes. When updating this setting, the functions of the keys are as follows:

TABLE 18. KEY FUNCTIONS ON THE DISPLAY OPTIONS SCREEN

Key/Button	Function
Horizontal right arrow key	Select successive blocks for editing settings on the screen
Left arrow key	Return to the previous screen
+ or - keys	Adjust values on the Adjust screen of the Display Setup screen
Save button	Save any changes; after saving, the **Save** button changes to the **Adjust** button

NOTICE
The following screen represents the standard view. If using a remote operator panel, which may be purchased as an option, the screen may look slightly different. This procedure applies to both operator panels.

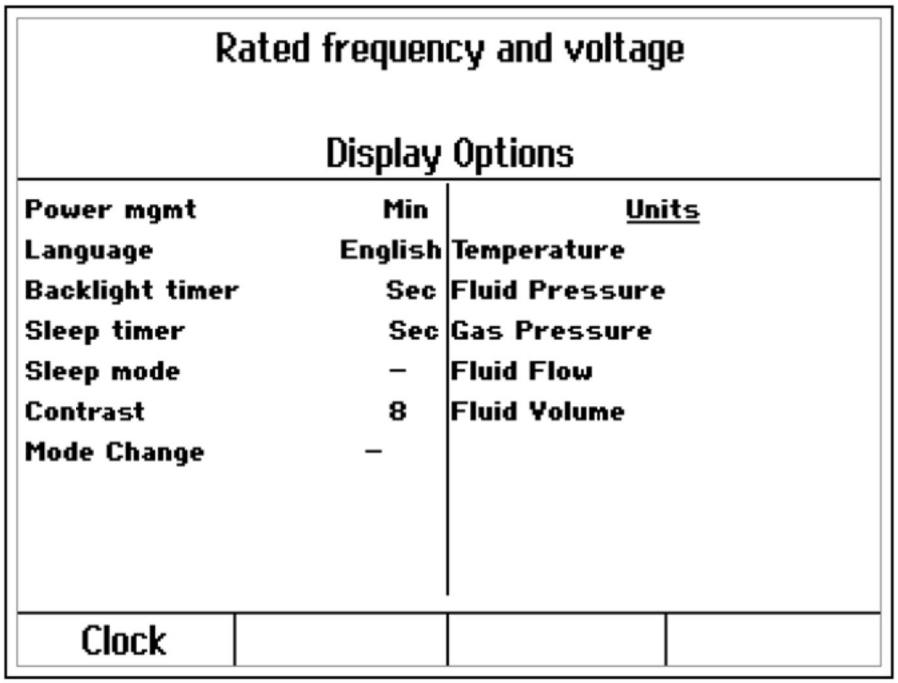


FIGURE 15. DISPLAY OPTIONS SCREEN

Updating Daylight Saving Adjust Screens

Update Values 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.
2. Navigate to the Genset Service Menu.

3. Select **Clock Exerciser** to access the Time Setup screen.
4. Press the down key on the Time Setup screen to access the Daylight Saving Adjust screen.
5. Select **Adjust**. When updating these settings, the functions of the keys are as follows:

TABLE 19. KEY FUNCTIONS ON THE DAYLIGHT SAVING ADJUST SCREEN

Key/Button	Function
Horizontal right arrow key	Select successive blocks for editing settings on the screen
Left arrow key	Return to the previous screen
+ or - keys	Adjust values on the Adjust screen of the Daylight Saving Adjust screen
Save button	Save any changes; after saving, the **Save** button changes to the **Adjust** button

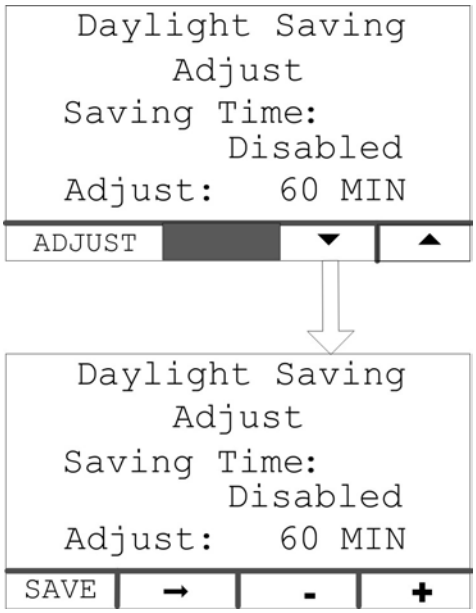


FIGURE 16. "DAYLIGHT SAVING ADJUST SAVING TIME" SCREEN NAVIGATION

Access and Update the Daylight Saving Adjust Start Screen

1. Press the down arrow key on the Daylight Saving Adjust screen.
2. Press **Adjust**. When updating these settings, the functions of the keys are as follows:

TABLE 20. KEY FUNCTIONS ON THE DAYLIGHT SAVING ADJUST START SCREEN

Key/Button	Function
Horizontal right arrow key	Select successive blocks for editing settings on the screen
+ or - keys	Adjust Month, Week, Day or Hour
Save button	Save any changes; after saving, the **Save** button changes to the **Adjust** button

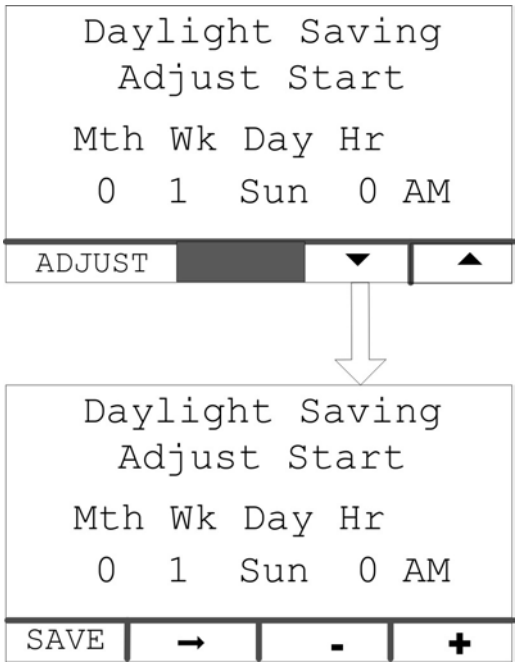


FIGURE 17. DAYLIGHT SAVING ADJUST START SCREEN

Update the Daylight Saving Adjust End Screen

1. Press the down key on the Daylight Saving Adjust Start screen.
2. Press **Adjust**. When updating these settings, the functions of the keys are as follows:

TABLE 21. KEY FUNCTIONS ON THE DAYLIGHT SAVING ADJUST END SCREEN

Key/Button	Function
Horizontal right arrow key	Select successive blocks for editing settings on the screen
+ or - keys	Adjust Month, Week, Day or Hour
Save button	Save any changes; after saving, the **Save** button changes to the **Adjust** button

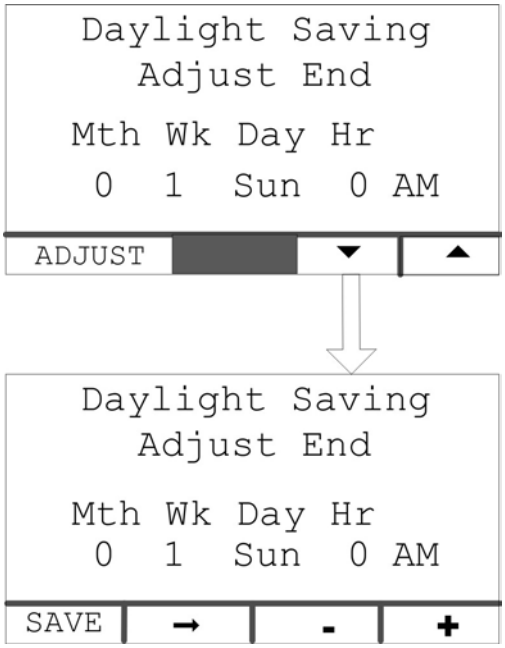


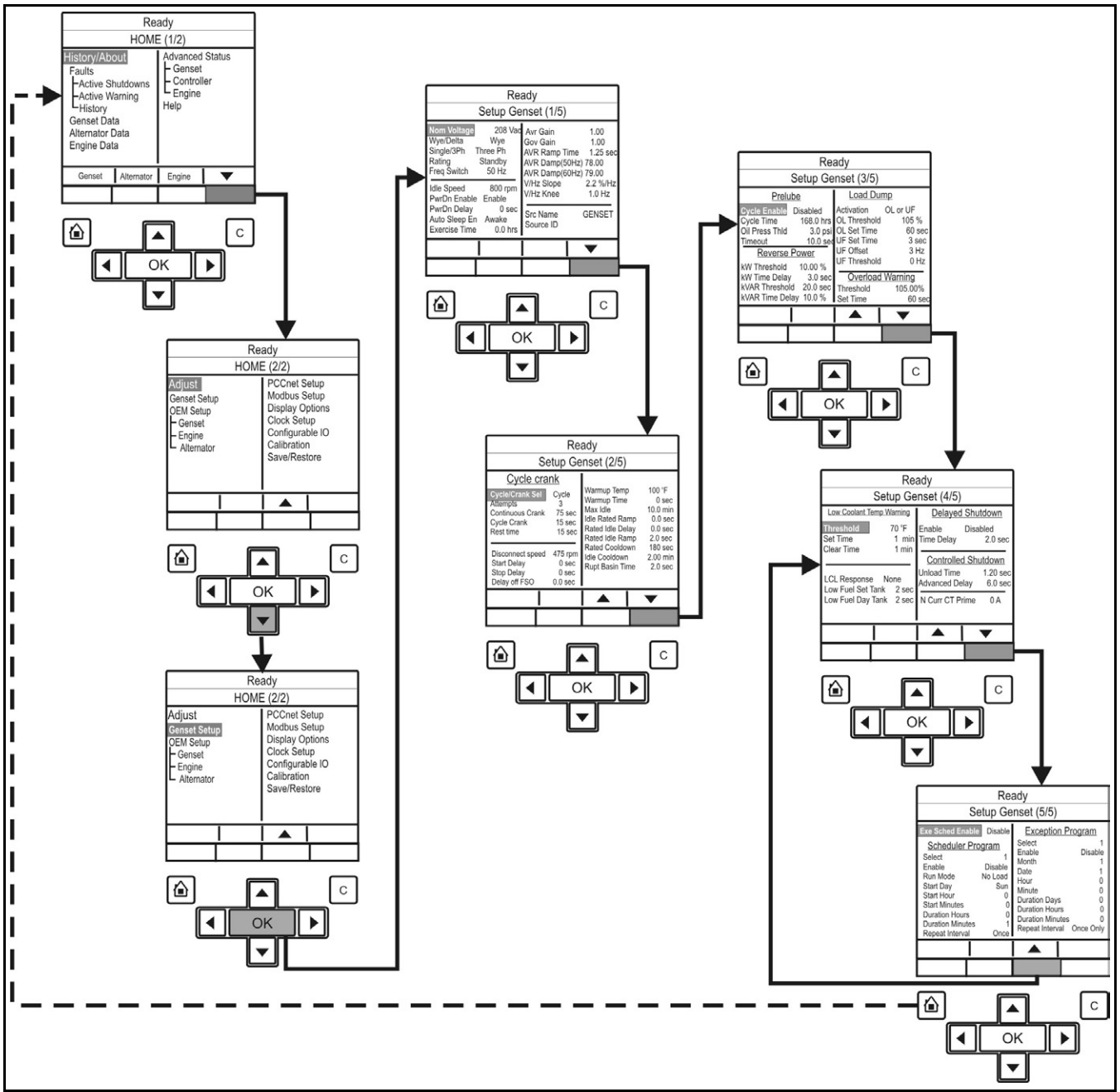
FIGURE 18. DAYLIGHT SAVING ADJUST END SCREEN

Genset Setup Menu

Use the Genset Setup menu to view generator setup data. The figure below shows block representations of the Genset Setup menu and sub-menus.

1. Use the two soft-key buttons below the up and down arrows (▲ and ▼) to page down to the second page of the HOME (2/2) menu.
2. In the HOME (2/2) menu, use the up and down arrows (▲ and ▼), to highlight the Genset Setup text.
3. With the Genset Setup text highlighted, press the **OK** button. This will display the Setup Genset menu.
4. Use the two soft-key buttons below the up and down arrows (▲ and ▼) to page through the five pages of generator setup data.

NOTICE
If any of these settings need to be changed, please contact your authorized service center.



Press the **Home** Button to return to the main menu at any time.

Press the **C** Button to return to the previous menus. Settings will not be saved when this button is pressed.

FIGURE 19. GENSET SETUP MENU - TYPICAL DATA

5.2 Checklist

Tick	Item
	General
	Generator set output is sufficient to handle maximum anticipated load.
	At least 0.9 m (3 feet) of clearance (or greater for housing door) is provided around the entire generator set for service and ventilation.
	The generator set is located in an area not subject to flooding.
	All operating personnel have read and are familiar with the generator set operator manual, all health and safety procedures, warnings, cautions, precautions, and the other documentation supplied with the generator set.
	All operators have been thoroughly briefed on preventative maintenance procedures.
	All operators have read and understand all important safety instructions.
	Any parts requiring software have been checked for the latest version. Contact the service representative for more information.
	Generator Set Position
	The floor, roof, or earth on which the generator set rests is strong enough and will not allow shifting or movement. Observe local codes on soil bearing capacity due to freezing and thawing.
	The generator set is properly supported and retained to an approved base.
	The supporting base is large enough and is of non-combustible material, extending 15 cm (6 inches) all around the generator set.
	Provisions have been made for site specific environmental operating conditions (weather protection, proximity to coastline, dusty environments, etc.,)
	Cooling Air Flow
	Generator set air inlet is faced into the direction of strongest, prevailing winds.
	Air inlet openings are unrestricted and are at least 1 to $1^{1}/_{2}$ times larger than air outlet area.
	Cooling air outlet is on downwind side of building (if not, a wind barrier is constructed).
	Proper ducting material (sheet metal, canvas) is used between radiator and air outlet.
	Fuel System
	Fuel lines are properly installed, supported, and protected against damage.
	The fuel filters have been installed.
	Approved flexible fuel line is installed between the main fuel supply and the generator set's fuel system near the generator set, to protect it against damage caused by vibration, expansion, and contraction.
	Fuel supply shutoff valves are installed to prevent fuel flow in case of leaks.

Tick	Item
	No fuel leaks are found in supply line or engine fuel system.
	Check fuel line and use equations to verify it has proper volume capability.
	Check if fuel pressure is between 1.5 - 3.2 kPa (6 - 13 inches water column) under any condition.
	Make sure fuel pressure does not drop below 1.5 kPa (6 inches water column) under full load.
	If necessary, perform initial demand regulator adjustment procedure.
	Exhaust System
	The breather tube routing is set up to blow the fumes away from the generator set (if applicable)
	Operators are thoroughly briefed on the dangers of carbon monoxide gas.
	If the installation includes a heavy duty air cleaner, it has been installed.
	Areas around generator set are well ventilated, with no possibility of exhaust fumes entering building doors, windows, or intake fans.
	Exhaust gases are piped safely outside and away from building.
	The correct length of approved rigid pipe is connected to the generator set flexible pipe using approved securing methods with no weight resting on engine exhaust components. There are no bends in flex section.
	Condensation drain is provided in lowest section of exhaust piping.
	Exhaust piping is insulated to guard against burns to personnel.
	Exhaust piping passing through walls or ceilings have approved fire-proof materials and are in compliance with all codes.
	Exhaust piping is large enough in diameter to prevent excessive back pressure on engine.
	AC and DC Wiring
	Wire sizes, insulation, conduits and connection methods all meet applicable codes.
	AC and DC wires are separated in their own conduit to prevent electrical induction.
	All load, line and generator connections are well made and correct.
	Flexible conduit is used between the generator and the building or surrounding structure.
	Check phase rotation.
	Generator Set Pre-Start
	Generator set engine is properly serviced with oil and coolant.
	Battery charger is installed using the appropriate cable size and is operational.

Tick	Item
	Battery charger is configured for the proper DC battery voltage, battery type, and float voltage.
	Batteries are properly installed, serviced and charged.
	Cooling system is filled with correct volume and concentration of coolant. The water used in the coolant mix has passed water quality check.
	Engine coolant heater (if applicable) is connected and operational.
	All generator set covers and safety shields are installed correctly.
	All fuel and coolant shutoff valves are operational.
	Shipping brackets are removed.
	Radiator fan and other external moving parts, including drive belts, are unrestricted.

5.3 Before Starting

NOTICE
One operator should be in complete charge, or working under the direction of someone who is in charge. Remember that, upon starting the engine, cables and switchgear will become energized, possibly for the first time. Furthermore, equipment that does not form part of the generator set installation may become electrically charged. Only authorized and competent personnel should carry out this work.

NOTICE
Do not use the Emergency Stop button to shut down an engine unless a serious fault develops. The Emergency Stop button must not be used for a normal shut-down as this will prevent a cooling down run in which the lubricating oil and engine coolant carry the heat away from the engine combustion chamber and bearings in a safe manner.

NOTICE
Diesel engines only: **Avoid off-load running for other than short periods. A minimum loading of 30% is recommended. The engine must be shut down as soon as possible after the appropriate functions have been checked.**

NOTICE
Gaseous engines only**: Avoid running the generator set at no-load and light-loads for extended periods.**

Before attempting to start the generator set, the operator should read through this entire manual and the specific literature provided as part of the documentation pack supplied with the generator set. It is essential that the operator be completely familiar with the generator set and the PowerCommand® control.

The sub-sections below cover the systems used to start and stop the generator set.

Before starting the generator set, make sure that exhaust and fuel fittings are tight and properly positioned, and that proper maintenance and pre-start checks have been performed.

During starting, automatic checks are carried out for the integrity of various protection systems. The PowerCommand® control will not allow the generator set to continue the starting sequence if the integrity of a sensor is considered to be in doubt.

The generator set can be configured for a number of starting cycles (one to seven) with set times for crank and rest periods for all starting modes (manual/remote). The default setting is for three start cycles, composed of fifteen seconds of cranking and 30 seconds of rest.

NOTICE

The number of starting cycles, and the crank and rest times are set from within the Setup menu. Trained and experienced service personnel are required to change the default setting. Contact your authorized Cummins distributor.

Initial Pre-Start Checks

⚠ WARNING

Electric Shock Hazard

Voltages and currents present an electrical shock hazard that can cause severe burns or death.

Make sure that only personnel who are trained and experienced work with distribution voltages. Even after generator set shutdown, an electrical shock hazard may still exist, caused by induced or residual voltage within the alternator or cables. Some interfaces may display zero voltage even when voltages are present.

⚠ 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.

Before starting, competent personnel must make the following checks to make sure that the unit is ready for operation:

TABLE 22. INITIAL PRE-START CHECKS

Check	Description
Generator Set Grounding	Grounding (earthing) must be checked prior to performing service or inspection procedures that may expose personnel to conductors normally energized with voltages greater than 600 Volts. Contact your authorized Cummins distributor.
Insulation Testing[1]	This must be performed on all generator sets before initial start-up and after the generator set grounding procedure has been completed. Insulation testing for low voltage (less than 600 Volts) generator sets is recommended by Cummins. These tests are used to verify that the windings are dry before the generator set is operated, and to develop a base line for future test comparisons. Contact your authorized Cummins distributor.
Lubrication[2]	Check the engine lubrication oil level and ensure that the correct level is always maintained.
Coolant[3,4,5]	Check the engine coolant level and ensure that the level is always maintained. Fill the cooling system to the bottom of the fill neck in the radiator fill or expansion tank. Do not check the level while the engine is hot.

[1]When wire insulation-testing an alternator, failure to protect the voltage regulator, control and diodes could result in permanent damage to one or more of the electronic components.

[2]*Generator sets shipped dry only:* They must be filled with the correct type and quantity of oil before use. Be sure to check the oil level before initial start. Failure to fill to the recommended level can result in equipment damage.

[3]*Generator sets that require a mix of anti-freeze and DCA inhibitor only:* You must comply with Cummins requirements for the correct type and concentration of anti-freeze and DCA inhibitor. Warranty claims for damage will be rejected if the incorrect mix is used. Consult your authorized Cummins distributor for the correct anti-freeze specifications and concentration for your operating conditions.

[4]*Radiators with two fill necks only:* Both fill necks must be filled after the cooling system has been drained.

[5]*Generator sets shipped dry only:* The engine must be filled with the correct type and quantity of coolant before use. Be sure to check coolant level(s), before the initial start.

Operator's Pre-Start Checks

⚠ WARNING

Arc Flash and Shock Hazard
Electric arc flash can cause electrical shock, severe burns, or death.
Make sure the alternator is dry before the generator set is operated.

⚠ 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.

NOTICE

***Radiators with two fill necks only:* Both fill necks must be filled when the cooling system has been drained.**

TABLE 23. OPERATOR'S PRE-START CHECKS

Check	Description
Fuel Supply *(Diesel Only)*	Make sure that: • The fuel tank is filled to the normal level with clean water-free fuel and that the fuel system is primed; • All the valves required for operation are open; • There are no leaks and that all fittings are tight; and • If equipped, the auxiliary fuel system is properly connected.
DEF Supply *(If Equipped)*	Make sure that: • The DEF tank is filled to the normal full level with DEF, and • If equipped, the auxiliary DEF system is properly connected.
Lubrication	With the engine stationary, check the engine lubrication oil level and make sure that the correct level is always maintained.
Coolant	Check the engine coolant level and make sure that the level is always maintained at the coolant expansion tank. Fill the cooling system to the bottom of the fill neck in the radiator fill or expansion tank. Do not check while the engine is hot.
Cooling Air Inlet/Outlets	Make sure that the cooling air inlets/outlets are unobstructed.
Exhaust Outlet	Make sure that: • Exhaust components are secured and not warped; • The exhaust outlet is unobstructed; • No combustible materials are near the system; • Gases are discharged away from building openings; and • There are no leaks and that all fittings are tight.

Check	Description
Batteries	Make sure that the batteries are charged, and that all connections are clean, correct and tight (if applicable).
Auxiliary Powered AC Supplies	Make sure that all auxiliary equipment is receiving power from the customer's supply.
Emergency Stop	Make sure that the emergency stop button is fully operational.

Starting at the Operator Panel (Manual Run Mode)

NOTICE
Make sure that all Pre-start Checks are carried out before starting the generator set. Do not attempt to start the generator set until it is safe to do so. Warn all others in the vicinity of the generator set and connected load equipment that the generator set is about to start.

STARTING IN MANUAL RUN MODE

1. Make sure the main circuit breaker is in the open position.
2. To start the generator set in the **Manual Run** mode:
   a. Press the **Manual** button 

on the operator panel.
   b. Press the **Start** button 

within ten seconds.

NOTICE
Failure to press the Start button within this time will result in the generator set changing to the Off mode. Refer also to the Selecting Manual Run Mode section.

NOTICE
If the mode change access code feature has been enabled, enter the access code when prompted. See the Passwords and Mode Change Access section.

3. The PowerCommand® control will initiate a starter cranking signal and will perform an automatically sequenced manual start, under a complete engine protection system combined with full monitoring capability. This will activate the engine control system and the starting procedure. The starter will begin cranking and, after a few seconds, the engine will start and the starter will disconnect.

   If the engine fails to start, the starter will disengage after a specified period of time and the control will indicate a Fail to Start shutdown.

To clear a Fail to Start shutdown:

a. Press the **Stop** button. 

b. Press the **Reset** button. 

4. Before attempting to re-start, wait a minimum of two minutes for the starter motor to cool and then repeat the starting procedure. If the engine does not run after a second attempt, refer to the Troubleshooting section of the operator manual.

DISABLING MANUAL MODE

To disable Manual mode, change to **Auto** or **Off** mode. If the generator set is running when it leaves **Manual** mode, it will continue to run if **Auto** mode has been selected and the remote start signal is active. If there is no active remote start signal, the generator set will stop.

Starting from Remote Location (Auto Mode)

NOTICE
Make sure that all Pre-start Checks are carried out before starting the generator set. Do not attempt to start the generator set until it is safe to do so. Warn all others in the vicinity that the generator set is about to start.

1. To start the generator set in the **Auto Run** mode, select the **Auto** button from the operator panel. 

Refer also to the Selecting Auto Mode section.

   Once the PowerCommand® control receives a remote start signal, and after a Time Delay to Start, the control will initiate the starting sequence as above. The Remote Start LED will be lit.

NOTICE
If the mode change access code feature has been enabled, enter the access code when prompted. See the Passwords and Mode Change Access section.

NOTICE
When the generator set is operating in the Remote Start mode, removing the Remote Start command does not shut off the engine if the load is more than 10%, the cooldown timer is set to zero, and the control is configured for a single unit (not in parallel). The generator set continues to operate until it runs out of fuel, the E-stop button is used, or the load is removed.

2. To disable **Auto** mode, change to **Manual** or **Off** mode.

Cold Starting with Loads

NOTICE

Make sure that all pre-start checks are carried out before starting the generator set. Do not attempt to start the generator set until it is safe to do so. Warn all others in the vicinity that the generator set is about to start.

Use a coolant heater if a separate source of power is available. The optional heater available from Cummins will help provide reliable starting under adverse weather conditions. Be sure the voltage of the separate power source is correct for the heater element rating.

Cummins recommends equipping standby generator sets (life safety systems) with engine water jacket coolant heaters to maintain the coolant at a minimum of 32 °C (90 °F) and, for most applications, accept the emergency load in ten seconds or less. Although most Cummins generator sets will start in temperatures down to -32 °C (-25 °F) when equipped with engine water jacket coolant heaters, it might take more than ten seconds to warm the engine up before a load can be applied when ambient temperatures are below 4 °C (40 °F).

The **Low Coolant Temp** (Code 1435) message along with the lighting of the **Warning** LED are provided to alert the operator of a possible delay in accepting the load. The engine cold sensing logic initiates a warning when the engine water jacket coolant temperature falls below 21 °C (70 °F). In applications where the ambient temperature falls below 4 °C (40 °F), a cold engine may be indicated even though the coolant heaters are connected and functioning correctly. Under these conditions, although the generator set may start, it may not be able to accept load within ten seconds. When this condition occurs, check the coolant heaters for correct operation. If the coolant heaters are operating correctly, other precautions may be necessary to warm the engine before applying a load.

Checking Coolant Heater Operation

⚠ WARNING

Hot Surfaces
Contact with the hot surfaces can cause severe burns.
Avoid contact with hot parts. Allow hot parts to completely cool.

Do not touch the cooling system outlet hose. The coolant heater is operating if radiant heat can be felt with your hand held close to the outlet hose and the engine is not running.

5.4 Startup

⚠ 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 (–) cable first.

- 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 following information applies to C125 N6 and C150 N6 generator set models only:* Adaptive learn is an engine ECM function that allows the generator set to "learn" its environment. There are small differences in the performance of each engine and fuel system component, so the ECM uses inputs from the engine sensors to adjust running conditions to operate more consistently for each individual generator set.

  After installation is complete and while testing the overall system function, you must run the generator set with no active faults under load (that is, with the transfer switch connected to maximum customer load available) until the engine temperature reaches 65.5 °C (150 °F) to allow the adaptive learn function to initialize.
- The generator set is shipped from the factory with the proper level of engine oil and coolant, but make sure to check each before starting the generator set.
- Start and operate the generator set following all the instructions and precautions in the operator manual.
- Before leaving the site:
  - Ensure that the bonding bolts are installed into the service panels.
  - If the generator set is ready to be placed in service, put the generator set in Auto mode to provide automatic standby power.
  - Make sure the circuit breakers are in the ON position.

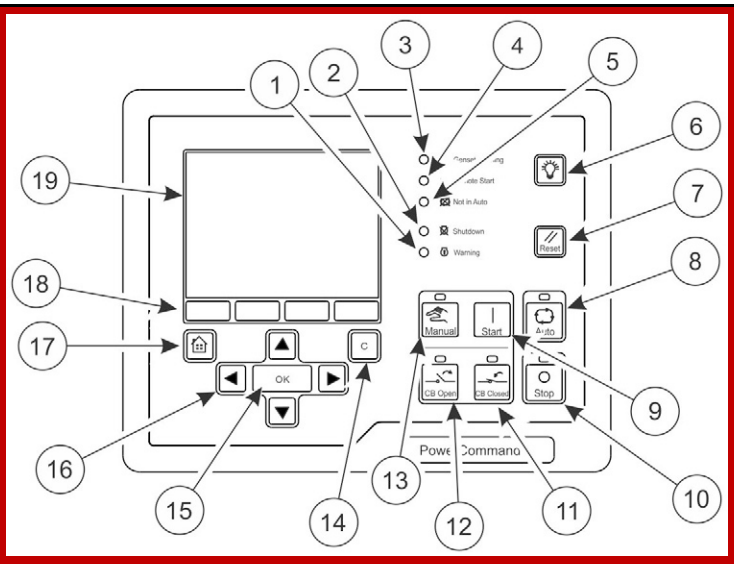
NOTICE

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

6 Startup and Configuration PCC 3.3

6.1 Operator Panel

Figure 20 shows the features of the front panel. It includes five lamp indicators; the graphical display with four menu select and seven menu navigation buttons; and six control mode buttons. This display panel enables the operator to look at the status, adjust the settings, and start and stop the generator set.



No.	Description	No.	Description
1	Indicator Lamp – Warning	11	Circuit Breaker – Closed Button
2	Indicator Lamp – Shutdown	12	Circuit Breaker – Open Button
3	Indicator Lamp – Genset Running	13	Manual Button
4	Indicator Lamp – Remote Start	14	Previous Menu Button (or Clear)
5	Indicator Lamp – Not in Auto	15	Item Select Button (OK)
6	Lamp Test Button	16	Menu Navigation Buttons (Up, Down, Left, Right)
7	Reset Button	17	Home Button
8	Auto Mode Button	18	Menu Select Buttons (Used with Graphical Display)
9	Start Button	19	Graphical Display
10	Stop Button		

FIGURE 20. OPERATOR PANEL

Selection Buttons

Four momentary buttons are used to navigate and change the selection in the graphical display:

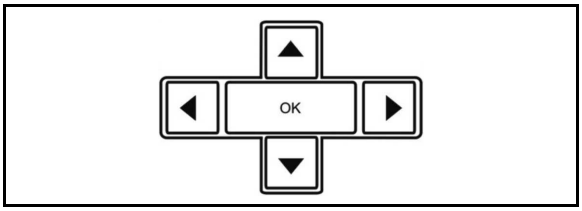


FIGURE 21. SELECTION BUTTONS

Press the **OK** button to select the item that is currently highlighted in the graphical display:

Item	Results of Pressing OK
Menu	Opens the sub-menu or screen
Parameter	Allows adjustment of the parameter (if possible) or prompts for a password
Adjusted Value	Saves the change
Action	The graphical display runs the action or prompts for a password

Default Settings

The operator panel can display SAE or Metric units of measurement and should be set during the initial setup of the generator set. Only trained and experienced personnel are allowed to change the default setting. Contact your authorized distributor.

Lamp Indicators

Figure 20 on page 69 shows the front panel of the Operator Panel with the five lamp indicators.

Warning

This amber lamp is lit whenever the control detects a Warning condition. This lamp is automatically shut off when the Warning condition no longer exists.

Shutdown Status

This red lamp is lit when the control detects a Shutdown condition. The generator set cannot be started when this lamp is on. After the condition has been corrected, the lamp can be reset by first pressing the **Stop** button and then the **Reset** button.

Not in Auto

This red lamp is lit when the control is not in Auto.

Remote Start

This green lamp indicates the control is receiving a **Remote Run** signal. The **Remote Run** signal has no effect unless the generator set is in Auto.

Generator Set Running Lamp

The green lamp is lit when the generator set is running at, or near, rated speed and voltage. This is not lit while the generator set is warming up or cooling down.

Lamp (LED) Test Button

Press this button to test the lamps (LEDs). All of the lamps should turn on for five seconds.

Press and hold this for three seconds to turn on or off (to toggle) an external panel lamp.

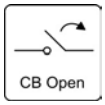
Reset Button

Press this to reset any active faults.

If the condition(s) that caused an existing shutdown fault still exists, the generator set generates the fault again.

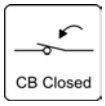
If the condition(s) that caused an existing warning fault still exists, the generator set generates the fault again, but the operator panel stops displaying it in the graphical display.

CB Open Button



The **circuit breaker open** button is used for electrically operated circuit breakers in Manual mode only. When pressed, it enables the generator set circuit breaker to open and disconnect from the load.

CB Closed Button



The **circuit breaker closed** button is used for electrically operated circuit breakers in Manual mode only. When pressed it enables the generator set circuit breaker to close when the set is up to speed and voltage and therefore, ready to accept the load.

NOTICE
This button has no effect unless the bus is dead, or the generator set is synchronized with the other source.

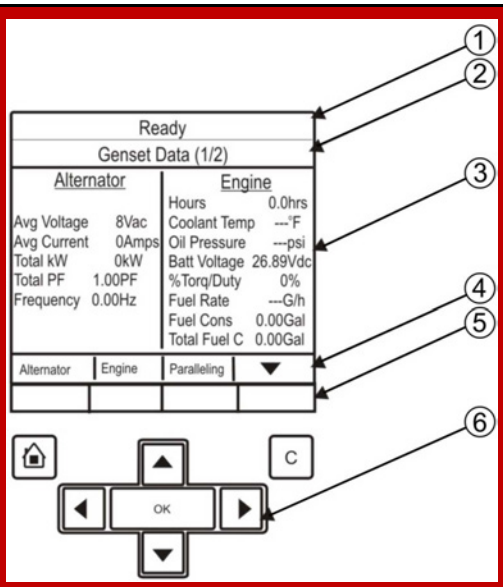
Graphical Display and Buttons

Figure 22 on page 72 shows the graphical display and the relevant menu selection buttons.

The graphical display is used to view menus of the menu-driven operating system. System messages (communication, event, and fault) are also shown on the display.

Four momentary soft-key buttons (item 5) are used to change menus, or pages within each screen. These selection buttons are “active” when any text or the up and down triangles (▲ and ▼ in Section 4) are displayed in the graphical display. Some sub-menus do not include any active buttons.

Use the graphical display to view event/fault information, status, screens, and parameters.



No.	Description	No.	Description
1	Display Panel Section 1 (Control Status)	4	Display Panel Section 4 (Additional Functions and Page Up or Down Availability)
2	Display Panel Section 2 (Active Fault or Screen Name)	5	Selection Buttons Relevant to Section 4
3	Display Panel Section 3 (Relevant Data to Section 2)	6	Selection Change or Accept Buttons

FIGURE 22. GRAPHICAL DISPLAY WITH TYPICAL SCREENSHOT

Section 1 - Control Status

Section 1 displays the status of the controller.

TABLE 24. CONTROL STATUS

Status	Description
Ready	This is the default state. The controller is ready to start the generator set, or it has started one of the start sequences but has not started the engine yet.
Starting	The controller is starting the engine in one of the start sequences, and the engine speed is greater than zero.
Idle Warmup	The controller is raising the engine speed to idle speed, or the engine is running at idle speed in one of the start sequences.
Rated Freq and Voltage	The controller is raising the engine speed to rated speed; the generator set is running at rated speed and voltage; or the controller has started one of the stop sequences but has not started reducing the engine speed yet.
Idle Cooldown	The controller is reducing the engine speed to idle speed, or the engine is running at idle speed in one of the stop sequences.
Stopping	The controller is stopping the engine, and the engine speed is still greater than zero.
Emergency Stop	There is an active shutdown fault.
Setup Mode	The controller is in Setup mode.
Wait to Powerdown	The controller is ready to enter Powerdown mode, but another device is sending a System Wakeup signal.
Off	The controller is in the process of entering power-down mode. The controller is performing some last-second checks.
Demo Mode	The controller is running a demonstration. Every screen is available in the demonstration, and any changes you make in the demonstration will have no effect on the controller. To end the demonstration, the operator panel must be turned off.

Section 2 - Active Fault or Screen Name

Section 2 displays the screen name and information about the last active shutdown fault. If there are no active shutdown faults, it displays the last active warning fault.

If there is an active fault, the operator panel displays the following information about it:

- Fault type
- Event/fault code
- Name of the controller that detected the fault (e.g., the engine ECM unit); this is blank if the controller detected the fault
- Fault name

If you press the **Reset** button, the operator panel stops displaying active warning faults, even if the condition(s) that caused the fault(s) has not been corrected. However, the Warning LED remains on.

The operator panel always displays any active shutdown faults, even if the **Reset** button is pressed.

TABLE 25. ACTIVE FAULT TYPES

Fault Type	Description
Warning	This is a warning fault. (See the Troubleshooting section.)
Derate	This is a derate fault. (See the Troubleshooting section.)
Shutdown	This is a shutdown fault that initiates a Shutdown Without Cooldown sequence. (See the Troubleshooting section.)
Shutdown with Cooldown	This is a shutdown fault that initiates a Shutdown With Cooldown sequence.

Section 3 - Interactive Screen or Menu

Section 3 shows information relevant to Section 2. You can view the operating values for the generator set, navigate through screen and adjust parameters (if permitted).

The default screen is the Genset Data screen.

The following table explains how the operator panel displays when the value of a specific parameter is missing, unexpected, or outside the range allowed for the parameter.

TABLE 26. PARAMETER VALUES THAT ARE MISSING, UNEXPECTED, OR OUTSIDE THE RANGE ALLOWED

Operator Panel	Description
NWF	Network Failure - There is a PCCNet network failure or a CAN (ECM) failure
OORL	Out Of Range Low - The value is less that the lowest allowed value for this parameter
OORH	Out Of Range High - This value is greater than the highest allowed value for this parameter

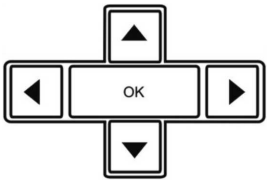
Operator Panel	Description
-- -- --	This value is not applicable

Section 4 - Additional Functions Indicators

Section 4 indicates if additional information or further sub-menus are available by up or down arrows (▲ and ▼). If that particular page or menu has no additional information, then no arrow will be visible at this time.

For example if the graphical display is not big enough to display the screen at one time an up and/or down arrow (▲ and ▼) will be visible. Press the appropriate selection button beneath the graphical display to look at the previous or next page of information in that screen.

Menu Navigation Buttons



Four momentary buttons are used to navigate and change the selection in the graphical display.

Press the **OK** button to select the item that is currently highlighted in the graphical display:

- If the selected item is a menu item, this opens the sub-menu or screen.
- If the selected item is a parameter, this lets you adjust the parameter (if possible) or prompts you for a password.
- If the selected item is a value you have just adjusted, this saves the change.
- If the selected item is an action, the graphical display runs the action or prompts you for a password.

6.2 Operator Panel - Initial Operator Menu

Figure 23 on page 78 shows the initial menu which is displayed over two pages. Use the soft-key buttons below the up and down arrows (▲ and ▼) to toggle between the two pages.

Use the soft-key buttons below Genset, Alternator, or Engine to short-cut to those menus.

Pressing the **Home** button from any screen will return the display to the main menu screens.

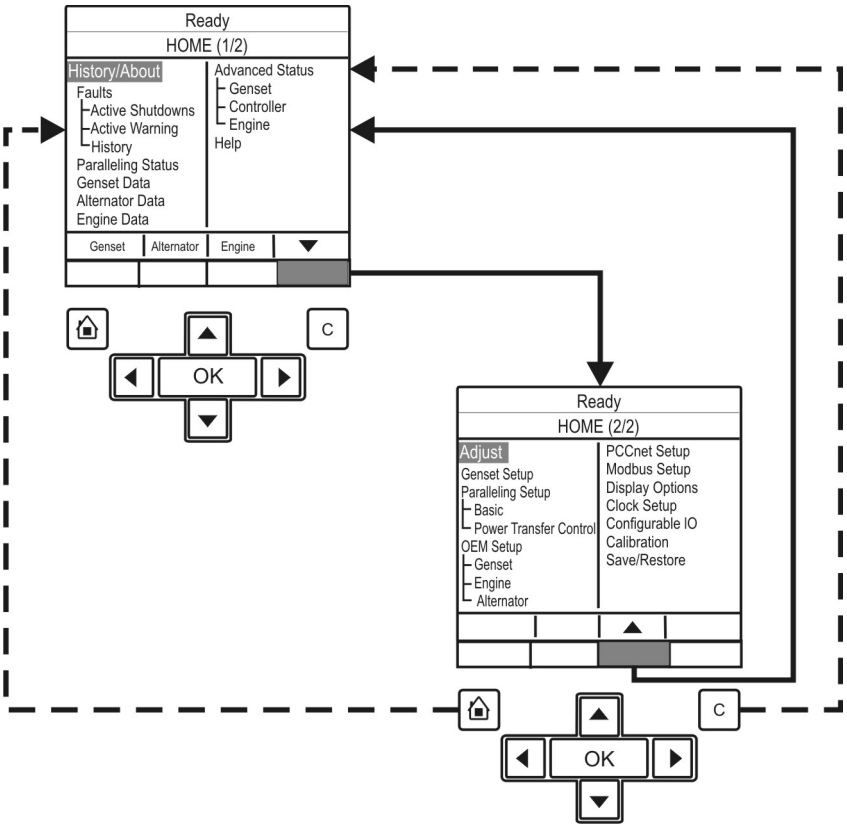
Initial Menu Data

This menu displays the information available through the menus.

TABLE 27. INITIAL MENU DATA

Name	Description
History/About	Use this screen to view historical information about your generator set.
Faults:	If there are no active Faults, these screens will not be available.
Active Shutdowns	Use this screen to view active Shutdown faults.
Active Warning	Use this screen to view active Warning faults.
History	Use this screen to view faults that have been cleared.
Paralleling Status	Use this screen to view the bus, circuit breakers, and paralleling states.
Genset Data	Use this screen to view the status of the generator set.
Alternator Data	Use this screen to view the status of the alternator.
Engine Data	Use this screen to view the status of the engine.
Advanced Status:	
Genset	Use this screen to view power, energy, phase difference, and other detailed generator set information.
Controller	Use this screen to view sequences of operation, configurable inputs and outputs, and other detailed controller information.
Engine	Use this screen to view pressures, voltages, temperatures, and other detailed engine information.
Help	Use this screen to obtain more information regarding the operator panel.
Setup Menus:	

Name	Description
Adjust	The use of these screens is restricted to authorized personnel only.
Genset Setup	
Paralleling Setup	
OEM Setup	
PCCnet Setup	
Modbus Setup	
Display Options	
Clock Setup	
Configurable IO	
Calibration	
Save/Reserve	



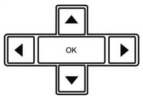
Press the **Home** Button to return to the main menu at any time.

Press the **C** Button to return to the previous menus. Settings will not be saved when this button is pressed.

FIGURE 23. INITIAL OPERATOR MENU

6.3 Operator Panel - Generator Set Data Operator Menu

Figure 24 shows a block representation of a typical Genset Data menu. To navigate from the Home menu (HOME [1/2]), press the soft-key button below the function button indicating Genset. This will take you directly to the Genset menu.



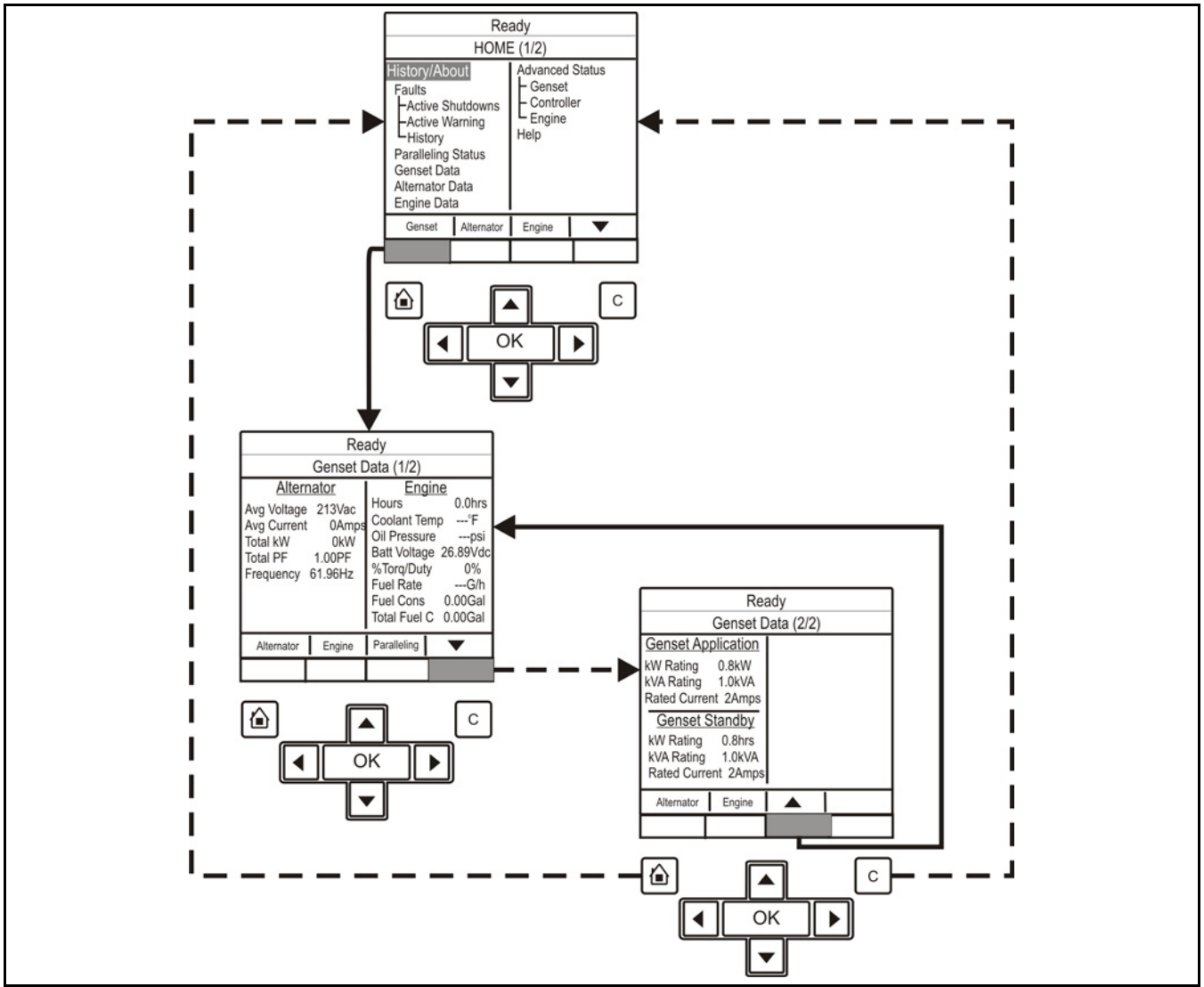
The Genset Data menu is displayed on two pages. Use the two soft-key buttons below the up and down arrows (▲ and ▼) to toggle between the pages.

Generator Set Data

Use this menu to look at the status of the generator set.

TABLE 28. GENERATOR SET DATA

PARAMETER	DESCRIPTION
Alternator	
Genset LL Average Voltage	Generator Set Line to Line average voltage
Genset Average Current	Generator Set average current
Genset Total kW	Generator Set total kW
Genset Total Power Factor	Generator Set L1 power factor
Genset Frequency	Generator Set frequency
Engine	
Engine Running Time	Total engine run time
Coolant Temperature	Monitor point for the Coolant Temperature
Oil Pressure	Monitor point for the Oil Pressure Allowed values: 0~145 PSI.
Battery Voltage	Battery voltage value.
Percent Engine Torque/Duty Cycle	Monitor point for the percent engine torque output and the governor percent duty cycle output when used with the HM ECM Allowed values: -125~125%.
Fuel Rate	Monitor point for the Fuel Rate Allowed values: 0~845 liters/hr (223.2 gal/hr)
Fuel Consumption Since Reset	Fuel consumption since last reset.
Total Fuel Consumption	Total fuel consumption since start of engine.
Genset Application	
Genset Application kW rating	The Generator Set KW rating.
Genset Application kVA rating	The Generator Set KVA rating.
Genset Application Nominal Current	The value of the Generator Set application nominal current.
Genset Standby	
Genset Standby kW rating	KW rating for the Generator Set in Standby configuration.
Genset Standby kVA rating	KVA rating for the Generator Set in Standby configuration.
Genset Standby Nominal Current	The value of the Generator Set standby nominal current.



Press the **Home** Button to return to the main menu at any time.

Press the **C** Button to return to the previous menus. Settings will not be saved when this button is pressed.

FIGURE 24. GENERATOR SET DATA MENU - TYPICAL DATA

6.4 Operator Panel - Engine Data Operator Menu

Figure 25 on page 82 shows a block representation of a typical Engine Data menu. To navigate from the Home menu (HOME [1/2]), press the soft-key button below the function button indicating Engine. This will take you directly to the Engine menu.

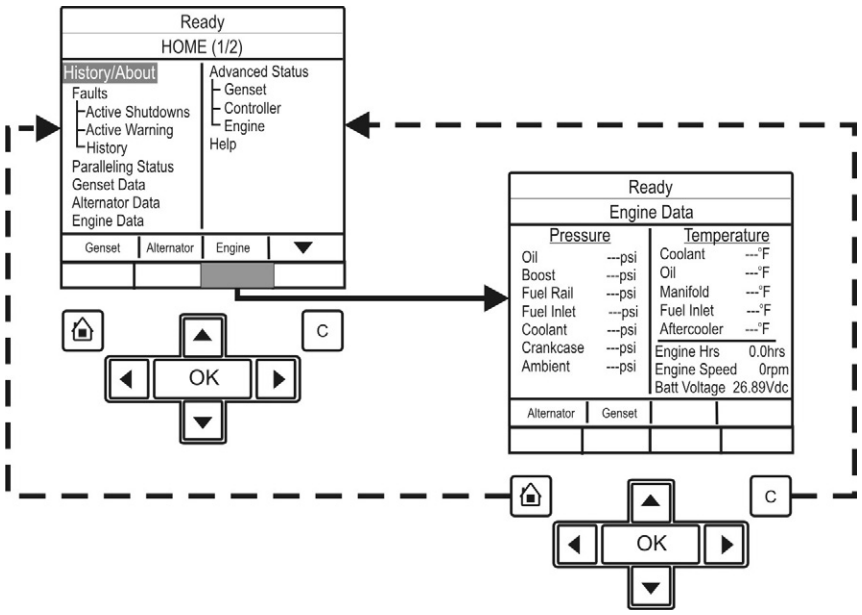
The Engine Data menu is displayed on one page.

Engine Data

Use this menu to look at the status of the engine.

TABLE 29. ENGINE DATA (LBNG GENSET ENABLE IS SET TO DISABLE)

Name	Description
Oil Pressure	Monitor point for the Oil Pressure Allowed values: 0~145 PSI.
Boost Pressure	Monitor point for the Boost Absolute Pressure Allowed values: 0~148 PSI.
Coolant Pressure	Monitor point for the Coolant Pressure Allowed values: 0~145 PSI.
Fuel Supply Pressure	Monitor point for the Fuel Supply Pressure Allowed values: 0~145 PSI.
Fuel Outlet Pressure	Monitor point for the Fuel Outlet Pressure Allowed values: 0~36404 PSI.
Crankcase Pressure	Monitor point for the Crankcase Pressure Allowed values: -35.67~38 PSI.
Barometric Absolute Pressure	Monitor point for the Barometric Absolute Pressure Allowed values: 0~37 PSI.
Coolant Temperature	Monitor point for the Coolant Temperature
Oil Temperature	Monitor point for the Oil Temperature Allowed values: -40~410 °F.
Intake Manifold Temperature	Monitor point for the Intake Manifold Temperature Allowed values: -40~410 °F.
Fuel Temperature	Monitor point for the Fuel Temperature Allowed values: -40~410 °F.
Aftercooler Temperature	Monitor point for the Aftercooler Temperature Allowed values: -40~410 °F.
Battery Voltage	Battery voltage value
Average Engine Speed	Monitor point for the Average Engine Speed
Engine Running Time	Total engine run time
Glow Plug Command	Output of glow plug logic Allowed values: Driver Off, Driver On.
Oil Pressure Switch Status	Low or Not Low. Allowed values: Not Low, Low.



Press the **Home** Button to return to the main menu at any time.

Press the **C** Button to return to the previous menus. Settings will not be saved when this button is pressed.

FIGURE 25. ENGINE DATA MENU - TYPICAL DATA

History/About Menu

Figure 26 on page 84 shows a block representation of a typical History/About menu.

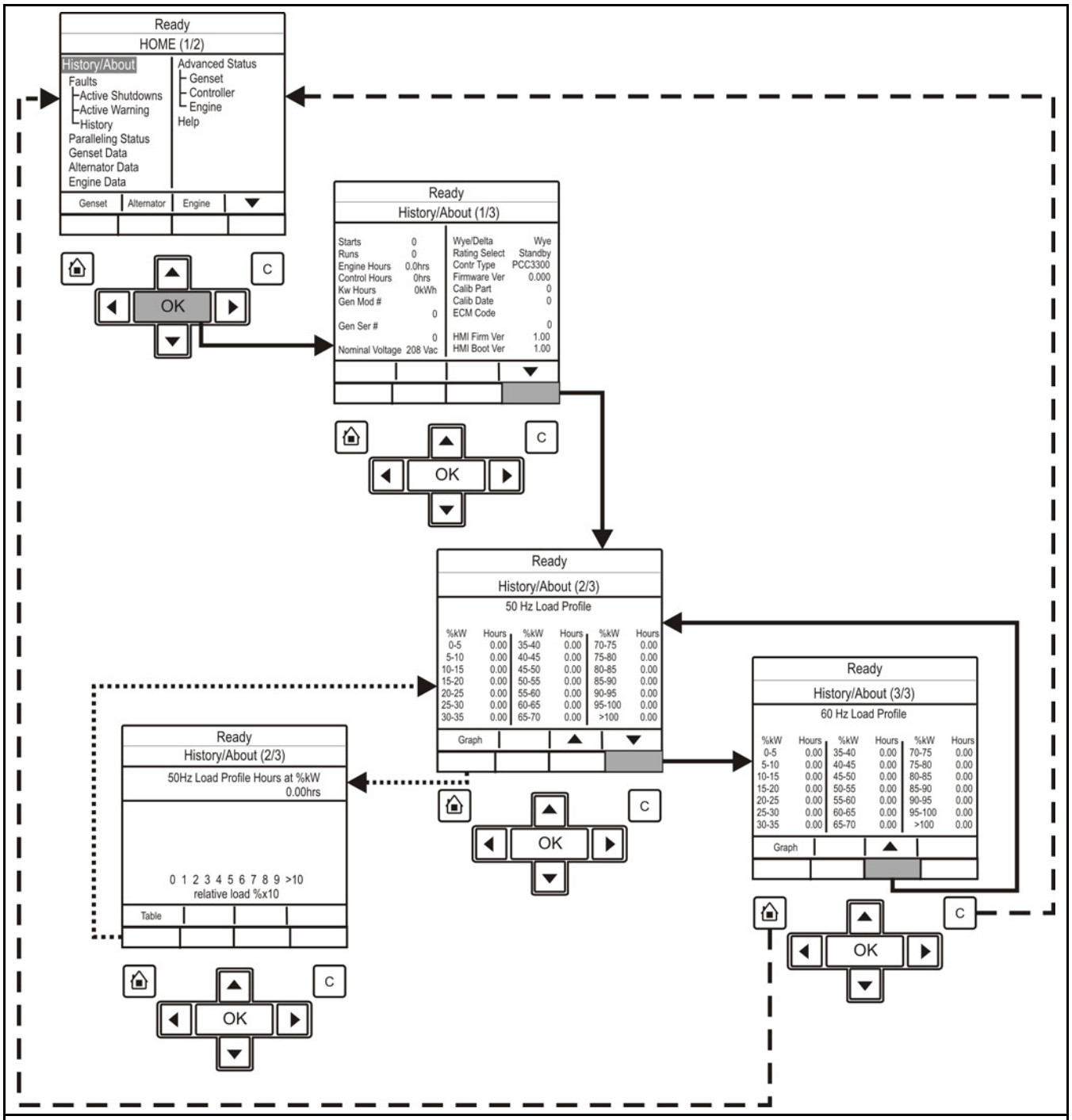
To navigate from the Home menu, toggle down until the History/About line of text is highlighted and press the **OK** button. This information is displayed over three pages. Use the two soft-key buttons below the up and down arrows (▲ and ▼) to toggle between the pages.

This screen displays the historical information about the generator set.

TABLE 30. HISTORY/ABOUT

Name	Description
Start Attempts (Starts)	Total number of start attempts Allowed values: 0~65535
Total Number of Runs (Runs)	Total number of generator set runs Allowed values: 0~65535
Engine Running Time (Engine Hours)	Total engine run time in hours

Name	Description
Controller On Time (Control Hours)	Controller ON time in hours, Upper limit is 136 years Allowed values: 0~4294967291 hours
Generator Set Total Net (Kw Hours)	Generator set total net kWh accumulation Allowed values: -2147483648~2147483643 kWh
Generator Set Model Number (Gen Mod #)	Number identifying the model of this generator set (Password level: 2)
Generator Set Serial Number (Gen Ser #)	Serial number identifying this generator set
Generator Set Nominal Voltage (Nominal Voltage)	Generator set nominal line-line voltage (Password level: 1) Allowed values: 1~45000 Vac (Default: 1 VAC)
Generator Set Delta/Wye Connection (Wye/Delta)	Delta or Wye for generator set connection (Password level: 1) Allowed values: Delta, Wye (Default: Wye)
Application Rating Select (Rating Select)	Selects generator set's standby/prime/base application rating (Password level: 1) Allowed values: Standby, Prime, Base (Default: Standby)
Controller Device Type (Contr Type)	Used by the PC Tool Allowed values: PCC3300, PCC3300 with Masterless Load Demand (MLD)
Calibration Part Number (Calib Part)	The unique calibration part number loaded into this control (Password level: 3)
Calibration Revision Date (Calib Date)	The revision date of the calibration part number loaded into this control (Password level: 3)
Firmware Version Number (Contr H/ ver)	Version of S/W loaded into this control, obtained from PCC Filename



Press the **Home** Button to return to the main menu at any time.

Press the **C** Button to return to the previous menus. Settings will not be saved when this button is pressed.

FIGURE 26. HISTORY/ABOUT MENU - TYPICAL DATA

6.5 Operator Panel - Alternator Data Operator Menu

Figure 27 on page 87 shows a block representation of a typical Alternator Data menu. To navigate from the Home menu (HOME [1/2]), press the soft-key button below the function button indicating Alternator. This will take you directly to the Alternator menu.

The Alternator Data menu is displayed on one page.

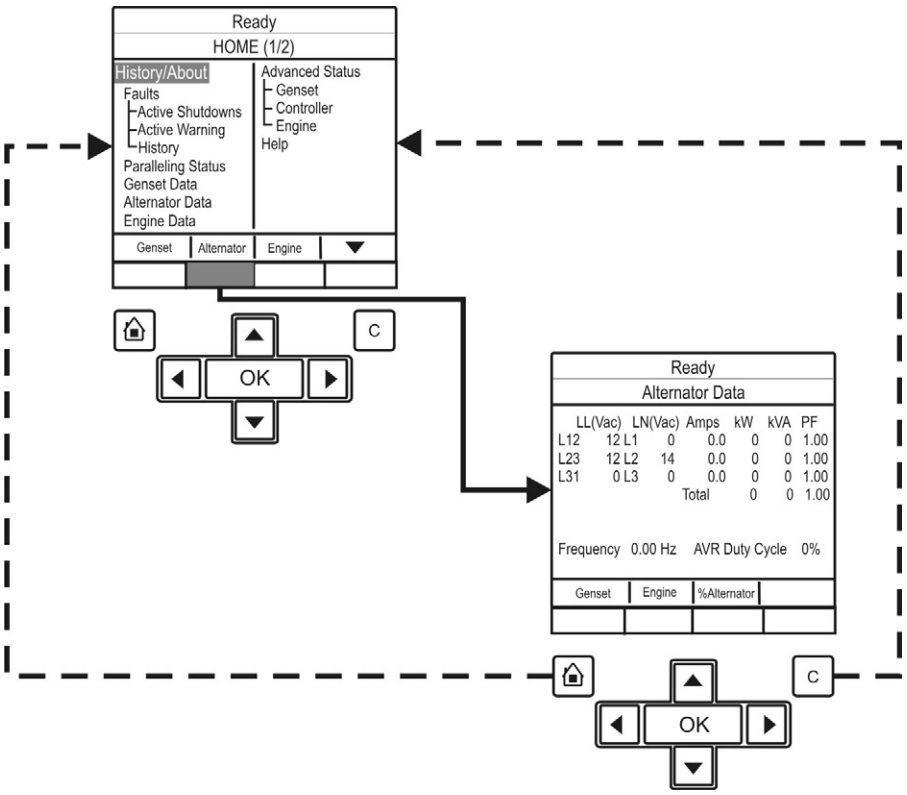
Alternator Data

Use this menu to look at the status of the alternator. This menu displays line-to-line voltage, line-to-neutral voltage, current, and generator set power (in kVA). Some values are not available, dependent on the number of phases (one or three) and whether or not the application has current transformers.

TABLE 31. ALTERNATOR DATA

Parameter	Description
Genset L1L2 Voltage	Generator Set L1L2 voltage
Genset L1N Voltage	Generator Set L1N voltage
Genset L1 Current	Monitors the genset L1 current value
Genset L1 kW	Generator Set L1 kW
Genset L1 KVA	Generator Set L1 kVA
Genset L1 Power Factor	Generator Set L2 power factor Allowed values: -1.28~1.27 PF
Genset L2L3 Voltage	Generator Set L2L3 voltage
Genset L2N Voltage	Generator Set L2N voltage
Genset L2 Current	Generator Set L2 current
Genset L2 kW	Generator Set L2 kW Allowed values: -32768~32762 kW
Genset L2 KVA	Generator Set L2 kVA
Genset L2 Power Factor	Generator Set L2 power factor Allowed values: -1.28~1.27 PF
Genset L3L1 Voltage	Generator Set L3L1 voltage
Genset L3N Voltage	Generator Set L3N voltage
Genset L3 Current	Generator Set L3 current
Genset L3 kW	Generator Set L3 kW Allowed values: -32768~32762 kW

Parameter	Description
Genset L3 KVA	Generator Set L3 kVA Allowed values: 0~4294967.29 kVA
Genset L3 Power Factor	Generator Set L3 power factor Allowed values: -1.28~1.22 PF
Genset Total kW	Generator Set total kW
Genset Total KVA	Generator Set total kVA
Genset Total Power Factor	Generator Set L1 power factor
Genset Frequency	Generator Set frequency
AVR PWM Command	The AVR PWM software command. Linear relationship between counts and % duty cycle with 10000 counts=100% duty cycle
Genset Neutral Current	Generator Set neutral current ***NOTICE*** **This is not displayed if the neutral current is not available.**
Ground Current	Ground current
Alternator Temperatures	
Non-Drive End Bearing Temperature (Aux101)	Monitor point for the Non-Drive End Bearing Temp input from the I/O Module. Allowed values: -65534~65535 °F
Drive End Bearing Temperature (Aux101)	Monitor point for the Drive End Bearing Temp input from the I/O Module. Allowed values: -32767~32762 °F
Alternator Temperature 1 (Aux101)	Monitor point for the Alternator Temp 1 input from the Aux 101 I/O Module. Allowed values: -32767~32762 °F
Alternator Temperature 2 (Aux101)	Monitor point for the Alternator Temp 2 input from the Aux 101 I/O Module. Allowed values: -32767~32762 °F
Alternator Temperature 3 (Aux101)	Monitor point for the Alternator Temp 3 input from the Aux 101 I/O Module. Allowed values: -32767~32762 °F



Press the **Home** Button to return to the main menu at any time.

Press the **C** Button to return to the previous menus. Settings will not be saved when this button is pressed.

FIGURE 27. ALTERNATOR DATA MENU - TYPICAL DATA

6.6 Operator Panel - Faults and Warnings Menus

The Faults and Warning menu is divided into three main sub-sections; Shutdown Faults (Active Shutdowns); Warning Faults (Active Warnings); and Faults History (showing up to thirty-two faults that have been cleared).

Fault Menu

Figure 28 shows a block representation of a typical Fault menu.

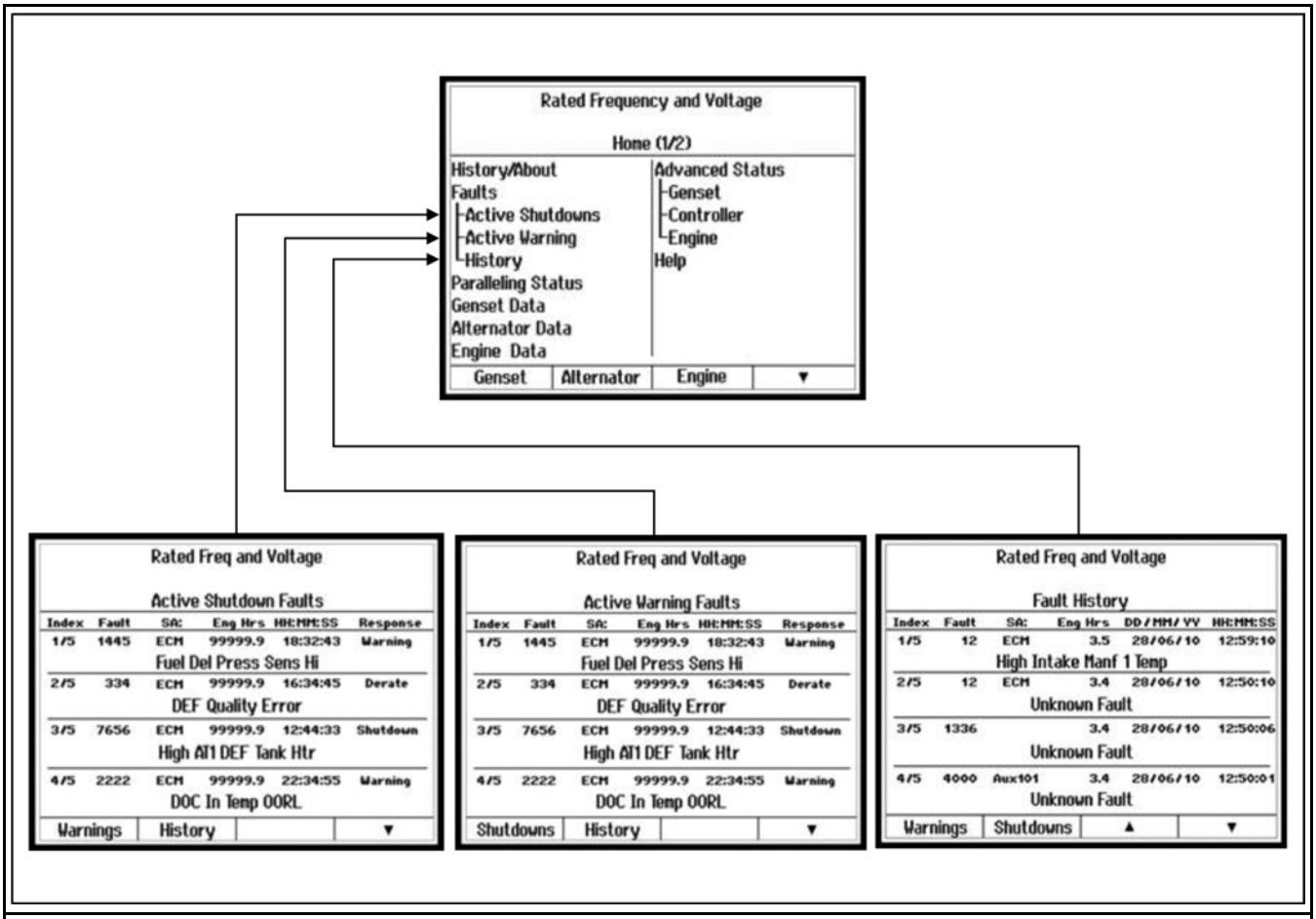
To navigate from the Home menu, select the Fault menu from the Home screen.

The fault menu home screen displays, which is divided into three main sub-sections: Active Faults (Active Shutdowns), Active Warnings, and Faults History. The Faults History screen shows up to thirty-two faults that have been cleared.

Use the two soft-key buttons below the up and down arrows (▲ and ▼) to toggle between the pages.

TABLE 32. ACTIVE SHUTDOWN FAULTS

Name	Description
Index	This is the index number of the fault
Fault	This is the fault code
SA	Source Address This is the controller that identified the fault, it is blank if the PCC identified the fault
Eng Hrs	This is how many hours the engine had run (not necessarily continuously) when the fault was generated
YY/MM/DD	This is the date the fault was generated
HH:MM:SS	This is the time the fault was generated
Response	This is the type of fault that was generated
	The name of the fault appears below the rest of the information



Press the **Home** Button to return to the main menu at any time.

Press the **C** Button to return to the previous menus. Settings will not be saved when this button is pressed.

FIGURE 28. FAULTS MENU

Fault Messages

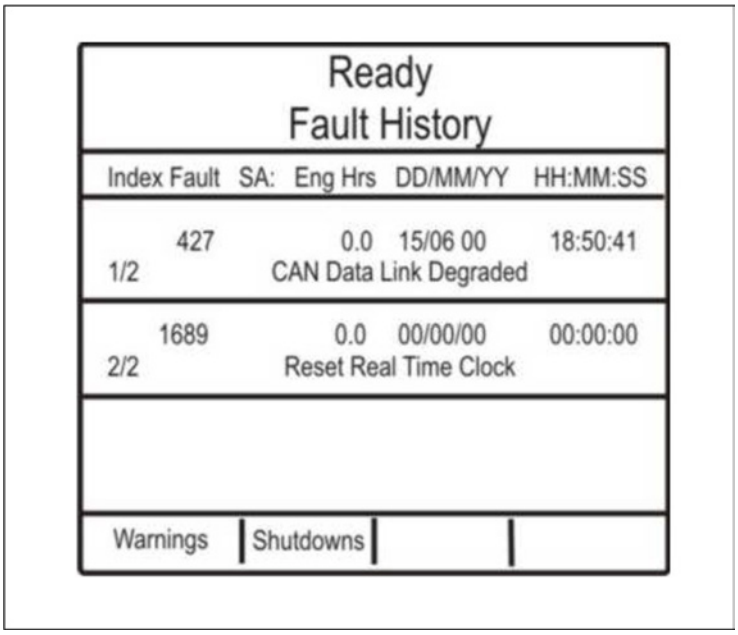


FIGURE 29. FAULT MESSAGE DISPLAY SCREEN

A Fault message is an indicator of a Warning or Shutdown condition. It includes the fault number, and a short description. It also includes where the fault occurred if the generator set control did not detect the fault and is simply reporting the fault. The Troubleshooting chapter of the Operator manual provides a list of the fault codes, types, and message displayed.

Active and acknowledged faults may be viewed in the Faults menu.

Fault Acknowledgement

Shutdown faults must be acknowledged after the fault has been corrected. If in Auto or Manual mode, the control must be set to Stop mode (Off). Faults are cleared from the control panel display by pressing the **Reset** button.

Faults are re-announced if they are detected again after being acknowledged. See the Reset Button section.

NOTICE
Faults may also be acknowledged when in Auto mode and the Remote Start command is removed. Contact you authorized distributor for this option.

Warning Fault Menu

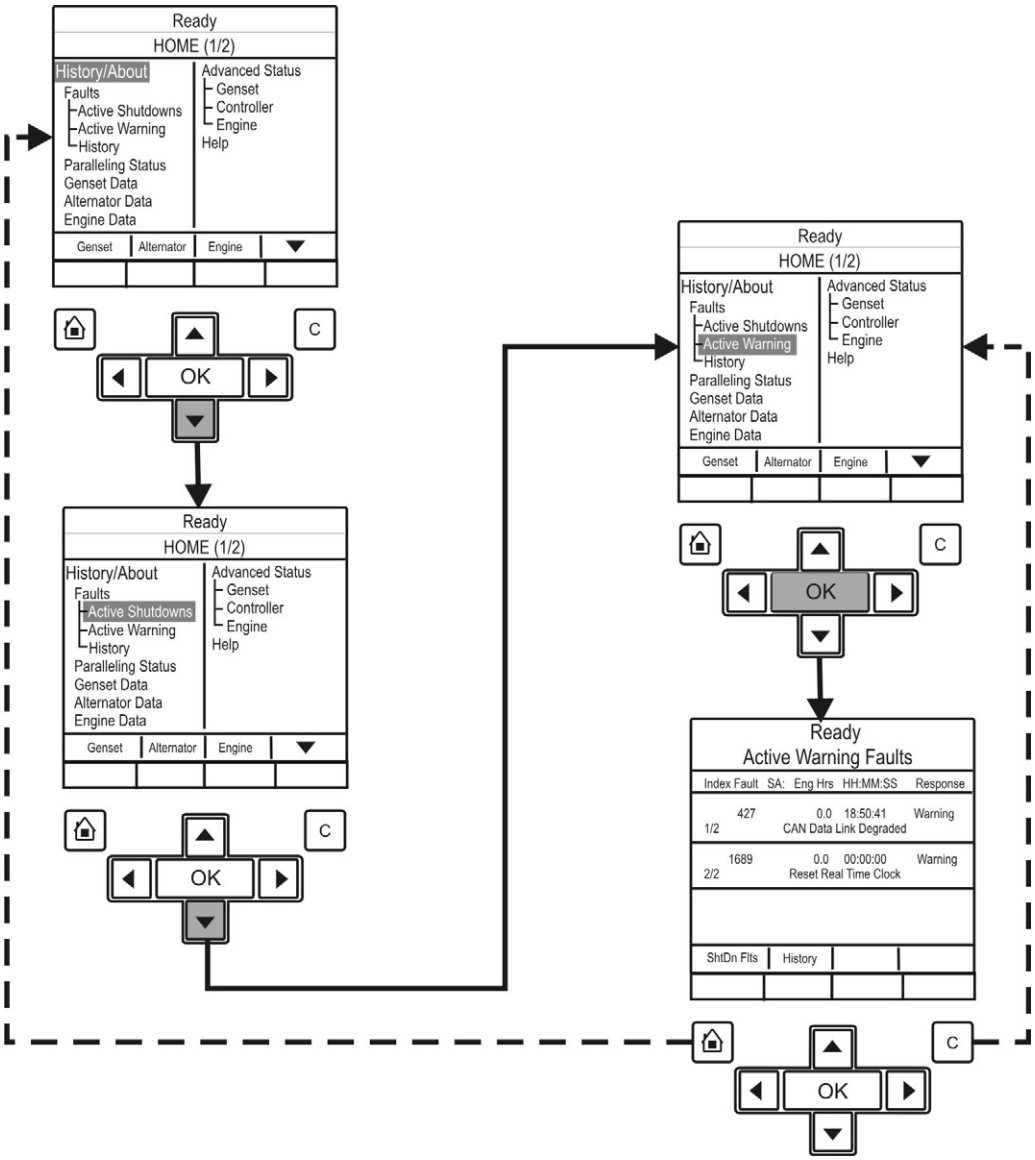
Figure 30 shows a block representation of a typical Warning Fault menu.

To navigate from the Home menu, toggle down until the Faults - Warning Fault line of text is highlighted and press the **OK** button. This will then display information regarding the current fault. Use the two soft-key buttons below the up and down arrows (▲ and ▼) to toggle between the pages.

This menu displays up to thirty-two faults. The same event/fault code may appear multiple times if detected by different sources.

TABLE 33. ACTIVE WARNING FAULTS

Name	Description
Index	This is the index number of the fault
Fault	This is the Fault code
SA	Source Address This is the controller that identified the fault, it is blank if the PCC identified the fault
Eng Hrs	This is how many hours the engine had run (not necessarily continuously) when the fault was generated
HH:MM:SS	This is the time the fault was generated.
Response	This is the type of fault that was generated.
	The name of the fault appears below the rest of the information



Press the **Home** Button to return to the main menu at any time.

Press the **C** Button to return to the previous menus. Settings will not be saved when this button is pressed.

FIGURE 30. WARNING FAULT MENU - TYPICAL DATA

Faults History Data Operator Menu

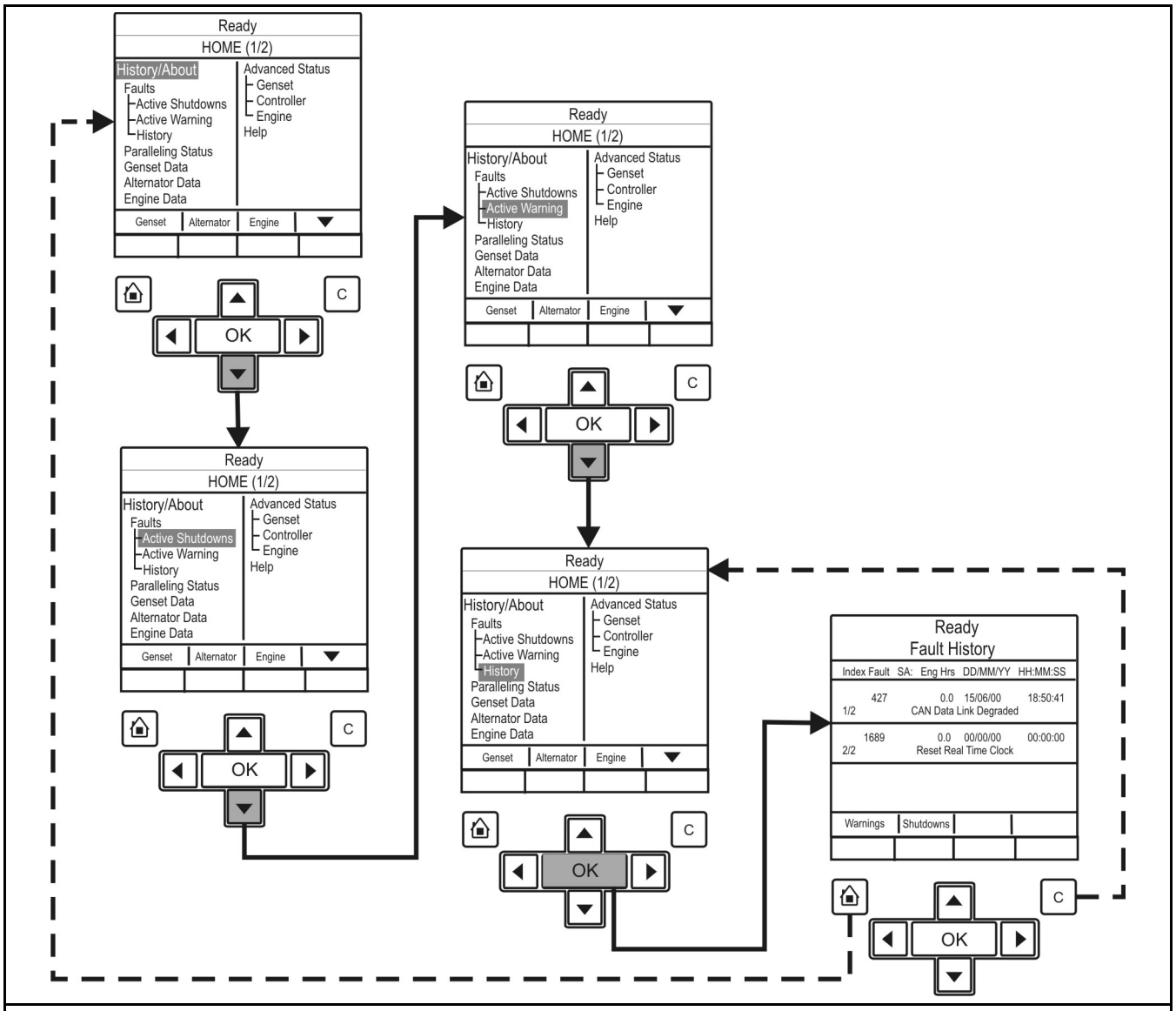
Figure 31 on page 94 shows a block representation of a typical Fault History menu.

To navigate from the Home menu, toggle down until the Faults -History line of text is highlighted and press the **OK** button. This will then display information regarding the fault(s) history. Use the two soft-key buttons below the up and down arrows (▲ and ▼) to toggle between the pages.

This menu displays up to thirty-two faults. The same event/fault code may appear multiple times if detected by different sources.

TABLE 34. FAULTS HISTORY DATA OPERATOR MENU

Name	Description
Index	This is the index number of the fault.
Fault	This is the Fault code.
SA	This is the controller that identified the fault. It is blank if the PowerCommand® 3.3 control identified the fault.
Engine Hrs	This is how many hours the engine had run (not necessarily continuously) when the fault was generated.
MM/DD/YY	This is the date the fault was generated.
HH/MM/SS	This is the time the fault was generated.
	The name of the fault appears below the rest of the information.



Press the **Home** Button to return to the main menu at any time.

Press the **C** Button to return to the previous menus. Settings will not be saved when this button is pressed.

FIGURE 31. HISTORY FAULT MENU - TYPICAL DATA

6.7 Operator Panel - Adjust Menu

Figure 32 on page 96 shows a block representation of a typical Adjust menu. To navigate from the Home menu (HOME [1/2]), press the soft-key button below the down arrow in the display window. This will show the second page of the Home menu (HOME [2/2]). With the Adjust line of text highlighted, press the **OK** button to display the information.

The Adjust menu is displayed on one page.

NOTICE

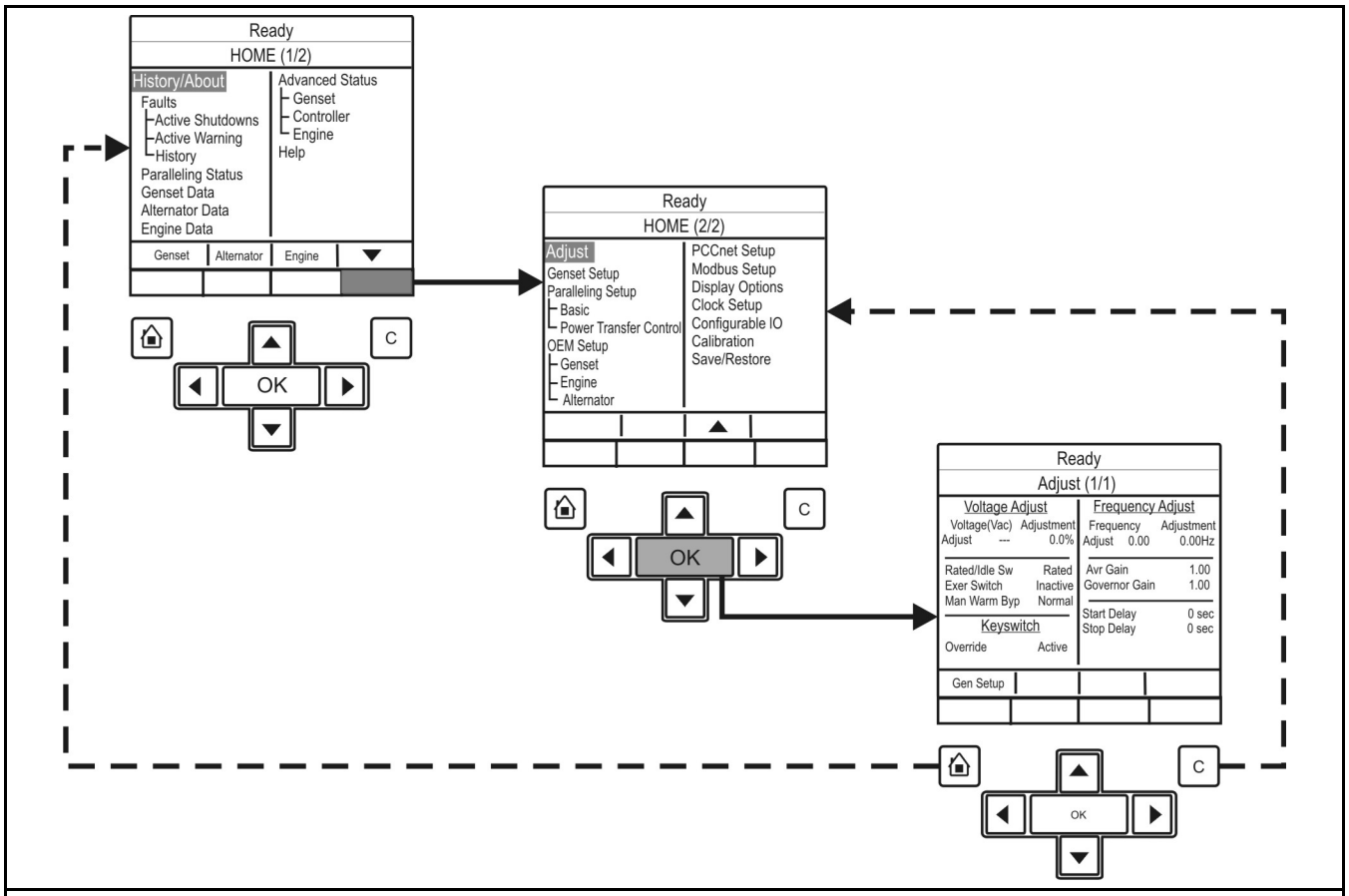
Should any of these settings require amendment or change, please contact your authorized service center.

NOTICE

You cannot adjust Frequency Adjust or Voltage Adjust if Paralleling Speed Control Mode is set to Synchronize, Load Share, or Load Govern.

TABLE 35. OPERATOR PANEL - ADJUST MENU

Name	Description
Voltage Adjust	
Genset LL Average Voltage	Generator set Line-to-Line average voltage.
Voltage Adjust	A trim that allows the user to add/subtract an offset to the nominal voltage when calculating the voltage setpoint. Allowed values: -5~5%. Default value: 0%
Rated/Idle Sw	Allowed values: Rated, Idle. Default value: Rated.
Exer Switch	Allowed values: Inactive, Active. Default value: Inactive.
Man Warm Byp	Allowed values: Normal, Bypass Warmup.
Keyswitch	
Keyswitch Status	Allowed values: Inactive, Active.
Frequency Adjust	
Final Frequency Reference	The frequency scaled version of the final speed reference. Allowed values: 0~100 Hz.
Frequency Adjust	A method of adding in a frequency offset to the base frequency subject to high and low limit calibrations. Allowed values: -6~6 Hz. Default value: 0 Hz.
Avr Gain	A trim that allows the user to modify the overall gains of the AVR. Allowed values: 0.05~10. Default value: 1
Governor Gain	A trim that allows the user to modify the overall gain of the governor. Allowed values: 0.05~10. Default value: 1
Start Delay	Allowed values: 0~300 seconds. Default value: 0 seconds.
Stop Delay	Allowed values: 0~600 seconds. Default value: 0 seconds.



Press the **Home** Button to return to the main menu at any time.

Press the **C** Button to return to the previous menus. Settings will not be saved when this button is pressed.

FIGURE 32. ADJUST MENU - TYPICAL DATA

6.8 Operator Panel - Genset Setup Data Operator Menu

Figure 33 on page 98 shows block representations of the Genset Setup Data menu.

Page down to the second page of the Home menu (using the two soft-key buttons below the up and down arrows [▲ and ▼]). See Section 6.2 on page 75.

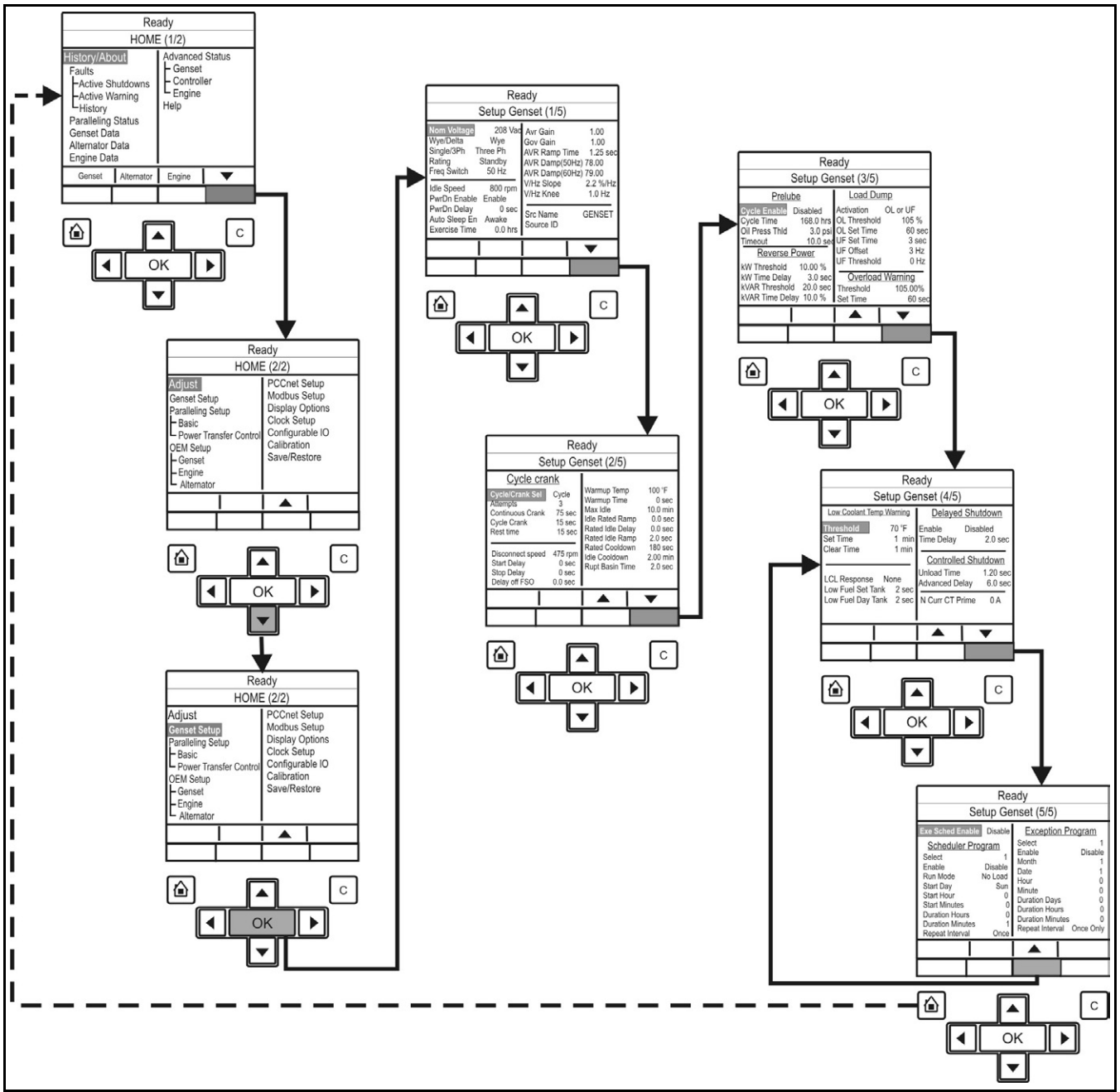
In the HOME (2/2) menu, using the up and down arrows, toggle down again until the Genset Setup text is highlighted.

With the Genset Setup line of text highlighted, press the **OK** button. This will display the Setup Menu.

Use the two soft-key buttons below the up and down arrows [▲ and ▼] to page through the five pages of the Setup data.

NOTICE

Should any of these settings require amendment or change, please contact your authorized service center.



Press the **Home** Button to return to the main menu at any time.

Press the **C** Button to return to the previous menus. Settings will not be saved when this button is pressed.

FIGURE 33. SETUP DATA MENU - TYPICAL DATA

6.9 Operator Panel - Paralleling Status Menu

Figure 34 on page 106 and Figure 35 on page 107 show block representations of a typical Paralleling Status menu. This screen varies according to the application type. See Generator Set Application Type section in the Operator manual.

In the HOME (1/2) menu, using the up and down arrows, toggle down until the Paralleling Status text is highlighted.

With the Paralleling Status line of text highlighted, press the **OK** button. This will then display the Paralleling Status Menu (if the generator set application type is not Standalone).

Use the two soft-key buttons below the up and down arrows [▲ and ▼] to page through the six pages of the Paralleling Status menu.

TABLE 36. PARALLELING STATUS

Parameter	Description
ES State	Internal paralleling status variable Allowed values: Standby, Dead Bus, Synchronize, Load Share, Load Govern
Genset LL Average Voltage	Generator set line-to-line average voltage
Genset Frequency	Generator set frequency
Genset Total kW	Generator set total kW
Genset Total kVAR	Generator set total kVAR
Genset Total Power Factor	Generator set L1 power factor
Genset CB Position Status	Indicates generator set breaker position Allowed values: Open, Closed, Not Available
Phase Match Error	Phase error signal for the synchronizer control algorithm
Load Demand Stop Command	Indicates status of the final load demand stop command to generator set start stop control function Allowed values: Don't Stop, Stop
Genset Bus LL Average Voltage	Generator set bus line-to-line average voltage
Genset Bus Frequency	Generator set bus line frequency
Genset Bus Total kW	Generator set bus total kW
Genset Bus Total kVAR	Generator set bus total kVAR
Genset Bus Total Power Factor	Generator set bus total power factor

Parameter	Description
Synchronizer Status	Indicates whether synchronizer is on or off Allowed values: Synchronizer Off, Synchronizer On
Bus Status	Indicates status of the bus Allowed values: Unavailable, Dead, Live
Permissive Close Allowed	Indicates when permissive sync check conditions have been met Allowed values: Not Allowed, Allowed
Phase Matched	Sync check phase match status Allowed values: Inactive, Active
Voltage Matched	Sync check voltage match status Allowed values: Inactive, Active
Frequency Matched	Sync check frequency match status Allowed values: Inactive, Active
Phase Match Error	Phase error signal for the synchronizer control algorithm
Frequency Match Error	Frequency match error value used by frequency match PI loop
Voltage Match Error	Voltage match error value used by voltage match PI loop
Load Govern kW Target	Indicates the final target set point for generator set kW output when paralleled to utility
Load Govern kVAR Target	Indicates the final target set point for generator set kVAR output when paralleled to utility
Power Factor Setpoint	Indicates analog input power factor set point derived from kVAR analog input
Paralleling Speed Control Mode	Indicates which speed control algorithm is in effect Allowed values: Isochronous, Droop, Synchronize, Load Share, Load Govern
Paralleling Voltage Control Mode	Indicates which voltage control algorithm is in effect Allowed values: Isochronous, Droop, Synchronize, Load Share, Load Govern
Genset CB Tripped Command	Generator set CB tripped command Allowed values: Inactive, Active (Default: Inactive)
Genset CB Inhibit Command	Generator set CB inhibit command Allowed values: Inactive, Active (Default: Inactive)
Load Share %kW Error	Indicates %kW error for load sharing control algorithm
Utility CB Tripped Command	Utility CB tripped command Allowed values: Inactive, Active (Default: Inactive)
Load Share %kVAR Error	Indicates %kVAR error for load sharing control algorithm

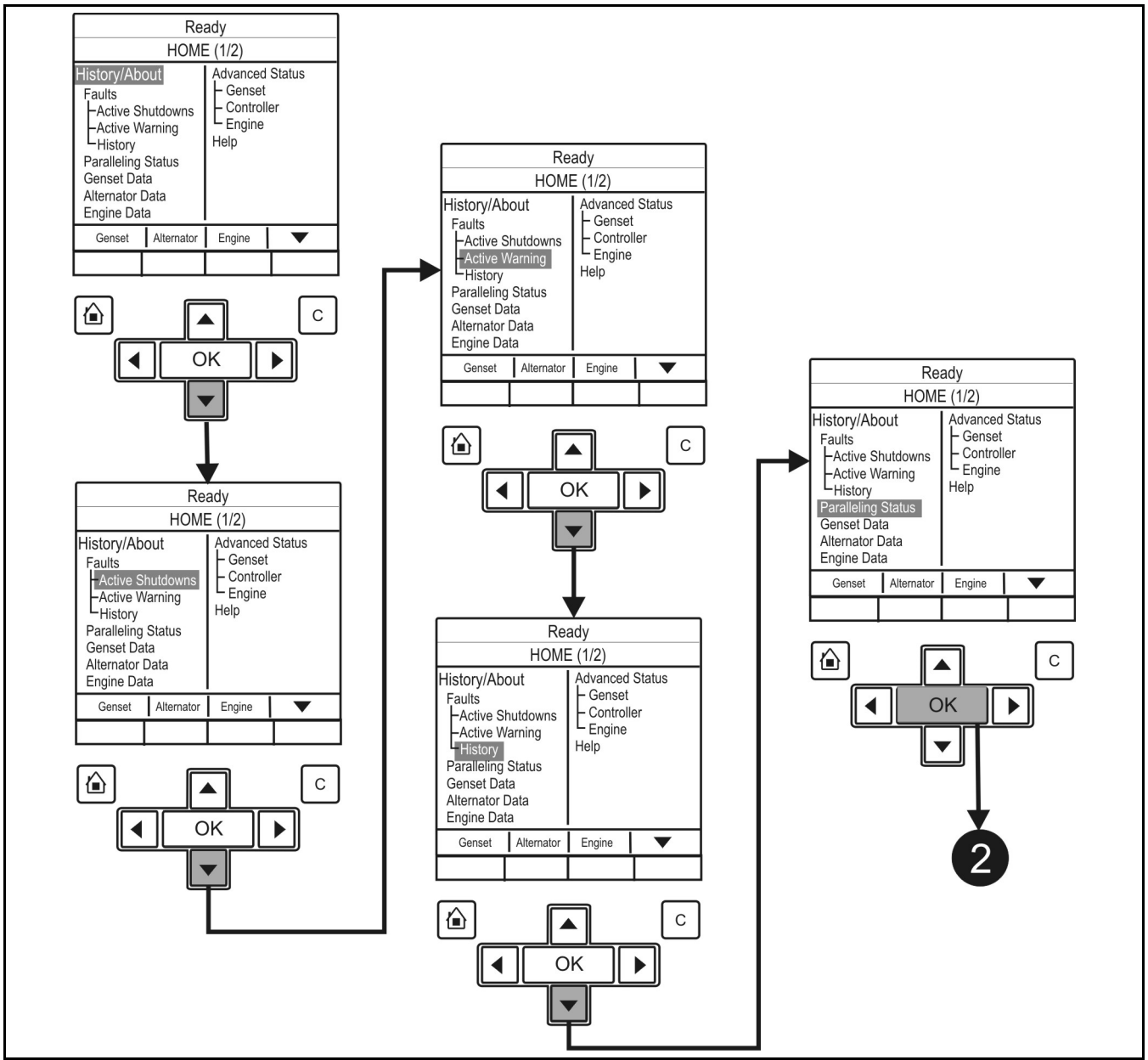
Parameter	Description
Utility CB Inhibit Command	Utility CB inhibit command Allowed values: Inactive, Active (Default: Inactive)
Utility Current Based Breaker Position	Indicates utility breaker position based on current
Genset Bus L1L2 Voltage	Generator set bus L1L2 voltage
Genset Bus L2L3 Voltage	Generator set bus L2L3 voltage
Genset Bus L3L1 Voltage	Generator set bus L3L1 voltage
Genset Bus L1N Voltage	Generator set bus L1N voltage
Genset Bus L2N Voltage	Generator set bus L2N voltage
Genset Bus L3N Voltage	Generator set bus L3N voltage
Genset Bus L1 Current	Generator set bus L1 current Allowed values: 0~65530 amps
Genset Bus L2 Current	Generator set bus L2 current Allowed values: 0~65530 amps
Genset Bus L3 Current	Generator set bus L3 current Allowed values: 0~65530 amps
Genset Bus L1 kW	Generator set bus L1 kW Allowed values: -32768~32762 kW
Genset Bus L2 kW	Generator set bus L2 kW Allowed values: -32768~32762 kW
Genset Bus L3 kW	Generator set bus L3 kW Allowed values: -32768~32762 kW
Genset Bus Total kW	Generator set bus total kW
Genset Bus L1 kVA	Generator set bus L1 kVA
Genset Bus L2 kVA	Generator set bus L2 kVA
Genset Bus L3 kVA	Generator set bus L3 kVA
Genset Bus Total kVA	Generator set bus total kVA
Genset Bus L1 Power Factor	Generator set bus L1 power factor Allowed values: -1.28~1.22 PF
Genset Bus L2 Power Factor	Generator set bus L2 power factor Allowed values: -1.28~1.22 PF

Parameter	Description
Genset Bus L3 Power Factor	Generator set bus L3 power factor Allowed values: -1.28~1.22 PF
Genset Bus Total Power Factor	Generator set bus total power factor
Genset Bus Frequency	Generator set bus line frequency
Genset Bus L1 Positive kWh	Generator set bus L1 positive kWh accumulation Allowed values: 0~4294967290 kWh (Default: 0 kWh)
Genset Bus L2 Positive kWh	Generator set bus L2 positive kWh accumulation Allowed values: 0~4294967290 kWh (Default: 0 kWh)
Genset Bus L3 Positive kWh	Generator set bus L3 positive kWh accumulation Allowed values: 0~4294967290 kWh (Default: 0 kWh)
Genset Bus Total Positive kWh	Generator set bus total positive kWh accumulation
Genset Bus L1 Negative kWh	Generator set bus L1 negative kWh accumulation Allowed values: 0~4294967290 kWh (Default: 0 kWh)
Genset Bus L2 Negative kWh	Generator set bus L2 negative kWh accumulation Allowed values: 0~4294967290 kWh (Default: 0 kWh)
Genset Bus L3 Negative kWh	Generator set bus L3 negative kWh accumulation Allowed values: 0~4294967290 kWh (Default: 0 kWh)
Genset Bus Total Negative kWh	Generator set bus total negative kWh accumulation
Genset Bus Total Net kWh	Generator set bus total net kWh accumulation
Genset Bus L1 Positive kVARh	Generator set bus L1 positive kVARh accumulation Allowed values: 0~4294967290 kVARh (Default: 0 kVARh)
Genset Bus L2 Positive kVARh	Generator set bus L2 positive kVARh accumulation Allowed values: 0~4294967290 kVARh (Default: 0 kVARh)
Genset Bus L3 Positive kVARh	Generator set bus L3 positive kVARh accumulation Allowed values: 0~4294967290 kVARh (Default: 0 kVARh)
Genset Bus Total Positive kVARh	Generator set bus total positive kVARh accumulation
Genset Bus L1 Negative kVARh	Generator set bus L1 negative kVARh accumulation Allowed values: 0~4294967290 kVARh (Default: 0 kVARh)
Genset Bus L2 Negative kVARh	Generator set bus L2 negative kVARh accumulation Allowed values: 0~4294967290 kVARh (Default: 0 kVARh)

Parameter	Description
Genset Bus L3 Negative kVARh	Generator set bus L3 negative kVARh accumulation Allowed values: 0~4294967290 kVARh (Default: 0 kVARh)
Genset Bus Total Negative kVARh	Generator set bus total negative kVARh accumulation
Genset Bus Total Net kVARh	Generator set bus total net kVARh accumulation
Genset Bus Reset All Energy Meters Timestamp - Hour	Time stamp of when energy meters were last reset Allowed values: 0~23 (Default: 0)
Genset Bus Reset All Energy Meters Timestamp - Minute	Time stamp of when energy meters were last reset Allowed values: 0~59 (Default: 0)
Genset Bus Reset All Energy Meters Timestamp - Second	Time stamp of when energy meters were last reset Allowed values: 0~59 (Default: 0)
Genset Bus Reset All Energy Meters Timestamp - Day	Time stamp of when energy meters were last reset Allowed values: 1~31 (Default: 1)
Genset Bus Reset All Energy Meters Timestamp - Month	Time stamp of when energy meters were last reset Allowed values: 1~12 (Default: 1)
Genset Bus Reset All Energy Meters Timestamp - Year	Time stamp of when energy meters were last reset Allowed values: 0~99 (Default: 0)
Genset Bus L1 kVAR	Generator set bus L1 kVAR Allowed values: -32678~32672 kVAR
Genset Bus L2 kVAR	Generator set bus L2 kVAR Allowed values: -32768~32762 kVAR
Genset Bus L3 kVAR	Generator set bus L3 kVAR Allowed values: -32768~32762 kVAR
Genset Bus L1L2 Phase Difference	Generator set bus L1L2 voltage phase angle
Genset Bus L2L3 Phase Difference	Generator set bus L2L3 voltage phase angle
Genset Bus L3L1 Phase Difference	Generator set bus L3L1 voltage phase angle
Genset Bus L1 kVAh	Generator set bus L1 kVAh accumulation Allowed values: 0~4294967290 kVAh (Default: 0 kVAh)

Parameter	Description
Genset Bus L2 kVAh	Generator set bus L2 kVAh accumulation Allowed values: 0~4294967290 kVAh (Default: 0 kVAh)
Genset Bus L3 kVAh	Generator set bus L3 kVAh accumulation Allowed values: 0~4294967295 kVAh (Default: 0 kVAh)
Genset Bus Total kVAh	Generator set bus total kVAh accumulation
Genset Bus Phase Rotation	Generator set bus phase rotation Allowed values: L1-L2-L3, L1-L3-L2, Not Available
System Network Termination Resistor Switch Status	Indicates the status of the on-board CAN termination resistor switch (S1)
Load Demand State	Indicates the status of load demand operation PCC3300 MLD controls only
Load Demand Online Capacity	Indicates the total amount of online kW bus capacity for load demand Only generator sets which are eligible for load demand count PCC3300 MLD controls only
Load Demand Genset Bus Total kW	Indicates the total load of system network connected generator sets PCC3300 MLD controls only
Load Demand Surplus Capacity	Indicates the amount of unused online kW bus capacity (spinning reserve) PCC3300 MLD controls only
Load Demand Total Spare Capacity Requested	Indicates the total kW value of all currently active spare capacity requests in the system PCC3300 MLD controls only
Load Demand Spare Capacity Available	Indicates when the current load and spare capacity requirements are satisfied PCC3300 MLD controls only
Load Demand Next Stop Threshold (kW)	The kW load at which the next generator set will be stopped PCC3300 MLD controls only
Load Demand Next Start Threshold (kW)	The kW load at which the next generator set will be started PCC3300 MLD controls only
Load Demand Next Gen to Start	Indicates Genset ID of the next generator set to start PCC3300 MLD controls only
Load Demand Next Gen to Stop	Indicates Genset ID of the next generator set to stop PCC3300 MLD controls only

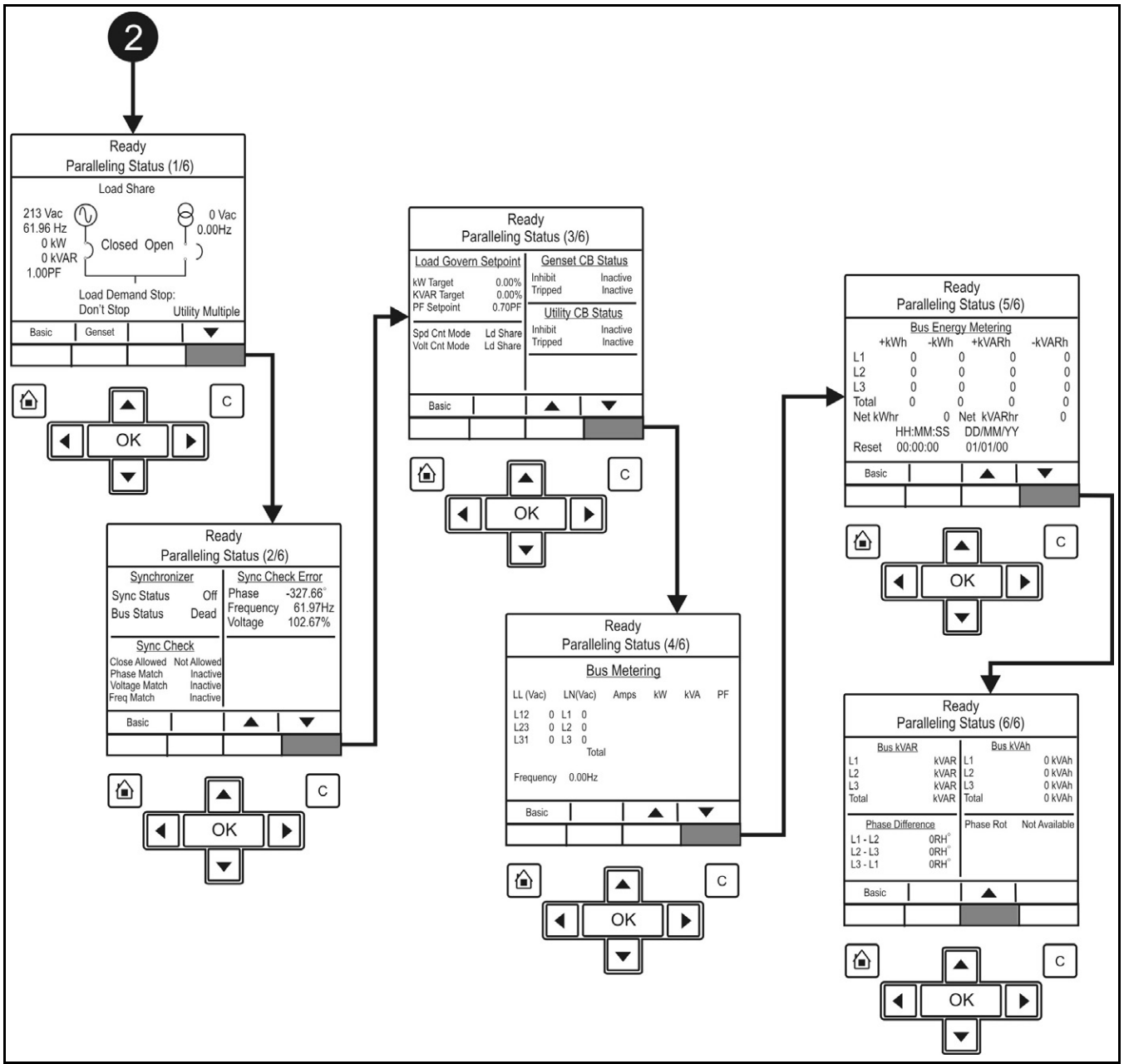
Parameter	Description
Load Demand Initial Delay Timer	Indicates the time remaining before generator sets are allowed to stop after initial start or after resuming from halted load demand This timer is set by Load Demand Initial Delay PCC3300 MLD controls only
Load Demand Start Delay Timer	Indicates the time remaining before next generator set is allowed to start This timer is set by Load Demand Start Delay PCC3300 MLD controls only
Load Demand Stop Delay Timer	Indicates the time remaining before next generator set is allowed to stop This timer is set by Load Demand Stop Delay PCC3300 MLD controls only
Load Demand Inhibit Local	Indicates the status of the Load Demand Inhibit input When Active all the generator sets will start PCC3300 MLD controls only
Load Demand Genset Status Table	Indicates the load demand priorities and status of all load demand system network connected generator sets PCC3300 MLD controls only
Genset ID	Generator set identifier. All load demand generator sets must have a unique Genset ID PCC3300 MLD controls only
Load Demand Genset Run Hours	Run hour accumulator used for load demand run hour equalization This is writable Allowed Values: 0~999999.9 hours (Default: 0 hours) PCC3300 MLD controls only
System Network Datalink Status	Indicates communication status of the local generator set on system network (used for load demand) PCC3300 MLD controls only
Load Demand Spare Capacity Request Status	Indicates the status of the spare capacity request input When Active additional spare capacity (set by Load Demand Spare Capacity Request Value) is requested PCC3300 MLD controls only



Press the **Home** Button to return to the main menu at any time.

Press the **C** Button to return to the previous menus. Settings will not be saved when this button is pressed.

FIGURE 34. PARALLELING STATUS DATA SHEET 1 - TYPICAL DATA



Press the **Home** Button to return to the main menu at any time.

Press the **C** Button to return to the previous menus. Settings will not be saved when this button is pressed.

FIGURE 35. PARALLELING STATUS DATA SHEET 2 - TYPICAL DATA

6.10 Operator Panel - Paralleling/Basic Setup Menu

Figure 36 on page 109 and Figure 37 on page 110 show block representations of a typical Paralleling/Basic Setup menu.

To navigate from the HOME (1/2) menu, press the soft-key button below the down arrow in the display window. This will show the second page of the home menu (HOME 2/2). Using the up and down arrows, toggle down until the Paralleling/Basic Setup text is highlighted.

With the Paralleling/Basic Setup line of text highlighted, press the **OK** button. This will then display the Paralleling/Basic Setup Menu.

NOTICE

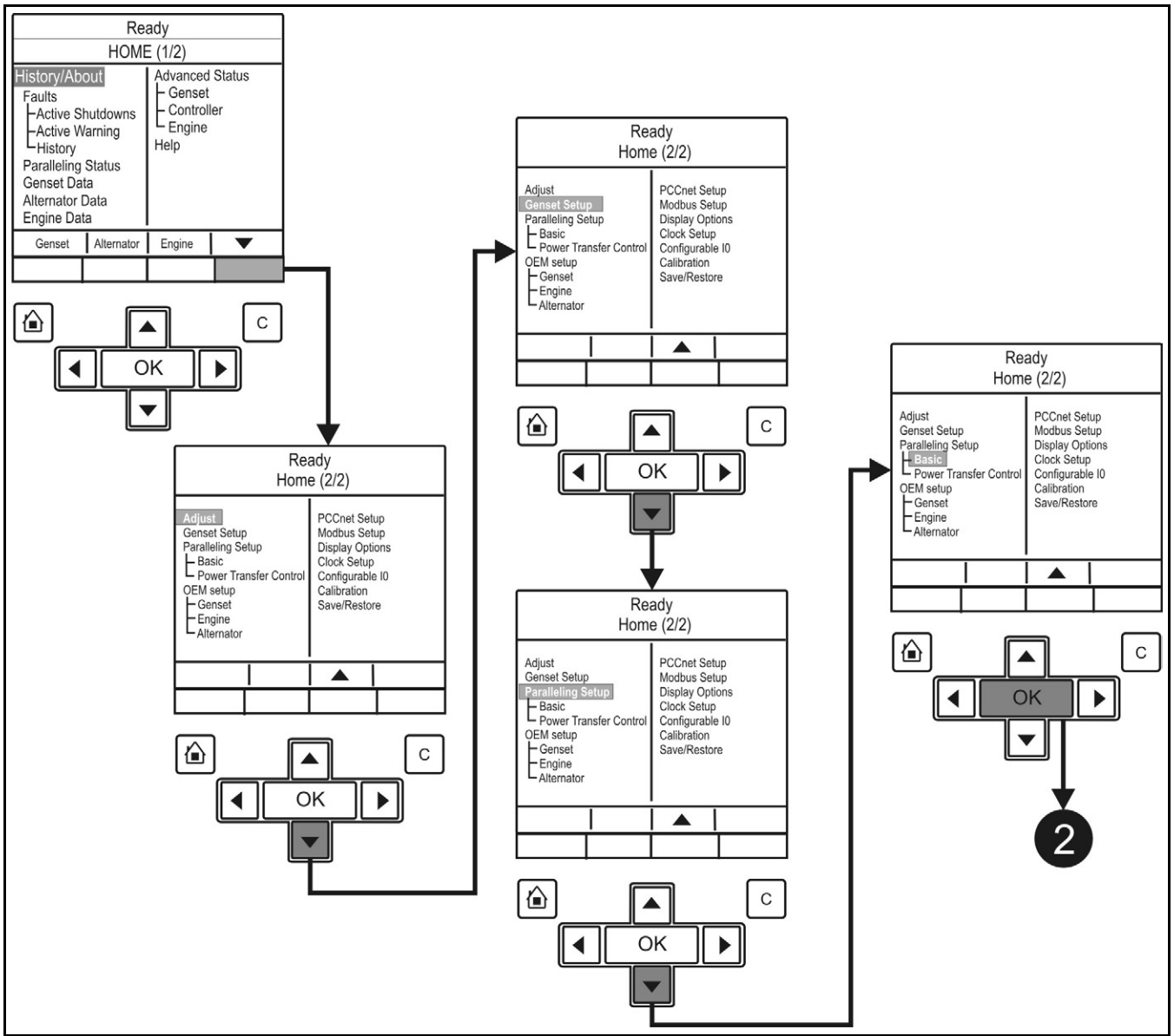
It is also possible to short-cut to this menu by pressing the soft-key button below the function button indicating Basic within the Paralleling Status menu.

Use the two soft-key buttons below the up and down arrows [▲ and ▼] to page through the six pages of the Paralleling/Basic Setup menu.

The adjustment of these submenus is intended for qualified service personnel and site personnel only and may require a USER password for this operation. If a password is required the USER password menu will appear when you try to modify the menu. (Refer to Password Menu in the Operator manual).

NOTICE

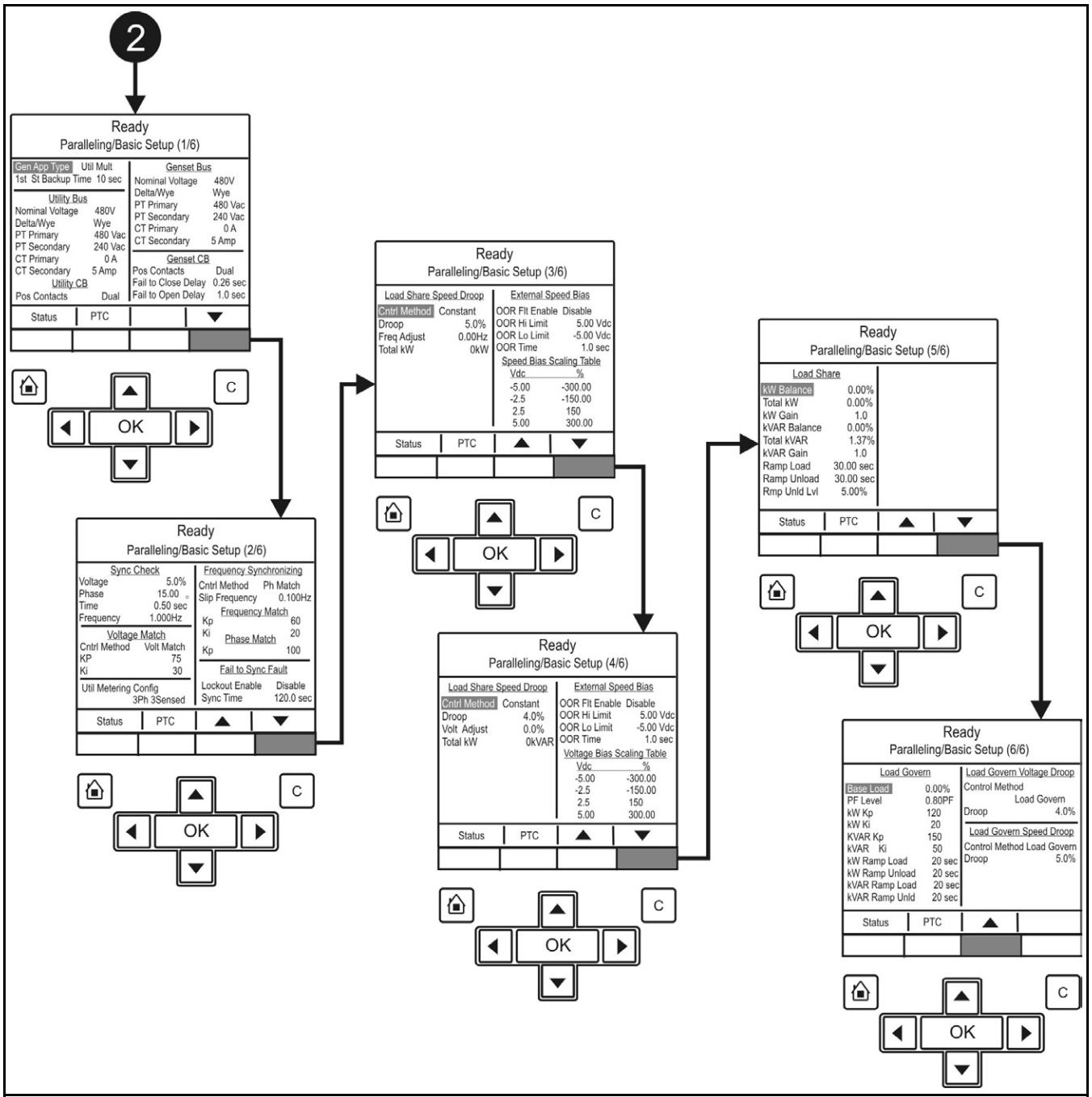
Should any of these settings require amendment or change, please contact your authorized service center.



Press the **Home** Button to return to the main menu at any time.

Press the **C** Button to return to the previous menus. Settings will not be saved when this button is pressed.

FIGURE 36. PARALLELING/BASIC DATA (SHEET 1 OF 2) - TYPICAL DATA



Press the **Home** Button to return to the main menu at any time.

Press the **C** Button to return to the previous menus. Settings will not be saved when this button is pressed.

FIGURE 37. PARALLELING/BASIC DATA (SHEET 2 OF 2) - TYPICAL DATA

6.11 Paralleling

Refer to the 3.3 Controller Service Manual (0900-0670) for additional paralleling information.

6.12 Selecting Operating Modes

Passwords and Mode Change Access

Entering the Mode Change Access Code

The Mode Change submenus are intended for qualified service personnel and site personnel only, and by default will require an Access password. If a password is required, the Mode Change – Access Code menu will appear when you try to switch between Auto, Manual Run, or Stop modes.

To enter the mode access code:

1. With the first character highlighted, press the up and down arrow buttons until the required value is displayed.
2. Press the left arrow button to move to the next numeric character.
3. Repeat steps 1 and 2 until all characters of the Access Code are correct.
4. After you have completed entering the password, press the **OK** button.

FIGURE 38. MODE CHANGE ACCESS CODE DISPLAY SCREEN

NOTICE
If an incorrect password is entered, the Operator menu that was displayed before Auto, Manual Run, or Stop mode was selected is re-displayed.

Passwords

It is possible for the operator to view every parameter in the graphical display; however, a password may be required before adjustment of a parameter is permitted. The generator set will prompt you if a password is required and inform you of the level of password required.

TABLE 37. PASSWORDS

Level	Description	Comment
0	No password	None required
1	Operator password	Restricted
2	Service password	Restricted
3	Engineering password	Restricted

Selecting Manual Run Mode

NOTICE
When changing modes, the generator set may start or stop without warning. Make sure there is no danger to personnel or equipment should the generator set unexpectedly start or stop.

Press the **Manual** button 

and then (within ten seconds) the **Start** button 

. This bypasses the "Time Delay to Start" function and activates the engine control system and the starting system.

If the engine does not start, the starter disengages after a specified period of time and the controller indicates a "Fail to Start" shutdown.

The generator set can be configured for 1–7 starting cycles with set times for crank and rest periods for all starting modes (manual/remote). The default setting is 3 start cycles, composed of 15 seconds of cranking and 30 seconds of rest.

NOTICE
The InPower service tool or access to the setup menu is required to change the cycle number, and crank and rest times. Contact your authorized distributor for assistance.

To clear a Fail to Start shutdown, press the **Stop** button 

and then press the **Reset** button 

.

Before attempting to restart, wait 2 minutes for the starter motor to cool and repeat the starting procedure. If the engine does not run after a second attempt, refer to the Troubleshooting section.

Selecting Auto Mode

NOTICE

When changing modes, the generator set can start or stop without warning. Make sure there is no danger to personnel or equipment should the generator set start or stop.

NOTICE

Make sure that it is safe to do so before proceeding to change the mode.

Press the **Auto** button. 

This allows the generator set to be started from a remote switch or device (e.g. transfer switch).

In response to the **Remote Start**, the control lights the Remote Start indicator and initiates the starting sequence. This start incorporates a Time Delay to Start function.

NOTICE

The InPower service tool or access to the setup menu is required to change the cycle number, and crank and rest times. Contact your authorized distributor for assistance.

NOTICE

Should a remote start signal be received, the generator set starts automatically. Make sure there is no danger to personnel or equipment should the generator set start without warning.

The starting/stopping sequence for a remote start is as follows:

1. A **remote start** signal is received at the customer connection on the generator set. This input signal is received from a transfer switch, a remote start switch, etc.
2. The Time Delay to Start (0–300 seconds) begins.
3. When the Time Delay to Start has expired, the engine starts. Once it has reached its rated speed and voltage, the generator set is available for use.
4. When the **remote start** signal is removed, a Time Delay to Stop (0–600 seconds) begins. This time delay is used to transfer the load (if connected to another power source) and let the engine cool down.
5. When the Time Delay to Stop has expired, the engine stops.

NOTICE

If the emergency stop or control off button is pressed at any time during the starting/stopping sequence, the engine immediately stops, bypassing the cooldown sequence.

Selecting Off Mode

NOTICE

When changing modes, the generator set can stop without warning. Make sure there is no danger to personnel or equipment should the generator set stop.

Press the **Stop** button 

to put the generator set into the Off mode. This disables Auto and Manual modes.

If the generator set is running in either Manual or Auto mode, and the **Stop** button is pressed, the engine will shut down. This action may include a cool down run.

NOTICE

Do not perform a hot shutdown under load; a hot shutdown may result in engine damage.

6.13 Changing the Display Language on the HMI

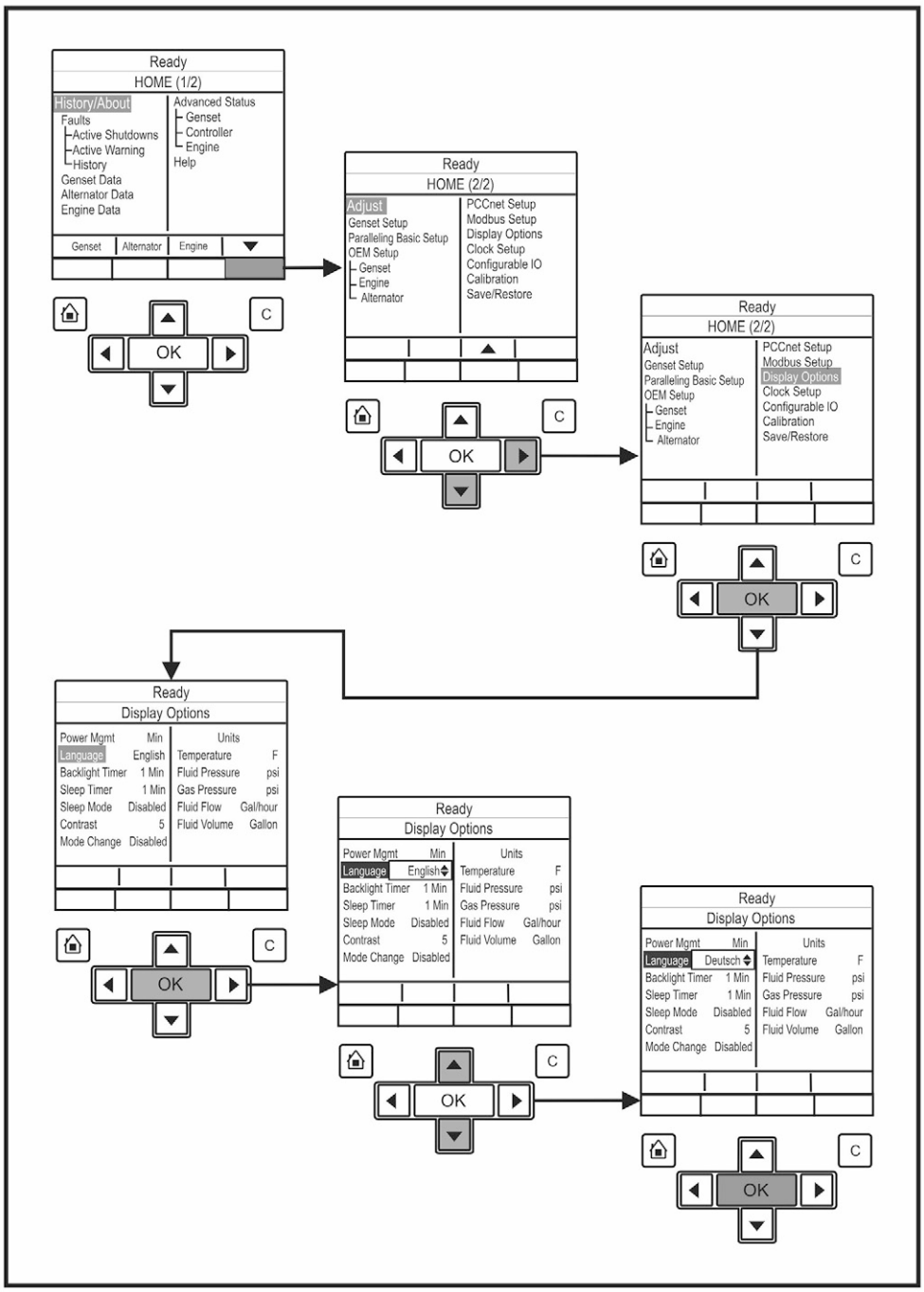


FIGURE 39. CHANGING THE DISPLAY LANGAUGE MENUS

1. Press the **Home** button.
2. Press the page down arrow to move to Home page 2.
3. Use the scroll arrows to select **Display Options** and press **OK**.
4. Scroll down to select **Languages** and press **OK**.

5. Use the up and down scroll buttons to select the required language and press **OK**.

6.14 PowerCommand 3.3 Customer Connections

Configurable Outputs

Each output has normally-open contacts. The contacts can be used to control small devices, indicator lamps, or relays.

The contacts are programmed to energize by entering a code number for the desired event.

NOTICE
Using the InPower service tool or accessing the Setup submenus is required to modify the customer outputs. Contact an authorized distributor for assistance.

Contact Ratings for Configurable Outputs

TABLE 38. CONTACT RATINGS FOR CONFIGURABLE OUTPUTS

Description	Value
Maximum Voltage	30 VDC
Maximum Current	3.5 Amps

Remote Start

⚠ WARNING
Automated Machinery ***Accidental or remote starting of the generator set can cause severe personal injury or death.*** ***Make sure that the generator set cannot be started accidentally or remotely before starting work on the generator.***

NOTICE
Remote start terminals should only be used for a remote application. Remote start terminals are not to be shorted if the remote start function is not intended to be used.

When the control is in Auto/Remote mode, grounding this input initiates the engine cranking and start sequence. This circuit must be opened to permit resetting a shutdown condition with the Reset input. (The remote stop is actually the removal of the remote start signal to the control.)

Configurable Inputs

Grounding any one of these inputs activates the corresponding warning or shutdown sequence.

External sensing equipment must be connected to the designated digital input.

The nature of the fault is an optional customer selection. Example inputs: Low Coolant Level, Low Fuel Level, Ground Fault, etc.

NOTICE
The InPower service tool or access to the Setup submenus is required to modify the customer fault inputs. Contact your authorized distributor for assistance.

Remote Emergency Stop

Opening this input causes an immediate shutdown. Emergency stop must be reset at the remote panel, then at the front panel.

6.15 Before Starting

NOTICE
One operator should be in complete charge, or working under the direction of someone who is in charge. Remember that, upon starting the engine, cables and switchgear will become energized, possibly for the first time. Furthermore, equipment that does not form part of the generator set installation may become electrically charged. Only authorized and competent personnel should carry out this work.

NOTICE
Do not use the Emergency Stop button to shut down an engine unless a serious fault develops. The Emergency Stop button must not be used for a normal shut-down as this will prevent a cooling down run in which the lubricating oil and engine coolant carry the heat away from the engine combustion chamber and bearings in a safe manner.

NOTICE
Diesel engines only: **Avoid off-load running for other than short periods. A minimum loading of 30% is recommended. The engine must be shut down as soon as possible after the appropriate functions have been checked.**

NOTICE
Gaseous engines only**: Avoid running the generator set at no-load and light-loads for extended periods.**

Before attempting to start the generator set, the operator should read through this entire manual and the specific literature provided as part of the documentation pack supplied with the generator set. It is essential that the operator be completely familiar with the generator set and the PowerCommand® control.

The sub-sections below cover the systems used to start and stop the generator set.

Before starting the generator set, make sure that exhaust and fuel fittings are tight and properly positioned, and that proper maintenance and pre-start checks have been performed.

During starting, automatic checks are carried out for the integrity of various protection systems. The PowerCommand® control will not allow the generator set to continue the starting sequence if the integrity of a sensor is considered to be in doubt.

The generator set can be configured for a number of starting cycles (one to seven) with set times for crank and rest periods for all starting modes (manual/remote). The default setting is for three start cycles, composed of fifteen seconds of cranking and 30 seconds of rest.

NOTICE

The number of starting cycles, and the crank and rest times are set from within the Setup menu. Trained and experienced service personnel are required to change the default setting. Contact your authorized Cummins distributor.

Operator’s Pre-Start Checks

⚠ WARNING

Arc Flash and Shock Hazard

Electric arc flash can cause electrical shock, severe burns, or death.

Make sure the alternator is dry before the generator set is operated.

⚠ 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.

NOTICE

***Radiators with two fill necks only:* Both fill necks must be filled when the cooling system has been drained.**

TABLE 39. OPERATOR'S PRE-START CHECKS

Check	Description
Fuel Supply *(Diesel Only)*	Make sure that: • The fuel tank is filled to the normal level with clean water-free fuel and that the fuel system is primed; • All the valves required for operation are open; • There are no leaks and that all fittings are tight; and • If equipped, the auxiliary fuel system is properly connected.
DEF Supply *(If Equipped)*	Make sure that: • The DEF tank is filled to the normal full level with DEF, and • If equipped, the auxiliary DEF system is properly connected.
Lubrication	With the engine stationary, check the engine lubrication oil level and make sure that the correct level is always maintained.
Coolant	Check the engine coolant level and make sure that the level is always maintained at the coolant expansion tank. Fill the cooling system to the bottom of the fill neck in the radiator fill or expansion tank. Do not check while the engine is hot.
Cooling Air Inlet/Outlets	Make sure that the cooling air inlets/outlets are unobstructed.
Exhaust Outlet	Make sure that: • Exhaust components are secured and not warped; • The exhaust outlet is unobstructed; • No combustible materials are near the system; • Gases are discharged away from building openings; and • There are no leaks and that all fittings are tight.
Batteries	Make sure that the batteries are charged, and that all connections are clean, correct and tight (if applicable).
Auxiliary Powered AC Supplies	Make sure that all auxiliary equipment is receiving power from the customer's supply.
Emergency Stop	Make sure that the emergency stop button is fully operational.

Starting at Operator Panel (Manual Run Mode)

NOTICE
Make sure that all Pre-start Checks are carried out before starting the generator set. Do not attempt to start the generator set until it is safe to do so. Warn all others in the vicinity of the generator set and the connected load equipment that the generator set is about to start.

1. Make sure the main circuit breaker is in the open position.

2. To start the generator set in the **Manual Run** mode, press the **Manual** button 

on the Operator Panel, and then press the **Start** button 

within ten seconds. Failure to press the **Start** button within this time will result in the generator set changing to the **Off** mode. (Refer also to Selecting Manual Run Mode section).

NOTICE
If the mode change access code feature has been enabled, enter the access code when prompted.(See Mode Change Access Code section).

The PowerCommand® control will initiate a starter cranking signal and will perform an automatically sequenced manual start, under a complete engine protection system combined with full monitoring capability. This will activate the engine control system and the starting procedure. The starter will begin cranking, and after a few seconds the engine will start and the starter will disconnect.

Should the engine fail to start, the starter will disengage after a specified period of time and the control will indicate a Fail to Start shutdown.

To clear a Fail to Start shutdown, press the **Stop** button 

and then press the **Reset** button. 

Before attempting to re-start wait a minimum of two minutes for the starter motor to cool and then repeat the starting procedure. If the engine does not run after a second attempt, refer to the Troubleshooting section in the Operator manual.

To disable **Manual** mode, change to **Auto** or **Off** mode. If the generator set is running when it leaves **Manual** mode, it will continue to run if **Auto** mode has been selected and the remote start signal is active. If there is no active remote start signal, the generator set will stop.

3. Allow the engine to warm up and reach the rated speed and voltage.

4. Close the main circuit breaker and apply load as required.

Starting from Remote Location (Auto Mode)

NOTICE
Make sure that all Pre-start Checks are carried out before starting the generator set. Do not attempt to start the generator set until it is safe to do so. Warn all others in the vicinity that the generator set is about to start.

To start the generator set in the **Auto Run** mode, select the **Auto** button 

from the Operator Panel. (Refer also to Selecting Auto Mode section).

Only on receipt of a remote start signal, and after a Time Delay to Start, will the PowerCommand® control initiate the starting sequence as above.

The Remote Start LED will be lit.

There are two start modes that are selectable for the Remote Start input; one for non-emergency start and the other for emergency start. In the non-emergency start, the control will complete the warm-up at idle. In the emergency mode, the generator set will omit the warm-up stage and proceed directly to rated speed and voltage.

In response to the Remote Start signal, or the control detects the loss of the Utility voltage, the control lights the Remote Start indicator and initiates the starting sequence, except for the following:

- In Auto position, the control will complete the Time Delay to Start (0 to 300 seconds) for a non-emergency start signal only.

NOTICE
If the mode change access code feature has been enabled, enter the access code when prompted. (See Mode Change Access Code section).

To disable **Auto** mode, change to **Manual** or **Stop** mode. Refer to Stopping in the Operator manual.

Cold Starting with Loads

NOTICE
Make sure that all pre-start checks are carried out before starting the generator set. Do not attempt to start the generator set until it is safe to do so. Warn all others in the vicinity that the generator set is about to start.

Use a coolant heater if a separate source of power is available. The optional heater available from Cummins will help provide reliable starting under adverse weather conditions. Be sure the voltage of the separate power source is correct for the heater element rating.

Cummins recommends equipping standby generator sets (life safety systems) with engine water jacket coolant heaters to maintain the coolant at a minimum of 32 °C (90 °F) and, for most applications, accept the emergency load in ten seconds or less. Although most Cummins generator sets will start in temperatures down to -32 °C (-25 °F) when equipped with engine water jacket coolant heaters, it might take more than ten seconds to warm the engine up before a load can be applied when ambient temperatures are below 4 °C (40 °F).

The **Low Coolant Temp** (Code 1435) message along with the lighting of the **Warning** LED are provided to alert the operator of a possible delay in accepting the load. The engine cold sensing logic initiates a warning when the engine water jacket coolant temperature falls below 21 °C (70 °F). In applications where the ambient temperature falls below 4 °C (40 °F), a cold engine may be indicated even though

the coolant heaters are connected and functioning correctly. Under these conditions, although the generator set may start, it may not be able to accept load within ten seconds. When this condition occurs, check the coolant heaters for correct operation. If the coolant heaters are operating correctly, other precautions may be necessary to warm the engine before applying a load.

Checking Coolant Heater Operation

⚠ WARNING

Hot Surfaces
Contact with the hot surfaces can cause severe burns.
Avoid contact with hot parts. Allow hot parts to completely cool.

Do not touch the cooling system outlet hose. The coolant heater is operating if radiant heat can be felt with your hand held close to the outlet hose and the engine is not running.

Appendix A. Fuel Line Selection

Table of Contents

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:

TABLE 41. REQUIRED INFORMATION FOR DETERMINING FUEL LINE SIZE

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 43. NFPA EQUIVALENT LENGTHS OF PIPE FITTINGS AND VALVES IN FEET (METERS)

Type of Fitting	Nominal Inch (Millimeters) Pipe Size								
	1/2 (15)	3/4 (20)	1 (25)	1-1/4 (32)	1-1/2 (40)	2 (50)	2-1/2 (65)	3 (80)	4 (100)
90° Std. Elbow or Tee Reduced ½.	1.6 (0.5)	2.0 (0.6)	2.6 (0.8)	3.3 (1.0)	4.0 (1.2)	5.0 (1.5)	6.0 (1.8)	7.5 (2.3)	10.0 (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 (0.2)	0.9 (0.3)	1.3 (0.4)	1.7 (0.5)	2.1 (0.6)	2.6 (0.8)	3.2 (1.0)	4.0 (1.2)	5.2 (1.6)
180° Std. Bend	2.5 (0.8)	3.2 (1.0)	4.1 (1.2)	5.6 (1.7)	6.3 (1.9)	8.2 (2.5)	10.0 (3.1)	12.0 (3.7)	17.0 (5.2)
TEE, Side Inlet or Outlet	3.0 (0.9)	4.0 (1.2)	5.0 (1.5)	7.0 (2.1)	8.0 (2.4)	10.0 (3.0)	12.0 (3.7)	15.0 (4.6)	21.0 (6.4)

Type of Fitting	Nominal Inch (Millimeters) Pipe Size								
	1/2 (15)	3/4 (20)	1 (25)	1-1/4 (32)	1-1/2 (40)	2 (50)	2-1/2 (65)	3 (80)	4 (100)
Foot Valve and Strainer	3.7 (1.1)	4.9 (1.5)	7.5 (2.3)	8.9 (2.7)	11.0 (3.4)	15.0 (4.6)	18.0 (5.5)	22.0 (6.7)	29.0 (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, Fully Open	18.0 (5.5)	22.0 (6.7)	29.0 (8.8)	38.0 (11.6)	43.0 (13.1)	55.0 (16.8)	69.0 (21.0)	84.0 (25.6)	120.0 (36.6)
Angle Valve, Fully Open	7.0 (2.1)	9.0 (2.7)	12.0 (3.7)	15.0 (4.6)	18.0 (5.5)	24.0 (7.3)	29.0 (8.8)	35.0 (10.7)	47.0 (14.3)
Gate Valve, Fully Open	0.7 (0.2)	0.9 (0.3)	1.0 (0.3)	1.5 (0.5)	1.8 (0.5)	2.3 (0.7)	2.8 (0.9)	3.2 (1.0)	4.5 (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.
2. 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 45. NATURAL GAS SCHEDULE 40 METALLIC PIPE SIZING IN INCHES

Gas:	Natural
Inlet Pressure:	Less than 2 psi
Pressure Drop:	0.5 in. water column
Specific Gravity:	0.6

	Pipe Size													
Nominal:	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	10	12
Actual ID:	0.622	0.824	1.049	1.38	1.61	2.067	2.469	3.068	4.026	5.047	6.065	7.981	10.02	11.938
Length (ft)	**Capacity in Cubic Feet of Gas per Hour**													
10	172	360	678	1390	2090	4020	6400	11300	23100	41800	67600	139000	252000	399000
20	118	247	466	957	1430	2760	4400	7780	15900	28700	46500	95500	173000	275000
30	95	199	374	768	1150	2220	3530	6250	12700	23000	37300	76700	139000	220000
40	81	170	320	657	985	1900	3020	5350	10900	19700	31900	65600	119000	189000
50	72	151	284	583	873	1680	2680	4740	9660	17500	28300	58200	106000	167000
60	65	137	257	528	791	1520	2430	4290	8760	15800	25600	52700	95700	152000
70	60	126	237	486	728	1400	2230	3950	8050	14600	23600	48500	88100	139000
80	56	117	220	452	677	1300	2080	3670	7490	13600	22000	45100	81900	130000
90	52	110	207	424	635	1220	1950	3450	7030	12700	20600	42300	76900	122000
100	50	104	195	400	600	1160	1840	3260	6640	12000	19500	40000	72600	115000
125	44	92	173	355	532	1020	1630	2890	5890	10600	17200	35400	64300	102000
150	40	83	157	322	482	928	1480	2610	5330	9650	15600	32100	58300	92300
175	37	77	144	296	443	854	1360	2410	4910	8880	14400	29500	53600	84900
200	34	71	134	275	412	794	1270	2240	4560	8260	13400	27500	49900	79000
250	30	63	119	244	366	704	1120	1980	4050	7320	11900	24300	44200	70000
300	27	57	108	221	331	638	1020	1800	3670	6630	10700	22100	40100	63400
350	25	53	99	203	305	587	935	1650	3370	6100	9880	20300	36900	58400
400	23	49	92	189	283	546	870	1540	3140	5680	9190	18900	34300	54300
450	22	46	86	177	266	512	816	1440	2940	5330	8620	17700	32200	50900
500	21	43	82	168	251	484	771	1360	2780	5030	8150	16700	30400	48100
550	20	41	78	159	239	459	732	1290	2640	4780	7740	15900	28900	45700
600	19	39	74	152	228	438	699	1240	2520	4560	7380	15200	27500	43600

650	18	38	71	145	218	420	669	1180	2410	4360	7070	14500	26400	41800
700	17	36	68	140	209	403	643	1140	2320	4190	6790	14000	25300	40100
750	17	35	66	135	202	389	619	1090	2230	4040	6540	13400	24400	38600
800	16	34	63	130	195	375	598	1060	2160	3900	6320	13000	23600	37300
850	16	33	61	126	189	363	579	1020	2090	3780	6110	12600	22800	36100
900	15	32	59	122	183	352	561	992	2020	3660	5930	12200	22100	35000
950	15	31	58	118	178	342	545	963	1960	3550	5760	11800	21500	34000
1000	14	30	56	115	173	333	530	937	1910	3460	5600	11500	20900	33100
1100	14	28	53	109	164	316	503	890	1810	3280	5320	10900	19800	31400
1200	13	27	51	104	156	301	480	849	1730	3130	5070	10400	18900	30000
1300	12	26	49	100	150	289	460	813	1660	3000	4860	9980	18100	28700
1400	12	25	47	96	144	277	442	781	1590	2880	4670	9590	17400	27600
1500	11	24	45	93	139	267	426	752	1530	2780	4500	9240	16800	26600
1600	11	23	44	89	134	258	411	727	1480	2680	4340	8920	16200	25600
1700	11	22	42	86	130	250	398	703	1430	2590	4200	8630	15700	24800
1800	10	22	41	84	126	242	386	682	1390	2520	4070	8370	15200	24100
1900	10	21	40	81	122	235	375	662	1350	2440	3960	8130	14800	23400
2000	NA	20	39	79	119	229	364	644	1310	2380	3850	7910	14400	22700

TABLE 48. NATURAL GAS SEMIRIGID COPPER TUBING SIZING

Gas:	Natural
Inlet Pressure:	Less than 2 psi
Pressure Drop:	0.5 in. water column
Specific Gravity:	0.6

	Tube Size (in.)								
Nominal K & L:	1/4	3/8	1/2	5/8	3/4	1	1 1/4	1 1/2	2
Nominal ACR:	3/8	1/2	5/8	3/4	7/8	1 1/8	1 3/8	—	—
Outside:	0.375	0.5	0.625	0.75	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 Cubic Feet of Gas per Hour**								
10	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 capacities are based on Type K copper tubing inside diameter (shown), which has the smallest inside diameter of the copper tubing products.

TABLE 51. PROPANE VAPOR SCHEDULE 40 METALLIC PIPE SIZING

Gas:	Undiluted Propane
Inlet Pressure:	11.0 in. water column
Pressure Drop:	0.5 in. water column
Specific Gravity:	1.5
INTENDED USE: Pipe Sizing Between Single- or Second-Stage (Low-Pressure) Regulator and Appliance	

	Pipe Size (in.)								
Nominal Inside:	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4
Actual:	0.622	0.824	1.049	1.38	1.61	2.067	2.469	3.068	4.026
Length (ft.)	**Capacity in Thousands of BTU per 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	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
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 54. PROPANE VAPOR SEMIRIGID COPPER TUBING SIZING

Gas:	Undiluted Propane
Inlet Pressure:	11.0 in. water column
Pressure Drop:	0.5 in. water column
Specific Gravity:	1.5
INTENDED USE: Tube Sizing Between Single- or Second-Stage (Low-Pressure) Regulator and Appliance	

	Tube Size (in.)								
Nominal K& L:	1/4	3/8	1/2	5/8	3/4	1	1 1/4	1 1/2	2
Nominal ACR:	3/8	1/2	5/8	3/4	7/8	1 1/8	1 3/8	—	—
Outside:	0.375	0.5	0.625	0.75	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	93	188	329	467	997	1,800	2,830	5,890
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 capacities are based on Type K copper tubing inside diameter (shown), which has the smallest inside diameter of the copper tubing products.

TABLE 57. PROPANE SCHEDULE 40 IRON PIPE SIZING, LIQUID WITHDRAWAL (MAXIMUM CAPACITY OF PIPE IN CUBIC FEET OF GAS PER HOUR)*

Equivalent Length of Pipe (ft.)	Schedule 40 Iron Pipe Size (in.): Nominal (Inside Diameter)								
	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)
30	733	1,532	2,885	5,924	8,876	17,094	48,164	70,519	98,238
40	627	1,311	2,469	5,070	7,597	14,630	41,222	60,355	84,079

Equivalent Length of Pipe (ft.)	Schedule 40 Iron Pipe Size (in.): Nominal (Inside Diameter)								
	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)
50	556	1,162	2,189	4,494	6,733	12,966	36,534	53,492	74,518
60	504	1,053	1,983	4,072	6,100	11,748	33,103	48,467	67,519
70	463	969	1,824	3,746	5,612	10,808	30,454	44,589	62,116
80	431	901	1,697	3,484	5,221	10,055	28,331	41,482	57,787
90	404	845	1,593	3,269	4,899	9,434	26,583	38,921	54,220
100	382	798	1,504	3,088	4,627	8,912	25,110	36,764	51,216
150	307	641	1,208	2,480	3,716	7,156	20,164	29,523	41,128
200	262	549	1,034	2,122	3,180	6,125	17,258	25,268	35,200
250	233	486	916	1,881	2,819	5,428	15,295	22,395	31,198
300	211	441	830	1,705	2,554	4,919	13,859	20,291	28,267
350	194	405	764	1,568	2,349	4,525	12,750	18,667	26,006
400	180	377	711	1,459	2,186	4,209	11,861	17,366	24,193
450	169	354	667	1,369	2,051	3,950	11,129	16,295	22,700
500	160	334	630	1,293	1,937	3,731	10,512	15,391	21,442
600	145	303	571	1,172	1,755	3,380	9,525	13,946	19,428
700	133	279	525	1,078	1,615	3,110	8,763	12,830	17,873
800	124	259	488	1,003	1,502	2,893	8,152	11,936	16,628
900	116	243	458	941	1,409	2,715	7,649	11,199	15,601
1000	110	230	433	889	1,331	2,564	7,225	10,579	14,737
1500	88	184	348	713	1,069	2,059	5,802	8,495	11,834
2000	76	158	297	611	915	1,762	4,966	7,271	10,128

*Pipe size recommendations are based on schedule 40 black iron pipe.

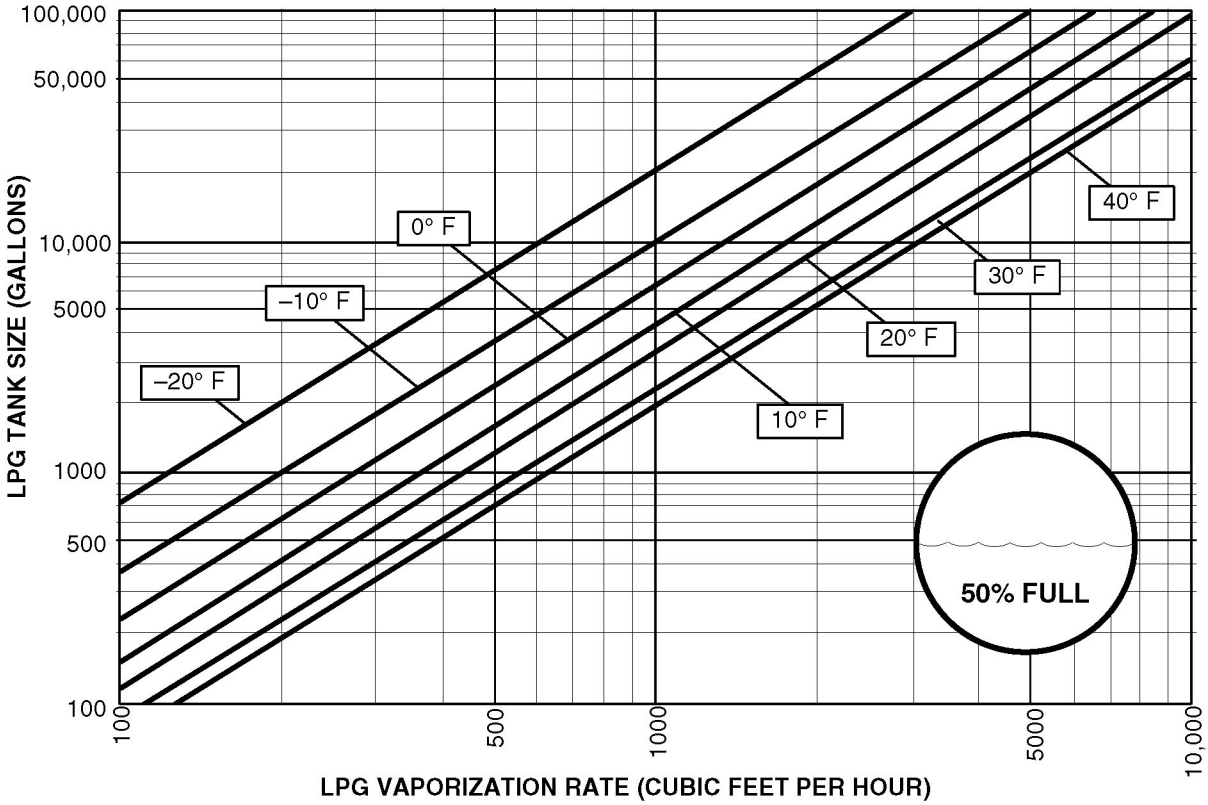


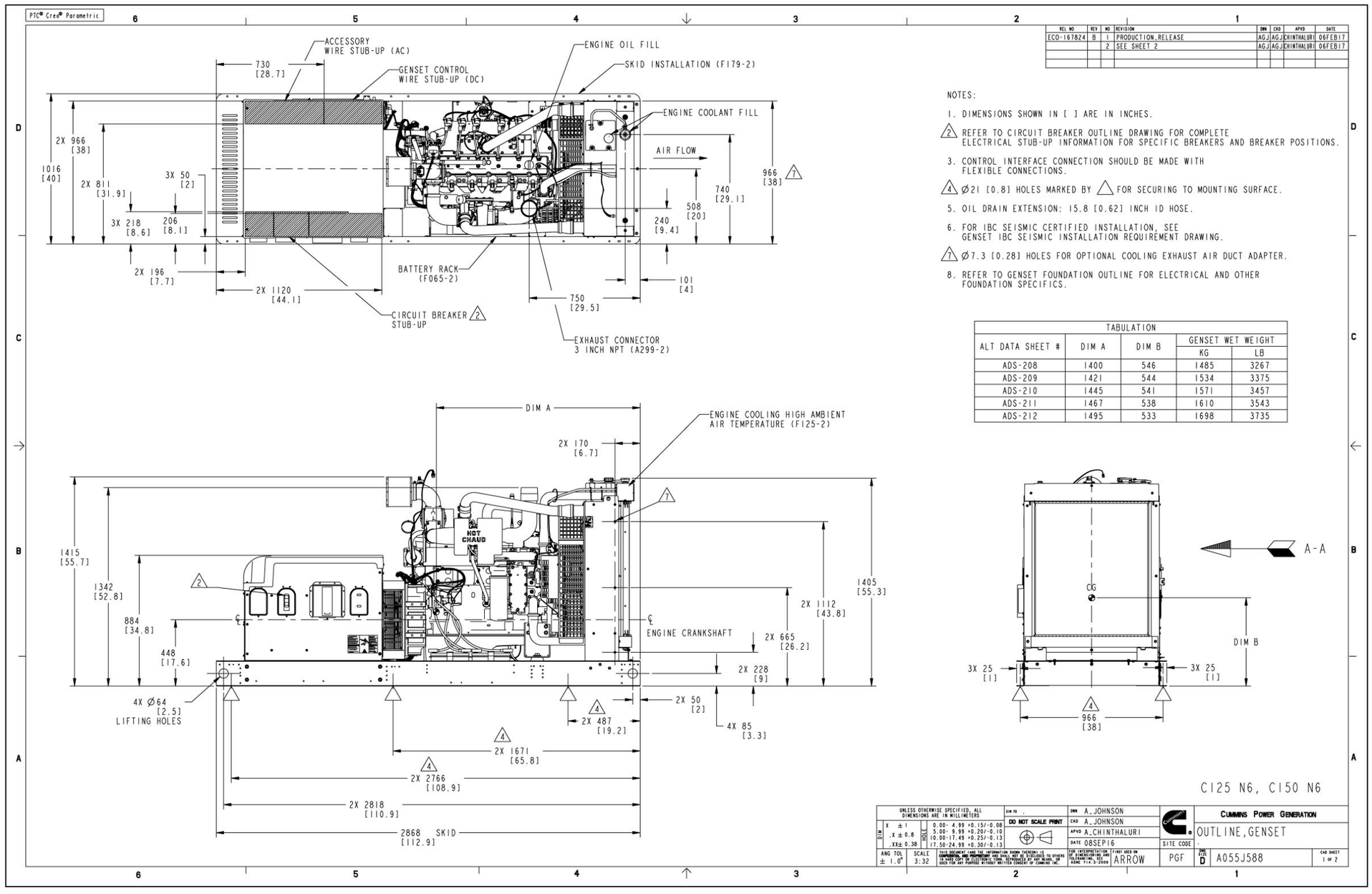
FIGURE 40. MINIMUM LPG TANK SIZE (50% FULL) REQUIRED TO MAINTAIN 5 PSIG AT SPECIFIC WITHDRAWAL RATE AND MINIMUM EXPECTED WINTER TEMPERATURE

This page is intentionally blank.

Appendix B. Outline and System Drawings

Table of Contents

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



REL NO	REV	NO	REVISION	DWN	CKD	APVD	DATE
ECO-167824	B	1	PRODUCTION RELEASE	AGJ	AGJ	CHINTHALURI	06FEB17
		2	SEE SHEET 2	AGJ	AGJ	CHINTHALURI	06FEB17

NOTES:

1. DIMENSIONS SHOWN IN [ ] ARE IN INCHES.
2. REFER TO CIRCUIT BREAKER OUTLINE DRAWING FOR COMPLETE ELECTRICAL STUB-UP INFORMATION FOR SPECIFIC BREAKERS AND BREAKER POSITIONS.
3. CONTROL INTERFACE CONNECTION SHOULD BE MADE WITH FLEXIBLE CONNECTIONS.
4. Ø21 [0.8] HOLES MARKED BY △ FOR SECURING TO MOUNTING SURFACE.
5. OIL DRAIN EXTENSION: 15.8 [0.62] INCH ID HOSE.
6. FOR IBC SEISMIC CERTIFIED INSTALLATION, SEE GENSET IBC SEISMIC INSTALLATION REQUIREMENT DRAWING.
7. Ø7.3 [0.28] HOLES FOR OPTIONAL COOLING EXHAUST AIR DUCT ADAPTER.
8. REFER TO GENSET FOUNDATION OUTLINE FOR ELECTRICAL AND OTHER FOUNDATION SPECIFICS.

TABULATION				
ALT DATA SHEET #	DIM A	DIM B	GENSET WET WEIGHT KG	GENSET WET WEIGHT LB
ADS-208	1400	546	1485	3267
ADS-209	1421	544	1534	3375
ADS-210	1445	541	1571	3457
ADS-211	1467	538	1610	3543
ADS-212	1495	533	1698	3735

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS
DIM: X ±1; .X ± 0.8; .XX± 0.38
ANG TOL ± 1.0° SCALE 3:32
DO NOT SCALE PRINT
DWN A_JOHNSON
CKD A_JOHNSON
APVD A_CHINTHALURI
DATE 08SEP16
FIRST USED ON ARROW
PGF
SIZE D
A055J588
CAD SHEET 1 of 2
CUMMINS POWER GENERATION
OUTLINE,GENSET

FIGURE 41. GENERATOR SET OUTLINE, 125-150 KW (SHEET 1 OF 2)

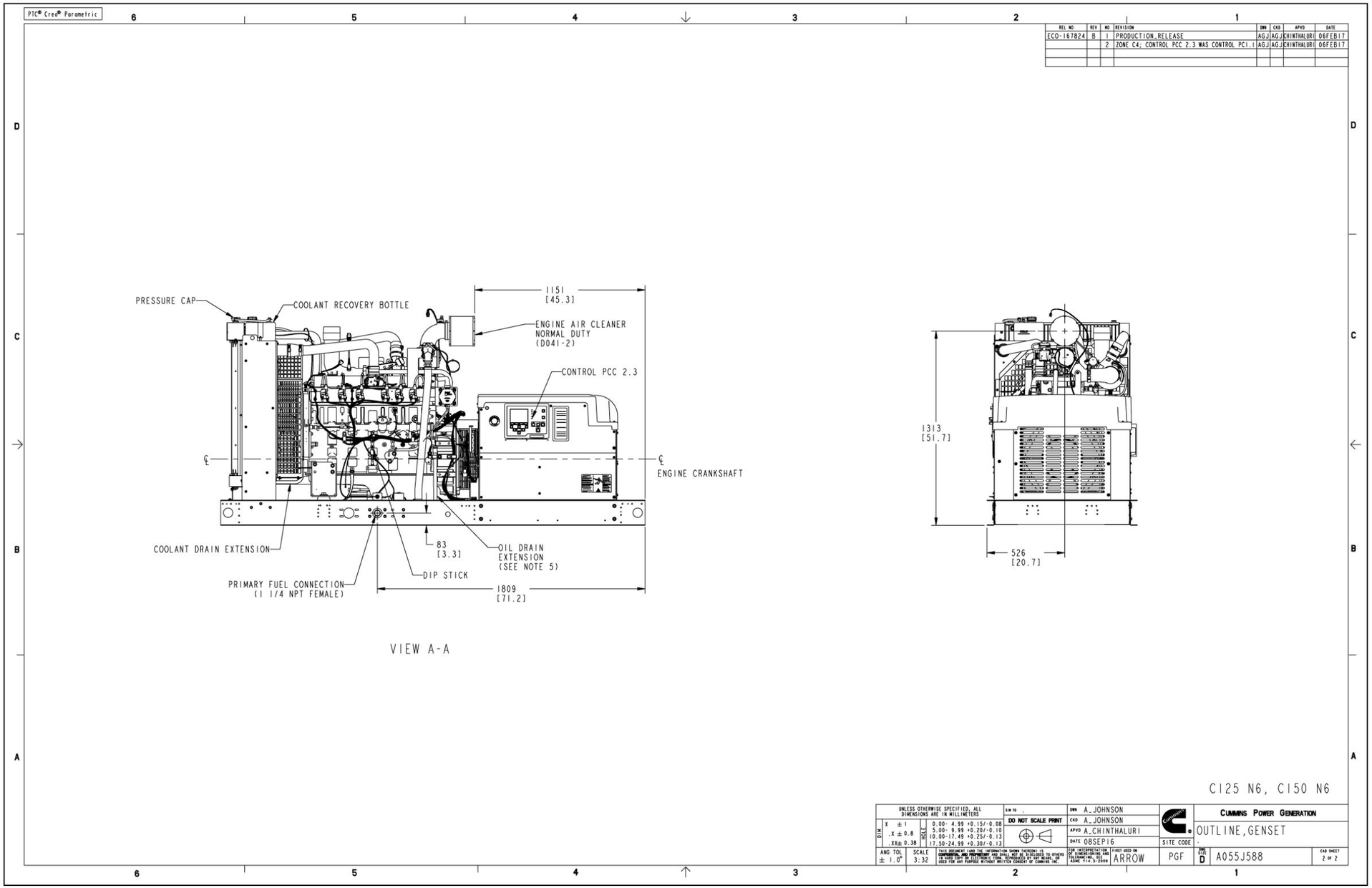


FIGURE 42. GENERATOR SET OUTLINE, 125-150 KW (SHEET 2 OF 2)

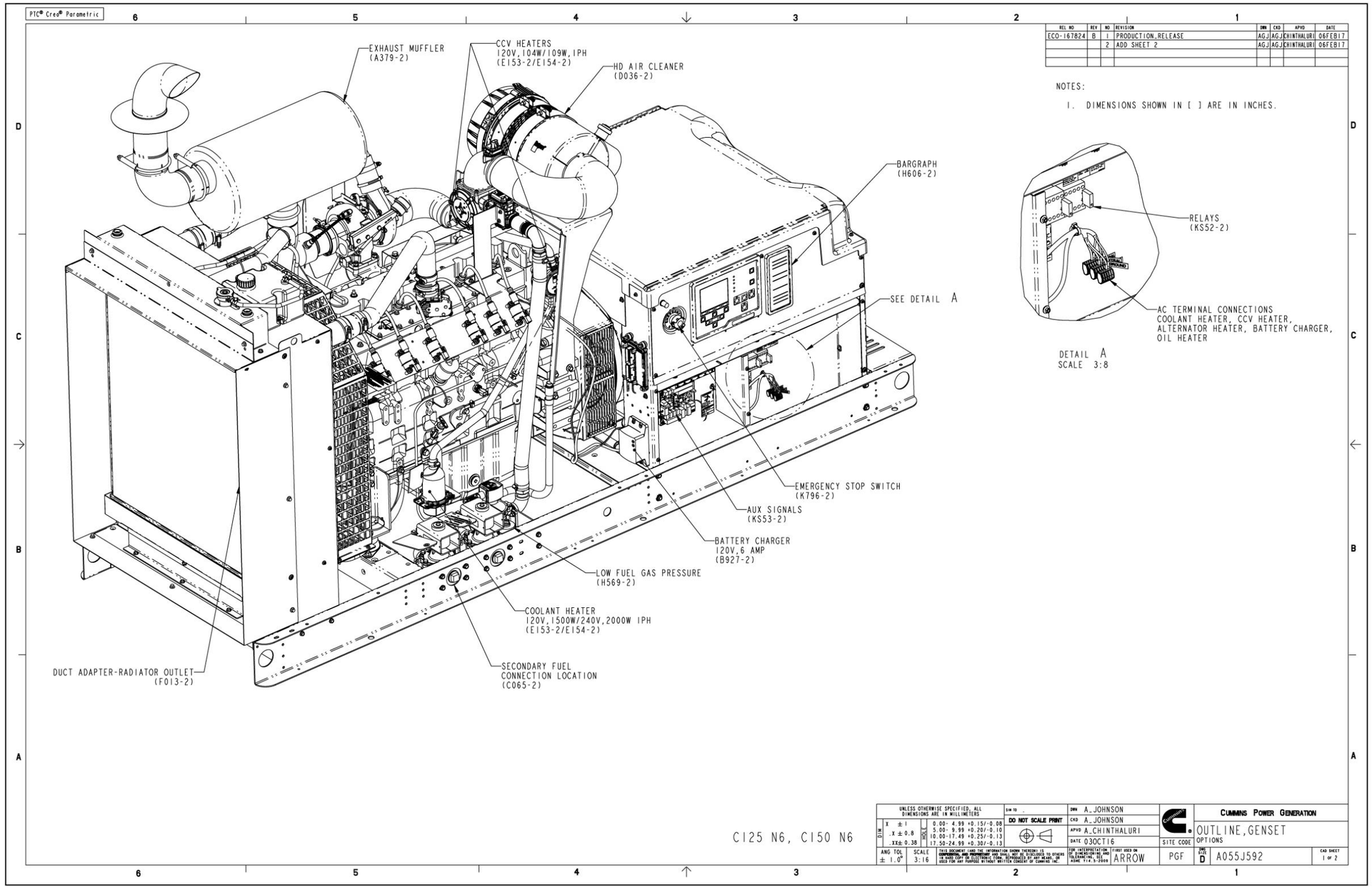


FIGURE 43. GENERATOR SET OUTLINE, ACCESSORIES (SHEET 1 OF 2)

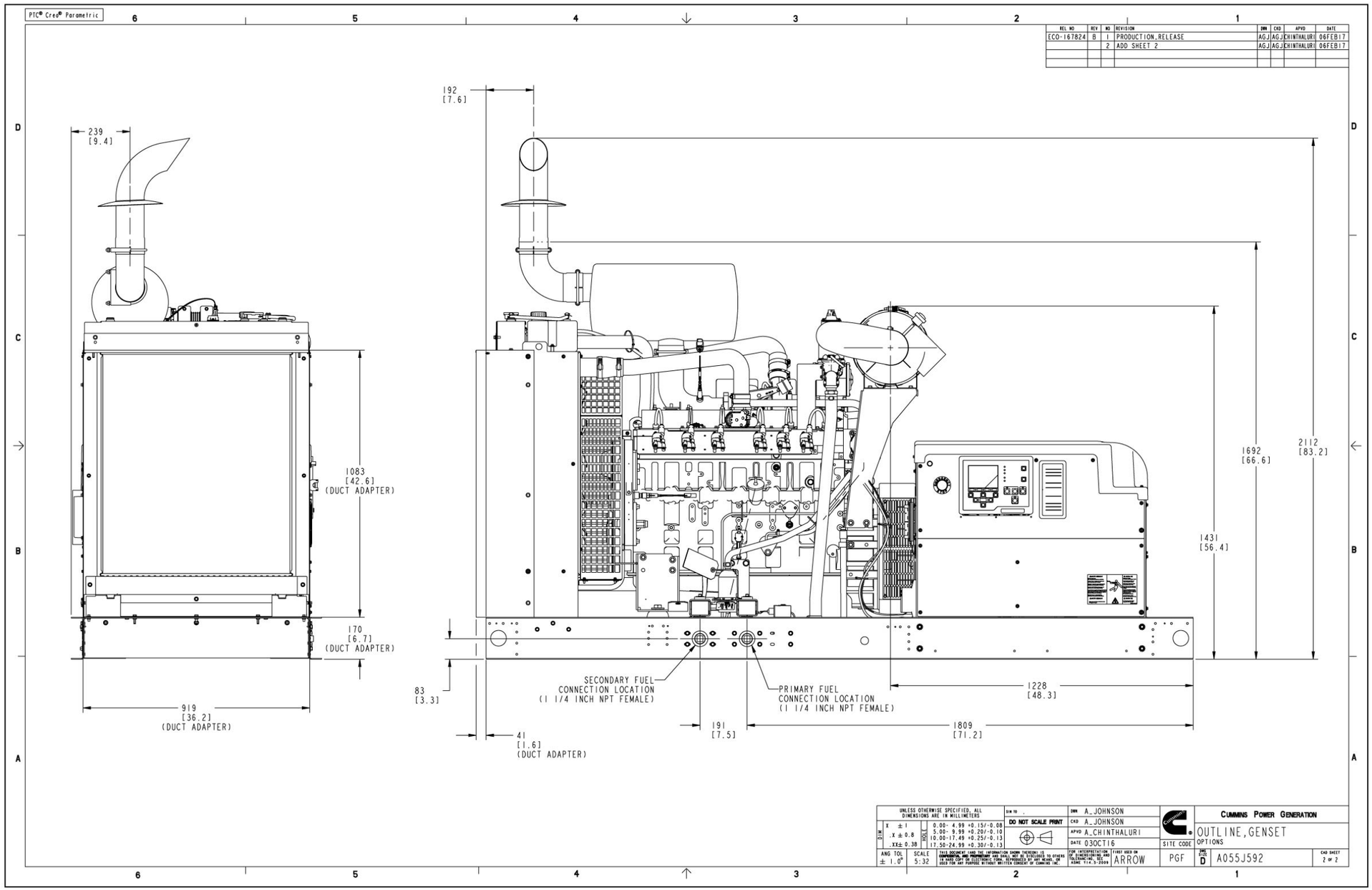


FIGURE 44. GENERATOR SET OUTLINE, ACCESSORIES (SHEET 2 OF 2)

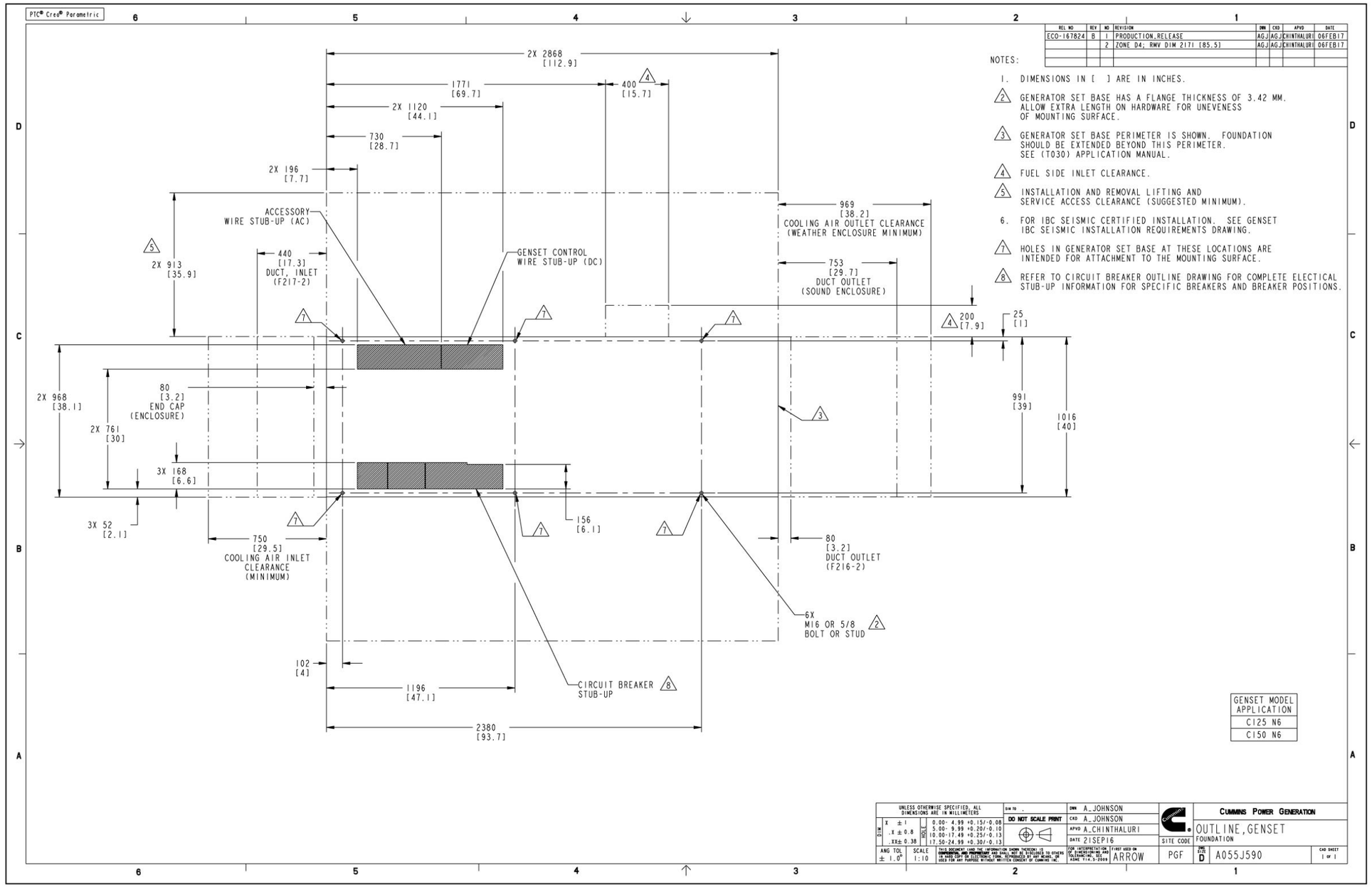


FIGURE 45. FOUNDATION OUTLINE (SHEET 1 OF 1)

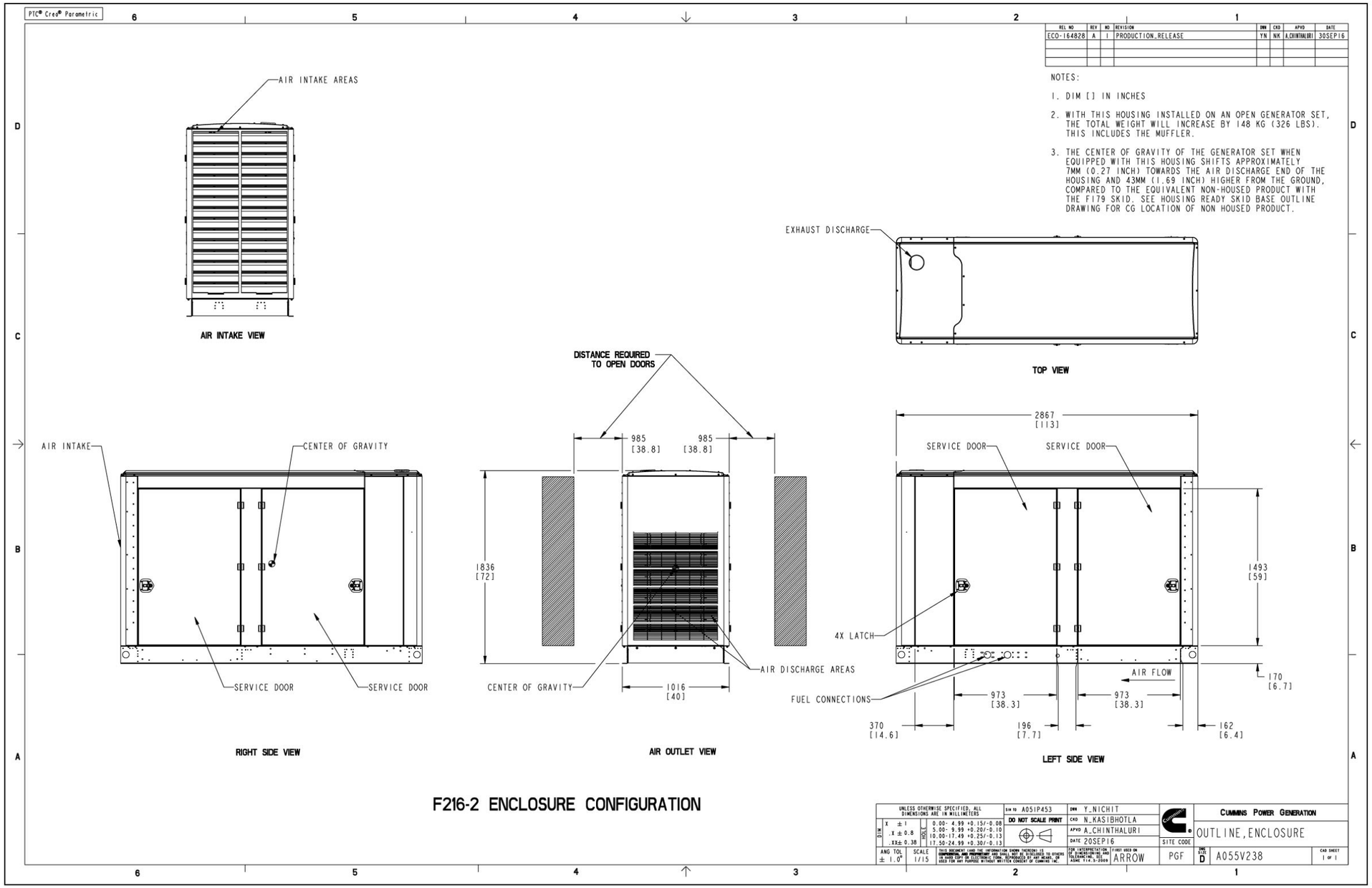


FIGURE 46. ENCLOSURE OUTLINE, WEATHER (SHEET 1 OF 1)

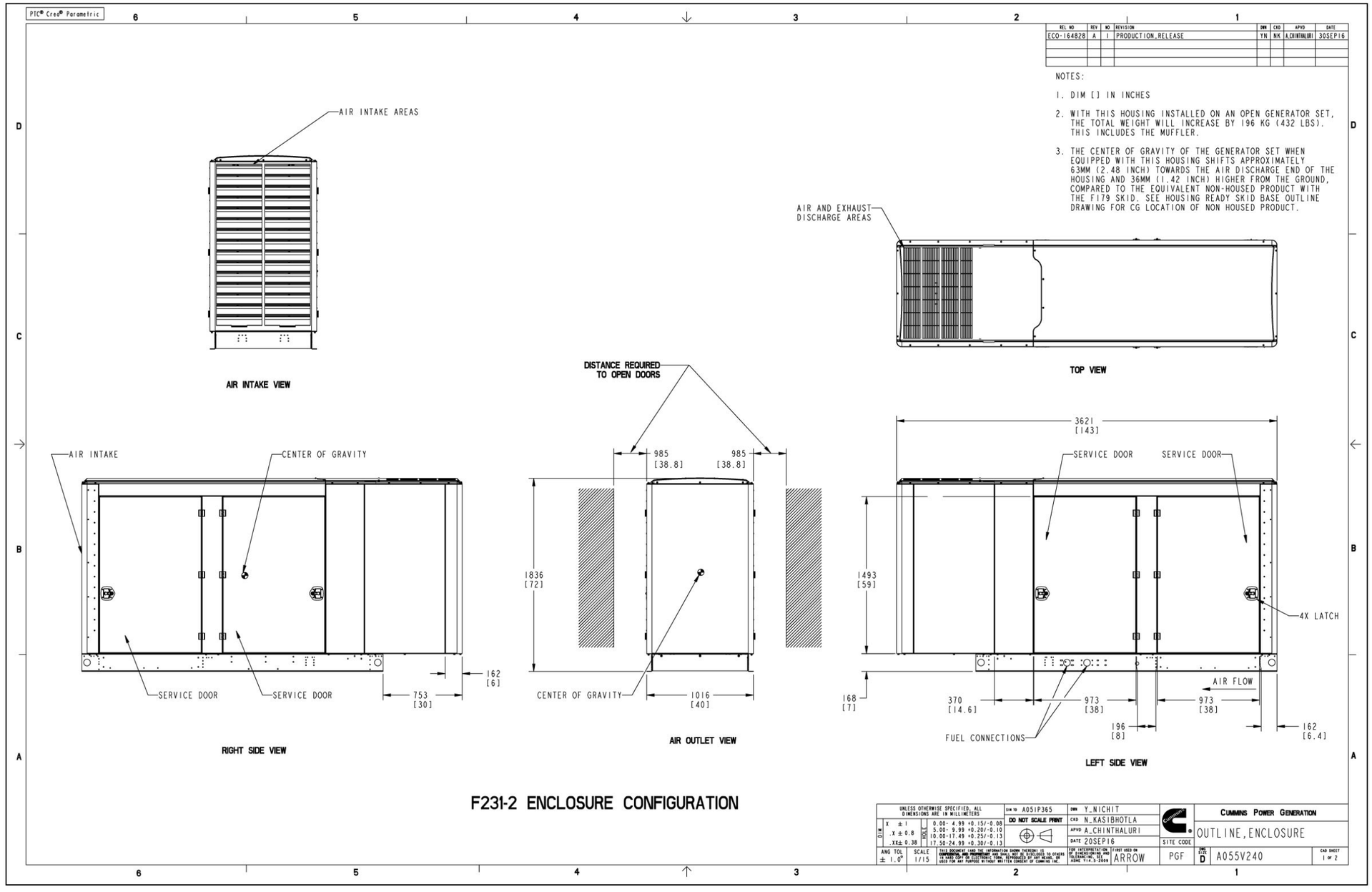


FIGURE 47. ENCLOSURE OUTLINE, SOUND ATTENTION LEVEL 1 AND LEVEL 2 (SHEET 1 OF 2)

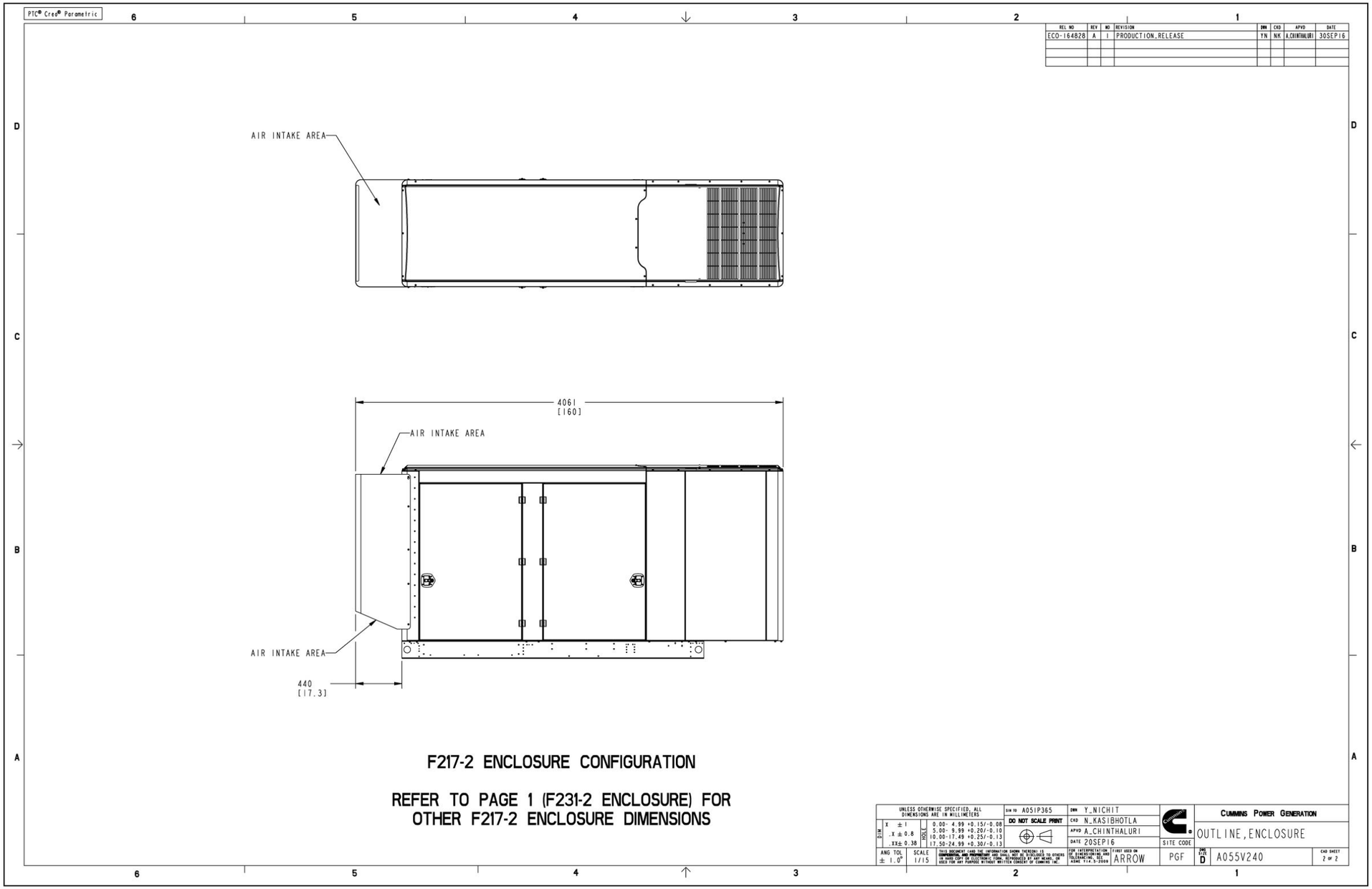
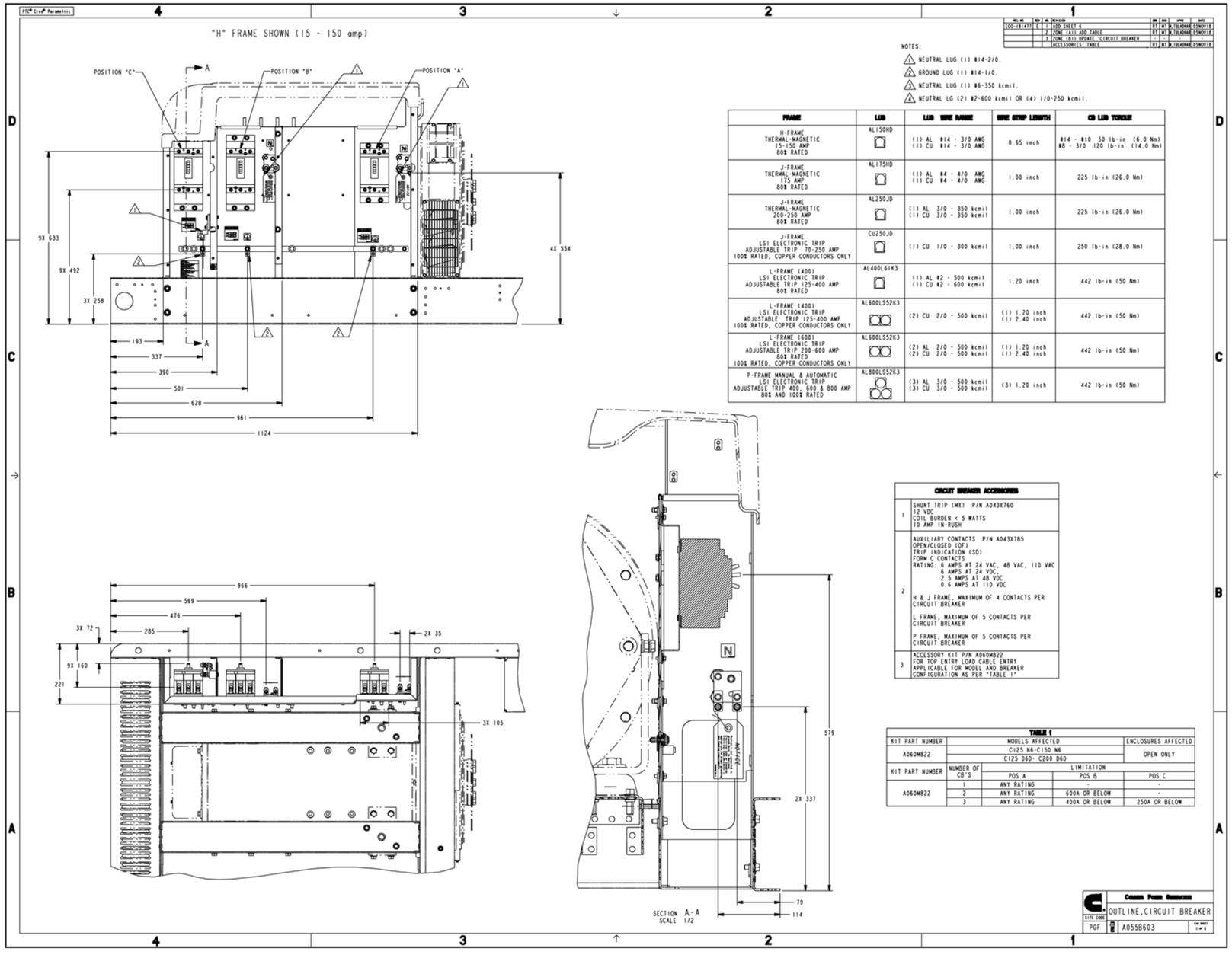


FIGURE 48. ENCLOSURE OUTLINE, SOUND ATTENTION LEVEL 1 AND LEVEL 2 (SHEET 2 OF 2)



FRAME	LUG	LUG WIRE RANGE	WIRE STRIP LENGTH	CB LUG TORQUE
H-FRAME THERMAL-MAGNETIC 15-150 AMP 80% RATED	AL150HD	(1) AL #14 - 3/0 AWG (1) CU #14 - 3/0 AWG	0.65 inch	#14 - #10 50 lb-in (6.0 Nm) #8 - 3/0 120 lb-in (14.0 Nm)
J-FRAME THERMAL-MAGNETIC 175 AMP 80% RATED	AL175HD	(1) AL #4 - 4/0 AWG (1) CU #4 - 4/0 AWG	1.00 inch	225 lb-in (26.0 Nm)
J-FRAME THERMAL-MAGNETIC 200-250 AMP 80% RATED	AL250JD	(1) AL 3/0 - 350 kcmil (1) CU 3/0 - 350 kcmil	1.00 inch	225 lb-in (26.0 Nm)
J-FRAME LSI ELECTRONIC TRIP ADJUSTABLE TRIP 70-250 AMP 100% RATED, COPPER CONDUCTORS ONLY	CU250JD	(1) CU 1/0 - 300 kcmil	1.00 inch	250 lb-in (28.0 Nm)
L-FRAME (400) LSI ELECTRONIC TRIP ADJUSTABLE TRIP 125-400 AMP 80% RATED	AL400L61K3	(1) AL #2 - 500 kcmil (1) CU #2 - 600 kcmil	1.20 inch	442 lb-in (50 Nm)
L-FRAME (400) LSI ELECTRONIC TRIP ADJUSTABLE TRIP 125-400 AMP 100% RATED, COPPER CONDUCTORS ONLY	AL600LS52K3	(2) CU 2/0 - 500 kcmil	(1) 1.20 inch (1) 2.40 inch	442 lb-in (50 Nm)
L-FRAME (600) LSI ELECTRONIC TRIP ADJUSTABLE TRIP 200-600 AMP 80% RATED 100% RATED, COPPER CONDUCTORS ONLY	AL600LS52K3	(2) AL 2/0 - 500 kcmil (2) CU 2/0 - 500 kcmil	(1) 1.20 inch (1) 2.40 inch	442 lb-in (50 Nm)
P-FRAME MANUAL & AUTOMATIC LSI ELECTRONIC TRIP ADJUSTABLE TRIP 400, 600 & 800 AMP 80% AND 100% RATED	AL800LS52K3	(3) AL 3/0 - 500 kcmil (3) CU 3/0 - 500 kcmil	(3) 1.20 inch	442 lb-in (50 Nm)

FIGURE 49. OUTLINE, CIRCUIT BREAKER (SHEET 1 OF 6)

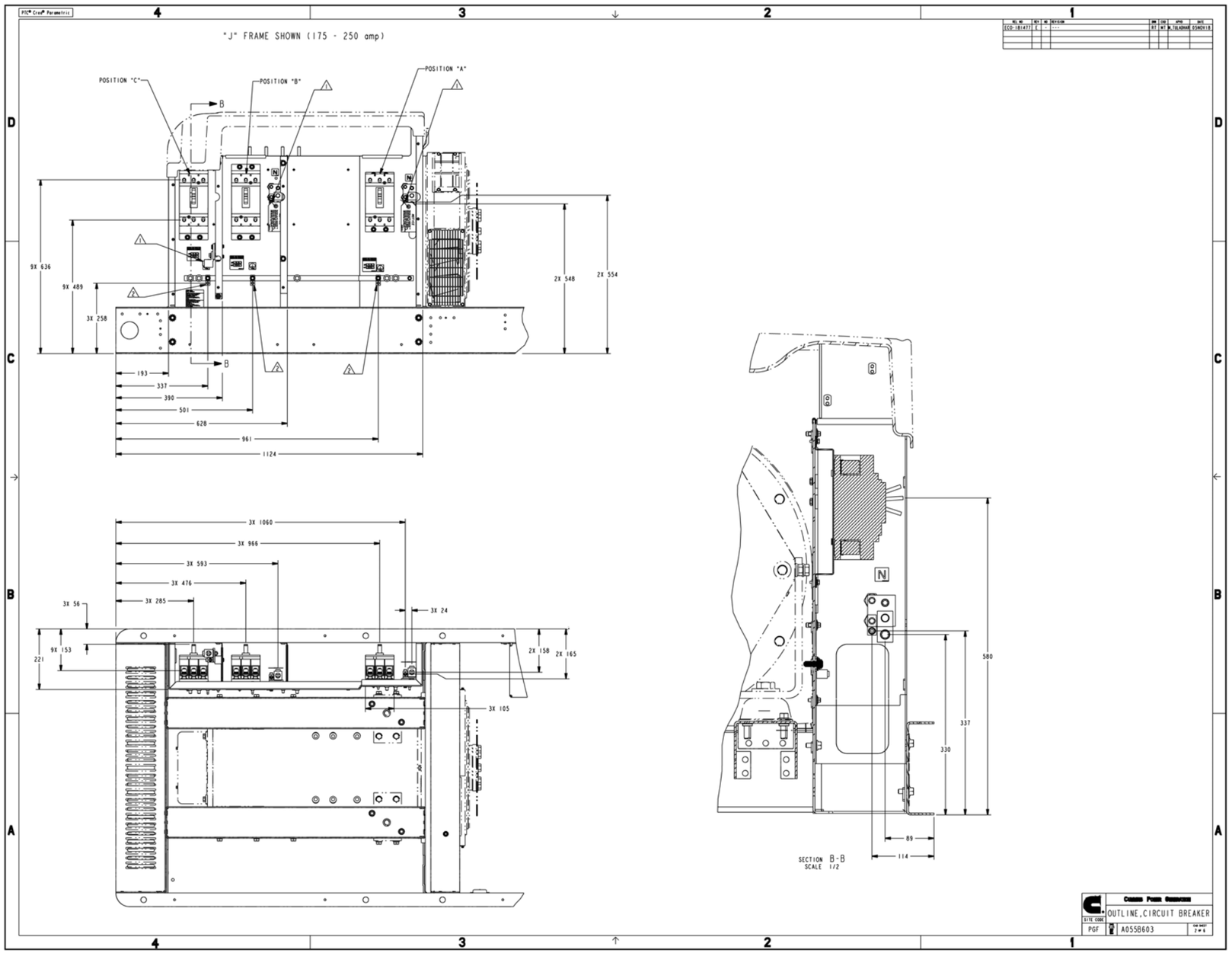


FIGURE 50. OUTLINE, CIRCUIT BREAKER (SHEET 2 OF 6)

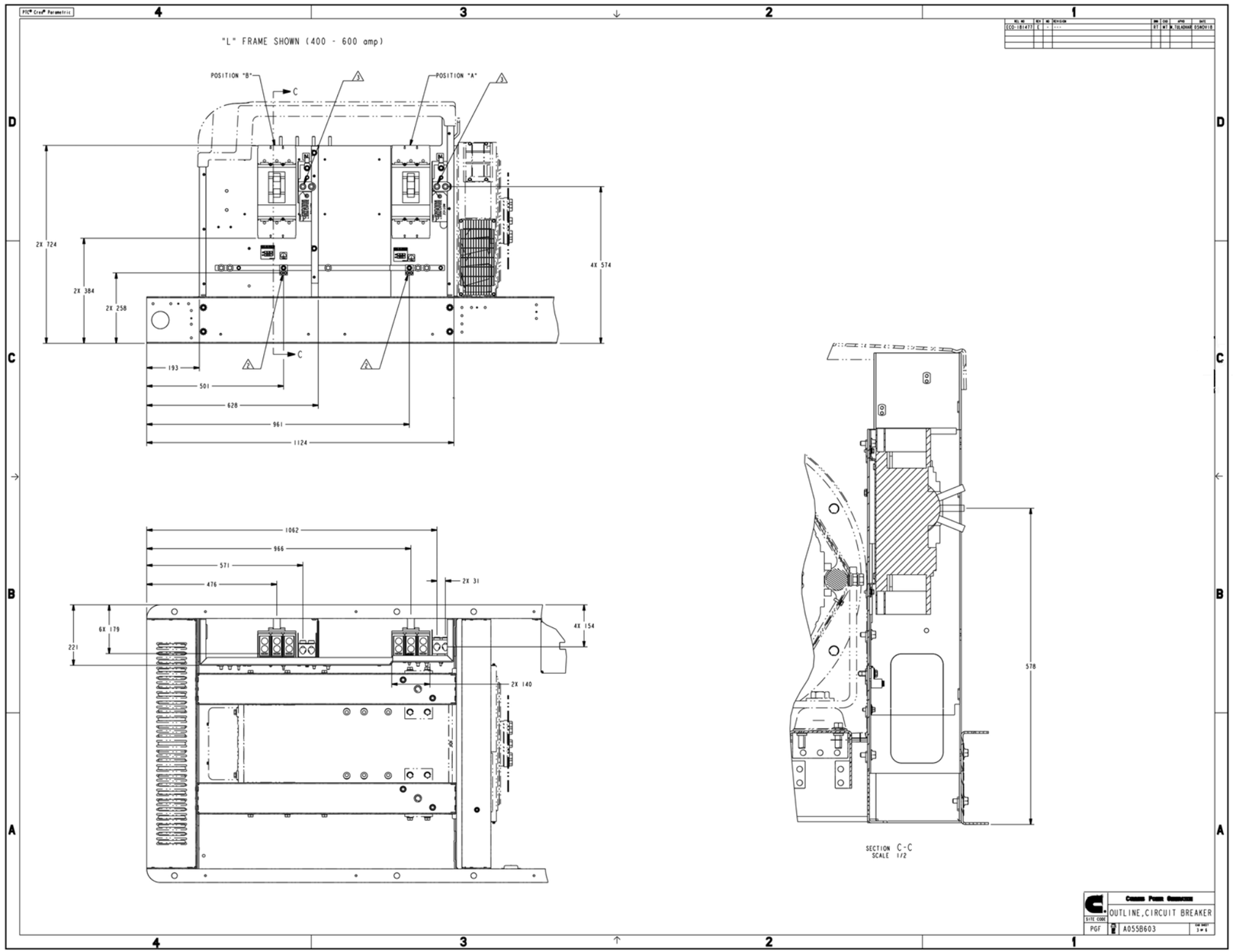


FIGURE 51. OUTLINE, CIRCUIT BREAKER (SHEET 3 OF 6)

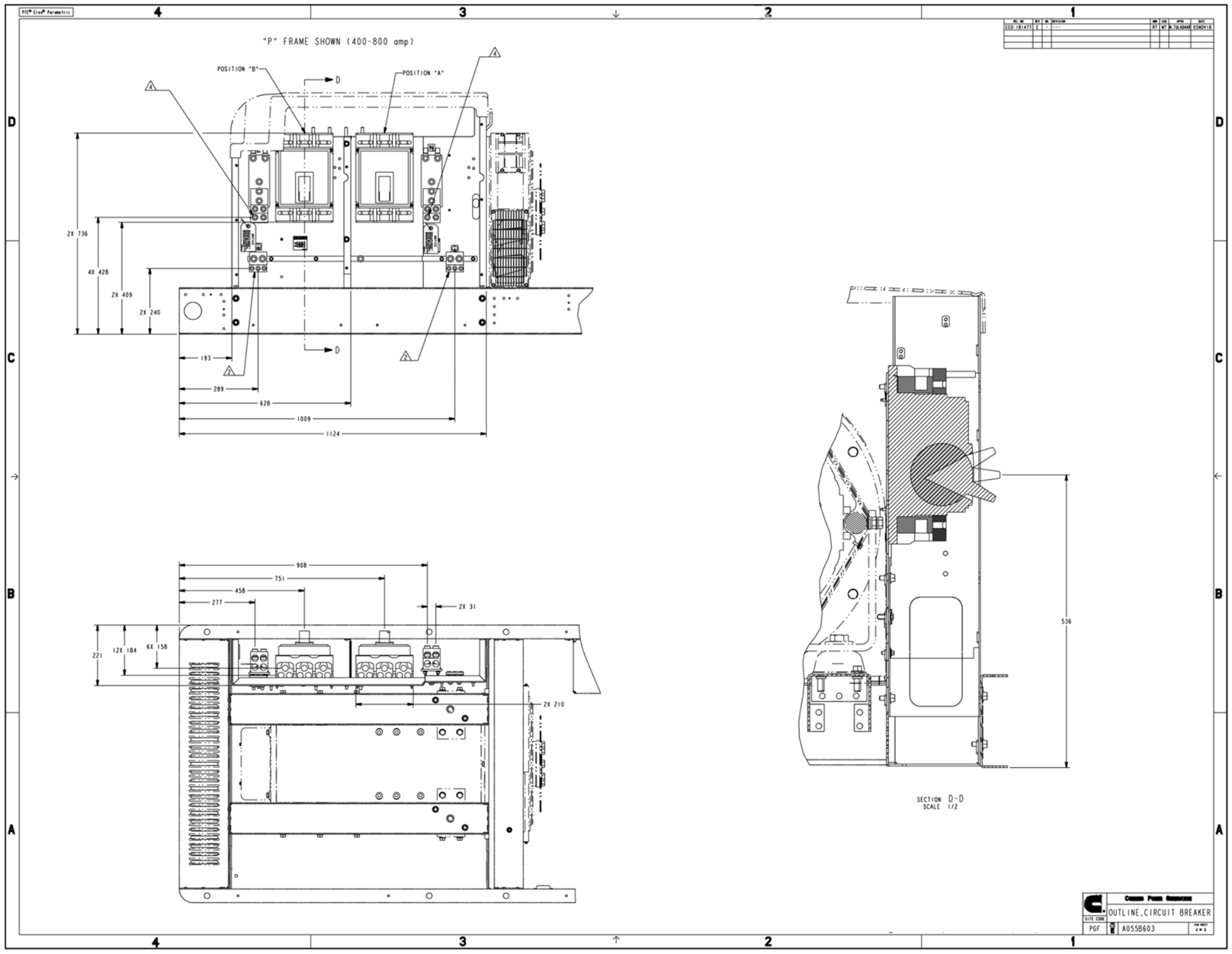


FIGURE 52. OUTLINE, CIRCUIT BREAKER (SHEET 4 OF 6)

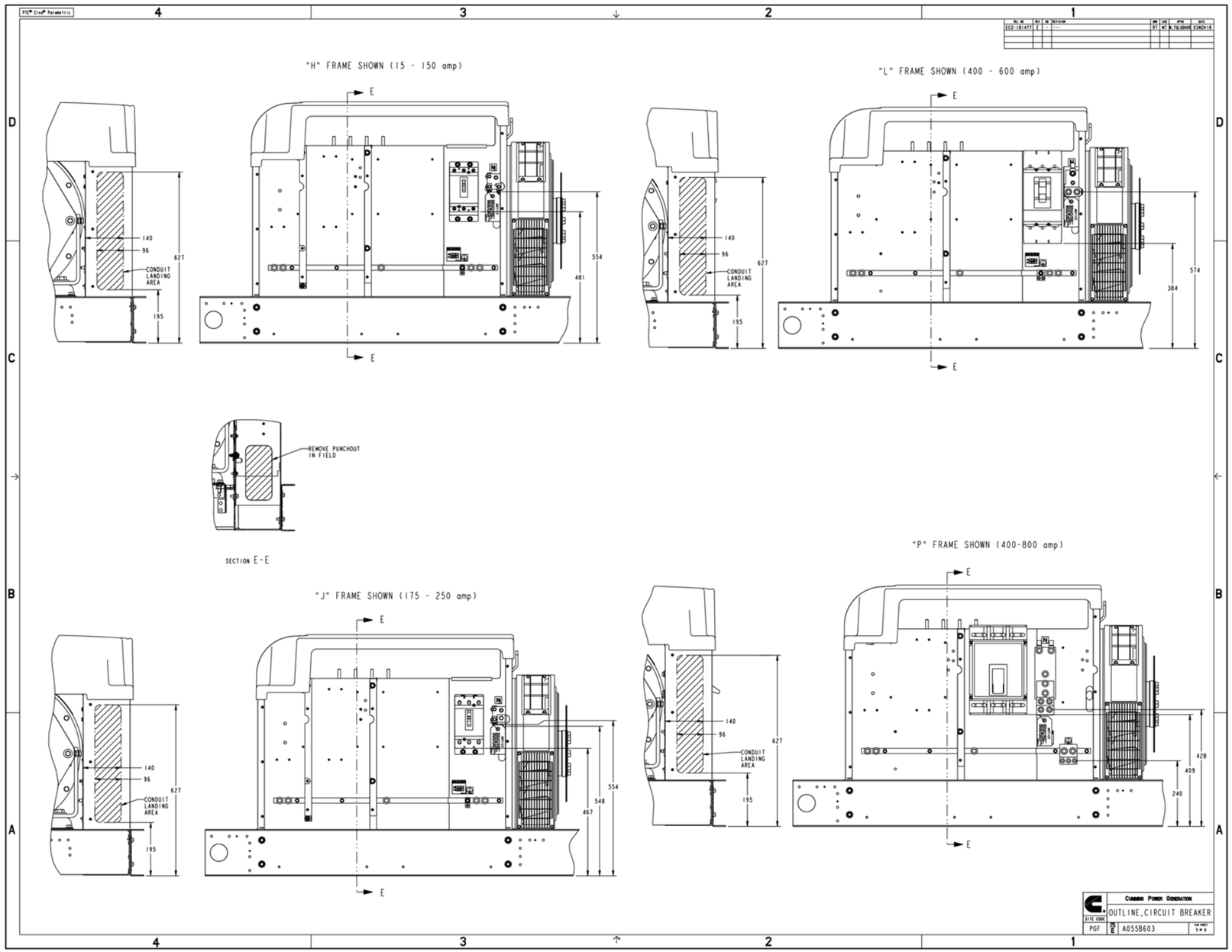


FIGURE 53. OUTLINE, CIRCUIT BREAKER (SHEET 5 OF 6)

This page is intentionally blank.

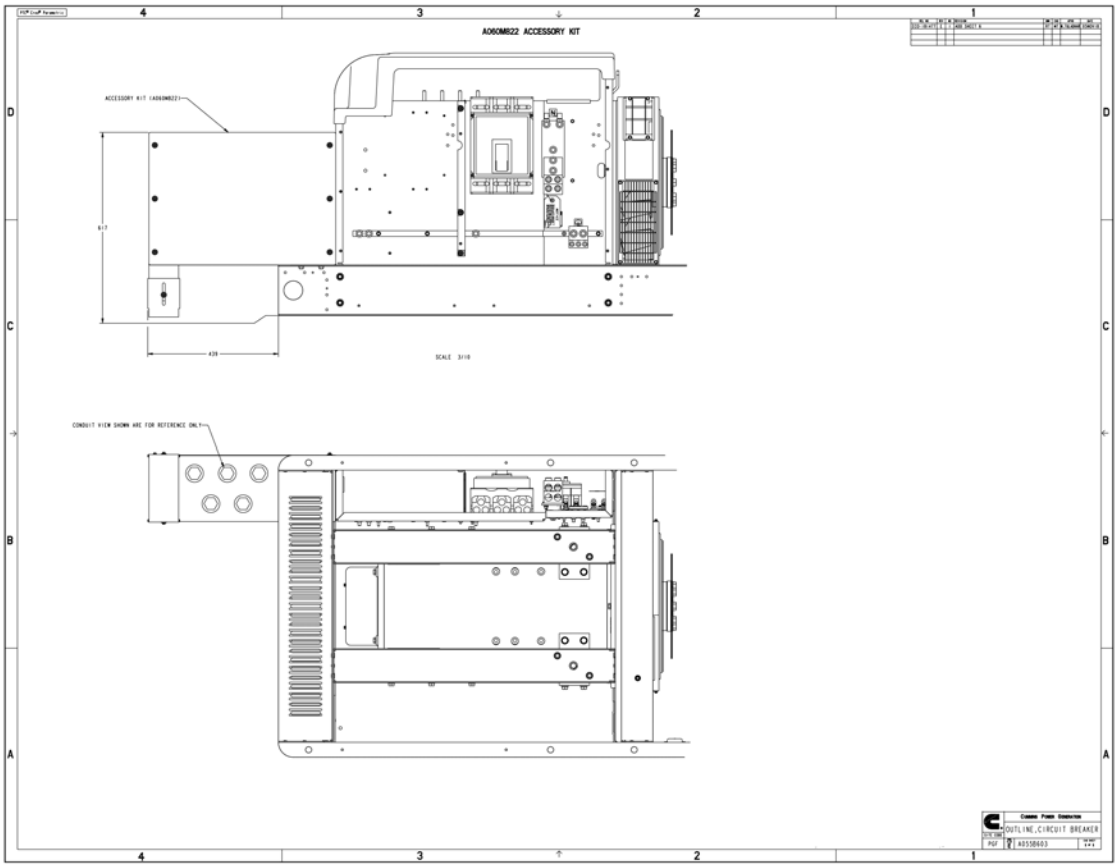


FIGURE 54. OUTLINE, CIRCUIT BREAKER (SHEET 6 OF 6)

This page is intentionally blank.

Appendix C. Wiring Diagrams

Table of Contents

C.0 Wiring Diagrams

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

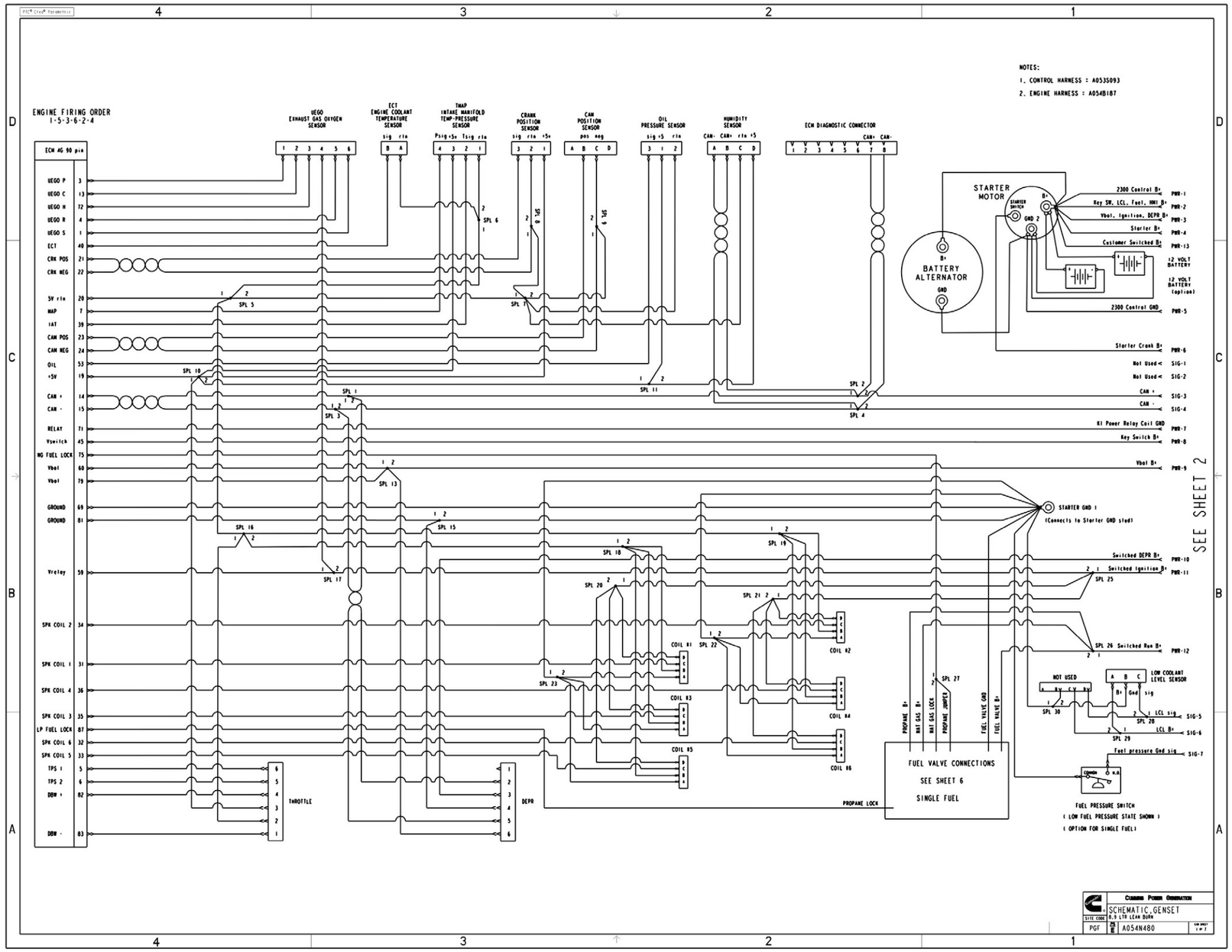


FIGURE 55. WIRING DIAGRAM PC 2.3 (SHEET 1 OF 7)

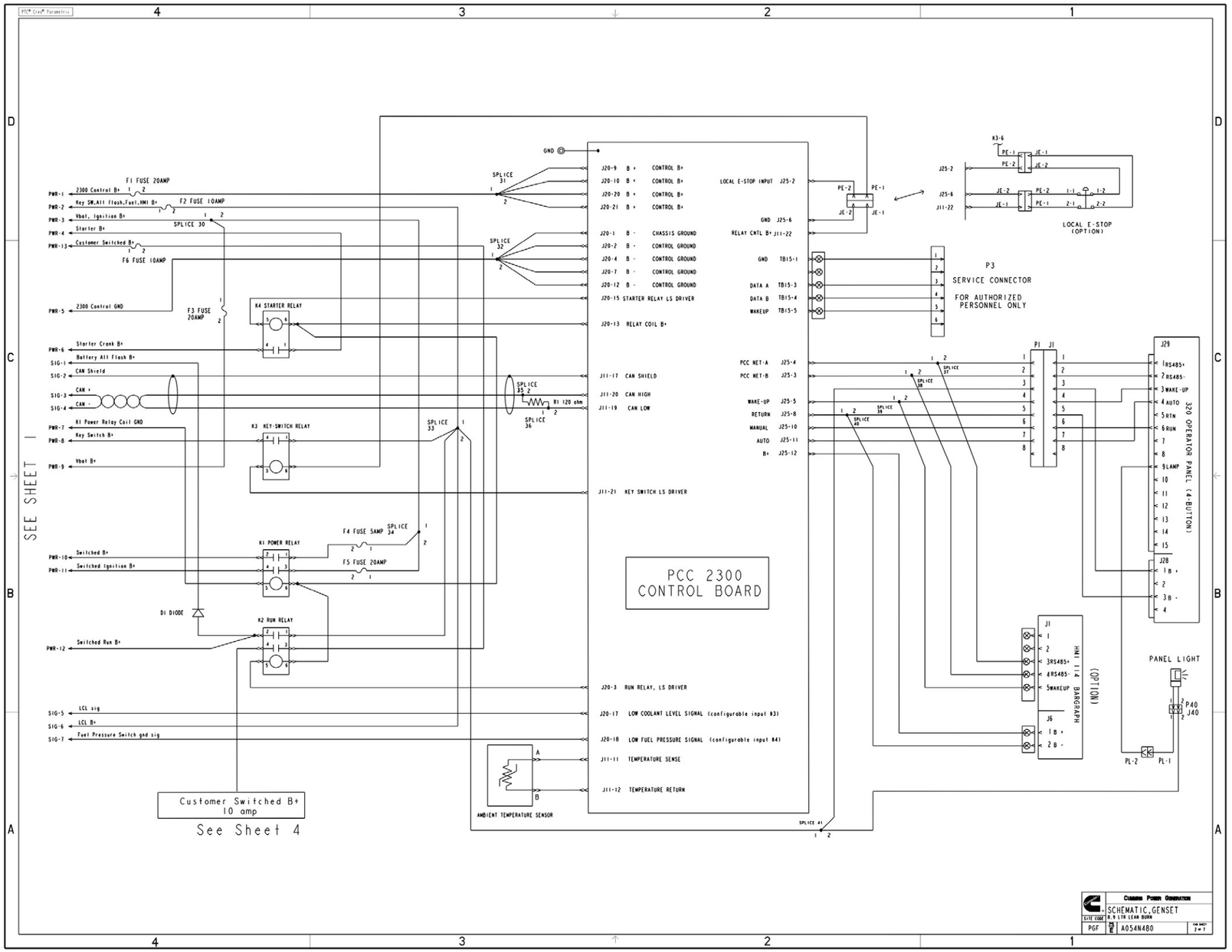


FIGURE 56. WIRING DIAGRAM PC 2.3 (SHEET 2 OF 7)

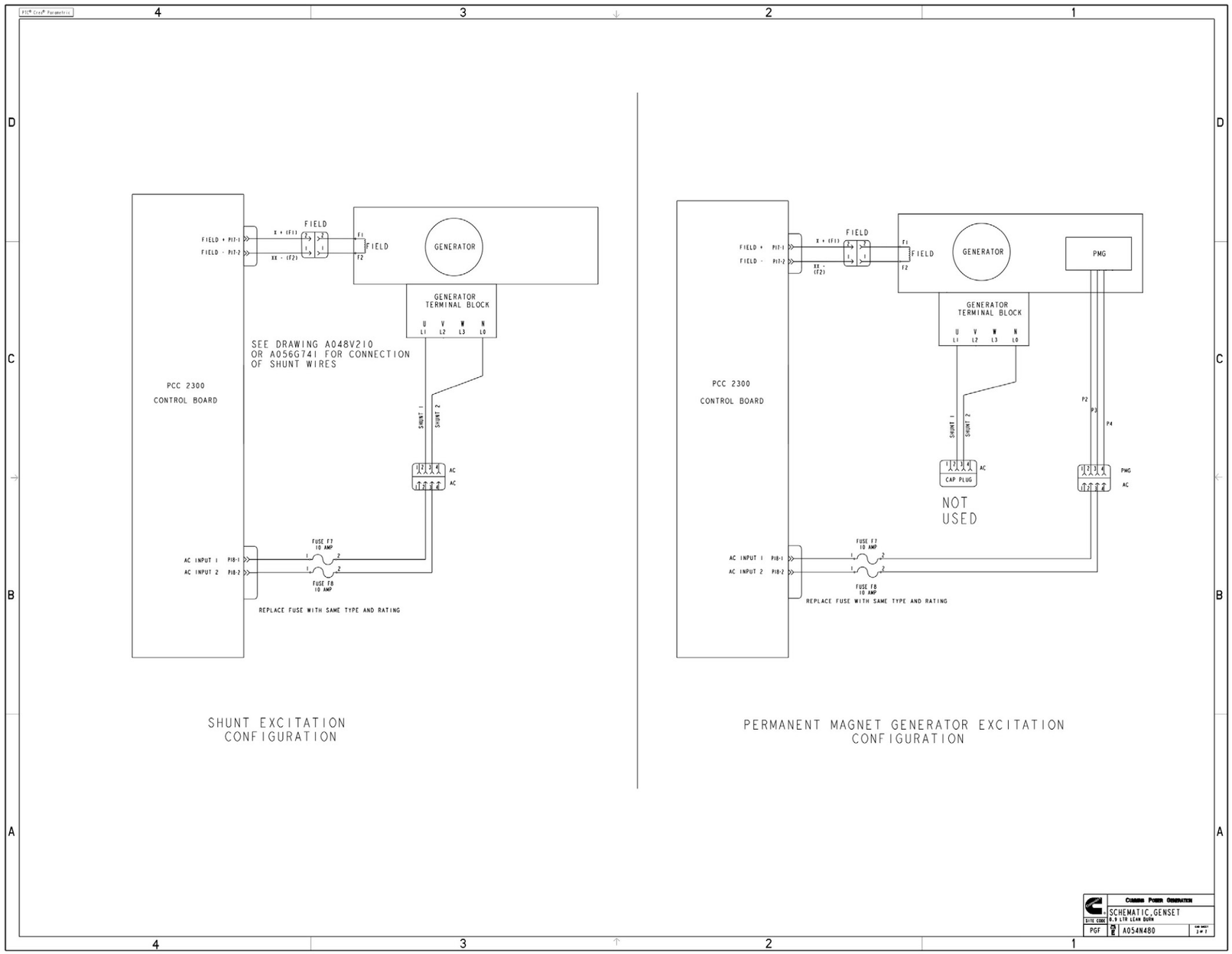


FIGURE 57. WIRING DIAGRAM PC 2.3 (SHEET 3 OF 7)

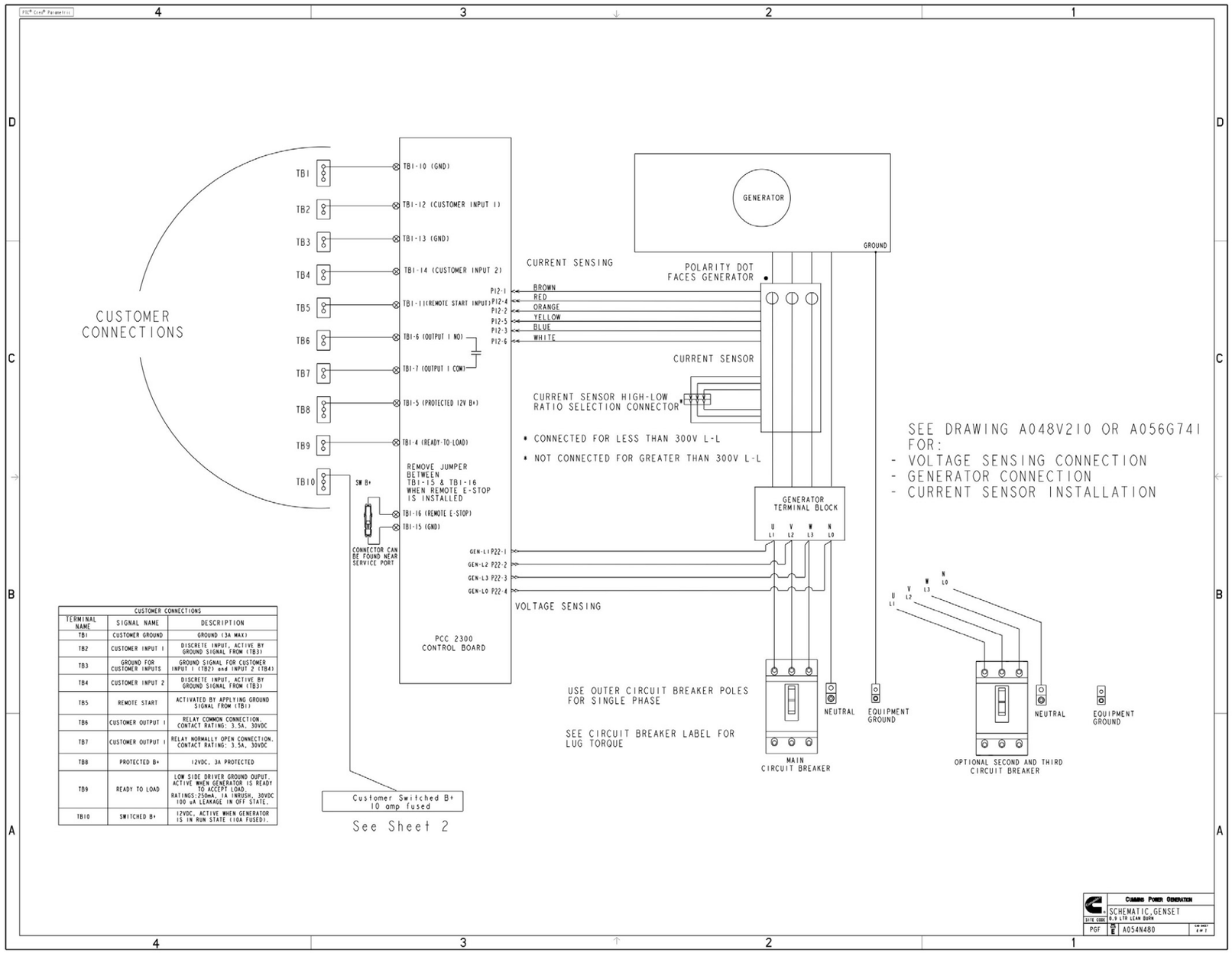


FIGURE 58. WIRING DIAGRAM PC 2.3 (SHEET 4 OF 7)

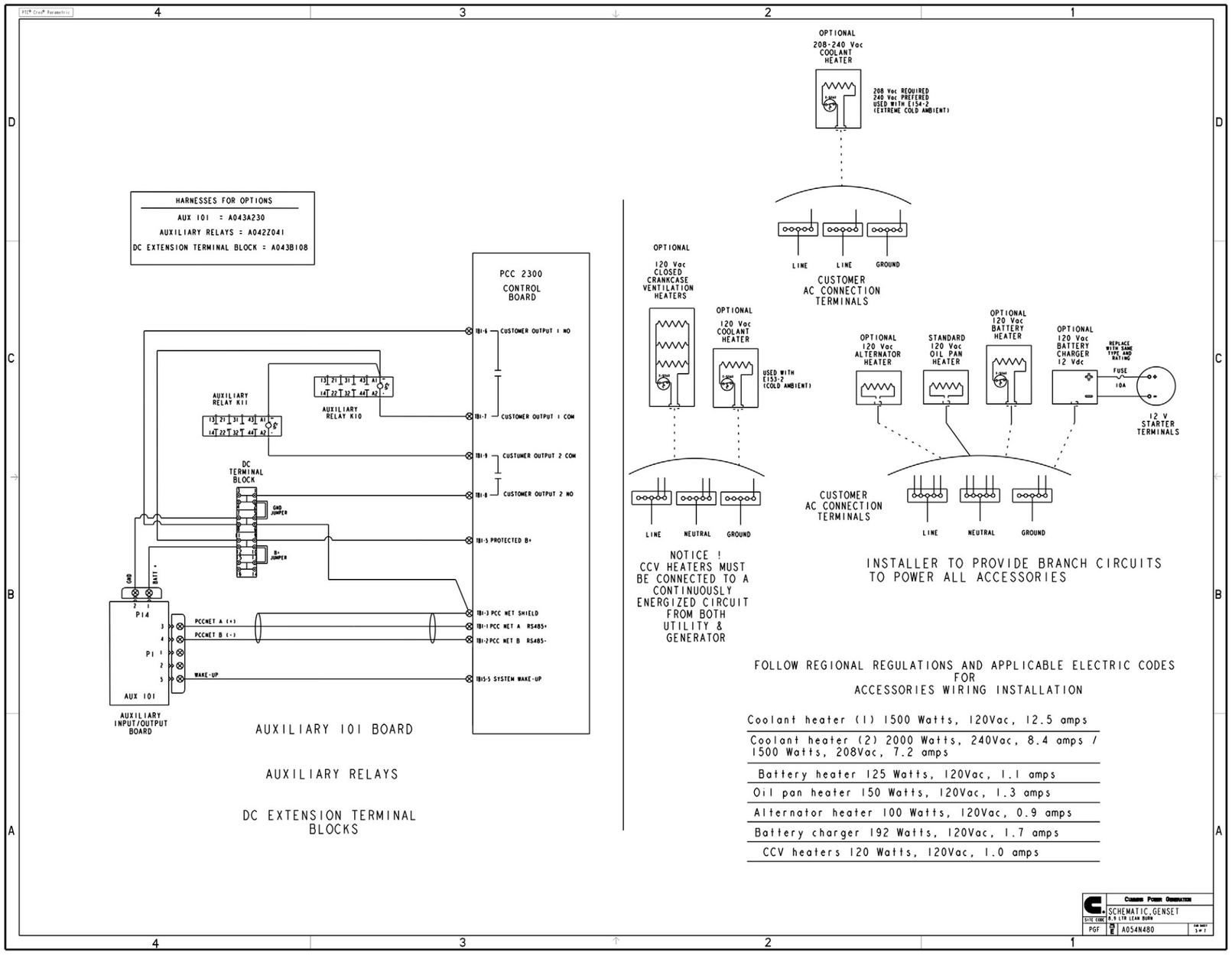


FIGURE 59. WIRING DIAGRAM PC 2.3 (SHEET 5 OF 7)

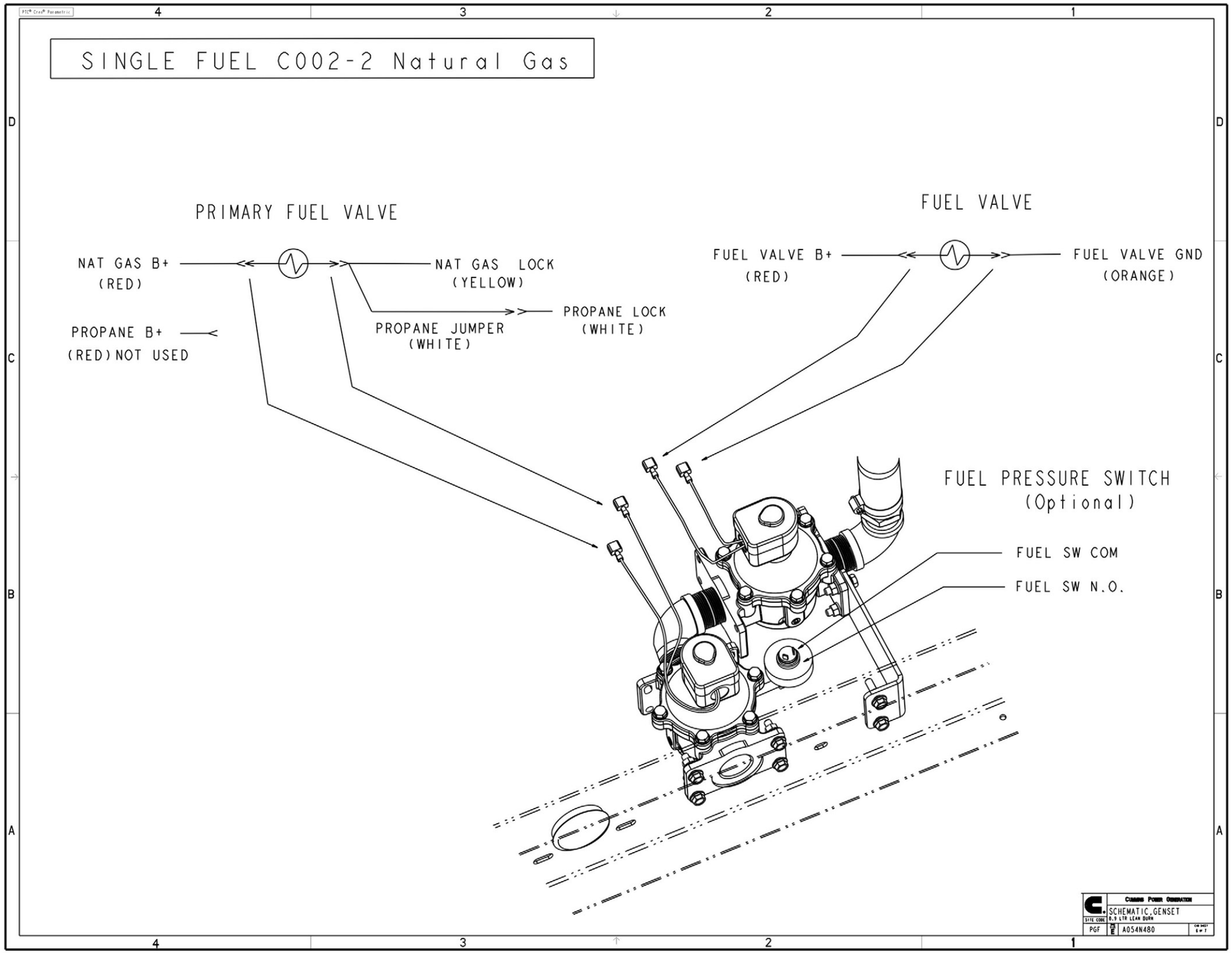


FIGURE 60. WIRING DIAGRAM PC 2.3 (SHEET 6 OF 7)

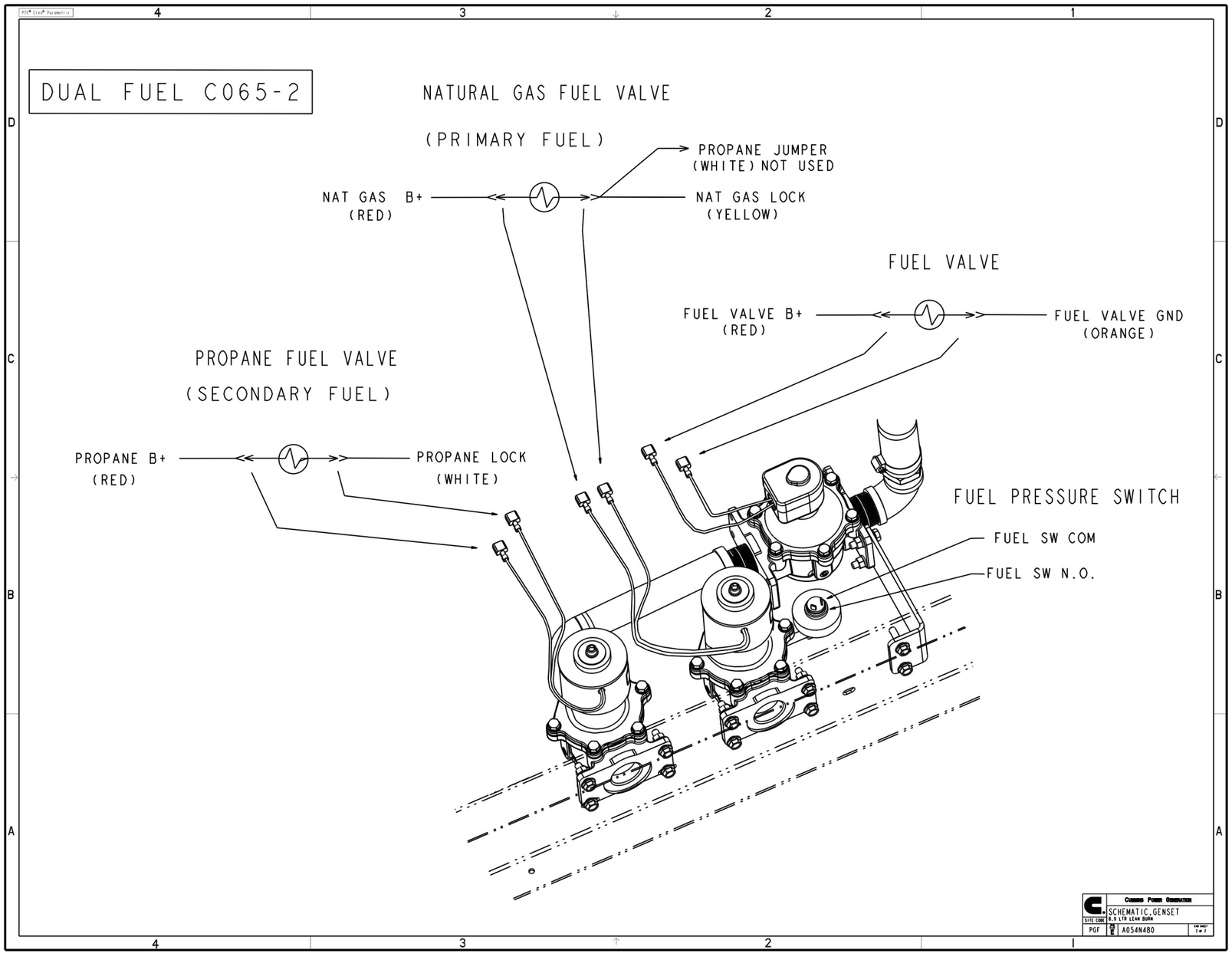
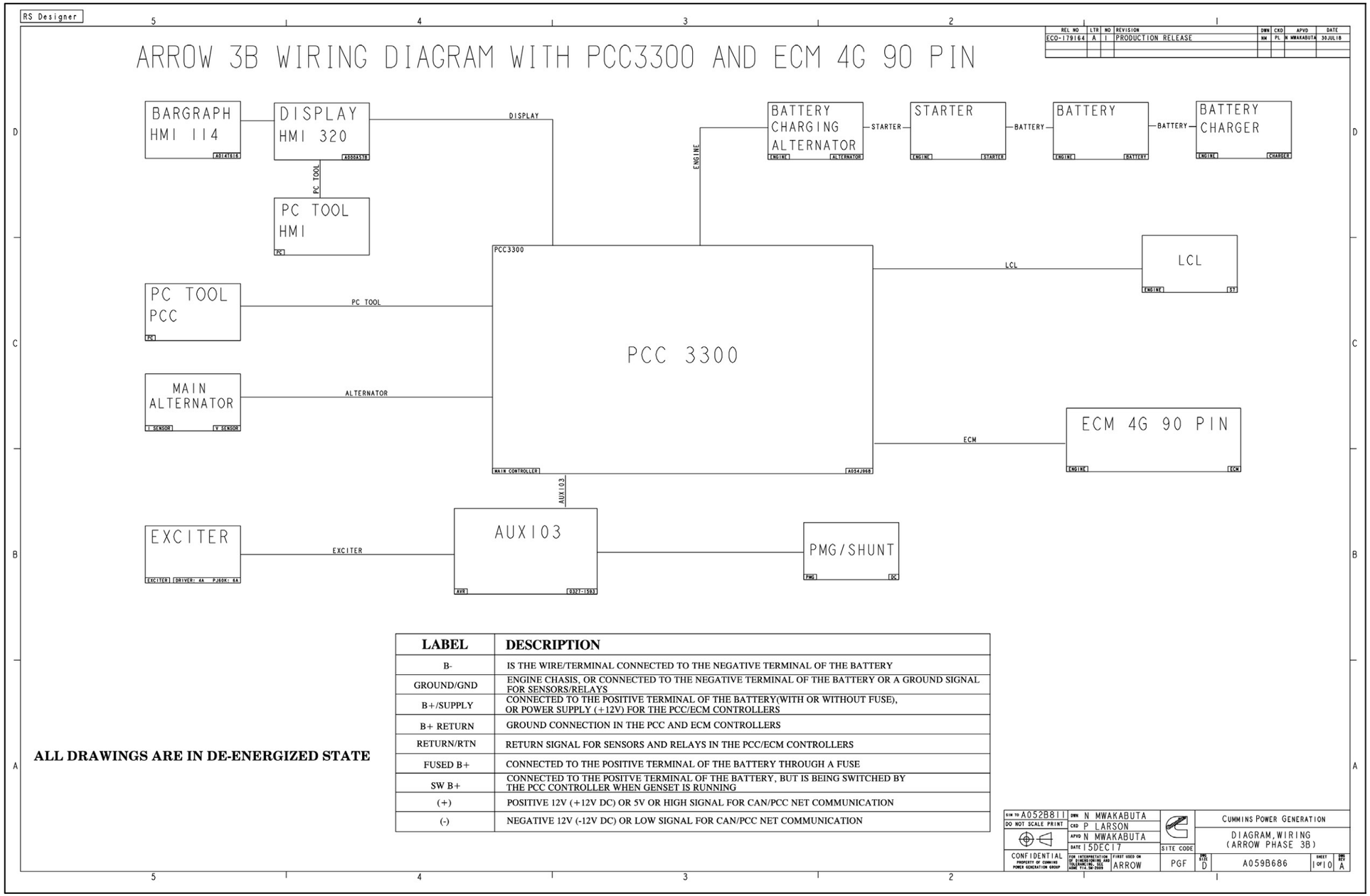


FIGURE 61. WIRING DIAGRAM PC 2.3 (SHEET 7 OF 7)



LABEL	DESCRIPTION
B-	IS THE WIRE/TERMINAL CONNECTED TO THE NEGATIVE TERMINAL OF THE BATTERY
GROUND/GND	ENGINE CHASIS, OR CONNECTED TO THE NEGATIVE TERMINAL OF THE BATTERY OR A GROUND SIGNAL FOR SENSORS/RELAYS
B+/SUPPLY	CONNECTED TO THE POSITIVE TERMINAL OF THE BATTERY(WITH OR WITHOUT FUSE), OR POWER SUPPLY (+12V) FOR THE PCC/ECM CONTROLLERS
B+ RETURN	GROUND CONNECTION IN THE PCC AND ECM CONTROLLERS
RETURN/RTN	RETURN SIGNAL FOR SENSORS AND RELAYS IN THE PCC/ECM CONTROLLERS
FUSED B+	CONNECTED TO THE POSITIVE TERMINAL OF THE BATTERY THROUGH A FUSE
SW B+	CONNECTED TO THE POSITVE TERMINAL OF THE BATTERY, BUT IS BEING SWITCHED BY THE PCC CONTROLLER WHEN GENSET IS RUNNING
(+)	POSITIVE 12V (+12V DC) OR 5V OR HIGH SIGNAL FOR CAN/PCC NET COMMUNICATION
(-)	NEGATIVE 12V (-12V DC) OR LOW SIGNAL FOR CAN/PCC NET COMMUNICATION

FIGURE 62. WIRING DIAGRAM PC 3.3 (SHEET 1 OF 10)

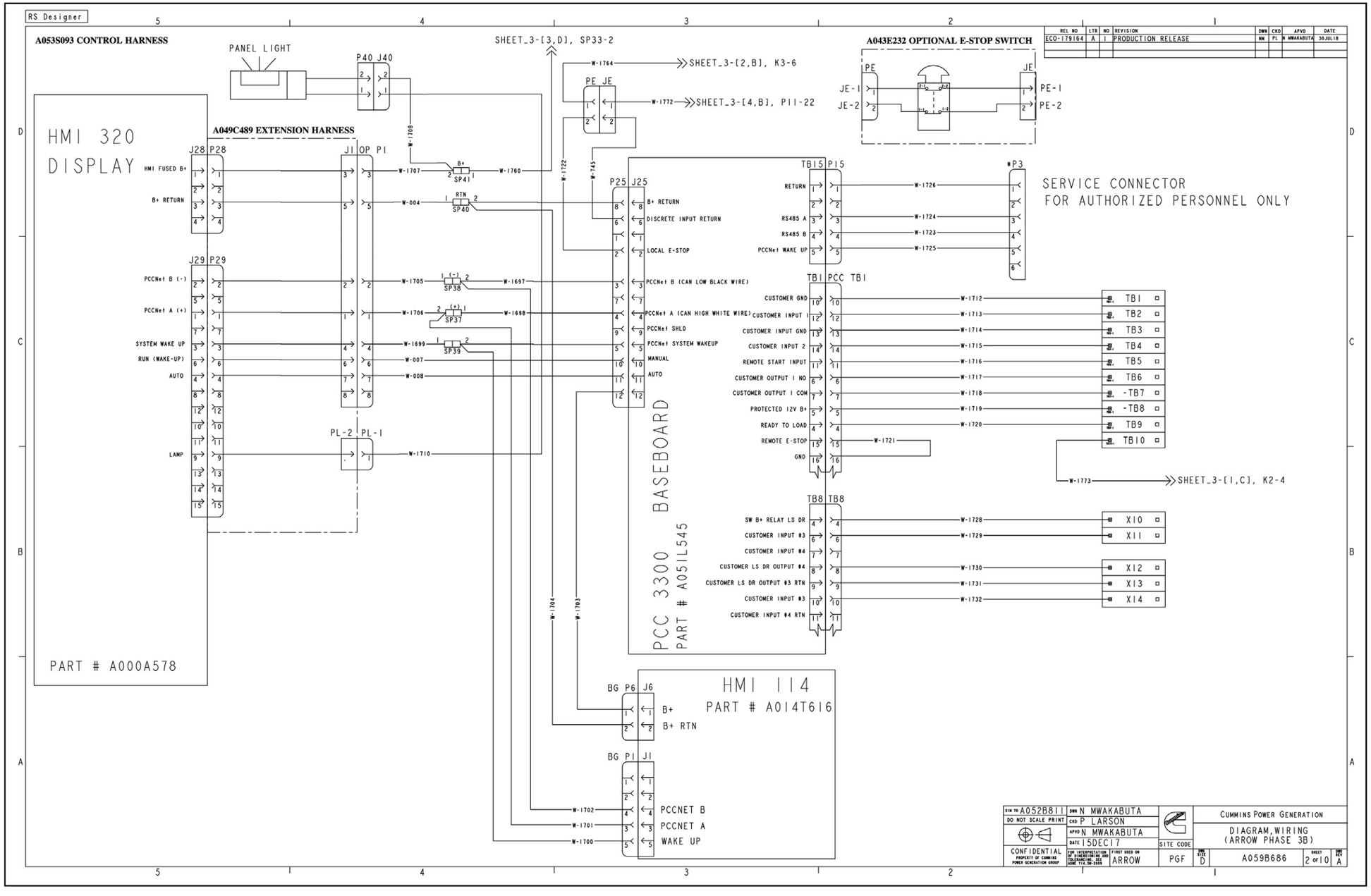


FIGURE 63. WIRING DIAGRAM PC 3.3 (SHEET 2 OF 10)

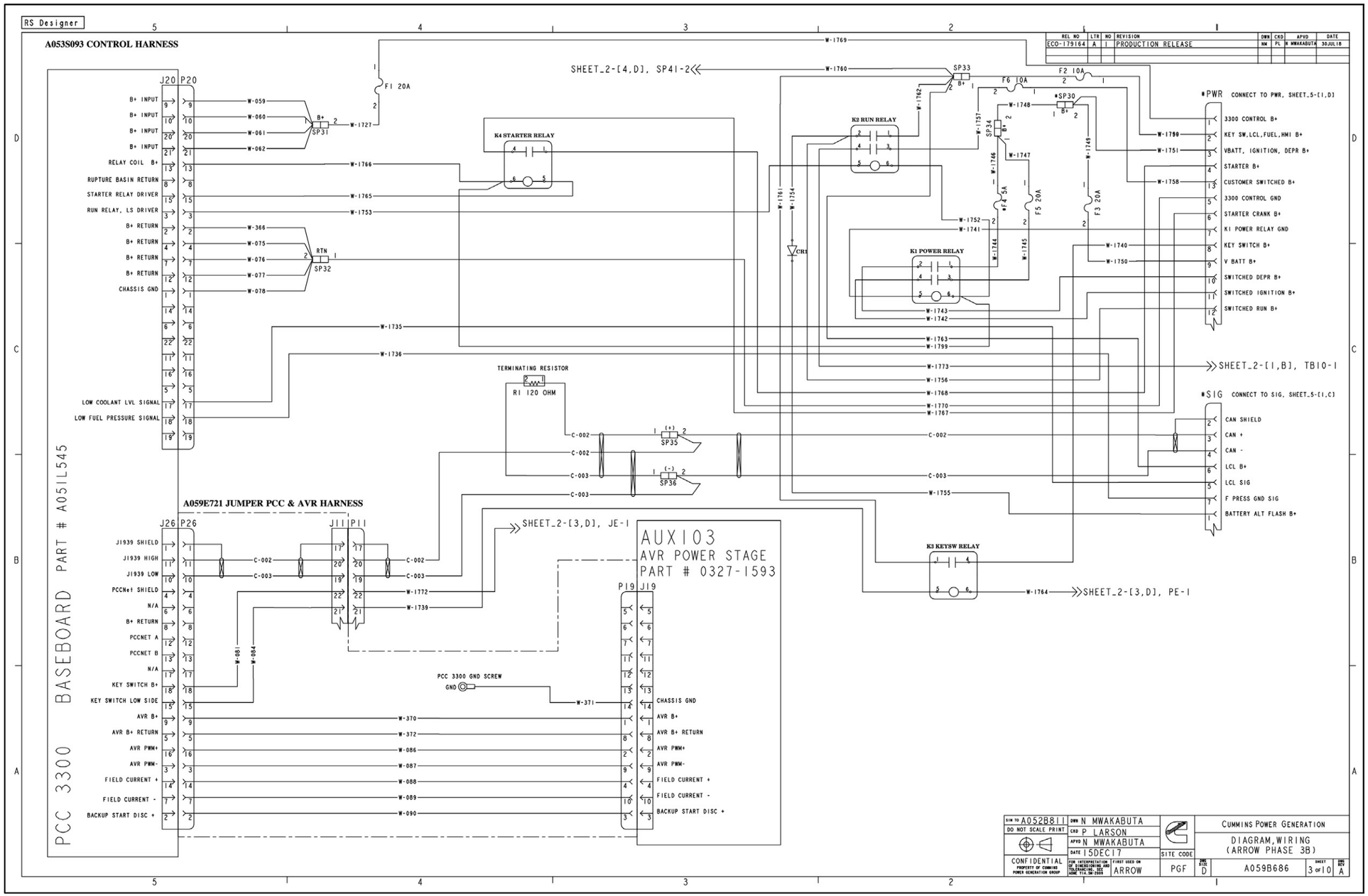


FIGURE 64. WIRING DIAGRAM PC 3.3 (SHEET 3 OF 10)

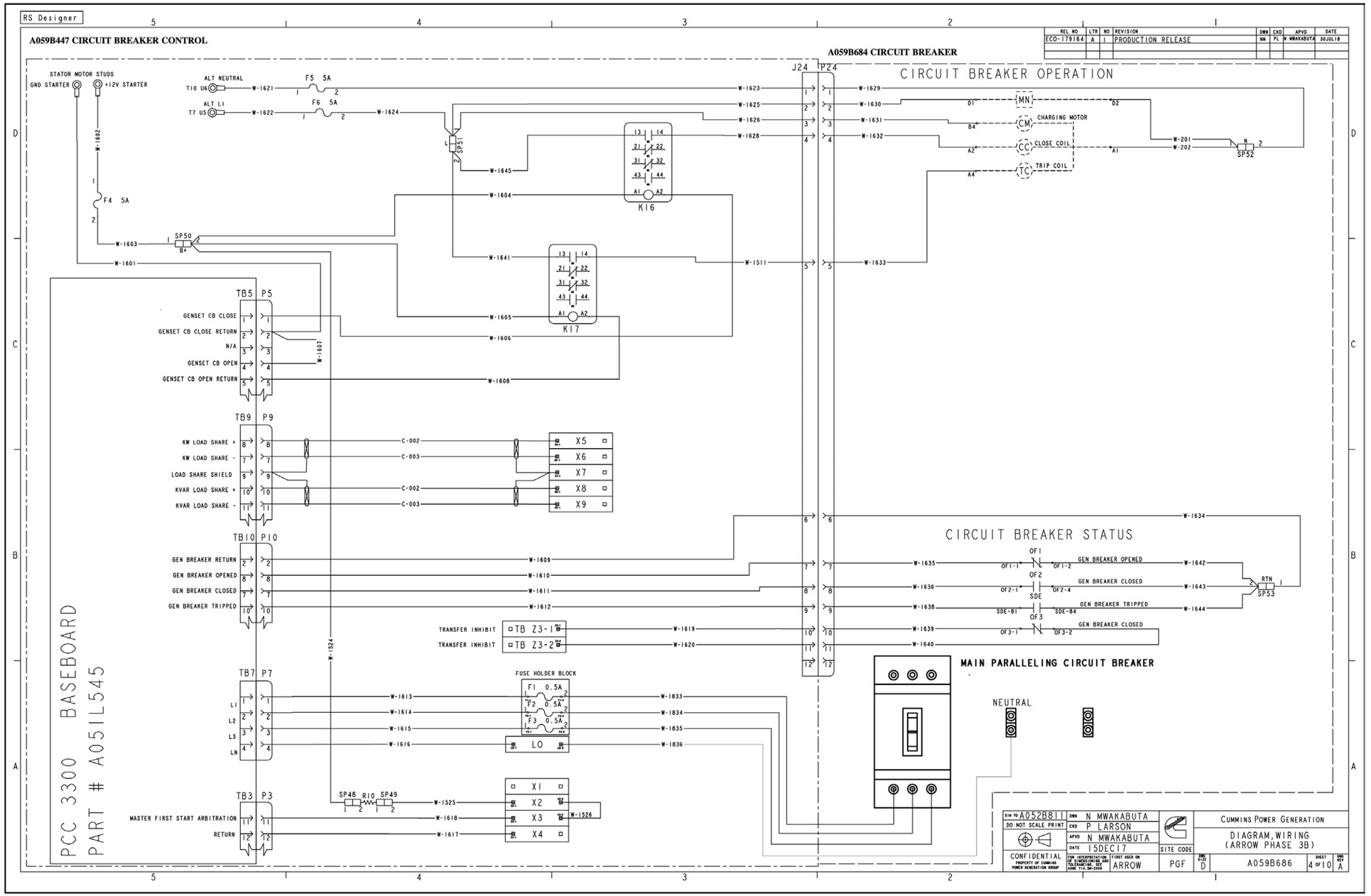


FIGURE 65. WIRING DIAGRAM PC 3.3 (SHEET 4 OF 10)

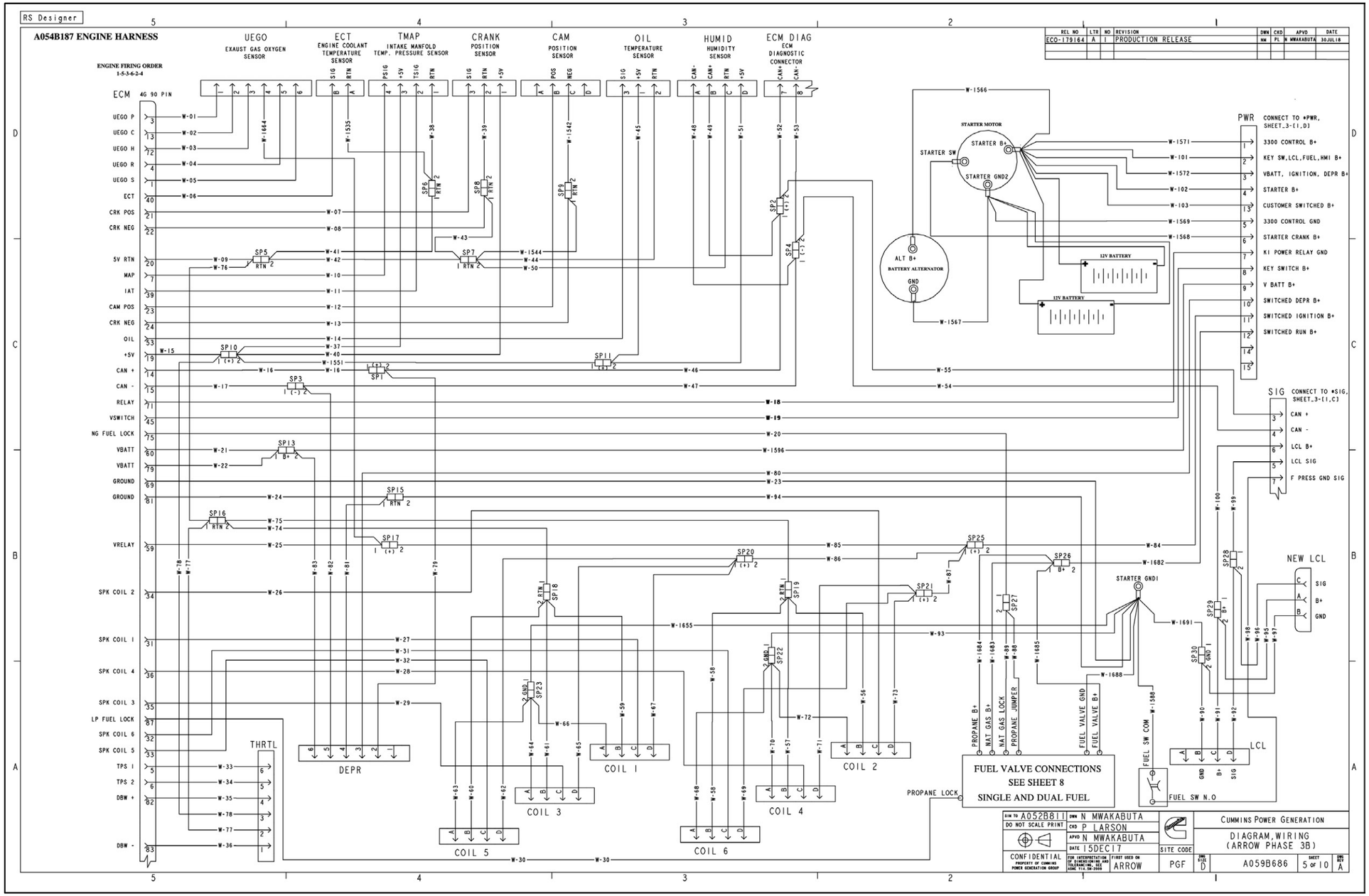


FIGURE 66. WIRING DIAGRAM PC 3.3 (SHEET 5 OF 10)

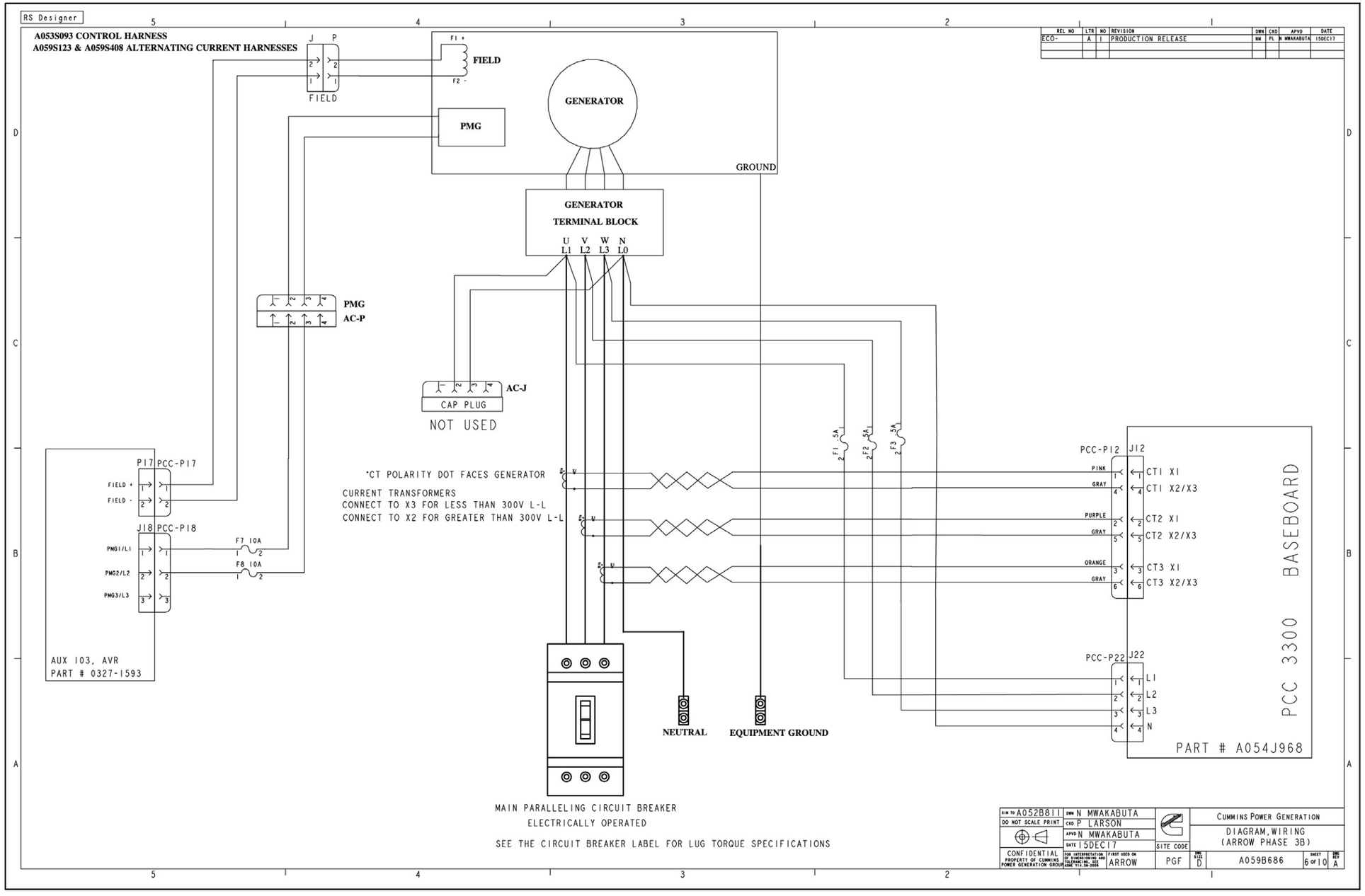


FIGURE 67. WIRING DIAGRAM PC 3.3 (SHEET 6 OF 10)

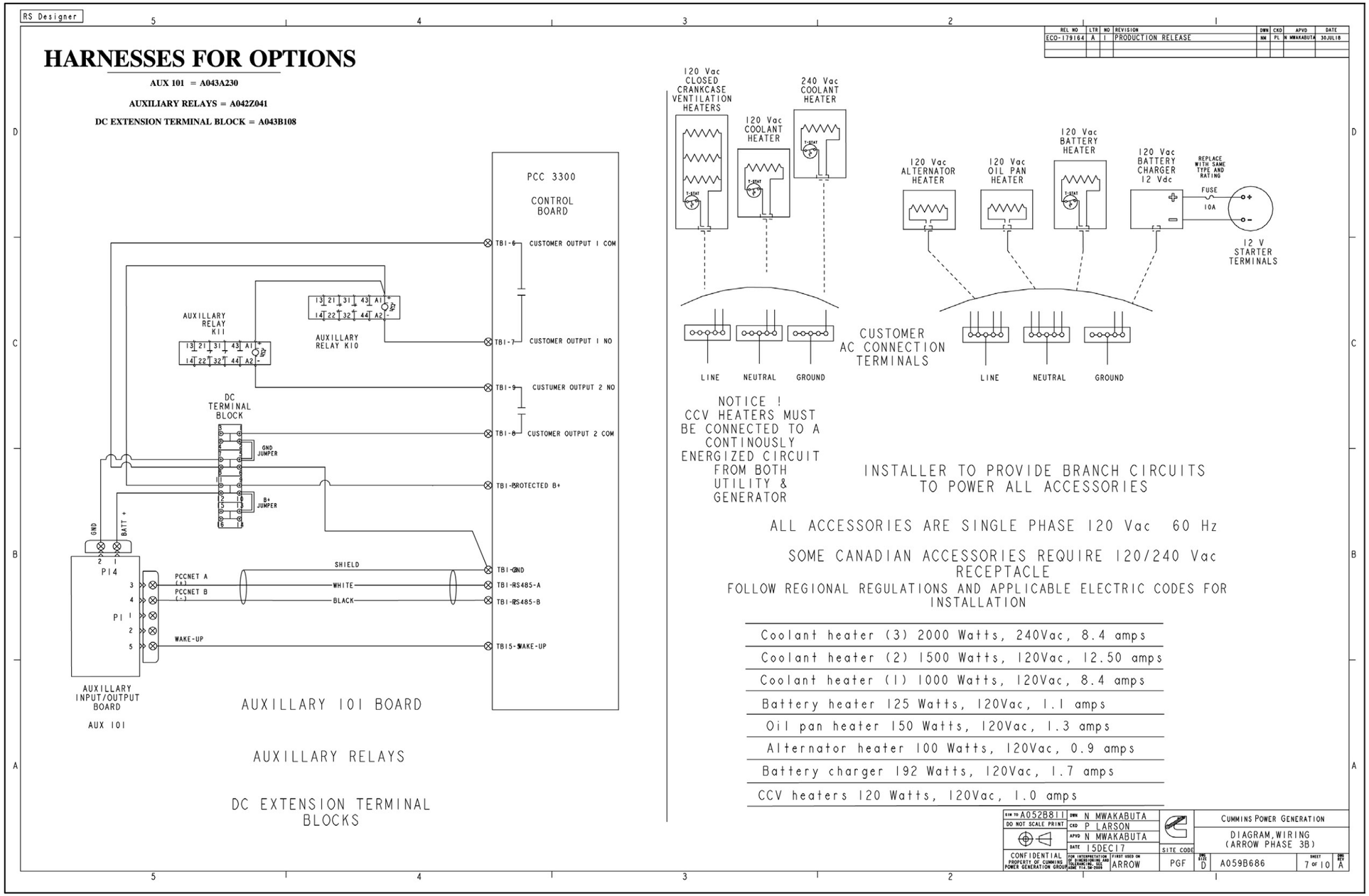


FIGURE 68. WIRING DIAGRAM PC 3.3 (SHEET 7 OF 10)

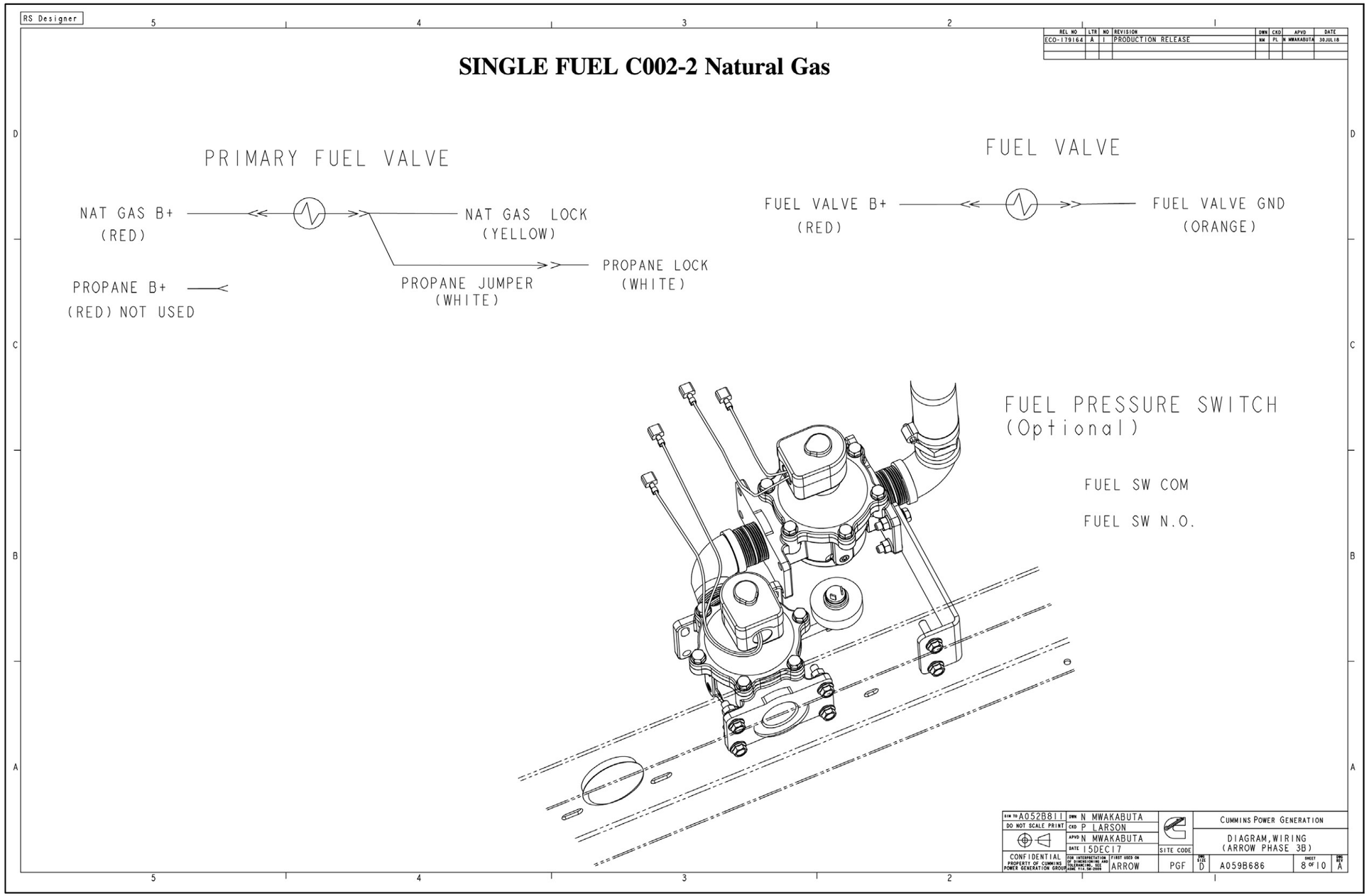


FIGURE 69. WIRING DIAGRAM PC 3.3 (SHEET 8 OF 10)

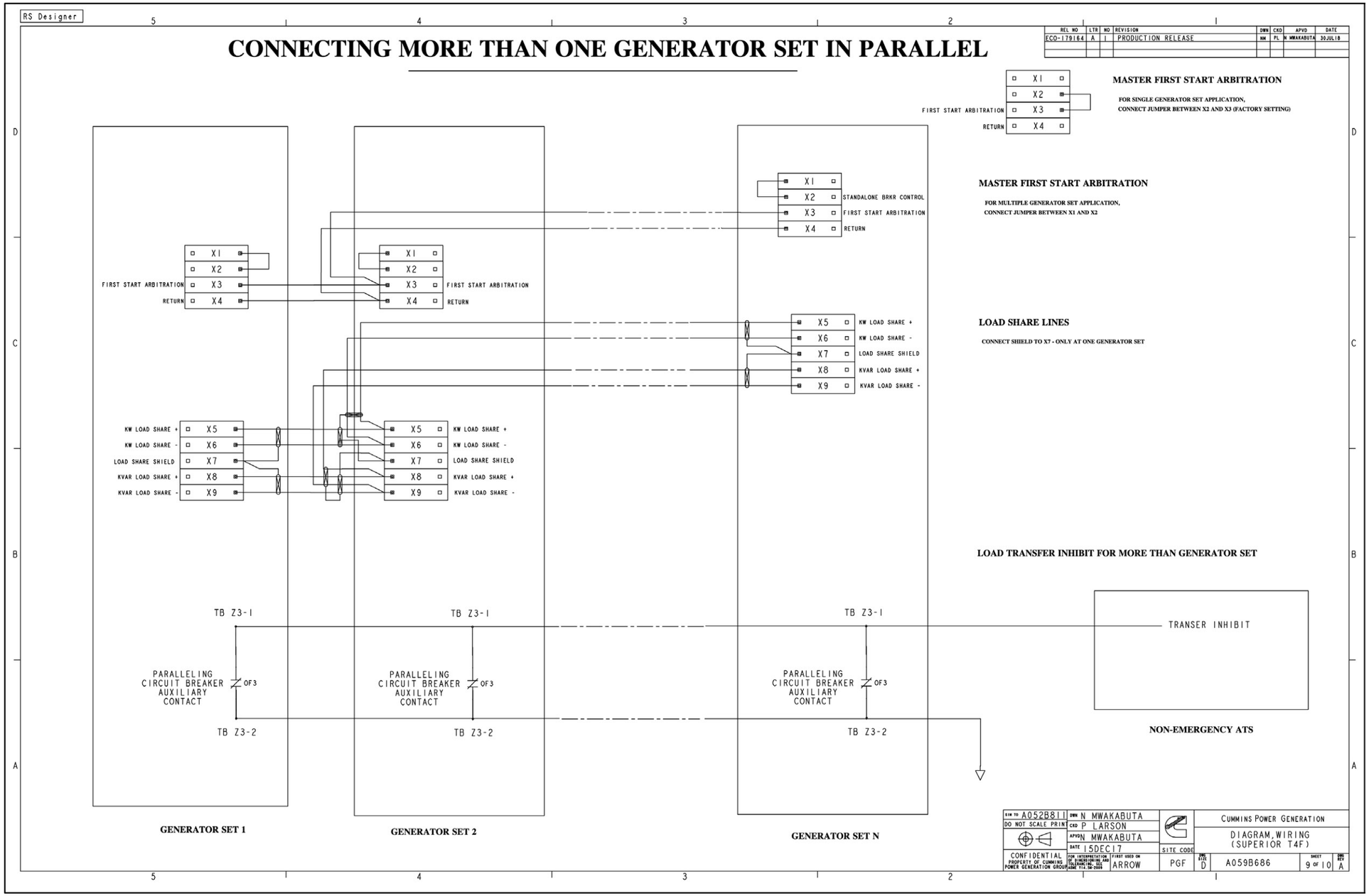


FIGURE 70. WIRING DIAGRAM PC 3.3 (SHEET 9 OF 10)

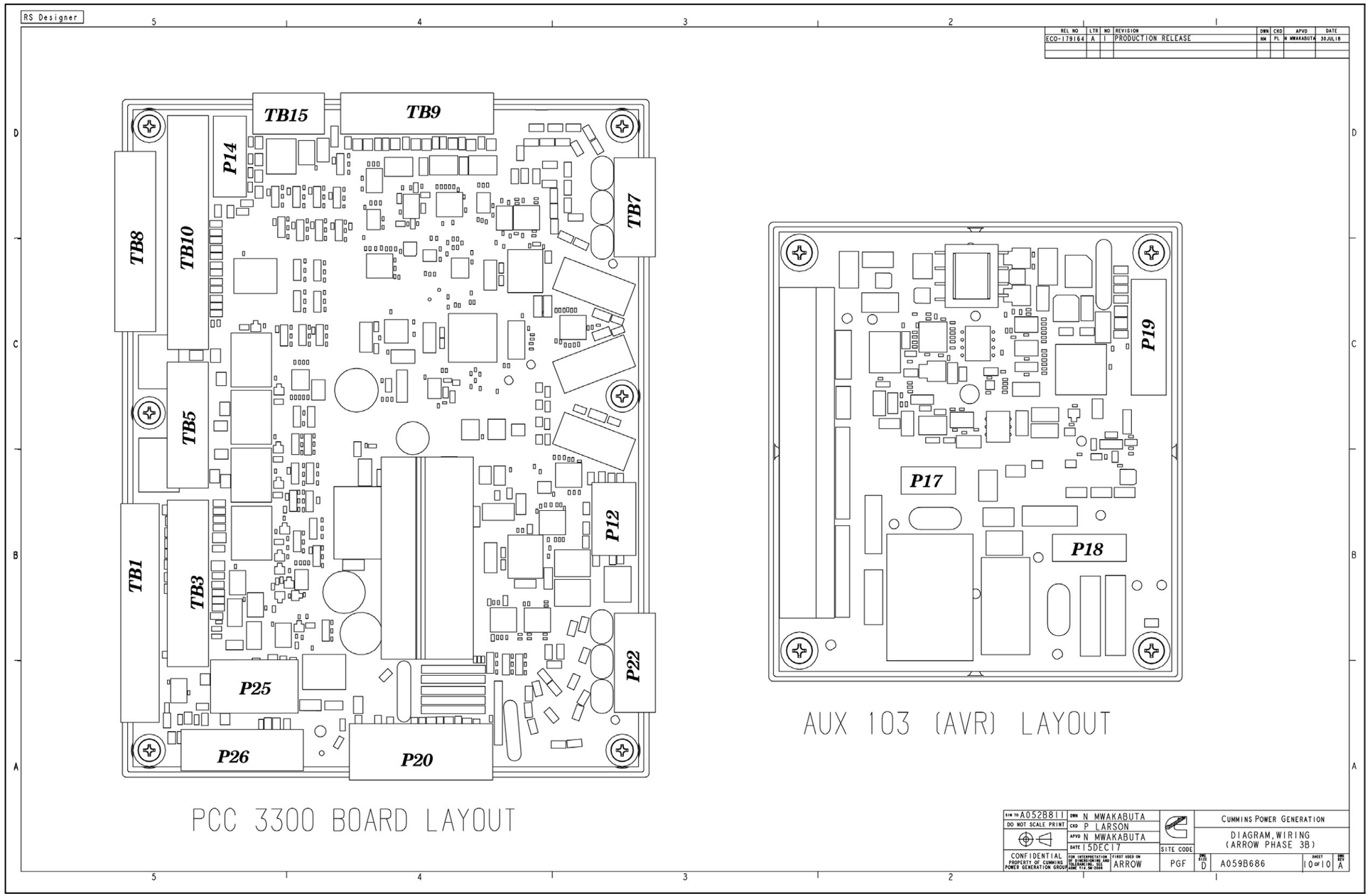
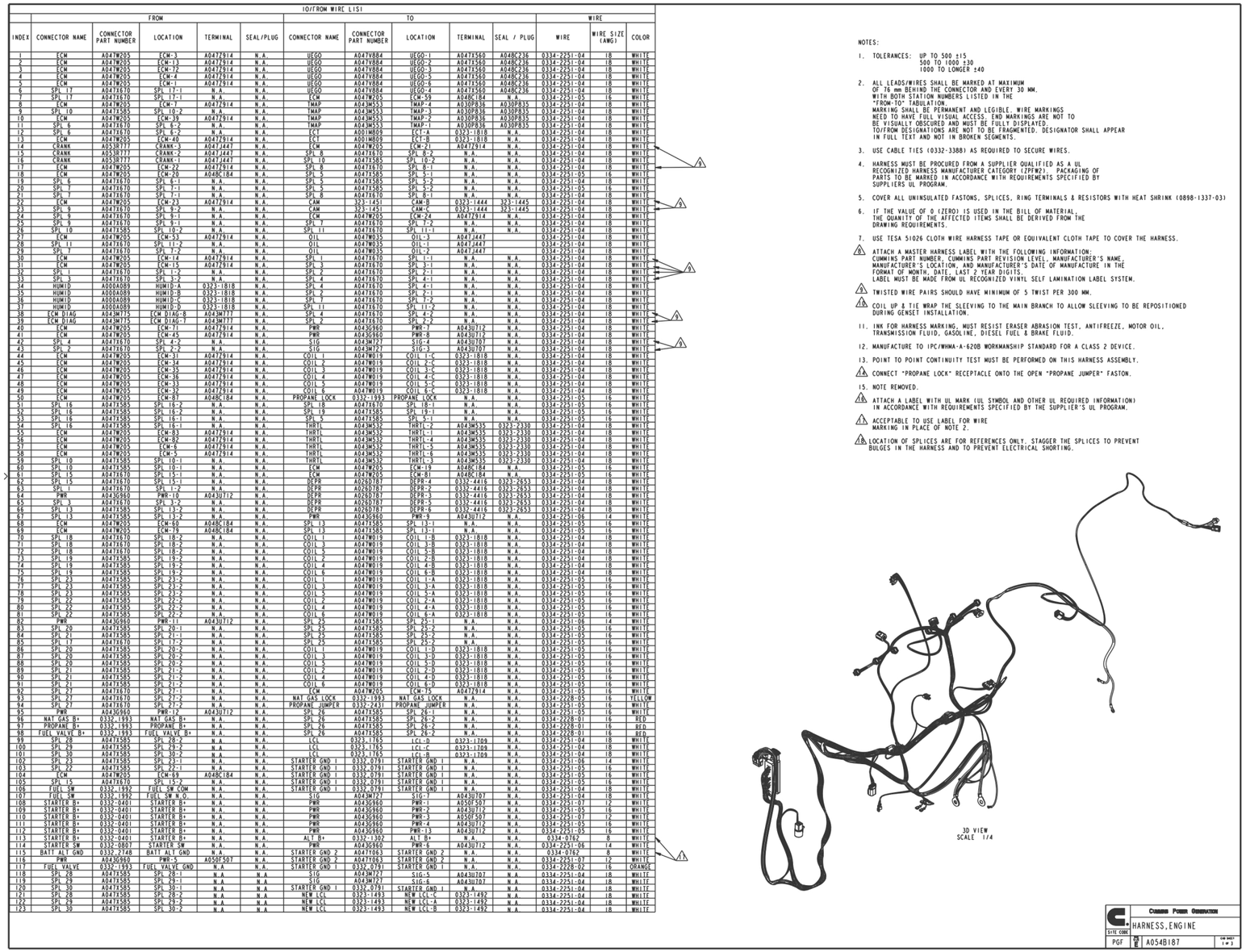


FIGURE 71. WIRING DIAGRAM PC 3.3 (SHEET 10 OF 10)



INDEX	FROM CONNECTOR NAME	FROM CONNECTOR PART NUMBER	FROM LOCATION	FROM TERMINAL	FROM SEAL/PLUG	TO CONNECTOR NAME	TO CONNECTOR PART NUMBER	TO LOCATION	TO TERMINAL	TO SEAL / PLUG	WIRE	WIRE SIZE (AWG)	COLOR
1	ECM	A047W205	ECM-3	A0477914	N.A.	UEGO	A047V884	UEGO-1	A047X560	A048BC236	0334-2251-04	18	WHITE
2	ECM	A047W205	ECM-13	A0477914	N.A.	UEGO	A047V884	UEGO-2	A047X560	A048BC236	0334-2251-04	18	WHITE
3	ECM	A047W205	ECM-12	A0477914	N.A.	UEGO	A047V884	UEGO-3	A047X560	A048BC236	0334-2251-04	18	WHITE
4	ECM	A047W205	ECM-4	A0477914	N.A.	UEGO	A047V884	UEGO-5	A047X560	A048BC236	0334-2251-04	18	WHITE
5	ECM	A047W205	ECM-1	A0477914	N.A.	UEGO	A047V884	UEGO-6	A047X560	A048BC236	0334-2251-04	18	WHITE
6	SPL 17	A0471670	SPL 17-1	N.A.	N.A.	UEGO	A047V884	UEGO-4	A047X560	A048BC236	0334-2251-04	18	WHITE
7	SPL 17	A0471670	SPL 17-1	N.A.	N.A.	ECM	A047W205	ECM-59	A048C184	N.A.	0334-2251-05	16	WHITE
8	ECM	A047W205	ECM-7	A0477914	N.A.	TMAP	A043M553	TMAP-4	A030P836	A030P835	0334-2251-04	18	WHITE
9	SPL 10	A0471585	SPL 10-2	N.A.	N.A.	TMAP	A043M553	TMAP-3	A030P836	A030P835	0334-2251-04	18	WHITE
10	ECM	A047W205	ECM-39	A0477914	N.A.	TMAP	A043M553	TMAP-2	A030P836	A030P835	0334-2251-04	18	WHITE
11	SPL 6	A0471670	SPL 6-2	N.A.	N.A.	TMAP	A043M553	TMAP-1	A030P836	A030P835	0334-2251-04	18	WHITE
12	SPL 6	A0471670	SPL 6-2	N.A.	N.A.	CCT	A001M809	CCT-A	0323-1818	N.A.	0334-2251-04	18	WHITE
13	ECM	A047W205	ECM-40	A0477914	N.A.	CCT	A001M809	CCT-B	0323-1818	N.A.	0334-2251-04	18	WHITE
14	CRANK	A053R777	CRANK-3	A0471447	N.A.	ECM	A047W205	ECM-21	A0477914	N.A.	0334-2251-04	18	WHITE
15	CRANK	A053R777	CRANK-2	A0471447	N.A.	SPL 8	A047E670	SPL 8-2	N.A.	N.A.	0334-2251-04	18	WHITE
16	CRANK	A053R777	CRANK-1	A0471447	N.A.	SPL 10	A047E585	SPL 10-2	N.A.	N.A.	0334-2251-04	18	WHITE
17	ECM	A047W205	ECM-22	A0477914	N.A.	SPL 8	A047E670	SPL 8-1	N.A.	N.A.	0334-2251-04	18	WHITE
18	ECM	A047W205	ECM-20	A048C184	N.A.	SPL 5	A047E585	SPL 5-1	N.A.	N.A.	0334-2251-05	16	WHITE
19	SPL 6	A047E670	SPL 6-1	N.A.	N.A.	SPL 5	A047E585	SPL 5-2	N.A.	N.A.	0334-2251-04	18	WHITE
20	SPL 7	A047E670	SPL 7-1	N.A.	N.A.	SPL 5	A047E585	SPL 5-2	N.A.	N.A.	0334-2251-05	16	WHITE
21	SPL 7	A047E670	SPL 7-1	N.A.	N.A.	SPL 8	A047E670	SPL 8-1	N.A.	N.A.	0334-2251-04	18	WHITE
22	ECM	A047W205	ECM-23	A0477914	N.A.	CAM	323-1451	CAM-B	0323-1444	323-1445	0334-2251-04	18	WHITE
23	SPL 9	A047E670	SPL 9-2	N.A.	N.A.	CAM	323-1451	CAM-C	0323-1444	323-1445	0334-2251-04	18	WHITE
24	SPL 9	A047E670	SPL 9-1	N.A.	N.A.	ECM	A047W205	ECM-24	A0477914	N.A.	0334-2251-04	18	WHITE
25	SPL 9	A047E670	SPL 9-1	N.A.	N.A.	SPL 7	A047E670	SPL 7-2	N.A.	N.A.	0334-2251-04	18	WHITE
26	SPL 10	A047E585	SPL 10-2	N.A.	N.A.	SPL 11	A047E670	SPL 11-1	N.A.	N.A.	0334-2251-04	18	WHITE
27	ECM	A047W205	ECM-53	A0477914	N.A.	OIL	A047W035	OIL-3	A047J447		0334-2251-04	18	WHITE
28	SPL 11	A047E670	SPL 11-2	N.A.	N.A.	OIL	A047W035	OIL-1	A047J447		0334-2251-04	18	WHITE
29	SPL 7	A047E670	SPL 7-2	N.A.	N.A.	OIL	A047W035	OIL-2	A047J447		0334-2251-04	18	WHITE
30	ECM	A047W205	ECM-14	A0477914	N.A.	SPL 1	A047E670	SPL 1-1	N.A.	N.A.	0334-2251-04	18	WHITE
31	ECM	A047W205	ECM-15	A0477914	N.A.	SPL 3	A047E670	SPL 3-1	N.A.	N.A.	0334-2251-04	18	WHITE
32	SPL 1	A047E670	SPL 1-2	N.A.	N.A.	SPL 2	A047E670	SPL 2-1	N.A.	N.A.	0334-2251-04	18	WHITE
33	SPL 3	A047E670	SPL 3-2	N.A.	N.A.	SPL 4	A047E670	SPL 4-1	N.A.	N.A.	0334-2251-04	18	WHITE
34	HUMID	A000A089	HUMID-A	0323-1818	N.A.	SPL 1	A047E670	SPL 1-2	N.A.	N.A.	0334-2251-04	18	WHITE
35	HUMID	A000A089	HUMID-B	0323-1818	N.A.	SPL 2	A047E670	SPL 2-1	N.A.	N.A.	0334-2251-04	18	WHITE
36	HUMID	A000A089	HUMID-C	0323-1818	N.A.	SPL 7	A047E670	SPL 7-2	N.A.	N.A.	0334-2251-04	18	WHITE
37	HUMID	A000A089	HUMID-D	0323-1818	N.A.	SPL 11	A047E670	SPL 11-2	N.A.	N.A.	0334-2251-04	18	WHITE
38	ECM DIAG	A043M775	ECM DIAG-B	A043M777	N.A.	SPL 4	A047E670	SPL 4-2	N.A.	N.A.	0334-2251-04	18	WHITE
39	ECM DIAG	A043M775	ECM DIAG-T	A043M777	N.A.	SPL 2	A047E670	SPL 2-2	N.A.	N.A.	0334-2251-04	18	WHITE
40	ECM	A047W205	ECM-71	A0477914	N.A.	PWR	A043G960	PWR-7	A043U712	N.A.	0334-2251-04	18	WHITE
41	ECM	A047W205	ECM-45	A0477914	N.A.	PWR	A043G960	PWR-8	A043U712	N.A.	0334-2251-04	18	WHITE
42	SPL 4	A047E670	SPL 4-2	N.A.	N.A.	SIG	A043M727	SIG-4	A043U707	N.A.	0334-2251-04	18	WHITE
43	SPL 2	A047E670	SPL 2-2	N.A.	N.A.	SIG	A043M727	SIG-3	A043U707	N.A.	0334-2251-04	18	WHITE
44	ECM	A047W205	ECM-51	A0477914	N.A.	COIL 1	A047W019	COIL 1-C	0323-1818	N.A.	0334-2251-04	18	WHITE
45	ECM	A047W205	ECM-34	A0477914	N.A.	COIL 2	A047W019	COIL 2-C	0323-1818	N.A.	0334-2251-04	18	WHITE
46	ECM	A047W205	ECM-35	A0477914	N.A.	COIL 3	A047W019	COIL 3-C	0323-1818	N.A.	0334-2251-04	18	WHITE
47	ECM	A047W205	ECM-36	A0477914	N.A.	COIL 4	A047W019	COIL 4-C	0323-1818	N.A.	0334-2251-04	18	WHITE
48	ECM	A047W205	ECM-33	A0477914	N.A.	COIL 5	A047W019	COIL 5-C	0323-1818	N.A.	0334-2251-04	18	WHITE
49	ECM	A047W205	ECM-32	A0477914	N.A.	COIL 6	A047W019	COIL 6-C	0323-1818	N.A.	0334-2251-04	18	WHITE
50	ECM	A047W205	ECM-87	A048C184	N.A.	PROPANE LOCK	0332-1993	PROPANE LOCK	N.A.	N.A.	0334-2251-05	16	WHITE
51	SPL 16	A0471585	SPL 16-2	N.A.	N.A.	SPL 18	A047E670	SPL 18-1	N.A.	N.A.	0334-2251-05	16	WHITE
52	SPL 16	A0471585	SPL 16-2	N.A.	N.A.	SPL 19	A047E585	SPL 19-1	N.A.	N.A.	0334-2251-05	16	WHITE
53	SPL 16	A0471585	SPL 16-1	N.A.	N.A.	SPL 5	A047E585	SPL 5-1	N.A.	N.A.	0334-2251-05	16	WHITE
54	SPL 16	A0471585	SPL 16-1	N.A.	N.A.	THRTL	A043M532	THRTL-2	A043M535	0323-2330	0334-2251-04	18	WHITE
55	ECM	A047W205	ECM-83	A0477914	N.A.	THRTL	A043M532	THRTL-1	A043M535	0323-2330	0334-2251-04	18	WHITE
56	ECM	A047W205	ECM-82	A0477914	N.A.	THRTL	A043M532	THRTL-4	A043M535	0323-2330	0334-2251-04	18	WHITE
57	ECM	A047W205	ECM-6	A0477914	N.A.	THRTL	A043M532	THRTL-5	A043M535	0323-2330	0334-2251-04	18	WHITE
58	ECM	A047W205	ECM-5	A0477914	N.A.	THRTL	A043M532	THRTL-6	A043M535	0323-2330	0334-2251-04	18	WHITE
59	SPL 10	A0471585	SPL 10-1	N.A.	N.A.	THRTL	A043M532	THRTL-3	A043M535	0323-2330	0334-2251-04	18	WHITE
60	SPL 10	A0471585	SPL 10-1	N.A.	N.A.	ECM	A047W205	ECM-19	A048C184	N.A.	0334-2251-05	16	WHITE
61	SPL 15	A047E670	SPL 15-1	N.A.	N.A.	ECM	A047W205	ECM-81	A048C184	N.A.	0334-2251-05	16	WHITE
62	SPL 15	A047E670	SPL 15-1	N.A.	N.A.	DEPR	A026D787	DEPR-4	0332-4416	0323-2653	0334-2251-04	18	WHITE
63	SPL 1	A047E670	SPL 1-2	N.A.	N.A.	DEPR	A026D787	DEPR-2	0332-4416	0323-2653	0334-2251-04	18	WHITE
64	PWR	A043G960	PWR-10	A043U712	N.A.	DEPR	A026D787	DEPR-3	0332-4416	0323-2653	0334-2251-04	18	WHITE
65	SPL 3	A047E670	SPL 3-2	N.A.	N.A.	DEPR	A026D787	DEPR-5	0332-4416	0323-2653	0334-2251-04	18	WHITE
66	SPL 13	A0471585	SPL 13-2	N.A.	N.A.	DEPR	A026D787	DEPR-6	0332-4416	0323-2653	0334-2251-04	18	WHITE
67	SPL 13	A0471585	SPL 13-2	N.A.	N.A.	PWR	A043G960	PWR-9	A043U712	N.A.	0334-2251-06	14	WHITE
68	ECM	A047W205	ECM-60	A048C184	N.A.	SPL 13	A047E585	SPL 13-1	N.A.	N.A.	0334-2251-05	16	WHITE
69	ECM	A047W205	ECM-79	A048C184	N.A.	SPL 13	A047E585	SPL 13-1	N.A.	N.A.	0334-2251-05	16	WHITE
70	SPL 18	A047E670	SPL 18-2	N.A.	N.A.	COIL 1	A047W019	COIL 1-B	0323-1818	N.A.	0334-2251-04	18	WHITE
71	SPL 18	A047E670	SPL 18-2	N.A.	N.A.	COIL 3	A047W019	COIL 3-B	0323-1818	N.A.	0334-2251-04	18	WHITE
72	SPL 18	A047E670	SPL 18-2	N.A.	N.A.	COIL 5	A047W019	COIL 5-B	0323-1818	N.A.	0334-2251-04	18	WHITE
73	SPL 19	A0471585	SPL 19-2	N.A.	N.A.	COIL 2	A047W019	COIL 2-B	0323-1818	N.A.	0334-2251-04	18	WHITE
74	SPL 19	A0471585	SPL 19-2	N.A.	N.A.	COIL 4	A047W019	COIL 4-B	0323-1818	N.A.	0334-2251-04	18	WHITE
75	SPL 19	A0471585	SPL 19-2	N.A.	N.A.	COIL 6	A047W019	COIL 6-B	0323-1818	N.A.	0334-2251-04	18	WHITE
76	SPL 23	A0471585	SPL 23-2	N.A.	N.A.	COIL 1	A047W019	COIL 1-A	0323-1818	N.A.	0334-2251-05	16	WHITE
77	SPL 23	A0471585	SPL 23-2	N.A.	N.A.	COIL 3	A047W019	COIL 3-A	0323-1818	N.A.	0334-2251-05	16	WHITE
78	SPL 23	A0471585	SPL 23-2	N.A.	N.A.	COIL 5	A047W019	COIL 5-A	0323-1818	N.A.	0334-2251-05	16	WHITE
79	SPL 22	A0471585	SPL 22-2	N.A.	N.A.	COIL 2	A047W019	COIL 2-A	0323-1818	N.A.	0334-2251-05	16	WHITE
80	SPL 22	A0471585	SPL 22-2	N.A.	N.A.	COIL 4	A047W019	COIL 4-A	0323-1818	N.A.	0334-2251-05	16	WHITE
81	SPL 22	A0471585	SPL 22-2	N.A.	N.A.	COIL 6	A047W019	COIL 6-A	0323-1818	N.A.	0334-2251-05	16	WHITE
82	PWR	A043G960	PWR-11	A043U712	N.A.	SPL 25	A047E585	SPL 25-1	N.A.	N.A.	0334-2251-06	14	WHITE
83	SPL 20	A0471585	SPL 20-1	N.A.	N.A.	SPL 23	A047E585	SPL 23-2	N.A.	N.A.	0334-2251-05	16	WHITE
84	SPL 21	A0471585	SPL 21-1	N.A.	N.A.	SPL 25	A047E585	SPL 25-2	N.A.	N.A.	0334-2251-05	16	WHITE
85	SPL 17	A047E670	SPL 17-2	N.A.	N.A.	SPL 25	A047E585	SPL 25-2	N.A.	N.A.	0334-2251-05	16	WHITE
86	SPL 20	A0471585	SPL 20-2	N.A.	N.A.	COIL 1	A047W019	COIL 1-D	0323-1818	N.A.	0334-2251-05	16	WHITE
87	SPL 20	A0471585	SPL 20-2	N.A.	N.A.	COIL 3	A047W019	COIL 3-D	0323-1818	N.A.	0334-2251-05	16	WHITE
88	SPL 20	A0471585	SPL 20-2	N.A.	N.A.	COIL 5	A047W019	COIL 5-D	0323-1818	N.A.	0334-2251-05	16	WHITE
89	SPL 21	A0471585	SPL 21-2	N.A.	N.A.	COIL 2	A047W019	COIL 2-D	0323-1818	N.A.	0334-2251-05	16	WHITE
90	SPL 21	A0471585	SPL 21-2	N.A.	N.A.	COIL 4	A047W019	COIL 4-D	0323-1818	N.A.	0334-2251-05	16	WHITE
91	SPL 21	A0471585	SPL 21-2	N.A.	N.A.	COIL 6	A047W019	COIL 6-D	0323-1818	N.A.	0334-2251-05	16	WHITE
92	SPL 27	A047E670	SPL 27-1	N.A.	N.A.	ECM	A047W205	ECM-75	A0477914	N.A.	0334-2251-05	16	WHITE
93	SPL 27	A047E670	SPL 27-2	N.A.	N.A.	NAT GAS LOCK	0332-1993	NAT GAS LOCK	N.A.	N.A.	0334-2228-05	16	YELLOW
94	SPL 27	A047E670	SPL 27-2	N.A.	N.A.	PROPANE JUMPER	0332-2431	PROPANE JUMPER	N.A.	N.A.	0334-2251-05	16	WHITE
95	PWR	A043G960	PWR-12	A043U712	N.A.	SPL 26	A047E585	SPL 26-1	N.A.	N.A.	0334-2251-05	16	WHITE
96	NAT GAS B+	0332-1993	NAT GAS B+	N.A.	N.A.	SPL 26	A047E585	SPL 26-2	N.A.	N.A.	0334-2228-01	16	RED
97	PROPANE B+	0332-1993	PROPANE B+	N.A.	N.A.	SPL 26	A047E585	SPL 26-2	N.A.	N.A.	0334-2228-01	16	RED
98	FUEL VALVE B+	0332-1993	FUEL VALVE B+	N.A.	N.A.	SPL 26	A047E585	SPL 26-2	N.A.	N.A.	0334-2228-01	16	RED
99	SPL 28	A0471585	SPL 28-2	N.A.	N.A.	LCL	0323-1765	LCL-D	0323-1709	N.A.	0334-2251-04	18	WHITE
100	SPL 29	A0471585	SPL 29-2	N.A.	N.A.	LCL	0323-1765	LCL-C	0323-1709	N.A.	0334-2251-04	18	WHITE
101	SPL 30	A0471585	SPL 30-2	N.A.	N.A.	LCL	0323-1765	LCL-B	0323-1709	N.A.	0334-2251-04	18	WHITE
102	SPL 23	A0471585	SPL 23-1	N.A.	N.A.	STARTER GND 1	0332-0791	STARTER GND 1	N.A.	N.A.	0334-2251-06	14	WHITE
103	SPL 22	A0471585	SPL 22-1	N.A.	N.A.	STARTER GND 1	0332-0791	STARTER GND 1	N.A.	N.A.	0334-2251-05	16	WHITE
104	ECM	A047W205	ECM-69	A048C184	N.A.	STARTER GND 1	0332-0791	STARTER GND 1	N.A.	N.A.	0334-2251-05	16	WHITE
105	SPL 15	A047E670	SPL 15-2	N.A.	N.A.	STARTER GND 1	0332-0791	STARTER GND 1	N.A.	N.A.	0334-2251-05	16	WHITE
106	FUEL SW	0332-1992	FUEL SW COM	N.A.	N.A.	STARTER GND 1	0332-0791	STARTER GND 1	N.A.	N.A.	0334-2251-04	18	WHITE
107	FUEL SW	0332-1992	FUEL SW N.O.	N.A.	N.A.	SIG	A043M727	SIG-7	A043U707	N.A.	0334-2251-04	18	WHITE
108	STARTER B+	0332-0401	STARTER B+	N.A.	N.A.	PWR	A043G960	PWR-1	A050F507	N.A.	0334-2251-07	12	WHITE
109	STARTER B+	0332-0401	STARTER B+	N.A.	N.A.	PWR	A043G960	PWR-2	A043U712	N.A.	0334-2251-05	16	WHITE
110	STARTER B+	0332-0401	STARTER B+	N.A.	N.A.	PWR	A043G960	PWR-3	A050F507	N.A.	0334-2251-07	12	WHITE
111	STARTER B+	0332-0401	STARTER B+	N.A.	N.A.	PWR	A043G960	PWR-4	A043U712	N.A.	0334-2251-05	16	WHITE
112	STARTER B+	0332-0401	STARTER B+	N.A.	N.A.	PWR	A043G960	PWR-13	A043U712	N.A.	0334-2251-05	16	WHITE
113	STARTER B+	0332-0401	STARTER B+	N.A.	N.A.	ALT B+	0332-1302	ALT B+	N.A.	N.A.	0334-0762	8	WHITE
114	STARTER SW	0332-0807	STARTER SW	N.A.	N.A.	PWR	A043G960	PWR-6	A043U712	N.A.	0334-2251-06	14	WHITE
115	BATT ALT GND	0332-2748	BATT ALT GND	N.A.	N.A.	STARTER GND 2	A047T063	STARTER GND 2	N.A.	N.A.	0334-0762	8	WHITE
116	PWR	A043G960	PWR-5	A050F507	N.A.	STARTER GND 2	A047T063	STARTER GND 2	N.A.	N.A.	0334-2251-07	12	WHITE
117	FUEL VALVE	0332-1993	FUEL VALVE GND	N.A.	N.A.	STARTER GND 1	0332-0791	STARTER GND 1	N.A.	N.A.	0334-2228-02	16	ORANGE
118	SPL 28	A0471585	SPL 28-1	N.A.	N.A.	SIG	A043M727	SIG-5	A043U707	N.A.	0334-2251-04	18	WHITE
119	SPL 29	A0471585	SPL 29-1	N.A.	N.A.	SIG	A043M727	SIG-6	A043U707	N.A.	0334-2251-04	18	WHITE
120	SPL 30	A0471585	SPL 30-1	N.A.	N.A.	STARTER GND 1	0332-0791	STARTER GND 1	N.A.	N.A.	0334-2251-04	18	WHITE
121	SPL 28	A0471585	SPL 28-2	N.A.	N.A.	NEW LCL	0323-1493	NEW LCL-C	0323-1492	N.A.	0334-2251-04	18	WHITE
122	SPL 29	A0471585	SPL 29-2	N.A.	N.A.	NEW LCL	0323-1493	NEW LCL-A	0323-1492	N.A.	0334-2251-04	18	WHITE
123	SPL 30	A0471585	SPL 30-2	N.A.	N.A.	NEW LCL	0323-1493	NEW LCL-B	0323-1492	N.A.	0334-2251-04	18	WHITE

FIGURE 72. HARNESS, GENERATOR SET ELECTRICAL (SHEET 1 OF 3)

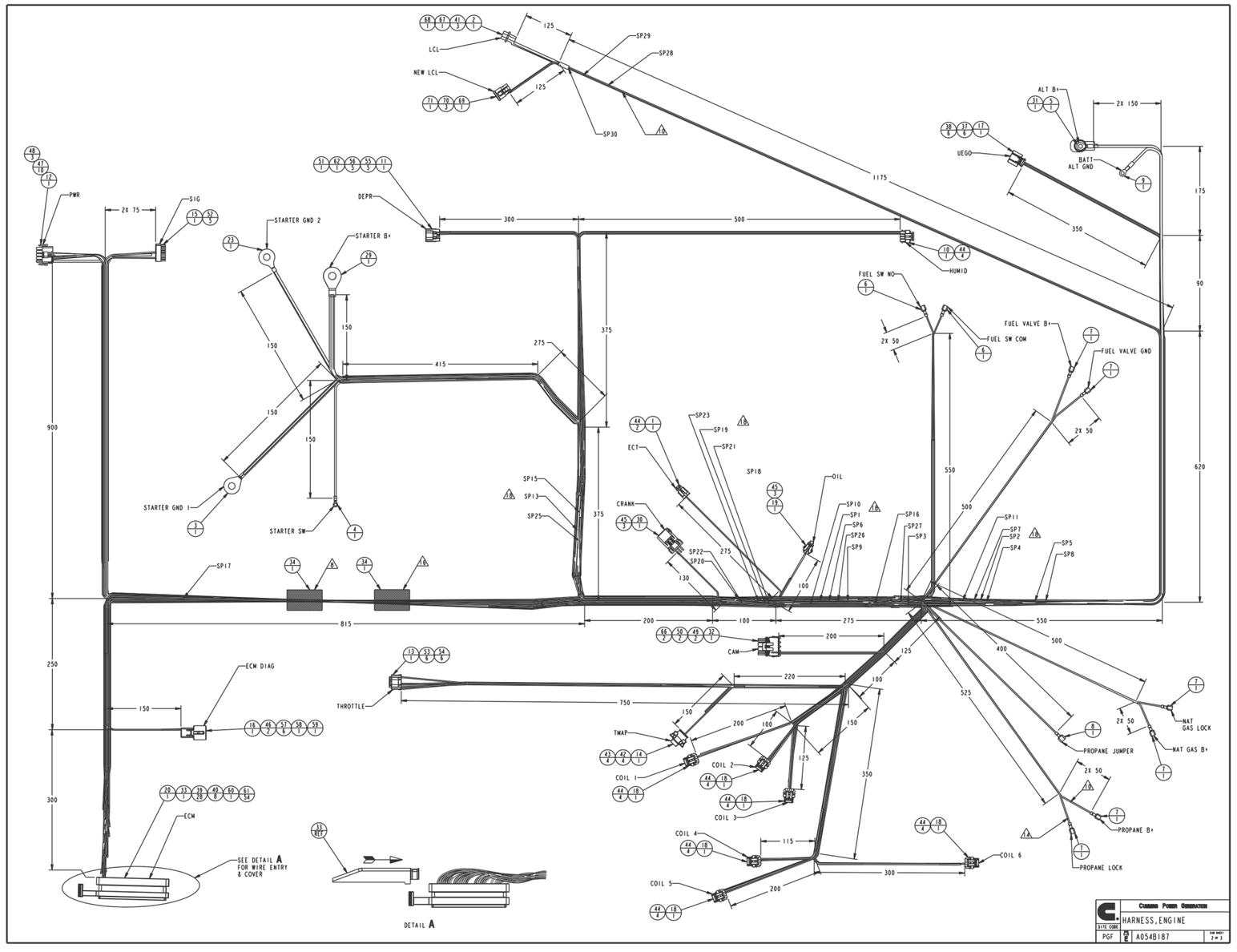


FIGURE 73. HARNESS, GENERATOR SET ELECTRICAL (SHEET 2 OF 3)

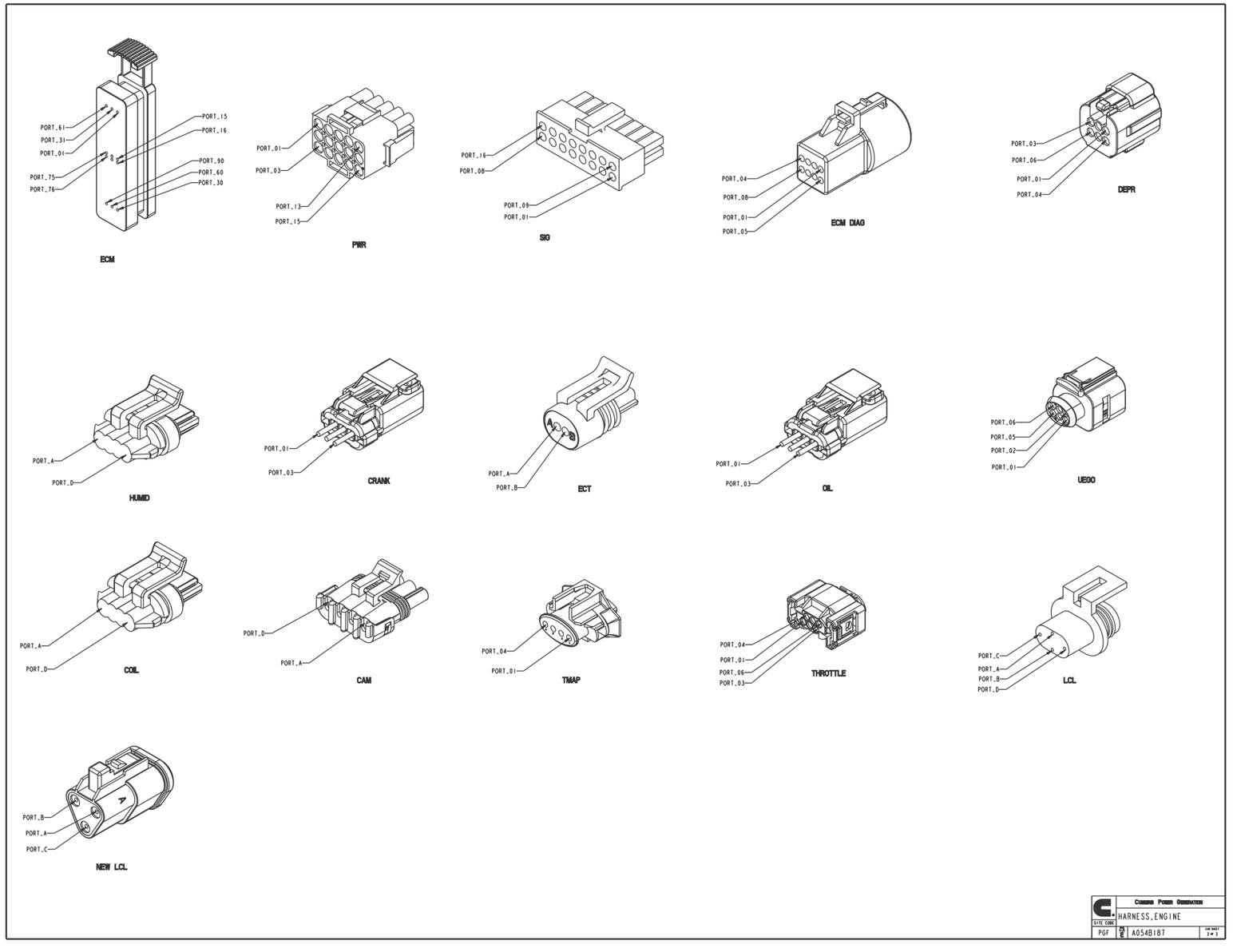


FIGURE 74. HARNESS, GENERATOR SET ELECTRICAL (SHEET 3 OF 3)

WIRE FROM / TO TABLE

LEAD NO	FROM STATION	FROM CPG P/N	TO STATION	TO CPG P/N	WIRE WIRE SIZE	WIRE COLOR	WIRE CPG P/N
101	PWR 1	A050S773	FUSE F1-1	0332-1995	12	WHITE	0334-0760
102	SPLICE 31-1	0332-3638	FUSE F1-2	0332-1995	12	WHITE	0334-0760
103	SPLICE 31-2	0332-3638	P20-9	0323-2466	18	WHITE	0334-0757
104			P20-10	0323-2466	18	WHITE	0334-0757
105			P20-20	0323-2466	18	WHITE	0334-0757
106			P20-21	0323-2466	18	WHITE	0334-0757
107	PWR 2	A043U187	FUSE F2-1	0332-1993	16	WHITE	0334-0758
108	SPLICE 33-1	0332-3638	FUSE F2-2	0332-1993	16	WHITE	0334-0758
109	SPLICE 33-2	0332-3638	K3-1	0332-1993	16	WHITE	0334-0758
110			SIG 6	A043H311	18	WHITE	0334-0757
111			SPLICE 41-1	0332-3638	18	WHITE	0334-0757
113			K2-1	0332-1993	16	WHITE	0334-0758
114	PWR 3	A050S773	SPLICE 30-1	0332-3638	12	WHITE	0334-0760
115	FUSE F3-1	0332-1995	SPLICE 30-2	0332-3638	12	WHITE	0334-0760
116	SPLICE 34-1	0332-3638				WHITE	0334-0760
117	SPLICE 34-2	0332-3638	FUSE F4-1	0332-1993	16	WHITE	0334-0758
118			FUSE F5-1	0332-1995	12	WHITE	0334-0760
119	FUSE F3-2	0332-1995	PWR 9	A043U187	14	WHITE	0334-0759
120	FUSE F4-2	0332-1993	K1-1	0332-1993	16	WHITE	0334-0758
121	FUSE F5-2	0332-1995	K1-3	0332-1995	12	WHITE	0334-0760
122	PWR 5	A043U187	SPLICE 32-1	0332-3638	16	WHITE	0334-0758
123	P20-1	0323-2466	SPLICE 32-2	0332-3638	18	WHITE	0334-0757
124	P20-2	0323-2466			18	WHITE	0334-0757
125	P20-4	0323-2466			18	WHITE	0334-0757
126	P20-7	0323-2466			18	WHITE	0334-0757
127	P20-12	0323-2466			18	WHITE	0334-0757
128	PWR 6	A050S773	K4-4	0332-1995	12	WHITE	0334-0760
129	PWR 10	A043U187	K1-2	0332-1993	16	WHITE	0334-0758
130	PWR 11	A050S773	K1-4	0332-1995	12	WHITE	0334-0760
131	PWR 12	A043U187	K2-2	0332-4041	16	WHITE	0334-0758
132	PWR 7	A043U187	K1-5	0332-1993	16	WHITE	0334-0758
133	PWR 8	A043U187	K3-4	0332-1993	16	WHITE	0334-0758
134	SIG 5	A043H311	P20-17	0323-2466	18	WHITE	0334-0757
135	SIG 7	A043H311	P20-18	0323-2466	18	WHITE	0334-0757
136	K2-5	0332-1992	P20-3	0323-2466	18	WHITE	0334-0757
137	K4-5	0332-1992	P20-15	0323-2466	18	WHITE	0334-0757
138	PWR 4	A043U187	K4-1	0332-1993	16	WHITE	0334-0758
139	K3-5	0332-1992	P11-21	0323-2466	18	WHITE	0334-0757
140	K4-6	0332-4041	P20-13	0323-2466	18	WHITE	0334-0757
141			K1-6	0332-4041	16	WHITE	0334-0757
142	K2-6	0332-1992			18	WHITE	0334-0757
143	SIG 1	A043H311	CR1-C	0332-1993	16	WHITE	0334-0758
144	CR1-A	0332-1993	K2-2	0332-4041	16	WHITE	0334-0758
145	SIG 2	A043H311	CAN SHIELD		18	-	0334-1354
146	CAN SHIELD	-	P11-17	0323-2466	18	-	0334-1354
147	SIG 3	A043H311	SPLICE 35-1	0332-3638	18	WHITE	0334-1354
148	R1-1	0351-1596-59			--	--	-
149	SIG 4	A043H311	SPLICE 36-1	0332-3638	18	BLACK	0334-1354
150	R1-2	0351-1596-59			--	-	-
151	SPLICE 35-2	0332-3638	P11-20	0323-2466	18	WHITE	0334-1354
152	SPLICE 36-2	0332-3638	P11-19	0323-2466	18	BLACK	0334-1354
153	K3-6	0332-1992	PE-1	0323-2332	18	WHITE	0334-0757
154	P11-22	0323-2466	JE-1	A040M659	18	WHITE	0334-0757
155	P25-2	0323-2466	PE-2	0323-2332	18	WHITE	0334-0757
156	P25-6	0323-2466	JE-2	A040M659	18	WHITE	0334-0757
157	TB15-1	0332-3491-01	P3-1	A040B973	18	WHITE	0334-0757
158	TB15-3	0332-3491-01	P3-3	A040B973	18	WHITE	0334-0757
159	TB15-4	0332-3491-01	P3-4	A040B973	18	WHITE	0334-0757
160	TB15-5	0332-3491-01	P3-5	A040B973	18	WHITE	0334-0757
161	P25-4	0323-2466	SPLICE 37-1	0332-3638	20	WHITE	0334-0756
162	OP P1-1	0323-2466	SPLICE 37-2	0332-3638	20	WHITE	0334-0756
163	BG P1-3	0332-3491-01			20	WHITE	0334-0756
164	P25-3	0323-2466	SPLICE 38-1	0332-3638	20	WHITE	0334-0756
165	OP P1-2	0323-2466	SPLICE 38-2	0332-3638	20	WHITE	0334-0756
166	BG P1-4	0332-3491-01			20	WHITE	0334-0756
167	P25-5	0323-2466	SPLICE 39-1	0332-3638	20	WHITE	0334-0756
168	OP P1-4	0323-2466	SPLICE 39-2	0332-3638	20	WHITE	0334-0756
169	BG P1-5	0332-3491-01			20	WHITE	0334-0756
170	P25-8	0323-2466	SPLICE 40-1	0332-3638	20	WHITE	0334-0756
171	OP P1-5	0323-2466	SPLICE 40-2	0332-3638	20	WHITE	0334-0756
172	BG P6-2	0332-3491-01			20	WHITE	0334-0756
173	P25-10	0323-2466	OP P1-6	0323-2466	20	WHITE	0334-0756
174	P25-11	0323-2466	OP P1-7	0323-2466	20	WHITE	0334-0756
175	P25-12	0323-2466	BG P6-1	0332-3491-01	20	WHITE	0334-0756
176	P18-1	0323-2332	F7-1	0332-1993	16	WHITE	0334-0758
177	F7-2	0332-1993	AC-P-2	A043L492	16	WHITE	0334-0758
178	P18-2	0323-2332	F8-1	0332-1993	16	WHITE	0334-0758
179	F8-2	0332-1993	AC-P-3	A043L492	16	WHITE	0334-0758
180	TB1-1	0332-3491-01	PCC-TB1-10	0332-3491-01	18	WHITE	0334-0757
181	TB5-1	0332-3491-01	PCC-TB1-11	0332-3491-01	18	WHITE	0334-0757
182	TB2-1	0332-3491-01	PCC-TB1-12	0332-3491-01	18	WHITE	0334-0757
183	TB7-1	0332-3491-01	PCC-TB1-7	0332-3491-01	18	WHITE	0334-0757
184	PCC-TB1-15	0332-3491-01	PCC-TB1-16	0332-3491-01	18	WHITE	0334-0757
185	TB6-1	0332-3491-01	PCC-TB1-6	0332-3491-01	18	WHITE	0334-0757
186	TB8-1	0332-3491-01	PCC-TB1-5	0332-3491-01	18	WHITE	0334-0757
187	TB4-1	0332-3491-01	PCC-TB1-14	0332-3491-01	18	WHITE	0334-0757
188	TB3-1	0332-3491-01	PCC-TB1-13	0332-3491-01	18	WHITE	0334-0757
189	TB9-1	0332-3491-01	PCC-TB1-4	0332-3491-01	18	WHITE	0334-0757
190	PWR-13	A043U187	FUSE F6-1	0332-1993	16	WHITE	0334-0758
191	FUSE F6-2	0332-1993	K2-3	0332-1993	16	WHITE	0334-0758
192	TB10-1	0332-3491-01	K2-4	0332-1993	16	WHITE	0334-0758
193	P11-11	0323-2466	TEMP-A	0323-1818	18	WHITE	0334-0757
194	P11-12	0323-2466	TEMP-B	0323-1818	18	WHITE	0334-0757
195	SPLICE 41-2	0332-3638	OP P1-3	0323-2466	20	WHITE	0334-0756
196			J40-2	0323-1859	18	WHITE	0334-0757
197	PL-1	0332-2430	J40-1	0323-1859	18	WHITE	0334-0757
198	P18-3	0323-2332	AC-P-4	A043L492	16	WHITE	0334-0758

NOTES:

1. TOLERANCES: UP TO 500 +15/-5.
   500 TO 1000 +30/-10.
   1000 TO LONGER +40/-20.

2. ALL LEADS/WIRES SHALL BE MARKED AT MAXIMUM OF 76 mm BEHIND THE CONNECTOR AND AT EVERY 30 mm INTERVAL WITH BOTH STATION NUMBERS LISTED IN THE "FROM-TO" TABULATION.
   MARKING SHALL BE PERMANENT AND LEGIBLE. WIRE MARKINGS NEED TO HAVE FULL VISUAL ACCESS.END MARKINGS ARE NOT TO BE VISUALLY OBSCURED AND MUST BE FULLY DISPLAYED.
   TO/FROM DESIGNATIONS ARE NOT TO BE FRAGMENTED. DESIGNATOR SHALL APPEAR IN FULL TEXT AND NOT IN BROKEN SEGMENTS.

3. USE CABLE TIES (0332-3388) AT EVERY 200 mm AS NECESSARY TO SECURE WIRES.EXCEPT IN THOSE CABLE TIES EXPLICITLY DIMENSIONED IN THE DRAWING.

4 FOLD BACK SHIELD WIRE (0334-1354) AND SECURE TO CABLE WITH ELECTRICAL TAPE (0895-0030).

5. HARNESS MUST BE PROCURED FROM A SUPPLIER QUALIFIED AS A UL RECOGNIZED HARNESS MANUFACTURER CATEGORY (ZPFW2). PACKAGING OF PARTS TO BE MARKED IN ACCORDANCE WITH REQUIREMENTS SPECIFIED BY SUPPLIERS UL PROGRAM.

6 STAGGER THE SPLICES, RESISTORS & DIODE. COVER WITH HEAT SHRINK (0898-1337-03). PLACE THE SPLICES INLINE WITH BUNDLE.

⚠7 LABEL MUST BE MADE FROM UL RECOGNIZED VINYL SELF LAMINATION LABEL SYSTEM.
MARK FUSES ABOVE THE FUSE HOLDERS ON THE BRACKET F1:20A, F2:10A, F3:20A ,F4:5A, F5:20A, F6:10A, F7:10A, F8:10A
MARK RELAYS TOP-CENTER K1,K2,K3 & K4 (DO NOT COVER TECHNICAL INFORMATION OF THE RELAY)

8. IF THE VALUE OF 0 (ZERO) IS USED IN THE BILL OF MATERIAL, THE QUANITY OF THE AFFECTED ITEMS SHALL BE DERIVED FROM THE DRAWING REQUIREMENTS.

9. SLEEVING MATERIAL SHOULD BE UL 94-V2 RATED & WITHSTAND UP TO -40°C TO 125°C OPERATING TEMPERATURE, CONTINUOUS USE 105°C. COLOR BLACK.

⚠10 PLUG PE CONNECTOR IN TO JE CONNECTOR .

11 SHIPPING METHOD: BUNDLE THE WIRE WITH WIRE TIE (0332-3388).

12. INK FOR HARNESS MARKING,MUST RESIST ERASER ABRASION TEST,ANTIFREEZE,MOTOR OIL, TRANSMISSION FLUID,GASOLINE,DIESEL FUEL & BRAKE FLUID

⚠13 SCREW TORQUE: 0.6-0.8 Nm.

14. CABLE AND HARNESS WORKMANSHIP SHALL COMPLY WITH IPC/WHMA-A-620 CLASS II REQUIREMENTS AND ACCEPTANCE FOR CABLE AND WIRE HARNESS ASSEMBLIES MOST CURRENT REVISION.

15. POINT TO POINT CONTINUITY TEST MUST BE PERFORMED ON THIS HARNESS ASSEMBLY.

⚠16 ATTACH A MASTER HARNESS LABEL WITH THE FOLLOWING INFORMATION:
CUMMINS PART NUMBER, CUMMINS PART REVISION LEVEL, MANUFACTURER'S NAME, MANUFACTURER'S LOCATION, AND MANUFACTURER'S DATE OF MANUFACTURE IN THE FORMAT OF MONTH, DATE, LAST 2 YEAR DIGITS.

⚠17 PLACE INDIVIDUAL LABEL WITH FOLLOWING DETAIL

TB1 : "GROUND".

TB2 : "INPUT 1".

TB3 : "INPUTS RETURN".

TB4 : "INPUT 2".

TB5 : "REMOTE START".

TB6 : "OUTPUT 1 COM".

TB7 : "OUTPUT 1 N.O.".

TB8 : "FUSE B+ (3A)".

TB9 : "READY TO LOAD".

TB10: "SW B+ (10A)"

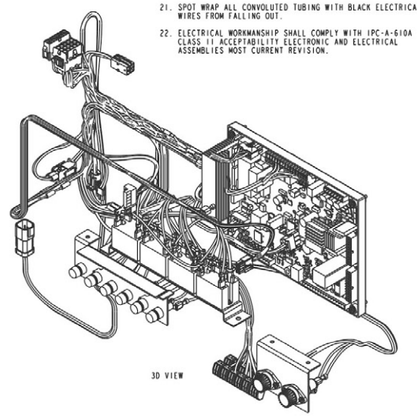
⚠18 ATTACH A LABEL WITH UL MARK (UL SYMBOL AND OTHER UL REQUIRED INFORMATION) IN ACCORDANCE WITH REQUIREMENTS SPECIFIED BY THE SUPPLIER'S UL PROGRAM.

⚠19 TORQUE TO 2.5-3.3 Nm.

20. CONVOLUTED TUBING ENDS SHALL BE WRAPPED WITH A MINIMUM OF 2 LAYERS OF BLACK ELECTRICAL TAPE, 0895-0030.

21. SPOT WRAP ALL CONVOLUTED TUBING WITH BLACK ELECTRICAL TAPE, 0895-0030 TO PREVENT WIRES FROM FALLING OUT.

22. ELECTRICAL WORKMANSHIP SHALL COMPLY WITH IPC-A-610A CLASS II ACCEPTABILITY ELECTRONIC AND ELECTRICAL ASSEMBLIES MOST CURRENT REVISION.



3D VIEW

1	63	0332-2430	TERMINAL-RECEPTICAL
2	62	0323-1859	SOCKET-CONTACT
1	61	A049E678	HOUSING,RECEPTACLE
2	60	A040C012	SEAL,CONNECTOR
2	59	0323-1818	TERMINAL,SOCKET
1	58	0323-1755	CONNECTOR,SOCKET
2	57	0321_0372_05	FUSE,CARTRIDGE
12	56	0823_0002_04	SCREW,PAN HEAD TORX
4	55	A050S773	CONTACT,SOCKET
1	54	0257_0030	RECTIFIER,SILICON
1	53	A047D782	PLATE,MOUNTING
1	52	A047W483	PLATE,MOUNTING
1	51	A047C561	PANEL,RELAY
1	50	0323_1678_15	CONNECTOR,PLUG
7	49	A034P713	CONNECTOR,TERMINAL BLOCK
3	48	A034P636	CONNECTOR,TERMINAL BLOCK
1	47	0323_1626	WEDGE,RECEPTACLE
0	46	0334_0759	WIRE
0	45	0334_0756	WIRE
0	44	0334_0757	WIRE
0	43	0334_0758	WIRE
0	42	0334_0760	WIRE
2	41	A042F472	FUSE,CARTRIDGE
2	40	A042F482	HOLDER,FUSE
2	39	0207_2968_01	RELAY,POWER
2	38	0207_2968_03	RELAY,POWER
3	37	0321_0372_07	FUSE,CARTRIDGE
1	36	0321_0372_03	FUSE,CARTRIDGE
6	35	0321_0173	HOLDER,FUSE
11	34	A028W642	LABEL
1	33	A046S942	CAP
0	32	0898_1193_02	SLEEVING-CONVOLUTED
0	31	0898_1337_03	HEATSHRINK (SLEEVING W/ADHESIVE)
0	30	0895_0030	TAPE,FRICTION
0	29	0334_1354	CABLE,SHIELDED
0	28	0332_3388	TIE,CABLE
4	27	0323_2332	CONTACT,SOCKET
2	26	A040M659	CONTACT,PIN
9	25	A043U187	CONTACT,SOCKET
7	24	A043H311	TERMINAL,CRIMP
30	23	A0062863	TERMINAL,PIN
33	22	A001R345	TERMINAL,PIN
4	21	A040B973	TERMINAL,ELECTRICAL
2	20	A043L492	PIN,CONTACT
1	19	0323_2098	CONNECTOR,PLUG
1	18	0323_2237	CONNECTOR (2 PINS)
1	17	0323_1678_01	CONNECTOR-PLUG (3
1	16	0323_2011	CIRCUIT_BREAKER (15-AMPS-BLACK)
1	15	A044R291	CONNECTOR,RECEPTACLE (6 POSITION)
1	14	A042R319	HOUSING,RECEPTACLE
1	13	A043G964	CONNECTOR,HEADER
1	12	A043T411	CONNECTOR,HEADER
1	11	0323_2444	CONNECTOR,PLUG
1	10	0351_1596_59	RESISTOR-METAL OXIDE
12	9	0332_3638	SPLICE-BUTT (#10-12_AWG)
5	8	0332_1992	TERMINAL-RECEPTICAL (.25)
9	7	0332_1995	TERMINAL-RECEPTICAL (.25)
21	6	0332_1993	TERMINAL-RECEPTICAL (.25)
2	5	0323_2187_04	CIRCUIT_BREAKER (15-AMPS-BLACK)
1	4	0323_2161	
1	3	0332_2445	CONNECTOR,PLUG
1	2	0323_2446	CONNECTOR,PLUG
3	1	0332_4041	TERMINAL,RECEPTACLE (.250 FEMALE FASTON)
QTY	ITEM NO	PLN_NUM	PLN_NOUN_NAME

CUMMINS POWER GENERATION

HARNESS,GENERATOR ELECTRICAL PCC 2300

SIZE CODE IDENT NO. A053S093 SHEET 1 OF 4 REV

FIGURE 75. CONTROL BOX HARNESS DIAGRAM (SHEET 1 OF 4)

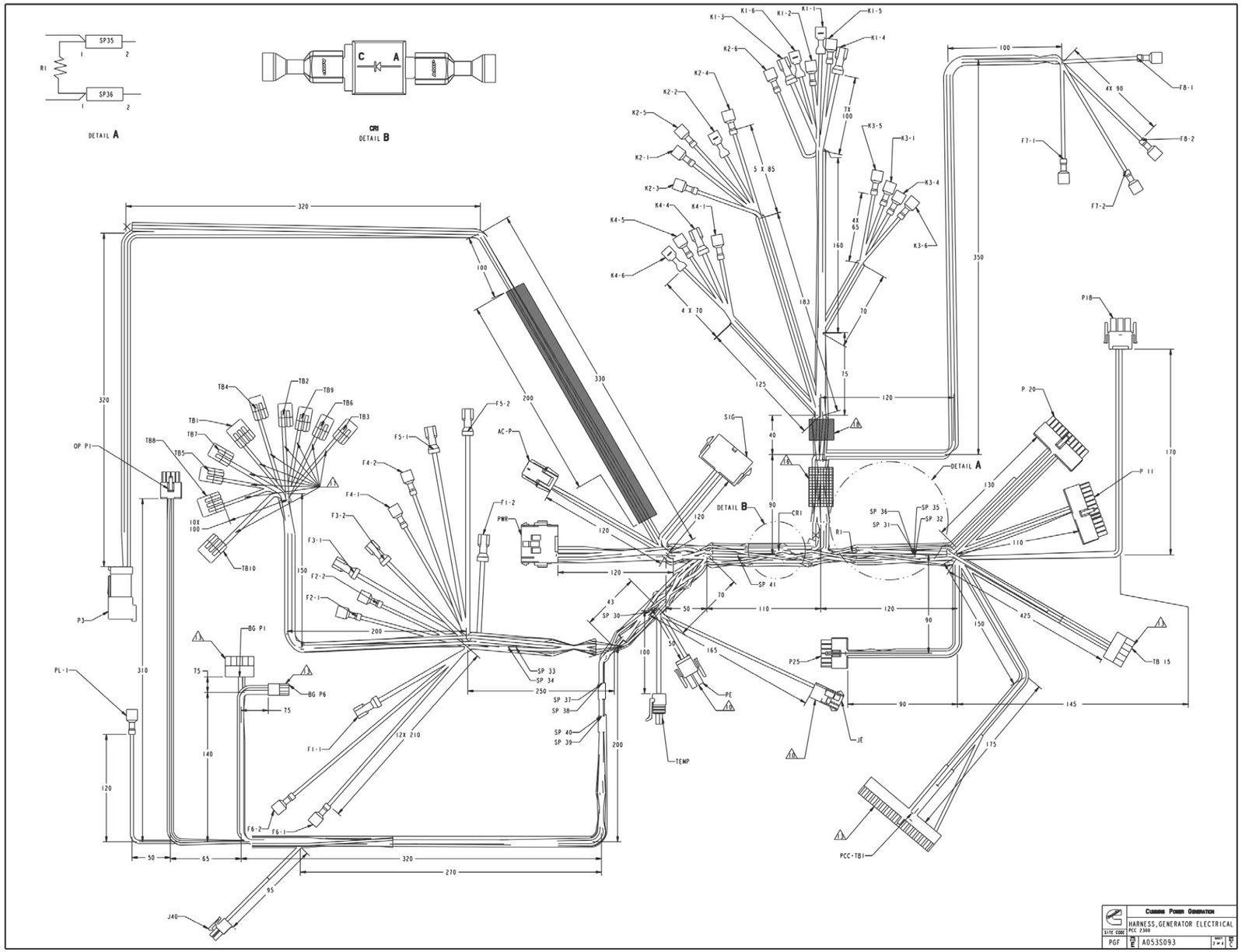


FIGURE 76. CONTROL BOX HARNESS DIAGRAM (SHEET 2 OF 4)

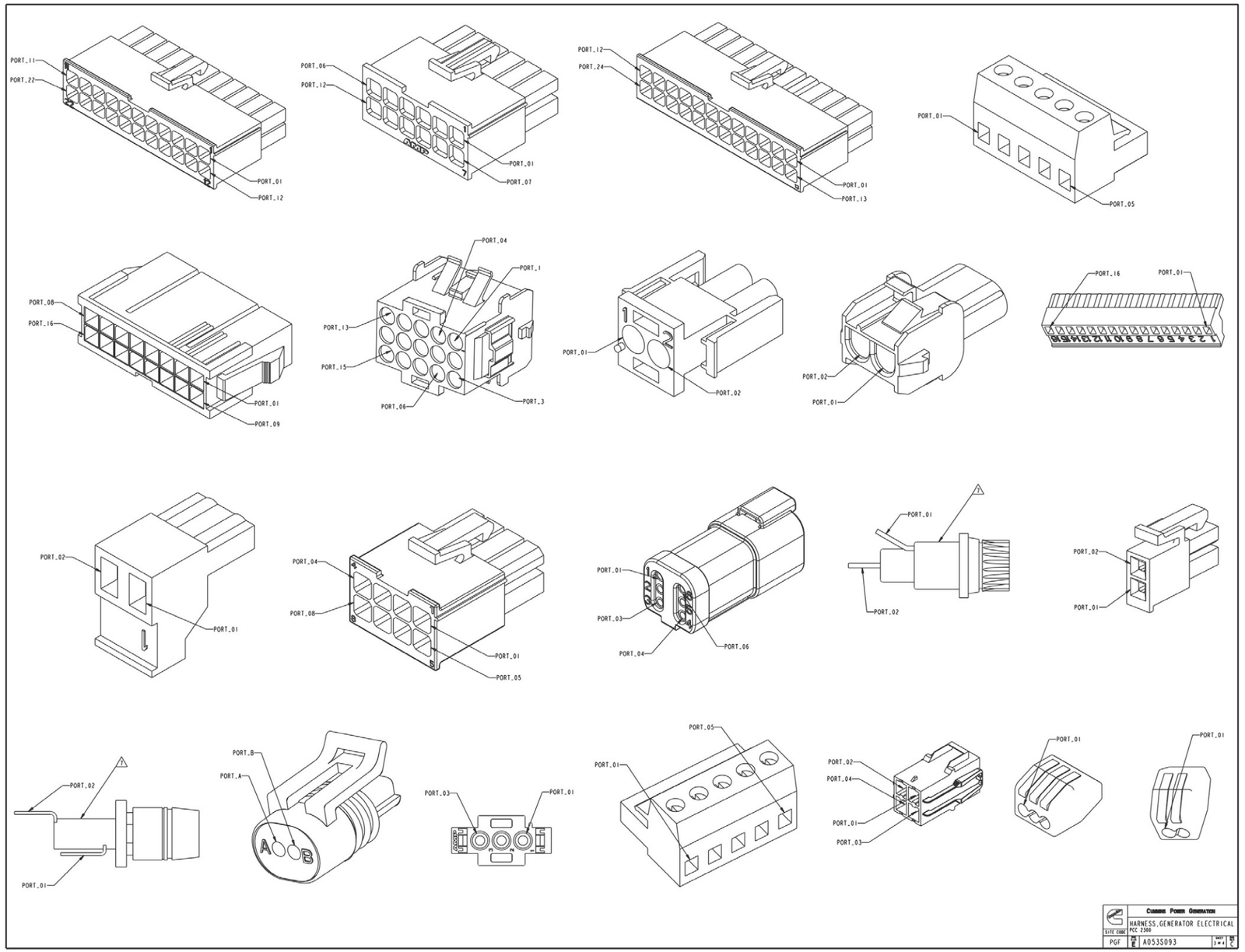


FIGURE 77. CONTROL BOX HARNESS DIAGRAM (SHEET 3 OF 4)

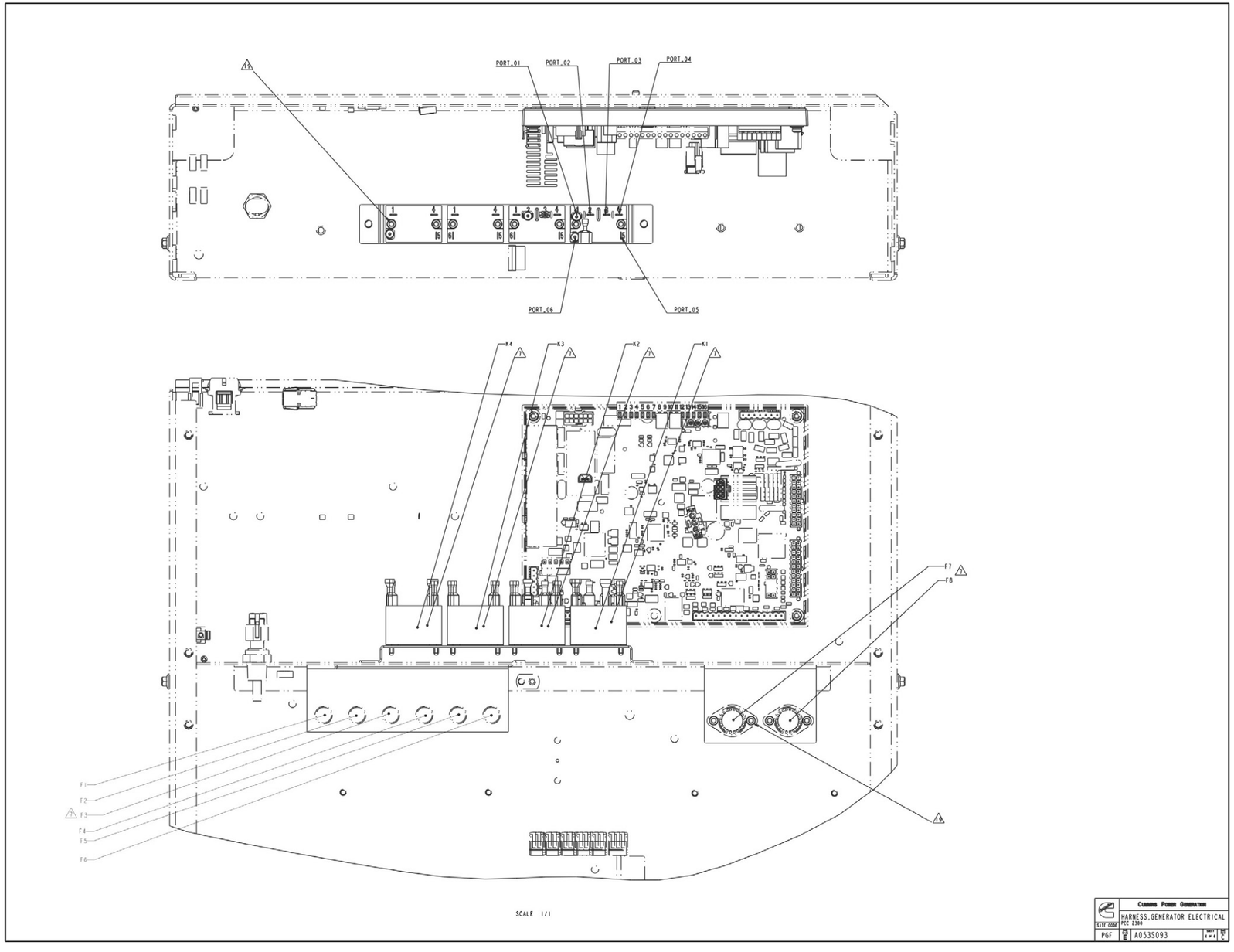


FIGURE 78. CONTROL BOX HARNESS DIAGRAM (SHEET 4 OF 4)

Appendix D. Seismic Requirements

Table of Contents

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

D.1 Seismic Installation Instructions

PTC® Creo® Parametric

REL NO	LTR	NO	REVISION	DRW	CKD	APVD	DATE
ECO-165950	A	1	PRODUCTION RELEASE	AGJ	AGJ	M.WICKMANN	07NOV16

SEISMIC INSTALLATIONS NOTES:

1. THE DESIGN OF POST-INSTALLED ANCHORS IN CONCRETE USED FOR THE COMPONENT ANCHORAGE IS PRE-QUALIFIED FOR SEISMIC APPLICATIONS IN ACCORDANCE WITH "ACI 355.2-07" AND DOCUMENTED IN A REPORT BY A REPUTABLE TESTING AGENCY. (EX. THE EVALUATION SERVICE REPORT ISSUED BY THE INTERNATIONAL CODE COUNCIL)
2. ANCHORS MUST BE INSTALLED TO AN EMBEDMENT DEPTH AS RECOMMENDED IN THE PRE-QUALIFICATION TEST REPORT AS DEFINED IN NOTE 1. FOR "CBC 2016" APPLICATIONS.
3. ANCHORS MUST BE INSTALLED IN MINIMUM 3000 PSI COMPRESSIVE STRENGTH NORMAL WEIGHT STRUCTURAL CONCRETE. CONCRETE AGGREGATE MUST COMPLY WITH "ASTM C33".
4. ANCHORS MUST BE INSTALLED TO THE TORQUE SPECIFICATION AS RECOMMENDED BY THE ANCHOR MANUFACTURER.
5. ANCHORS MUST BE INSTALLED IN LOCATIONS SPECIFIED ON THIS INSTALLATION DRAWING.
6. WASHERS MUST BE INSTALLED AT EACH ANCHOR LOCATION BETWEEN THE ANCHOR HEAD AND EQUIPMENT FOR TENSION LOAD DISTRIBUTION. WASHERS MUST BE TYPE A OR B PLAIN WASHERS MEETING ASME B18.21.1-2009. WASHER SIZE TO MATCH ANCHOR DIAMETER.
7. CONCRETE FLOOR SLAB AND CONCRETE HOUSEKEEPING PADS MUST BE DESIGNED FOR SEISMIC APPLICATIONS IN ACCORDANCE WITH "ACI 318-11".
8. ALL HOUSEKEEPING PAD THICKNESSES MUST BE DESIGNED IN ACCORDANCE WITH THE PRE-QUALIFICATION TEST REPORT AS DEFINED IN NOTE 1 OR A MINIMUM OF 1.5X THE ANCHOR EMBEDMENT DEPTH, WHICHEVER IS LARGEST (UNLESS NOTED OTHERWISE).
9. ALL HOUSEKEEPING PADS MUST BE DOWELLED OR CAST INTO THE BUILDING STRUCTURAL FLOOR SLAB AND DESIGNED FOR SEISMIC APPLICATION PER "ACI 318-11" AND AS APPROVED BY THE STRUCTURAL ENGINEER OF RECORD.
10. FLOOR MOUNTED EQUIPMENT (WITH OR WITHOUT A HOUSEKEEPING PAD) MUST BE INSTALLED TO A STEEL REINFORCED STRUCTURAL CONCRETE FLOOR THAT IS SEISMICALLY DESIGNED AND APPROVED BY THE ENGINEER OF RECORD TO RESIST ALL LOADS FROM EQUIPMENT BEING ANCHORED TO THE FLOOR.
11. COORDINATE REINFORCEMENT OF SUPPORT STRUCTURE WITH EQUIPMENT ANCHOR LOCATIONS.
12. ATTACHING SEISMIC CERTIFIED EQUIPMENT TO FLOOR OTHER THAN THOSE DESIGNED TO ACCEPT THE SEISMIC LOADS FROM CERTIFIED EQUIPMENT BY THE STRUCTURAL ENGINEER OF RECORD IS PROHIBITED.
13. INSTALLATION ONTO A STEEL ROOF STRUCTURE OR MANUFACTURED STEEL CURB SHALL BE COORDINATED WITH THE STRUCTURAL ENGINEER OF RECORD.
14. CONNECTIONS TO THE EQUIPMENT, INCLUDING BUT NOT LIMITED TO CONDUIT, WIRING FROM CABLE TRAYS, OTHER ELECTRICAL SERVICES OR OTHER CONNECTIONS, ARE THE RESPONSIBILITY OF THE INSTALLING CONTRACTOR AND BEYOND THE SCOPE OF THIS DOCUMENT.
    FLEXIBLE ATTACHMENTS MUST BE USED FOR SEISMIC CONNECTIONS TO ISOLATED COMPONENTS OR ISOLATED EQUIPMENT.
    THE FLEXIBLE ATTACHMENT MUST PROVIDE FOR ENOUGH RELATIVE DISPLACEMENT TO REMAIN CONNECTED TO THE EQUIPMENT AND FUNCTIONAL DURING AND AFTER A SEISMIC EVENT.
15. REFER TO GENSET OUTLINE DRAWINGS FOR WEIGHT, CG AND CONFIGURATION SPECIFICS.

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS
DIM: X ±1; .X ±0.8; .XX± 0.38
RND: 0.00- 4.99 +0.15/-0.08; 5.00- 9.99 +0.20/-0.10; 10.00-17.49 +0.25/-0.13; 17.50-24.99 +0.30/-0.13
ANG TOL: ± 1.0° SCALE: 1/1
SIM TO NONE
DO NOT SCALE PRINT
- CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP
DRN A_JOHNSON
CKD A_JOHNSON
APVD M_WICKMANN
DATE 07NOV16
FOR INTERPRETATION OF DIMENSIONS AND TOLERANCES SEE ASME Y14.5M-1994
FIRST USED ON ARROW
SITE CODE PGF
CUMMINS POWER GENERATION
INSTALLATION,GENSET SEISMIC REQUIREMENTS
DWG SIZE D A056M541 SHEET 1 of 4 DWG REV A

FIGURE 79. SEISMIC INSTALLATION REQUIREMENTS (SHEET 1 OF 4)

PTC® Creo® Parametric

REL NO	LTR	NO	REVISION	DRN	CKD	APVD	DATE
ECO-165950	A	1	PRODUCTION RELEASE	AGJ	AGJ	M.WICKMANN	07NOV16

GRADE MOUNTED GENERATOR SETS

CUMMINS GENSET MODEL	CONFIGURATION	ATTACHMENT TO CONCRETE					
		EVALUATION PARAMETERS	CONCRETE ANCHORS	ANCHOR EMBEDMENT	ANCHOR SPACING	DISTANCE TO NEAREST EDGE	CONCRETE SLAB THICKNESS
C125 N6 C150 N6	GENERATOR SET WITH OR WITHOUT ENCLOSURE	CBC 2016/IBC 2015 Sds <= 2.5 Ip <= 1.5 ap/Rp <= 2.5/2.0 z/h = 1.0 Ω = 2.5	SEE NOTE				

NOTE: TYPE OF ANCHOR, ANCHOR ATTACHMENT SPECIFICS AND MINIMUM SLAB THICKNESS TO BE DESIGNED BY ENGINEER OF RECORD.

GRADE/ROOF MOUNTED GENERATOR SETS

CUMMINS GENSET MODEL	CONFIGURATION	ATTACHMENT TO STEEL	
		EVALUATION PARAMETERS	STEEL BOLTS
C125 N6 C150 N6	GENERATOR SET WITH OR WITHOUT ENCLOSURE	CBC 2016/IBC 2015 Sds <= 2.5 Ip <= 1.5 ap/Rp <= 2.5/2.0 z/h <= 1.0	(QTY 6) 5/8" DIAMETER ASTM A325N OR A490 BOLTS WITH WASHERS THROUGH THE BASE RAIL MOUNTING HOLES.

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS
DIM: X ±1; .X ±0.8; .XX± 0.38
HOLE: 0.00- 4.99 +0.15/-0.08; 5.00- 9.99 +0.20/-0.10; 10.00-17.49 +0.25/-0.13; 17.50-24.99 +0.30/-0.13
ANG TOL: ± 1.0° SCALE: 1/1
DIM TO NONE
DO NOT SCALE PRINT
- CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP
DRN A.JOHNSON
CKD A.JOHNSON
APVD M.WICKMANN
DATE 07NOV16
FIRST USED ON ARROW
SITE CODE PGF
CUMMINS POWER GENERATION
INSTALLATION,GENSET
SEISMIC REQUIREMENTS
ENG D A056M541
SHEET 2 OF 4
DWG REV A

FIGURE 80. SEISMIC INSTALLATION REQUIREMENTS (SHEET 2 OF 4)

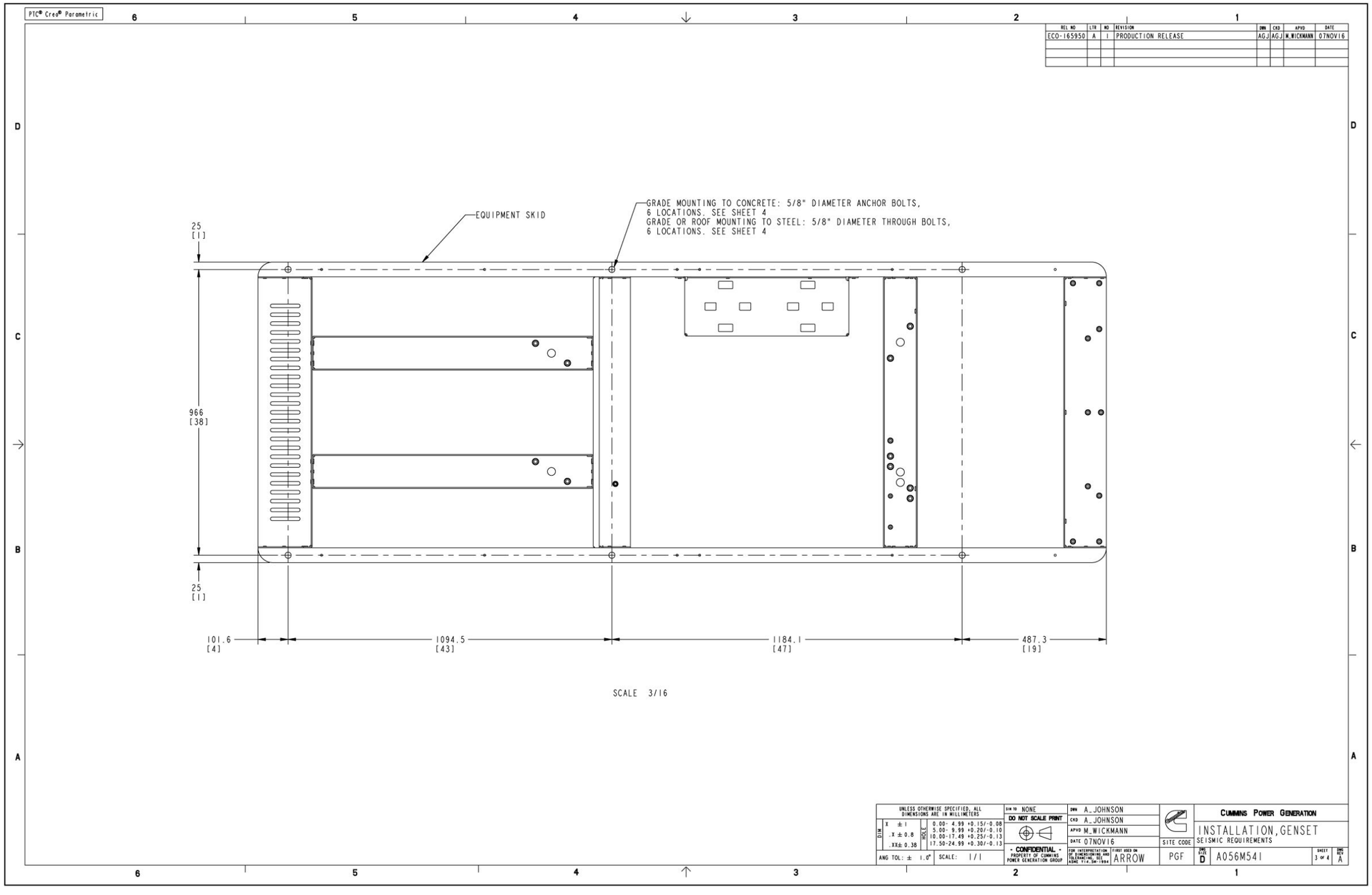


FIGURE 81. SEISMIC INSTALLATION REQUIREMENTS (SHEET 3 OF 4)

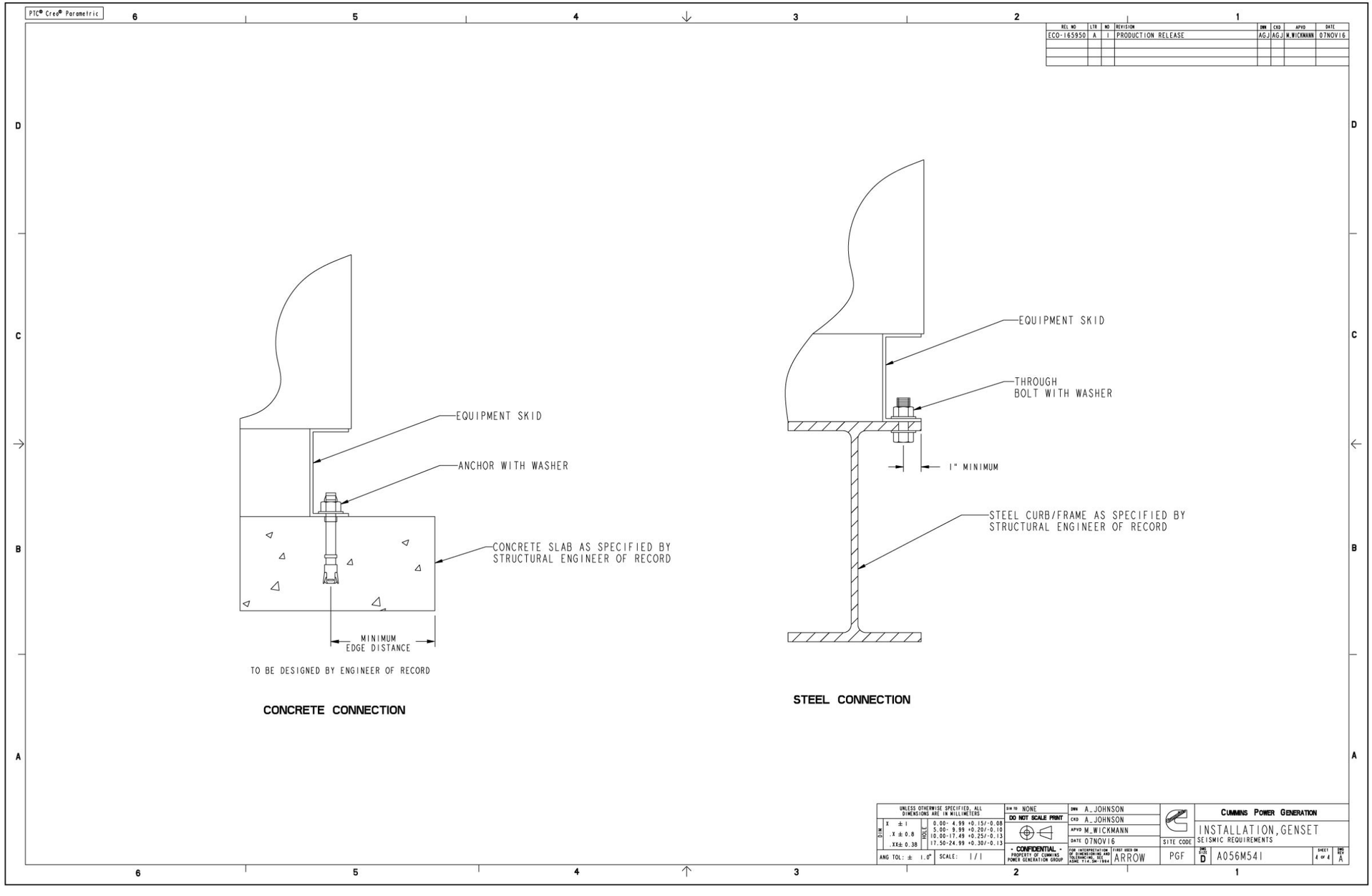


FIGURE 82. SEISMIC INSTALLATION REQUIREMENTS (SHEET 4 OF 4)

power.cummins.com