Installation Manual

Generator Set with QSJ5.9G Engine and PowerCommand® 1.1/2.3 Control

C45 N6 (Spec A)
C50 N6 (Spec A)
C60 N6 (Spec A)
C70 N6 (Spec A)
C80 N6 (Spec A)
C100 N6 (Spec A)

English
Original Instructions

7-2018

A051X873 (Issue 10)

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 General Information

This manual should form part of the documentation package supplied by Cummins Inc. 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.

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.

1.3 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.

1.4 Fuel and Fumes Are Flammable

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

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

1.5 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.***

1.6 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.
  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.

1.7 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.***

1.8 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.

1.9 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.

1.10 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.

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2 Introduction

⚠ WARNING

Hazardous Voltage

Contact with high voltages can cause severe electrical shock, burns, or death.

Make sure that only a trained and experienced electrician makes generator set electrical output connections, in accordance with the installation instructions and all applicable codes.

⚠ WARNING

Electrical Generating Equipment

Faulty electrical generating equipment can cause severe personal injury or death.

Generator sets must be installed, certified, and operated by trained and experienced person in accordance with the installation instructions and all applicable codes.

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 Inc. 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 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 to familiarize themselves with the warnings and operating procedures.

The literature provided with the generator set is as follows:

- Operator Manual (A051X877)
- Installation Manual (A051X873)

NOTICE
A generator set must be operated and maintained properly if you are to expect safe and reliable operation. The Operator manual includes a maintenance schedule and a troubleshooting guide. **The Health and Safety manual must be read in conjunction with this manual for the safe operation of the generator set:** • **Health and Safety Manual (0908-0110)** • **Warranty Statement (A028U870)** • ***C45 N6, C50 N6 and C60 N6 models only:* Emissions Component Defect Warranty Statement (A028X278)** • ***C70 N6, C80 N6 and C100 N6 models only:* Emissions Component Defect Warranty Statement (A028X279)**

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

- Service Manual (A051X880)
- Parts Manual (A051X891)
- EControls, Inc., Global Control Platform (GCP) Software Service Manual (A035C596)
- EControls, Inc., 4G Software Service Manual (A052G032)
- EControls, Inc., GCP Engine Display Interface Software (EDIS) Training Manual (A035C608)
- EControls, Inc., 4G Software Operator Manual (A052G024)
- Engine Operation & Maintenance Manual for QSJ5.9G (4388606)

- RA Series Transfer Switch Owner Manual (A046S594) - if applicable
- PowerCommand® 1302 Controller Owner's Manual (0900-0661)
- PowerCommand® 2300 Operator Manual (A029M413)
- Service Tool Manual (A043D529)
- Standard Repair Times - HL Family (A053K365)
- T-030: Liquid Cooled Generator Set Application Manual (A040S369) - for application information

2.3 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

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. 5.9L MODEL VARIATIONS

Models	Description
C45 N6, C50 N6, C60 N6, C70 N6, C80 N6, C100 N6	60 Hz, 1800 RPM

TABLE 2. COLD WEATHER SPECIFICATIONS (ALL MODELS)

Temperature	Description	Battery Type	Group
Above 4 °C (40 °F)	Battery charger	Standard	34
-17 to 4 °C (0 to 40 °F)	Battery charger, coolant heater (1000W), CCV heater[1]	Standard	34
Below -17 °C (0 °F)	Battery charger, coolant heater (1500W), oil heater, battery heater, CCV heater[1], cold weather starter[2]	Larger	4D

Temperature	Description	Battery Type	Group
[1]CCV heaters are provided as part of the cold and extreme cold coolant heater packages. [2]The cold weather starter is provided as part of the extreme cold coolant heater package.			

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	C45 N6	C50 N6	C60 N6	C70 N6	C80 N6	C100 N6
Liquid Propane Full Load	scfh	289.6	321.6	370.2	384.2	420.8	518.7
	BTU/hr	651,600	723,600	832,950	864,450	946,800	1,167,075
Natural Gas Full Load	scfh	711.2	806.3	933.8	988.4	1,083.5	1,317.7
	BTU/hr	721,868	818,395	947,807	1,003,226	1,099,753	1,337,466
Fuel Pressure	6-13 inches of water column (1.5 - 3.2 kPa) 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	102 mm 94.02 in)
Stroke	120 mm (4.72 in)
Displacement	5.88 L (359 in^3)
Compression Ratio (Natural Gas & LPG)	8.5:1
Firing Order	1-5-3-6-2-4
Spark Plug Gap 45, 50, 60 kW)	0.508 mm (0.020 in)
Spark Plug Gap (70, 80, 100 kW)	0.40 mm (016 in)
Spark Plug Torque	38 Nm (28 ft-lb)
Crankshaft Rotation (Viewed from the Front of the Engine)	Clockwise

Type	Specification
Engine Weight (Dry, Long Block Only)	413 kg (911 lb)
Valve Clearance (Intake)	0.305 mm (0.012 in)
Valve Clearance (Exhaust)	0.610 mm (0.024 in)
Coolant	• 50/50 coolant solution (50% pure water and 50% anti-freeze) • 16 L (4.23 gal) capacity
Oil Capacity	15 L (4 gal)
Oil Standards	• Must adhere to Cummins® Engineering Standard (CES) 20085 • 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)	104 kPa (15 psi)
Lubricating Oil Pressure at Rated Speed (Minimum)	
Filter Bypass Valve-Opening Pressure	311 kPa (45 psi)
Pressure Regulator Valve-Opening Pressure	449 kPa (65 psi)
Lubricating Oil Capacity (Standard Sump):	
--High	14.2 L (15 qt)
--Low	12.4 L (13 qt)
--Total System	15.1 L (16 qt)

TABLE 6. GENERATOR SET SIZE SPECIFICATIONS

Enclosure Type	Size (L x W x H)
Open/Weather	2489 x 1016 x 1473 mm (98 x 40 x 58 in); does not include exhaust discharge elbow
Sound Level 1	3023 x 1016 x 1473 mm (119 x 40 x 58 in)
Sound Level 2	3454 x 1016 x 1473 mm (136 x 40 x 58 in)

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

Configuration	C45 N6	C50 N6	C60 N6	C70 N6	C80 N6	C100 N6
Open	2180	2180	2431	2449	2587	2719
Weather	2359	2359	2610	2628	2766	2898
Sound Level 1	2455	2455	2706	2724	2862	2994
Sound Level 2	2485	2485	2736	2754	2892	3024

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	C45 N6	C50 N6	C60 N6	C70 N6	C80 N6	C100 N6
Generator	Brushless, 4-pole rotating field, single bearing					
Power (kVA) 1 Phase	45	50	60	70	80	100
Power (kVA) 3 Phase	56.3	62.5	75	87.5	100	125
Rated Voltages (V)	120/240, 1 Ph					
	227/480, 3 Ph					
	347/600, 3 Ph					
	120/240, 3 Ph					
	120/208, 3 Ph					
	127/220, 3 Ph					
	F1PO (Reconnectable, Full Single Phase Output)					

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
C45 N6	Both	675 m (2200 ft)	40 °C (104 °F)	4% per 300 m (985 ft)	2% per 10 °C (18 °F)
C50 N6	Both	150 m (490 ft)	25 °C (77 °F)		
C60 N6	Both	1000 m (3280 ft)	40 °C (104 °F)		
C70 N6	1	2575 m (8450 ft)			
	3	3048 m (10000 ft)			
C80 N6	1	1825 m (5985 ft)			
	3	2500 m (8200 ft)			
C100 N6	1	700 m (1560 ft)	25 °C (77 °F)		
	3	1000 m (3280 ft)	40 °C (104 °F)		

TABLE 10. CONTROL SPECIFICATIONS (ALL MODELS)

Control	Purpose
PC 1.1 or PC 2.3	Generator Set
Enovations I28 EPR	Engine (45, 50, 60 kW Generator Sets)
Enovations 4G LDI	Engine (70, 80, 100 kW Generator Sets)

TABLE 11. DC SYSTEM SPECIFICATIONS (ALL MODELS)

Type	Specification
Nominal Battery Voltage	12 VDC
Battery Group	34 standard, 4D high capacity (requires large battery tray)
Battery Type	Maintenance-free
Minimum Cold Crank Amps	850 standard, 1080 high capacity (requires large battery tray)

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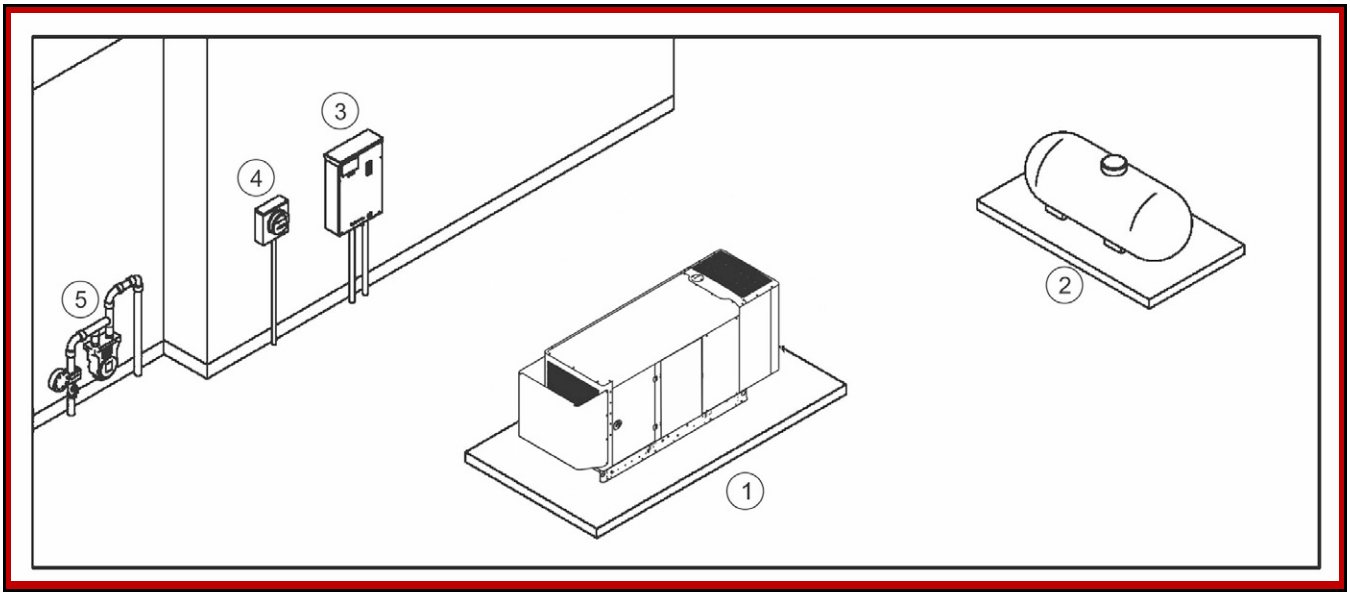
3 Pre-Installation Considerations

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 12. 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 wire must be used for L1, L2, and L3 with the wire size determined by the 75 °C ampacity tables. Aluminum wire is not allowed with 100% rated breakers.

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

Electrical Materials:

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

- Four code compliant AC power wires; L1, L2, N and Gnd (add another wire for 3-phase for a total of 5 AC wires)
- If an RA automatic transfer switch will be installed, refer to the RA Series Transfer Switch Owner Manual.
- Wire sizes (DC control and power and AC sense only):
  - DC control or AC sense wires under 1000 feet circuit length => 18-14 AWG of the insulation type below
  - DC control or AC sense wires 1000-2000 feet circuit length => 16-14 AWG of the insulation type below
- All AC and DC wires and cables must be rated 75 °C 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)

- Code compliant conduit for all wires

Mounting Materials:

- Four base tie-down bolts

NOTICE
Seismic zone installations require compliance to specific mounting configurations.

Fuel Materials:

- Flexible fuel line (provided with the generator set, attached to the radiator guard)
- UL listed pipe thread sealant
- Fuel line at generator set (natural gas and propane: 6-13 inches of water column [1.5 - 3.2 kPa] fuel pressure)
- Fuel pressure regulator (as required)
- Manual fuel shut-off at generator set ahead of automatic valves on generator set fuel system

Loose Parts Shipped with the Generator Set

The following loose parts are shipped with the generator set:

- Flexible fuel hose assembly (attached to the radiator guard)
- 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)

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4 Installation

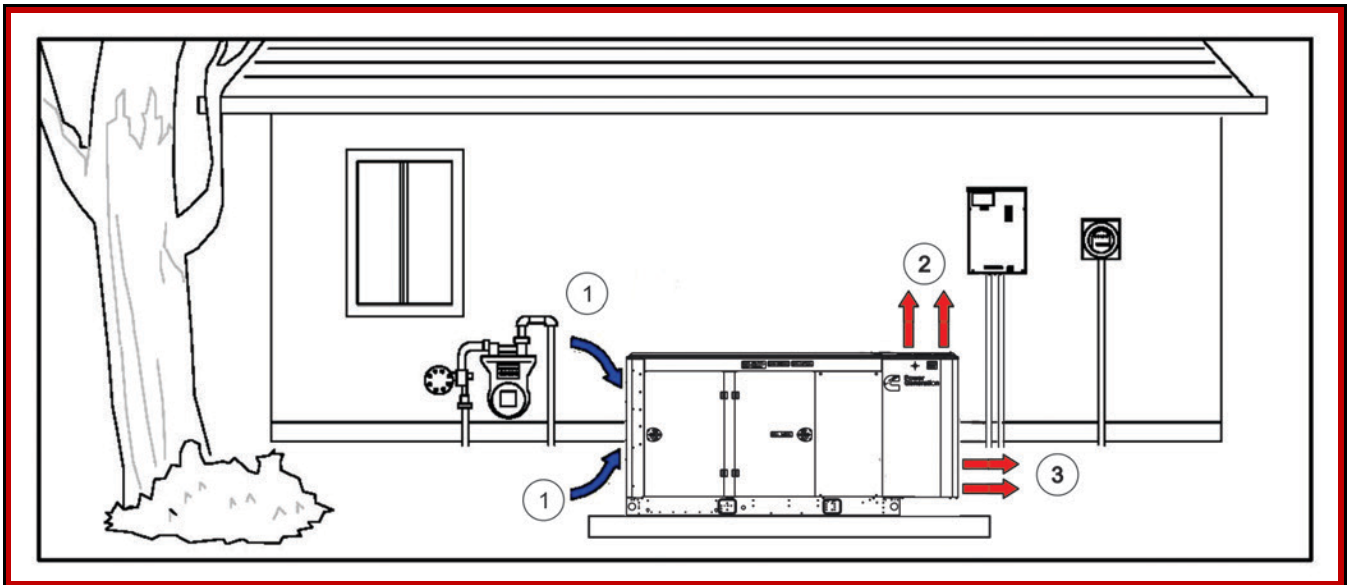
4.1 Site Assessment and Preparation

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.

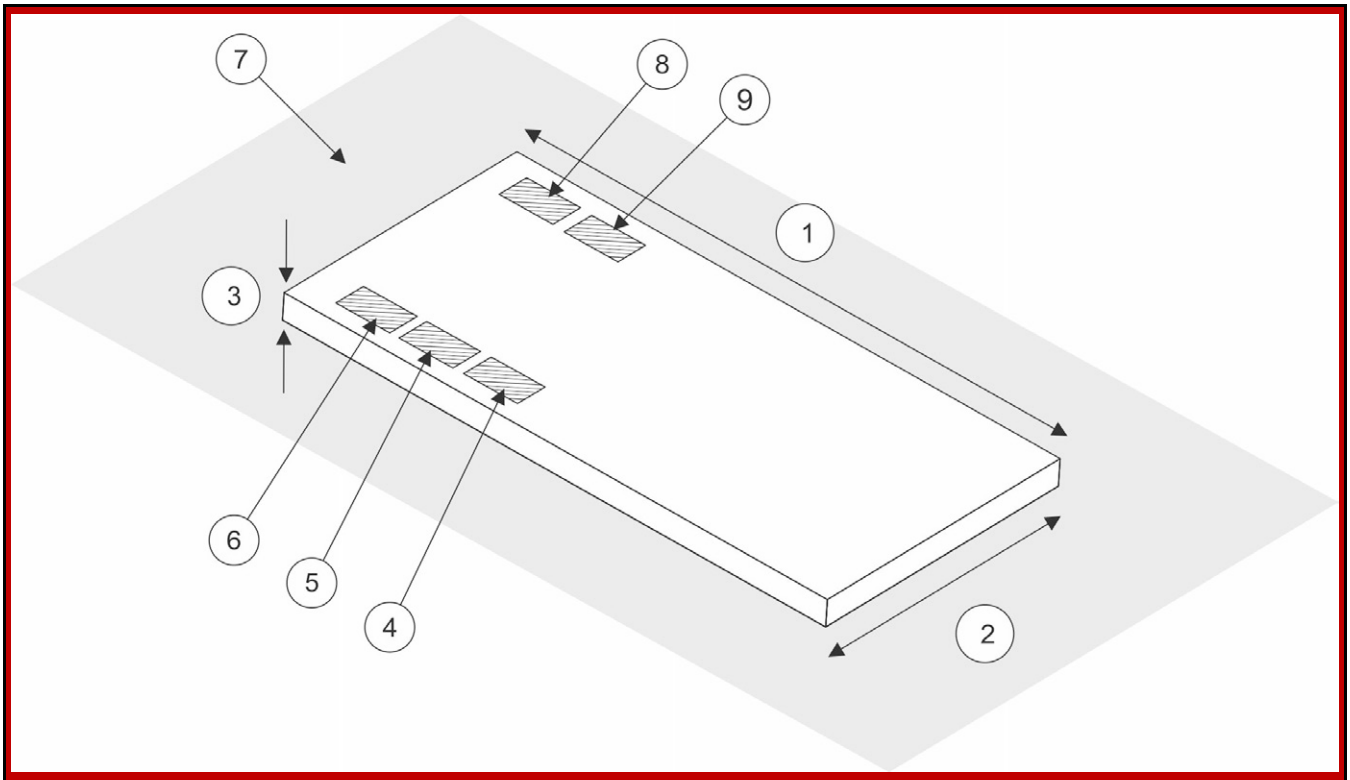
NOTICE

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 lengthwise, widthwise, and diagonally.

NOTICE

Seismic installation may require specific anchorage.

4.2 Fuel Selection and Fuel System Connection

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

NOTICE

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

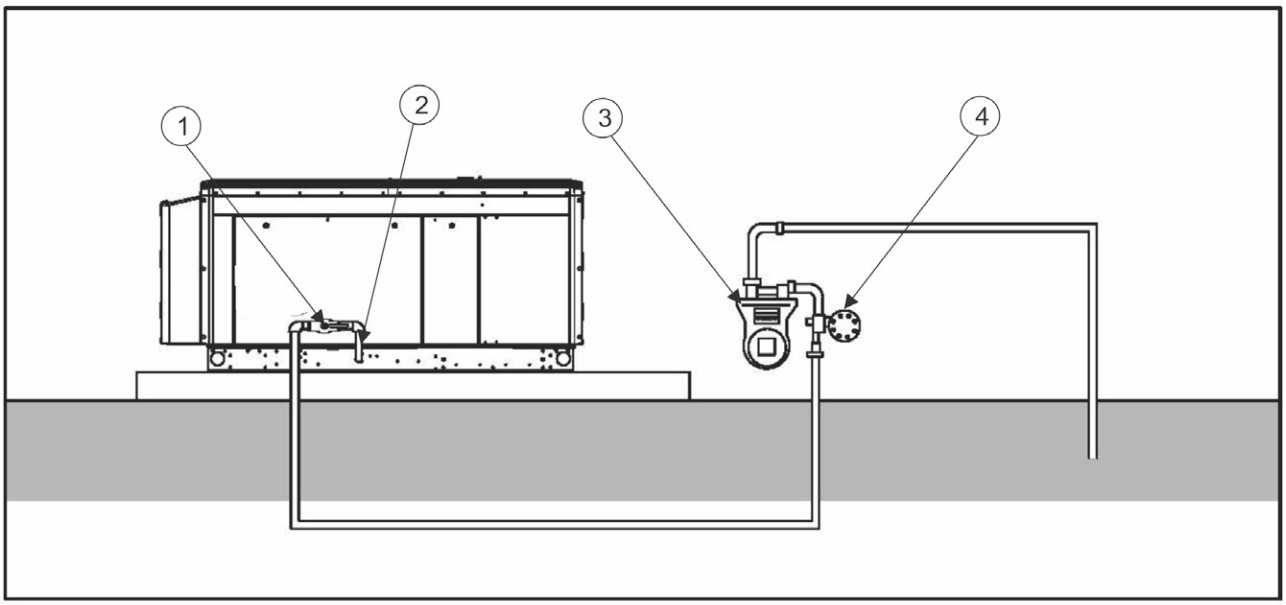
NOTICE

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

- Cummins flexible fuel line (attached to the radiator guard) 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 (Attached to Radiator Guard)	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.

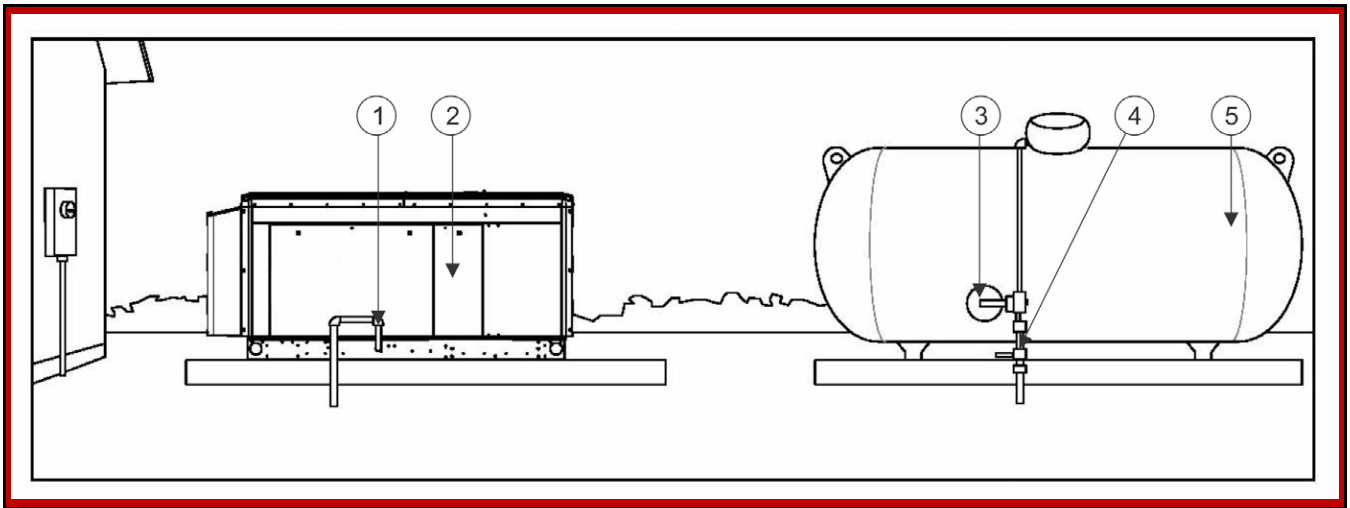
NOTICE

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.

Component	Description
Cummins Flexible Fuel Line	Attached to radiator guard. Protects the fuel system from vibration, expansion, and contraction.



No.	Description	No.	Description
1	Flexible Fuel Line (Attached to Radiator Guard)	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 (attached to the radiator guard)
- 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

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

⚠ WARNING

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

⚠ WARNING

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

4.4 Electrical Connections

⚠ WARNING

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

⚠ WARNING

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

1. ***Press the generator set's "O" (Off) button to stop the generator set. Allow the generator set to thoroughly cool to the touch.***
2. ***Turn off and disconnect the battery charger from the AC source before disconnecting the battery cables.***
3. ***Disconnect the negative (–) cable from the battery and secure it from contacting the battery terminals to prevent accidental starting.***

NOTICE

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

NOTICE

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

AC Connections

⚠ WARNING

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 wire must be used for L1, L2, and L3 with the wire size determined by the 75 °C ampacity tables.

NOTICE

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

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. Remove the enclosure side panel to gain access to the main circuit box.
3. Place the circuit breaker handle in the OFF position.
4. Remove the four 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).

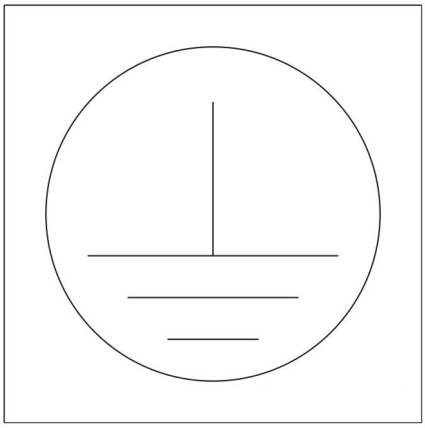
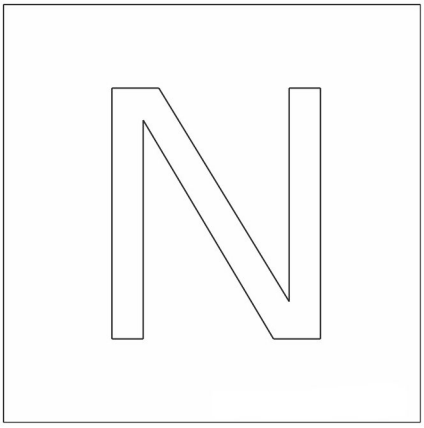
Equipment Grounding Conductor Symbol	Equipment Neutral Connection Symbol
	

FIGURE 6. SYMBOLS ON CIRCUIT BREAKER BOX

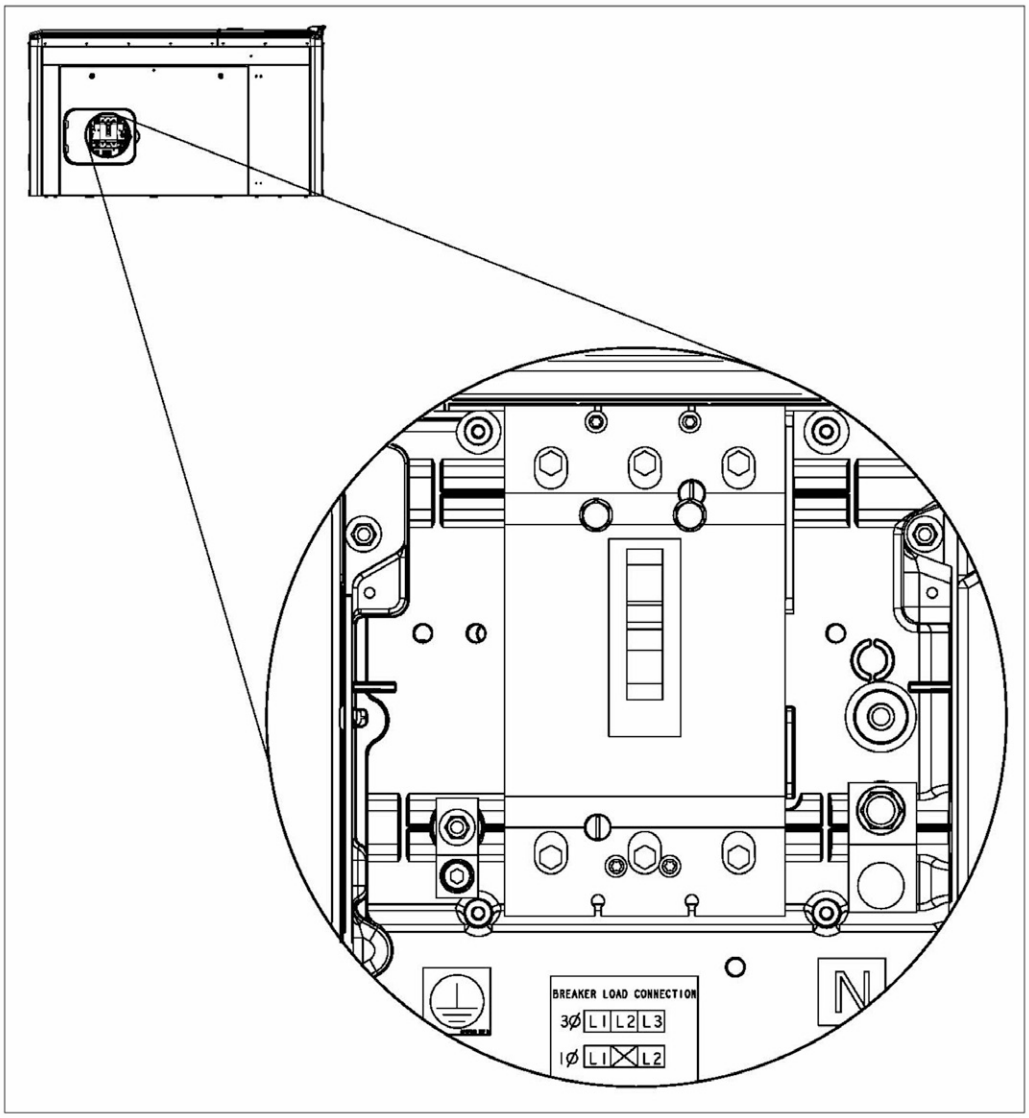


FIGURE 7. CIRCUIT BREAKER AC LOAD CONNECTIONS LOCATION (SYMBOLS SHOWN AT BOTTOM)

6. Torque the circuit breaker terminals per specifications on the circuit breaker label.
7. Torque the neutral lug to 31.1 Nm (275 in-lb).
8. Torque the equipment grounding lug to 13.8 Nm (120 in-lb).
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.

Automatic Transfer Switch AC Connections

⚠ WARNING

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

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

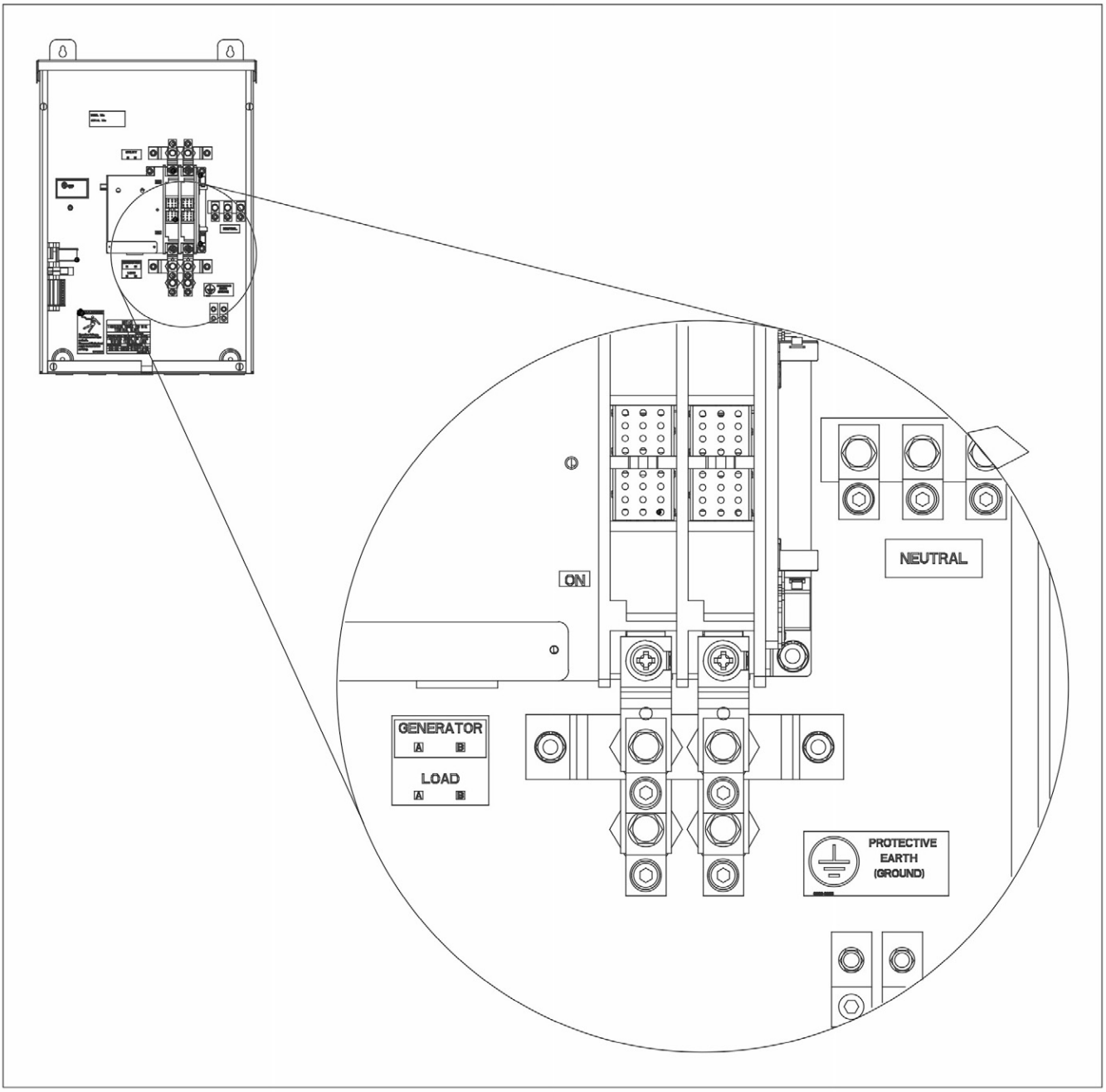


FIGURE 8. RA SERIES TRANSFER SWITCH AC CONNECTIONS LOCATION

Factory Option and Accessory Connections

The AC-powered options or accessories available include the battery charger, engine coolant heater, alternator heater, oil heater, battery warmer, and CCV heater (included with coolant heater).

NOTICE

The CCV heater requires power from a 120 VAC, 20 Amp protected circuit from the Main Distribution Panel. The CCV needs to be powered even during utility outages. Use 12 AWG 167 °F (75 °C) conductors to connect to the generator set AC distribution connector.

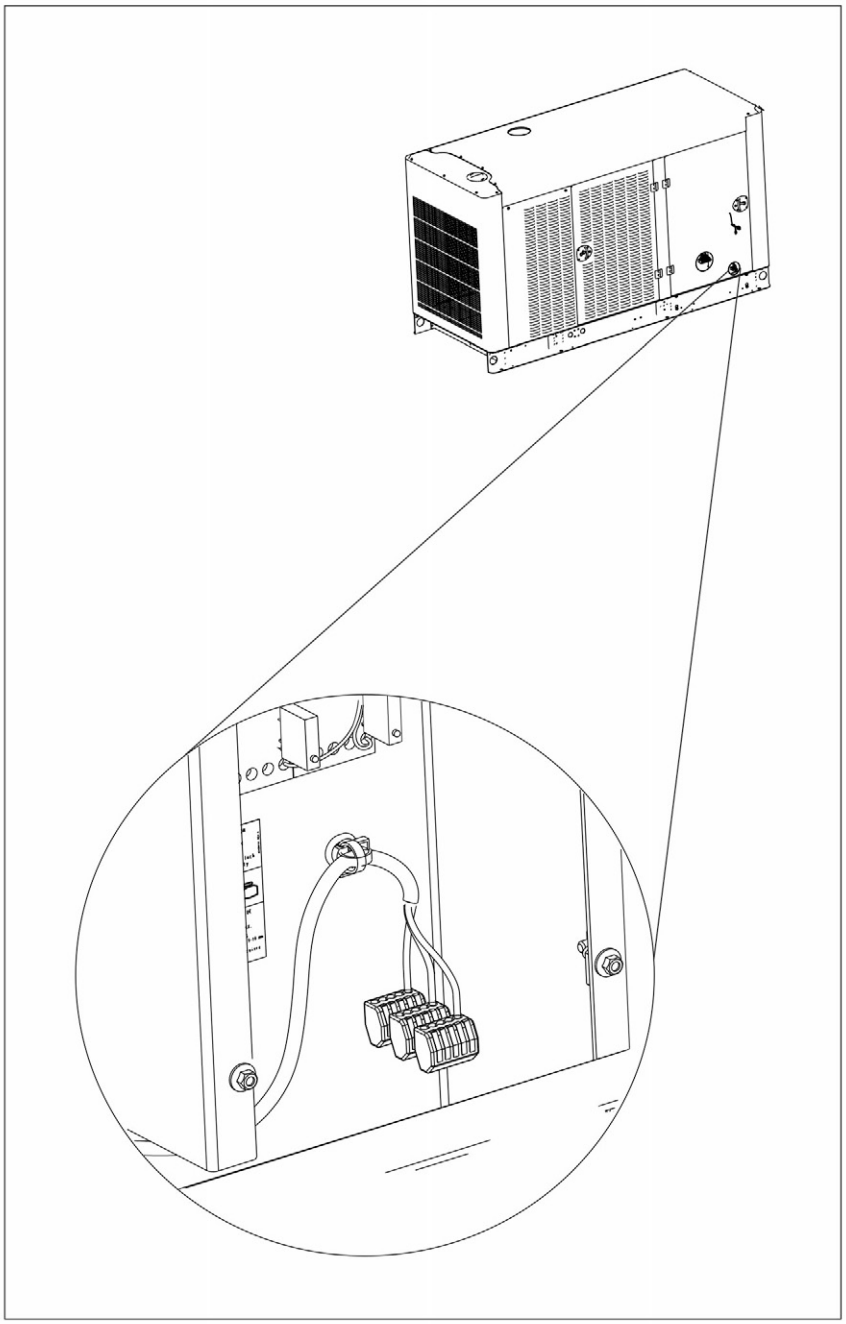


FIGURE 9. AC ACCESSORY CONNECTIONS

DC Connections

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

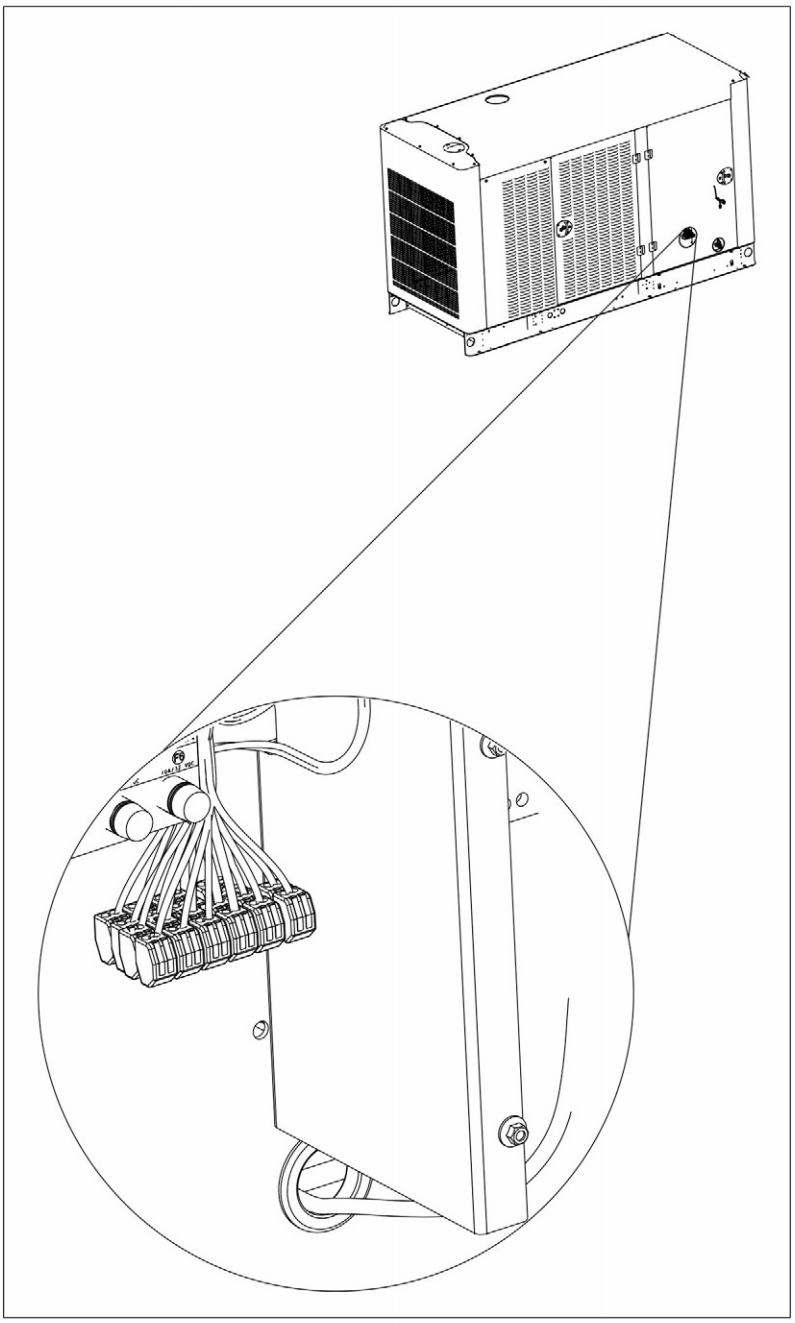


FIGURE 10. DC CUSTOMER CONNECTIONS

Automatic Transfer Switch DC Connections

⚠ WARNING

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

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

NOTICE

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

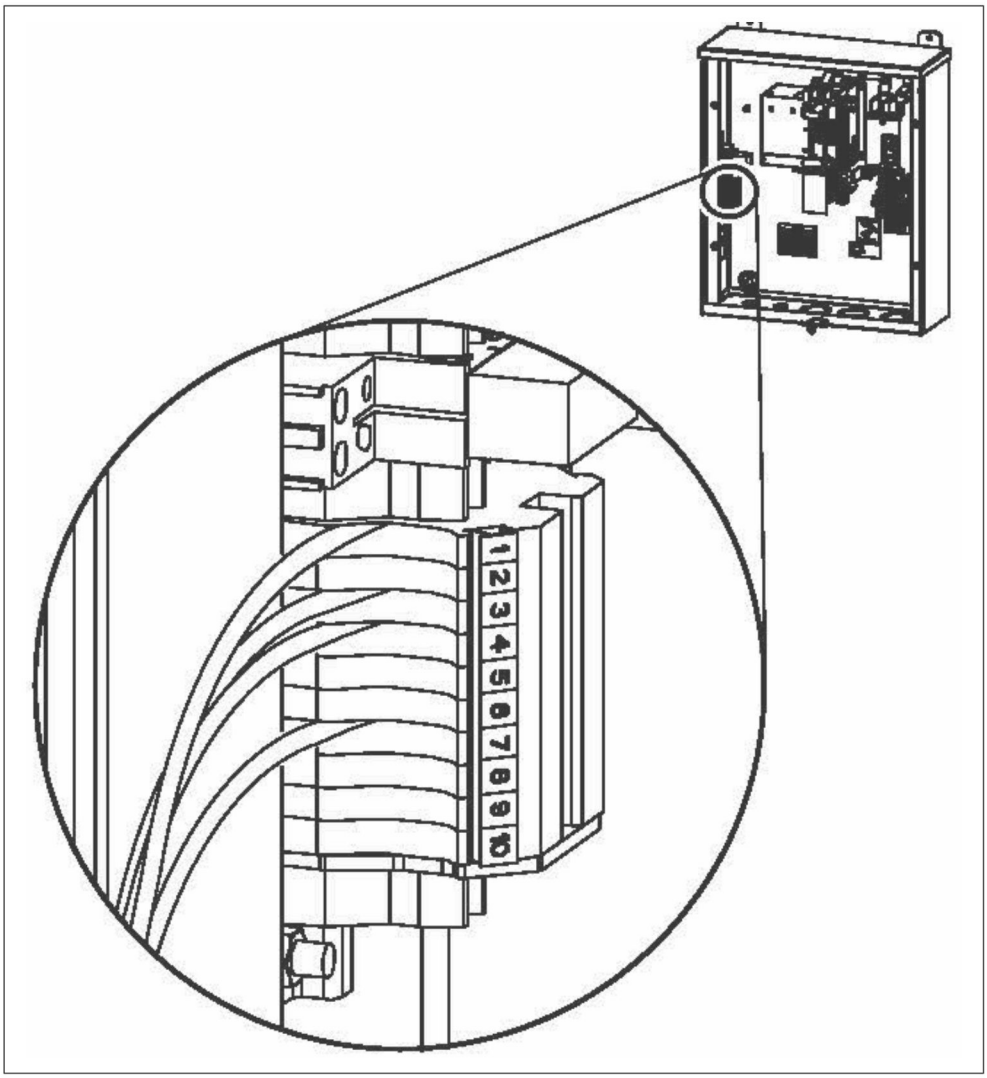
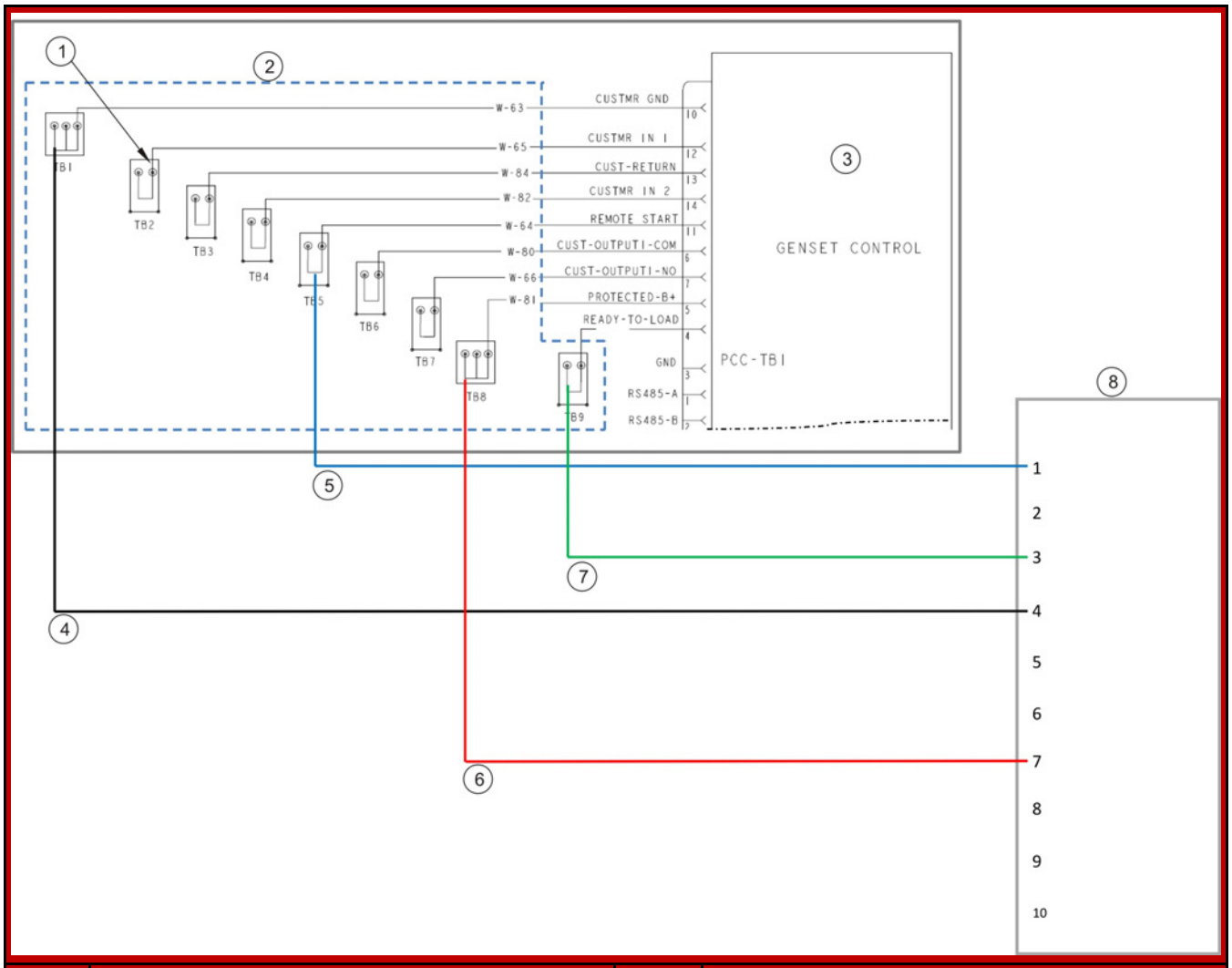


FIGURE 11. RA SERIES TRANSFER SWITCH DC CONNECTIONS LOCATION



No.	Description	No.	Description
1	DC Circuit Connectors	5	Remote Start
2	DC Customer Connections (within Dotted Line Box)	6	Fuse B+ (5A)
3	PCC 1.1 or PCC 2.3	7	Ready to Load
4	Ground (B-)	8	RA Transfer Switch Terminal Block

FIGURE 12. GENERATOR SET TO RA TRANSFER SWITCH 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.

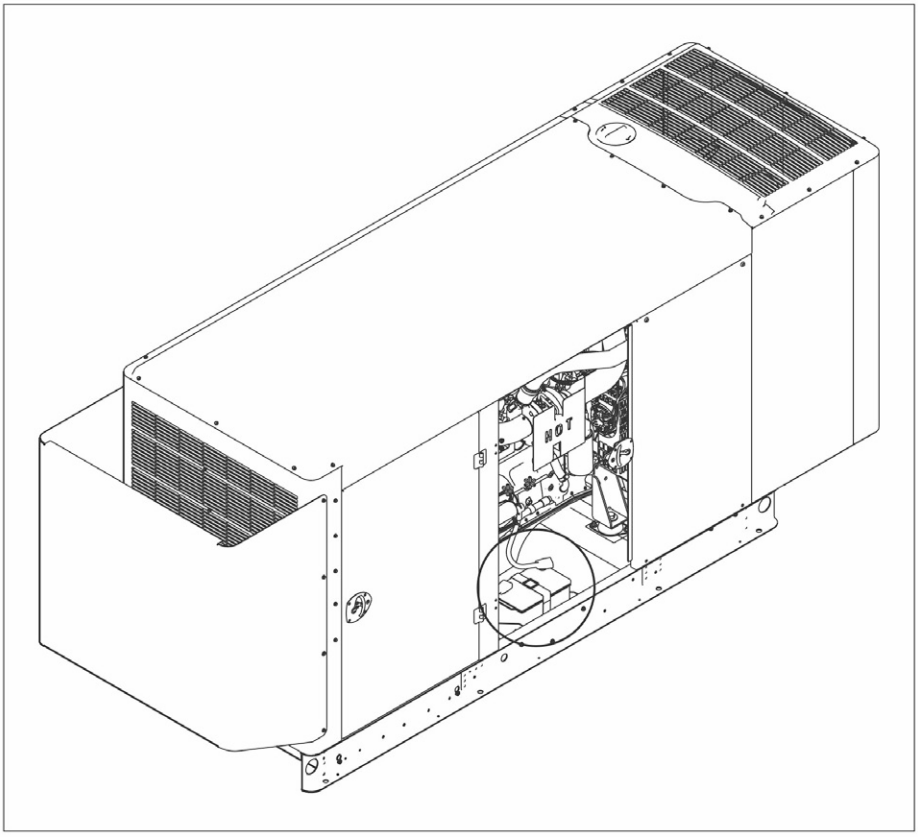


FIGURE 13. BATTERY LOCATION

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.

5 Startup and Configuration PCC 1.1

5.1 Time Setup (1-Phase ATS)

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

NOTICE
Not applicable without a single phase RA series transfer switch.

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

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

When updating these settings, the functions of the keys are as follows:

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

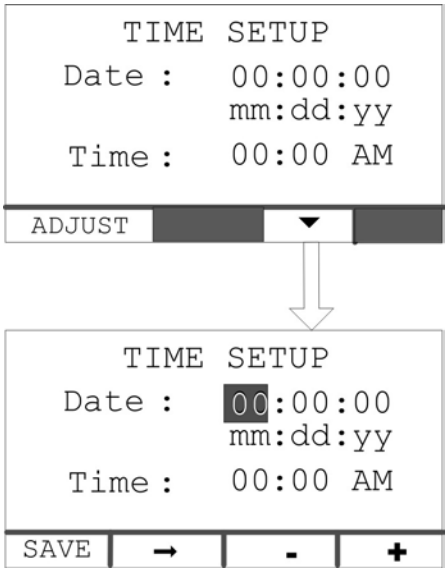


FIGURE 14. TIME SETUP SCREEN

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 13. 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

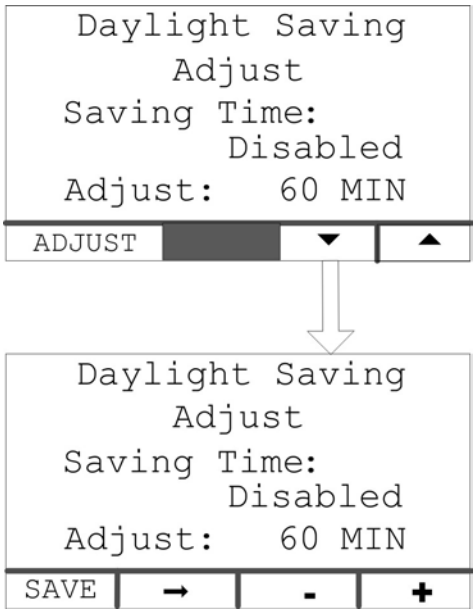


FIGURE 15. "DAYLIGHT SAVING ADJUST SAVING TIME" SCREEN NAVIGATION

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 14. 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

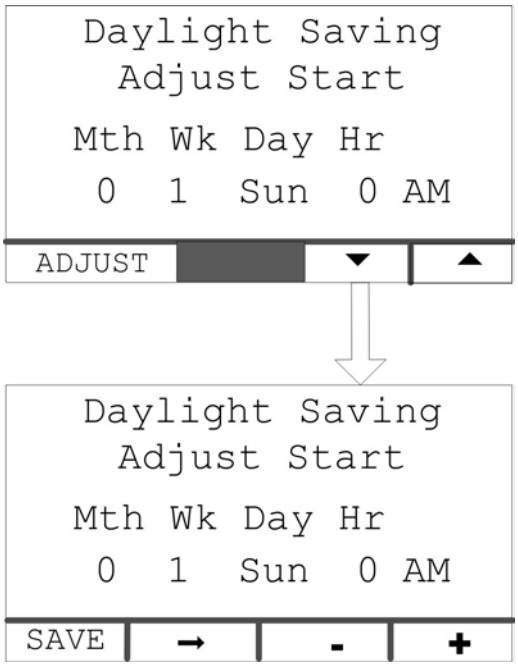


FIGURE 16. DAYLIGHT SAVING ADJUST START SCREEN

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 15. 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

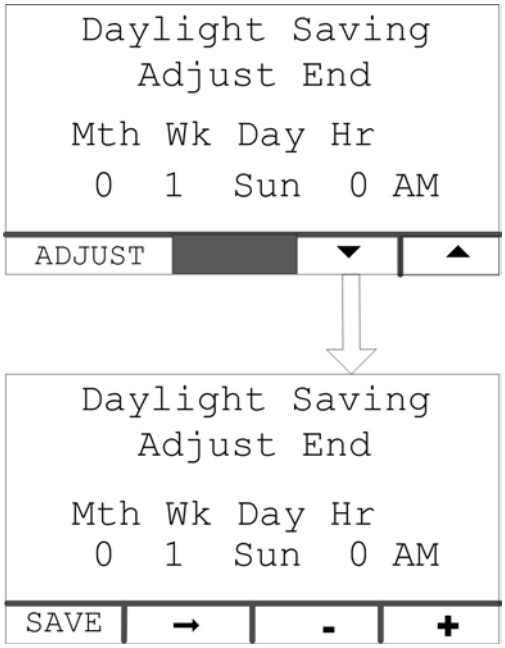


FIGURE 17. DAYLIGHT SAVING ADJUST END SCREEN

5.2 Exercise Settings

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

NOTICE
Not applicable without a single phase RA series transfer switch.

To access the Clock/Exerciser Menu:

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

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

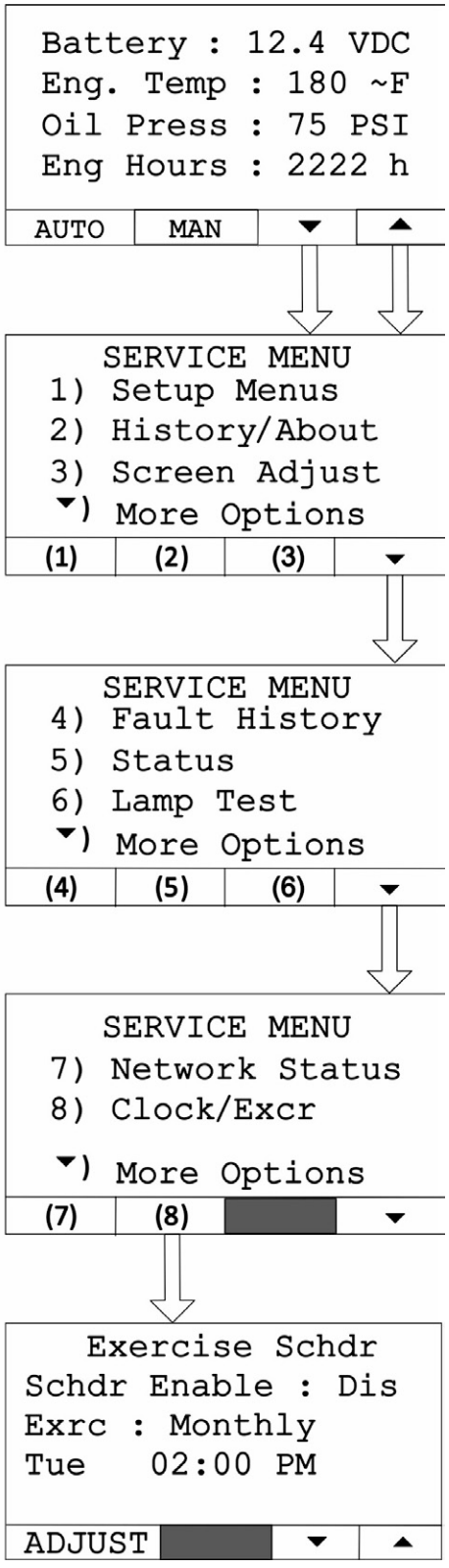


FIGURE 18. CLOCK/EXERCISER MENU NAVIGATION

Updating Exercise Frequency (1-Phase ATS)

NOTICE
Not applicable without a single phase RA series transfer switch.

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

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

When updating these settings, the functions of the keys are as follows:

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

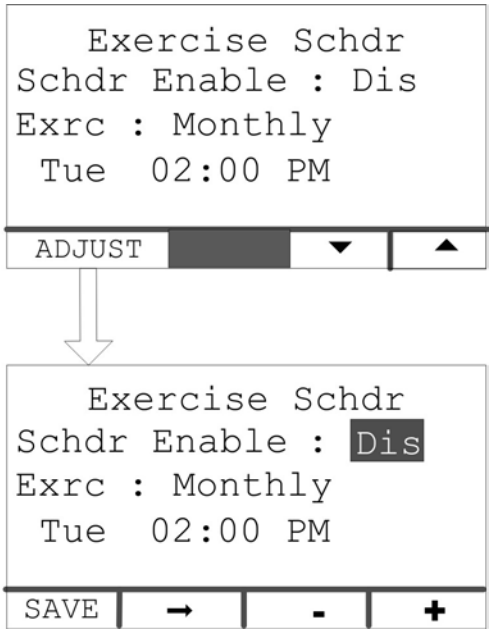


FIGURE 19. EXERCISE FREQUENCY NAVIGATION

Updating Exercise Duration (1-Phase ATS)

NOTICE
Not applicable without a single phase RA series transfer switch.

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

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

When updating these settings, the functions of the keys are as follows:

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

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

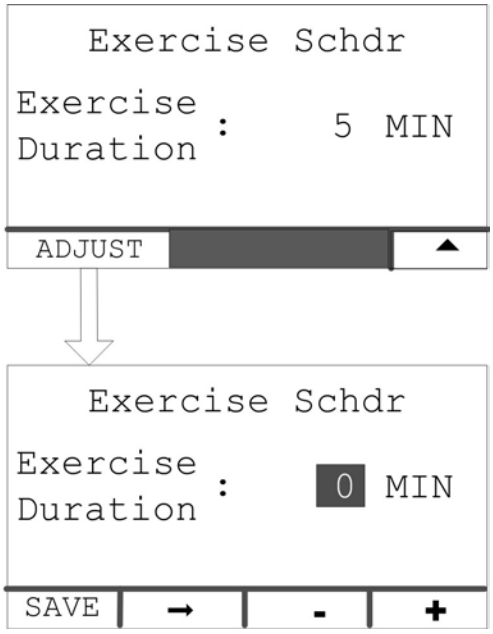


FIGURE 20. EXERCISE DURATION NAVIGATION

5.3 Brightness and Contrast

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

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

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

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

When updating these settings, the functions of the keys are as follows:

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

NOTICE

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

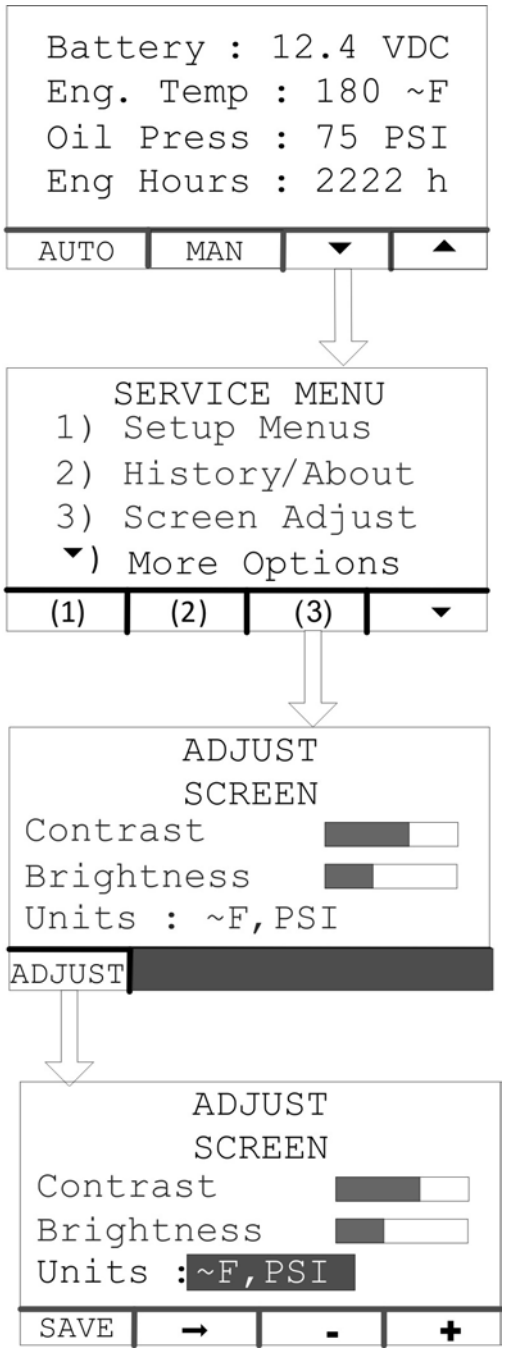


FIGURE 21. BRIGHTNESS AND CONTRAST SCREEN NAVIGATION

NOTICE

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

5.4 History and About Menu

To access the History/About screen:

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

NOTICE

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

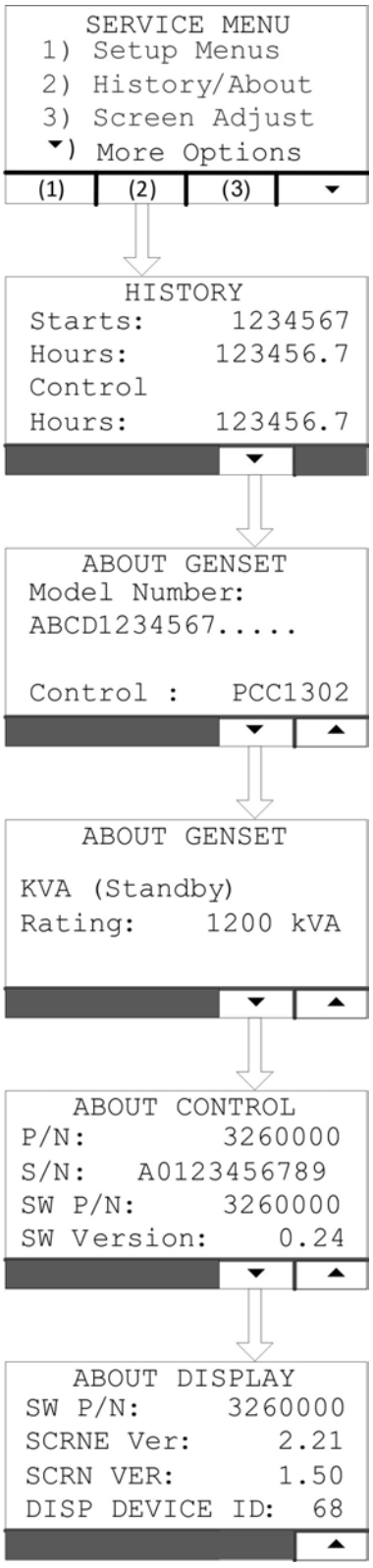


FIGURE 22. HISTORY/ABOUT MENU

5.5 Checklist

Tick	Item
	General
	Generator set wattage capacity is sufficient to handle maximum anticipated load.
	At least 5 feet of clearance to combustible materials is provided. At least 3 feet of clearance is provided around the entire generator set for service and ventilation.
	The generator set is located in an area not subject to flooding.
	All installers have read and are familiar with the Generator Set Installation manual and the Health and Safety manual.
	All installers have been thoroughly briefed on preventive maintenance procedures.
	All installers have read and understand all important safety instructions.
	Generator Set Support
	The floor, roof or earth on which the generator set rests is strong enough and will not allow shifting or movement. Local codes for soil bearing capacity were followed.
	The generator set is properly supported and secured to an approved base.
	The supporting base is of non-combustible material and extends 6 inches all around the generator set.
	Fuel System
	The generator set is configured to the fuel being used. (See the Fuel Selection and Fuel System Connection section.)
	Fuel line size has been verified for generator set fuel consumption and pressure.
	An approved flexible fuel line (attached to the radiator guard) is installed between the main fuel supply and the generator set's fuel system near the generator set
	Fuel lines are properly installed, supported and protected against damage.
	Fuel supply shutoff valves are installed to turn off fuel flow in case of leaks.
	No leaks are found in fuel supply line as a result of leak testing fuel systems.
	The inside of all fuel supply lines is free of contaminants.
	The fuel pressure is at 1.5 - 3.2 kPa (6-13 inches of water column) under any condition.
	Fuel pressure maintains at least 1.5 kPa (6 inches water column) when the generator set is at rated load.
	The installation is compliant with all state and local codes and regulations.
	AC and DC Wiring
	The control is configured for the proper fuel type.

Tick	Item
	Wire sizes, wire types, insulation, conduits and connection methods all meet applicable codes.
	AC and DC wires are separated in their own conduit to prevent electrical induction.
	All load, line and generator connections are well made and correct.
	Generator Set Pre-Start
	A safety check was performed just before starting.
	The generator set engine is properly serviced with oil and coolant.
	The battery is properly installed, serviced and charged.
	The battery charger and engine coolant heater are connected and operational, if applicable.
	All generator set covers and safety shields are installed correctly.
	The fuel supply is turned on.
	All fuel shutoff valves are operational.
	The date and time have been set in the generator set control.
	The generator set operating mode has been selected.

5.6 Startup

⚠ WARNING

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 C70 N6, C80 N6, and C100 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, the generator set must be run with no active faults under load (that is, transfer switch connected to maximum customer load available) until the engine temperature reaches 80 °C (175 °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 each should be checked before the generator set is started. Start and operate the generator set following all the instructions and precautions in the Operator Manual. Ensure that the bonding bolts are installed into the service panels before leaving the site.

NOTICE
Before leaving the site, if the generator set is ready to be placed in service, put the generator set in Auto mode to provide automatic standby power.

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

5.7 InPower Service Tool

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

5.8 Disabling the AMF Feature

NOTICE
This procedure must be performed by a qualified technician.

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

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

NOTICE

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

1. Connect to the PCC 1.1 or PCC 2.3 via InPower.
2. Navigate to the Adjustments->Features->Automatic Transfer Switch folder.
3. Select the Auto Mains Failure Enable parameter.
4. Double-click on Enabled in the Value field.
5. A pop-up will appear with available choices. Select Disabled.
6. Select Device->Save Adjustments from the top menu bar.
7. A pop-up will appear asking if the change is to be saved. Click the Save button.
8. After a pop-up appears confirming that the change has been saved, disconnect InPower from the PCC1302.

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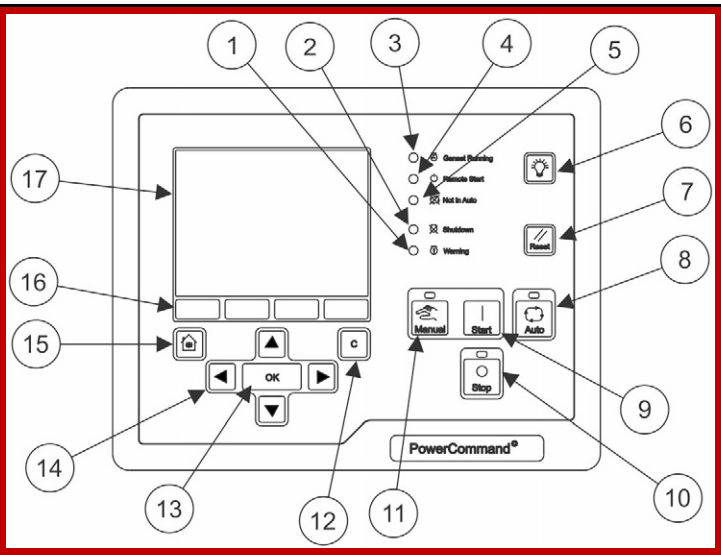
6 Startup and Configuration PCC 2.3

6.1 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 23. OPERATOR PANEL

Operator Panel - Initial Operator Menu

Figure 24 on page 67 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 16. 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	

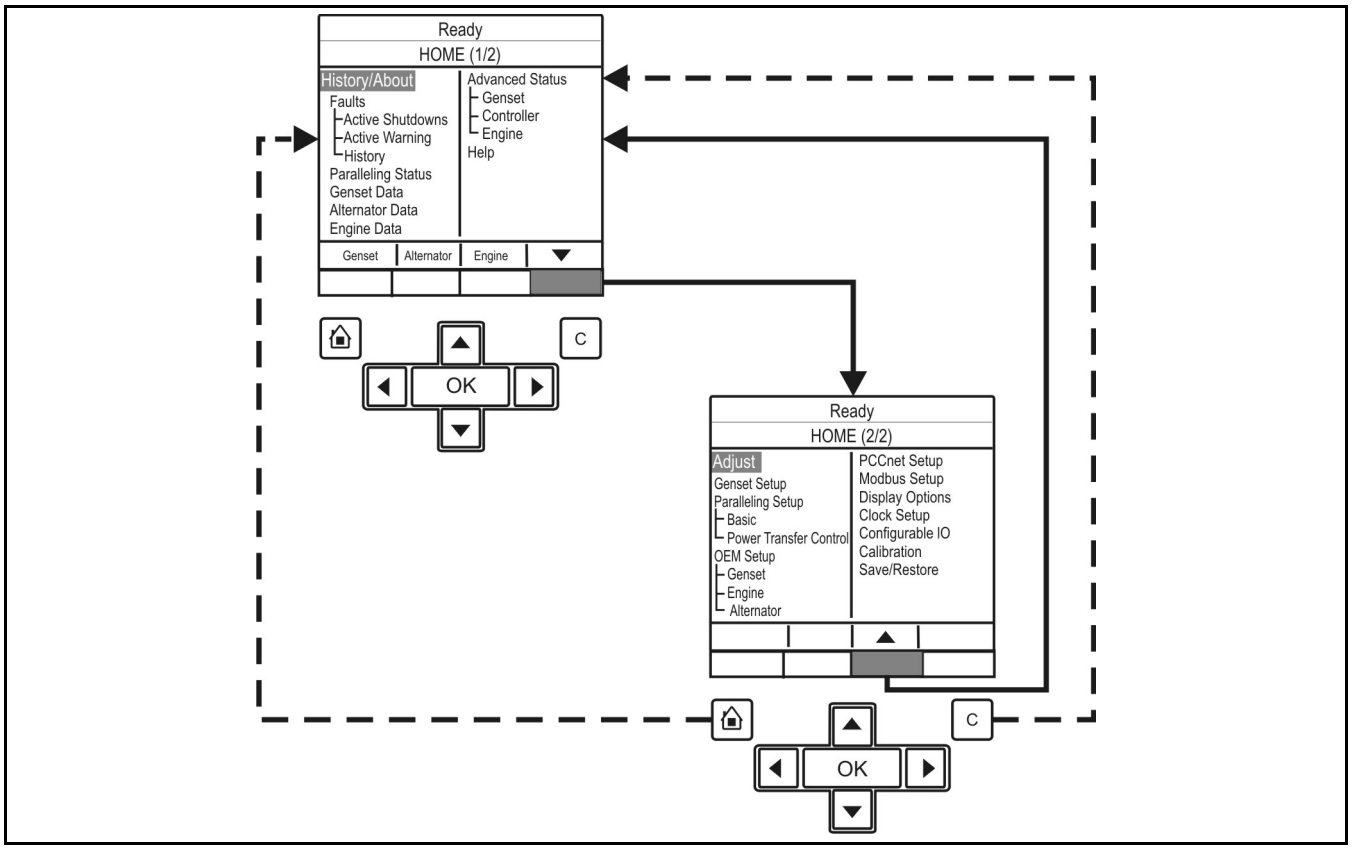


FIGURE 24. INITIAL OPERATOR MENU

- 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 17. 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	

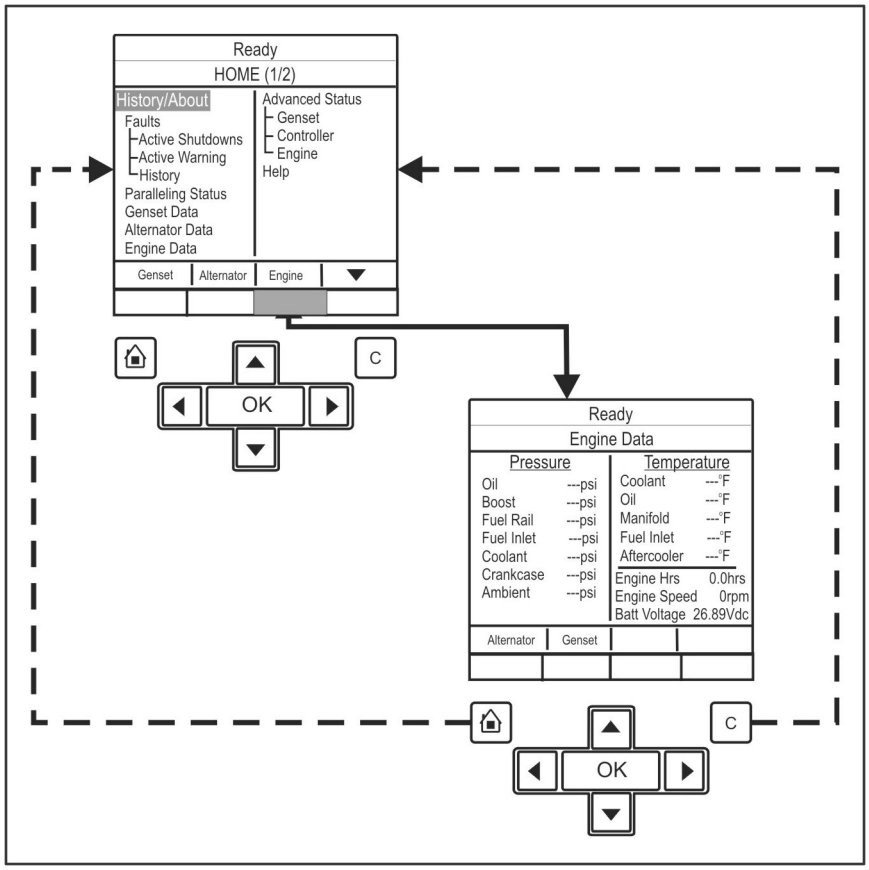


FIGURE 25. ENGINE DATA MENU - TYPICAL DATA

- 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 26 on page 71 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 18. 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.	

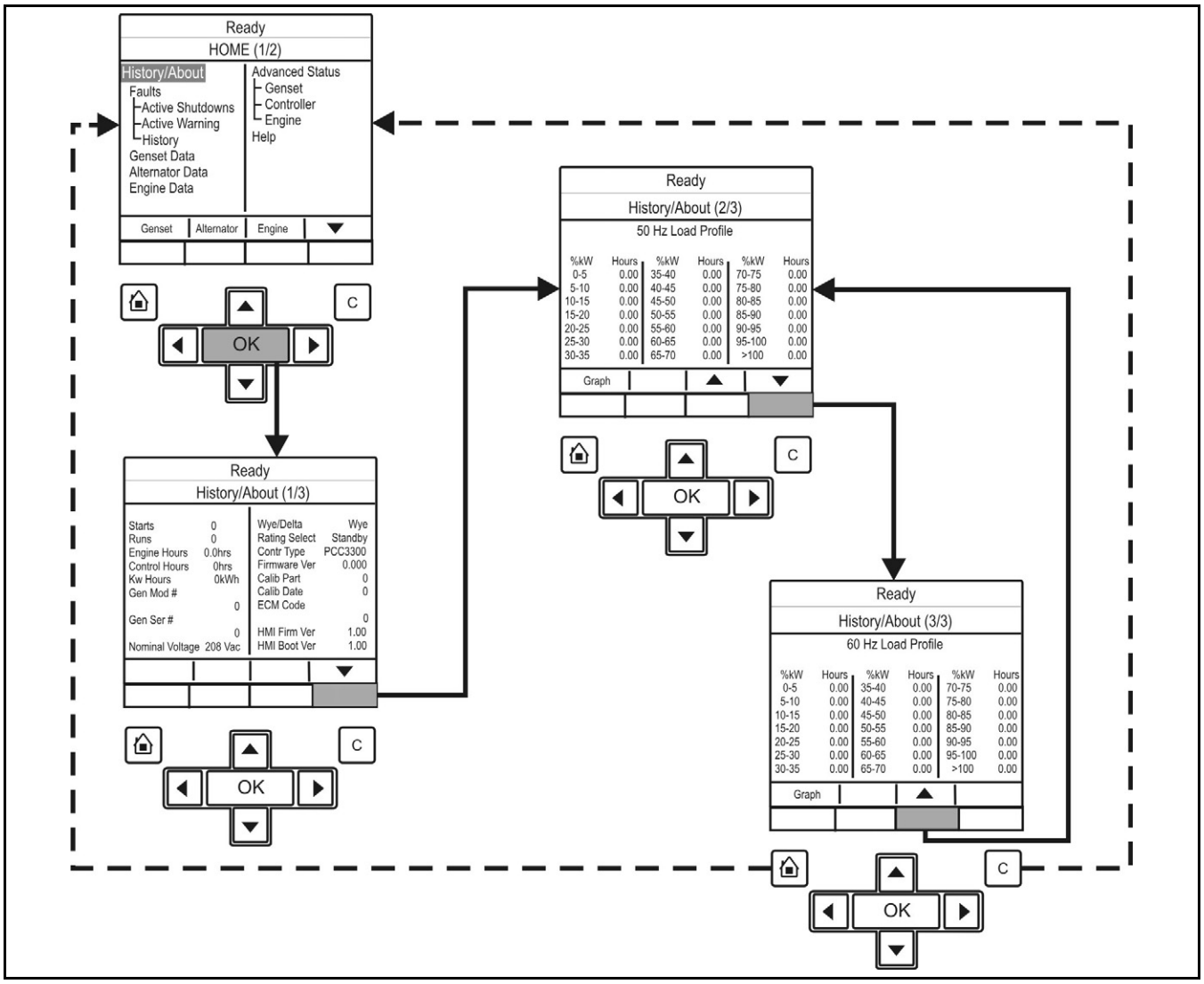


FIGURE 26. HISTORY/ABOUT MENU - TYPICAL DATA

- 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 19. 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.

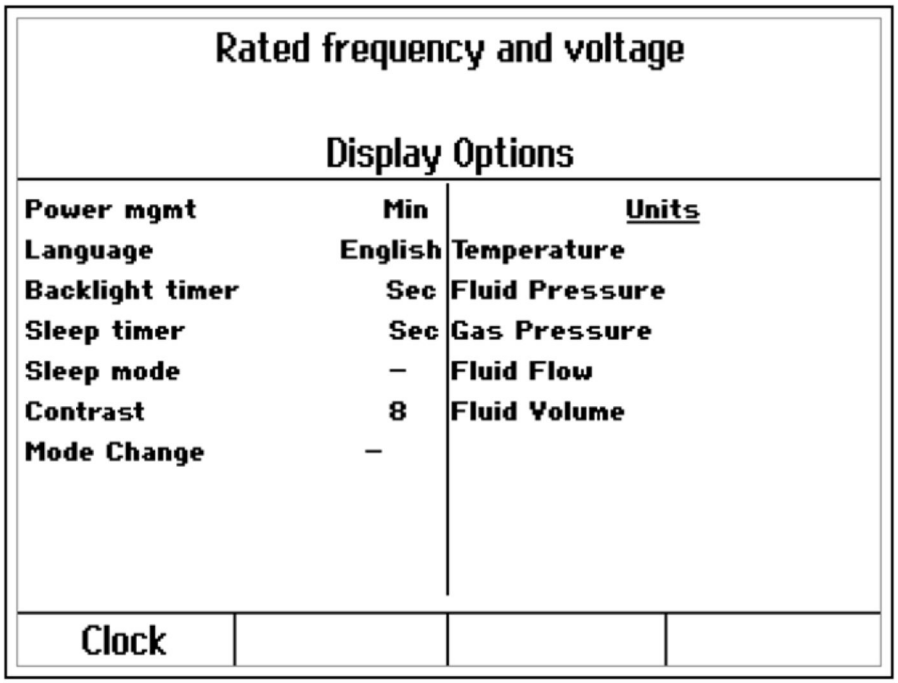


FIGURE 27. DISPLAY OPTIONS SCREEN

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 20. 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

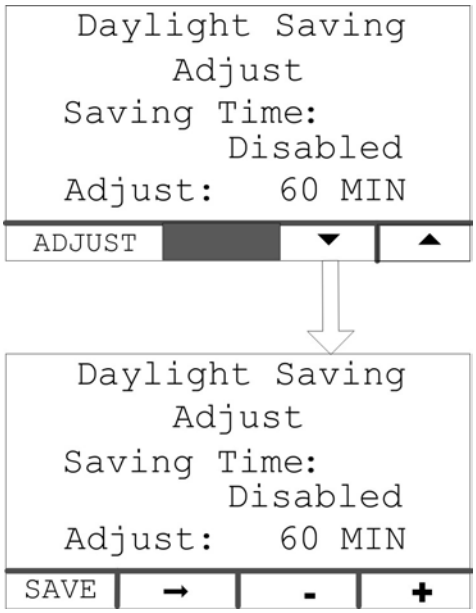


FIGURE 28. "DAYLIGHT SAVING ADJUST SAVING TIME" SCREEN NAVIGATION

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 21. 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

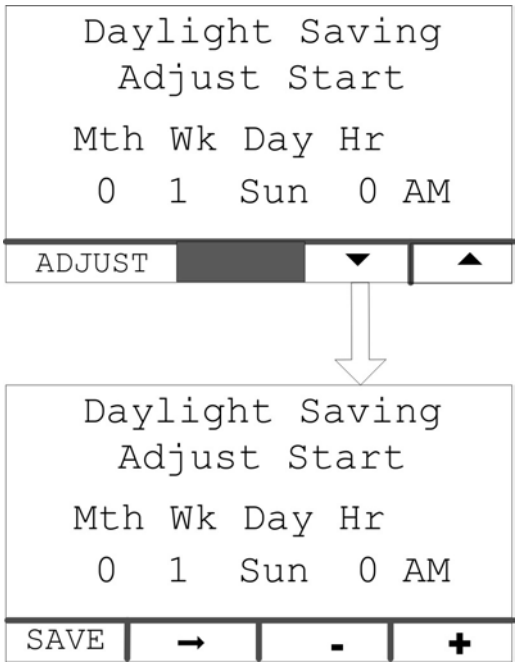


FIGURE 29. DAYLIGHT SAVING ADJUST START SCREEN

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 22. 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

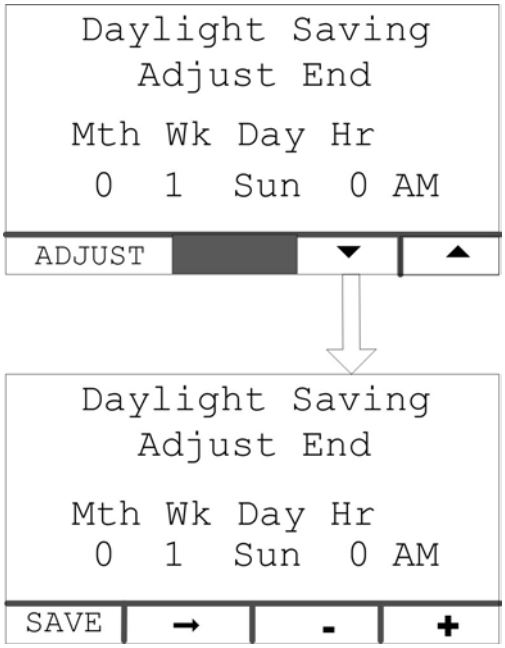


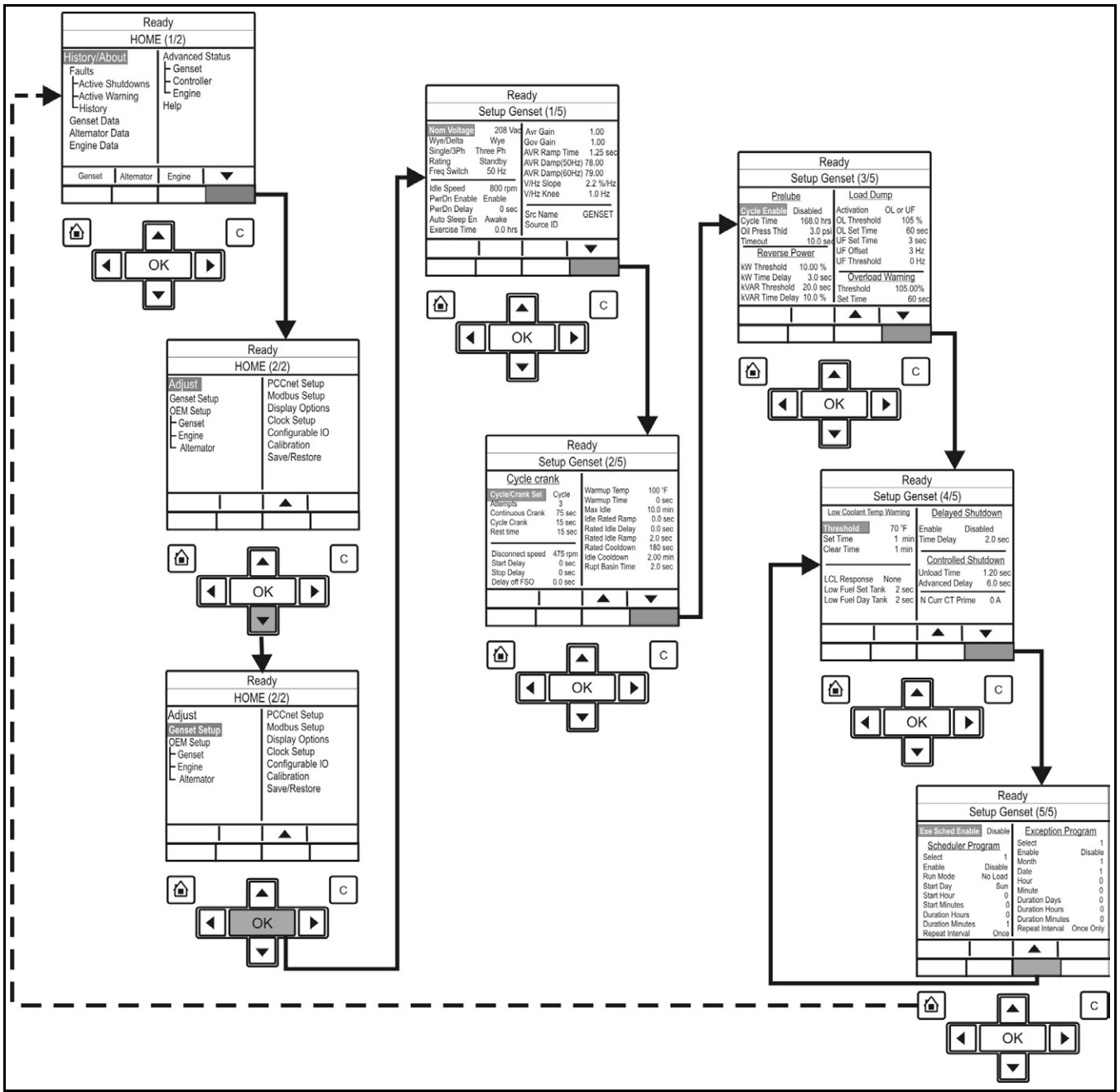
FIGURE 30. DAYLIGHT SAVING ADJUST END SCREEN

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 31. GENSET SETUP MENU - TYPICAL DATA

6.2 InPower Service Tool

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

6.3 Checklist

Tick	General Items
	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.
	Diesel Fuel System (if applicable)
	Fuel tanks meet or exceed all local, State, or National codes (if applicable).

Tick	General Items
	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.
	Strainer or fuel screen (100 to 200 mesh) is installed in the fuel supply line to protect the fuel lift pump, day tank transfer pump, or float valve seat from fuel tank debris (if applicable).
	The fuel filter assembly shipped with the generator set is installed and operational (if applicable).
	Fuel supply shutoff valves are installed to prevent fuel flow in case of leaks.
	No shutoff valves are installed on engine fuel return line (if applicable).
	External fuel pumps are connected and operational at all times - generator set started or shut down (if applicable).
	Fuel tanks are filled with the correct grade / type of fuel (if applicable).
	Fuel system is properly primed.
	No fuel leaks are found in supply line or engine fuel system.
	Gaseous Fuel System (if applicable)
	Check fuel line and use equations to verify it has proper volume capability.
	Check if fuel pressure is between 7-13 inches water column.
	Check for any gas leaks.
	If necessary, perform initial demand regulator adjustment procedure.
	Make sure fuel pressure does not drop below 7 inches water column under full load.
	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.

Tick	General Items
	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.
	Verify that the pyrometer meters are functioning.
	AC and DC Wiring
	For bottom entry circuit breaker installations, the cable chute has been installed (if applicable).
	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.
	Battery charger is configured for the proper DC battery voltage, battery type, and float voltage.
	Batteries are properly installed, serviced and charged.
	Battery temperature sensor is connected and operational (if applicable).
	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 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.

6.4 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 23. 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 24. 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.

6.5 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.

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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 26. 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 28. 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 30. 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 33. 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 36. 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 39. 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 42. 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.									

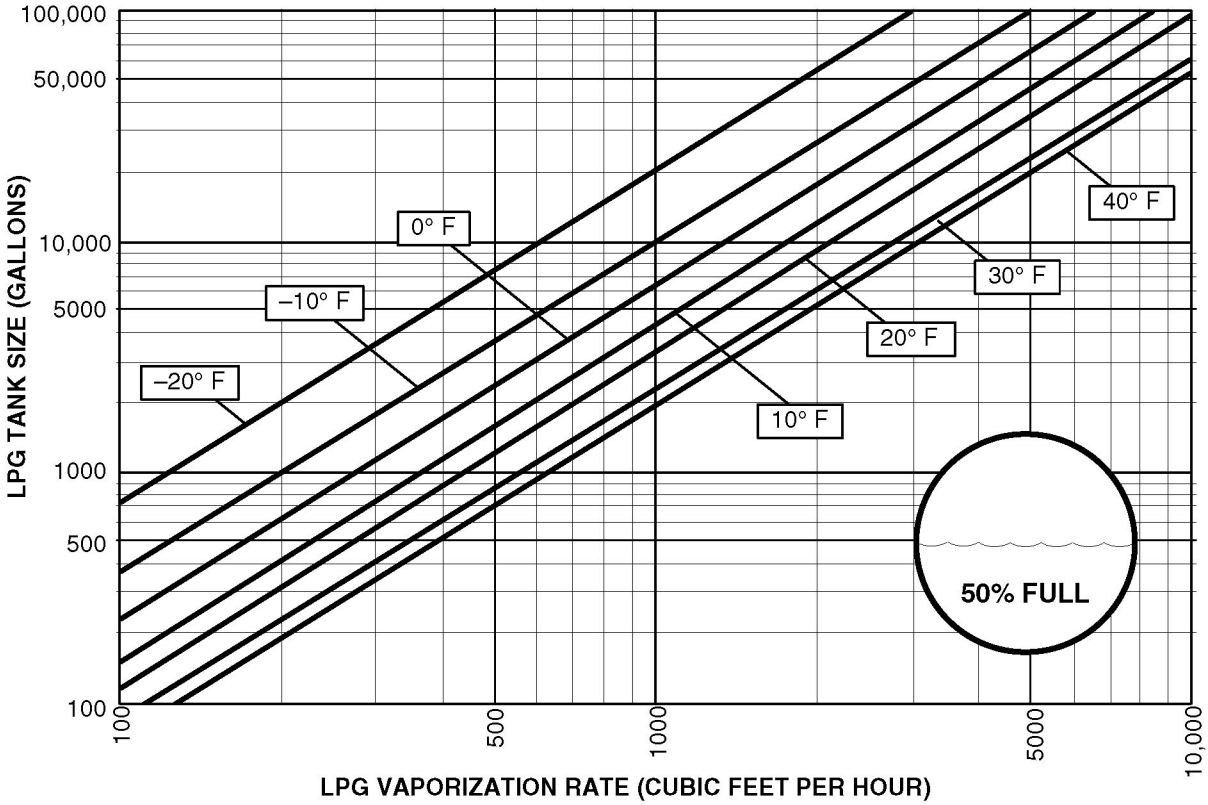

FIGURE 32. MINIMUM LPG TANK SIZE (50% FULL) REQUIRED TO MAINTAIN 5 PSIG AT SPECIFIC WITHDRAWAL RATE AND MINIMUM EXPECTED WINTER TEMPERATURE

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Appendix B. Outline and System Drawings

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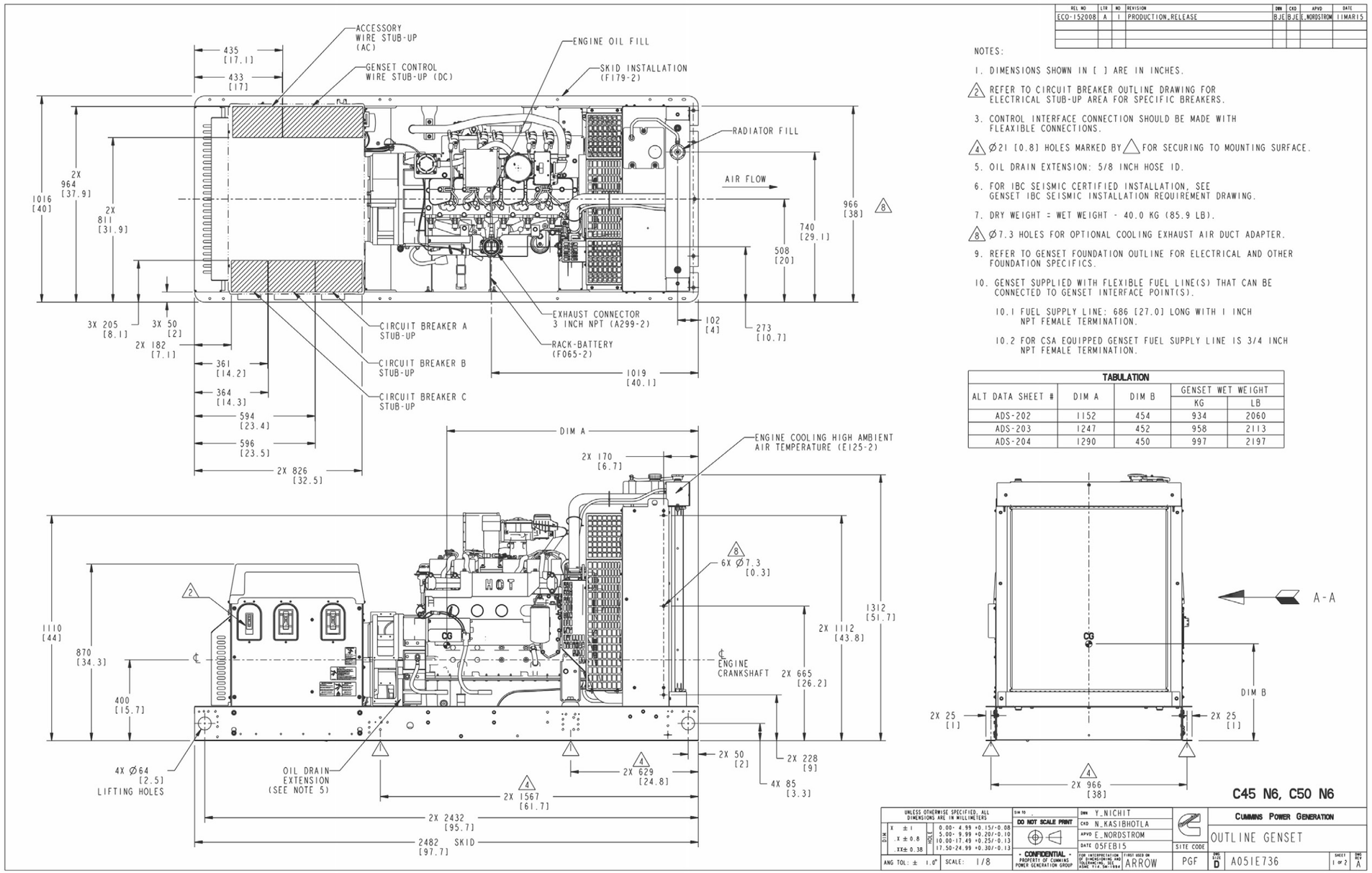


REL NO	LTR	NO	REVISION	DRN	CKD	APVD	DATE
ECO-152008	A	1	PRODUCTION_RELEASE	BJE	BJE	E_NORDSTROM	11MAR15

NOTES:

1. DIMENSIONS SHOWN IN [ ] ARE IN INCHES.
2. REFER TO CIRCUIT BREAKER OUTLINE DRAWING FOR ELECTRICAL STUB-UP AREA FOR SPECIFIC BREAKERS.
3. CONTROL INTERFACE CONNECTION SHOULD BE MADE WITH FLEAXIBLE CONNECTIONS.
4. Ø21 [0.8] HOLES MARKED BY △ FOR SECURING TO MOUNTING SURFACE.
5. OIL DRAIN EXTENSION: 5/8 INCH HOSE ID.
6. FOR IBC SEISMIC CERTIFIED INSTALLATION, SEE GENSET IBC SEISMIC INSTALLATION REQUIREMENT DRAWING.
7. DRY WEIGHT = WET WEIGHT - 40.0 KG (85.9 LB).
8. Ø7.3 HOLES FOR OPTIONAL COOLING EXHAUST AIR DUCT ADAPTER.
9. REFER TO GENSET FOUNDATION OUTLINE FOR ELECTRICAL AND OTHER FOUNDATION SPECIFICS.
10. GENSET SUPPLIED WITH FLEXIBLE FUEL LINE(S) THAT CAN BE CONNECTED TO GENSET INTERFACE POINT(S).
    - 10.1 FUEL SUPPLY LINE: 686 [27.0] LONG WITH 1 INCH NPT FEMALE TERMINATION.
    - 10.2 FOR CSA EQUIPPED GENSET FUEL SUPPLY LINE IS 3/4 INCH NPT FEMALE TERMINATION.

TABULATION

ALT DATA SHEET #	DIM A	DIM B	GENSET WET WEIGHT	
			KG	LB
ADS-202	1152	454	934	2060
ADS-203	1247	452	958	2113
ADS-204	1290	450	997	2197

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS
DIM: X ±1; X ±0.8; XX± 0.38
TOL: 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: 1/8
DIM TO DO NOT SCALE PRINT
- CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP
DRN Y_NICHIT
CKD N_KASIBHOTLA
APVD E_NORDSTROM
DATE 05FEB15
FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ASME Y14.5M-1994
FIRST USED ON ARROW
CUMMINS POWER GENERATION
OUTLINE GENSET
SITE CODE PGF
SIZE D A051E736 SHEET 1 OF 2 REV A

FIGURE 33. GENERATOR SET OUTLINE, 45-50 KW (SHEET 1 OF 2)

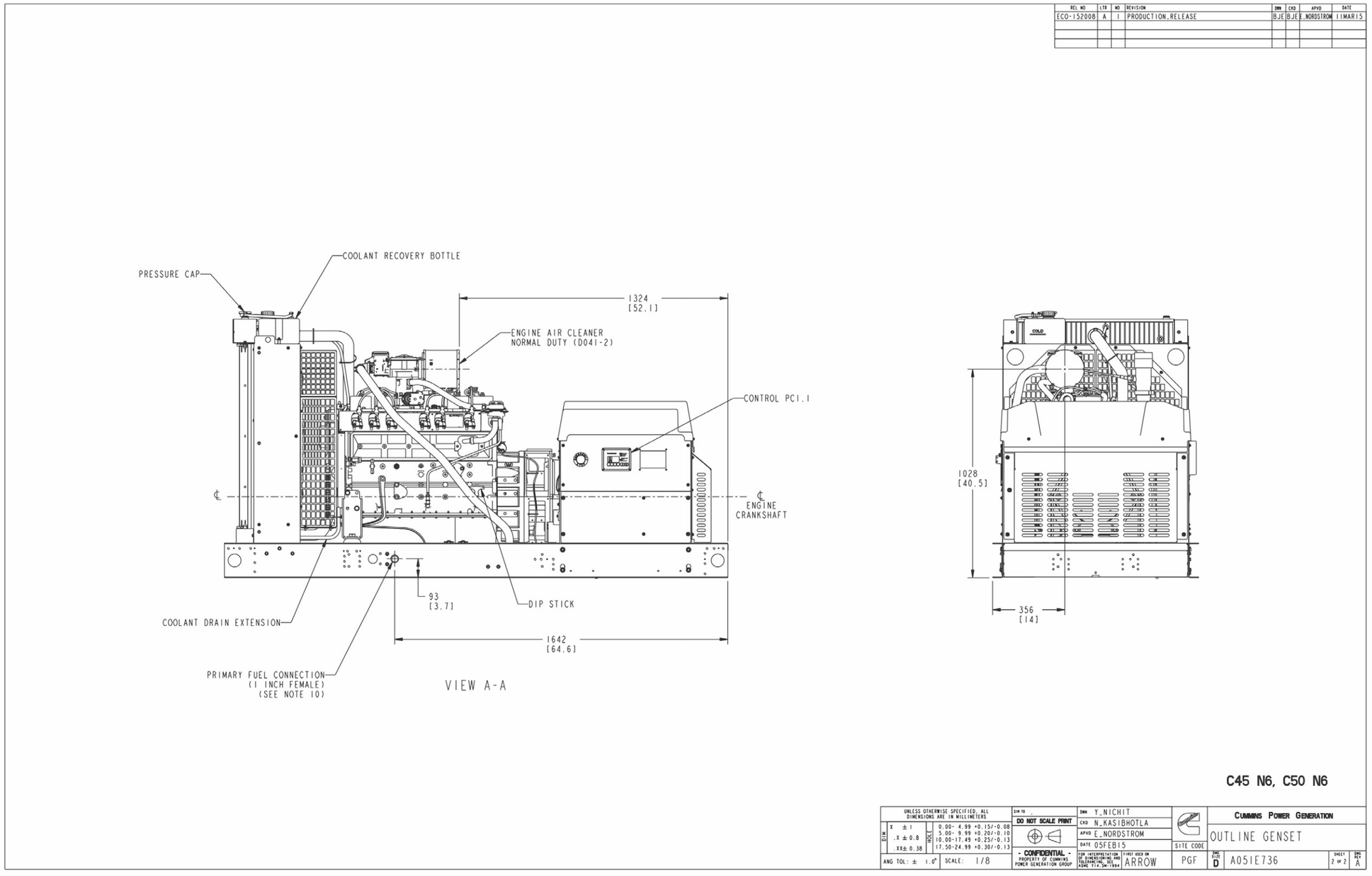
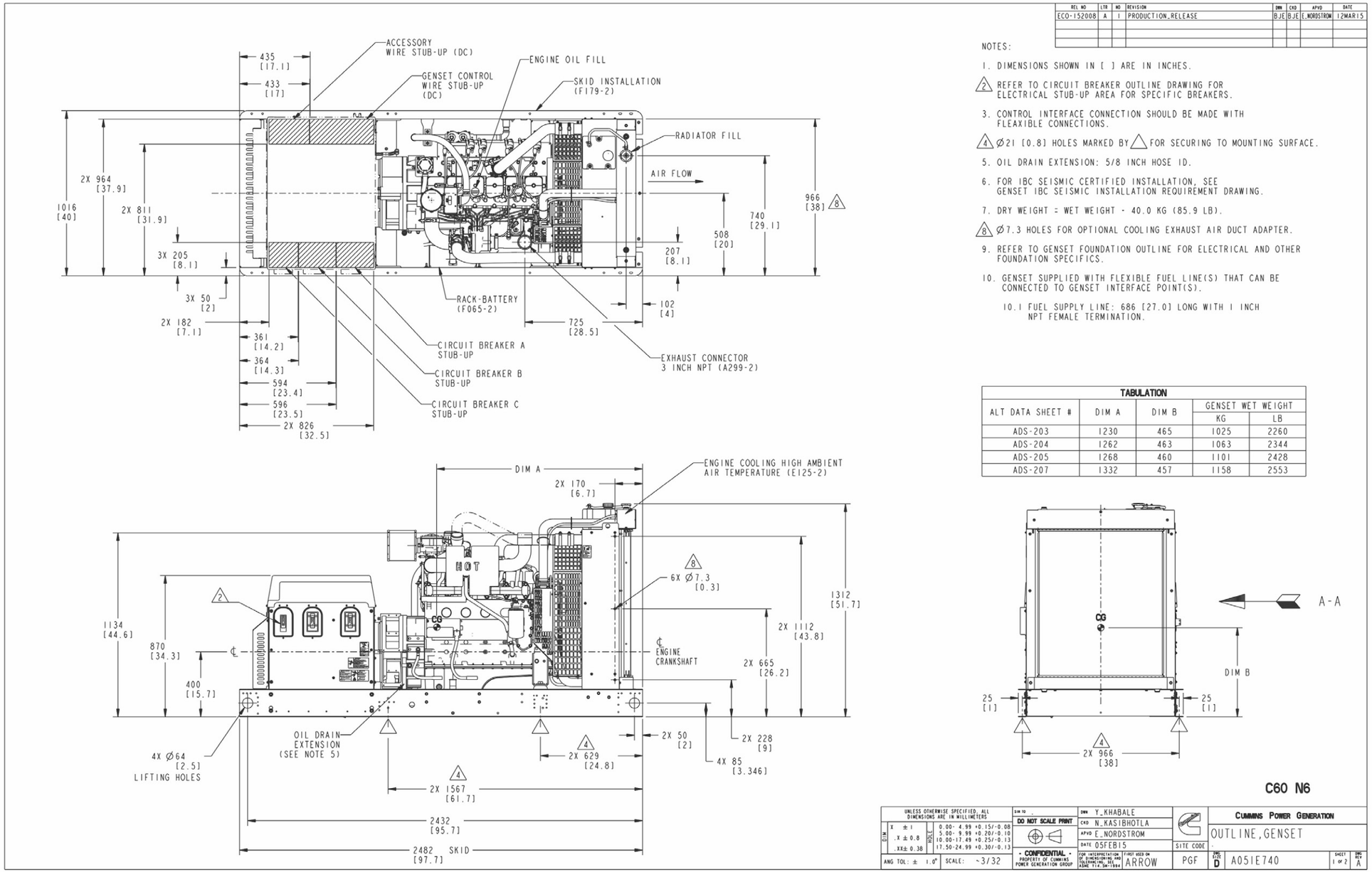


FIGURE 34. GENERATOR SET OUTLINE, 45-50 KW (SHEET 2 OF 2)



REL NO	LTR	NO	REVISION	DRN	CKD	APVD	DATE
ECO-152008	A	1	PRODUCTION_RELEASE	BJE	BJE	E.NORDSTROM	12MAR15

NOTES:

1. DIMENSIONS SHOWN IN [ ] ARE IN INCHES.
2. REFER TO CIRCUIT BREAKER OUTLINE DRAWING FOR ELECTRICAL STUB-UP AREA FOR SPECIFIC BREAKERS.
3. CONTROL INTERFACE CONNECTION SHOULD BE MADE WITH FLEAXIBLE CONNECTIONS.
4. Ø21 [0.8] HOLES MARKED BY △ FOR SECURING TO MOUNTING SURFACE.
5. OIL DRAIN EXTENSION: 5/8 INCH HOSE ID.
6. FOR IBC SEISMIC CERTIFIED INSTALLATION, SEE GENSET IBC SEISMIC INSTALLATION REQUIREMENT DRAWING.
7. DRY WEIGHT = WET WEIGHT - 40.0 KG (85.9 LB).
8. Ø7.3 HOLES FOR OPTIONAL COOLING EXHAUST AIR DUCT ADAPTER.
9. REFER TO GENSET FOUNDATION OUTLINE FOR ELECTRICAL AND OTHER FOUNDATION SPECIFICS.
10. GENSET SUPPLIED WITH FLEXIBLE FUEL LINE(S) THAT CAN BE CONNECTED TO GENSET INTERFACE POINT(S).
    10.1 FUEL SUPPLY LINE: 686 [27.0] LONG WITH 1 INCH NPT FEMALE TERMINATION.

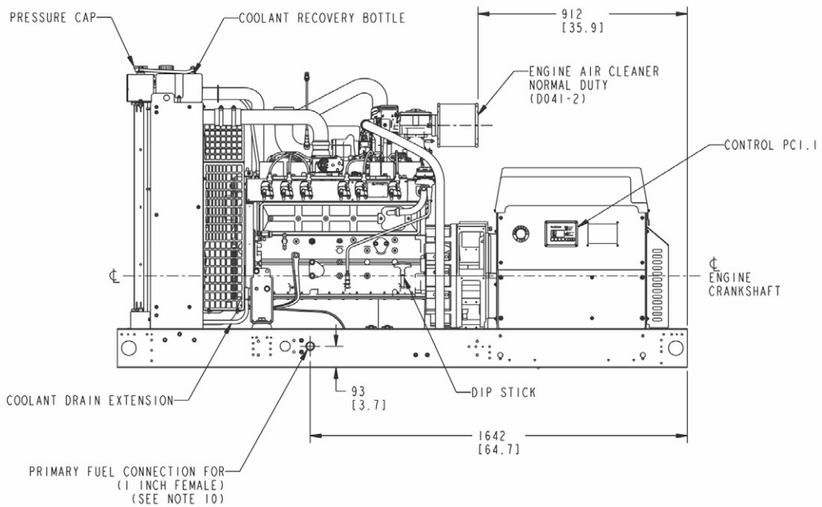
TABULATION

ALT DATA SHEET #	DIM A	DIM B	GENSET WET WEIGHT	
			KG	LB
ADS-203	1230	465	1025	2260
ADS-204	1262	463	1063	2344
ADS-205	1268	460	1101	2428
ADS-207	1332	457	1158	2553

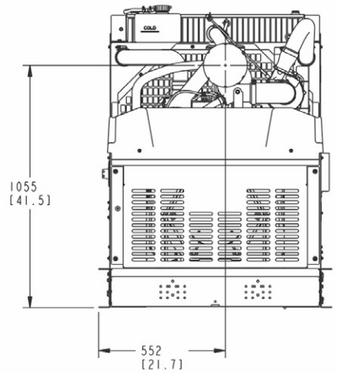
UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS
DIM: X ±1; .X ±0.8; .XX± 0.38
HOLE: 0.00- 4.99 +0.15/-0.08; 5.00- 9.99 +0.20/-0.10; 10.00-17.49 +0.25/-0.13; 17.50-24.99 +0.30/-0.13
ANG TOL: ± 1.0° SCALE: ~3/32
DO NOT SCALE PRINT
* CONFIDENTIAL * PROPERTY OF CUMMINS POWER GENERATION GROUP
FOR INTERPRETATION OF DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994
FIRST USED ON ARROW
DRN Y_KHABALE
CKD N_KASIBHOTLA
APVD E_NORDSTROM
DATE 05FEB15
SITE CODE PGF
CUMMINS POWER GENERATION
OUTLINE,GENSET
SIZE D A051E740 SHEET 1 OF 2 REV A

FIGURE 35. GENERATOR SET OUTLINE, 60 KW (SHEET 1 OF 2)

REL NO	LTR	NO	REVISION	DRN	CKD	APVD	DATE
ECO-152008	A	1	PRODUCTION_RELEASE	BJE	BJE	E.NORDSTROM	12MAR15



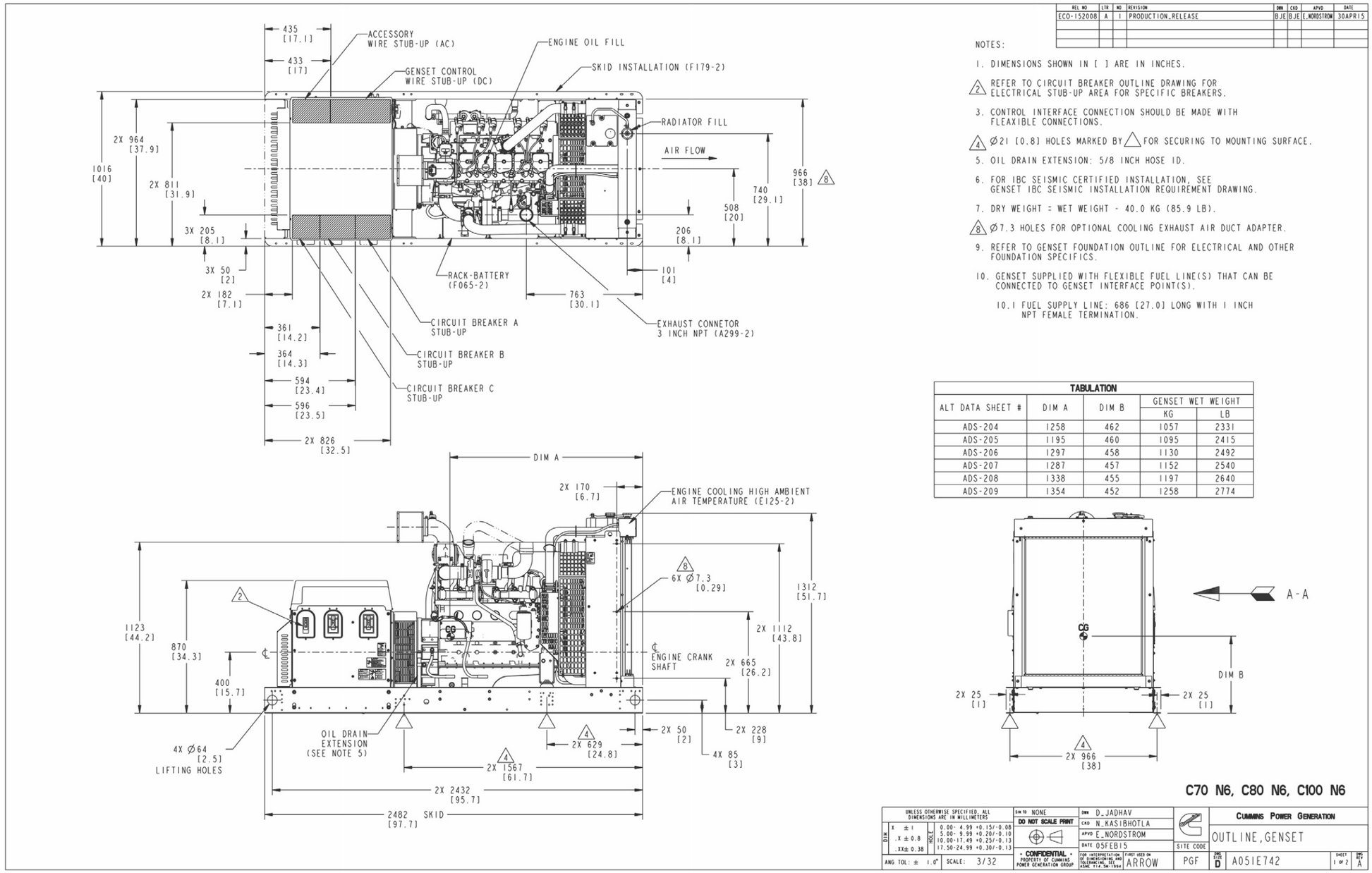
VIEW A-A



C60 N6

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS			Size	DO NOT SCALE PRINT	DRN Y_KHABALE		CUMMINS POWER GENERATION
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				CKD N_KASIBHOTLA		OUTLINE, GENSET
					APVD E_NORDSTROM	SITE CODE	
				- CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP	DATE 05FEB15		
ANG TOL: ± 1.0°	SCALE: ~3/32				FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ASME Y14.5M-1994	FIRST USED ON ARROW	PGF
						SIZE D	A051E740
						SHEET 2 OF 2	DWG REV A

FIGURE 36. GENERATOR SET OUTLINE, 60 KW (SHEET 2 OF 2)



REL NO	LTR	NO	REVISION	DRN	CKD	APVD	DATE
ECO-152008	A	1	PRODUCTION_RELEASE	BJE	BJE	E.NORDSTROM	30APR15

NOTES:

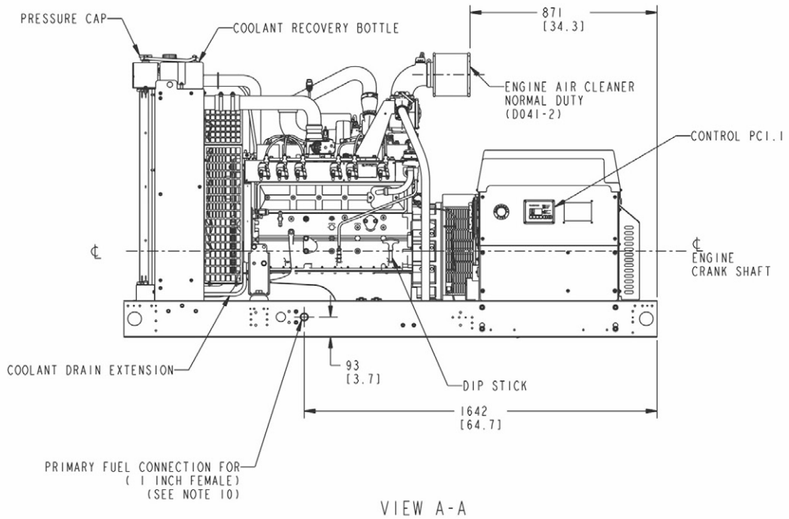
1. DIMENSIONS SHOWN IN [ ] ARE IN INCHES.
2. REFER TO CIRCUIT BREAKER OUTLINE DRAWING FOR ELECTRICAL STUB-UP AREA FOR SPECIFIC BREAKERS.
3. CONTROL INTERFACE CONNECTION SHOULD BE MADE WITH FLEAXIBLE CONNECTIONS.
4. Ø21 [0.8] HOLES MARKED BY △ FOR SECURING TO MOUNTING SURFACE.
5. OIL DRAIN EXTENSION: 5/8 INCH HOSE ID.
6. FOR IBC SEISMIC CERTIFIED INSTALLATION, SEE GENSET IBC SEISMIC INSTALLATION REQUIREMENT DRAWING.
7. DRY WEIGHT = WET WEIGHT - 40.0 KG (85.9 LB).
8. Ø7.3 HOLES FOR OPTIONAL COOLING EXHAUST AIR DUCT ADAPTER.
9. REFER TO GENSET FOUNDATION OUTLINE FOR ELECTRICAL AND OTHER FOUNDATION SPECIFICS.
10. GENSET SUPPLIED WITH FLEXIBLE FUEL LINE(S) THAT CAN BE CONNECTED TO GENSET INTERFACE POINT(S).
    10.1 FUEL SUPPLY LINE: 686 [27.0] LONG WITH 1 INCH NPT FEMALE TERMINATION.

TABULATION				
ALT DATA SHEET #	DIM A	DIM B	GENSET WET WEIGHT	
			KG	LB
ADS-204	1258	462	1057	2331
ADS-205	1195	460	1095	2415
ADS-206	1297	458	1130	2492
ADS-207	1287	457	1152	2540
ADS-208	1338	455	1197	2640
ADS-209	1354	452	1258	2774

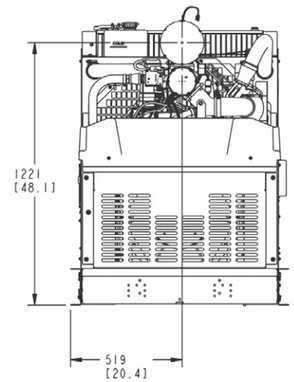
UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS
DIM X ±1; .X ±0.8; .XX± 0.38
ROLL 0.00- 4.99 +0.15/-0.08; 5.00- 9.99 +0.20/-0.10; 10.00-17.49 +0.25/-0.13; 17.50-24.99 +0.30/-0.13
ANG TOL: ± 1.0° SCALE: 3/32
DIM TO NONE
DO NOT SCALE PRINT
CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP
DWN D_JADHAV
CKD N_KASIBHOTLA
APVD E_NORDSTROM
DATE 05FEB15
FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
FIRST USED ON ARROW
SITE CODE PGF
CUMMINS POWER GENERATION
OUTLINE,GENSET
SIZE D
DRG NO A051E742
SHEET 1 OF 2
REV A

FIGURE 37. GENERATOR SET OUTLINE, 70-100 KW (SHEET 1 OF 2)

REL NO	LTR	NO	REVISION	DRN	CKD	APVD	DATE
ECO-152008	A	1	PRODUCTION_RELEASE	BJE	BJE	E_NORDSTROM	30APR15



VIEW A-A



C70 N6, C80 N6, C100 N6

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS			SIM TO NONE	DRN D_JADHAV		CUMMINS POWER GENERATION	
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		DO NOT SCALE PRINT	CKD N_KASIBHOTLA		OUTLINE,GENSET	
			- CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP	APVD E_NORDSTROM			
				DATE 05FEB15			
ANG TOL: ± 1.0°	SCALE: 3/32		FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ASME Y14.5M-1994	FIRST USED ON ARROW	SITE CODE PGF	DWG SIZE D A051E742	SHEET 2 of 2 DWG REV A

FIGURE 38. GENERATOR SET OUTLINE, 70-100 KW (SHEET 2 OF 2)

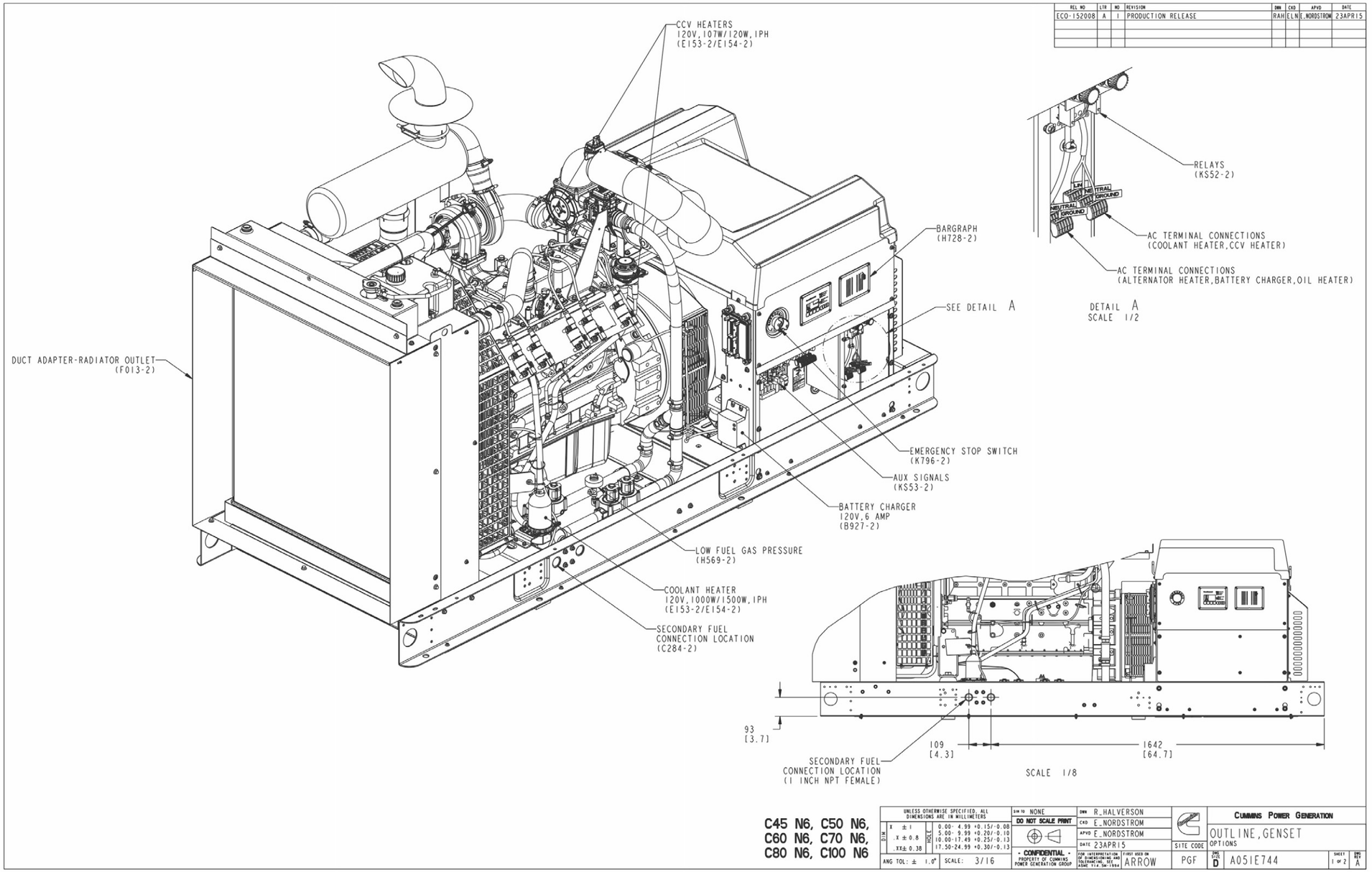


FIGURE 39. GENERATOR SET OUTLINE, ACCESSORIES (SHEET 1 OF 2)

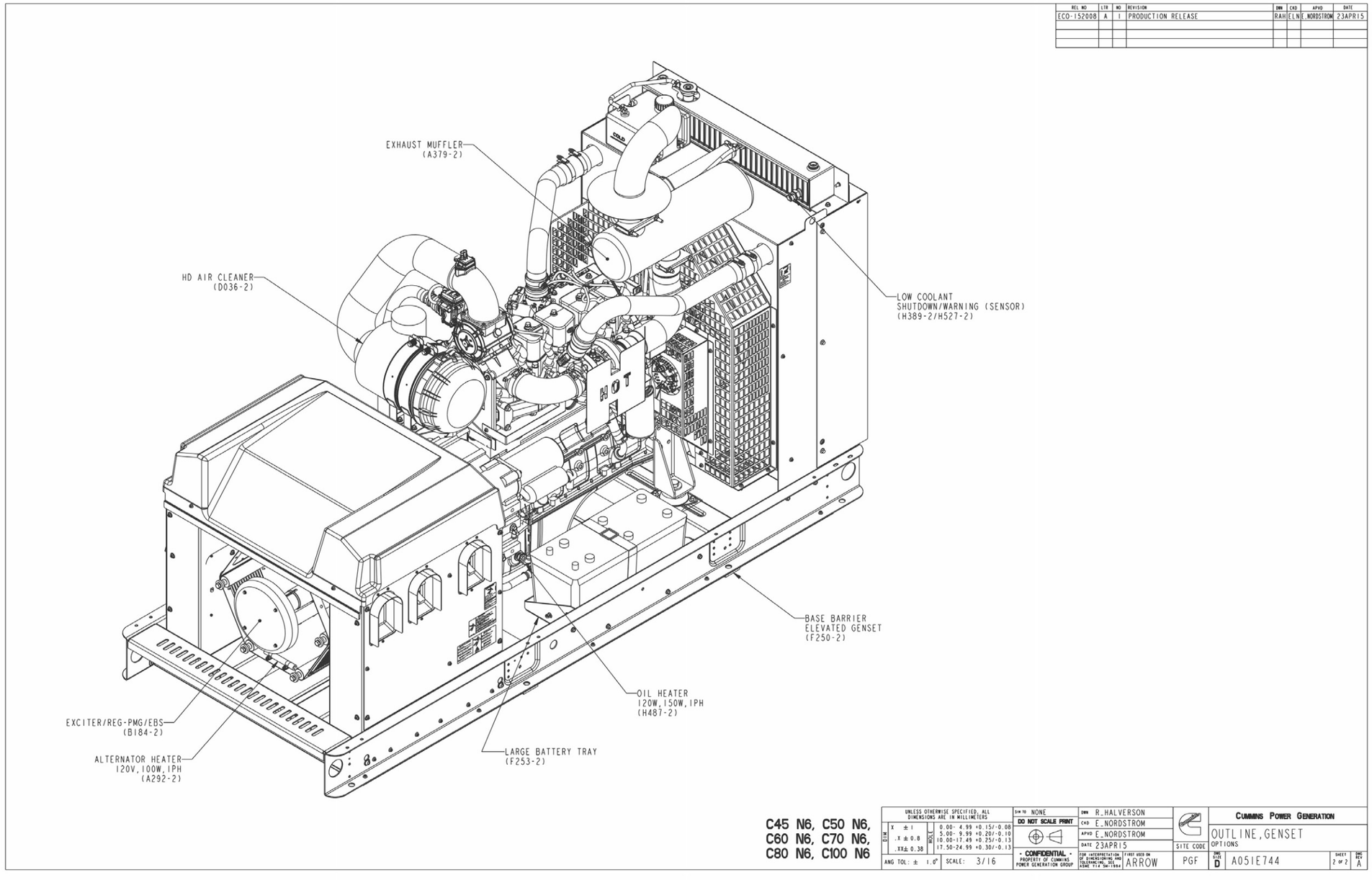


FIGURE 40. GENERATOR SET OUTLINE, ACCESSORIES (SHEET 2 OF 2)

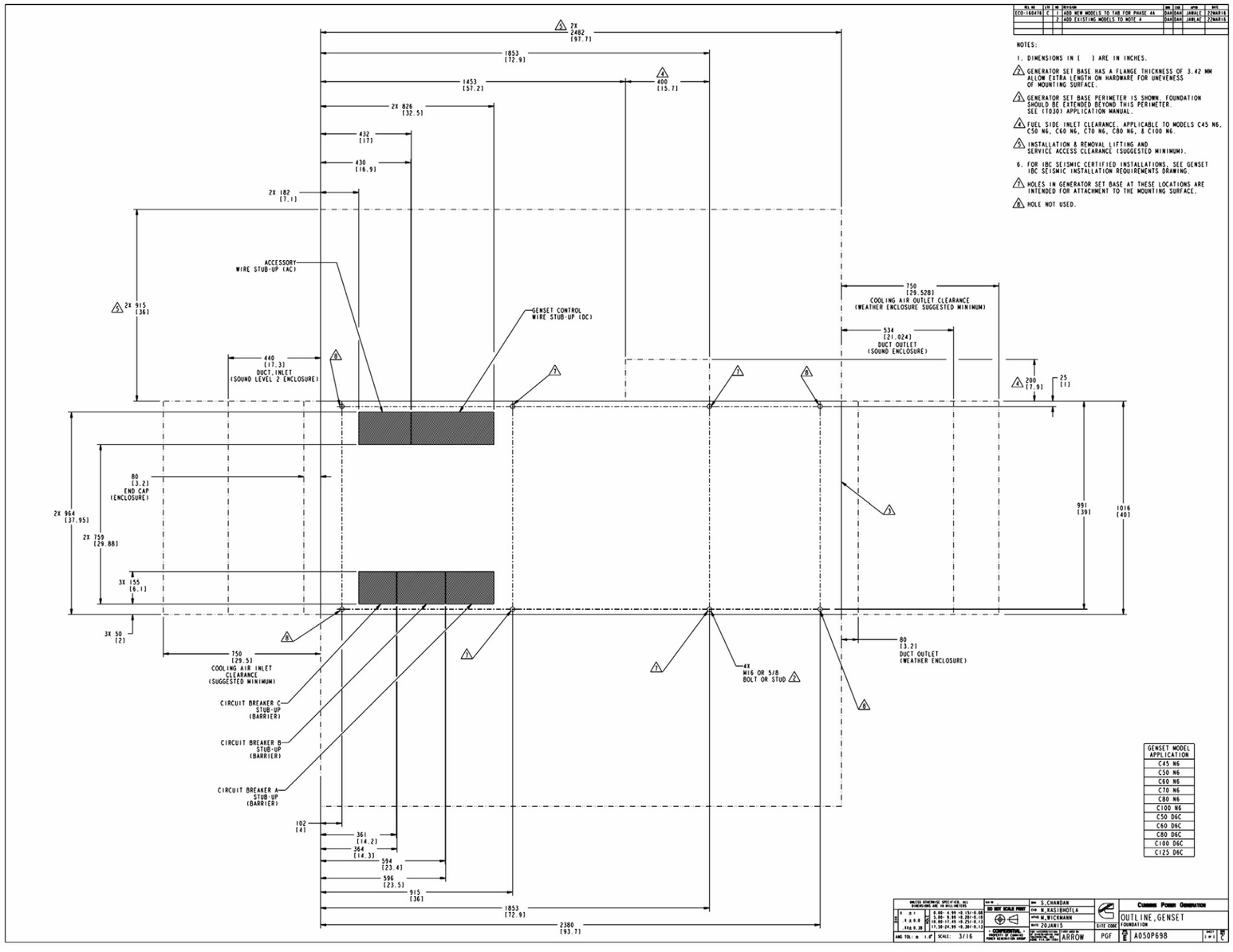


FIGURE 41. FOUNDATION OUTLINE (SHEET 1 OF 1)

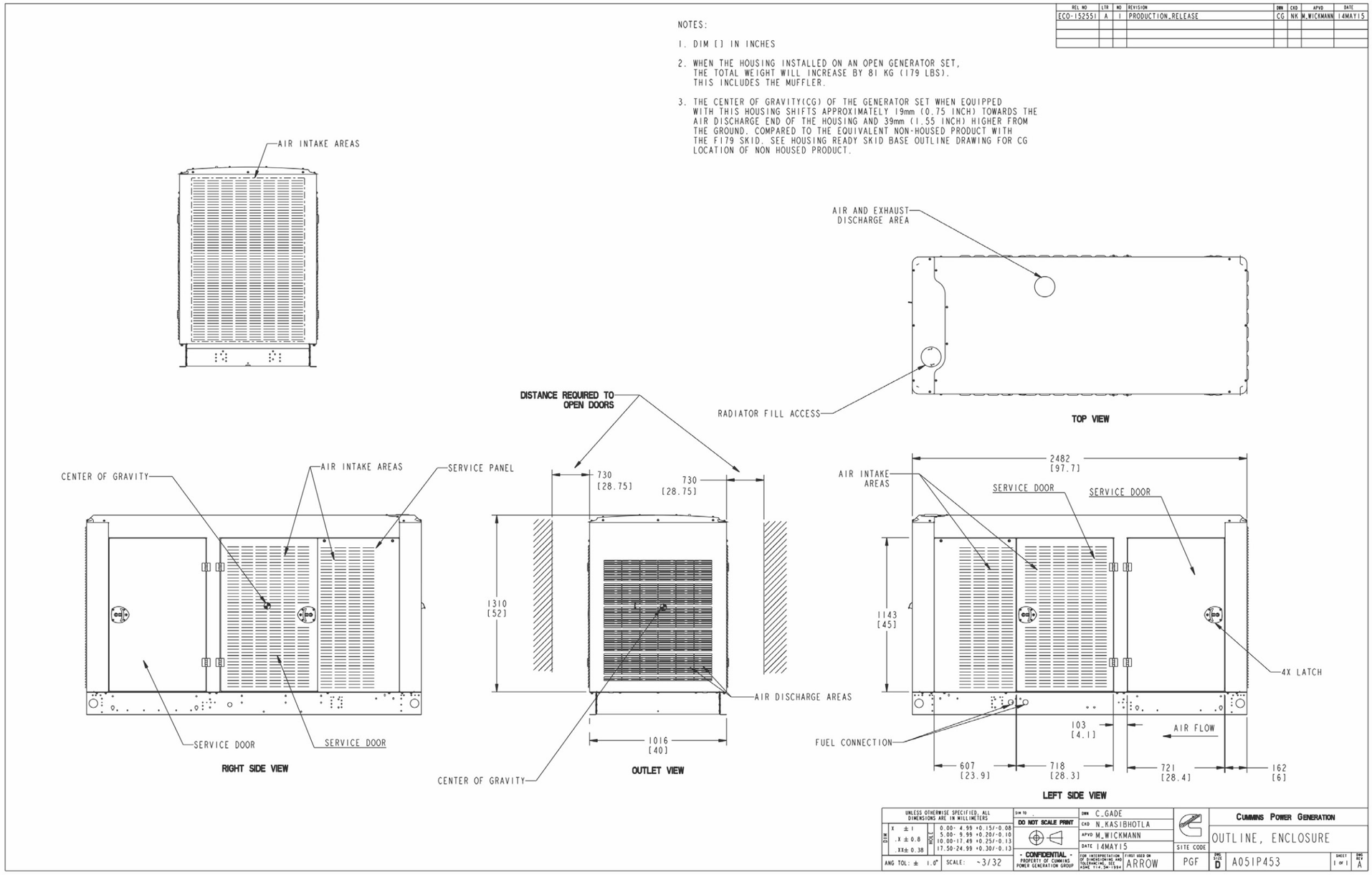
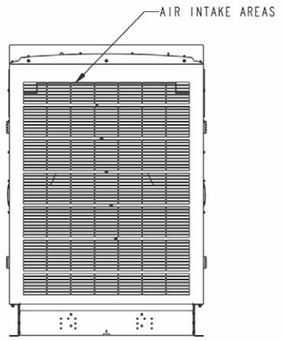


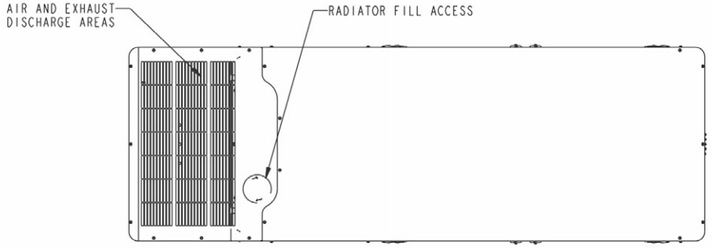
FIGURE 42. ENCLOSURE OUTLINE, WEATHER (SHEET 1 OF 1)

REL NO	LTR	NO	REVISION	DRN	CKD	APVD	DATE
ECO-152551	A	1	PRODUCTION_RELEASE	CG	NK	M_WICKMANN	14MAY15

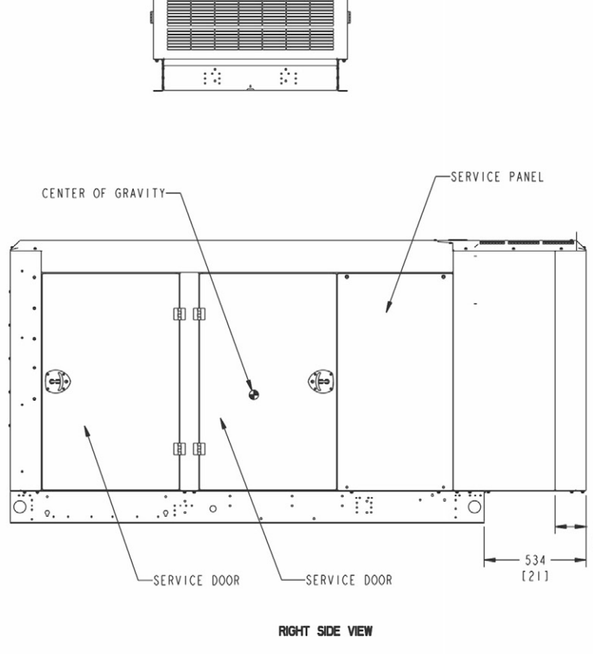
NOTES:

1. DIM [] IN INCHES
2. WHEN THE HOUSING INSTALLED ON AN OPEN GENERATOR SET, THE TOTAL WEIGHT WILL INCREASE BY 131.5 KG (290 LBS). THIS INCLUDES THE MUFFLER.
3. THE CENTER OF GRAVITY(CG) OF THE GENERATOR SET WHEN EQUIPPED WITH THIS HOUSING SHIFTS APPROXIMATELY 65mm (2.55 inch) TOWARDS THE AIR DISCHARGE END OF THE HOUSING AND 42MM (1.66 INCH) HIGHER FROM THE GROUND. COMPARED TO THE EQUIVALENT NON-HOUSED PRODUCT WITH THE F179 SKID. SEE HOUSING READY SKID BASE OUTLINE DRAWING FOR CG LOCATION OF NON HOUSED PRODUCT.

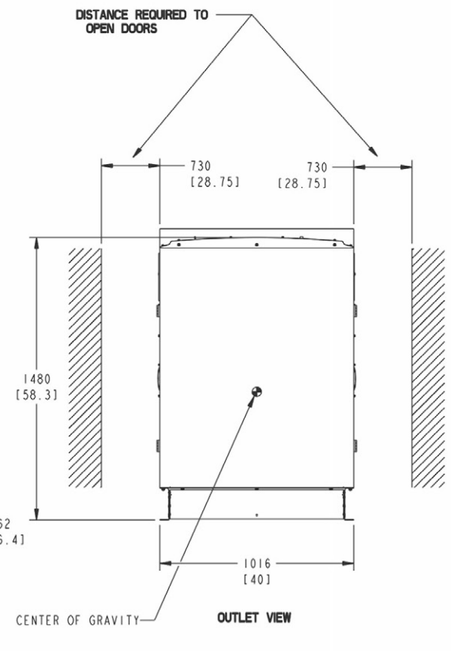




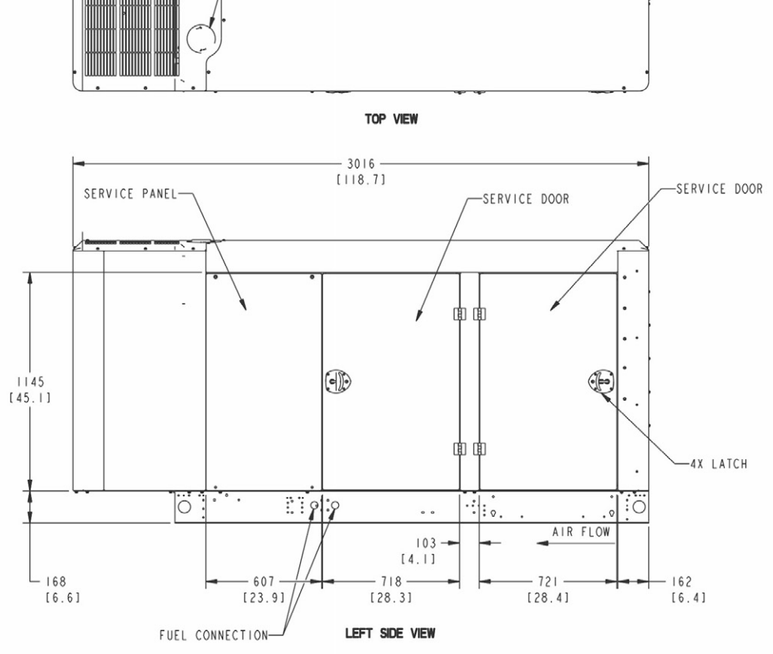
TOP VIEW



RIGHT SIDE VIEW



OUTLET VIEW



LEFT SIDE VIEW

F231-2 ENCLOSURE CONFIGURATION

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS	FINISH: NONE	DRN: C_GADE		CUMMINS POWER GENERATION
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	DO NOT SCALE PRINT	CKD: N_KASIBHOTLA		OUTLINE, ENCLOSURE
ANG TOL: ± 1.0°	SCALE: ~3/32	APVD: M_WICKMANN	SITE CODE: PGF	SIZE: D; DWG NO: A051P365; SHEET: 1 OF 2; RPO REV: A
	· CONFIDENTIAL · PROPERTY OF CUMMINS POWER GENERATION GROUP	DATE: 14MAY15		
	FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ASME Y14.5M-1994	FIRST USED ON: ARROW		

FIGURE 43. ENCLOSURE OUTLINE, SOUND ATTENTION LEVEL 1 AND LEVEL 2 (SHEET 1 OF 2)

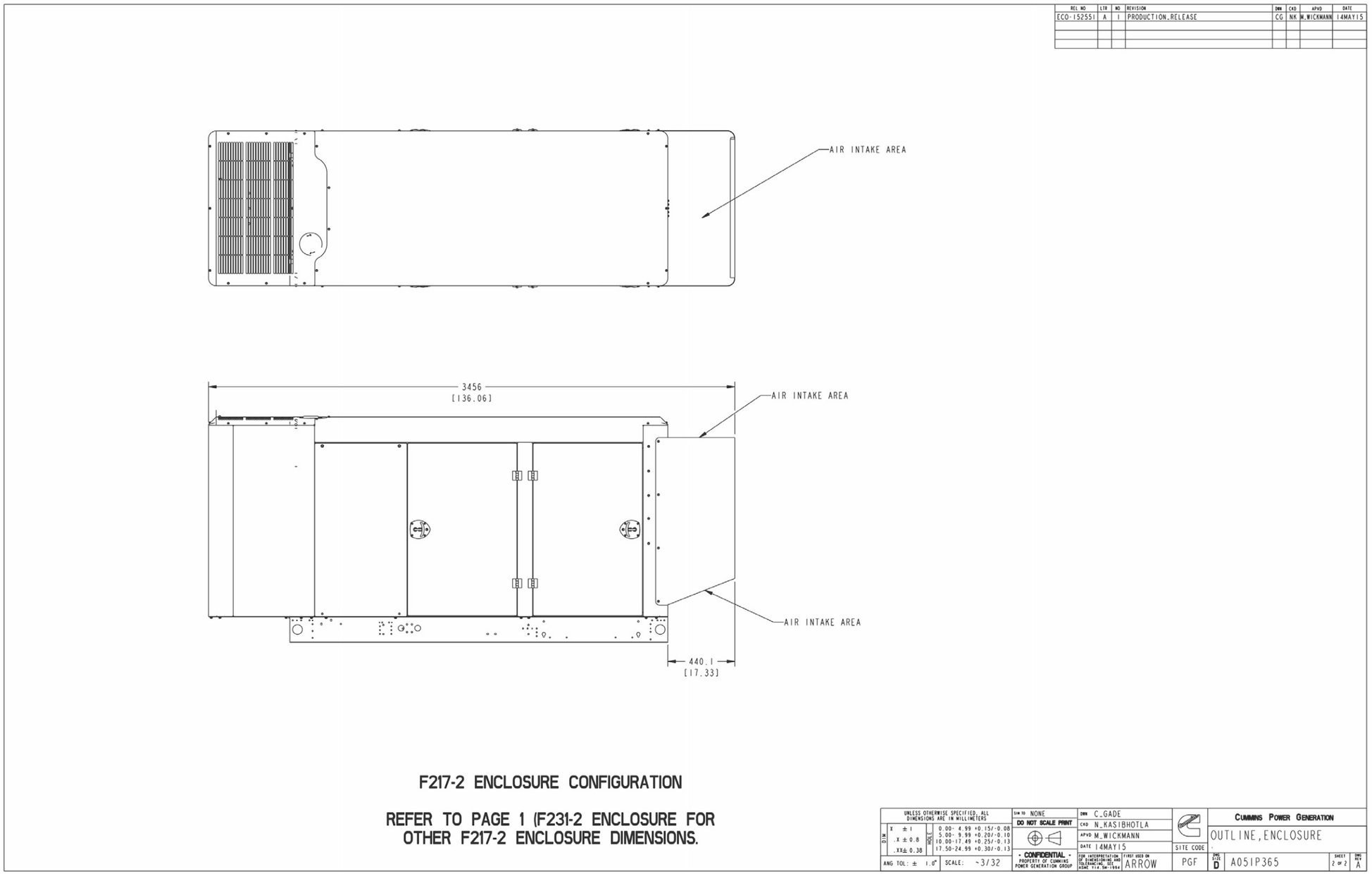


FIGURE 44. ENCLOSURE OUTLINE, SOUND ATTENTION LEVEL 1 AND LEVEL 2 (SHEET 2 OF 2)

Appendix C. Wiring Diagrams

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.

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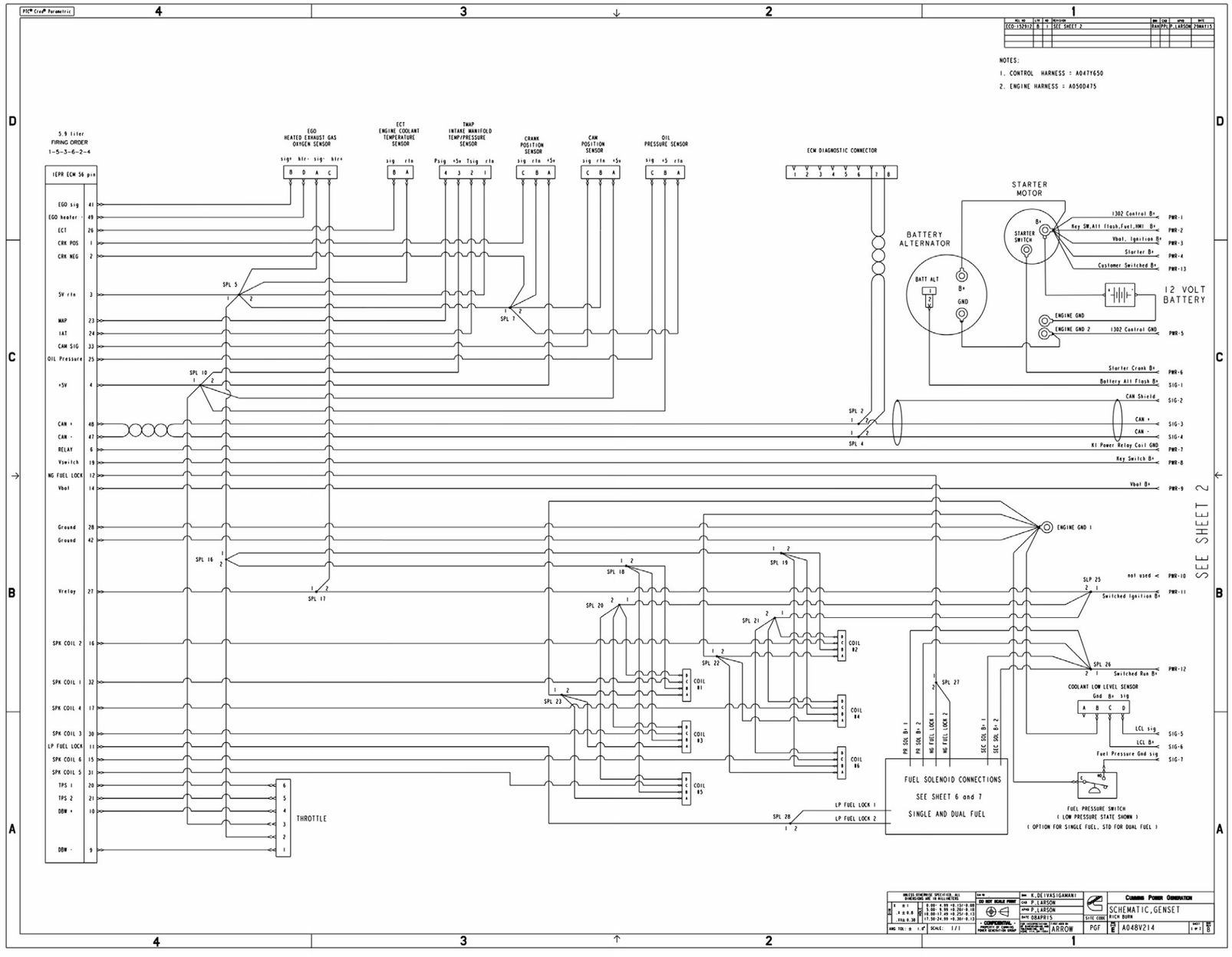


FIGURE 45. WIRING DIAGRAM FOR PCC 1302 (56 PIN ECM) (SHEET 1 OF 7)

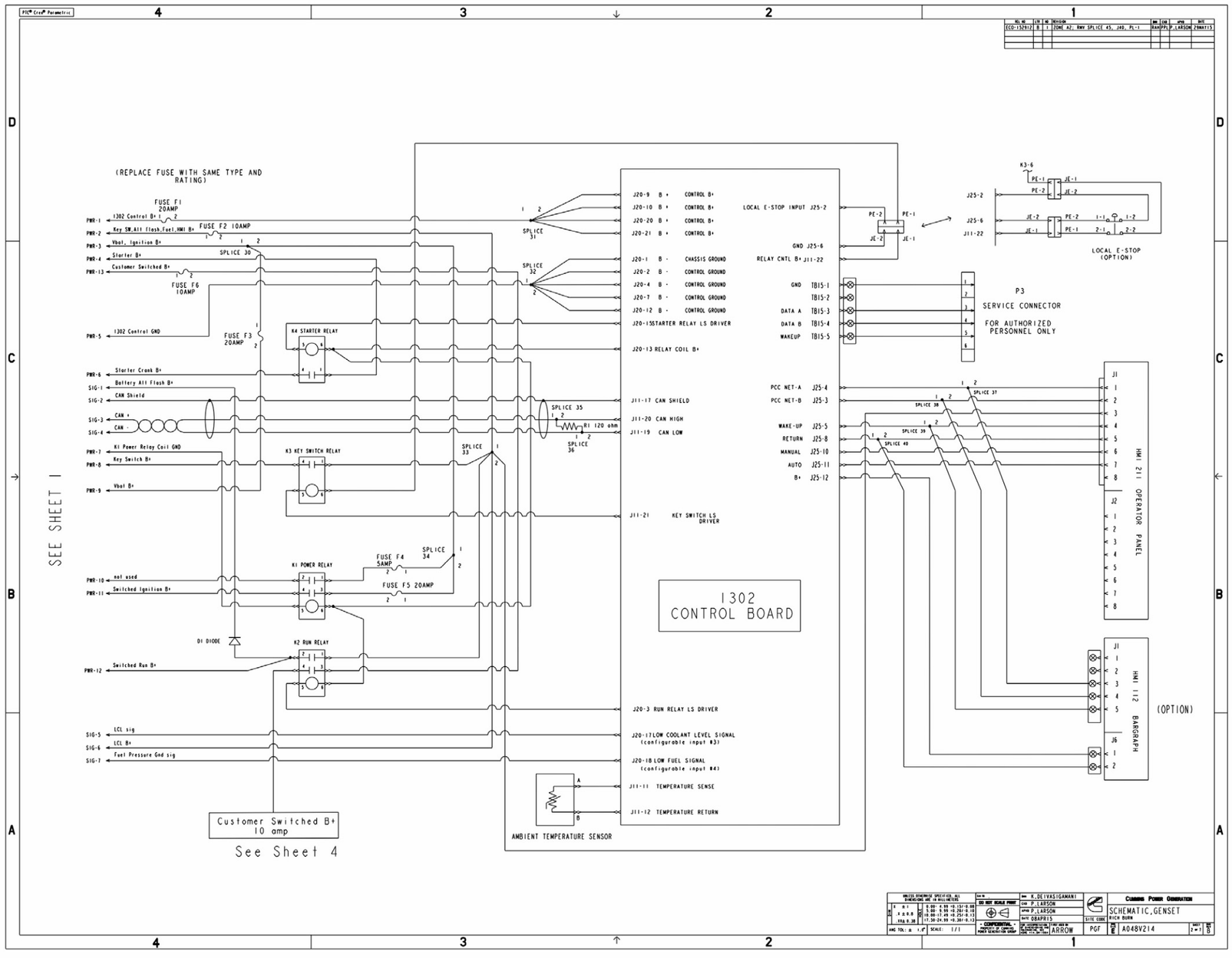


FIGURE 46. WIRING DIAGRAM FOR PCC 1302 (56 PIN ECM) (SHEET 2 OF 7)

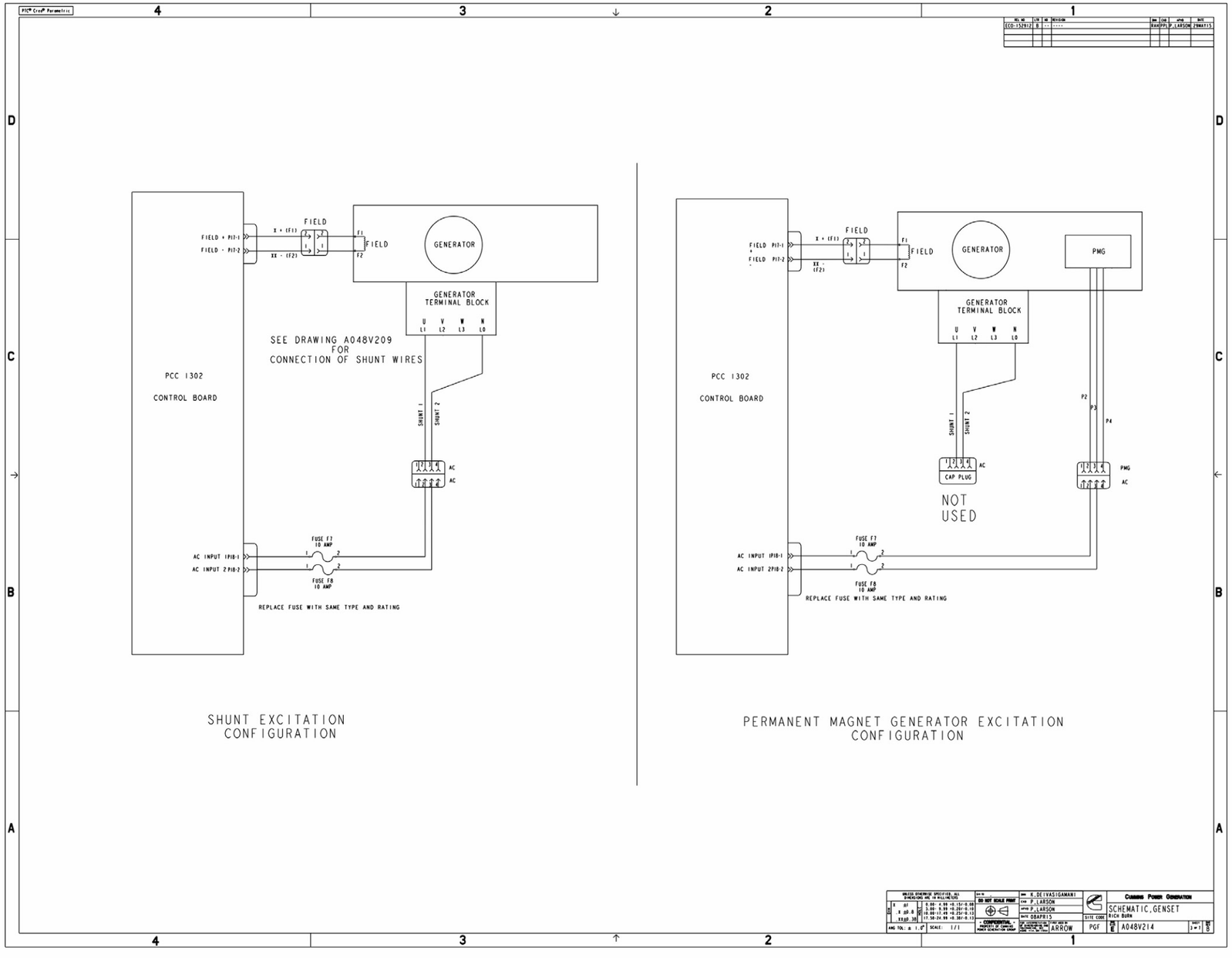
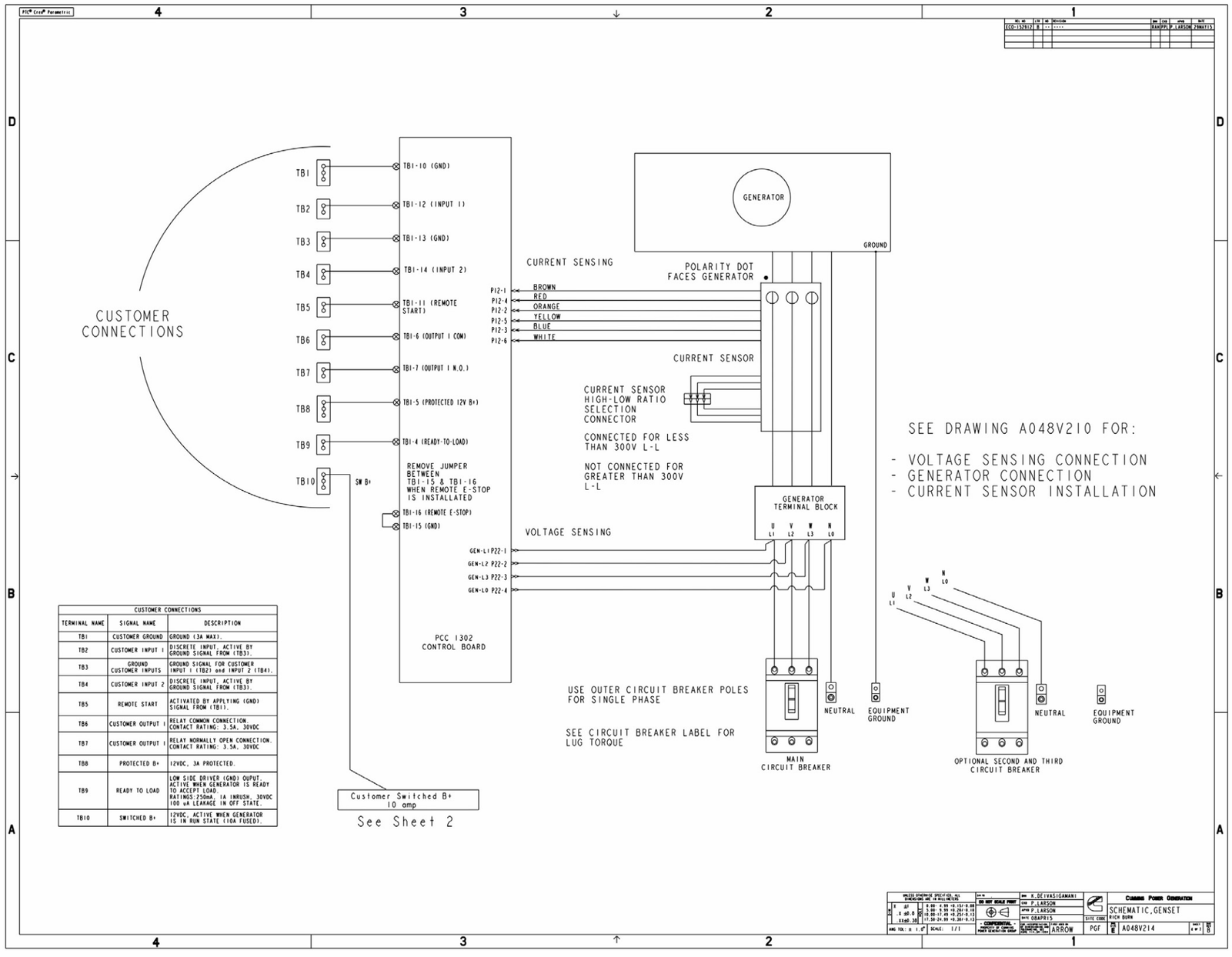


FIGURE 47. WIRING DIAGRAM FOR PCC 1302 (56 PIN ECM) (SHEET 3 OF 7)



CUSTOMER CONNECTIONS		
TERMINAL NAME	SIGNAL NAME	DESCRIPTION
TB1	CUSTOMER GROUND	GROUND (3A MAX).
TB2	CUSTOMER INPUT 1	DISCRETE INPUT, ACTIVE BY GROUND SIGNAL FROM (TB3).
TB3	GROUND CUSTOMER INPUTS	GROUND SIGNAL FOR CUSTOMER INPUT 1 (TB2) and INPUT 2 (TB4).
TB4	CUSTOMER INPUT 2	DISCRETE INPUT, ACTIVE BY GROUND SIGNAL FROM (TB3).
TB5	REMOTE START	ACTIVATED BY APPLYING (GND) SIGNAL FROM (TB1).
TB6	CUSTOMER OUTPUT 1	RELAY COMMON CONNECTION. CONTACT RATING: 3.5A, 30VDC
TB7	CUSTOMER OUTPUT 1	RELAY NORMALLY OPEN CONNECTION. CONTACT RATING: 3.5A, 30VDC
TB8	PROTECTED B+	12VDC, 3A PROTECTED.
TB9	READY TO LOAD	LOW SIDE DRIVER (GND) OUPUT. ACTIVE WHEN GENERATOR IS READY TO ACCEPT LOAD. RATINGS:250mA, 1A INRUSH, 30VDC 100 uA LEAKAGE IN OFF STATE.
TB10	SWITCHED B+	12VDC, ACTIVE WHEN GENERATOR IS IN RUN STATE (10A FUSED).

FIGURE 48. WIRING DIAGRAM FOR PCC 1302 (56 PIN ECM) (SHEET 4 OF 7)

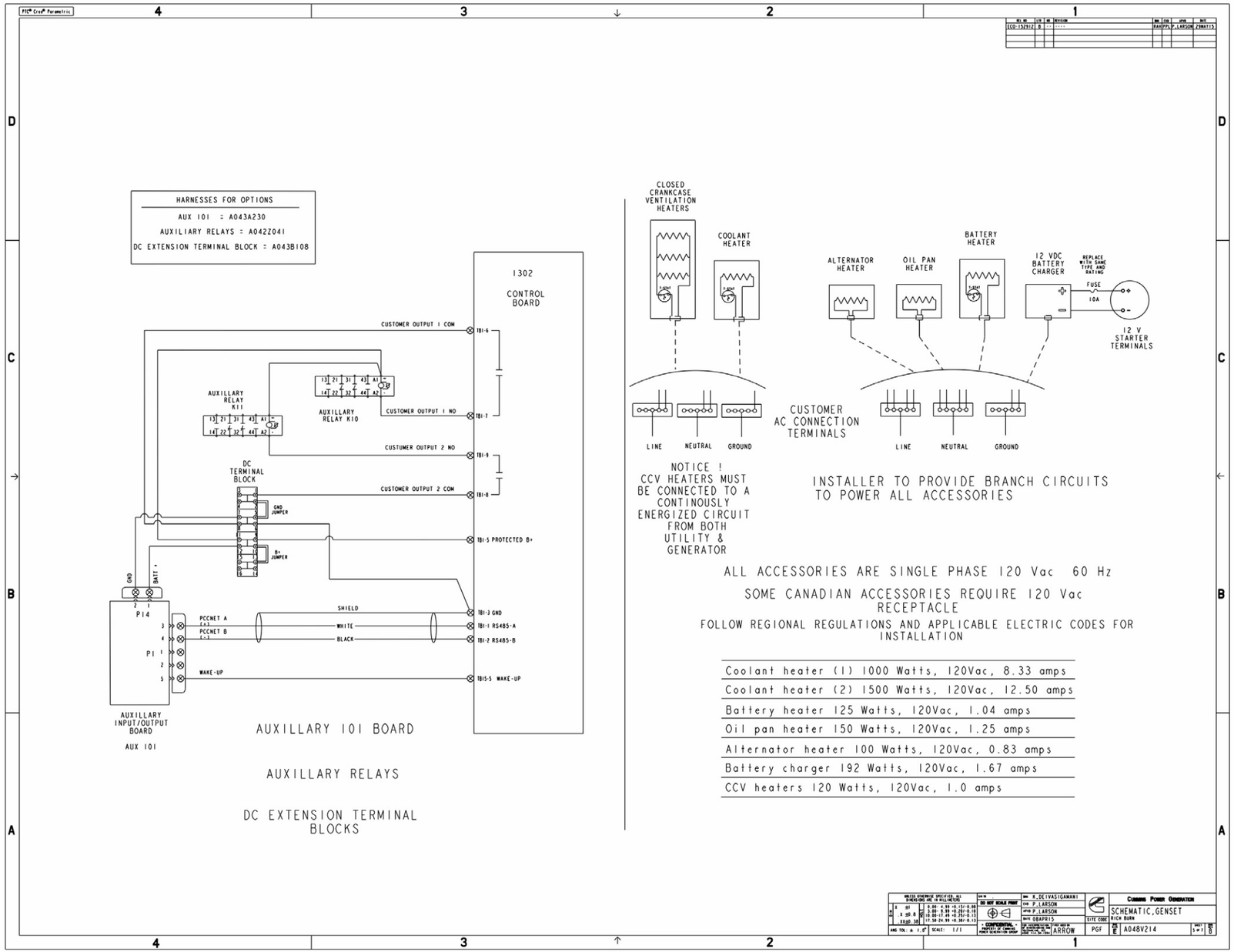


FIGURE 49. WIRING DIAGRAM FOR PCC 1302 (56 PIN ECM) (SHEET 5 OF 7)

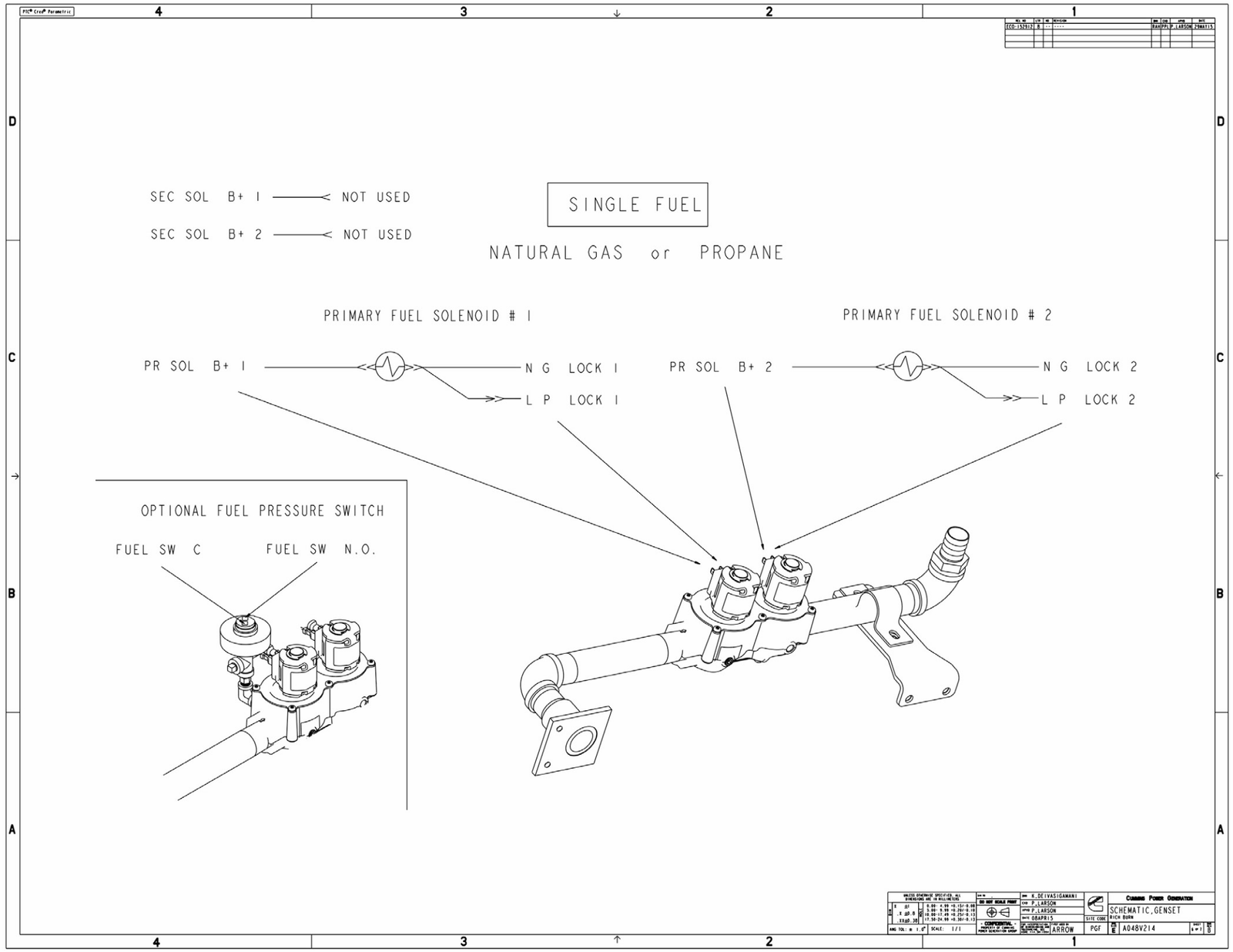


FIGURE 50. WIRING DIAGRAM FOR PCC 1302 (56 PIN ECM) (SHEET 6 OF 7)

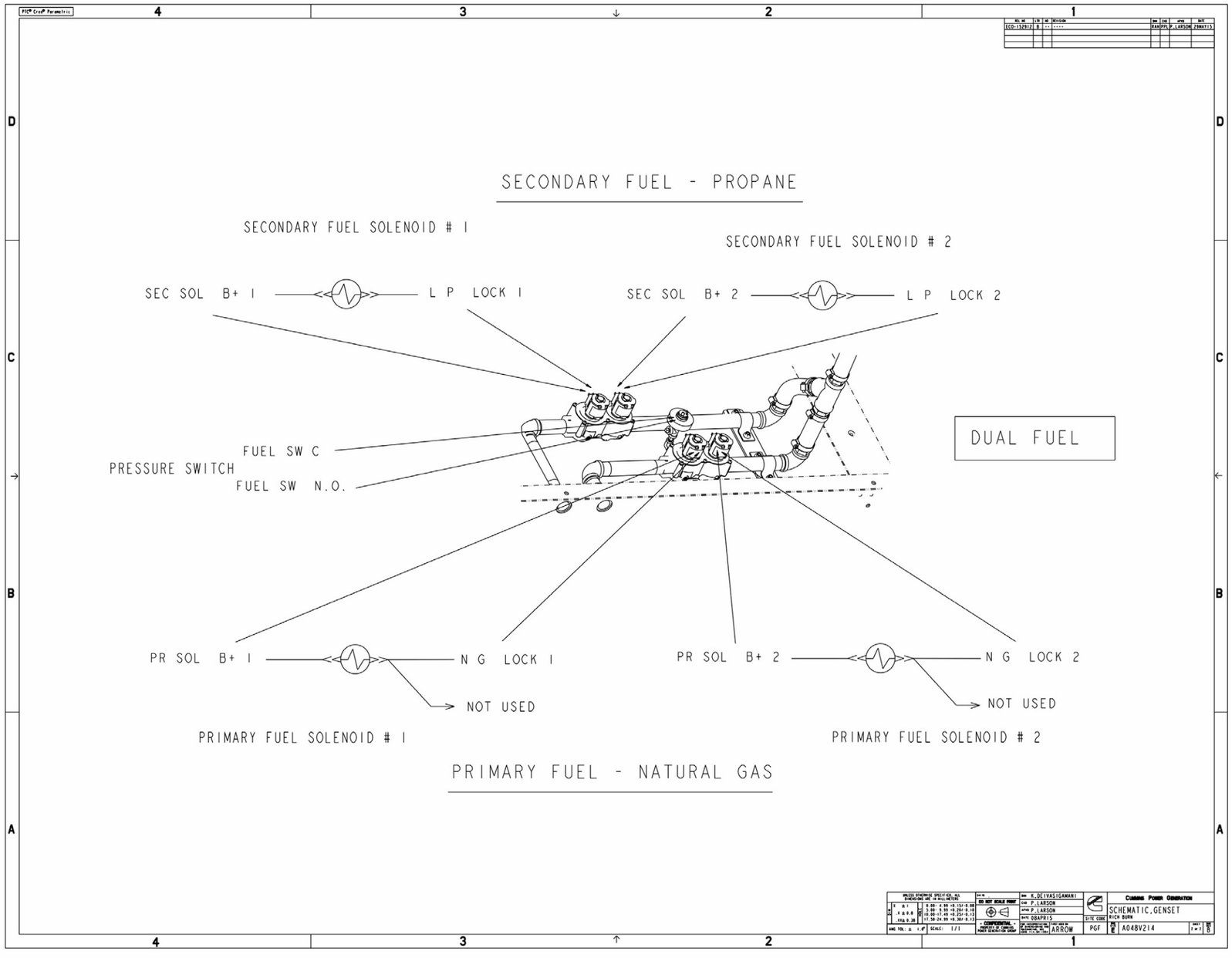


FIGURE 51. WIRING DIAGRAM FOR PCC 1302 (56 PIN ECM) (SHEET 7 OF 7)

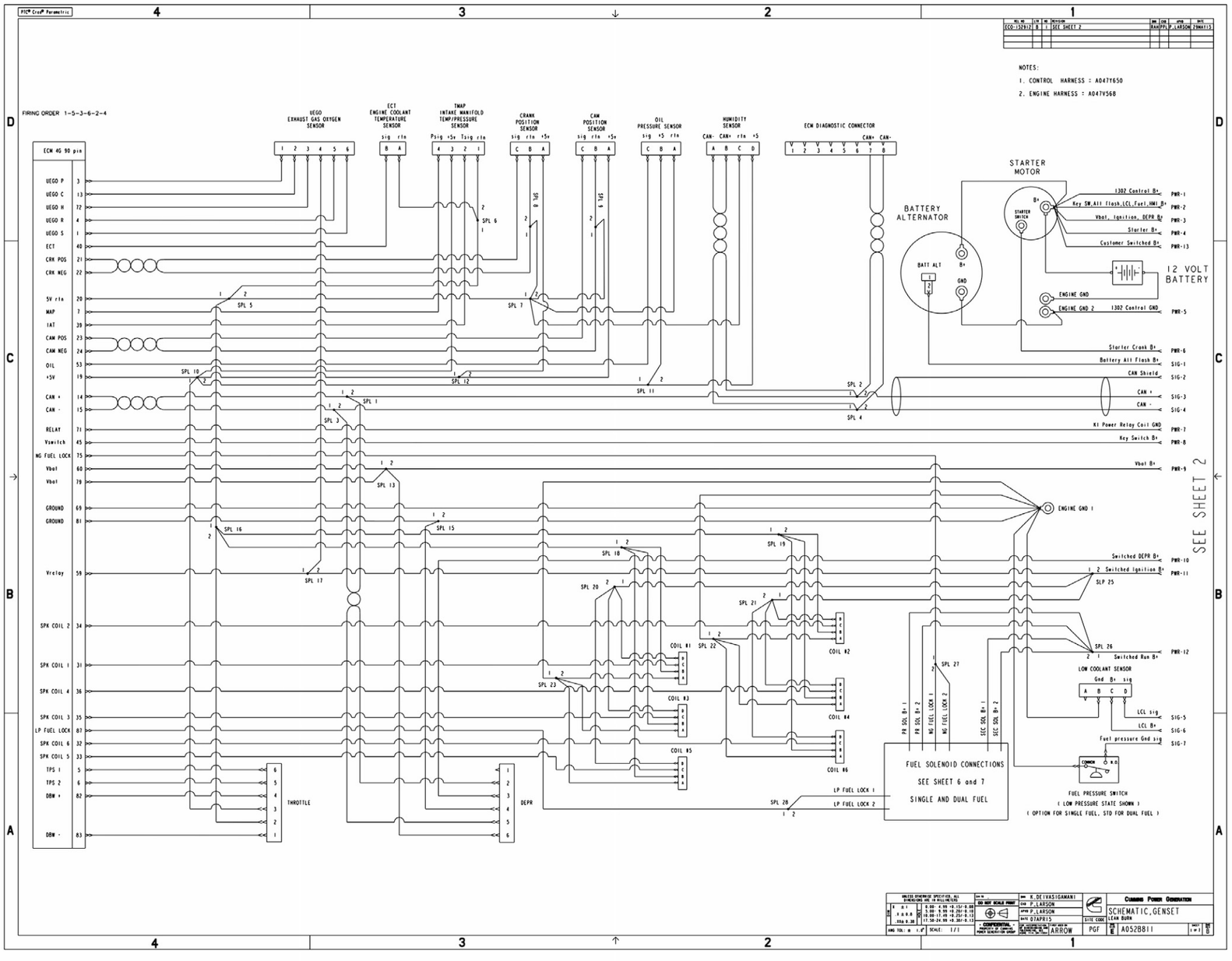


FIGURE 52. WIRING DIAGRAM FOR PCC 1302 (90 PIN ECM) (SHEET 1 OF 7)

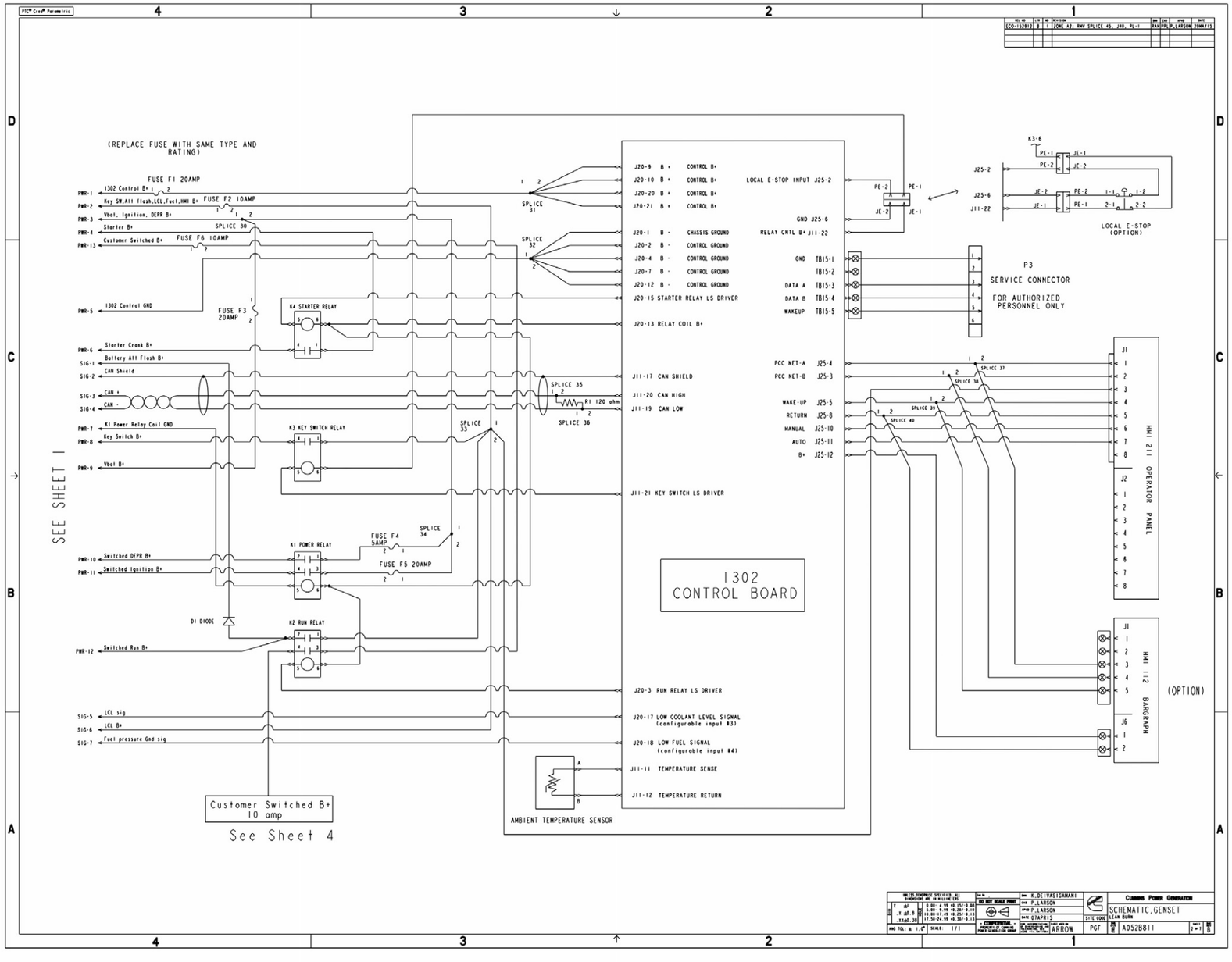


FIGURE 53. WIRING DIAGRAM FOR PCC 1302 (90 PIN ECM) (SHEET 2 OF 7)

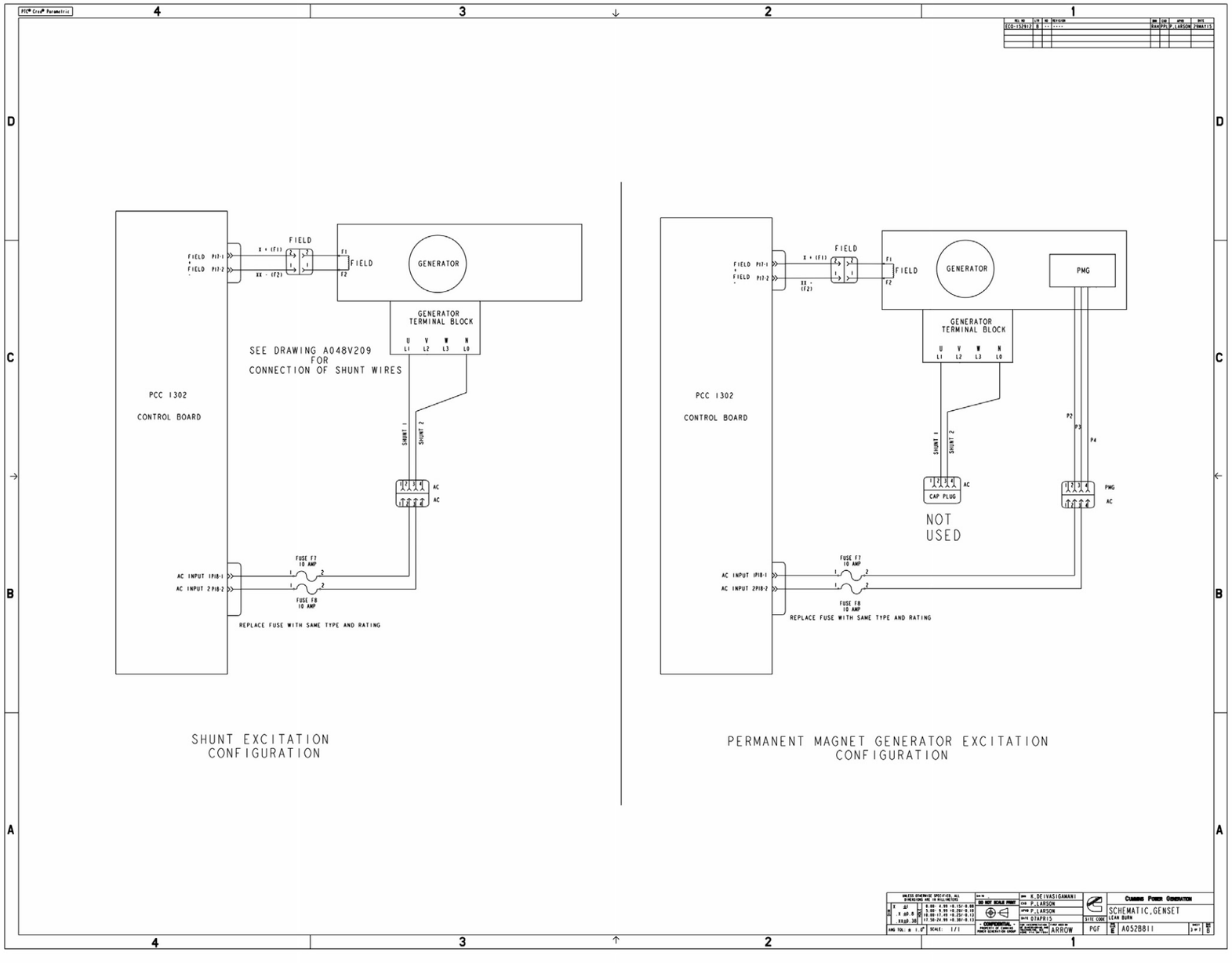


FIGURE 54. WIRING DIAGRAM FOR PCC 1302 (90 PIN ECM) (SHEET 3 OF 7)

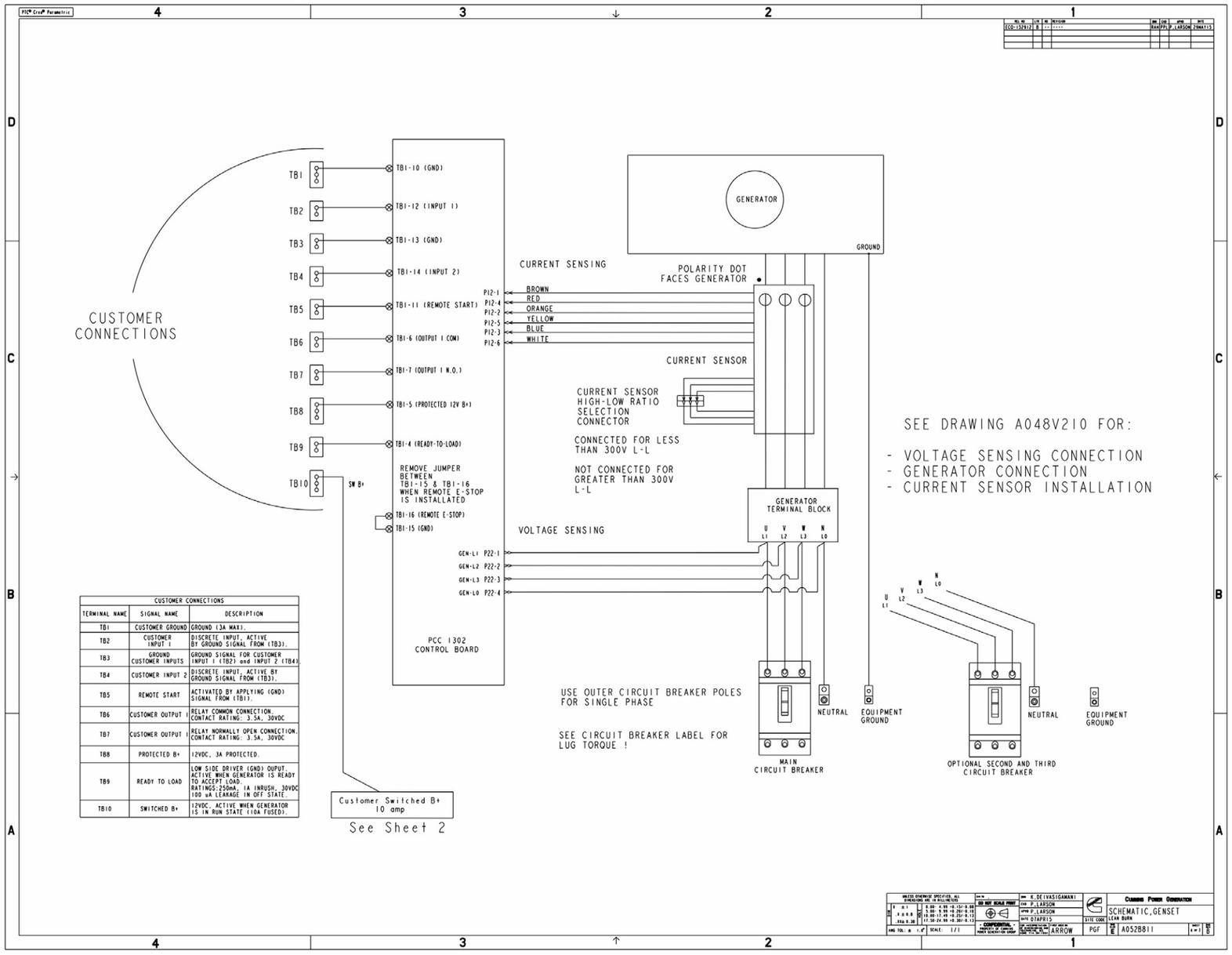


FIGURE 55. WIRING DIAGRAM FOR PCC 1302 (90 PIN ECM) (SHEET 4 OF 7)

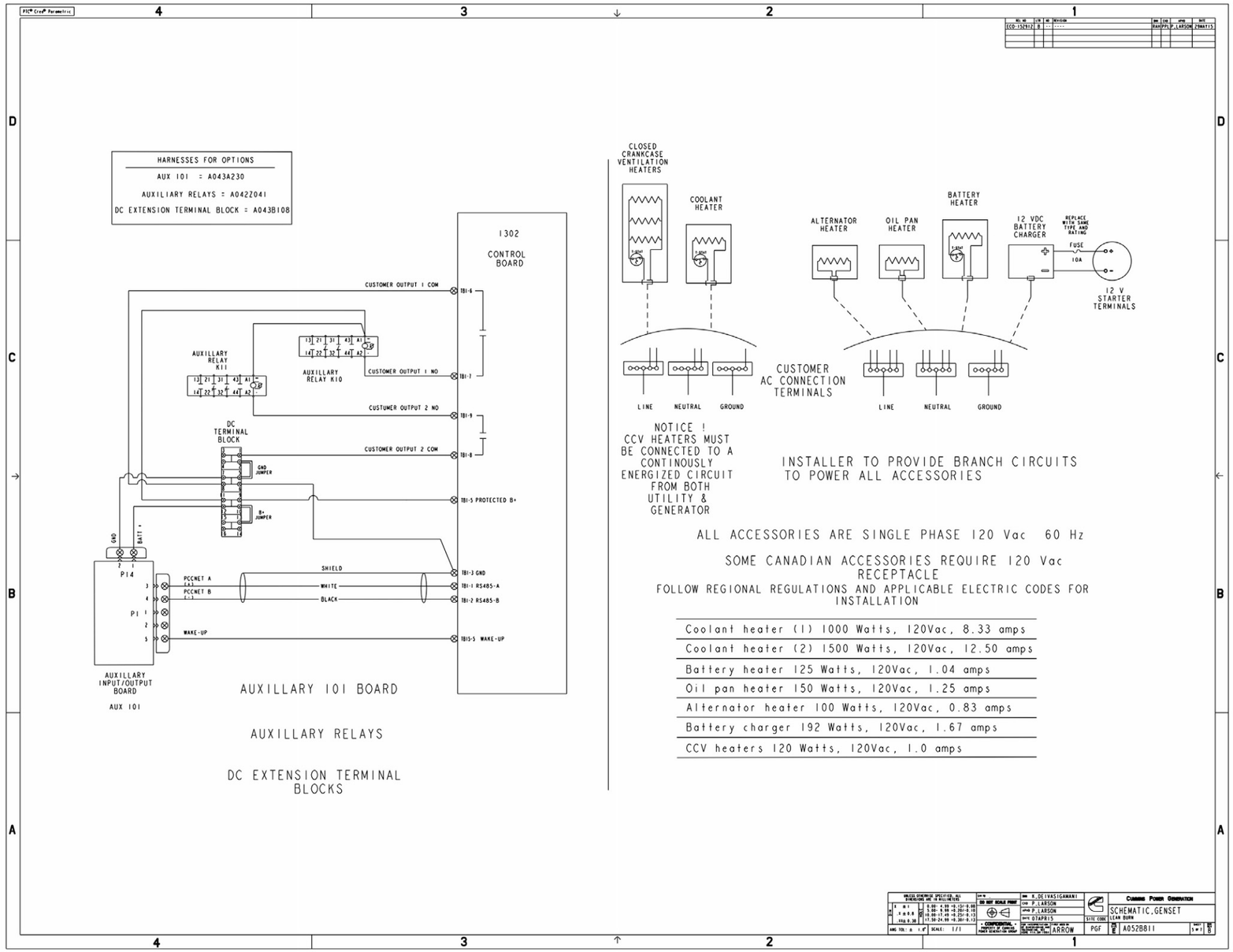


FIGURE 56. WIRING DIAGRAM FOR PCC 1302 (90 PIN ECM) (SHEET 5 OF 7)

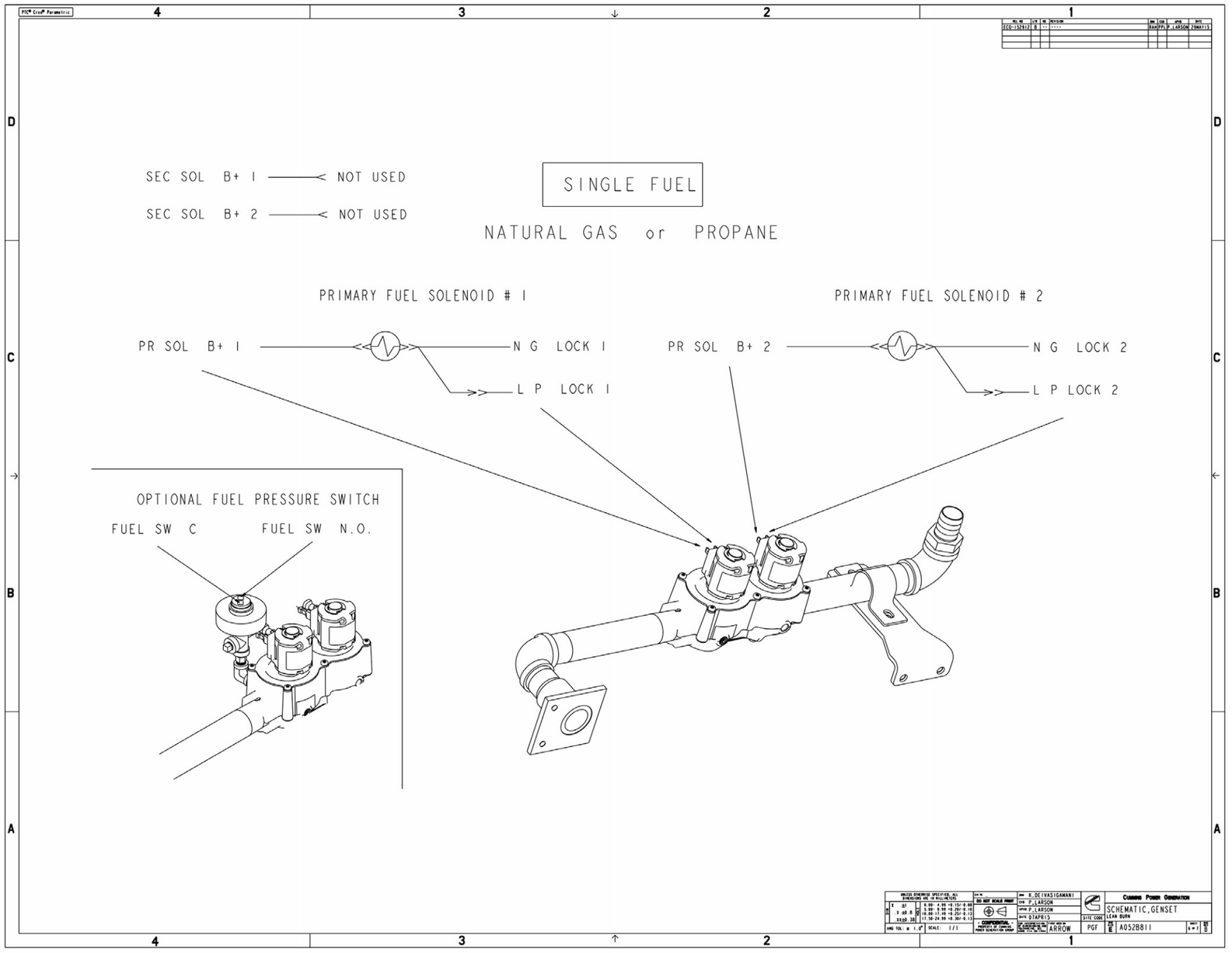


FIGURE 57. WIRING DIAGRAM FOR PCC 1302 (90 PIN ECM) (SHEET 6 OF 7)

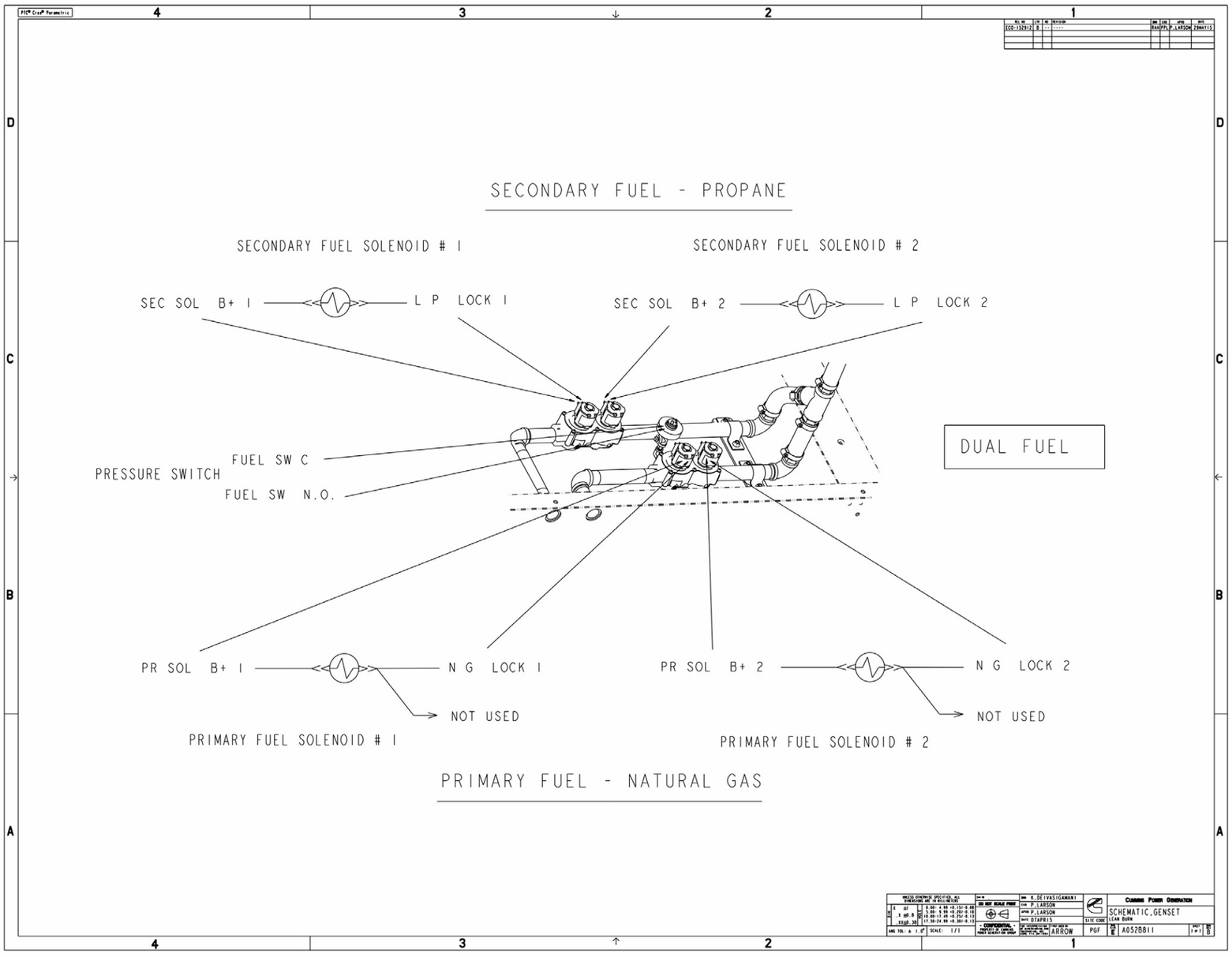


FIGURE 58. WIRING DIAGRAM FOR PCC 1302 (90 PIN ECM) (SHEET 7 OF 7)

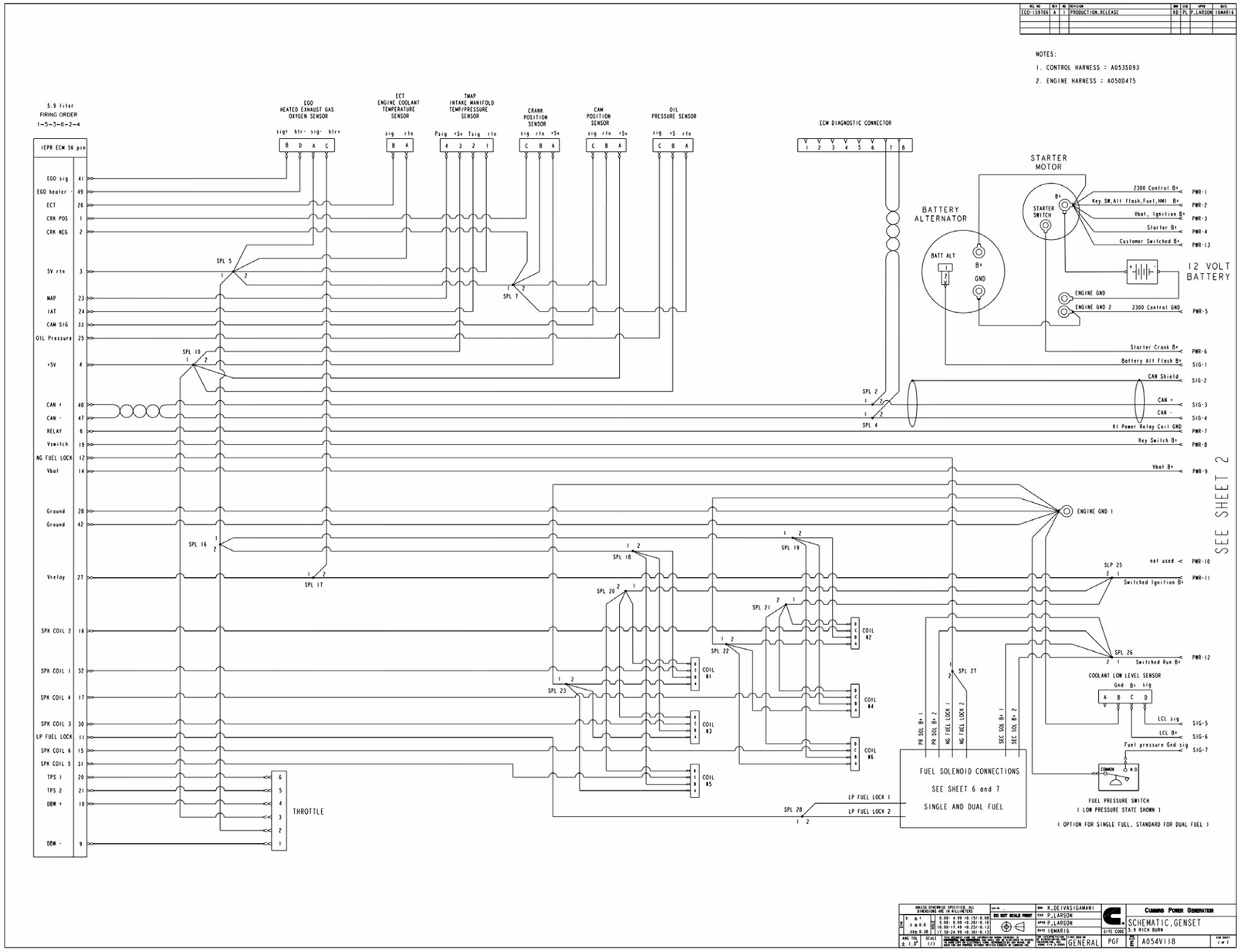


FIGURE 59. WIRING DIAGRAM FOR PCC 2300 (56 PIN ECM) (SHEET 1 OF 7)

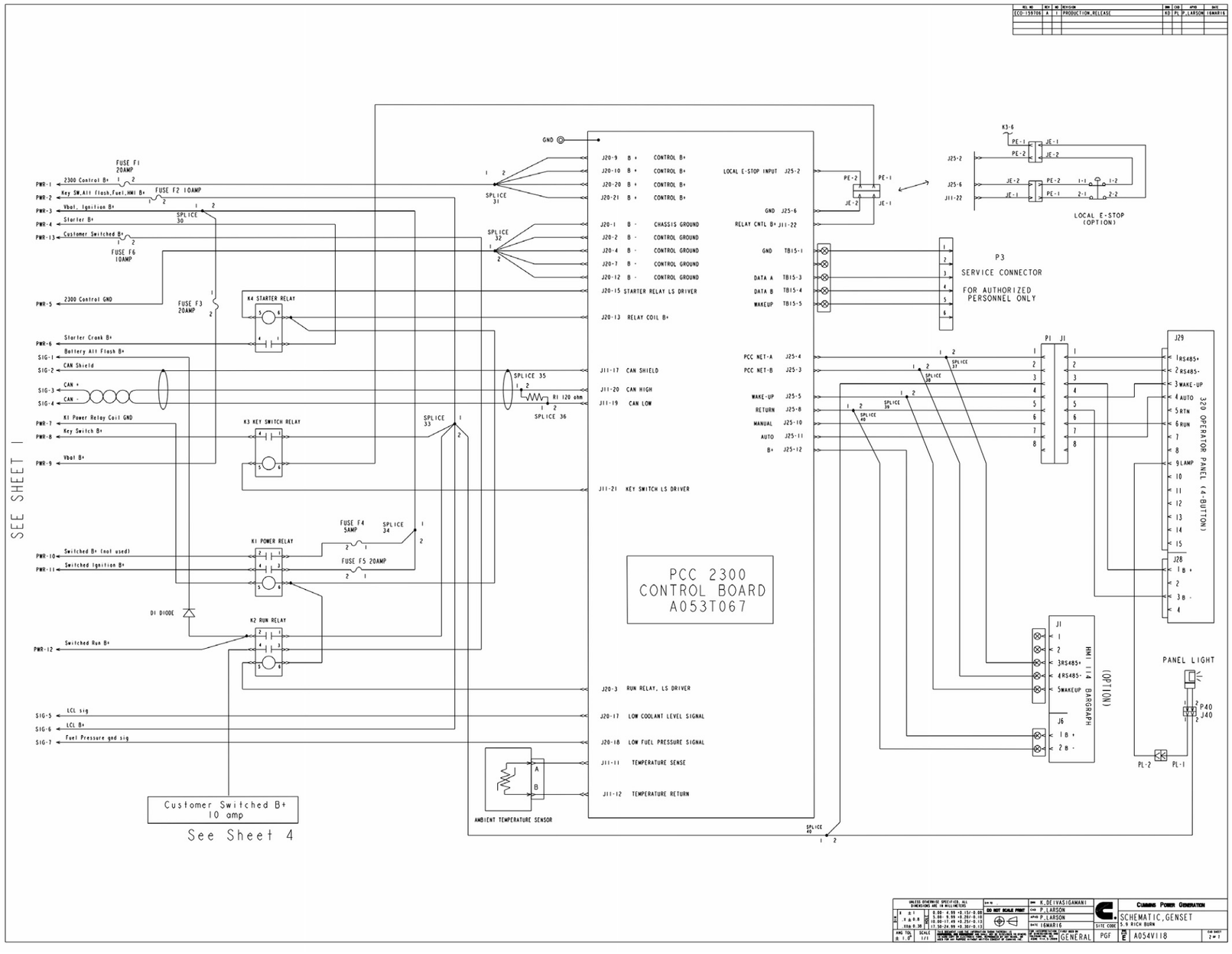


FIGURE 60. WIRING DIAGRAM FOR PCC 2300 (56 PIN ECM) (SHEET 2 OF 7)

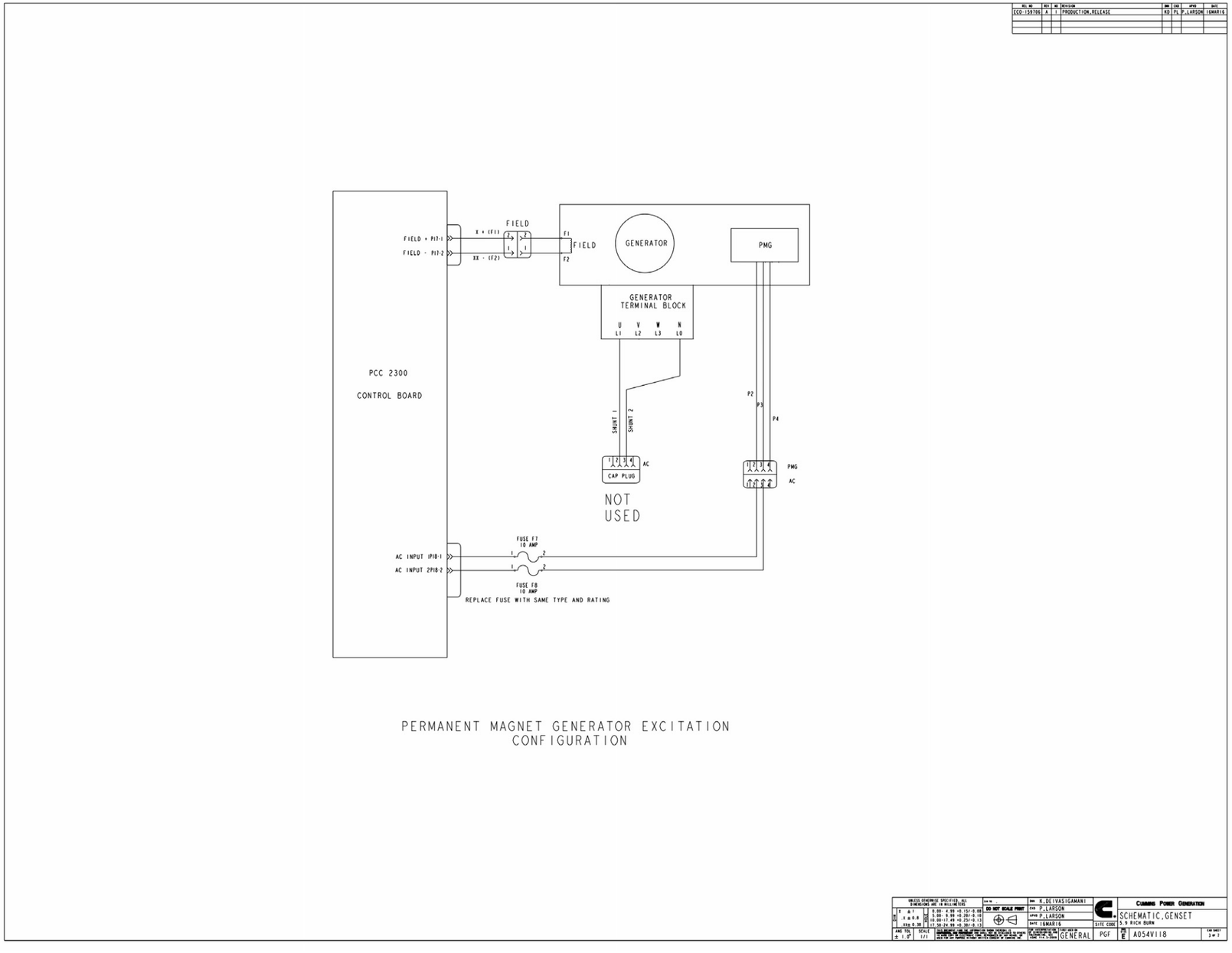
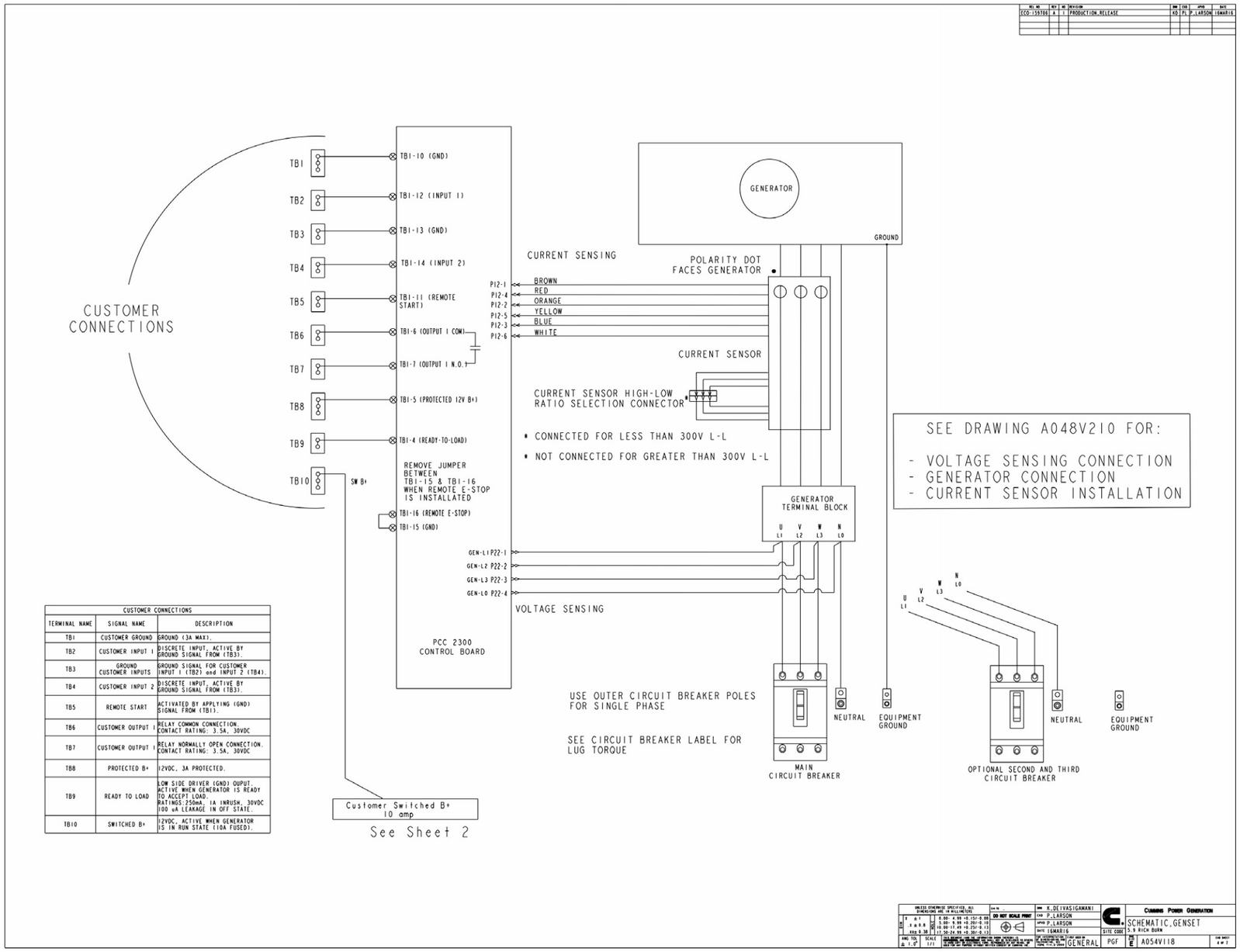


FIGURE 61. WIRING DIAGRAM FOR PCC 2300 (56 PIN ECM) (SHEET 3 OF 7)



CUSTOMER CONNECTIONS		
TERMINAL NAME	SIGNAL NAME	DESCRIPTION
TB1	CUSTOMER GROUND	GROUND (3A MAX).
TB2	CUSTOMER INPUT 1	DISCRETE INPUT, ACTIVE BY GROUND SIGNAL FROM (TB3).
TB3	GROUND CUSTOMER INPUTS	GROUND SIGNAL FOR CUSTOMER INPUT 1 (TB2) and INPUT 2 (TB4).
TB4	CUSTOMER INPUT 2	DISCRETE INPUT, ACTIVE BY GROUND SIGNAL FROM (TB3).
TB5	REMOTE START	ACTIVATED BY APPLYING (GND) SIGNAL FROM (TB1).
TB6	CUSTOMER OUTPUT 1	RELAY COMMON CONNECTION. CONTACT RATING: 3.5A, 30VDC
TB7	CUSTOMER OUTPUT 1	RELAY NORMALLY OPEN CONNECTION. CONTACT RATING: 3.5A, 30VDC
TB8	PROTECTED B+	12VDC, 3A PROTECTED.
TB9	READY TO LOAD	LOW SIDE DRIVER (GND) OUPUT. ACTIVE WHEN GENERATOR IS READY TO ACCEPT LOAD. RATINGS:250mA, 1A INRUSH, 30VDC 100 uA LEAKAGE IN OFF STATE.
TB10	SWITCHED B+	12VDC, ACTIVE WHEN GENERATOR IS IN RUN STATE (10A FUSED).

FIGURE 62. WIRING DIAGRAM FOR PCC 2300 (56 PIN ECM) (SHEET 4 OF 7)

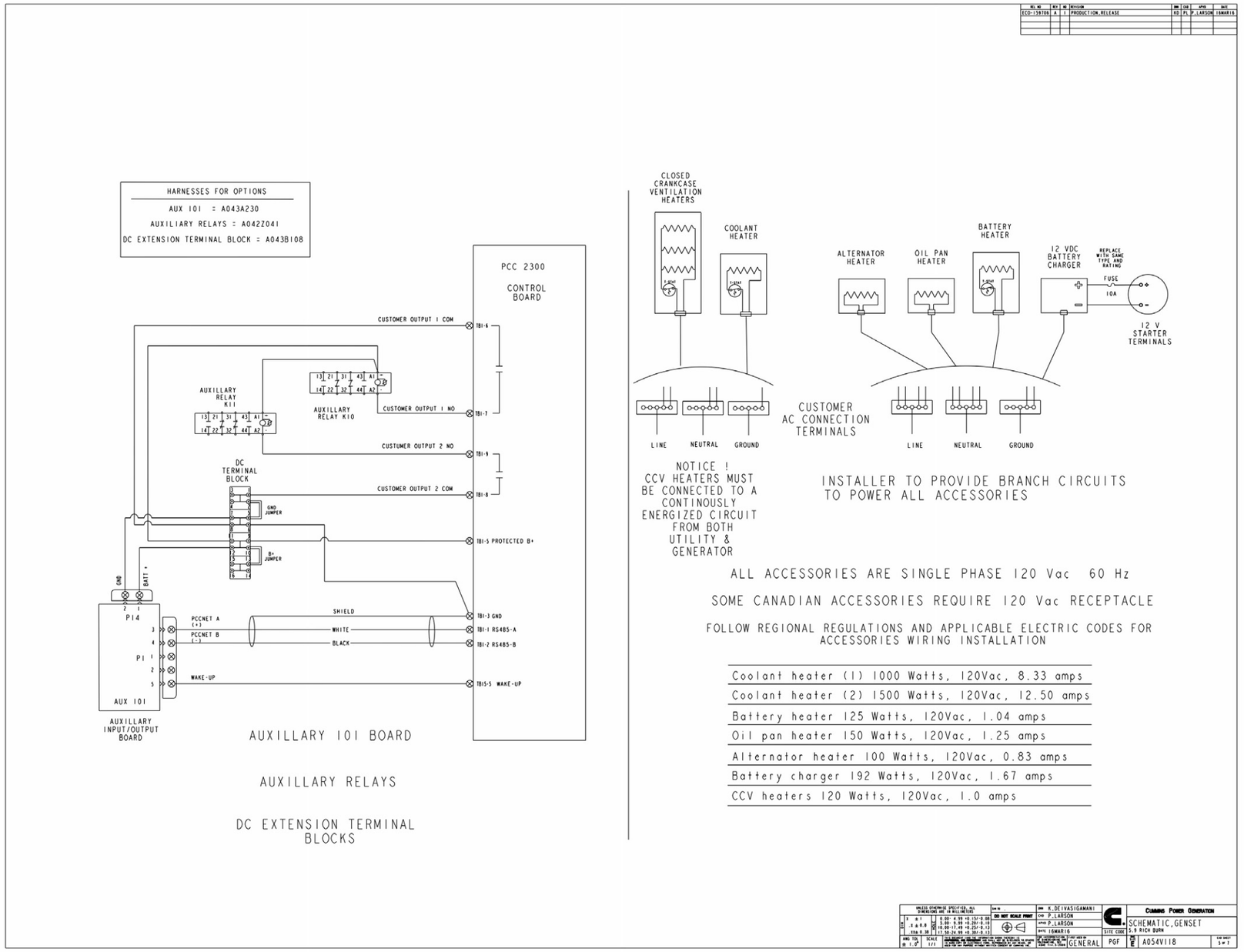


FIGURE 63. WIRING DIAGRAM FOR PCC 2300 (56 PIN ECM) (SHEET 5 OF 7)

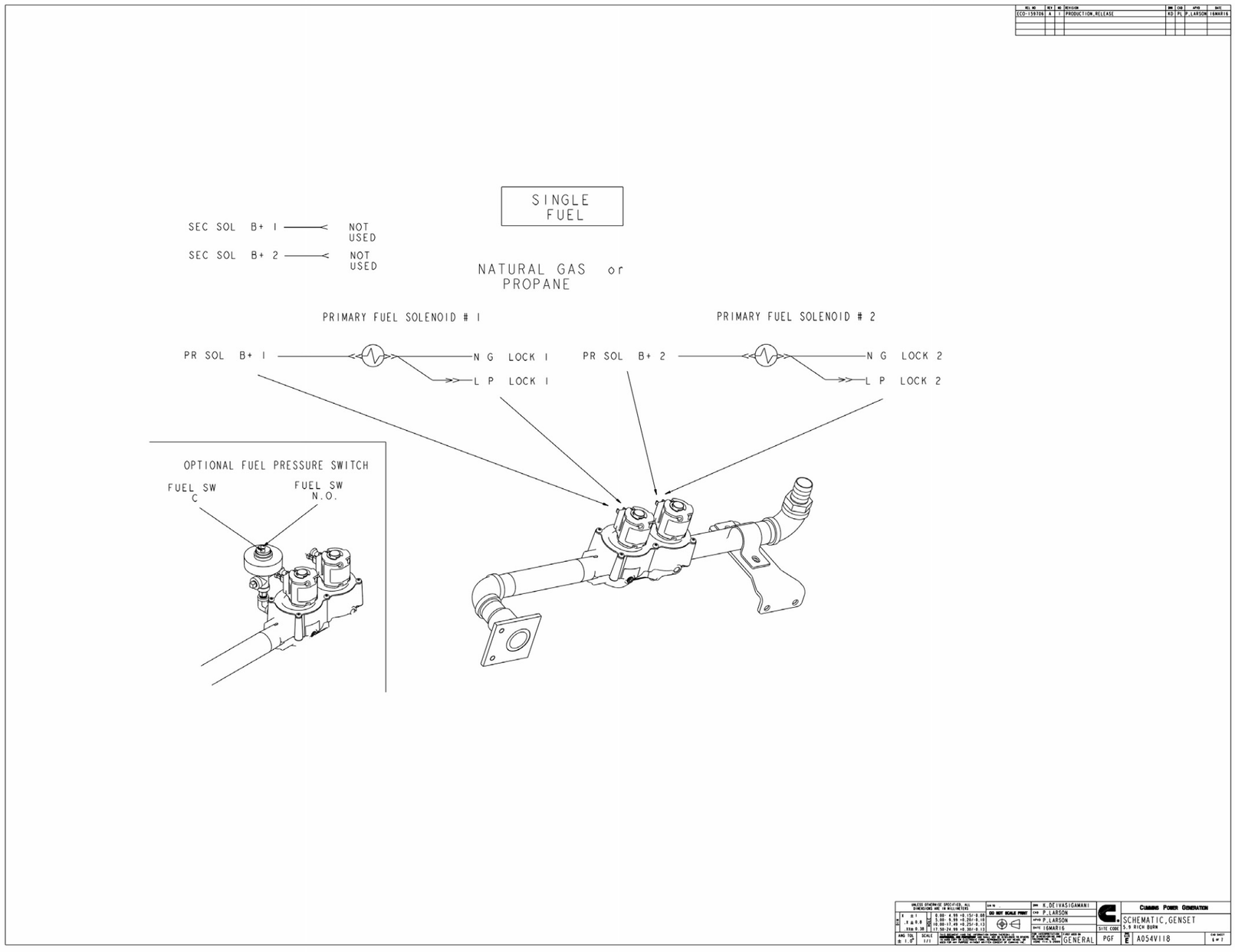


FIGURE 64. WIRING DIAGRAM FOR PCC 2300 (56 PIN ECM) (SHEET 6 OF 7)

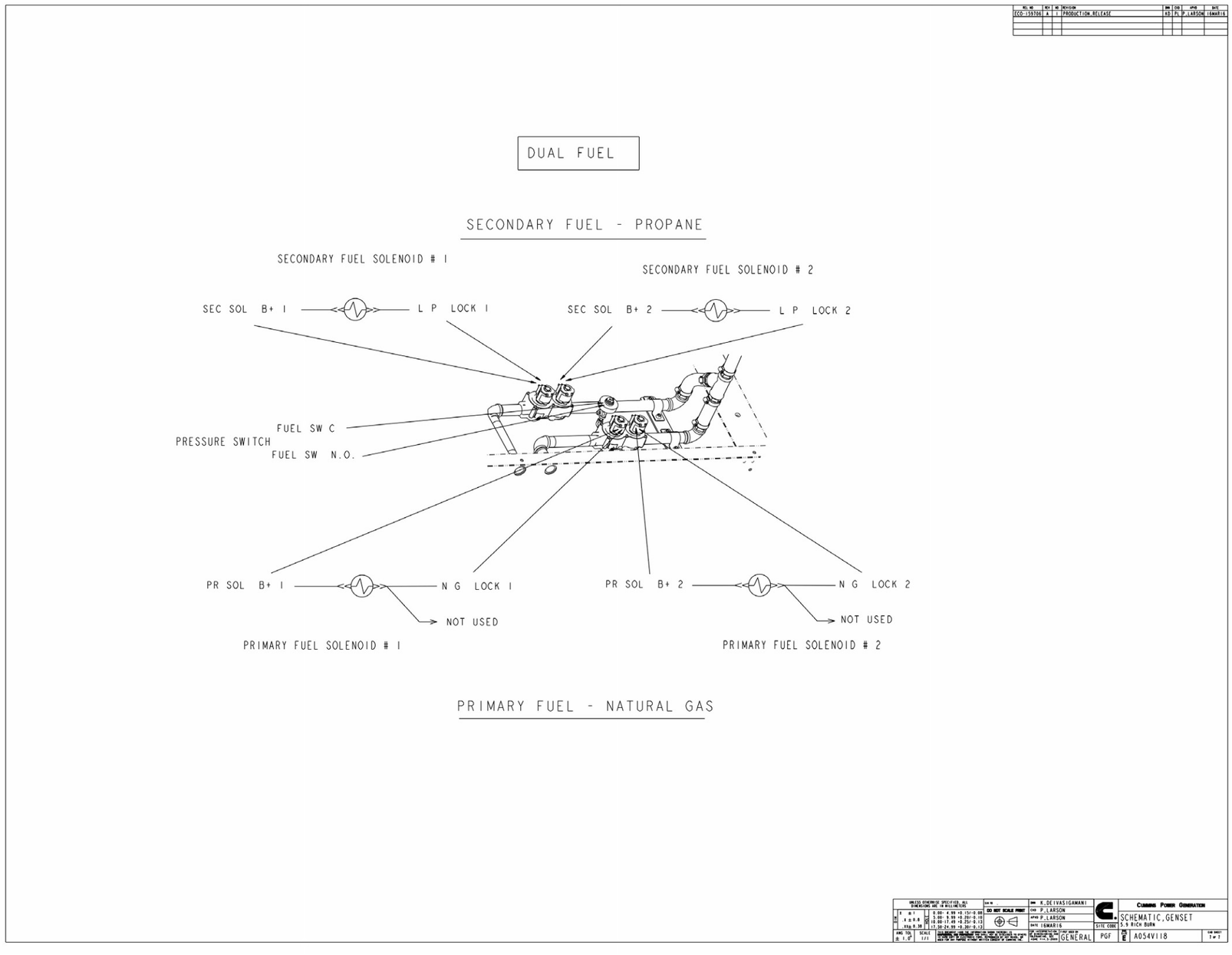


FIGURE 65. WIRING DIAGRAM FOR PCC 2300 (56 PIN ECM) (SHEET 7 OF 7)

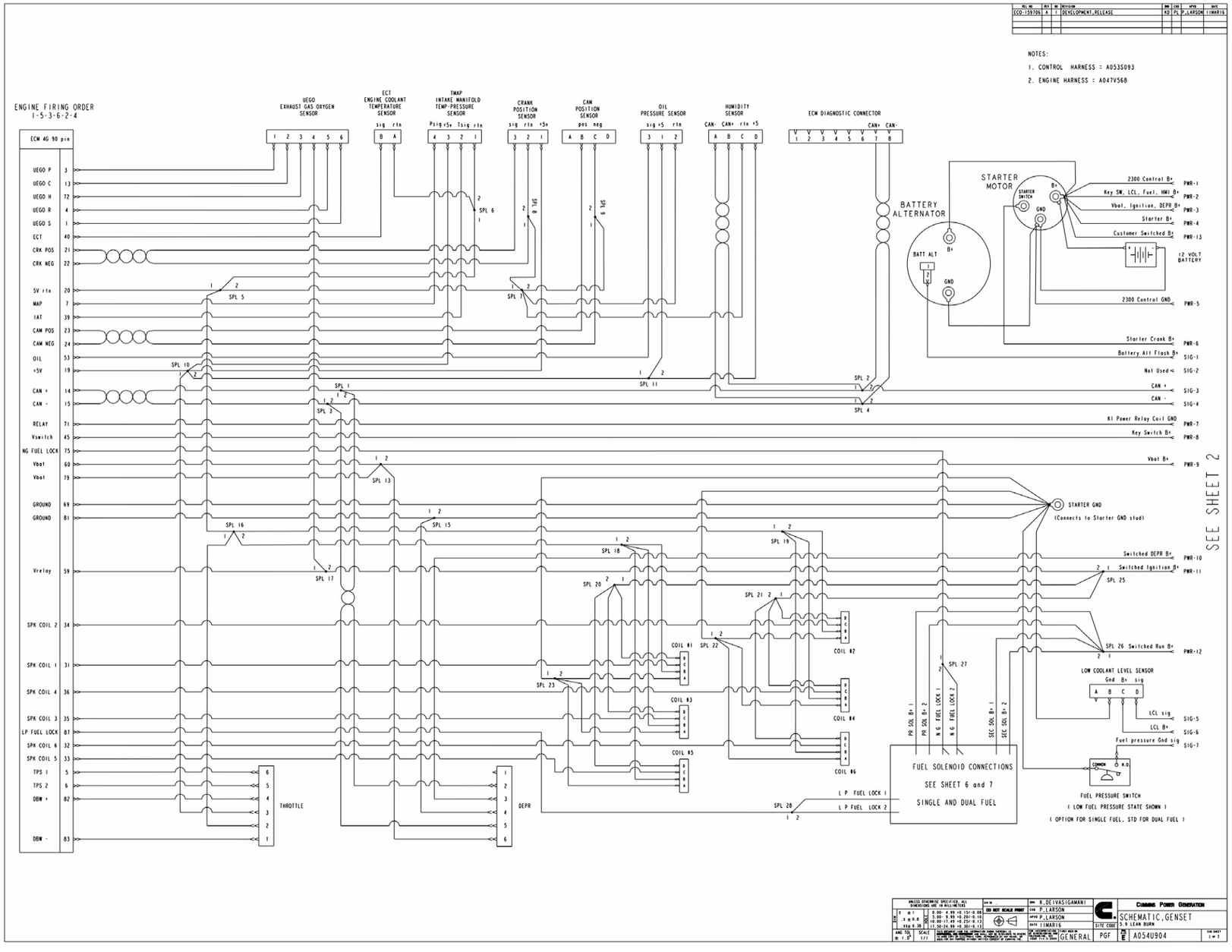


FIGURE 66. WIRING DIAGRAM FOR PCC 2300 (90 PIN ECM) (SHEET 1 OF 7)

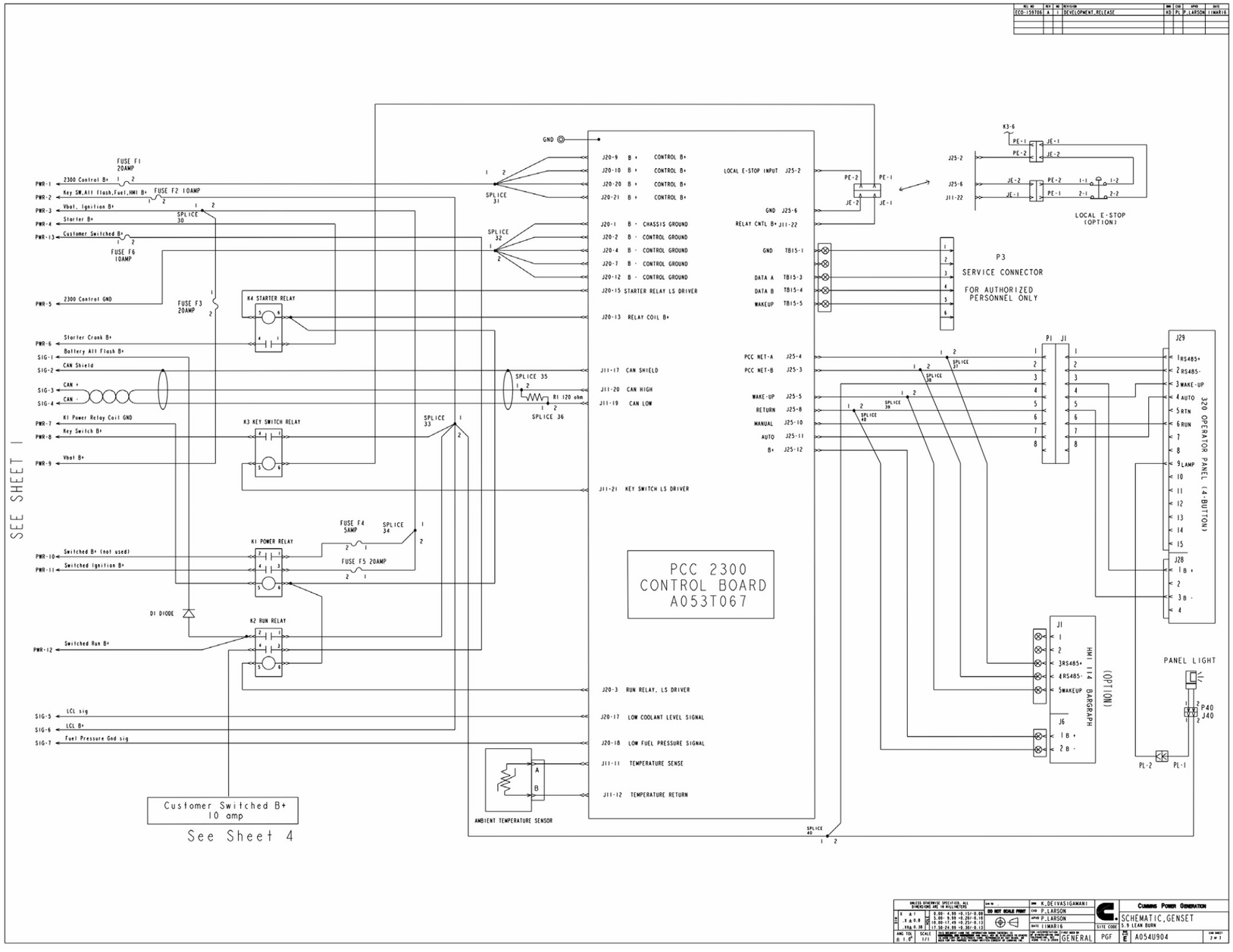


FIGURE 67. WIRING DIAGRAM FOR PCC 2300 (90 PIN ECM) (SHEET 2 OF 7)

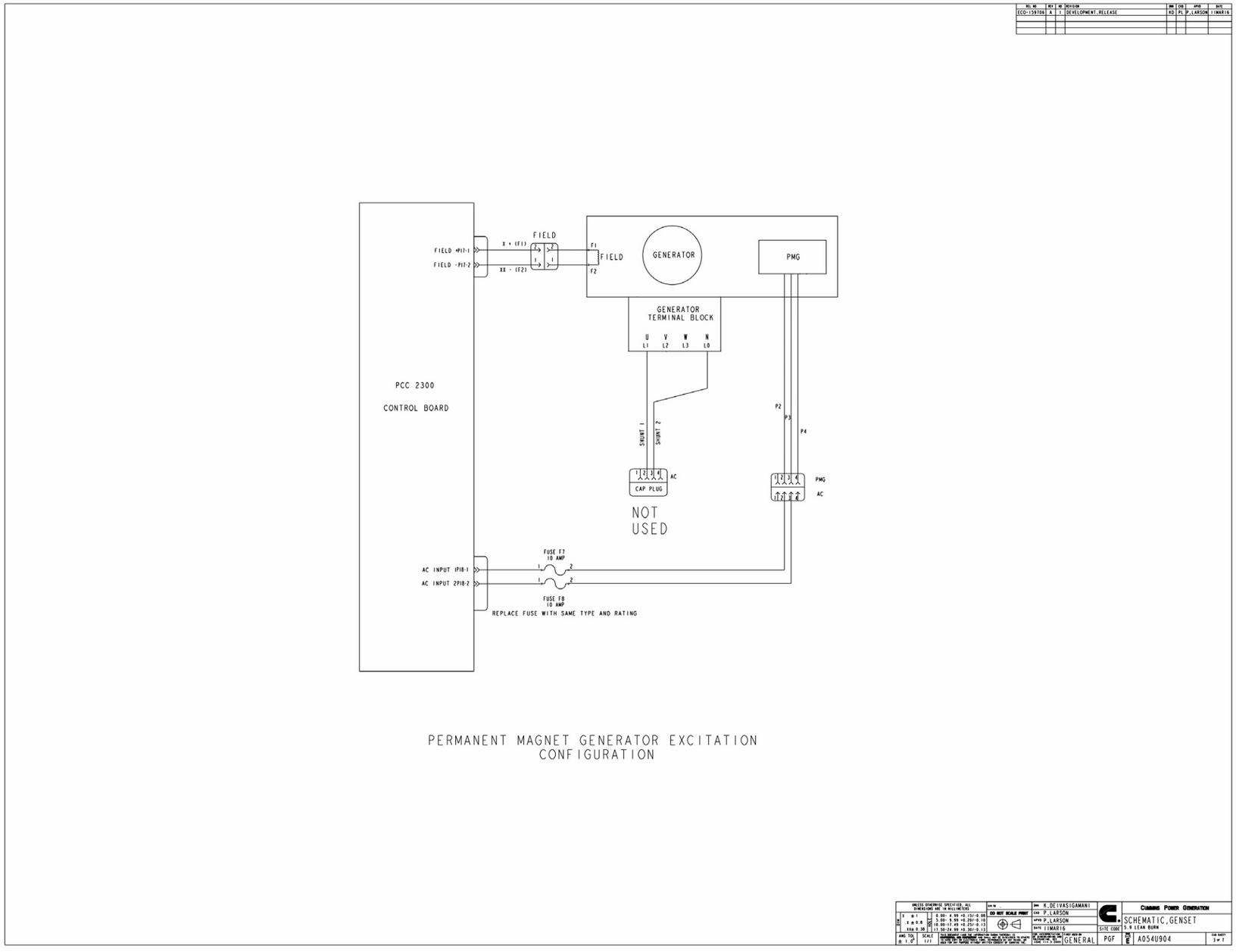
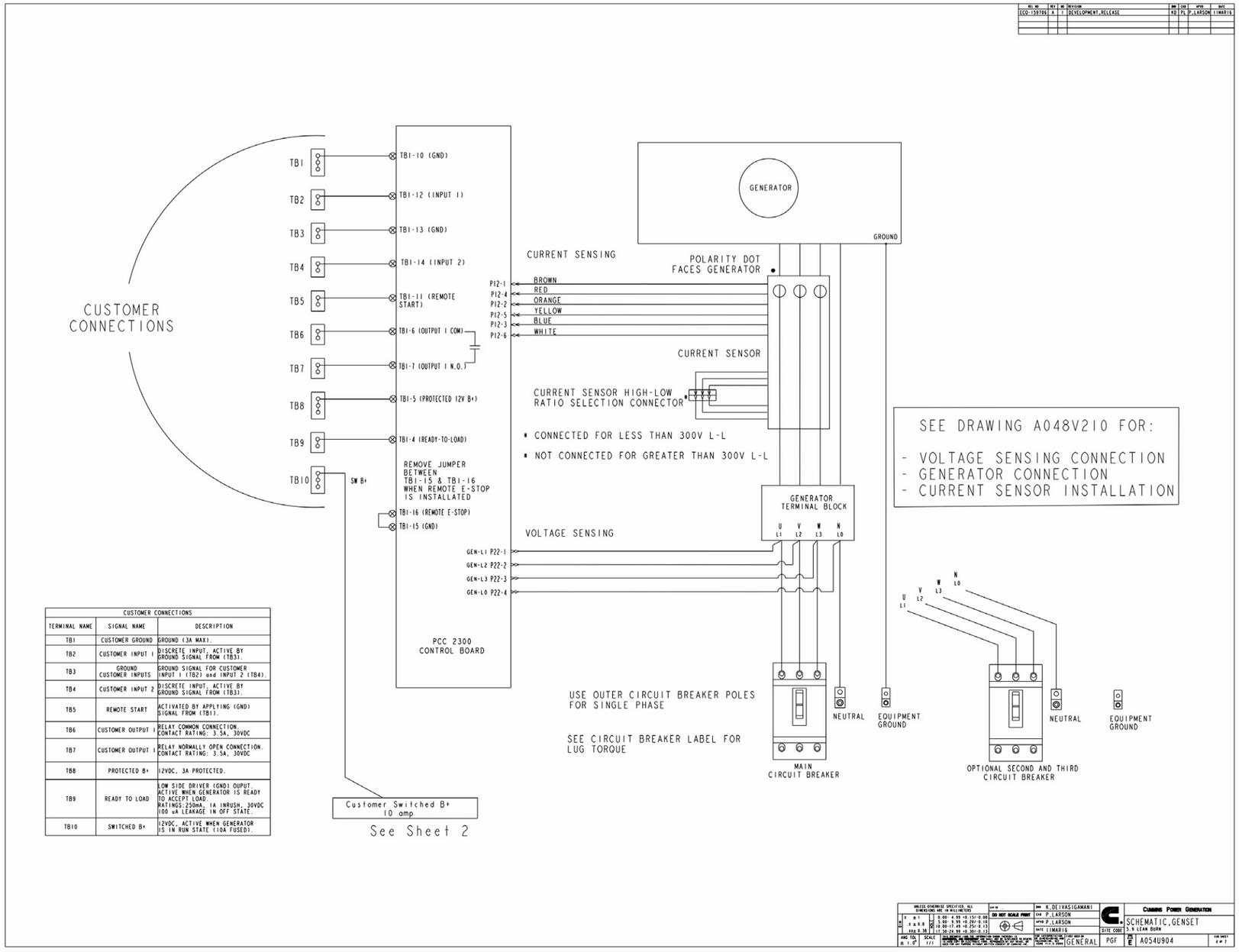


FIGURE 68. WIRING DIAGRAM FOR PCC 2300 (90 PIN ECM) (SHEET 3 OF 7)



CUSTOMER CONNECTIONS		
TERMINAL NAME	SIGNAL NAME	DESCRIPTION
TB1	CUSTOMER GROUND	GROUND (3A MAX).
TB2	CUSTOMER INPUT 1	DISCRETE INPUT, ACTIVE BY GROUND SIGNAL FROM (TB3).
TB3	GROUND CUSTOMER INPUTS	GROUND SIGNAL FOR CUSTOMER INPUT 1 (TB2) and INPUT 2 (TB4).
TB4	CUSTOMER INPUT 2	DISCRETE INPUT, ACTIVE BY GROUND SIGNAL FROM (TB3).
TB5	REMOTE START	ACTIVATED BY APPLYING (GND) SIGNAL FROM (TB1).
TB6	CUSTOMER OUTPUT 1	RELAY COMMON CONNECTION. CONTACT RATING: 3.5A, 30VDC
TB7	CUSTOMER OUTPUT 1	RELAY NORMALLY OPEN CONNECTION. CONTACT RATING: 3.5A, 30VDC
TB8	PROTECTED B+	12VDC, 3A PROTECTED.
TB9	READY TO LOAD	LOW SIDE DRIVER (GND) OUPUT. ACTIVE WHEN GENERATOR IS READY TO ACCEPT LOAD. RATINGS:250mA; 1A INRUSH, 30VDC 100 uA LEAKAGE IN OFF STATE.
TB10	SWITCHED B+	12VDC, ACTIVE WHEN GENERATOR IS IN RUN STATE (10A FUSED).

FIGURE 69. WIRING DIAGRAM FOR PCC 2300 (90 PIN ECM) (SHEET 4 OF 7)

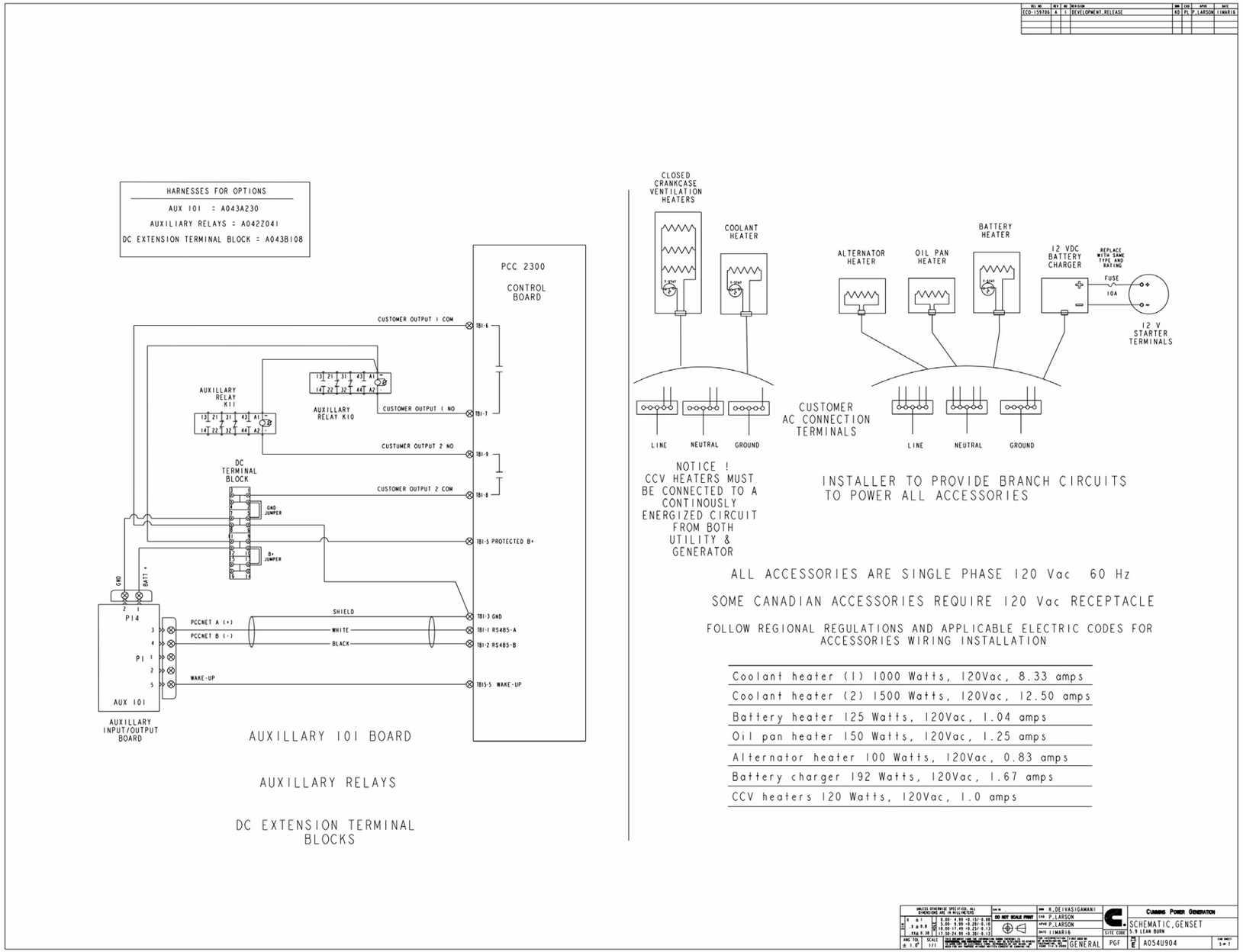


FIGURE 70. WIRING DIAGRAM FOR PCC 2300 (90 PIN ECM) (SHEET 5 OF 7)

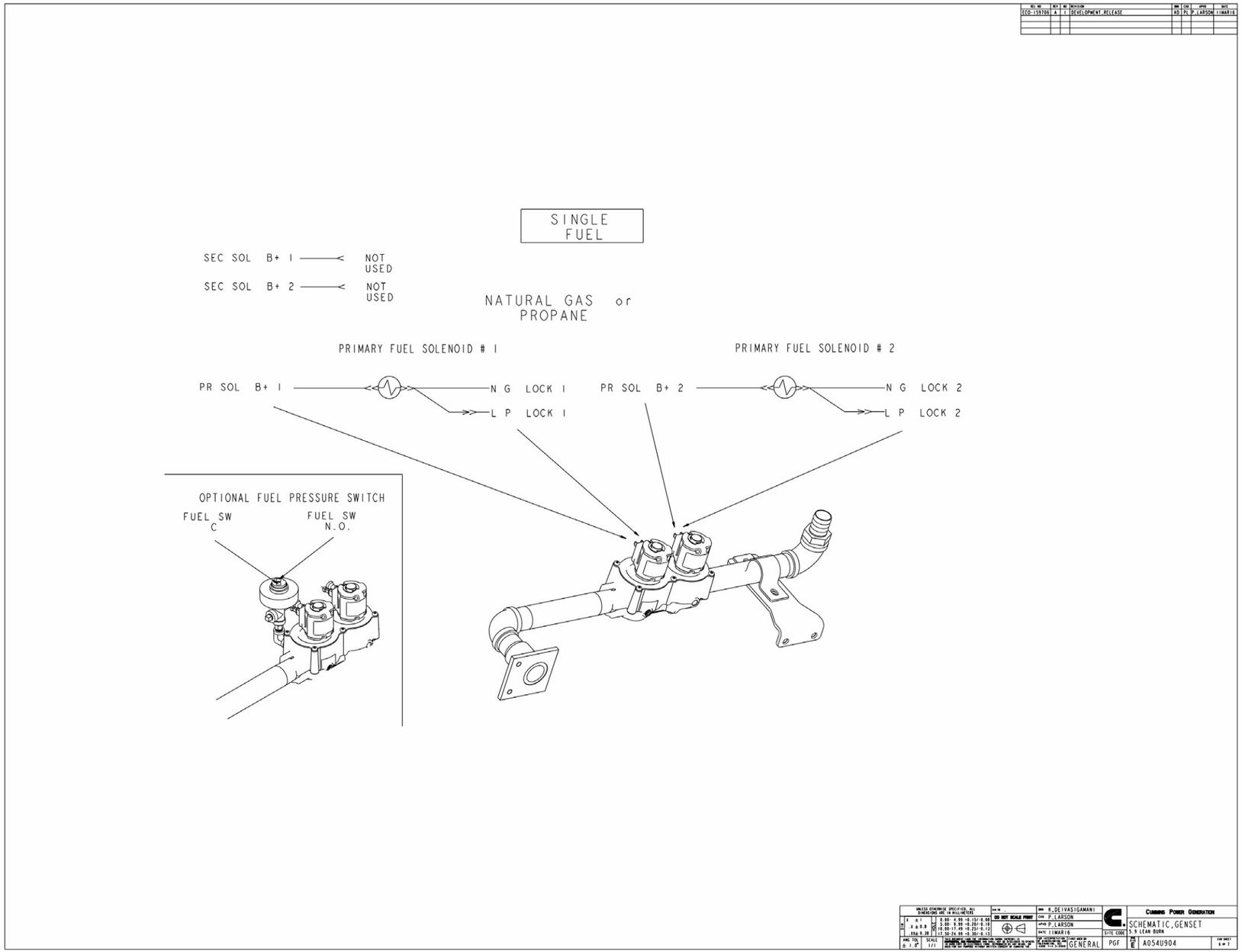


FIGURE 71. WIRING DIAGRAM FOR PCC 2300 (90 PIN ECM) (SHEET 6 OF 7)

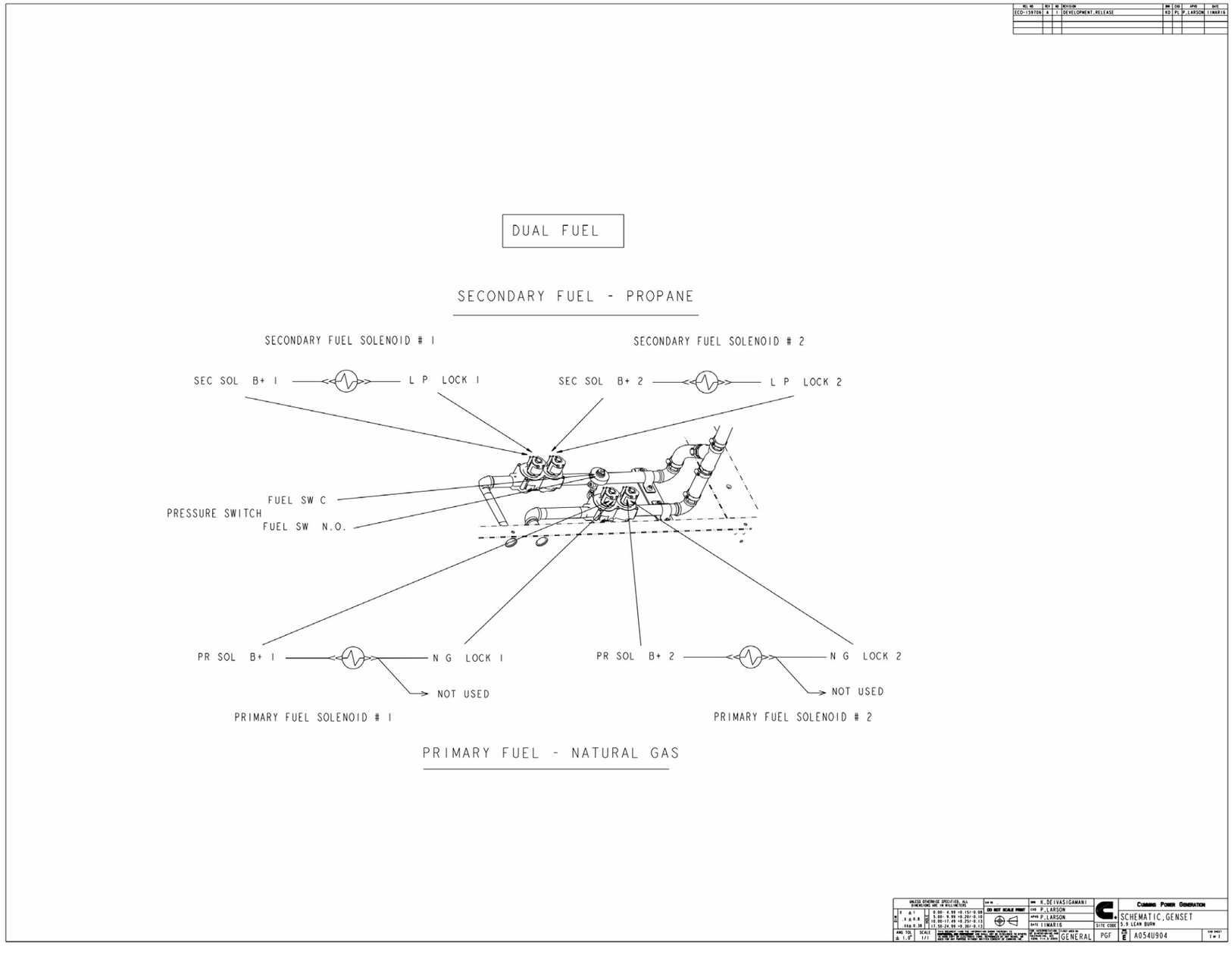
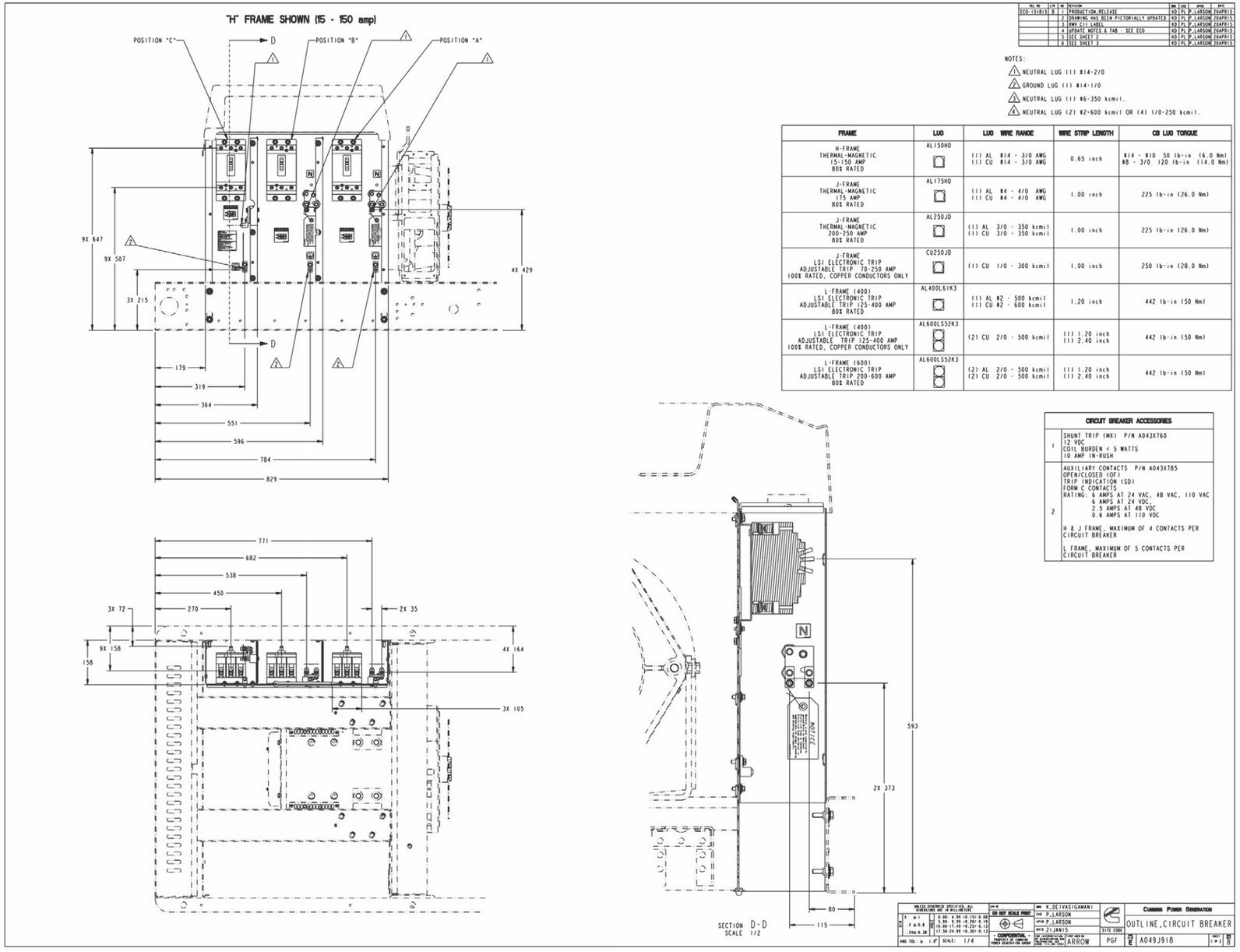


FIGURE 72. WIRING DIAGRAM FOR PCC 2300 (90 PIN ECM) (SHEET 7 OF 7)



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	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)

FIGURE 73. CIRCUIT BREAKER OUTLINE (SHEET 1 OF 3)

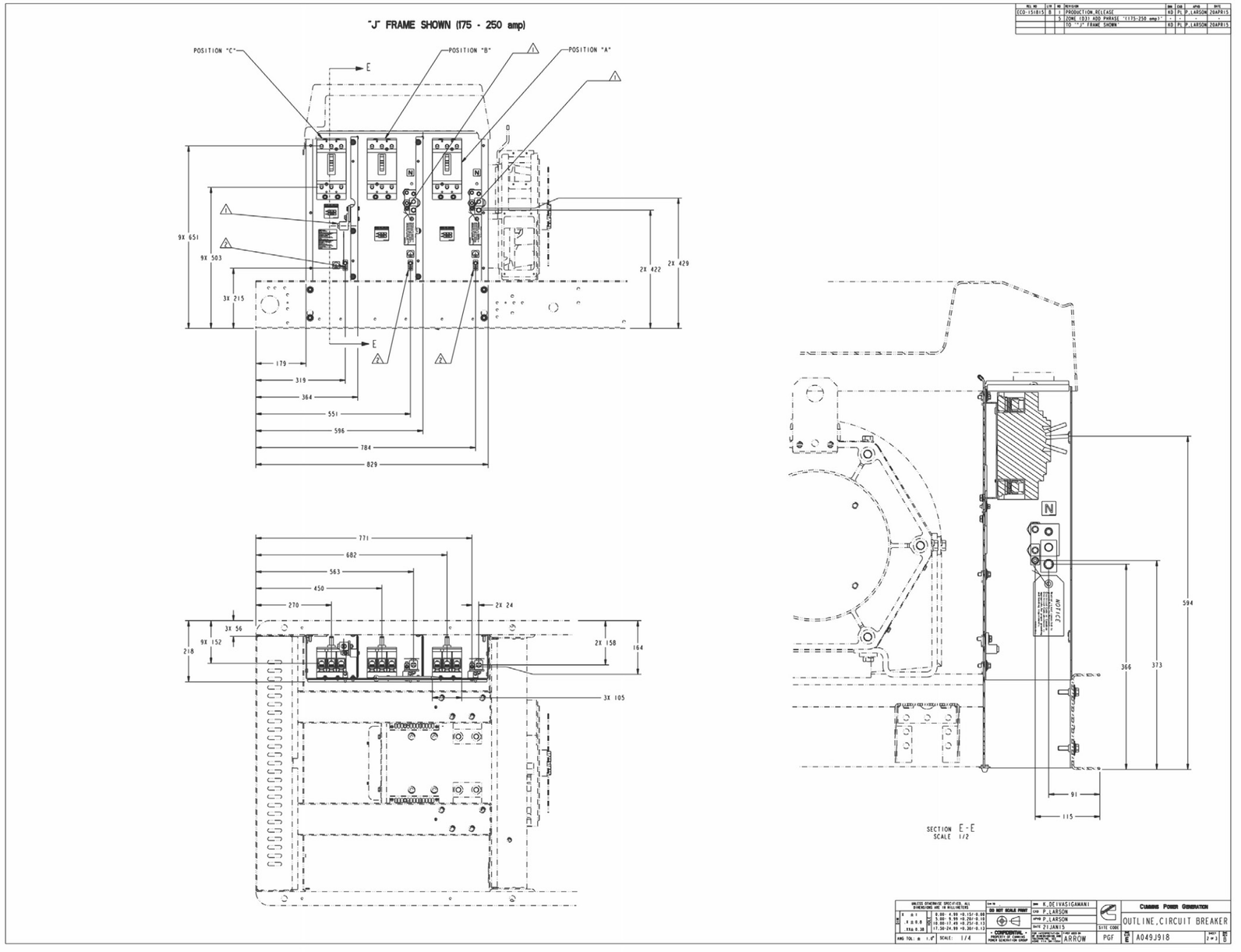


FIGURE 74. CIRCUIT BREAKER OUTLINE (SHEET 2 OF 3)

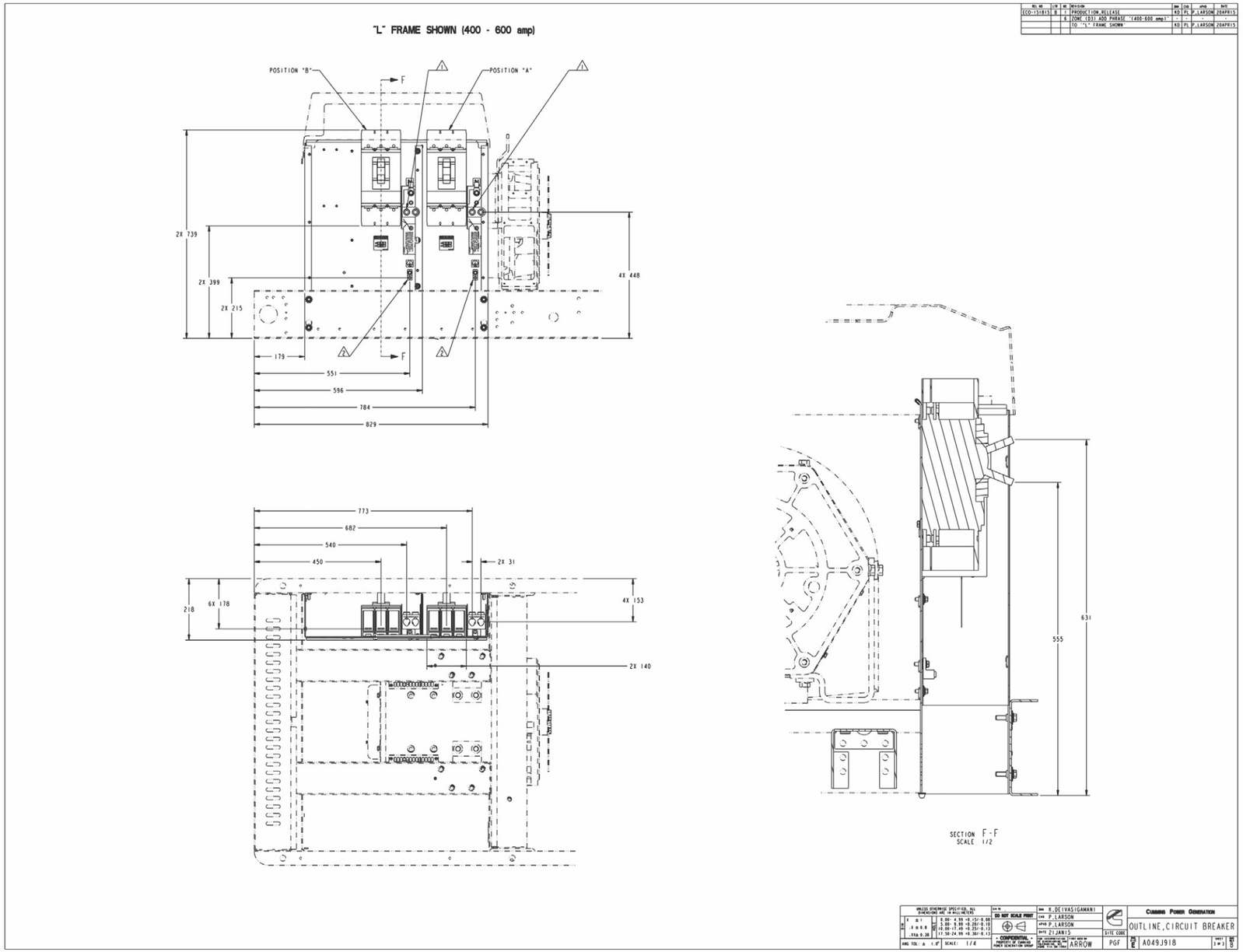


FIGURE 75. CIRCUIT BREAKER OUTLINE (SHEET 3 OF 3)

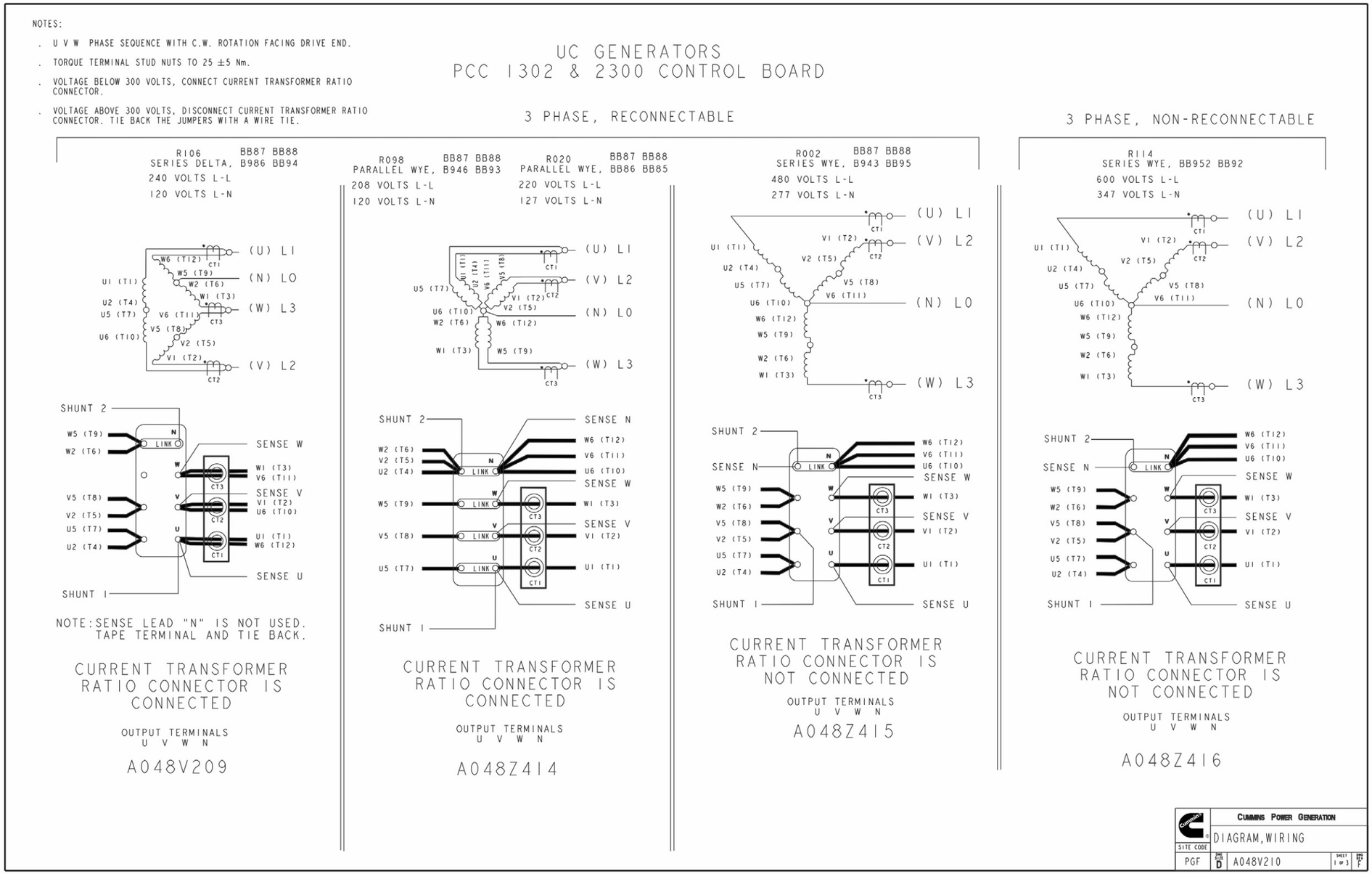


FIGURE 76. PCC 1302/2300 (SHEET 1 OF 3)

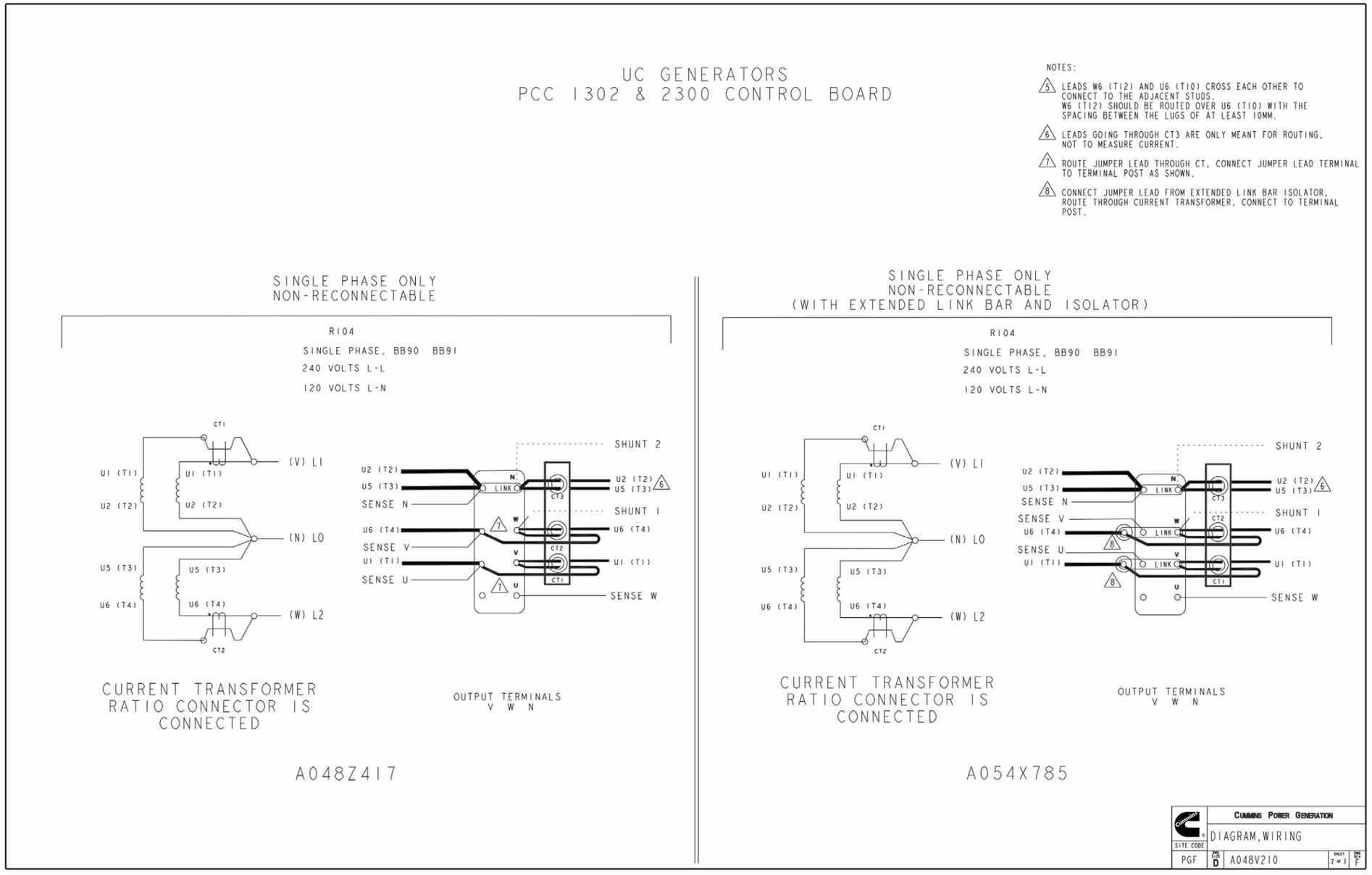


FIGURE 77. PCC 1302/2300 (SHEET 2 OF 3)

UC GENERATORS
PCC 1302 & 2300 CONTROL BOARD

NOTES:

5 LEADS W6 (T12) AND U6 (T10) CROSS EACH OTHER TO CONNECT TO THE ADJACENT STUDS. W6 (T12) SHOULD BE ROUTED OVER U6 (T10) WITH THE SPACING BETWEEN THE LUGS OF AT LEAST 10MM.

6 LEADS GOING THROUGH CT3 ARE ONLY MEANT FOR ROUTING, NOT TO MEASURE CURRENT.

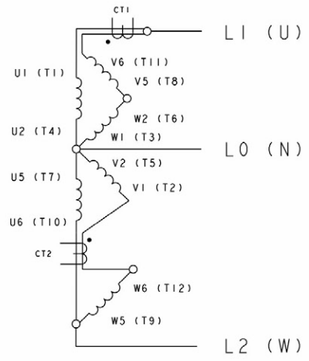
SINGLE PHASE
RECONNECTABLE

R104

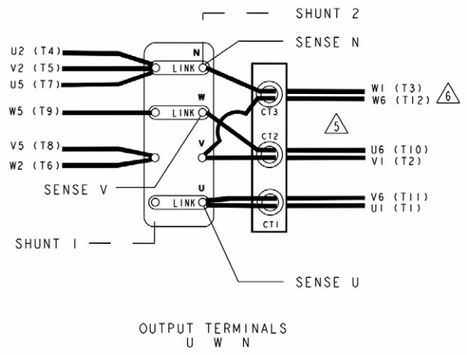
SINGLE PHASE DOUBLE-DELTA, BB88 BB87

240 VOLTS L-L

120 VOLTS L-N



CURRENT TRANSFORMER RATIO CONNECTOR IS CONNECTED



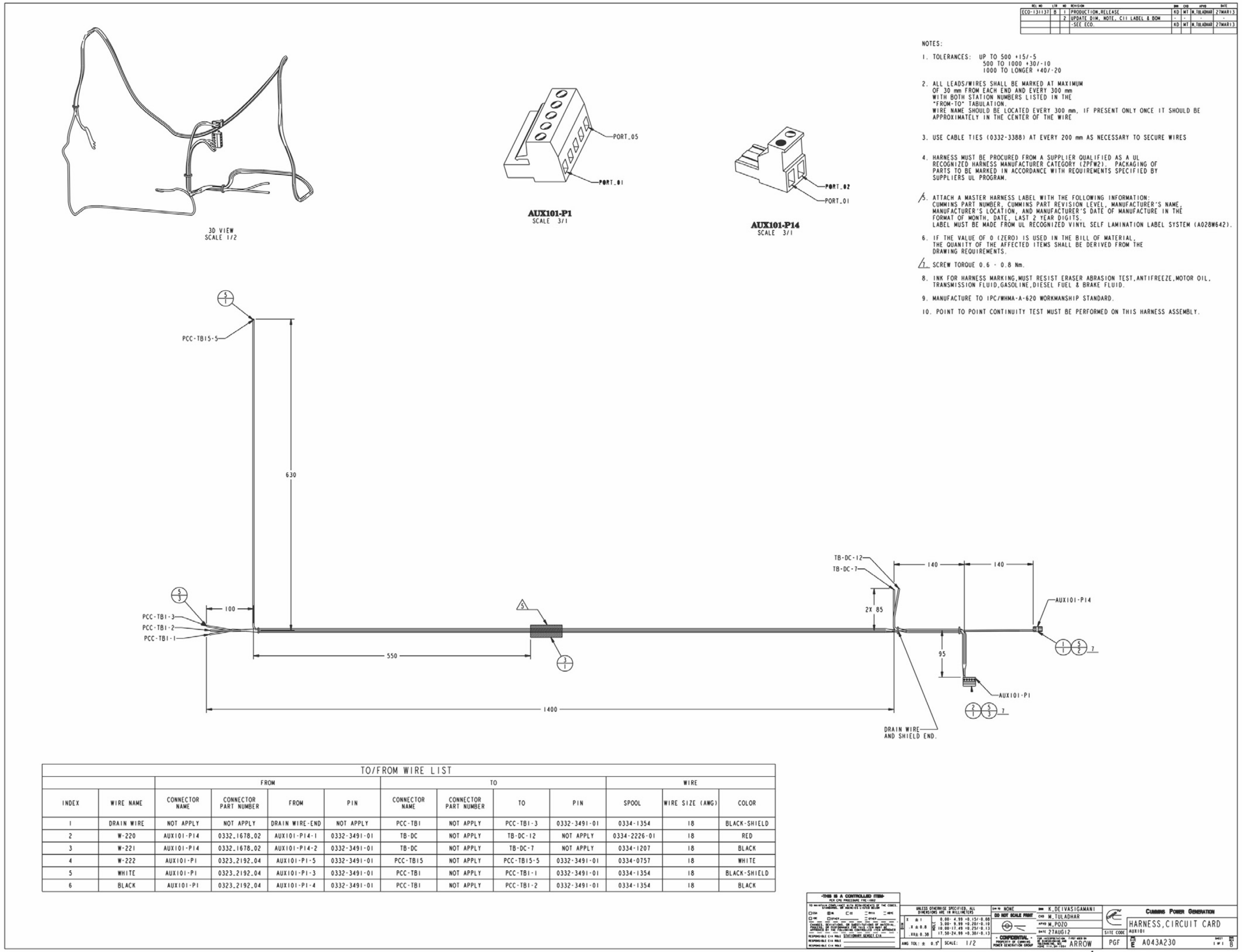
OUTPUT TERMINALS
U W N

NOTE: SENSE LEAD "W" IS NOT USED. TAPE TERMINAL AND TIE BACK.

A051L778

	CUMMINS POWER GENERATION	
SITE CODE	DIAGRAM, WIRING	
PGF	SIZE D A048V210	SHEET 3 OF 3 REV F

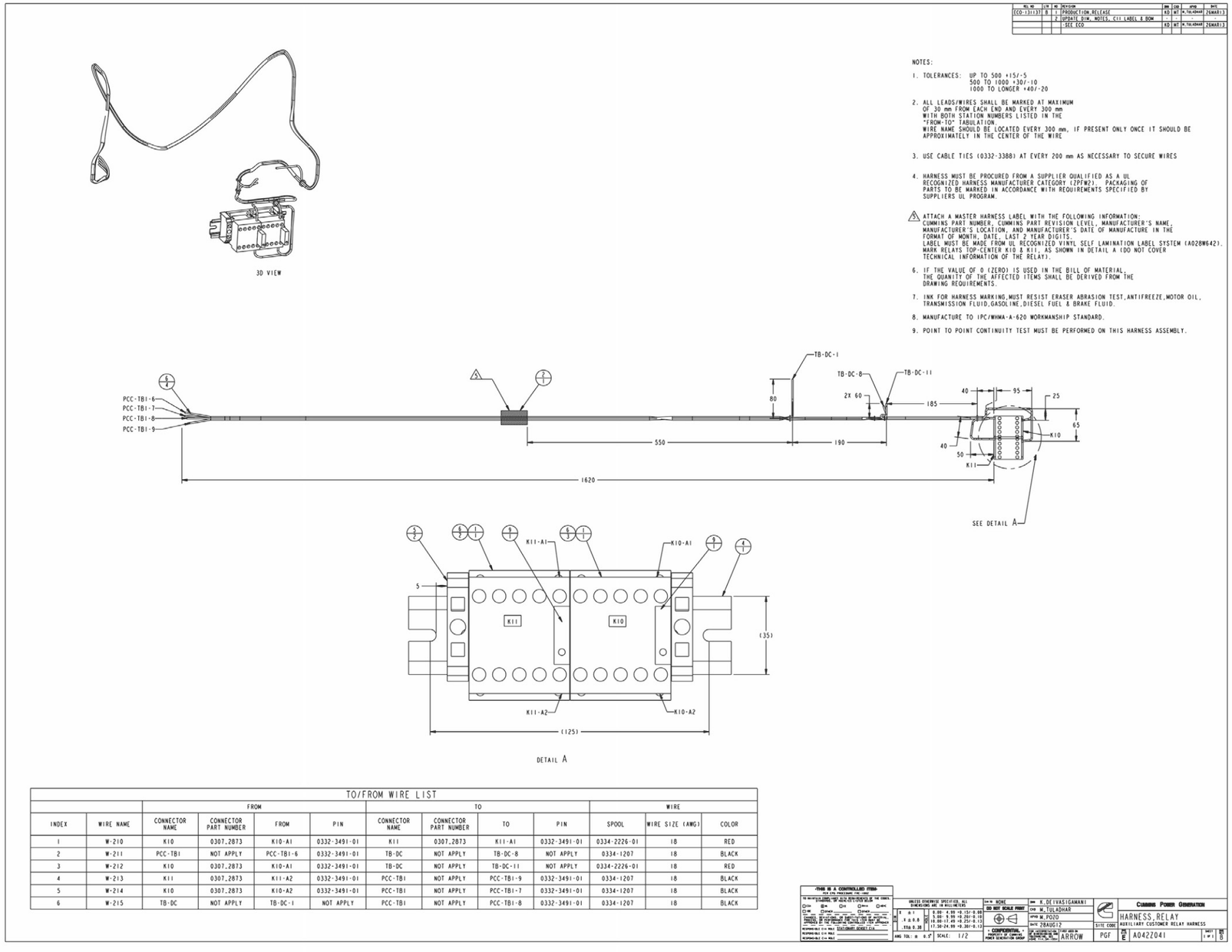
FIGURE 78. PCC 1302/2300 (SHEET 3 OF 3)



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 30 mm FROM EACH END AND EVERY 300 mm WITH BOTH STATION NUMBERS LISTED IN THE "FROM-TO" TABULATION.
WIRE NAME SHOULD BE LOCATED EVERY 300 mm, IF PRESENT ONLY ONCE IT SHOULD BE APPROXIMATELY IN THE CENTER OF THE WIRE
3. USE CABLE TIES (0332-3388) AT EVERY 200 mm AS NECESSARY TO SECURE WIRES
4. 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.
5. 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.
LABEL MUST BE MADE FROM UL RECOGNIZED VINYL SELF LAMINATION LABEL SYSTEM (A028W642).
6. 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.
7. SCREW TORQUE 0.6 - 0.8 Nm.
8. INK FOR HARNESS MARKING,MUST RESIST ERASER ABRASION TEST,ANTIFREEZE,MOTOR OIL, TRANSMISSION FLUID,GASOLINE,DIESEL FUEL & BRAKE FLUID.
9. MANUFACTURE TO IPC/WHMA-A-620 WORKMANSHIP STANDARD.
10. POINT TO POINT CONTINUITY TEST MUST BE PERFORMED ON THIS HARNESS ASSEMBLY.
ECO-131137 B 1 PRODUCTION,RELEASE KD MT M.TULADHAR 27MAR13
2 UPDATE DIM, NOTE, C11 LABEL & BOM -SEE ECO. KD MT M.TULADHAR 27MAR13
3D VIEW
SCALE 1/2
PORT,05
PORT,01
AUX101-P1
SCALE 3/1
PORT,02
PORT,01
AUX101-P14
SCALE 3/1
PCC-TB15-5
630
PCC-TB1-3
PCC-TB1-2
PCC-TB1-1
100
550
1400
TB-DC-12
TB-DC-7
140
140
2X 85
95
AUX101-P14
AUX101-P1
DRAIN WIRE AND SHIELD END.
HARNESS,CIRCUIT CARD
A043A230

TO/FROM WIRE LIST												
		FROM				TO				WIRE		
INDEX	WIRE NAME	CONNECTOR NAME	CONNECTOR PART NUMBER	FROM	PIN	CONNECTOR NAME	CONNECTOR PART NUMBER	TO	PIN	SPOOL	WIRE SIZE (AWG)	COLOR
1	DRAIN WIRE	NOT APPLY	NOT APPLY	DRAIN WIRE-END	NOT APPLY	PCC-TB1	NOT APPLY	PCC-TB1-3	0332-3491-01	0334-1354	18	BLACK-SHIELD
2	W-220	AUX101-P14	0332_1678_02	AUX101-P14-1	0332-3491-01	TB-DC	NOT APPLY	TB-DC-12	NOT APPLY	0334-2226-01	18	RED
3	W-221	AUX101-P14	0332_1678_02	AUX101-P14-2	0332-3491-01	TB-DC	NOT APPLY	TB-DC-7	NOT APPLY	0334-1207	18	BLACK
4	W-222	AUX101-P1	0323_2192_04	AUX101-P1-5	0332-3491-01	PCC-TB15	NOT APPLY	PCC-TB15-5	0332-3491-01	0334-0757	18	WHITE
5	WHITE	AUX101-P1	0323_2192_04	AUX101-P1-3	0332-3491-01	PCC-TB1	NOT APPLY	PCC-TB1-1	0332-3491-01	0334-1354	18	BLACK-SHIELD
6	BLACK	AUX101-P1	0323_2192_04	AUX101-P1-4	0332-3491-01	PCC-TB1	NOT APPLY	PCC-TB1-2	0332-3491-01	0334-1354	18	BLACK

FIGURE 79. CIRCUIT CARD HARNESS (SHEET 1 OF 1)

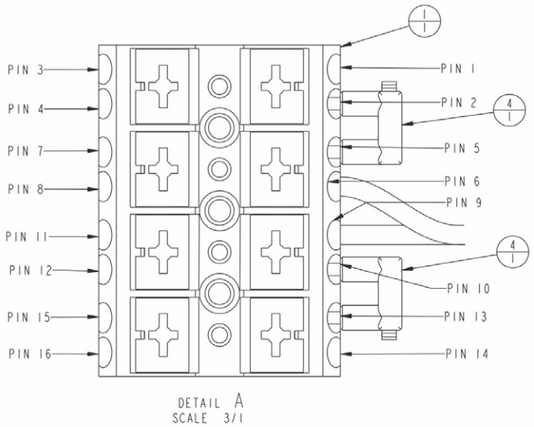


TO/FROM WIRE LIST

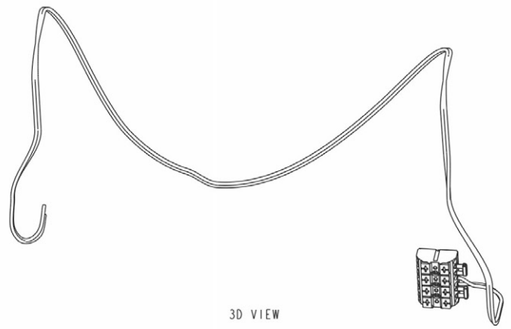
		FROM				TO				WIRE		
INDEX	WIRE NAME	CONNECTOR NAME	CONNECTOR PART NUMBER	FROM	PIN	CONNECTOR NAME	CONNECTOR PART NUMBER	TO	PIN	SPOOL	WIRE SIZE (AWG)	COLOR
1	W-210	K10	0307_2873	K10-A1	0332-3491-01	K11	0307_2873	K11-A1	0332-3491-01	0334-2226-01	18	RED
2	W-211	PCC-TB1	NOT APPLY	PCC-TB1-6	0332-3491-01	TB-DC	NOT APPLY	TB-DC-8	NOT APPLY	0334-1207	18	BLACK
3	W-212	K10	0307_2873	K10-A1	0332-3491-01	TB-DC	NOT APPLY	TB-DC-11	NOT APPLY	0334-2226-01	18	RED
4	W-213	K11	0307_2873	K11-A2	0332-3491-01	PCC-TB1	NOT APPLY	PCC-TB1-9	0332-3491-01	0334-1207	18	BLACK
5	W-214	K10	0307_2873	K10-A2	0332-3491-01	PCC-TB1	NOT APPLY	PCC-TB1-7	0332-3491-01	0334-1207	18	BLACK
6	W-215	TB-DC	NOT APPLY	TB-DC-1	NOT APPLY	PCC-TB1	NOT APPLY	PCC-TB1-8	0332-3491-01	0334-1207	18	BLACK

FIGURE 80. RELAY HARNESS (SHEET 1 OF 1)

REL NO	LTR	NO	REVISION	DRN	CKD	APVD	DATE
ECO-131137	B	1	PRODUCTION RELEASE	KD	MT	M.TULADHAR	26MAR13
		2	UPDATE DIM, NOTES, CII LABEL & BOM	-	-	-	-
			-SEE ECO.	KD	MT	M.TULADHAR	26MAR13



DETAIL A
SCALE 3/1



3D VIEW

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 30 mm FROM EACH END AND EVERY 300 mm WITH BOTH STATION NUMBERS LISTED IN THE "FROM-TO" TABULATION.
   WIRE NAME SHOULD BE LOCATED EVERY 300 mm, IF PRESENT ONLY ONCE IT SHOULD BE APPROXIMATELY IN THE CENTER OF THE WIRE

3. USE CABLE TIES (0332-3388) AT EVERY 200 mm AS NECESSARY TO SECURE WIRES

4. 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.

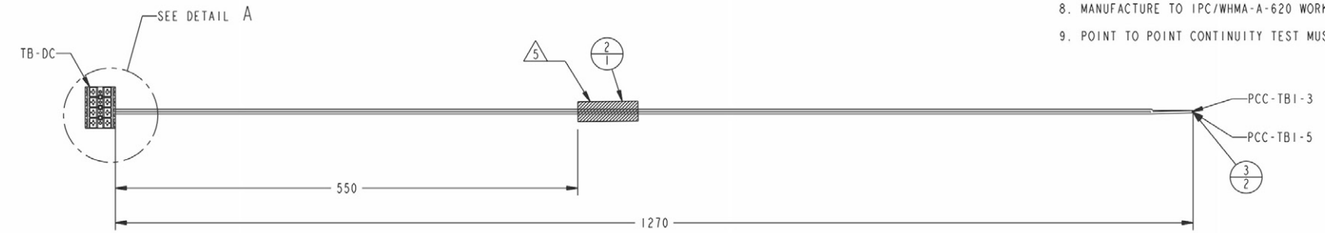
5. ATTACH A MASTER HARNESS LABEL WITH THE FOLLOWING INFORMATION: CUMMINS PART NUMBER, CUMMINS PART REVISION LEVEL, MANUFACTURER'S NAME, MANUFACTURER'S LOCATION, AND MANUFACTURER'S DATE OF MANUFACTURE IN THE FORMAT OF MONTH, DATE, LAST 2 YEAR DIGITS.
   LABEL MUST BE MADE FROM UL RECOGNIZED VINYL SELF LAMINATION LABEL SYSTEM (A028W642).

6. 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.

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

8. MANUFACTURE TO IPC/WHMA-A-620 WORKMANSHIP STANDARD.

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



TO/FROM WIRE LIST

		FROM				TO				WIRE			
INDEX	WIRE NAME	CONNECTOR NAME	CONNECTOR PART NUMBER	FROM	PIN	CONNECTOR NAME	CONNECTOR PART NUMBER	TO	PIN	SPOOL	WIRE SIZE (AWG)	LENGTH (REFERENCE ONLY) DO NOT CUT WIRE TO THIS LENGTH	COLOR
1	W-205	PCC-TBI	0323_1678_15	PCC-TBI-5	0332-3491-01	TB-DC	A043K557	TB-DC-9	NOT APPLY	0334-2226-01	18	1263	RED
2	W-206	PCC-TBI	0323_1678_15	PCC-TBI-3	0332-3491-01	TB-DC	A043K557	TB-DC-6	NOT APPLY	0334-1207	18	1250	BLACK

-THIS IS A CONTROLLED ITEM-
PER CPG PROCEDURE FRE-1002
TO MAINTAIN COMPLIANCE WITH REQUIREMENTS OF THE CODES, STANDARDS, OR AGENCIES LISTED BELOW
☐ CSA ☒ UL ☐ CE ☐ RVIA ☐ ABYC ☐ SAE ☐ OTHER ☐ OTHER
CHANGES, DEVIATIONS, OR SUBSTITUTIONS OF MATERIAL, PROCESS, OR PERFORMANCE FOR THIS ITEM MUST BE APPROVED BY THE FOLLOWING CONTROLLED ITEM APPROVER
RESPONSIBLE C/A ROLE STATIONARY GENSET C/A
RESPONSIBLE C/A ROLE
RESPONSIBLE C/A ROLE

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: ± 0.5° SCALE: 5/8

SHR TO NONE
DO NOT SCALE PRINT
• CONFIDENTIAL •
PROPERTY OF CUMMINS POWER GENERATION GROUP

DRN K_DEIVASIGAMANI
CKD M_TULADHAR
APVD M_POZO
DATE 28AUG12
TOP INTERPRETATION (FIRST USED ON) OF DIMENSIONING AND TOLERANCING, SEE ASME Y14.5M-1994
ARROW

SITE CODE PGF

CUMMINS POWER GENERATION
HARNESS,GENERATOR ELECTRICAL
2 WIRE HARNESS FOR B+,B- EXTENSION
DWG SIZE D A043B108 SHEET 1 OF 1 DWG REV B

FIGURE 81. GENERATOR ELECTRICAL HARNESS (SHEET 1 OF 1)

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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

REL NO	LTR	NO	REVISION	DRN	CKD	APVD	DATE
ECO-152302	C	1	RMV REBAR REINFORDED FROM NOTE 7	RAH	ELN	E.NORDSTROM	05MAY15
		2	ADD NOTE 15	RAH	ELN	E.NORDSTROM	05MAY15
		3	SEE SHEET 2	RAH	ELN	E.NORDSTROM	05MAY15
		4	SEE SHEET 2	RAH	ELN	E.NORDSTROM	05MAY15
		5	SEE SHEET 2	RAH	ELN	E.NORDSTROM	05MAY15
		6	SEE SHEET 2	RAH	ELN	E.NORDSTROM	05MAY15
		7	SEE SHEET 2	RAH	ELN	E.NORDSTROM	05MAY15
		8	SEE SHEET 2	RAH	ELN	E.NORDSTROM	05MAY15
		9	SEE SHEET 4	RAH	ELN	E.NORDSTROM	05MAY15
		10	SEE SHEET 4	RAH	ELN	E.NORDSTROM	05MAY15

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 2013" 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.

-THIS IS A CONTROLLED ITEM-
PER CPG PROCEDURE PRE-1002
TO MAINTAIN COMPLIANCE WITH REQUIREMENTS OF THE CODES, STANDARDS, OR AGENCIES LISTED BELOW
☐ CSA ☐ UL ☐ CE ☐ RVIA ☐ HDHC
☒ IBC ☒ OTHER OSHPD ☐ OTHER
CHANGES, DEVIATIONS, OR SUBSTITUTIONS OF MATERIAL, DESIGN, OR PROCESS SHALL NOT BE MADE WITHOUT APPROVAL BY THE FOLLOWING CONTROLLED ITEM APPROVER
RESPONSIBLE C/A ROLE SEISMIC
RESPONSIBLE C/A ROLE
RESPONSIBLE C/A ROLE

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS
DECIMAL: X ±1 | .X ±0.8 | .XX± 0.38
FRACTIONAL: 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 D HOFMEISTER
CKD D HOFMEISTER
APVD E NORDSTROM
DATE 28FEB15
FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE ASME Y14.5M-1994
THIRD ANGLE PROJECTION
NEXT ASSY ARROW

CUMMINS POWER GENERATION
INSTALLATION,GENSET
SEISMIC REQUIREMENTS
SITE CODE PGF
SIZE D A051N157
SHEET 1 OF 4
REV C

FIGURE 82. SEISMIC INSTALLATION REQUIREMENTS (SHEET 1 OF 4)

REL NO	LTR	NO	REVISION	DWN	CKD	APVD	DATE
ECO-152302	C	3	ADD NOTE TYPE---RECORD.	RAH	ELN	E.NORDSTROM	05MAY15
		4	RMV ATTACHMENT TO STEEL COLUMN FROM TABLE	RAH	ELN	E.NORDSTROM	05MAY15
		5	ZONE D5,ADD VALUES TO EVALUATION PARAMETERS	RAH	ELN	E.NORDSTROM	05MAY15
		6	ZONE C4,GRADE/ROOF WAS ROOF	RAH	ELN	E.NORDSTROM	05MAY15
		7	ZONE B3,ADD VALUES TO EVALUATION PARAMETERS	RAH	ELN	E.NORDSTROM	05MAY15
		8	ZONE B3,ASTM A325N OR A490 WAS 307	RAH	ELN	E.NORDSTROM	05MAY15

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
C45 N6 C50 N6 C60 N6 C70 N6 C80 N6 C100 N6	GENERATOR SET WITH OR WITHOUT ENCLOSURE	CBC 2013/IBC 2012 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
C45 N6 C50 N6 C60 N6 C70 N6 C80 N6 C100 N6	GENERATOR SET WITH OR WITHOUT ENCLOSURE	CBC 2013/IBC 2012 Sds <= 2.5 Ip <= 1.5 ap/Rp <= 2.5/2.0 z/h <= 1.0	(QTY 4) 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
SIM TO NONE
DO NOT SCALE PRINT
- CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP
DWN D HOFMEISTER
CHD D HOFMEISTER
APVD E NORDSTROM
DATE 28FEB15
FIRST USED ON ARROW
SITE CODE PGF
CUMMINS POWER GENERATION
INSTALLATION,GENSET
SEISMIC REQUIREMENTS
SIZE D A051N157 SHEET 2 OF 4 REV C

FIGURE 83. SEISMIC INSTALLATION REQUIREMENTS (SHEET 2 OF 4)

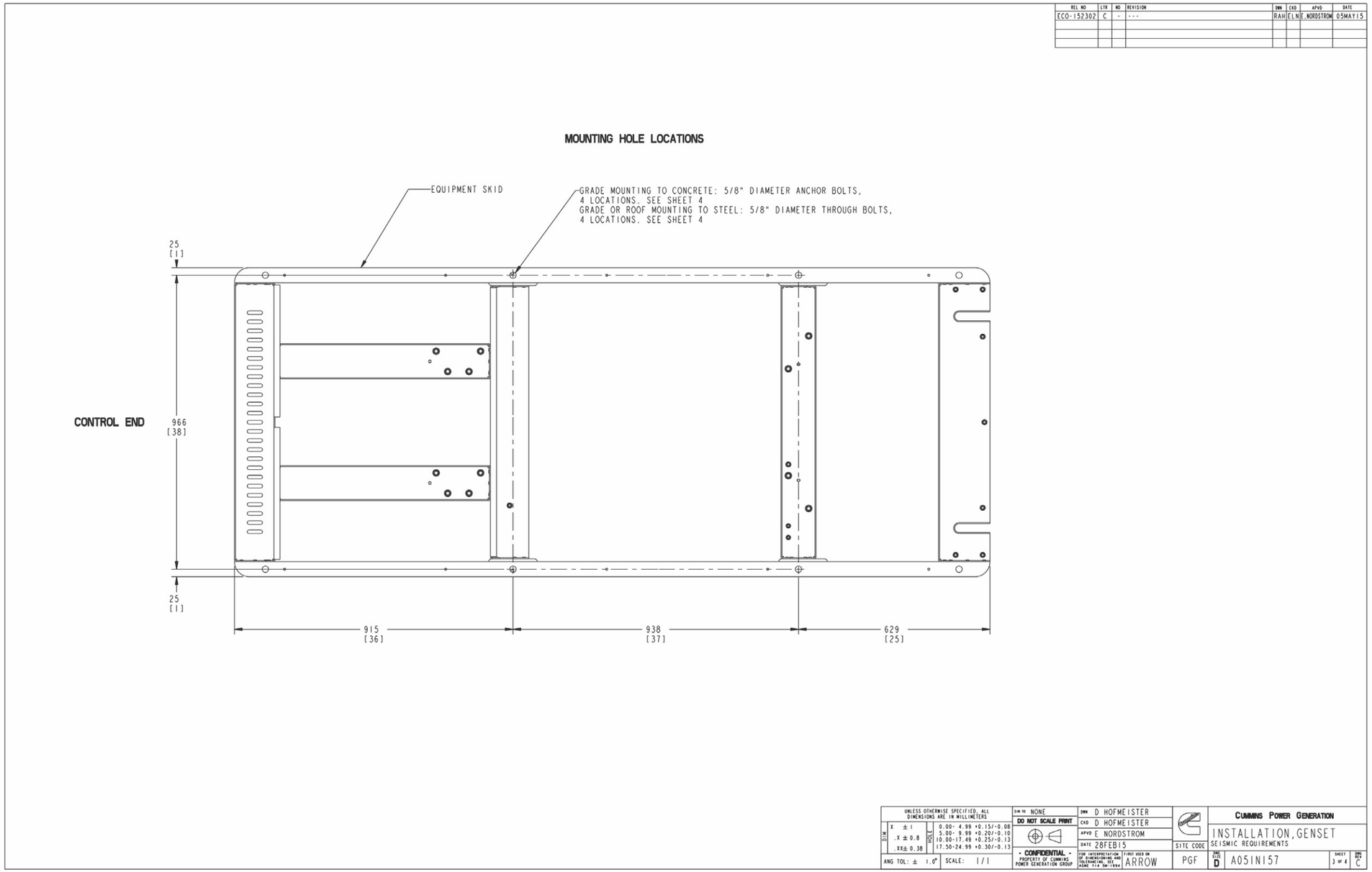
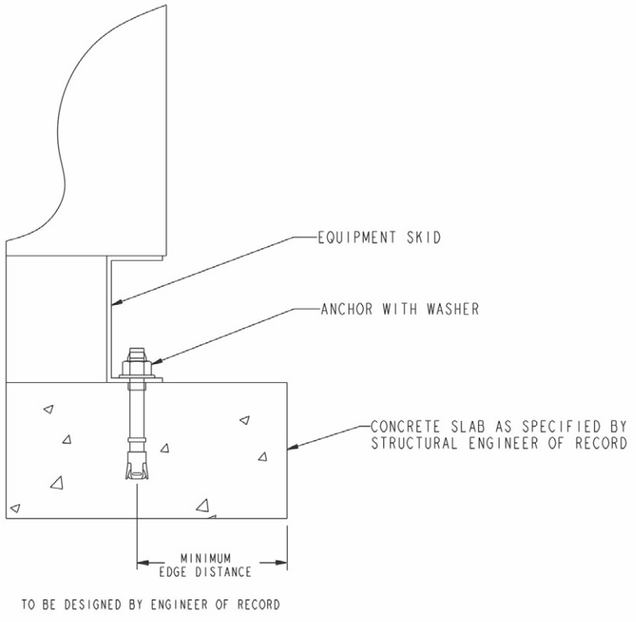
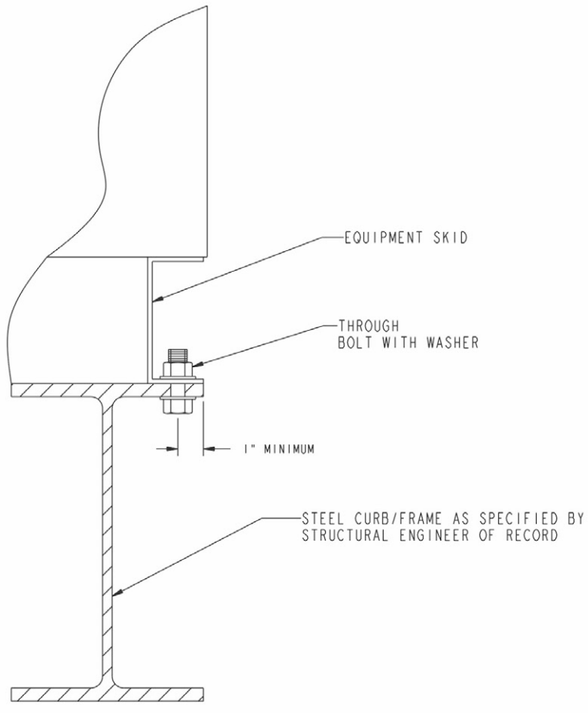


FIGURE 84. SEISMIC INSTALLATION REQUIREMENTS (SHEET 3 OF 4)

REL NO	LTR	NO	REVISION	DWN	CKD	APVD	DATE
ECO-152302	C	9	ZONE A5,WAS REFER---LOCATION	RAH	ELN	E.NORDSTROM	05MAY15
		10	ZONE C2,WAS EQUIPMENT---MOUNT	RAH	ELN	E.NORDSTROM	05MAY15



CONCRETE CONNECTION



STEEL CONNECTION

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
SIM TO NONE
DO NOT SCALE PRINT
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FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ASME Y14.5M-1994
DWN D HOFMEISTER
CKD D HOFMEISTER
APVD E NORDSTROM
DATE 28FEB15
FIRST USED ON ARROW
SITE CODE PGF
CUMMINS POWER GENERATION
INSTALLATION,GENSET SEISMIC REQUIREMENTS
SIZE D | A051N157 | SHEET 4 OF 4 | REV C

FIGURE 85. SEISMIC INSTALLATION REQUIREMENTS (SHEET 4 OF 4)

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