Service Manual

Our energy working for you.™

Power Generation

Controller

PowerCommand® 1301

English – Original Instructions 6–2010 A031B792 (Issue 1)

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Safety Precautions

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

Before operating the generator set (genset), read the Operator's Manual and become familiar with it and the equipment. **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.

The following symbols, found throughout this manual, alert you to potentially dangerous conditions to the operator, service personnel, or the equipment.

⚠ DANGER ***This symbol warns of immediate hazards which will result in severe personal injury or death.***

⚠WARNING ***This symbol refers to a hazard or unsafe practice which can result in severe personal injury or death.***

⚠CAUTION ***This symbol refers to a hazard or unsafe practice which can result in personal injury or product or property damage.***

FUEL AND FUMES ARE FLAMMABLE

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

- DO NOT fill fuel tanks while engine is running, unless 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 zinc coated or copper fuel lines with diesel fuel.
- Natural gas is lighter than air, and will tend to gather under hoods. Propane is heavier than air, and will tend to gather in sumps or low areas. NFPA code requires all persons handling propane to be trained and qualified.
- Be sure all fuel supplies have a positive shutoff valve.
- Be sure 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.

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 for leaks daily or per the maintenance schedule. Make sure that exhaust manifolds are secured and not warped. Do not use exhaust gases to heat a compartment.
- The exhaust vent should be high enough to help clear gases, avoid accumulation of snow, and in accordance with local mechanical codes.
- Be sure the unit is well ventilated.
- Engine exhaust and some of its constituents are known to the state of California to cause cancer, birth defects, and other reproductive harm.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Keep your hands, clothing, and jewelry away from moving parts.
- Before starting work on the generator set, disconnect battery charger from its AC source, then disconnect starting batteries, negative (–) cable first. In lean-burn natural gas (LBNG) gensets, also make sure the starter's air supply line is disconnected or completely vented until the generator set is ready to start. This will prevent accidental starting.
- Make sure that fasteners on the generator set are secure. Tighten supports and clamps, keep guards in position over fans, drive belts, etc.

- Do not wear loose clothing or jewelry in the vicinity of moving parts, or while working on electrical equipment. Loose clothing and jewelry can become caught in moving parts.
- If adjustment must be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.

DO NOT OPERATE IN FLAMMABLE AND EXPLOSIVE ENVIRONMENTS

Flammable vapor can cause an engine to overspeed and become difficult to stop, resulting in possible fire, explosion, severe personal injury and death. Do not operate a genset where a flammable vapor environment can be created by fuel spill, leak, etc., unless the genset is equipped with an automatic safety device to block the air intake and stop the engine. The owners and operators of the genset are solely responsible for operating the genset safely. Contact your authorized Cummins Power Generation distributor for more information.

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Remove electric power before removing protective shields or touching electrical equipment. Use rubber insulative mats placed on dry wood platforms over floors that are metal or concrete when around electrical equipment. Do not wear damp clothing (particularly wet shoes) or allow skin surface to be damp when handling electrical equipment. Do not wear jewelry. Jewelry can short out electrical contacts and cause shock or burning.
- Use extreme caution when working on electrical components. High voltages can cause injury or death. DO NOT tamper with interlocks.
- Follow all applicable state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician. Tag and lock open switches to avoid accidental closure.
- DO NOT CONNECT GENERATOR SET DIRECTLY TO ANY BUILDING ELECTRICAL SYSTEM. Hazardous voltages can flow from the generator set into the utility line. This creates a potential for electrocution or property damage. Connect only through an approved isolation switch or an approved paralleling device.

MEDIUM VOLTAGE GENERATOR SETS (601V to 15kV)

- Medium voltage acts differently than low voltage. Special equipment and training is required to work on or around medium voltage equipment. Operation and maintenance must be done only by persons trained and qualified to work on such devices. Improper use or procedures will result in severe personal injury or death.
- Do not work on energized equipment. Unauthorized personnel must not be permitted near energized equipment. Due to the nature of medium voltage electrical equipment, induced voltage remains even after the equipment is disconnected from the power source. Plan the time for maintenance with authorized personnel so that the equipment can be deenergized and safely grounded.

GENERAL SAFETY PRECAUTIONS

- Coolants under pressure have a higher boiling point than water. DO NOT open a radiator or heat exchanger pressure cap while the engine is running. To prevent severe scalding, let engine cool down before removing coolant pressure cap. Turn cap slowly, and do not open it fully until the pressure has been relieved.
- Used engine oils have been identified by some state or federal agencies as causing cancer or reproductive toxicity. When checking or changing engine oil, take care not to ingest, breathe the fumes, or contact used oil.
- Keep multi-class ABC fire extinguishers handy. Class A fires involve ordinary combustible materials such as wood and cloth; Class B fires, combustible and flammable liquid fuels and gaseous fuels; Class C fires, live electrical equipment. (ref. NFPA No. 10).
- Make sure that rags or combustible material are not left on or near the generator set.
- Make sure generator set is mounted in a manner to prevent combustible materials from accumulating under or near the unit.
- Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and engine damage which present a potential fire hazard.
- Keep the generator set and the surrounding area clean and free from obstructions. Re-

move any debris from the set and keep the floor clean and dry.

- Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment unsafe.

- Substances in exhaust gases have been identified by some state or federal agencies as causing cancer or reproductive toxicity. Take care not to breath or ingest or come into contact with exhaust gases.

- Do not store any flammable liquids, such as fuel, cleaners, oil, etc., near the generator set. A fire or explosion could result.
- Wear hearing protection when near an operating generator set.
- To prevent serious burns, avoid contact with hot metal parts such as radiator system, turbo charger system and exhaust system.

KEEP THIS MANUAL NEAR THE GENSET FOR EASY REFERENCE

DISPOSE OF THIS UNIT PROPERLY

List of Acronyms

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

ACRONYM	DESCRIPTION
AC	Alternating Current
AMP	AMP, Inc., part of Tyco Electronics
ASTM	American Society for Testing and Materials (ASTM International)
ATS	Automatic Transfer Switch
AVR	Automatic Voltage Regulator
AWG	American Wire Gauge
CAN	Controlled Area Network
CB	Circuit Breaker
CE	Conformité Européenne
CGT	Cummins Generator Technologies
CT	Current Transformer
DC	Direct Current
ECM	Engine Control Module
ECS	Engine Control System
EMI	Electromagnetic Interference
EN	European Standard
EPS	Engine Protection System
E-Stop	Emergency Stop
FAE	Full Authority Electronic
FMI	Failure Mode Identifier
FSO	Fuel Shutoff
genset	Generator Set
GCS	Genset Control System
GND	Ground
HMI	Human-machine Interface
IC	Integrated Circuit
ISO	International Organization for Standardization
LBNG	Lean-burn Natural Gas
LCD	Liquid Crystal Display
LCL	Low Coolant Level
LCT	Low Coolant Temperature
LED	Light-emitting Diode
Mil Std	Military Standard
NC	Not Connected Normally Closed
NFPA	National Fire Protection Agency
NO	Normally Open
NWF	Network Failure
OEM	Original Equipment Manufacturer
OOR	Out of Range
OORH ORH	Out of Range High
OORL ORL	Out of Range Low
PB	Push Button
PC	Personal Computer
PCC	PowerCommand® Controller
PGI	Power Generation Interface
PGN	Parameter Group Number
PI	Proportional/Integral
PID	Proportional/Integral/Derivative
PLC	Programmable Logic Controller
PMG	Permanent Magnet Generator
PT	Potential Transformer
PTC	Power Transfer Control
PWM	Pulse-width Modulation
RFI	Radio Frequency Interference
RH	Relative Humidity
RMS	Root Mean Square
RTU	Remote Terminal Unit
SAE	Society of Automotive Engineers
SPN	Suspect Parameter Number
SW_B+	Switched B+
UL	Underwriters Laboratories

TERM	DEFINITION
Normally-closed Normally-open	Some inputs and outputs use open circuits and short circuits to distinguish between active and inactive. If an input or output is normally-closed, an open circuit means the input or output is active, and a short circuit means the input or output is inactive. If an input or output is normally-open, a short circuit means the input or output is active, and an open circuit means the input or output is inactive.
Parameter	Refers to monitored values or settings in the PCC or the Operator Panel that can be looked at and, in some cases, adjusted. Some parameters are protected by passwords. In this manual, *italics* are used to identify a specific parameter by name.
Pin	A specific point on the PCC or the Operator Panel to which it is acceptable to connect a specific point on an external device. For example, a B+ pin might be connected to the positive terminal on the battery. It takes more than one pin to connect an external device to the PCC. For example, it takes B+ and Ground to connect the battery to the PCC. Depending on the access you have to the controller, you might see a specific pin on the PCC base board, the terminal at the end of a harness, a wire that runs between the PCC and the external device, or nothing at all.
Sensor	Refers to a device that measures something and reports one of many (or unlimited) values. For example, an oil pressure sensor reports the current oil pressure.
Sequence of operation	A term used to describe the steps the PCC follows when it starts the genset or when it stops the genset.
Signal	A term used for convenience to talk about two or more connections as a single input. Usually, all of these connections have the same effect on the PCC's behavior, and it does not matter which connection is active. For example, the term "remote start signal" is used frequently. In Auto mode, the PCC starts the genset when the remote start signal is active. The remote start signal may come from any of several connections: a switch connected to the remote start pin, the Operator Panel, a PLC (programmable logic controller) connected on Modbus, InPower, etc. It is not important between these connections when explaining the way the remote start signal affects the PCC's decisions to start and stop the genset. It is only important whether or not any of them are active.
Switch	Refers to a device that measures something and reports one of two states, active or inactive, about something. For example, a low coolant level switch is active when the coolant level is too low, but the low coolant level switch does not report what the coolant level really is. In some cases, this may refer to a physical switch (similar to a light switch) instead.
Trim	Refers to the subset of parameters that can be adjusted, as opposed to parameters that can only be monitored.

1. Introduction

Read ***Safety Precautions***, and carefully observe all of the instructions in this manual. Keep this manual with the other generator set and/or controller manuals.

ABOUT THIS MANUAL

You should have a basic understanding of generator and power generation before you read this manual.

This is the service manual for the PCC 1301. It is not the service manual for the generator set ("genset") or any accessories.

SYSTEM OVERVIEW

The PCC is a microprocessor-based control for Cummins Power Generation generator sets. All generator set control functions are contained on one circuit board (Base board). The Base board provides fuel control, main alternator voltage output regulation and complete generator set control and monitoring.

The operating software provides control of the generator set and its performance characteristics, and displays performance information on a digital display panel. It accepts menu-driven control and set-up input from the push button switches on the front panel.

TEST EQUIPMENT

To perform the test procedures in this manual, the following test equipment must be available

- True RMS meter for accurate measurement of small AC and DC voltages. Fluke models 87 or 8060A are good choices.
- Grounding wrist strap to prevent circuit board damage due to electrostatic discharge (ESD).
- Battery Hydrometer.
- Jumper Leads.
- Tachometer or Frequency Meter.
- Wheatstone Bridge or Digital Ohmmeter.
- Variac.
- Load Test Panel.
- Megger or Insulation Resistance Meter.
- InPower™ Service Tool (PC based genset service tool).
- PCC1301 Interface Kit (Used with InPower Service Tool)

HOW TO OBTAIN SERVICE

Always give the complete Model, Specification and Serial number of the generator set as shown on the nameplate when seeking additional service information or replacement parts. The nameplate is located on the back of the control box.

⚠WARNING ***Incorrect service or replacement of parts can result in severe personal injury or death, and/or equipment damage. Service personnel must be trained and experienced to perform electrical and mechanical service. Read and follow Important Safety Instructions on pages iii and iv.***