



**Bill of Materials**

Feature Code	Description	Qty
DQFAD US-Stat 1000DQFAD A331-2 L170-2 L090-2 H609-2 H704-2 H678-2 KP74-2 KU67-2 H536-2 KU93-2 KP87-2 L228-2 KB73-2 H723-2 KR01-2 D041-2 B786-2 E126-2 H389-2 E098-2 H557-2 R002-2 L028-2 BC34-2 L050-2 A412-2 A292-2 F205-2 P178-2 F194-2 F208-2 F211-2 F224-2 H657-2 K102-2 KS47-2	<b>DQFAD, Commercial Diesel Generator Set, 1000kW Standby 60Hz</b> U.S. EPA, Stationary Emergency Application 1000DQFAD, Diesel Genset, 60Hz, 1000kW Duty Rating-Standby Power (ESP) Emission Certification, EPA, Tier 2, NSPS CI Stationary Emergency Listing-UL 2200 Control Mounting-Left Facing PowerCommand 3.3 Controller, Paralleling Capable LCD Control Display Stop Switch-Emergency, Externally Mounted Relays-Paralleling Circuit Breaker Control Control Display Language-English Circuit Breaker or Entrance Box or Terminal Box-Left Only Circuit Breaker-1600, Left, 3P, UL 600, IEC 415, UL Serv Ent 100% Cert-Seismic, IBC2000, IBC2003, IBC2006, IBC2009, IBC2011 Bottom Entry, Left Indication-Ground Fault, Terminal Box (or) Circuit Breaker Box-Left Circuit Breaker Lugs-Mechanical, Left Side Engine Air Cleaner-Normal Duty External Battery Charger-12 Amp, Regulated Engine Cooling-Radiator, Enhanced High Ambient Air Temperature, Ship Fitted Shutdown-Low Coolant Level Sight Glass-Coolant Level Coolant Heater-208/240/480 Volts AC, Below 40F Ambient Temperature Voltage-277/480, 3 Phase, Wye, 4 Wire Genset Warranty-2 Years Base Alternator-60Hz, Wye, BR, 125/105C-Standby/Prime Literature-English Packing-None, Base Mounted Housing Alternator Heater, 120 Volt AC Aluminum Sound Attenuated Level 2 Enclosure, with Exhaust System Enclosure Color-Sandstone, Aluminum Vibration Isolators-Earthquake Certified Cooling Air Outlet-Horizontal, Sound Attenuated Louvers-Air Inlet, 24 Volts AC Motor Closed, Spring Opened Louvers-Air Outlet, Gravity Close Distribution Panel-Prewired AC Features Service Receptacle-120V, 20A, External GFCI, NEMA 5-20R Enclosure Lighting-120 Volts AC	1
A045J201	<b>Annunciator-panel mount with enclosure (RS485)</b>	1



# Diesel generator set QST30 series engine

680 kW - 1000 kW 60 Hz



## Description

Cummins® commercial generator sets are fully integrated power generation systems providing optimum performance, reliability and versatility for stationary Standby and Prime power applications.

## Features

**Cummins heavy-duty engine** - Rugged 4-cycle, industrial diesel delivers reliable power, low emissions and fast response to load changes.

**Alternator** - Several alternator sizes offer selectable motor starting capability with low reactance 2/3 pitch windings, low waveform distortion with non-linear loads and fault clearing short-circuit capability.

**Permanent Magnet Generator (PMG)** - Offers enhanced motor starting and fault clearing short circuit capability.

**Circuit breakers** - Option for manually-and/or electrically-operated circuit breakers.

**Control system** - The PowerCommand® electronic control is standard equipment and provides total generator set system integration including automatic remote starting/stopping, precise frequency and voltage regulation, alarm and status message display, AmpSentry™ protection, output metering, auto-shutdown at fault detection and NFPA 110 Level 1 compliance.

**Masterless Paralleling** - An optional electrically operated circuit breaker can be added for a simple masterless paralleling solution.

**Cooling system** - Standard integral set-mounted radiator system, designed and tested for rated ambient temperatures, simplifies facility design requirements for rejected heat.

**NFPA** - The generator set accepts full rated load in a single step in accordance with NFPA 110 for Level 1 systems.

**Warranty and service** - Backed by a comprehensive warranty and worldwide distributor network.

Model	Standby rating	Prime rating	Continuous rating	Data sheets
	60 Hz kW (kVA)	60 Hz kW (kVA)	60 Hz kW (kVA)	60 Hz
DQFAA	750 (938)	680 (850)		D-3329
DQFAB	800 (1000)	725 (907)		D-3330
DQFAC	900 (1125)	818 (1023)		D-3331
DQFAD	1000 (1250)	900 (1125)		D-3332

## Generator set specifications

Governor regulation class	ISO 8528 Part 1 Class G2
Voltage regulation, no load to full load	± 0.5%
Random voltage variation	± 0.5%
Frequency regulation	Isochronous
Random frequency variation	± 0.25%
Radio frequency emissions compliance	IEC 61000-4-2: Level 4 Electrostatic discharge IEC 61000-4-3: Level 3 Radiated susceptibility

## Engine specifications

Bore	140 mm (5.51 in.)
Stroke	165.0 mm (6.5 in.)
Displacement	30.5 L (1860 in <sup>3</sup> )
Cylinder block	Cast iron, V 12 cylinder
Battery capacity	1600 amps minimum at ambient temperature of -18 °C to 0 °C (0 °F to 32 °F)
Battery charging alternator	35 amps
Starting voltage	24 volt, negative ground
Fuel system	Direct injection: number 2 diesel fuel, fuel filter, automatic electric fuel shutoff
Fuel filter	Triple element, 10 micron filtration, spin-on fuel filters with water separator
Air cleaner type	Dry replaceable element
Lube oil filter type(s)	Four spin-on, combination full flow filter and bypass filters
Standard cooling system	High ambient radiator

## Alternator specifications

Design	Brushless, 4 pole, drip-proof, revolving field
Stator	2/3 pitch
Rotor	Single bearing flexible discs
Insulation system	Class H on low and medium voltage, Class F on high voltage
Standard temperature rise	125 °C Standby at 40 °C ambient
Exciter type	PMG (Permanent Magnet Generator)
Phase rotation	A (U), B (V), C (W)
Alternator cooling	Direct drive centrifugal blower fan
AC waveform Total Harmonic Distortion (THDV)	< 5% no load to full linear load, < 3% for any single harmonic
Telephone Influence Factor (TIF)	< 50 per NEMA MG1-22.43
Telephone Harmonic Factor (THF)	< 3

## Available voltages

### 60 Hz Line – Neutral/Line - Line

• 120/208	• 220/380	• 240/416	• 347/600
• 139/240	• 230/400	• 277/480	

Note: Consult factory for other voltages.

## Generator set options

### Engine

- 208/240/480 V coolant heater for ambient above 4.5 °C (40 °F)
- 208/240/480 V coolant heater for ambient below 4.5 °C (40 °F)

### Control panel

- PowerCommand 3.3 with Masterless Load Demand (MLD)
- Run relay package
- Ground fault indication
- Paralleling configuration

- Remote fault signal package
- Exhaust gas temperature sensor
- 120/240 V 100 W control anti-condensation heater

### Alternator

- 80 °C rise
- 105 °C rise
- 125 °C rise
- 120/240 V 300 W anti-condensation heater
- Temperature sensor - RTDs, 2-phase

- Temperature sensor – alternator bearing RTD
- Differential current transformers

### Exhaust system

- Critical grade exhaust silencer
- Exhaust packages
- Industrial grade exhaust silencer
- Residential grade exhaust silencer

### Cooling system

- High ambient 50 °C radiator

### Generator set

- AC entrance box
- Battery
- Battery rack with hold-down - floor standing
- Circuit breaker - set mounted
- Disconnect switch - set mounted
- PowerCommand network
- Remote annunciator panel
- Spring isolators
- 2 year warranty
- 5 year warranty
- 10 year major components warranty

Note: Some options may not be available on all models - consult factory for availability.

## PowerCommand 3.3 Control System



An integrated microprocessor based generator set control system providing voltage regulation, engine protection, alternator protection, operator interface and isochronous governing. Refer to document S-1570 for more detailed information on the control.

**AmpSentry** – Includes integral AmpSentry protection, which provides a full range of alternator protection functions that are matched to the alternator provided.

**Power management** – Control function provides battery monitoring and testing features and smart starting control system.

**Advanced control methodology** – Three phase sensing, full wave rectified voltage regulation, with a PWM output for stable operation with all load types.

**Communications interface** – Control comes standard with PCCNet and Modbus® interface.

**Regulation compliant** – Prototype tested: UL, CSA and CE compliant.

**Service** - InPower™ PC-based service tool available for detailed diagnostics, setup, data logging and fault simulation.

**Easily upgradeable** – PowerCommand controls are designed with common control interfaces.

**Reliable design** – The control system is designed for reliable operation in harsh environment.

**Multi-language support**

### Operator panel features

#### Operator/display functions

- Displays paralleling breaker status
- Provides direct control of the paralleling breaker
- 320 x 240 pixels graphic LED backlight LCD

- Auto, manual, start, stop, fault reset and lamp test/panel lamp switches
- Alpha-numeric display with pushbuttons
- LED lamps indicating generator set running, remote start, not in auto, common shutdown, common warning, manual run mode, auto mode and stop

#### Paralleling control functions

- First Start Sensor System selects first generator set to close to bus
- Phase Lock Loop Synchronizer with voltage matching
- Sync check relay
- Isochronous kW and kVar load sharing
- Load govern control for utility paralleling
- Extended Paralleling (Base Load/Peak Shave) Mode
- Digital power transfer control, for use with a breaker pair to provide open transition, closed transition, ramping closed transition, peaking and base load functions,
- Alternator data
- Line-to-Neutral and Line-to-Line AC volts
- 3-phase AC current
- Frequency
- kW, kVar, power factor kVA (three phase and total)
- Engine data
- DC voltage
- Engine speed
- Lube oil pressure and temperature
- Coolant temperature
- Comprehensive FAE data (where applicable)
- Other data
- Genset model data
- Start attempts, starts, running hours, kW hours
- Load profile (operating hours at % load in 5% increments)
- Fault history
- Data logging and fault simulation (requires InPower)



## Standard control functions

### Digital governing

- Integrated digital electronic isochronous governor
- Temperature dynamic governing

### Digital voltage regulation

- Integrated digital electronic voltage regulator
- 3-phase, 4-wire Line-to-Line sensing
- Configurable torque matching

### AmpSentry AC protection

- AmpSentry protective relay
- Over current and short circuit shutdown
- Over current warning
- Single and three phase fault regulation
- Over and under voltage shutdown
- Over and under frequency shutdown
- Overload warning with alarm contact
- Reverse power and reverse Var shutdown
- Field overload shutdown

### Engine protection

- Battery voltage monitoring, protection and testing
- Overspeed shutdown
- Low oil pressure warning and shutdown
- High coolant temperature warning and shutdown
- Low coolant level warning or shutdown
- Low coolant temperature warning
- Fail to start (overcrank) shutdown
- Fail to crank shutdown
- Cranking lockout
- Sensor failure indication
- Low fuel level warning or shutdown
- Fuel-in-rupture-basin warning or shutdown
- Full authority electronic engine protection

### Control functions

- Time delay start and cool down
- Real time clock for fault and event time stamping
- Exerciser clock and time of day start/stop
- Data logging
- Cycle cranking
- Load shed
- Configurable inputs and outputs (4)
- Remote emergency stop

### Options

- Auxiliary output relays (2)

## Ratings definitions

### Emergency Standby Power (ESP):

Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

### Limited-Time Running Power (LTP):

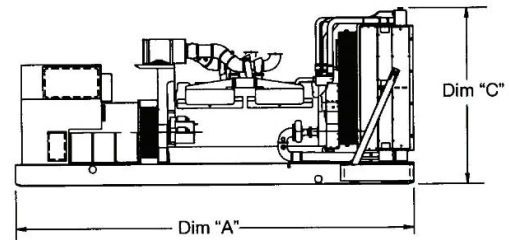
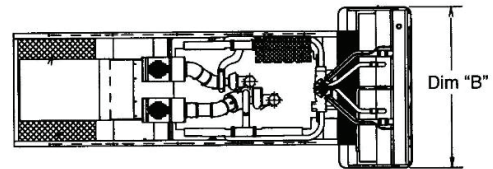
Applicable for supplying power to a constant electrical load for limited hours. Limited-Time running Power (LTP) is in accordance with ISO 8528.

### Prime Power (PRP):

Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

### Base Load (Continuous) Power (COP):

Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514.



- This outline drawing is for reference only. See respective model data sheet for specific model outline drawing number.





Model	Dim 'A' mm (in.)	Dim 'B' mm (in.)	Dim 'C' mm (in.)	Set Weight dry* (lb)	Set Weight wet* (lb)
DQFAA	4287 (168.8)	1990 (78.3)	2355 (92.7)	6671 (14707)	6969 (15363)
DQFAB	4287 (168.8)	1990 (78.3)	2355 (92.7)	6894 (15199)	7192 (15855)
DQFAC	4287 (168.8)	1990 (78.3)	2355 (92.7)	7373 (16254)	7670 (16910)
DQFAD	4287 (168.8)	1990 (78.3)	2355 (92.7)	7631 (16824)	7929 (17480)

\* Weights represent a set with standard features. See outline drawings for weights of other configurations.

see below drawings for overall shipping weight and dimensions

## Codes and standards

Codes or standards compliance may not be available with all model configurations – consult factory for availability.

 <p>This generator set is designed in facilities certified to ISO 9001 and manufactured in facilities certified to ISO 9001 or ISO 9002.</p>	 <p>The generator set is available listed to UL 2200, Stationary Engine Generator Assemblies for all 60 Hz low voltage models. The PowerCommand control is Listed to UL 508 - Category NITW7 for U.S. and Canadian usage. Circuit breaker assemblies are UL 489 Listed for 100% Continuous operation and also UL 869A Listed Service Equipment.</p>
 <p>The Prototype Test Support (PTS) program verifies the performance integrity of the generator set design. Cummins products bearing the PTS symbol meet the prototype test requirements of NFPA 110 for Level 1 systems.</p>	<p><b>U.S. EPA</b></p> <p>Engine certified to Stationary Emergency U.S. EPA New Source Performance Standards, 40 CFR 60 subpart IIII Tier 2 exhaust emission levels. U.S. applications must be applied per this EPA regulation.</p>
 <p>All low voltage models are CSA certified to product class 4215-01.</p>	<p><b>International Building Code</b></p> <p>The generator set package is available certified for seismic application in accordance with the following International Building Code: IBC2000, IBC2003, IBC2006, IBC2009 and IBC2012.</p>

**Warning:** Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

For more information contact your local Cummins distributor or visit [power.cummins.com](http://power.cummins.com)

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## Generator Set Data Sheet



**Model:** DQFAD  
**Frequency:** 60 Hz  
**Fuel Type:** Diesel  
**kW Rating:** 1000 Standby  
 900 Prime

**Emissions level:** EPA NSPS Stationary Emergency Tier 2

Exhaust emission data sheet:	EDS-1063
Exhaust emission compliance sheet:	EPA-1097
Sound performance data sheet:	MSP-1038
Cooling performance data sheet:	MCP-156
Prototype test summary data sheet:	PTS-266
Standard set-mounted radiator cooling outline:	A049K674
Optional remote radiator cooling outline:	A053G787

Fuel Consumption	Standby				Prime				Continuous
	kW (kVA)				kW (kVA)				kW (kVA)
Ratings	1000 (1250)				900 (1125)				
Load	1/4	1/2	3/4	Full	1/4	1/2	3/4	Full	Full
US gph	18.7	36.4	54.2	71.9	16.9	32.4	48.0	63.5	
L/hr	70.6	137.8	205.1	272.3	64.0	122.8	181.5	240.3	

Engine	Standby rating	Prime rating	Continuous rating
Engine manufacturer	Cummins Inc.		
Engine model	QST30-G5 NR2		
Configuration	Cast iron, V 12 cylinder		
Aspiration	Turbocharged and low temperature after-cooled		
Gross engine power output, kWm (bhp)	1112 (1490)	1007 (1350)	
BMEP at set rated load, kPa (psi)	2417 (351)	2160 (313)	
Bore, mm (in.)	140 (5.51)		
Stroke, mm (in.)	165 (6.5)		
Rated speed, rpm	1800		
Piston speed, m/s (ft/min)	9.91 (1950)		
Compression ratio	14.7:1		
Lube oil capacity, L (qt)	154 (162.8)		
Overspeed limit, rpm	2100 ±50		
Regenerative power, kW	82		

Fuel Flow		
Maximum fuel flow, L/hr (US gph)	570 (150)	
Maximum fuel inlet restriction, kPa (in Hg)	27 (8.0)	
Maximum fuel inlet temperature, °C (°F)	66 (150)	

<b>Air</b>	<b>Standby rating</b>	<b>Prime rating</b>	<b>Continuous rating</b>
Combustion air, m <sup>3</sup> /min (scfm)	88 (3150)	81 (2880)	
Maximum air cleaner restriction, kPa (in H <sub>2</sub> O)	6.2 (25)		
Alternator cooling air, m <sup>3</sup> /min (cfm)	204 (7300)		

### **Exhaust**

Exhaust flow at set rated load, m <sup>3</sup> /min (cfm)	211 (7540)	195 (6950)	
Exhaust temperature, °C (°F)	477 (890)	467 (873)	
Maximum back pressure, kPa (in H <sub>2</sub> O)	6.8 (27)		

### **Standard Set-Mounted Radiator Cooling**

Ambient design, °C (°F)	<b>50 (122)</b>		
Fan load, kW <sub>m</sub> (HP)	19.0 (25.5)		
Coolant capacity (with radiator), L (US gal)	167 (44)		
Cooling system air flow, m <sup>3</sup> /min (scfm)	1115 (38800)		
Total heat rejection, MJ/min (Btu/min)	49.1 (46545)	44.07 (41775)	
Maximum cooling air flow static restriction, kPa (in H <sub>2</sub> O)	0.12 (0.5)		
Maximum fuel return line restriction kPa (in Hg)	67.5 (20)		

### **Optional Heat Exchanger Cooling**

Set coolant capacity, L (US gal)			
Heat rejected, jacket water circuit, MJ/min (Btu/min)			
Heat rejected, aftercooler circuit, MJ/min (Btu/min)			
Heat rejected, fuel circuit, MJ/min (Btu/min)			
Total heat radiated to room, MJ/min (Btu/min)			
Maximum raw water pressure, jacket water circuit, kPa (psi)			
Maximum raw water pressure, aftercooler circuit, kPa (psi)			
Maximum raw water pressure, fuel circuit, kPa (psi)			
Maximum raw water flow, jacket water circuit, L/min (US gal/min)			
Maximum raw water flow, aftercooler circuit, L/min (US gal/min)			
Maximum raw water flow, fuel circuit, L/min (US gal/min)			
Minimum raw water flow at 27 °C (80 °F) inlet temp, jacket water circuit, L/min (US gal/min)			
Minimum raw water flow at 27 °C (80 °F) inlet temp, aftercooler circuit, L/min (US gal/min)			
Minimum raw water flow at 27 °C (80 °F) inlet temp, fuel circuit, L/min (US gal/min)			
Raw water delta P at min flow, jacket water circuit, kPa (psi)			
Raw water delta P at min flow, aftercooler circuit, kPa (psi)			
Raw water delta P at min flow, fuel circuit, kPa (psi)			
Maximum jacket water outlet temp, °C (°F)			
Maximum aftercooler inlet temp, °C (°F)			
Maximum aftercooler inlet temp at 25 °C (77 °F) ambient, °C (°F)			
Maximum fuel return line restriction, kPa (in Hg)			

<b>Optional Remote Radiator Cooling<sup>1</sup></b>	<b>Standby rating</b>	<b>Prime rating</b>	<b>Continuous rating</b>
Set coolant capacity, L (US gal)			
Max flow rate at max friction head, jacket water circuit, L/min (US gal/min)	992 (262)		
Max flow rate at max friction head, aftercooler circuit, L/min (US gal/min)	303 (80)		
Heat rejected, jacket water circuit, MJ/min (Btu/min)	22.67 (21500)	21.01 (19925)	
Heat rejected, aftercooler circuit, MJ/min (Btu/min)	18.35 (17400)	15.69 (14885)	
Heat rejected, fuel circuit, MJ/min (Btu/min)			
Total heat radiated to room, MJ/min (Btu/min)	6.1 (5753)	5.6 (5301)	
Maximum friction head, jacket water circuit, kPa (psi)	69 (10)		
Maximum friction head, aftercooler circuit, kPa (psi)	48 (7)		
Maximum static head, jacket water circuit, m (ft)	14 (46)		
Maximum static head, aftercooler circuit, m (ft)	14 (46)		
Maximum jacket water outlet temp, °C (°F)	104 (220)	100 (212)	
Maximum aftercooler inlet temp at 25 °C (77 °F) ambient, °C (°F)	41 (105)		
Maximum aftercooler inlet temp, °C (°F)	62 (143)	56 (133)	
Maximum fuel flow, L/hr (US gph)			
Maximum fuel return line restriction, kPa (in Hg)	67.5 (20)		

## Weights<sup>2</sup>

Unit dry weight kgs (lbs)	7594 (16742)
Unit wet weight kgs (lbs)	7857 (17322)

### Notes:

<sup>1</sup> For non-standard remote installations contact your local Cummins representative.

<sup>2</sup> Weights represent a set with standard features. See outline drawing for weights of other configurations.

## Derating Factors

<b>Standby</b>	Engine power available up to 701 m (2300 ft) at ambient temperatures up to 40 °C (104 °F). Above these elevations, derate at 3.5% per 305 m (1000 ft) and 7% per 10 °C (18°F).
<b>Prime</b>	Engine power available up to 727 m (2385 ft) at ambient temperatures up to 40 °C (104 °F). Above these elevations, derate at 3.5% per 305 m (1000 ft) and 7% per 10 °C (18 °F).
<b>Continuous</b>	

## Ratings Definitions

<b>Emergency Standby Power (ESP):</b>	<b>Limited-Time Running Power (LTP):</b>	<b>Prime Power (PRP):</b>	<b>Base Load (Continuous) Power (COP):</b>
Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.	Applicable for supplying power to a constant electrical load for limited hours. Limited-Time Running Power (LTP) is in accordance with ISO 8528.	Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.	Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) is in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514. No sustained overload capability is available at this rating.

## Alternator Data

Voltage	Connection <sup>1</sup>	Temp rise degrees C	Duty <sup>2</sup>	Single phase factor <sup>3</sup>	Max surge kVA <sup>4</sup>	Surge kW	Winding No.	Alternator data sheet	Feature code
208-240/416-480	Wye	125/105	S/P		4725	1034	311	ADS-633	BC34-2
380-480	Wye	125/105	S/P		4602	1018	312	ADS-330	B282-2
600	Wye	125/105	S/P		3866	1021	7	ADS-311	B300-2
380-480	Wye	105/80	S/P		4602	1018	312	ADS-330	B283-2
600	Wye	105/80	S/P		4234	1024	7	ADS-312	B301-2
380-480	Wye	80	S		5521	1024	312	ADS-331	B284-2
600	Wye	80	S		4602	1004	7	ADS-330	B604-2

### Notes:

<sup>1</sup> Limited single phase capability is available from some three phase rated configurations. To obtain single phase rating, multiply the three phase kW rating by the Single Phase Factor<sup>3</sup>. All single phase ratings are at unity power factor.

<sup>2</sup> Standby (S), Prime (P) and Continuous ratings (C).

<sup>3</sup> Factor for the *Single phase output from Three phase alternator* formula listed below.

<sup>4</sup> Maximum rated starting kVA that results in a minimum of 90% of rated sustained voltage during starting.

## Formulas for Calculating Full Load Currents:

### Three phase output

$$\frac{\text{kW} \times 1000}{\text{Voltage} \times 1.73 \times 0.8}$$

### Single phase output

$$\frac{\text{kW} \times \text{SinglePhaseFactor} \times 1000}{\text{Voltage}}$$

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**Our energy working for you.™**





# PowerCommand® 3.3 Generator Set Digital Integrated Control System



Bargraph Optional

## Introduction

The PowerCommand® 3.3 control system is a microprocessor-based generator set monitoring, metering, and control system, which is comprised of PowerCommand® Control 3300 and the Human Machine Interface 320. PCC3300 supports multiple operation modes including:

- Standalone,
- Synchronization only,
- Isolated bus paralleling,
- Utility single generator set paralleling,
- Utility multiple generator set paralleling,
- Utility single generator set paralleling with power transfer control (automatic mains failure),
- Isolated bus paralleling with Masterless Load Demand

PowerCommand® Control 3300 is designed to meet the exacting demands of the harsh and diverse environments of today's typical power generation applications for Full Authority Electronic or Hydromechanical engine power generator sets.

Offering enhanced reliability and performance over more conventional generator set controls via the integration of all generator control functions into a single system, PCC3300 is your Power of One generator set control solution.

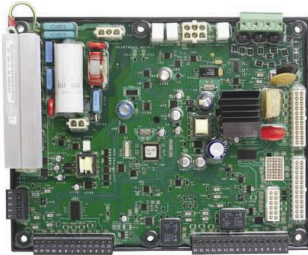
## Benefits and Features

- 320 x 240 pixels graphical LED backlit LCD
- Multiple languages supported
- AmpSentry™ protection provides industry-leading generator overcurrent protection
- Digital Power Transfer Control (Automatic Mains Failure) provides load transfer operation in open transition, closed transition, or soft (ramping) transfer modes

- Extended Paralleling (Peak Shave/Base Load) regulates the genset real and reactive power output while paralleled to the utility. Power can be regulated at either the genset or utility bus monitoring point
- Digital frequency synchronization and voltage matching
- Isochronous Load Sharing
- Droop kW and kVAr control
- Real time clock for fault and event time stamping
- Exerciser clock and time of day start/stop initiate a test with or without load, or a Base Load or Peak Shave session
- Digital automatic voltage regulation is provided using three phase sensing and full wave FET type regulator, which is compatible with either shunt or PMG excited systems with a standard AUX103 AVR or an option for a more powerful high-current field drive capability AUX106 AVR
- Digital engine speed governing is provided on applicable platforms
- Generator set monitoring (including metering) and protection with PCC3300 measuring voltage, current, kW and kVAr offering a measurement accuracy of 1%
- Utility / AC Bus metering and protection with PCC3300 voltage, current, kW and kVAr offering a measurement accuracy of 1%
- 12 V (DC) and 24 V (DC) battery operation
- RS-485 Modbus® interface for interconnecting to customer equipment
- Warranty and service – Cummins Power Generation offers a comprehensive warranty and worldwide distributor service network
- Global regulatory certification and compliance: PCC3300 is suitable for use on gensets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std., UKCA, and CE standards



# PowerCommand® Generator Set Digital Control System PCC 3300



## Introduction

PCC3300 is an industry-leading digital generator set control suitable for usage on a wide range of diesel and lean burn natural gas generator sets in both standalone as well as paralleling applications.

PowerCommand® is compatible with either shunt or PMG excitation, and is suitable for usage with reconnectable or non-reconnectable generators. Configuration for any frequency, voltage and power connection from 120 V (AC) to 600 V (AC) line-to-line or 601 V (AC) to 45k V (AC) with an external PT is supported. The PCC3300 derives its own power from the generator set starting batteries and functions over a voltage range of 8 V (DC) to 30 V (DC).

## Features

- PCC3300 supports configurable control features via software download using InPower PC-compatible software
- 12 V (DC) and 24 V (DC) battery operation
- Digital automatic voltage regulation is provided using three phase sensing and full wave FET type regulator, which is compatible with either shunt or PMG excited systems with a standard AUX103 AVR or an option for a more powerful high-current field drive capability AUX106 AVR
- Digital engine speed governing on applicable platform is provided, which is capable of providing isochronous frequency regulation
- Full authority J1939 CANBus® prime mover communications and control is provided for platforms with an Engine Control Module (ECM)
- AmpSentry™ protection provides industry-leading alternator overcurrent protection:
  - Time-based generator protection applicable to both line-to-line and line-to-neutral, that can detect an unbalanced fault condition and swiftly react appropriately. Balanced faults can also be detected by AmpSentry and appropriate acted upon.
  - Reduces the risk of Arc Flash due to thermal overload or electrical faults by inverse time protection

- Generator set monitoring offers status information for all critical prime mover and generator functions
- AC and DC digital generator set metering is provided. AC measurements are configurable for single or three phase sensing with PCC3300 measuring voltage, current, kW and kVAr offering a measurement accuracy of 1%
- Battery monitoring system continually monitors the battery output and warns of the potential occurrence of a weak battery condition
- Relay drivers for prime mover starter, fuel shutoff (FSO), glow plug/spark ignition power and switched B+ applications are provided
- Integrated generator set protection is offered to protect the prime mover and generator
- Real time clock for fault and event time stamping
- Exerciser clock and time of day start/stop initiate a test with or without load, or a Base Load or Peak Shave session
- Digital Power Transfer Control (Automatic Mains Failure) provides load transfer operation in open transition, closed transition, or soft (ramping) transfer modes
- Extended Paralleling (Peak Shave/Base Load) regulates the genset real and reactive power output while paralleled to the utility. Power can be regulated at either the genset or utility bus monitoring point
- Digital frequency synchronization and voltage matching
- Isochronous Load Sharing
- Droop kW and kVAr Control
- The synchronization check function provides adjustments for phase angle window, voltage window, frequency window and time delay
- Utility / AC Bus metering and protection with PCC3300 voltage, current, kW and kVAr offering a measurement accuracy of 1%
- Advanced serviceability is offered via InPower™, a PC-based software service tool
- PCC3300 is designed for reliable operation in harsh environments with the unit itself being a fully encapsulated module
- RS-485 ModBus interface for interconnecting to customer equipment
- Native on PCC3300: Four discrete inputs, two dry contact relay outputs and two low-side driver outputs are provided and are all configurable.
  - Optional extra PCC3300 input and output capability available via AUX101
- Warranty and service – Cummins Power Generation offers a comprehensive warranty and worldwide distributor service network
- Global regulatory certification and compliance: PCC3300 is suitable for use on gensets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std., UKCA and CE standards

## Base Control Functions

### HMI capability

Options: Local and remote HMI320 options are available

Operator adjustments: The HMI320 includes provisions for many set up and adjustment functions.

Genset hardware data: Access to the control and software part number, genset rating in kVA and genset model number is provided from the HMI320 or InPower.

Data logs: Information concerning all of the following parameters is periodically logged and available for viewing; engine run time, controller on time, number of start attempts, total kilowatt hours, and load profile. (Control logs data indicating the operating hours at percent of rated kW load, in 5% increments. The data is presented on the operation panel based on total operating hours on the generator.)

Fault history: Provides a record of the most recent fault conditions with control date and time stamp. Up to 32 events are stored in the control non-volatile memory.

### Alternator data

- Voltage (single or three phase line-to-line and line-to-neutral)
- Current (single or three phase)
- kW, kVAR, Power Factor, kVA (three phase and total)
- Frequency

For Lean Burn Natural Gas Engine applications:

- Alternator heater status
- Alternator winding temperature (per phase) as well as alternator drive end and non-drive end bearing

### Utility/AC bus data

- Voltage (three phase line-to-line and line-to-neutral)
- Current (three phase and total)
- kW, kVAR, Power Factor, kVA (three phase and total)
- Frequency

AmpSentry: 3x current regulation for downstream tripping/motor inrush management. Thermal damage curve (3-phase short) or fixed timer (2 sec for 1-Phase Short or 5 sec for 2-Phase short).

### Engine data

- Starting battery voltage
- Engine speed
- Engine temperature
- Engine oil pressure
- Engine oil temperature
- Intake manifold temperature
- Coolant temperature
- Comprehensive Full Authority Engine (FAE) data (where applicable)

Lean Burn Natural Gas (LBNG) application parameters include:

- Safety shutoff valve status
- Valve proving status
- Downstream gas pressure
- Gas inlet pressure
- Gas mass flow rate
- Control valve position
- Gas outlet pressure
- Manifold pressure and temperature
- Throttle position
- Compressor outlet pressure
- Turbo speed
- Compressor bypass position
- Cylinder configuration (e.g., drive end and non-drive end configurations)
- Coolant pressure 1 and 2 as well as coolant temperature 1 and 2 for both HT/LT respectively
- Exhaust port temperature (up to 18 cylinders)
- Pre-filter oil pressure
- Exhaust back pressure
- Parent ECM internal temperature and isolated battery voltage
- Speed bias
- Child ECM internal temperature and isolated battery voltage
- Knock level, spark advance, and knock count (for up to 18 cylinders)
- Auxiliary supply disconnect status
- Engine heater status
- Coolant circulating pump status
- Lube oil priming pump status
- Lube oil status
- Oil heater status
- Derate authorization status
- Start system status
- Ventilator fan status
- Ventilation louvre status
- Radiator fan status
- DC PSU status
- Start inhibit/enable status and setup

Service adjustments – The HMI320 includes provisions for adjustment and calibration of genset control functions. Adjustments are protected by a password. Functions include:

- Engine speed governor adjustments
- Voltage regulation adjustments
- Cycle cranking
- Configurable fault set up
- Configurable input and output set up
- Meter calibration
- Paralleling setup
- Display language and units of measurement

## Prime Mover Control

SAE-J1939 CAN interface to full authority ECMs (where applicable). Provides data transfer between genset and engine controller for control, metering and diagnostics.

12 V (DC) or 24 V (DC) nominal battery voltage is supported by PCC3300 for normal operation.

Temperature dependant prime mover governing dynamics: This function is supported enabling the engine to be responsive when warm and more stable when operating at lower temperature via providing control and modification over electronic governing parameters as a function of engine temperature.

Isochronous governing is provided in order to control prime mover speed within  $\pm 0.25\%$  of nominal rated speed for any steady state load from no load to full load. During operation frequency drift should not exceed  $\pm 0.5\%$  of nominal frequency given a 33°C (or 60°F) change in ambient temperature within an eight-hour period.

Droop electronic speed is governing capability is natively offered by PCC3300 to permit droop from 0% to 10% between no load to full load.

Remote start capability is built into the PCC3300 as the unit accepts a ground signal from remote devices to automatically command the starting of the generator set as well as the reaching of rated speed, voltage and frequency or otherwise run at idle speed until prime mover temperature is adequate. The presence of a remote start signal shall cause the PCC3300 to leave sleep mode and return to normal power mode. PCC3300 supports an option for delayed start or stop.

Remote Start Integrity: In compliance with NEC2017 Start Signal Integrity standard – NFPA70 Article 700.10(D)(3), the remote start circuit from ATS to PCC3300 is continuously monitored for signal disturbance due to broken, disconnected or shorted wires via a configurable input. Loss of signal integrity results in activation of a remote start signal.

Remote and local emergency stopping capability: PCC3300 accepts ground signal from a locally or remotely mounted emergency stop switch to cause the generator set to immediately shutdown. The generator set is prevented from either running or cranking with the emergency stop switch engaged. If PCC3300 is in sleep mode, then the activation of any emergency stop switch shall return PCC3300 to normal powered state along with the activation of the corresponding shutdown and run-prevention states.

Sleep mode: PowerCommand 3.3 supports a configurable low current draw state, which is designed with consideration to the needs of prime applications or other applications without a battery charger (in order to minimize battery current drain).

Automatic prime mover starting: Any generator set controlled by PCC3300 is capable of automatic starting achieved via either magnetic pickup or main alternator output frequency. PCC3300 additionally supports

configurable glow plug control where applicable.

Prime mover cycle cranking: PCC3300 supports configurable starting cycles and rest periods. Built-in starter protection is incorporated to prevent the operator from specifying a starting sequence that may be damaging.

Configurable time delay functionality: PCC3300 supports time delayed generator set starting and stopping (for cooldown). Permissible time delays are as follows (noting a default setting is 0 seconds):

1. Start delay: 0 seconds to 300 seconds prior to starting after receiving a remote start signal.
2. Stop delay: 0 seconds to 600 seconds prior to shut down after receiving a signal to stop in normal operation modes.

Lean Burn Natural Gas application specific parameters

PCC3300 supports prime mover inhibiting in order to permit application-specific processes (i.e. Auxiliaries) to be started first.

## Generator Control

PCC3300 performs both Genset voltage sensing and Genset voltage regulation as follows:

- Voltage sensing is integrated into PCC3300 via three phase line-to-line sensing that is compatible with shunt or PMG excitation systems
- Automatic voltage regulation is accomplished by using a three phase fully rectified input and has a FET output for good motor starting capability.

Major features of generator control include:

Digital output voltage regulation - Capable of regulating output voltage to within  $\pm 1.0\%$  for any loads between no load and full load. Voltage drift will not exceed  $\pm 1.5\%$  for a 40 °C (104 °F) change in temperature in an eight-hour period. On engine starting or sudden load acceptance, voltage is controlled to a maximum of 5% overshoot over nominal level.

The automatic voltage regulator feature can be disabled to allow the use of an external voltage regulator.

Droop voltage regulation - Control can be adjusted to droop from 0-10% from no load to full load.

Torque-matched V/Hz overload control - The voltage roll-off set point and rate of decay (i.e. the slope of the V/Hz curve) is adjustable in the control.

Fault current regulation - PowerCommand<sup>®</sup> will regulate the output current on any phase to a maximum of three times rated current under fault conditions for both single phase and three phase faults. In conjunction with a permanent magnet generator, it will provide three times rated current on all phases for motor starting and short circuit coordination purpose.

Cylinder Cut-off System (CCS): PCC 3300 supports Cylinder Cut-off System which is used to operate the engines on half bank at no load and light load conditions. CCS has the following benefits on engine

performance- improved emission standards, improved fuel efficiency, reduced hydrocarbons, reduced white smoke, reduced wet stacking and higher exhaust temperature at light loads to improve turbocharger operations and catalytic performance.

**Step Timing Control (STC):** PCC 3300 supports STC functionality which is used to advance the engine timing of a hydro-mechanical engine during start up and light load conditions. During ADVANCED injection timing, it:

- Improves cold weather idling characteristics
- Reduces cold weather white smoke
- Improves light load fuel economy
- Reduces injector carboning

## Paralleling Functions

**First Start Sensor™ system** – PowerCommand® provides a unique control function that positively prevents multiple gensets from simultaneously closing to an isolated bus under black start conditions. The First Start Sensor system is a communication system between the gensets that allows the gensets to work together to determine which genset is a system should be the first to close to the bus. The system includes an independent backup function, so that if the primary system is disabled the required functions are still performed.

**Synchronizing** – Control incorporates a digital synchronizing function to force the genset to match the frequency, phase and voltage of another source such as a utility grid. The synchronizer includes provisions to provide proper operation even with highly distorted bus voltage waveforms. The synchronizer can match other sources over a range of 60-110% of nominal voltage and -24 to +6 hertz. The synchronizer function is configurable for slip frequency synchronizing for applications requiring a known direction of power flow at instant of breaker closure or for applications where phase synchronization performance is otherwise inadequate.

**Load sharing control** – The genset control includes an integrated load sharing control system for both real (kW) and reactive (kVar) loads when the genset(s) are operating on an isolated bus. The control system determines kW load on the engine and kVar load on the alternator as a percent of genset capacity, and then regulates fuel and excitation systems to maintain system and genset at the same percent of load without impacting voltage or frequency regulation. The control can also be configured for operation in droop mode for kW or kVar load sharing.

**Load govern control**– When PowerCommand® receives a signal indicating that the genset is paralleled with an infinite source such as a utility (mains) service, the genset will operate in load govern mode. In this mode the genset will synchronize and close to the bus, ramp to a pre-programmed kW and kVar load level, and then operate at that point. Control is adjustable for kW

values from 0-100% of standby rating, and 0.7-1.0 power factor (lagging). Default setting is 80% of standby and 1.0 power factor. The control includes inputs to allow independent control of kW and kVar load level by a remote device while in the load govern mode. The rate of load increase and decrease is also adjustable in the control. In addition, the control can be configured for operation in kW or kVAR load govern droop.

**Load demand control** – The control system includes the ability to respond to an external signal to initiate load demand operation. On command, the genset will ramp to no load, open its paralleling breaker, cool down, and shut down. On removal of the command, the genset will immediately start, synchronize, connect, and ramp to its share of the total load on the system.

**Sync check** – The sync check function decides when permissive conditions have been met to allow breaker closure. Adjustable criteria are: phase difference from 0.1-20 deg, frequency difference from 0.001-1.0 Hz, voltage difference from 0.5-10%, and a dwell time from 0.5-5.0 sec. Internally the sync check is used to perform closed transition operations. An external sync check output is also available.

**Genset and utility/AC bus source AC metering** – The control provides comprehensive three phase AC metering functions for both monitored sources, including: 3-phase voltage (L-L and L-N) and current, frequency, phase rotation, individual phase and totalized values of kW, kVAR, kVA and Power Factor; totalized positive and negative kW-hours, kVAR-hours, and kVA-hours. Three wire or four wire voltage connection with direct sensing of voltages to 600V, and up to 45kV with external transformers. Current sensing is accomplished with either 5 amp or 1 CT secondaries and with up to 10,000 amp primary. Maximum power readings are 32,000kW/kVAR/kVA.

**Power transfer control** – provides integrated automatic power transfer functions including source availability sensing, genset start/stop and transfer pair monitoring and control. The transfer/retransfer is configurable for open transition, fast closed transition (less than 100msec interconnect time), or soft closed transition (load ramping) sequences of operation. Utility source failure will automatically start genset and transfer load, retransferring when utility source returns. Test will start gensets and transfer load if test with load is enabled. Sensors and timers include:

**Under voltage sensor:** 3-phase L-N or L-L under voltage sensing adjustable for pickup from 85-100% of nominal. Dropout adjustable from 75-98% of pickup. Dropout delay adjustable from 0.1-30 sec.

**Over voltage sensor:** 3-phase L-N or L-L over voltage sensing adjustable for pickup from 95-99% of dropout. Dropout adjustable from 105-135% of nominal. Dropout delay adjustable from 0.5-120 sec. Standard configuration is disabled and is configurable to enabled in the field using the HMI or InPower service tools.



Over/Under frequency sensor: Center frequency adjustable from 45-65 Hz. Dropout bandwidth adjustable from 0.3-5% of center frequency beyond pickup bandwidth. Pickup bandwidth adjustable from 0.3-20% of center frequency. Field configurable to enable.

Loss of phase sensor: Detects out of range voltage phase angle relationship. Field configurable to enable.

Phase rotation sensor: Checks for valid phase rotation of source. Field configurable to enable.

Breaker tripped: If the breaker tripped input is active, the associated source will be considered as unavailable.

Timers: Control provides adjustable start delay from 0 - 300sec, stop delay from 0 - 800sec, transfer delay from 0-120sec, retransfer delay from 0-1800sec, programmed transition delay from 0-60sec, and maximum parallel time from 0-1800sec.

Negative Sequence Current Protection: PCC3300 supports this protection natively in order to determine if the generator is at any point was running subject to negative phase sequencing.

**Breaker control** – Utility and Genset breaker interfaces include separate relays for opening and closing breaker, as well as inputs for both 'a' and 'b' breaker position contacts and tripped status. Breaker diagnostics include Contact Failure, Fail to Close, Fail to Open, Fail to Disconnect, and Tripped. Upon breaker failure, appropriate control action is taken to maintain system integrity.

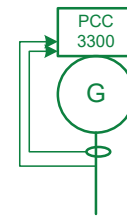
**Exerciser clock** –The exerciser clock (when enabled) allows the system to be operated at preset times in either test without load, test with load, or extended parallel mode. A Real Time Clock is built in. Up to 12 different programs can be set for day of week, time of day, duration, repeat interval, and mode. For example, a test with load for 1 hour every Tuesday at 2AM can be programmed. Up to 6 different exceptions can also be set up to block a program from running during a specific date and time period.

**Extended paralleling** – In extended paralleling mode (when enabled) the controller will start the genset and parallel to a utility source and then govern the real and reactive power output of the genset based on the desired control point. The control point for the real power (kW) can be configured for either the genset metering point ("Base Load") or the utility metering point ("Peak Shave"). The control point for the reactive power (kVAR or Power Factor) can also be independently configured for either the genset metering point or the utility metering point. This flexibility would allow base kW load from the genset while maintaining the utility power factor at a reasonable value to avoid

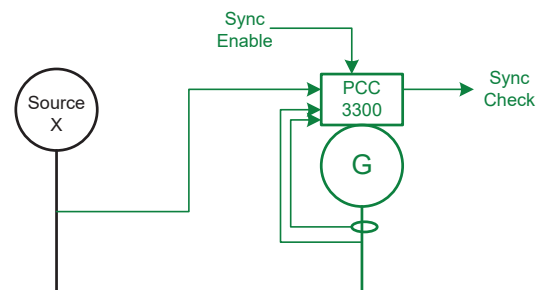
penalties due to low power factor. The System always operates within genset ratings. The control point can be changed while the system is in operation. Set points can be adjusted via hardwired analog input or adjusted through an operator panel display or service tool.

**Application types** – Controller is configured to operating in one of six possible application types. These topologies are often used in combinations in larger systems, with coordination of the controllers in the system either by external device or by interlocks provided in the control. Topologies that may be selected in the control include:

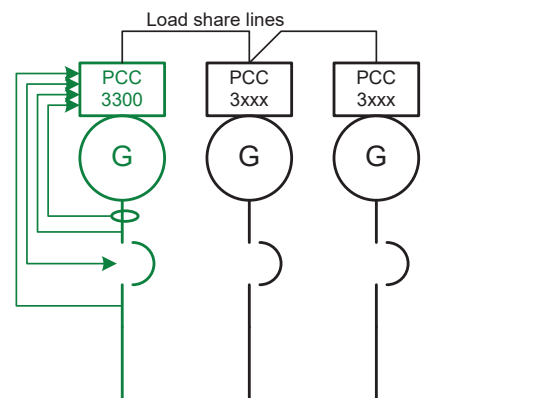
Standalone: Control provides monitoring, protection and control in a non-paralleling application.



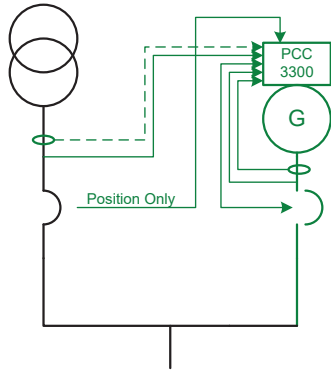
Synchronizer only: control will synchronize the genset to other source when commanded to either via a hardwired or Modbus driven input.



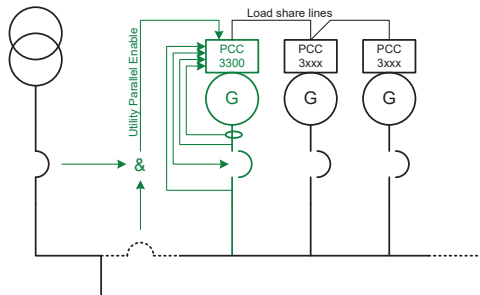
Isolated Bus: allows the genset to perform a dead bus closure or synchronize to the bus and isochronously share kW and kVAR loads with other gensets.



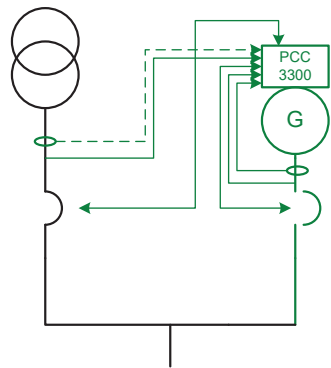
**Utility Single:** Control monitors one genset and utility. The control will automatically start and provide power to a load if the utility fails. The control will also resynchronize the genset back to the utility and provides extended paralleling capabilities.



**Utility Multiple:** Supports all functionality of Isolated Bus and provides extended paralleling to the utility. Extended paralleling load set points follow a constant setting; dynamically follow an analog input, Modbus register or HMI.

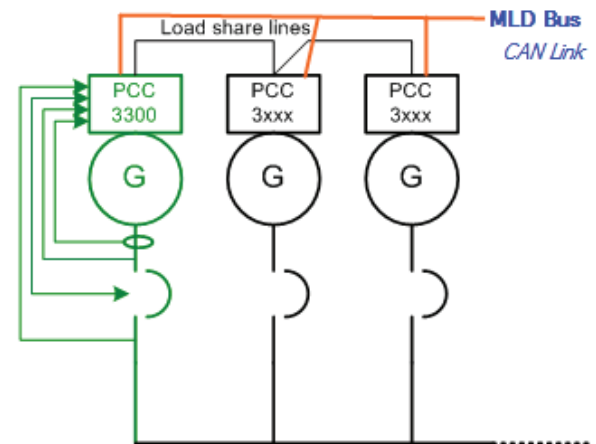
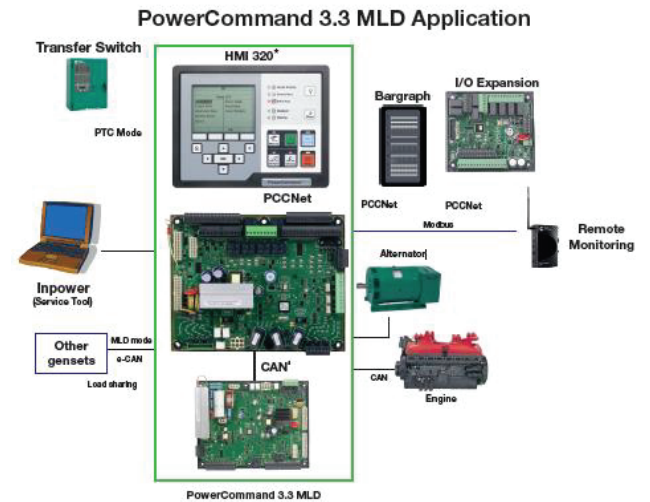


**Power Transfer Control:** Control operates a single genset/single utility transfer pair in open transition, fast closed transition, or soft closed transition. Extended paralleling functionality also provides base load and peak shave options.



**Masterless Load Demand (Optional Feature):**

PowerCommand® 3.3 with Masterless Load Demand (MLD) technology enables generator sets to start/stop automatically based on load demand. Masterless Load Demand-capable generators are equipped with an additional s-CAN network connection that allows sharing of information amongst paralleled generator sets. MLD has been designed for hassle-free installation, commissioning and operation. MLD functionality. Integrated on-board system logic provides the MLD topology control without the need for any additional system.



**PCC3300 External Voltage and Frequency Biasing Inputs**

PCC3300 supports externally driven voltage and frequency biasing capability in order to permit external paralleling (if intending to use this feature please contact your local distributor for further information).

## Protective Functions

On operation of a protective function the control will indicate a fault by illuminating the appropriate status LED on the HMI, as well as display the fault code and fault description on the LCD. The nature of the fault and time of occurrence are logged in the control. The service manual and InPower service tool provide service keys and procedures based on the service codes provided. Protective functions include:

### Battle short mode

When enabled and the *battle short* switch is active, the control will allow some shutdown faults to be bypassed. If a bypassed shutdown fault occurs, the fault code and description will still be annunciated, but the genset will not shutdown. This will be followed by a *fail to shutdown* fault. Emergency stop shutdowns and others that are critical for proper operation (or are handled by the engine ECM) are not bypassed. Please refer to the Control Application Guide or Manual for list of these faults.

### Derate

The Derate function reduces output power of the genset in response to a fault condition. If a Derate command occurs while operating on an isolated bus, the control will issue commands to reduce the load on the genset via contact closures or Modbus. If a Derate command occurs while in utility parallel mode, the control will actively reduce power by lowering the base load kW to the derated target kW.

### Configurable alarm and status inputs

The control accepts up to four alarm or status inputs (configurable contact closed to ground or open) to indicate a configurable (customer-specified) condition.

The control is programmable for warning, derate, shutdown, shutdown with cooldown or status indication and for labeling the input.

### Emergency stop

Annunciated whenever either emergency stop signal is received from external switch.

### General prime mover protection

Low and high battery voltage warning - Indicates status of battery charging system (failure) by continuously monitoring battery voltage.

Weak battery warning - The control system will test the battery each time the genset is signaled to start and indicate a warning if the battery indicates impending failure.

Low coolant level warning - Can be set up to be a warning or shutdown.

Low coolant temperature warning - Indicates that engine temperature may not be high enough for a 10 second start or proper load acceptance.

Fail to start (overcrank) shutdown - The control system will indicate a fault if the genset fails to start by the completion of the engine crank sequence.

Fail to crank shutdown - Control has signaled starter to crank engine but engine does not rotate.

Cranking lockout - The control will not allow the starter to attempt to engage or to crank the engine when the engine is rotating.

Fault simulation -The control in conjunction with InPower software, will accept commands to allow a technician to verify the proper operation of the control and its interface by simulating failure modes or by forcing the control to operate outside of its normal operating ranges. InPower also provides a complete list of faults and settings for the protective functions provided by the controller.

### For Lean Burn Natural Gas Engine applications:

Off load running (protection) - This feature protects the engine in the event the genset is being called to go off load for too long.

### Hydro Mechanical fuel system engine protection:

Overspeed shutdown - Default setting is 115% of nominal

Low lube oil pressure warning/shutdown - Level is preset (configurable with InPower or HMI) to match the capabilities of the engine used. Control includes time delays to prevent nuisance alarms.

High lube oil temperature warning/shutdown - Level is preset (configurable with InPower or HMI) to match the capabilities of the engine used. Control includes time delays to prevent nuisance alarms.

High engine temperature warning/shutdown - Level is preset (configurable with InPower or HMI) to match the capabilities of the engine used. Control includes time delays to prevent nuisance alarms.

Low coolant temperature warning - Indicates that engine temperature may not be high enough for a 10 second start or proper load acceptance.

High intake manifold temperature shutdown - Level is preset (configurable with InPower or HMI) to match the capabilities of the engine used. Control includes time delays to prevent nuisance alarms.

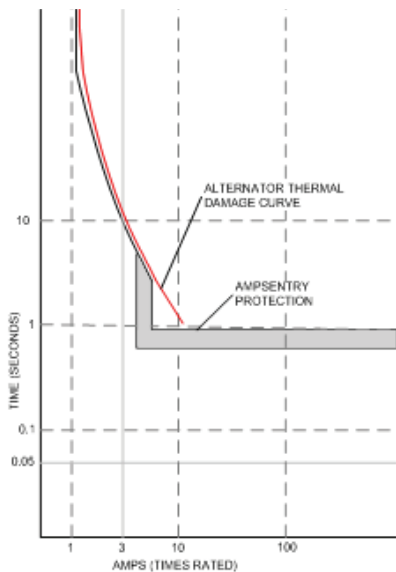
### Full authority electronic engine protection:

Engine fault detection is handled inside the engine ECM. Fault information is communicated via the SAE-J1939 data link for annunciation in the HMI.



## Alternator Protection

AmpSentry protective relay - A comprehensive monitoring and control system integral to the PowerCommand® Control System that guards the electrical integrity of the alternator and power system by providing protection against a wide array of fault conditions in the genset or in the load. It also provides single and three phase fault current regulation (3x Current) so that downstream protective devices have the maximum current available to quickly clear fault conditions without subjecting the alternator to potentially catastrophic failure conditions. Thermal damage curve (3 phase short) or fixed timer (2sec for 1P short, 5sec for 2P short). See document R1053 for a full-size time over current curve. The control does not include protection required for interconnection to a utility (mains) service.



AmpSentry Maintenance Mode (AMM) - Instantaneous tripping, if AmpSentry Maintenance mode is active (50mS response to turn off AVR excitation/shutdown genset) for arc flash reduction when personnel are near genset.

High AC voltage shutdown (59) - Output voltage on any phase exceeds preset values. Time to trip is inversely proportional to amount above threshold. Values adjustable from 105-125% of nominal voltage, with time delay adjustable from 0.1-10 seconds. Default value is 110% for 10 seconds.

Low AC voltage shutdown (27) - Voltage on any phase has dropped below a preset value. Adjustable over a range of 50-95% of reference voltage, time delay 2-20 seconds. Default value is 85% for 10 seconds. Function tracks reference voltage. Control does not nuisance trip when voltage varies due to the control directing voltage to drop, such as during a V/Hz roll-off or synchronizing.

Under frequency shutdown (81 u) - Genset output frequency cannot be maintained. Settings are adjustable from 2-10 Hz below reference governor set point, for a 5-20 second time delay. Default: 6 Hz, 10 seconds. Under frequency protection is disabled when excitation is switched off, such as when engine is operating in idle speed mode.

Over frequency shutdown/warning (81o) - Genset is operating at a potentially damaging frequency level. Settings are adjustable from 2-10 Hz above nominal governor set point for a 1-20 second time delay. Default: 6 Hz, 20 seconds, disabled.

Overcurrent warning/shutdown (51) - Implementation of the thermal damage curve with instantaneous trip level calculated based on current transformer ratio and application power rating.

Loss of sensing voltage shutdown - Shutdown of genset will occur on loss of voltage sensing inputs to the control.

Field overload shutdown - Monitors field voltage to shutdown genset when a field overload condition occurs.

Over load (kW) warning - Provides a warning indication when engine is operating at a load level over a set point. Adjustment range: 80-140% of application rated kW, 0-120 second delay. Defaults: 105%, 60 seconds.

Reverse power shutdown (32) - Adjustment range: 5-20% of standby kW rating, delay 1-15 seconds. Default: 10%, 3 seconds.

Reverse Var shutdown (40) - Shutdown level is adjustable: 15-50% of rated Var output, delay 10-60 seconds. Default: 20%, 10 seconds.

Short circuit protection - Output current on any phase is more than 175% of rating and approaching the thermal damage point of the alternator. Control includes algorithms to protect alternator from repeated over current conditions over a short period of time.

Negative sequence overcurrent warning (46) - Control protects the generator from damage due to excessive imbalances in the three phase load currents and/or power factors.

Custom overcurrent warning/shutdown (51) - Control provides the ability to have a custom time overcurrent protection curve in addition to the AmpSentry protective relay function.

Ground fault overcurrent (51G) - Control detects a ground fault either by an external ground fault relay via a contact input or the control can measure the ground current from an external current transformer. Associated time delays and thresholds are adjustable via InPower or HMI.

## Paralleling Protection

Breaker fail to close Warning: When the control signals a circuit breaker to close, it will monitor the breaker auxiliary contacts and verify that the breaker has closed. If the control does not sense a breaker closure within an adjustable time period after the close signal, the fail to close warning will be initiated.

Breaker fail to open warning: The control system monitors the operation of breakers that have been signaled to open. If the breaker does not open within an adjustable time delay, a Breaker Fail to Open warning is initiated.

Breaker position contact warning: The controller will monitor both 'a' and 'b' position contacts from the breaker. If the contacts disagree as to the breaker position, the breaker position contact warning will be initiated.

Breaker tripped warning: The control accepts inputs to monitor breaker trip / bell alarm contact and will initiate a breaker tripped warning if it should activate.

Fail to disconnect warning: In the controller is unable to open either breaker, a fail to disconnect warning is initiated. Typically, this would be mapped to a configurable output, allowing an external device to trip a breaker.

Fail to synchronize warning: Indicates that the genset could not be brought to synchronization with the bus. Configurable for adjustable time delay of 10 -900 seconds, 120 default.

Phase sequence sensing warning: Verifies that the genset phase sequence matches the bus prior to allowing the paralleling breaker to close.

Maximum parallel time warning (power transfer control mode only): During closed transition load transfers, control independently monitors paralleled time. If time is exceeded, warning is initiated and genset is disconnected.

Bus or genset PT input calibration warning: The control system monitors the sensed voltage from the bus and genset output voltage potential transformers. When the paralleling breaker is closed, it will indicate a warning condition if the read values are different.

## Field Control Interface

### Input signals to the PowerCommand® control include:

- Coolant level (where applicable)
  - Fuel level (where applicable)
  - Remote emergency stop
  - Remote fault reset
  - Remote start
  - Rupture basin
  - Start type signal
  - Battle short
  - Load demand stop
  - Synchronize enable
  - Genset circuit breaker inhibit
  - Utility circuit breaker inhibit
  - Single mode verify
  - Transfer inhibit – prevent transfer to utility (in power transfer control mode)
  - Retransfer inhibit – prevent retransfer to genset (in power transfer control mode)
  - kW and kVAR load setpoints
- Configurable inputs - Control includes (4) input signals from customer discrete devices that are configurable for warning, shutdown or status indication, as well as message displayed

### Input signals for Lean Burn Natural Gas Engine applications:

- Gearbox oil pressure/temperature protection
- Fire fault
- Earth fault support as a discrete input via an appropriate secondary detection device
- Differential fault
- DC power supply fault
- Genset Interface Box (GIB) isolator open fault
- Start inhibit/enable (x3)
- Radiator fan trip
- Ventilator fan trip
- Ventilation louvers closed
- Start system trip
- Alternator heater trip
- Alternator heater status
- Alternator winding temperature (PT100 RTDx3)
- Alternator drive end bearing temperature (PT100 RTD)
- Alternator non-drive end bearing temperature (PT100 RTD)

### Output signals from the PowerCommand® control include:

- Load dump signal: Operates when the genset is in an overload condition.
- Delayed off signal: Time delay-based output which will continue to remain active after the control has removed the run command. Adjustment range: 0 - 120 seconds. Default: 0 seconds.

- Configurable relay outputs: Control includes (4) relay output contacts (3 A, 30VDC). These outputs can be configured to activate on any control warning or shutdown fault as well as ready to load, not in auto, common alarm, common warning and common shutdown.
- Ready to load (genset running) signal: Operates when the genset has reached 90% of rated speed and voltage and latches until genset is switched to off or idle mode.
- Paralleling circuit breaker relays outputs: Control includes (4) relay output contacts (3.5A, 30 VDC) for opening and closing of the genset and utility breakers.

**Output Signals for Lean Burn Natural Gas Engine applications:**

- Start inhibit/enable event
- Emergency stop event
- Ventilator fan run control
- Louvre control
- Radiator fan control
- Alternator heater control
- Engine at idle speed event

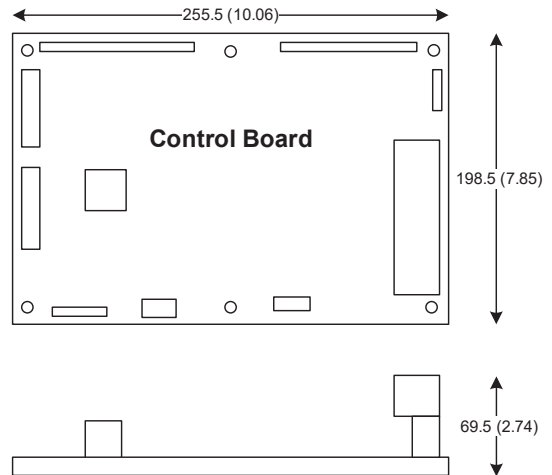
**Communications connections include:**

- PC tool interface: This RS-485 communication port allows the control to communicate with a personal computer running InPower software.
- Modbus RS-485 port: Allows the control to communicate with external devices such as PLCs using Modbus protocol.

Note - An RS-232 or USB to RS-485 converter is required for communication between PC and control.

- Networking: This RS-485 communication port allows connection from the control to the other Cummins Power Generation products.

**Mechanical Drawing**



# PowerCommand® Human Machine Interface HMI320



## Description

This control system includes an intuitive operator interface panel that allows for complete genset control as well as system metering, fault annunciation, configuration and diagnostics. The interface includes five genset status LED lamps with both internationally accepted symbols and English text to comply with customer's needs. The interface also includes an LED backlit LCD display with tactile feel soft-switches for easy operation and screen navigation. It is configurable for units of measurement and has adjustable screen contrast and brightness.

The *run/off/auto* switch function is integrated into the interface panel.

All data on the control can be viewed by scrolling through screens with the navigation keys. The control displays the current active fault and a time-ordered history of the five previous faults.

## Features:

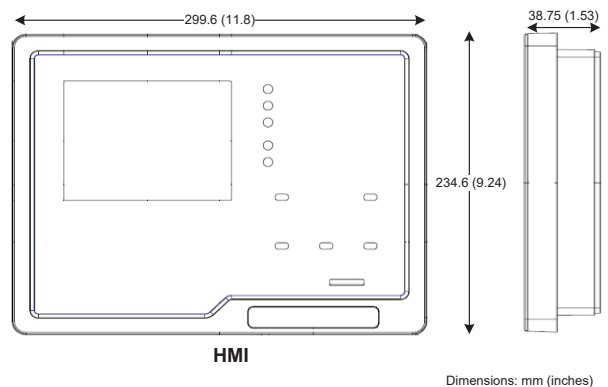
- LED indicating lamps
  - genset running
  - remote start
  - not in auto
  - shutdown
  - warning
  - auto
  - manual and stop
  - Circuit breaker open (if equipped)
  - Circuit breaker closed (if equipped)
- 320 x 240 pixels graphic LED backlight LCD.
- Four tactile feel membrane switches for LCD defined operation. The functions of these switches are defined dynamically on the LCD.
- Seven tactile feel membrane switches dedicated screen navigation buttons for up, down, left, right, ok, home and cancel.

- Six tactile feel membrane switches dedicated to control for auto, stop, manual, manual start, fault reset and lamp test/panel lamps.
- Two tactile feel membrane switches dedicated to control of circuit breaker (where applicable).
- Allows for complete genset control setup.
- Certifications: Suitable for use on gensets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std., UKCA and CE standards.
- Languages supported: English, Spanish, French, German, Italian, Greek, Portuguese, Finnish, Norwegian, Danish, Russian (Cyrillic), Chinese, Hungarian, Japanese, Polish, Korean, Romanian, Brazilian Portuguese, Turkish, Dutch, and Czech

## Communications connections include:

- PC tool interface - This RS-485 communication port allows the HMI to communicate with a personal computer running InPower.
- This RS-485 communication port allows the HMI to communicate with the main control board.

## Mechanical Drawing



## Software

InPower (beyond 6.5 version) is a PC-based software service tool that is designed to directly communicate to PowerCommand® gensets and transfer switches, to facilitate service and monitoring of these products.

## Environment

The control is designed for proper operation without recalibration in ambient temperatures from -40 °C (-40 °F) to +70 °C (158 °F), and for storage from -55 °C (-67 °F) to +80 °C (176 °F). Control will operate with humidity up to 95%, non-condensing.

The HMI is designed for proper operation in ambient temperatures from -20 °C (-4 °F) to +70 °C (158 °F), and for storage from -30 °C (-22 °F) to +80 °C (176 °F).

The control board is fully encapsulated to provide superior resistance to dust and moisture. Display panel has a single membrane surface, which is impervious to effects of dust, moisture, oil and exhaust fumes. This panel uses a sealed membrane to provide long reliable service life in harsh environments.

The control system is specifically designed and tested for resistance to RFI/EMI and to resist effects of vibration to provide a long reliable life when mounted on a genset. The control includes transient voltage surge suppression to provide compliance to referenced standards.

## Certifications

PowerCommand® meets or exceeds the requirements of the following codes and standards:

- NFPA 110 for level 1 and 2 systems.
- ISO 8528-4:2005 compliance, controls and switchgear (second edition)
- CE marking: The CE marking is only valid when equipment is used in a fixed installation application. Material compliance declaration is available upon request.
- UKCA marking- The UKCA marking is only valid when equipment is used in a fixed installation application. Material compliance declaration is available upon request.
- EN 50081-1,2 residential/light industrial emissions or industrial emissions.
- EN 50082-1,2 residential/light industrial or industrial susceptibility.
- ISO 7637-2, level 2; DC supply surge voltage test.
- Mil Std 202C, Method 101 and ASTM B117: Salt fog test.
- UL 6200 recognized, suitable for use on UL 2200 Listed generator sets.
- CSA C282-M1999 compliance
- CSA 22.2 No. 14 M91 industrial controls.
- PowerCommand® control systems and generator sets are designed and manufactured in ISO 9001 certified facilities.
- ROHS (Restriction of Hazardous substance) complaint both for HMI 320 & PCC3300v2.

## Reference Documents

Please refer to the following reference documents available in the PowerSuite library:

- PowerCommand™ 3.3. Application Guide
- T-037: PowerCommand Control Application Manual (ANSI Protective Functions)
- T-040: PowerCommand 3.3 Paralleling Application Guide

Please refer to the following reference documents available on Cummins Quickserve:

- Service Manuals for PC3.3 (non-MLD) and PC3.3 (MLD)
- Modbus Register Mapping

## Warranty

All components and subsystems are covered by an express limited one-year warranty. Other optional and extended factory warranties and local distributor maintenance agreements are available.





## Alternator Data Sheet Frame Size: S6L1D-F4

<b>Characteristics</b>								
	<b>No of Bearings:</b>		<b>1-bearing</b>		<b>2-bearing</b>			
<b>Weights:</b>	Stator assembly:	2421 lb	1098 kg	2421 lb	1098 kg			
	Rotor assembly:	2130 lb	966 kg	2037 lb	924 kg			
	Complete assembly:	5128 lb	2326 kg	5002 lb	2269 kg			
<b>Maximum speed:</b>		2250 rpm						
<b>Excitation current:</b>	Full load:	2.6 Amps						
	No load:	0.55 Amps (Wdg 311/312), 0.79 Amps (Wdg 07)						
<b>Insulation system:</b>	Class H throughout							
<b>3 <math>\phi</math> Ratings</b> (0.8 power factor)			<b>60 Hz</b> (winding no)					
			120/208 <u>240/416</u> (311/312)	127/220 <u>254/440</u> (311/312)	133/230 <u>266/460</u> (311/312)	139/240 <u>277/480</u> (311/312)	<u>120/240</u> <u>Delta</u> (311/312)	<u>347/600</u> (07)
150° C rise ratings	@ 40° C	kW	1080	1125	1160	1200	1080	1220
		kVA	1350	1406	1450	1500	1350	1525
125° C rise ratings	@ 40° C	kW	1020	1070	1110	1150	1020	1150
		kVA	1275	1338	1388	1438	1275	1438
105° C rise ratings	@ 40° C	kW	950	990	1020	1050	950	1050
		kVA	1188	1238	1275	1313	1188	1313
80° C rise ratings	@ 40° C	kW	824	860	880	900	824	900
		kVA	1030	1075	1100	1125	1030	1125
<b>Reactances</b> (per unit $\pm$ 10%)			120/208 <u>240/416</u> (311/312)	127/220 <u>254/440</u> (311/312)	133/230 <u>266/460</u> (311/312)	139/240 <u>277/480</u> (311/312)	<u>120/240</u> <u>Delta</u> (311/312)	<u>347/600</u> (07)
(Based on full load at 125° C rise rating)								
Synchronous			3.0	2.82	2.67	2.54	3.0	1.96
Transient			0.18	0.17	0.16	0.15	0.18	0.14
Subtransient			0.14	0.13	0.13	0.12	0.14	0.11
Negative sequence			0.21	0.20	0.19	0.18	0.21	0.15
Zero sequence			0.06	0.06	0.06	0.05	0.06	0.04
<b>Motor starting</b>			120/208 <u>240/416</u> (311/312)	127/220 <u>254/440</u> (311/312)	133/230 <u>266/460</u> (311/312)	139/240 <u>277/480</u> (311/312)	<u>120/240</u> <u>Delta</u> (311/312)	<u>347/600</u> (07)
Maximum kVA (90% sustained voltage)			4725	4725	4725	4725	4725	4725
<b>Time constants</b> (sec)			120/208 <u>240/416</u> (311/312)	127/220 <u>254/440</u> (311/312)	133/230 <u>266/460</u> (311/312)	139/240 <u>277/480</u> (311/312)	<u>120/240</u> <u>Delta</u> (311/312)	<u>347/600</u> (07)
Transient			0.097	0.097	0.097	0.097	0.097	0.104
Subtransient			0.0162	0.0162	0.0162	0.0162	0.0162	0.012
Open circuit			4.09	4.09	4.09	4.09	4.09	4.066
DC			0.0221	0.0221	0.0221	0.0221	0.0221	0.027
<b>Windings</b> (@22° C)			120/208 <u>240/416</u> (311/312)	127/220 <u>254/440</u> (311/312)	133/230 <u>266/460</u> (311/312)	139/240 <u>277/480</u> (311/312)	<u>120/240</u> <u>Delta</u> (311/312)	<u>347/600</u> (07)
Stator resistance (L-L Ohms)			0.0018	0.0018	0.0018	0.0018	0.0018	0.0048
Rotor resistance (Ohms)			2.13	2.13	2.13	2.13	2.13	2.13
Number of leads			12/6	12/6	12/6	12/6	12/6	6

\* Parallel Star connection only available with Wdg 311





## Prototype Test Supported Emergency/Standby Generator Sets Certification

Cummins Power Generation certifies that its commercial generator sets bearing the Prototype Test Supported (PTS) seal have been subjected to a design and development process that includes extensive prototype testing and evaluation. A PTS production model is engineered and manufactured according to documentation developed through comprehensive research, design and design verification.

Design verification is based on tests of preproduction prototype models manufactured specifically for prototype test purposes and not sold as new equipment. To be certified as a PTS model, the generator set must satisfy these prerequisites:

**DESIGN** - The PTS certified generator set must be designed specifically for emergency/standby applications that require high reliability and rapid response.

**PROTOTYPE TESTING** - Design suitability of the PTS certified generator set must be proven by tests on preproduction prototype models. The prototype test program is intended to:

1. Confirm the engine and generator have reserve capacity beyond rating to minimize the potential of damage or shutdown during steady state or transient loading conditions, including momentary overloads.
2. Demonstrate generator set, controls and accessories capability to perform reliably and compatibly in service during disturbances common in actual load circuits.
3. Verify the integrity of the generator and excitation system insulation systems and electrical components to withstand heating under rated load and transient overcurrent conditions.
4. Evaluate generator set mechanical and electrical strength to perform without damage during abnormal operating conditions, such as short circuits or out-of-phase paralleling. While operating at rated load, the generator set must be subjected to several 3-phase short circuits of 20 second duration. After the tests, the generator set is inspected to verify that no electrical or mechanical damage was incurred by any components.
5. Determine by endurance testing that no resonance conditions exist in the generator set or accessories that will cause premature failure of components on production units.
6. Investigate and identify failure modes to minimize the risk of any single component failure or human error that could lead to lack of essential electrical supply.
7. Provide a margin of safety, by actual trials, between the generator set component design and protection systems so that the components are not damaged before the protective devices activate a shutdown.

**DOCUMENTATION AND SOFTWARE** - The PTS certified generator set must be documented in a single drawing package with all components identified with Cummins Power Generation part numbers. A PTS test certificate must be created for each PTS generator set certifying the PTS testing performed.

**QUALITY ASSURANCE** - Engineering drawings, specifications and test requirements for a PTS certified generator set must be classified by components and assembly quality characteristics. A component and process inspection and test plan must be developed and maintained to measure product conformance to documentation requirements.

**PRODUCTION MODEL TESTING** - PTS certified generator sets must be subjected to complete production tests that demonstrate conformance to specifications at all rated conditions, including start-up, full load pickup and a performance run at full rated load and power factor.





## Prototype Test Support (PTS) 60 Hz test summary



<u>Generator set models</u>		<u>Representative prototype</u>	
750DQFAA	1000DQFAD	Model:	1000DQFAD
800DQFAB		Alternator:	HC6K
900DQFAC		Engine:	QST30-G5 NR2

The following summarizes prototype testing conducted on the designated representative prototype of the specified models. This testing is conducted to verify the complete generator set electrical and mechanical design integrity. Prototype testing is conducted only on generator sets not sold as new equipment.

**Maximum surge power: 1055 kW**  
The generator set was evaluated to determine the stated maximum surge power.

**Torsional analysis and testing:**  
The generator set was tested to verify that the design is not subjected to harmful torsional stresses. A spectrum analysis of the transducer output was conducted over the speed range of 1200 to 2000 RPM.

**Cooling system:** 50 °C ambient  
0.5 in H2O restriction  
  
The cooling system was tested to determine ambient temperature and static restriction capabilities. The test was performed at full rated load in elevated ambient temperature under stated static restriction conditions.

**Electrical and mechanical strength:**  
The generator set was tested to several single phase and three phase faults to verify that the generator can safely withstand the forces associated with short circuit conditions. The generator set was capable of producing full rated output at the conclusion of the testing.

**Steady state performance:**  
The generator set was tested to verify steady state operating performance was within the specified maximum limits.

Voltage regulation:	± 0.50%
Random voltage variation:	± 0.50%
Frequency regulation:	± 0.25%
Random frequency variation:	± 0.25%

**Transient performance:**  
The generator set was tested with the standard alternator to verify single step loading capability as required by NFPA 110. Voltage and frequency response on load: addition and rejection were evaluated. The following results were recorded at 0.8 power factor:

Full load acceptance:

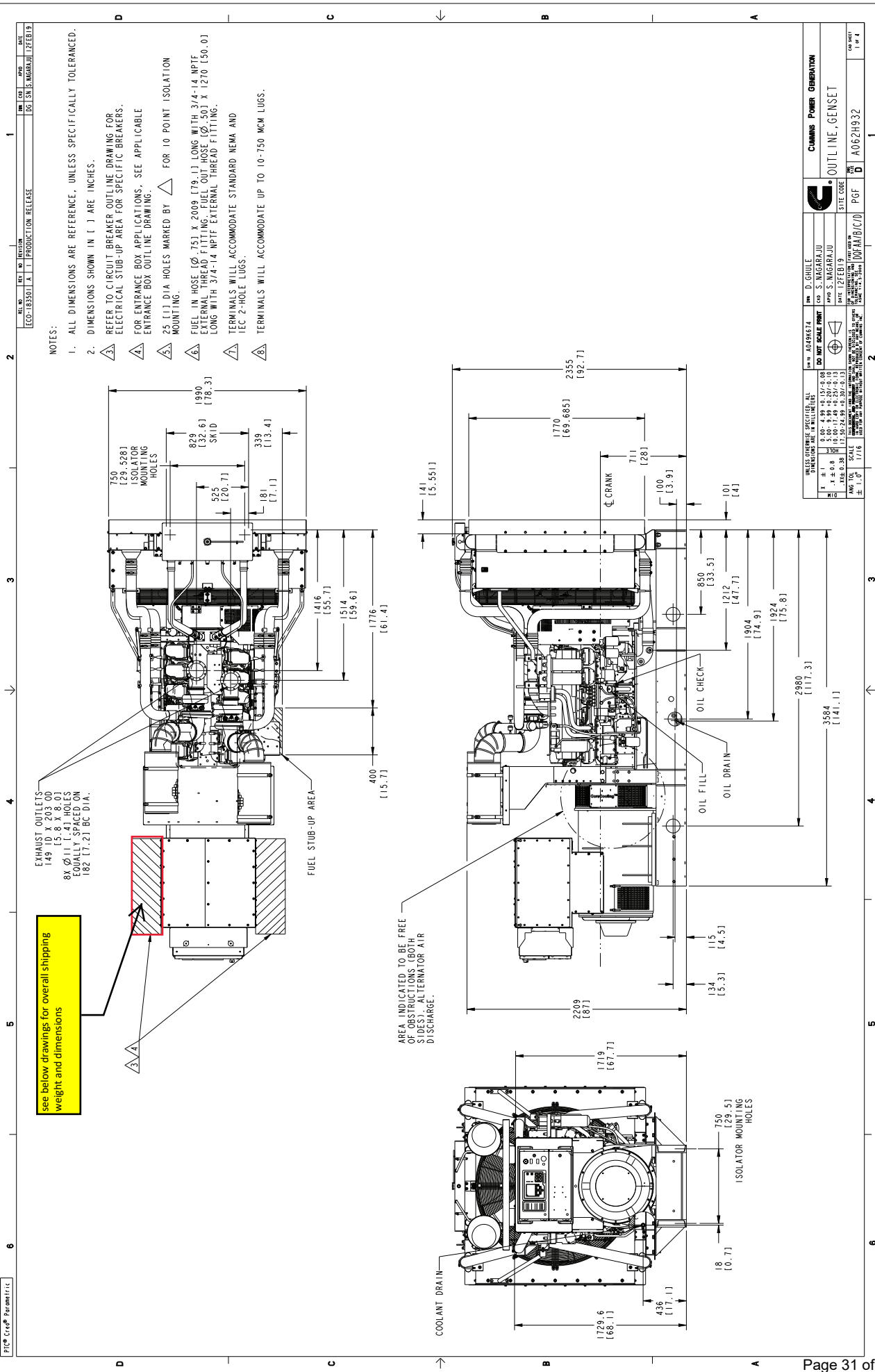
Voltage dip:	35.9%
Recovery time:	4.5 seconds
Frequency dip:	11.4%
Recovery time:	5.0 seconds

Full load rejection:

Voltage rise:	25.7%
Recovery time:	1.8 seconds
Frequency rise:	7.8%
Recovery time:	3.3 seconds

**Harmonic analysis:**  
(per MIL-STD-705B, Method 601.4)

Harmonic	<u>Line to Line</u>		<u>Line to Neutral</u>	
	<u>No load</u>	<u>Full load</u>	<u>No load</u>	<u>Full load</u>
3	0.052	0.04	0.144	0.092
5	0.128	1.36	0.058	1.32
7	1.0	0.196	1.0	0.19
9	0.012	0.034	0.033	0.066
11	0.985	0.84	1.01	0.83
13	0.158	0.32	0.12	0.29
15	0.0	0.005	0.025	0.022

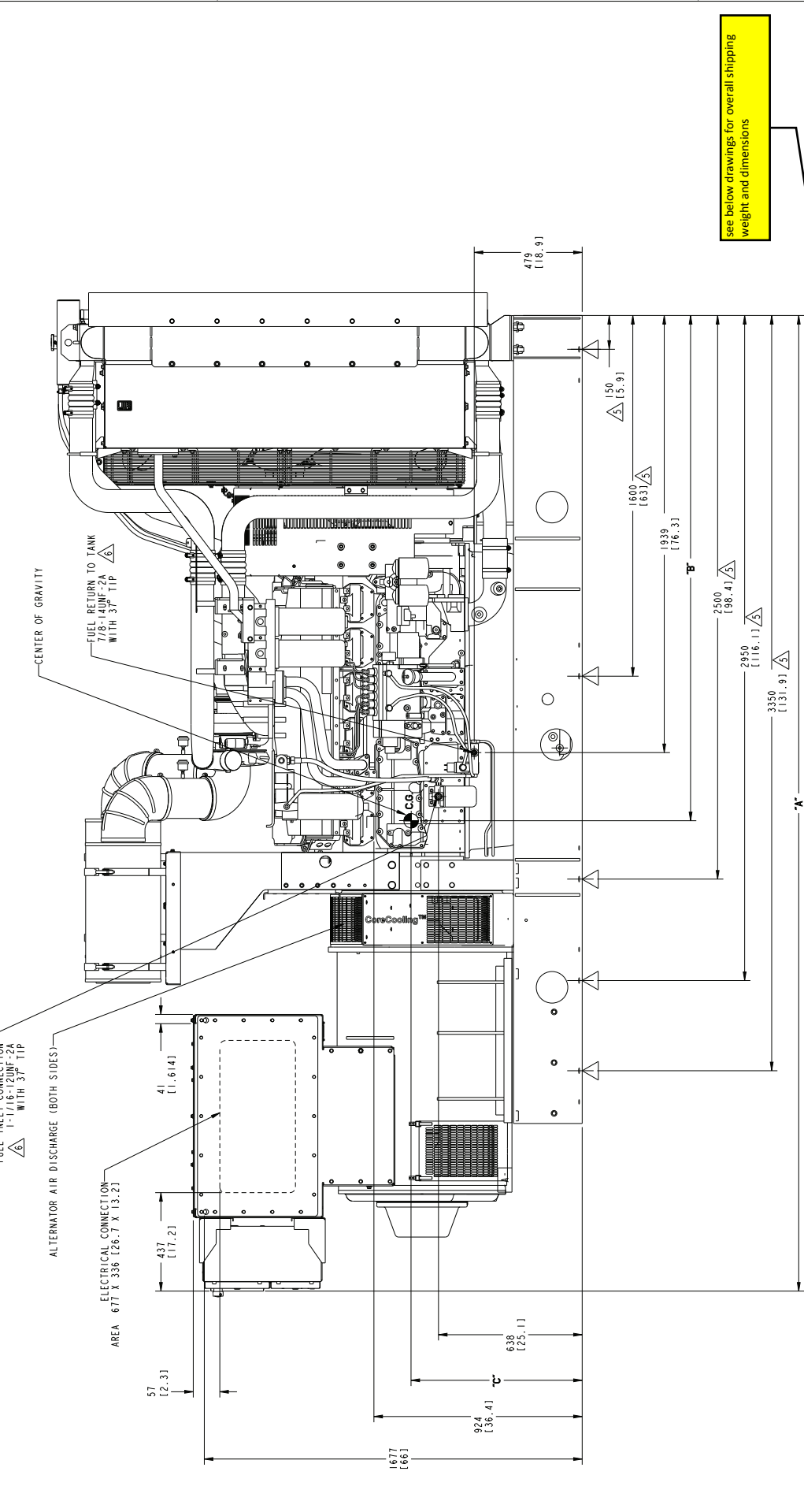


see below drawings for overall shipping weight and dimensions

- NOTES:**
- ALL DIMENSIONS ARE REFERENCE, UNLESS SPECIFICALLY TOLERANCED.
  - DIMENSIONS SHOWN IN ( ) ARE INCHES.
  - REFER TO CIRCUIT BREAKER OUTLINE DRAWING FOR ELECTRICAL STUB-UP AREA FOR SPECIFIC BREAKERS.
  - FOR ENTRANCE BOX APPLICATIONS, SEE APPLICABLE ENTRANCE BOX OUTLINE DRAWING.
  - 25 (1) DIA HOLES MARKED BY  $\triangle$  FOR 10 POINT ISOLATION MOUNTING.
  - FUEL IN HOSE (Ø. 75) X 2009 (79.1) LONG WITH 3/4-14 NPT EXTERNAL THREAD FITTING. FUEL OUT HOSE (Ø. 50) X 1270 (50.0) LONG WITH 3/4-14 NPT EXTERNAL THREAD FITTING.
  - TERMINALS WILL ACCOMMODATE STANDARD NEMA AND IEC 2-HOLE LUGS.
  - TERMINALS WILL ACCOMMODATE UP TO 10-750 MCM LUGS.

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5000.00-9999.99 (+/-1.25)	14																																																																																																																							
10000.00-14999.99 (+/-1.50)	15																																																																																																																							
15000.00-24999.99 (+/-1.75)	16																																																																																																																							
25000.00-49999.99 (+/-2.00)	17																																																																																																																							
50000.00-99999.99 (+/-2.50)	18																																																																																																																							
100000.00-149999.99 (+/-3.00)	19																																																																																																																							
150000.00-249999.99 (+/-3.50)	20																																																																																																																							
250000.00-499999.99 (+/-4.00)	21																																																																																																																							
500000.00-999999.99 (+/-5.00)	22																																																																																																																							
REV	DATE	BY	CHK	<p>ECO-183501 X 1 (PRODUCTION RELEASE)</p>																																																																																																																				
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ECO-183501	X 11	PRODUCTION RELEASE
REV. NO.	REV. BY	REVISION
ECO-183501	X 11	PRODUCTION RELEASE
DATE	DATE	DATE
03/13/2009	03/13/2009	03/13/2009



see below drawings for overall shipping weight and dimensions

GEN. FRAME SIZE	DIM. "A"	DIM. "B"	DIM. "C"	DIM. "C" C.G.	GEN SET DRY WT LBS	GEN SET DRY WT KGS	GEN SET WET WT LBS	GEN SET WET WT KGS
S6D	4326 [170.3]	2022 [79.6]	830 [32.7]	6377	14060	6641	14640	6640
S6E	4326 [170.3]	2060 [81.1]	828 [32.6]	6615	14585	6879	15165	6879
S6F	4326 [170.3]	2096 [82.5]	824 [32.4]	6838	15076	7102	15656	7102

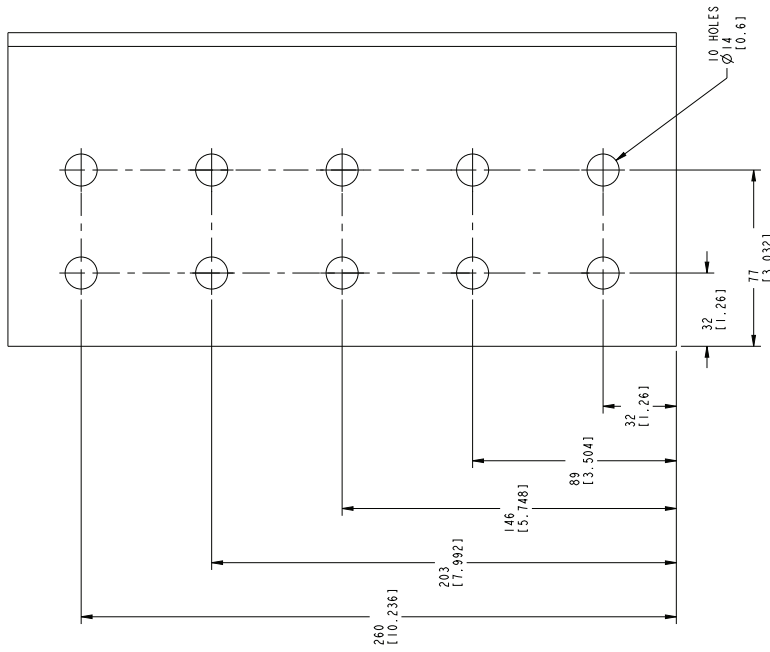
UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS (INCHES IN PARENTHESES)

1	0.00	4.98	12.50	0.00
2	0.00	4.98	12.50	0.00
3	0.00	4.98	12.50	0.00
4	0.00	4.98	12.50	0.00
5	0.00	4.98	12.50	0.00
6	0.00	4.98	12.50	0.00

DATE: 03/13/2009 11:30:43 AM  
 DRAWN BY: J. J. BROWN  
 CHECKED BY: J. J. BROWN  
 APPROVED BY: J. J. BROWN  
 TITLE: GENSET  
 PART NO: A062H932  
 SITE CODE: 000AM/B/C/D  
 PGF: D  
 CUMMINS POWER GENERATION  
 OUTLINE, GENSET  
 ECO-183501

REV	DATE	BY	DESCRIPTION
00	03/13/2009	SM	PRODUCTION RELEASE

GENERATOR OUTPUT TERMINALS  
(FOR 12 LEAD ALTERNATORS/WINDING 311)



D C B A

D C B A

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		REV	DATE	BY	DESCRIPTION	
1	0.00	4	08	15	08	DO NOT SCALE PRINT
2	1.25	08	10	09	14	DO NOT SCALE PRINT
3	1.75	08	10	09	14	DO NOT SCALE PRINT
4	1.75	08	10	09	14	DO NOT SCALE PRINT
5	1.75	08	10	09	14	DO NOT SCALE PRINT
6	1.75	08	10	09	14	DO NOT SCALE PRINT
7	1.75	08	10	09	14	DO NOT SCALE PRINT
8	1.75	08	10	09	14	DO NOT SCALE PRINT
9	1.75	08	10	09	14	DO NOT SCALE PRINT
10	1.75	08	10	09	14	DO NOT SCALE PRINT
11	1.75	08	10	09	14	DO NOT SCALE PRINT
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13	1.75	08	10	09	14	DO NOT SCALE PRINT
14	1.75	08	10	09	14	DO NOT SCALE PRINT
15	1.75	08	10	09	14	DO NOT SCALE PRINT
16	1.75	08	10	09	14	DO NOT SCALE PRINT
17	1.75	08	10	09	14	DO NOT SCALE PRINT
18	1.75	08	10	09	14	DO NOT SCALE PRINT
19	1.75	08	10	09	14	DO NOT SCALE PRINT
20	1.75	08	10	09	14	DO NOT SCALE PRINT
21	1.75	08	10	09	14	DO NOT SCALE PRINT
22	1.75	08	10	09	14	DO NOT SCALE PRINT
23	1.75	08	10	09	14	DO NOT SCALE PRINT
24	1.75	08	10	09	14	DO NOT SCALE PRINT
25	1.75	08	10	09	14	DO NOT SCALE PRINT
26	1.75	08	10	09	14	DO NOT SCALE PRINT
27	1.75	08	10	09	14	DO NOT SCALE PRINT
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47	1.75	08	10	09	14	DO NOT SCALE PRINT
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50	1.75	08	10	09	14	DO NOT SCALE PRINT
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71	1.75	08	10	09	14	DO NOT SCALE PRINT
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73	1.75	08	10	09	14	DO NOT SCALE PRINT
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75	1.75	08	10	09	14	DO NOT SCALE PRINT
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81	1.75	08	10	09	14	DO NOT SCALE PRINT
82	1.75	08	10	09	14	DO NOT SCALE PRINT
83	1.75	08	10	09	14	DO NOT SCALE PRINT
84	1.75	08	10	09	14	DO NOT SCALE PRINT
85	1.75	08	10	09	14	DO NOT SCALE PRINT
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90	1.75	08	10	09	14	DO NOT SCALE PRINT
91	1.75	08	10	09	14	DO NOT SCALE PRINT
92	1.75	08	10	09	14	DO NOT SCALE PRINT
93	1.75	08	10	09	14	DO NOT SCALE PRINT
94	1.75	08	10	09	14	DO NOT SCALE PRINT
95	1.75	08	10	09	14	DO NOT SCALE PRINT
96	1.75	08	10	09	14	DO NOT SCALE PRINT
97	1.75	08	10	09	14	DO NOT SCALE PRINT
98	1.75	08	10	09	14	DO NOT SCALE PRINT
99	1.75	08	10	09	14	DO NOT SCALE PRINT
100	1.75	08	10	09	14	DO NOT SCALE PRINT

# Circuit Breakers



## Description

This data sheet provides circuit breaker manufacturer part numbers and specifications. The circuit breaker box description is the rating of that breaker box installation on a Cummins® generator. Please refer to the website of the circuit breaker manufacturer for breaker specific ratings and technical information.

## Applicable Models

Engine	Models			
QSK23-G7	DQCA	DQCB	DQCC	
<b>QST30-G5</b>	DQFAA	DQFAB	DQFAC	<b>DQFAD</b>
QST30-G17	DQFAH			
QSK50-G5	DQGAE	DQGAF		
QSK50-G4	DQGAA	DQGAB		
QSK50-G8	DQGAS			
QSK60-G6	DQKAA	DQKAB	DQKAD	DQKAE
QSK60-G14	DQKAF			
QSK60-G17	DQKAM			

## Instructions

1. Locate the circuit breaker feature code or part number and use the charts below to find the corresponding manufacturer circuit breaker catalog number.
2. Use the first letter of the circuit breaker catalog number to determine the "frame" of the breaker. If the first letter is an "N", use the second letter. Then follow the corresponding website link from the table below to find the breaker catalog number description.

Please refer to the catalog numbering systems page, which is given in the chart, to understand the nomenclature of the catalog number.

Frame	Catalog Name*	Catalog Number description pages
P and R	<a href="http://www.schneiderelectric.us/en/download/document/0612CT0101/">0612CT0101</a> <a href="http://www.schneiderelectric.us/en/download/document/0612CT0101/">http://www.schneiderelectric.us/en/download/document/0612CT0101/</a>	16-17
L	<a href="http://www.schneiderelectric.us/en/download/document/0611CT1001/">0611CT1001</a> <a href="http://www.schneiderelectric.us/en/download/document/0611CT1001/">http://www.schneiderelectric.us/en/download/document/0611CT1001/</a>	8-9
MasterPact NT/NW	<a href="http://www.schneider-electric.us/en/faqs/FA231180/">http://www.schneider-electric.us/en/faqs/FA231180/</a>	Please refer to PLS007 Rev 25

\*The following link may also be used to search specifically by the breaker part number or for the catalog name listed above.

<http://products.schneider-electric.us/technical-library/>

3. Search the catalog by using the first 3 letters of the breaker catalog number and the first 5 numbers to find information such as trip curves, accessories, and dimensional details regarding the circuit breaker.

\*If the catalog number starts with "N", skip the N and begin your search with the second letter.

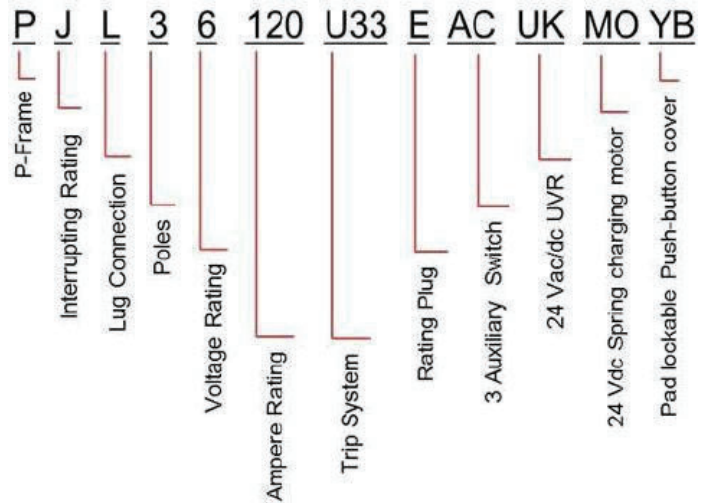
\*If the first 3 letters are "PJP," the search will not work. You will need to start with just "PJ" and use the description pages to obtain the information you are looking for on the "PJP."

### Example

After finding your circuit breaker catalog number to be "PJL36120U33EACUKMOYB," navigate to the P-frame catalog by using the link provided.

Look at pages 16-17 of the pdf catalog to find the nomenclature of the breaker.

Search the P-frame spec sheet using the search "PJL36120."



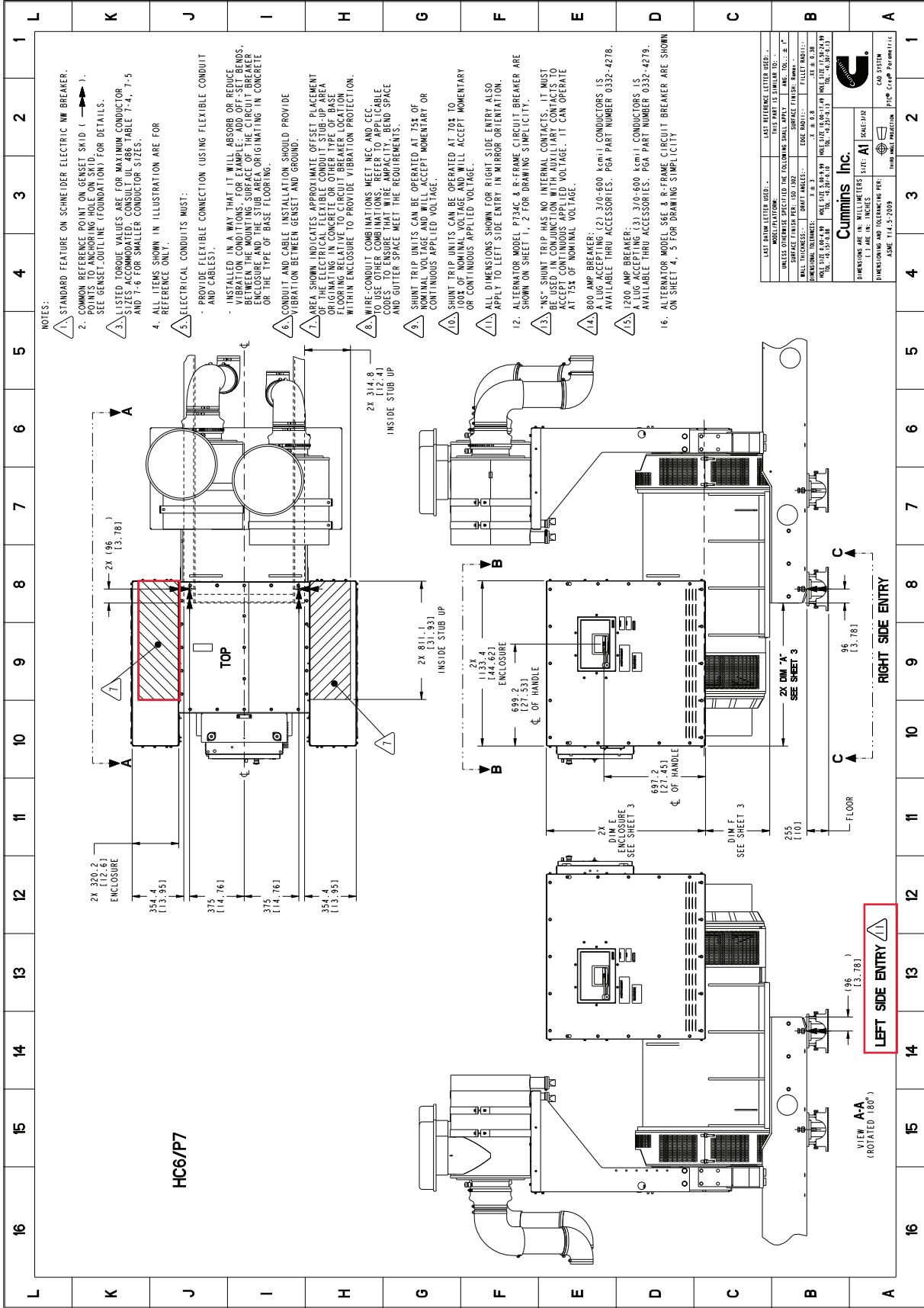
The following link is another way to decode the Schneider products

[https://www.productinfo.schneider-electric.com/portals/ui/digest/viewer/561d5d65e4b0c5c41a243bf2/561d5f9ae4b0c5c41a24480c/r/17707021\\_83351#\\_17707021\\_83351](https://www.productinfo.schneider-electric.com/portals/ui/digest/viewer/561d5d65e4b0c5c41a243bf2/561d5f9ae4b0c5c41a24480c/r/17707021_83351#_17707021_83351)

For decoding the ABB breakers, see the decoder sheet, titled "T8 Catalog number explanation"



Mechanically operated breakers							
Feature Code	Breaker box description	Cummins part #	Engine	Manufacturer	Breaker catalog number	Trip unit	Plug type
KP82-2	CB-2500, Right, 3P, UL600, IEC 415, UL Serv Ent, 100%	0320-2164-01	QST30-G5, 30L, QSK50-G4, QSK50-G5, QSK50-G7, QSK60-G6, QSK60-G11 QSK60-G14, QSK60-G18	Schneider Electric	RLF36250U31F	MicroLogic 3.0 LI	F
		A054K364	QSK19-G8, QSK23-G7		RLF36250U33F	MicroLogic 5.0 LSI	
KP83-2	CB-2500A, Left, 3P, 600, IEC 415, UL Serv Ent, 100%	0320-2164-01	QST30-G5, 30L, QSK50-G4, QSK50-G5, QSK50-G7, QSK60-G6, QSK60-G11 QSK60-G14, QSK60-G18	Schneider Electric	RLF36250U31F	MicroLogic 3.0 LI	F
		A054K364	QSK19-G8, QSK23-G7		RLF36250U33F	MicroLogic 5.0 LSI	
KP84-2	CB-2000, Right, 3P, UL 600, IEC 415, UL Serv Ent 100%	0320-2164-02	QST30-G5, 30L, QSK50-G4, QSK50-G5, QSK50-G7, QSK60-G6, QSK60-G11 QSK60-G14, QSK60-G18	Schneider Electric	RLF36200U31F	MicroLogic 3.0 LI	F
		A054K366	QSK19-G8, QSK23-G7		RLF36200U33F	MicroLogic 5.0 LSI	
KP85-2	CB-2000, Left, 3P, UL 600, IEC 415, UL Serv Ent, 100%	0320-2164-02	QST30-G5, 30L, QSK50-G4, QSK50-G5, QSK50-G7, QSK60-G6, QSK60-G11 QSK60-G14, QSK60-G18	Schneider Electric	RLF36200U31F	MicroLogic 3.0 LI	F
		A054K366	QSK19-G8, QSK23-G7		RLF36200U33F	MicroLogic 5.0 LSI	
KP86-2	CB-1600A, Right, 3P, UL 600, IEC 415, UL Serv Ent 100%	0320-2164-03	QST30-G5, 30L, QSK50-G4, QSK50-G5, QSK50-G7, 50L, 60L, QSK60-G6, QSK60-G11 QSK60-G14, QSK60-G18	Schneider Electric	RLF36160U31F	MicroLogic 3.0 LI	F
		A054K368	QSK19-G8, QSK23-G7		RLF36160U33F	MicroLogic 5.0 LSI	
KP87-2	CB-1600, Left, 3P, UL 600, IEC 415, UL Serv Ent 100%	0320-2164-03	QST30-G5, 30L, QSK50-G4, QSK50-G5, QSK50-G7, QSK60-G6, QSK60-G11 QSK60-G14, QSK60-G18	Schneider Electric	RLF36160U31F	MicroLogic 3.0 LI	F
		A054K368	QSK19-G8, QSK23-G7		RLF36160U33F	MicroLogic 5.0 LSI	
KP88-2	CB-1200, Right, 3P, UL 600, IEC 415, UL Serv Ent, 100%	0320-2183	QST30-G5, 30L, QSK50-G4, QSK50-G5, QSK50-G7, QSK60-G6, QSK60-G11 QSK60-G14, QSK60-G18	Schneider Electric	PJP36120U31E	MicroLogic 3.0 LI	E
		A054K408	QSK19-G8, QSK23-G7		PJP36120U33F	MicroLogic 5.0 LSI	
KP89-2	CB-1200, Left, 3P, UL 600, IEC 415, UL Serv Ent, 100%	0320-2183	QST30-G5, 30L, QSK50-G4, QSK50-G5, QSK50-G7, QSK60-G6, QSK60-G11 QSK60-G14, QSK60-G18	Schneider Electric	PJP36120U31E	MicroLogic 3.0 LI	E
		A054K408	QSK19-G8, QSK23-G7		PJP36120U33F	MicroLogic 5.0 LSI	
KP90-2	CB-800A, Right, 3P, UL 600, IEC 415, UL Serv Ent 100%	0320-2182	QST30-G5, 30L, QSK50-G4, QSK50-G5, QSK50-G7, QSK60-G6, QSK60-G11 QSK60-G14, QSK60-G18	Schneider Electric	PJP36080U31F	MicroLogic 3.0 LI	F
		A054K405	QSK19-G8, QSK23-G7		PJP36080U33F	MicroLogic 5.0 LSI	
KP91-2	CB-800A, Left, 3P, UL 600, IEC 415, UL Serv Ent, 100%	0320-2182	QST30-G5, 30L, QSK50-G4, QSK50-G5, QSK50-G7, QSK60-G6, QSK60-G11 QSK60-G14, QSK60-G18	Schneider Electric	PJP36080U31F	MicroLogic 3.0 LI	F
		A054K405	QSK19-G8, QSK23-G7		PJP36080U33F	MicroLogic 5.0 LSI	
KP92-2	CB-600A, Right, 3P, UL 600, IEC 690, UL Serv Ent 100%	A044T468	QSK19-G8, QSK23-G7, 30L, QSK50-G4, QSK50-G5, QSK50-G7, QSK60-G6, QSK60-G11 QSK60-G14, QSK60-G18	Schneider Electric	NLGL36600U33X-600A	MicroLogic 3.3S LSI	N/A
KP93-2	CB-600A, Left, 3P, UL 600, IEC 690, UL Serv Ent, 100%	A044T468	QSK19-G8, QSK23-G7, 30L, QSK50-G4, QSK50-G5, QSK50-G7, QSK60-G6, QSK60-G11 QSK60-G14, QSK60-G18	Schneider Electric	NLGL36600U33X-600A	MicroLogic 3.3S LSI	N/A
KU62-2	CB-3000A, 3P, 600/690V, UL/IEC, ServEnt, 100%UL, Right	A029B150	QSK50-G5, QSK50-G7, QSK60-G6, QSK60-G11 QSK60-G14, QSK60-G18	Schneider Electric	RLF36300U31A	MicroLogic 3.0 LI	F
KU68-2	CB-3000A, 3P, 600/690V, UL/IEC, ServEnt, 100%UL, Left	A029B150	QSK50-G5, QSK50-G7, QSK60-G6, QSK60-G11 QSK60-G14, QSK60-G18	Schneider Electric	RLF36300U31A	MicroLogic 3.0 LI	F

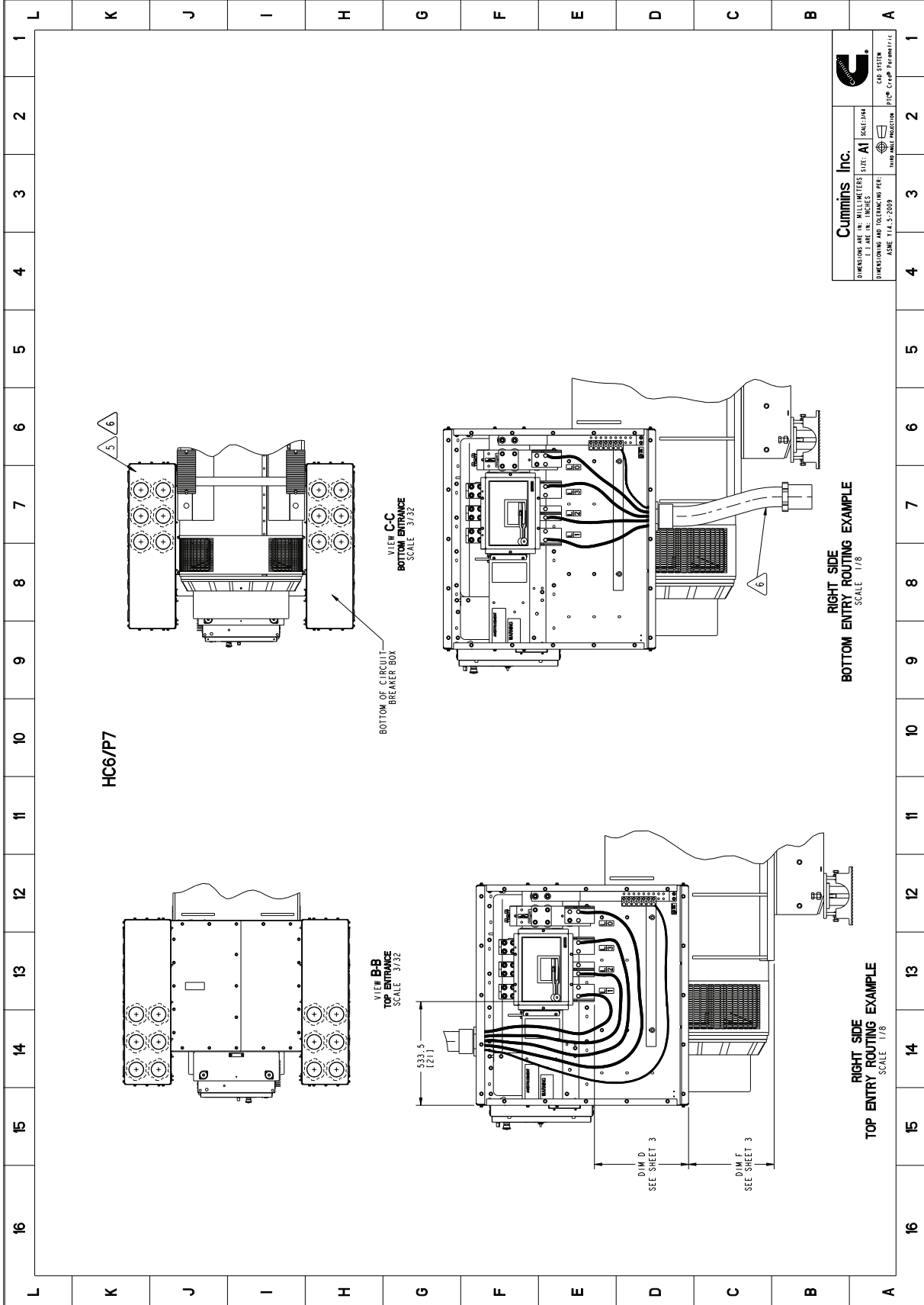


- NOTES:
- STANDARD FEATURE ON SCHNEIDER ELECTRIC MW BREAKER.
  - COMMON REFERENCE POINT ON GENSET SKID ( → ). SEE GENSET-OUTLINE (FOUNDATION) FOR DETAILS.
  - LISTED TORQUE VALUES ARE FOR MAXIMUM CONDUCTOR SIZES ACCOMMODATED. CONSULT UL 486 TABLE 7-4, 7-5 AND 7-6 FOR SMALLER CONDUCTOR SIZES.
  - ALL ITEMS SHOWN IN ILLUSTRATION ARE FOR REFERENCE ONLY.
  - ELECTRICAL CONDUITS MUST:
    - PROVIDE FLEXIBLE CONNECTION (USING FLEXIBLE CONDUIT AND CABLES).
    - BE INSTALLED IN A WAY THAT IT WILL ABSORB OR REDUCE VIBRATION CONDITIONS. FOR EXAMPLE: ADD OFF-SET BENDS BETWEEN THE MOUNTING SURFACE OF THE CIRCUIT BREAKER AND THE FLOOR OR THE TYPE OF BASE FLOORING.
    - CONDUIT AND CABLE INSTALLATION SHOULD PROVIDE VIBRATION BETWEEN GENSET AND GROUND.
    - AREA SHOWN INDICATES APPROXIMATE OFFSET PLACEMENT OF THE ELECTRICAL FLEXIBLE CONDUIT, STUB-UP AREA AND FLOORING. CONDUIT SHOULD BE INSTALLED ON THE FLOORING RELATIVE TO CIRCUIT BREAKER LOCATION WITHIN ENCLOSURE TO PROVIDE VIBRATION PROTECTION.
    - WIRE CONDUIT COMBINATIONS MEET NEC AND CEC REQUIREMENTS. REFER TO WIRE CABLE CODES TO ENSURE THAT WIRE CAPACITY, BEND SPACE AND GUNTING SPACE MEET THE REQUIREMENTS.
    - SHUNT TRIP UNITS CAN BE OPERATED AT 75% OF NOMINAL VOLTAGE AND WILL ACCEPT MOMENTARY OR CONTINUOUS APPLIED VOLTAGE.
    - SHUNT TRIP UNITS CAN BE OPERATED AT 100% TO 100% OF NOMINAL VOLTAGE AND WILL ACCEPT MOMENTARY OR CONTINUOUS APPLIED VOLTAGE.
    - ALL DIMENSIONS SHOWN FOR RIGHT SIDE ENTRY. ALSO APPLY TO LEFT SIDE ENTRY IN MIRROR ORIENTATION.
  - ALTERNATOR MODEL PT3AC & R-FRAME CIRCUIT BREAKER ARE SHOWN ON SHEET 1, 2 FOR DRAWING SIMPLICITY.
  - "NS" SHUNT TRIP HAS NO INTERNAL CONTACTS. IT MUST BE USED IN CONJUNCTION WITH AUXILIARY CONTACTS TO ACCEPT MOMENTARY OR CONTINUOUS APPLIED VOLTAGE. IT CAN OPERATE AT 75% OF NOMINAL VOLTAGE.
  - 800 AMP BREAKER (2) 3/10-600 kcmil CONDUCTORS IS AVAILABLE THRU ACCESSORIES. PGM PART NUMBER 0332-4278.
  - 1200 AMP BREAKER (3) 3/10-600 kcmil CONDUCTORS IS AVAILABLE THRU ACCESSORIES. PGM PART NUMBER 0332-4279.
  - ALTERNATOR MODEL S6E & R-FRAME CIRCUIT BREAKER ARE SHOWN ON SHEET 4, 5 FOR DRAWING SIMPLICITY.

LAST DRAWING LETTER USED:		LAST REFERENCE LETTER USED:	
MODEL PLATFORM:	THIS PART IS SIMILAR TO:		
UNLESS OTHERWISE SPECIFIED THE FOLLOWING SHALL APPLY:	ANG. UNITS: °, °, °, °, °		
	UNIT: INCHES		
WALL THICKNESS:	DRIFT ANGLES:	EDGE RADIUS:	FILLET RADIUS:
1.5 ± .3	1.5 ± .8	1.5 ± .38	1.5 ± .38
DIMENSIONAL TOLERANCES:	1.5 ± .3	1.5 ± .38	1.5 ± .38
FRACTIONAL DIMENSIONS:	FRACTIONAL DIMENSIONS:	FRACTIONAL DIMENSIONS:	FRACTIONAL DIMENSIONS:
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Cummins Inc.		Cummins Inc.	
DIMENSIONS ARE IN MILLIMETERS UNLESS INDICATED OTHERWISE		DIMENSIONS ARE IN MILLIMETERS UNLESS INDICATED OTHERWISE	
DIN EN ISO 15775-1:2016		DIN EN ISO 15775-1:2016	
ASME Y14.5-2009		ASME Y14.5-2009	

Part Number: A040V836 Part Revision: F  
 Part Name: OUTLINE, CIRCUIT BREAKER  
 Drawing Category: Detail State: Released  
 Sheet 1 of 6

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


















HC6/P7


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DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE INDICATED		ASME Y14.5-2009	ISO 15775-1:2008	ISO 15775-2:2008
CUMMINS INC. 2600 NORTH BRIDGEMAN ROAD		CUMMINS INC. 2600 NORTH BRIDGEMAN ROAD		

Part Number: **A040V836** Part Revision: **F**  
 Part Name: **OUTLINE, CIRCUIT BREAKER**  
 Drawing Category: **Detail State: Released** Sheet 2 of 6

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
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K	<b>TABLE 1</b>																K																																																																																																																				
J	UL/IEC LUGS						ACCESSORY SPECIFICATIONS										J																																																																																																																				
I	LUG	FRAME	MAX AMPS	WIRE RANGE COPPER	DIM D ±.25 [1.0]	DIM E ±.25 [1.0]	DIM F ±.25 [1.0]	ACCESSORY DESCRIPTION	CONTACT RATING	INRUSH	CONNECTION TYPE	<b>TABLE 2</b> TYPICAL CONDUIT AND WIRE SIZE BASED ON NEC 2008, ARTICLE 310.15 AT 75C TEMPERATURE RATED CONDUCTOR AT 30C AMBIENT AND ANNEX C  <table border="1"> <thead> <tr> <th rowspan="2">MAX BRKR AMPS</th> <th colspan="2">WIRE (COPPER)</th> <th rowspan="2">CABLE AMPACITY</th> <th colspan="2">TOTAL NUMBER OF CONDUITS</th> </tr> <tr> <th>QTY</th> <th>SIZE</th> <th>QTY</th> <th>SIZE (IN INCHES)</th> </tr> </thead> <tbody> <tr><td>2500</td><td>6</td><td>600 KCMIL</td><td>420</td><td>6</td><td>4</td></tr> <tr><td>2000</td><td>5</td><td>600 KCMIL</td><td>420</td><td>5</td><td>4</td></tr> <tr><td>1600</td><td>5</td><td>600 KCMIL</td><td>420</td><td>5</td><td>4</td></tr> <tr><td>1200</td><td>3</td><td>500 KCMIL</td><td>385</td><td>3</td><td>3</td></tr> <tr><td>1000</td><td>3</td><td>400 KCMIL</td><td>335</td><td>3</td><td>3</td></tr> <tr><td>800</td><td>2</td><td>300 KCMIL</td><td>285</td><td>2</td><td>3</td></tr> <tr><td>630</td><td>2</td><td>350 KCMIL</td><td>310</td><td>2</td><td>3</td></tr> <tr><td>600</td><td>2</td><td>350 KCMIL</td><td>310</td><td>2</td><td>3</td></tr> <tr><td>400</td><td>1</td><td>600 KCMIL</td><td>420</td><td>1</td><td>4</td></tr> <tr><td>250</td><td>1</td><td>250 KCMIL</td><td>255</td><td>1</td><td>2 1/2</td></tr> <tr><td>100</td><td>1</td><td>2 KCMIL</td><td>115</td><td>1</td><td>2</td></tr> </tbody> </table> TYPICAL CONDUIT AND WIRE SIZE BASED ON NEC 2008, ARTICLE 310.15 AND TABLE 310-16 AT 75C TEMPERATURE RATED CONDUCTOR AT 40C AMBIENT AND ANNEX C  <table border="1"> <thead> <tr> <th rowspan="2">MAX BRKR AMPS</th> <th colspan="2">WIRE (COPPER)</th> <th rowspan="2">CABLE AMPACITY</th> <th colspan="2">TOTAL NUMBER OF CONDUITS</th> </tr> <tr> <th>QTY</th> <th>SIZE</th> <th>QTY</th> <th>SIZE (IN INCHES)</th> </tr> </thead> <tbody> <tr><td>2500</td><td>6</td><td>750 KCMIL</td><td>418</td><td>6</td><td>4</td></tr> <tr><td>2000</td><td>5</td><td>700 KCMIL</td><td>405</td><td>5</td><td>4</td></tr> <tr><td>1600</td><td>4</td><td>700 KCMIL</td><td>405</td><td>4</td><td>4</td></tr> <tr><td>1000</td><td>3</td><td>500 KCMIL</td><td>334</td><td>3</td><td>3 1/2</td></tr> <tr><td>800</td><td>3</td><td>350 KCMIL</td><td>273</td><td>3</td><td>3</td></tr> </tbody> </table>					MAX BRKR AMPS	WIRE (COPPER)		CABLE AMPACITY	TOTAL NUMBER OF CONDUITS		QTY	SIZE	QTY	SIZE (IN INCHES)	2500	6	600 KCMIL	420	6	4	2000	5	600 KCMIL	420	5	4	1600	5	600 KCMIL	420	5	4	1200	3	500 KCMIL	385	3	3	1000	3	400 KCMIL	335	3	3	800	2	300 KCMIL	285	2	3	630	2	350 KCMIL	310	2	3	600	2	350 KCMIL	310	2	3	400	1	600 KCMIL	420	1	4	250	1	250 KCMIL	255	1	2 1/2	100	1	2 KCMIL	115	1	2	MAX BRKR AMPS	WIRE (COPPER)		CABLE AMPACITY	TOTAL NUMBER OF CONDUITS		QTY	SIZE	QTY	SIZE (IN INCHES)	2500	6	750 KCMIL	418	6	4	2000	5	700 KCMIL	405	5	4	1600	4	700 KCMIL	405	4	4	1000	3	500 KCMIL	334	3	3 1/2	800	3	350 KCMIL	273	3	3	I
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F							1 EA. FORM C 4 AUX CONTACT + 1 TRIP ALARM 	6A AT 240 VAC, 6A AT 480 VAC, 3A AT 600 VAC, 2.5A AT 48 VDC, 0.8A AT 125VDC, 0.3A AT 250 VDC	-----	200VA 	COMPRESSION TERMINALS FOR 1 OR 2 #18-14 AWG. TORQUE: 10 LB-IN	F																																																																																																																									
E							24 VDC SHUNT TRIP 	-----	200VA 	PUSH-IN TERMINAL FOR 1 OR 2 #18-14 AWG.	E																																																																																																																										
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C							24 VDC SHUNT TRIP 	-----	200VA 	PUSH-IN TERMINAL FOR 1 OR 2 #18-16 AWG.	C																																																																																																																										
B							1 EA. FORM C 4 AUX CONTACT + 1 TRIP ALARM 	6A AT 240 VAC, 6A AT 480 VAC, 3A AT 600 VAC, 2.5A AT 48 VDC, 0.8A AT 125VDC, 0.3A AT 250 VDC	-----	200VA 	COMPRESSION TERMINALS FOR 1 OR 2 #18-16 AWG. TORQUE: 10 LB-IN	B																																																																																																																									
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**TABLE 2**  
TYPICAL CONDUIT AND WIRE SIZE BASED ON NEC 2008, ARTICLE 310.15 AT 75C TEMPERATURE RATED CONDUCTOR AT 30C AMBIENT AND ANNEX C



MAX BRKR AMPS	WIRE (COPPER)		CABLE AMPACITY	TOTAL NUMBER OF CONDUITS	
	QTY	SIZE		QTY	SIZE (IN INCHES)
2500	6	600 KCMIL	420	6	4
2000	5	600 KCMIL	420	5	4
1600	5	600 KCMIL	420	5	4
1200	3	500 KCMIL	385	3	3
1000	3	400 KCMIL	335	3	3
800	2	300 KCMIL	285	2	3
630	2	350 KCMIL	310	2	3
600	2	350 KCMIL	310	2	3
400	1	600 KCMIL	420	1	4
250	1	250 KCMIL	255	1	2 1/2
100	1	2 KCMIL	115	1	2

TYPICAL CONDUIT AND WIRE SIZE BASED ON NEC 2008, ARTICLE 310.15 AND TABLE 310-16 AT 75C TEMPERATURE RATED CONDUCTOR AT 40C AMBIENT AND ANNEX C



MAX BRKR AMPS	WIRE (COPPER)		CABLE AMPACITY	TOTAL NUMBER OF CONDUITS	
	QTY	SIZE		QTY	SIZE (IN INCHES)
2500	6	750 KCMIL	418	6	4
2000	5	700 KCMIL	405	5	4
1600	4	700 KCMIL	405	4	4
1000	3	500 KCMIL	334	3	3 1/2
800	3	350 KCMIL	273	3	3

**TABLE 3**

GENSET MODEL	ALTERNATOR MODEL	DIM "A"
<input type="checkbox"/> HC634G		654 [25.74]
<input type="checkbox"/> HC634H		654 [25.74]
<input type="checkbox"/> HC634J		654 [25.74]
<input type="checkbox"/> HC634K		755 [29.72]
<input type="checkbox"/> P734B		746 [29.37]
<input type="checkbox"/> P734C		746 [29.37]
<input checked="" type="checkbox"/> S6D		528 [20.77]
<input type="checkbox"/> S6E		648 [24.49]
<input type="checkbox"/> S6F		

DQFAA  
 DQFAB  
 DQFAC  
 DQFAD

**Cummins Inc.**

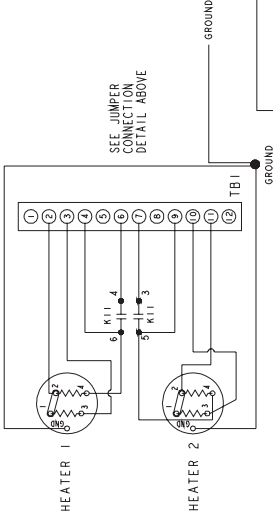
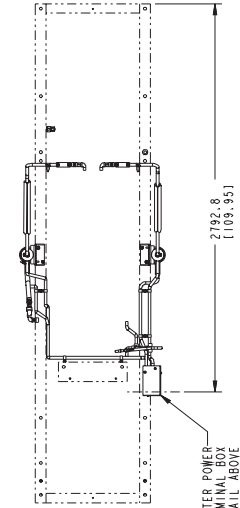
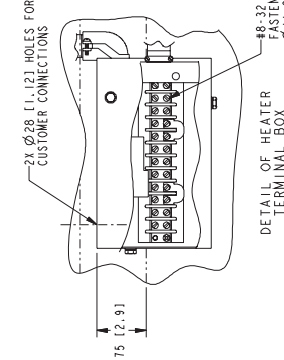
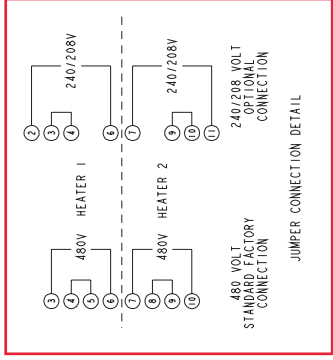
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DIMENSIONS AND TOLERANCING PER:  
 ASME Y14.5-2009

SIZE: A1 SCALE: 3/4" = 1"

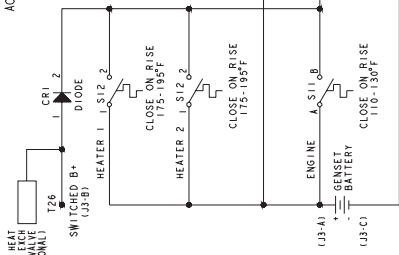
CAD SYSTEM  
 PTC® Creo® Parametric

REV.	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
1	03/23/04	LB	ISSUE FOR PRODUCTION RELEASE	03/23/04	LB	ISSUE FOR PRODUCTION RELEASE
2	08/24/04	LB	CHANGE TABLE 9844 WAS 9880	08/24/04	LB	CHANGE TABLE 9844 WAS 9880
3	08/24/04	LB	CHANGE TABLE 9850 WAS 8650	08/24/04	LB	CHANGE TABLE 9850 WAS 8650

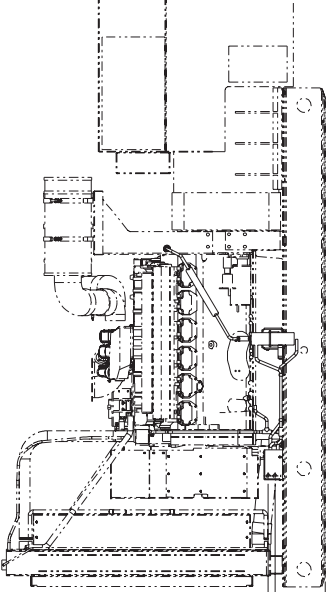


SINGLE PHASE HEATER VOLTAGE	FEATURE CODE H55A TWO HEATERS		FEATURE CODE H55B TWO HEATERS	
	HEATER AMPS	TOTAL WATTS	HEATER AMPS	TOTAL WATTS
208	18.0	36.0	7488	23.2
240	20.8	41.6	9884	26.75
480	10.4	20.8	9884	13.375
				26.75
				12840

AC POWER SCHEMATIC



DC CONTROL SCHEMATIC



- NOTES:
1. DIMENSIONS IN ( ) ARE INCHES.
  2. THE HEATER CONTROL RELAY DRAWS 83mA OF CURRENT WHEN THE HEATERS ARE UNPOWERED. HEATERS ARE NOT POWERED WHEN:
    - 1) TEMPERATURE HAS REACHED DESIGN SETPOINT
    - 2) THE ENGINE IS RUNNING.

▲ A BATTERY CHARGER IS REQUIRED TO PREVENT BATTERY DISCHARGE.

DO NOT SCALE PRINT	REVISION	DATE	DESCRIPTION
1	04/23/04	LB	REVISION
2	06/24/04	LB	REVISION
3	06/24/04	LB	REVISION

ITEM	PART NO.	DESCRIPTION OR MATERIAL
1	8650	HEATER
2	9884	HEATER

DATE	BY	DESCRIPTION
04/23/04	LB	ISSUE FOR PRODUCTION RELEASE
06/24/04	LB	CHANGE TABLE 9844 WAS 9880
06/24/04	LB	CHANGE TABLE 9850 WAS 8650

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# Enclosures and Tanks

250-1000 kW Gensets



## Enclosure Standard Features

- 14-gauge steel construction (panels)
- Stainless steel hardware
- Zinc phosphate pretreatment, e-coat primer and super durable powder topcoat paint minimize corrosion and color fade
- Package listed to UL 2200
- Designed to satisfy national electrical code installation requirements
- Fuel and electrical stub-up area within enclosure perimeter
- Fixed louvers
- Cambered roof prevents water accumulation
- Recessed, lockable doors in two sides
- Retainers hold doors open for easy access
- Enclosed exhaust silencer ensures safety and protects against rust
- Rain cap
- Exterior oil and coolant drains with interior valves for ease of service
- Rodent barriers on inlet
- Non-hydroscopic sound attenuating material
- Side mounted controls and circuit breakers
- Easy access lifting points for spreader bars
- Dual vibration isolation system (250-500 kW)
- Spring vibration isolation system (600-1000 kW)
- Enclosure mounts to lifting base or fuel tank (250-500 kW)
- Enclosure mounts to lifting base (600-1000 kW)
- Factory pre-assembled package
- Designed for outdoor use only
- Externally mounted emergency stop button for operator safety (optional on 250-500 kW)
- Horizontal air discharge to prevent leaf and snow accumulation (600-1000 kW)

## Options

- Three levels of sound attenuation
- Motorized louvers to protect from ice and snow accumulation (available on air inlet for all models and on air outlet on level II, 250-500 kW enclosures only)
- Horizontal air discharge, sound level 2 only (250-500 kW)
- Aluminium construction with roll-coated polymer paint
- Wind rated to 150 mph
- Neutral sandstone paint color
- Factory mounted battery charger
- External 120 VAC service outlet
- Rain hoods for air inlet (250-500 kW)
- Lifting base in lieu of a sub-base tank (250-500 kW)
  - Pre-wired AC distribution package
  - 100 amp (250-500 kW) or 150 amp (600-1000 kW) main circuit breaker; connected to 120 VAC Line-Neutral and 208 or 240 VAC Line-Line, spare breaker positions and capacity for future upgrades (600-1000 kW)
  - GFCI protected internal 120 VAC service receptacle
  - GFCI protected weather proof external 120 volt service receptacle
  - All factory installed AC powered features pre-wired into load center
- Interior lights – 120 volt (600-1000 kW)
- Rain hoods for air inlet (250-500 kW)
- Seismic isolators available (600-1000 kW)



## Enclosure Package Sound Pressure Levels @ 7 meters dB(A)

Genset model	Weather protective enclosure (F200, F203)	QuietSite level 1 sound attenuated enclosure (F201, F204)	QuietSite level 2 sound attenuated enclosure (F202, F205)
250 DQDAA	90	88	72
275 DQDAB	90	88	73
300 DQDAC	90	88	73
300 DQHAB	89	88	76
450 DFEJ	88	85	74
500 DFEK	89	87	73
600 DQCA	90.6/86*	79.3/78*	74.1/73*
600 DQPAA	89.10	80.70	74.70
650 DQPAB	89.70	81.40	75
750 DQCB	91.1/87*	79.9/79*	75.3/74*
750 DQFAA	87.8	77.8	73.8
800 DQCC	91.3/87*	80.2/79*	75.7/74*
800 DQFAB	88.1	78.3	74
900 DQFAC	88.8	79.1	74.6
<b>1000 DQFAD</b>	89.6	80.1	<b>75.3</b>

- All data is 60 Hz, full load standby rating, steel enclosures only.

- Data is a measured average of 8 positions.

- Sound levels for aluminium enclosures are approximately 2 dB(A) higher than listed sound levels for steel enclosures.

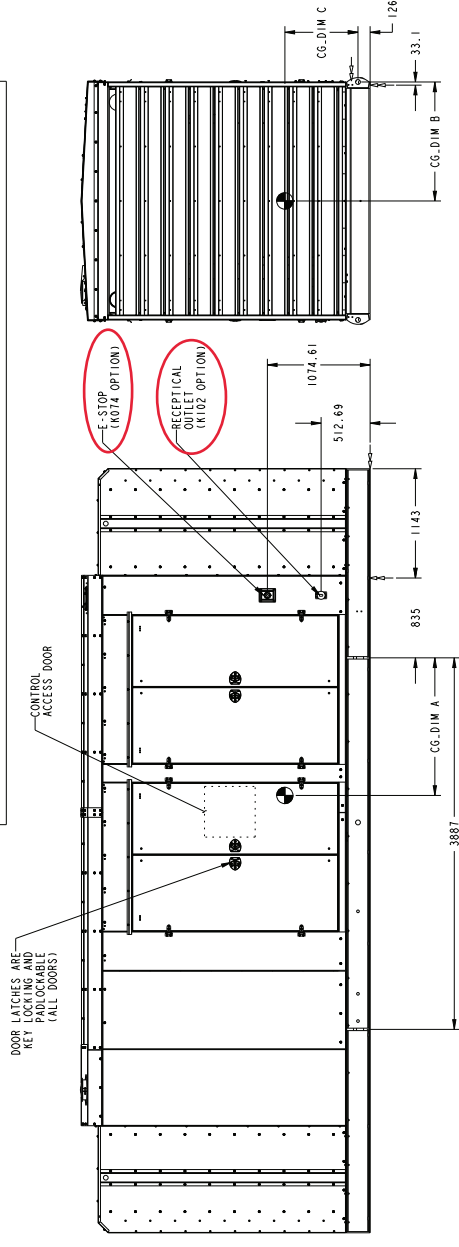
\* Sound data with seismic feature codes L228-2 (IBC) and/or L225-2 (OSHPD)

Use this drawing for overall shipping weight and dimension

- NOTES:
1. DIMENSIONS SHOWN IN ( ) ARE INCHES.
  2. FOUNDATION REFERENCE POINT (---). SEE FOUNDATION DRAWING FOR DETAILS.

MODEL		STEEL ENCLOSURE WEIGHT ±5%	ALUMINUM ENCLOSURE WEIGHT ±5%	CG-DIM "A"	CG-DIM "B"	CG-DIM "C"	DIM.D ±.75 (3)
DOCA, DOCB DOCC	HC6G	123.9 (2720.2)	108.84 (2394.1)	2038 (80.2)		846 (33.3)	
	HC6H	154.89 (3415.3)	103.4 (2282.5)	2028 (79.6)		845 (33.3)	
	HC6J	128.94 (2849.7)	114.39 (2525.1)	2013 (78.5)		844 (33.2)	152.9 (6.0)
	HC6K	123.39 (2740.7)	114.82 (2526.9)	2031 (80.0)		842 (33.1)	
	S8D	123.39 (2740.7)	108.84 (2394.1)	2038 (80.2)		846 (33.3)	
	S8E	124.89 (2769.7)	103.4 (2282.5)	2021 (78.6)		845 (33.3)	
DFGB, DFGE	HC6E	113.15 (2501.4)	99.16 (2186.6)	2139 (86.6)		1031 (41.0)	1490 (59)
	HC6F	113.55 (2511.4)	100.91 (2226.0)	2126 (83.1)		1034 (41.1)	
	HC6G	120.06 (2647.4)	105.53 (2326.6)	2080 (81.9)		1034 (41.1)	1599 (63)
	HC6H	120.16 (2652.4)	106.21 (2341.6)	2032 (80.8)		1033 (41.1)	
	HC6J	123.11 (2727.4)	109.16 (2406.6)	2020 (78.5)	1244.7 (49)	794 (31.3)	
	HC6K	126.34 (2785.3)	111.19 (2464.5)	2025 (81.3)		791 (31.1)	
DFHA, DFHB DFHC, DFHD DFHA, DFHAB DFHAC, DFHAD	HC6J	130.95 (2886.9)	116.40 (2566.1)	2017 (78.4)		788 (31.1)	1570 (62)
	HC6K	131.70 (2903.4)	117.15 (2582.6)	2009 (77.9)		787 (31.1)	
	PIB	132.56 (2924.4)	118.01 (2601.6)	1980 (77.2)		786 (30.9)	1688 (67)
	S8D	135.14 (2979.4)	120.59 (2658.6)	1945 (76.6)		784 (30.9)	
	S8E	128.72 (2837.7)	111.19 (2464.5)	2025 (81.3)		791 (31.3)	1570 (62)
	S8F	130.95 (2886.9)	114.17 (2516.9)	2017 (78.4)		788 (31.1)	
DOPAA, DOPAB	HC6F	113.37 (2504.4)	100.82 (2222.6)	2017 (78.4)		827 (32.6)	
	HC6H	116.08 (2559.2)	101.54 (2238.5)	2039 (81.1)		826 (32.5)	1438 (56.6)

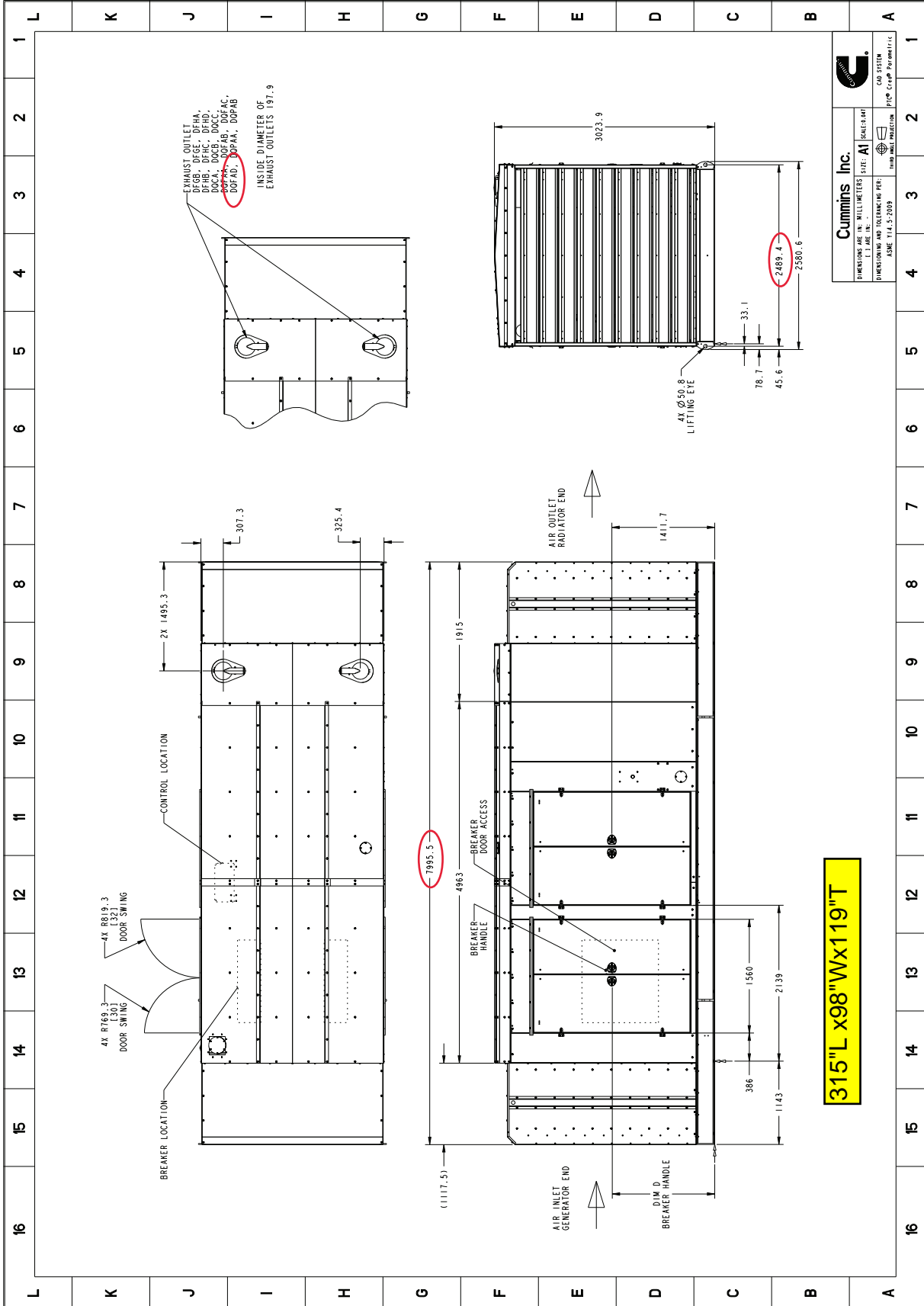
\*\*\* WEIGHT & CG'S ARE SHOWN WITH F202 STEEL ENCLOSURE, AND STANDARD WET GENSET. ADDITION OF OTHER FEATURES MAY CHANGE THE WEIGHT.



LAST DIMENSION LETTER USED... THIS PART IS SIMILAR TO: 0308-4147  
 UNLESS OTHERWISE SPECIFIED, THE FOLLOWING SHALL APPLY: FINISH: 303; 304; 307  
 WALL THICKNESS: 1/8" DRIFT ANGLES: EDGE RADIUS: 1/8" FILLET RADIUS: 1/8"  
 DIMENSIONAL TOLERANCES: ±.005  
 DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED  
 DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED  
 DIMENSIONAL TOLERANCES PER: ASME Y14.5-2004  
 CUBIC FEET  
 INCH POUND MECHANICAL  
 Cummins Inc.  
 DIMENSIONS ARE IN MILLIMETERS SIZE: A1 (SCALE: 1:1)  
 DIMENSIONAL TOLERANCES PER: ASME Y14.5-2004  
 INCH POUND MECHANICAL  
 Cummins Inc.

Part Number: A034L228 Part Revision: F  
 Part Name: OUTLINE, ENCLOSURE  
 Drawing Category: Detail State: Released Sheet 1 of 3

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315"L x98"Wx119"H

**Cummins Inc.**  
 DIMENSIONS ARE IN MILLIMETERS SIZE: A1 (SCALE: 1:1)  
 DIMENSIONAL TOLERANCING PER:  
 ASME Y14.5-2009

CAD SYSTEM: CATIA  
 DRAWING PRODUCTION: P100 Group Parametric

Part Number: A034L228 Part Revision: F  
 Part Name: OUTLINE, ENCLOSURE  
 Drawing Category: Detail State: Released Sheet 2 of 3

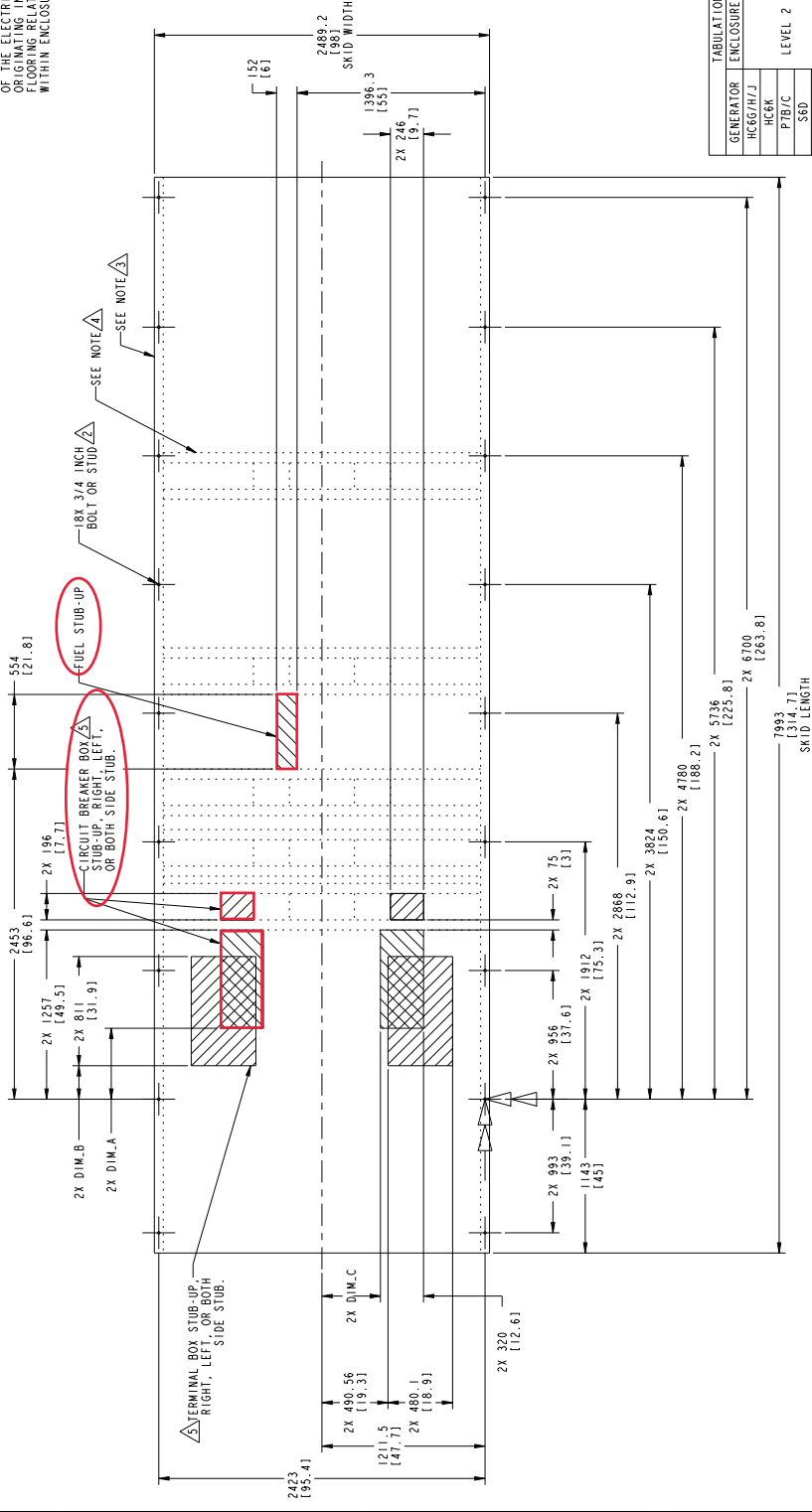
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Cummins Data Classification: Cummins Confidential

**DQFAA, DQFAB, DQFAC, DQFAD  
FEATURE CODE F202, F205  
(LIFTING BASE MOUNTED ENCLOSURE WITHOUT FUEL TANK)**

**NOTES:**

1. DIMENSIONS IN [ ] ARE IN INCHES.
- △ SKID-BASE HAS A FLANGE THICKNESS OF 7mm (.28 INCHES) ALLOW EXTRA LENGTH ON HARDWARE FOR UNEVENNESS OF MOUNTING SURFACE.
- △ LIFTING BASE OR FUEL TANK DIMENSIONS IS SHOWN. FOUNDATION IS PROVIDED BY CUSTOMER PER PERMETER. SEE (1030) APPLICATION MANUAL.
- △ HIDDEN LINES REPRESENT LIFT BASE CROSSMEMBER.
- △ AREA SHOWN INDICATES APPROXIMATE OFFSET PLACEMENT OF THE ELECTRICAL FLEXIBLE CONDUIT SUB-UP AREA OR GIMATING IN CONCRETE OR OTHER TYPE OF BASE FLOORING RELATIVE TO CIRCUIT BREAKER LOCATION WITHIN ENCLOSURE TO PROVIDE VIBRATION PROTECTION.



GENERATOR	TABULATION ENCLOSURE	DIM. A	DIM. B	DIM. C
HC66/H/J	LEVEL 2	446 [117.56]	248.4 [9.7]	434.5 [11.1]
HC6K		653 [25.7]	455.4 [117.9]	448.7 [11.7]
PTB/C		333 [21]	333.4 [13.2]	474.4 [18.7]
S/D				
SEE IT				

**Cummins Inc.**

DIMENSIONS ARE IN MILLIMETERS (SEE: D) SCALES: 1:1

DIMENSIONING AND TOLERANCING PER: ASME Y14.5-2009

UNITS: MILLIMETERS

FILE: C:\p\p\Parametric

Part Number: **A040V832** Part Revision: **E**  
 Part Name: **OUTLINE, GENSET**  
 Drawing Category: **Detail State: Released** Sheet 3 of 4

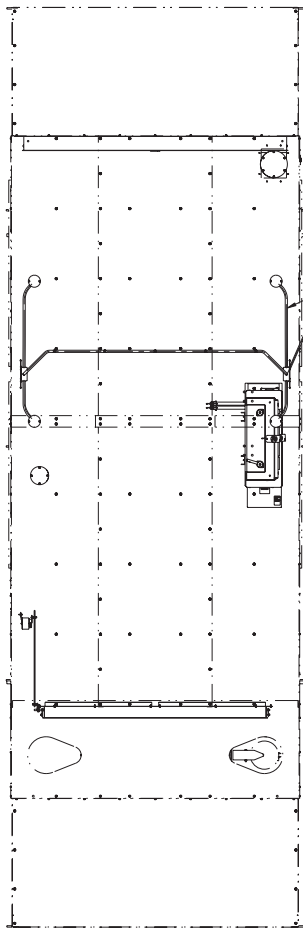
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Cummins Data Classification: **Internal Use Only**

FIG 5.00 Parametric | 4 | 3 | 2 | 1 | D | C | B | A

USE WITH MODELS	ENCLOSURE FEATURE CODE	FUEL TANK		DIM. A
		FEATURE CODE	CAPACITY GALLONS	
DF68L GE DF68A, AB, AC, AD DF68L, CC DF68A, AB, AC, AD	NO FUEL TANK	---	---	---
	F200, F203 (WEATHER) F204, F205 (WEATHER) F202, F205 (OUTLET SIDE 2) F204, AB, AC, AD	G249	200	355.6 (141)
		C205	660	457.2 (178)
		C250	1000	584.2 (223)
		C251	1500	584.2 (223)
	C252	2000	584.2 (223)	
	C253	2400	584.2 (223)	

MODEL/FEATURE TABLE, FOR REFERENCE ONLY



LIGHTING 120 VAC (K547)

LOWER (DAMPER AUTO) (F212, F213) NOTE 2

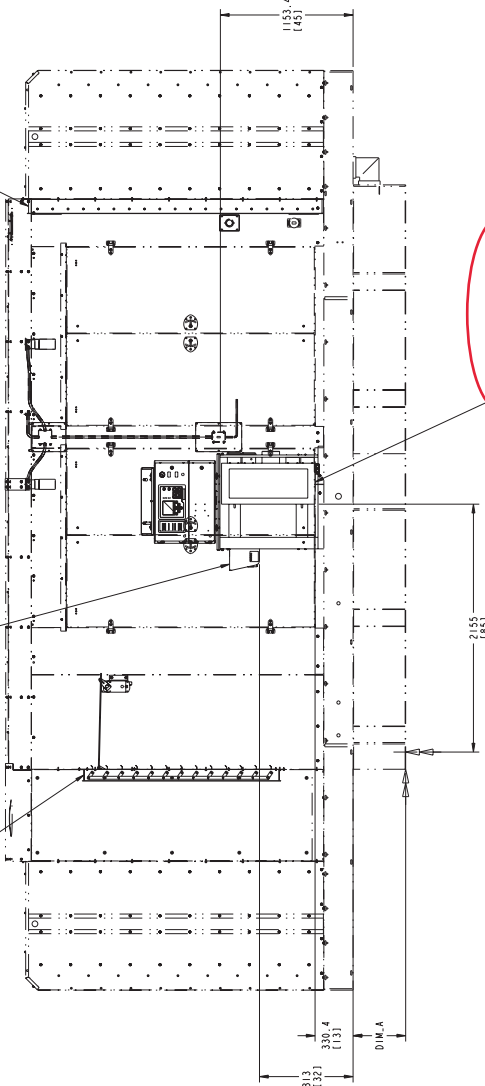
BATTERY CHARGER (NOT WITH DOMAIN)

LOWER (OPERATING INLET) (F210, F211)

LOWER (GRAVITY) (F224)

AC DISTRIBUTION (H657) OPERATING LOCATION APPROXIMATE - SEE NOTE

- NOTES:
- WITH AN AC DISTRIBUTION PANEL (H657) THE MOTORIZED LOUVERS ARE REQUIRED. WITHOUT AN AC DISTRIBUTION PANEL, 18GA WIRING SHALL BE USED. LOUVERS IS TERMINATED IN THE AC DISTRIBUTION PANEL LOCATION.
  - DIMENSION IN ( ) ARE INCHES.
  - SEE FOUNDATION DRAWING FOR REFERENCE POINT LOCATION ( --> )
  - ALL DIMENSIONS ARE REFERENCE. UNLESS SPECIFICALLY TOLERANCED.



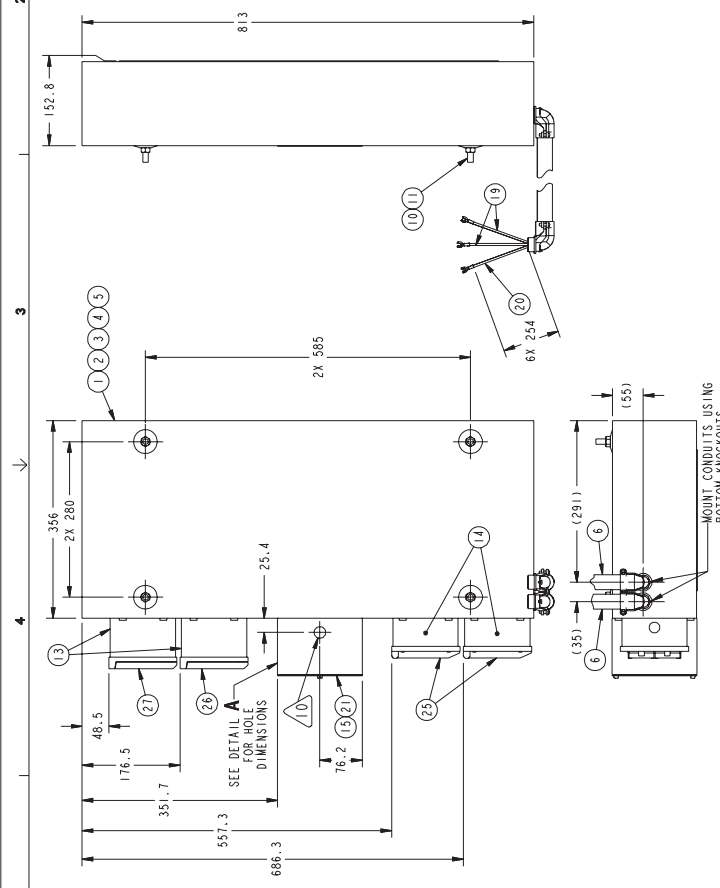
PROJECT: 00000000000000000000 SHEET: 00000000000000000000 DATE: 11/11/15 SCALE: 1/16 DRAWN BY: J. ROBINSON CHECKED BY: J. ROBINSON PROJECT MANAGER: J. ROBINSON PROJECT ENGINEER: J. ROBINSON PROJECT ARCHITECT: J. ROBINSON PROJECT CONTRACTOR: J. ROBINSON	<b>CLARKSON POWER GENERATION</b> <b>OUTLINE GENSET</b> SITE CODE: 001000 PGF: E NO: A0535071
---	--

REV.	DATE	BY	CHKD.	DESCRIPTION	DATE	BY	CHKD.
1	10/23/05	AW	AW	ISSUED FOR CONSTRUCTION	10/23/05	AW	AW
2	10/23/05	AW	AW	REVISION TO 10/23/05	10/23/05	AW	AW
3	10/23/05	AW	AW	REVISION TO 10/23/05	10/23/05	AW	AW
4	10/23/05	AW	AW	REVISION TO 10/23/05	10/23/05	AW	AW
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6	10/23/05	AW	AW	REVISION TO 10/23/05	10/23/05	AW	AW
7	10/23/05	AW	AW	REVISION TO 10/23/05	10/23/05	AW	AW
8	10/23/05	AW	AW	REVISION TO 10/23/05	10/23/05	AW	AW
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49	10/23/05	AW	AW	REVISION TO 10/23/05	10/23/05	AW	AW
50	10/23/05	AW	AW	REVISION TO 10/23/05	10/23/05	AW	AW

**DIMENSIONS ARE METRIC**

**NOTES:**

1. ALL ELECTRICAL MATERIALS AND COMPONENTS SHALL BE UL LISTED OR RECOGNIZED FOR THEIR APPLICATIONS.
2. ALL WIRE SHALL BE STRANDED, OIL RESISTANT AND UL RECOGNIZED AS BOTH MTW AND THW.
3. WIRE COLORS SHALL BE AS FOLLOWS:  
ALL HOTS-BLACK  
ALL NEUTRALS-WHITE  
ALL GROUND WIRES-GREEN OR GREEN WITH YELLOW STRIPE
4. ALL OUTLETS SHALL HAVE SEPARATE GROUND WIRES CONNECTING BACK TO PANEL GROUND BAR.
5. SPARE TERMINAL LUGS SHALL BE USED ON LEAD WIRES WHERE THEY ATTACH TO RECEPTACLE OR TERMINAL LUGS FOR COOLANT HEATER SHALL FIT #8 TERMINAL SCREWS.
6. INSULATED BUSHINGS SHALL BE USED AT ALL POINTS WHERE CONDUCTORS PASS THROUGH PANELS.
7. ALL OUTLETS AND BREAKERS SHALL BE CLEARLY LABELLED PER LABEL LIST.
8. ALL CONNECTIONS SHALL BE SECURED TO MANUFACTURERS SPECIFIED TORQUES.
9. FUNCTIONAL TEST-AFTER ASSEMBLY THE FOLLOWING TESTS SHALL BE PERFORMED ON EACH PANEL ASSY:  
ALL TESTS SHALL BE CONDUCTED WITH THE PANEL GROUNDED AND COMPLETELY ASSEMBLED EXCEPT THE FRONT PANEL MAY BE REMOVED.  
120/208 OR 120/240 VOLTS SHALL BE APPLIED TO THE PANEL THROUGH THE MAIN BREAKER INPUT TERMINALS AND ALL BREAKERS SHALL BE SWITCHED ON & OFF TO CONFIRM THEY FUNCTION AND CONTROL THE CORRECT RECEPTACLES.  
ALL OUTLETS SHALL BE CHECKED FOR CORRECT CONNECTION AND GROUNDING.  
THE GFCI SHALL BE TESTED FOR PROPER TRIPPING WITH AN EXTERNAL TEST FAULT.  
AFTER ALL TESTS ARE SUCCESSFULLY COMPLETED, A LABEL SHALL BE AFFIXED TO THE BACK OF THE PANEL GIVING THE DATE AND THE INITIALS OF THE PERSON WHO PERFORMED THEM.  
HOLE SIZE TO BE Ø13/16 INCH OR NEAREST EQUIVALENT  
DRILL SIZE NOT TO EXCEED Ø13/16 INCH.



TABULATION	
PART NO.	CURRENT LER
0320 2281-01	FRO28249
0320 2281-02	FRO28249

**LIST OF PARTS FOR REFERENCE ONLY**

1	1	27	RECEPTACLE COVER P/N: E98620N-CAR
1	1	26	RECEPTACLE (GFCI) COVER P/N: E98620N-CAR
2	2	25	RECEPTACLE COVER P/N: E98620N-CAR
1	1	24	THIST LOCK RECEPTACLE
1	1	23	EUROPA TERMINAL BLOCK W/WIRE PROTECTOR (TYCO # 4-1437387-1)
6	-	22	LUG FOR 8-32 TERMINAL
1	1	21	INSULATED TERMINAL STRIP, 2 POSITION
AR	-	20	GREEN #8 WIRE PER NOTES
AR	-	19	BLACK #8 WIRE PER NOTES
AR	AR	18	GREEN 12 WIRE PER NOTES
AR	AR	17	WHITE #12 WIRE PER NOTES
AR	AR	16	BLACK #12 WIRE PER NOTES
1	1	15	6" X 6" X 4" BOX W/O HOLES FOR LOUVER TRANSFORMERS, HOFFMAN A5E6XANK OR EQUAL
2	2	14	OUTLET BOX P/N: E9802 (NON-METALIC)
2	2	13	OUTLET BOX P/N: E9801 (NON-METALIC)
1	1	12	UL LABEL
4	4	11	M10 HEX JAM NUT
4	4	10	M10 MOUNTING BOLTS W/75° OF EXPOSED THREAD FOR MTG
4	4	9	NEMA 15-20R, SPEC GRADE DUPLEX RECEPTACLE, IVORY
1	1	8	120V, 20 AMP GFCI RECEPTACLE, IVORY
4	-	7	90° CONNECTORS FOR FLEXIBLE METAL CONDUIT
2	-	6	Ø3/4 INCH X 120 INCH LONG FLEXIBLE METAL CONDUIT
1	1	5	EQUIPMENT GROUND BAR, SO D PK1567A-L
6	6	4	CIRCUIT BRKR, CIRC 4.6, 5, 10, 12 & 14 20 AMP SINGLE POLE, BOLT ON, SO D DOB
3	3	3	CIRCUIT BRKR, CIRC 3.5, 7, 9, 11 & 13 40 AMP TWO POLE BOLT, BOLT ON, SO D DOB
1	1	2	CIRCUIT BRKR, CIRC 1 & 2, 150 AMP TWO POLE BOLT, BOLT ON, SO D DOB
1	1	1	BREAKER PNL, SURFACE MT, NEMA 1, 120/240/1PH/150 AMP LUGS, SO D IN00D30L225CU
99	99	ITEM	DESCRIPTION



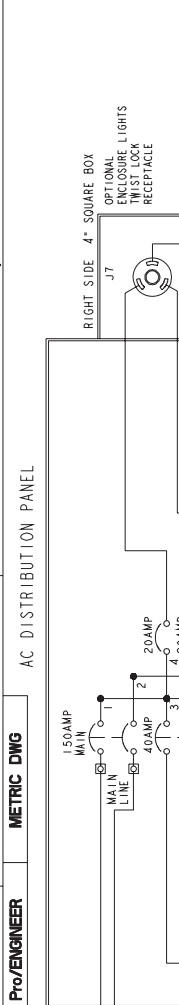
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2	08-23-05	...	...	...	...	...	...
3	08-23-05	...	...	...	...	...	...
4	08-23-05	...	...	...	...	...	...
5	08-23-05	...	...	...	...	...	...
6	08-23-05	...	...	...	...	...	...

0320\_2281

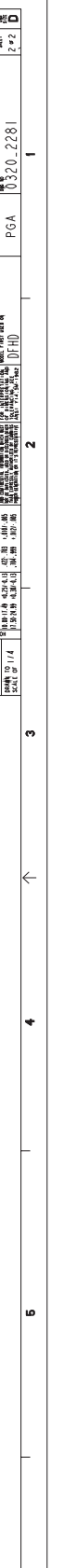
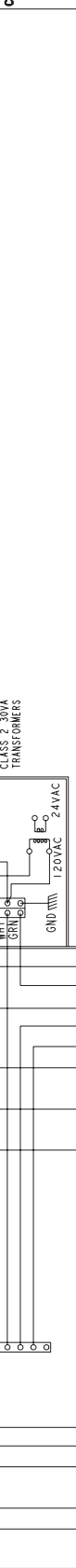
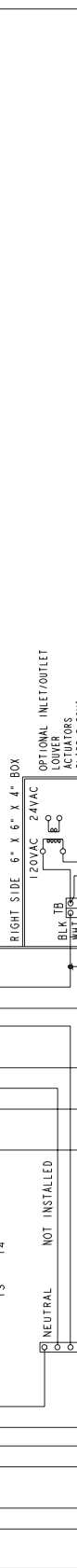
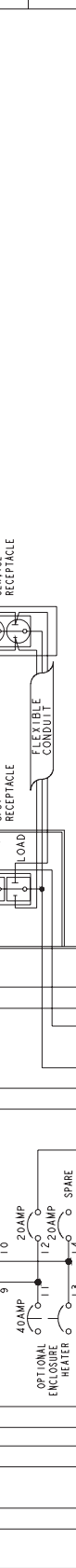
Pro/ENGINEER METRIC DWG

AC DISTRIBUTION PANEL

CUSTOMER PROVIDED SHORE POWER 120/208-240V-1PH 150AMPS



FROM	TO	DESCRIPTION LABEL
CE1	CE2	MAIN BREAKER
CE3	CE4	CUSTOMER POWER SUPPLY
CE5	CE6	ENGINE COOLANT HEATER
CE7	CE8	ENGINE COOLANT HEATER
CE9	CE10	ENGINE COOLANT HEATER
CE11	CE12	ENCLOSURE HEATER
CE13	CE14	ENCLOSURE HEATER
CE15	CE16	OPTIONAL ENCLOSURE HEATER
CE17	CE18	OPTIONAL ENCLOSURE LIGHTS
CE19	CE20	SERVICE RECEPTACLES
CE21	CE22	J3: ALTERNATOR AND CONTROL CABINET HEATER/OPTIONAL LOWER ACTUATORS
CE23	CE24	LOUVER (20/24 VAC TX)
CE25	CE26	OPTIONAL SERVICE RECEPTACLE
CE27	CE28	BATTERY CHARGER
CE29	CE30	BATTERY CHARGER AND TRANSFER PUMP CONTROL
CE31	CE32	SPARE



REV.	DATE	BY	CHKD.	DESCRIPTION	DATE	BY	CHKD.
1	08-23-05	...	...	...	...	...	...
2	08-23-05	...	...	...	...	...	...
3	08-23-05	...	...	...	...	...	...
4	08-23-05	...	...	...	...	...	...
5	08-23-05	...	...	...	...	...	...
6	08-23-05	...	...	...	...	...	...

0320\_2281

Pro/ENGINEER METRIC DWG

AC DISTRIBUTION PANEL

CUSTOMER PROVIDED SHORE POWER 120/208-240V-1PH 150AMPS

FROM	TO	DESCRIPTION LABEL
CE1	CE2	MAIN BREAKER
CE3	CE4	CUSTOMER POWER SUPPLY
CE5	CE6	ENGINE COOLANT HEATER
CE7	CE8	ENGINE COOLANT HEATER
CE9	CE10	ENGINE COOLANT HEATER
CE11	CE12	ENCLOSURE HEATER
CE13	CE14	ENCLOSURE HEATER
CE15	CE16	OPTIONAL ENCLOSURE HEATER
CE17	CE18	OPTIONAL ENCLOSURE LIGHTS
CE19	CE20	SERVICE RECEPTACLES
CE21	CE22	J3: ALTERNATOR AND CONTROL CABINET HEATER/OPTIONAL LOWER ACTUATORS
CE23	CE24	LOUVER (20/24 VAC TX)
CE25	CE26	OPTIONAL SERVICE RECEPTACLE
CE27	CE28	BATTERY CHARGER
CE29	CE30	BATTERY CHARGER AND TRANSFER PUMP CONTROL
CE31	CE32	SPARE

REV.	DATE	BY	CHKD.	DESCRIPTION	DATE	BY	CHKD.
1	08-23-05	...	...	...	...	...	...
2	08-23-05	...	...	...	...	...	...
3	08-23-05	...	...	...	...	...	...
4	08-23-05	...	...	...	...	...	...
5	08-23-05	...	...	...	...	...	...
6	08-23-05	...	...	...	...	...	...

0320\_2281

Pro/ENGINEER METRIC DWG

AC DISTRIBUTION PANEL

CUSTOMER PROVIDED SHORE POWER 120/208-240V-1PH 150AMPS

Page 48 of 57

# PowerCommand<sup>®</sup> Annunciator Discrete Input or PCCNet



## > Specification sheet

Our energy working for you.<sup>™</sup>



**Power  
Generation**

## Description

The Universal Annunciator Module provides visual and audible indication of up to 20 separate alarm or status conditions, based on discrete (relay) inputs or network inputs. Each LED can be controlled by either a discrete wire input or by a signal on the PCCNet network sent from an external device, such as a PCC1301 or PCC2100 (version 2.4 or later) control.

In addition to the LEDs, the annunciator can control four custom relays based on signals received over the PCCNet. When one of the annunciator's discrete inputs is activated, the annunciator will broadcast that information over the network. By taking advantage of the network, discrete inputs and custom relays, the annunciator can be used as expanded I/O for a genset controller.

Easily installed in a location to give immediate notification of an alarm or warning status. Designed to give operating/monitoring personnel quick-glance status information. The module directly senses battery voltage to provide green/yellow/red alarm and status information for that parameter.

Genset controller complies with NFPA level two requirements when used with the display but without the annunciator panel. When used with the annunciator it meets NFPA level one requirements (emergency and standby power systems). The annunciator module can also be used for monitoring of transfer switch or other equipment status.

## Features

- Visual and audible warnings of up to 20 separate alarm or status conditions.
- LEDs can be controlled either via PCCNet or discrete input.
- Status of discrete inputs is broadcast on network.
- Four custom relays can be controlled over the PCCNet network.
- Configurable LED color (red, yellow or green) and selectable horn operation allows maximum flexibility.
- Standard NFPA 110 label, field configurable for other alarm status and conditions.
- Each audible alarm is annunciated, regardless of the number of existing alarm conditions displayed.
- Sealed membrane panel design provides environmental protection for internal components and is easy to clean.
- Configurable for negative (ground) input or positive input.
- Integral DC voltage sensing.
- Flush or surface mount provisions.
- UL Listed and labeled; CSA certified; CE marked.

## Specifications

### Signal requirements

Positive - Input impedance is 1.82 kOhms to ground; maximum input voltage = 31 VDC.

Negative - Input impedance is 1.82 kOhms to Bat+; inputs are at Bat+ level when open.

Sink/source current threshold for detection - 150 uA minimum, 3 mA maximum.

Typical conductor size: 16 ga for 304.8 m (1000 ft)

Max conductor size for terminal: 12 ga

### Relay outputs

0.2 A at 125 VAC and 1 A at 30 VDC

### Network connections

Use Belden 9729 two pair, stranded, shielded 24 AWG twisted pair cable for all PCCNet connections. Total network length can not exceed 1219 m (4000 ft). Up to 20 nodes can be connected to the network.

Note: Any communications wire connected to the generator set should be stranded cable.

### Power

Maximum consumption: 15 watts

### Battery voltage

Functional range - Audible and visual conditions operational from 6.5 to 31 VDC.

Low voltage setting - 12.0 VDC for 12 Volt nominal systems; 24.0 for 24 Volt nominal systems.

High voltage setting - 16.0 Volt for 12 Volt nominal systems; 32.0 Volt for 24 Volt nominal systems.

### Alarm horn

Sound level: 90 dB at 30 cm

### Physical

Weight (with enclosure): 1.4 kg (3.0 lbs)

### Temperature

-20 °C to +70 °C (-4 °F to +158 °F)

### Humidity

10% to 95% RH (non-condensing)

## Default lamp configurations

Can be configured for current NFPA 110 standard or as a replacement for Legacy (pre-2001) NFPA 110 annunciator (300-4510 or 300 4511)

Lamp	Description	NFPA 110		
		Color	Horn	Flash
DS1	Customer fault 1	Green	No	No
DS2	Customer fault 2	Amber	No	No
DS3	Customer fault 3	Red	No	No
DS4	Genset supplying load	Amber	No	No
DS5	Charger AC failure	Amber	Yes	No
DS6	Low coolant level	Amber	Yes	No
DS7	Low fuel level	Red	Yes	No
DS8	Check generator set	Amber	No	No
DS9	Not in auto	Red	Yes	Yes
DS10	Generator set running	Amber	No	No
DS11	High battery voltage	Amber	Yes	No
DS12	Low battery voltage	Red	Yes	No
DS13	Weak battery	Red	Yes	No
DS14	Fail to start	Red	Yes	No
DS15	Low coolant temp	Red	Yes	No
DS16	Pre-high engine temp	Amber	Yes	No
DS17	High engine temp	Red	Yes	No
DS18	Pre-low oil pressure	Red	Yes	No
DS19	Low oil pressure	Red	Yes	No
DS20	Overspeed	Red	Yes	No

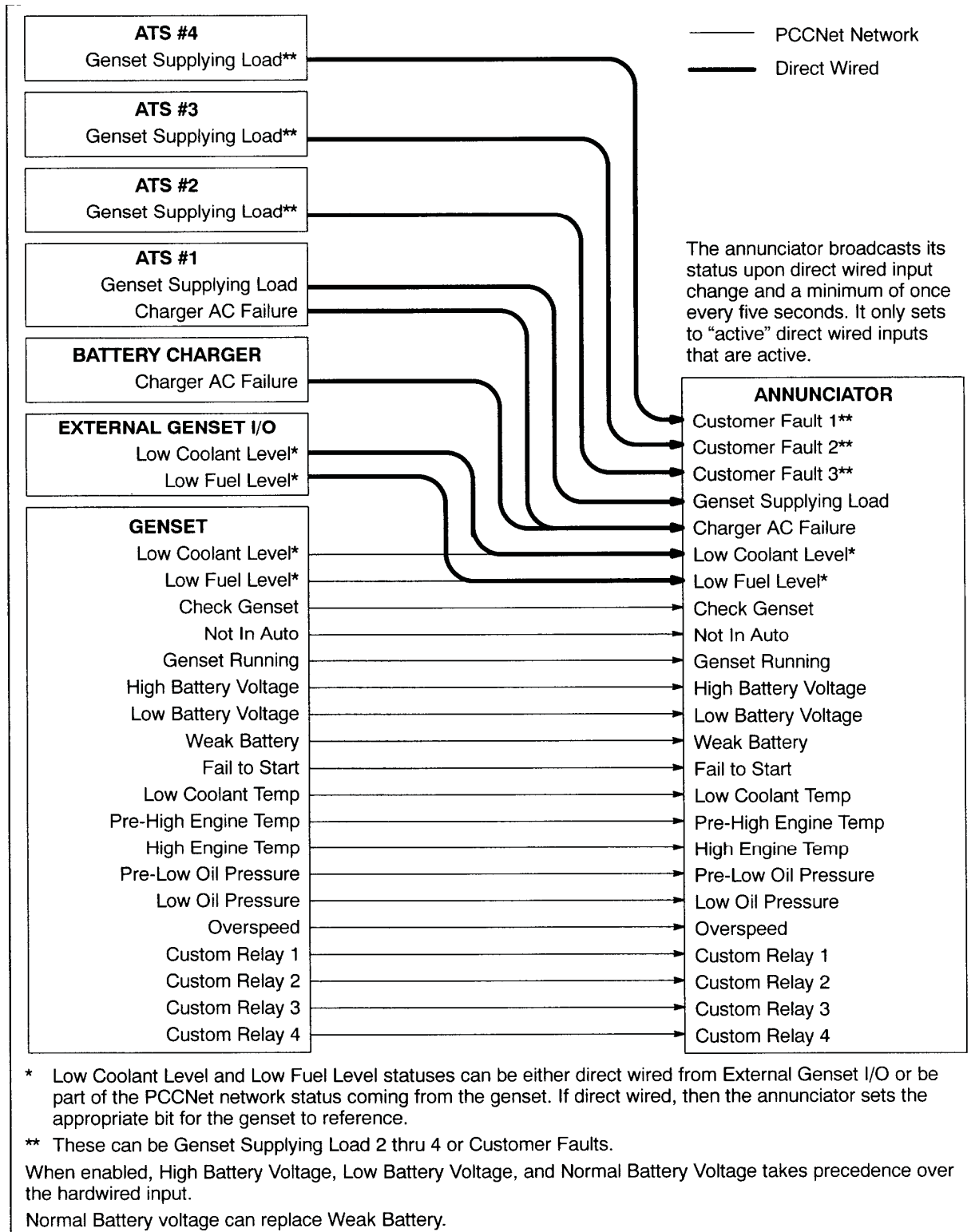
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## Typical installation



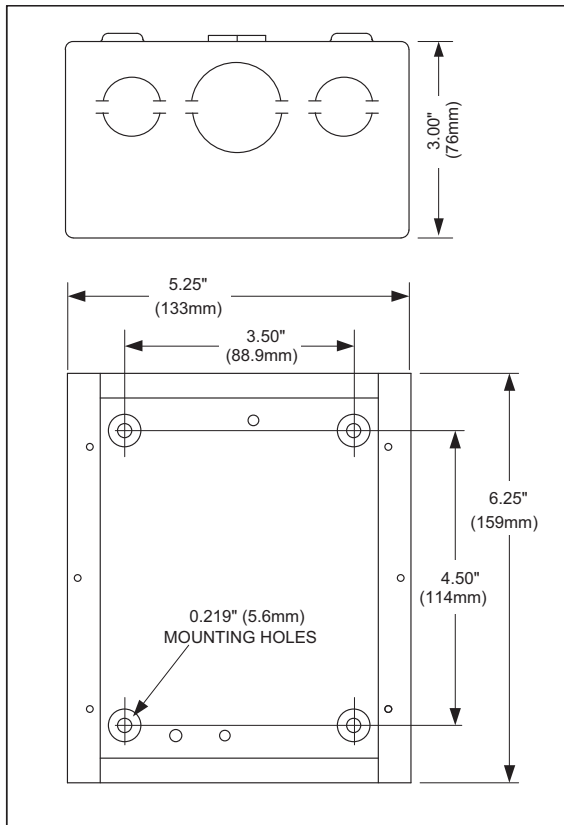
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## Dimensions



Dimensions: in (mm)

## Ordering information

Part number	Description
0300-5929-01	Panel mount
0300-5929-02	Panel with enclosure

**PCCNet**  
  
**COMPATIBLE**

**See your distributor for more information.**

### Cummins Power Generation

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 Fax: 763 574 5298

#### Europe, CIS, Middle East and Africa

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 Kent CT 12 5BF United Kingdom  
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#### Asia Pacific

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# Four-stage battery charger

15 amp @ 12 volt

12 amp @ 24 volt



## > Specification sheet

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## Power Generation

### Description

Cummins Power Generation fully automatic battery chargers - using switched mode power electronics - are constant voltage/constant current chargers incorporating a 4-stage charging algorithm. Designed for use in applications where battery life and reliability are important; these chargers, complete with built-in equalize charge capability, are ideal for stationary or portable starting battery charging service.

To achieve optimum battery life, a 4-stage charging cycle is implemented. The four charging stages are trickle, bulk, absorption and float. The trickle stage safely charges overly discharged batteries. It protects a damaged or shorted battery from excessive current. During bulk charge a constant current is applied to quickly restore the maximum battery charge level in the shortest amount of time. The absorption stage applies a constant voltage to the battery to bring the battery to 100% capacity. The float stage tailors the constant voltage output to maintain the battery at full capacity while serving DC operated loads.

An optional temperature sensor may be used to adjust charging rate based on internal battery temperature in the absorption and float stages. Use of a battery temperature sensor helps to increase battery life by preventing over or under charging of the battery. The battery temperature sensor also protects the battery from overheating. Temperature compensation is recommended in all applications, but is particularly valuable for generator sets in outdoor applications.

Battery chargers are field-configurable for charging either 12 or 24 VDC battery systems and for operation at 50 or 60 Hz. Output voltage and battery type selection is done through the alphanumeric display.

### Features

**Protection** - All models include a 20 amp DC output breaker. Re-settable breakers are used for input voltages 240 VAC and lower. For over 240 VAC branch circuit rated fuses are used.

**Easy installation** - Clearly marked terminal blocks and panel knockouts provide convenient connections of input and output leads.

**User display** - Output voltage and current, fault information and configuration options are indicated on the alphanumeric display.

**Monitoring** - An LED indicates the condition of the charger. Green indicates normal charging operation, amber indicates equalizing and red indicates a fault condition.

**Adjustable float voltage** - Float voltage can be set through the alpha-numeric display for optimum battery performance and life.

**Faults** - The charger senses and annunciates the following fault conditions: Input overvoltage, input undervoltage, AC power loss, battery overvoltage, battery undervoltage, charger circuitry overtemperature, battery overtemperature, unrecoverable battery and overload/overcurrent.

**Output relay** - Output contacts are closed in a fault condition. 30 volt 2 amp contacts.

**Temperature compensation** - An optional external sensor is available for temperature compensated battery charging.

**Corrosion resistant aluminum enclosure.**

**Vibration resistant design** - complies with UL 991 vibration resistance requirements.

**RFI/EMI and voltage surge resistant.**

**UL 1236 (BBHH) Listing** - for use with lead acid batteries in generator set installations. Also suitable for use with NiCad, gel and AGM batteries.



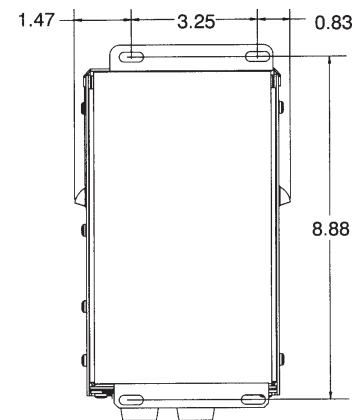
## Specifications

### Performance and physical characteristics

<b>Output:</b>	Nominal voltage	12 or 24 VDC
	Float voltage – 12 V batteries	12.8, 13.0, 13.3, 13.5, 13.6, 14.3
	Float voltage – 24 V batteries	25.7, 26.1, 26.6, 27.0, 27.2, 28.6
	Equalize-voltage	15.5 or 31.0 VDC
	Output voltage regulation	±1%
	Maximum output current	15 A @ 12 VDC or 12 A @ 24 VDC
	Equalize charger time	0-12 hrs
<b>Input:</b>	Voltage AC	120, 208, 240, 277, 380, 416, 480, 600
	Frequency	50 or 60 Hz
<b>Approximate net weights:</b>		11.6 lbs (5.3 Kg)
<b>Approximate dimensions: height x width x depth - in (mm)</b>		9.75 x 5.56 x 6.14 (248 x 141 x 156)
<b>Ambient temperature operation:</b>		-22 °F to 122 °F (-30 °C to 50 °C)



Input volts	Genset kit part number	ATS kit part number
<b>120/208/240</b>	0300-5878-01	0300-5878-13
<b>277</b>	0300-5878-02	0300-5878-14
<b>380</b>	0300-5878-03	0300-5878-15
<b>416</b>	0300-5878-04	0300-5878-16
<b>480</b>	0300-5878-05	0300-5878-17
<b>600</b>	0300-5878-06	0300-5878-18
<b>Temperature sensor kit</b>	0541-0918	0541-0918



Mounting dimensions – inches  
Bottom view

## Enclosure

The NEMA 1, corrosion resistant, aluminum enclosure is designed for wall mounting. When wall mounted, louvers protect cooling holes in the sides of the enclosure. Use 1/4 in (6.35 mm) diameter bolts for mounting.

## RFI/EMI and voltage surge compliance

Charger complies with the requirements of EN61000-4-5 for voltage surge resistance, EN50082-2 (heavy industrial) for immunity, EN61000-4-2 for ESD, EN61000-4-3 for radiated immunity, ANSI/IEEE C62.41 Category B & EN 61000-4-4 for electrically fast transient, EN61000-4-6 for conducted, and FCC Part 15 Class A for emissions.

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Singapore 608838  
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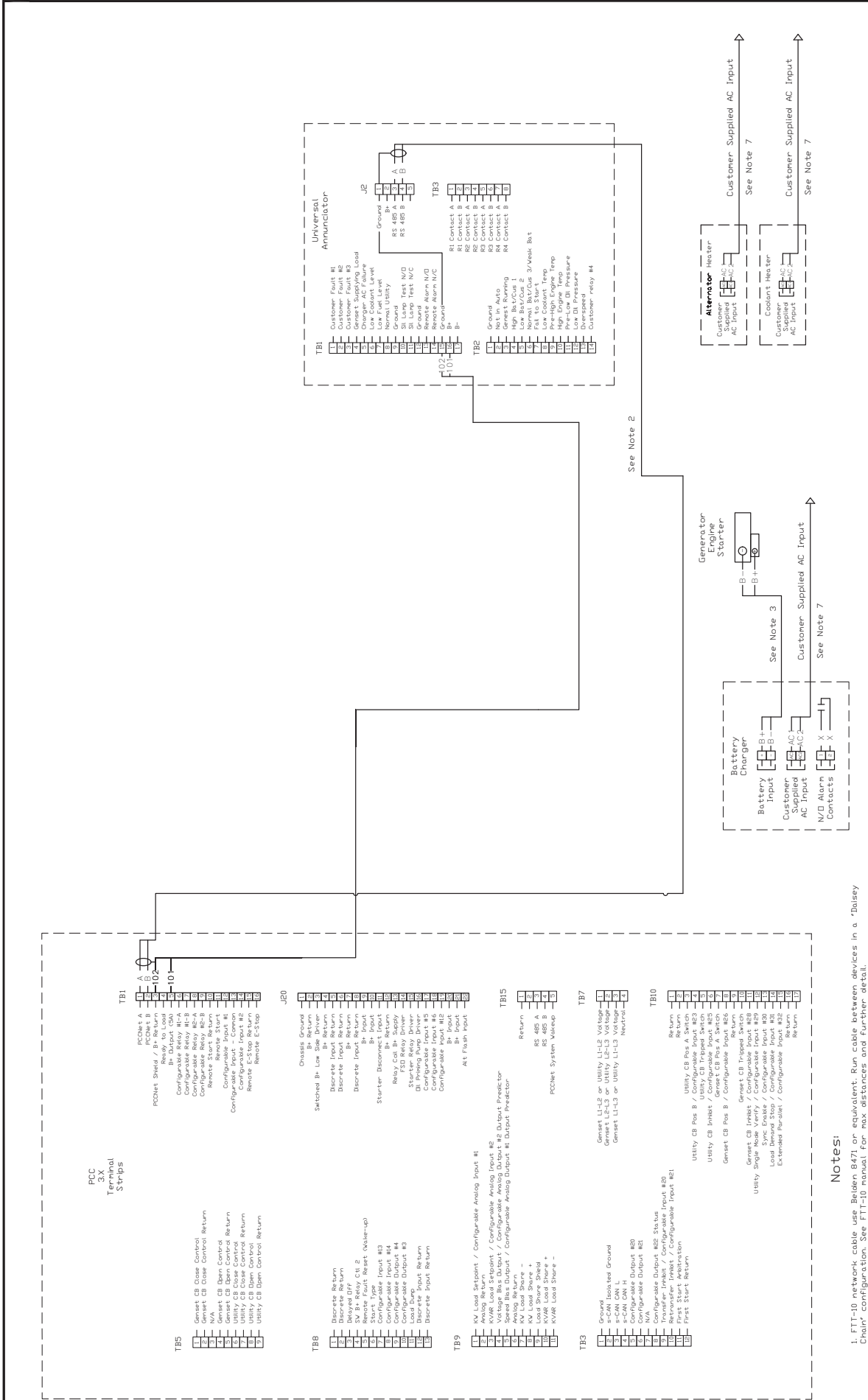
**Warning:** Back feed to a utility system can cause electrocution and/or property damage. Do not connect generator sets to any building electrical system except through an approved device or after building main switch is open.

**Warning:** For professional use only. Must be installed by a qualified service technician. Improper installation presents hazards of electrical shock and improper operation, resulting in severe personal injury and/or property damage.

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**Notes:**

- FTT-10 network cable use Belden 9471 or equivalent. Run cable between devices in a "Daisy Chain" configuration. See FTT-10 manual for max distances and further detail.
- PCC NET network cable use Belden 9729 or equivalent. See Cummins documentation for max distances and further detail.
- See size chart in battery charger installation manual or NEC guide.
- See size chart in battery charger installation manual or NEC guide.
- See instruction sheet C673b For Kodion II Gateway Kit pinout and further detail.
- See AUX 101 / 102 Operator Manual for pinout and further detail.
- See BDM for voltage.
- See Protomode instruction guide for detailed wiring layout and more information.

Revision: 1.5

Sheet: 1 of 1

**Project:**

**Title:**

**AUTHOR:** D. Fields      **Date:**

Power Generation

**Limited Warranty**

**Commercial Generating Set**

This limited warranty applies to all Cummins Power Generation® branded commercial generating sets and associated accessories (hereinafter referred to as "Product").

This warranty covers any failures of the Product, under normal use and service, which result from a defect in material or factory workmanship.

**Warranty Period:**

The warranty start date<sup>†</sup> is the date of initial start up, first rental, demonstration or 18 months after factory ship date, whichever is sooner. See table for details.

**Continuous Power (COP)** is defined as being the maximum power which the generating set is capable of delivering continuously whilst supplying a constant electrical load when operated for an unlimited number of hours per year. No overload capability is available for this rating.

**Prime Power (PRP)** is defined as being the maximum power which a generating set is capable of delivering continuously whilst supplying a variable electrical load when operated for an unlimited number of hours per year. The permissible average power output over 24 hours of operation shall not exceed 70% of the PRP. For applications requiring permissible average output higher than stated, a COP rating should be used.

**Limited-Time Running Power (LTP)** is defined as the maximum power available, under the agreed operating conditions, for which the generating set is capable of delivering for up to 500 hours of operation per year.

**Emergency Standby Power (ESP)** is defined as the maximum power available during a variable electrical power sequence, under the stated operating conditions, for which a generating set is capable of delivering in the event of a utility power outage or under test conditions for up to 500 hours of operation per year. The permissible average power output over 24 hours of operation shall not exceed 70% of the ESP.

**Environmental Protection Agency – Stationary Emergency (EPA-SE)** is defined as being the maximum power available during a variable electrical power sequence, under the stated operating conditions, for which a generator set is capable of delivering in the event of a utility power outage or under test conditions and used in strict accordance with the EPA NSPS for stationary engines, 40 CFR part 60, subparts IIII and JJJJ, where a reliable utility must be present. The permissible average power output over 24 hours of operation shall not exceed 70% of the EPA-SE.

**Data Center Continuous (DCC)** is defined as the maximum power which the generator is capable of delivering continuously to a constant or varying electrical load for unlimited hours in a data center application.

**Base Warranty Coverage Duration (Whichever occurs first)**

Rating	Months	Max. Hours
COP	12	Unlimited
PRP	12	Unlimited
LTP	12	500 hrs
ESP	24	1000 hrs
EPA-SE	24	Unlimited
DCC	24	Unlimited

<sup>†</sup> Warranty start date for designated rental and oil and gas model Products is determined to be date of receipt of Product by the end customer.

**Cummins Power Generation® Responsibilities:**

In the event of a failure of the Product during the warranty period due to defects in material or workmanship, Cummins Power Generation® will only be responsible for the following costs:

- All parts and labor required to repair the Product.
- Reasonable travel expenses to and from the Product site location.
- Maintenance items that are contaminated or damaged by a warrantable failure.

**Owner Responsibilities:**

The owner will be responsible for the following:

- Notifying Cummins Power Generation® distributor or dealer within 30 days of the discovery of failure.
- Installing, operating, commissioning and maintaining the Product in accordance with Cummins Power Generation®'s published policies and guidelines.
- Providing evidence for date of commissioning.
- Providing sufficient access to and reasonable ability to remove the Product from the installation in the event of a warrantable failure.
- Incremental costs and expenses associated with Product removal and reinstallation resulting from non-standard installations.
- Costs associated with rental of generating sets used to replace the Product being repaired.
- Costs associated with labor overtime and premium shipping requested by the owner.
- All downtime expenses, fines, all applicable taxes, and other losses resulting from a warrantable failure.

**Limitations:**

This limited warranty does not cover Product failures resulting from:

- Inappropriate use relative to designated power rating.
- Inappropriate use relative to application guidelines.
- Inappropriate use of an EPA-SE application generator set relative to EPA's standards.
- Normal wear and tear.
- Improper and/or unauthorized installation.
- Negligence, accidents or misuse.
- Lack of maintenance or unauthorized repair.
- Noncompliance with any Cummins Power Generation® published guideline or policy.
- Use of improper or contaminated fuels, coolants or lubricants.
- Improper storage before and after commissioning.
- Owner's delay in making Product available after notification of potential Product problem.
- Replacement parts and accessories not authorized by Cummins Power Generation®.
- Use of Battle Short Mode.
- Owner or operator abuse or neglect such as: operation without adequate coolant or lubricants; overfueling; overspeeding; lack of maintenance to lubricating, cooling or air intake systems; late servicing and maintenance; improper storage, starting, warm-up, run-in or shutdown practices, or for progressive damage resulting from a defective shutdown or warning device.

- Damage to parts, fixtures, housings, attachments and accessory items that are not part of the generating set.

This limited warranty does not cover costs resulting from:

- Difficulty in gaining access to the Product.
- Damage to customer property.

A "Data center" is defined as a dedicated facility that house computers and associated equipment for data storage and data handling.

Reliable utility is defined as utility power without routine or regularly scheduled black-outs.

Please contact your local Cummins Power Generation® Distributor for clarification concerning these limitations.

**CUMMINS POWER GENERATION® RIGHT TO FAILED COMPONENTS:**

Failed components claimed under warranty remain the property of Cummins Power Generation®. Cummins Power Generation® has the right to reclaim any failed component that has been replaced under warranty.

**Extended Warranty:**

Cummins Power Generation® offers several levels of Extended Warranty Coverage. Please contact your local Cummins Power Generation® Distributor for details.

[www.power.cummins.com](http://www.power.cummins.com)

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**IN NO EVENT IS CUMMINS POWER GENERATION® LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.**

This limited warranty shall be enforced to the maximum extent permitted by applicable law. This limited warranty gives the owner specific rights that may vary from state to state or from jurisdiction to jurisdiction.

Product Model Number: \_\_\_\_\_  
 Product Serial Number: \_\_\_\_\_  
 Date in Service: \_\_\_\_\_