

Diesel generator set QSK60 series engine



> Specification sheet 1600 kW - 2000 kW 60 Hz

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Description

Cummins Power Generation commercial generator sets are fully integrated power generation systems providing optimum performance, reliability and versatility for stationary standby and prime power applications. Codes may not be available with all model configurations – consult factory for availability.



This generator set is designed in facilities certified to ISO 9001 and manufactured in facilities certified to ISO 9001 or ISO 9002.



The Prototype Test Support (PTS) program verifies the performance integrity of the generator set design. Cummins Power Generation products bearing the PTS symbol meet the prototype test requirements of NFPA 110 for Level 1 systems.



All low voltage models are CSA certified to product class 4215-01.



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.

U.S. EPA

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.

International Building Code

The generator set package is available certified for seismic application in accordance with the following International Building Code: IBC2000, IBC2003, IBC2006 and IBC2009.

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.

Control system - The PowerCommand® electronic control is standard equipment and provides total genset 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.

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

NFPA - The genset 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)	50 Hz kW (kVA)	60 Hz kW (kVA)	50 Hz kW (kVA)	60 Hz kW (kVA)	50 Hz kW (kVA)	60 Hz	50 Hz
DQKAA	1750 (2188)		1600 (2000)				D-3335	
DQKAB	2000 (2500)		1825 (2281)				D-3336	

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Generator set specifications

Governor regulation class	ISO8528 Part 1 Class G3
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 801.2 through IEC 801.5; MIL STD 461C, Part 9

Engine specifications

Bore	158.8 mm (6.25 in)
Stroke	190.0 mm (7.48 in)
Displacement	60.2 litres (3673 in ³)
Configuration	Cast iron, V 16 cylinder
Battery capacity	2200 amps minimum at ambient temperature of -18 °C to 0 °C (0 °F to 32 °F)
Battery charging alternator	40 amps
Starting voltage	24 volt, negative ground
Fuel system	Cummins' Modular Common Rail System
Fuel filter	Dual element, 10 micron filtration, spin-on fuel filters with 15 micron 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	150 °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	< 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	50 Hz line-neutral/line-line
<ul style="list-style-type: none"> • 219/380 • 254/440 • 277/480 • 347/600 • 2400/4160 • 7200/12470 • 7620/13200 • 7970/13800 	<ul style="list-style-type: none"> • 220/380 • 230/400 • 240/415 • 254/440 • 1905/3300 • 3640/6300 • 3810/6600 • 6350/11000

* Note: Consult factory for other voltages.

Generator set options and accessories

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

- ☐ 120/240 V 100 W control anti-condensation heater
- ☐ Paralleling configuration
- ☐ Remote fault signal package
- ☒ Run relay package

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

- ☐ Industrial grade exhaust silencer
- ☐ Residential grade exhaust silencer
- ☐ Critical grade exhaust silencer

Cooling system

- ☐ Remote 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.

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Control system PCC 3201



PowerCommand control is an integrated generator set control system providing governing, voltage regulation, engine protection and operator interface functions. Major features include:

- Integral AmpSentry™ Protective Relay providing a full range of alternator protection functions that are matched to the alternator provided.
- Battery monitoring and testing features and smart starting control system.
- Three phase sensing, full wave rectified voltage regulation system, with a PWM output for stable operation with all load types.
- Control suitable for operation in ambient temperatures from -40 °C to +70 °C (-40 °F to +158 °F) and altitudes to 5000 meters (13,000 feet).
- Prototype tested; UL, CSA, and CE compliant.
- InPower™ PC-based service tool available for detailed diagnostics.
- Optional Echelon® LONWORKS® network interface.

Operator/display panel

- Off/manual/auto mode switch
- Manual run/stop switch
- Panel lamp test switch
- Emergency stop switch
- Exercise switch
- Alpha-numeric display with pushbutton access for viewing engine and alternator data and providing setup, controls and adjustments
- LED lamps indicating not in auto, common warning, common shutdown, remote start
- Configurable for local language

Engine protection

- Overspeed shut down
- Low oil pressure warning and shut down
- High coolant temperature warning and shut down
- High oil temperature warning
- Low coolant level warning or shut down
- Low coolant temperature warning
- High and low battery voltage warning
- Weak battery warning
- Dead battery shut down
- Fail to start (overcrank) shut down
- Fail to crank shut down
- Redundant start disconnect
- Cranking lockout
- Sensor failure indication

Engine data

- DC voltage
- Lube oil pressure
- Coolant temperature
- Lube oil temperature
- Engine speed
- Engine ECM data

AmpSentry AC protection

- Over current and short-circuit shut down
- Over current warning
- Single and three phase fault regulation
- Over and under voltage shut down
- Over and under frequency shut down
- Overload warning with alarm contact
- Reverse power and reverse Var shut down

Alternator data

- Line-to-line and line-to-neutral AC volts
- Three phase AC current
- Frequency
- Total and individual phase power factor, kW and kVA
- Bus voltage and frequency (with paralleling options)

Other data

- Genset model data
- Start attempts, starts, running hours
- kW hours (total and since reset)
- Fault history
- Load profile (accessible with InPower)

Governing

- Digital electronic isochronous governor
- Temperature dynamic governing
- Smart idle speed mode

Voltage regulation

- Digital PWM electronic voltage regulation
- Three phase line-to-neutral sensing
- Single and three phase fault regulation
- Configurable torque matching

Control functions

- Data logging on faults
- Fault simulation (requires InPower)
- Time delay start and cooldown
- Cycle cranking
- Configurable customer outputs (4)
- Configurable network inputs (8) and outputs (16) (with optional network)
- Remote emergency stop

Paralleling (Option)

- Active digital phase lock loop synchronizer
- Isochronous kW and kVar load sharing controls
- kW import/export and kVar/PF control for utility (mains) paralleling

Options

- ☐ Thermostatically controlled space heater
- ☐ Key-type mode switch
- ☐ Ground fault module
- ☒ Auxiliary relays (3)
- ☐ Echelon LONWORKS interface
- ☐ Modion Gateway to convert to Modbus (loose)
- ☐ PowerCommand iWatch web server for remote monitoring and alarm notification (loose)
- ☐ Digital input and output module(s) (loose)
- ☒ Remote annunciator (loose)
- ☐ Paralleling
- ☐ Power transfer control

For further detail see document S-1444.

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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):

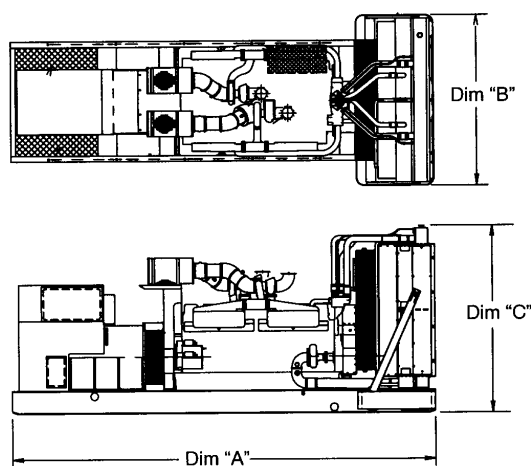
Applicable for supplying power to a constant electrical load for limited hours. Limited Time Running Power (LTP) is in accordance with ISO 8528.

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.

Do not use for installation design

Model	Dim "A" mm (in.)	Dim "B" mm (in.)	Dim "C" mm (in.)	Set Weight* dry kg (lbs)	Set Weight* wet kg (lbs)
DQKAA	6175 (243)	2534 (100)	3043 (120)	15231 (33569)	15396 (33932)
DQKAB	6175 (243)	2534 (100)	3043 (120)	17382 (38309)	17908 (39470)

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

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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.

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Model: DQKAB
Frequency: 60
Fuel type: Diesel
KW rating: 2000 standby
1825 prime

Emissions level: EPA NSPS Stationary Emergency Tier 2

➤ **Generator set data sheet**

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Exhaust emission data sheet:	EDS-1065
Exhaust emission compliance sheet:	EPA-1099
Sound performance data sheet:	
Cooling performance data sheet:	MCP-158
Prototype test summary data sheet:	PTS-267
Standard set-mounted radiator cooling outline:	0500-4392
Optional set-mounted radiator cooling outline:	0500-4780
Optional heat exchanger cooling outline:	
Optional remote radiator cooling outline:	0500-4393

Fuel consumption	Standby				Prime				Continuous
	kW (kVA)				kW (kVA)				kW (kVA)
Ratings	2000 (2500)				1825 (2281)				
Load	1/4	1/2	3/4	Full	1/4	1/2	3/4	Full	Full
US gph	46.5	82	107.3	141.3	43.4	75.1	100.6	124.1	
L/hr	176	311	407	535	164	285	381	470	

Engine	Standby rating	Prime rating	Continuous rating
Engine manufacturer	Cummins Inc.		
Engine model	QSK60-G6 NR2		
Configuration	Cast iron, V 16 cylinder		
Aspiration	Turbocharged and low temperature aftercooled		
Gross engine power output, kWm (bhp)	2179 (2922)	1975 (2647)	
BMEP at set rated load, kPa (psi)	2420 (350)	2185 (316)	
Bore, mm (in)	159 (6.25)		
Stroke, mm (in)	190 (7.48)		
Rated speed, rpm	1800		
Piston speed, m/s (ft/min)	11.4 (2244)		
Compression ratio	14.5:1		
Lube oil capacity, L (qt)	334 (304)		
Overspeed limit, rpm	2100 ±50		
Regenerative power, kW	168		

Fuel flow		
Maximum fuel flow, L/hr (US gph)	946 (250)	
Maximum fuel inlet restriction, kPa (in Hg)	30 (9.0)	
Maximum fuel inlet temperature, °C (°F)	71 (160)	

Air	Standby rating	Prime rating	Continuous rating
Combustion air, m ³ /min (scfm)	178 (6295)	159 (5615)	
Maximum air cleaner restriction, kPa (in H ₂ O)	6.2 (25)		
Alternator cooling air, m ³ /min (cfm)	204 (7300)		

Exhaust

Exhaust flow at set rated load, m ³ /min (cfm)	436 (15385)	385 (13580)	
Exhaust temperature, °C (°F)	488 (900)	466 (870)	
Maximum back pressure, kPa (in H ₂ O)	6.8 (27)		

Standard set-mounted radiator cooling

Ambient design, °C (°F)	40 (104)		
Fan load, kW _m (HP)	57 (77)		
Coolant capacity (with radiator), L (US gal)	492 (130)		
Cooling system air flow, m ³ /min (scfm)	1922 (67870)		
Total heat rejection, MJ/min (Btu/min)	99.5 (94395)	91.0 (86382)	
Maximum cooling air flow static restriction, kPa (in H ₂ O)	0.12 (0.5)		
Maximum fuel return line restriction kPa (in Hg)	30 (9.0)		

Optional set-mounted radiator cooling

Ambient design, °C (°F)	50 (122)		
Fan load, kW _m (HP)	57 (77)		
Coolant capacity (with radiator), L (US gal)	163 (43)		
Cooling system air flow, m ³ /min (scfm)	2795 (98700)		
Total heat rejection, MJ/min (Btu/min)	99.5 (94395)	91 (86382)	
Maximum cooling air flow static restriction, kPa (in H ₂ O)	0.12 (0.5)		
Maximum fuel return line restriction, kPa (in Hg)	30 (9.0)		

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)			

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Optional remote radiator cooling¹	Standby rating	Prime rating	Continuous rating
Set coolant capacity, L (USg gal)			
Max flow rate at max friction head, jacket water circuit, L/min (US gal/min)	1902 (502)		
Max flow rate at max friction head, aftercooler circuit, L/min (US gal/min)	606 (160)		
Heat rejected, jacket water circuit, MJ/min (Btu/min)	46.9 (44526)	44.1 (41824)	
Heat rejected, aftercooler circuit, MJ/min (Btu/min)	33.9 (32156)	30.4 (28887)	
Heat rejected, fuel circuit, MJ/min (Btu/min)			
Total heat radiated to room, MJ/min (Btu/min)	18.7 (17713)	16.5 (15671)	
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)	18 (60)		
Maximum static head, aftercooler circuit, m (ft)	18 (60)		
Maximum jacket water outlet temp, °C (°F)	104 (220)	100 (212)	
Maximum aftercooler inlet temp at 25 °C (77 °F) ambient, °C (°F)	49 (120)		
Maximum aftercooler inlet temp, °C (°F)	66 (150)		
Maximum fuel flow, L/hr (US gph)			
Maximum fuel return line restriction, kPa (in Hg)	30 (9.0)		

Weights²

Unit dry weight kgs (lbs)	14628 (32249)
Unit wet weight kgs (lbs)	15155 (33410)

Notes:

¹ For non-standard remote installations contact your local Cummins Power Generation representative.

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

Derating factors

Standby	Engine power available up to 447 m (1466 ft) at ambient temperatures up to 40 °C (104 °F). From 447 m (1466 ft) up to 2001 m (6562 ft) engine derates at 5.1% per 305 m (1000 ft) for 40 °C (104 °F). Above these elevations, derate an additional 5.8% per 305 m (1000 ft). For temperatures from 40 °C (104 °F) to 50 °C (122 °F) derate 14.6%. For temperatures above 50 °C (122 °F) derate 29% per 10 °C (50 °F).
Prime	Engine power available up to 447 m (1466 ft) at ambient temperatures up to 40 °C (104 °F). From 447 m (1466 ft) up to 2001 m (6562 ft) engine derates at 5.1% per 305 m (1000 ft) for 40 °C (104 °F). Above these elevations, derate an additional 5.8% per 305 m (1000 ft). For temperatures from 40 °C (104 °F) to 50 °C (122 °F) derate 14.6%. For temperatures above 50 °C (122 °F) derate 29% per 10 °C (50 °F).
Continuous	

Ratings definitions

Emergency standby power (ESP):	Limited-time running power (LTP):	Prime power (PRP):	Base load (continuous) power (COP):
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.

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Alternator data

Voltage	Connection ¹	Temp rise degrees C	Duty ²	Single phase factor ³	Max surge kVA ⁴	Winding No.	Alternator data sheet	Feature Code
380	Wye, 3-phase	150/125/105	S/P/C		7327	13	ADS-515	B595
380	Wye, 3-phase	125/105/80	S/P/C		7327	13	ADS-515	B598
380	Wye, 3-phase	105/80	S/P		7327	13	ADS-515	B599
380	Wye, 3-phase	80	S		7963	13	ADS-516	B660
440	Wye, 3-phase	125/105/80	S/P/C		7361	312	ADS-334	B663
440	Wye, 3-phase	105	S		7284	12	ADS-515	B665
480	Wye, 3-phase	125/105/80	S/P/C		7361	312	ADS-334	B462
480	Wye, 3-phase	105/80	S/P		7695	312	ADS-335	B463
480	Wye, 3-phase	125/105	P/C		6716	312	ADS-332	B464
480	Wye, 3-phase	80	S		8412	12	ADS-516	B601
480	Wye, 3-phase	80	P		8412	12	ADS-516	B694
480	Wye, 3-phase	105	S		7695	12	ADS-517	B796
600	Wye, 3-phase	125/105/80	S/P/C		7361	07	ADS-334	B465
600	Wye, 3-phase	105/80	S/P		7695	07	ADS-335	B301
600	Wye, 3-phase	125/105	P/C		6716	07	ADS-333	B466
600	Wye, 3-phase	80	S		7265	07	ADS-516	B604
4160	Wye, 3-phase	125/105/80	S/P/C		6307	51	ADS-518	B467
4160	Wye, 3-phase	105/80	S/P		6307	51	ADS-518	B313
4160	Wye, 3-phase	80	S		6307	51	ADS-518	B605
4160	Wye, 3-phase	105	S		6307	51	ADS-520	B795
12470-13800	Wye, 3-phase	125/105/80	S/P/C		6062	91	ADS-521	B448
12470	Wye, 3-phase	105/80	S/P		6038	87	ADS-521	B567
13200-13800	Wye, 3-phase	105/80	S/P		6062	91	ADS-521	B612
12470	Wye, 3-phase	80	S		6685	87	ADS-522	B607
13200-13800	Wye, 3-phase	80	S		8012	91	ADS-523	B628
13800	Wye, 3-phase	80	S		6833	91	ADS-521	B610
13800	Wye, 3-phase	105	S		6062	91	ADS-523	B797

Notes:

¹ 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 Factor³. All single phase ratings are at unity power factor.

² Standby (S), Prime (P) and Continuous ratings (C).

³ Factor for the *Single Phase Output from Three Phase Alternator* formula listed below.

⁴ 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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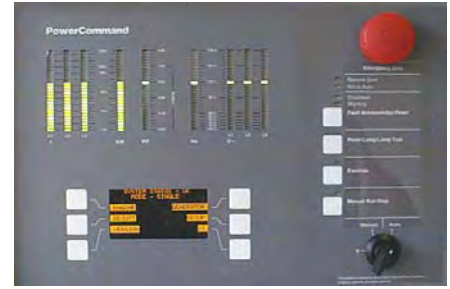
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PowerCommand® 3201 digital generator set control



> Specification sheet

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Description

The PowerCommand® 3201 Control is a microprocessor-based generator set monitoring, metering and control system. The control provides an operator interface to the genset, digital voltage regulation, digital governing and generator set protective functions. It may incorporate optional automatic digital paralleling controls and/or power transfer controls. The integration of all the functions into a single control system provides enhanced reliability and performance compared to conventional control systems.

The PowerCommand control is designed for mounting on the generator set and is suitable for use on generator sets ranging in size from 20 kW to 4000 kW. It will directly read AC voltages up to 600 VAC and can be configured for any frequency, voltage and power connection configuration from 120 to 13,800 VAC. The operator panel may be remote-mounted from the generator set and connected via an RS485 network connection.

The control offers a wide range of standard control and digital display features so custom control configurations are not needed to meet application requirements and system reliability is not compromised by use of untested special components.

Power for PowerCommand Control is usually derived from the generator set starting batteries. It functions over a voltage range from 8 VDC to 35 VDC.

Features

Digital full authority electronic engine controls - Provide engine monitoring, protection and governing. These functions are integrated with voltage regulation and paralleling functions for optimum system performance.

Digital voltage regulation - Provides fast, controlled response to load changes and high levels of immunity to the effects of non-linear loads.

AmpSentry™ protective relay - UL Listed, true alternator overcurrent protection.

AC output metering - Includes analog and digital display.

Battery monitoring system - Senses and warns against weak battery condition that is not detected by conventional DC over and undervoltage monitoring.

Message display - Digital alarm and status.

Generator set monitoring - Displays status of all critical engine and alternator generator set functions.

Smart starting control system - Integrated fuel ramping to limit black smoke and frequency overshoot, in addition to optimized cold weather starting.

Advanced serviceability - Utilizes InPower™, a PC-based software service tool.

Digital power transfer control - Optional control functions that allow operation in open transition, closed transition or soft (ramping) transfer modes.

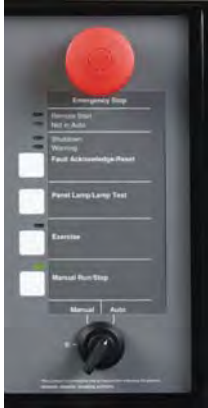
PowerCommand LonWorks® network - Optional network interface providing expanded input/output capability, remote monitoring and control by annunciators and other equipment, and easier installation.

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

Operator panel

The operator panel provides the user with a complete package of easy to view and use information. It includes an enhanced graphical operator panel that allows the user to view up to 9 lines of information, as well as graphical displays of system data. Connections to the operator panel are sealed, locking plug interfaces for reliable, vibration-resistant interconnection to the generator set wiring harness.

Control switches and functions



Off/manual/auto mode control switch - The *not in auto* lamp will flash when the control is in the *manual* or *off* mode. In the *auto* mode, the generator set can be started using the exercise push-button or with a start signal from a remote device, such as automatic transfer switches.

Manual run/stop control switch and indicating LED - When the mode control switch is in the *manual* position and the *manual run/stop* switch is pressed, the generator set will start, bypassing all time delay starts. (Time delay idle can also be bypassed with another control action.) If the generator set is running in the *manual* mode, pressing the *run/stop* switch will cause the generator set to shut down. An LED (light emitting diode) lamp adjacent to the switch will light to indicate the generator set is in manual mode.

Exercise control switch and indicating LED - When the mode control switch is in the *auto* position the *exercise* control switch is used to complete a pre-programmed exercise sequence. All exercise functions are disabled when an emergency start command is received by the control. An LED lamp adjacent to the switch will light to indicate the generator set is in exercise mode.

Panel lamp/lamp test control switch.

Fault acknowledge/reset switch - The control includes a fault acknowledge function to allow the operator to reset the fault condition. If the fault condition is not corrected, the fault will reappear, but will not be logged as a separate event. Multiple faults can be logged and displayed at one time.

Emergency stop control switch.

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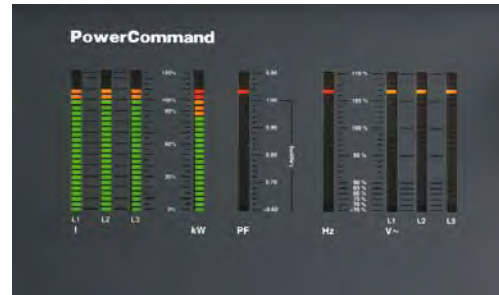
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Operator adjustments - The control includes provisions for many set up and adjustment functions via raise/lower switches on the operator panel. Functions that can be adjusted by the operator include:

- Time delay start (0-300 seconds)
- Time delay stop (0-600 seconds)
- Alternator voltage ($\pm 5\%$)
- Alternator frequency (± 3 Hz)

The operator panel can be configured to require an access code prior to adjusting these values. A second access code is used to protect the control from unauthorized service level adjustments. Voltage and frequency adjustments are disabled during operation in parallel with a system bus to prevent inadvertent misadjustment of the paralleling load sharing functions.

Analog AC metering panel



The PowerCommand control is equipped with an analog AC metering panel that simultaneously displays 3-phase line-to-line AC volts and current, kW, power factor and frequency.

The meter panel is composed of a series of LEDs configured in bar graphs for each function. The LEDs are color coded with green indicating normal range values, amber for warning levels and red for shutdown conditions. Scales for each function are in % of nominal rated values.

Graphical display panel



The PowerCommand control is provided with a graphical display capable of displaying up to 9 lines of data with approximately 27 characters per line. The graphical display is accompanied by a set of six tactile-feel membrane switches that are used by the operator to navigate through control menus and to make control adjustments. Display is configurable for multiple languages. It is configurable for units of measurement. The display incorporates three levels of operation and adjustability. All data on the control can be viewed by

scrolling through screens with the navigation keys. The top three lines of the display are allocated to mode and status messages that continuously display the operating mode of the control system, as well as any faults or warning conditions that may be present on the controller. If more than one fault or warning message is present, the messages will scroll to allow the operator to view all active messages in the system.

Screen-saver mode - The operator panel can be programmed to automatically switch off to reduce battery voltage drain when the control is not being used and the generator set is not running. Depressing any button on the operator panel, new fault conditions or receipt of a remote signal at the control will “wake up” the control.

Generator set data

Generator set hardware data - Generator set rating in kVA, complete generator set model number and serial number, engine model and serial number and alternator model and serial number. The control also displays the part number of the control and the software version present in the control.

Data logs - Number of start attempts and number of start attempts since reset. Number of times generator set has run and number of times since reset. Duration of generator set running time and duration of running time since last reset. Generator set kWh produced and kWh produced since last reset.

Adjustment history - Record of adjustment and setting changes made on the control, identifies whether adjustment was made via the operator panel or with a service tool. If a service tool is used, the control provides a record of the serial number of the tool used. This information is read with InPower.

Fault history - Record of the most recent fault conditions with time stamp, along with the number of times each fault has occurred. At least 20 events are stored in the control memory.

Load profile data - Data indicating the total operating hours at percent of load in 10% increments and since reset.

Generator set AC data

Generator set output frequency, voltage and current - All phases (line-to-line and line-to-neutral for voltage. Accuracy 1%.

Generator set power output - PowerCommand displays generator set kW and kVA output (average phase, individual phase and direction of flow) and power factor with leading/lagging indication. Accuracy 5%.

Generator set kWh energy output - Total kWh produced and total produced since last reset with time stamp of time of last reset.

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Digital synchroscope - Bus voltage and frequency, generator set bus voltage and frequency, the phase angle displacement and a signal indicating “ready to close”. A breaker control switch is included on this panel for convenient operation of the equipment without switching between viewing screens.

Engine data

Basic engine data - Engine starting battery voltage, engine lube oil pressure and engine coolant temperature.

Engine service data - Varies with engine used, but typically includes: Engine coolant pressure, engine fuel rail temperature and pressure, engine fuel input and output temperature, intake manifold temperature and pressure, ambient air pressure, crankcase blowby flow and aftercooler inlet coolant temperature.

Engine fuel consumption - The fuel consumed by the engine is calculated by the control based on fuel flow into the engine and returned by the engine, and the temperature of the two flow streams. Accuracy is $\pm 5\%$ over 500 hours of operation. Data provided includes overall average fuel consumed and consumption since reset. This information is read with InPower.

Engine exhaust temperature (optional).

Power transfer control data (optional)

Utility (mains) source data - Displays line-to-line and line-to-neutral voltage of utility (mains) source, frequency and estimated amps, and kW and kVA supplied by utility (mains) source (optional when power transfer control is used).

System status information - Provides graphical system status display showing availability of sources and positions of each contactor.

System control - Allows operator to view status of system and manually control operation of the system. Provides manual adjustment capability for time delay start, stop, transfer and retransfer, as well as time delays for program transition (when used) and power transfer overlap time.

Internal control functions

General functions

System control voltage - The control operates on 24 VDC from the generator set starting batteries. Control functions are fully operational over a voltage range of 8 VDC to 36 VDC.

Emergency start mode - PowerCommand accepts a ground signal from remote devices or a network signal to automatically start the generator set and immediately accelerate to rated speed and voltage.

PowerCommand includes a smart starting system that is designed to quickly start the engine, minimize black smoke, minimize voltage and frequency overshoot, and

oscillations on starting. The control system does this by careful simultaneous control of the engine fuel system and alternator excitation system.

Non-emergency start mode - The control is provided with a separate remote start input or a network signal to start the generator set via the programmable idle control. Using the non-emergency mode, the generator set takes longer to start, but there is less wear on the engine. In this start mode, the generator set will start, operate at idle speed for a predefined time period or until the engine reaches operating temperature (whichever time is shorter), and then ramp to rated speed and voltage. Time delay is adjustable from 0-300 seconds and default is 10 seconds. The control also monitors and records the source of start signals, when that information is available. The control automatically exits idle mode if an emergency remote start signal is received at the control.

Data logging - The control maintains a record of manual control operations, warning and shutdown conditions and other events. It uses the control "on" time as the time-stamp means when a real time clock is not included with the control. The control also stores critical engine and alternator data before and after a fault occurs, for use by InPower and the technician in evaluating the root causes for the fault condition.

Fault simulation mode - PowerCommand, in conjunction with InPower software, will accept commands to allow a technician to verify the proper operation of critical protective functions of the control 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 of the specific generator set it is communicating with.

Built in test - The control system automatically tests itself, and all the sensors, actuators and harnesses in the control system, on a startup signal. The test can also be initiated from InPower and can be accomplished either locally to the generator set or remotely.

Engine control

Engine starting - The control operates a factory-supplied fuel valve that enables engine starting.

Cycle cranking - Configurable for number of starting cycles (1 to 7) and duration of crank and rest periods. Control includes starter protection algorithms to prevent the operator from specifying a starting sequence that might be damaging. Default setting is for (3) start cycles composed of 15 seconds of cranking and 15 seconds of rest.

Programmable idle speed control - In this mode the generator set would start and run to idle speed. It would operate at that speed for a programmed time period, then ramp to rated speed. When the control gets a signal to stop, it will ramp to idle, operate for the programmed period at idle and then shut down. During idle mode,

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engine protective functions are adjusted for the lower engine speed and alternator function is disabled.

Time delay start and stop (cool down) - Configurable for time delay of 0-300 seconds prior to starting after receiving a remote start signal in normal operation modes and for time delay of 0-600 seconds prior to ramp-to-idle or shutdown after signal to stop in normal operation modes. The generator set control will monitor the load during operation of the generator set, and if the total load on the set is less than 10% of rated it will reduce the operation time for the time delay stop in order to prevent extended operation of the engine at very light load levels. Default for both time delay periods is 0 seconds.

Engine governing

Isochronous governing - Controls engine speed within $\pm 0.25\%$ for any steady state load from no load to full load. Frequency drift will not exceed $\pm 0.5\%$ for a 33 °C (60 °F) change in ambient temperature over an 8 hour period.

Droop governing - Control can be adjusted to droop from 0 to 10% from no load to full load, using InPower.

Temperature dynamics - Modifies the engine fuel system control parameters as a function of engine temperature. Allows engine to be more responsive when warm and more stable when operating at lower temperature levels.

Isochronous load sharing control - See *Paralleling Functions/Load sharing controls*.

Droop load sharing control - See *Paralleling Functions/Load sharing controls*.

Idle mode - Engine governing can be regulated at an idle speed for a programmed period on start or stop of the engine. When the engine is operating at idle speed, the alternator excitation is automatically switched off.

Alternator control

Digital output voltage regulation - PowerCommand will regulate output voltage to within 0.5% for any loads between no load and full load. Voltage drift will not exceed $\pm 0.5\%$ for a 33 °C (60 °F) change in temperature in an 8 hour period. On engine starting, or sudden load acceptance, voltage is controlled to a maximum of 5% overshoot over nominal level.

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. This function is automatically disabled when the control is in a synchronizing mode.

Fault current regulation - PowerCommand will regulate the output current on any phase to a maximum of 3 times rated current under fault conditions for both single phase and three phase faults. In conjunction with a permanent magnet generator, it will provide 3 times rated current on all phases for motor starting and short circuit coordination purposes.

Isochronous (kVar) load sharing control - See *Paralleling Functions/Load sharing controls*.

Droop (kVar) load sharing control - See *Paralleling Functions/Load sharing controls*.

Protective functions

On a warning condition, the control will indicate a fault by lighting the warning LED on the control panel and displaying the fault name and code on the operator display panel. 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.

On a shutdown condition, the control will light the shutdown LED on the control panel, display the fault name and code, initiate shutdown and lock out the generator set. The shutdown sequence of the generator set includes programmable cooldown at idle for fault conditions that do not endanger the engine. The control maintains a data log of all fault conditions as they occur and time stamps them with the controller run time and engine operating hours data. Adjustments to most set points are made using the InPower service tool.

The control system includes a “*fault bypass*” mode that forces the system to function regardless of the status of protective functions. In this mode, the only protective functions that are operational are over speed, loss of both speed sensors, moving the control switch to the *off* position or pressing the *emergency stop* switch. The control maintains a record of the time that the mode is enabled and of all warning or shutdown conditions that have occurred while in the “*fault bypass*” mode.

Many protective functions within the control system are configurable for warning, shutdown or both (2 levels). Exceptions to this include functions such as over speed conditions, and loss of speed sensing. In addition, some warning functions can incorporate control functions as a consequence of a fault.

System protective functions:

Ground fault warning (option - 600 VAC class generator sets) - Ground (earth) fault sensing is adjustable over a range of 100-1200 amps with time delays of 0-1 second. May be configured for shutdown rather than alarm.

Configurable alarm and status inputs - PowerCommand will accept up to four alarm or status inputs (contact closed to ground) to indicate customer-specified conditions. The control is programmable for warning, shutdown or status indication and for labeling the input (up to 24 characters). Sixteen additional faults can be input to the control via the network.

Breaker fail to close and breaker auxiliary contact warning or shutdown - When the paralleling control signals a circuit breaker to close, it will monitor the breaker

auxiliary contacts and verify that the breaker has connected the generator set to the system bus. If the control does not sense a breaker closure within 0.5 second of the close signal, the control will monitor the phase relationship between the generator set and the bus. If this indicates that the generator set is not closed to the bus, the “*breaker fail to close*” alarm will be indicated, the breaker will be opened and the generator set shut down. If the phase relationship monitor indicates that the generator set is in parallel with the bus, “*circuit breaker auxiliary contact failure*” will be indicated and the generator set will continue to run in normal operation mode.

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 1 second of initiation of signal, a “*breaker fail to open*” warning is initiated. The control will logically allow the generator set to continue to run if shutdown of the generator set with the breaker closed will cause potential damage or operating problems.

Bus or generator set PT input calibration error - The control system monitors the sensed voltage from the bus and generator set output voltage-potential transformers. When the paralleling breaker is closed, it will indicate a warning condition when they read different values.

Emergency stop - Annunciated whenever the local or remote emergency stop signal is received. Alarm panel distinguishes between local or remote operation.

AmpSentry protective relay

AmpSentry protective relay is a UL Listed 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 generator set or in the load. It also provides single and three phase fault current regulation so that downstream protective devices have the maximum current available to quickly clear fault conditions without subjecting the alternator to potentially catastrophic failure conditions. See document R1053 below for a full size time over current curve. The control does not include protection required for interconnection to a utility (mains) service.

Over current warning - Output current on any phase at more than 110% of rating for more than 60 seconds.

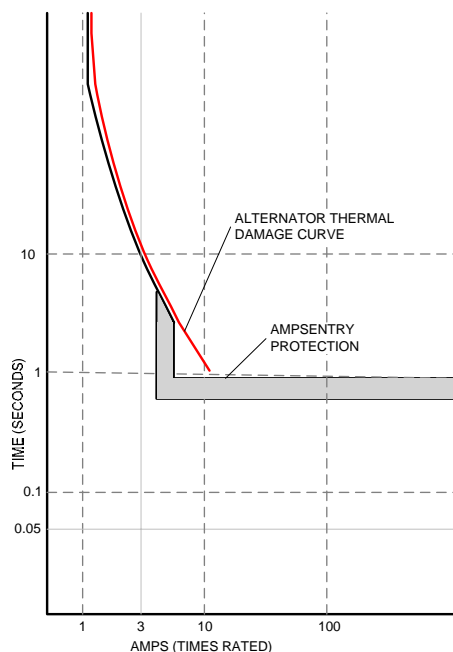
Over current shutdown (51V) - Output current on any phase is more than 110%, less than 175% of rating and approaching thermal damage point of alternator. Control includes algorithms to protect alternator from repeated over current conditions over a short period of time. The control does not include instantaneous trip functions, as they are not necessary for alternator protection and complicate short circuit coordination (discrimination).

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Short circuit shutdown (51) - Output current on any phase is more than 175% of rating at time of shutdown. The control replicates the function of a 51V relay by discriminating between short circuit conditions and shutdown conditions, and shutting down the genset as fast as is necessary on a short circuit condition while operating as long as is possible on an overload condition. Control includes algorithms to protect alternator from repeated over current conditions over a short time.

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 0.25-10 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 2-10 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 voltage roll-off during synchronizing.

Under frequency shutdown (81u) - Generator set output frequency cannot be maintained. Settings are adjustable from 0-10 Hz below nominal governor set point, for a 0-20 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 or the synchronizer is enabled).

Over frequency shutdown/warning (81o) - Generator set is operating at a potentially damaging frequency level. Defaults: Disabled.

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 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. Defaults: 10%, 3 seconds.

Sync check (25) - Verifies that the generator set is operating in synchronism with the system bus prior to allowing the paralleling breaker to close. Includes dead bus sensing capability.

Fail to synchronize warning or shutdown - Indicates that the generator set could not be brought to synchronization with the system bus. Configurable for warning or shutdown and adjustable for time delay of 10-120 seconds. Default is 120 seconds.

Phase sequence sensing shutdown - Verifies that the generator set phase sequence matches the bus prior to allowing the paralleling breaker to close. The generator set will shutdown if the generator set and bus phase sequence do not match.

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

High alternator temperature (option).

Engine protection

Over speed shutdown - Default setting is 115% of nominal.

Low lube oil pressure shutdown - Level is preset to match the capabilities of each engine. Control includes time delays to prevent nuisance shutdown signals.

Low lube oil pressure warning - Level is preset to match the capabilities of each engine. Control includes time delays to prevent nuisance shutdown signals.

High coolant temperature shutdown.

High coolant temperature warning.

Low coolant pressure warning/shutdown.

Low coolant level warning/shutdown.

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

Low and high battery voltage warning - Indicates battery charging system failure by continuously monitoring battery voltage and indicating a problem when voltage is outside a preset acceptance band.

Discharged battery protection - When DC voltage is below a preset threshold, the control will shut down to avoid completely discharging the battery.

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

Fail to start (overcrank) shutdown.

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

Redundant starter disconnect.

Redundant speed sensors - Loss of one sensor results in a mag pickup sensor warning. Loss of both sensors results in mag pickup failure.

Low fuel day tank and low fuel main tank warning.

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

Sensor failure indication - All analog sensors are provided with sensor failure logic to indicate if the sensor or interconnecting wiring has failed. Separate indication is provided for fail high or low.

High crankcase blowby level warning.

High fuel temperature warning.

High intake manifold temperature/pressure.

Aftercooler cooler inlet over temperature.

Paralleling functions (optional)

First Start Sensor™ System - PowerCommand provides a unique control function that positively prevents multiple generator sets from simultaneously closing to an isolated bus under black start conditions. The First Start Sensor system is a communication system between generator sets that allows the generator sets to work together to determine which generator set in 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.

Synchronizer - PowerCommand incorporates a digital synchronizing function to force the generator set to match the phase relationship and voltage of the generator set output with the system bus or utility grid. The synchronizer includes provisions to provide proper operation even with highly distorted bus voltage waveforms. The synchronizer includes adjustments for phase angle window (5°-20°) and time delay (0.5-5 seconds). The synchronizer is 3-phase sensing, and includes controls to directly operate a paralleling breaker. The breaker controls include fail to open and fail to close protection.

Load sharing controls - The generator set control includes an integrated load sharing control system for both real (kW) and reactive (kVar) loads when the generator set(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 generator set 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 controls - When PowerCommand receives a signal indicating that the generator set is paralleled with an infinite source such as a utility (mains) service, the generator set will operate in load govern mode. In this mode the generator set 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 (leading). Default setting is 80% of standby and 1.0 power factor. The control includes inputs to allow independent control of kW and kVar load sharing level by a remote device while in the load govern mode. The rate of load increase and decrease is also adjustable in the control.

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

Power transfer control (optional)

The Power transfer control feature allows PowerCommand to provide integrated automatic power transfer functions including source availability sensing and transfer device (circuit breaker) monitoring and control. The control is configurable for open transition, fast transfer (100 mS), or soft (ramping) sequences of operation. Standard functions include:

- 3-phase (line-to-neutral) close differential under voltage sensing for utility (mains) service. Sensing for pickup in an adjustable range from 85-100% of nominal, with default at 95% of dropout setting. Dropout is configurable 75-98% of pickup, with default at 85%.
- 3-phase over voltage sensing for normal utility service adjustable for pickup at 95-105% of dropout and dropout configurable for 105-135% of nominal. Time delay is adjustable in a range of 0.5-120 seconds. Default is disabled and is enabled using InPower.
- Under frequency sensing for normal utility service. Adjustment range is 80-95% of nominal. Default is disabled and is enabled using InPower.
- Configurable sequence of operation with or without adjustable program-transition capability. Adjustment range is 0-60 seconds.
- Remote exercise feature accepts a remote signal to initiate with or without load testing, or testing can be

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initiated by the operator. Test sequence may include a programmed idle period prior to acceleration to rated voltage and frequency, and after cool down. Test may be configured to be performed with load or without load.

- Time delay start and stop as described in this document; time delay transfer adjustable in a range of 0-120 seconds and retransfer in a range of 0-1800 seconds; all in 1-second increments.
- Fail to disconnect timer is adjustable in a range of 0.1 to 120 seconds.

Environment

The control is designed for proper operation without recalibration in ambient temperatures from -40 °C to +70 °C (-40 °F to +158 °F) and for storage from -40 °C to +80 °C (-40 °F to +176 °F). Control will operate with humidity up to 95%, non-condensing and at altitudes up to 5000 m (13,000 ft).

The operator control panel has a single membrane surface which is impervious to the effects of dust, moisture, oil and exhaust fumes. The panel uses sealed membrane or oil-tight switches to provide long reliable service life in harsh environments.

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

The control is mounted on a vibration-isolated structure attached to the generator set skid and includes all generator set wiring factory-installed.



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Control interface

Input signals to the PowerCommand control include:

Remote start signal - May be connected via either discrete signal or Lon® Network or both for premium reliability. Discrete signal is normally open contact to ground or normally closed contact that opens to indicate start signal. Separate signal inputs available for emergency start and non-emergency start.

Remote emergency stop.

Low main or day tank fuel level warning.

Remote alarm reset.

Load demand stop.

Utility parallel (load govern) mode command.

Configurable customer inputs - Control includes provisions for (4) input signals from customer discrete devices. (16) additional input signals can be implemented with the use of external network modules.

Output signals from the control include:

Generator set running signal - Fused normally open contact rated 5 A at 30 VDC/180 VAC, closes to indicate generator set is running.

Generator set common shutdown signal - Self-protected relay driver.

Load shed signal - Self-protected relay driver. Operation is configurable for under frequency or over kW load or both. Adjustment range is 80-140% of standby rating with time delay of 0-120 seconds. Default settings are overload 105%, 60 sec, and under frequency 3 Hz below governor reference for 3 seconds.

Ready to load signal - Self-protected relay driver. Operates when the generator set has reached 90% of rated speed and voltage and latches until generator set is switched to off or idle mode.

Modem control signal - Self-protected relay driver.

Paralleling breaker interface - Fused normally open relay contact (5 A, 30 VDC/180 VAC) for parallel breaker close signal and normally open contact for parallel breaker open signal.

Control power for auxiliary devices is available from the controller.

Network connections include:

Serial interface - This communication port is to allow the control to communicate with a personal computer running InPower service and maintenance software.

Echelon® LonWorks interface (option) - System allows for fast, effective incorporation of auxiliary I/O, remote annunciation, redundant start commands from Cummins transfer switches, and other control functions.



**Power
Generation**

Software

InPower - An optional PC-based software service tool that is designed to directly communicate to PowerCommand generator sets and transfer switches to facilitate service and monitoring of these products.

PowerCommand for Windows® - An optional software tool that is used to remotely monitor and control generator sets, transfer switches and other on-site power system devices.

Certifications

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

NFPA110: For Level 1 systems

UL508: Recognized or Listed and suitable for use on UL 2200 Listed generator sets

CSA C282-M: 1999 compliance

CSA 22.2 No. 14 M91: Industrial Controls

ISO 8528-4: 1993 compliance, Controls and Switchgear

NFPA99: Standard for Health Care Facilities

CE Mark

EN 50081-1: Residential, Commercial, Light Industrial

EN 50081-2: Industrial

EN 50082-1: Residential, Commercial, Light Industrial

EN 50082-2: Industrial

ISO 7637, pulses #2b, 4: DC Supply Surge Voltage Test

Mil Std 202C, Method 101: Salt Fog Test

ANSI C62.41: Surge Withstand

IEC 801.2, 3, 4, 5

ISO9001: PowerCommand control systems and generator sets are designed and manufactured in ISO9001 certified facilities.

Warranty

PowerCommand control systems are a part of complete power systems provided by Cummins Power Generation and are covered by a one year limited warranty as a standard feature.

Extended warranty options are available for coverage up to 10 years.

Options and accessories

- ☐ Isolated bus paralleling. Provides all automatic and manual paralleling functions for systems that operate isolated from the utility service.
- ☐ Full function paralleling. Provides all paralleling functions, including automatic and manual operation, protection, and other features described in this document.
- ☐ Open transition power transfer control. Control will operate two circuit breakers to provide power transfer between a normal source and a generator in a “break before make” sequence.
- ☐ Fast closed transition power transfer control. Control will operate two circuit breakers to provide power transfer between a normal source and generator in a “make before break” sequence between live sources, and “break before make” from a failed source. Overlap between sources is 100 mS or less.
- ☐ Closed transition (ramping) power transfer control. Control will operate two circuit breakers to provide power transfer between a normal source and generator in a “make before break” sequence between live sources, and “break before make” from a failed source. Overlap time between sources is configurable, and control ramps load from source to source to minimize disturbances on transfer.
- ☐ Key-type mode select switch.
- ☐ Ground fault alarm module.
- ☐ Exhaust temperature monitoring.
- ☐ Alternator temperature monitoring.
- ☒ Network Interface Module
- ☒ Digital remote annunciator. (See S-1343)
- ☐ Digital output relay module (See S-1431)
- ☐ Modbus® interface. (See S-1471)
- ☐ Cummins Power Generation iWatch™ remote monitoring system (S-1518)
- ☐ Cummins Power Generation iWatch Wireless™ remote monitoring system (S-1572)
- ☐ ILSI (isochronous load sharing interface). Allows PowerCommand to share real load with other load sharing systems that incorporate analog load sharing lines. See document C604 for more information.
- ☐ Utility protective relaying. Gensets can be provided with power switching mechanisms and utility grade protective relaying to meet local grid protection requirements.

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CERTIFICATE OF COMPLIANCE

Cummins Power Generation has qualified the listed standard engine generator set packages as CERTIFIED¹ for seismic application.

The basis of qualification is by shake table testing and analysis, in accordance with the following International Building Code² (IBC) releases.

IBC 2000, IBC 2003, IBC 2006, IBC 2009

The following model designations and bulleted options are included in this certification. A complete list of certified models, options, and installation methods are detailed in report number VMA-45188-RS as issued by The VMC Group.

Model Designation	Basic Open Generator Set	Steel Enclosure Options			Aluminum Enclosure Options			Fuel Tank Options
		Weather Protective	Sound Level 1	Sound Level 2	Weather Protective	Sound Level 1	Sound Level 2	Standard Sub-base
DQLC, DQLD, DQLE	•	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DQKH	•	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DQKAA, DQKAB	•	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DQGAA, <u>DQGAB</u>	•	N/A	N/A	N/A	N/A	N/A	N/A	N/A

This certification includes the open generator set only and does not include the enclosure or any fuel tank. The generator set and included options must be a catalogue design and factory supplied. The generator set and applicable options must be installed and attached to the building structure per the manufacturer supplied seismic installation instructions. This certification is exclusive only to factory supplied accessories. Non-factory accessories such as, but not limited to, mufflers, remote radiators, isolation/restraint devices, and electrical components are beyond the scope of this certification.

The above referenced equipment is APPROVED for seismic application when properly installed,³ used as intended, and located in the United States. Lookup the interpolated project specific Design Spectral Response Acceleration at Short Periods, S_{DS} , value in the table below as it pertains to the applicable building code and Importance Factor, I_p , and compare to the allowed value. As limited by the tabulated values, below grade, grade, and roof-level installations, as well as installations in essential facilities and for life safety applications, both requiring post event functionality, were $I_p=1.5$ are permitted and included in this certification.

The basis of this certification is through finite element analysis of the main force resisting members of the unit. Additional calculations were conducted to ensure components, accessories, and options remained intact and attached to the unit under seismic load conditions. All non-robust components, considered critical to the unit's continued function, were successfully shake tested, in three (3) orthogonal axes, under the witness of and analytical evaluation by an independent approval agency, The VMC Group. Seismic shake table testing was conducted in accordance with ICC-ES AC-156 to envelope the required response spectrum (RRS) of maximum flexible region acceleration (A_{FLEX}) of 3.09g and a zero period acceleration (A_{RIG}) of 2.32g. However, the certification is limited by the analysis seismic design level shown next.

For calculations and analysis, the Seismic Design Acceleration, F_p/W_p ,⁴ was calculated as 1.45g for Load Resistance Factored Design (LRFD) methods, equivalent to 1.02g for Allowable Stress Design (ASD) methods. All calculations were conducted using the ASD analysis method. This included but was not limited to the finite element analysis of the main force resisting members of the unit, skid anchoring requirements, component attachment hardware, and various component stress analyses. The Seismic Design Acceleration, F_p/W_p , used for calculations and analysis, is defined per the building code (or respective design standard) for the section titled Seismic Design Requirements for Non-structural (architectural, mechanical, and electrical) Components. The seismic design level is based on the LRFD calculation shown below.

IBC 2009 / 2006	$F_p/W_p = 0.4 \times (S_{DS}=1.93) \times (F_A=1.0) \times (I_p=1.5) \times (a_p/R_p=1.25) \times (1+2(z/h=0.0))$	= 1.45g (grade)
	$F_p/W_p = 0.4 \times (S_{DS}=0.64) \times (F_A=1.0) \times (I_p=1.5) \times (a_p/R_p=1.25) \times (1+2(z/h=1.0))$	= 1.45g (roof)
IBC 2003 / 2000	$F_p/W_p = 0.4 \times (S_{DS}=2.41) \times (F_A=1.0) \times (I_p=1.5) \times (a_p/R_p=1.00) \times (1+2(z/h=0.0))$	= 1.45g (grade)
	$F_p/W_p = 0.4 \times (S_{DS}=0.80) \times (F_A=1.0) \times (I_p=1.5) \times (a_p/R_p=1.00) \times (1+2(z/h=1.0))$	= 1.45g (roof)

This certification covers all applications that fall below the limitations in the chart below.

IBC 2009 / 2006	IBC 2009 / 2006	IBC 2003 / 2000	IBC 2003 / 2000
$S_{DS} \leq 0.64$	$S_{DS} \leq 1.93$	$S_{DS} \leq 0.80$	$S_{DS} \leq 2.41$
$I_p \leq 1.5$	$I_p \leq 1.5$	$I_p \leq 1.5$	$I_p \leq 1.5$
$a_p/R_p \leq 1.25$	$a_p/R_p \leq 1.25$	$a_p/R_p \leq 1.0$	$a_p/R_p \leq 1.0$
$z/h \leq 1.0$ (roof)	$z/h = 0$ (grade)	$z/h \leq 1.0$ (roof)	$z/h = 0$ (grade)

Soil Classes A, B, C, D, E, Seismic Use groups I, II, III, IV, and Seismic Design Categories A, B, C, D, E, and F are all covered under this certification, limited by the S_{DS} value stated above.

CERTIFICATE OF COMPLIANCE

Notes and Comments:

1. All equipment listed herein successfully passed the seismic acceptance criteria for shake testing non-structural components and systems as set forth in the ICC AC-156 (2007). The test response spectrum (TRS) enveloped the design response spectrum (DRS) for all units tested. The units cited in this certification were representative samples of a contingent of models and all remained captive and structurally sound after the seismic shake simulation. The units also remained functionally operational after the simulation testing as functional testing was completed by the equipment manufacturer before and after the seismic simulations. Although a seismic qualified unit inherently contains some wind resisting capacity, that capacity is undetermined and is excluded from this certification. Snow/Ice loads have been neglected and thus limit the unit to be installed both indoors (covered by an independent protective structure) and out of doors (exposed to accumulating snow/ice) for snow/ice loads no greater than 30 psf for all applications.
2. The following building codes are addressed under this certification:
 - IBC 2000 – referencing ASCE 7-98 and ICC AC-156
 - IBC 2003 – referencing ASCE 7-02 and ICC AC-156
 - IBC 2006 – referencing ASCE 7-05 and ICC AC-156
 - IBC 2009 – referencing ASCE 7-05 and ICC AC-156
3. Refer to the manufacturer supplied installation drawings for anchor requirements and mounting considerations for seismic applications. Required anchor locations, size, style, and load capacities (tension and shear) are specified on the installation drawings. Mounting requirement details such as anchor brand, type, embedment depth, edge spacing, anchor-to-anchor spacing, concrete strength, special inspection, wall design, and attachment to non-building structures must be outlined and approved by the Engineer of Record for the project or building. Structural walls, structural floors, and housekeeping pads must also be seismically designed and approved by the project or building Structural Engineer of Record to withstand the seismic anchor loads as defined on the installation drawings. The installing contractor is responsible for observing the installation requirements detailed in the seismic installation drawings and the proper installation of all anchors and mounting hardware.
4. When the site soil properties or final equipment installation location are not known, the soil site coefficient, F_A , defaults to the Soil Site Class D coefficient. Soil Classes A, B, C, D, E, Seismic Use groups I, II, III, IV, and Seismic Design Categories A, B, C, D, E, and F are all covered under this certification, limited by the S_{ds} values on page 1, respective to the applicable building code, Importance factor, and z/h ratio. A seismic importance factor, $I_p=1.5$, applies to this certification to include essential facility requirements and life safety applications for post event functionality.

Certification Issued By: The VMC Group
Document Control Number: VMA-45188-CCS Rev. 1

Issue Date: 11/11/2009
Revision Date: 05/25/2010
Expiration Date: 05/31/2011



John P. Giuliano, PE
President, The VMC Group



Gary A. Lafine
Product Management Director
Consumer and Genset Business
Cummins Power Generation



Exhaust Emission Data Sheet

2000DQKAB*

60 Hz Diesel Generator Set

Engine Information:

Model:	Cummins Inc QSK60-G6 NR2	Bore:	6.25 in. (158 mm)
Type:	4 Cycle, 60°V, 16 Cylinder Diesel	Stroke:	7.48 in. (189 mm)
Aspiration:	Turbocharged and Low Temperature Air Aftercooled	Displacement:	3673 cu. In. (60.1 liters)
Compression Ratio:	14.5:1		
Emission Control Device:	Turbocharged and Low Temperature Aftercooled		

	1/4	1/2	3/4	Full	Full
PERFORMANCE DATA	Standby	Standby	Standby	Standby	Prime
BHP @ 1800 RPM (60 Hz)	730	1460	2189	2919	2639
Fuel Consumption (gal/Hr)	46.5	82	107.3	141.3	124.1
Exhaust Gas Flow (CFM)	6510	10220	12000	14920	13780
Exhaust Gas Temperature (°F)	772	838	873	893	884
EXHAUST EMISSION DATA					
HC (Total Unburned Hydrocarbons)	0.22	0.13	0.10	0.11	0.09
NOx (Oxides of Nitrogen as NO ₂)	2.70	3.10	4.70	5.30	6.00
CO (carbon Monoxide)	0.57	0.36	0.13	0.18	0.16
PM (Particular Matter)	0.16	0.14	0.04	0.04	0.02
SO ₂ (Sulfur Dioxide)	0.14	0.13	0.11	0.11	0.11
Smoke (Bosch)	0.50	0.60	0.20	0.20	0.10

All values are Grams per HP-Hour, Smoke is Bosch#

TEST CONDITIONS

Data is representative of steady-state engine speed (± 25 RPM) at designated genset loads. Pressures, temperatures, and emission rates were stabilized.

Fuel Specification:	ASTM D975 No. 2-D diesel fuel with 0.03-0.05% sulfur content (by weight), and 40-48 cetane number.
Fuel Temperature:	99 \pm 9 °F (at fuel pump inlet)
Intake Air Temperature:	77 \pm 9 °F
Barometric Pressure:	29.6 \pm 1 in. Hg
Humidity:	NOx measurement corrected to 75 grains H ₂ O/lb dry air
Reference Standard:	ISO 8178

The NO_x, HC, CO and PM emission data tabulated here are representative of test data taken from a single engine under the test conditions shown above. Data for the other components are estimated. These data are subjected to instrumentation and engine-to-engine variability. Field emission test data are not guaranteed to these levels. Actual field test results may vary due to test site conditions, installation, fuel specification, test procedures and instrumentation. Engine operation with excessive air intake or exhaust restriction beyond published maximum limits, or with improper maintenance, may result in elevated emission levels.



EPA Tier 2 Exhaust Emission Compliance Statement 2000DQKAB 60 Hz Diesel Generator Set

Compliance Information:

The engine used in this generator set complies with the Tier 2 emissions limits of U.S EPA New Source Performance Standards for Stationary Emergency engines under the provisions of 40 CFR 60 Subpart IIII when tested per ISO 8178 D2.

Engine Manufacturer:	Cummins Inc
EPA Certificate Number:	CEX-STATCI-11-06
Effective Date:	06/08/2010
Date Issued:	06/08/2010
EPA Diesel Engine Family:	BCEXL060.AAD
CARB Executive Order:	

Engine Information:

Model:	Cummins Inc QSK60-G6 NR2	Bore:	6.25 in. (159 mm)
Engine Nameplate HP:	2922		
Type:	4 Cycle, 60°V, 16 Cylinder Diesel	Stroke:	7.48 in. (190 mm)
Aspiration:	Turbocharged and Low Temperature Aftercooled	Displacement:	3673 cu. in. (60.2 liters)
Compression Ratio:	14.5:1		
Emission Control Device:	Turbocharged and Low Temperature Aftercooled		

U.S. Environmental Protection Agency NSPS Stationary Emergency Tier 2 Limits

(All values are Grams per HP-Hour)

COMPONENT

NOx + HC (Oxides of Nitrogen as NO2 + Non Methane Hydrocarbons)	4.77
CO (Carbon Monoxide)	2.61
PM (Particulate Matter)	0.15

Engine operation with excessive air intake or exhaust restriction beyond published maximum limits, or with improper maintenance, may result in elevated emission levels.

High Ambient Air Temperature Radiator Cooling System

	Duty	Rating (kW)	Max Cooling @ Air Flow Static Restriction, Unhoused (inches water/mm water)					Housed in Free Air, No Air Discharge Restriction			
			0.0/0.0	0.25/6.4	0.5/12.7	0.75/19.1	1.0/25.4				
			Maximum Allowable Ambient Temperature, Degree C								
60 Hz	Standby	2000	47.0	43.8	40.5	37.9	36.0	N/A	N/A	N/A	N/A
	Prime	1825	47.5	44.1	40.7	38.2	36.5	N/A	N/A	N/A	N/A
	Continuous		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
50 Hz	Standby		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Prime		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Continuous		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Enhanced High Ambient Air Temperature Radiator Cooling System

	Duty	Rating (kW)	Max Cooling @ Air Flow Static Restriction, Unhoused (inches water/mm water)					Housed in Free Air, No Air Discharge Restriction			
			0.0/0.0	0.25/6.4	0.5/12.7	0.75/19.1	1.0/25.4				
			Maximum Allowable Ambient Temperature, Degree C								
	Standby	2000	50.6	50.1	49.6	49	48.4	N/A	N/A	N/A	N/A
60 Hz	Prime	1825	50.6	50.1	49.6	49	48.4	N/A	N/A	N/A	N/A
	Continuous		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Standby		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
50 Hz	Prime		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Continuous		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Notes:

1. Data shown are anticipated cooling performance for typical generator set.
2. Cooling data is based on 1000 ft (305 m) site test location.
3. Generator set power output may need to be reduced at high ambient conditions. Consult generator set data sheet for derate schedules.
4. Cooling performance may be reduced due to several factors including but not limited to: Incorrect installation, improper operation, fouling of the cooling system, and other site installation variables.



Sound Pressure Levels @ 7 meters dB(A)

Configuration		Position (Note 1)								8 Position Average
		1	2	3	4	5	6	7	8	
Standard-Unhoused (Note 3)	Infinite Exhaust	99.2	99.6	100.1	99.9	96.8	100.8	99.6	100.4	99.7

Note:

1. Position 1 faces the engine front at 23 feet (7 m) from the surface of the generator set. The positions proceed around the generator set in a counter-clockwise direction in 45° increments.
2. Data based on full rated load with standard radiator-fan package.
3. Sound data for generator set with infinite exhaust do not include exhaust noise.
4. Sound pressure levels per ANSI S1.13-1971 as applicable.
5. Reference sound pressure is 20 μ Pa.
6. Sound pressure levels are subject to instrumentation, measurement, installation and generator set variability.

Sound Power Levels dB(A)

Configuration		Octave Band Center Frequency (Hz)								Sound Power Level
		63	125	250	500	1000	2000	4000	8000	
Standard-Unhoused (Note 3)	Infinite Exhaust	90.6	106.7	118.9	123.4	121.3	117.8	118.7	120.4	128.3

Note:

1. Sound pressure levels per ANSI S12.34-1988 and SIO 3744 as applicable.
2. Data based on full rated load with standard radiator-fan package.
3. Sound data for generator set with infinite exhaust do not include exhaust noise.
4. Reference sound pressure is 1pW-1x10⁻¹² W.
5. Sound pressure levels are subject to instrumentation, measurement, installation and generator set variability.

Exhaust Sound Pressure Levels @ 1 meter dB(A)

Open Exhaust (No Muffler) @ Rated Load	Octave Band Center Frequency (Hz)								Sound Pressure Level
	63	125	250	500	1000	2000	4000	8000	
	97.7	107.5	108.5	110.5	108.1	112.9	113.7	108.7	

Note: Sound pressure level per ISO 6798 Annex A as applicable.



PROTOTYPE TEST SUPPORT (PTS) 60 HZ TEST SUMMARY

GENERATOR SET MODELS

1750DQKAA

2000DQKAB

REPRESENTATIVE PROTOTYPE

Model: 2000DQKAB

Alternator: P734G

Engine: QSK60-G6 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: 2125 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: 40 °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 or rejection were evaluated. The following results were recorded:

Full Load Acceptance:

Voltage Dip:	39.2	%
Recovery Time:	5.8	Second
Frequency Dip:	8.8	%
Recovery Time:	4.6	Second

Full Load Rejection:

Voltage Rise:	21.9	%
Recovery Time:	2.4	Second
Frequency Rise:	2.8	%
Recovery Time:	1.4	Second

Harmonic Analysis:

(per MIL-STD-705B, Method 601.4)

Line to Line

Line to Neutral

Harmonic	No Load	Full Load	No Load	Full Load
3	0.18	0.014	0.134	0.08
5	0.20	2.3	0.13	2.3
7	0.52	1.46	0.48	0.74
9	0.08	0.03	0.03	0.068
11	0.65	0.485	0.64	0.46
13	0.21	0.28	0.19	0.31
15	0.05	0.053	0.025	0.098

ALTERNATOR DATA SHEET

Frame Size P734F

CHARACTERISTICS

WEIGHTS:

Stator Assembly:	4206 lb	1908 kg
Rotor Assembly:	3547 lb	1609 kg
Complete Assembly:	8466 lb	3840 kg

MAXIMUM SPEED:

2250 rpm

EXCITATION CURRENT:

Full Load	3.6 Amps
No Load	0.5 Amps

INSULATION SYSTEM: Class H Throughout

3 Ø RATINGS		(0.8 power factor)		60 Hz Voltage				(winding no)
(Based on specific temperature rise at 40°C ambient temperature)		<u>220/380</u> (13)	<u>240/416</u> (13)	<u>220/380</u> (312)	<u>240/416</u> (312)	<u>254/440</u> (312)	<u>277/480</u> (312)	<u>347/600</u> (07)
163°C Rise Ratings	kW			1764	2004	2140	2228	2228
	kVA			2205	2505	2675	2785	2785
150°C Rise Ratings	kW			1716	1948	2080	2164	2164
	kVA			2145	2435	2600	2705	2705
125°C Rise Ratings	kW			1648	1872	2000	2080	2080
	kVA			2060	2340	2500	2600	2600
105°C Rise Ratings	kW			1532	1744	1860	1936	1936
	kVA			1915	2180	2325	2420	2420
80°C Rise Ratings	kW			1416	1612	1720	1792	1792
	kVA			1770	2015	2150	2240	2240
REACTANCES								
(per unit ± 10%)		<u>220/380</u> (13)	<u>240/416</u> (13)	<u>220/380</u> (312)	<u>240/416</u> (312)	<u>254/440</u> (312)	<u>277/480</u> (312)	<u>347/600</u> (07)
(Based on full load at 125°C Rise Rating)								
Synchronous				3.74	3.54	3.38	2.96	2.48
Transient				0.22	0.21	0.20	0.18	0.13
Subtransient				0.16	0.16	0.15	0.13	0.10
Negative Sequence				0.24	0.23	0.22	0.19	0.13
Zero Sequence				0.03	0.03	0.03	0.02	0.02
MOTOR STARTING								
		<u>220/380</u> (13)	<u>240/416</u> (13)	<u>220/380</u> (312)	<u>240/416</u> (312)	<u>254/440</u> (312)	<u>277/480</u> (312)	<u>347/600</u> (07)
Maximum kVA (90% Sustained Voltage)				7361	7361	7361	7361	7361
TIME CONSTANTS								
(Sec)		<u>220/380</u> (13)	<u>240/416</u> (13)	<u>220/380</u> (312)	<u>240/416</u> (312)	<u>254/440</u> (312)	<u>277/480</u> (312)	<u>347/600</u> (07)
Transient				0.154	0.154	0.154	0.154	0.154
Subtransient				0.020	0.020	0.020	0.020	0.020
Open Circuit				2.540	2.540	2.540	2.540	2.540
DC				0.020	0.020	0.020	0.020	0.020
WINDINGS								
(@ 20°C)		<u>220/380</u> (13)	<u>240/416</u> (13)	<u>220/380</u> (312)	<u>240/416</u> (312)	<u>254/440</u> (312)	<u>277/480</u> (312)	<u>347/600</u> (07)
Stator Resistance (Line to Line, Ohms)				0.00076	0.00076	0.00076	0.00076	0.00220
Rotor Resistance (Ohms)				2.31	2.31	2.31	2.31	2.31
Number of Leads				6	6	6	6	6

ALTERNATOR DATA SHEET

Frame Size P734F

CHARACTERISTICS

WEIGHTS:

Stator Assembly:	4206 lb	1908 kg
Rotor Assembly:	3547 lb	1609 kg
Complete Assembly:	8466 lb	3840 kg

MAXIMUM SPEED:

2250

EXCITATION CURRENT:

Full Load	3.6
No Load	0.5

INSULATION SYSTEM: Class H Throughout

3 Ø RATINGS

(0.8 power factor)

(Based on specific temperature rise at 40°C ambient temperature)

50 Hz Voltage

(winding no)

		<u>220/380</u> (312)	<u>240/400</u> (312)	<u>240/415</u> (312)	<u>254/440</u> (312)
163°C Rise Ratings	kW	1732	1784	1784	1748
	kVA	2165	2230	2230	2185
150°C Rise Ratings	kW	1684	1736	1736	1700
	kVA	2105	2170	2170	2125
125°C Rise Ratings	kW	1616	1664	1664	1632
	kVA	2020	2080	2080	2040
105°C Rise Ratings	kW	1504	1548	1548	1520
	kVA	1880	1935	1935	1900
80°C Rise Ratings	kW	1388	1432	1432	1404
	kVA	1735	1790	1790	1755

REACTANCES

(per unit ± 10%)

(Based on full load at 125°C Rise Rating)

	<u>220/380</u> (312)	<u>240/400</u> (312)	<u>240/415</u> (312)	<u>254/440</u> (312)
Synchronous	2.93	2.73	2.53	2.21
Transient	0.18	0.17	0.16	0.14
Subtransient	0.13	0.12	0.11	0.10
Negative Sequence	0.19	0.17	0.16	0.14
Zero Sequence	0.02	0.02	0.02	0.02

MOTOR STARTING

	<u>220/380</u> (312)	<u>240/400</u> (312)	<u>240/415</u> (312)	<u>254/440</u> (312)
Maximum kVA (90% Sustained Voltage)	5000	5000	5000	5000

TIME CONSTANTS

(Sec)

	<u>220/380</u> (312)	<u>240/400</u> (312)	<u>240/415</u> (312)	<u>254/440</u> (312)
Transient	0.154	0.154	0.154	0.154
Subtransient	0.020	0.020	0.020	0.020
Open Circuit	2.540	2.540	2.540	2.540
DC	0.020	0.020	0.020	0.020

WINDINGS

(@20°C)

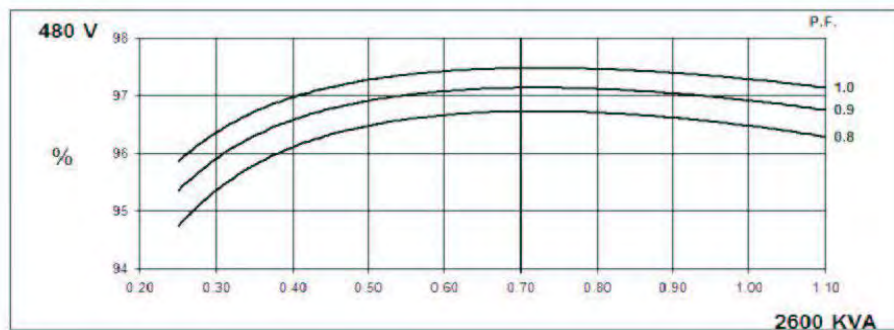
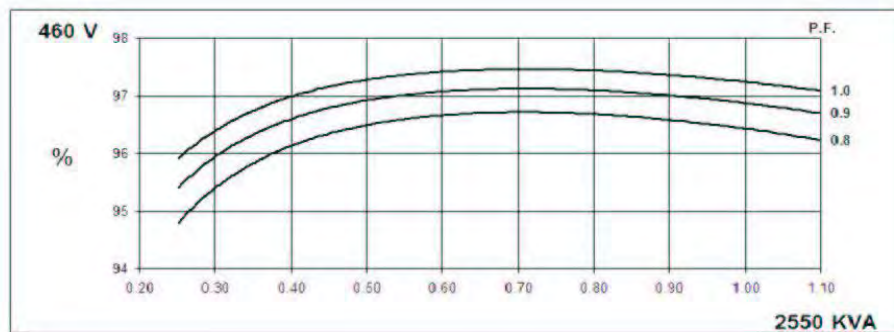
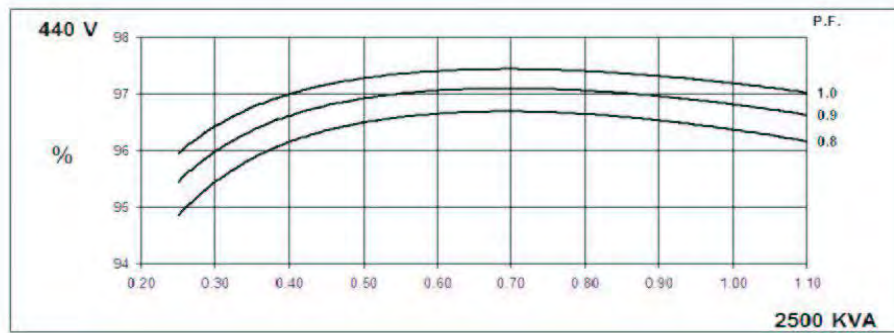
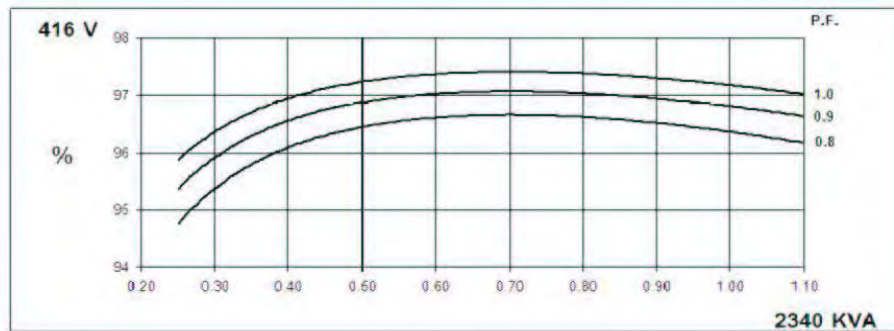
	<u>220/380</u> (312)	<u>240/400</u> (312)	<u>240/415</u> (312)	<u>254/440</u> (312)
Stator Resistance (Line to Line, Ohms)	0.00076	0.00076	0.00076	0.00076
Rotor Resistance (Ohms)	2.31	2.31	2.31	2.31
Number of Leads	6	6	6	6



**60
Hz**

Winding 312

THREE PHASE EFFICIENCY CURVES

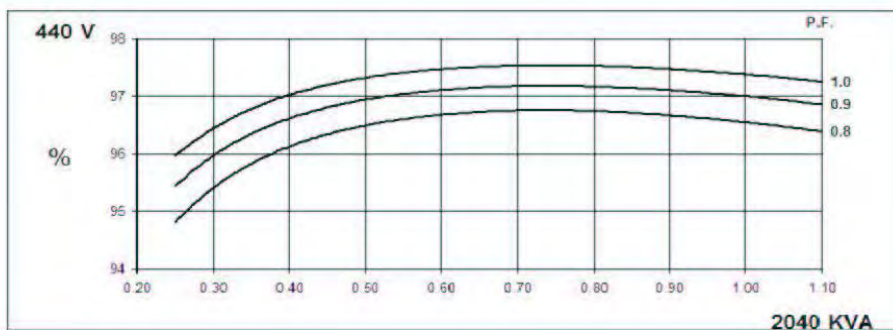
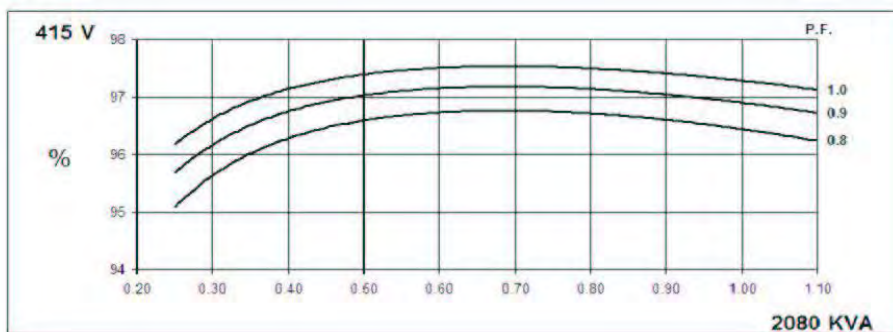
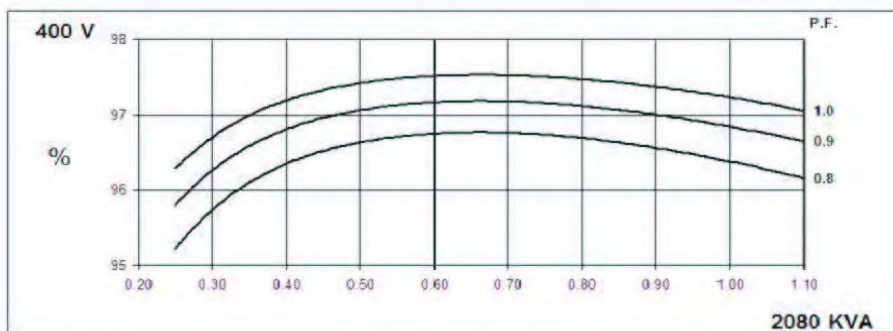
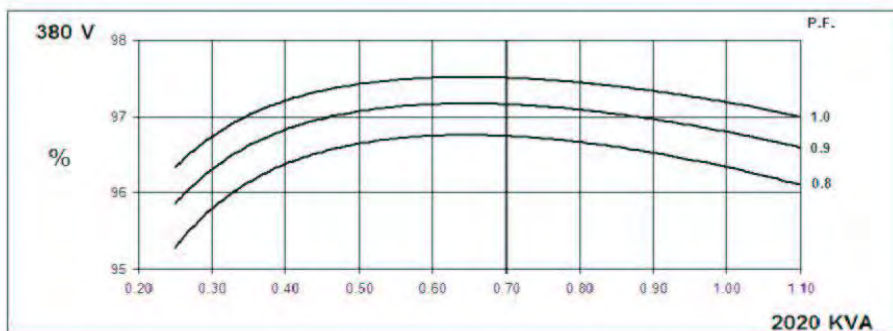


Alternator Data Sheet Frame Size: P734F

**50
Hz**

Winding 312

THREE PHASE EFFICIENCY CURVES





Alternator Data Sheet Frame Size: P734F

Wdg 7, 60Hz

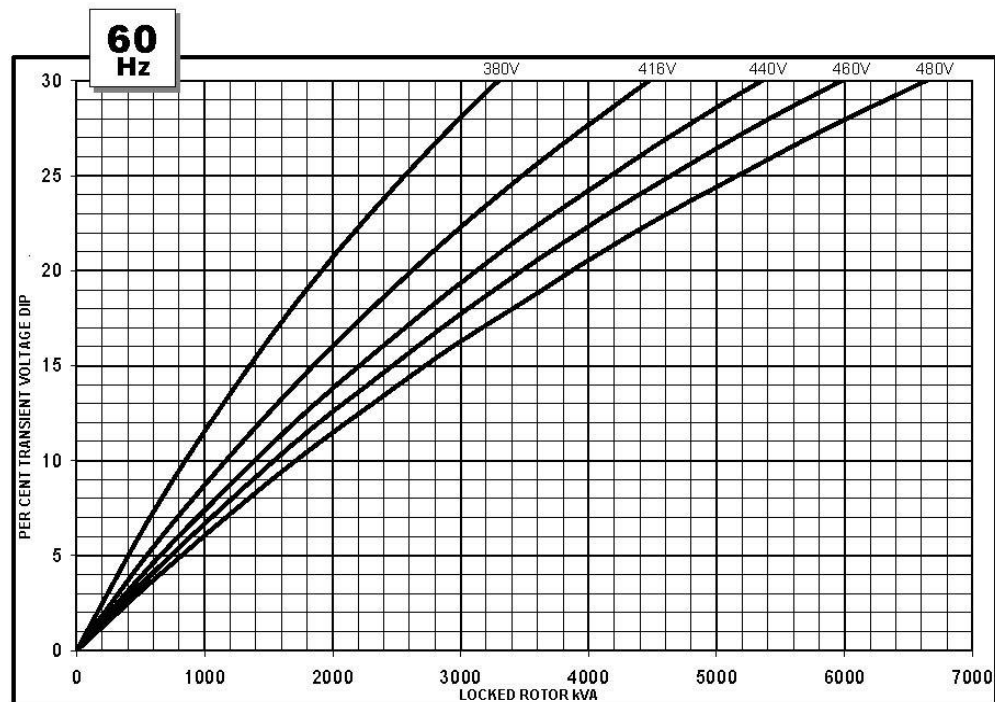
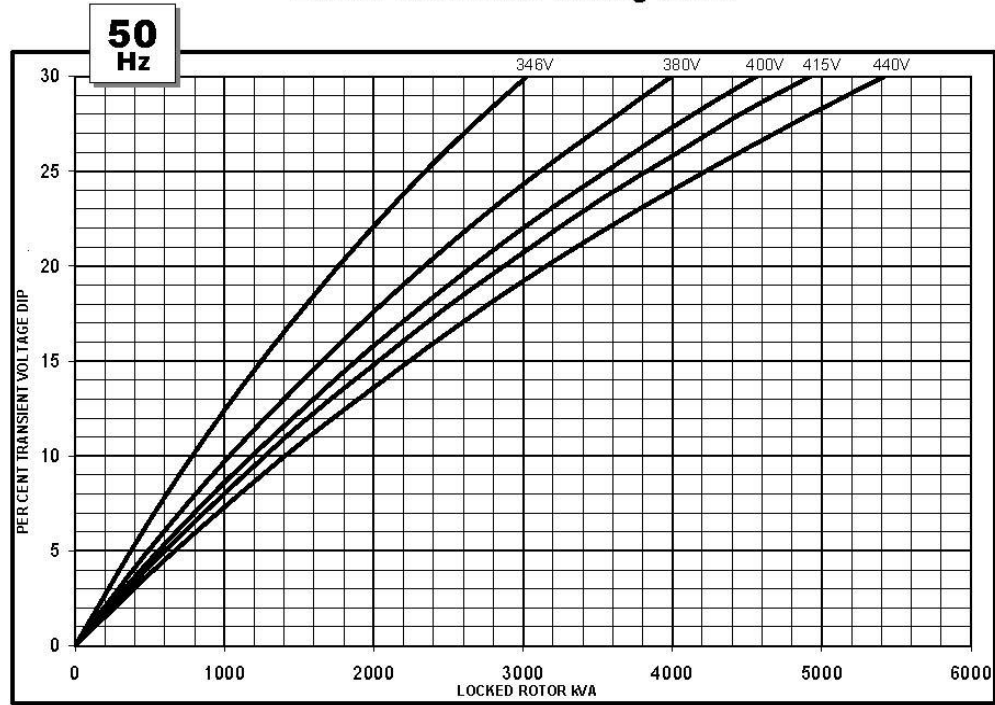




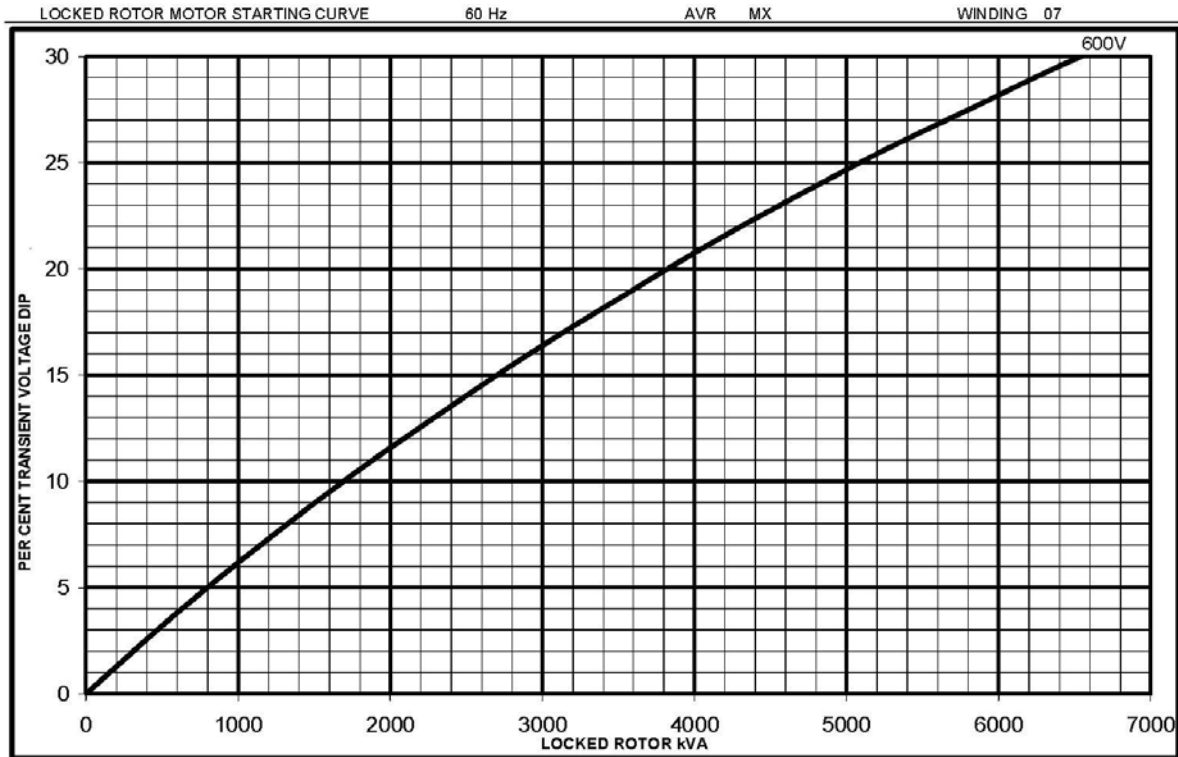
Alternator Data Sheet Frame Size: **P734F**

Winding 312

Locked Rotor Motor Starting Curve



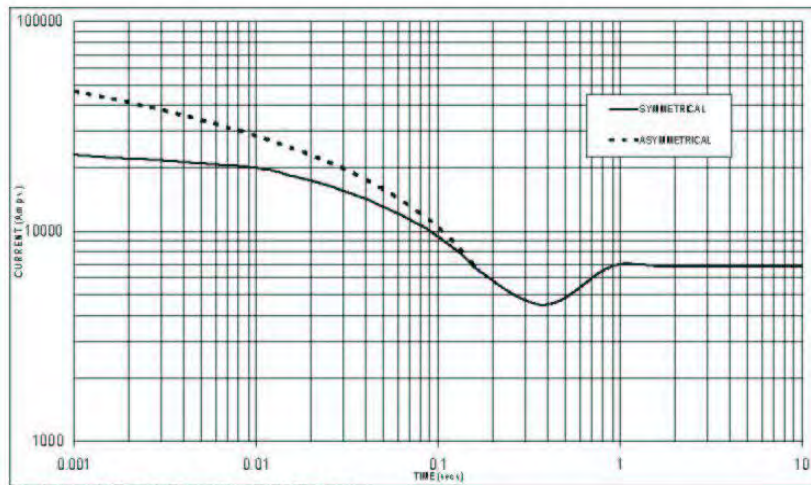
Alternator Data Sheet Frame Size: P734F





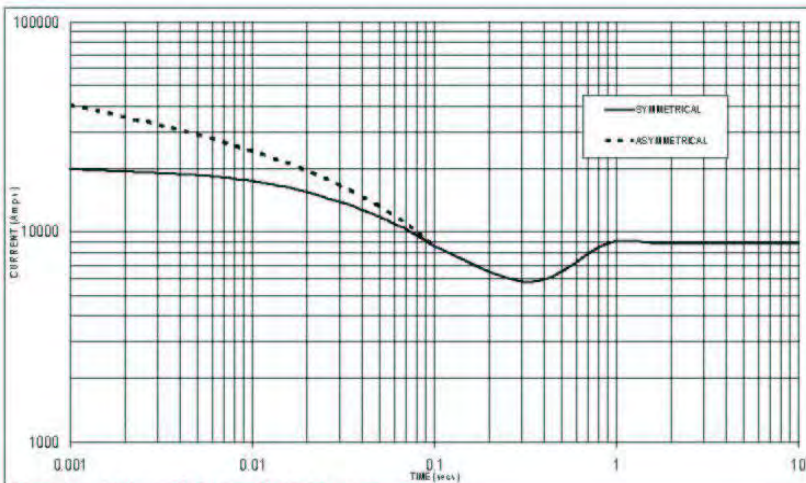
Three-phase Short Circuit Decrement Curve. No-load Excitation at Rated Speed
Based on star (wye) connection.

50
Hz



Sustained Short Circuit = 6,850 Amps

60
Hz



Sustained Short Circuit = 8,900 Amps

Note 1

The following multiplication factors should be used to adjust the values from curve between time 0.001 seconds and the minimum current point in respect of nominal operating voltage :

50Hz		60Hz	
Voltage	Factor	Voltage	Factor
380v	x 1.00	416v	x 1.00
400v	x 1.05	440v	x 1.06
415v	x 1.09	460v	x 1.10
440v	x 1.16	480v	x 1.15

The sustained current value is constant irrespective of voltage level

Note 2

The following multiplication factor should be used to convert the values calculated in accordance with NOTE 1 to those applicable to the various types of short circuit :

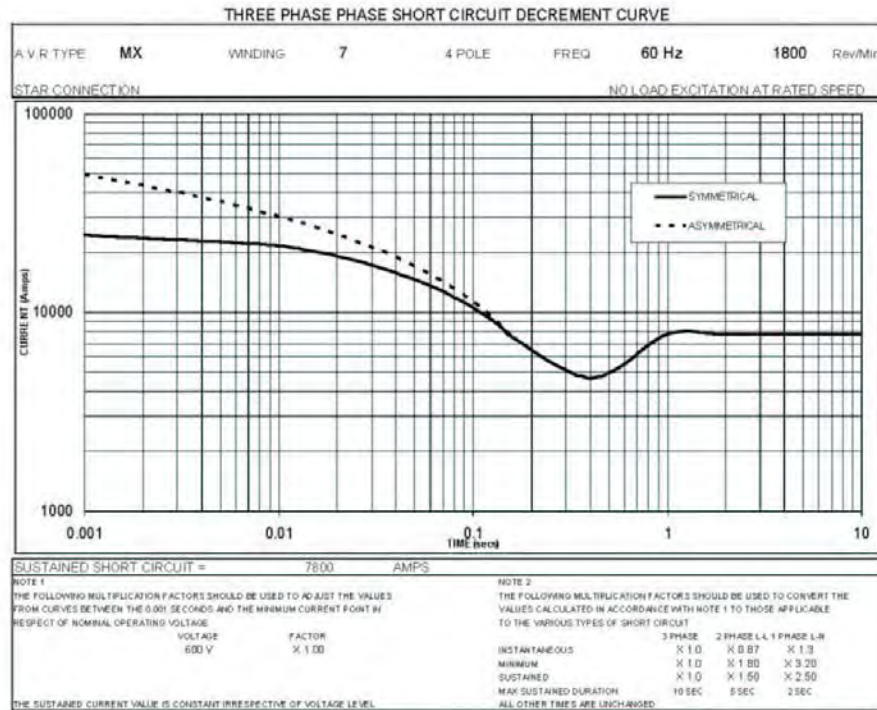
	3-phase	2-phase L-L	1-phase L-N
Instantaneous	x 1.00	x 0.87	x 1.30
Minimum	x 1.00	x 1.80	x 3.20
Sustained	x 1.00	x 1.50	x 2.50
Max. sustained duration	10 sec.	5 sec.	2 sec.

All other times are unchanged

Note 3

Curves are drawn for Star (Wye) connected machines.

Alternator Data Sheet Frame Size: P734F



U.S. EPA emissions regulations for on-site power generation



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Final standards for stationary and nonroad diesel generator sets

On July 11, 2006, the US EPA finalized its proposal to regulate emissions from stationary diesel compression-ignition engines. Called the "New Source Performance Standards," the EPA rule requires emissions from stationary diesel-powered generator sets to be harmonized with nonroad (mobile) applications starting from January 1, 2007.

As a result of the rule:

- > Generators with engine ratings of 10-99 hp must comply with Tier 2 regulations;
- > Generators with engine ratings of 100-751 hp must comply with Tier 3 regulations;
- > Generators with engine ratings of 752-3000 hp must comply with Tier 2 regulations;
- > Engines that are not certified to 2007 nonroad standards must be installed by the end-user by January 1, 2009.

Key exceptions are:

- > Stationary engines over 3000 hp will remain at Tier 1 until their Tier 4 requirements become effective in 2011.
- > Beginning in 2011 at Tier 4, emergency stationary diesel generators will not have to advance to standards that require aftertreatment.

Proposed regulations for spark-ignited gas engines

On June 12, 2006, the EPA proposed new rules to regulate emissions from stationary spark-ignited gas engines. The first regulation will become effective July 1, 2007, when emissions levels for stationary non-emergency engines (typically used in peaking and landfill gas) and engines below 25 hp will be regulated. Spark-ignited gas engines above 25 hp used in stationary emergency applications will require EPA certification effective January 1, 2009.

Cummins Power Generation intends to offer EPA-certified gas products to meet the EPA stationary emergency requirements for spark-ignited gas. Please consult your Cummins Power Generation dealer or visit www.cumminspower.com for a list of our EPA-compliant gas generator sets.

Award-winning diesel technology

Frost & Sullivan named Cummins Power Generation the recipient of the 2006 North American Diesel Engine Technology Leadership of the Year Award. The award recognizes Cummins Power Generation's advancements and market leadership in emissions technology.



"As a recognized industry leader, Cummins Power Generation has been working closely with the EPA and supports their efforts to strengthen emissions regulations for nonroad and stationary diesel engines. Cummins Power Generation was the first manufacturer to offer EPA-certified Tier 3 generator sets.

"Cummins Power Generation's design strategy for meeting new emissions standards has been to focus on our existing electronic-controlled engine platforms and new in-cylinder design

enhancements. We believe this has been the best approach to higher performance, better fuel efficiency and high reliability than designs that rely on costly exhaust aftertreatments. This design strategy has helped us become one of the few manufacturers who can offer the marketplace a full line of EPA-certified products."

Tom Linebarger
President, Cummins Power Generation

Cummins Power Generation Tier-certified products by application

Cummins Power Generation offers a full range of diesel generator sets that meet or exceed

EPA requirements. Below are the U.S. EPA Tier levels for stationary and nonroad applications and corresponding Cummins Power Generation Tier-certified models:

Cummins Power Generation Tier-certified diesel generator sets

	Stationary*	Nonroad	Stationary and Nonroad	Stationary and Nonroad	Stationary and Nonroad
kWe	2006	2006	2007	2008	2009
15 / 20 / 25	DK Series	DK Series	DK Series	DSBAB, DSCAA, DSCAB	DSBAB, DSCAA, DSCAB
30				DSCAC	DSCAC
35	DGGD, DGBB**	DGBB**	DGBB**, DGGD**	DSDAA	DSDAA
40	DGHD, DGBC**	DGBC**	DGBC**, DGHD**	DSDAB	DSDAB
50	DGHE, DGCA**	DGCA**	DGCA**, DGHE**	DSDAC	DSDAC
60	DGCB**	DGCB**	DGCB**	DSFAA	DSFAA
80	DGCG, DGDA	DGDA	DSFAE	DSFAE	DSFAE
100	DGDB	DGDB	DSHAF, DSGAA	DSGAA	DSGAA
125	DGDK, DSGAB	DSHAE	DSHAE, DSGAB	DSGAB	DSGAB
150	DGFA, DSHAA	DSHAA	DSHAA, DSGAC	DSGAC	DSGAC
175	DGFB, DSHAB	DSHAB	DSHAB	DSHAB	DSHAB
200	DGFC, DSHAC	DSHAC	DSHAC	DSHAC	DSHAC
230	DGFS, DSHAD	DSHAD	DSHAD	DSHAD	DSHAD
250	DQDAA	DQDAA***	DQDAA***	DQDAA***	DQDAA***
275	DQDAB	DQHAA	DQHAA	DQHAA	DQHAA
300	DQDAC	DQHAB	DQHAB	DQHAB	DQHAB
350	DFEG	DFEG	DFEG	DFEG	DFEG
400	DFEH	DFEH	DFEH	DFEH	DFEH
450	DFEJ	DFEJ	DFEJ	DFEJ	DFEJ
500	DFEK	DFEK	DFEK	DFEK	DFEK
600	DFHA, DQCA, DQMAA	DQMAA, DQCA	DQMAA, DQCA	DQMAA, DQCA	DQMAA, DQCA
750	DFHA, DQCB, DQFAA	DQFAA, DQCB	DQFAA, DQCB	DQFAA, DQCB	DQFAA, DQCB
800	DFHB, DQCC, DQFAB	DQFAB, DQCC	DQFAB, DQCC	DQFAB, DQCC	DQFAB, DQCC
900	DFHD, DQFAC	DQFAC	DQFAC	DQFAC	DQFAC
1000	DFHD, DQFAD	DQFAD	DQFAD	DQFAD	DQFAD
1250	DFLE, DQGAA	DQGAA	DQGAA	DQGAA	DQGAA
1500	DFLE, DQGAB	DQGAB	DQGAB	DQGAB	DQGAB
1750	DQKB, DQKAA	DQKAA	DQKAA	DQKAA	DQKAA
2000	DQKC, DQKAB	DQKAB	DQKAB	DQKAB	DQKAB
2250*	DQKH	DQKH	DQKH	DQKH	DQKH
2500*	DQLC		DQLC	DQLC	DQLC

EPA Certification Levels:

Tier 2

Tier 3

Tier 4

Tier 1
Stationary only
(cannot use for nonroad)

* Tier 1 or greater required for stationary from 4/1/2006.

** Tier 1 and Tier 2 models available.

*** Tier 1 and Tier 3 models available.

Note: Our interpretation of the NSPS as it applies to stationary diesel generators is believed to be accurate. However, do not rely solely on this document for compliance information.

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**Power
Generation**

Four-stage battery charger

15 amp @ 12 volt

12 amp @ 24 volt



> Specification sheet

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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.

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

Faults - The charger senses and annunciates the following fault conditions: Input overvoltage, input undervoltage, AC power loss, battery overvoltage, battery undervoltage, charger circuitry over temperature, battery over temperature, unrecoverable battery and overload/overcurrent. Includes 30 volt/2 amp isolated contact for common alarm.

Parallel redundant operation - Chargers can be operated in parallel for redundant reliability or additional charging capacity.

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

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

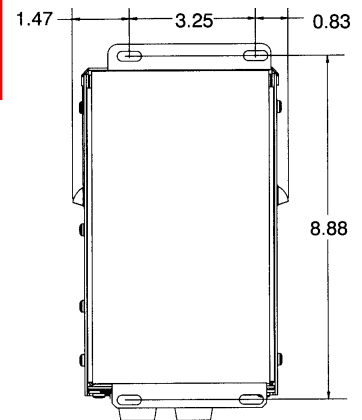
Specifications

Performance and physical characteristics

Output:	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
Input:	Equalize charger time	0-12 hrs
	Voltage AC	120, 208, 240, 277, 380, 416, 480, 600
	Frequency	50 or 60 Hz
Approximate net weights:		11.6 lbs (5.3 Kg)
Approximate dimensions: height x width x depth - in (mm)		9.75 x 5.56 x 6.14 (248 x 141 x 156)
Ambient temperature operation:		-22 °F to 122 °F (-30 °C to 50 °C)



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



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.

Mounting dimensions – inches
Bottom view

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.

Americas

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Phone: 763 574 5000
Fax: 763 574 5298

Europe, CIS, Middle East and Africa

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Manston Ramsgate
Kent CT 12 5BF United Kingdom
Phone 44 1843 255000
Fax 44 1843 255902

Asia Pacific

10 Toh Guan Road #07-01
TT International Tradepark
Singapore 608838
Phone 65 6417 2388
Fax 65 6417 2399

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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S-1470d (5/08) Page 2 of 2



PowerCommand® Remote Annunciator Panel (LonWorks System annunciator)



> Specification sheet

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Description

The PowerCommand® Network Annunciator is a network component that provides remote system status indication for emergency and other power systems in compliance to the requirements of NFPA 110. The network annunciator may also be used for remote indication of any condition that is monitored by a PowerCommand Network.

The Network Annunciator reduces installation costs and improves design flexibility by use of a PowerCommand Network to transmit all the genset and transfer switch system signals rather than using relay contacts for this purpose.

Control power for PowerCommand Network products is usually derived from the genset starting batteries. The control functions over a voltage range from 8 VDC to 35 VDC.

Features

- Visual indication of 20 network conditions and network status.
- Audible indication of any network condition - Annunciator also includes pushbutton switch to silence the audible alarm. Alarm horn sound level is approximately 90 dB(A) at 30 cm.
- Standard NFPA 110 label, field configurable for other alarm and status conditions.
- Configurable for compliance to NFPA 99 requirements.
- Sealed membrane panel design provides environmental protection for internal components and is easy to clean.
- Warranty - PowerCommand Controls are supported by a worldwide network of independent distributors who provide parts, service and warranty support.
- UL Listed and labeled; CSA certified; CE marked.
- Wall mount NEMA 1 enclosure or flush mount configurations available.

Specifications

Signal requirements

Network connections: Echelon® LonWorks®, twisted-pair 78 kbps, FT-10.

Control power: 8-30 VDC, 3.5 W (maximum) 0.8 W typical.

Wiring materials for network signals are UL Listed 4 twisted pair wiring. Terminations for control power accept wire up to 16 ga.

Environment

The annunciator is designed for proper operation in ambient temperatures from -40 °C to +70 °C (-40 °F to +158 °F) and for storage from -40 °C to +80 °C (-40 °F to +176 °F). Control will operate with humidity up to 95%, non-condensing and at altitudes up to 5000 m (13,000 ft).

Alarm Horn

Sound Level: 90 dB(A) at 30 cm

Physical

Weight: 1.45 kg (3.2 lbs) (board plus enclosure)

Power

Maximum Consumption: 5 W

Standby Consumption: 0.4 W or less

Network Length: Maximum 1400 m (4600 ft), when using NEMA Level 4 cable

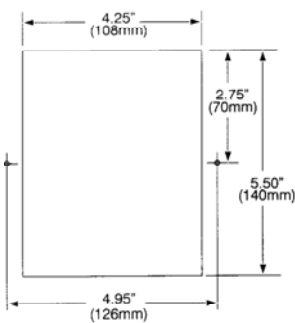
Self-binding configurations - Supports use of up to four annunciators with up to one genset and one transfer switch.

Maximum wire lengths - control power-self-binding system

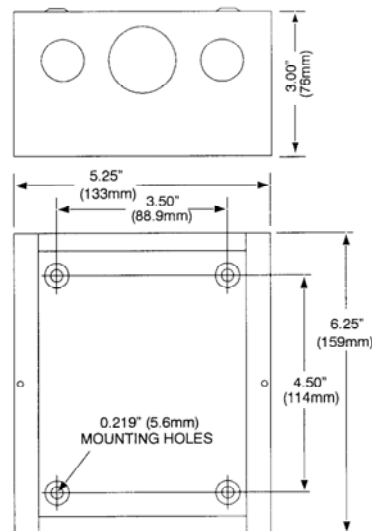
Wire size	12 VDC	24 VDC
22 ga	100 m (330 ft)	338 m (1100 ft)
20 ga	158 m (520 ft)	537 m (1760 ft)
18 ga	250 m (820 ft)	852 m (2790 ft)
16 ga	398 m (1300 ft)	1352 m (4430 ft)
14 ga	631 m (2070 ft)	1400 m (4600 ft)

Dimensions

Cut out detail (without enclosure)



Annunciator enclosure



Dimensions: in (mm)

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S-1343e (9/07)



Label configurations & standard bindings

NFPA 110 genset alarm and status annunciator

The following conditions are provided as standard on the annunciator:

- High battery voltage (A)
- Low battery voltage (A)
- Genset running (G)
- Genset supplying load (G)
- Pre-low oil pressure (A)
- Low oil pressure (R)
- Pre-high coolant temperature (A)
- High coolant temperature (R)
- Low engine temperature (A)
- Overspeed (R)
- Fail to start (overcrank) (R)
- Not in auto (R)
- Battery charger malfunction (A)
- Low fuel (A)
- Low coolant level (R)
- Spare (4) (G)
- Common alarm

(A) = Amber; (R) = Red; (G) = Green

Extended genset alarm and status annunciator

The following conditions are provided as standard on the annunciator:

- Check genset (R)
- Ground fault (A)
- High AC voltage (R)
- Low AC voltage (R)
- Under frequency (R)
- Overload (R)
- Over current (R)
- Short circuit (R)
- Reverse KW (R)
- Reverse kVAR (A)
- Fail to sync (A)
- Fail to close (R)
- Load demand (G)
- Genset CB tripped (R)
- Utility CB tripped (R)
- Emergency stop (R)
- Spare (4) (G)

(A) = Amber; (R) = Red; (G) = Green

8-Point (genset)

The following conditions are provided as standard on the annunciator:

- Check genset (A)
- Genset supplying load (A)
- Genset running (G)
- Not in auto (G)
- High/low engine temp (G)
- Low oil pressure (A)
- Low coolant level (R)
- Low fuel level (A)
- Spare (8) (G)

(A) = Amber; (R) = Red; (G) = Green

4-Point (genset)

The following conditions are provided as standard on the annunciator:

- Check genset (A)
- Genset supplying load (A)
- Genset running (G)
- Not in auto (G)
- Spare (16) (G)

(A) = Amber; (R) = Red; (G) = Green

ATS-extended

This annunciation set is often used with PLT-series equipment. The following conditions are provided as standard on the annunciator:

- Source 1 available (G)
- Source 2 available (G)
- Source 1 connected (G)
- Source 2 connected (G)
- Check ATS (R)
- ATS not in auto
- Test/exercise
- Transfer pending
- Load shed
- Transfer inhibit
- Fail to close
- Fail to disconnect
- Fail to synchronize
- Low battery-controller
- Low battery-network

(A) = Amber; (R) = Red; (G) = Green

ATS 8-point

The following conditions are provided as standard on the annunciator:

- Source 1 available (G)
- Source 2 available (G)
- Source 1 connected (G)
- Source 2 connected (G)
- Common alarm (A)
- Not in auto (R)
- Test/exercise mode (A)
- Low control battery (A)
- Spare (8) (G)

(A) = Amber; (R) = Red; (G) = Green

ATS 4-point

The following conditions are provided as standard on the annunciator:

- Source 1 available (G)
- Source 2 available (G)
- Source 2 connected (G)
- Source 1 connected (G)

(A) = Amber; (R) = Red; (G) = Green

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S-1343e (9/07)



Custom alarm configuration

#	Color (R/Y/G)	Label	Horn (Y/N)	#	Color (R/Y/G)	Label	Horn (Y/N)
1				11			
2				12			
3				13			
4				14			
5				15			
6				16			
7				17			
8				18			
9				19			
10				20			

Ordering information

Part number	Description
0541-0814-01	Network annunciator, open construction, for panel mounting
0541-0814-02	Network annunciator including control box for surface wall mounting

See your distributor for more information.

Cummins Power Generation

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Asia Pacific

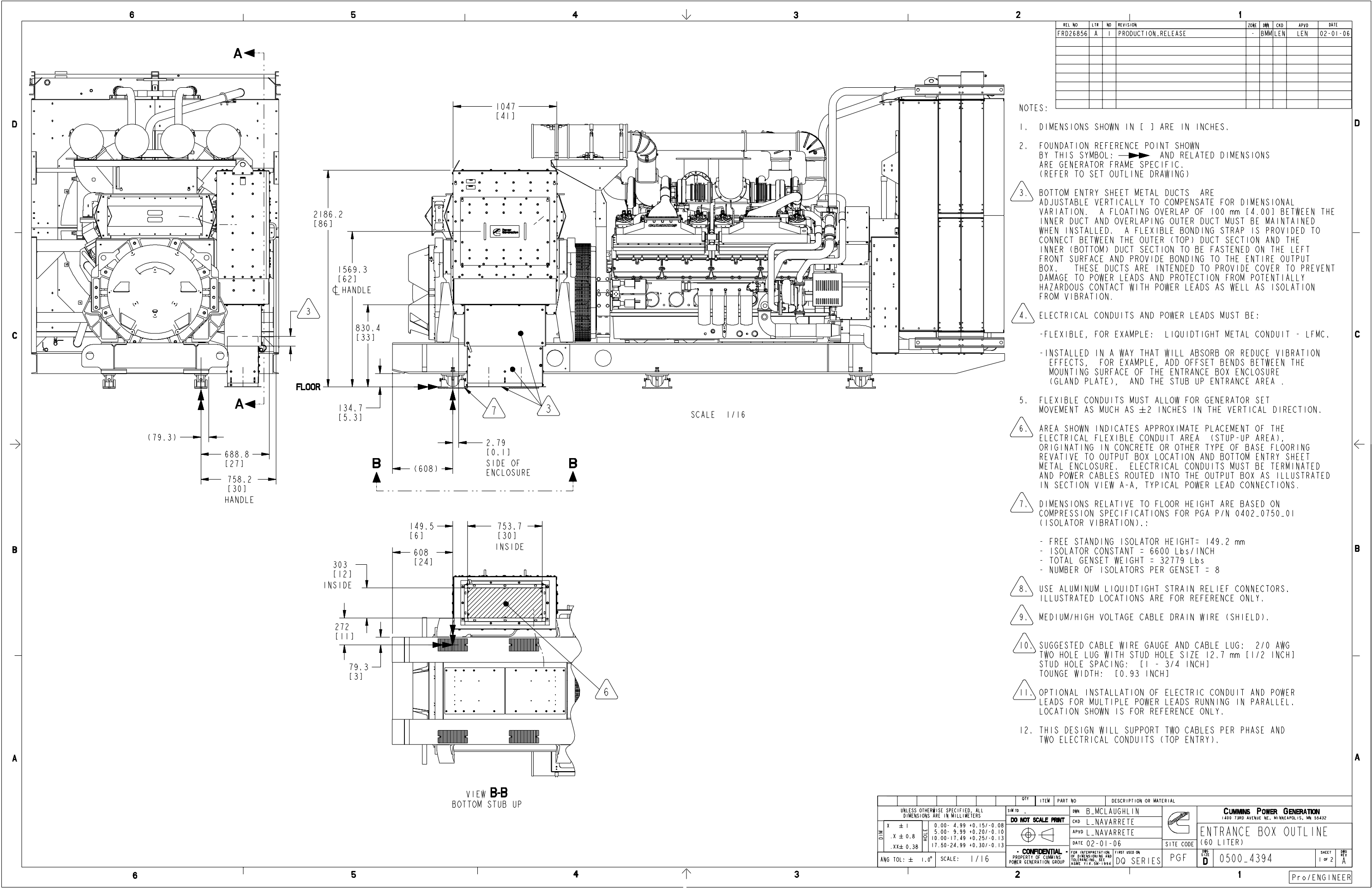
10 Toh Guan Road #07-01
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S-1343e (9/07)

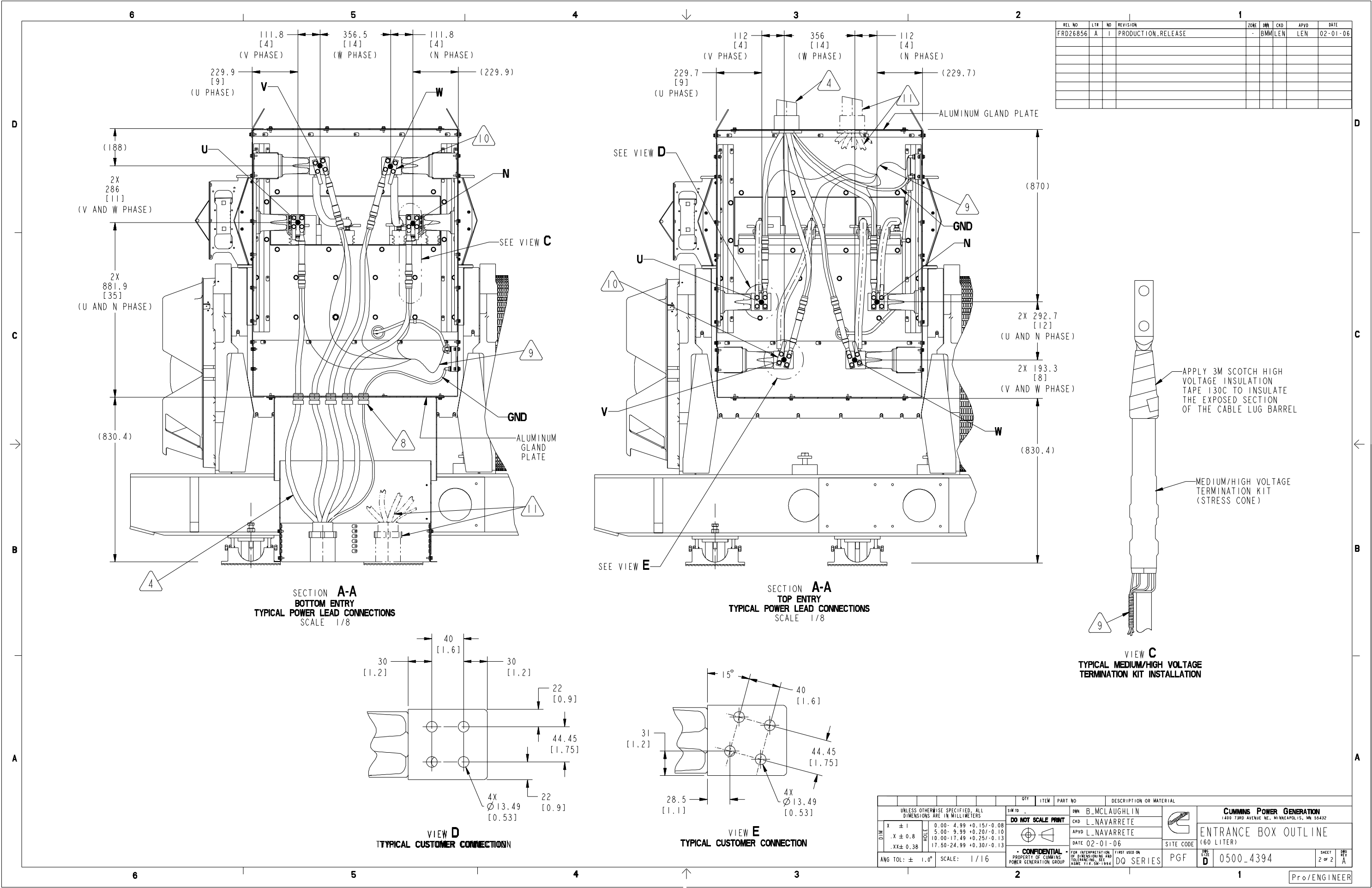




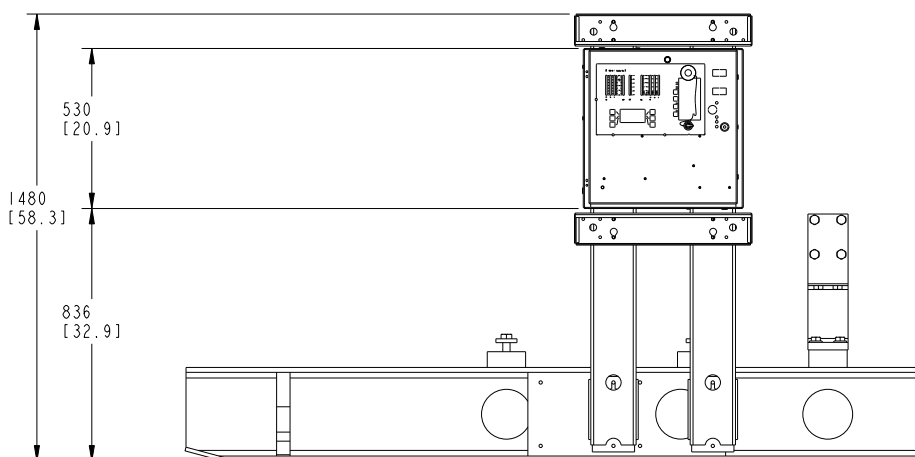
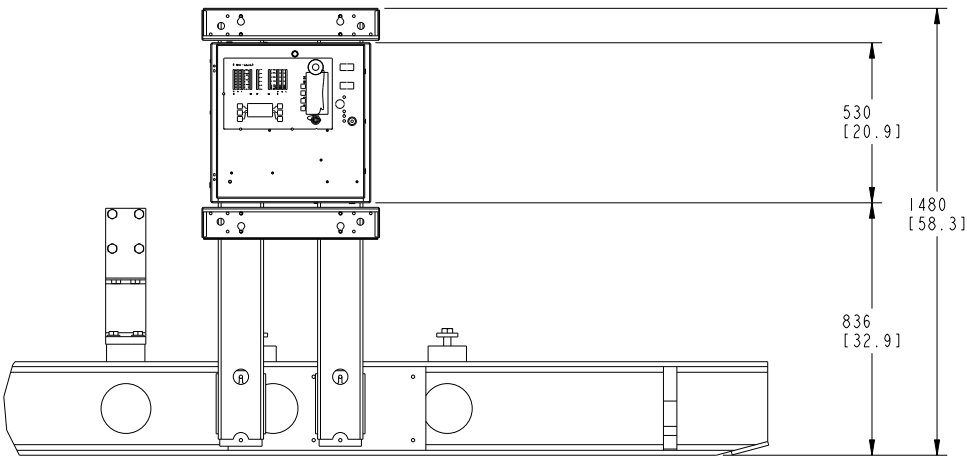
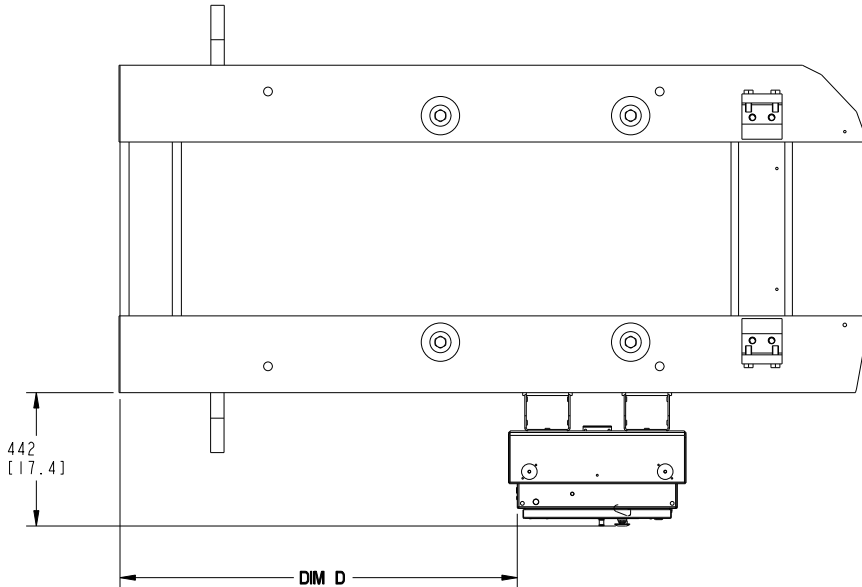
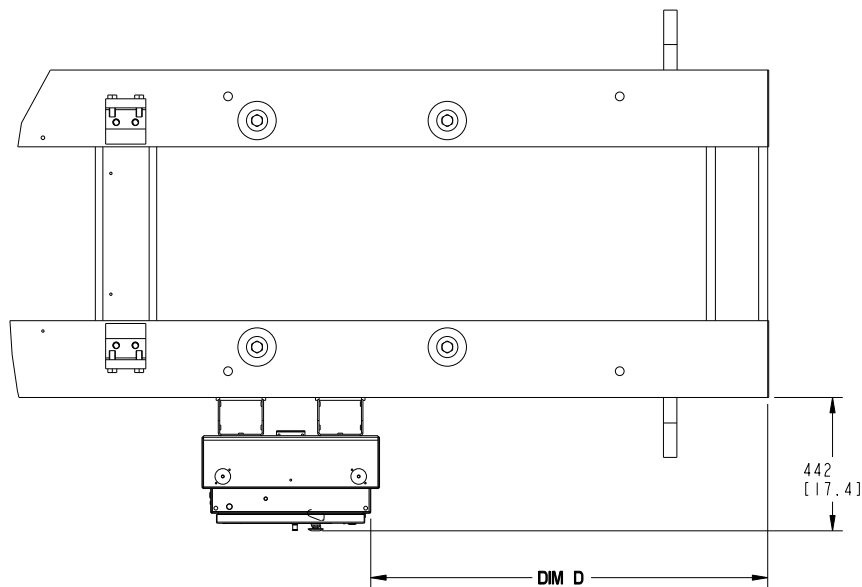
REL NO	LTR	NO	REVISION	ZONE	DWN	CKD	APVD	DATE
FRD26856	A	1	PRODUCTION RELEASE	-	BMM	LEN	LEN	02-01-06

- NOTES:
- DIMENSIONS SHOWN IN [] ARE IN INCHES.
 - FOUNDATION REFERENCE POINT SHOWN BY THIS SYMBOL:  AND RELATED DIMENSIONS ARE GENERATOR FRAME SPECIFIC. (REFER TO SET OUTLINE DRAWING)
 - BOTTOM ENTRY SHEET METAL DUCTS ARE ADJUSTABLE VERTICALLY TO COMPENSATE FOR DIMENSIONAL VARIATION. A FLOATING OVERLAP OF 100 mm [4.00] BETWEEN THE INNER DUCT AND OVERLAPPING OUTER DUCT MUST BE MAINTAINED WHEN INSTALLED. A FLEXIBLE BONDING STRAP IS PROVIDED TO CONNECT BETWEEN THE OUTER (TOP) DUCT SECTION AND THE INNER (BOTTOM) DUCT SECTION TO BE FASTENED ON THE LEFT FRONT SURFACE AND PROVIDE BONDING TO THE ENTIRE OUTPUT BOX. THESE DUCTS ARE INTENDED TO PROVIDE COVER TO PREVENT DAMAGE TO POWER LEADS AND PROTECTION FROM POTENTIALLY HAZARDOUS CONTACT WITH POWER LEADS AS WELL AS ISOLATION FROM VIBRATION.
 - ELECTRICAL CONDUITS AND POWER LEADS MUST BE:
 - FLEXIBLE, FOR EXAMPLE: LIQUIDTIGHT METAL CONDUIT - LFMC.
 - INSTALLED IN A WAY THAT WILL ABSORB OR REDUCE VIBRATION EFFECTS, FOR EXAMPLE, ADD OFFSET BENDS BETWEEN THE MOUNTING SURFACE OF THE ENTRANCE BOX ENCLOSURE (GLAND PLATE), AND THE STUB UP ENTRANCE AREA.
 - FLEXIBLE CONDUITS MUST ALLOW FOR GENERATOR SET MOVEMENT AS MUCH AS ± 2 INCHES IN THE VERTICAL DIRECTION.
 - AREA SHOWN INDICATES APPROXIMATE PLACEMENT OF THE ELECTRICAL FLEXIBLE CONDUIT AREA (STUP-UP AREA), ORIGINATING IN CONCRETE OR OTHER TYPE OF BASE FLOORING REVATIVE TO OUTPUT BOX LOCATION AND BOTTOM ENTRY SHEET METAL ENCLOSURE. ELECTRICAL CONDUITS MUST BE TERMINATED AND POWER CABLES ROUTED INTO THE OUTPUT BOX AS ILLUSTRATED IN SECTION VIEW A-A, TYPICAL POWER LEAD CONNECTIONS.
 - DIMENSIONS RELATIVE TO FLOOR HEIGHT ARE BASED ON COMPRESSION SPECIFICATIONS FOR PGA P/N 0402-0750-01 (ISOLATOR VIBRATION).:
 - FREE STANDING ISOLATOR HEIGHT= 149.2 mm
 - ISOLATOR CONSTANT = 6600 Lbs/INCH
 - TOTAL GENSET WEIGHT = 32779 Lbs
 - NUMBER OF ISOLATORS PER GENSET = 8
 - USE ALUMINUM LIQUIDTIGHT STRAIN RELIEF CONNECTORS. ILLUSTRATED LOCATIONS ARE FOR REFERENCE ONLY.
 - MEDIUM/HIGH VOLTAGE CABLE DRAIN WIRE (SHIELD).
 - SUGGESTED CABLE WIRE GAUGE AND CABLE LUG: 2/0 AWG TWO HOLE LUG WITH STUD HOLE SIZE 12.7 mm [1/2 INCH] STUD HOLE SPACING: [1 - 3/4 INCH] TOUNGE WIDTH: [0.93 INCH]
 - OPTIONAL INSTALLATION OF ELECTRIC CONDUIT AND POWER LEADS FOR MULTIPLE POWER LEADS RUNNING IN PARALLEL. LOCATION SHOWN IS FOR REFERENCE ONLY.
 - THIS DESIGN WILL SUPPORT TWO CABLES PER PHASE AND TWO ELECTRICAL CONDUITS (TOP ENTRY).

						QTY		ITEM		PART NO		DESCRIPTION OR MATERIAL					
UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS												CUMMINS POWER GENERATION 1400 73RD AVENUE NE, MINNEAPOLIS, MN 55432					
DIM	X ± 1	0.00 - 4.99 +0.15/-0.08	HOLE	SIM TO		DO NOT SCALE PRINT		DWN B.MCLAUGHLIN				ENTRANCE BOX OUTLINE (60 LITER)					
	X ± 0.8	5.00 - 9.99 +0.20/-0.10				CKD L.NAVARRETE											
	X ± 0.6	10.00 - 17.49 +0.25/-0.13				APVD L.NAVARRETE											
	X ± 0.4	17.50 - 24.99 +0.30/-0.13				DATE 02-01-06											
	ANG TOL: ± 1.0°	SCALE: 1/16												SITE CODE			
												FOR INTERPRETATION OF DIMENSIONS AND TOLERANCES, SEE ASME Y12.5M-1994		SHEET 1 OF 2			
- CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP												DO SERIES		PGF		0500_4394	
												D				D	



REL NO	LTR	NO	REVISION	OWN	CAD	APVD	DATE
ECO-110813	B	--	----	DDC	SLS	SUYDAM	14 JUN 10



H609

H608

RADIATOR COOLED

TABULATION	
GEN STYLE	DIM "D"
P7	1314.4 [51.75]
P80	1073.7 [42.27]

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		SIN 10 0500_4780	OWN J. GIANNINI		CUMMINS POWER GENERATION	
DO NOT SCALE PRINT			CAD K. RABADI		OUTLINE, GENSET	
DATE 29MAR10			APVD K. RABADI		SITE CODE	
ANG TOL: ± 1.0°	SCALE: 1/1	CONFIDENTIAL	FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE ASME Y14.5M-1994	FIRST USED ON DQKAB	PGF	SHEET 3 OF 8

A



Drawing Name: A030Y636 Revision: B
Part Name: A030Y635 Revision: B Page 51 of 84
Sheet 4 of 9