NPower

Lombard Water Project

Engineering Submittal

Submitted By:
Cummins NPower, LLC
Attn: Paul Hoogervorst, Sales Engineer
7145 Santa Fe Drive
Hodgkins, IL 60525
Phone: (708) 482-2884

Project Coordinator: Pamela Fenili
Phone: (920) 338-5904
Technical Support-Product and Installation- Jim Nilles
Phone: (708) 482-2881
For Start Up and Testing Service
Phone: (708) 579-9222

Specification sheet

Diesel generator set QSX15 series engine

350 kW - 500 kW standby

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.

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.

Enclosures - Optional weather protective and sound attenuated enclosures are available.

Fuel tanks - Dual wall sub-base fuel tanks are also available.

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.

	Standby rating		Prime rating		Continuous rating		Data sheets	
Model	60 Hz kW (kVA)	50 Hz kW (kVA)	60 Hz kW (kVA)	50 Hz kW (kVA)	60 Hz kW (kVA)	50 Hz kW	60 Hz	50 Hz
DFEG	350 (438)		320 (400)				D-3398	
DFEH	400 (500)	352 (440)	365 (456)	320 (400)			D-3399	D-3402
DFEJ	450 (563)	400 (500)	410 (513)	364 (455)			D-3400	D-3403
DFEK	500 (625)	440 (550)	455 (569)	400 (500)			D-3401	D-3404

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Generator set specifications

Governor regulation class	ISO 8528 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, Level 4 electrostatic discharge IEC 801.3; Level 3 radiated susceptibility

Engine specifications

Design	Turbocharged with air-to-air charge air cooling
Bore	136.9 mm (5.39 in)
Stroke	168.9 mm (6.65 in)
Displacement	14.9 L (912.0 in^3)
Configuration	Cast iron with replaceable wet liners, in-line 6 cylinder
Battery capacity	900 amps minimum at ambient temperature of 0 °C (32 °F)
Battery charging alternator	35 amps
Starting voltage	24 volt, negative ground
Fuel system	Full authority electronic (FAE) Cummins HPI-TP
Fuel filter	
Air cleaner type	
Lube oil filter type(s)	Single spin-on combination full flow and bypass filters
Standard cooling system	40 °C (104 °F) 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
Standard temperature rise	125 °C standby at 40 °C ambient
Exciter type	PMG (Permanent magnet generator)
Phase rotation	A (U), B (V), C (W)
Alternator cooling	Direct drive centrifugal blower
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			
• 110/190	• 110/220	• 115/200	• 115/230	• 110/190	• 110/220	• 115/200	• 115/230
• 120/208	• 127/220	• 139/240	• 220/380	• 120/208	• 127/220	• 139/240	• 220/380
• 230/400	• 240/416	• 255/440	• 277/480	• 230/400	• 240/415	• 255/440	
• 347/600							

Note: Consult factory for other voltages.

Generator set options and accessories

Engine
- ☐ 208/240/480 V thermostatically controlled coolant heater for ambient above 4.5 °C (40 °F)
- ☐ 208/240/480 V thermostatically controlled coolant heater for ambient below 4.5 °C (40 °F)
- ☐ 120 V 300 W lube oil heater
- ☐ Heavy duty air cleaner with safety element

Alternator
- ☐ 80 °C rise
- ☐ 105 °C rise
- ☐ 150 °C rise
- ☐ 120/240 V 300 W anti-condensation heater

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

Fuel system - 60 Hz
- ☐ 1136 L (300 gal) sub-base tank
- ☐ 1514 L (400 gal) sub-base tank
- ☐ 1893 L (500 gal) sub-base tank
- ☐ 2271 L (600 gal) sub-base tank
- ☐ 2498 L (660 gal) sub-base tank
- ☐ 3218 L (850 gal) sub-base tank
- ☐ 6435 L (1700 gal) sub-base tank

Fuel system - 50 Hz
- ☐ 155 L (41 gal) in-skid day tank (dual wall)
- ☐ 208 L (55 gal) in-skid day tank (single wall)
- ☐ 1595 L (425 gal) sub-base tank
- ☐ 3191 L (850 gal) sub-base tank

Cooling system
- ☐ High ambient 50 °C radiator

Control panel
- ☐ 120/240 V 100 W control anti-condensation heater
- ☐ Ground fault indication
- ☐ Power transfer control
- ☐ Remote fault signal package
- ☐ Run relay package

Generator set
- ☐ AC entrance box
- ☐ Battery
- ☐ Battery charger
- ☐ Export box packaging
- ☐ UL 2200 Listed
- ☐ Main line circuit breaker
- ☐ Paralleling accessories
- ☐ Remote annunciator panel
- ☐ Spring isolators
- ☐ Enclosure: aluminum, steel, weather protective or sound attenuated
- ☐ 2 year standby power warranty
- ☐ 2 year prime power warranty
- ☐ 5 year basic power 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 PCC2100 or PCC3201

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.
- Standard PCCNet™ and optional Echelon® LonWorks® network interface.
- 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.

Operator/display panel

- Off/manual/auto mode switch
- Manual run/stop switch
- Panel lamp test switch
- Emergency stop switch
- Alpha-numeric display with pushbutton access for viewing engine and alternator data and providing setup, controls and adjustments
- LED lamps indicating genset running, not in auto, common warning, common shutdown
- 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 (some models)
- 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 (some models)
- Engine speed

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
- Excitation fault

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

Other data

- Genset model data
- Start attempts, starts, running hours
- kW hours (total and since reset)
- Fault history

Governing

- Digital electronic isochronous governor
- Temperature dynamic governing
- Smart idle speed mode
- Glow plug control (some models)

Voltage regulation

- Digital PWM electronic voltage regulation
- Three phase line-to-neutral sensing
- Suitable for PMG or shunt excitation
- 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 inputs (4)
- 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

- ☐ PCC 3201 paralleling control
- ☐ LED bargraph AC data display
- ☐ 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)

For further detail on PCC 2100 see document S-1409.
For further detail on PCC 3201 see document S-1444.

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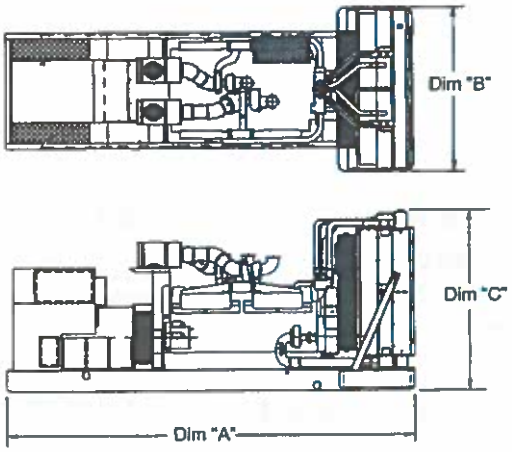
Emergency standby power (ESP):
Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

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)
DFEG	3864 (152.1)	1524 (60.0)	1812 (71.3)	3856 (8500)	3992 (8800)
DFEH	3864 (152.1)	1524 (60.0)	1812 (71.3)	3856 (8500)	3992 (8800)
DFEJ	3864 (152.1)	1524 (60.0)	1812 (71.3)	4082 (9000)	4218 (9300)
DFEK	3864 (152.1)	1524 (60.0)	1812 (71.3)	4309 (9500)	4445 (9800)

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

Codes and standards

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

ISO 9001	This generator set is designed in facilities certified to ISO 9001 and manufactured in facilities certified to ISO 9001 or ISO 9002.	UL	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.
PTS	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.	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.
CSA	All low voltage models are CSA certified to product class 4215-01.	International Building Code	The generator set package is available certified for seismic application in accordance with the following International Building Code: IBC2000, IBC2003, IBC2006, IBC2009 and IBC2012.

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.

North America
1400 73rd Avenue N.E.
Minneapolis, MN 55432
USA
Phone 763 574 5000
Fax 763 574 5298

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S-1582f (3/13)

Power Generation

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Generator set data sheet

Power Generation

Model: DFEJ
Frequency: 60
Fuel type: Diesel
KW rating: 450 standby
410 prime
Emissions level: EPA NSPS Stationary Emergency Tier 2

Exhaust emission data sheet:	**EDS- 184**
Exhaust emission compliance sheet:	**EPA-1025**
Sound performance data sheet:	**MSP-183**
Cooling performance data sheet:	**MCP-106**
Prototype test summary data sheet:	**PTS-145**
Standard set-mounted radiator cooling outline:	**0500-3326**
Optional set-mounted radiator cooling outline:	
Optional heat exchanger cooling outline:	
Optional remote radiator cooling outline:	

Fuel consumption

	Standby				Prime				Continuous
	kW (kVA)				kW (kVA)				kW (kVA)
Ratings	450 (563)				410 (513)				
Load	**1/4**	**1/2**	**3/4**	**Full**	**1/4**	**1/2**	**3/4**	**Full**	**Full**
US gph	10.8	17.4	23.4	30.1	10.2	16.2	21.9	27.7	
L/hr	41	66	89	114	39	61	83	105	

Engine

	Standby rating	Prime rating	Continuous rating
Engine manufacturer	Cummins Inc.		
Engine model	QSX15-G9		
Configuration	Cast iron with replaceable wet cylinder liners, in-line 6 cylinder		
Aspiration	Turbocharged with air-to-air charge air cooling		
Gross engine power output, kWm (bhp)	563.0 (755.0)	507.3 (680.0)	
BMEP at set rated load, kPa (psi)	2192.5 (318.0)	2006.4 (291.0)	
Bore, mm (in)	136.9 (5.39)		
Stroke, mm (in)	168.9 (6.65)		
Rated speed, rpm	1800		
Piston speed, m/s (ft/min)	10.1 (1995.0)		
Compression ratio	17.0:1		
Lube oil capacity, L (qt)	83.3 (88.0)		
Overspeed limit, rpm	2150 ± 50		
Regenerative power, kW	52.00		

Fuel flow

Fuel flow at rated load, L/hr (US gph)	423.9 (112.0)	
Maximum inlet restriction, mm Hg (in Hg)	127.0 (5.0)	
Maximum return restriction, mm Hg (in Hg)	165.1 (6.5)	

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Air

	Standby rating	Prime rating	Continuous rating
Combustion air, m3/min (scfm)	38.3 (1355.0)	36.8 (1300.0)	
Maximum air cleaner restriction, kPa (in H2O)	6.2 (25.0)		
Alternator cooling air, m3/min (scfm)	62.0 (2190.0)		

Exhaust

Exhaust flow at set rated load, m^3/min (cfm)	87.9 (3105.0)	82.4 (2910.0)	
Exhaust temperature, ° C (° F)	462.8 (865.0)	440.6 (825.0)	
Maximum back pressure, kPa (in H_2O)	10.2 (41.0)		

Standard set-mounted radiator cooling

Ambient design, ° C (° F)	40 (104)		
Fan load, kW_m (HP)	19 (25.5)		
Coolant capacity (with radiator), L (US Gal)	57.9 (15.3)		
Cooling system air flow, m^3/min (scfm)	707.5 (25000.0)		
Total heat rejection, MJ/min (Btu/min)	19.6 (18485.0)	17.7 (16680.0)	
Maximum cooling air flow static restriction, kPa (in H_2O)	0.12 (0.5)		

Optional set-mounted radiator cooling

Ambient design, °C (°F)	50 (122)		
Fan load, kW_m (HP)	19 (25.5)		
Coolant capacity (with radiator), L (US gal)	57.9 (15.3)		
Cooling system air flow, m^3/min (scfm)	707.5 (25000.0)		
Total heat rejection, MJ/min (Btu/min)	19.6 (18485.0)	17.7 (16680.0)	
Maximum cooling air flow static restriction, kPa (in H_2O)	0.12 (0.5)		

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)			

Optional remote radiator cooling[1]

	Standby rating	Prime rating	Continuous rating
Set coolant capacity, L (US gal)			
Max flow rate at max friction head, jacket water circuit, L/min (US gal/min)			
Max flow rate at max friction head, aftercooler circuit, L/min (US gal/min)			
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 friction head, jacket water circuit, kPa (psi)			
Maximum friction head, aftercooler circuit, kPa (psi)			
Maximum static head, jacket water circuit, m (ft)			
Maximum static head, aftercooler circuit, m (ft)			
Maximum jacket water outlet temp, °C (°F)			
Maximum aftercooler inlet temp at 25 °C (77 °F) ambient, °C (°F)			
Maximum aftercooler inlet temp, °C (°F)			
Maximum fuel flow, L/hr (US gph)			
Maximum fuel return line restriction, kPa (in Hg)			

Weights[2]

Unit dry weight kgs (lbs)	4082 (9000)
Unit wet weight kgs (lbs)	4218 (9300)

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	Genset may be operated up to 1740 m (5700 ft) and 40 °C (104 °F) without power deration. For sustained operation above these conditions up to 2220 m (7280 ft), derate by 2.8% per 305 m (1000 ft), and 5.7% per 10 °C (3.2% per 10 °F). Above 2220 m (7280 ft) up to 3000 m (9840 ft), derate 3.9% total for 2200 m (7280 ft) plus 4.3% per 305 m (1000 ft), and 5.7% per 10 °C (3.2% per 10 °F). Above 3000 m (9840 ft), derate 14.9% total for 3000 m (9840 ft) plus 1.8% per 305 m (1000 ft) and 10% per 10 °C (5.6% per 10 °F).
Prime	Genset may be operated up to 1740 m (5700 ft) and 40 °C (104 °F) without power deration. For sustained operation above these conditions up to 2220 m (7280 ft), derate by 2.8% per 305 m (1000 ft), and 5.7% per 10 °C (3.2% per 10 °F). Above 2220 m (7280 ft) up to 3000 m (9840 ft), derate 3.9% total for 2200 m (7280 ft) plus 4.3% per 305 m (1000 ft), and 5.7% per 10 °C (3.2% per 10 °F). Above 3000 m (9840 ft), derate 14.9% total for 3000 m (9840 ft) plus 1.8% per 305 m (1000 ft) and 10% per 10 °C (5.6% per 10 °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

Three Phase Table[1]		105 °C	105 °C	125 °C	125 °C	125 °C	125 °C	125 °C	150 °C	150 °C	150 °C	150 °C
Feature Code		B259	B301	B258	B252	B414	B246	B300	B426	B413	B424	B419
Alternator Data Sheet Number		308	306	307	306	307	305	305	307	306	305	305
Voltage Ranges		110/190 thru 139/240 220/380 thru 277/480	347/600	110/190 thru 139/240 220/380 thru 277/480	120/208 thru 139/240 240/416 thru 277/480	120/208 thru 139/240 240/416 thru 277/480	277/480	347/600	110/190 thru 139/240 220/380 thru 277/480	120/208 thru 139/240 240/416 thru 277/480	277/480	347/600
Surge kW		515	516	513	512	515	513	511	513	512	513	511
Motor Starting kVA (at 90% sustained voltage)	Shunt											
	PMG	2429	1896	2208	1896	2208	1749	1749	2208	1896	1749	1749

Full Load Current Amps at Standby Rating	110/190	120/208	110/220	115/230	139/240	220/380	230/400	240/416	255/440	277/480	347/600
	1711	1563	1478	1414	1355	856	813	782	739	677	542

Note:
[1] Single phase power can be taken from a three phase generator set at up to 40% of the generator set nameplate kW rating at unity power factor.

Formulas for calculating full load currents:

Three phase output

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

Single phase output

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

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.

North America
1400 73rd Avenue N.E.
Minneapolis, MN 55432
USA

Phone 763 574 5000
Fax 763 574 5298

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D-3400c (11/12)

Power Generation

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Power Generation

PROTOTYPE TEST SUPPORT (PTS)
60 HZ TEST SUMMARY

GENERATOR SET MODELS	REPRESENTATIVE PROTOTYPE	
350DFEG	Model:	500DFEK
400DFEH		
450DFEJ	Engine:	QSX15-G9
500DFEK	Alternator:	HC5F

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: **516 KW**

The generator set was evaluated to determine the stated maximum surge power.

Maximum Motor Starting: **2429 KVA**

The generator set was tested to simulate motor starting by applying the specified kVA load at low lagging power factor (0.4 or lower). With this load applied, the generator set recovered to a minimum of 90% rated voltage

Torsional Analysis and Testing:

The generator set was tested to verify that the design is not subjected to harmful torsional stresses in excess of 5000psi. A spectrum analysis of the transducer output was conducted over the
speed range of 1200 to 2000 RPM.

Cooling System: 50 °C Ambient
0.50 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.

Durability:

The generator set was subjected to a minimum 500 hour endurance test operating at variable load up to the standby rating based upon MIL-STD-705 to verify structural soundness and durability of the design.

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:	±0.5%
Random Voltage Variation:	±0.3%
Frequency Regulation:	Isochronous
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. Verify acceptable Voltage and frequency response on load addition or rejection were evaluated. The following results were recorded:

Full Load Acceptance:		
Voltage Dip:	32.1	%
Recovery Time:	3.4	Second
Frequency Dip:	10.8	%
Recovery Time:	4	Second
Full Load Rejection:		
Voltage Rise:	16.3	%
Recovery Time:	0.9	Second
Frequency Rise:	4	%
Recovery Time:	0.6	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	0.104	0.026	0.1	0.044
5	0.38	2.1	0.36	2.5
7	0.42	0.58	0.42	1.1
9	0.033	0.014	0	0.066
11	0.74	0.77	0.74	0.72
13	0.25	0.235	0.2	0.3
15	0.02	0.18	0	0.012

PowerCommand® 2100 digital generator set control

> Specification sheet

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Description

The PowerCommand® 2100 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. 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 a wide range of generator sets in non-paralleling applications. The PowerCommand Control will directly read AC voltages up to 600 VAC and can be configured for any frequency, voltage and power connection configuration from 120 to 600 VAC.

The control offers a wide range of standard control and digital display features so custom control configurations are not needed to meet application specifications. 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 without degradation in performance over a voltage range from 8 VDC to 35 VDC.

Features

Digital engine speed governing controls - Provide isochronous frequency regulation (optional on some genset models).

Digital voltage regulation – 3-phase sensing.

AmpSentry™ protective relay – UL Listed, true alternator over current protection.

Analog and digital AC output metering.

Battery monitoring system - Senses and warns against a weak battery condition.

Digital alarm and status message display.

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

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

PCCNet Interface - A proprietary RS485 network interface to allow easy plug and play interface to remote annunciators, relay modules for extensible I/O and other devices.

Advanced serviceability - Interfaces to InPower™, a PC-based software service tool. A version of InPower is available for customer use.

PowerCommand LonWorks® network (optional) - Provides interfaces to external devices through a twisted pair wire and other media.

Certifications - Suitable for use on generator sets that are designed, manufactured, tested, and certified to relevant UL, NFPA, ISO, IEC, and CSA standards.

Warranty and service - 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. Connections to the operator panel are 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 with a start signal from a remote device, such as an automatic transfer switch.

Manual run/stop control switch - When the mode control switch is in the *manual* position and the *manual/run/stop* switch is pressed, the generator set will start, bypassing time delay start. The control is configurable to include an idle period on manual start. If the generator set is running in the *manual* mode, pressing the *run/stop* switch will cause the generator set to shut down after a cool down at idle period.

Panel lamp/lamp test control switch - Depressing the *panel lamp* switch will cause the panel illumination to operate for approximately 10 minutes. Pressing and holding the switch will sequentially illuminate all LED lamps on the panel to confirm proper operation of these components.

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 - Pressing the *emergency stop* switch will cause the generator set to immediately shut down. The generator set is prevented from running or cranking with the switch pressed in.

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 (±5%)
- Alternator frequency (±5%)

Indicating lamps

The operator panel includes a series of LED indicating lamps to allow the operator to view the general status of the generator set. Functions displayed include:

Green lamps to indicate generator set running (operating at rated voltage and frequency); remote start signal received.

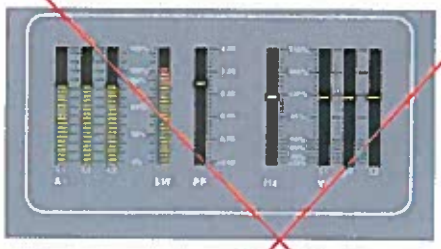
Red (flashing) lamp to indicate not-in-auto mode and a red lamp to indicate common shutdown.

Amber lamp for common warning.

Lamps (5) are configurable for color and function. These lamps are configured with InPower for any condition monitored by the control. Default configuration for these lamps include the following functions:

- Low oil pressure warning
- High engine temperature warning
- Low oil pressure shutdown
- Over speed shutdown
- Fail to start

Analog AC metering panel (optional)



The PowerCommand control can be 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. Resolution is 1% for values close to nominal and increases at values far from nominal.

Alphanumeric display panel

The PowerCommand control is provided with an alphanumeric display capable of displaying 2 lines of data with approximately 20 characters per line. The display is accompanied by a set of six tactile-feel membrane switches that are used by the operator to navigate through

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control menus and to make control adjustments. (There are no rotary potentiometers in the control. All adjustments are made via the display panel or InPower). Display is configurable for multiple languages. It is configurable for units of measurement.

All data on the control can be viewed by scrolling through screens with the navigation keys.

The control displays all active fault conditions with the latest displayed first. Active and inactive faults are displayed.

The display panel includes a screen-saver timer that will turn off the display after 30 minutes of inactivity. Touching any key will turn the screen back on.

Generator set hardware data - Generator set rating in kVA, complete generator set model number and provisions for generator set serial number, engine model and serial number, and alternator model and serial number. The control stores the part number of the control and the software version present in the control. This information is read using InPower.

Data logs - Number of start attempts and number of start attempts since reset. Number of times generator set has run and duration of generator set running time. Generator set kWh produced. The control also stores number of start attempts, operating hours and kW hours since each has been reset. This data is read with InPower.

Adjustment history - Provides a record of adjustment and setting changes made on the control and 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 - Provides a record of the most recent fault conditions with time stamp, along with the number of times each fault has occurred. Up to 20 events are stored in the control non-volatile memory.

Load profile data - Control logs data indicating the operating hours at percent of rated kW load in 10% increments. The data is presented on the operator panel based on total operating hours on the generator set based on number of hours under 30% load and number of hours at more than 90% of rated. InPower can be used to read data in detail (10% increments).

Generator set output voltage - All phases, line-to-line and line-to-neutral, accuracy 1%. Data for all phases is displayed simultaneously to allow viewing of voltage balance.

Generator set output current - All phases, accuracy 1%. Data for all phases is displayed simultaneously to allow viewing of load balance.

Generator set output frequency.

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

Generator set kWh power output - Displays total kilowatt-hours produced by the generator set and total produced since last reset, with time stamp of time of last reset.

Generator set control temperature.

Engine starting battery voltage.

Engine lube oil pressure.

Engine coolant temperature.

Engine lube oil temperature (option on some genset models).

System data display - The generator set will exchange data with Cummins Power Generation transfer switches utilizing PowerCommand transfer controls and other generator sets using the PowerCommand 2100 control that are located on the same site and interconnected using a PowerCommand network. Information displayed from each transfer switch in the system includes: transfer switch name (assigned by customer at site), kW load (when fitted with load monitoring equipment), sources available, source connected and if any alarm conditions are present on the switch. Genset data includes genset name, kW load, status and name of any alarm conditions that are present.

Service adjustments - The operator panel includes provisions for adjustment and set up of all control functions in the generator set. The operator panel includes an access code that is used to protect the control from unauthorized service level adjustments.

Internal control functions

Engine control

Remote 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 control of the engine fuel system and alternator excitation system.

The control can incorporate a time delay start and a warm-up period at idle speed. See *Engine governing* for details.

Sleep mode - PowerCommand can be configured to include a sleep mode. When enabled, and when the mode select switch is in the off position, the control will revert to

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a low power consumption mode until a control switch on the operator panel is operated (reset, panel lamp, manual run or emergency stop).

Data logging - The control maintains a record of manual control operations, warning and shutdown conditions, and other events. 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 all protective functions of the control by simulating failure modes or by forcing the control to operate outside of its normal operating ranges.

Engine starting - The control system automatically controls the engine starter and provides proper engine fueling and alternator control to provide fast and efficient 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.

Time delay start and stop (cool down) - Configurable for time delay of 0-300 seconds prior to starting after receiving a remote start signal; and for time delay of 0-600 seconds prior to ramp-to-idle or shutdown after signal to stop in normal operation modes. Default for both time delay periods is 0 seconds.

Engine governing

The PowerCommand control includes integrated digital governing capability to directly drive an engine fuel control valve. Features of the governing system (when enabled) include:

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

Temperature dynamics - Modifies the engine fuel system (governing) 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.

Smart idle mode - Engine governing can be regulated at an idle speed for a programmed period on automatic stop of the engine or in manual mode. In an automatic mode, the control will bypass the idle period if the engine is at a low load level for sufficient duration for cool down. During idle mode engine protective functions are adjusted for the lower engine speed, and alternator function and protections are disabled.

Idle speed can be initiated by the operator when the generator set is running in the manual mode.

Glow plug control (optional) - Modifies the engine start cycle to include a programmed time period for operation of glow plugs. This feature is available on generator sets that require glow plug control only.

Alternator control

PowerCommand includes an integrated 3-phase line-to-neutral sensing voltage regulation system that is compatible with either shunt or PMG type excitation systems (some generator set models are always PMG). The voltage regulation system is full wave rectified and has a PWM output for good motor starting capability and stability when powering non-linear loads. Major system features include:

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 ±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.

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. The regulation system will drive a permanent magnet generator (PMG) to provide 3 times rated current on all phases for motor starting and short circuit coordination purposes.

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 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 may be enabled by a service technician. The fault bypass mode forces the system to function regardless of the status of protective functions. (Each function must be individually bypassed.) In this mode the only protective functions that are operational are over speed, loss of speed sensor, 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,

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and all warning or shutdown conditions that have occurred while in the *"fault bypass"* mode.

The control system automatically captures the generator set logged parameters on a fault condition.

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 functions can incorporate control functions as a consequence of a fault.

System protective functions:

Ground fault warning (optional) - 600 VAC class generator sets with solid ground. Ground 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 (configurable contact closed to ground or open) to indicate customer-specified conditions. The control is programmable for warning, shutdown or status indication, and for labeling the input. Eight additional faults can be input to the control via the network.

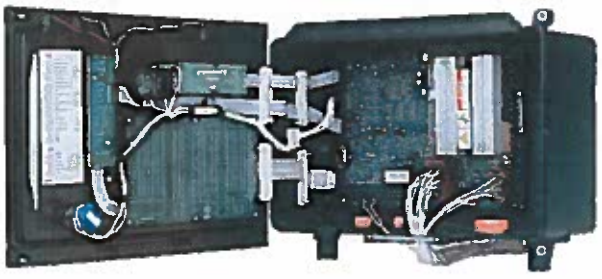
Emergency stop - Annunciated whenever the local or remote emergency stop signal is received. Alarm panel distinguishes between local or remote operation.

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

High coolant temperature warning - Level is preset to match the capabilities of each engine. Control includes time delays to prevent nuisance shutdown signals.

High oil temperature warning (optional) - Level is preset to match the capabilities of each engine. Control includes time delays to prevent nuisance shutdown signals.

Low coolant level warning/shutdown - Optional on some genset models.

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.

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.

Dead battery shutdown - Indicates that generator set failed to start due to failed starting battery.

Fail to start (overcrank) shutdown.

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

Redundant starter disconnect.

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.

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.

Over current warning - Output current on any phase at more than 110% of rating for more than 60 seconds or more than 400% for more than 1 second.

Over current shutdown (51) - 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.

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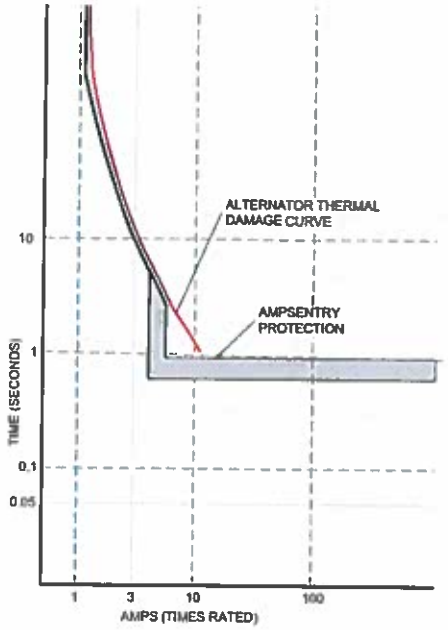

Short circuit shutdown - Output current on any phase is more than 110%, more than 175% of rating, and approaching thermal damage point of alternator. Control includes algorithms to protect alternator from repeated over current conditions over a short period of time.

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.

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.

Over frequency shutdown/warning (81o) - Adjustable for operation in a range of 0-10 Hz above nominal frequency, with a time delay of 0-20 seconds. Defaults: Disabled.

Over load (kW) warning - Provides a warning indication when engine is operating at a load level over a set point or due to under frequency. Adjustment range: 50-140% 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.

Reverse Var shutdown - Shutdown level is adjustable: threshold 0.15-0.50 per unit, delay 10-60 seconds. Defaults: 0.20, 10 seconds.

Excitation fault - Shutdown of generator set will occur on loss of voltage sensing inputs to control.

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 55 °C to +80 °C (-67 °F to +176 °F). Control will operate with humidity up to 95%, non-condensing. Control operation is not restricted by altitude.

The control system is housed in a NEMA 3R/IP53 enclosure. 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 and tested 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.

Control interface

Input signals to the PowerCommand control include:

Remote start signal - May be connected via either discrete signal or Lon™ Network, or both.

Remote emergency stop.

Remote alarm reset.

Configurable customer inputs - Control includes (4) input signals from customer discrete devices that are configurable for warning, shutdown or status indication, as well as message displayed.

Output signals from the control include four configurable relay drivers. Defaults for these are:

Generator set common warning signal - Operates when unit set is running under alarm conditions.

Generator set common shutdown signal.

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Not in auto - Indicates that the mode control switch is not in the *auto* position or that the genset is shutdown under a fault condition.

Ready to load (generator set running) signal - 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.

Control power for auxiliary devices is available from the controller.

Network connections include:

PCCNet interface - A proprietary dedicated RS485 network for use in operating remote annunciator panels and remote I/O modules.

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

Echelon® LonWorks® interface (optional).

Software

InPower - A 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® - A software tool that is used primarily by operators to remotely monitor and control generator sets, transfer switches and other on-site power system devices.

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.

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-M1999: 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: Control system suitable for use on generator sets to be CE-marked
EN 50081-2: Industrial Emissions
EN 50082-2: Industrial Susceptibility
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: For Susceptibility, Conducted and Radiated Electromagnetic Emissions.
ISO9001: PowerCommand control systems and generator sets are designed and manufactured in ISO9001 certified facilities.

Options and accessories

- ❑ Analog AC metering display - Provides a bar graph display of 3-phase AC volts and amps, kW, power factor and frequency.
- ❑ Key-type mode select switch - Replaces off/manual/auto switch with a key-type switch.
- ❑ Ground fault alarm module - Installs a separate ground fault indication relay and harness into a control customer input.
- ❑ Exhaust temperature monitoring.
- ❑ Digital remote annunciator.
- ❑ Digital output relay module - Provides (3) relays, each with 2 normally open and 2 normally closed contacts rated 10 A at 600 VAC, 5 A at 24 VDC. Functions of the relays are configurable.
- ❑ Engine oil temperature indication - Some genset models incorporate this feature as standard. On all models, the control may be configured to include an oil temperature warning or shutdown when oil temperature sensing is provided.
- ❑ CAN engine interface (optional on some models). Allows the genset control to directly monitor an engine control module.
- ❑ LON interface.
- ❑ Input/output expansion module – Provides up to 16 configurable Form-C relays, 12 configurable discrete inputs and 8 analog inputs.

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See your distributor for more information

Cummins Power Generation

Americas
1400 73rd Avenue N.E.
Minneapolis, MN 55432 USA
Phone: 763 574 5000
Fax: 763 574 5298

Europe, CIS, Middle East and Africa
Manston Park Columbus Ave.
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 to any building electrical except through an approved device or after building main breaker is open.

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ALTERNATOR DATA SHEET — Frame Size HC5E

CHARACTERISTICS

WEIGHTS:	Wound Stator Assembly:	1621 lb	730 kg
	Rotor Assembly:	1308 lb	589 kg
	Complete Assembly:	3430 lb	1545 kg
MAXIMUM SPEED:		2250	rpm
EXCITATION CURRENT:	Full Load	1.72	Amps
	No Load	0.40	Amps

INSULATION SYSTEM: Class H Throughout

3 ∅ RATINGS (0.8 power factor) (Based on specific temperature rise at 40°C ambient temperature)		**60 Hz** (winding no)				**50 Hz** (winding no)		
		110/190 220/380 (311/312)	120/208 240/416 (311/312)	139/240 277/480 (311/312)	347/600 (07/17)	110/190 220/380 (311/312)	120/208 240/415 (311/312)	127/220 254/440 (311/312)
150°C Rise Ratings	kW	525	575	640	616	509	509	509
	kVA	656	719	800	770	636	636	636
125°C Rise Ratings	kW	498	545	600	580	480	480	480
	kVA	623	681	750	725	600	600	600
105°C Rise Ratings	kW	456	500	540	526	440	440	440
	kVA	570	625	675	658	550	550	550
80°C Rise Ratings	kW	400	440	475	456	384	384	384
	kVA	500	550	594	570	480	480	480

REACTANCES (per unit ± 10%) (Based on full load at 125C Rise Rating)	110/190 220/380	120/208 240/416	139/240 277/480	347/600	110/190 220/380	120/208 240/415	127/220 254/440
Synchronous	3.87	3.53	2.92	2.95	3.14	2.63	2.34
Transient	0.19	0.17	0.14	0.14	0.17	0.15	0.13
Subtransient	0.13	0.12	0.10	0.10	0.12	0.10	0.09
Negative Sequence	0.25	0.23	0.19	0.19	0.19	0.16	0.14
Zero Sequence	0.11	0.10	0.08	0.08	0.09	0.07	0.06

MOTOR STARTING	Broad Range	600	Broad Range
Maximum kVA (90% Sustained Voltage)	2208	2208	1633

TIME CONSTANTS (Sec)	Broad Range	600	Broad Range
Transient	0.080	0.080	0.080
Subtransient	0.012	0.012	0.012
Open Circuit	2.500	2.500	2.500
DC	0.019	0.019	0.019

WINDINGS (@20°C)	Broad Range	600	Broad Range
Stator Resistance (Ohms per phase)	0.0086	0.0136	0.0086
Rotor Resistance (Ohms)	1.9600	1.9600	1.9600
Number of Leads	12	6	12

Single phase power can be taken up to 40% of 3 phase- ratings

Four-stage battery charger

15 amp @ 12 volt
12 amp @ 24 volt

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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.

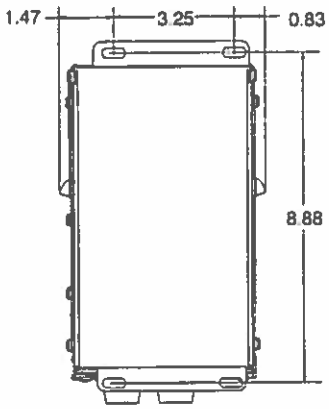
UL 1236 (BBHH) Listing - for use with lead acid batteries in generator set installations. Also suitable for use with NiCad, gel and AGM batteries.

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
	Equalize charger time	0-12 hrs
Input:	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



Mounting dimensions – inches
Bottom view

Enclosure

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

RFI/EMI and voltage surge compliance

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

Americas
1400 73rd Avenue N.E.
Minneapolis, MN 55432 USA
Phone: 763 574 5000
Fax: 763 574 5298

Europe, CIS, Middle East and Africa
Manston Park Columbus Ave.
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.

Our energy working for you.™

www.cumminspower.com

Cummins Power Generation

Power Generation

Sound Data

450DFEJ 60Hz

Sound Pressure Level @ 7 meters, dB(A)

See Notes 1-8 listed below

Configuration		Measurement Location Number								Average
		1	2	3	4	5	6	7	8	
Standard - Unhoused	Infinite Exhaust	89	92	92	91	88	91	91	93	91
F183 -Residential Muffler	Mounted Muffler	87	90	90	88	87	88	87	90	89
F200–Weather	Mounted Muffler	88	89	84	87	89	87	84	90	88
F201 - Quiet Site II First Stage	Mounted Muffler	87	88	83	82	78	80	82	89	85
F202 - Quiet Site II Second Stage	Mounted Muffler	73	73	72	74	75	75	75	74	74

Sound Power Level, dB(A)

See Notes 2-6, 9, 10 listed below

Configuration		Octave Band Center Frequency (Hz)								Overall Sound Power Level
		63	125	250	500	1000	2000	4000	8000	
Standard - Unhoused	Infinite Exhaust	85	100	103	110	112	113	108	105	118
F183 –Residential Muffler	Mounted Muffler	104	114	113	110	108	107	101	103	119
F200–Weather	Mounted Muffler	102	108	104	108	110	109	106	101	116
F201 - Quiet Site II First Stage	Mounted Muffler	102	108	104	107	109	107	105	98	115
F202 - Quiet Site II Second Stage	Mounted Muffler	83	92	95	95	97	99	96	90	104

Exhaust Sound Pressure Level @ 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	
	103	119	125	123	125	126	127	121	133

Note:

1. Position 1 faces the engine front. The positions proceed around the generator set in a counter-clockwise direction in 45° increments. All positions are at 7m (23 ft) from the surface of the generator set and 1.2m (48") from floor level.
2. Sound levels are subject to instrumentation, measurement, installation and manufacturing variability.
3. Sound data with remote-cooled generator sets are based on rated loads without cooling fan noise.
4. Sound levels for aluminum enclosures are approximately 2 dB(A)s higher than listed sound levels for steel enclosures.
5. Sound data for generator set with infinite exhaust do not include exhaust noise.
6. Data is based on full rated load with standard radiator-cooling fan package
7. Sound Pressure Levels are measured per ANSI S1.13 and ANSI S12.18, as applicable.
8. Reference sound pressure is 20 µPa.
9. Sound Power Levels per ISO 3744 and ISO 8528-10, as applicable.
10. Reference power = 1 pw (10^{-12} W)
11. Exhaust Sound Pressure Levels are per ISO 6798, as applicable.

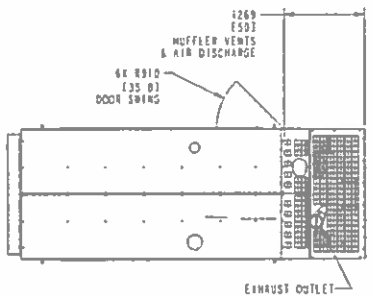
Creo Parametric

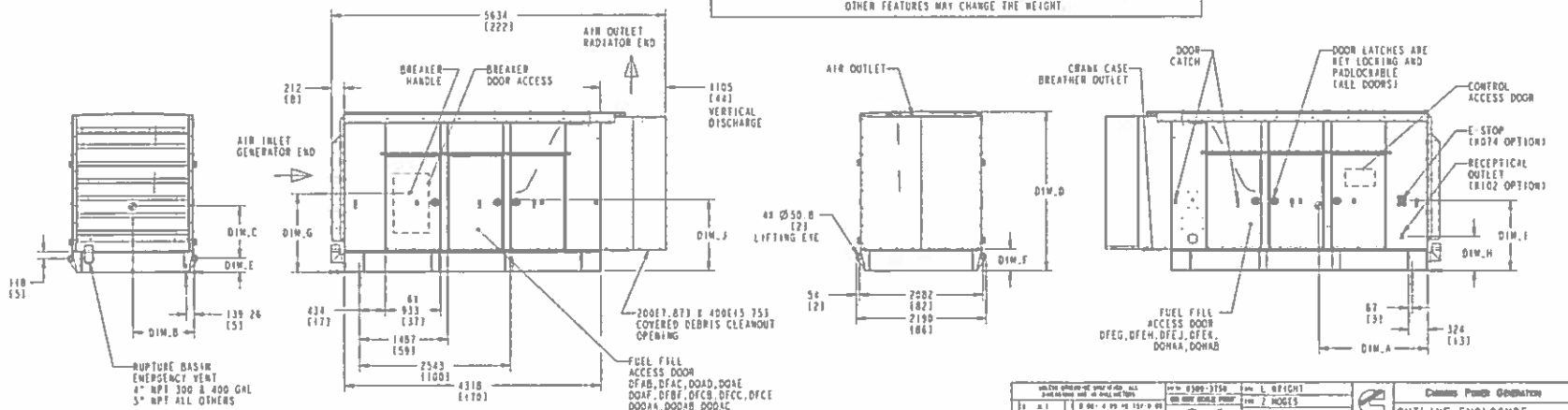
TABULATION													
TANK/LIFT BASE FEATURE CODE	TANK CAPACITY	TANK WEIGHT DRY KG (LBS)	DIM_D	DIM_E	DIM_F	DIM_G DFEG, DFEH, DFEJ, DFEK	DIM_G DOHAA, DOHAB	DIM_G DODAA, DODAB, DODAC	DIM_H	DIM_I	DIM_J	DIM_K
C201	300	1060 (2338)	2643 (104)	183 (7.2)	305 (12)	1625.6 (64.0)	1447.6 (57.0)	1371.8 (54.0)	526 (20.7)	1126 (44.3)	1122 (44.2)	614.2 (24.2)
C202/C242	400/770	1105 (2438)	2694 (106)	234 (9.2)	356 (14)	1676.6 (66.0)	1498.6 (59.0)	1422.8 (56.0)	577 (22.7)	1177 (46.3)	1173 (46.2)	665 (26.2)
C203	500	1171 (2584)	2743 (108)	284 (11.2)	406 (16)	1726.6 (68.0)	1548.6 (61.0)	1472.8 (58.0)	627 (24.7)	1228 (48.3)	1224 (48.2)	716.3 (28.2)
C204	600	1253 (2765)	2819 (111)	361 (14.2)	483 (19)	1803.6 (71.0)	1625.6 (64.0)	1549.8 (61.0)	704 (27.7)	1304 (51.3)	1300 (51.2)	792.5 (31.2)
C205	660	1295 (2857)	2858 (112.5)	399 (15.7)	521 (20.5)	1841.6 (72.5)	1663.6 (65.5)	1587.8 (62.5)	742 (29.2)	1343 (52.9)	1339 (52.7)	830.6 (32.7)
C206	720	1275 (2814)	2895 (114)	437 (17.2)	558 (22)	NA	NA	1625.8 (64.0)	780 (30.7)	1381 (54.3)	1377 (54.2)	868.7 (34.2)
C207	850	1445 (3188)	2997 (118)	538 (21.2)	660 (26)	1980.6 (78.0)	1802.6 (71.0)	NA	881 (34.7)	1481 (58.3)	1478 (58.2)	970.3 (38.2)
F214	NA	NA	2540 (100)	81 (3.2)	203 (8)	1523.6 (60.0)	1345.6 (53.0)	1371.8 (150.0)	424 (16.7)	1024 (40.3)	1021 (40.2)	513.1 (20.2)

TABULATION							
MODEL	KW	CG_DIM "A"	CG_DIM "B"	CG_DIM "C"	STEEL ENCLOSURE WEIGHT KG (LBS)	ALUMINUM ENCLOSURE WEIGHT KG (LBS)
DFAB	230	2161 (85.1)	1041 (41)	669 (26.3)	5755 (12688)	5265 (11598)
DFAC	250	2403 (82.8)		866 (34.1)	5823 (12838)	5333 (11748)
DOAD	250					
DOAE	275	2093 (82.4)		869 (34.2)	5914 (13038)	5424 (11948)
DOAF	300	2095 (82.5)		871 (34.3)	6027 (13288)	5537 (12198)
DFBF	275	2049 (80.7)		881 (34.7)	6387 (14078)	5897 (12988)
DFCB	300	2035 (80.1)		884 (34.8)	6522 (14378)	6032 (13288)
DFCC	350	2614 (79.3)		886 (34.9)	6635 (14628)	6145 (13539)
DFCE	400	1999 (78.7)		889 (35.0)	6735 (14848)	6245 (13758)
DFEG	350	1994 (78.5)		734 (29.9)	3743 (13702)	7253 (15982)
DFEH	400	1976 (77.8)			7673 (16918)	7383 (16283)
DFEJ	450	1956 (77.0)		737 (29.0)	8026 (17696)	7536 (16606)
DFEK	500	1933 (76.1)			8162 (17996)	7672 (16906)
DODAA	253	1927 (75.9)		723 (28.5)	5957 (13088)	5467 (11998)
DODAB	275					
DODAC	300	1945 (76.6)		724 (28.5)	6057 (13388)	5567 (12298)
DOHAA	275	2093 (82.4)		869 (34.2)	6271 (13826)	5781 (12736)
DOHAB	300	2085 (82.1)		871 (34.3)	6384 (14076)	5894 (12986)

***WEIGHT & CG'S ARE SHOWN WITH HIGHEST GALLON FUEL TANK, ENCLOSURE, AND STANDARD WET GENSET. ADDITION OF OTHER FEATURES MAY CHANGE THE WEIGHT.

OPTIONAL FEATURE
F202,F205



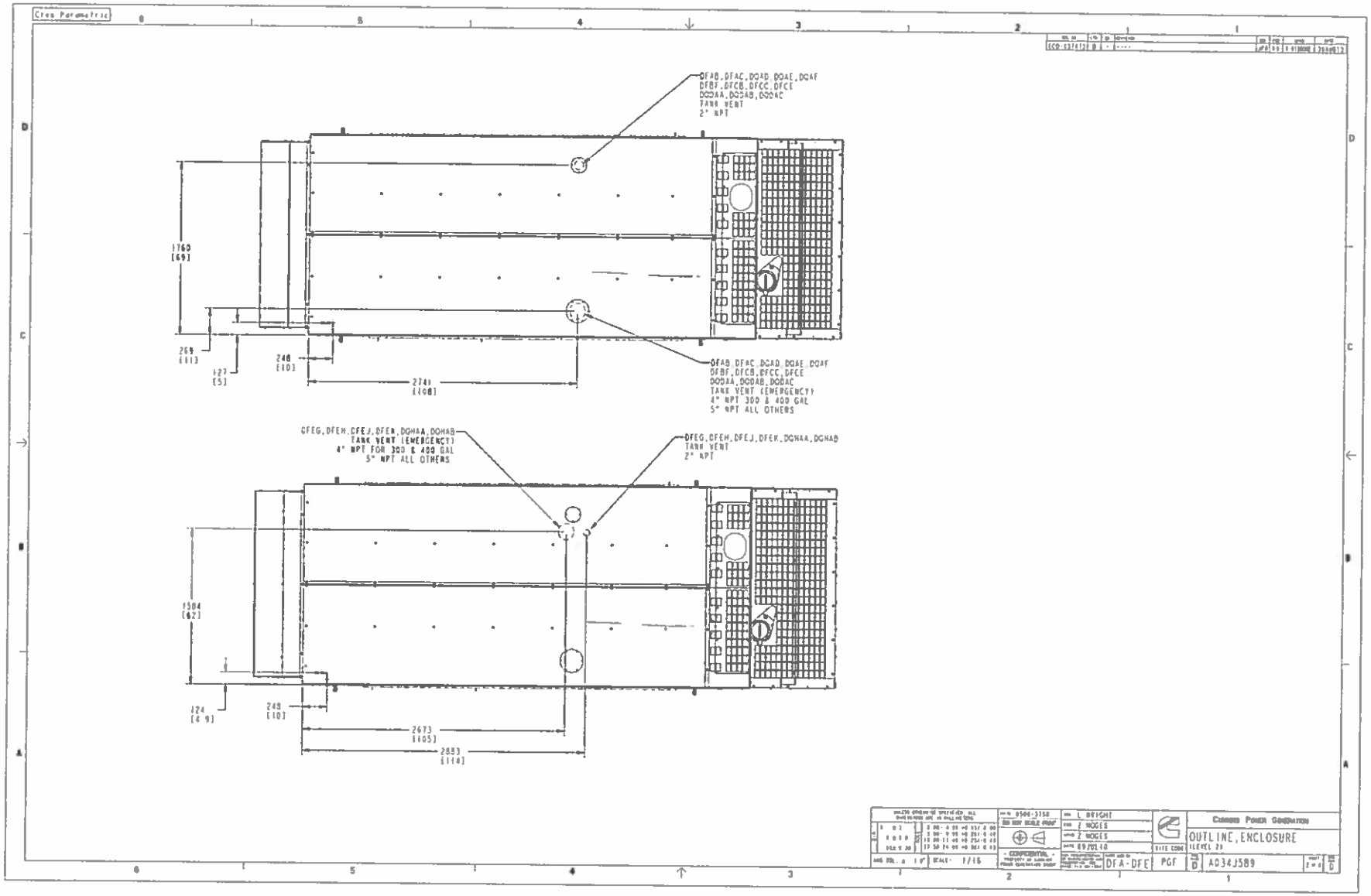


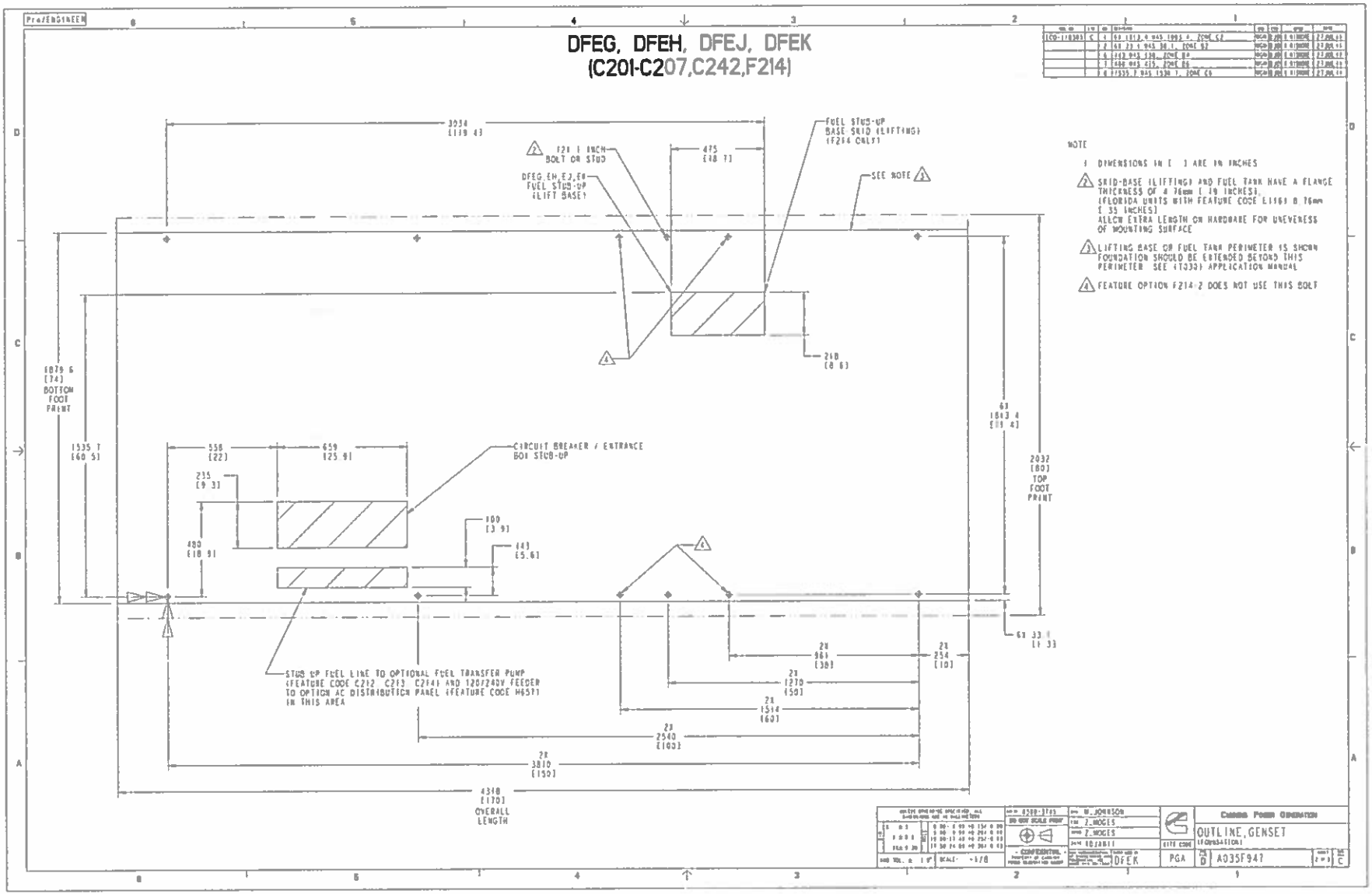
NOTES
1. DIMENSIONS SHOWN IN [ ] ARE INCHES
2 FOUNDATION REFERENCE POINT (—•—) SEE FOUNDATION DRAWING FOR DETAILS
3 FOR FEATURE CODE A196 (FLORIDA TANKS) ADD 105.6 [4.16"] TO DIMS D, J
4 SEE SHEET 2 FOR TANK VENT LOCATIONS
5 EXCESSIVE TWISTING OF THE FUEL TANK, WHEN FASTENING IT TO A FOUNDATION, MAY RESULT IN STRUCTURAL FAILURE OF THE TANK. TO INSURE THE INSTALLATION DOES NOT EXCESSIVELY TWIST THE FUEL TANK, THE FOLLOWING PROCEDURE MUST BE OBSERVED:
5.1 REFER TO OHAN APPLICATION MANUAL TO30 FOR GENERAL GENSET/TANK MOUNTING GUIDELINES
5.2 (NOTE REMOVED)
5.3 (NOTE REMOVED)
5.4 (NOTE REMOVED)
5.5 TIGHTEN TANK HOLD DOWN MOUNTING FASTENERS

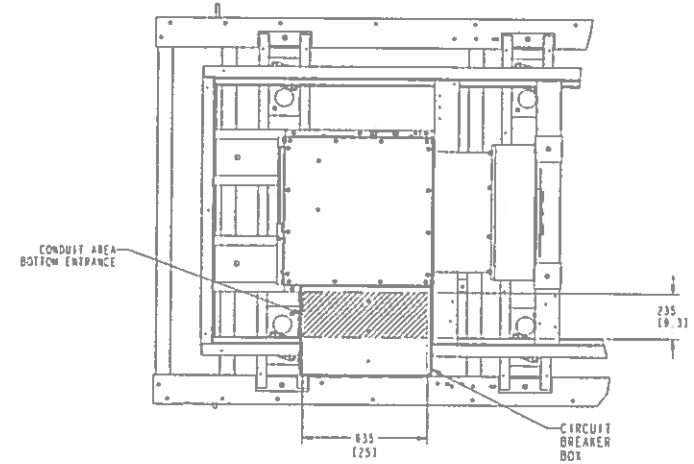
ECO-037078	D	1	SEPARATED DIM_G BY MODEL, PAGE 04	JPS	08 SEP 2010	2844613
		2	SEE SHEET 4	JPS	08 SEP 2010	2844613

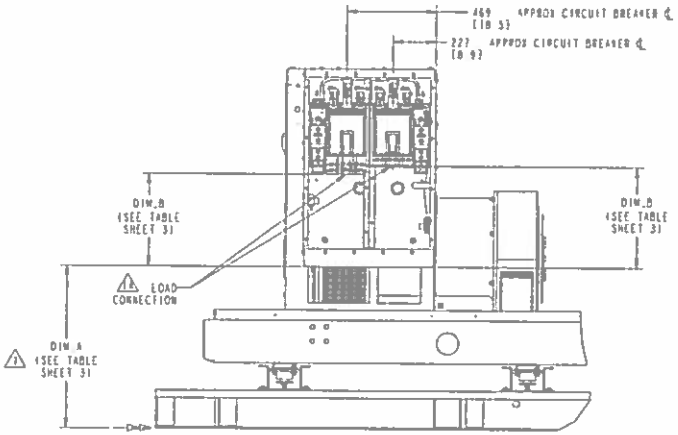
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS AND ANGLES IN DEGREES. TOLERANCES: X ±1, .X ±0.5, .XX ±0.25, ANGLES ±0.5°	DO NOT SCALE PRINT	DRN L WRIGHT	Cummins Power Generation		
		CHK Z HODGES	OUTLINE, ENCLOSURE LEVEL 2A		
		APP Z HODGES			
CONFIDENTIAL - Copyright © 2010 Cummins Power Generation. All rights reserved.		DATE 09/28/10	SIZE CODE DFA DFE PGF	DWG NO A034J589	REV D
SHEET SIZE D SCALE 1/32				SHT 1 OF 5	

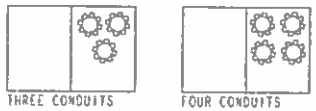
Drawing Name: A034J590 Revision: D
Part Name: A034J589 Revision: D
Sheet 1 of 5

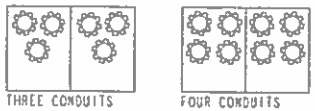

DFAB,DFAC,DOAD,DOAE,DOAF
DFBF,DFCB,DFCC,DFCE
DOBAA,DOBAB,DOBAC
TANK VENT
2" NPT
1760
[69]
269
[11]
127
[5]
248
[10]
2743
[108]
DFAB,DFAC,DOAD,DOAE,DOAF
DFBF,DFCB,DFCC,DFCE
DOBAA,DOBAB,DOBAC
TANK VENT (EMERGENCY)
4" NPT 300 & 400 GAL
5" NPT ALL OTHERS
DFEG,DFEH,DFEJ,DFEK,DOHAA,DOHAB
TANK VENT (EMERGENCY)
4" NPT FOR 300 & 400 GAL
5" NPT ALL OTHERS
DFEG,DFEH,DFEJ,DFEK,DOHAA,DOHAB
TANK VENT
2" NPT
1584
[62]
124
[4.9]
249
[10]
2673
[105]
2883
[114]
L BRIGHT
2 HOLES
2 HOLES
09/02/10
SCALE: 1/16
DFA-DFE
PGF
A034J589
CUMMINS POWER GENERATION
OUTLINE, ENCLOSURE
LEVEL 2

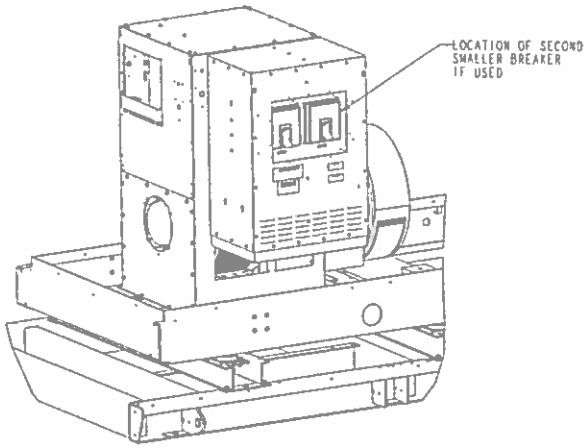

DFEG, DFEH, DFEJ, DFEK
(C201-C207,C242,F214)
3034
[119 43]
FUEL STUB-UP
BASE SKID (LIFTING)
(F214 ONLY)
121 1 INCH
BOLT OR STUD
475
[18 7]
DFEG,EH,EJ,EK
FUEL STUB-UP
(LIFT BASE)
SEE NOTE 1
NOTE
1 DIMENSIONS IN [ ] ARE IN INCHES
1 SKID-BASE (LIFTING) AND FUEL TANK HAVE A FLANGE THICKNESS OF 4 76mm [19 INCHES].
(FLORIDA UNITS WITH FEATURE CODE E1161 0 76mm [35 INCHES]
ALLOW EXTRA LENGTH ON HARDWARE FOR UNEVENESS OF MOUNTING SURFACE
1 LIFTING BASE OR FUEL TANK PERIMETER IS SHOWN FOUNDATION SHOULD BE EXTENDED BEYOND THIS PERIMETER SEE (T330) APPLICATION MANUAL
1 FEATURE OPTION F214-2 DOES NOT USE THIS BOLT
210
[8 3]
1879 6
[74]
BOTTOM
FOOT
PRINT
1535 7
[60 5]
558
[22]
659
[25 9]
CIRCUIT BREAKER / ENTRANCE
BOX STUB-UP
235
[9 3]
480
[18 9]
100
[3 9]
143
[5.6]
63
1643 4
[64 4]
2032
[80]
TOP
FOOT
PRINT
63 33 1
[1 33]
STUB UP FUEL LINE TO OPTIONAL FUEL TRANSFER PUMP
(FEATURE CODE C212 C213 C214) AND 120/240V FEEDER
TO OPTION AC DISTRIBUTION PANEL (FEATURE CODE H657)
IN THIS AREA
2X
961
[38]
2X
254
[10]
2X
1270
[50]
2X
1514
[60]
2X
2540
[100]
2X
3810
[150]
4318
[170]
OVERALL
LENGTH
M JOHNSON
Z MODELS
Z MODELS
DFEK
PGA
OUTLINE, GENSET
(CONFIGURATION)
A035F947











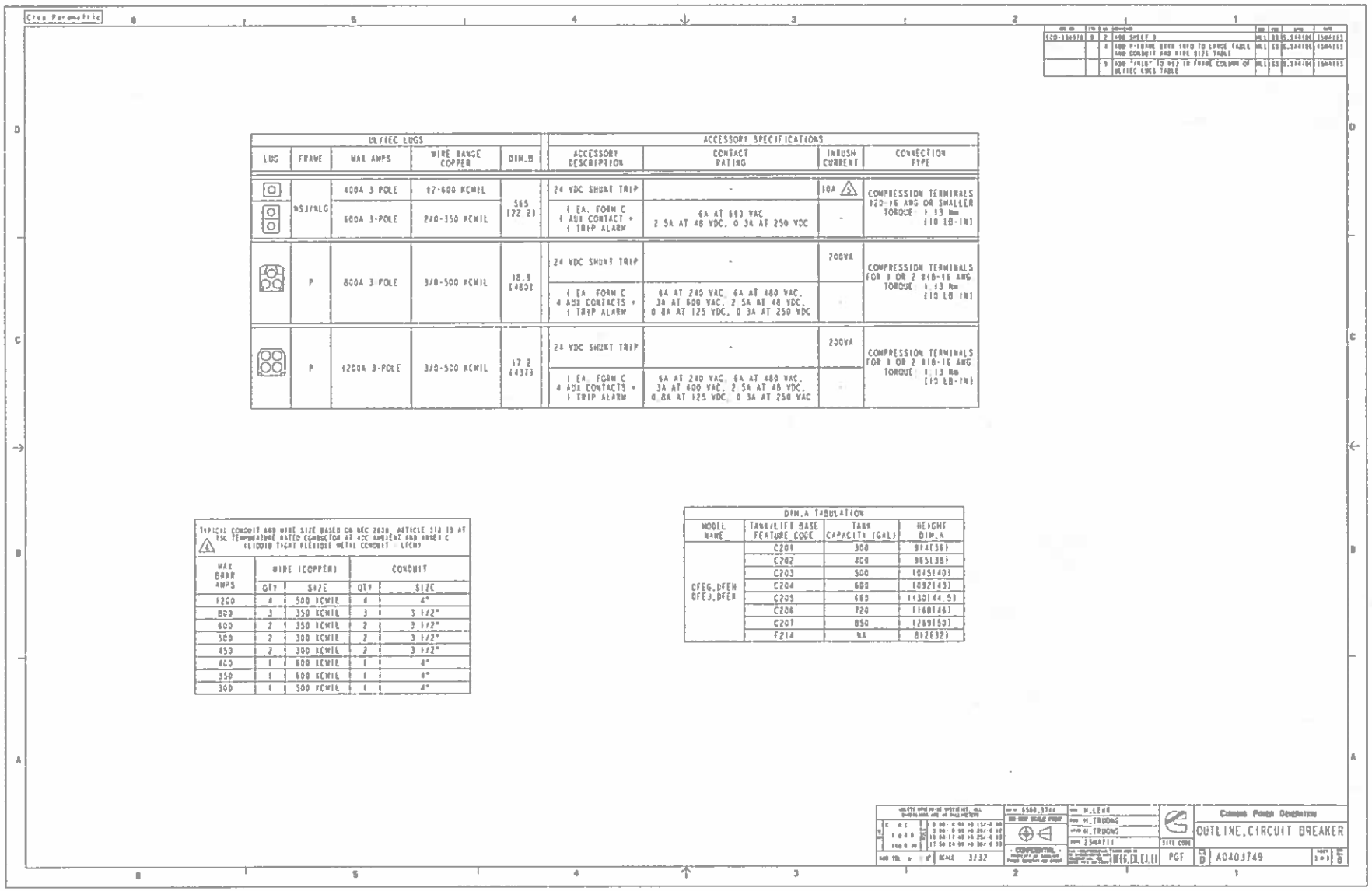
DFEG/DFEH/DFEJ/DFEK
CIRCUIT BREAKER BOX
(RIGHT HAND BOTTOM ENTRY CONFIGURATION
P-FRAME BREAKERS SHOWN)

P-FRAME 800-1200A BREAKER
RECOMMENDED CONDUIT LOCATIONS

BOTTOM COVER
(LOOKING DOWN AT BOTTOM
OF BREAKER BOX)

ECO-[illegible] ADD P-FRAME BRKR SIZES AND INFO

Cummins Power Generation
OUTLINE, CIRCUIT BREAKER
SCALE: 3/32
CONFIDENTIAL
H.TRUONG
H.TRUONG
25MAY11
DFEG,EH,EJ,EK
PGF
D A040J749



UL/IEC LUGS					ACCESSORY SPECIFICATIONS			
LUG	FRAME	MAX AMPS	WIRE RANGE COPPER	DIM. B	ACCESSORY DESCRIPTION	CONTACT RATING	INRUSH CURRENT	CONNECTION TYPE
	NSJ/NLG	400A 3 POLE	#2-600 KCMIL	565 [22.2]	24 VDC SHUNT TRIP	-	10A ⚠	COMPRESSION TERMINALS #20-#6 AWG OR SMALLER TORQUE: 1.13 Nm [10 LB-IN]
		600A 3-POLE	2/0-350 KCMIL		1 EA. FORM C 1 AUX CONTACT + 1 TRIP ALARM	6A AT 600 VAC 2.5A AT 48 VDC, 0.3A AT 250 VDC	-	
	P	800A 3 POLE	3/0-500 KCMIL	18.9 [480]	24 VDC SHUNT TRIP	-	200VA	COMPRESSION TERMINALS FOR 1 OR 2 #18-#6 AWG TORQUE: 1.13 Nm [10 LB-IN]
					1 EA. FORM C 4 AUX CONTACTS + 1 TRIP ALARM	6A AT 240 VAC, 6A AT 480 VAC, 3A AT 600 VAC, 2.5A AT 48 VDC, 0.8A AT 125 VDC, 0.3A AT 250 VDC	-	
	P	1200A 3-POLE	3/0-500 KCMIL	17.2 [437]	24 VDC SHUNT TRIP	-	200VA	COMPRESSION TERMINALS FOR 1 OR 2 #18-#6 AWG TORQUE: 1.13 Nm [10 LB-IN]
					1 EA. FORM C 4 AUX CONTACTS + 1 TRIP ALARM	6A AT 240 VAC, 6A AT 480 VAC, 3A AT 600 VAC, 2.5A AT 48 VDC, 0.8A AT 125 VDC, 0.3A AT 250 VAC	-	

TYPICAL CONDUIT AND WIRE SIZE BASED ON NEC 2020, ARTICLE 310.15 AT ⚠ 75C TEMPERATURE RATED CONDUCTOR AT 40C AMBIENT AND USING C (LIQUID TIGHT FLEXIBLE METAL CONDUIT - LFCM)				
MAX BRKR AMPS	WIRE (COPPER)		CONDUIT	
	QTY	SIZE	QTY	SIZE
1200	4	500 KCMIL	4	4"
800	3	350 KCMIL	3	3 1/2"
600	2	350 KCMIL	2	3 1/2"
500	2	300 KCMIL	2	3 1/2"
450	2	300 KCMIL	2	3 1/2"
400	1	600 KCMIL	1	4"
350	1	600 KCMIL	1	4"
300	1	500 KCMIL	1	4"

DIM.A TABULATION			
MODEL NAME	TANK/LIFT BASE FEATURE CODE	TANK CAPACITY (GAL)	HEIGHT DIM.A
DFEG,DFEH DFEJ,DFER	C201	300	914[36]
	C202	420	965[38]
	C203	500	1041[41]
	C204	600	1092[43]
	C205	665	1130[44.5]
	C206	720	1168[46]
	C207	850	1269[50]
	F214	NA	812[32]

REV	ECO	QTY	DESCRIPTION	BY	DATE
	ECO-136976	B	2 ADD SHEET 3	ML1	03/05/2021
		A	ADD P-FRAME BREB INFO TO LARGE TABLE ADD CONDUIT AND WIRE SIZE TABLE	ML1	03/05/2021
		B	ADD "PHILS" TO REF TO FRAME COLUMN OF UL/IEC LUGS TABLE	ML1	03/05/2021

DRAWN	M.LEWIS	Eaton Power Distribution	
CHECKED	M.TRUONG	OUTLINE,CIRCUIT BREAKER	
APPROVED	M.TRUONG		
DES APPR	ZSWATTI	SITE CODE	
SCALE	3/32	PGT	
SIZE	D	A040J749	REV B

Drawing Name: A040J750 Revision: B
Part Name: A040J749 Revision: B
Sheet 3 of 4

Transfer switch OTEC open transition

> Specification sheet
40 - 1200 Amp

Our energy working for you.™

Cummins Power Generation

Description

OTEC transfer switches are designed for operation and switching of electrical loads between primary power and standby generator sets. They are suitable for use in emergency, legally required, and optional standby applications. The switches monitor both power sources, signal generator set startup, automatically transfer power, and return the load to the primary power source once a stable utility is available.

The fully integrated controller is designed for practical functionality, with LED indicators and digital pushbuttons for ease of operator use.

UL	All switches are UL 1008 Listed with UL Type Rated cabinets and UL Listed CU-AL terminals.
CSA	All switches are certified to CSA 282 Emergency Electrical Power Supply for Buildings, up to 600 VAC.
NEC	Equipment shall be suitable for use in systems compliant to 700, 701 and 702.
NFPA	All switches comply with NFPA 70, 99 and 110.
NEMA	All switches comply with NEMA ICS 10.
IEEE	All switches comply with IEEE 446 Recommended Practice for Emergency and Standby Power Systems.
ISO 9001	This transfer switch is designed and manufactured in facilities certified to ISO9001.

Features

Microprocessor control - Easy-to-use, standard control. LEDs display transfer switch status; pushbuttons allow operator to activate control test, exercise timing and transfer mode.

Programmed transition – Open transition timing can be adjusted to completely disconnect the load from both sources for a programmed time period, as recommended by NEMA MG-1 for transfer of inductive loads.

Advanced transfer switch mechanism - Unique bi-directional linear actuator provides virtually friction-free, constant force, straight-line transfer switch action during automatic operation.

Manual operation - Manual operating handles, shielded termination, and over-center contact mechanisms allow effective manual operation under de-energized conditions.

Positive interlocking - Mechanical and electrical interlocking prevent source-to-source connection through the power or control wiring.

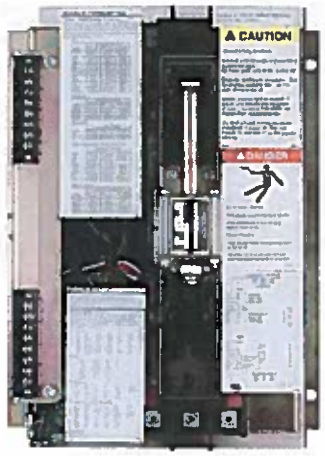
Main contacts - Heavy-duty silver alloy contacts with multi-leaf arc chutes are rated for 100% load interruption. They require no routine contact maintenance and provide 100% continuous current ratings.

Easy service/access - Single-plug harness connection and compatible terminal markings simplify servicing. Access space is ample. Door-mounted controls are field-programmable; no tool is required.

Complete product line - Cummins Power Generation offers a wide range of equipment, accessories and services to suit virtually any backup power application.

Warranty and service - Products are backed by a comprehensive warranty and a worldwide network of distributors with factory-trained service technicians.

Transfer switch mechanism



- Transfer switch mechanism is electrically operated and mechanically held in the Source 1 and Source 2 positions. The transfer switch incorporates electrical and mechanical interlocks to prevent inadvertent interconnection of the sources.
- Independent break-before-make action is used for both 3-pole and 4-pole/switched neutral switches. This design allows use of sync check operation when required, or control of the operating speed of the transfer switch for proper transfer of motor and rectifier-based loads (programmed transition feature).
- True 4-pole switching allows for proper ground (earth) fault sensing and consistent, reliable operation for the life of the transfer switch. The neutral poles of the transfer switch have the same ratings as the phase poles and are operated by a common crossbar mechanism, eliminating the possibility of incorrect neutral operation at any point in the operating cycle, or due to failure of a neutral operator.
- Electrical interlocks prevent simultaneous closing signals to normal and emergency contacts and interconnection of normal and emergency sources through the control wiring.
- High pressure silver alloy contacts resist burning and pitting. Separate arcing surfaces further protect the main contacts. Contact wear is reduced by multiple leaf arc chutes that cool and quench the arcs. Barriers separate the phases to prevent interphase flashover. A transparent protective cover allows visual inspection while inhibiting inadvertent contact with energized components.
- Switch mechanism, including contact assemblies, is third-party certified to verify suitability for applications requiring high endurance switching capability for the life of the transfer switch. Withstand and closing ratings are validated using the same set of contacts, further demonstrating the robust nature of the design.

Specifications

Voltage rating	Transfer switches rated from 40 A through 1200 A are rated up to 600 VAC, 50 or 60 Hz.
Arc interruption	Multiple leaf arc chutes cool and quench the arcs. Barriers prevent interphase flashover.
Neutral bar	A full current-rated neutral bar with lugs is standard on enclosed 3-pole transfer switches.
Auxiliary contacts	Two contacts (one for each source) are provided for customer use. Wired to terminal block for easy access. Rated at 10A continuous and 250 VAC maximum.
Operating temperature	-22 °F (-30 °C) to 140 °F (60 °C)
Storage temperature	-40 °F (-40 °C) to 140 °F (60 °C)
Humidity	Up to 95% relative, non-condensing
Altitude	Up to 10,000 ft (3,000 m) without derating
Total transfer time (source-to-source)	Will not exceed 6 cycles at 60 Hz with normal voltage applied to the actuator and without delayed transition enabled.
Manual operation handles	Transfer switches are equipped with permanently attached operating handles and quick-break, quick-make contact mechanisms suitable for manual operation under de-energized conditions.

Open transition/programmed – Controls the time required for the device to switch from source to source, so that the load-generated voltages decay to a safe level before connecting to an energized source. Recommended by NEMA MG-1 to prevent nuisance tripping breakers and load damage. Adjustable 0-60 seconds, default 0 seconds.

Open transition/in-phase – Initiates open transition transfer when in-phase monitor senses both sources are in phase. Operates in a break-before-make sequence. Includes ability to enable programmed transition as a backup. If sources are not in phase within 120 seconds, the system will transfer using programmed transition.

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S-1464o (5/12)

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Microprocessor control

- Simple, easy-to-use control provides transfer switch information and operator controls
- LED lamps for source availability and source connected indication, exercise mode, and test mode. LED status lamps also provided for control set-up and configuration.
- Pushbutton controls for initiating test, overriding time delays and setting exercise time.
- Field-configurable for in-phase open or programmed open transition.
- Integral exerciser clock
- Control is prototype-tested to withstand voltage surges per EN 60947-6-1.
- Gold-flashed generator start contacts

Control functions

Voltage sensing: All phases on the normal source and single phase on generator source. Normal Source Pickup: adjustable 90-95%, Dropout: adjustable 70-90% of nominal voltage; Generator Source Pickup: 90%, dropout: 75% of nominal voltage.

Frequency sensing: Generator Source Pickup: 90% of nominal frequency; Dropout: 75% of nominal frequency.

Exerciser clock: Switch is furnished with an integral engine exerciser configurable for operation on a 7, 14, 21, or 28-day cycle with a fixed exercise period duration of 20 minutes. A 12-hr exerciser time offset allows for the convenient setting of exercise time without the need to activate the timer at the exact time that you need to schedule the generator exercise for. Software selectable capability allows for the exercising of the generator with or without load.

Time-delay functions

Engine start: Prevents nuisance genset starts due to momentary power system variation or loss. Adjustable: 0-10 seconds; default: 3 seconds.

Transfer normal to emergency: Allows genset to stabilize before application of load. Prevents power interruption if normal source variation or loss is momentary. Allows staggered transfer of loads in multiple transfer switch systems. Adjustable 0-300 seconds, default 5 seconds.

Retransfer emergency to normal: Allows the utility to stabilize before retransfer of load. Prevents needless power interruption if return of normal source is momentary. Allows staggered transfer of loads in multiple transfer switch systems. Adjustable 0-30 minutes, default 10 minutes.

Genset stop: Maintains availability of the genset for immediate reconnection in the event that the normal source fails shortly after transfer. Allows gradual genset cool down by running unloaded. Adjustable 0-30 minutes, default 10 minutes.

Delayed (programmed) transition: Controls the speed of operation of the transfer switch power contacts to allow load generated voltages from inductive devices to decay prior to connecting a live source. Adjustable 0-10 seconds, default 0 seconds.

Elevator signal: Provides a relay output contact for the elevator signal relay (load disconnect). The signal can also be configured to provide a post transfer delay of the same duration. Adjustable: 0-300 seconds (requires optional elevator signal relay for use).

Options

Elevator signal relay: Provides a relay output contact for the signal relay function

Programmable exerciser clock: Provides a fully-programmable 7-day clock to provide greater flexibility in scheduling exercise periods than standard integral exerciser. Time-of-day setting feature operates generator during periods of high utility rates.

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UL withstand and closing ratings

The transfer switches listed below must be protected by circuit breakers or fuses. Referenced drawings include detailed listings of specific breakers or fuse types that must be used with the respective transfer switches. Consult with your distributor/dealer to obtain the necessary drawings. Withstand and Closing Ratings (WCR) are stated in symmetrical RMS amperes.

	MCCB protection			Special circuit breaker protection		
Transfer switch ampere	WCR at volts max with specific manufacturers MCCBs	Max MCCB rating	Drawing reference	With specific current limiting breakers (CLB)	Max CLB rating	Drawing reference
40, 70, 125 3-pole	14,000 at 600	225 A	098-6885	200,000 @ 600	225 A	098-6918
40, 70, 125 4-pole	30,000 at 600	225 A	098-6885	200,000 @ 600	225 A	098-6918
150, 225, 260	30,000 at 600	400 A	098-6886	200,000 @ 600	400 A	098-6919
300, 400, 600	65,000 at 600	1200 A	098-6887	200,000 @ 600	1200 A	098-6920
800, 1000	65,000 at 480 50,000 at 600	1400 A	098-6888	200,000 @ 600	1400 A	098-6921
1200	85,000 at 480 65,000 at 600	1600 A	A030U183	200,000 @ 600	1600 A	A030U185

Fuse protection

Transfer switch ampere	WCR at volts max. with current limiting fuses	Max fuse, size and type	Drawing reference
40, 70, 125 3- and 4-pole	200,000 at 600	200 A Class, J, RK1, RK5, T	098-6885
150, 225, 260	200,000 at 600	1200 A Class L or T, or 600 A class J, RK1, RK5	098-6886
300, 400, 600	200,000 at 600	1200 A Class L or T, or 600 A Class, J, RK1, RK5	098-6887
800, 1000	200,000 at 600	2000 A Class L or 1200 A class T or 600 A class J, RK1, RK5	098-6888
1200	200,000 at 600	2000 A Class L or 1200 A class T or 600 A class J, RK1, RK5	A030U183

3-cycle ratings

Transfer switch ampere	WCR at volts max 3-cycle rating	Max MCCB rating	Drawing reference
1200	42,000 at 600 50,000 at 480	1600 A	A030U183

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Enclosures

The transfer switch and control are wall-mounted in a key-locking enclosure. Wire bend space complies with 2008 NEC.

Dimensions - transfer switch in UL type 1 enclosure

	Height		Width		Depth				Weight		Outline drawing
					Door closed		Door open				
Amp rating	in	mm	in	mm	in	mm	in	mm	lb	kg	
40, 70, 125 3-pole	27.0	686	20.5	521	12.0	305	31.5	800	82	37	0310-0544
40, 70, 125 4-pole	35.5	902	26.0	660	16.0	406	41.0	1042	165	75	0500-4896
150, 225	35.5	902	26.0	660	16.0	406	41.0	1042	165	75	0310-0414
260	43.5	1105	28.5	724	16.0	406	43.0	1093	170	77	0310-0540
300, 400, 600	54.0	1372	25.5	648	18.0	457	42.0	1067	225	102	0310-1307
800, 1000	68.0	1727	30.0	762	19.5	495	48.5	1232	360	163	0310-0417
1200	90.0	2286	39.0	991	27.0	698	63.0	1600	730	331	A030L411

Dimensions - transfer switch in UL type 3R, 4, 4X, or 12 enclosure

	Height		Width		Depth				Weight		Cabinet type	Outline drawing
					Door closed		Door open					
Amp rating	in	mm	in	mm	in	mm	in	mm	lb	kg		
40, 70, 125 3-pole	34.0	864	26.5	673	12.5	318	36.5	927	125	57	3R, 12	0310-0453
											4	0310-0445
	46.0	1168	32.0	813	16.0	406	46.0	1168	255	102	4X	0500-4184
40, 70, 125 4-pole	42.5	1080	30.5	775	16.0	406	44.0	1118	215	97	3R, 12	0500-4896
											4	0500-4896
	46.0	1168	32.0	813	16.0	406	46.0	1168	255	102	4X	0500-4184
150, 225	42.5	1080	30.5	775	16.0	406	44.0	1118	215	97	3R, 12	0310-0454
											4	0310-0446
	46.0	1168	32.0	813	16.0	406	46.0	1168	255	102	4X	0500-4184
260	46.0	1168	32.0	813	16.0	406	46.0	1168	255	102	3R, 12	0310-0455
											4	0310-0447
											4X	0500-4184
300, 400, 600	59.0	1499	27.5	699	16.5	419	41.5	1054	275	125	3R, 12	0310-1315
											4	0310-1316
	73.5	1867	32.5	826	19.5	495	49.5	1257	410	186	4X	0500-4185
800, 1000	73.5	1867	32.5	826	19.5	495	49.5	1257	410	186	3R, 12	0310-0457
											4	0310-0449
											4X	0500-4185
1200	90.0	2286	39.0	991	27.0	698	63.0	1600	730	331	3R, 12	A030L411
											4, 4X	A041N370

Transfer switch lug capacities

All lugs accept copper or aluminum wire unless indicated otherwise.

Transfer switch ampere	Cables per phase	Size
40, 70, 125 3-pole	1	#12 AWG-2/0
40 4-pole	1	#12 AWG-2/0
70, 125 4-pole	1	#6 AWG - 300 MCM
150, 225	1	#6 AWG - 300 MCM
260	1	#6 AWG - 400 MCM
300, 400	1	3/0 - 600 MCM
300, 400	2	3/0 - 250 MCM
600	2	250 - 500 MCM
800	4	250 - 500 MCM
1000,1200	4	#2 AWG-750 MCM

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Submittal detail

Amperage ratings
- ☐ 40
- ☐ 70
- ☐ 125
- ☐ 150
- ☐ 225
- ☐ 260
- ☐ 300
- ☐ 400
- ☐ 600
- ☐ 800
- ☐ 1000
- ☐ 1200

Voltage ratings
- ☐ R020 120
- ☐ R038 190
- ☐ R021 208
- ☐ R022 220
- ☐ R023 240
- ☐ R024 380
- ☐ R025 416
- ☐ R035 440
- ☐ R026 480
- ☐ R027 600

Pole configuration
- ☐ A028 Poles - 3 (solid neutral)
- ☐ A029 Poles - 4 (switched neutral)

Frequency
- ☐ A044 60 Hertz
- ☐ A045 50 Hertz

Application
- ☐ A035 Utility to genset

System options
- ☐ A041 Single phase, 2-wire or 3-wire
- ☐ A042 Three phase, 3-wire or 4-wire

Enclosure
- ☐ B002 Type 3R: intended for outdoor use, provides some protection from dirt, rain and snow (similar to IEC Type IP34)
- ☐ B003 Type 4: indoor or outdoor use, provides some protection from wind-blown dust and water spary (similar to IEC Type IP65)
- ☐ B010 Type 12: indoor use, some protection from dust (similar to IEC Type IP61)
- ☐ B025 Type 4X: stainless steel, indoor or outdoor use, provides some protection from corrosion (similar to IEC Type IP65)

Standards
- ☐ A046 UL 1008/CSA certification
- ☐ A080 Seismic certification

Control voltage
- ☐ M033 12V, Genset starting voltage
- ☐ M034 24V, Genset starting voltage

Control options
- ☐ J030 External exercise clock
- ☐ M032 Elevator signal relay

Battery chargers
- ☐ K001 2 amps, 12/24 volts
- ☐ KB59 15 amps, 12 volts
- ☐ KB60 12 amps, 24 volts

Auxiliary relays

Relays are UL Listed and factory installed. All relays provide (2) normally closed isolated contacts rated 10 A @ 600 VAC. Relay terminals accept (1) 18 gauge to (2) 12 gauge wires per terminal.

- ☐ L101 24 VDC coil - installed, not wired (for customer use).
- ☐ L102 24 VDC coil - emergency position - relay energized when switch is in source 2 (emergency) position.
- ☐ L103 24 VDC coil - normal position - relay energized when switch is in source 1 (normal) position
- ☐ L201 12 VDC coil installed, not wired (for customer use)
- ☐ L202 12 VDC coil - emergency position - relay energized when switch is in source 2 (emergency) position
- ☐ L203 12 VDC coil - normal position - relay energized when switch is in source 1 (normal) position

Miscellaneous options
- ☐ C027 Cover - guard
- ☐ M003 Terminal block - 30 points (not wired)

Optional lug kits
- ☐ N032 Lug adapters, compression, ½ stab
- ☐ N045 Cable lugs, mechanical, 600 MCM, 4 per pole
- ☐ N066 Cable lugs, mechanical, 750 MCM, 4 per pole

Warranty
- ☐ G009 1 year comprehensive
- ☐ G004 2 year comprehensive
- ☐ G006 5 year basic
- ☐ G007 5 year comprehensive
- ☐ G008 10 year major components

Shipping
- ☐ A051 Packing - export box (800-1000 A)

Accessories
- ☐ AC-170 Accessories specifications sheet

Cummins Power Generation

Americas
1400 73rd Avenue N.E.
Minneapolis, MN 55432 USA
Phone: 763 574 5000
Fax: 763 574 5298

Europe, CIS, Middle East and Africa
Manston Park Columbus Ave.
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
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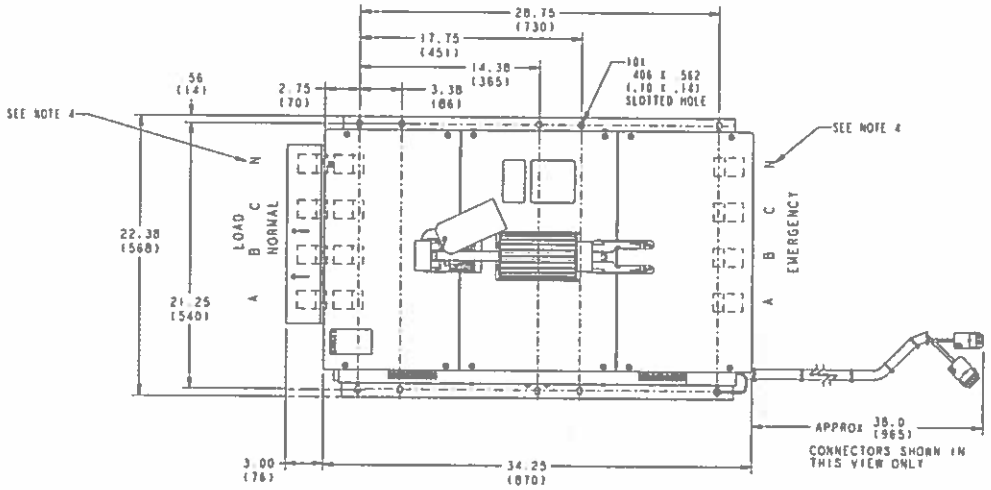
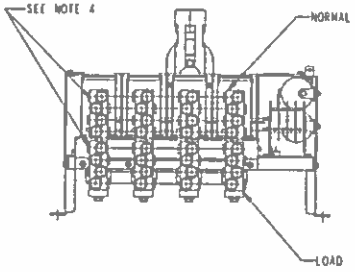
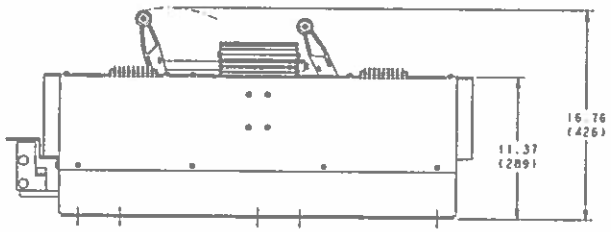
0500_4187	D	Pro/ENGINEER	METRIC DWG







NOTES:

1. APPROX WEIGHT : 165 LBS
   MASS : 75 kg
2. DIMENSIONS IN ( ) ARE MILLIMETERS.
3. LUG CAPACITY:
   (QUANTITY 4) 250-500 MCM
   (150-240) CU-AL WIRE
4. 4 POLE MODEL SHOWN. NEUTRAL POLE NOT SUPPLIED ON 3 POLE MODELS.

800-1000 AMP
3 AND 4 POLE, FRONT CONNECT

	E. KEPLER	02-28-95	CUMMINS POWER GENERATION
	J. MORLEY	02-28-95	TRANSFER SW OUTLINE
	J. MILLER	02-28-95	
	DIEC	PGA	0500_4187 D