



CITY OF ALBANY
Public Works Department

ADDENDUM #1

WTP-22-01, AM-WTP Raw Water Pump Station Generator

DATE: FEBRUARY 8, 2023

In order to clarify the intent of the Specifications and Drawings, the following provisions are provided and shall be considered part of the contract documents.

Replace Section I-13 with the following:

WORK ON PRIVATE PROPERTY

Permits will be required for all plumbing, electrical, and site work on private property. Permits may be obtained from the Building Department at Linn County, Oregon. Payment for obtaining permits will be considered incidental to the appropriate bid items and should be verified with Linn County by the Contractor.

Additional information or clarification:

1. Attached to this addendum is the generator and automatic transfer switch submittal package provided by Cummins.
2. The e-stop is furnished by Cummins.
3. The amp sentry relay is integral to the generator. Refer to the approved submittals as part of this addendum.

In order to ensure that all bidders are aware of these provisions, each bidder must sign this addendum below and attach it to the proposal.

IMPORTANT: Failure to include a signed Addendum could result in the disqualification of your bid.

Contractor's Signature

Date

Company Name *(please type or print)*



4711 N Basin Ave
Portland, OR 97217
503-289-0900
November 10, 2022

Formal approval of this submittal is REQUIRED. Please fill out red lines, check 'Approved...' and sign in 'Customer Approval' box below, then return cover sheet to Cummins Project Manager

City of Albany, AM-WTP Raw Water Pump Station

Cummins Inc. Project No. 372642

City of Albany PO# TBD

*****Transfer switch(es) require a withstand and closing rating (WCR) capable of meeting the available upstream fault current (kAIC). The WCR may be based on a specific breaker rating or a time-based rating and it is the responsibility of the facility designer or engineer to verify compatibility. A full listing of the WCR is included as a part of this submittal.*****

Prepared for:

Nolan Nelson

City of Albany

310 Waverly Dr NE

Albany OR, 97321

Phone No. 541-791-0130

Email nolan.nelson@cityofalbany.net

Prepared by: Jeremy Petersen

Office Number: 503-289-0900

Mobile Number: 971-337-4373

Email address: Jeremy.Petersen@cummins.com

Customer Approval/Acknowledgement

Requested delivery date(s): _____

Equipment delivery address: _____

Delivery contact name & phone #: _____

Record submittal confirmed received

Revise and Resubmit

Approved as Noted/Release for Production

Released for Production

By: _____ **Dated:** _____

Important:

1. By signing this submittal you're approving it as submitted unless noted.
2. Any change to the scope of supply may impact the current shipping schedule and the contract price.
3. If submittal states 'Approval Required' Cummins WILL NOT proceed with production without an approved submittal.



November 10, 2022

Project Name: **City of Albany, AM-WTP Raw Water Pump Station**
Project Number: **372642**

Dear: Nolan Nelson

Thank you for your order. In the following pages please find Cummins' submittal showing the equipment configuration, prepared by Jeremy Petersen, the Project Manager assigned to your project.

Please review the submittal, sign the cover sheet, indicate approval and return it as soon as possible. If changes are necessary, please indicate that on the cover sheet and return it as soon as possible. Only with an approved submittal can Cummins release the ordered equipment to production.

If 'Approval is REQUIRED' is indicated on the cover sheet of this submittal, Cummins WILL NOT release equipment to production until formal approval is received.

Approximate current lead time: **Generator 44 - 46 Weeks / ATS 23 - 24 Weeks**

Drop shipments on equipment that do not need local upfit are preferred, but requirements must be advised at the time of release.

Note: Requested delivery date is not guaranteed. Leadtimes at time of release can vary due to market conditions and production capacities. We will advise you of our target ship date 1-2 weeks of submittal approval.

Please direct all questions and concerns to myself for the duration of the project. My contact info is below.

Name	Office Phone	Mobile Phone	Email	Title
Jeremy Petersen	503-289-0900	971-337-4373	Jeremy.Petersen@cummins.com	Project Manager

Best regards,

A handwritten signature in cursive script that reads 'Jeremy Petersen'.

Jeremy Petersen
Cummins Inc.



November 10, 2022

Notice to End User or Contractor

Please make sure you've reviewed our Automatic Transfer Switch Withstand and Closing Rating Chart for compliance with our list of acceptable breakers being used upstream of the ATS.

This order is provided with one set of owners and installation manual meant for the installing contractor. Additional copies may require a change order while electronic copies can be provided free of charge.

Approval Drawings

This Approval Drawing Package is submitted as our interpretation of the contract drawings and/or the specifications for this job.

It is the obligation of the equipment purchaser to determine that the item quantities and equipment configuration shown in this submittal is correct as required for the job. Any inaccuracies or deviations must be addressed with Cummins Inc. before release to manufacturing. Any releases of material to manufacturing by the above parties constitute an acceptance of the accuracy of the submittal. Any changes after release will be viewed as a change order and could be subject to pricing changes.

Please take the time to review this package for accuracy to prevent any after-shipment problems. This will allow the job to be shipped correctly and prevent any delay in energization.

General Wiring Guidelines

Interconnect wiring to be # 14 AWG stranded or larger.

AC and DC wires to be in separate conduits

Battery Charger to Battery to Be Sized For Charger Output And length of run.

For AC Connections: Use # 14 AWG or larger for lengths up to 40 Feet.

Use # 12 AWG or larger for lengths up to 50 Feet.

Use # 10 AWG or larger for lengths up to 100 Feet.

For DC Connections: Use # 14 AWG or larger for lengths up to 100 Feet.

Paralleling load share cable to be 18 AWG 4 - conductor twisted shielded cable.

Modbus and PCCnet cable to be Belden model 9729 twisted shielded pair.

Echelon Lontalk network cable to be stranded CAT5.

Cummins recommends running additional 20% spare wires.

****REFER TO WIRING DIAGRAMS SUPPLIED WITH SUBMITTAL FOR SPECIFIC INFORMATION****

Section 1 Bill of Materials & Warranty





November 8, 2022

Bill of Material

Feature Code	Description	Qty
DQCA	DQCA, Commercial Diesel Generator Set, 600kW Standby 60Hz	1
Install-US-Stat 600DQCA A331-2 L170-2 L090-2 L228-2 R002-2 B876-2 A293-2 F202-2 P175-2 F194-2 F208-2 C251-2 L116-2 L163-2 C215-2 C256-2 C127-2 H609-2 H703-2 H606-2 H678-2 H720-2 K631-2 KP74-2 KS53-2 KU32-2 H536-2 KU93-2 KC53-2 5010 KB73-2 6160 H723-2 D041-2 E074-2 H389-2 H556-2 L010-2 L023-2 L026-2 L028-2 L050-2 A412-2	U.S. EPA, Stationary Emergency Application 600DQCA, Diesel Genset, 60Hz, 600kW Duty Rating - Standby Power (ESP) Emission Certification, EPA, Tier 2, NSPS CI Stationary Emergency Listing - UL 2200 Cert - Seismic, IBC2000, IBC2003, IBC2006, IBC2009, IBC2011 Voltage - 277/480, 3 Phase, Wye, 4 Wire Alternator - 60Hz, Wye, 480 Volts, 105C - Standby Alternator Heater, 240 Volt AC Steel Sound Attenuated Level 2 Enclosure, with Exhaust System Enclosure Color - Green, Steel Vibration Isolators - Earthquake Certified Cooling Air Outlet - Horizontal, Sound Attenuated Fuel Tank - Sub Base, 1500 Gallon, UL142 Compliant Compliance - Fuel Tank, Florida Listing, ULC - S601 - 07 Alarm - High Fuel Fill Fuel Tank Connection - Dual Stub Up Fuel Water Separator Control Mounting - Left Facing PowerCommand 2.3 Controller Analog Meters - AC Output LCD Control Display AmpSentry™ UL Listed Protective Relay Relays - Genset Status, User Configured Stop Switch - Emergency, Externally Mounted Signals - Auxiliary, 8 Inputs/8 Outputs Relay - Alarm Shutdown Control Display Language - English Circuit Breaker or Entrance Box or Terminal Box - Left Only Terminal Box - Low Voltage, Left Terminal Box-Low Voltage, Right-None Bottom Entry, Left Circuit Breaker or Entrance Box or Terminal Box, Top Entry, Right-None Indication - Ground Fault, Terminal Box (or) Circuit Breaker Box - Left Engine Air Cleaner - Normal Duty Engine Cooling - Radiator, 50C Ambient Shutdown - Low Coolant Level Coolant Heater - 208/240/480 Volts AC, 40F Minimum Ambient Temperature Test Record - Strip Chart Test Record - Safety Shutdowns Cummins Certified Test Record Genset Warranty - 2 Years Base Literature - English Packing - None, Base Mounted Housing	
A048G602	Battery Charger-10Amp, 120/208/240VAC, 12/24V, 50/60Hz	1
NSBOP34	BATTERY GROUP 34: C34-HC	4
NSBOP34	FMI51-P1KREJA3D1A, Endress & Hauser Fuel Tank Level Sensor	1
NSBOP34	Pilla E-Stop Station with Clear Protective Cover	1
NSBOP23	Seismic Calcs	1
CXRGSE CXR2000SE S043-7 A080-7	CXRGSE, CXR Series Service Entrance Transfer Switch with PowerCommand Control: 2000A CXR2000SE, Transfer Switch, PowerCommand, 2000 Amp Listing - UL 1008 IBC Seismic Certification	1

Quotation: Q-139436-20221108-1747



Feature Code	Description	Qty
A035-7 B002-7 N070-7 A077-7 A029-7 A044-7 A091-7 R026-7 C109-7 D403-7 M076-7 G004-7 A050-7	Application - Utility to Genset Cabinet - Type 3R Cable Lugs - Mechanical, 1/0 - 750 MCM Transfer Mode - In - Phase Transition Poles - 4 (Switched Neutral) Frequency - 60 Hz System - 3 Phase, 4-Wire (Solid or Switched Neutral) Voltage - 480 Volts AC PC80 Control Integrated High Accuracy Power Quality Metering Standard Customer I/O Transfer Switch Warranty - 2 Year Comprehensive Packing - Wooden Crate	
NSBOP34	NFPA 110 Startup, Cold Start Test, 30-Min Building Test, 4-Hr LB Test and Demonstration & Training	1

EXCEPTIONS AND CLARIFICATIONS:

16232: 1.5.A Warranty period begins at time of startup or 18 months from invoice date, whichever comes first
2.4.C Generator height is 91" from the floor to the top of the controller. Others will need to provide steps (if required)
16416: 1.5.A Warranty period begins at time of startup or 18 months from invoice date, whichever comes first

NOTES:

Quote is valid for 30 days.
Removed the CB and added a Terminal Box
Changed the Alternator Heater from 120VAC to 240VAC



Warranty Statement

Global Commercial Warranty Statement

Generator Set

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Limited Warranty

Commercial Generating Set

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

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

Warranty Period:

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

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

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

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

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

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

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

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

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

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

Cummins Power Generation® Responsibilities:

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

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

Owner Responsibilities:

The owner will be responsible for the following:

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

Limitations:

This limited warranty does not cover Product failures resulting from:

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

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

This limited warranty does not cover costs resulting from:

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

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

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

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

CUMMINS POWER GENERATION® RIGHT TO FAILED COMPONENTS:

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

Extended Warranty:

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

www.power.cummins.com

THE WARRANTIES SET FORTH HEREIN ARE THE SOLE WARRANTIES MADE BY CUMMINS POWER GENERATION® IN REGARD TO THE PRODUCT. CUMMINS POWER GENERATION® MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OR OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

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

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

Product Model Number: _____
Product Serial Number: _____
Date in Service: _____

Power Electronics Extended Warranty Statements

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Power Electronics Extended Warranty Statements

Feature Codes

G004

G006

G007

G008

G013

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Limited 2 Year Comprehensive Extended Warranty – G004

Transfer Switch and Paralleling Systems

When purchased, this limited extended warranty applies to all Cummins Power Generation® branded Transfer Switches, Paralleling Systems and associated accessories (hereinafter referred to as "Product").

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

Warranty Period:

The limited extended warranty start date is the date of commissioning[†], demonstration or 18 months after factory ship date, whichever is sooner. The coverage duration is 2 years from warranty start date.

[†] Date of commissioning not to exceed date of Generator Set initial start-up.

Cummins Power Generation® Responsibilities:

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

- All parts and labor required to repair the Product
- Reasonable travel expenses to and from the Product site location..

Owner Responsibilities:

The owner will be responsible for the following:

- Notifying Cummins Power Generation® distributor or dealer within 30 days of the discovery of failure.
- Installing, operating, commissioning and maintaining the Product in accordance with Cummins Power Generation®'s published policies and guidelines.
- Providing evidence for date of commissioning.
- Providing sufficient access to and reasonable ability to remove the Product from the installation in the event of a warrantable failure.

In addition, the owner will be responsible for:

- Incremental costs and expenses associated with Product removal and reinstallation resulting from non-standard installations.
- Costs associated with rental of power generating equipment used to replace the Product being repaired.
- Costs associated with labor overtime and premium shipping requested by the owner.
- All downtime expenses, fines, all applicable taxes, and other losses resulting from a warrantable failure.

Limitations:

This limited extended warranty does not cover Product failures resulting from:

- Inappropriate use relative to designated power rating.
- Inappropriate use relative to application guidelines.
- Non-conformance to applicable industry standards for installation
- Normal wear and tear.
- Improper and/or unauthorized installation.
- Owner's or operator's negligence, accidents or misuse.
- Lack of maintenance or unauthorized repair.
- Noncompliance with any Cummins Power Generation® published guideline or policy.
- Improper storage before and after commissioning.
- Owner's delay in making Product available after notification of potential Product problem.

- Use of steel enclosures within 60 miles of the coast of salt water when aluminum or an alternate non-corrosive material enclosure option is available.
- Replacement parts and accessories not authorized by Cummins Power Generation®.
- Owner or operator abuse or neglect such as: late servicing and maintenance and improper storage.
- Damage to parts, fixtures, housings, attachments and accessory items that are not part of the transfer switch or paralleling system.

This limited extended warranty does not cover costs resulting from:

- Difficulty in gaining access to the Product.
- Repair of cosmetic damage to enclosures.

CUMMINS POWER GENERATION® RIGHT TO FAILED COMPONENTS:

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

www.cumminspower.com

THE WARRANTIES SET FORTH HEREIN ARE THE SOLE WARRANTIES MADE BY CUMMINS POWER GENERATION® IN REGARD TO THE PRODUCT. CUMMINS POWER GENERATION® MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OR OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

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

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

Product Model Number: _____

Product Serial Number: _____

Date in Service: _____

Section 2 Generator Submittal Information



Specification Sheet



Diesel Generator Set QSK23 Series Engine

600 kW - 800 kW 60 Hz
Standby



Description

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

Features

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

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

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

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

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

Peer-to-peer paralleling - For applications where two or more generators with PowerCommand 3.3 control can be combined with an electrically operated circuit breaker and a combination of transfer switch(s).

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.

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

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

Model	Standby rating	Prime rating	Continuous rating	Data sheets
	60 Hz kW (kVA)	60 Hz kW (kVA)	60 Hz kW (kVA)	60 Hz
DQCA	600 (750)	545 (681)		D-3352
DQCB	750 (938)	680 (850)		D-3353
DQCC	800 (1000)	725 (906)		D-3354

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Generator Set Specifications

Performance class	Genset models have been tested in accordance with ISO 8528-5. Consult factory for transient performance information.
Voltage regulation, no load to full load	± 0.5%
Random voltage variation	± 0.5%
Frequency regulation	Isochronous
Random frequency variation	± 0.25%
Electromagnet Compatibility Performance	Emissions to EN 61000-6-2:2005 Immunity to EN 61000-6-4:2007+A1:2011

Engine Specifications

Bore	169.9 mm (6.69 in)
Stroke	169.9 mm (6.69 in)
Displacement	23.15 liters (1413 in ³)
Configuration	Cast iron, in line 6 cylinder
Battery capacity	1600 amps minimum at ambient temperature of 0 °C to 10 °C (32 °F to 50 °F)
Battery charging alternator	35 amps
Starting voltage	24 volt, negative ground
Fuel system	Direct injection: number 2 diesel fuel, fuel filter, automatic electric fuel shutoff
Fuel filter	Spin-on fuel filters with water separator
Air cleaner type	Dry replaceable element with restriction indicator
Lube oil filter type(s)	Fleet guard dual venturi spin-on, combination full flow and bypass filters
Standard cooling system	High ambient radiator

Alternator Specifications

Design	Brushless, 4 pole, drip proof, revolving field
Stator	2/3 pitch
Rotor	Single bearing flexible disc
Insulation system	Class H
Standard temperature rise	125 °C Standby at 40 °C ambient
Exciter type	Permanent Magnet Generator (PMG)
Phase rotation	A (U), B (V), C (W)
Alternator cooling	Direct drive centrifugal blower fan
AC waveform Total Harmonic Distortion (THDV)	< 5% no load to full linear load, < 3% for any single harmonic

Available Voltages

60 Hz Line-Neutral/Line-Line

- | | | | |
|-----------|-----------|-----------|-----------|
| • 110/190 | • 127/220 | • 230/380 | • 277/480 |
| • 115/200 | • 139/240 | • 240/416 | • 347/600 |
| • 120/208 | • 220/380 | • 255/440 | |

Note: Consult factory for other voltages.

Generator Set Options and Accessories

Engine

- 208/240/480 V coolant heater for ambient above 4.5 °C (40 °F)
- Fuel/water separator
- Heavy duty air cleaner

Alternator

- 80 °C rise
- 105 °C rise
- 125 °C rise

- 120/240 V anti-condensation heater
- Temperature sensor - alternator bearing RTD

Control panel

- PC3.3
- PC3.3 with MLD
- 120/240 V 100 W control anti-condensation heater
- Ground fault indication
- Remote fault signal package
- Run relay package

- Run time display

Cooling system

- 50 °C ambient

Generator Set Options and Accessories (continued)

Exhaust system

- Industrial grade exhaust silencer (12 to 18 dBA)
- Residential grade exhaust silencer (18 to 25 dBA)
- Critical grade exhaust silencer (25 to 35 dBA)
- Super critical exhaust silencer (35 to 45 dBA)

Generator set

- AC entrance box
- Battery
- Battery rack with hold-down
- Circuit breaker - set mounted
- Remote annunciator panel
- Spring isolators

- 2 year warranty
- 5 year warranty
- 10 year major components warranty

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

PowerCommand 2.3 – Control system



PowerCommand 2.3 control - An integrated generator set control system providing voltage regulation, engine protection, generator protection, operator interface, and isochronous governing (optional).

Control - Provides battery monitoring and testing features and smart-starting control system.

InPower™ - PC based service tool available for detailed diagnostics.

PCCNet RS485 - Network interface (standard) to devices such as remote annunciator for NFPA 110 applications.

Control boards - Potted for environmental protection.

Ambient operation - Suitable for operation in ambient temperatures from -40 °C to +70 °C and altitudes to 13,000 feet (5000 meters).

Prototype tested - UL, CSA, and CE compliant.

AC protection

- AmpSentry protective relay
- Over current warning and shutdown
- Over and under voltage shutdown
- Over and under frequency shutdown
- Over excitation (loss of sensing) fault
- Field overload
- Overload warning
- Reverse kW shutdown
- Reverse Var shutdown
- Short circuit protection

Engine protection

- Overspeed shutdown
- Low oil pressure warning and shutdown
- High coolant temperature warning and shutdown
- Low coolant level warning or shutdown
- Low coolant temperature warning
- High, low and weak battery voltage warning
- Fail to start (over crank) shutdown
- Fail to crank shutdown
- Redundant start disconnect
- Cranking lockout

- Sensor failure indication
- Low fuel level warning or shutdown
- Fuel-in-rupture-basin warning or shutdown

Operator/display panel

- Manual off switch
- 128 x 128 alpha-numeric display with push button access for viewing engine and alternator data and providing setup, controls and adjustments (English or international symbols)
- LED lamps indicating generator set running, not in auto, common warning, common shutdown, manual run mode and remote start
- Suitable for operation in ambient temperatures from -20 °C to +70 °C

Alternator data

- Line-to-Neutral AC volts
- Line-to-Line AC volts
- 3-phase AC current
- Frequency
- kVA, kW, power factor

Engine data

- DC voltage
- Lube oil pressure
- Coolant temperature

Other data

- Generator set model data
- Start attempts, starts, running hours
- Fault history
- RS485 Modbus® interface
- Data logging and fault simulation (requires InPower service tool)
- Total kilowatt hours
- Load profile

Digital governing (optional)

- Integrated digital electronic isochronous governor
- Temperature dynamic governing

Digital voltage regulation

- Integrated digital electronic voltage regulator
- 3-phase Line-to-Line sensing
- Configurable torque matching
- Fault current regulation under single or three phase fault conditions

Control functions

- Time delay start and cool down
- Glow plug control (some models)
- Cycle cranking
- PCCNet interface
- (4) Configurable inputs
- (4) Configurable outputs
- Remote emergency stop
- Battle short mode
- Load shed
- Real time clock with exerciser
- Derate

Options

- Auxiliary output relays (2)
- 120/240 V, 100 W anti-condensation heater
- Remote annunciator with (3) configurable inputs and (4) configurable outputs
- PMG alternator excitation
- PowerCommand for Windows® remote monitoring software (direct connect)
- AC output analogue meters
- PowerCommand 2.3 and 3.3 control with AmpSentry protection

For further detail on PC 2.3, see document S-1569.
For further detail on PC 3.3, see document S-1570.

Ratings Definitions

Emergency Standby Power (ESP):

Applicable for supplying power continuously to varying electrical loads for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528 and ISO 3046-1, obtained and corrected in accordance with ISO 15550).

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.

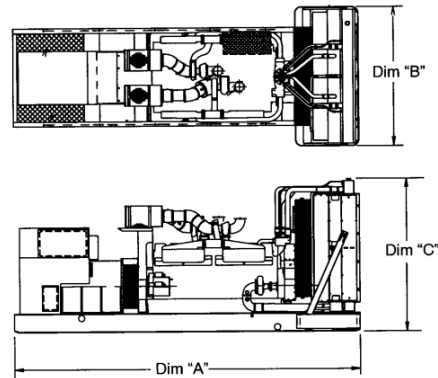
Prime Power (PRP):

Applicable for supplying power to varying electrical loads for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046-1. Data shown above represents gross engine performance and capabilities as per ISO 3046-1, obtained and corrected in accordance with ISO 15550.

Base Load (Continuous) Power (COP):

Applicable for supplying power continuously to a constant load up to the full output rating for unlimited hours. No sustained overload capability is available for this rating. Consult authorized distributor for rating. (Equivalent to Continuous Power in accordance with ISO 8528 and ISO 3046-1, obtained and corrected in accordance with ISO 15550).

This rating is not applicable to all generator set models.



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

Do not use for installation design

Dimensions and Weights with Standard Cooling System

Model	Dim 'A' mm (in.)	Dim 'B' mm (in.)	Dim 'C' mm (in.)	Set weight* dry kg (lbs)	Set weight* wet kg (lbs)
DQCA	4395.4 (173)	1855.5 (73)	2065.7 (81)	6075 (13395)	6337 (13973)
DQCB	4395.4 (173)	1855.5 (73)	2065.7 (81)	6075 (13395)	6337 (13973)
DQCC	4395.4 (173)	1855.5 (73)	2065.7 (81)	6075 (13395)	6337 (13973)

Dimensions and Weights with Optional Cooling System with Seismic Feature Codes L228-2 and/or L225-2

Model	Dim 'A' mm (in.)	Dim 'B' mm (in.)	Dim 'C' mm (in.)	Set weight* dry kg (lbs)	Set weight* wet kg (lbs)
DQCA	4395.4 (173)	1715 (68)	2060.1 (81.1)	6377 (14061)	6518 (14372)
DQCB	4395.4 (173)	1715 (68)	2060.1 (81.1)	6377 (14061)	6518 (14372)
DQCC	4395.4 (173)	1715 (68)	2060.1 (81.1)	6377 (14061)	6518 (14372)

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




**For more information contact your local Cummins distributor
or visit power.cummins.com**

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Codes and Standards

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

<p>ISO 9001 ISO 14001 ISO 45001</p>	<p>This product was manufactured in a facility whose quality management system is certified to ISO 9001 and its Health Safety Environmental Management Systems certified to ISO 14001 and ISO 45001.</p>		<p>This product is listed to UL 2200, Stationary Engine Generator Assemblies.</p>
	<p>The Prototype Test Support (PTS) program verifies the performance integrity of the generator set design. Cummins products bearing the PTS symbol meet the prototype test requirements of NFPA 110 for Level 1 systems.</p>	<p>U.S. EPA</p>	<p>Engine certified to Stationary Emergency U.S. EPA New Source Performance Standards, 40 CFR 60 subpart IIII Tier 2 exhaust emission levels. U.S. applications must be applied per this EPA regulation.</p>
	<p>All genset models are available as CSA certified to CSA C22.2 No.100.</p>	<p>International Building Code</p>	<p>The generator set package is available certified for seismic application in accordance with International Building Code.</p>



Generator Set Data Sheet



Model: DQCA
Frequency: 60 Hz
Fuel type: Diesel
kW rating: 600 Standby
 545 Prime
Emissions level: EPA NSPS Stationary Emergency Tier 2

Exhaust emission data sheet:	EDS-1086
Exhaust emission compliance sheet:	EPA-1120
Sound data sheet:	MSP-1158
Sound data sheet – with seismic feature codes L228-2 (IBC) and/or L225-2 (OSHDP):	MSP-1011
Cooling system data in various ambient conditions:	MCP-247
Cooling system data in various ambient conditions – with seismic feature codes L228-2 (IBC) and/or L225-2 (OSHDP):	MCP-173
Prototype test summary data sheet:	PTS-160

Fuel Consumption	Standby				Prime				Continuous
	kW (kVA)				kW (kVA)				kW (kVA)
Ratings	600 (750)				545 (681)				
Load	1/4	1/2	3/4	Full	1/4	1/2	3/4	Full	Full
US gph	13.0	22.5	33.0	42.0	12.0	21.0	30.0	38.5	
L/hr	49.2	85.2	124.9	159.0	45.4	79.5	113.6	145.7	

Engine	Standby Rating	Prime Rating	Continuous Rating
Engine manufacturer	Cummins Inc.		
Engine model	QSK23-G7 NR2		
Configuration	Cast iron, in line 6 cylinder		
Aspiration	Turbocharged and air-to-air after-cooled		
Gross engine power output, kWm (bhp)	910 (1220)	809 (1085)	
BMEP at set rated load, kPa (psi)	1944 (282)	1752 (254)	
Bore, mm (in.)	170 (6.69)		
Stroke, mm (in.)	170 (6.69)		
Rated speed, rpm	1800		
Piston speed, m/s (ft/min)	10.21 (2010)		
Compression ratio	16:1		
Lube oil capacity, L (qt)	102 (108)		
Overspeed limit, rpm	2100		
Regenerative power, kW	93		

Fuel Flow	
Maximum fuel flow, L/hr (US gph)	685 (181)
Maximum fuel inlet restriction, kPa (in Hg)	13.44 (4)
Maximum fuel inlet temperature, °C (°F)	71 (160)

Air	Standby Rating	Prime Rating	Continuous Rating
Combustion air, m ³ /min (scfm)	59 (2081)	56 (1961)	
Maximum air cleaner restriction, kPa (in H ₂ O)	6.2 (25)		
Alternator cooling air, m ³ /min (cfm)	117 (4156)		

Exhaust			
Exhaust flow at set rated load, m ³ /min (cfm)	137 (4830)	128 (4515)	
Exhaust temperature, °C (°F)	440 (824)	429 (804)	
Maximum back pressure, kPa (in H ₂ O)	10.1 (40.8)		

Standard Set-mounted Radiator Cooling (non-seismic)			
Ambient design, °C (°F)	50 (122)		
Fan load, kW _m (HP)	24 (32)		
Coolant capacity (with radiator), L (US gal)	109.5 (29)		
Cooling system air flow, m ³ /min (scfm)	1069.8 (37779.6)		
Total heat rejection, MJ/min (Btu/min)	26.4 (25002)	23.9 (22706)	
Maximum cooling air flow static restriction, kPa (in H ₂ O)	0.12 (0.5)		
Maximum fuel return line restriction kPa (in Hg)	30.47 (9)		

Optional Set-mounted Radiator Cooling (with seismic feature codes L228-2 (IBC) and/or L225-2 (OSHPD))			
Ambient design, °C (°F)	50 (122)		
Fan load, kW _m (HP)	27 (36)		
Coolant capacity (with radiator), L (US gal)	89 (23.5)		
Cooling system air flow, m ³ /min (scfm)	1252 (44183)		
Total heat rejection, MJ/min (Btu/min)	26.4 (25002)	23.9 (22706)	
Maximum cooling air flow static restriction, kPa (in H ₂ O)	0.12 (0.5)		
Maximum fuel return line restriction kPa (in Hg)	30.47 (9)		

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

Optional Remote Radiator Cooling¹

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)			

Weights²

Unit dry weight kgs (lbs)	6075 (13395)
Unit wet weight kgs (lbs)	6337 (13973)

Notes:

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

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

Derating Factors

Standby	Engine power available up to 2705 m (8875 ft) at ambient temperatures up to 40 °C (104 °F). Above these elevations, derate at 4.4% per 305 m (1000 ft). Above 40 °C (104 °F), derate 10% per 10 °C (18 °F).
Prime	Engine power available up to 2641 m (8665 ft) at ambient temperatures up to 40 °C (104 °F). Above these elevations, derate at 4.5% per 305 m (1000 ft). Above 40 °C (104 °F), derate 20.9% per 10 °C (18 °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. No sustained overload capability is available at this rating.

Alternator Data

Voltage	Connection ¹	Temp Rise Degrees C	Duty ²	Single phase Factor ³	Max surge kVA ⁴	Winding No.	Alternator Data Sheet	Feature Code
208-240/416-480	Wye	125/105	S/P		3657	311	ADS-631	BC34-2
400	Wye	125/105	S/P		2944	311	ADS-309	BC35-2
400	Wye	125/105	S/P		2944	312	ADS-309	BC36-2
600	Wye	125/105	S/P		2944	7	ADS-309	B300-2
208/416	Wye	80	S		3657	311	ADS-631	BC44-2
208/416	Wye	105/80	S/P		3657	311	ADS-631	B733-2
380	Wye	125/105	S/P		3657	311	ADS-631	BC37-2
380	Wye	105/80	S/P		3657	311	ADS-631	BC43-2
480	Wye	105	S		3657	311	ADS-631	B876-2
480	Wye	80	P		3657	311	ADS-631	B879-2
600	Wye	105/80	S/P		2944	7	ADS-309	B301-2
480	Wye	80	S		3657	311	ADS-631	B878-2
380	Wye	80	S		4200	311	ADS-632	B870-2
600	Wye	80	S		2944	7	ADS-309	B604-2

Notes:

- ¹ Limited single phase capability is available from some three phase rated configurations. To obtain single phase rating, multiply the three phase kW rating by the Single Phase Factor³. All single phase ratings are at unity power factor.
- ² Standby (S), Prime (P) and Continuous ratings (C).
- ³ Factor for the *Single-phase output from Three phase alternator* formula listed below.
- ⁴ Maximum rated starting kVA that results in a minimum of 90% of rated sustained voltage during starting.

Formulas for Calculating Full Load Currents:

Three phase output	Single phase output
$\frac{\text{kW} \times 1000}{\text{Voltage} \times 1.73 \times 0.8}$	$\frac{\text{kW} \times \text{SinglePhaseFactor} \times 1000}{\text{Voltage}}$

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.

For more information contact your local Cummins distributor or visit power.cummins.com



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Specification Sheet



PowerCommand® 2.3 Control System



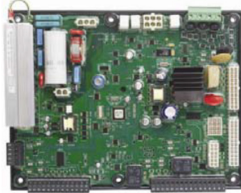
Control System Description

The PowerCommand control system is a microprocessor-based generator set monitoring, metering and control system designed to meet the demands of today's engine driven generator sets. The integration of all control functions into a single control system provides enhanced reliability and performance, compared to conventional generator set control systems. These control systems have been designed and tested to meet the harsh environment in which gensets are typically applied.

Features

- 320 x 240 pixels graphic LED backlight LCD.
- Multiple language support.
- AmpSentry™ protective relay - true alternator overcurrent protection.
- Real time clock for fault and event time stamping.
- Exerciser clock and time of day start/stop.
- Digital voltage regulation. Three phase full wave FET type regulator compatible with either shunt or PMG systems.
- Generator set monitoring and protection.
- 12 and 24 VDC battery operation.
- Modbus® interface for interconnecting to customer equipment.
- Warranty and service. Backed by a comprehensive warranty and worldwide distributor service network.
- Certifications - suitable for use on generator sets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std., CE and CSA standards.

PowerCommand Digital Genset Control PCC 2300



Description

The PowerCommand generator set control is suitable for use on a wide range of generator sets in non-paralleling applications. The PowerCommand control is compatible with shunt or PMG excitation style. It is suitable for use with reconnectable or non-reconnectable generators, and it can be configured for any frequency, voltage and power connection from 120-600 VAC Line-to-Line.

Power for this control system is derived from the generator set starting batteries. The control functions over a voltage range from 8 VDC to 30 VDC.

Features

- 12 and 24 VDC battery operation.
- Digital voltage regulation - Three phase full wave FET type regulator compatible with either shunt or PMG systems. Sensing is three phase.
- Full authority engine communications (where applicable) - Provides communication and control with the Engine
- due to thermal Control Module (ECM).
- AmpSentry™ protection provides industry-leading alternator overcurrent protection:
 - Time-based generator protection applicable to both line-to-line and line-to-neutral, that can detect an unbalanced fault condition and swiftly react appropriately. Balanced faults can also be detected by AmpSentry and appropriate acted upon.
- ▲ Reduces the risk of Arc Flash overload or electrical faults by inverse time protection
- Common harnessing - with higher feature Cummins controls. Allows for easy field upgrades.
- Generator set monitoring - Monitors status of all critical engine and alternator functions.
- Digital genset metering (AC and DC).
- Genset battery monitoring system to sense and warn against a weak battery condition.
- Configurable for single or three phase AC metering.
- Engine starting - Includes relay drivers for starter, Fuel Shut Off (FSO), glow plug/spark ignition power and switch B+ applications.
- Generator set protection – Protects engine and alternator.
- Real time clock for fault and event time stamping.
- Exerciser clock and time of day start/stop.
- Advanced serviceability - using InPower™, a PC-based software service tool.

- Environmental protection - The control system is designed for reliable operation in harsh environments. The main control board is a fully encapsulated module that is protected from the elements.
- Modbus interface for interconnecting to customer equipment.
- Configurable inputs and outputs - Four discrete inputs and four dry contact relay outputs.
- Warranty and service - Backed by a comprehensive warranty and worldwide distributor service network.
- Certifications - Suitable for use on generator sets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std., CE and CSA standards.

Base Control Functions

HMI Capability

Operator adjustments - The HMI includes provisions for many set up and adjustment functions.

Generator set hardware data - Access to the control and software part number, generator set rating in kVA and generator set model number is provided from the HMI or InPower.

Data logs - Includes engine run time, controller on time, number of start attempts, total kWh, and load profile (control logs data indicating the operating hours at percent of rated kW load, in 5% increments. The data is presented on the operation panel based on total operating hours on the generator.)

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

Alternator data

- Voltage (single or three phase Line-to-Line and Line-to-Neutral)
- Current (single or three phase)
- kW, kVar, power factor, kVA (three phase and total)
- Frequency

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

Engine data

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

Service adjustments - The HMI includes provisions for adjustment and calibration of generator set control functions. Adjustments are protected by a password. Functions include:

Service adjustments (continued)

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

Engine Control

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

12 VDC/24 VDC battery operations - PowerCommand will operate either on 12 VDC or 24 VDC batteries.

Temperature dependent governing dynamics (with electronic governing) - modifies the engine governing control parameters as a function of engine temperature. This allows the engine to be more responsive when warm and more stable when operating at lower temperature levels.

Isochronous governing - (where applicable) Capable of controlling 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.

Drop electronic speed governing - Control can be adjusted to droop from 0 to 10% from no load to full load.

Remote start mode - It accepts a ground signal from remote devices to automatically start the generator set and immediately accelerate to rated speed and voltage. The remote start signal will also wake up the control from sleep mode. The control can incorporate a time delay start and stop.

Remote and local emergency stop - The control accepts a ground signal from a local (genset mounted) or remote (facility mounted) emergency stop switch to cause the generator set to immediately shut down. The generator set is prevented from running or cranking with the switch engaged. If in sleep mode, activation of either emergency stop switch will wakeup the control.

Sleep mode - The control includes a configurable low current draw state to minimize starting battery current draw when the genset is not operating. The control can also be configured to go into a low current state while in auto for prime applications or applications without a battery charger.

Engine starting - The control system supports automatic engine starting. Primary and backup start disconnects are achieved by one of two methods: magnetic pickup or main alternator output frequency. The control also supports configurable glow plug control when applicable.

Cycle cranking - Is configurable for the 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 (cooldown) - 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 shut down after signal to stop in normal operation modes. Default for both time delay periods is 0 seconds.

Alternator Control

The control includes an integrated three phase Line-to-Line sensing voltage regulation system that is compatible with shunt or PMG excitation systems. The voltage regulation system is a three phase full wave rectified and has an FET output for good motor starting capability.

Major system features include:

Digital output voltage regulation - Capable of regulating output voltage to within +/-1.0% for any loads between no load and full load. Voltage drift will not exceed +/- 1.5% for a 40 °C (104 °F) change in temperature in an eight hour period. On engine starting or sudden load acceptance, voltage is controlled to a maximum of 5% overshoot over nominal level. The automatic voltage regulator feature can be disabled to allow the use of an external voltage regulator.

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

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

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

Protective Functions

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

Battle Short Mode

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

Derate

The derate function reduces output power of the genset in response to a fault condition. If a derate command occurs while operating on an isolated bus, the control will issue commands to reduce the load on the genset via contact closures or modbus.

Configurable Alarm and Status Inputs

The control accepts up to four alarm or status inputs (configurable contact closed to ground or open) to indicate a configurable (customer-specified) condition. The control is programmable for warning, shutdown or status indication and for labeling the input.

Emergency Stop

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

Full Authority Electronic Engine Protection

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

General Engine Protection

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

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

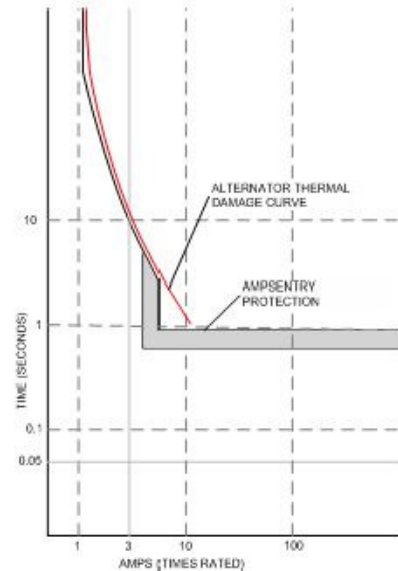
Fail to start (overcrank) shutdown - The control system will indicate a fault if the generator set fails to start by the completion of the engine crank sequence.

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

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

Alternator Protection

AmpSentry protective relay - A comprehensive monitoring and control system integral to the PowerCommand Control System that guards the electrical integrity of the alternator and power system by providing protection against a wide array of fault conditions in the 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. Thermal damage curve (3-Phase short) or fixed timer (2 sec for 1-Phase short, 5 sec for 2-Phase short). See document R1053 for a full-size time over current curve.



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

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

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

Under frequency shutdown (81 u) - Generator set output frequency cannot be maintained. Settings are adjustable from 2-10 Hz below reference governor set point, for a 5-20 second time delay. Default: 6 Hz, 10 seconds.

Under frequency protection is disabled when excitation is switched off, such as when engine is operating in idle speed mode.

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

Overcurrent warning/shutdown - Thresholds and time delays are configurable. Implementation of the thermal damage curve with instantaneous trip level calculated based on current transformer ratio and application power rating.

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

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

Over load (kW) warning - Provides a warning indication when engine is operating at a load level over a set point.

Adjustment range: 80-140% of application rated kW, 0-120 second delay. Defaults: 105%, 60 seconds.

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

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

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

Field Control Interface

Input signals to the PowerCommand control include:

- Coolant level (where applicable)
- Fuel level (where applicable)
- Remote emergency stop
- Remote fault reset
- Remote start
- Battleshort
- Rupture basin
- Start type signal
- Configurable inputs - Control includes (4) input signals from customer discrete devices that are configurable for warning, shutdown or status indication, as well as message displayed

Output signals from the PowerCommand control include:

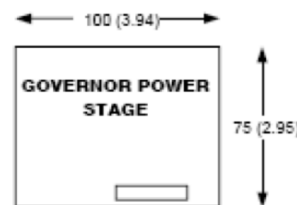
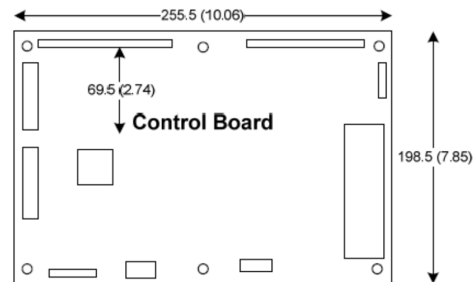
- Load dump signal: Operates when the generator set is in an overload condition.
- Delayed off signal: Time delay based output which will continue to remain active after the control has removed the run command. Adjustment range: 0 – 120 seconds. Default: 0 seconds.

- Configurable relay outputs: Control includes (4) relay output contacts (3 A, 30 VDC). These outputs can be configured to activate on any control warning or shutdown fault as well as ready to load, not in auto, common alarm, common warning and common shutdown.
- Ready to load (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.

Communications Connections Include:

- PC tool interface: This RS-485 communication port allows the control to communicate with a personal computer running InPower software.
- Modbus RS-485 port: Allows the control to communicate with external devices such as PLCs using Modbus protocol.
Note - An RS-232 or USB to RS-485 converter is required for communication between PC and control.
- Networking: This RS-485 communication port allows connection from the control to the other Cummins products.

Mechanical Drawings



PowerCommand Human Machine Interface HMI320



Description

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

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

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

Features

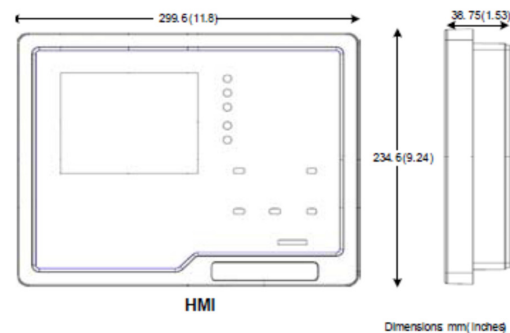
- LED indicating lamps:
 - Genset running
 - Remote start
 - Not in auto
 - Shutdown
 - Warning
 - Auto
 - Manual and stop
- 320 x 240 pixels graphic LED backlight LCD.
- Four tactile feel membrane switches for LCD defined operation. The functions of these switches are defined dynamically on the LCD.
- Seven tactile feel membrane switches dedicated screen navigation buttons for up, down, left, right, ok, home and cancel.
- Six tactile feel membrane switches dedicated to control for auto, stop, manual, manual start, fault reset and lamp test/panel lamps.

- Two tactile feel membrane switches dedicated to control of circuit breaker (where applicable).
- Allows for complete genset control setup.
- Certifications: Suitable for use on generator sets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std., CE and CSA standards.
- LCD languages supported: English, Spanish, French, German, Italian, Greek, Dutch, Portuguese, Finnish, Norwegian, Danish, Russian and Chinese Characters.

Communications connections include:

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

Mechanical Drawing



Software

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

Environment

The control is designed for proper operation without recalibration in ambient temperatures from -40 °C 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.

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

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

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

Certifications

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

- NFPA 110 for level 1 and 2 systems.
- ISO 8528-4: 1993 compliance, controls and switchgear.
- CE marking: The control system is suitable for use on generator sets to be CE-marked.
- EN50081-1,2 residential/light industrial emissions or industrial emissions.
- EN50082-1,2 residential/light industrial or industrial susceptibility.
- ISO 7637-2, level 2; DC supply surge voltage test.
- Mil Std 202C, Method 101 and ASTM B117: Salt fog test.
- UL 6200 recognized and suitable for use on UL 2200 Listed generator sets.
- CSA C282-M1999 compliance
- CSA 22.2 No. 14 M91 industrial controls.
- PowerCommand control systems and generator sets are designed and manufactured in ISO 9001 certified facilities.

Warranty

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



**For more information contact your local Cummins distributor
or visit power.cummins.com**

Our energy working for you.™





Exhaust emission data sheet

600DQCA

**60 Hz Diesel generator set
EPA NSPS stationary emergency**

Engine information:

Model:	Cummins Inc QSK23-G7 NR2	Bore:	6.69 in. (170 mm)
Type:	4 Cycle, In line, 6 cylinder diesel	Stroke:	6.69 in. (170 mm)
Aspiration:	Turbocharged and CAC	Displacement:	1413 cu. in. (23.1 liters)
Compression ratio:	16.0:1		
Emission control device:	Turbocharged with charge air-cooled		

<u>Performance data</u>	<u>1/4</u> <u>Standby</u>	<u>1/2</u> <u>Standby</u>	<u>3/4</u> <u>Standby</u>	<u>Full</u> <u>Standby</u>	<u>Full</u> <u>Prime</u>
Engine HP @ stated load (1800 RPM)	220	440	660	880	792
Fuel consumption (gal/Hr)	12.9	22.6	32.3	41.8	38.1
Exhaust gas flow (CFM)	2029.9	2987.1	3862.8	4600.3	4390
Exhaust gas temperature (°F)	576.7	685.6	750.6	810	774

Exhaust emission data

HC (Total unburned hydrocarbons)	1.1	0.51	0.28	0.18	0.25
NOx (Oxides of nitrogen as NO2)	2.99	3.15	3.64	4.49	4.05
CO (Carbon monoxide)	1.24	0.6	0.3	0.21	0.2
PM (Particular matter)	0.34	0.17	0.08	0.05	0.05
SO2 (Sulfur dioxide)	0.13	0.12	0.11	0.1	0.1
Smoke (Bosch)	0.8	0.63	0.44	0.35	0.36

All values are Grams per HP-Hour

Test conditions

Data was recorded during steady-state rated engine speed (± 25 RPM) with full load ($\pm 2\%$). Pressures, temperatures, and emission rates were stabilized.

Fuel specification:	46.5 Cetane Number, 0.035 Wt.% Sulfur; Reference ISO8178-5, 40CFR86. 1313-98 Type 2-D and ASTM D975 No. 2-D.
Fuel temperature:	99 \pm 9 °F (at fuel pump inlet)
Intake air temperature:	77 \pm 9 °F
Barometric pressure:	29.6 \pm 1 in. Hg
Humidity:	NOx measurement corrected to 75 grains H2O/lb dry air
Reference standard:	ISO 8178

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



2023 EPA Tier 2 Exhaust Emission Compliance Statement

600DQCA

Stationary Emergency 60 Hz Diesel Generator Set

Compliance Information:

The engine used in this generator set complies with Tier 2 emissions limit of U.S. EPA New Source Performance Standards for stationary emergency engines under the provisions of 40 CFR 60 Subpart IIII.

Engine Manufacturer:	Cummins Inc.
EPA Certificate Number:	PCEXL023.AAB-031
Effective Date:	06/10/2022
Date Issued:	06/10/2022
EPA Engine Family (Cummins Emissions Family):	PCEXL023.AAB

Engine Information:

Model:	QSK23-G7 NR2	Bore:	6.69 in. (170 mm)
Engine Nameplate HP:	1220	Stroke:	6.69 in. (170 mm)
Type:	4 Cycle, In-line, 6 Cylinder Diesel	Displacement:	1413 cu. in. (23.2 liters)
Aspiration:	Turbocharged and CAC	Compression ratio:	16.0:1
Emission Control Device:	Engine Design Modification	Exhaust stack diameter:	10 in.

Diesel Fuel Emission Limits

D2 Cycle Exhaust Emissions	Grams per BHP-hr			Grams per kWm-hr		
	<u>NO_x + NMHC</u>	<u>CO</u>	<u>PM</u>	<u>NO_x + NMHC</u>	<u>CO</u>	<u>PM</u>
EPA Emissions Limit	4.8	2.6	0.15	6.4	3.5	0.20

Test methods: EPA emissions recorded per 40 CFR Part 60, 89, 1039, 1065 and weighted at load points prescribed in the regulations for constant speed engines.

Diesel fuel specifications: Cetane number: 40-50, Reference: ASTM D975 No. 2-D, 300-500 ppm Sulphur

Reference conditions: Air Inlet Temperature: 25 °C (77 °F), Fuel Inlet Temperature: 40 °C (104 °F). Barometric Pressure: 100 kPa (29.53 in Hg), Humidity: 10.7 g/kg (75 grains H₂O/lb) of dry air; required for NO_x correction, Restrictions: Intake Restriction set to a maximum allowable limit for clean filter; Exhaust Back Pressure set to a maximum allowable limit..

Tests conducted using alternate test methods, instrumentation, fuel or reference conditions can yield different results. Engine operation with excessive air intake or exhaust restriction beyond published maximum limits, or with improper maintenance, may result in elevated emission levels.



Cooling System Data

DQCA

EPA NSPS Stationary Emergency: Tier 2

High Ambient Air Temperature Radiator Cooling System

	Duty	Rating (kW)	Max Cooling @ Air Flow Static Restriction, Unhoused inches water (mm water)					Housed in Free Air, No Air Discharge Restriction		
			0.0 (0.0)	0.25 (6.4)	0.5 (12.7)	0.75 (19.1)	1.0 (25.4)	Weather	Sound Level1	Sound Level2
			Maximum Allowable Ambient Temperature, Degree C							
60	Standby	600	71.5	68.9	66.7	62.9	60.7	63.6	63.1	61.6
Hz	Prime	545	68.0	65.5	64.0	59.2	57.6	61.9	61.5	59.6

Notes:

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



Sound data

600DQCA 60 Hz

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

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 - unhooded	Infinite exhaust	89	93	94	95	98	95	93	93	94
F200 - weather	Mounted muffler	84	80	78	89	90	90	77	80	86
F201 - quiet site II first stage	Mounted muffler	84	79	72	73	77	73	73	79	78
F202 - quiet site II second stage	Mounted muffler	72	70	73	73	74	75	74	71	73

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 - unhooded	Infinite exhaust	82	101	106	112	114	114	112	107	120
F200 - weather	Mounted muffler	92	101	106	108	107	106	103	98	114
F201 - quiet site II first stage	Mounted muffler	91	99	100	101	100	100	99	94	108
F202 - quiet site II second stage	Mounted muffler	85	95	95	92	99	98	98	90	105

Exhaust sound power level, dB(A)

Open exhaust (no muffler rated load)	Octave band center frequency (Hz)								Sound power level
	63	125	250	500	1000	2000	4000	8000	
	104	111	119	120	120	125	125	123	131

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 7 m (23 ft) from the surface of the generator set and 1.2 m (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.



Prototype Test Support (PTS) 60 Hz test summary



<u>Generator set models</u>	<u>Representative prototype</u>
600DQCA	Model: 800DQCC
800DQCC	Alternator: HC6H
750DQCB	Engine: QSK23-G7 NR2
	Rated voltage: 480 V

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: 833 kW

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

Torsional analysis and testing:

The generator set was tested to verify that the design is not subjected to harmful torsional stresses. A spectrum analysis of the transducer output was conducted over the speed range of 1350 to 1950 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:	± 0.50%
Random voltage variation:	± 0.50%
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. Voltage and frequency response on load: addition and rejection were evaluated. The following results were recorded at 0.8 PF:

Full load acceptance:

Voltage dip:	30.0%
Recovery time:	2.3 seconds
Frequency dip:	9.3%
Recovery time:	3.9 seconds

Full load rejection:

Voltage rise:	23.7%
Recovery time:	2.6 seconds
Frequency rise:	4.6%
Recovery time:	3.4 seconds

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

Harmonic	<u>Line to Line</u>		<u>Line to Neutral</u>	
	<u>No load</u>	<u>Full load</u>	<u>No load</u>	<u>Full load</u>
3	0.036	0.245	0.093	0.169
5	0.083	2.081	0.112	2.171
7	0.824	0.609	0.820	0.597
9	0.023	0.042	0.021	0.074
11	0.600	0.355	0.613	0.397
13	0.307	0.300	0.295	0.308
15	0.009	0.017	0.009	0.094



Alternator Data Sheet Frame Size: S6L1D-D4

Characteristics			No of Bearings:		1-bearing		2-bearing		
Weights:	Stator assembly:		2037 lb	924 kg	2037 lb	924 kg			
	Rotor assembly:		1764 lb	800 kg	1671 lb	758 kg			
	Complete assembly:		4306 lb	1953 kg	4475 lb	2030 kg			
Maximum speed:		2250 rpm							
Excitation current:	Full load:		2.9 Amps						
	No load:		0.87 Amps (Wdg 311/312), 0.78 Amps (Wdg 07)						
Insulation system:		Class H throughout							
3 Ø Ratings (0.8 power factor)			60 Hz (winding no)						
			120/208 <u>240/416</u> (311/312)	127/220 <u>254/440</u> (311/312)	133/230 <u>266/460</u> (311/312)	139/240 <u>277/480</u> (311/312)	120/240 <u>Delta</u> (311/312)	347/600 (07)	
150° C rise ratings	@ 40° C	kW	870	900	910	950	870	900	
		kVA	1088	1125	1138	1188	1088	1125	
125° C rise ratings	@ 40° C	kW	820	850	860	900	820	850	
		kVA	1025	1063	1075	1125	1025	1063	
105° C rise ratings	@ 40° C	kW	732	772	800	820	732	770	
		kVA	915	965	1000	1025	915	963	
80° C rise ratings	@ 40° C	kW	632	680	700	720	632	720	
		kVA	790	850	875	900	790	900	
Reactances (per unit ± 10%)			120/208 <u>240/416</u> (311/312)	127/220 <u>254/440</u> (311/312)	133/230 <u>266/460</u> (311/312)	139/240 <u>277/480</u> (311/312)	120/240 <u>Delta</u> (311/312)	347/600 (07)	
(Based on full load at 125° C rise rating)									
Synchronous			2.29	2.12	1.96	1.88	2.29	1.87	
Transient			0.16	0.15	0.14	0.14	0.16	0.13	
Subtransient			0.13	0.12	0.11	0.11	0.13	0.10	
Negative sequence			0.2	0.18	0.17	0.16	0.2	0.14	
Zero sequence			0.05	0.05	0.05	0.04	0.05	0.03	
Motor starting			120/208 <u>240/416</u> (311/312)	127/220 <u>254/440</u> (311/312)	133/230 <u>266/460</u> (311/312)	139/240 <u>277/480</u> (311/312)	120/240 <u>Delta</u> (311/312)	347/600 (07)	
Maximum kVA		(90% sustained voltage)	3657	3657	3657	3657	3657	3657	
Time constants (sec)			120/208 <u>240/416</u> (311/312)	127/220 <u>254/440</u> (311/312)	133/230 <u>266/460</u> (311/312)	139/240 <u>277/480</u> (311/312)	120/240 <u>Delta</u> (311/312)	347/600 (07)	
Transient			0.088	0.088	0.088	0.088	0.088	0.091	
Subtransient			0.0149	0.0149	0.0149	0.0149	0.0149	0.013	
Open circuit			3.63	3.63	3.63	3.63	3.63	3.352	
DC			0.0246	0.0246	0.0246	0.0246	0.0246	0.021	
Windings (@22° C)			120/208 <u>240/416</u> (311/312)	127/220 <u>254/440</u> (311/312)	133/230 <u>266/460</u> (311/312)	139/240 <u>277/480</u> (311/312)	120/240 <u>Delta</u> (311/312)	347/600 (07)	
Stator resistance		(L-L Ohms)	0.0022	0.0022	0.0022	0.0022	0.0022	0.007	
Rotor resistance		(Ohms)	1.82	1.82	1.82	1.82	1.82	1.82	
Number of leads			12/6	12/6	12/6	12/6	12/6	6	

* Parallel Star connection only available with Wdg 311



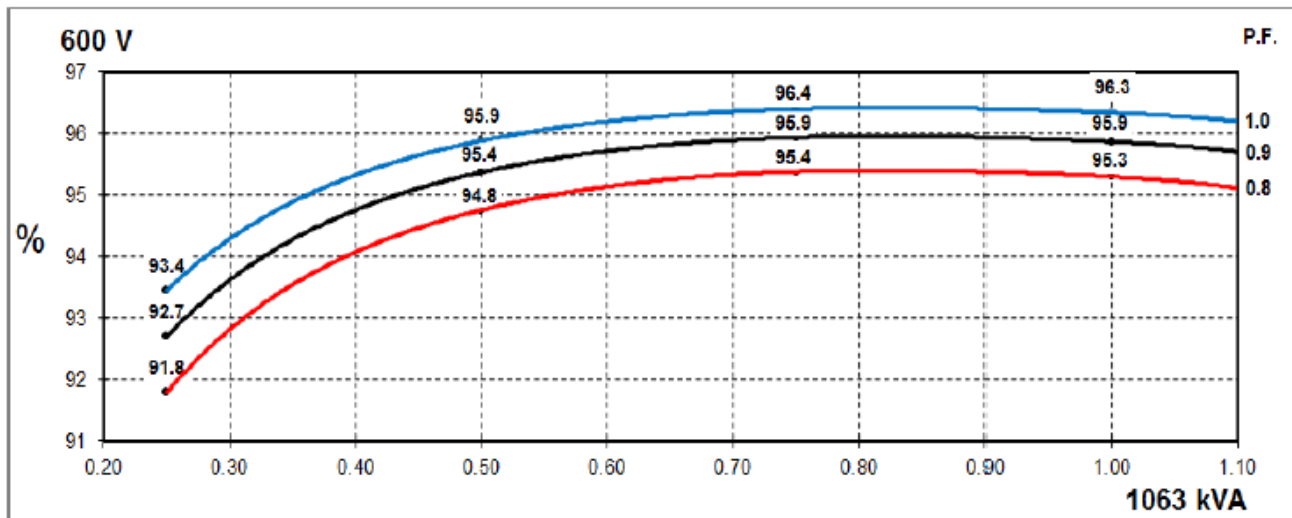
Alternator Data Sheet

Frame Size: S6L1D-D4

S6L1D-D4 Wdg.07

THREE PHASE EFFICIENCY CURVES

60Hz





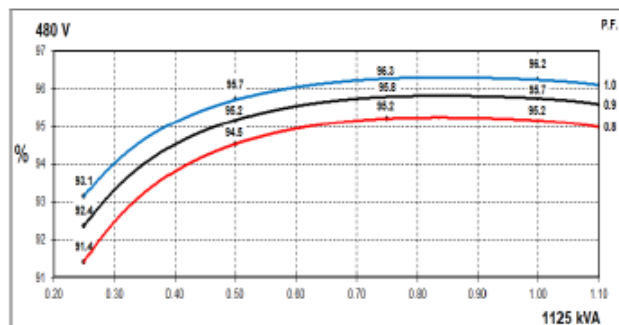
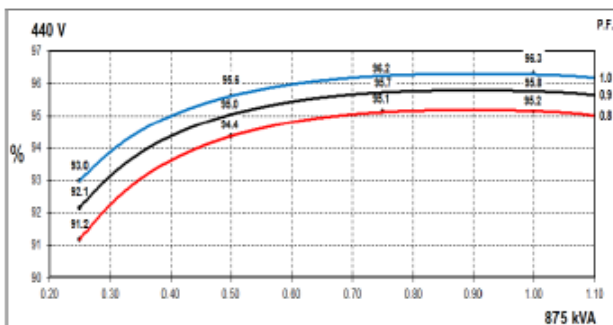
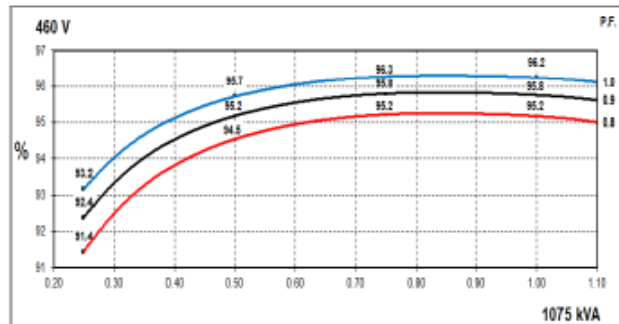
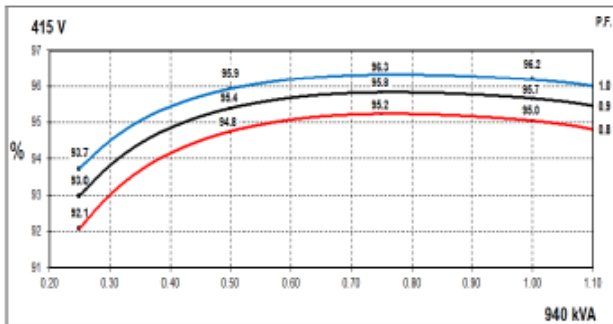
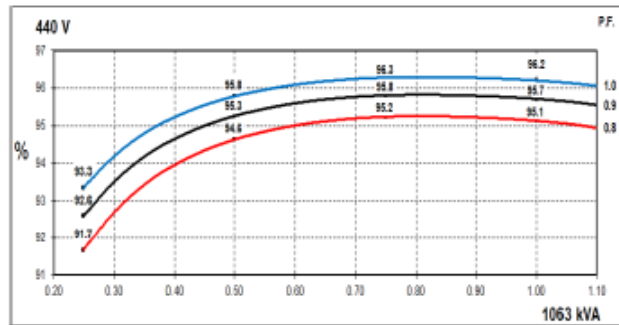
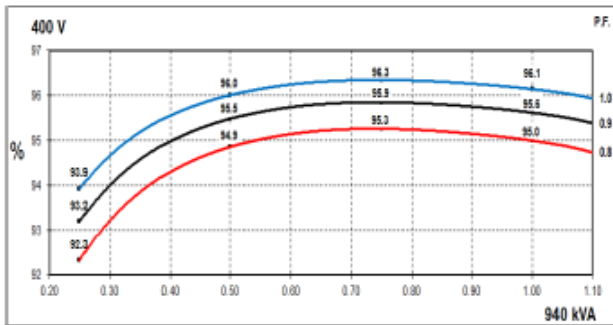
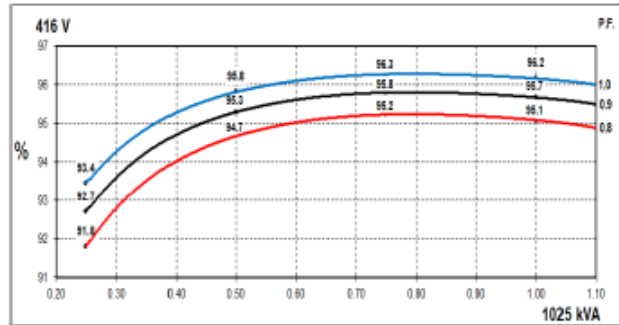
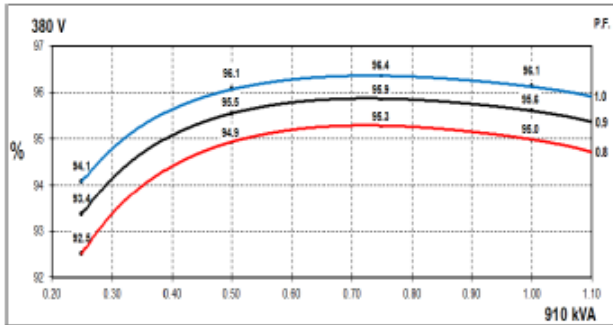
Alternator Data Sheet Frame Size: S6L1D-D4

S6L1D-D4 Wdg.311/312

THREE PHASE EFFICIENCY CURVES

50Hz

60Hz



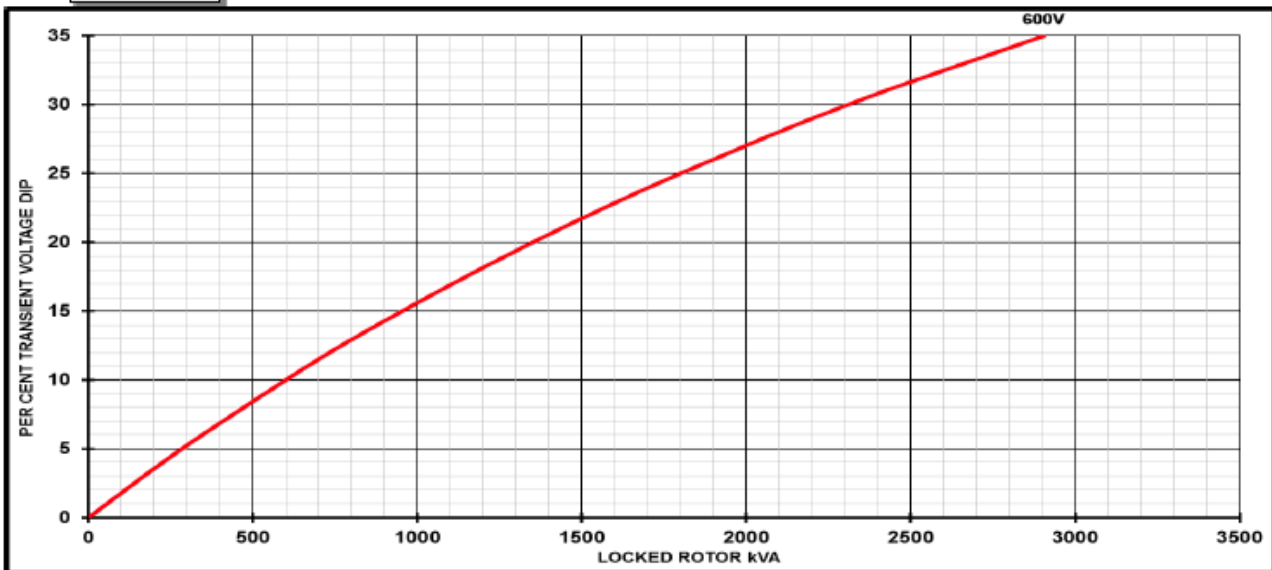


Alternator Data Sheet Frame Size: S6L1D-D4

S6L1D-D4 Wdg.07

Locked Rotor Motor Starting Curves - Separately Excited

60Hz



Transient Voltage Dip Scaling Factor		Transient Voltage Rise Scaling Factor
PF	Factor	For voltage rise multiply voltage dip by 1.25
< 0.5	1	
0.5	0.97	
0.6	0.93	
0.7	0.9	
0.8	0.85	
0.9	0.83	

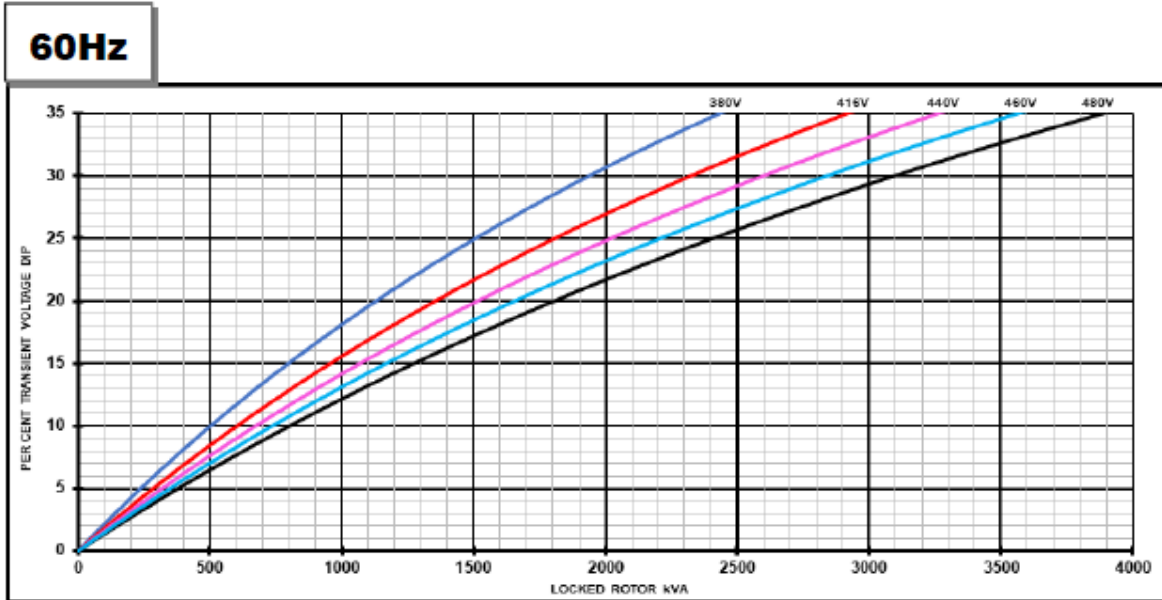
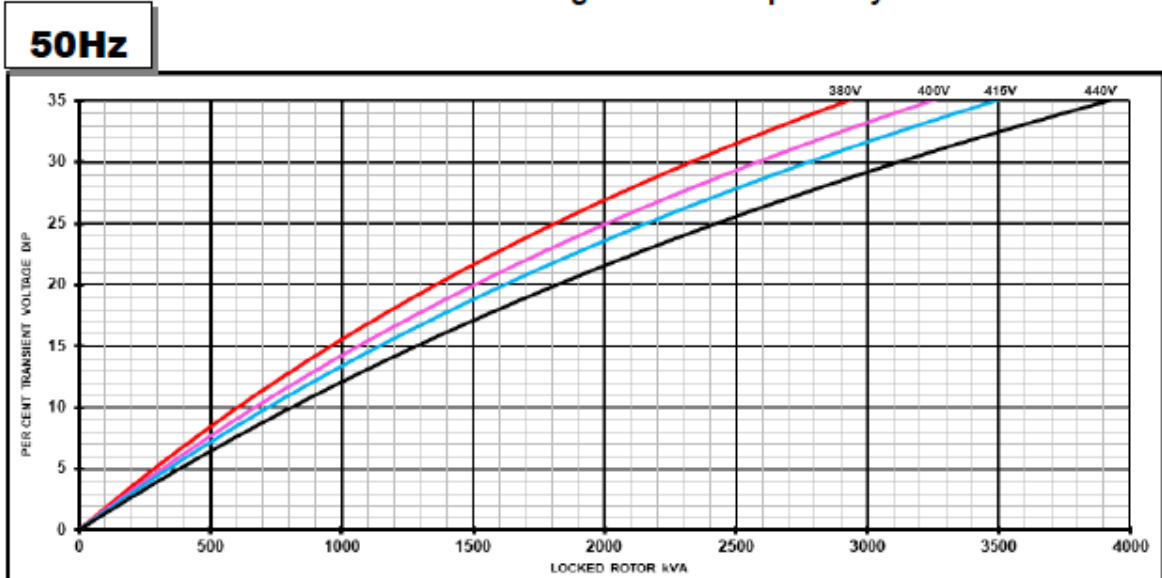


Alternator Data Sheet

Frame Size: S6L1D-D4

S6L1D-D4 Wdg.311/312

Locked Rotor Motor Starting Curves - Separately Excited



Transient Voltage Dip Scaling Factor		Transient Voltage Rise Scaling Factor	
PF	Factor	For voltage rise multiply voltage dip by 1.25	
< 0.5	1		
0.5	0.97		
0.6	0.93		
0.7	0.9		
0.8	0.85		
0.9	0.83		

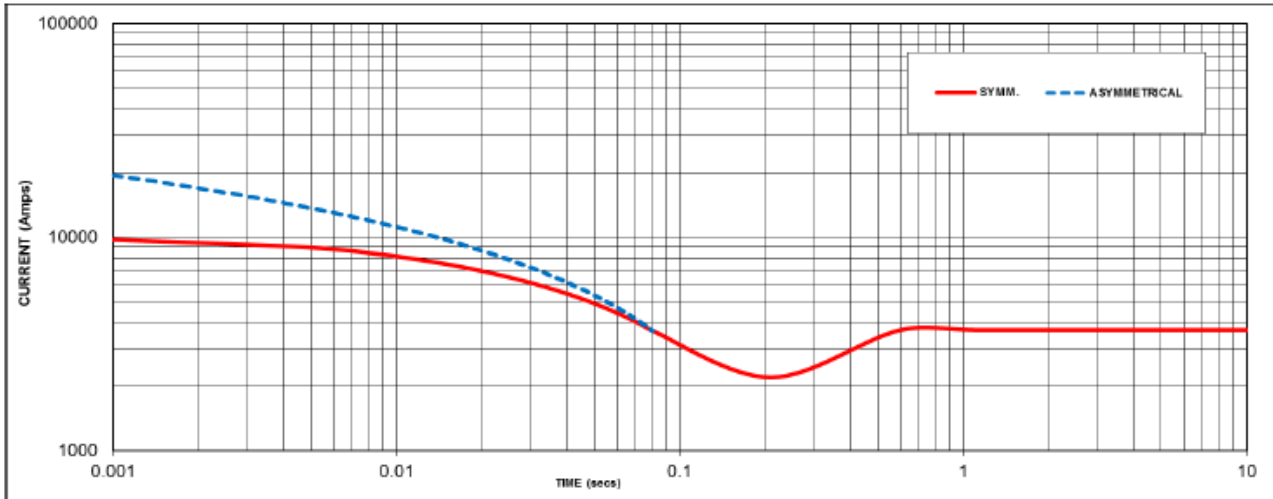


Alternator Data Sheet Frame Size: S6L1D-D4

S6L1D-D4 Wdg.07

Three-phase Short Circuit Decrement Curve - Separately Excited

60Hz



Sustained Short Circuit = 3672 Amps

Note 1

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

50Hz		60Hz	
Voltage	Factor	Voltage	Factor
-	-	600V	-
-	-	-	-
-	-	-	-
-	-	-	-

The sustained current value is constant irrespective of voltage level

Note 2

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

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

All other times are unchanged

Note 3

Curves are drawn for Star connected machines under no-load excitation at rated speeds. For other connection the following multipliers should be applied to current values as shown :
Parallel Star = Curve current value X 2
Series Delta = Curve current value X 1.732



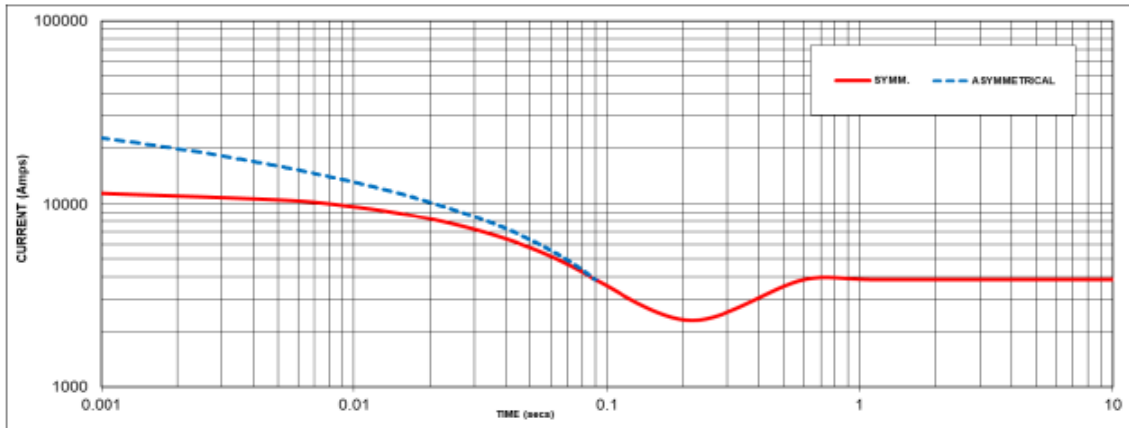
Alternator Data Sheet

Frame Size: S6L1D-D4

S6L1D-D4 Wdg.311/312

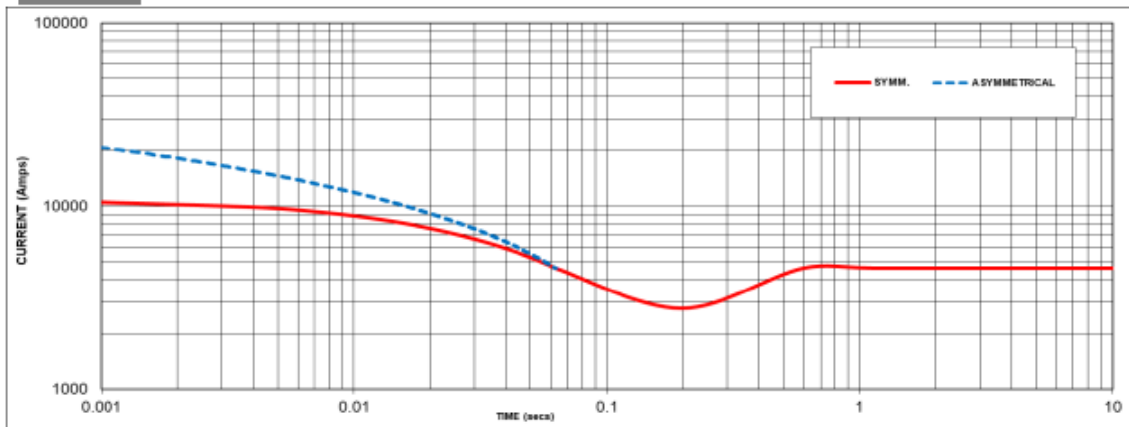
Three-phase Short Circuit Decrement Curve - Separately Excited

50Hz



Sustained Short Circuit = 3859 Amps

60Hz



Sustained Short Circuit = 4591 Amps

Note 1

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

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

The sustained current value is constant irrespective of voltage level

Note 2

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

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

Note 3

All other times are unchanged

Curves are drawn for Star connections under no-load excitation at rated speeds. For other connection (where applicable) the following multipliers should be applied to current values as shown :

Parallel Star = Curve current value X 2

Series Delta = Curve current value X 1.732



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CERTIFICATE OF COMPLIANCE

SEISMIC DESIGN OF NONSTRUCTURAL COMPONENTS AND SYSTEMS



Certification No.

VMA-50999-01C (Revision 10)

Expiration Date: 6/30/2023

Certification Parameters:

The nonstructural products (mechanical and/or electrical components) listed on this certificate are CERTIFIED¹ FOR SEISMIC APPLICATIONS in accordance with the following building code² releases.

IBC 2006, 2009, 2012, 2015

The following model designations, options, and accessories are included in this certification. Reference report number VMA-50999-01 as issued by The VMC Group for a complete list of certified models, included accessories/options, and certified installation methods.

Cummins Power Generation, Inc.; Diesel Gensets
DQCA-C, DQFA-H, DQGAA-B, DQKAA-B, DQLC-H, DQPAA-B; 600kW - 2750kW

The above referenced equipment is APPROVED for seismic application when properly installed³, used as intended, and contains a Seismic Certification Label referencing this Certificate of Compliance⁴. As limited by the tabulated values, below grade, grade, and roof-level installations, installations in essential facilities, for life safety applications, and/or of equipment containing hazardous contents are permitted and included in this certification with an Equipment Importance Factor assigned as $I_p=1.5$. The equipment is qualified by successful seismic shake table testing at the nationally recognized University of California Berkeley Pacific Earthquake Engineering Research Center under the review of the ISO Accredited Product Certification Agency, the VMC Group.

Certified Seismic Design Levels			
Certified IBC	Importance $I_p \leq 1.5$ Soil Classes A-E Risk Categories I-IV Design Categories A-F	$z/h \leq 1.0$	$z/h = 0.0$
		$S_{DS} \leq 0.647 g$	$S_{DS} \leq 1.940 g$

Certified Seismic Installation Methods ⁸	
External Isolation Mounting From Unit Base To Fuel Tank	External Isolation Mounting From Unit Base To Rigid Structure
Rigid Mounting From Unit Base To Fuel Tank	Rigid Mounting From Unit Base To Rigid Structure

HEADQUARTERS
113 Main Street
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CERTIFICATE OF COMPLIANCE

SEISMIC DESIGN OF NONSTRUCTURAL COMPONENTS AND SYSTEMS

Certified Product Table:

Series	Model	Max Rating [kW]	Length [in]	Width [in]	Height [in]	S _{DS} @ z/h=0	S _{DS} @ z/h=1	Tank Range [gal]	Enclosure ¹	Mounting Configurations
DQCx (QSK23)	A, B, C	600, 750, 800	338	102	142	1.94	0.64	200-2400	F200-F205	External Isolation Mounting From Unit Base to Rigid Structure/Fuel Tank
DQFx (QST30)	A, B, C, D, H	750, 800, 900, 1000, 1000								
DQPax (QSK19)	A, B	600, 650		101.6						External Isolation Mounting From Unit Base to Rigid Structure/Fuel Tank
DQGAx (QSK50)		1250, 1500	278	104	125	1.44	N/A	N/A	External Isolation Mounting From Unit Base to Rigid Structure/Fuel Tank	
DQKAx (QSK60)		1750, 2000	244	100	120					
DQLx (QSK78)	C, D, E, F, H	2500, 2750, 2500, 2750, 2750	292	125	153	2.1	2.0			

¹Note: The F201, F202, F204, & F205 are certified in the tested mineral wool foam configuration, as well as the analyzed PU foam configuration highlighted in the FEA section of Certification Report VMA-50999-01

Note: DQPAA-B, DQCA-C, DQGAA-B, DQKAA-B, DQLC-H, and DQFAA-D,H generator sets are certified for the configuration that allows the use of remote radiators. However, the seismic certification of said remote radiators is the responsibility of others and is not covered under this certification

Note: This certification includes the use of the breather stand on the ECO generator set models. All other generator set models are not certified for use with the breather stand.

Group	Type	S _{DS} (z/h=0)	S _{DS} (z/h=1)	A _{Flex-H}	A _{Rig-H}	A _{Flex-V}	A _{Rig-V}	Rigid Mounting F _p /W _p	Isolated Mounting F _p /W _p
Seismic	AC156	1.940	0.647	1.94	0.776	1.293	0.518	0.466	1.455

This certification includes the open generator set and the enclosed generator set when installed with or without the sub-base tank. The generator set and included options shall be a catalogue design and factory supplied. The generator set and applicable options shall be installed and attached to the building structure per the manufacturer supplied seismic installation instructions. This certification excludes After Treatment Units (ATUs), all non-factory supplied accessories, including but not limited to mufflers, isolation/restraint devices, remote control panels, remote radiators, pumps and other electrical/mechanical components.



VMA-50999-01C (Revision 10)
Issue Date: Thursday, March 2, 2017
Revision Date: Monday, June 22, 2020
Expiration Date: Friday, June 30, 2023



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CERTIFICATE OF COMPLIANCE

SEISMIC DESIGN OF NONSTRUCTURAL COMPONENTS AND SYSTEMS

Notes & Comments:

1. All equipment listed herein successfully passed the seismic acceptance criteria for shake testing non-structural components and systems as set forth in the ICC AC-156. The Test Response Spectrum (TRS) enveloped the Required Response Spectrum (RRS) for all units tested. The units cited in this certification were representative sample(s) of a contingent of models and all remained captive and structurally sound after the seismic shake simulation. The units also remained functionally operational after the simulation testing as functional testing was completed by the equipment manufacturer before and after the seismic simulations. Although a seismic qualified unit inherently contains some wind resisting capacity, that capacity is undetermined and is excluded from this certification. Snow/Ice loads have been neglected and thus limit the unit to be installed both indoors (covered by an independent protective structure) and out of doors (exposed to accumulating snow/ice) for ground snow loads no greater than 30 psf for all applications.
2. The following building codes are addressed under this certification:
 - IBC 2015 referencing ASCE7-10 and ICC-ES AC-156
 - IBC 2012 referencing ASCE7-10 and ICC-ES AC-156
 - IBC 2009 referencing ASCE7-05 and ICC-ES AC-156
 - IBC 2006 referencing ASCE7-05 and ICC-ES AC-156
3. Refer to the manufacturer supplied installation drawings for anchor requirements and mounting considerations for seismic applications. Required anchor locations, size, style, and load capacities (tension and shear) may be specified on the installation drawings or specified by a 3rd party. Mounting requirement details such as anchor brand, type, embedment depth, edge spacing, anchor-to-anchor spacing, concrete strength, special inspection, wall design, and attachment to non-building structures must be outlined and approved by the Engineer of Record for the project or building. Structural walls, structural floors, and housekeeping pads must also be seismically designed and approved by the project or building Structural Engineer of Record to withstand the seismic anchor loads as defined on the installation drawings. The installing contractor is responsible for ensuring the proper installation of all anchors and mounting hardware.
4. For this certificate and certification to remain valid, this certificate must correspond to the "Seismic Certification Label" found affixed to the unit by the factory. The label ensures the manufacturer built the unit in conformance to the IBC seismic design criteria set forth by the Certified Seismic Qualification Agency, the VMC Group, and meets the seismic design levels claimed by this certificate.
5. Mechanical, Electrical, and Plumbing connections to the equipment must be flexibly attached as to not transfer load through the connection. The structural integrity of any conduit, cable trays, piping, ductwork and/or flexible connections is the responsibility of others. This certification does not guarantee the equipment will remain compliant to NEMA, IP, UL, or CSA standards after a seismic event.
6. This certificate applies to units manufactured at:
Cummins Power Generation, Inc., 1400 73rd Ave NE, Minneapolis, MN 55432
7. This certification follows the VMC Group's ISO-17065 Scheme.
8. The certified seismic installation methods states are a summary for all series this certificate covers, for more detailed information on the certified seismic installation methods, see the certified product tables.

John P. Giuliano, PE
President, VMC Group



VMA-50999-01C (Revision 10)
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Specification Sheet



Enclosures and Tanks

250-1000 kW Gensets



Enclosure Standard Features

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

Options

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

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Fuel Tanks

Standard sub-base tank features

- UL 142 Listed
- ULC-S601-07 Listed
- NFPA37 compliant
- Dual walled, steel construction
- Emergency tank and rupture basin vents
- Tank mounted mechanical fuel gauge
- Fuel supply and return tubes
- Top mounted leak detection float switch
- Low and high level fuel switches
- Mounting brackets for optional pump and control (250-500 kW)
- Integral lifting points

Sub-base tank options

- Pre-wired fuel pump and control
- Fuel overfill alarm – internal or external
- Overflow and tank fill plugs
- Five gallon spill fill box – internal or external
- Fill pipe extender
- Local code approvals available

200-500 kW Dual Wall Sub-base Fuel Tanks – usable operating hours

Genset model (60 Hz)	Gallons /hour at full load	270 gallon tank	300 gallon tank	400 gallon tank	500 gallon tank	600 gallon tank	660 gallon tank	720 gallon tank	850 gallon tank	1420 gallon tank	1470 gallon tank	1700 gallon tank	2050 gallon tank	2525 gallon tank
250 DQDAA	20	14	15	20	25	30	33	36		72	74		104	
275 DQDAB	21	13	14	19	24	29	31	34		66	70		96	
300 DQDAC	23	12	13	17	22	26	29	31		61	64		88	
300 DQHAB	23	12	13	17	22	26	29		37			74		
450 DFEJ	30	9	10	13	17	20	22		28			57		84
500 DFEK	34	8	9	11	15	18	19		25			50		74

Operating hours are measured at 60 Hz, standby rating.

600-1000 kW Dual Wall Sub-base Fuel Tanks – usable operating hours

Genset model	Gallons /hour at full load	200 gallon tank	660 gallon tank	1000 gallon tank	1500 gallon tank	2000 gallon tank	2400 gallon tank
600 DQCA	42	5	16	24	36	48	57
600 DQPAA	45	4	15	22	33	44	53
650 DQPAB	50	4	13	20	30	40	48
750 DQCB	51	4	13	20	29	39	47
750 DQFAA	53	4	12	19	28	38	45
800 DQCC	53	4	12	19	28	38	45
800 DQFAB	56	4	12	18	27	36	43
900 DQFAC	64	3	10	16	23	31	38
1000 DQFAD	72	3	9	14	21	28	33

*3000 gallon tank offered as an accessory kit – refer to NAAC-5853 spec sheet.

- Operating hours are measured at 60 Hz, standby rating.

- Up to 90% fill alarm to comply with NFPA30, operating capacity is reduced by 10%.

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

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

- All data is 60 Hz, full load standby rating, steel enclosures only.
- Data is a measured average of 8 positions.
- Sound levels for aluminium enclosures are approximately 2 dB(A) higher than listed sound levels for steel enclosures.
- * Sound data with seismic feature codes L228-2 (IBC) and/or L225-2 (OSHPD)

Package Dimensions of Enclosure, Exhaust System, and UL Tank

250-500 kW

Tank size (gal)	Weather protective package length (in)	QuietSite level 1 package length (in)	QuietSite level 2 package length (in)	Width (in)	Height (in)	Weather protective package weight (lbs)	QuietSite level 1 package weight (lbs)	QuietSite level 2 package weight (lbs)
270	188	188	222	82	106	4991	5471	6711
300	188	188	222	82	104	5648	6073	6991
400	188	188	222	82	106	5833	6258	7176
500	188	188	222	82	108	5956	6381	7299
600	188	188	222	82	111	6116	6541	7459
660	188	188	222	82	113	6235	6660	7578
720	188	188	222	82	114	6174	6599	7517
850	188	188	222	82	118	6529	6954	7872
1420	200	200	222	82	128	6863	7343	8583
1470	192	192	222	82	128	7253	7733	8973
1700	234	234	234	82	128	7982	8407	9325
2050	284	284	284	82	128	8383	8863	10103
2525	346	346	346	82	128	9391	9871	11111
Lifting base	188	188	222	82	100	4335	4760	5678

600-1000 kW

Tank size (gal)	Weather protective package length (in)	QuietSite level 1 package length (in)	QuietSite level 2 package length (in)	Width (in)	Height (in)	Weather protective package weight (lbs)	QuietSite level 1 package weight (lbs)	QuietSite level 2 package weight (lbs)
200	260	303	315	98	137	10194	13074	14954
660	260	303	315	98	137	9586	12466	14346
1000	260	303	315	98	141	10117	12997	14877
1500	260	303	315	98	146	10677	13557	15437
2000	292	327	327	98	143	11959	14839	16719
2400	338	338	338	98	143	12961	15841	17721

- This weight does not include the generator set. Consult your local Cummins distributor or the appropriate generator specification sheet.
- Width is 86" lifting eye to lifting eye (250-500 kW), 102" lifting eye to lifting eye (600-1000 kW).
- Height - Florida, Michigan, and Suffolk add 6.4" (250-500 kW) or 2" (600-1000 kW) for bottom space.
- Maximum length emergency vent removed.



CSA - The generator set is CSA certified to product class 4215-01.

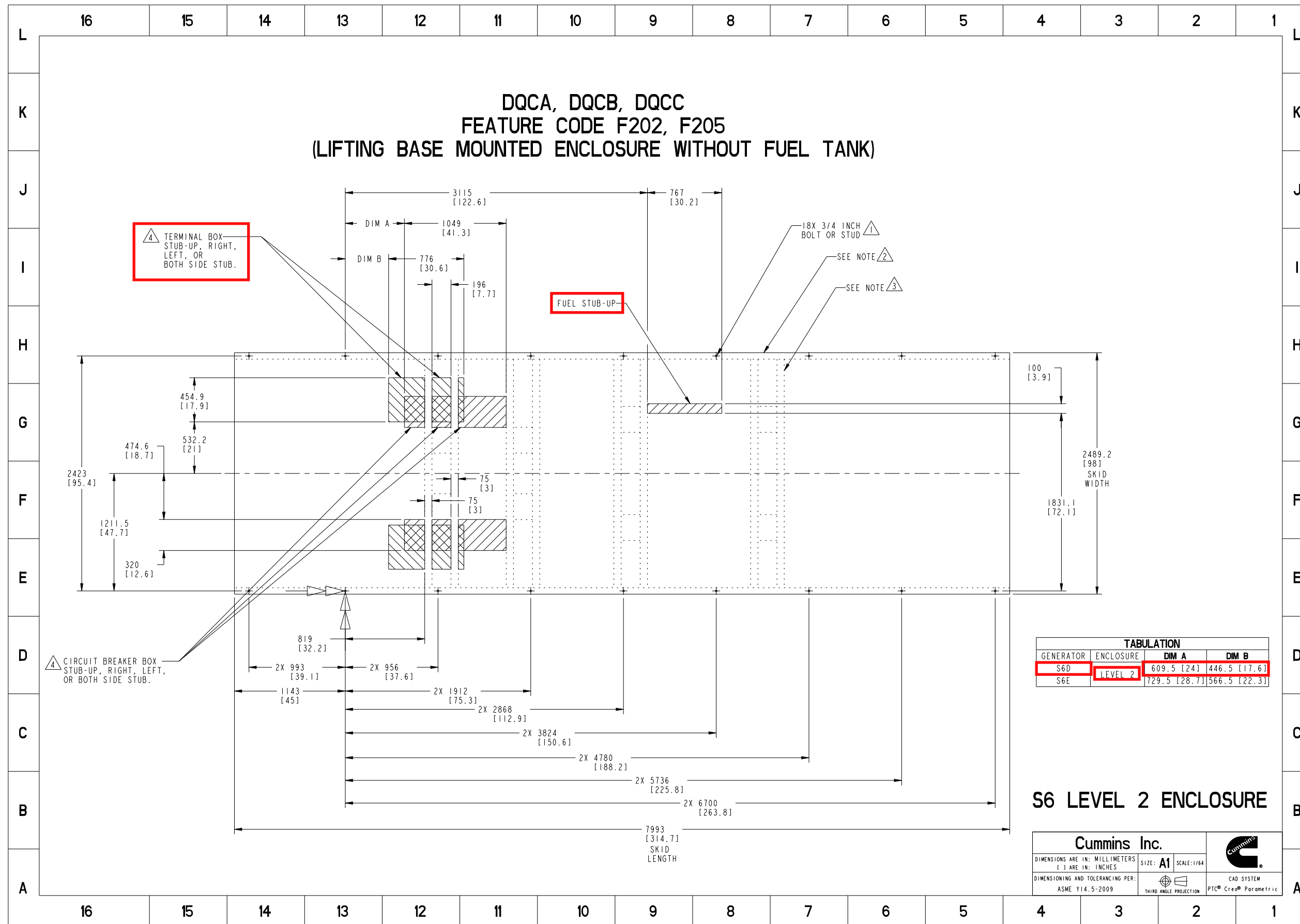


UL - The generator set is available listed to UL 2200, stationary engine generator assemblies. The PowerCommand® control is listed to UL 508 - Category NITW7 for U.S. and Canadian usage.

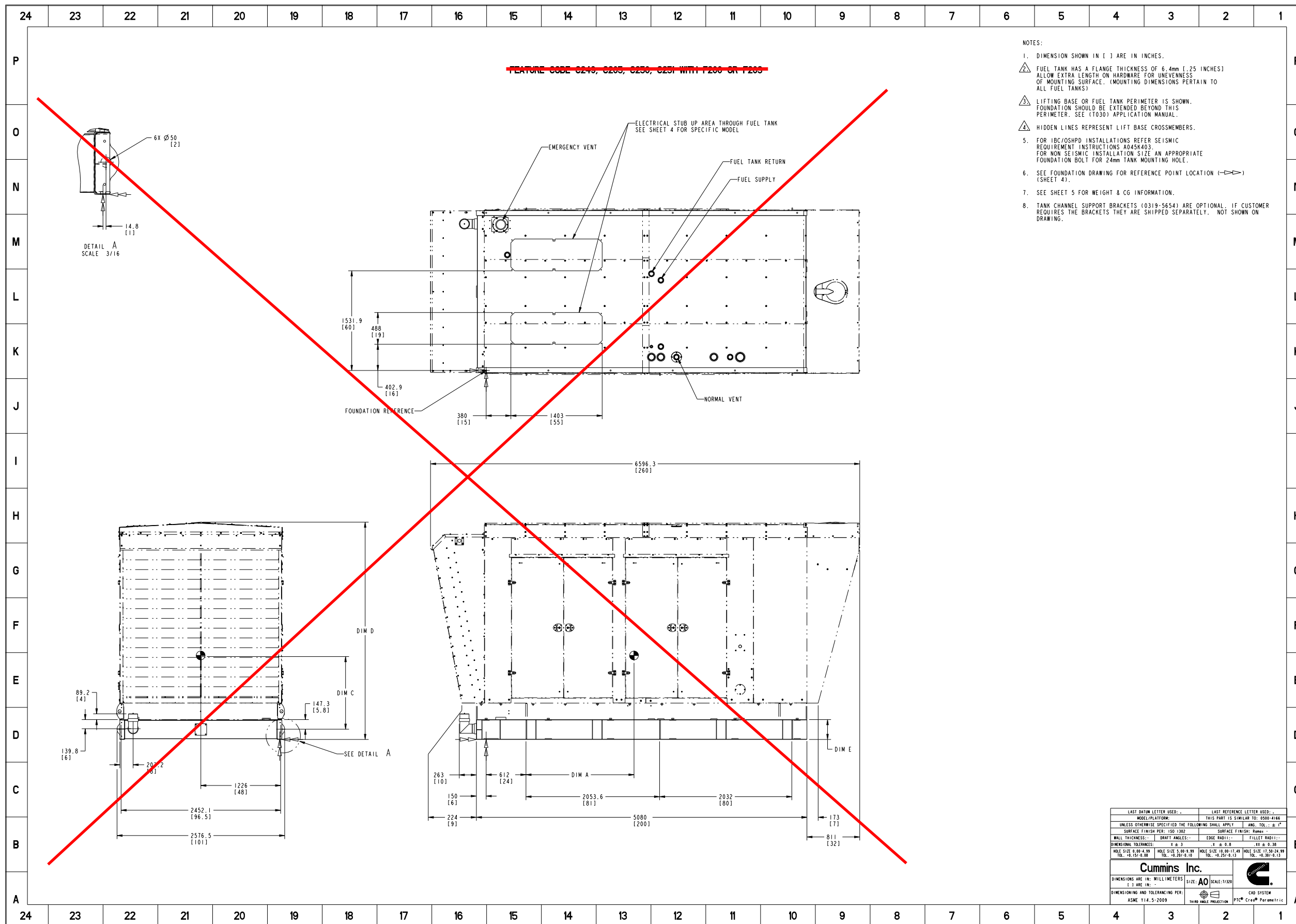
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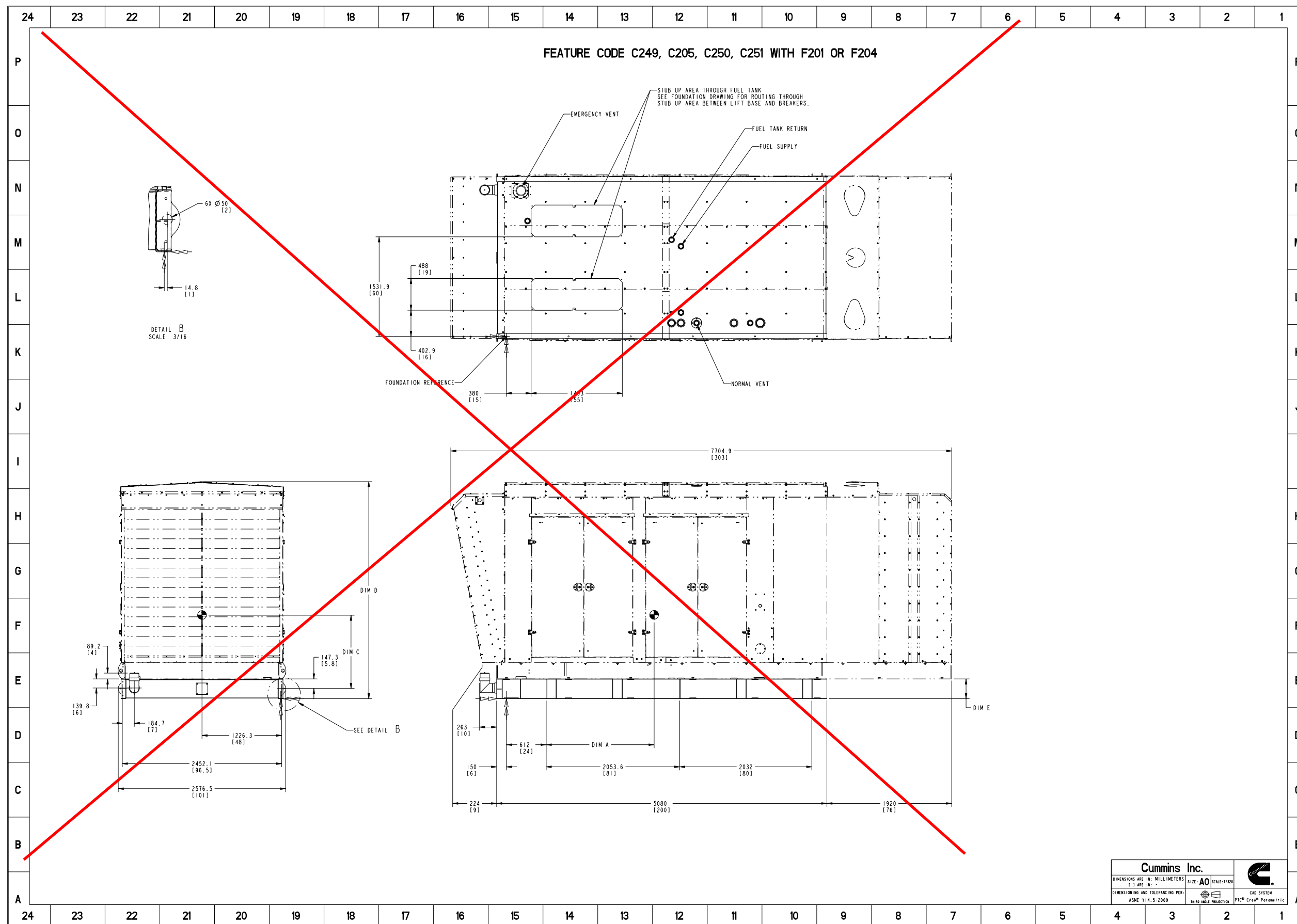


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Part Number: **A035J956** Part Revision: **J**
Part Name: **OUTLINE,FUEL SYSTEM**
Drawing Category: **Detail** State: **Released** Sheet 1 of 7

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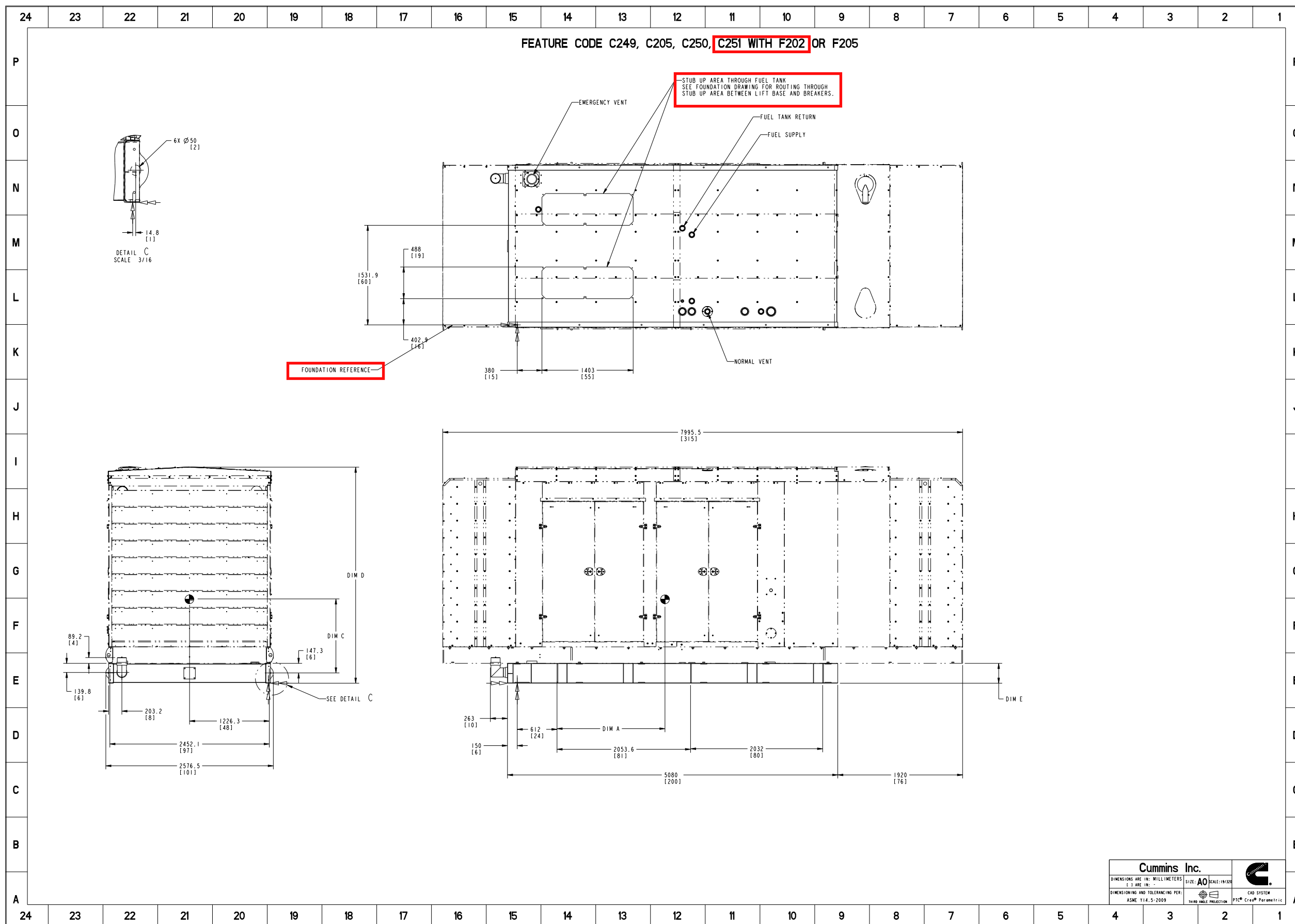
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Drawing Category: **Detail** State: **Released** Sheet 2 of 7

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DIMENSIONS ARE IN: MILLIMETERS		SIZE: A0 (SCALE: 1:50)	
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DIMENSIONING AND TOLERANCING PER: ASME Y14.5-2009		THIRD ANGLE PROJECTION	

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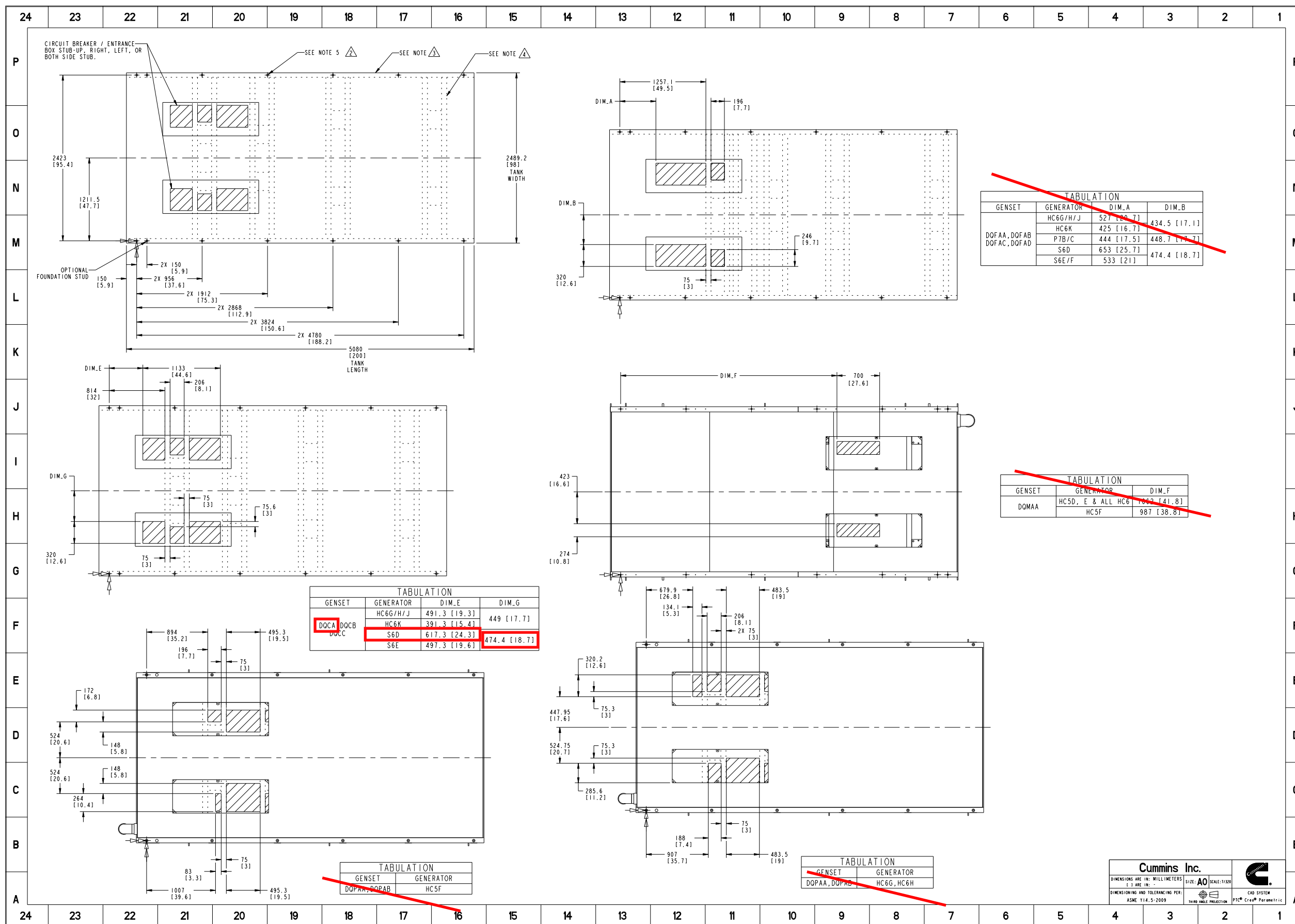


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Drawing Category: **Detail** State: **Released** Sheet 4 of 7

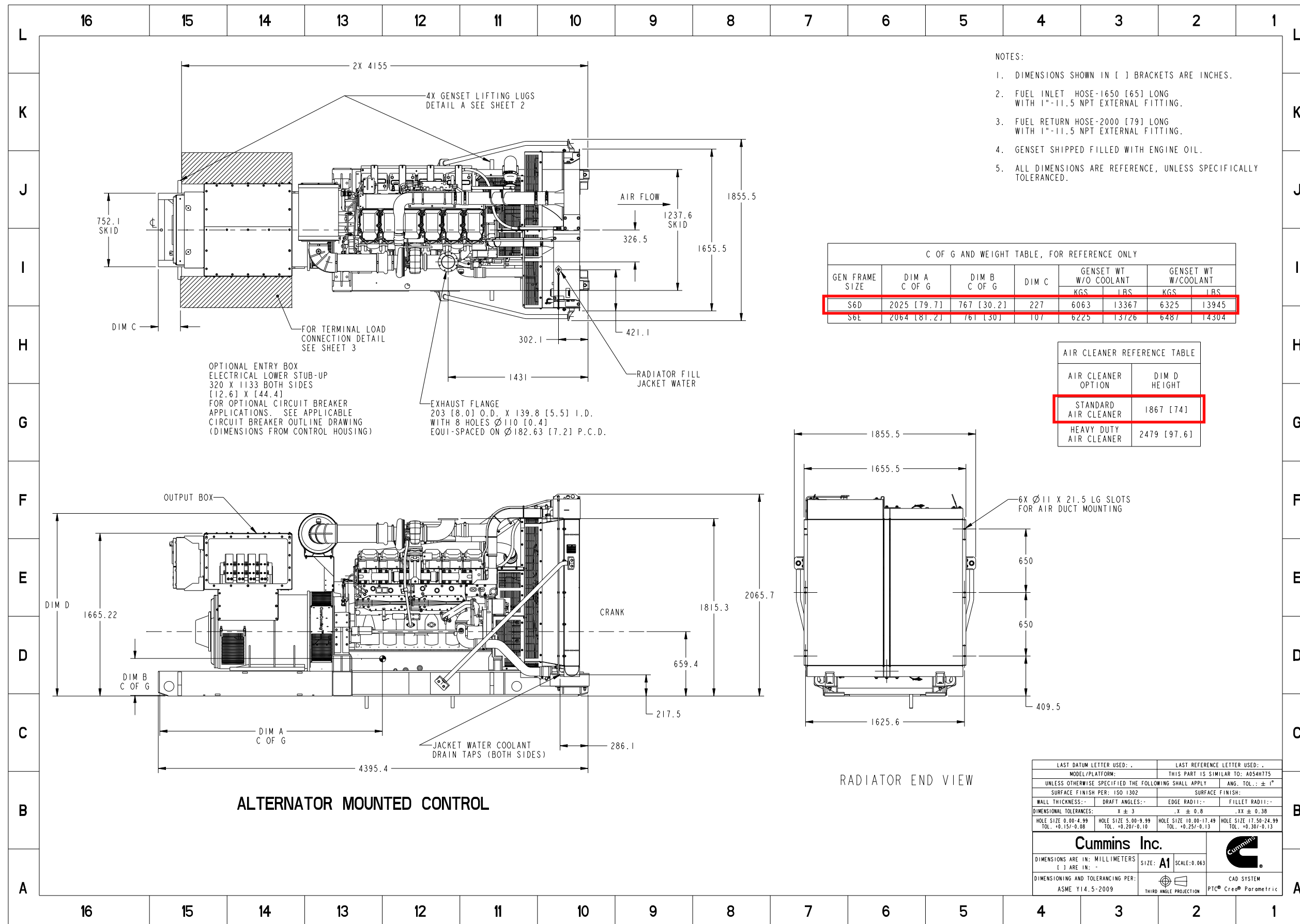
24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1						
TABULATION																													
FUEL TANK WITH LEVEL 2 ENCLOSURE FEATURE CODE F202 OR F205																													
	FUEL TANK FEATURE CODE	FUEL TANK SIZE/WEIGHT/DIM.E	MODEL	GENERATOR	WEIGHT KG (LBS)	CG_DIM "A"	CG_DIM "C"	DIM_D																					
P	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A	C249	200 GALLON 1380 [3040] 254 [110]	DOCA, DOCB DOCC	HC6G	13589	[29959]	2204	[87]	1102	[43]	3272 [1291]			
O																			HC6H	13739	[30290]	2187	[86]	1103	[43]				
N																			HC6J	13894	[30631]	2170	[85]	1103	[43]				
M																			HC6K	4167	[31233]	2140	[84]	1104	[43]				
L																			S6D	13589	[29959]	2204	[87]	1102	[43]				
K																			S6E	13739	[30290]	2187	[86]	1103	[43]				
J																			HC6G	14119	[31126]	2221	[87]	1141	[45]				
I																			HC6H	14356	[31650]	2199	[87]	1143	[45]				
H																			HC6J	14579	[32142]	2178	[86]	1144	[45]				
G																			HC6K	14654	[32306]	2170	[85]	1161	[46]				
F																			P7B	4740	[32497]	2151	[85]	1161	[46]				
E																			P7C	5135	[33367]	2127	[84]	1147	[45]				
D																			S6D	14119	[31126]	2221	[87]	1141	[45]				
C																			S6E	14356	[31650]	2199	[87]	1143	[45]				
B																			S6F	14579	[32142]	2178	[86]	1144	[45]				
A																			HC5D	11580	[25530]	2139	[84.2]	785	[30.9]				
																			HC5E	11730	[25861]	2118	[83.4]	785	[30.9]				
																			HC5F	11871	[26170]	2047	[80.6]	782	[30.8]				
																			HC6G	11930	[26302]	2082	[82.9]	790	[31.1]				
																			HC6H	12169	[26827]	2050	[80.7]	787	[31.0]				
																			HC5F	12481	[27514]	2139	[84.2]						
																			HC6G	12553	[27672]	2154	[84.8]	962	[37.8]				
																			HC6H	12791	[28197]	2174	[85.6]						
																			HC6G	13824	[30447]	2193	[86]	1072	[42]				
																			HC6H	13961	[30778]	2177	[86]	1073	[42]				
																			HC6J	14115	[31119]	2160	[85]	1074	[42]				
																			HC6K	14388	[31721]	2131	[84]	1076	[42]				
																			S6D	13824	[30447]	2193	[86]	1072	[42]				
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	HC6G	14340	[31614]	2210	[87]	1112	[44]																						
	HC6H	14578	[32138]	2188	[86]	1114	[44]																						
	HC6J	14801	[32630]	2168	[85]	1116	[44]																						
	HC6K	14876	[32795]	2160	[85]	1116	[44]																						
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	P7C	5356	[33855]	2119	[83]	1120	[44]																						
	S6D	14340	[31614]	2210	[87]	1112	[44]																						
	S6E	14578	[32138]	2188	[86]	1114	[44]																						
	S6F	14801	[32630]	2168	[85]	1116	[44]																						
	HC5D	11802	[26018]	2129	[83.8]	749	[29.5]																						
	HC5E	11952	[26349]	2108	[83.0]	749	[29.5]																						
	HC5F	12092	[26658]	2039	[80.3]	749	[29.5]																						
	HC6G	12152	[26790]	2072	[81.6]	754	[29.7]																						
	HC6H	12390	[27315]	2050	[80.4]	754	[29.7]																						
	HC5F	12701	[28002]	2133	[83.9]	962	[37.8]																						
	HC6G	12773	[28160]	2147	[84.5]																								
	HC6H	13011	[28685]	2167	[85.3]	961	[37.8]																						
	HC6G	14056	[30988]	2188	[86]	1052	[41]																						
	HC6H	14206	[31319]	2172	[86]	1054	[41]																						
	HC6J	14361	[31660]	2155	[85]	1055	[42]																						
	HC6K	14634	[32262]	2127	[84]	1057	[42]																						
	S6D	14056	[30988]	2188	[86]	1052	[41]																						
	S6E	14206	[31319]	2172	[86]	1054	[41]																						
	HC6G	14585	[32155]	2205	[87]	1092	[43]																						
	HC6H	14823	[32679]	2184	[86]	1094	[43]																						
	HC6J	15046	[33171]	2164	[85]	1097	[43]																						
	HC6K	15121	[33336]	2156	[85]	1097	[43]																						
	P7B	5207	[33526]	2138	[84]	1098	[43]																						
	P7C	5602	[34396]	2115	[83]	1102	[43]																						
	S6D	14585	[32155]	2205	[87]	1092	[43]																						
	S6E	14823	[32679]	2184	[86]	1094	[43]																						
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	HC5E	12197	[26890]	2103	[82.8]	729	[28.7]																						
	HC5F	12337	[27199]	2035	[80.1]	729	[28.7]																						
	HC6G	12397	[27331]	2068	[81.4]	734	[28.9]																						
	HC6H	12590	[27756]	2037	[80.2]	734	[28.9]																						
	HC5F	12947	[28543]	2126	[83.7]																								
	HC6G	13019	[28701]	2140	[84.2]	944	[37.1]																						
	HC6H	13257	[29226]	2160	[85.0]	945	[37.2]																						
	HC6G	14124	[31139]	2181	[86]	1024	[40]																						
	HC6H	14275	[31470]	2165	[85]	1025	[40]																						
	HC6J	14429	[31811]	2157	[85]	1027	[40]																						
	HC6K	14702	[32413]	2121	[84]	1029	[41]																						
	S6D	14124	[31139]	2181	[86]	1024	[40]																						
	S6E	14275	[31470]	2165	[85]	1025	[40]																						
	HC6G	14654	[32306]	2198	[87]	1064	[42]																						
	HC6H	14891	[32830]	2177	[86]	1067	[42]																						
	HC6J	15115	[33322]	2157	[85]	1069	[42]																						
	HC6K	15189	[33487]	2150	[85]	1070	[42]																						
	P7B	5276	[33677]	2092	[82]	1071	[42]																						
	P7C	5670	[34547]	2110	[83]	1075	[42]																						
	S6D	14654	[32306]	2198	[87]	1064	[42]																						
	S6E	14891	[32830]	2177	[86]	1067	[42]																						
	S6F	15115	[33322]	2157	[85]	1069	[42]																						
	HC5D	12115	[26710]	2118	[83.4]	696	[27.4]																						
	HC5E	12275	[27061]	2098	[82.6]	696	[27.4]																						
	HC5F	12406	[27350]	2029	[79.9]	696	[27.4]																						
	HC6G	12466	[27482]	2062	[81.2]	701	[27.6]																						
	HC6H	12704	[28007]	2034	[80.1]	701	[27.6]																						
	HC5F	13015	[29694]	2124	[83.6]																								
	HC6G	13087	[28852]	2138	[84.1]	924	[36.3]																						
	HC6H	13325	[29377]	2158	[84.9]	925	[36.4]																						
*** WEIGHT & CG'S ARE SHOWN WITH F202 STEEL ENCLOSURE, AND STANDARD WET GENSET. ADDITION OF OTHER FEATURES MAY CHANGE THE WEIGHT. FOR F205 ENCLOSURE (ALUMINUM) REDUCE WEIGHT BY 924 (2036).																													
																		Cummins Inc.				DIMENSIONS ARE IN: MILLIMETERS 1:1 ARE IN: -		SIZE: A0 (SCALE: 1:200) DIMENSIONING AND TOLERANCING PER: ASME Y14.5-2009				CAD SYSTEM: PTC® Creo® Parametric	

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Part Number: **A035J956** Part Revision: **J**
 Part Name: **OUTLINE, FUEL SYSTEM**
 Drawing Category: **Detail** State: **Released** Sheet 6 of 7

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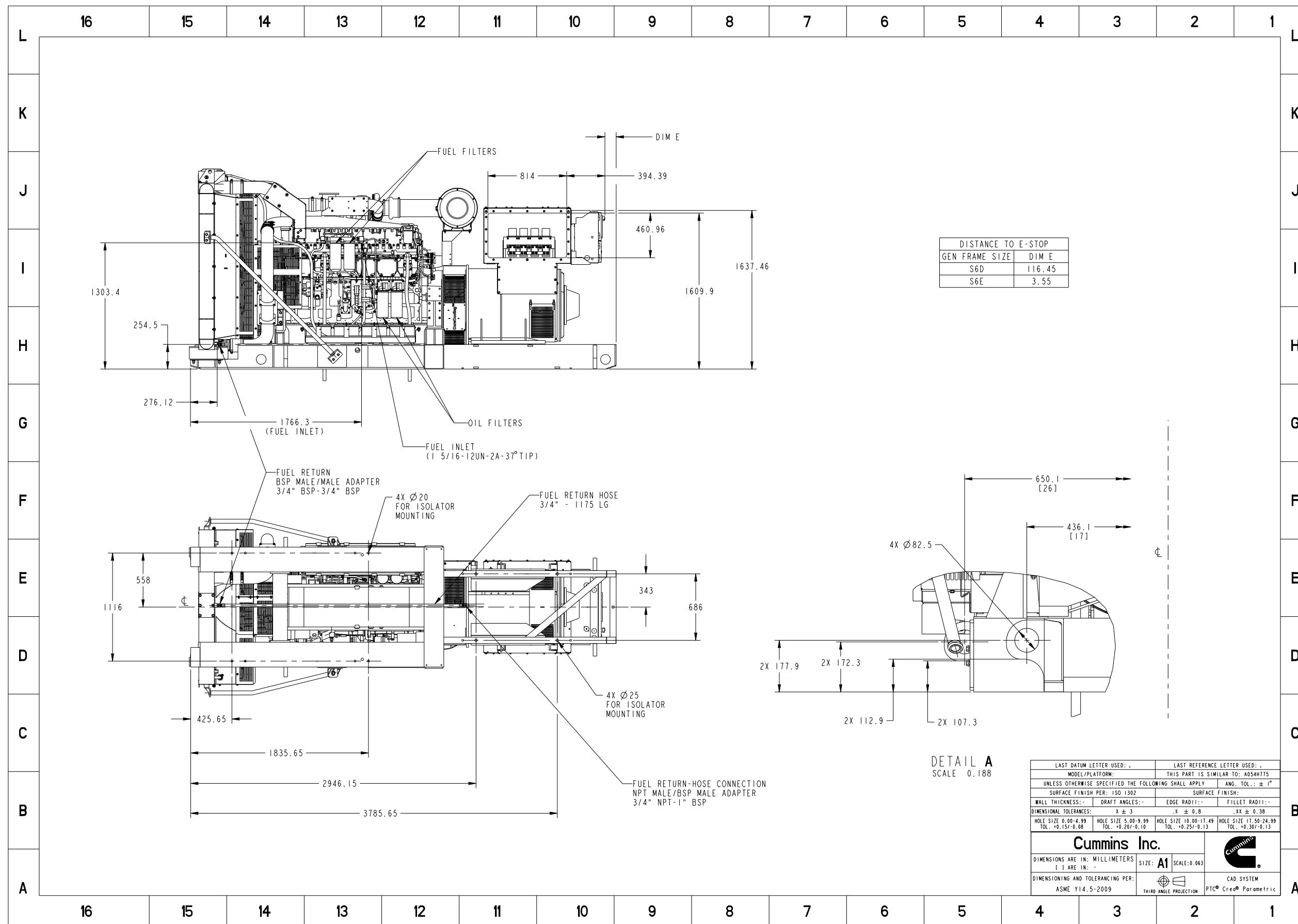


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Part Number: **A062A609** Part Revision: **C**
Part Name: **OUTLINE,GENSET**
Drawing Category: **Detail** State: **Released** Sheet 1 of 4

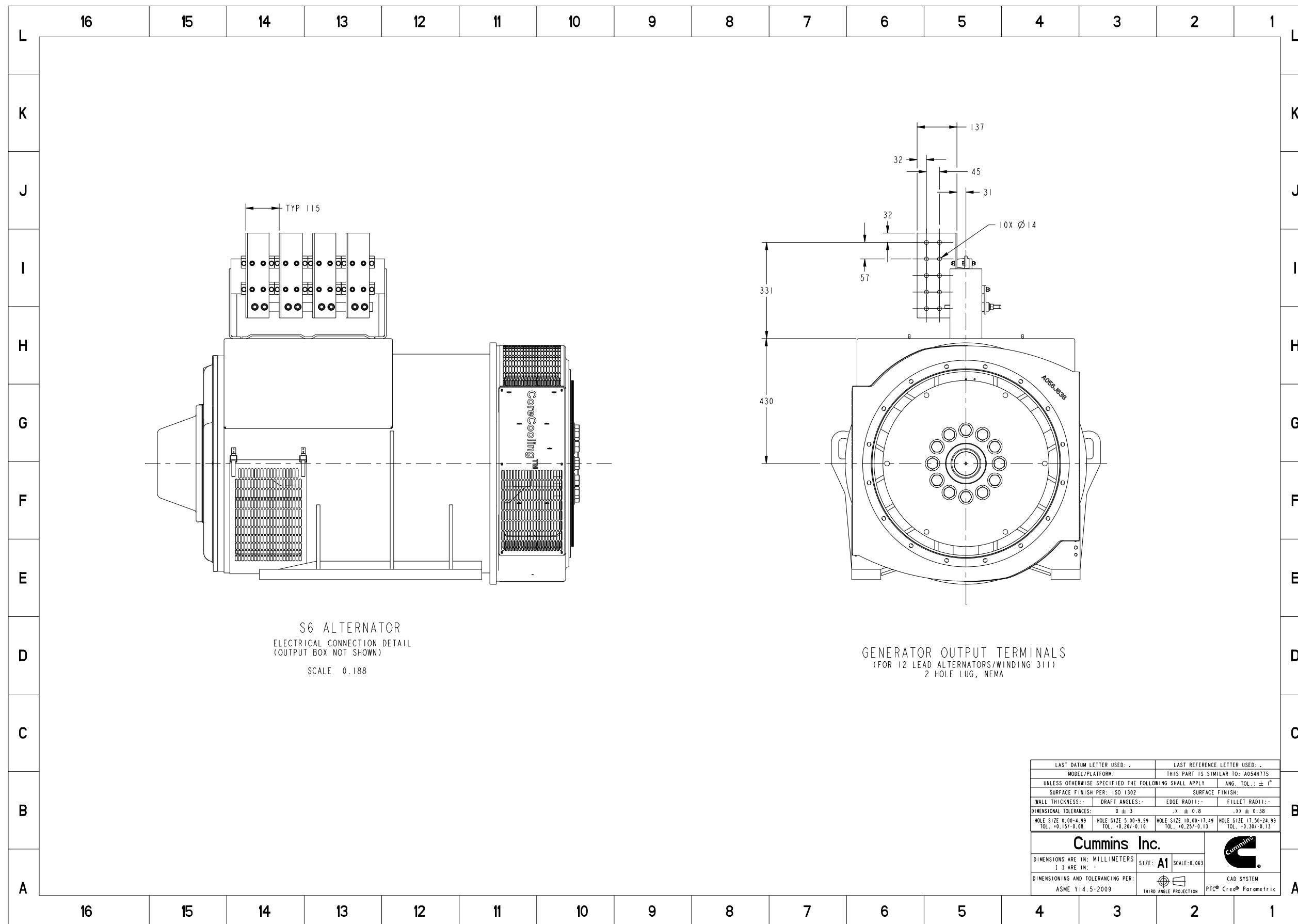


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Part Number: **A062A609** Part Revision: **C**
Part Name: **OUTLINE,GENSET**
Drawing Category: **Detail** State: **Released** Sheet 2 of 4

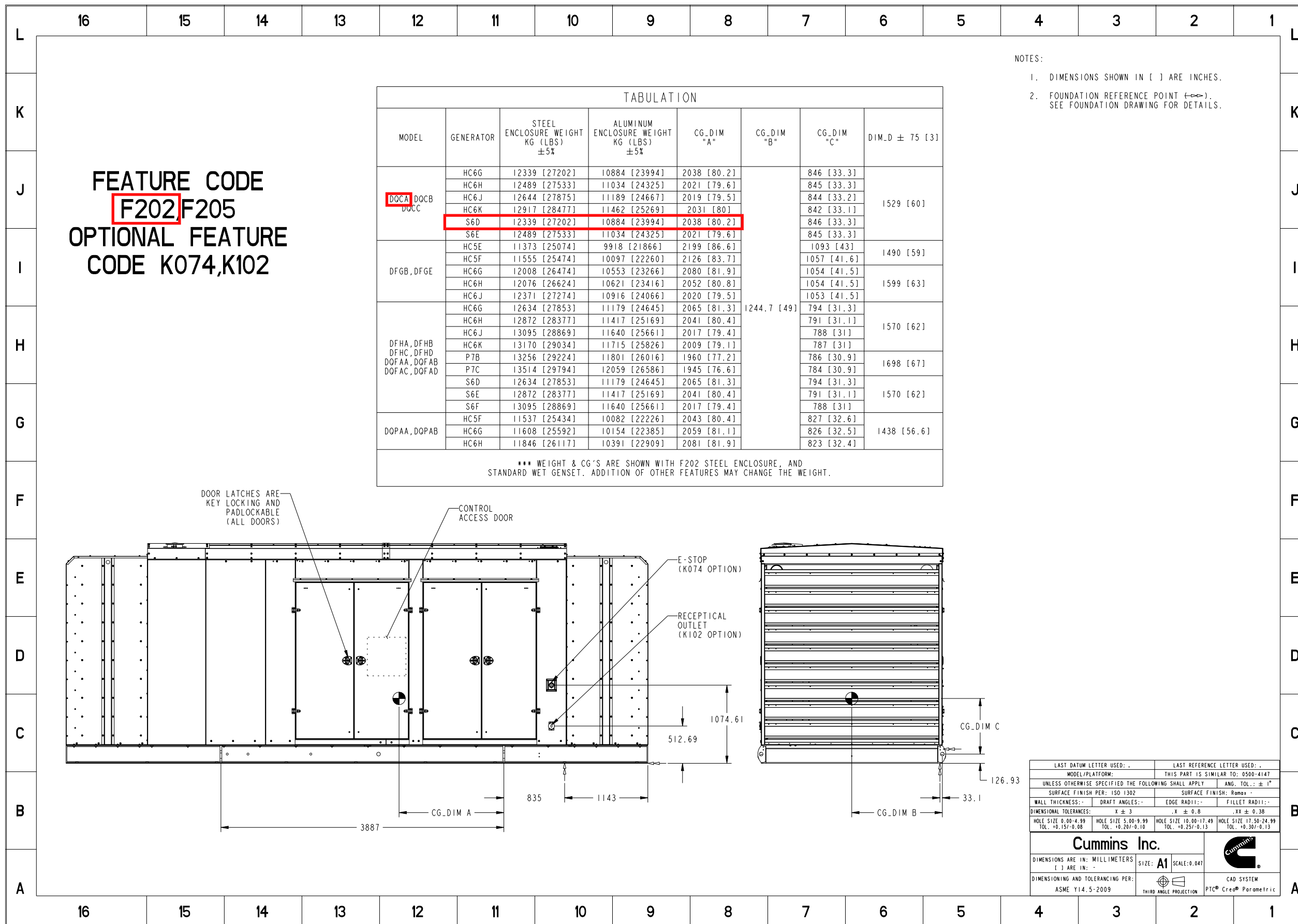


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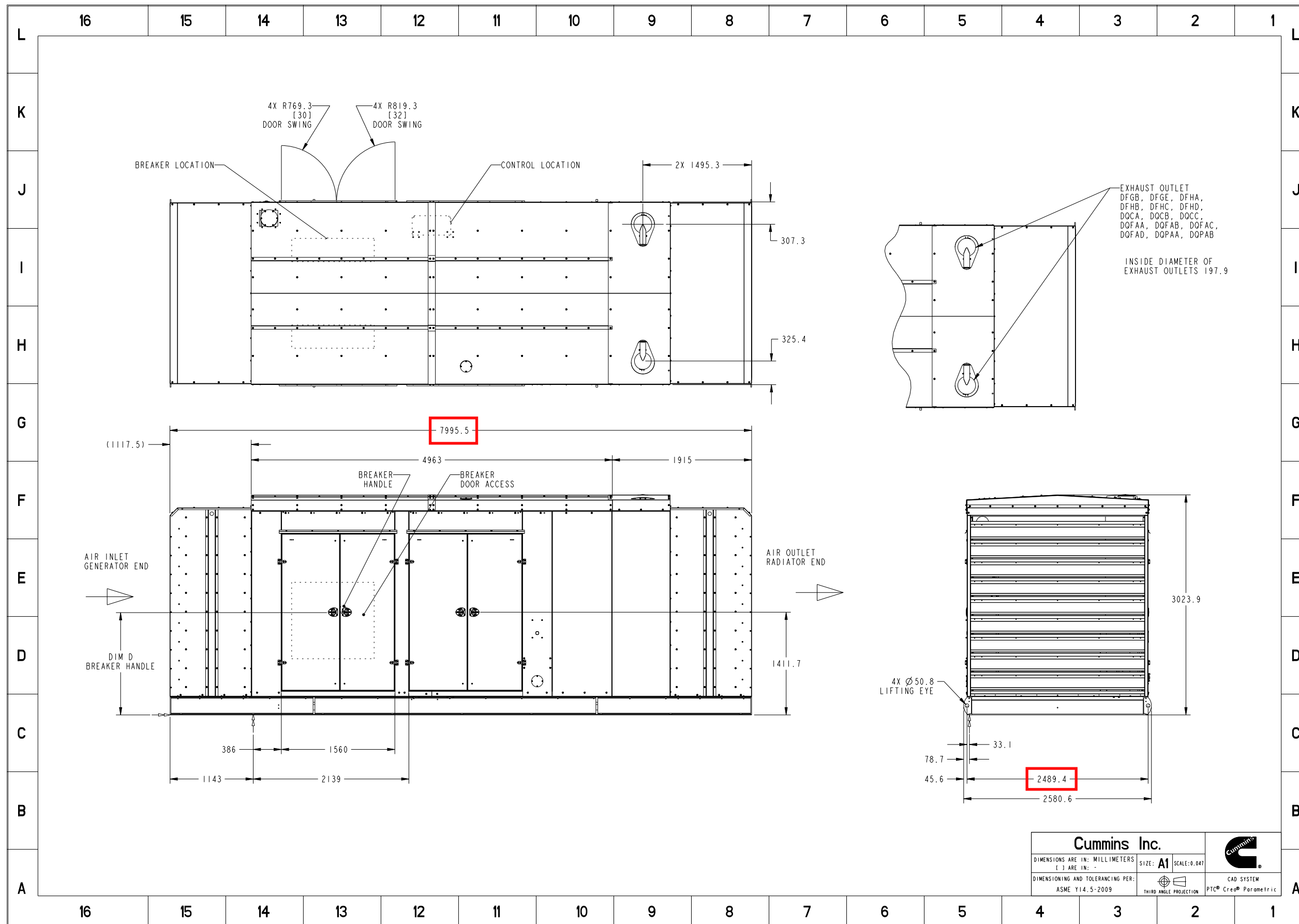
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Part Number: **A062A609** Part Revision: **C**
Part Name: **OUTLINE,GENSET**
Drawing Category: **Detail** State: **Released** Sheet 3 of 4

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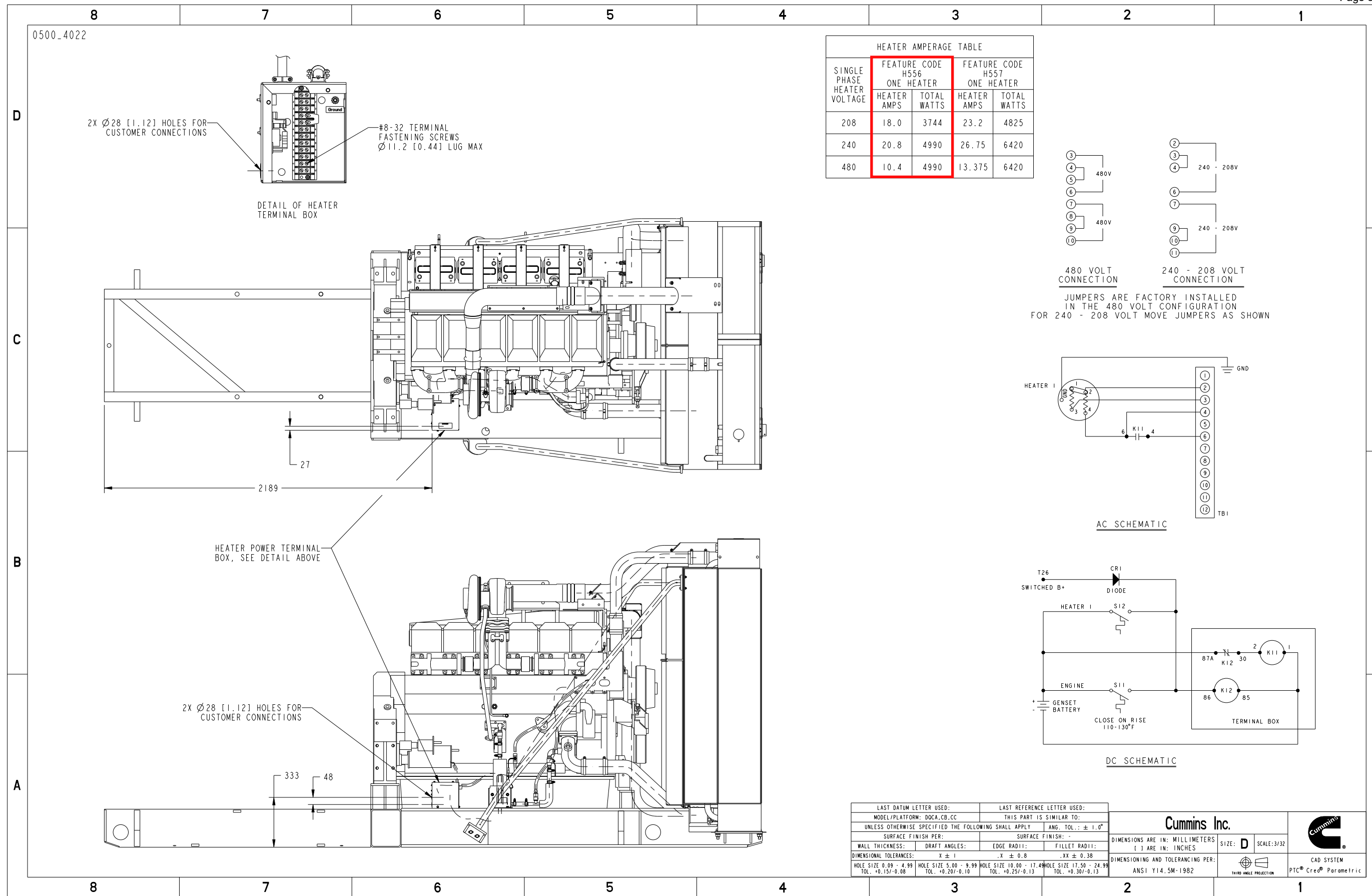
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Part Number: **A034L228** Part Revision: **F**
 Part Name: **OUTLINE,ENCLOSURE**
 Drawing Category: **Detail** State: **Released** Sheet 2 of 3

Cummins Inc.			
DIMENSIONS ARE IN: MILLIMETERS	SIZE: A1	SCALE: 0.047	
DIMENSIONING AND TOLERANCING PER: ASME Y14.5-2009		THIRD ANGLE PROJECTION	CAD SYSTEM: PTC® Creo® Parametric

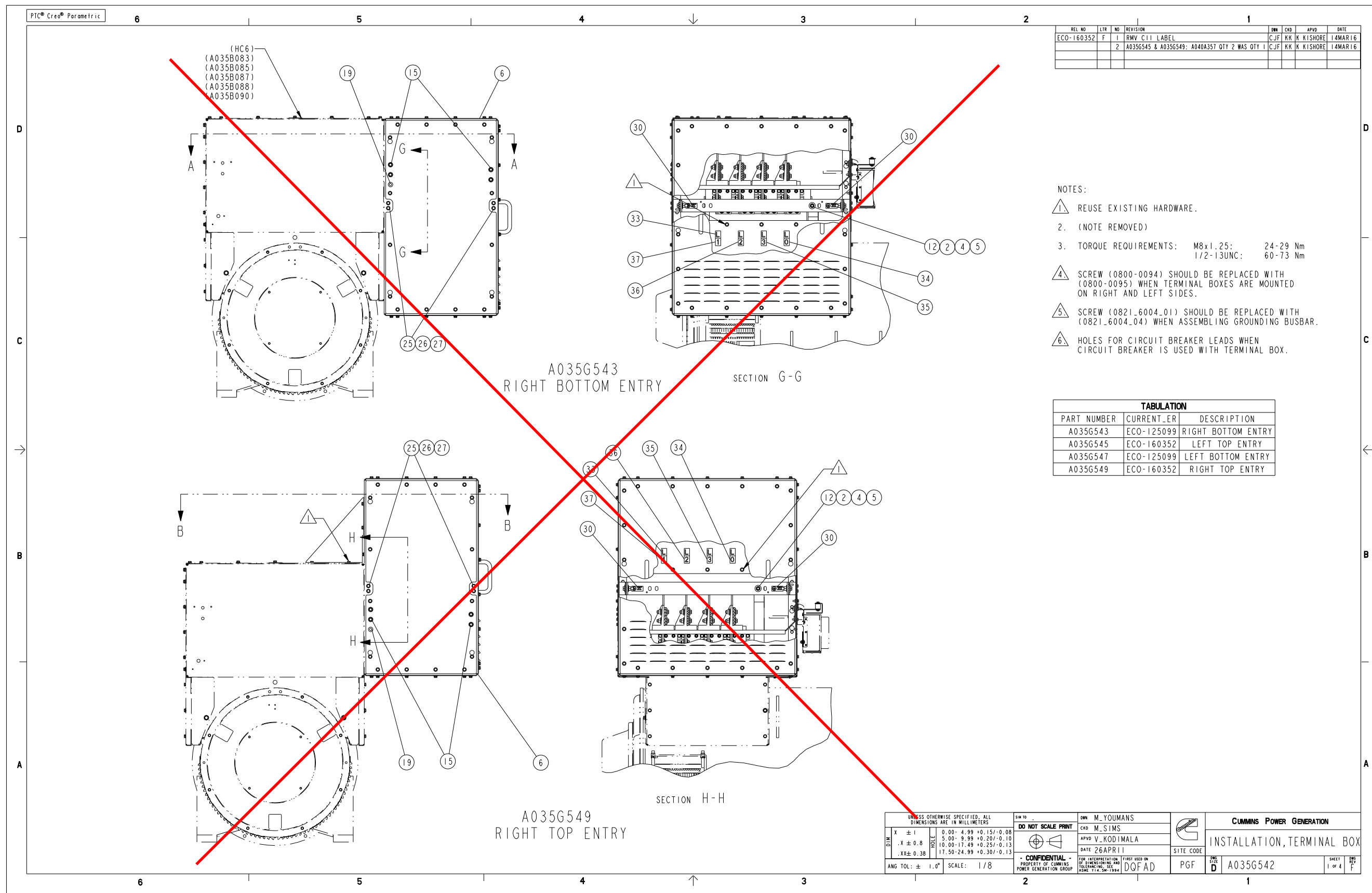


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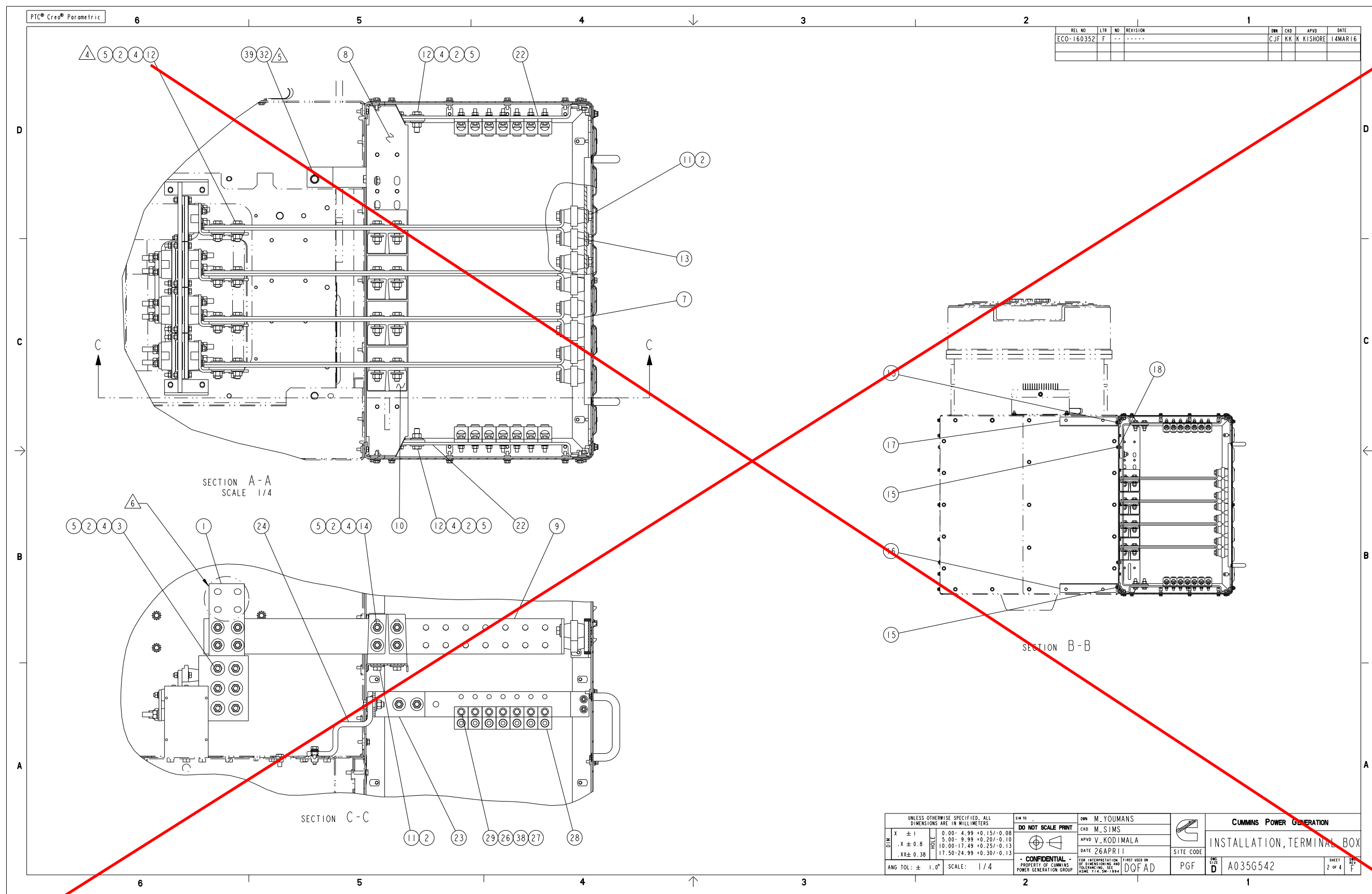
Part Number: **0500-4022** Part Revision: **C**
Part Name: **OUTLINE,HEATER INTERFACE**
Drawing Category: **Detail** State: **Released** Sheet 1 of 2

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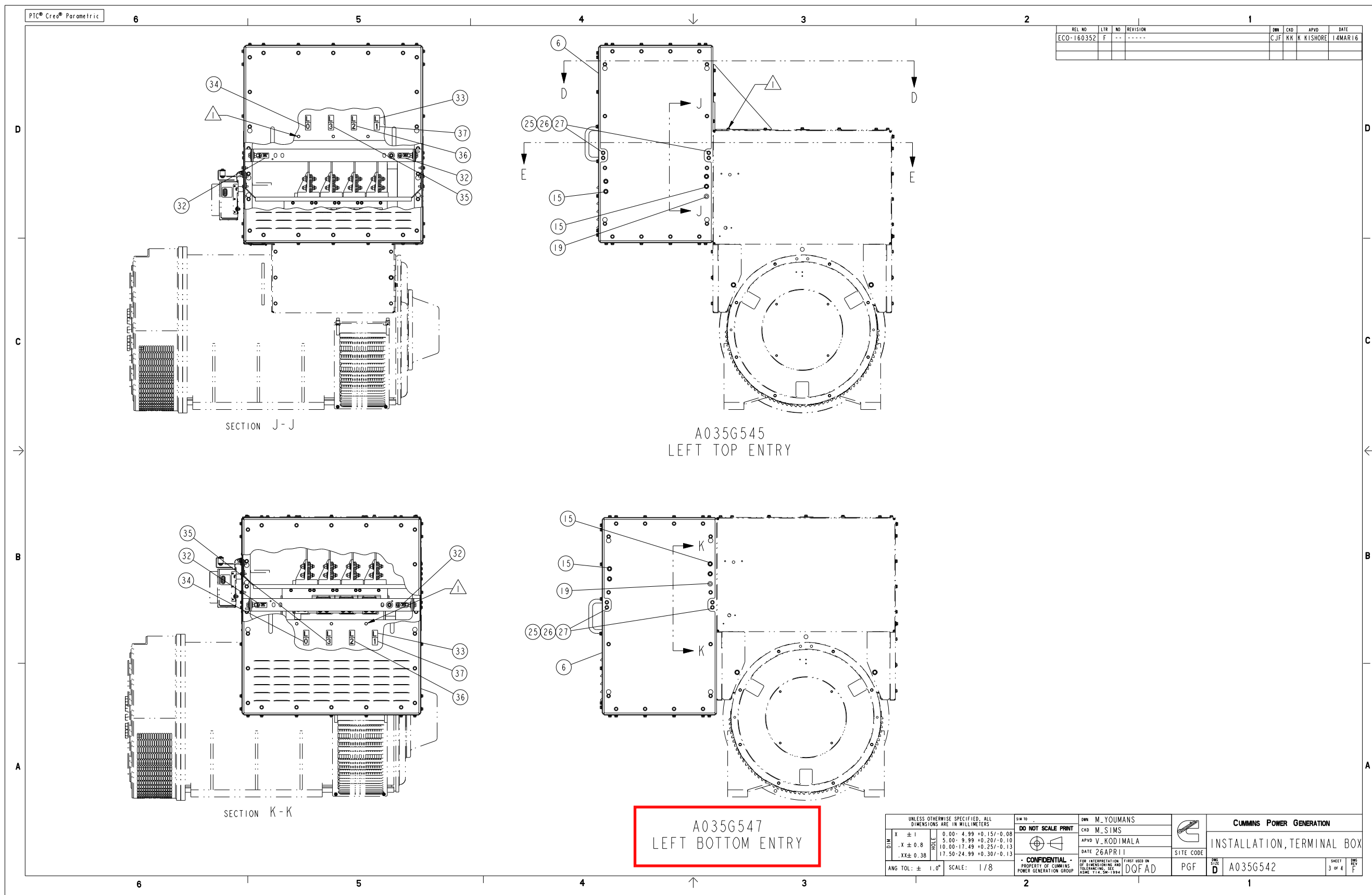
Regulatory Review and Approval is required prior to changing this item per PGG 1-01-01-116. This item impacts compliance with these External Regulations: UL, CSA

Drawing Name: A035G542 Revision: F
Part Name: A035G547 Revision: E
ECO-125099 Sheet 1 of 6



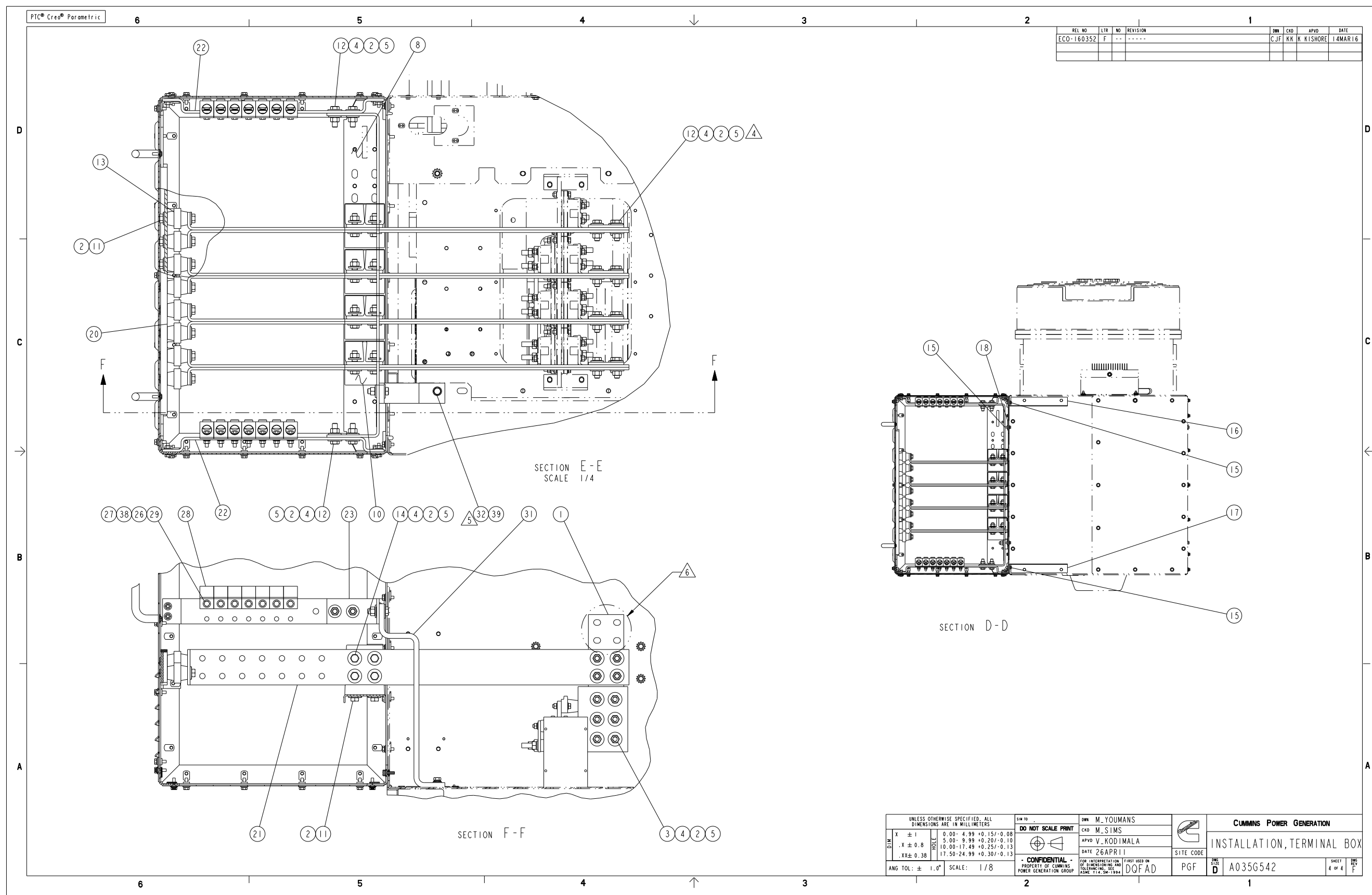
Regulatory Review and Approval is required prior to changing this item per PGG 1-01-01-116. This item impacts compliance with these External Regulations: UL, CSA

Drawing Name: A035G542 Revision: F
Part Name: A035G547 Revision: E
ECO-125099 Sheet 2 of 6



Regulatory Review and Approval is required prior to changing this item per PGG 1-01-01-116. This item impacts compliance with these External Regulations: UL, CSA

Drawing Name: A035G542 Revision: F
Part Name: A035G547 Revision: E
ECO-125099 Sheet 3 of 6



Regulatory Review and Approval is required prior to changing this item per PGG 1-01-01-116. This item impacts compliance with these External Regulations: UL, CSA

Drawing Name: A035G542 Revision: F
Part Name: A035G547 Revision: E
ECO-125099 Sheet 4 of 6

Section 3 ATS Submittal Information



PowerCommand® X-Series Transfer Switch



Service Entrance

PowerCommand® 80 Control
Automatic (Open/Closed Transition)
Non-Automatic

1000 A - 2000 A



Description

The X-Series service entrance transfer switches are designed for operation and switching of electrical loads between the utility and alternate power sources. They can be used in utility-generator set, utility-utility, generator set-generator set, or three-source system (dual standby) application types.

The X-Series service entrance transfer switch meets UL 1008 standards for service entrance applications. The switch contains an UL Listed overcurrent disconnect device on the main incoming utility source, Source 1.

The X-Series transfer switches are available use in applications requiring closed transition operations. By briefly paralleling the two sources (for 100 ms or less), the transfer from the alternate source back to the normal source occurs without power interruption to the loads.

The X-Series transfer switches are suitable for use in emergency, legally required and optional standby applications. The transfer switch monitors both power sources, signals the generator set to start and automatically transfers the load to the alternate power source. When the preferred power source returns and has stabilized, the load is automatically transferred back.

Features

Overcurrent disconnect device – Schneider Electric UL 489 electronically operated air circuit breaker.

PowerCommand® 80 control – A sophisticated, fully featured microprocessor-based control with LED backlit colored LCD display and tactile-feel soft-switches for easy operation and screen navigation. Please see the PowerCommand® 80 control specification sheet for the full description, benefits and features.

3-Position mechanism – The 3-position mechanism allows for independent source actuation (i.e. source transfer is not dependent on the position of the opposing source). The transfer switch is either closed on Source 1, closed on Source 2 or in a center off, neutral position (not closed on either source). Thus, provides safe transfer operation for large stored energy loads by allowing the residual voltage to decay to a safe level before transfer.

Advanced transfer switch mechanism – Patented Blow-On design allows for high survivability in extreme fault current conditions. Actuator designed for high strength locking capability, ensuring electrical contacts remain closed when needed to be closed.

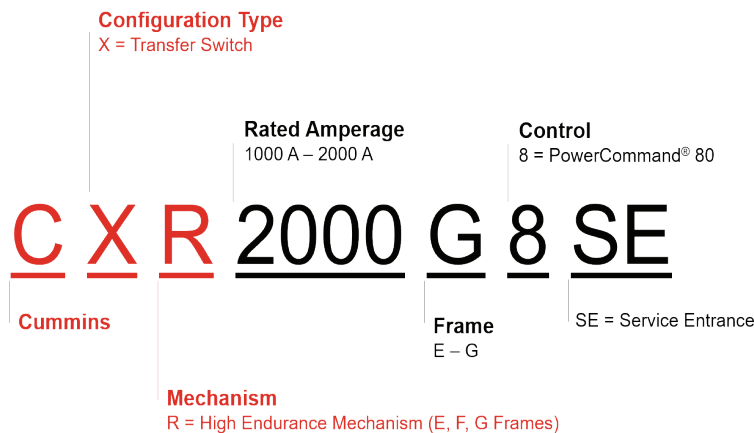
Main contacts – Heavy-duty silver alloy contacts used with multi-leaf arc chutes are rated for motor loads or total system load transfer.

Ease of service and access – Built-in plug-and-play control with minimized point-to-point connections and compatible terminal markings simplify servicing. Access space is ample. Door-mounted controls are field-programmable; no special tools are required.

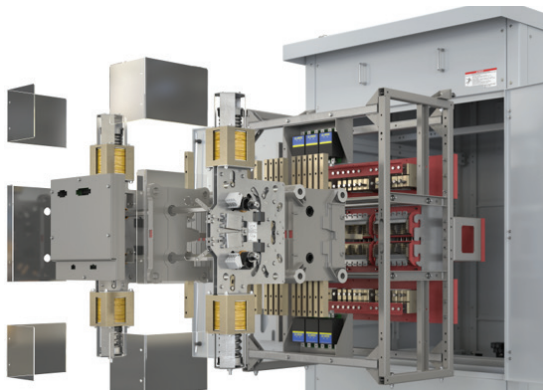
Complete product line – Cummins is a single source supplier with full scope of systems offering, integration and capability.

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

Model naming structure



Transfer switch mechanism



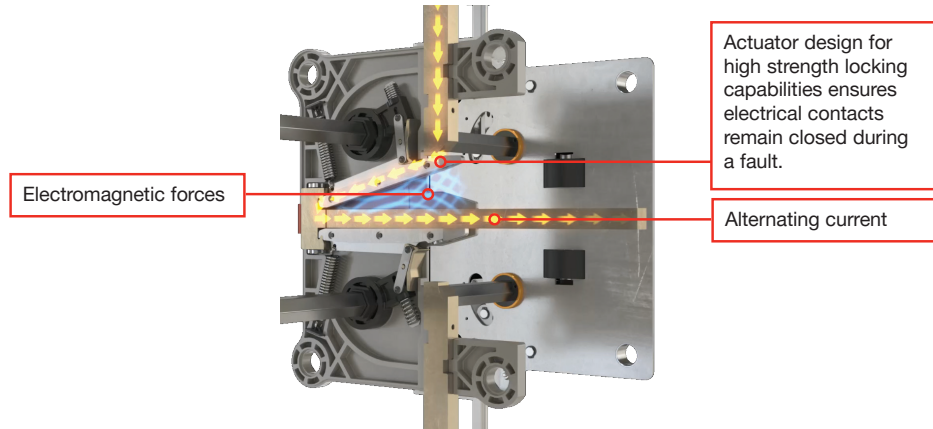
- Transfer switch mechanism is electrically operated and mechanically held in the Source 1 and Source 2 positions. The transfer switch incorporates electrical and mechanical interlocks for open and programmed transition only to prevent inadvertent interconnection of the sources.
- Independent break-before-make action is used for both 3-pole and 4-pole / simultaneously switched neutral. 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). For closed transition,

transition, make-before-break action with the use of sync check allows for uninterrupted power when transferring between available sources.

- 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.
- 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 UL 1008 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.

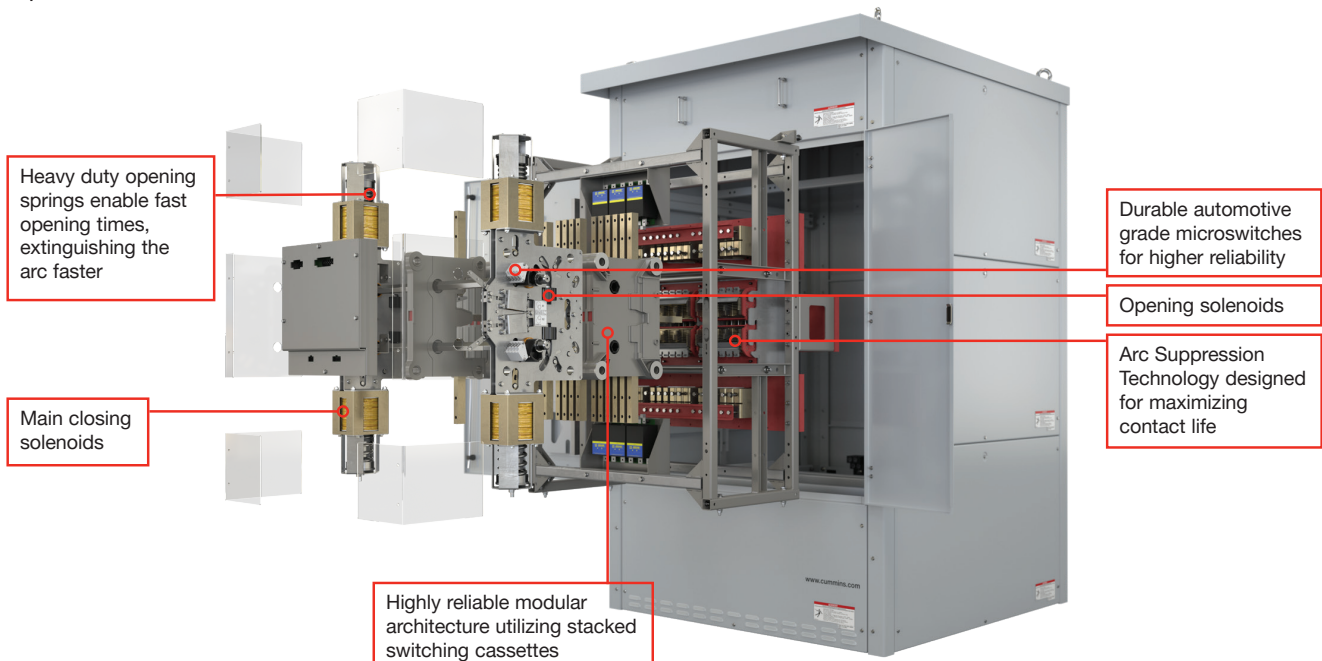
High Endurance Mechanism power cassette

- Cassette design ensures that all phases and neutral are switched at the same speed, providing true four pole operation.
- Encapsulated contactor design increases phase to phase isolation and reduces possibility of arcing between phases.
- New design eliminates a common failure point in many transfer switches by not using electrical connections made of braided metal in the mechanism's current path.
- Simple design with fewer parts minimizes failure modes and maximizes product reliability.



The innovative design of the High Endurance Mechanism

The High Endurance Mechanism (HEM) is designed to minimize the contact damage during a fault condition thus, retaining its capability to carry up to 100 % of its rated load. Electromagnetic forces developed during a fault cause a conventional transfer switch's contacts to blow open, producing destructive arcing that often results in extensive internal damage to the switch. Typically, after a conventional switch experiences a fault, its contacts, arc chutes and in some cases, its control needs to be replaced. On the other hand, the blow-on technology utilized by the HEM, uses that same electromagnetic energy to hold the contacts closed during a fault, practically eliminating arcing, contact damage, and performance degradation. With the high short-time ratings of this innovative blow-on technology, costly repairs or inconvenient downtime can be minimized after a fault.



One control for complete simplicity

- The revolutionary PowerCommand® 80 transfer switch control delivers unrivaled adaptability, connectivity and intelligence.
- Highly advanced and customizable control designed to work in a wide variety of applications.
- Intuitive, easy to navigate HMI with color display.
- Integrated advanced high-accuracy metering with harmonic analysis capability provides a simplified but highly accurate way to monitor and detect power quality problems and also capture energy usage data.
- Integrated automatic load management capability provides the ability to easily set up downstream load management schemes without the need for additional hardware or complicated setup.
- Fully integrated networking solutions without requiring add-on modules (Modbus® RS485 and TCP/IP communications, PowerCommand® Cloud ready).
- Integrated control dc power supply provides the capability to connect up to three independent dc sources.
- Detailed event logging with enhanced fault codes, alert lists, power event history, and source statistics enhances diagnostic capability during service events and provides the ability to meet any reporting requirements.
- Please see the PowerCommand® 80 control specification sheet for the full description, benefits and features.



Specifications

Voltage rating	Up to 600 Vac, 50 or 60 Hz.
Arc interruption	Multiple leaf arc chutes provide dependable arc interruption.
Neutral bar	A full current-rated solid neutral bar with lugs is optional on enclosed 3-pole transfer switches.
Auxiliary contacts	Two isolated contacts (one for each source) indicating switch position are provided for customer use. Contacts are normally open, and close to indicate connection to the source. Wired to terminal block for easy access. Rated at 10 A continuous and 250 Vac maximum. An additional two contacts are available with the premium Customer I/O option. UL recognized, and CSA-certified.
Operating temperature	-13 °F (-25 °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 6,600 ft (2,012 m) without derating
Surge withstand ratings	Voltage surge performance and testing in compliance with the requirements of IEEE C62.41 (Category B3) and IEEE C62.45.
Total transfer time (source-to-source)	Will not exceed 6 cycles at 60 Hz with normal voltage applied to the actuator and without programmed transition enabled.
Manual operation*	Transfer switch mechanisms are equipped with means to manually transfer. All sources must be de-energized before manual operation is attempted.
Overcurrent disconnect device	Service entrance switches have electrically operated UL 489 Listed drawout air circuit breakers. The breakers feature an advanced digital control unit with Ground Fault Protection (GFP) and Energy Reduction Maintenance Settings (ERMS).

* See Operator Manual for further details.

UL 1008 short-circuit withstand/closing (WCR)

Frame			Amperage Rating (A)				Integrated Circuit Breaker		
			1000	1200	1600	2000	Part Number	Schneider Electric Device Short Name	Control Unit/Control Unit Commercial Reference
E	0.05 s [3-cycle] (kA)	All WCR values are at 600 Vac and below	85	85			A063T867	MTZ2 12H	
F	0.05 s [3-cycle] (kA)			85	85		A063L693	MTZ2 16H	Micrologic 6.0 X LSIG/LV847608
G	0.05 s [3-cycle] (kA)				100	100	A063H507	MTZ2 20L	

All 0.05 seconds (3-cycle) ratings are the short-circuit WCR.

The MasterPact MTZ Circuit Breaker Catalog number is 0614CT1701 (Micrologic 6.0 Control Unit Tripping Curves found in catalog).

The MasterPact MTZ MicroLogic 6.0 Control Unit User Guide number is DOCA0102EN-06.

Mechanical cable lug capacity

Frame	Amperage Rating (A)	Maximum Cables per Phase	Size	Part Number	OEM Model Number	Manufacturer
E	1000-1200	4		0332-3036	PB4-750	
F	1200-1600	6	1/0 - 750 MCM	A059T589	D3984	ILSCO
G	1600-2000	8		A058P583	D3980	

All lugs are 90 °C rated and accept copper or aluminium wire unless indicated otherwise.

Refer to the latest NFPA 70 Article 310 - Conductors for general wiring for the ampacity calculations.

Compression cable lug capacity

Size (MCM)	Maximum Cables per Phase			Part Number	Manufacturer/Model Number
	E Frame	F Frame	G Frame		
750	4	5	6	A058X606*	BURNDY/YA39A5

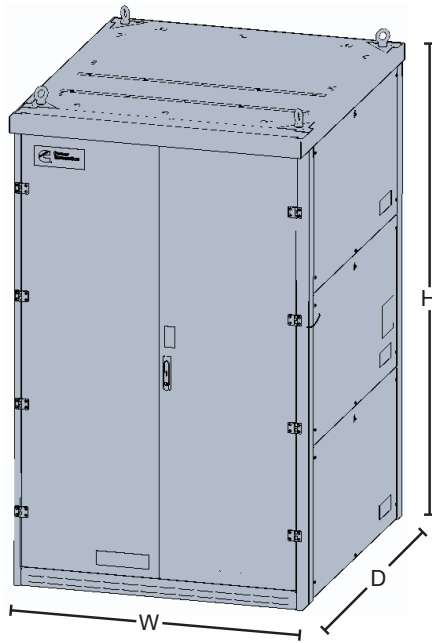
* Configurable option.

Additional hardware is required for compression lug installation. Refer to lug installation drawing for more details.

All lugs are 90 °C rated and accept copper or aluminium wire unless indicated otherwise.

Refer to the latest NFPA 70 Article 310 - Conductors for general wiring for the ampacity calculations.

Enclosure dimensions



Frame	Amperage Rating (A)	Measurements	NEMA Rated Enclosures		
			Type 1	Type 3R	
E	1000-1200	Dimension (mm/in)	W	1812.0/71.3	
			D	1486.6/58.5, 1650.0**/65.0**	1594.0/62.8, 1650.0**/65.0**
			H	2359.0*/92.9*	
		Approximate Weight _{max} (kg/lb)	1346.3/2968.0		
F	1200-1600	Dimension (mm/in)	W	1812.0/71.3	
			D	1486.6/58.5, 1650.0**/65.0**	1594.0/62.8, 1650.0**/65.0**
			H	2359.0*/92.9*	
		Approximate Weight _{max} (kg/lb)	1430.6/3154.0		
G	1600-2000	Dimension (mm/in)	W	1812.0/71.3	
			D	1486.6/58.5, 1650.0**/65.0**	1594.0/62.8, 1650.0**/65.0**
			H	2359.0*/92.9*	
		Approximate Weight _{max} (kg/lb)	1533.1/3380.0		

* Dimension includes additional heights for lifting hooks provided with the enclosure.

** Dimension considers additional depths for a roof that overhangs from the front wall of the enclosure. Refer to the outline drawings for more details.

Type 3R enclosure is secure front designed for greater protection from the elements and vandals.

Enclosure access for cable installation and maintenance

Frame	Amperage Rating (A)	Access	
		Type 1	Type 3R
E	1000-1200	Rear	
F	1200-1600		
G	1600-2000		

Ensure minimum working space clearance is maintained in front of the transfer switch per NEC. Additional front clearance is needed to remove the mechanism. Refer to the outline drawing. All frames allow for top and bottom cable entry.

X-Series drawing part numbers

Frame	Amperage Rating (A)	Outline Drawing	WCR Label	Wiring Diagram			
		Type 1 & 3R	0.05 s [3-cycle]	Open/Delayed Transition	Closed Transition	Interconnect U-G* & U-U**	Interconnect G-G****
E	1000-1200	A064N818	A063N544	A054H094	A060Z676	A062F795***	A062F805
F	1200-1600	A064N819					
G	1600-2000	A064N820	A063N546				

* U-G stands for Utility-Generator Set

** U-U stands for Utility-Utility

*** Drawing contains wiring for NEC Start Integrity

**** G-G stands for Generator Set-Generator Set

Product codes for G-Frame submittal detail

Model

- CXRGSE_CXR1600SE 1600 A, G frame
- CXRGSE_CXR2000SE 2000 A, G frame

Transfer modes

- CXRGSE_A077-7 Open transition/in-phase [STANDARD]
- CXRGSE_A078-7 Open transition/time delayed (programmed)
- CXRGSE_A079-7 Closed transition
- CXRGSE_A088-7 Non-automatic transition

Poles

- CXRGSE_A028-7 3-poles [STANDARD]
- CXRGSE_A029-7 4-poles, switched neutral

Application

- CXRGSE_A035-7 Utility to generator set [STANDARD]
- CXRGSE_A036-7 Utility to utility
- CXRGSE_A037-7 Generator set to generator set

Frequency

- CXRGSE_A044-7 60 Hz [STANDARD]
- CXRGSE_A045-7 50 Hz

Phase

- CXRGSE_A091-7 3-phase, 4-wire [STANDARD]

Voltage

- CXRGSE_R021-7 208 V
- CXRGSE_R026-7 480 V
- CXRGSE_R027-7 600 V

Cabinet

- CXRGSE_B001-7 Type 1: Indoor use, provides some protection against dirt (similar to IEC type IP30) [STANDARD]
- CXRGSE_B002-7 Type 3R: Intended for outdoor use, provides some protection from dirt, rain and snow (similar to IEC type IP34)

Standards

- CXRGSE_A046-7 UL 1008/CSA certification [STANDARD]
- CXRGSE_A080-7 IBC seismic certification
- CXRGSE_A085-7 OSHPD seismic pre-approval certification
- CXRGSE_S043-7 UL 1008 listing

Control

- CXRGSE_C109-7 PC80 Control [STANDARD]

Control options

- CXRGSE_D403-7 Integrated high accuracy power quality metering
- CXRGSE_L214-7 Load shed from standby source
- CXRGSE_M079-7 Integral control power supply

Customer Input/Output

- CXRGSE_M076-7 Standard - 5 digital inputs, 6 digital outputs, 2 dry-contact outputs
- CXRGSE_M077-7 Premium - includes Standard plus 2 digital inputs, 6 digital outputs, 2 dry-contact output

Protective relays

- CXRGSE_M045-7 IEEE protective relays, 62PL parallel timer, 86 lock-out
- CXRGSE_M047-7 IEEE Protective Relays, 62PL parallel Timer, 86 lock-out, 32R reverse power with 3-phase sensing

Cable Lugs

- CXRGSE_N069-7 No cable lugs, bus stabs [STANDARD]
- CXRGSE_N070-7 Cable lugs, mechanical, 1/0-750 MCM
- CXRGSE_N071-7 Cable lugs, compression, 750 MCM

Power quality meter

- CXRGSE_D011-7 Utility grade PQM, 4-wire, for wye systems

Surge protective device (SPD)

- CXRGSE_M060-7 S1 SPD, 120 kA, for wye systems
- CXRGSE_M064-7 S1 SPD, 240 kA, for wye systems
- CXRGSE_M068-7 S2 SPD, 120 kA, for wye systems
- CXRGSE_M072-7 S2 SPD, 240 kA, for wye systems

Miscellaneous

- CXRGSE_M080-7 Anti-condensation cabinet heater

Build Location

- CXRGSE_Z111-7 Manufactured/Assembled in U.S.

Warranty

- CXRGSE_G004-7 2-years, comprehensive [STANDARD]
- CXRGSE_G007-7 5-years, comprehensive
- CXRGSE_G014-7 3-years, comprehensive
- CXRGSE_G015-7 10-years, comprehensive

Shipping

- CXRGSE_A050-7 Packing - wooden crate [STANDARD]
- CXRGSE_A051-7 Packing - export box






Request for quotation (RFQ)

- CXRGSE_Z555-7 Nonconfigurable spec [ETO]

Accessories

- Refer to the Parts Manual

Codes and Standards

	All switches are UL 1008 Listed with UL 50E Type Rated cabinets and UL Listed CU-AL terminals.		All switches comply with NEMA ICS 10 .
	All switches are UL 1008 Listed for Canadian requirements.		All switches comply with IEEE 446 Recommended Practice for Emergency and Standby Power Systems.
	All switches comply with NFPA 20, 70, 99 and 110 (Level 1) .	RoHS	All switches are RoHS compliant
NEC®	Suitable for use in emergency, legally required and Standby and Critical Operations Power Systems (COPS) applications per NEC 700, 701, 702 and 708 .	ISO	All switches are designed and manufactured in facilities certified to ISO 9001 .
IBC®	All switches are IBC 2018 listed.	OSHPD	All switches are certified to CBC 2019 .
EMC	All switches have been tested to meet the following Electromagnetic Compatibility (EMC) standards: EN 61000-4-3 Radiated Immunity EN 61000-4-4 Electrical Fast Transients EN 61000-4-2 Electrostatic Discharge EN 61000-4-6 Conducted Immunity EN 61000-4-8 Power Frequency Magnetic Field EN 61000-6-2 Generic Immunity Standard		



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NAS-6544-EN PD0000531 (Revised: 08/2021)



PowerCommand® 80 Transfer Switch Control



X-Series Transfer Switches



Description

The revolutionary PowerCommand® 80 Transfer Switch Control delivers unrivaled adaptability, connectivity and intelligence. Designed by Cummins experts, the PowerCommand® 80 is a single integrated control - no extra modules are needed. All functionalities can easily be implemented as needed without add-on hardware. In addition, the control features a highly customizable customer inputs/outputs which can be tailored to suit a wide range of application requirements.

The control human machine interface (HMI) includes a LED backlit LCD display with tactile-feel soft-switches for easy operation and screen navigation. All data on the control can be viewed by scrolling through screens with the navigation keys. Forward and backward navigation functionality is also provided. The control displays the current active fault, fault occurrences and time-ordered history of the 256 previous faults with respect to Real Time Clock Stamp and Engine Running Time.

Features

Integrated advanced high accuracy metering – Built-in capability to measure and display power, energy and total harmonic distortion (THD) provides a simplified but highly accurate way to monitor and detect power quality problems and capture energy usage data.

Integrated Automatic Load Management (ALM) – Built-in capability to easily setup downstream load management schemes for up to two loads without the need for additional hardware or complicated setup.

Integrated network communication – Built-in communication capability and cloud connectivity without need for external add-on communications modules: Modbus RTU RS485 connection (1 serial port), Modbus TCP/IP Ethernet connection (2 ethernet ports) and external USB port for service tool interface.

PowerCommand Cloud™ ready – The control is fully mapped to cloud interface for a plug-and-play experience.

Integrated control DC power supply – The power supply board is integrated into the main control module. The three diode isolated inputs provide the capability to connect up to three independent DC sources.

Diagnostics and reporting – Detailed event logging with enhanced fault codes, alert lists, power event history, and source statistics enhances diagnostic capability during service events and provides the ability to meet any reporting requirements.

Ease of service and access – Built-in plug-and-play control with minimized point-to-point connections and compatible terminal markings simplify servicing.

Complete product line – Cummins is a single source supplier with full scope of power system solutions, integration and service capability, from paralleling to system level controls, switchgear and remote connectivity.

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

PowerCommand® 80 Control

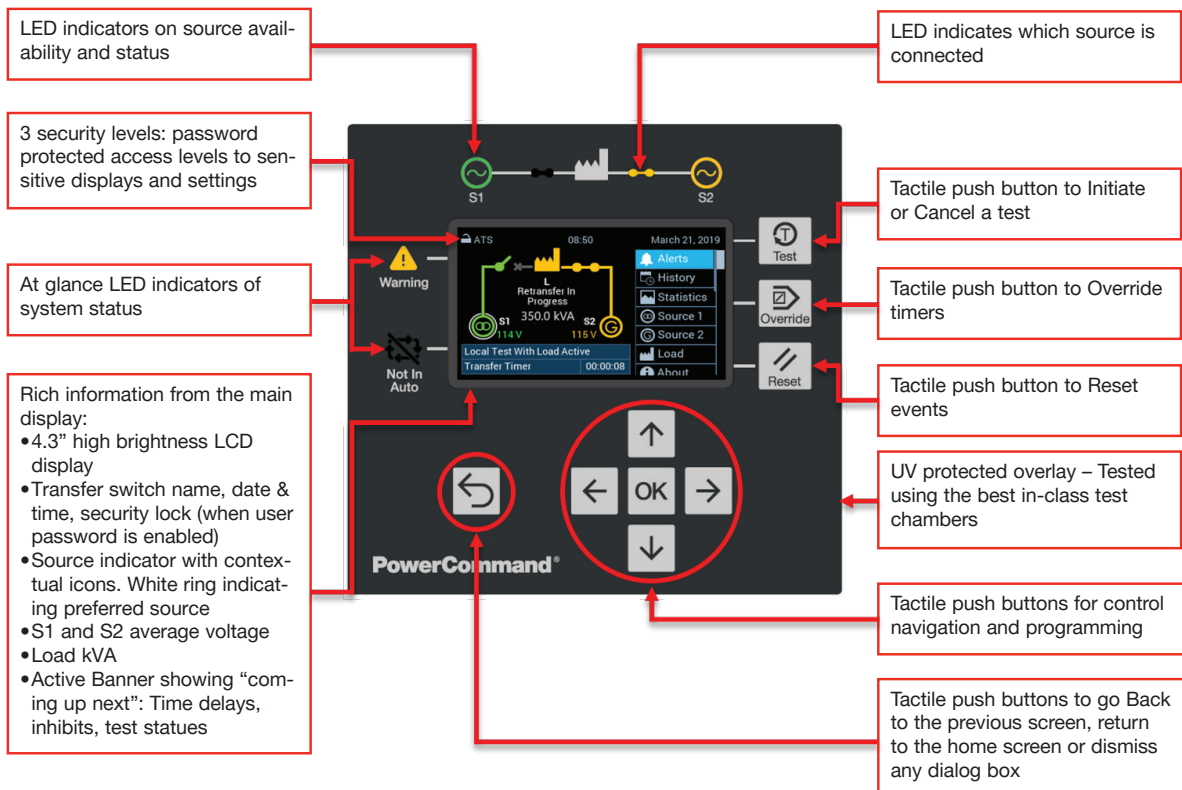


Isometric (ISO) projection: front views



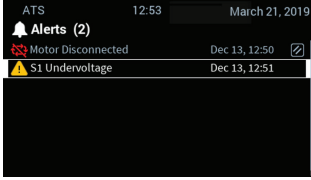
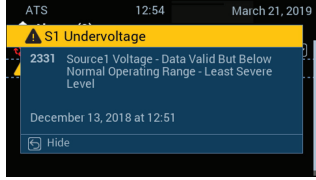
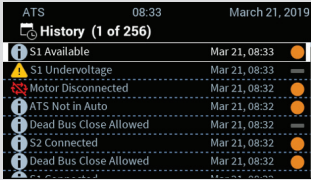
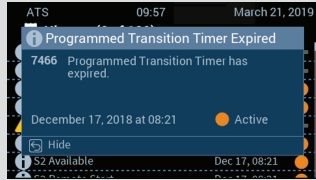
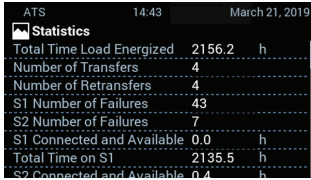
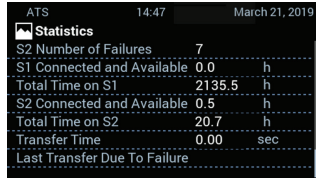
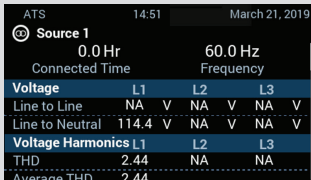
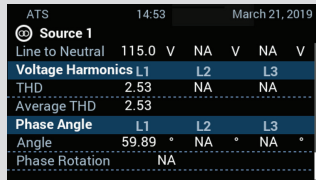
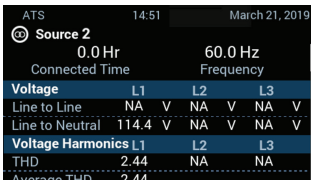
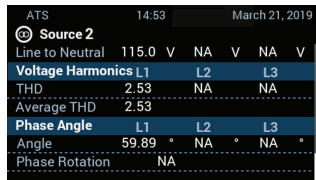
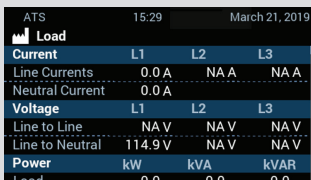
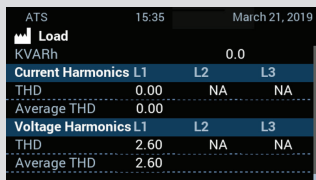
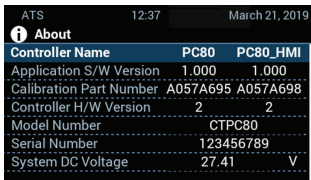
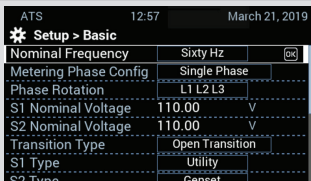
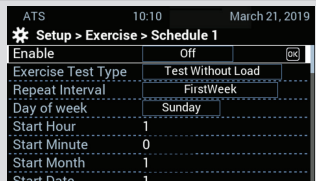
Isometric (ISO) projection: rear view

Human Machine Interface (HMI) capabilities



- Additional LCD display features include:
- 480x(RGB)x272 pixels (4.3") color graphics
 - Ability to set brightness
 - Backlight timers
 - Ability to test all the LEDs

Human Machine Interface (HMI) main screens

Main Menu	Description	Screen Image	
Alerts	Gives information about the active system events in chronological order.		
History	Shows the system event list with date and time of all the warnings, alerts, etc. Up to 256 events are captured. Data is maintained through power outage.		
Statistics	Shows collected source data.		
Source 1	Gives information regarding Voltage, Current, Voltage Harmonics and Phase Angle of Source 1		
Source 2	Gives information regarding Voltage, Current, Voltage Harmonics and Phase Angle of Source 2		
Load	Gives information regarding Current, Voltage, Power, Energy, Current Harmonics and Voltage Harmonics		
About	Shows the information regarding system current version and model.		
Setup	Provides system configuration options. Setup screens are password protected.		

Event logging:

- Log and Display critical events on front screen
- Record's real time stamped events including s, min, h, date. Data will be maintained through a power outage
- User trend data is logged (20-30 pieces of information captured)

Control functions

Transfer Inhibit

When transfer inhibit external input is active, the control does not automatically transfer the transfer switch to a standby source even when the preferred source fails.

Retransfer Inhibit

When retransfer inhibit external input is active, the control does not automatically retransfer the transfer switch to a preferred source even when the preferred source returns.

Override

Override is an external signal which allows the user to bypass the following features: Transfer Inhibit, Retransfer Inhibit, Transfer Time Delay, Retransfer Time Delay, Engine Start Time Delay.

For example, if override is active while Transfer Inhibit is active, then, Transfer Inhibit is bypassed/ignored and control proceeds with transfer operation.

Automatic Load Management (ALM)

The control has the integrated capability to automatically add or shed loads downstream of the transfer switch by controlling feeder breakers. When the load is energized by a generator set, this functionality can help prevent overloading the source and ensure only the higher priority loads remain energized.

Load sequencing:

- Load Add
 1. Block – Load 1 and Load 2 will be added simultaneously to the source after the duration of the initial time delay load add (configurable delay)
 2. Sequential – Load 1 then load 2 will be added sequentially after predefined time delays
- Load shed – This type of load sequencing automatically removes low priority loads. If the generator set frequency drops below a threshold for a predefined duration, load is shed before and overload or underfrequency fault occurs. When the generator source is stable again, the loads are automatically added back sequentially.

Mechanism Failures

The control implements event codes for the four types of mechanism failures:

- Preferred/Standby source fail to close
- Preferred/Standby source fail to open

When a source connection is expected to open/close and the operation does not occur in expected time, the fault is declared and control runs into not-in-auto mode.

Real Time Clock

This feature is used by the control for fault and event time stamping and as a reference for exerciser schedules and exception schedules.

Unexpected Operation

Unexpected operation is the undesired behavior in which switch opens or closes without an active command. The feature then outputs an event code to indicate that an unexpected operation has occurred. For example, preferred/standby source unexpected operation.

Test - Remote, Local, Network

Test feature allows the user to automatically test the standby source and the transfer switch. The test command can be issued from three sources (remote, local, network).

The test has following types available:

- Preferred/Standby
- Without load
- With load
- Test button

Transfer to standby – This feature keeps the load connected to the standby source for the specified duration, regardless of the preferred source availability. Transfer to standby is canceled automatically if the standby source fails.

Fail to Disconnect

This feature monitors the time for which both the sources are paralleled (in a closed transition type method) and declares a fault (failed to disconnect) if the sources stay paralleled for time more than fail to disconnect time limit.

Preferred Source Selection

Using this feature the user can swap the priority of the sources which are preferred and standby.

Source Inversion

Using this feature the user can swap the physical source designations of Source 1 and Source 2 on the transfer switch such that there is no need for rewiring source connections if source inversion is needed. Source inversion is simple via the HMI settings in the field.

Exerciser

This feature helps to prevent the typical electro-mechanical issues that could arise if equipment is not operated for long period of time. Up to 12 exercise schedules and up to 12 exception schedules are supported.

There are two sub features: exerciser schedules and exception schedules. Exerciser schedules are the schedules in time which initiate the test (automatic testing of standby source) at the scheduled time intervals. Exception schedules are set up to bypass any predefined exerciser schedules. For example, an automatic test on the standby source is initiated for every time interval defined in an exerciser schedule. If an exception schedule has been defined for a certain time and date, the exerciser scheduled test will not occur during that period.

Control functions

Source Availability

This feature monitors the frequency and voltage sensors on the preferred and standby sources to determine and declare the availability status of the two sources, irrespective of which source is connected to the load. It declares the states as event codes. Preferred/Standby Available - active inactive.

Configurable Input/Output

This feature allows the configurable inputs to be configured to perform any of the below assignable input functions and configurable output pins to perform any of the below assignable output functions:

Assignable input functions:

- Remote Test
- Remote Override
- Transfer to Standby
- Transfer Inhibit
- Retransfer Inhibit
- Battery Charger Fault
- Preferred Source Shutdown Fault Active
- Standby Source Shutdown Fault Active
- External Fault (1 input with customerizable message)
- Load Shed
- Dual Standby Start Inhibit

Assignable output functions:

- Preferred Source Start
- Standby Source Start
- Preferred Source Available
- Standby Source Available
- Preferred Source Connected
- Standby Source Connected
- Test Active
- Fault Code Functions (up to 4 can be assigned)
- Elevator Pretransfer
- Synchronizer Enable
- Load Contact 1
- Load Contact 2

Voltage sensing

3-phase sensing on Source 1 and Source 2 (up to 600 Vac with no need for additional PTs).

Current sensing

3-phase and neutral CT connection.

Dual Standby

This is a configuration type of how a system can be designed with two ATS; one for the primary source (called lead/local ATS) and the other for the pair of standby sources (called upstream ATS).

Automatic changeover

This feature is primarily for a GEN-GEN prime power application. System switches the preferred and standby sources, after every calibrated number of hours. The purpose of the automatic changeover is to balance loads on generator set in a gen/gen application. It will change the source priority based on the Automatic Source Priority Changeover Threshold Hrs. Automatic Changeover functionality is used for Prime Power applications, when the generator set run for extended time intervals.

Alternate Preferred Source

This feature is primarily for a GEN-GEN dual standby configuration. The control switches the preferred source every time the upstream ATS is requested to start one of the generator sets, and power the loads; when enabled using the configuration. This feature is used to keep the running time equally distributed between both generator sets.

Non-Automatic Mode

Non-Automatic switches are used only for optional standby applications. The non-automatic transfer mode can be set in either as local/remote using a 2-position switch installed on the transfer switch. Local operation allows the user to transfer/retransfer based on the position of a non-auto-mode source selection switch position. Remote operation allows an external input signal to transfer/retransfer. No automatic exercisers or tests are performed while in this mode.

Real-time power source data

The control displays real-time power source data for three phase, two phase, single phase configurations (Source 1 and Source 2).

Time Delays

The following adjustable time delays are built into the transfer switch control. External modules to accomplish these delays are not required.

- Normal to Emergency Time Delay (adjustable from 0 to 15,549 s)
- Time Delay Retransfer (adjustable from 0 to 15,549 s)
- Program Transition Time Delay: (adjustable duration of 0 seconds to 600 s)
- Time Delay Engine Start (adjustable from 0 to 3,600 s)
- Time Delay Engine Cooldown (adjustable from 0 to 3,600 s)
- Elevator Time Delay (adjustable from 0 to 600)
- Elevator Post Transfer Time Delay (adjustable from 0 to 600 s)

Control functions

Integrated high accuracy power quality metering

Capable of monitoring the following parameters:

- Current (A)
- Total Power (kW)
- Reactive Power (kvar)
- Apparent Power (kVA)
- Power Factor (PF)
- Energy (kWh)
- Reactive Energy (kvarh)
- Apparent Energy (kVAh)
- THD (%)

Load metering capability is fully integrated into the main transfer switch control. Additional external modules are not required.

The following parameters are measured and displayed with the minimum accuracies listed in parenthesis:

- Line and Neutral Current (0.25 %)
- Line to Line and Line to Neutral Voltage (0.25 %)
- Frequency (0.03 Hz)
- Power Factor (0.25 %)
- Apparent Power (0.25 %)
- Active Power (0.25 %)
- Reactive Power (0.50 %)
- Apparent Energy (0.50 %)
- Active Energy (0.50 %)
- Reactive Energy (0.70 %)
- Total Harmonic Distortion (THD), Current (<1.00 %)
- Average THD, Current (<1.00 %)
- Total Harmonic Distortion (THD), Voltage (<1.00 %)
- Average THD, Voltage (<1.00 %)
- Phase angle
- Phase rotation

Supported applications

Application Types

- Utility - Utility
- Utility - Generator Set
- Generator Set - Generator Set
- Three-Source System (Dual Standby)

Communications

The PowerCommand® 80 Transfer Switch Control features a fully integrated network capability and cloud connectivity without need for external add-on communications modules.

Features include:

- Integrated Modbus® RTU RS485 connection (1 isolated serial port)
- Integrated Modbus® TCP/IP Ethernet connection (2 Ethernet ports)
- Exterior USB port for service tool interface mounted on the transfer switch door
- PowerCommand Cloud™ Ready – a fully mapped cloud remote monitoring interface for plug-and-play experience

Safety

Service connection is accessible from the outside of the transfer switch cabinet (accessible without being exposed to high voltage).

Source Statistics

The control displays the following source statistics:

- Total Time Load Energized
- Number of Transfers
- Number of Retransfers
- S1 Number of Failures
- S2 Number of Failures
- S1 Connected and Available
- Total Time on S1
- S2 Connected and Available
- Total Time on S2
- Transfer Time
- Last Transfer Due to Failure

Events

The control displays information on up to 256 events displayed in chronological order, beginning with the most recent event, about either source. The event information shall include the following:

- Fault codes
- Active time delays
- Power system changes
- Tests and exercises
- User-driven inputs (e.g., override, transfer inhibit)

Protection

Phase rotation sensing

- Time Delay: 100 ms

Under-Voltage sensing

- 3-phase normal, 3-phase emergency
- Accuracy: ± 2 %
- Pick-Up: 85 % to 98 % of nominal voltage
- Drop-Out: 75 % to 98 % of Pick-Up setting
- Drop-Out Time Delay: 0.1 s to 1.0 s

High Neutral Current sensing

- Sensor Enable: On/Off
- Warning Threshold: 100 % to 150 %
- Warning Delay: 10 s to 60 s

Overvoltage sensing

- 3-phase normal, 3-phase emergency
- Accuracy: ± 2 %
- Pick-Up: 95 % to 99 % of Drop-Out setting
- Drop-Out: 105 % to 135 % of nominal voltage
- Drop-Out Time Delay: 0.5 s to 120.0 s

Over/under frequency sensing

- Normal and emergency
- Accuracy: ± 0.05 Hz
- Pickup: ± 5 % to ± 20 % of nominal frequency
- Drop-Out: ± 1 % beyond Pick-Up setting
- Drop-Out Time Delay: 0.1 s to 15.0 s

Voltage imbalance sensing

- Drop-Out: 2 % to 10 %
- Pick-Up: 90 % of Drop-Out setting
- Time Delay: 2.0 s to 20.0 s





Loss of single phase detection

- Time Delay: 100 ms

Environment

Operating Temperature Range	Control operates over an ambient temperature range: -40 °C to 70 °C. (Surrounding the control) LCD display operates over an ambient temperature range of -20 °C to +70 °C without heaters, 85 % RH (absolute humidity limit 46 g/m ³).
Storage Temperature Range	The control operates after being exposed to Storage Temperatures in the range of -40 °C to 80 °C. The LCD display functions after being exposed to storage temperatures of -30 °C to 80 °C.
Altitude	The control operates over the altitude range of 0-5000 m above sea level.
Ingress Protection	Control as installed in the transfer switch enclosure complies with NEMA 4X and IP65 at the switch level. Providing resistance from rain, sand, moisture, dust and snow.

Codes and Standards

	<p>UL Recognized to both UL 1008 and CSA C22.2 No. 178.1. Evaluated against UL 508 and UL 50E – NEMA 4X for use on the UL 1008 Listed X-Series transfer switches.</p>		<p>Capable of being used on systems compliant with NFPA 20, 70, 99 and 110 (Level 1).</p>
	<p>The control is IEEE C37.90.2 certified. Capable of being used on IEEE 446 compliant systems; Recommended Practice for Emergency and Standby Power Systems.</p>		<p>Control and display as installed in a transfer switch enclosure complies with NEMA 4X and IP65 at the transfer switch level - if the transfer switch enclosure is also NEMA 4X & IP65 compliant.</p>
<p>RoHS</p>	<p>The control is RoHS compliant.</p>	<p>NEC®</p>	<p>Capable of being used on systems suitable for use in emergency, legally required and Standby and Critical Operations Power Systems (COPS) applications per NEC 700, 701, 702 and 708.</p>
<p>EMC</p>	<p>The control is tested to meet the the following CE Electromagnetic Compatibility (EMC) standards for EN 61000 series (electromagnetic compatibility) and EN 55011 (electromagnetic emissions):</p> <ul style="list-style-type: none"> EN 61000-4-3 Radiated Immunity EN 61000-4-4 Electrical Fast Transients EN 61000-4-2 Electrostatic Discharge EN 61000-4-6 Conducted Immunity EN 61000-4-8 Power Frequency Magnetic Field EN 61000-6-2 Generic Immunity Standard EN 55011 Class B Radio-Frequency Disturbance CISPR 16-2-3 Disturbance and Immunity 		



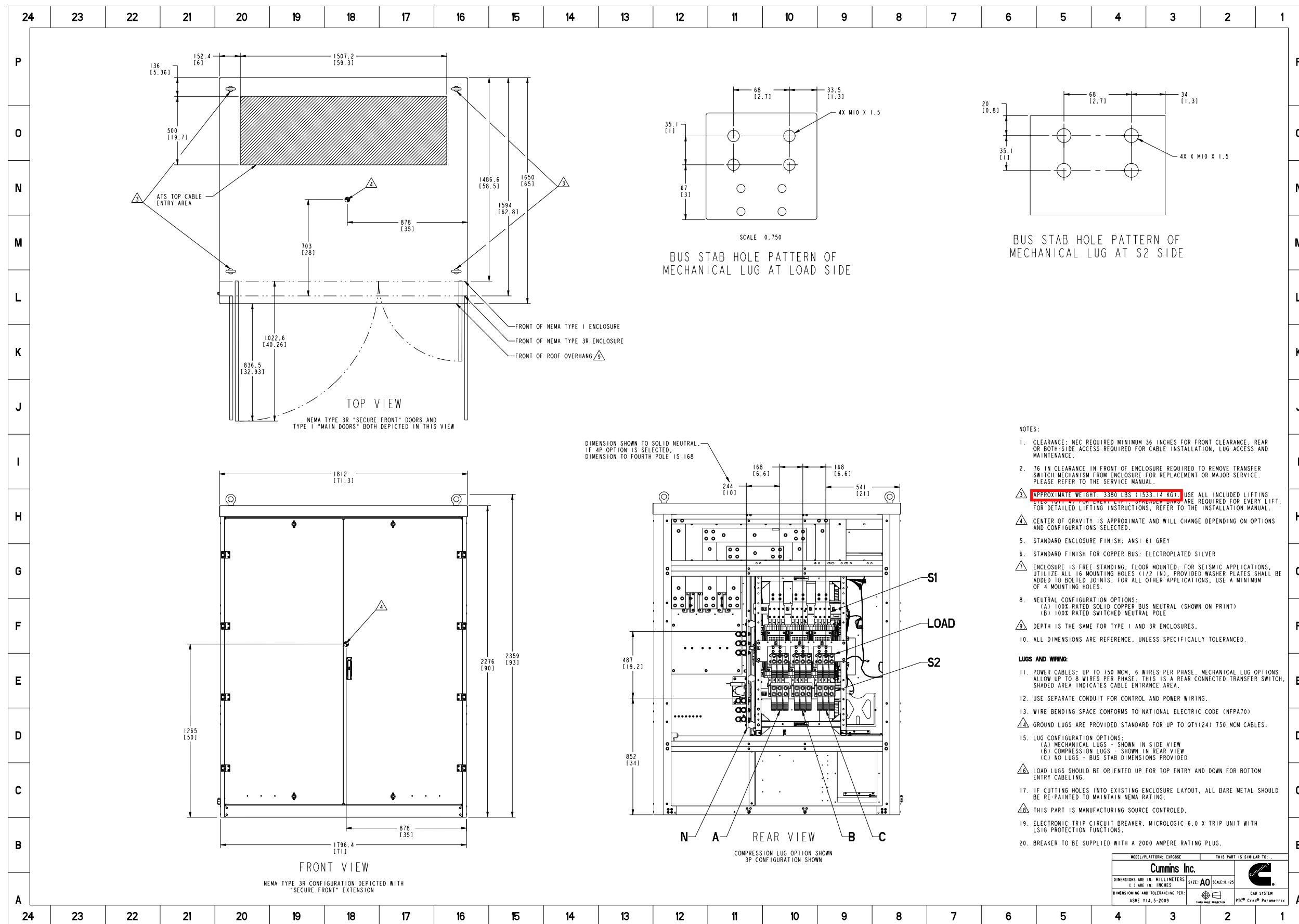
For more information, please contact your local Cummins distributor or visit cummins.com

Our energy working for you.™

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NAS-6543-EN PD00000530 (Last revised: 12/2020)



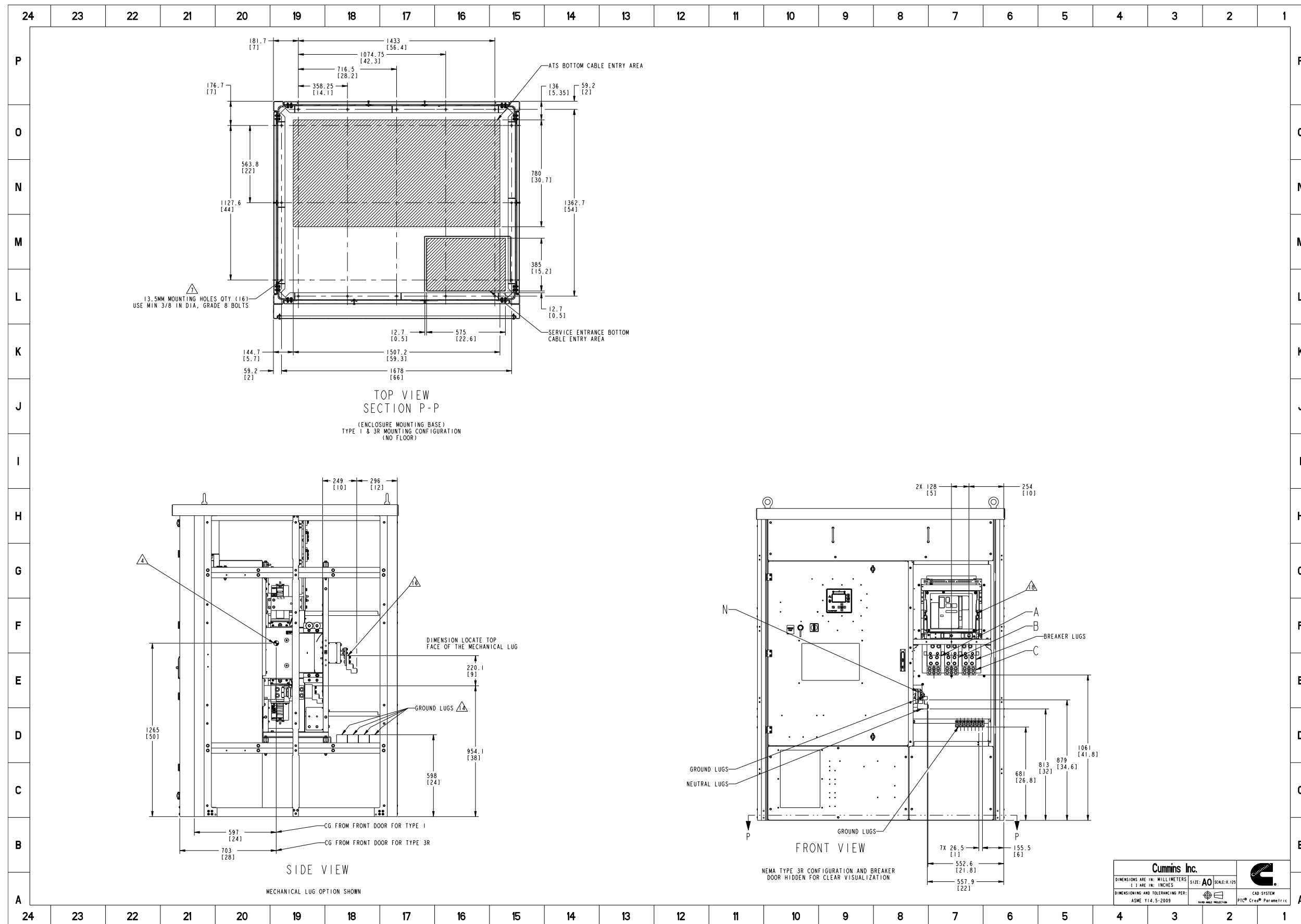


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Part Number: **A064N820** Part Revision: **C**
Part Name: **OUTLINE,ENCLOSURE**
Drawing Category: **Outline State: Released** Sheet 1 of 3

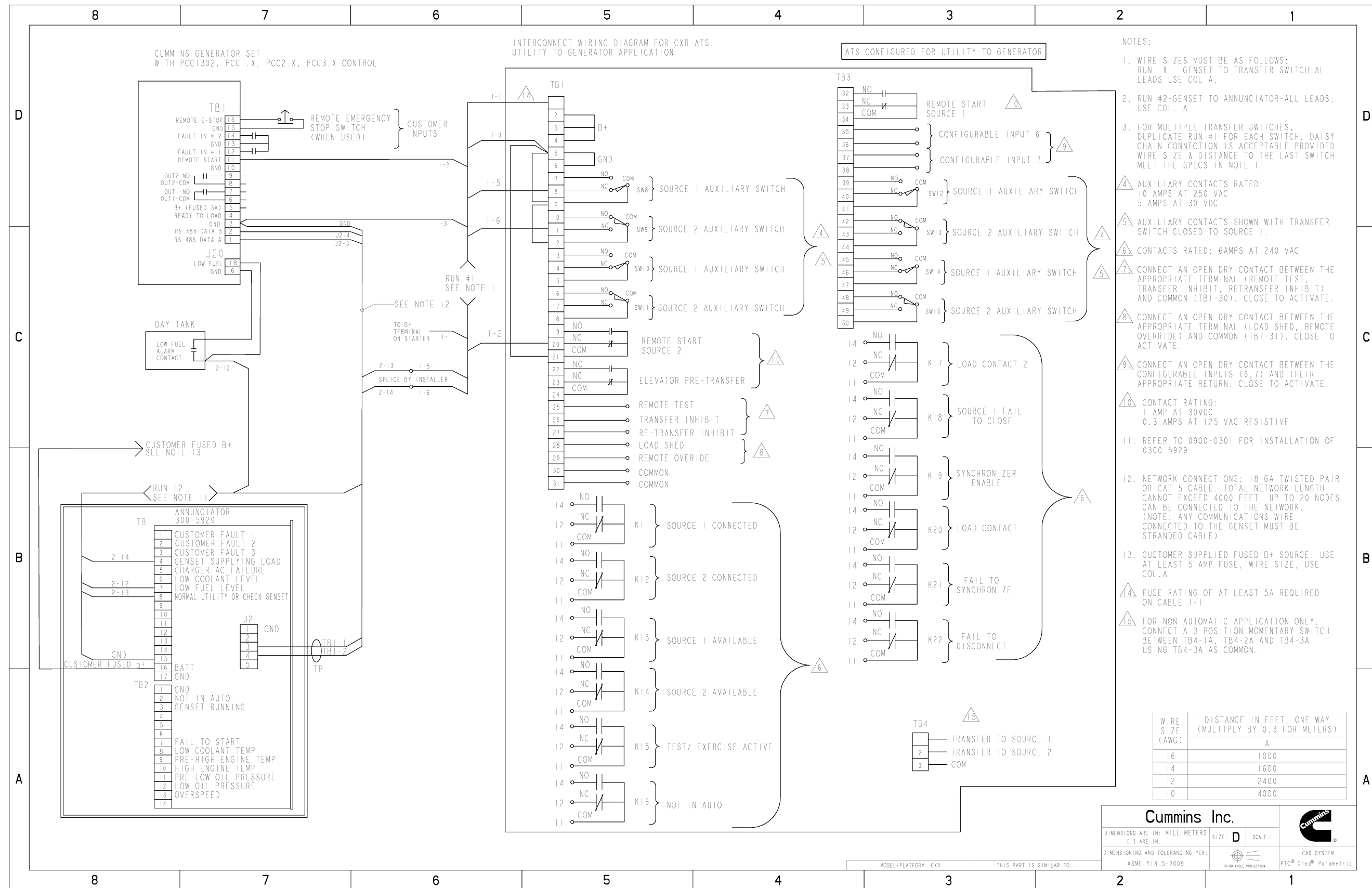


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Drawing Category: **Outline State: Released** Sheet 2 of 3

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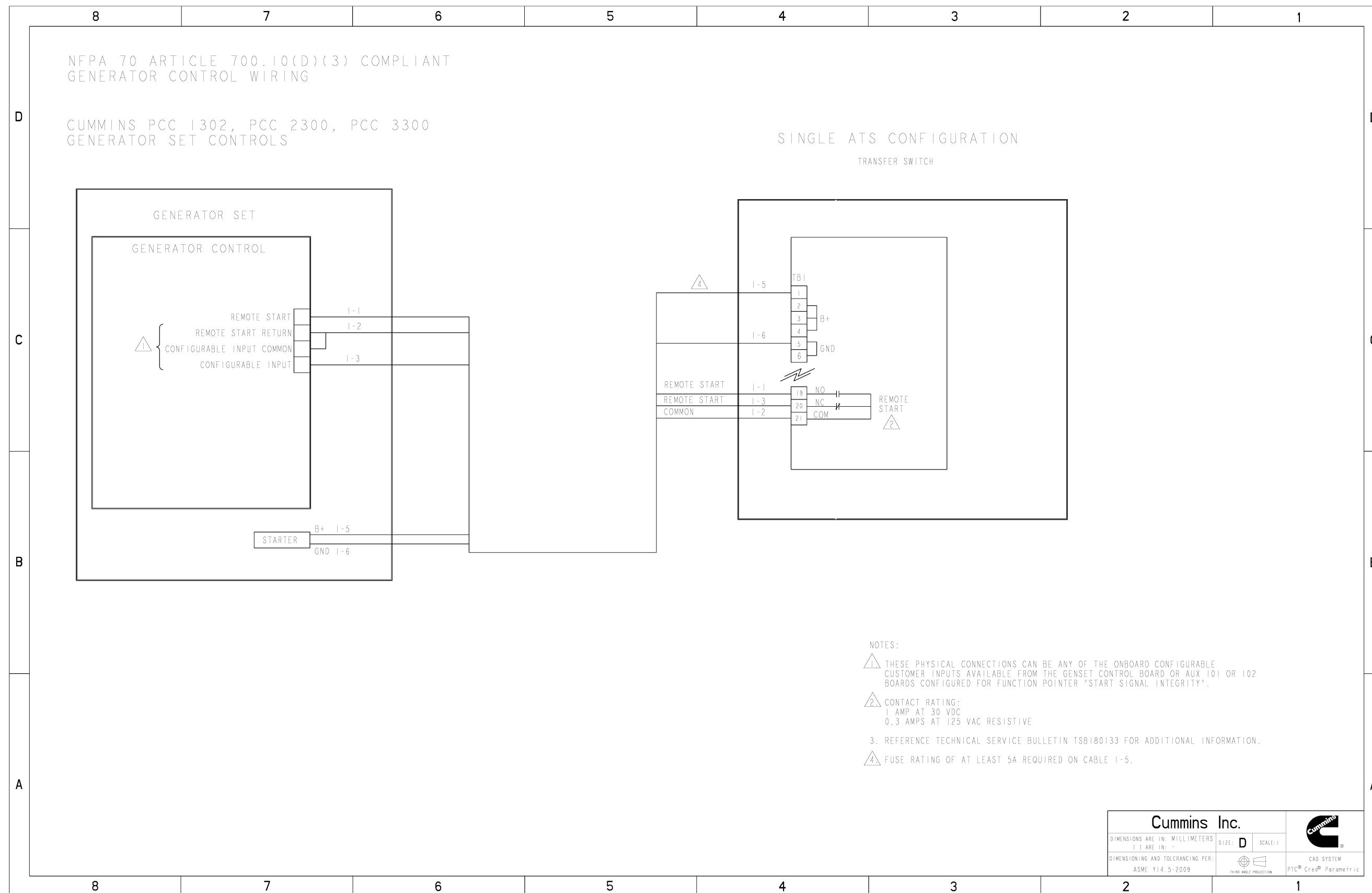


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Part Number: **A062F795** Part Revision: **C**
Part Name: **DIAGRAM,INTERCONNECT WIRING**
Drawing Category: **Detail** State: **Released** Sheet 1 of 4

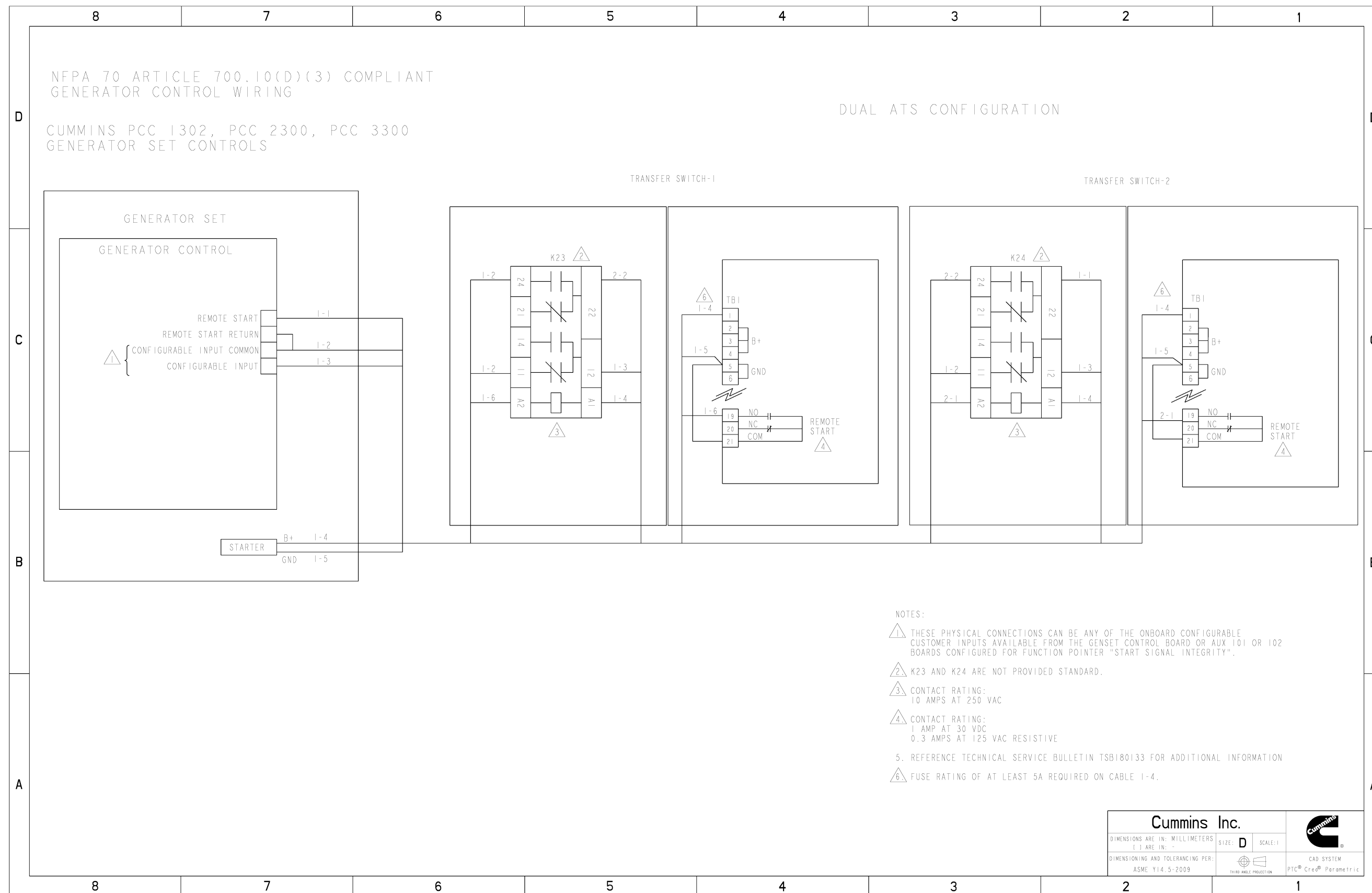


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Drawing Category: **Detail** State: **Released** Sheet 2 of 4




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Part Name: **DIAGRAM,INTERCONNECT WIRING**
Drawing Category: **Detail** State: **Released** Sheet 3 of 4

	Part Number: A062F795				3D image provided when available for visual reference only.																
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	Release Phase Code	Production (P)	Drawing Specification	DSA062F796																	
	External Regulations	No External Regulation																			
Associated Specifications																					
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Section 4 Miscellaneous Submittal Information



CUMMINS PREMIUM®

C8DXH-FT

KEEP YOUR DAY POWERED WITH QUALITY AND DURABILITY.

Cummins offers batteries of outstanding performance and battery warranties for any transport which needs to resist high or low temperatures.

- 12-volt, heavy-duty commercial battery.
- Reliable battery for any weather.
- 18-month free replacement.
- Anchor bonded for vibration resistance.
- Sealed and reinforced polypropylene case.
- Maintenance free plate materials.



SPECIFICATIONS

Group Size	8D
Terminal BCI Figure	SAE
Voltage	12
CCA 0°F (-18°C) (SAE-Standard)	1400
CA 32°F (0°C) (SAE-Standard)	1750
RC @80°F (27°C) (SAE-Standard)	450
Ampere Hour	188
Weight (lb)	132.3
Electrolyte Quantity Gallons	4.25
Electrolyte Quantity Fluid Ounces	544

BATTERY DIMENSIONS

Terminal BCI Figure

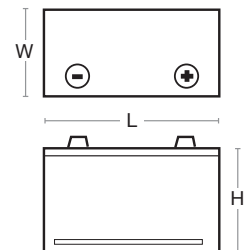


SAE

Length: **20 3/4"**

Width: **11 1/8"**

Height: **9 7/8"**



*This battery is only available for purchase in the US

TYPE OF ELECTROLYTE

- Sulfuric Acid
- Water
- Solution

SDS #UN2794

For more information contact us: 1-800-CUMMINS™

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120V = ~564W

Specification Sheet



Battery Charger

A048G602 10 A 50/60 Hz

A051H785 20 A 50/60 Hz



Description

Cummins® fully automatic battery chargers 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 constant current, high-rate taper charge, finishing charge, and maintaining charge. During the constant current cycle the charger operates at maximum possible output in the fast charge mode. During the high-rate taper charge cycle the charger stays at fast charge voltage level until battery current acceptance falls to a portion of the chargers rated output. During the finishing charge cycle the charger operates at the float voltage and completes the battery charge. During the maintaining charge cycle the charger supplies only a few milliamps required by the battery to stay at peak capability.

An optional temperature sensor (A043D534) may be used to adjust charging voltage based on temperature of the battery. Use of a battery temperature sensor helps to increase battery life by preventing over or under charging. The battery temperature sensor also protects the battery from overheating. Temperature compensation sensor is required for all applications when battery charger and battery are located in different temperature or battery heater is being used.

Battery chargers are field-configurable for charging either 12 or 24 VDC battery systems at 50/60 Hz operation. Simple jumper selectors enable selection of output voltage and battery type.

Features

Protection – Surge protected to IEEE and EN standards. All models include single pole cartridge type fuses mounted on the printed circuit board to protect against input or output overcurrent.

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 status are indicated on the front panel. Includes precision ammeter and voltmeter.

Monitoring – Status LED indicators are provided to show the condition of the charger. LED's on the right side of the monitor indicate operational functions for Temperature Compensation active (Green), AC on (Green), Float (Green) or Boost (Amber) mode, as well as Battery Fault (Red). LED's on the left side of the monitor illuminate (in Red) when Charger fail, High or Low VDC or AC fail occur.

Adjustable Float Voltage – Float voltage can be set, using easy to understand jumpers, for optimum battery performance and life.

Construction – NEMA-1 (IP20) corrosion resistant aluminium enclosure designed for wall mounting.

Faults – The charger senses and annunciates the following fault conditions: AC power loss, battery overvoltage, battery under voltage, battery fault conditions and charger failure. Includes an individual 30 volt/2 amp isolated contact for each alarm.

Vibration Resistant Design – complies with UL991 class B vibration resistance requirements.

Listed – C-UL listed to UL 1236 CSA standard 22.2 No 107.2-M89. Suited for flooded and AGM lead acid and NiCd batteries in generator set installations.

Warranty – 5 year CPG warranty.

Our energy working for you.™

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power.cummins.com



Status and Fault LED



Field Selectable Jumper

Specifications

Performance and Physical Characteristics

Output:	Nominal voltage	12VDC* or 24VDC
	Float voltage – 12VDC batteries	12.87, 13.08, 13.31, 13.50*, 13.62, 14.30
	Float voltage – 24VDC batteries	25.74, 26.16, 26.62, 27.00*, 27.24, 28.60
	Equalize-voltage	6.5% above float voltage sensing
	Output voltage regulation	±0.5% (1/2%) line and load regulation
	Maximum output current	10 or 20 amps nominal
	Equalize charging	Battery interactive auto-boost
Input:	Voltage AC	120, 208, 240 ±10%
	Frequency	60/50 Hz +5%
Approximate net weight:		10A: 25 lbs. (11.36 Kg) 20A: 50 lbs. (22.68 Kg)
Approximate dimensions: height x width x depth-in		10A: 12.50" x 7.66" x 6.50"(318 x 195 x 165 mm) 20A: 13.06" x 13.95" x 6.83"(332 x 354 x 173 mm)
Ambient temperature operation: At full rated output -		- 4 °F to 104 °F (-20 °C to 45 °C)

Note:

- Battery charger comes with default settings of 12VDC and 13.50/27.00VDC float voltage and can be changed to the battery manufacture recommendations. Replacement printed circuit board and f uses are identified in the Owner's Manual (10A: A050S537 and 20A: A051X126) which resides in Quick Serve On-Line. Service parts can be purchased through the Memphis Distribution Center. The PC board replacement instruction sheet (10A: A052N073, 20A: A053W929) and service manual (A050D829) is also available.
- Installation and application must comply with "section 4.5.3 batteries and battery charger" of application guide T-030 (Liquid Cooled Generator Set Application Manual A040S369).

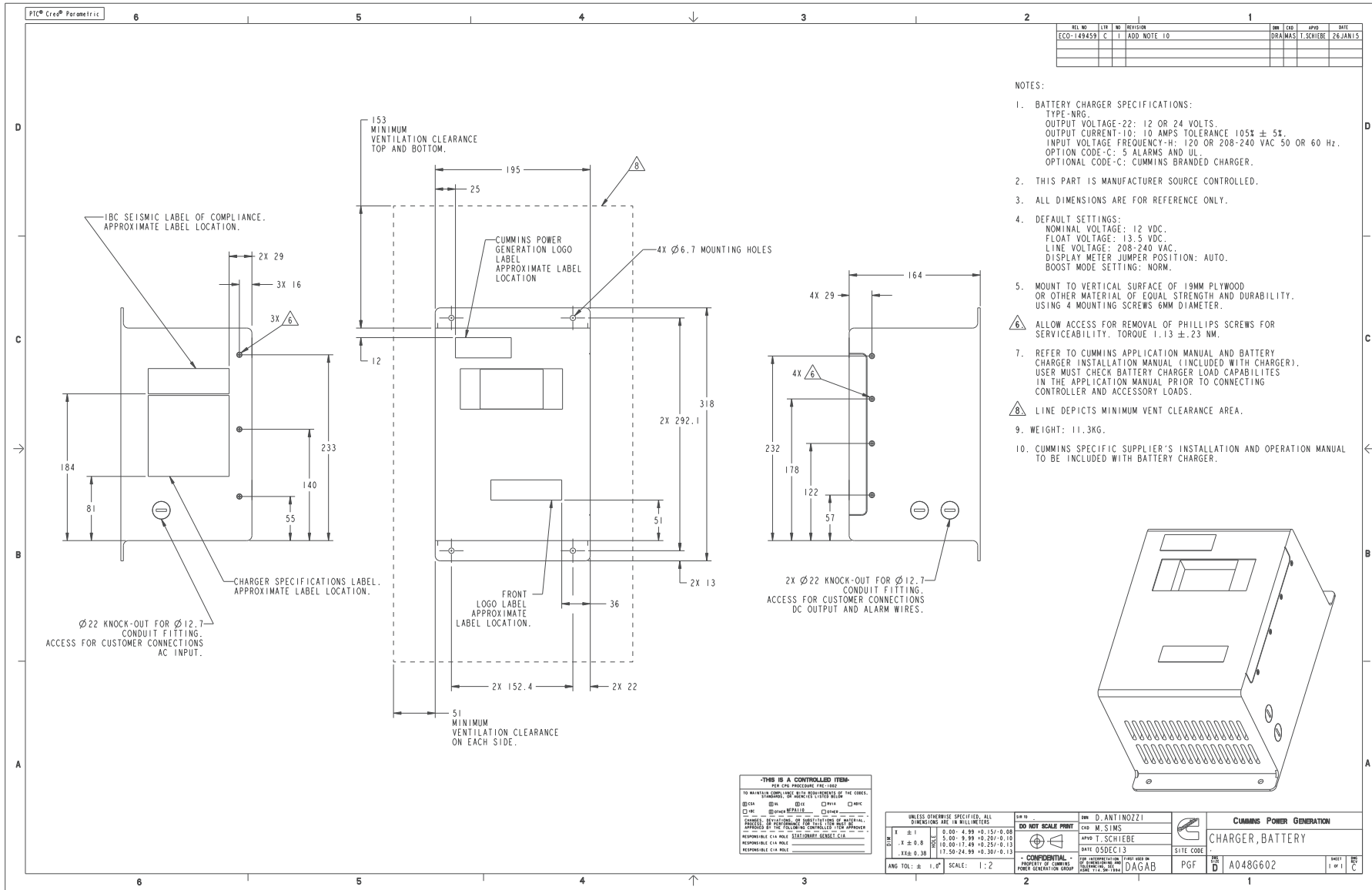
Caution:

- Higher input voltages (i.e. 480VAC or 600VAC) can be applied if a transformer with a 120VAC-240VAC output is installed. Higher input voltages (i.e. 480VAC or 600VAC) can be applied if a transformer with a 120VAC-240VAC output is installed. For voltages higher than 240 VAC, stepdown transformer must be used. Review the respective Owner/Installation manual A050S537 for 10Amp and A051X126 20A chargers for supplier recommended stepdown transformer requirements.
- 10Amp battery charger is recommended for genset applications with 1 or 2 factory provided batteries. 20Amp battery charger is recommended for Cummins Genset applications with 3 or 4 factory provided batteries. Please consider the auxiliary DC loads connected to the genset batteries and size this charger as per the T-030 application guide to prevent misapplication issues.
- 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.
- 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.
- Use this charger for charging LEAD-ACID or LIQUID ELECTROLYTE NICKEL-CADMIUM batteries only. Do not use this battery charger for charging dry cells, alkaline, lithium, nickel-metal hydride, or sealed nickel-cadmium batteries that are commonly used with home appliances. These batteries may burst and cause injuries to persons and damage to property.
- Do not parallel these battery chargers with any other charging system.

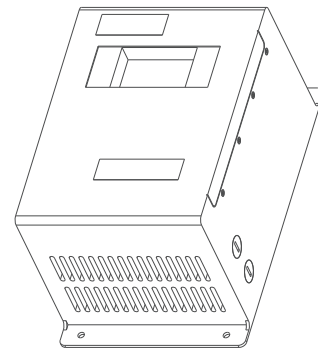
For more information contact your local Cummins distributor
or visit power.cummins.com

Our energy working for you.™





- NOTES:
- BATTERY CHARGER SPECIFICATIONS:
TYPE-NRG.
OUTPUT VOLTAGE-22: 12 OR 24 VOLTS.
OUTPUT CURRENT-10: 10 AMPS TOLERANCE 105% ± 5%.
INPUT VOLTAGE FREQUENCY-H: 120 OR 208-240 VAC 50 OR 60 Hz.
OPTION CODE-C: 5 ALARMS AND UL.
OPTIONAL CODE-C: CUMMINS BRANDED CHARGER.
 - THIS PART IS MANUFACTURER SOURCE CONTROLLED.
 - ALL DIMENSIONS ARE FOR REFERENCE ONLY.
 - DEFAULT SETTINGS:
NOMINAL VOLTAGE: 12 VDC.
FLOAT VOLTAGE: 13.5 VDC.
LINE VOLTAGE: 208-240 VAC.
DISPLAY METER JUMPER POSITION: AUTO.
BOOST MODE SETTING: NORM.
 - MOUNT TO VERTICAL SURFACE OF 19MM PLYWOOD OR OTHER MATERIAL OF EQUAL STRENGTH AND DURABILITY. USING 4 MOUNTING SCREWS 6MM DIAMETER.
 - ALLOW ACCESS FOR REMOVAL OF PHILLIPS SCREWS FOR SERVICEABILITY. TORQUE 1.13 ±.23 NM.
 - REFER TO CUMMINS APPLICATION MANUAL AND BATTERY CHARGER INSTALLATION MANUAL (INCLUDED WITH CHARGER). USER MUST CHECK BATTERY CHARGER LOAD CAPABILITIES IN THE APPLICATION MANUAL PRIOR TO CONNECTING CONTROLLER AND ACCESSORY LOADS.
 - LINE DEPICTS MINIMUM VENT CLEARANCE AREA.
 - WEIGHT: 11.3KG.
 - CUMMINS SPECIFIC SUPPLIER'S INSTALLATION AND OPERATION MANUAL TO BE INCLUDED WITH BATTERY CHARGER.



THIS IS A CONTROLLED ITEM
PER THE PROCEDURE PRE-1002
TO MAINTAIN CONTROL OVER THE MOVEMENT OF THE CODED DIMENSIONS, DO NOT CHECK OUT THIS DRAWING
DRAWING CONTROLLED BY: []
RESPONSIBLE CUMMINS: []
RESPONSIBLE CUMMINS: []
RESPONSIBLE CUMMINS: []

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		DWG NO. D. ANTINOZZI		CUMMINS POWER GENERATION	
DO NOT SCALE PRINT		CRD. M. SIMS		CHARGER, BATTERY	
ANG. TOL: ± 1.0°		DATE 05DEC13		SITE CODE:	
SCALE: 1:2		PGF		A048G602	
CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP		DAGAB		C	

Emergency Operator Stations
Power Control Stations

Pilla Electrical
Products, Inc.



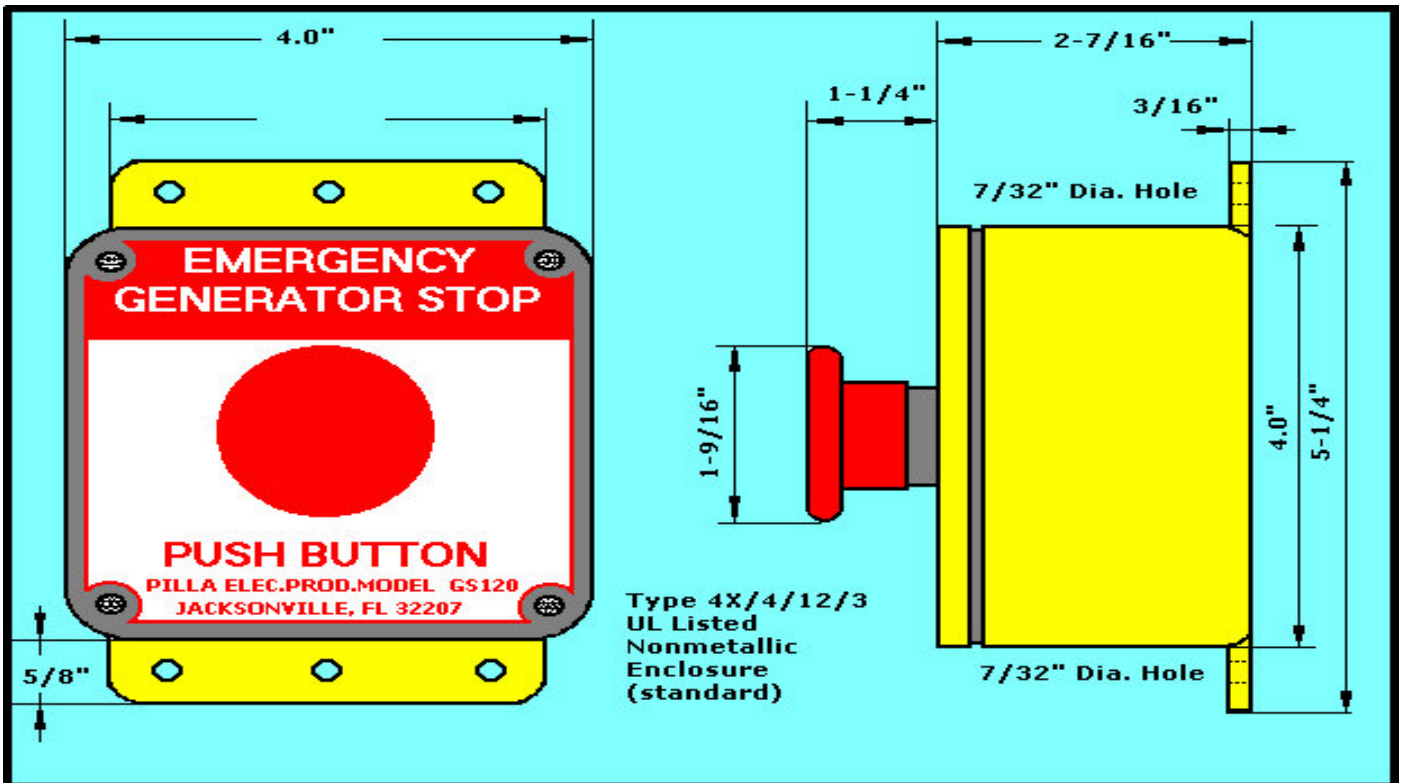
**EMERGENCY GENERATOR STOP
PUSH BUTTON
PILLA MODEL SERIES GS120**

FEATURES

- Large heavy duty mushroom operator, maintained "Pull to Reset" (standard)
- Maintained "Turn to Reset" mushroom model also available: Add model suffix TW
- Momentary mushroom model also available: Add suffix MO
- Nonmetallic NEMA 4X enclosure with stainless steel machine screws (standard)
- Bold, silk screen legends on white enamel aluminium face plate (standard)
- Economy NEMA 1 metal backbox models also available for both surface and flush mount applications
- Standard depth 4 x 4x 2.375 inch nonmetallic enclosure holds two contact blocks
- Extra depth 4 x 4x 4.5 inch nonmetallic enclosure holds six contact blocks: Add suffix XD
- Super depth 4 x 4x 6.5 inch nonmetallic enclosure holds ten contact blocks: Add suffix SD
- Metal backbox models(surface and flush mount)use 4 x 4x 3 inch enclosure holding four contacts blocks
- All-metal models meet NYC, Chicago and other specific requirements: Add suffix MT1, MT4 or MS as needed
- Illuminated models include 120V lamp (standard, specify if other voltage desired) in mushroom or round push button (Note 2 above): Add model suffix IL
- Restricted operator access available: See options available above for model suffix RP/RR/CP/CR
- Restricted operator access available: See Series PIL accessory PILCHCOV1
- Key Release mushroom model restricts reset/release access only



**CLEAR
PROTECTIVE
COVER
PILCLHCOV1**



Section 5

Start and Test





Cummins Sales and Service Customer / Contractor Pre Commissioning Inspection Form

The intent of this form is for the contractor to prepare for equipment to be commissioned by a certified Cummins Field Service Power Generation Technician. Filling out this form is required and will minimize delays due to equipment failing to meet requirements. Completing this checklist in its entirety should minimize the need for additional billing beyond the previously provided commissioning quote.

The items listed are the responsibility of the contractor and not Cummins Sales and Service.

Project Name/End User: _____

Contractor: _____

Address: _____ **Contact:** _____

Business Phone: _____ **Cell Phone:** _____

Email: _____

ON SITE INFORMATION

On-Site Contact Information: _____

Address: _____

Time Requested Onsite: _____

Sub location of Generator (ie. Roof, basement, floor): _____

Does the facility have the following: Loading Dock Elevator

Access (from truck and load bank parking to generator in feet): _____

Parking: Is parking available on-site for service truck: Yes No

Permits: Have all necessary air quality and local permits been secured: Yes No N/A

Fuel Tank Testing: Is fuel tank testing required: Yes No

 If yes when is the inspector scheduled for: _____



ON SITE INFORMATION CONTINUED

YES NA NO

Is the facility occupied and is customer aware there will be power outages after generator is started?

Will there be any site safety training needed for technician prior to beginning? On site contact for training: _____

Will customer representative be on site for operator training?

On site contact for operator training: _____

MECHANICAL LOCATION AND PLACEMENT OF THE GENERATOR SET

YES NA NO

Generator is properly secured to pad or vibration isolators

Generator Enclosure and/or Room is free of all debris

No airflow obstructions to the engine or generator are present for cooling combustion
(See Cummins T-030 or Installation manual of generator set)

Room is designed for adequate inlet and outlet airflow

GASEOUS FUEL Natural Gas/LP Vapor/LP Liquid

YES NA NO

Natural gas and/or LPG fuel supply is connected.

Fuel piping is the appropriate size based on full-load CFH/BTU requirement. Pipe size after service regulator: _____

Service regulator(s), (if supplied), fuel strainer(s), flexible fuel line(s) and manual shut off are installed

Fuel pressure after service regulator is: _____ inches of H2O

I have read and fully understand the fuel requirements for this equipment, I am verifying that the piping and fuel supply meets or exceeds those requirements. I also understand failure to meet the requirements will result in additional charges.

Contractor "requestor" Signature

Date



DIESEL FUELED GENERATORS

YES NA NO

Flexible fuel connections, (supply and return) are connected to generator and piping.

Day tank installed, wired and plumbed (lines free of obstruction) to genset and main fuel tank if applicable. Only black iron pipe for fuel lines, never use copper or galvanized pipe.

All tanks filled with enough fuel to perform startup and testing.

A return line from engine to day tank and day tank to main tank should be in place

EXHAUST SYSTEM

YES NA NO

Exhaust wrapped or isolated to prevent accidental activation of fire protection devices and sprinklers.

Exhaust flex-pipe is installed at engine exhaust outlet (The silencer and flex-pipe are supplied with the generator set).

Silencer is installed with appropriate supports (no weight should be placed on the exhaust outlet of the genset).

Exhaust system has proper expansion joints and wall thimbles (Thimbles are required for wall or roof penetration).

GENERATOR ELECTRICAL CONNECTIONS

YES NA NO

Load conductors connected to breakers

Flexible connections used on all conduit connections to the generator set output box

Remote start interconnection **stranded** wiring is installed between the generator set and the automatic transfer switch(s) and annunciator.

AC Power conductors in dedicated conduit separate from any DC control or network wiring

Ground fault connected/functioning on generator, if supplied

AC power wired to the coolant heaters (Do NOT energize)

Check for AC oil pan heater, control heater or generator winding heater (Needing AC wiring)

Generator is grounded in compliance with local codes

If applicable, louver motors are operational and connected to generator controls



GENERATOR ELECTRICAL CONNECTIONS CONTINUED

YES NA NO

Annunciator mounted in a location where someone can observe a fault of the remote generator system
Where is annunciator located? _____

Are there additional ancillary devices/equipment that need to be integrated into the system? If yes, please define _____

Battery charger mounted (free of vibration, weather, accessible for an operator to observe easily) and connected to the appropriate AC and DC wiring to operate the charger.

TRANSFER SWITCH ELECTRICAL CONNECTIONS

YES NA NO

Conductors connected for Utility, Load and Emergency

Remote start interconnection **stranded** wiring is installed between the generator set and the automatic transfer switch(s).

Four Pole Transfer Switch: Is generator neutral grounded?

DAY OF STARTUP

YES NA NO

Training of facility personnel will be done on the same day as start up. Additional trips for operational training will be an additional charge.

Can transfer switch be tested at time of generator startup? (There will be a power interruption) **Note: After hours testing could result in additional charges.**

If the associated switchgear and/or ATS(s) are not provided by Cummins, will the manufacturer's representative be on site?

Exercise with or without load? _____

If known, Transfer Time delay set recommendations Generator Set to exercise Day: _____ Time: _____

Contractor "requestor" Signature

Printed Name

Date: _____

Please complete this form and return to schedule start up, if not returned within 5 business days prior to scheduled startup it may be delayed. I understand that the start-up date may have to be rescheduled at my expense if the above items have not been completed properly.



NFPA 110 Standards and Procedures

Section 1 Safety

Cummins Pacific is committed to a safe work environment. To ensure job site safety, all Cummins Pacific technicians will follow the Safety Guidelines outlined in the Cummins Pacific Safety Policy and Procedure Manual. This manual can be accessed through the Cummins intranet at: <http://cpintranet/HSE/HSEProcedures>

1. Technician will arrive on site and check in.
2. Perform a Pre-Job Job Safety Analysis SA
3. Minimum required PPE
4. Additional PPE (as required)
 - a. Hearing Protection (CPSAF016)
 - b. Electrical gloves (CPSAF011 & NFPA 70E)
 - c. Arc rated hood & face shield (CPSAF011 & NFPA 70E)
 - d. Arc rated clothing (CPSAF011 & NFPA 70E)
 - e. Ladders safety (CPSAF025)
 - f. Fall Protection Harness (CPSAF013)
5. Secure equipment using Lock-Out Tag-Out procedures (CPSAF026)

The technician will update the JSA throughout the repair and stop work if any hazards arise. The technician will not work in an unsafe manner and will inform the contractor and supervisor of any hazards impeding his work.

Section 2 Support Material

Prior to performing NFPA 110 testing the Power Generation Engineering Team will provide the following documentation to the technician:

1. A scope of work authorizing the NFPA 110 testing
 - a. Special instructions not outlined in 110 5-13
 - b. Modifications to the generator control panel (single line)
 - c. Alarm function and testing
 - d. Annunciation template and customer requested faults
2. Factory Certificates
 - a. Prototype test
 - b. Certificate of Compliance



c. Rated Load Compliance

Section 3 Procedure

The technician(s) will follow the procedures:

Step 1: Building Load Test

7.13.4.1 The on-site installation acceptance test shall be conducted in accordance with 7.13.4.1.1 through 7.13.4.1.3.

7.13.4.1.1 In a new and unoccupied building or facility, with the prime mover in a cold start condition and the emergency load at operating level, a normal power failure shall be initiated by opening all switches or circuit breakers supplying the normal power to the building or facility.

7.13.4.1.2 In an existing occupied building or facility, with the prime mover in a cold start condition and the emergency load at operating level, a normal power failure shall be simulated by operating at least one transfer switch test function or initiated by opening all switches or breakers supplying normal power to all ATSS that are part of the EPSS being commissioned by this initial acceptance test.

A.7.13.4.1.1 Cold start is typical standby condition under normal ambient conditions with coolant heaters functioning normally. *(Not being run 6 to 12 hours prior to test is normally acceptable to AHJ)*

7.13.4.1.3 The tests conducted in accordance with 7.13.4.1.1 and 7.13.4.1.2 shall be performed in accordance with (1) through (12).

- (1) When the EPSS consists of paralleled EPSs, the quantity of EPSs intended to be operated simultaneously shall be tested simultaneously with building load for the test period identified in 7.13.4.1.3(10).
- (2) The test load shall be all loads that are served by the EPSS. There is no minimum loading requirement for this portion of the test.



- (3) The time delay on start shall be observed and recorded
- (4) The cranking time until the prime mover starts and runs shall be observed and recorded
- (5) The time taken to reach operating speed shall be observed and recorded
- (6) The engine start function shall be confirmed by verifying operation of the initiating circuit of all transfer switches supplying EPSS loads.
- (7) The time taken to achieve a steady-state condition with all switches transferred to the emergency position shall be observed and recorded.
- (8) The voltage, frequency, and amperes shall be recorded.
- (9) Where applicable, the prime mover oil pressure and water temperature shall be recorded
- (10) The load test with building load, or other loads that simulate the intended load as specified in Section 5.4, shall be continued for not less than 1.5 hours, and the run time shall be recorded.
- (11) When normal power is restored to the building or facility, the time delay on retransfer to normal power for each switch with a minimum setting of 5 minutes shall be recorded.
- (12) The time delay on the prime mover cooldown period and shutdown shall be recorded.

7.13.4.2 After completion of the test performed in 7.13.4.1, the prime mover shall be allowed to cool for not less than 5 minutes.

Step 2: 100% Load Bank Test

7.13.4.3 A load shall be applied for a 2-hour, full-load test. The building load shall be permitted to serve as part or all of the load, supplemented by a load bank of sufficient size to provide a load equal to 100 percent of the nameplate kW rating of the EPS, less applicable derating factors for site conditions.

7.13.4.3.1 This full-load test shall be initiated after the test specified in 7.13.4.1.3 by any method that starts the prime mover and, upon reaching rated rpm, picks up not less than 30 percent of the nameplate kW rating for the first 30 minutes, not less than 50 percent of the nameplate kW rating for the next 30 minutes, and 100 percent of the nameplate kW rating for the next 60 minutes, less applicable derating factors for site conditions.



7.13.4.3.2 A unity power factor shall be permitted for on-site testing, provided that rated load tests at the rated power factor have been performed by the manufacturer of the EPS prior to shipment.

7.13.4.3.3 Where the EPS is a paralleled multi-unit EPS, each unit shall be permitted to be tested individually at its rating.

7.13.4.3.4 The data specified in 7.13.4.1.3(4), (5), (7), (8), and (9) shall be recorded at first load acceptance and every 15 minutes thereafter until the completion of the test period identified in 7.13.4.1.3(10).

(1) The cranking time until the prime mover starts and runs shall be observed and recorded

(2) The time taken to reach operating speed shall be observed and recorded

(3) The time taken to achieve a steady-state condition with all switches transferred to the emergency position shall be observed and recorded.

(4) The voltage, frequency, and amperes shall be recorded.

(5) Oil pressure and water temperature shall be recorded

Step 3: Cycle Crank Test

7.13.4.4 Crank Cycle Test (3x 15 sec crank cycles, with 15 sec rest cycles)

Step 4: Safeties Testing

7.13.4.5 All safeties specified in 5.6.5 and 5.6.6 shall be tested on site as recommended by the manufacturer

Exception: It shall be permitted for the manufacturer to test and document overcrank, high engine temperature, low lube oil pressure and overspeed safeties prior to shipment.

(a) Overcrank (Fail to Start)
(b) Low Water Temperature
(c) High engine temperature warning
(d) High engine temperature shutdown
Low oil pressure warning (Not listed in 2013)
(e) Low oil pressure shutdown



(f) Overspeed
(g) Low fuel main tank
(h) Low coolant level
(i) EPS supplying load
(j) Control not-in-auto
(k) High battery voltage
(l) Low cranking voltage (weak battery)
(m) Low battery voltage
(n) Battery charger ac fail
(o) Lamp test
(p) Common alarm
(q) Audible alarm silence switch
(r) (s) and (t) does not apply to Cummins
(u) Remote emergency stop

7.13.4.6 Items (1) through (4) shall be made available to the authority having jurisdiction at the time of the acceptance test:

- (1) Evidence of the prototype test as specified in 5.2.1.2 (*prototype test report*)
- (2) A certified analysis as specified in 5.6.10.2 (*torsional vibration compatibility of the rotating element*)
- (3) A letter of compliance as specified in 5.6.10.5
- (4) A manufacturer's certification of a rated load test at rated power factor with the ambient temperature, altitude, and fuel grade recorded.
(*Factory Test Report*)

Section 4 Duration

The NFPA 110 test time is determined by site readiness, site access, and technician test requirements as outlined by the following personnel:

1. The Fire Marshal
2. Fire Life Safety Officer
3. Inspector of Record
4. The General and Electrical Contractor



Generally testing can be performed in 2 to 3 days, not including travel. The complexity of the testing and the requirements of the inspectors can increase the hours needed to complete the task

Section 5 Miscellaneous & Special Instructions

1. Inspector of Record, Fire Marshall and Fire Life Safety Officer special requirements not covered under the standard NFPA 110 testing guidelines will be noted and brought to the contractor's attention immediately.
2. Additional charges may apply for any additional time and material due to inspector delays or site changes. Damaged or failed equipment will be noted and brought to the contractor's attention immediately.
3. Test stoppages or failures caused by equipment not sold through Cummins Pacific, LLC that require retesting are the sole responsibility of the contractor. This includes but is not limited to load bank fees, transformer fees, mileage charges, labor charges, additional fuel, and vendor labor charges
4. Additional tools or instruments not out lined in this test but requested by the inspectors will be noted and brought to the contractor's attention immediately.
5. Generator and Switchgear in a Parallel System requiring NFPA110 Testing will require additional time. Contact your Territory Manager for further information.
6. This procedure must be accompanied by the Generator S&T or ATS (only) S&T.