



2250 DQKAF

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## Bill of Materials

### Description

DQKAF-1818877	
H606-2	Meters-AC Output,Analog
KR78-2	Output Terminals-2-Hole Lug, NEMA
A331-2	Duty Rating-Standby Power
A358-2	Packing-None
A334-2	ENGINE STARTER-24 VDC MOTOR
F149-2	Vib Isolators-Normal Duty
C127-2	Separator-Fuel/Water
KA08-2	Alarm-Audible,EngShutdown
R002-2	Voltage-277/480,3 Phase,Wye,4 Wire
H704-2	GENSET CONTROL-POWERCOMMAND 3.3
L050-2	Literature-English
D041-2	ENGINE AIR CLEANER-NORMAL DUTY
H557-2	CoolHtr-208to480V,Sub40F
A030L570	ENGINE,DIESEL
A030L819	INSTALLATION,ENGINE ACCESSORIES
H609-2	CONTROL MTG-LEFT FACING
A333-2	BATTERY CHARGING ALTERNATOR-NO
KP78-2	Ckt Brkr or Entr Box-None
H536-2	Display Language-English
L170-2	Emissions Certification, EPA, Tier 2, NSPS CI Stationary Emergency
A030Z455	INSTALLATION,HEATER
A034R480	CODE-DES FEATURE COMMERCIAL COMMON (QSK60-G14 60 Hz)
A416-2	Heater-Alt, 110/220 (120/240) Volt
L090-2	Listing-UL 2200
H607-2	Filters-Eng Oil,Full Flow/Bypass
H389-2	Shutdown-Low Coolant Lvl
A030Y833	INSTALLATION,GENERATOR
A034R487	CODE-DES FEATURE COMMERCIAL COMMON (QSK60 Paralleling Gains)
A034J623	LIST,SHIPPING PARTS
B738-2	Alt-60Hz,Wye,480V,125C-S
A034T326	OUTLINE,INTERFACE
H678-2	Display-Control, LCD
A043B392	INSTALLATION,NAMEPLATE LABELS
L183-2	ST 5YR 2500HR PARTS
A046F282	INSTALLATION,AIR FILTER
H720-2	AmpSentry™ Protective Relay
A048P746	INSTALLATION,RADIATOR
A049A190	INSTALLATION,COOLING SYSTEM
A051P788	INSTALLATION,CHASSIS
E126-2	Engine Cooling-Enhanced High Ambient Air Temperature
A049G469	LABEL,GENERATOR DATA
A050H784	INSTALLATION,CONTROL PANEL
A051B931	INSTALLATION,HARNESS



A051Z376 INSTALLATION,CONTROL PANEL  
A053S709 CONTROL,GENSET  
A054A883 INSTALLATION,ENGINE ACCESSORIES  
A054B161 DIAGRAM,WIRING SCHEMATIC  
A054B629 INSTALLATION,CONTROL  
A054G137 INSTALLATION,HARNES  
A054M294 OUTLINE,GENSET  
A055A958 OUTLINE,GENSET  
A055F837 LIST,LITERATURE  
KS53-2 Signals - Auxiliary, 8 Inputs/8 Outputs  
KY01-2 Signals - Auxiliary 2, 8 Inputs/8 Outputs  
SPEC-F PRODUCT REVISION-F  
A050W538 INSTALLATION,LABELS  
A055Y805 INSTALLATION,FUEL FILTER  
A057C391 CODE-DES CONTROLLER HMI320(HMI320 OP LOCAL W/CB AND REMOTE-ENGLISH,SPANISH)

300-5929-02 Remote Annunciator  
A051H785 Battery Charger, 24 VDC, 20 AMP – 2 Sets  
BA Batteries – 2 Sets  
BR Battery Racks  
BBS Best Battery System  
MB Modbus TCP/IP  
A049W397 Vibration Isolators  
B045H Dual Starters  
B009U Fuel Filters

24 Hour Subbbase Fuel Tank

- 5 Gallon Spill Fill
- Ultrasonic Fuel Sensor
- Inlet and outlet at opposite sides of tank and piped to a single location outside the enclosure for connection of external fuel polishing system

Stairs and Platform  
Training & Testing  
Start-up & Load Bank Test  
Freight



# Diesel generator set QSK60 series engine

1450 kW - 2250 kW 60 Hz



## Description

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

## Features

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

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

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

**Control system** - The PowerCommand® digital 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™ protective relay, output metering, auto-shutdown at fault detection and NFPA 110 Level 1 compliance.

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

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

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

Model	Standby rating	Prime rating	Continuous rating	Emissions compliance	Data sheets
	60 Hz kW (kVA)	60 Hz kW (kVA)	60 Hz kW (kVA)	EPA	60 Hz
DQKAD	1750 (2187)	1600 (2000)	1450 (1812)	EPA	D-3509
DQKAE	2000 (2500)	1825 (2281)	1600 (2000)	EPA Tier 2	D-3510
DQKAF	2250 (2812)	1825 (2281)		EPA Tier 2	D-3511



## Generator set specifications

Governor regulation class	ISO8528 Part 1 Class G3
Voltage regulation, no load to full load	± 0.5%
Random voltage variation	± 0.5%
Frequency regulation	Isochronous
Random frequency variation	± 0.25%
Radio frequency emissions compliance	IEC 801.2 through IEC 801.5; MIL STD 461C, Part 9

## Engine specifications

Bore	158.8 mm (6.25 in)
Stroke	190.0 mm (7.48 in)
Displacement	60.2 litres (3673 in <sup>3</sup> )
Configuration	Cast iron, V 16 cylinder
Battery capacity	2200 amps minimum at ambient temperature of (0 °F to 32 °F)
Battery charging alternator	55 amps
Starting voltage	24 volt, negative ground
Fuel system	Cummins' modular common rail system
Fuel filter	Two stage spin-on fuel filter and water separator system. Stage 1 has a three element, 7 micron filter and Stage 2 has a three element, 3 micron filter.
Air cleaner type	Dry replaceable element
Lube oil filter type(s)	Four spin-on, combination full flow filter and bypass filters
Standard cooling system	High ambient cooling system

## Alternator specifications

Design	Brushless, 4 pole, drip proof, revolving field
Stator	2/3 pitch
Rotor	Single bearing, flexible disc
Insulation system	Class H on low and medium voltage, Class F on high voltage
Standard temperature rise	125 °C Standby/105 °C Prime
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
Telephone Influence Factor (TIF)	< 50 per NEMA MG1-22.43
Telephone Harmonic Factor (THF)	< 3%

## Available voltages





### 60 Hz Line-Neutral/Line-Line

- |           |           |             |              |
|-----------|-----------|-------------|--------------|
| • 220/380 | • 240/416 | • 255/440   | • 7200/12470 |
| • 277/480 | • 347/600 | • 2400/4160 | • 7620/13200 |
|           |           |             | • 7970/13800 |

Note: Consult factory for other voltages.

## Codes and standards

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

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

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

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

**Our energy working for you.™**



## Generator set data sheet



**Model:** **DQKAF**  
**Frequency:** **60 Hz**  
**Fuel type:** **Diesel**  
**kW rating:** **2250 Standby**  
**1825 Prime**  
**Emissions level:** **EPA NSPS Stationary Emergency Tier 2**

Exhaust emission data sheet:	EDS-1120
Exhaust emission compliance sheet:	EPA-1166
Sound performance data sheet:	MSP-1132
Cooling performance data sheet:	MCP-208
Prototype test summary data sheet:	PTS-308
Standard set-mounted radiator cooling outline:	A034T734
Optional set-mounted radiator cooling outline:	A034H896
Optional heat exchanger cooling outline:	A034H896
Optional remote radiator cooling outline:	A034U921

Fuel consumption	Standby				Prime				Continuous
	kW (kVA)				kW (kVA)				kW (kVA)
Ratings	2250 (2812)				1825 (2281)				
Load	1/4	1/2	3/4	Full	1/4	1/2	3/4	Full	
US gph	50.6	85.6	119.3	151.8	43.9	72.6	100.4	127.4	
L/hr	191.7	324.1	451.7	574.6	166.2	274.6	380.0	482.2	

Engine	Standby rating	Prime rating	Continuous rating
Engine manufacturer	Cummins Inc.		
Engine model	QSK60-G14 NR2		
Configuration	Cast iron, V 16 cylinder		
Aspiration	Turbocharged and low temperature after-cooled		
Gross engine power output, kWm (bhp)	2446 (3280)	1980 (2655)	
BMEP at set rated load, kPa (psi)	2710 (393)	2193 (318)	
Bore, mm (in.)	159 (6.25)		
Stroke, mm (in.)	190 (7.48)		
Rated speed, rpm	1800		
Piston speed, m/s (ft/min)	11.4 (2243)		
Compression ratio	14.5:1		
Lube oil capacity, L (qt)	261 (276)	378 (400)	
Overspeed limit, rpm	2070		
Regenerative power, kW	277		

Fuel flow	
Maximum fuel flow, L/hr (US gph)	1033 (273)
Maximum fuel inlet restriction, kPa (in Hg)	16.9 (5)
Maximum fuel inlet temperature, °C (°F)	71 (160)

<b>Air</b>	<b>Standby rating</b>	<b>Prime rating</b>	<b>Continuous rating</b>
Combustion air, m <sup>3</sup> /min (scfm)	195 (6900)	167 (5910)	
Maximum air cleaner restriction, kPa (in H <sub>2</sub> O)	3.7 (15)		
Alternator cooling air, m <sup>3</sup> /min (cfm)	222 (7840)		

### **Exhaust**

Exhaust flow at set rated load, m <sup>3</sup> /min (cfm)	473 (16700)	402 (14205)	
Exhaust temperature, °C (°F)	474 (885)	457 (855)	
Maximum back pressure, kPa (in H <sub>2</sub> O)	6.7 (27)		

### **Standard set-mounted radiator cooling**

Ambient design, °C (°F)	40 (104)		
Fan load, kW <sub>m</sub> (HP)	46 (61)		
Coolant capacity (with radiator), L (US gal)	537 (142)		
Cooling system air flow, m <sup>3</sup> /min (scfm)	2094 (73937)		
Total heat rejection, MJ/min (Btu/min)	121.3 (114968)	98.5 (93385)	
Maximum cooling air flow static restriction, kPa (in H <sub>2</sub> O)	0.12 (0.5)		
Maximum fuel return line restriction kPa (in Hg)	34 (10)		

### **Optional set-mounted radiator cooling**

Ambient design, °C (°F)	50 (122)		
Fan load, kW <sub>m</sub> (HP)	66 (88)		
Coolant capacity (with radiator), L (US gal)	606 (160)		
Cooling system air flow, m <sup>3</sup> /min (scfm)	2347 (82891)		
Total heat rejection, MJ/min (Btu/min)	121.3 (114968)	98.5 (93385)	
Maximum cooling air flow static restriction, kPa (in H <sub>2</sub> O)	0.12 (0.5)		
Maximum fuel return line restriction kPa (in Hg)			

## Weights<sup>2</sup>

Unit dry weight kgs (lbs)	16182 (35675)
Unit wet weight kgs (lbs)	16882 (37218)

### Notes:

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

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

## Derating factors

<b>Standby</b>	<p><u>Standard cooling system:</u> Full rated power available up to 578.6 m (1898 ft) elevation at ambient temperatures up to 40 °C (104 °F). Above these conditions derate by 6.4% per 305 m (1000 ft), and derate by an additional 8.5% per 10 °C (18 °F).</p> <p><u>Enhanced cooling system:</u> Full rated power available up to 588.6 m (1930.5 ft) elevation at ambient temperatures up to 40 °C (104 °F). Above these conditions derate by 6.4% per 305 m (1000 ft). Full rated power available up to 32.9 m (107.8 ft) elevation at ambient temperatures up to 50 °C (122 °F). Above these conditions derate by 4% per 305 m (1000 ft). At higher ambient temperatures, derate by additional 12% per 10 °C (18 °F).</p>
<b>Prime</b>	<p>Full rated power available up to 64.1 m (210.3 ft) elevation at ambient temperature up to 40 °C (104 °F). Above these elevations, at 40 °C (104 °F), derate by 5.1% per 305 m (1000 ft). Derate by 17% at sea level at ambient temperatures up to 50 °C (122 °F). Above these elevations, at 50 °C (122 °F), derate by an additional 5.1% per 305 m (1000 ft). At higher ambient temperatures, derate by an additional 16% per 10 °C (18 °F).</p>
<b>Continuous</b>	

## Ratings definitions

<b>Emergency Standby Power (ESP):</b>	<b>Limited-Time Running Power (LTP):</b>	<b>Prime Power (PRP):</b>	<b>Base Load (Continuous) Power (COP):</b>
<p>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.</p>	<p>Applicable for supplying power to a constant electrical load for limited hours. Limited-Time Running Power (LTP) is in accordance with ISO 8528.</p>	<p>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.</p>	<p>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.</p>



# PowerCommand® 3.3 control system



## Control system description

The PowerCommand control system is a microprocessor-based genset monitoring, metering and control system designed to meet the demands of today's engine driven gensets. The integration of all control functions into a single control system provides enhanced reliability and performance, compared to conventional genset 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™ protection - for true alternator overcurrent protection.
- Digital power transfer control (AMF) provides load transfer operation in open transition, closed transition, or soft (ramping) transfer modes.
- Extended paralleling (peak shave/base load) regulates the genset real and reactive power output while paralleled to the utility. Power can be regulated at either the genset or utility Bus monitoring point.
- Digital frequency synchronization and voltage matching.
- Isochronous load share
- Droop kW and kVAr control
- Real time clock for fault and event time stamping.
- Exerciser clock and time of day start/stop initiate a test with or without load, or a base load or peak shave session.
- Digital voltage regulation. Three phase full wave FET type regulator compatible with either shunt or PMG systems.
- Digital engine speed governing (where applicable)
- Generator set monitoring and protection.
- Utility/AC Bus metering and protection
- 12 and 24 V DC 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 gensets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std. and CE standards.

# PowerCommand digital genset control PCC 3300



## Description

The PowerCommand genset control is suitable for use on a wide range of diesel and lean burn natural gas gensets in 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, 601-45,000 VAC with external PT.

Power for this control system is derived from the genset 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.
- Digital engine speed governing (where applicable) - Provides isochronous frequency regulation.
- Full authority engine communications (where applicable) - Provides communication and control with the Engine Control Module (ECM).
- AmpSentry protection - for true alternator overcurrent protection.
- Genset 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.
- Genset protection – Protects engine and alternator.
- Real time clock for fault and event time stamping.
- Exerciser clock and time of day start/stop initiate a test with or without load, or a base load or peak shave session.
- Digital power transfer control (AMF) provides load transfer operation in open transition, closed transition, or soft (ramping) transfer modes.
- Extended paralleling (peak shave/base load) regulates the genset real and reactive power output while paralleled to the utility. Power can be regulated at either the genset or utility bus monitoring point.
- Digital frequency synchronization and voltage matching.
- Isochronous load share
- Droop kW and KVA<sub>r</sub> control
- Sync cCheck – The sync check function has adjustments for phase angle window, voltage window, frequency window and time delay.
- Utility/AC Bus metering and protection
- 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 gensets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std. and CE standards.

## Base control functions

### HMI capability

Options – Local and remote HMI options.

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

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

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

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

#### Alternator data

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

For Lean burn natural gas engine applications:

- Alternator heater status
- Alternator winding temperature (per phase)
- Alternator drive end bearing temperature
- Alternator non-drive end bearing temperature

#### Utility/AC Bus data

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

#### Engine data

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

For lean burn natural gas engine applications:

- Safety shutoff valve status
- Valve proving status
- Downstream gas pressure
- Gas inlet pressure
- Gas mass flow rate
- Control valve position
- Gas outlet pressure
- Manifold pressure
- Manifold temperature
- Throttle position
- Compressor outlet pressure
- Turbo speed
- Compressor bypass position
- Cylinder configuration (e.g., drive end and non-drive end configurations)
- Coolant pressure 1 and 2 (e.g., HT and LT)
- Coolant temperature 1 and 2 (e.g., HT and LT)
- Exhaust port temperature (up to 18 cylinders)
- Pre-filter oil pressure
- Exhaust back pressure
- CM700 internal temperature
- CM700 isolated battery voltage
- Speed bias
- CM558 internal temperature
- CM558 isolated battery voltage
- Knock level (up to 18 cylinders)

- Spark advance (up to 18 cylinders)
- Knock count (up to 18 cylinders)
- Auxiliary supply disconnect status
- Engine heater status
- Coolant circulating pump status
- Lube oil priming pump status
- Lube oil status
- Oil heater status
- Derate authorization status
- Start system status
- Ventilator fan status
- Ventilation louvre status
- Radiator fan status
- DC PSU status
- Start inhibit/enable status and setup

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

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

#### **Engine control**

SAE-J1939 CAN interface to full authority ECMs (where applicable). Provides data transfer between genset and engine controller for control, metering and diagnostics. 12 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.

Droop 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 genset and immediately accelerates to rated speed and voltage or run at idle until engine temperature is adequate. 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 genset to immediately shut down. The genset is prevented from running or cranking with the switch engaged. If in sleep mode, activation of either emergency stop switch will wake up 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.

For lean burn natural gas engine applications:

Engine start inhibit/enable – The function will allow application-specific processes to be started prior to the genset/engine start (e.g., pumps, boosters, etc.).

### **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.

## **Paralleling functions**

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

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

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

**Load govern control** – When PowerCommand receives a signal indicating that the genset is paralleled with an infinite source such as a utility (mains) service, the genset will operate in load govern mode. In this mode the genset will synchronize and close to the bus, ramp to a pre-programmed kW and kVar load level, and then operate at that point. Control is adjustable for kW values from 0- 100% of Standby rating, and 0.7-1.0 power factor (lagging). Default setting is 80% of Standby and 1.0 power factor. The control includes inputs to allow independent control of kW and kVar load level by a remote device while in the load govern mode. The rate of load increase and decrease is also adjustable in the control. In addition, the control can be configured for operation in kW or kVAR load govern droop.

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

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

**Genset and utility/AC Bus source AC metering** – The control provides comprehensive three phase AC metering functions for both monitored sources, including:

3-phase voltage (L-L and L-N) and current, frequency, phase rotation, individual phase and totalized values of kW, kVAr, kVA and Power Factor; totalized positive and negative kW-hours, kVAr-hours, and kVA-hours. Three wire or four wire voltage connection with direct sensing of voltages to 600V, and up to 45kV with external transformers. Current sensing is accomplished with either 5 amp or 1 CT secondaries and with up to 10,000 amp primary. Maximum power readings are 32,000kW/kVAR/kVA.

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

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

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

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

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

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

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

Timers: Control provides adjustable start delay from 0- 300 sec, stop delay from 0-800 sec, transfer delay from

0- 120 sec, retransfer delay from 0-1800 sec, programmed transition delay from 0-60sec, and maximum parallel time from 0-1800 sec.

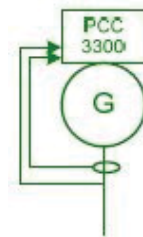
**Breaker control** – Utility and genset breaker interfaces include separate relays for opening and closing breaker, as well as inputs for both 'a' and 'b' breaker position contacts and tripped status. Breaker diagnostics include contact failure, fail to close, fail to open, fail to disconnect, and tripped. Upon breaker failure, appropriate control action is taken to maintain system integrity.

**Extended paralleling** – In extended paralleling mode (when enabled) the controller will start the genset and parallel to a utility source and then govern the real and reactive power output of the genset based on the desired control point. The control point for the real power (kW) can be configured for either the genset metering point ("base load") or the utility metering point ("peak shave"). The control point for the reactive power (kVAr or Power Factor) can also be independently configured for either the genset metering point or the utility metering point. This flexibility would allow base kW load from the genset while maintaining the utility power factor at a reasonable value to avoid penalties due to low power factor. The System always operates within genset ratings. The control point can be changed while the system is in operation. Set points can be adjusted via hardwired analog input or adjusted through an operator panel display or service tool.

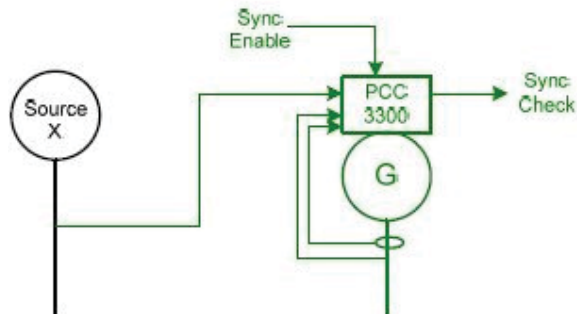
**Exerciser clock** –The exerciser clock (when enabled) allows the system to be operated at preset times in either test without load, test with load, or extended parallel mode. A real time clock is built in. Up to 12 different programs can be set for day of week, time of day, duration, repeat interval,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

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

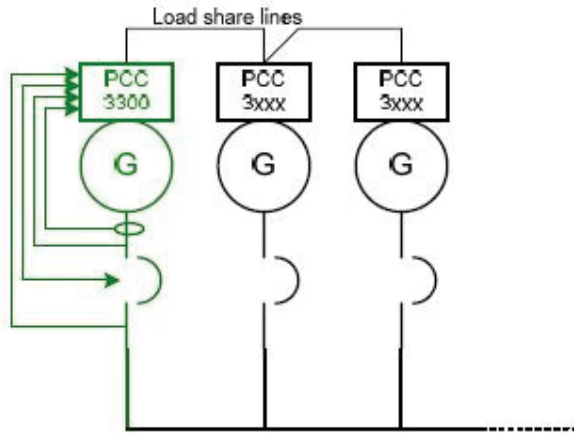
Standalone: Control provides monitoring, protection and control in a non-paralleling application.



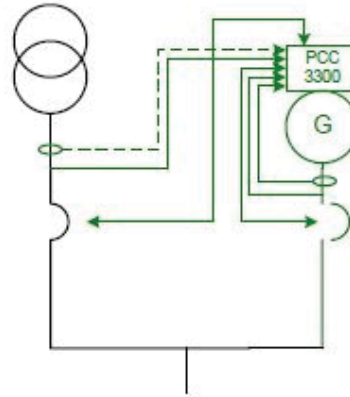
Synchronizer only: control will synchronize the genset to other source when commanded to either via a hardwired or Modbus driven input.



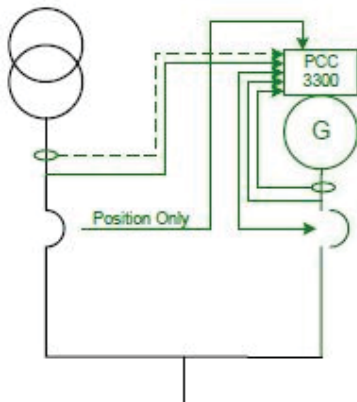
**Isolated Bus:** allows the genset to perform a dead bus closure or synchronize to the bus and isochronously share kW and kVAR loads with other gensets.



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



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



## Protective functions

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

Protective functions include:

### Battle short mode

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

### Derate

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

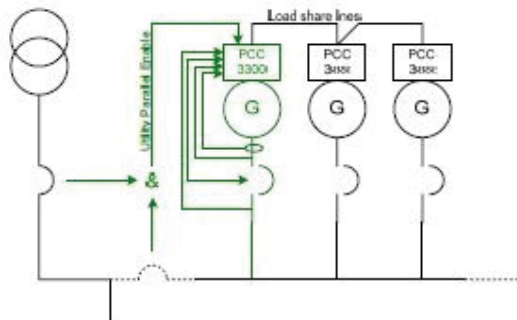
### Configurable alarm and status inputs

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

### Emergency stop

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

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



## 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 genset 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 genset fails to start by the completion of the engine crank sequence.

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

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

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

For lean burn natural gas engine applications:

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

## Hydro mechanical fuel system engine protection

**Overspeed shutdown** - Default setting is 115% of nominal Low lube oil pressure warning/shutdown - Level is preset (configurable with InPower or HMI) to match the capabilities of the engine used. Control includes time delays to prevent nuisance alarms.

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

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

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

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

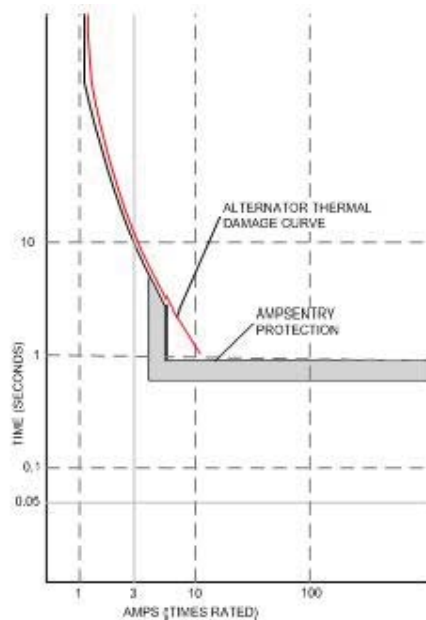
**High intake manifold temperature shutdown** - Level is preset (configurable with InPower or HMI) to match the capabilities of the engine used. Control includes time delays to prevent nuisance alarms.

## Full authority electronic engine protection

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

## Alternator protection

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



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

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

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



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

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

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

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

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

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

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

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

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

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

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

## Paralleling protection

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

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

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

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

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

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

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

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

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

## Field control interface

### Input signals to the PowerCommand control include:

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

For lean burn natural gas engine applications:

- Gearbox oil pressure/temperature protection
- Fire fault
- Earth fault
- Differential fault
- DC power supply fault
- Genset Interface Box (GIB) isolator open fault
- Start inhibit/enable (x3)
- Radiator fan trip

- Ventilator fan trip
- Ventilation louvers closed
- Start system trip
- Alternator heater trip
- Alternator heater status
- Alternator winding temperature (PT100 RTDx3)
- Alternator drive end bearing temperature (PT100 RTD)
- Alternator non-drive end bearing temperature (PT100 RTD)

**Output signals from the PowerCommand control include:**

- Load dump signal: Operates when the genset is in an overload condition.
- Delayed off signal: Time delay based output which will continue to remain active after the control has removed the run command. Adjustment range: 0 - 120 seconds. Default: 0 seconds.
- Configurable relay outputs: Control includes (4) relay output contacts (3 A, 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 (genset running) signal: Operates when the genset has reached 90% of rated speed and voltage and latches until genset is switched to off or idle mode.
- Paralleling circuit breaker relays outputs: Control includes (4) relay output contacts (3.5 A, 30 VDC) for opening and closing of the genset and utility breakers.

For lean burn natural gas engine applications:

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

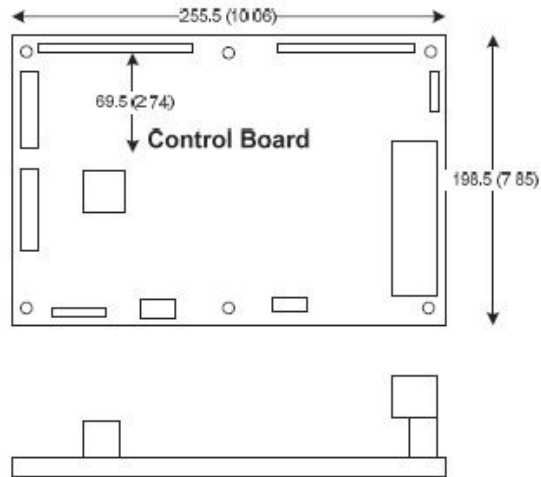
**Communications connections include:**

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

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

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

**Mechanical drawing**



# PowerCommand Human Machine Interface HMI320



## Description

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

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

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

## Features

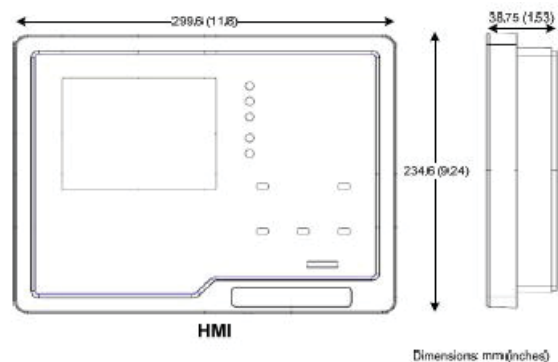
- LED indicating lamps:
  - Genset running
  - Remote start
  - Not in auto
  - Shutdown
  - Warning
  - Auto
  - Manual and stop
- Circuit breaker open (if equipped)
- Circuit breaker closed (if equipped)
- 320 x 240 pixels graphic LED backlight LCD.
- Four tactile feel membrane switches for LCD defined operation. The functions of these switches are defined dynamically on the LCD.
- Seven tactile feel membrane switches dedicated screen navigation buttons for up, down, left, right, ok, home and cancel.

- Six tactile feel membrane switches dedicated to control for auto, stop, manual, manual start, fault reset and lamp test/panel lamps.
- Two tactile feel membrane switches dedicated to control of circuit breaker (where applicable).
- Allows for complete genset control setup.
- Certifications: Suitable for use on gensets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std. and CE 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 gensets and transfer switches, to facilitate service and monitoring of these products.

## Environment

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

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

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

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

## Certifications

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

- NFPA 110 for level 1 and 2 systems.
- ISO 8528-4: 1993 compliance, controls and switchgear.
- CE marking: The control system is suitable for use on generator sets to be CE-marked.
- EN 50081-1,2 residential/light industrial emissions or industrial emissions.
- EN 50082-1,2 residential/light industrial or industrial susceptibility.
- ISO 7637-2, level 2; DC supply surge voltage test.
- Mil Std 202C, Method 101 and ASTM B117: Salt fog test.
- UL 508 recognized or Listed and suitable for use on UL 2200 Listed generator sets.
- CSA C282-M1999 compliance
- CSA 22.2 No. 14 M91 industrial controls.
- 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](http://power.cummins.com)**

**Our energy working for you.™**







## Alternator data sheet

Frame size: LVSI804R

<b>Characteristics</b>		2-bearing weight				
<b>Weights:</b>	Stator assembly:	7729 lb	3506 kg	7729 lb	3506 kg	
	Rotor assembly:	3856 lb	1749 kg	3719 lb	1687 kg	
	Complete assembly:	11585 lb	5255 kg	11448 lb	5193 kg	
<b>Maximum speed:</b>		2250 rpm				
<b>Excitation current:</b>	Full load:	3.6 Amps				
	No load:	0.86 Amps				
<b>Insulation system:</b>	Class H throughout					
<b>3 <math>\phi</math> Ratings</b>	(0.8 power factor)	<b>60 Hz</b> (winding no)				
(Based on specific temperature rise at 40° C ambient temperature)		<u>416</u> (12)	<u>440</u> (12)	<u>480</u> (12)	<u>600</u> (07)	<u>380</u> (13)
163° C rise ratings	@ 27° C	kW	2288	2420	2640	2640
			kVA	2860	3025	3300
150° C rise ratings		kW	2224	2352	2560	2560
		kVA	2780	2940	3200	3200
125° C rise ratings		kW	2080	2200	2400	2400
		kVA	2600	2750	3000	3000
105° C rise ratings		kW	1908	2016	2200	2200
		kVA	2385	2520	2750	2750
80° C rise ratings		kW	1664	1760	1920	1920
		kVA	2080	2200	2400	2400
<b>Reactances</b>	(per unit $\pm$ 10%)	<u>416</u> (12)	<u>440</u> (12)	<u>480</u> (12)	<u>600</u> (07)	<u>380</u> (13)
(Based on full load at 105° C rise rating)						
Synchronous		3.346	3.164	2.900	2.800	2.850
Transient		0.264	0.250	0.229	0.217	0.220
Subtransient		0.196	0.185	0.170	0.160	0.161
Negative sequence		0.280	0.265	0.243	0.230	0.232
Zero sequence		0.042	0.039	0.036	0.033	0.029
<b>Motor starting</b>		<u>416</u> (12)	<u>440</u> (12)	<u>480</u> (12)	<u>600</u> (07)	<u>380</u> (13)
Maximum kVA	(90% sustained voltage)	7267	7267	7267	7233	7333
<b>Time constants</b>		<u>416-480</u> (12)		<u>600</u> (07)	<u>380</u> (13)	
(sec)						
Transient			0.184	0.183	0.180	
Subtransient			0.015	0.014	0.015	
Open circuit			3.950	4.000	4.100	
DC			0.068	0.069	0.067	
<b>Windings</b>	(@20° C)	<u>416-480</u> (12)		<u>600</u> (07)	<u>380</u> (13)	
Stator resistance	(Ohms per phase)	0.00133		0.00195	0.00081	
Rotor resistance	(Ohms)	1.320		1.320	1.320	
Number of leads		6		6	6	

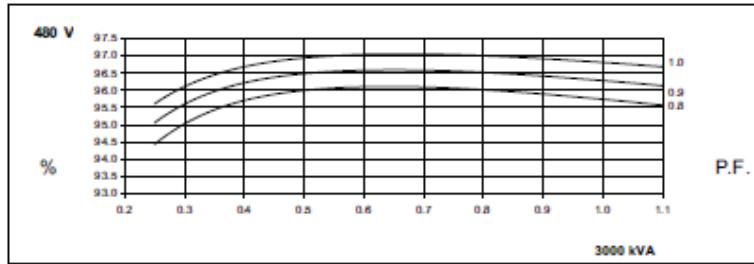


# Alternator data sheet

Frame size: LVSI804R

THREE PHASE EFFICIENCY CURVES WDG 12

60 Hz

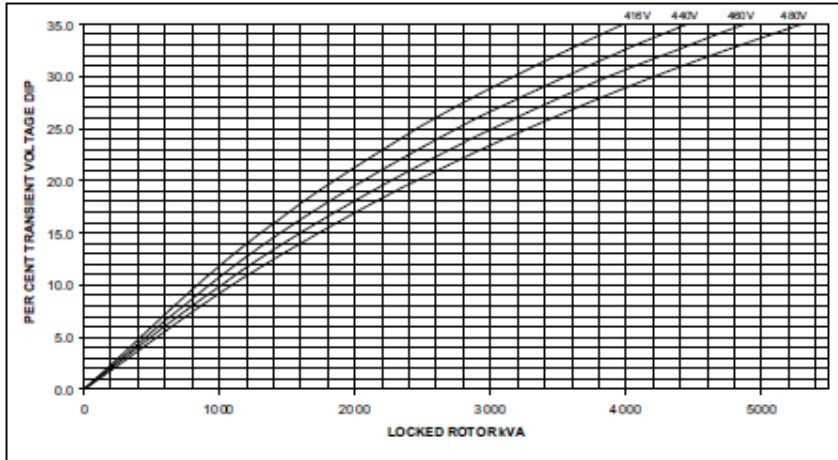




# Alternator data sheet

Frame size: LVSI804R

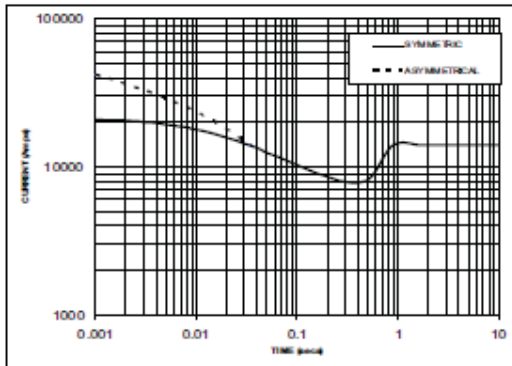
LOCKED ROTOR MOTOR STARTING CURVE WDG 12 60 HZ



## WDG 12 60Hz

### Three Phase Short Circuit Decrement Curve No- Load Excitation at Rated Speed

Based on series star (wye) connection



NOTE 1  
THE FOLLOWING MULTIPLICATION FACTORS SHOULD BE USED TO ADJUST THE VALUE FROM CURRENT (AMPERES) TO BE CONSIDERED THE MINIMUM CURRENT POINT IN RESPECT OF NORMAL OPERATING VOLTAGE:

VOLTAGE	FACTOR
415V	X0.87
440V	X0.82
460V	X0.96
480V	X1.00

THE SUSSTAINED CURRENT VALUES CONSIDERED RESPECTIVE OF ALL TOLERANCES.

NOTE 2  
THE FOLLOWING MULTIPLICATION FACTORS SHOULD BE USED TO CONVERT THE VALUE OBTAINED ACCORDING WITH NOTE 1 TO THEIR APPLICABLE TO THE VARIOUS TYPES OF SHORT CIRCUIT:

	3 PHASE	2 PHASE LL	1 PHASE LL
ASYMMETRICAL	X 1.0	X0.87	X1.20
WYME	X 1.0	X1.50	X2.50
ASYMMETRICAL	X 1.0	X1.50	X2.50
WYME	ISRC	ISRC	ISRC

ALL OTHER VALUES UNCHANGED

SUSTAINED SHORT CIRCUIT = 14073 Amps



# Triplex Diesel Fuel Filter Kit

## A044C235

### Description

Cummins Power Generation Triplex Fuel Filter Kit offers our customers optimum protection for their fuel systems and reduced operating costs for their bottom line. Our fuel filter kit offers remote-mount fuel filtration designed exclusively for electronic engines – the best choice for customers who want to extend service intervals and increase vehicle uptime.

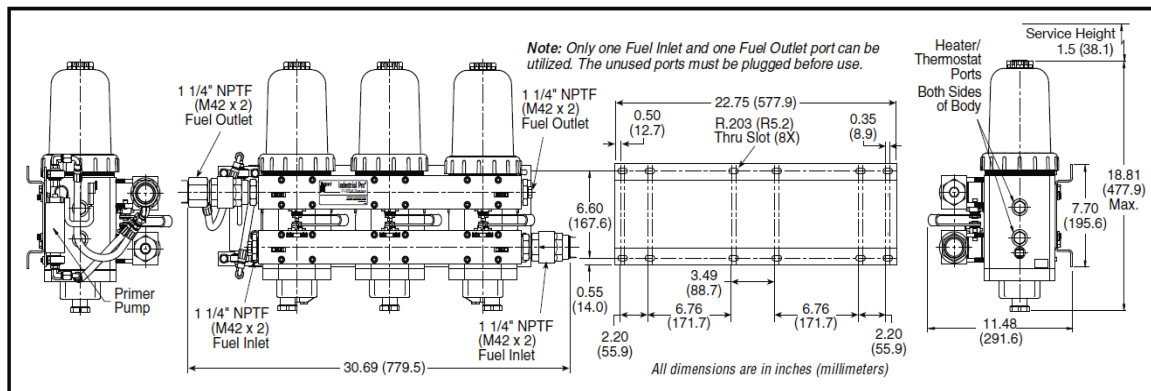
The introduction of global clean air standards that focused on reduce emissions (NOx and particulate) also increased the challenges for diesel engine fuel systems. Changing emissions regulations and increasing fuel costs established the use of ultra-low sulphur diesel (ULSD) and biodiesel blends, which created unique maintenance challenges for the fuel system. With filtration requirements as low as two microns on some high-pressure common rail (HPCR) fuel systems, it is imperative to have the best quality fuel and fuel filtration. Cummins Power Generation offers the product that you need to maintain and protect the modern fuel system.

### Specifications

- Patented 'Seeing Is Believing' technology, see when not to change the fuel filter
- Extended filter change intervals
- Five minute no mess filter change
- Low restriction check valve eliminations loss of prime when draining or changing the filter
- Sturdy, quick acting drain for water and containment removal
- Clear bottom bowl with sturdy, self-venting drain
- Includes Water In Fuel (WIF) sensor
- Reduced restriction to flow
- Meets OEM efficiency requirements
- Heavy duty design with anodized body and highly resistant polymers
- Biodiesel compatible to ASTM D6751 and EN14214 fuel standards
- Optional heater available through Cummins Filtration

## Specifications

Description	Measurement
Height overall	19.02" (483.1 mm)
Depth overall	10.46" (265.8 mm) / 11.04" (280.4 mm)
Width (maximum)	22.24" (564.9 mm)
Mounting bracket centers (vertical)	6.60" (167.6 mm)
Mounting bracket centers (horizontal)	6.75" (171.5 mm)
Weight (dry)	70 lbs (31.75 kg)
Fuel capacity (without filter)	1.11 gal (4202 ml)
Fuel connections	1 1/4" NPT (M42 x 2)
Fuel flow rate	600 gal/hr (2272 L/hr)
Recommended applications	Diesel generator sets / heavy duty diesel engines
Water trap capacity	60.9 fluid oz (1800 ml)
Filter service clearance	Minimum 1.5" (38.1 mm)
Electrical heater	Optional 12 VDC or 24 VDC through Cummins Filtration
Primer pump	Supply voltage 24 VDC
Fuel types	Diesel #1, Diesel #2, Kerosene, Biodiesel, JP8



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

Europe, CIS, Middle East and Africa  
Manston Park Columbus Ave.  
Manston Ramsgate  
Kent CT 12 5BT United Kingdom  
Phone: 44 1843 255000

Asia Pacific  
10 Toh Guan Road #07-01  
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# CUMMINS PREMIUM<sup>®</sup>

## C8D

### 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	<b>8D</b>
Terminal BCI Figure	<b>SAE</b>
Voltage	<b>12</b>
CCA 0°F (-18°C) (SAE-Standard)	<b>1155</b>
CA 32°F (0°C) (SAE-Standard)	<b>1445</b>
RC @80°F (27°C) (SAE-Standard)	<b>380</b>
Ampere Hour	<b>158</b>
Weight (lb)	<b>122.4</b>
Electrolyte Quantity Gallons	<b>4.25</b>
Electrolyte Quantity Fluid Ounces	<b>544</b>

## BATTERY DIMENSIONS

Terminal BCI Figure

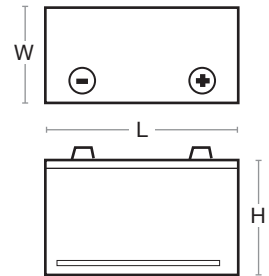


**SAE**

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**

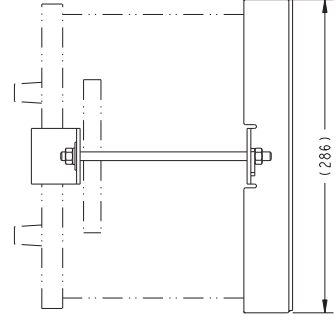
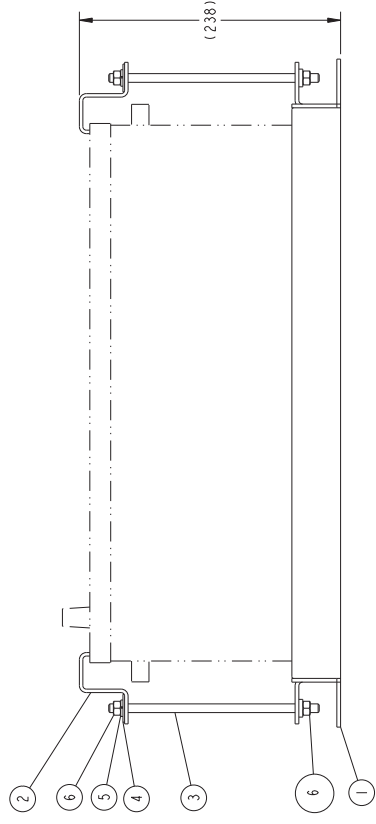
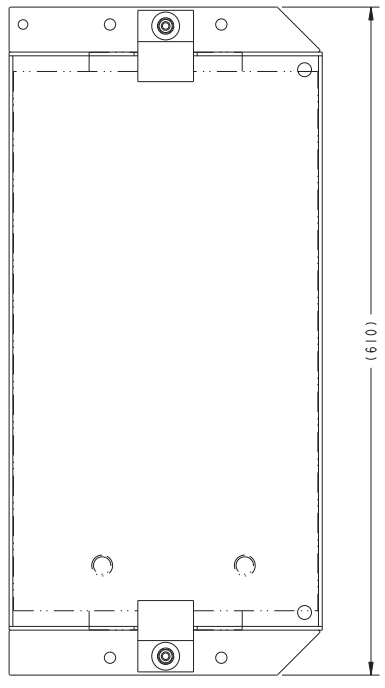
**For more information contact us: 1-800-CUMMINS™**

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PIT® Cre® Parametric

REV. NO.	DATE	BY	CHKD.	APPD.	DATE
ECO-142146 C					
DRAWING TITLE - BATTERY RACK - HOLD-DOWN ASSY. BATTERY RACK AND HOLD-DOWN ASSEMBLY					



UNLESS OTHERWISE SPECIFIED:		DIM. TO		FORM		CUMMINS POWER GENERATION	
TOLERANCES UNLESS OTHERWISE SPECIFIED:		DO NOT SCALE PRINT		APP. SR		BATTERY RACK - HOLD-DOWN ASSY	
.125 ± .005		.125 ± .005		DATE 17SEPP63		SITE CODE	
.250 ± .005		.250 ± .005		FOR MATERIALS / PARTS IN		PGF 0416_0527	
.375 ± .005		.375 ± .005		DRAWING, SPEC. AND		REV. C	
.500 ± .005		.500 ± .005		PARTS LIST		SHEET 1 OF 1	
.625 ± .005		.625 ± .005		SCALE: 1.3/32		GENERAL	
.750 ± .005		.750 ± .005		ANG TOL: ± 1.0°		C	

# Best Battery Selector BBS-1600 & BBS-4800

**Cross-couples Two Batteries to Two Independent Loads for Highest DC System Reliability**



- For dual battery, dual or single load configurations
- Delivers current to both loads from either one or both batteries
- Isolates one battery from the other
- All solid-state design, oversized heat sinks assure reliable operation
- IBC seismic certified

**SENS Best Battery Selectors (BBS) deliver power from two different batteries to one or two loads, such as engine starter motors or electrical switchgear. In case one battery is weak or failed, power automatically flows to both starters or loads from the other battery.**

**Although the BBS can deliver battery power from either battery to either load, it prevents parallel connection of two batteries so that the failure of one battery does not take down the other.**

**All solid-state design uses large diodes mounted on generously sized heat sinks. There are no moving parts or need for control electronics.**

**Two units are available, both suitable for a wide range of loads in applications ranging from 12 volts to 120 volts DC nominal. The BBS-1600 is rated for 2500 peak amps (for engine starting) and 50 amps for continuous loads. The BBS-4800 is rated for 6400 peak amps and 150 amps for continuous loads.**



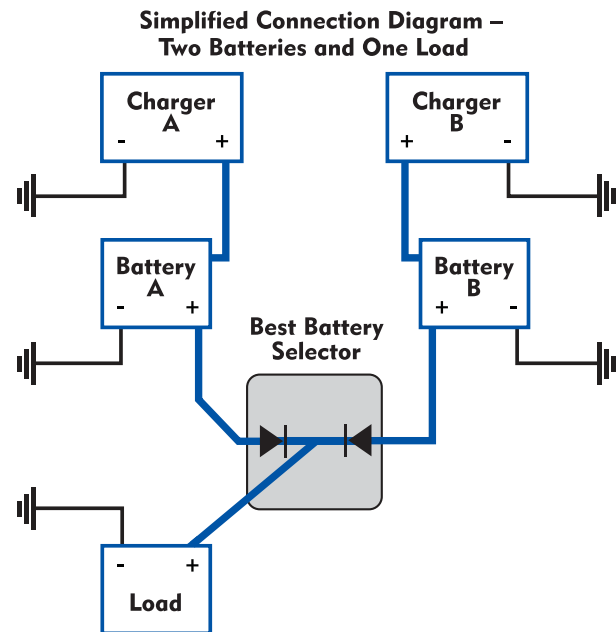
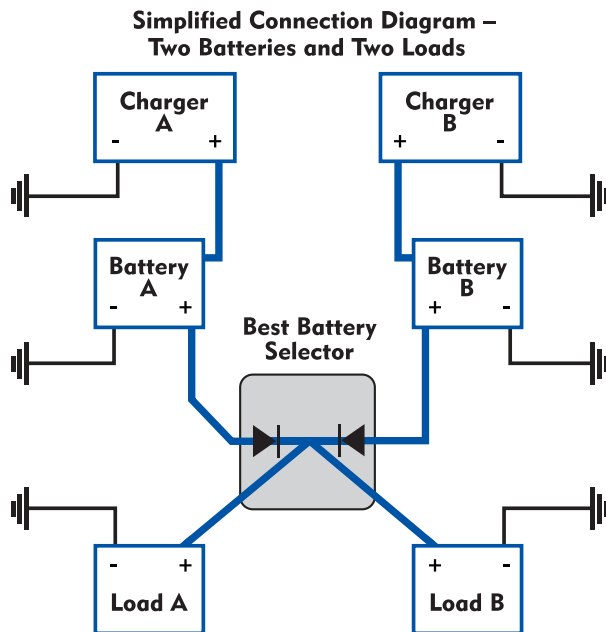


# Specifications

Specifications		
Model	BBS-1600	BBS-4800
Electrical configuration	Two diodes, common cathode	
DC system nominal voltage	Up to 120 volts DC	
NFPA Cranking Break-Away	2,500 amps	6,400 amps
BBS 30 sec. rated current	3,200 amps @ -18C 2,150 amps @ +50C	7,150 amps at -18C 4,950 amps at +50C
Engine start duty cycle	90 second continuous duty max	
BBS continuous rated current	50 amps @ +50C	150 amps @ +50C
Wire size	#6 AWG to 250 MCM	#6 AWG to 350 MCM
Dimensions	12.3"W x 8.6"D x 16.3"H	19.4"W x 13.0"D x 17.6"H
Weight	20 lbs / 9.1 kg	55 lbs / 24.9 kg
Transient protection	Large sized MOV	
Seismic Certification	IBC seismic certified to $S_{ds}$ value of 2.28g	

\* Diode rating only, not BBS rated output.

## Typical Connection Diagrams



During normal operation, current to either a single load or dual loads flows from both chargers and both batteries through the BBS. Should one battery fail (e.g. shorted cell or open circuit) the other battery will continue to power one or both loads automatically and without interruption. The Best Battery Selector (BBS) OR diodes fully isolate a bad battery from the rest of the system.

The BBS must be sized to carry the worst-case loads anticipated from one battery into one load.



### Contact information

For information and service on any SENS product, please contact us at:  
 Sales 1.866.736.7872 • 303.678.7500 • Fax 303.678.7504  
[www.sens-usa.com](http://www.sens-usa.com) • [info@sens-usa.com](mailto:info@sens-usa.com)  
 Stored Energy Systems, LLC  
 1840 Industrial Circle, Longmont, CO 80501 USA



# Battery charger-20 amp

## A042R355 60Hz



### Description

Cummins Power Generation 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 (A048N240) 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 is recommended in all applications, but is particularly valuable for generator sets in outdoor applications.

Battery charger is set for charging a 24 VDC battery systems at 50/60 Hz operation. Simple jumper selector enable selection of battery type to be used.

### 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 aluminum enclosure designed for wall mounting.

**Faults** – The charger senses and annunciates the following fault conditions: AC power loss, battery overvoltage, battery undervoltage, 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.

## Specifications

### Performance and physical characteristics

Output:	Nominal voltage	24 VDC
	Float voltage – 24 V 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	20 A @ 24 VDC
	Equalize charging	Battery interactive autoboot
Input:	Voltage AC	120, 208, 240 ±10%
	Frequency	50/60 Hz ±5% Model A042R355
Approximate net weight:		25 lbs (11.36 Kg)
Approximate dimensions: height x width x depth-in(mm)		13.06 x 13.95 x 6.83 (322 x 354 x 173)
Ambient temperature operation: At full rated output		- 4 °F to 104 °F (-20 °C to 45 °C)



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

**Europe, CIS, Middle East and Africa**  
 Manston Park Columbus Ave.  
 Manston Ramsgate  
 Kent CT 12 5BF United Kingdom  
 Phone 44 1843 255000  
 Fax 44 1843 255902

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

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

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

# PowerCommand<sup>®</sup> Annunciator

## Discrete Input or PCCNet



### > Specification sheet

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



## Power Generation

### Description

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

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

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

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

### Features

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

## Specifications

### Signal requirements

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

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

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

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

Max conductor size for terminal: 12 ga

### Relay outputs

0.2 A at 125 VAC and 1 A at 30 VDC

### Network connections

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

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

### Power

Maximum consumption: 15 watts

### Battery voltage

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

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

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

### Alarm horn

Sound level: 90 dB at 30 cm

### Physical

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

### Temperature

-20 °C to +70 °C (-4 °F to +158 °F)

### Humidity

10% to 95% RH (non-condensing)

## Default lamp configurations

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

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

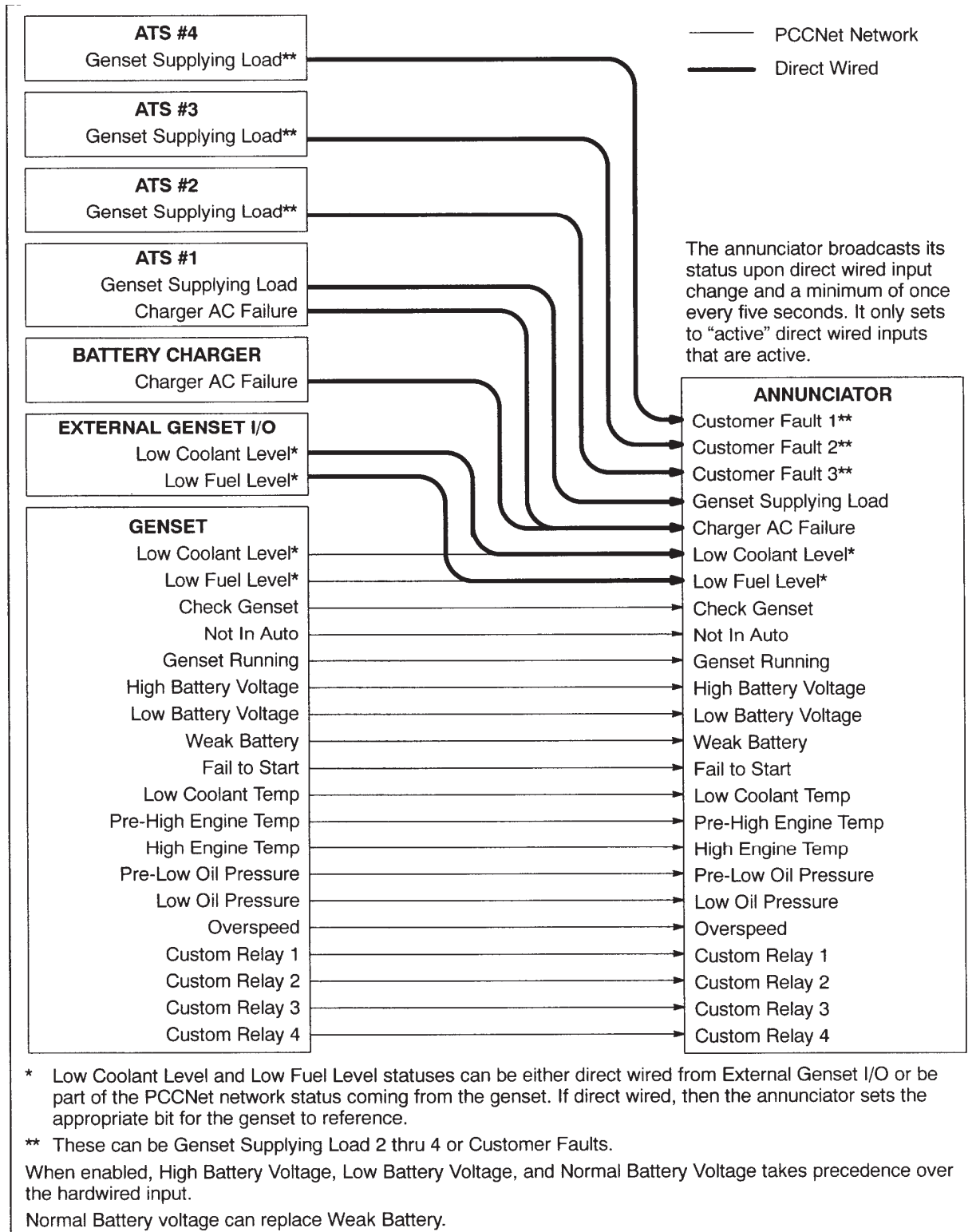
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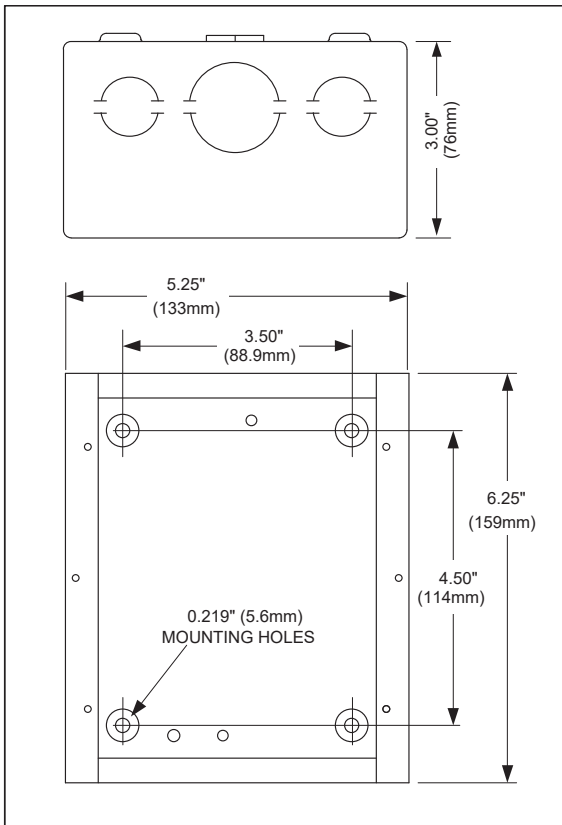
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## Typical installation



## Dimensions



Dimensions: in (mm)

## Ordering information

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

**PCCNet**  
  
**COMPATIBLE**

See your distributor for more information.

Cummins Power Generation

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

Europe, CIS, Middle East and Africa  
 Manston Park Columbus Ave.  
 Manston Ramsgate  
 Kent CT 12 5BF United Kingdom  
 Phone 44 1843 255000  
 Fax 44 1843 255902

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 10 Toh Guan Road #07-01  
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# Cummins®



## ProtoAir FPA-W44 Start-up Guide

### For Interfacing Cummins Products:

PCC\_1301, PCC\_2100\_3100, PCC\_2300, PCC\_3300, FIRE\_PMP,  
PCC\_3201\_1, PCC\_3201\_2, PCC\_3201\_3, PCC\_3201\_4, MCM3320,  
AUX101\_102, Pwr\_Mngr\_XP, Group\_5, Group\_G, Detector

### To Building Automation Systems and SMC Cloud:

BACnet/IP, BACnet MS/TP, Modbus RTU, Modbus TCP/IP, SNMP,  
EtherNet/IP, DF1, DNP 3.0 Serial and DNP 3.0 Ethernet

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#### APPLICABILITY & EFFECTIVITY

Explains ProtoAir hardware and how to install it.

The instructions are effective for the above as of January 2019.



## Technical Support

Thank you for purchasing the ProtoAir for Cummins.

Please call Cummins for technical support of the ProtoAir product.

Sierra Monitor Corporation does not provide direct support. If Cummins needs to escalate the concern, they will contact Sierra Monitor Corporation for assistance.

Support Contact Information:

Cummins Sales and Service  
Central CDUC  
875 Lawrence Dr., De Pere  
WI 54115

Cummins Service:  
(920) 337-9750

Email: [memea.customerassistance@cummins.com](mailto:memea.customerassistance@cummins.com)

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

## Quick Start Guide

1. Methods of Configuration: (**Section 2.2**)
  - Auto-Discovery: See **Figure 1** for the table of devices that support automatic configuration.
  - Web Configurator: For devices that cannot be automatically configured, use a web browser to access the Web Configurator page.
2. Record the information about the unit. (**Section 3.1**)
3. Set COM settings for the device that will be connected to ProtoAir. (**Section 3.3**)
4. Connect the ProtoAir 3 pin RS-485 R1 port to the RS-485 network connected to each of the devices. (**Section 4.1**)
5. Connect the ProtoAir 3 pin RS-485 R2 port to the field protocol cabling. (**Section 4.2**)
6. Connect power to ProtoAir's 3 pin connector. (**Section 4.5**)
7. Connect a PC to the ProtoAir via Ethernet cable or by the ProtoAir's Wi-Fi Access Point. (**Section 5**)
8. Auto-Discovery Devices: On the Web Configurator page, click the Discovery Mode button at the bottom of the screen. It may take about 3 minutes for all the devices to be discovered and the configuration file to be built. (**Section 6.3**)
9. Web Configuration Devices: Use a web browser to access the ProtoAir Web Configurator page to select the profile of the device attached to the ProtoAir and enter any necessary device information. Once the device is selected, the ProtoAir automatically builds and loads the appropriate configuration. (**Section 6.4**)

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# 1 CERTIFICATION

## 1.1 BTL Mark – BACnet<sup>®1</sup> Testing Laboratory



BACnet is a registered trademark of ASHRAE. ASHRAE does not endorse, approve or test products for compliance with ASHRAE standards. Compliance of listed products to requirements of ASHRAE Standard 135 is the responsibility of the BACnet International. BTL is a registered trademark of the BACnet International.

The BTL Mark on ProtoAir is a symbol that indicates that a product has passed a series of rigorous tests conducted by an independent laboratory which verifies that the product correctly implements the BACnet features claimed in the listing. The mark is a symbol of a high-quality BACnet product.

Go to [www.BACnetInternational.net](http://www.BACnetInternational.net) for more information about the BACnet Testing Laboratory. Click [here](#) for the BACnet PIC Statement.

<sup>1</sup> BACnet is a registered trademark of ASHRAE

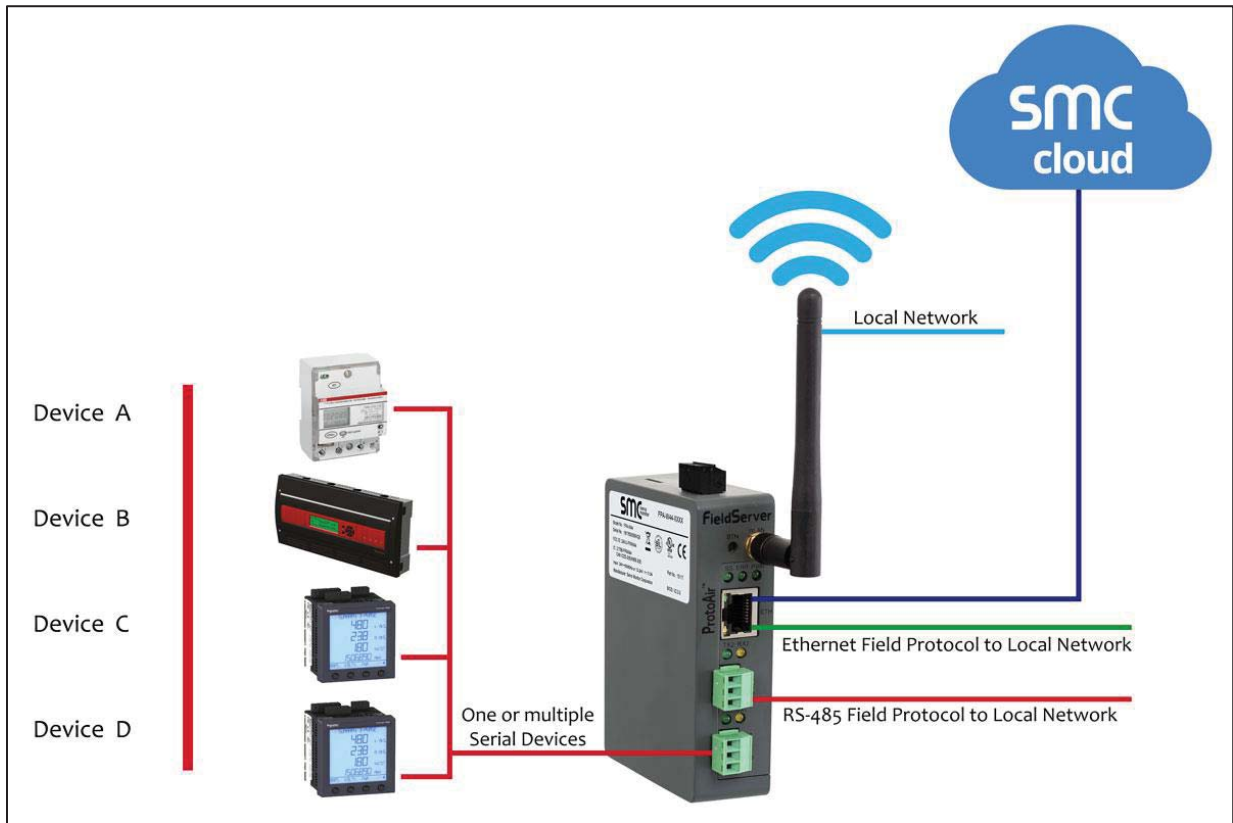
## 2 INTRODUCTION

### 2.1 ProtoAir Gateway

The ProtoAir wireless gateway is an external, high performance **building automation multi-protocol gateway** that is preconfigured to automatically communicate between Cummins' devices (hereafter simply called "device") connected to the ProtoAir and automatically configures them for BACnet/IP, BACnet MS/TP, Modbus TCP/IP, Modbus RTU, SNMP, EtherNet/IP, DF1, DNP 3.0 Serial and DNP 3.0 Ethernet.

It is not necessary to download any configuration files to support the required applications. The ProtoAir is pre-loaded with tested profiles/configurations for the supported devices.

**FPA-W44 Connectivity Diagram:**



The ProtoAir can connect with Sierra Monitor's SMC Cloud. The SMC Cloud allows technicians, the OEM's support team and Sierra Monitor's support team to remotely connect to the ProtoAir. The SMC Cloud provides the following capabilities for any registered devices in the field:

- Remotely monitor and control devices.
- Collect device data and view it on the SMC Cloud Dashboard and the SMC Smart Phone App.
- Create user defined device notifications (alarm, trouble and warning) via SMS and/or Email.
- Generate diagnostic captures (as needed for troubleshooting) without going to the site.

For more information about the SMC Cloud, refer to the [SMC Cloud Start-up Guide](#).



# 2020 EPA Tier 2 Exhaust Emission Compliance Statement

## 2250DQKAF

### 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 when tested per ISO8178 D2.

Engine Manufacturer:	Cummins Inc.
EPA Certificate Number:	LCEXL060.AAD-035
Effective Date:	07/08/2019
Date Issued:	07/08/2019
EPA Engine Family (Cummins Emissions Family):	LCEXL060.AAD

**Engine information:**

Model:	QSK60-G14 NR2	Bore:	6.25 in. (159 mm)
Engine Nameplate HP:	3280	Stroke:	7.48 in. (190 mm)
Type:	4 cycle, 60°V, 16 Cylinder Diesel	Displacement:	3673 cu. in. (60.2 liters)
Aspiration:	Turbocharged and Low Temperature Aftercooled	Compression Ratio:	14.5:1
Emission control device:	Electronic Control		

**Diesel Fuel Emissions Limits**

**D2 Cycle Exhaust Emissions**

	Grams per BHP-hr			Grams per kW <sub>m</sub> -hr		
	<u>NO<sub>x</sub> + NMHC</u>	<u>CO</u>	<u>PM</u>	<u>NO<sub>x</sub> + NMHC</u>	<u>CO</u>	<u>PM</u>
Test Results	4.5	0.3	0.04	6.0	0.4	0.05
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, 7-15 ppm Sulfur.

**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 H<sub>2</sub>O/lb) of dry air; required for NO<sub>x</sub> 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.





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



<u>Generator set models</u>	<u>Representative prototype</u>
2000DQKAE	Model: 2250DQKAF
1750DQKAD	Alternator: LVSI804T
	Engine: QSK60-G14

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: 2450 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 in excess of 2500 psi. A spectrum analysis of the transducer output was conducted over the speed range of 1350 to 1860 RPM.

**Cooling system:** High ambient  
Enhanced high 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 elevated ambient temperature under static restriction conditions.

**Durability:**  
The generator set was subjected to endurance test replicating field duty cycles 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. It was within the specified maximum limits.

Voltage regulation: ± 0.5%  
Random voltage variation: ± 0.5%  
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 or rejection were evaluated. The following results were recorded.

Full load acceptance:

Voltage dip:	40.9%
Recovery time:	4.3 seconds
Frequency dip:	12.7%
Recovery time:	5.4 seconds

Full load rejection:

Voltage rise:	18.0%
Recovery time:	2.5 seconds
Frequency rise:	5.5%
Recovery time:	3.4 seconds

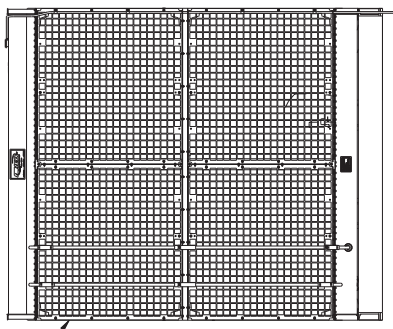
**Harmonic analysis:**  
(Per alternator P7G, MIL-STD-705B, method 601.4)

<u>Harmonic</u>	<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	0.06	0.18	0.06	0.08
5	0.86	1.20	0.87	1.24
7	0.72	1.96	0.76	1.96
9	0	0	0	0.03
11	0.39	0.65	0.40	0.64
13	0.13	0.48	0.14	0.46
15	0	0	0	0

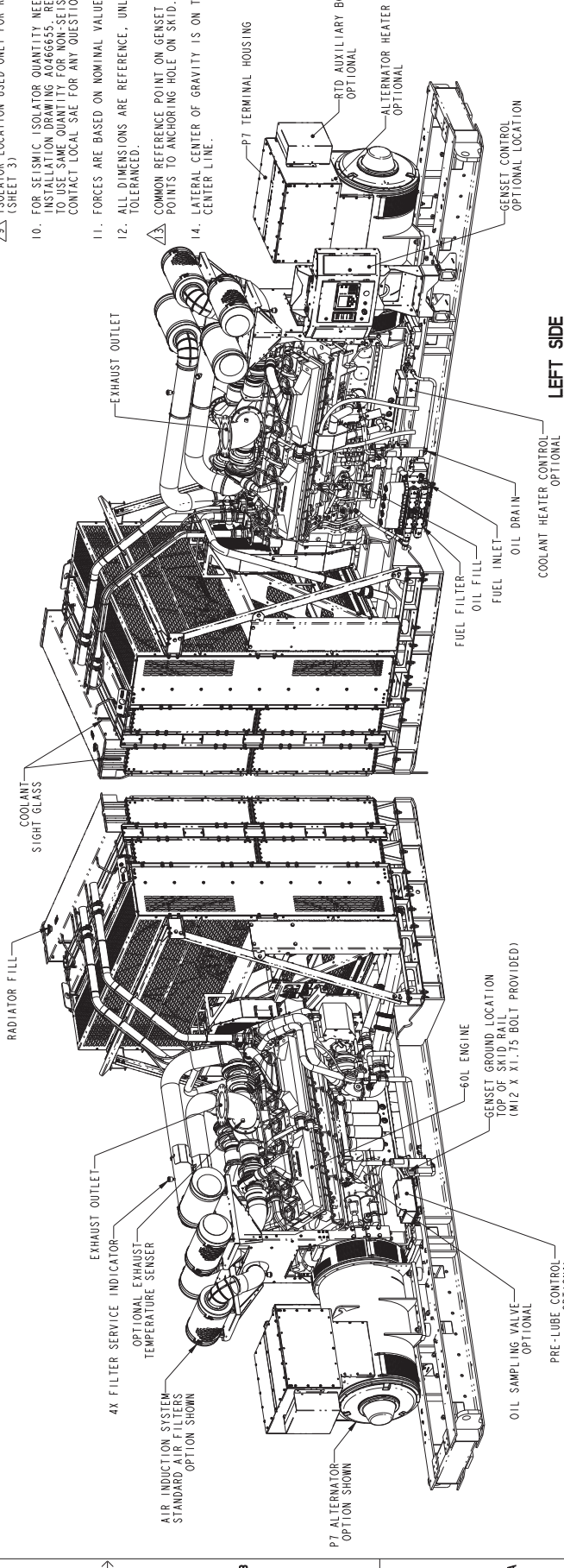
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		2	SEE SHEET 8	JCV AS	A. SAMUEL	16 JAN 19
		3	SEE SHEET 8	JCV AS	A. SAMUEL	16 JAN 19
		4	SEE SHEET 11	JCV AS	A. SAMUEL	16 JAN 19
		5	SEE SHEET 11	JCV AS	A. SAMUEL	16 JAN 19

NOTES:

1. ALL DIMENSIONS SHOWN IN [ ] ARE INCHES.
2. PROVIDE FLEXIBLE CONDUIT TO CONTROL BOX.
3. GENSET SHIPPED FILLED WITH ENGINE OIL.
4. SUPPLIED FUEL HOSE:
  - 4.1. FUEL INLET HOSE:  $\varnothing 22.2$  (0.88) X 1270 (50.0) LONG WITH 1-11/16 NPT EXTERNAL FITTING.
  - 4.2. FUEL OUTLET HOSE:  $\varnothing 16$  (0.64) X 1270 (50.0) LONG WITH 3/4-14 NPT EXTERNAL FITTING.
5. IN-SKID ANTI VIBRATION MOUNTS ARE STANDARD ON THESE GENSETS.
6. GENSET LIFTING SHACKLES TO BE USED PER DIMENSIONS SHOWN. (SHEETS 2 AND 3)
7. MINIMUM AIR FILTER REMOVAL DISTANCE: HEAVY DUTY AIR FILTER = 700 (28) (SHEET 3) STANDARD DUTY AIR FILTER = 610 (24) (SHEET 2)
8. GENSET WEIGHTS ARE WITH STANDARD DUTY AIR CLEANERS. ADD 59 kg (130 LBS) WITH HEAVY DUTY AIR CLEANER.
9. ISOLATOR LOCATION USED ONLY FOR ROOFTOP INSTALLATIONS.
10. FOR SEISMIC ISOLATOR QUANTITY NEEDED, USE GENSET INSTALLATION DRAWING A0486655. RECOMMENDATION TO USE SAME QUANTITY FOR NON-SEISMIC ISOLATORS AS WELL. CONTACT LOCAL SAE FOR ANY QUESTIONS.
11. FORCES ARE BASED ON NOMINAL VALUE.
12. ALL DIMENSIONS ARE REFERENCE, UNLESS SPECIFICALLY TOLERANCED.
13. COMMON REFERENCE POINT ON GENSET SKID (→) POINTS TO ANCHORING HOLE ON SKID. SEE SHEET 3.
14. LATERAL CENTER OF GRAVITY IS ON THE CRANK SHAFT CENTER LINE.



REAR



RIGHT SIDE

LEFT SIDE

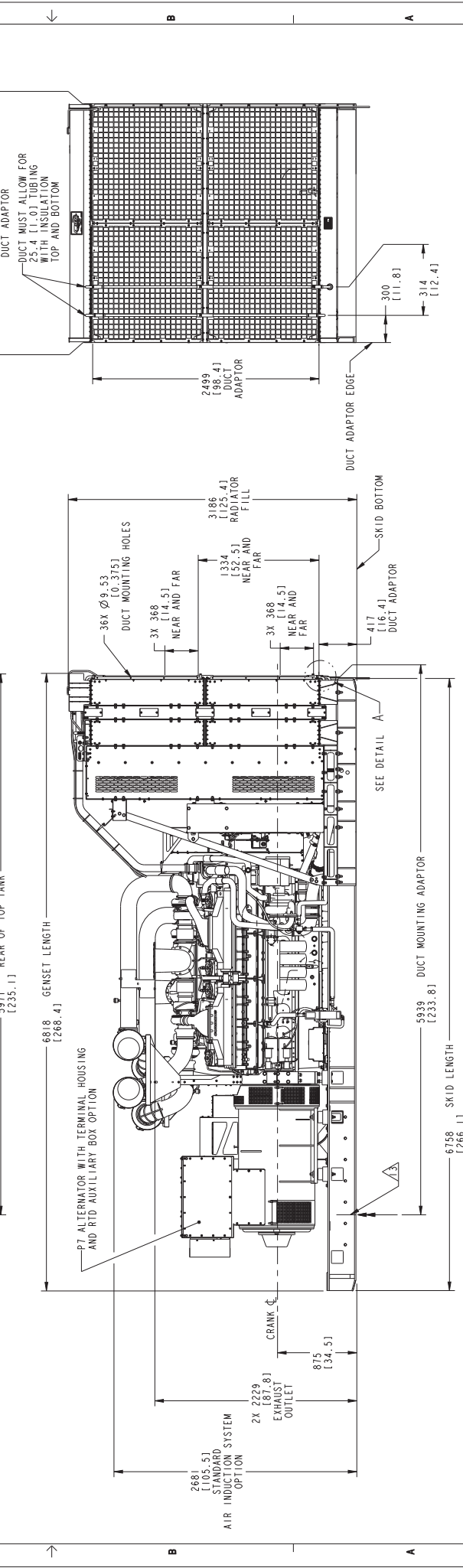
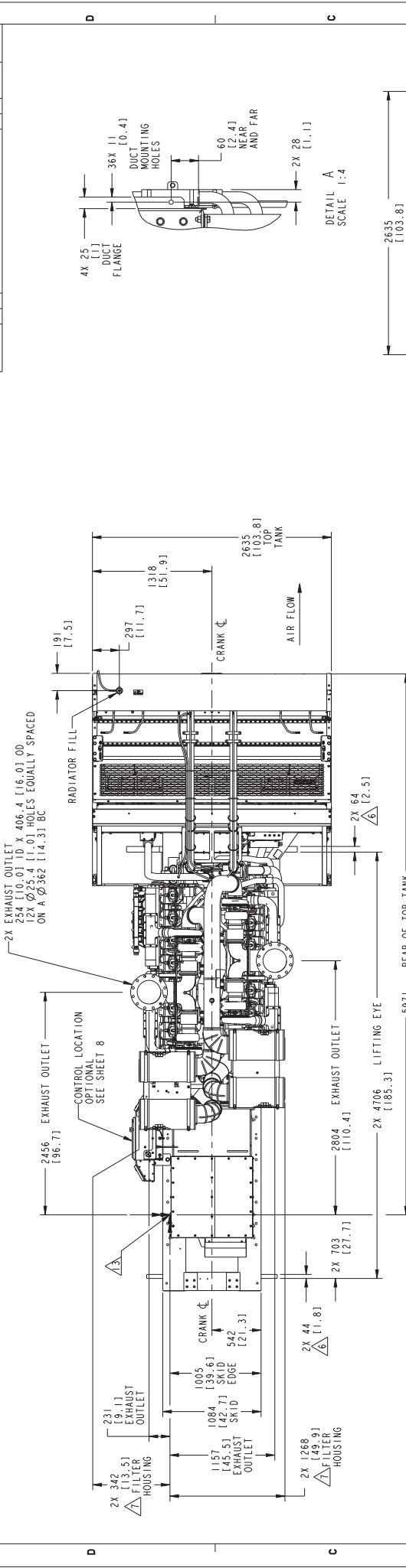
UNITS OF MEASURE		MM	IN
LENGTH	1:20	0.00 - 4.99	+0.15/-0.08
AREA	1:20	0.00 - 1.49	+0.25/-0.13
VOLUME	1:20	1.50 - 24.99	+0.30/-0.13
DIMENSIONS ARE UNLESS OTHERWISE SPECIFIED IN MILLIMETERS			
TOLERANCES UNLESS OTHERWISE SPECIFIED ARE: FRACTIONS DECIMALS MILLIMETERS			
FRACTIONS: ±0.10 ±0.05 ±0.025 ±0.0125			
DECIMALS: ±0.15 ±0.075 ±0.0375 ±0.01875			
MILLIMETERS: ±0.15 ±0.075 ±0.0375 ±0.01875			

DESIGNED BY	S. OSVOLD
CHECKED BY	L. ERNST
APPROVED BY	A. BORRITO
DATE	13 JAN 16
SCALE	1:20
PROJECT NO.	A054M294
REV.	B
DATE	16 JAN 19

**CUMMINS POWER GENERATION**  
**OUTLINE, GENSET**  
 BUILT, ENHANCED HIGH AMBIENT  
 PGF **B** A054M294  
 1 of 10

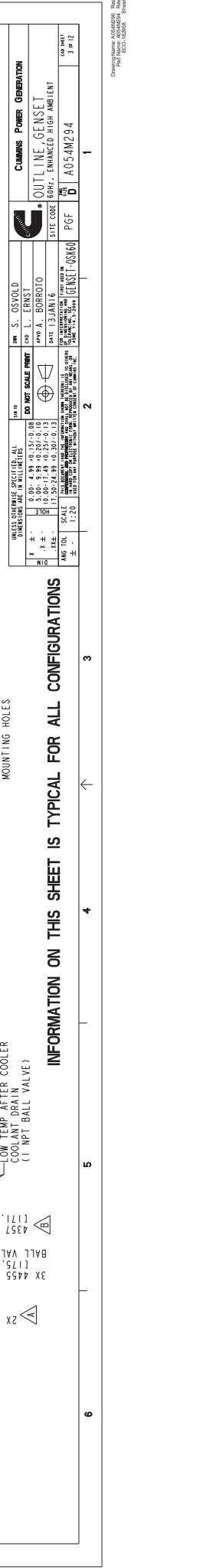
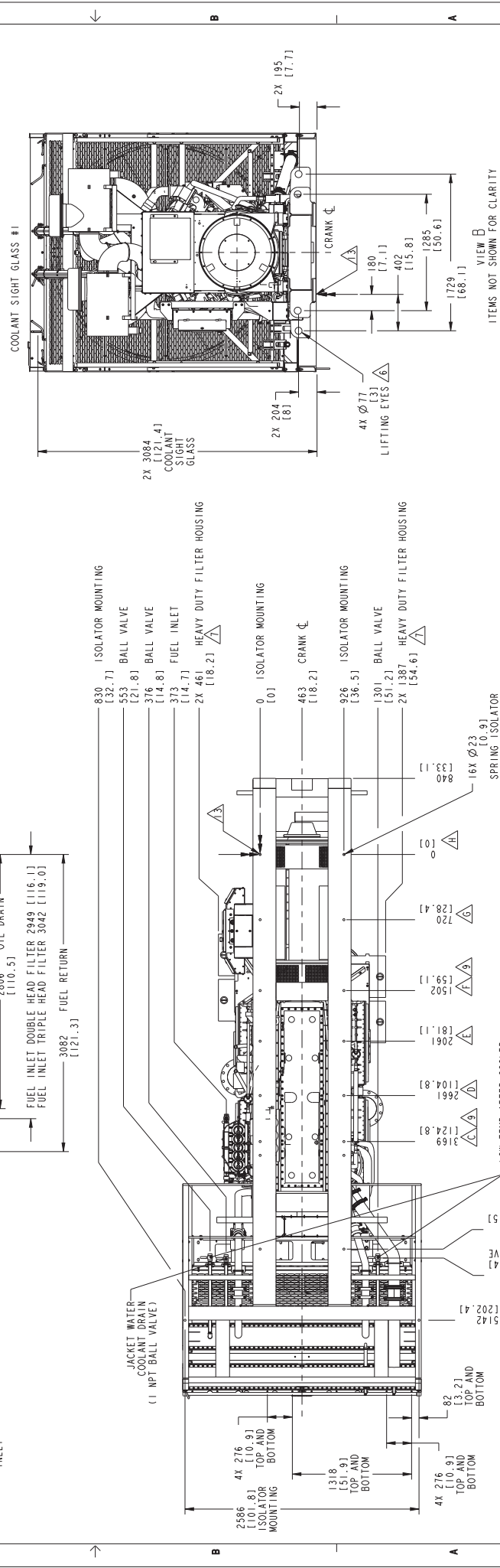
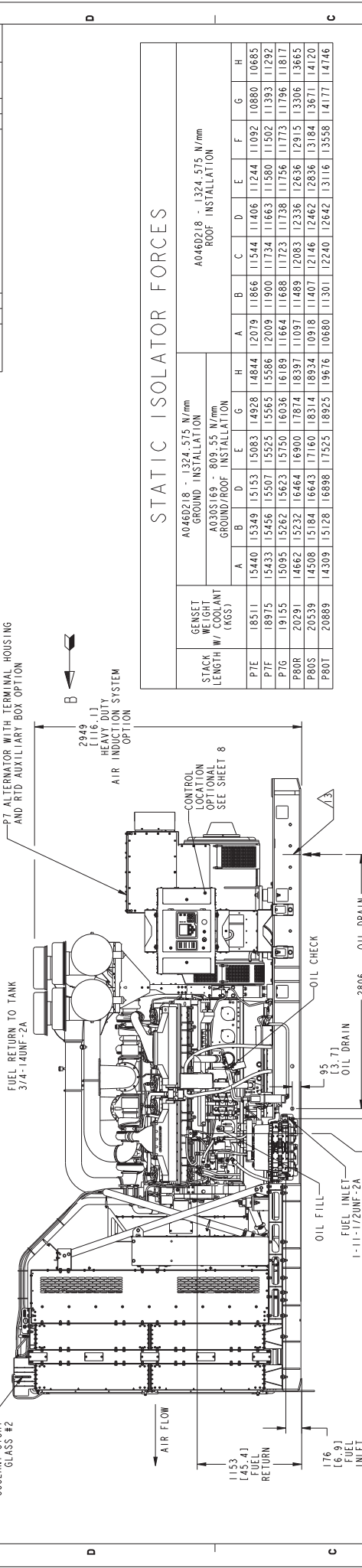
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1 REL NO: ECD-182958 PROJ: AS A. SAMUEL DATE: 16 JAN 19						



UNITS: DIMENSIONS ARE IN MILLIMETERS 1: X - 0.00 - 4.99 +0.15/-0.08 2: X - 5.00 - 24.99 +0.25/-0.13 3: X - 25.00 - 99.99 +0.50/-0.25 4: X - 100.00 - 249.99 +0.75/-0.38 5: X - 250.00 - 499.99 +1.00/-0.50 6: X - 500.00 - 999.99 +1.50/-0.75 7: X - 1000.00 - 2499.99 +2.00/-1.00 8: X - 2500.00 - 4999.99 +3.00/-1.50 9: X - 5000.00 - 9999.99 +4.00/-2.00 10: X - 10000.00 - 24999.99 +5.00/-2.50 11: X - 25000.00 - 49999.99 +7.00/-3.50 12: X - 50000.00 - 99999.99 +10.00/-5.00 DIMENSIONS NOT TO SCALE UNLESS OTHERWISE SPECIFIED		S. OSVOLD L. ERNST P. BORRITO DATE: 13 JAN 16 SCALE: 1:20 SHEET NO: 00160 SHEET TOTAL: 00160
<b>CUMMINS POWER GENERATION</b> <b>OUTLINE GENSET</b> BUZZ, ENHANCED HIGH AMBIENT		<b>PGF</b> A054M294

INFORMATION ON THIS SHEET IS TYPICAL FOR ALL CONFIGURATIONS

REV. NO.	REV. DATE	BY	CHKD.	DATE
ECO-182958	B	...	...	16 JAN 19



DESIGNER	REV. NO.	REV. DATE	BY	CHKD.	DATE
...	...	...	...	...	...

DESIGNER	REV. NO.	REV. DATE	BY	CHKD.	DATE
...	...	...	...	...	...

ITEM	DESCRIPTION	QTY	UNIT
1	ISOLATOR MOUNTING	830	PCS
2	BALL VALVE	553	PCS
3	BALL VALVE	376	PCS
4	FUEL INLET	373	PCS
5	HEAVY DUTY FILTER HOUSING	2X 461	PCS
6	ISOLATOR MOUNTING	0	PCS
7	CRANK	483	PCS
8	ISOLATOR MOUNTING	926	PCS
9	BALL VALVE	1301	PCS
10	HEAVY DUTY FILTER HOUSING	2X 1387	PCS
11	SPRING ISOLATOR MOUNTING HOLES	16X Ø23	HOLES
12	LOW TEMP AFTER COOLER COOLANT DRAIN (1 NPT BALL VALVE)	3X 4455	VALVES
13	BALL VALVE	4357	VALVES
14	ISOLATOR MOUNTING TOP AND BOTTOM	4X 276	PCS
15	ISOLATOR MOUNTING TOP AND BOTTOM	1318	PCS
16	ISOLATOR MOUNTING TOP AND BOTTOM	2586	PCS
17	ISOLATOR MOUNTING TOP AND BOTTOM	4X 276	PCS

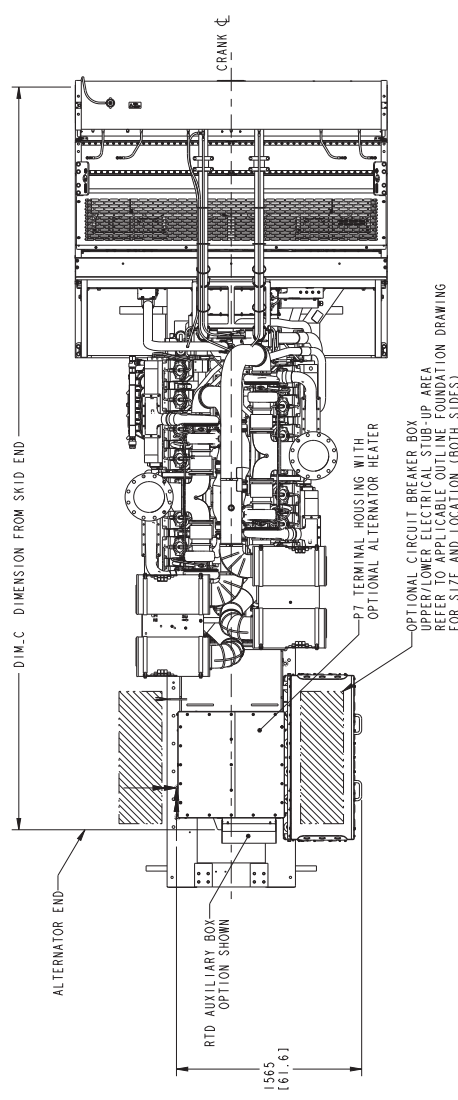
  

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BY	...
CHKD.	...
DATE	16 JAN 19

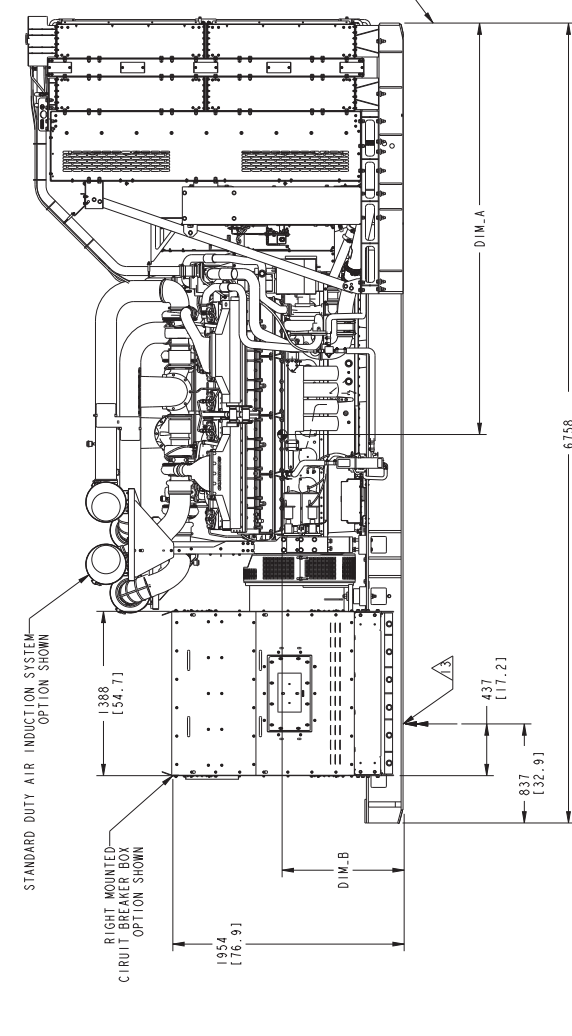
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ECO-182958	B	A. SAMUEL	16 JAN 19



OPTIONAL CIRCUIT BREAKER BOX UPPER/LOWER ELECTRICAL SLIP-UP AREA REFER TO APPLICABLE OUTLINE DRAWING FOR SIZE AND LOCATION (BOTH SIDES)



TABLETATION

ALTERNATOR FRAME SIZE	DIM. A C.G.	DIM. B C.G.	DIM. C C.G.	GENSET WT W/O COOLANT	GENSET WT W/COOLANT
				KG	KG
PTE	3405 [134.1]	1037 [40.8]	6237 [245.6]	17792	18511
PTF	3437 [135.3]	1034 [40.7]	6317 [248.7]	18076	18795
PTG	3476 [136.9]	1031 [40.6]	6338 [249.5]	18436	19155

**SHOWN WITH LOW VOLTAGE P7 ALTERNATOR AND TOP ENTRY CIRCUIT BREAKER BOX OPTIONS**

DESIGNER	REV. NO.	REV. DATE	REV. BY	REV. DATE
S. OSVOLD	L. ERNST	A. BORRITO	J. JIANG	...

SCALE	1:20
ANG. TOL.	± 0.13

PROJECT NO.	ECO-182958
PROJECT NAME	...

DATE	13 JAN 16
BY	J. JIANG

PROJECT	OUTLINE, GENSET
DESCRIPTION	BUFR., ENHANCED HIGH AMBIENT

PROJECT	A054M294
PROJECT	...

PROJECT	...
PROJECT	...

PROJECT	...
PROJECT	...

PROJECT	...
PROJECT	...

PROJECT	...
PROJECT	...

PROJECT	...
PROJECT	...

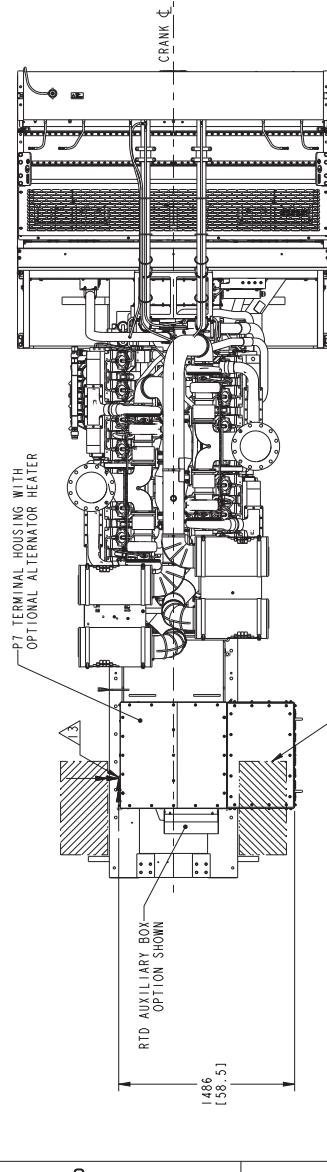
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PROJECT	...

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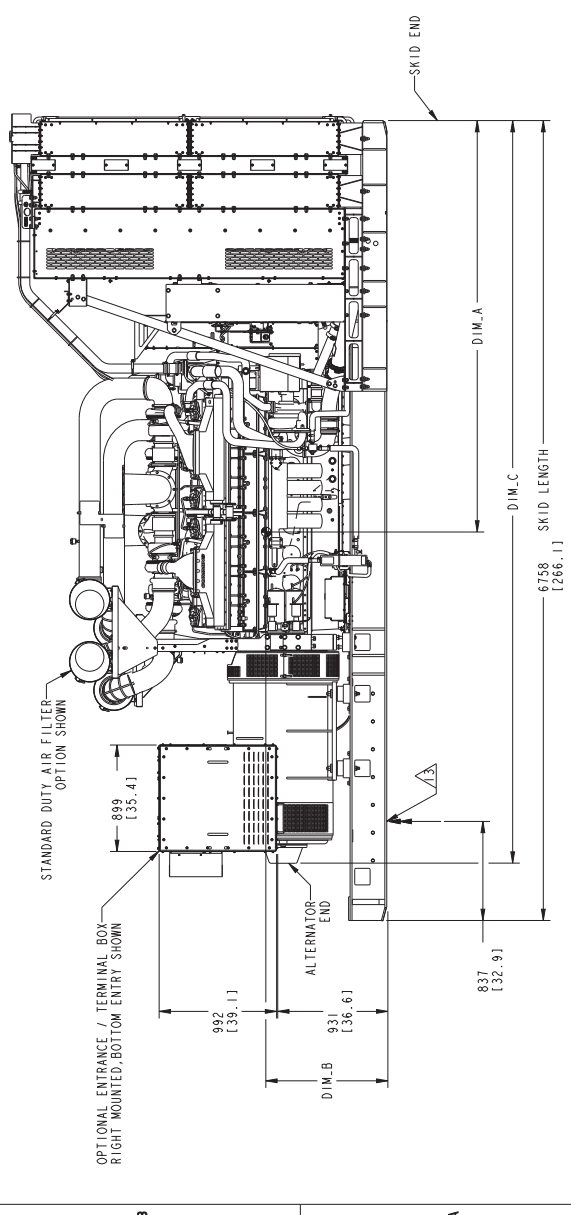
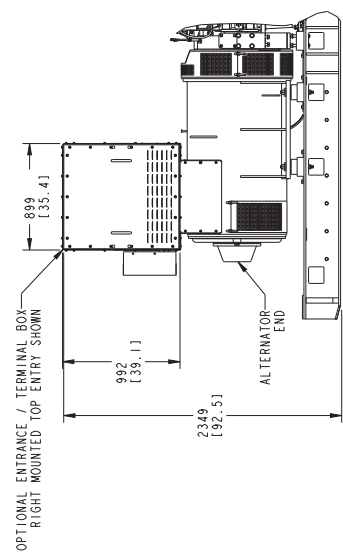
PROJECT	...
PROJECT	...



REV. NO.	REV. DATE	REV. BY	REV. DATE
ECO-182958	B	AS	16 JAN 19



OPTIONAL ENTRANCE / TERMINAL BOX UPPER/LOWER ELECTRICAL STUB-UP AREA REFER TO APPLICABLE OUTLINE FOUNDATION DRAWING FOR SIZE AND LOCATION (BOTH SIDES)



TABULATION

ALTERNATOR FRAME SIZE	DIM. A C.G.	DIM. B C.G.	DIM. C C.G.	GENSET WT W/O COOLANT	GENSET WT W/COOLANT
				KGS	LBS
P7E	3405 [134.1]	1037 [40.8]	6237 [245.6]	7792	39225
P7F	3437 [135.3]	1034 [40.7]	6317 [248.7]	8076	39851
P7G	3476 [136.9]	1031 [40.6]	6338 [249.5]	18436	40644
				19155	42230

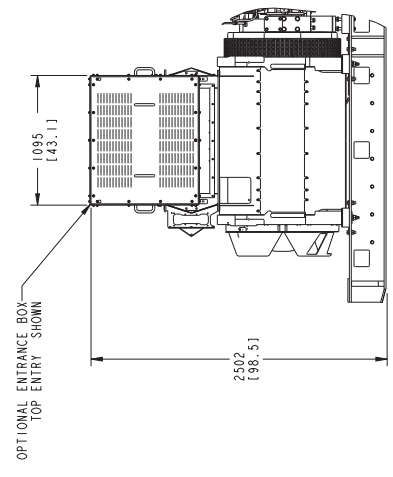
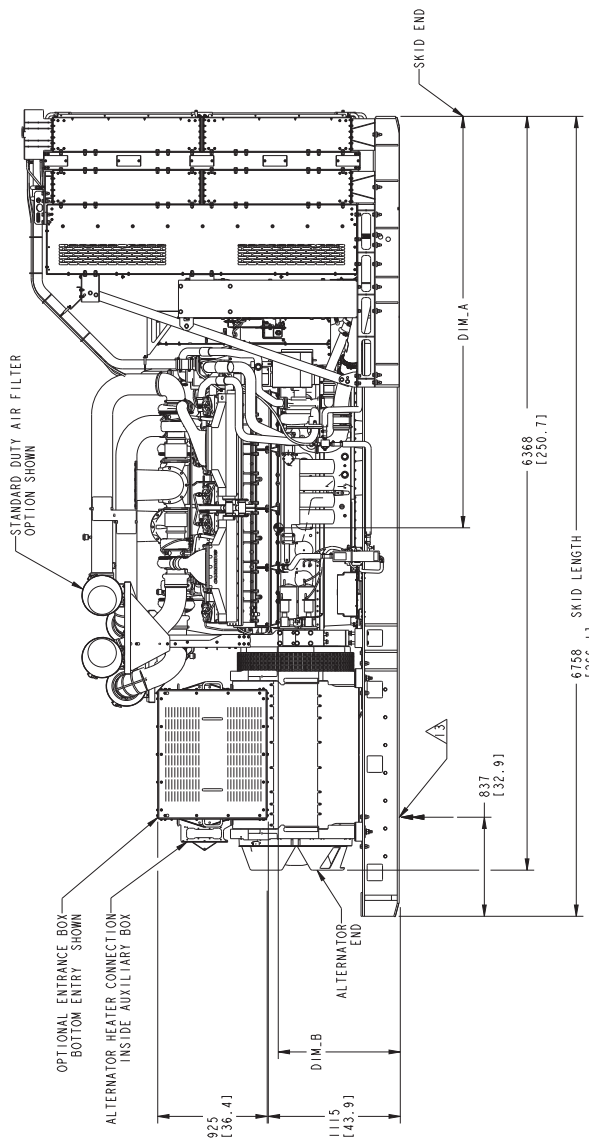
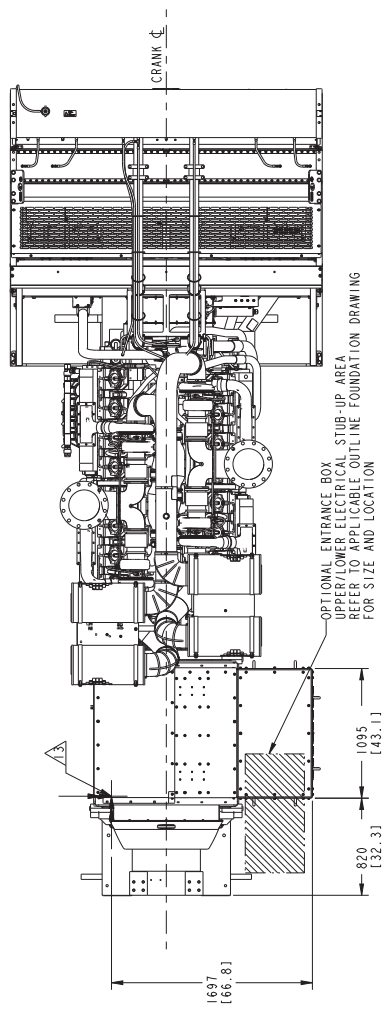
SHOWN WITH LOW VOLTAGE P7 ALTERNATOR AND ENTRANCE / TERMINAL BOX OPTIONS

MANUFACTURER	CUMMINS POWER GENERATION
MODEL	OUTLINE, GENSET
DESCRIPTION	OUTLINE, GENSET
DATE	13 JAN 16
BY	BORRTO
SCALE	1:20
PROJECT	A054M294
REV	B
DATE	16 JAN 19





REV. NO.	REV. DATE	REV. BY	REV. DATE
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2	.....	B	.....

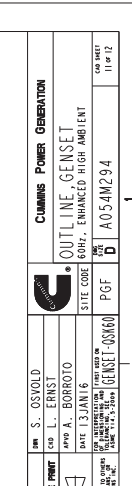
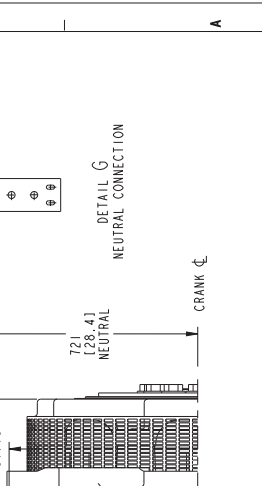
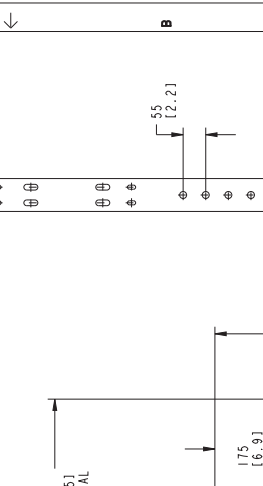
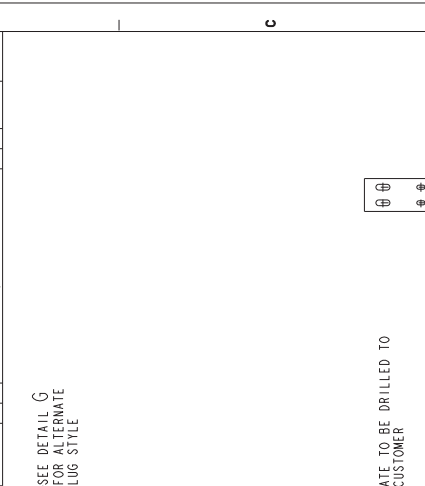


ALTERNATOR FRAME SIZE	DIM. A C.G.	DIM. B C.G.	GENSET WT W/O COOLANT	GENSET WT WITH COOLANT	KGS	LBS	GENSET WT W/O COOLANT	GENSET WT WITH COOLANT	KGS	LBS
LVS180ART	3577 [140.8]	1023 [40.3]	19572	43149	20291	44734				
LVS180AS	3602 [141.8]	1021 [40.2]	19820	43696	20539	45281				
LVS180AT1	3635 [143.1]	1019 [40.1]	20170	44467	20889	46052				

SHOWN WITH LOW VOLTAGE P80 ALTERNATOR AND ENTRANCE BOX STUB-UP OPTIONS

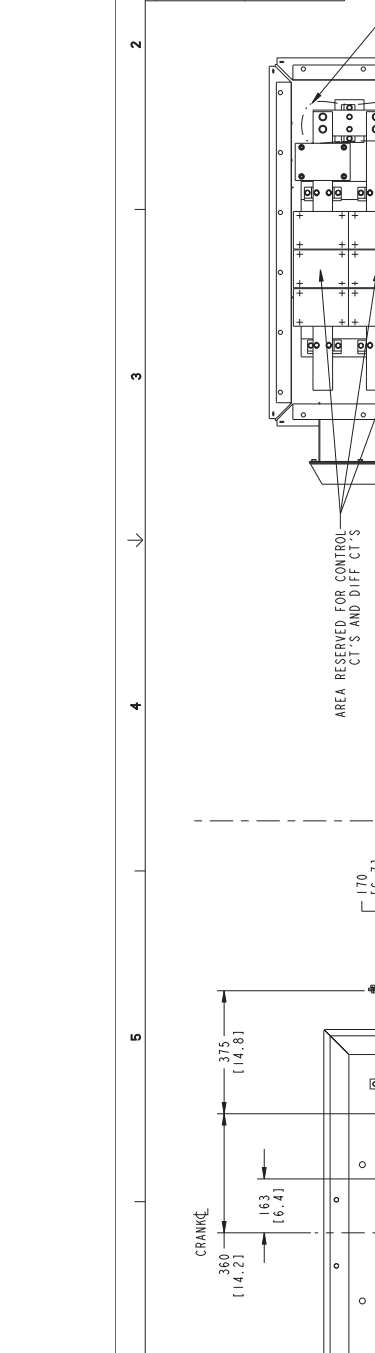
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CHECKER: L. ERNST	DRAWN: A. BORRITO
SCALE: 1:20	PROJECT: A054M294
UNITS: DIMENSIONS IN MILLIMETERS	CONVERSION FACTOR: 1/25.4
PROJ. NO.: 182958	REV. NO.: B
REV. DATE: 16/JAN/19	DESIGNER: S. OSVOLD
CHECKER: L. ERNST	DRAWN: A. BORRITO
CUSTOMER: CUMMINS POWER GENERATION	PROJECT: OUTLINE GENSET
SITE CODE: B09Z, ENHANCED HIGH AMBIENT	PGF: B
SCALE: 1/20	PROJECT: A054M294

REV	NO	REVISION	DATE
1	1	ZONE A1: 721 WAS 705 ZONE A4: 768 WAS 762 ZONE A5: 784 WAS 780 ZONE B1: 848 WAS 842 ZONE B2: 864 WAS 860 ZONE B3: 880 WAS 876 ZONE B4: 896 WAS 892 ZONE C1: 960 WAS 956 ZONE C2: 976 WAS 972 ZONE C3: 992 WAS 988 ZONE C4: 1008 WAS 1004 ZONE D1: 1072 WAS 1068 ZONE D2: 1088 WAS 1084 ZONE D3: 1104 WAS 1100 ZONE D4: 1120 WAS 1116	16 JAN 19
2	2	ZONE A1: 721 WAS 705 ZONE A4: 768 WAS 762 ZONE A5: 784 WAS 780 ZONE B1: 848 WAS 842 ZONE B2: 864 WAS 860 ZONE B3: 880 WAS 876 ZONE B4: 896 WAS 892 ZONE C1: 960 WAS 956 ZONE C2: 976 WAS 972 ZONE C3: 992 WAS 988 ZONE C4: 1008 WAS 1004 ZONE D1: 1072 WAS 1068 ZONE D2: 1088 WAS 1084 ZONE D3: 1104 WAS 1100 ZONE D4: 1120 WAS 1116	16 JAN 19



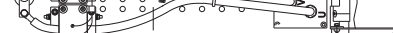
REV	NO	REVISION	DATE
1	1	ZONE A1: 721 WAS 705 ZONE A4: 768 WAS 762 ZONE A5: 784 WAS 780 ZONE B1: 848 WAS 842 ZONE B2: 864 WAS 860 ZONE B3: 880 WAS 876 ZONE B4: 896 WAS 892 ZONE C1: 960 WAS 956 ZONE C2: 976 WAS 972 ZONE C3: 992 WAS 988 ZONE C4: 1008 WAS 1004 ZONE D1: 1072 WAS 1068 ZONE D2: 1088 WAS 1084 ZONE D3: 1104 WAS 1100 ZONE D4: 1120 WAS 1116	16 JAN 19

**LVSI 804 ALTERNATOR**  
(P80 LOW VOLTAGE)



REV	NO	REVISION	DATE
1	1	ZONE A1: 721 WAS 705 ZONE A4: 768 WAS 762 ZONE A5: 784 WAS 780 ZONE B1: 848 WAS 842 ZONE B2: 864 WAS 860 ZONE B3: 880 WAS 876 ZONE B4: 896 WAS 892 ZONE C1: 960 WAS 956 ZONE C2: 976 WAS 972 ZONE C3: 992 WAS 988 ZONE C4: 1008 WAS 1004 ZONE D1: 1072 WAS 1068 ZONE D2: 1088 WAS 1084 ZONE D3: 1104 WAS 1100 ZONE D4: 1120 WAS 1116	16 JAN 19

**MVS1 / HVSI 804 ALTERNATOR**  
(P80 MEDIUM AND HIGH VOLTAGE)

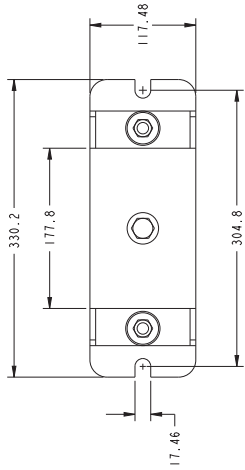


REV	NO	REVISION	DATE
1	1	ZONE A1: 721 WAS 705 ZONE A4: 768 WAS 762 ZONE A5: 784 WAS 780 ZONE B1: 848 WAS 842 ZONE B2: 864 WAS 860 ZONE B3: 880 WAS 876 ZONE B4: 896 WAS 892 ZONE C1: 960 WAS 956 ZONE C2: 976 WAS 972 ZONE C3: 992 WAS 988 ZONE C4: 1008 WAS 1004 ZONE D1: 1072 WAS 1068 ZONE D2: 1088 WAS 1084 ZONE D3: 1104 WAS 1100 ZONE D4: 1120 WAS 1116	16 JAN 19

REV	DATE	BY	CHKD	APPD	QTY
ECO-168192	C	J	CO	CO	MS
1					BP/BJPK, KLSHORE 2 LFEERIT
2					BP/BJPK, KLSHORE 2 LFEERIT
3					BP/BJPK, KLSHORE 2 LFEERIT
4					BP/BJPK, KLSHORE 2 LFEERIT

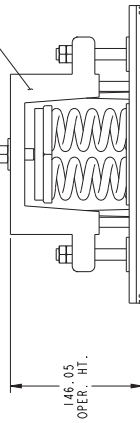
NOTES:

1. THIS PART IS MANUFACTURER SOURCE CONTROLLED.
2. ESTIMATED WEIGHT: 25 LBS.

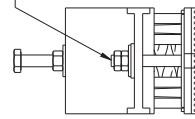


LEVELING AND ATTACHING BOLT 5/8"-11 UNC

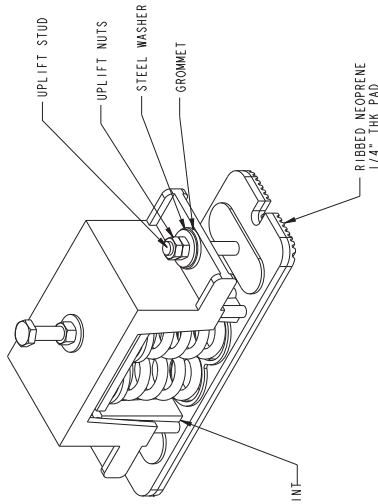
DUCTILE IRON HOUSING



VERTICAL RESTRAINT



HORIZONTAL RESTRAINT



RATED LOAD (LBS)	MAX DEF. (IN)	SPRING RATE (LBS/IN)	QTY SPRINGS
6080	1.00	6732	4

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS	REV	DATE	BY	CHKD	APPD	QTY
± .13	1	07-11-17	CO	CO	MS	
± .05	2	07-11-17	CO	CO	MS	
± .02	3	07-11-17	CO	CO	MS	
± .01	4	07-11-17	CO	CO	MS	

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS	REV	DATE	BY	CHKD	APPD	QTY
± .13	1	07-11-17	CO	CO	MS	
± .05	2	07-11-17	CO	CO	MS	
± .02	3	07-11-17	CO	CO	MS	
± .01	4	07-11-17	CO	CO	MS	

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS	REV	DATE	BY	CHKD	APPD	QTY
± .13	1	07-11-17	CO	CO	MS	
± .05	2	07-11-17	CO	CO	MS	
± .02	3	07-11-17	CO	CO	MS	
± .01	4	07-11-17	CO	CO	MS	

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS	REV	DATE	BY	CHKD	APPD	QTY
± .13	1	07-11-17	CO	CO	MS	
± .05	2	07-11-17	CO	CO	MS	
± .02	3	07-11-17	CO	CO	MS	
± .01	4	07-11-17	CO	CO	MS	

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS	REV	DATE	BY	CHKD	APPD	QTY
± .13	1	07-11-17	CO	CO	MS	
± .05	2	07-11-17	CO	CO	MS	
± .02	3	07-11-17	CO	CO	MS	
± .01	4	07-11-17	CO	CO	MS	

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS	REV	DATE	BY	CHKD	APPD	QTY
± .13	1	07-11-17	CO	CO	MS	
± .05	2	07-11-17	CO	CO	MS	
± .02	3	07-11-17	CO	CO	MS	
± .01	4	07-11-17	CO	CO	MS	

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS	REV	DATE	BY	CHKD	APPD	QTY
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± .05	2	07-11-17	CO	CO	MS	
± .02	3	07-11-17	CO	CO	MS	
± .01	4	07-11-17	CO	CO	MS	

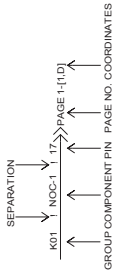
UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS	REV	DATE	BY	CHKD	APPD	QTY
± .13	1	07-11-17	CO	CO	MS	
± .05	2	07-11-17	CO	CO	MS	
± .02	3	07-11-17	CO	CO	MS	
± .01	4	07-11-17	CO	CO	MS	

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS	REV	DATE	BY	CHKD	APPD	QTY
± .13	1	07-11-17	CO	CO	MS	
± .05	2	07-11-17	CO	CO	MS	
± .02	3	07-11-17	CO	CO	MS	
± .01	4	07-11-17	CO	CO	MS	

REV. NO.	DATE	DESCRIPTION	DATE	BY
ESD-17861-1	8/1	ISSUED FOR ASSEMBLY		
2		ADD SHEET 16 FOR A0548162 AND A0548160		

NOTES

- △ REMOVABLE JUMPER WIRE FOR REMOTE E-STOP IS CONNECTED ON THE LOAD SIDE
- △ CTB4, 5, 6-4 OUTPUTS FUSED AT 20 AMPS
- △ CTB7, 8, 9-4 (MAX CURRENT=30 AMPS)
- 4. NOMINAL CONDUCTOR SIZE PER TERMINAL 28-12 AWG
- 5. WIRE TYPE USE 60 %/Z7C RATED MINIMUM, STRANDED COPPER WIRE
- 6. STRIP WIRE LENGTH TO 10.0MM
- 7. TO REMOVE WIRES FROM TERMINAL BLOCK, PUSH IN ORANGE TAB NEXT TO WIRE TERMINATION
- △ LOW SIDE DRIVER OUTPUT RATED AT 100 MICRO-A LEAKAGE IN OFF STATE. USE HIGH PRESSION DIODE REQUIRED FOR INDUCTIVE COILS.
- △ RELAY OUTPUT RATED AT 3.5A 30VDC, 250VAC.
- △ TO CONNECT TO OPTIONAL GROUND FAULT RELAY REMOVE SAFETY SHORTING BLOCK FROM HARNESS AND CONNECT TO GROUND FAULT RELAY TERMINALS.
- 11. CROSS REFERENCE WIRES ARE ON THE FOLLOWING FORMAT:



- 12. AUX101 BOARD SPECIFICATIONS (SHEET 11)
- 12.1 CUSTOMER INPUTS
- 12.1.1 TYPE=DISCRETE OR ANALOG
- MAX VOLTAGE ALLOWED AT ANY INPUT: -10-24 VDC (1-6)
- 40 VDC (7,8)
- DIFFERENTIAL VOLTAGE RANGE: -4.9-5V (INPUTS 1,2)
- 0-38V (INPUTS 7,8)
- INPUTS CONNECTIONS=J11
- 12.2 CUSTOMER OUTPUTS
- 12.2.1 CURRENT SOURCES=J10,3,4,5,6 (1mA-20mA)
- 12.2.2 VOLTAGE SOURCES=J1,7,8 (5VDC, 20mA)
- 12.2.3 GROUND=J10,9,10,11,12
- 12.3 OUTPUT RELAYS
- 12.3.1 TYPE=NON-LATCHING
- 12.3.2 NUMBER OF CONTACTS=1
- 12.3.3 CONTACTS=1 FORM C
- 250VAC OR 30VDC
- NC CONTACTS=3A
- 12.3.4 CONNECTIONS=J2, J3, J4
- 13. ALL RELAYS SHOWN IN RESET OR DE-ENERGIZED POSITION DO NOT MAINTAIN THE LAST STATE WHEN POWER IS LOST (SHEET 11).
- 14. OUTPUT RELAYS ARE CONTROLLED VIA THE NETWORK (SHEET 11).
- 15. TIE J1-1 AND J1-5 TO HOLD DEVICE IN WAKE UP STATE (SHEET 11).
- 16. DISPLAYS THE DEVICE NUMBER. IF MORE THAN ONE AUX 101 IS CONNECTED ON NETWORK BOTH NEED A UNIQUE DEVICE NUMBER (SHEET 11).
- 17. CONNECT J2 RING TERMINAL TO A GOOD EARTH GROUND. USE AN EXTERNAL TOOTH LOCKWASHER BETWEEN RING AND GROUNDING SURFACE (SHEET 11).
- 18. DIGITAL INPUTS NEED THE (-) INPUT GROUNDED (SHEET 11).
- 19. DS1 INDICATES ACTIVE NETWORK COMMUNICATION. DS2 INDICATES NO NETWORK CONNECTIVITY. (SHEET 11)
- 20. DS3-DS10 (GREEN) INDICATE WHICH RELAYS ARE ENERGIZED (SHEET 11)
- 21. RTD SENDERS CAN ONLY BE USED ON INPUTS 3-6 (SHEET 11).
- 22. PROGRAMMABLE CURRENT SOURCE USE (SHEET 11)
- CS1 IS USED FOR INPUT 3 ONLY
- CS2 IS USED FOR INPUT 4 ONLY
- CS3 IS USED FOR INPUT 5 ONLY
- CS4 IS USED FOR INPUT 6 ONLY
- 23. TWO STARTERS OPTION REFERS TO SHEET 3. FOUR STARTERS OPTION REFERS TO SHEET 16.

DESIGNER	DATE	DESCRIPTION	DATE	BY
AWA BORRTO	8/1	ISSUED FOR ASSEMBLY		
AWA BORRTO	8/1	ADD SHEET 16 FOR A0548162 AND A0548160		

CONFIDENTIAL	AWA BORRTO	AWA BORRTO	AWA BORRTO
CONFIDENTIAL	AWA BORRTO	AWA BORRTO	AWA BORRTO
CONFIDENTIAL	AWA BORRTO	AWA BORRTO	AWA BORRTO

CONFIDENTIAL	AWA BORRTO	AWA BORRTO	AWA BORRTO
CONFIDENTIAL	AWA BORRTO	AWA BORRTO	AWA BORRTO
CONFIDENTIAL	AWA BORRTO	AWA BORRTO	AWA BORRTO

CONFIDENTIAL	AWA BORRTO	AWA BORRTO	AWA BORRTO
CONFIDENTIAL	AWA BORRTO	AWA BORRTO	AWA BORRTO
CONFIDENTIAL	AWA BORRTO	AWA BORRTO	AWA BORRTO



# Hardin Industries LLC

400 Commercial St.

Lacon, IL 61540

Phone (309)246-8456 Fax (309)246-3117

**Hardin Submittal Package**

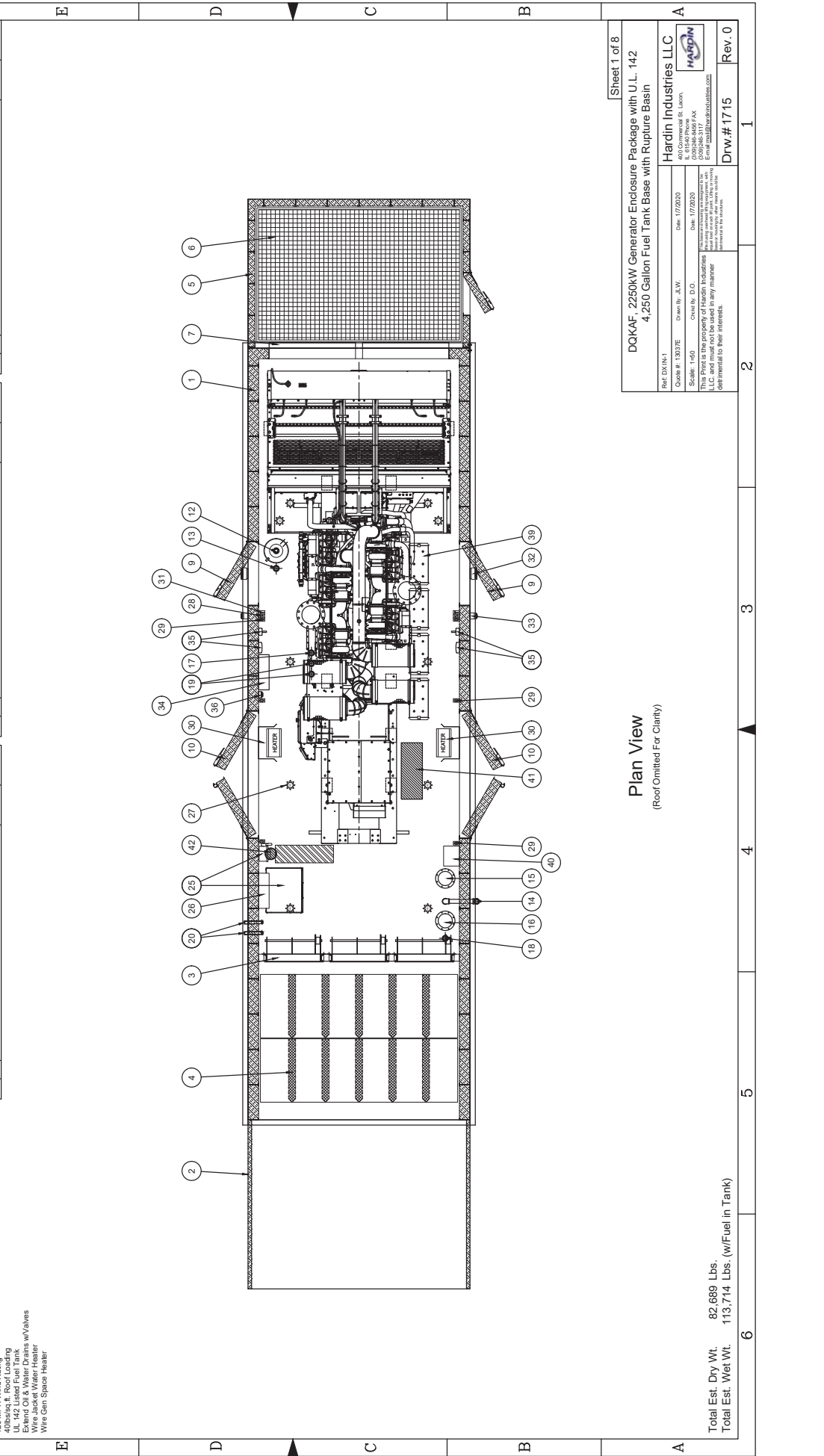
**Cummins**

**Job# 1715**

**Ref: DX IN-1**

**#13037E**

Item/Qty	Description	Sup. By	Ins. By	1	2	3	4	5	6
1	10 Aluminum Enclosure w/ Walls w/ Rockwool Insulation	Hardin	Hardin						
2	1 A/C Intake Plenum, Screened Intake w/ Sound Baffles	Hardin	Hardin						
3	3 Motorized Intake Damper's, Spring Open and Motor Close	Hardin	Hardin						
4	1 8" Deep Intake Sound Baffles	Hardin	Hardin						
5	1 8" Deep Intake Sound Baffles	Hardin	Hardin						
6	1 8" Deep Intake Sound Baffles	Hardin	Hardin						
7	4 Gravity Discharge Shutters	Hardin	Hardin						
8	1 Roof Mounted Exhaust Fan w/ Thermostat	Hardin	Hardin						
9	2 Single Personnel Access Doors w/ Cooler Style Handle & S.S. Hinges	Hardin	Hardin						
10	2 Double Service Access Doors w/ Cooler Style Handle & S.S. Hinges	Hardin	Hardin						
11	1 U.L. 142 Listed 4,250 Gallon Fuel Tank w/Upwards Basin Base	Hardin	Hardin						
12	1 U.L. 142 Listed 4,250 Gallon Fuel Tank w/Upwards Basin Base	Hardin	Hardin						
13	1 Mechanical Sight Fuel Level Gauge	Hardin	Hardin						
14	1 Normal Fuel Tank Vent Extended to Exterior	Hardin	Hardin						
15	1 Emergency Fuel Tank Vent Extended to Exterior	Hardin	Hardin						
16	1 Emergency Rupture Basin Vent Extended to Exterior	Hardin	Hardin						
17	1 Low and High Fuel Level Alarms	Hardin	Hardin						
18	1 Rupture Basin Alarm	Hardin	Hardin						
19	2 2" Floor Pack-UPS & Fuel Return Lines for Backup Maintenance	Hardin	Hardin						
20	2 2" Floor Pack-UPS & Fuel Return Lines for Backup Maintenance	Hardin	Hardin						
21	6 0.875 Customer Mounting Hooks Each Side of Base	Hardin	Hardin						
22	1 Beigant Interior Mounted Exhaust Silencer, P/N: 500-01292	Hardin	Hardin						
23	1 Exhaust Blankets for Silencer, Exhaust Flues & Discharge Piping	Hardin	Hardin						
24	1 Exhaust Extension thru Roof w/ Roof Start and Rain Cap	Hardin	Hardin						
25	1 45 VVA 1867-120/203 Thru Down Transformer w/Unused Disconnect	Hardin	Hardin						
26	1 45 VVA 1867-120/203 Thru Down Transformer w/Unused Disconnect	Hardin	Hardin						
27	8 AC Interior Mounted LED Vapor Light Lights	Hardin	Hardin						
28	2 3-Way Light Switches	Hardin	Hardin						
29	6 GFCI Receptacles	Hardin	Hardin						
30	2 3KW Space Heaters w/ Built In Thermostat	Hardin	Hardin						
31	2 DC Lights w/ 60 Minute Timer, Located at Two Entry Doors	Hardin	Hardin						
32	2 1/2" Mount Exterior LED Lights w/PhotoCell and Interior Switch	Hardin	Hardin						
33	2 Emergency Stop Buttons on Exterior of Enclosure, 1 Each Side	Hardin	Hardin						
34	2 Mount Wire Smoke Detectors and Heat Detectors Inside Enclosure	Hardin	Hardin						
35	2 Manual Pull Station E-Stop, Pull to Reset	Hardin	Hardin						
36	2 Galvanized Platform, Stairs and Railing - OSHA Compliant	Hardin	Hardin						
37	1 DOKCAF GenSet, 225kW @ 480V w/Control Panel	Hardin	Hardin						
38	1 (S/S) Lead Batteries w/ Rack and Cables	Hardin	Hardin						
39	1 (S/S) Lead Batteries w/ Rack and Cables	Hardin	Hardin						
40	1 Control Sub-Up Thru Base, Bottom Feed	Hardin	Hardin						
41	1 Control Sub-Up Thru Base, Bottom Feed	Hardin	Hardin						
42	1 207 AC Sub-Up Thru Base	Hardin	Hardin						



**Plan View**  
(Root Omitted For Clarity)

Sheet 1 of 8

**DOKAF 2250kW Generator Enclosure Package with U.L. 142  
4,250 Gallon Fuel Tank Base with Rupture Basin**

Ref: DW-N-1	Drawn By: J.W.	Date: 1/7/2020
Quote #: 13037E	Checked By: D.D.	Scale: 1/8" = 1'-0"
This Print is the property of Hardin Industries, LLC and must not be used in any manner that would harm Hardin Industries, LLC or its interests.		

**Hardin Industries LLC**  
 48100 Highway 68, Coon  
 P.O. Box 1450  
 Coon, IA 52006  
 Phone: 563-586-3147  
 Fax: 563-586-3147  
 Email: info@hardinindustries.com

Total Est. Dry Wt. 82,689 Lbs.  
 Total Est. Wet Wt. 113,714 Lbs. (w/Fuel in Tank)

Rev. 0  
 Draw # 1715

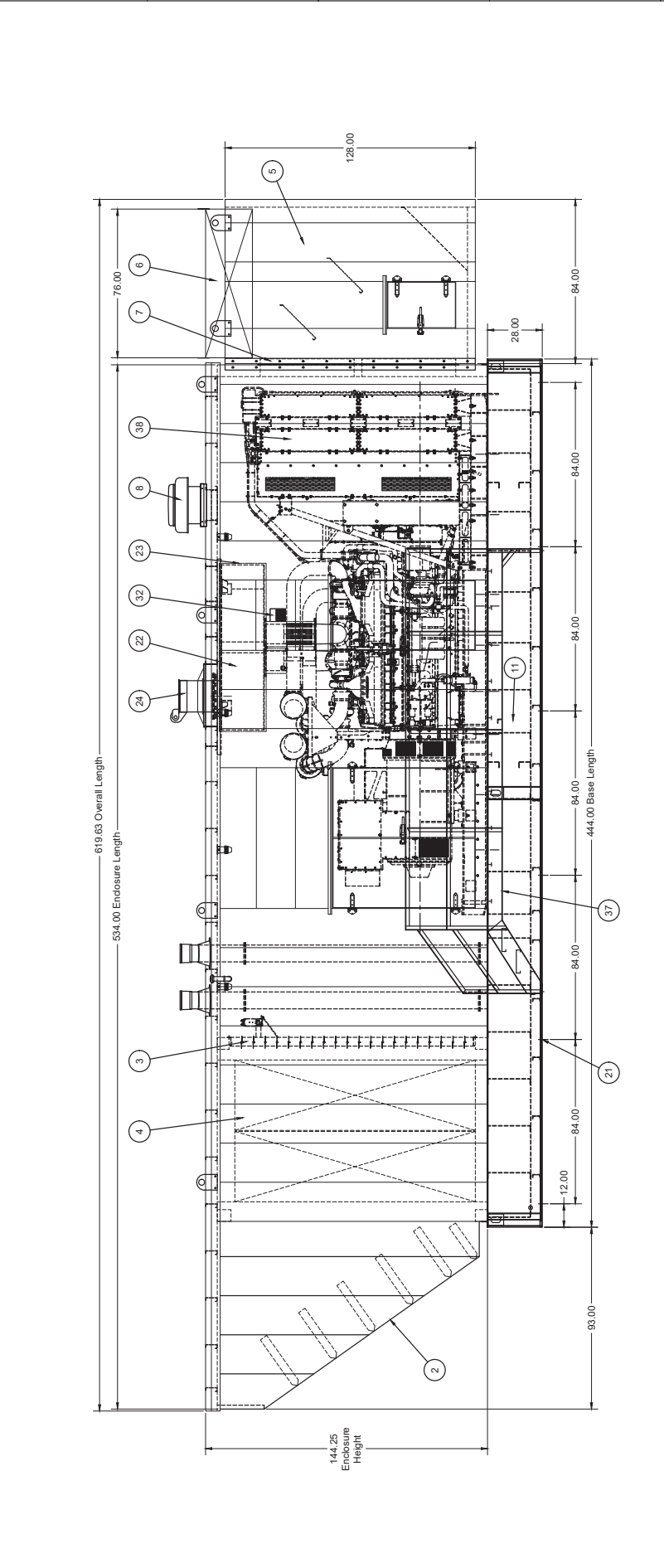
Approved As Drawn  
 Approved With Edits Shown  
 The undersigned hereby acknowledges that all information and specifications necessary to fabricate and install the above described equipment have been reviewed and approved by me. I warrant that the above information is true and correct and that I am not providing any false or misleading information. I warrant that the above information is true and correct and that I am not providing any false or misleading information. I warrant that the above information is true and correct and that I am not providing any false or misleading information.

**SUBMITTALS NOT APPROVED WITHOUT SIGNATURE**  
 Approved By: \_\_\_\_\_ Date: \_\_\_\_\_

Notes:  
 Sound Level: 75DBA @ 23ft. +/- 3dB(A) (Freefield) 5ft Above Grade  
 120 MPH Wind Rating  
 40 lbs/sq. ft. Roof Loading  
 U.L. 142 Listed Fuel Tank  
 10" Bend Oil & Water Drains w/ Valves  
 10" Bend Oil & Water Drains w/ Valves  
 Wire Gm Space Heater

Approved As Drawn  
 Approved With Edits Shown  
 The undersigned hereby acknowledges that all information and specifications necessary to fabricate and install the above described equipment have been reviewed and approved by the undersigned. ANY CHANGES MADE AFTER THE APPROVAL AND SIGNATURE OF THE UNDERSIGNED SHALL BE AT THE EXPENSE OF THE CUSTOMER AND HARDIN INDUSTRIES SHALL NOT BE HELD LIABLE.  
**SUBMITTALS NOT APPROVED WITHOUT SIGNATURE**  
 Approved By: \_\_\_\_\_ Date: \_\_\_\_\_

Item Qty	Description	Sup. By	Ins. By
1	10 Aluminum Enclosure w/ Walls w/ Rockwool Insulation	Hardin	Hardin
2	1 Air Intake Plenum, Screened Intake w/ Sound Baffles	Hardin	Hardin
3	3 Motorized Intake Damper's Spring Open and Motor Close	Hardin	Hardin
4	1 Deep Intake Sound Baffles	Hardin	Hardin
5	1 Air Discharge to Outside w/ Air Directed Upwards w/ Access Door	Hardin	Hardin
6	1 2" Deep Intake Sound Baffles	Hardin	Hardin
7	4 Gravity Discharge Shutters	Hardin	Hardin
8	1 Roof Mounted Exhaust Fan w/ Thermostat	Hardin	Hardin
9	2 Single Personnel Access Doors w/ Cooler Style Handle & S.S. Hinges	Hardin	Hardin
10	2 Double Service Access Doors w/ Cooler Style Handle & S.S. Hinges	Hardin	Hardin
11	1 U.L. Listed 2,250 Gallon Fuel Tank w/ Rupture Basin Base	Hardin	Hardin
12	1 1/2" U.L. Listed 2,250 Gallon Fuel Tank w/ Rupture Basin Base	Hardin	Hardin
13	1 Mechanical Split Fuel Level Gauge	Hardin	Hardin
14	1 Normal Fuel Tank Vent Extended to Exterior	Hardin	Hardin
15	1 Emergency Fuel Tank Vent Extended to Exterior	Hardin	Hardin
16	1 Emergency Rupture Basin Vent Extended to Exterior	Hardin	Hardin
17	1 Low and High Fuel Level Alarms	Hardin	Hardin
18	1 Rupture Basin Alarm	Hardin	Hardin
19	1 Fuel Filler Valve	Hardin	Hardin
20	2 Fuel Filler Valve & Fuel Return Lines for Remote Maintenance	Hardin	Hardin
21	6 0.875 Customer Mounting Hooks Each Side of Base	Hardin	Hardin
22	1 Beign Interior Mounted Exhaust Silencer, P/N: 503-01292	Hardin	Hardin
23	1 Exhaust Blankets for Silencer, Exhaust Flues & Discharge Piping	Hardin	Hardin
24	1 Exhaust Extension thru Roof w/ Roof Start and Rain Cap	Hardin	Hardin
25	1 45 V.A. 1807-120293 Step Down Transformer w/ Fused Disconnect	Hardin	Hardin
26	1 45 V.A. 1807-120293 Step Down Transformer w/ Fused Disconnect	Hardin	Hardin
27	8 AC Interior Mounted LED Vapor Light Lights	Hardin	Hardin
28	2 3-Way Light Switches	Hardin	Hardin
29	1 120V AC Sub-Up Thru Base	Hardin	Hardin
30	6 GFCI Receptacles	Hardin	Hardin
31	2 3KW Space Heaters w/ Built In Thermostat	Hardin	Hardin
32	2 DC Lights w/ 60 Minute Timer, Located at Two Entry Doors	Hardin	Hardin
33	2 12V Mount Exterior LED Lights w/ Flood and Interior Switch	Hardin	Hardin
34	2 Emergency Stop Buttons on Exterior of Enclosure, 1 Each Side	Hardin	Hardin
35	2 Mount Wire Detectors and Heat Detectors Inside Enclosure	Hardin	Hardin
36	1 Manual Pull Station E-Stop, Pull to Reset	Hardin	Hardin
37	2 Grounded Platform, Stairs and Railing - OSHA Compliant	Hardin	Hardin
38	1 DOKKAF Genset, 2250kW @ 480V w/ Control Panel	Commis	Hardin
39	1 (S/S) Lead Batteries w/ Rack and Cables	Hardin	Hardin
40	1 (S/S) Lead Batteries w/ Rack and Cables	Hardin	Hardin
41	1 Conduit Sub-Up Thru Base, Bottom Feed	Hardin	Hardin
42	1 120V AC Sub-Up Thru Base	Hardin	Hardin



Right Side View

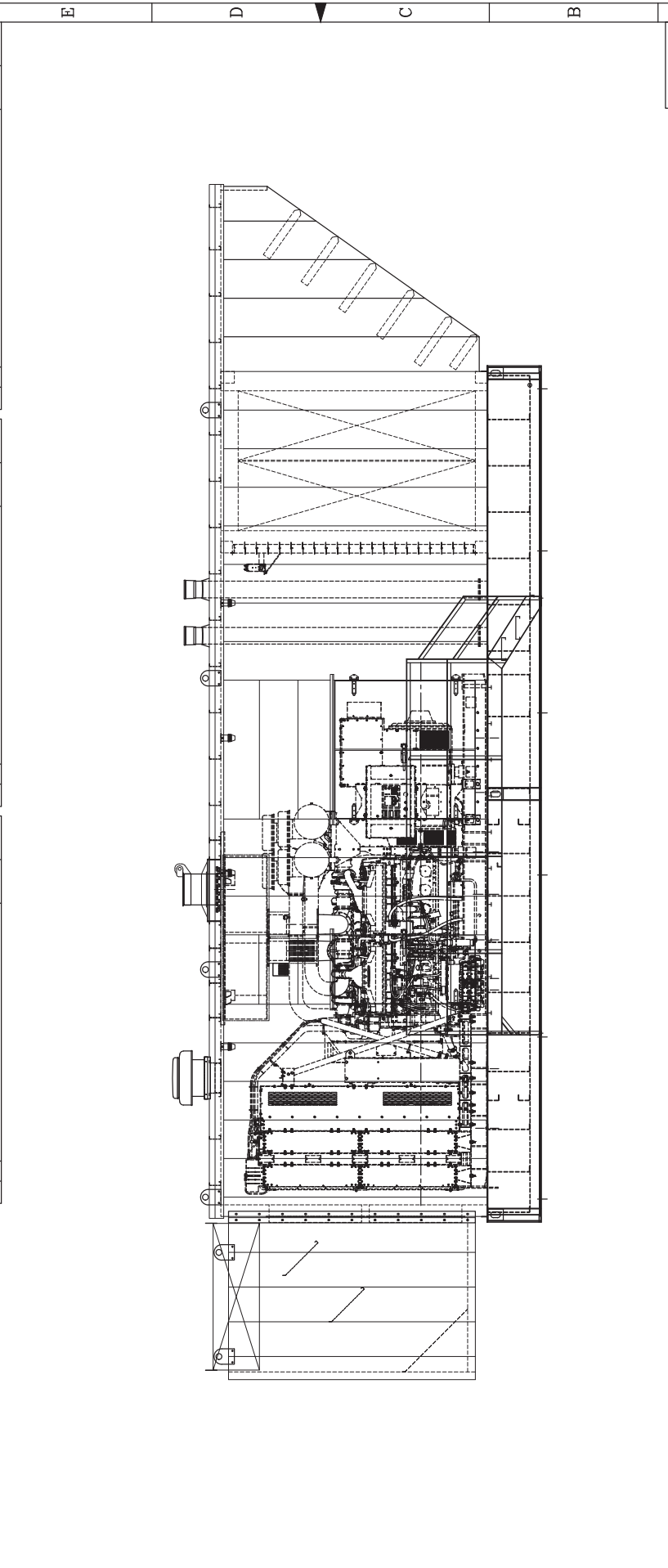
Sheet 2 of 8  
 DOKKAF 2250kW Generator Enclosure Package with U.L. 142  
 4,250 Gallon Fuel Tank Base with Rupture Basin

Rev. 0  
 Drawn By: J.W. Date: 1/7/2020  
 Checked By: D.D. Date: 1/7/2020  
 Scale: 1:50  
 This Print is the property of Hardin Industries LLC and must not be used in any manner deemed detrimental to their interests.  
 Hardin Industries LLC  
 48100 W. 136th St., Omaha, NE 68146  
 Phone: (402) 426-7000  
 Fax: (402) 426-7001  
 Email: info@hardinindustries.com



Approved As Drawn  
 Approved With Edits Shown  
 The undersigned hereby acknowledges that all information and specifications necessary for the construction of the above described work have been furnished to the contractor and that the contractor has accepted the same and agrees to construct the same in accordance with the drawings and specifications. THESE DRAWINGS SHALL BE AT THE EXPENSE OF THE CUSTOMER AND HARDON INDUSTRIES SHALL NOT BE HELD LIABLE.  
**SUBMITTALS NOT APPROVED WITHOUT SIGNATURE**  
 Approved By: \_\_\_\_\_ Date: \_\_\_\_\_

Item/Qty	Description	Sup. By	Ins. By	Item/Qty	Description	Sup. By	Ins. By	Item/Qty	Description	Sup. By	Ins. By
1	10 Aluminum Enclosure w/ Walls w/ Rockwool Insulation	Hardin	Hardin	15	Emergency Fuel Tank Vent Extended to Exterior	Hardin	Hardin	20	6 GFCI Receptacles	Hardin	Hardin
2	1 A/F Intake Plenum, Screened Intake w/ Sound Baffles	Hardin	Hardin	16	Emergency Rupture Basin Vent Extended to Exterior	Hardin	Hardin	30	3KW Space Heaters w/ Built In Thermostat	Hardin	Hardin
3	3 Motorized Intake Damper's, Spring Open and Motor Close	Hardin	Hardin	17	Low and High Fuel Level Alarms	Hardin	Hardin	31	2 DC Lights w/ 60 Minute Timer, Located at Two Entry Doors	Hardin	Hardin
4	1 Deep Intake Sound Baffles	Hardin	Hardin	18	Rupture Basin Alarm	Hardin	Hardin	32	2 Wall Mount Exterior LED Lights, w/ Photocell and Interior Switch	Hardin	Hardin
5	1 Air Discharge w/ 18" Dia. 18" High	Hardin	Hardin	19	2 Fuel Pumps	Hardin	Hardin	33	2 Emergency Stop Buttons on Exterior of Enclosure, 1 Each Side	Hardin	Hardin
6	1 21" Dia. 18" High	Hardin	Hardin	20	2 Fuel Pumps	Hardin	Hardin	34	2 Manual Pull Stations on Exterior of Enclosure, 1 Each Side	Hardin	Hardin
7	4 Gravity Discharge Shutters	Hardin	Hardin	21	6 0.875 Customer Mounting Hooks Each Side of Base	Hardin	Hardin	35	2 Mount Wire Smoke Detectors and Heat Detectors Inside Enclosure	Hardin	Hardin
8	1 Roof Mounted Exhaust Fan w/ Thermostat	Hardin	Hardin	22	1 Beigian Interior Mounted Exhaust Silencer, P/N: 500-01292	Hardin	Hardin	36	1 Manual Pull Station E-Stop, Pull to Reset	Hardin	Hardin
9	2 Single Personnel Access Doors w/ Cooler Style Handle & S.S. Hinges	Hardin	Hardin	23	1 Exhaust Blankets for Silencer, Exhaust Flues & Discharge Piping	Hardin	Hardin	37	2 Galvanized Platform, Stairs and Railing - OSHA Compliant	Hardin	Hardin
10	2 Double Service Access Doors w/ Cooler Style Handle & S.S. Hinges	Hardin	Hardin	24	1 Exhaust Extension thru Roof w/ Roof Sert and Rain Cap	Hardin	Hardin	38	1 DOKKAF Genset, 2250KW @ 480V w/ Control Panel	Hardin	Hardin
11	1 U.L. Listed 2,250 Gallon Fuel Tank w/ Rupture Basin Base	Hardin	Hardin	25	1 45 VVA 1807-120/208 Step Down Transformer w/ Fused Disconnect	Hardin	Hardin	39	2 (SIS) Lead Batteries w/ Rack and Cables	Hardin	Hardin
12	1 U.L. Listed 2,250 Gallon Fuel Tank w/ Rupture Basin Base	Hardin	Hardin	26	1 45 VVA 1807-120/208 Step Down Transformer w/ Fused Disconnect	Hardin	Hardin	40	1 100' AC Sub-Up Thru Base	Hardin	Hardin
13	1 Mechanical Split Fuel Level Gauge	Hardin	Hardin	27	8 AC Interior Mounted LED Vapor Light Lights	Hardin	Hardin	41	1 Conduit Sub-Up Thru Base, Bottom Feed	Hardin	Hardin
14	1 Normal Fuel Tank Vent Extended to Exterior	Hardin	Hardin	28	2 3-Way Light Switches	Hardin	Hardin	42	1 100' AC Sub-Up Thru Base	Hardin	Hardin



**Left Side View**

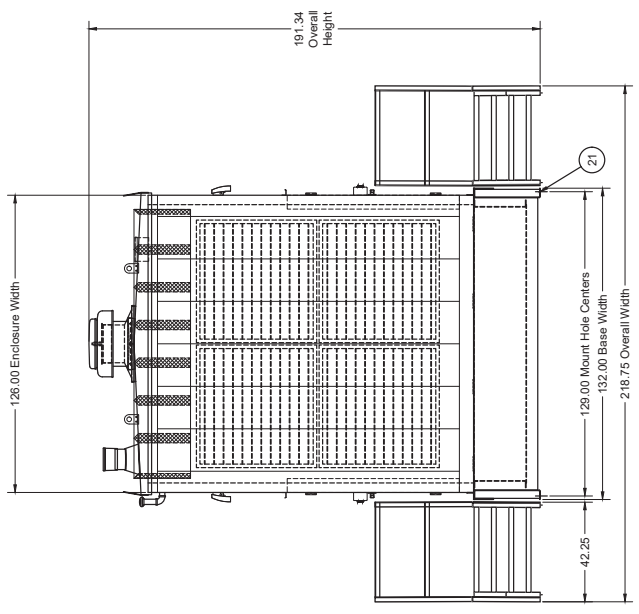
Sheet 3 of 8

DOKKAF 2250KW Generator Enclosure Package with U.L. 142  
4,250 Gallon Fuel Tank Base with Rupture Basin

Ref: DW-N-1 Quote #: 13037E Scale: 1/8" = 1'-0" This Print is the property of Hardon Industries LLC and must not be used in any manner deemed detrimental to their interests.	Drawn By: J.W. Check By: D.O. Date: 1/7/2020 Date: 1/7/2020	Hardon Industries LLC 48100 1st St. S. P.O. Box 100 Everett, WA 98203 Phone: (360) 966-3117 Email: info@hardonindustries.com	Drw.# 1715 Rev. 0
--	--	---	----------------------

Item Qty	Description	Sup. By	Ins. By	Item Qty	Description	Sup. By	Ins. By	Item Qty	Description	Sup. By	Ins. By
1	10 Aluminum Enclosure w/ Walls w/ Rockwool Insulation	Hardin	Hardin	15	Emergency Fuel Tank Vent Extended to Exterior	Hardin	Hardin	20	6 GFCI Receptacles	Hardin	Hardin
2	Air Intake Plenum, Screened Intake w/ Sound Baffles	Hardin	Hardin	16	Emergency Rupture Basin Vent Extended to Exterior	Hardin	Hardin	30	3KW Space Heaters w/ Built In Thermostat	Hardin	Hardin
3	Motorized Intake Damper's Spring Open and Motor Close	Hardin	Hardin	17	Low and High Fuel Level Alarms	Hardin	Hardin	31	2 DC Lights w/ 60 Minute Timer, Located at Two Entry Doors	Hardin	Hardin
4	1" Deep Intake Sound Baffles	Hardin	Hardin	18	Rupture Basin Alarm	Hardin	Hardin	32	2 Wall Mount Exterior LED Lights w/ Photocell and Interior Switch	Hardin	Hardin
5	2" Deep Intake Sound Baffles	Hardin	Hardin	19	Emergency Stop Button on Exterior of Enclosure, 1 Each Side	Hardin	Hardin	33	Emergency Stop Button on Exterior of Enclosure, 1 Each Side	Hardin	Hardin
6	2" Deep Intake Sound Baffles	Hardin	Hardin	20	2" Flat Pack-UPS & Fuel Return Lines for Remote Maintenance	Hardin	Hardin	34	2 Manual Pull Station E-Stop, Pull to Reset	Hardin	Hardin
7	4 Grassy Discharge Shutters	Hardin	Hardin	21	0.875 Customer Mounting Hooks Each Side of Base	Hardin	Hardin	35	2 Mount Wire Detectors and Heat Detectors Inside Enclosure	Hardin	Hardin
8	1 Roof Mounted Exhaust Fan w/ Thermostat	Hardin	Hardin	22	1 Beigian Interior Mounted Exhaust Silencer, P/N: 500-01292	Hardin	Hardin	36	2 Galvanized Platform, Stairs and Railing - OSHA Compliant	Hardin	Hardin
9	2 Single Personnel Access Doors w/ Cooler Style Handle & S.S. Hinges	Hardin	Hardin	23	1 Exhaust Blanks for Silencer, Exhaust Flues & Discharge Piping	Hardin	Hardin	37	2 Galvanized Platform, Stairs and Railing - OSHA Compliant	Hardin	Hardin
10	2 Double Service Access Doors w/ Cooler Style Handle & S.S. Hinges	Hardin	Hardin	24	1 Exhaust Extension thru Roof w/ Roof Start and Rain Cap	Hardin	Hardin	38	1 DOKAF Genset, 2250KW @ 480V w/ Control Panel	Commins	Hardin
11	1 U.L. Listed 4,250 Gallon Fuel Tank w/ Rupture Basin Base	Hardin	Hardin	25	1 45 VVA 480V-120/208 Step Down Transformer w/ fused Disconnect	Hardin	Hardin	39	1 (SIS) Load Batteries w/ Rack and Cables	Commins	Hardin
12	1 U.L. Listed 4,250 Gallon Fuel Tank w/ Rupture Basin Base	Hardin	Hardin	26	1 45 VVA 480V-120/208 Step Down Transformer w/ fused Disconnect	Hardin	Hardin	40	1 (SIS) Load Batteries w/ Rack and Cables	Commins	Hardin
13	1 Mechanical Sight Fuel Level Gauge	Hardin	Hardin	27	1 AC Interior Mounted LED Vapor Light Lights	Hardin	Hardin	41	1 Conduit Sub-Up Thru Base, Bottom Feed	Hardin	Hardin
14	1 Normal Fuel Tank Vent Extended to Exterior	Hardin	Hardin	28	2 3-Way Light Switches	Hardin	Hardin	42	1 207 AC Sub-Up Thru Base	Hardin	Hardin

Approved As Drawn  
 Approved With Edits Shown  
 The undersigned hereby acknowledges that all information and specifications necessary to fabricate and install the above described equipment have been reviewed and approved by me. I warrant that the above information is true and correct and that I have the authority to execute these drawings. THESE DRAWINGS SHALL BE AT THE EXPENSE OF THE CUSTOMER AND HARDIN INDUSTRIES SHALL NOT BE HELD LIABLE.  
 SUBMITTALS NOT APPROVED WITHOUT SIGNATURE  
 Approved By: \_\_\_\_\_ Date: \_\_\_\_\_



Front & Rear View

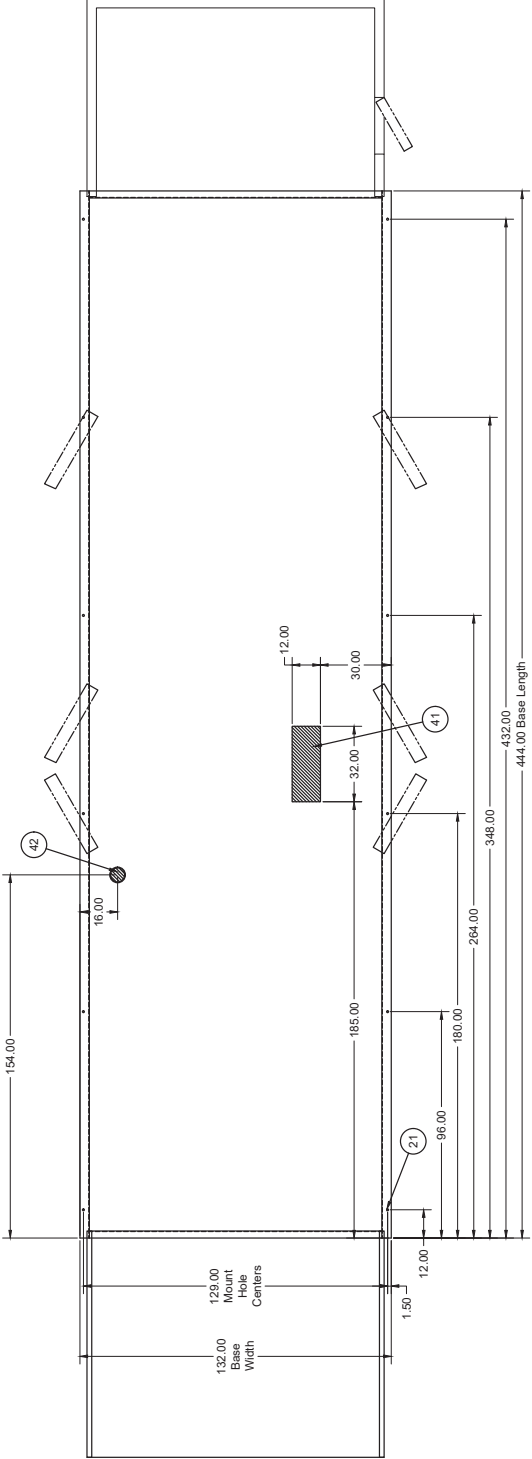
Sheet 4 of 8  
 DOKAF 2250KW Generator Enclosure Package with U.L. 142  
 4,250 Gallon Fuel Tank Base with Rupture Basin

Ref: DW-N-1  
 Quote #: 13037E Drawn by: J.W.  
 Date: 1/7/2020  
 Scale: 1/8" = 1'-0"  
 Checked by: D.O.  
 Date: 1/7/2020  
 This Print is the property of Hardin Industries, LLC and must not be used in any manner that would cause Hardin Industries, LLC or its subsidiaries to be held liable or responsible to their interests.  
 Hardin Industries, LLC  
 48100 Highway 108, Coon  
 P.O. Box 177200  
 Tulsa, Oklahoma 74117-0200  
 Phone: 918-436-7000  
 Fax: 918-436-3117  
 Email: mail@hardinindustries.com

Rev. 0  
 Drw.# 1715

Item/Qty	Description	Sup. By	Ins. By	1	2	3	4	5	6
1	10 Aluminum Enclosure w/ Walls w/ Rockwool Insulation	Hardin	Hardin						
2	AZ Intake Plenum, Screened Intake w/ Sound Baffles	Hardin	Hardin						
3	Motorized Intake Damper's Spring Open and Motor Close	Hardin	Hardin						
4	1" Deep Intake Sound Baffles	Hardin	Hardin						
5	1" Deep Intake Sound Baffles	Hardin	Hardin						
6	1" Deep Intake Sound Baffles	Hardin	Hardin						
7	4 Grassy Discharge Shutters	Hardin	Hardin						
8	1 Roof Mounted Exhaust Fan w/ Thermostat	Hardin	Hardin						
9	2 Single Personnel Access Doors w/ Cooler Style Handle & S.S. Hinges	Hardin	Hardin						
10	2 Double Service Access Doors w/ Cooler Style Handle & S.S. Hinges	Hardin	Hardin						
11	1 U.L. Listed 2,250 Gallon Fuel Tank w/ Rupture Basin Base	Hardin	Hardin						
12	1 U.L. Listed 2,250 Gallon Fuel Tank w/ Rupture Basin Base	Hardin	Hardin						
13	1 Mechanical Split Fuel Level Gauge	Hardin	Hardin						
14	1 Normal Fuel Tank Vent Extended to Exterior	Hardin	Hardin						
15	1 Emergency Fuel Tank Vent Extended to Exterior	Hardin	Hardin						
16	1 Emergency Rupture Basin Vent Extended to Exterior	Hardin	Hardin						
17	1 Low and High Fuel Level Alarms	Hardin	Hardin						
18	1 Rupture Basin Alarm	Hardin	Hardin						
19	2 1/2" Flat Pack U.L. & EUL Raining Lines for Rainwater Maintenance	Hardin	Hardin						
20	2 1/2" Flat Pack U.L. & EUL Raining Lines for Rainwater Maintenance	Hardin	Hardin						
21	6 0.875" Customer Mounting Hooks Each Side of Base	Hardin	Hardin						
22	1 Beigant Interior Mounted Exhaust Silencer, P/N: 500-01292	Hardin	Hardin						
23	1 Exhaust Blankets for Silencer, Exhaust Flues & Discharge Piping	Hardin	Hardin						
24	1 Exhaust Extension Thru Roof w/ Roof Start and Rain Cap	Hardin	Hardin						
25	1 45 VVA 4867-120/293 Step Down Transformer w/ Fused Disconnect	Hardin	Hardin						
26	1 45 VVA 4867-120/293 Step Down Transformer w/ Fused Disconnect	Hardin	Hardin						
27	8 AC Interior Mounted LED Vapor Light Lights	Hardin	Hardin						
28	2 3-Way Light Switches	Hardin	Hardin						
29	6 GFCI Receptacles	Hardin	Hardin						
30	2 3KW Space Heaters w/ Built In Thermostat	Hardin	Hardin						
31	2 DC Lights w/ 60 Minute Timer, Located at Two Entry Doors	Hardin	Hardin						
32	2 1/2" Mount Exterior LED Lights w/ Photocell and Interior Switch	Hardin	Hardin						
33	2 Emergency Stop Buttons on Exterior of Enclosure, 1 Each Side	Hardin	Hardin						
34	2 Emergency Stop Buttons on Exterior of Enclosure, 1 Each Side	Hardin	Hardin						
35	2 Mount Wire Selectors and Heat Detectors Inside Enclosure	Hardin	Hardin						
36	1 Manual Pull Station E-Stop, Pull to Reset	Hardin	Hardin						
37	2 Galvanized Platform, Stairs and Railing - OSHA Compliant	Hardin	Hardin						
38	1 DQKAF Genset, 2250kW @ 480V w/ Control Panel	Hardin	Hardin						
39	2 (SIS) Lead Batteries w/ Rack and Cables	Hardin	Hardin						
40	1 120V AC Sub-Up Thru Base	Hardin	Hardin						
41	1 120V AC Sub-Up Thru Base	Hardin	Hardin						
42	1 120V AC Sub-Up Thru Base	Hardin	Hardin						

Approved As Drawn  
 D Approved With Edits Shown  
 The undersigned hereby acknowledges that all information and specifications necessary for the construction of the above described project have been reviewed and approved by me. I warrant that the information and specifications are true and correct and that I have not been influenced by any other person in the preparation of these drawings. I warrant that these drawings shall be at the expense of the customer and HARDIN INDUSTRIES SHALL NOT BE HELD LIABLE.  
 SUBMITTALS NOT APPROVED WITHOUT SIGNATURE  
 Approved By: \_\_\_\_\_ Date: \_\_\_\_\_



**Pad Layout**  
 (Looking Down From the Top)

Sheet 5 of 8

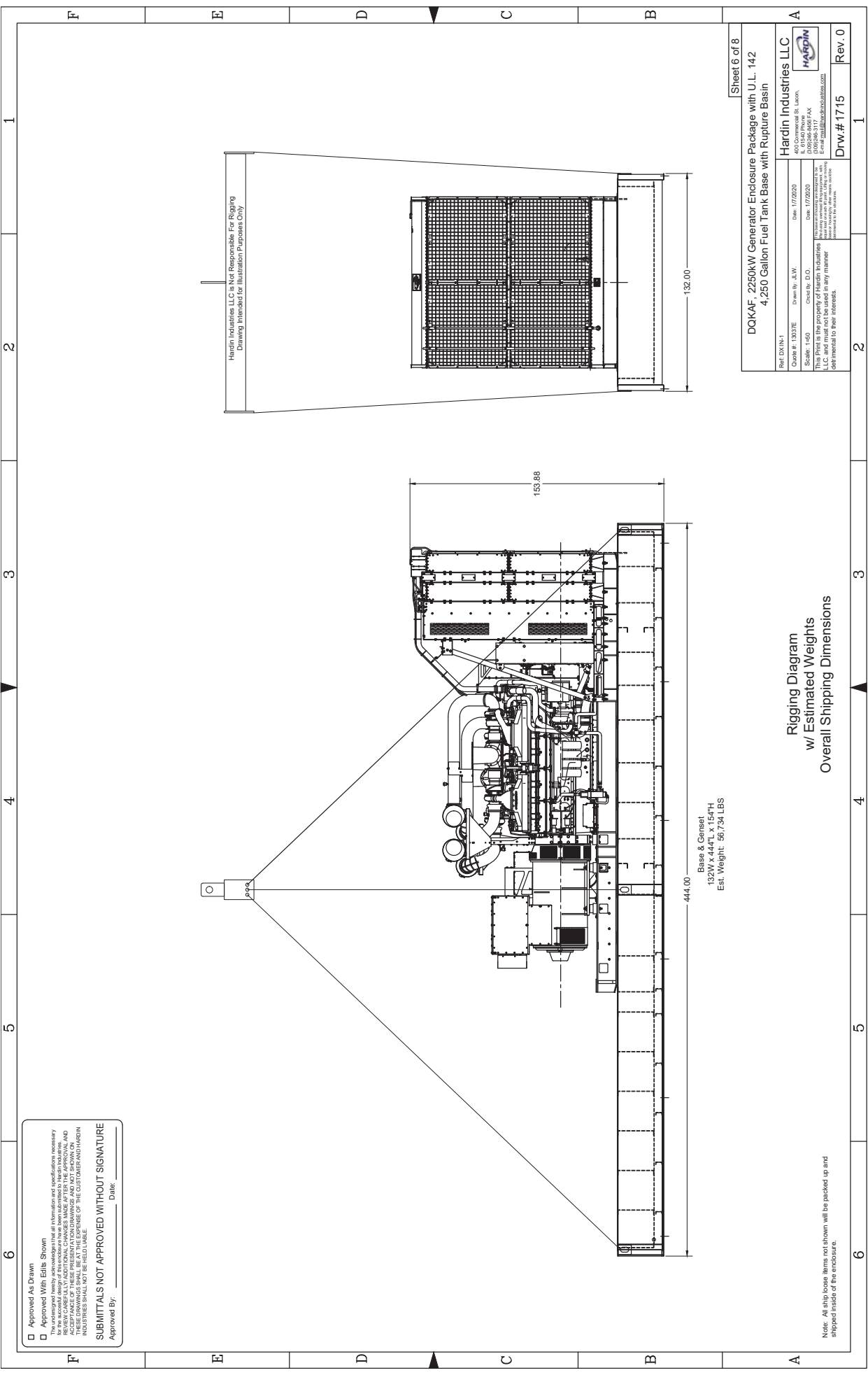
DQKAF 2250kW Generator Enclosure Package with U.L. 142  
 4,250 Gallon Fuel Tank Base with Rupture Basin

Ref: DW-N-1  
 Quote #: 13037E  
 Drawn By: J.W.  
 Date: 1/7/2020  
 Checked By: D.D.  
 Scale: 1/8" = 1'-0"

Hardin Industries LLC  
 4810-C West 13th St.  
 P.O. Box 114  
 Harbin, IA 51021  
 Phone: 515-614-7000  
 Fax: 515-614-7004  
 Email: info@hardinindustries.com

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 Rev. 0



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Base & Genset:  
132W x 444"L x 154"H  
Est. Weight: 56,734 LBS

Rigging Diagram  
w/ Estimated Weights  
Overall Shipping Dimensions

Approved As Drawn  
 Approved With Edits Shown  
 The undersigned hereby acknowledges that all information and specifications necessary for the proper construction and installation of the above described equipment have been reviewed and approved by me. I warrant that the information and specifications are correct and complete. THESE DRAWINGS SHALL BE AT THE EXPENSE OF THE CUSTOMER AND HARDIN INDUSTRIES SHALL NOT BE HELD LIABLE.  
**SUBMITTALS NOT APPROVED WITHOUT SIGNATURE**  
 Approved By: \_\_\_\_\_ Date: \_\_\_\_\_

Note: All ship loose items not shown will be packed up and shipped inside of the enclosure.

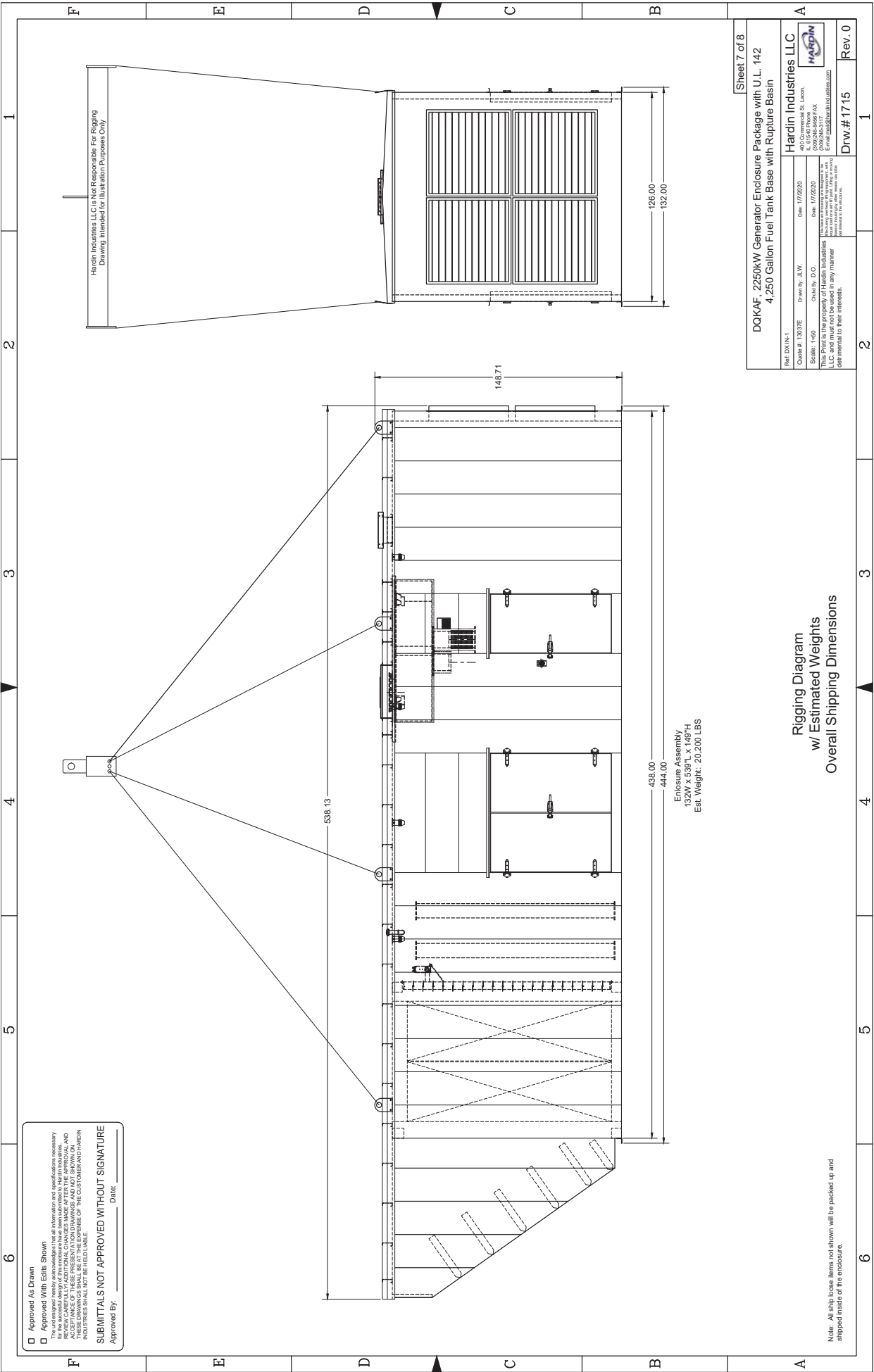
Sheet 6 of 8

DOKAF, 2250kW Generator Enclosure Package with U.L. 142  
4,250 Gallon Fuel Tank Base with Rupture Basin

Ref. DW No. 1	Drawn By: J.W.	Date: 1/7/2020
Quote #: 13037E	Checked By: D.D.	Scale: 1:50
Hardin Industries LLC 48100 S. 10th St. Omaha, NE 68146 P: 402.491.1000 F: 402.491.1001 Email: <a href="mailto:info@hardinindustries.com">info@hardinindustries.com</a>		

Hardin Industries LLC  
 48100 S. 10th St. Omaha, NE 68146  
 P: 402.491.1000 F: 402.491.1001  
 Email: [info@hardinindustries.com](mailto:info@hardinindustries.com)

Drw.# 1715 Rev. 0



Approved As Drawn  
 Approved With Edits Shown  
 The undersigned hereby acknowledges that all information and specifications necessary for the proper construction and installation of the above described equipment have been reviewed and approved by me. I warrant that the information and specifications are correct and complete. I warrant that the information and specifications are correct and complete. I warrant that the information and specifications are correct and complete. THESE WARRANTIES SHALL BE AT THE EXPENSE OF THE CUSTOMER AND HARDIN INDUSTRIES SHALL NOT BE HELD LIABLE.  
**SUBMITTALS NOT APPROVED WITHOUT SIGNATURE**  
 Approved By: \_\_\_\_\_ Date: \_\_\_\_\_

Enclosure Assembly  
 132W x 538L x 148H  
 Est. Weight: 20,200 LBS

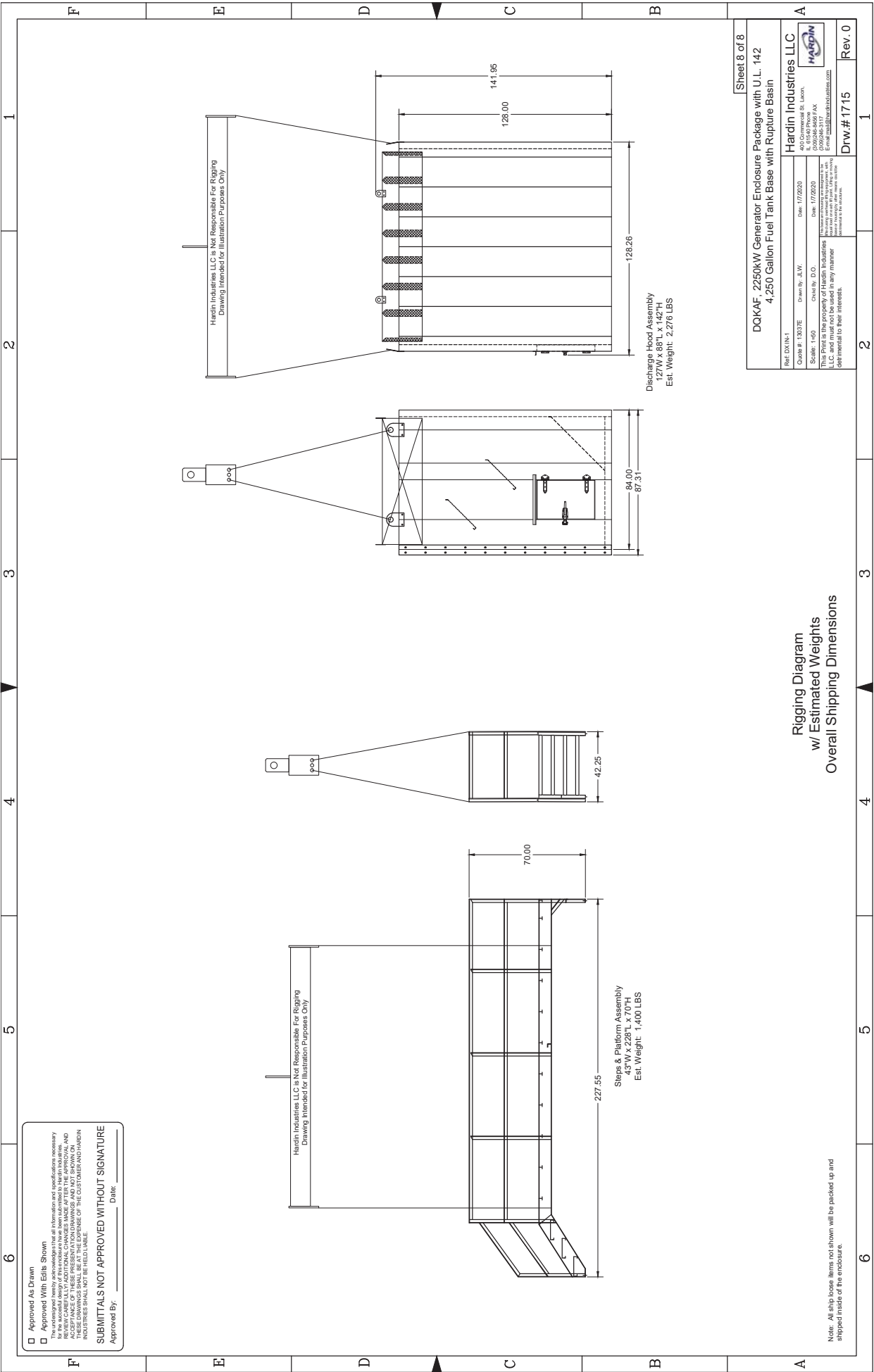
**Rigging Diagram  
 w/ Estimated Weights  
 Overall Shipping Dimensions**

Note: All ship loose items not shown will be packed up and shipped inside of the enclosure.

Sheet 7 of 8

**DQKAF\_2250kW Generator Enclosure Package with U.L. 142**  
**4,250 Gallon Fuel Tank Base with Rupture Basin**

Ref. DW-N-1	Drawn By: J.W.	Date: 1/7/2020	Hardin Industries LLC
Quote #: 13037E	Checked By: D.D.	Scale: 1/8" = 1'-0"	48100 S. Highway 108, P.O. Box 100, Hardin, TN 37056-0100
This Print is the property of Hardin Industries LLC and must not be used in any manner detrimental to their interests.		Hardin Industries LLC P.O. Box 100 Hardin, TN 37056-0100 Phone: 615-840-1000 Fax: 615-840-1001 Email: <a href="mailto:info@hardinindustries.com">info@hardinindustries.com</a>	
Rev. 0 Drw.# 1715			Rev. 0



Approved As Drawn  
 Approved With Edits Shown  
 The undersigned hereby acknowledges that all information and specifications necessary for the manufacture of the above described equipment have been furnished to the undersigned and that the undersigned has carefully reviewed and approved the same. ANY CHANGES MADE AFTER THE APPROVAL AND SIGNATURE OF THE UNDERSIGNED SHALL BE AT THE EXPENSE OF THE CUSTOMER AND HANSON INDUSTRIES SHALL NOT BE HELD LIABLE.  
**SUBMITTALS NOT APPROVED WITHOUT SIGNATURE**  
 Approved By: \_\_\_\_\_ Date: \_\_\_\_\_

Hardin Industries LLC is Not Responsible For Rigging Drawing Intended for Illustration Purposes Only.

Hardin Industries LLC is Not Responsible For Rigging Drawing Intended for Illustration Purposes Only.

**Steps & Platform Assembly**  
 43"W x 228"L x 70"H  
 Est. Weight: 1,400 LBS

**Discharge Hood Assembly**  
 127"W x 88"L x 142"H  
 Est. Weight: 2,276 LBS

**Rigging Diagram**  
 w/ Estimated Weights  
 Overall Shipping Dimensions

Note: All ship loose items not shown will be packed up and shipped inside of the enclosure.

Sheet 8 of 8  
**DQKAF\_2250kW Generator Enclosure Package with U.L. 142**  
 4,250 Gallon Fuel Tank Base with Rupture Basin




Ref. DW No. 1	Drawn By: J.W.	Date: 1/7/2020	Checked By: D.D.	Date: 1/7/2020
Scale: 1:50	This Print is the property of Hardin Industries LLC and must not be used in any manner detrimental to their interests.			
<b>Hardin Industries LLC</b> 4800 Industrial Blvd. P.O. Box 100 Ft. Worth, TX 76101 Phone: (817) 396-3117 Fax: (817) 396-3117 Email: <a href="mailto:info@hardinindustries.com">info@hardinindustries.com</a>		<b>Hardin Industries LLC</b> 4800 Industrial Blvd. Ft. Worth, TX 76101 Phone: (817) 396-3117 Fax: (817) 396-3117 Email: <a href="mailto:info@hardinindustries.com">info@hardinindustries.com</a>		

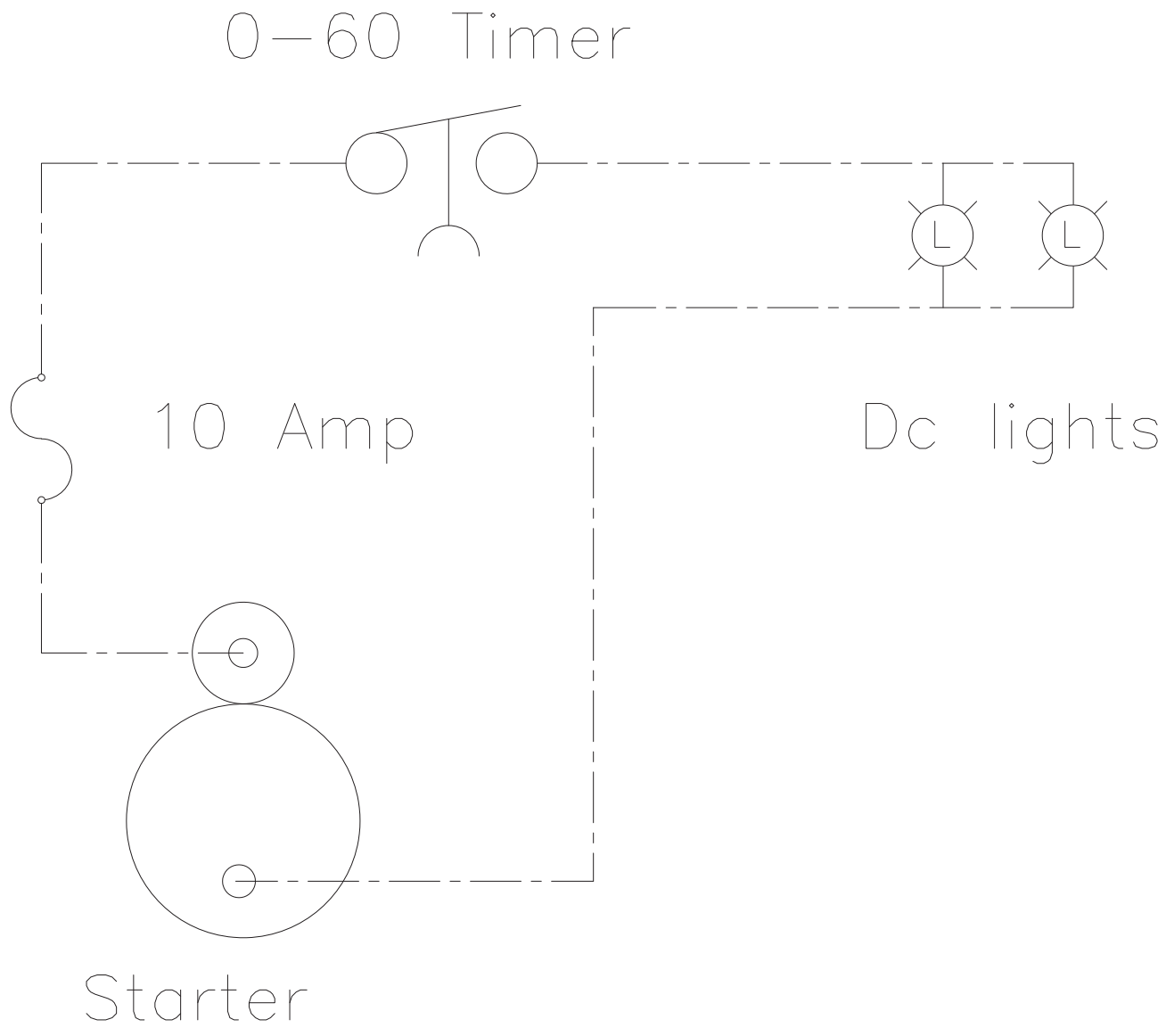
Drw.# 1715  
 Rev. 0






# LEGEND

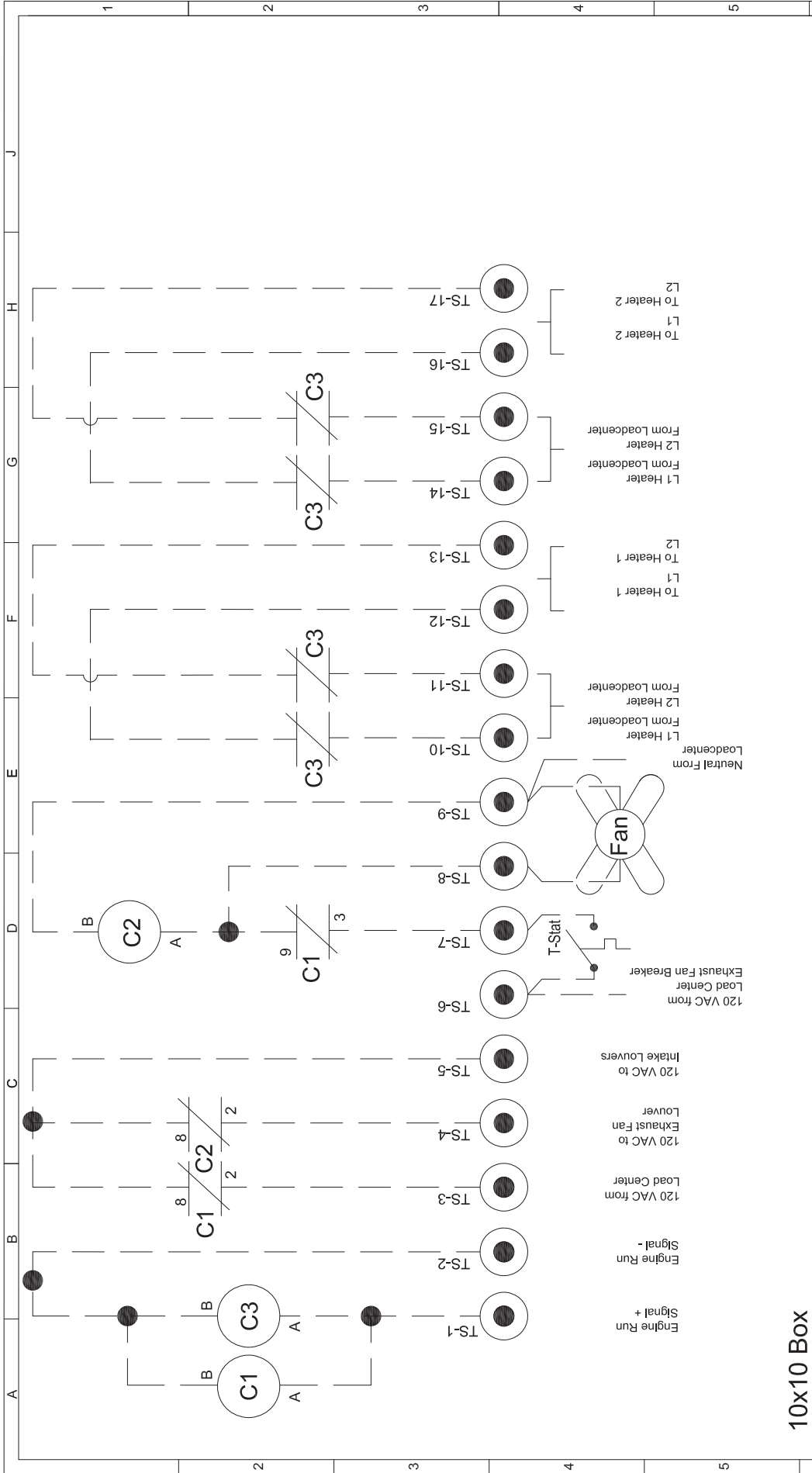
	HARDIN SUPPLIED WIRING
	CUSTOMER SUPPLIED WIRING
	OPTIONAL WIRING



Sheet 1 of 1

ENGINEERING CHANGES				
NO.	DATE	ENGR.	CHKD.	REASON

Dc Lights Schematic			
Ref: DX IN-1	W.O.# 1715	Drawn By: JK	Date: 12/19/19
Scale: _____		Checked By: _____	Date: _____
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Hardin Industries LLC 400 Commercial St. Ligon, N. 41540 Phone: (309)246-4466 FAX: (309)246-4117 Email: <a href="mailto:sales@hardinindustries.com">sales@hardinindustries.com</a>			
Drw.# 13037E		Rev. 0	



Sheet 1 of 1

Heater/Louver and Exhaust Fan  
Single Louver on Fan

**10x10 Box**  
**Note:**  
 C1 & C3 are 24 VDC Coils  
 C2 is 120 VAC Coil  
 C3 is a 4 Pole Power Relay  
 Louvers are Energized  
 to Closed Spring Open

**Hardin Industries LLC**  
 400 Commercial St. Lacon, IL 61542  
 (309)246-8456 FAX  
 (309)246-3117  
 E-mail: mail@hardinindustries.com

**HARDIN**

Ref: DX IN-1	Drawn By:- JK	Date: 12/18/19
W.O.# 1715	Checked By:-	
Scale:-	This base and knockout are designed to be fitted using overhead lifting equipment, with bases and knockouts being lowered into place. The weight of the bases and knockouts should be detrimental to the structures.	

CHG	DATE	ENGR	CHNGD	REASON
				ENGINEERING CHANGES

Rev. #13037E



# Hardin Industries LLC

400 Commercial St.

Lacon, IL 61540

Phone (309)246-8456 Fax (309)246-3117

**ENCLOSURE SPEC SHEETS**