



Technical Submittal Package for:



Trailer Package - Enclosed QSK60L

Integrated Gas Business

Submittal Revision: Apr 15th, 2021



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Chapter 1: Generator Set General Information

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Chapter 1: Generator Set General Information

1.1. Generator Set Datasheet



Natural Gas Generator Set QSK60 Series Engine

1000 kW – 1400 kW
60 Hz Continuous & Standby
EPA NSPS Stationary
EPA Non-Road Mobile



Description

This Cummins® gas generator set is a fully integrated power generation system utilizing state of the art technology that results in optimum performance and efficient use of fuel for Continuous, CHP, Peaking, and Standby applications.

Features

Exhaust Emissions - Lean burn technology provides exhaust emissions levels as low as 0.7 g/hp-hr NO_x. EPA NSPS Stationary and EPA Non-Road Mobile certified at 1.0 g/hp-hr NO_x.

Cummins Heavy-duty Engine - Rugged 4-cycle lean burn gas combustion engine utilizing full authority electronic engine management and monitoring.

Alternator - Several alternator sizes offer selectable voltage and temperature rise with low reactance 2/3 pitch windings; low waveform distortion with non-linear loads, fault clearing short circuit capability, bearing and stator RTDs, anti-condensation heater, class F or H insulation (see alternator datasheet for details). Mechanically strengthened for use on utility paralleling with unreliable grid.

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

Control System - The PowerCommand 3.3® generator set control is standard equipment and provides total genset system integration including full paralleling capability in grid or load share mode, precise frequency and voltage regulation, alarm and status message display, AmpSentry™ protection, output metering, auto-shutdown at fault detection and a user interface panel installed onto the genset. Optional remote operator panels are also available.

Cooling System - The generator set is equipped with the capability to interface with a remote radiator or heat exchanger.

Warranty and Service - Backed by a comprehensive warranty and worldwide distributor network that can provide all levels of service from replacement parts to performance guarantee programs.

Model*	Standby Rating, kW (kVA)**	Continuous Rating, kW (kVA)	Configuration	NOx Emissions, g/hp-hr	Emissions Compliance
C1000N6	1000 (1250)		4 pole direct drive	1.0	EPA NSPS Stationary EPA Non-Road Mobile
C1250N6	1250 (1563)		4 pole direct drive	1.0	EPA NSPS Stationary EPA Non-Road Mobile
C1350N6	1350 (1688)		4 pole direct drive	1.0	EPA NSPS Stationary EPA Non-Road Mobile
C1400N6C		1400 (1750)	4 pole direct drive	0.7 1.0	EPA NSPS Stationary EPA Non-Road Mobile

*Genset is capable of operating between 0.8 lagging and 1.0 power factor. All fuel consumption and heat balance data is at 1.0 power factor.

**Ratings indicate available power for standby loads including electric fan parasitics.

Generator Set Specifications

Governor regulation class	ISO 8528 Part 5, Class G1 with exceptions - see PTS (Prototype Test Support) Data Sheet
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	EN61000-6-2; EN61000-6-4; FCC Part 15 Subpart B; ICES-002; AS/NZS 2557
Single step load pickup	Generator set configuration dependent – consult factory for details

Engine Specifications

Design	4 cycle, V-block, turbo charged low temperature and after-cooled
Bore	159 mm (6.25 in.)
Stroke	190 mm (7.48 in.)
Displacement	60.3 L (3685 in. ³)
Cylinder block	Cast iron, V16
Battery charging alternator	None
Starting voltage	24 volts, negative ground
Fuel system	Lean burn
Ignition system	Individual coil on plug
Air cleaner type	Dry replaceable element
Lube oil filter type(s)	Full flow and bypass filters
Breather	Breather filter

Alternator Specifications

Design	Brushless, 4 pole, revolving field
Stator	2/3 pitch
Rotor	Two bearing
Insulation system	Class F and H see ADS (Alternator Data Sheet) for details
Standard temperature rise	105 °C (221 °F) Continuous @ 40 °C (104 °F) ambient
Exciter type	Permanent Magnet Generator (PMG)
Phase rotation	A (U), B (V), C (W)
Alternator cooling	Direct drive centrifugal blower fan
AC waveform Total Harmonic Distortion (THDV)	5% no load to full linear load, < 3% for any single harmonic
Telephone Influence Factor (TIF)	< 50% per NEMA MG1-22.43
Telephone Harmonic Factor (THF)	< 3%

Available Voltages

60 Hz Three phase Line – Neutral/Line – Line

• 240/416	• 254/440	• 277/480	• 347/600
• 2400/4160	• 7200/12470	• 7620/13200	• 7970/13800

Generator Set Options and Accessories

Engine

- NO_x 1.0 g/hp-hr
- NO_x 0.7 g/hp-hr
- Natural gas fuel methane index as low as 55 for some models

Accessories

- Exhaust silencers
- Gas train
- Radiators

- Bladder expansion tank
- Heat exchanger
- Exhaust heat recovery

Control Panel

Remote operator panel with HMI320

Warranty

- Prime 1yr Unlimited Hours Comprehensive Base Warranty
- Standby 2yrs 1000 Hours Comprehensive Base Warranty
- Standby 3, 4, or 5yrs Extended Warranty
- Prime/Peaking 2, 3, 5, or 10yrs Extended Warranty

Alternator

- 80 °C (176 °F) temperature rise
- 105 °C (221 °F) temperature rise
- 125 °C (257 °F) temperature rise

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

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PowerCommand 3.3 Control System



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. Major features include:

- AmpSentry protection providing a full range of alternator protection functions matched to the alternator provided.
- 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.
- Real time clock for start/stop to 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.
- Genset/Engine monitoring and protection.
- Utility/AC bus metering and protection.
- Modbus® interface for interconnecting to customer equipment.

Operator/Display Panel

- Auto/Manual/Run/Stop mode selectors.
- Alpha-numeric display with pushbutton access for viewing engine and alternator data and providing setup, controls and adjustment.
- Circuit breaker position indication and manual control.
- 320 x 240 pixels graphic LED backlight LCD.
- Multiple language support.

Engine Protection

- Engine vitals - oil temperature and pressure, coolant temperature and levels.
- Derate.
- Configurable alarm and status inputs.
- Emergency stop.
- Low and high battery voltage warning.
- Weak battery warning.
- Dead battery shutdown.
- Fail to start (overcrank) shutdown.
- Fail to crank shutdown.
- Cranking lockout.

Engine Data

- Oil temperature and pressure.
- Coolant temperature and pressure, HT and LT.
- Intake manifold pressure and temperature.
- Exhaust temperature and pressure.
- Engine electronics temperature and DC voltage.
- Gas inlet and downstream pressures, mass flow rate, and control valve position.
- Spark advance and knock level/count, per cylinder.
- Lube oil status, priming status.
- Oil and engine heater status.
- Start system status.
- Compressor and compressor bypass status.
- Auxiliary power supply status.

AmpSentry Alternator Protection

- Overcurrent and short circuit shutdown.
- Single and three phase fault current regulation.
- Over and under voltage shutdown.
- Over and under frequency shutdown.
- Overload warning and load shed alarm output.
- Reverse power and Var shutdown.
- Excitation fault.

Alternator Data

- AC voltage, Line-to-Line and Line-to-Neutral.
- Three phase AC current.
- Frequency.
- Total and individual phase power factor, kW and kVA.
- Alternator heater status.
- Winding and bearing temperatures.

Other Data

- Genset hardware data.
- Data logs - operational data.
- Fault history - up to 32 events.
- Start attempts, starts, running hours, kW hours.
- Engine data - operational data, monitored status functions, auxiliary system inputs, etc.
- Service adjustments - operational, customer configurable set up, calibration, etc.

Paralleling Data, Functions and Protection

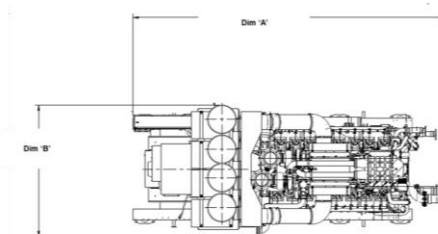
- Genset and utility/AC bus source AC metering.
- First start sensor™ system.
- Active digital phase lock loop synchronizer.
- Sync check.
- Isochronous kW and kVAr load share controls.
- kW import/export and kVAr/PF control for extended utility (mains) paralleling.
- Multiple genset load demand control.
- Power transfer control.
- Breaker control and status monitoring/warning.
- Inputs for remote kW and kVAr control.

For further detail on PowerCommand 3.3 see document S-1570.

Base Load (continuous) Definitions

Applicable for supplying power continuously to a constant load up to the full output rating for unlimited hours. No sustained overload capability is available for this rating.

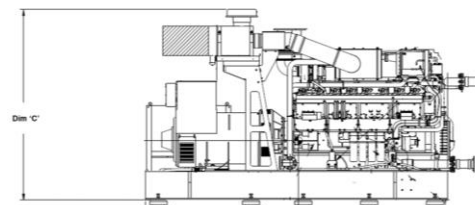
Consult authorized distributor for rating (equivalent to continuous power in accordance with ISO 8528, ISO 3046, AS2789, DIN 6271, and BS 5514). This rating is not applicable to all generator set models.



Emergency Standby Power (ESP)

Definition

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.



Generator Set Data Sheets

60 Hz

Model	Data sheet	MN*	Emissions g/hp-hr	LT (°C)	HT (°C)
C1000N6	D-6455	55	1.0	50	90
C1250N6	D-6454	72	1.0	50	90
C1350N6	D-6453	78	1.0	50	90
C1400N6C	D-3246	75	0.7	50	90
C1400N6C	D-6452	78	1.0	50	90

* MN = Methane

This outline drawing is to provide representative configuration details for model series only.

See respective model data sheet for specific model outline drawing number.

Do not use for installation design

Dimensions and Weights

Model	Dim 'A' mm (in.)	Dim 'B' mm (in.)	Dim 'C' mm (in.)	Set weight* wet kg (lbs)
C1000N6	5261 (207.1)	2231 (87.84)	2972 (116.99)	12877 (28388)
C1250N6	5261 (207.1)	2231 (87.84)	2972 (116.99)	12877 (28388)
C1350N6	5261 (207.1)	2231 (87.84)	2972 (116.99)	12877 (28388)
C1400N6C	5261 (207.1)	2231 (87.84)	2972 (116.99)	12877 (28388)

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

Codes and Standards

	This generator set is designed in facilities certified to ISO 9001 and manufactured in facilities certified to ISO 9001 or ISO 9002.		The Prototype Test Support (PTS) program verifies the performance integrity of the generator set design.
U.S. EPA	The engine used in this generator set meets U.S. EPA emission limits under 40 CFR Part 60 and 1048 (Stationary and Mobile).		This generator set is available with CE certification subject to EU RoHS exclusion per EU 2011/65

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

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S-6475 PD00000187 (10/19)

Generator Set Data Sheet

1400 kW Continuous



Model: C1400N6C
Frequency: 60 Hz
Fuel Type: Pipeline Natural Gas
Emissions NOx: EPA NSPS & Non-Road Mobile Factory Certified
LT water inlet temp: 50°C (122°F)
HT water outlet temp: 90°C (194°F)

Measured sound performance data sheet:	MSP-1007
Prototype test summary data:	PTS-644
Remote radiator cooling outline:	0500-5090

Fuel Consumption (ISO3046/1)	See Note	100% of Rated Load	90% of Rated Load	75% of Rated Load	50% of Rated Load
Fuel Consumption (LHV) ISO3046/1, kW (MMBTU/hr)	2,3,5	3776 (12.89)	3435 (11.73)	2923 (9.98)	2064 (7.05)
Electrical Efficiency ISO3046/1, percent	2,5,10	37.1%	36.7%	35.9%	33.9%
Thermal Efficiency ISO3046/1, percent	2,5,17	50.4%	50.9%	51.2%	52.0%

Engine

Engine Manufacturer	Cummins
Engine Model	QSK60G
Configuration	V16
Displacement, L (cu.in)	60 (3672)
Aspiration	Turbocharged and Charge Air Aftercooled
Gross Engine Power Output, kWm (hp)	1443 (1935)
BMEP, bar (psi)	16.1 (234)
Bore, mm (in)	159 (6.25)
Stroke, mm (in)	190 (7.48)
Rated Speed, rpm	1800
Piston Speed, m/s (ft/min)	11.4 (2244)
Compression Ratio	11.4:1
Lube Oil Capacity, L (qt)	379 (400)
Full Load Lubricating oil consumption, g/kWe-hr (g/hp-hr)	0.15 (0.11)

Fuel

Gas supply pressure to FSOV inlet, bar (psi) ¹⁸	0.2 - 0.46 (2.9 - 6.7)
Minimum Methane Index	78

Starting System(s)

Electric Starter Voltage, volts	24
Minimum Battery Capacity @ 40°C (104°F), AH	450

Genset dimensions (see Note 1)

Genset Length, m (ft)	5.00 (16.40)
Genset Width, m (ft)	2.33 (7.64)
Genset Height, m (ft)	2.97 (9.74)
Genset Weight (wet), kg (lbs)	13924 (30697)

Energy data

	See Notes	100% of Rated Load	90% of Rated Load	75% of Rated Load	50% of Rated Load
Continuous Generator Electrical Output kWe @ 1.0 pf	2,5,10	1400	1260	1050	700
Total Heat Rejected in LT Circuit, kW (MMBTU/h)	14	102 (0.35)	92 (0.32)	84 (0.29)	68 (0.23)
Total Heat Rejected in HT Circuit, kW (MMBTU/h)	14	925 (3.16)	846 (2.89)	710 (2.42)	497 (1.69)
Unburnt, kW (MMBTU/h)	14	114 (0.39)	106 (0.36)	93 (0.32)	68 (0.23)
Heat Radiated to Ambient, kW (MMBTU/h)	14	162 (0.55)	147 (0.50)	125 (0.43)	87 (0.30)
Available Exhaust heat to 120°C, kW (MMBTU/h)	14	980 (3.34)	902 (3.08)	787 (2.69)	576 (1.97)

Intake air flow

Intake Air Flow Mass, kg/s (lb/hr)	14	2.37 (18817)	2.14 (16961)	1.81 (14342)	1.28 (10183)
Intake Air Flow Volume, m³/s @ 0°C (scfm)	14	1.83 (4090)	1.65 (3690)	1.40 (3130)	0.99 (2210)
Maximum Air Cleaner Restriction, mmHG (in H ₂ O)	19	18.3 (9.8)	18.3 (9.8)	18.3 (9.8)	18.3 (9.8)

Exhaust air flow

Exhaust Gas Flow Mass, kg/s (lb/hr)	14	2.46 (19486)	2.21 (17569)	1.87 (14862)	1.33 (10556)
Exhaust Gas Flow Volume, m³/s (cfm)	14	5.25 (11120)	4.77 (10100)	4.10 (8680)	3.00 (6350)
Exhaust Temperature After Turbine, °C (°F)	4	482 (900)	488 (910)	501 (934)	524 (975)
Max Exhaust System Back Pressure, mmHG (in H ₂ O)	12	37.3 (20.0)	37.3 (20.0)	37.3 (20.0)	37.3 (20.0)
Min Exhaust System Back Pressure, mmHG (in H ₂ O)	12	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)

HT cooling circuit

HT Circuit Engine Coolant Volume, L (gal)		182 (48)	182 (48)	182 (48)	182 (48)
HT Coolant Flow @ Max Ext Restriction, m³/h (gal/min)	13,15	83 (365)	83 (365)	83 (365)	83 (365)
Maximum HT Engine Coolant Inlet Temp, °C (°F)	6	79 (174)	80 (176)	82 (179)	84 (183)
HT Coolant Outlet Temp, °C (°F)	6	90 (194)	90 (194)	90 (194)	90 (194)
Max Pressure Drop in External HT Circuit, bar (psig)	15	1.5 (21.8)	1.5 (21.8)	1.5 (21.8)	1.5 (21.8)
HT Circuit Maximum Pressure, bar (psig)		4.5 (65)	4.5 (65)	4.5 (65)	4.5 (65)
Minimum Static Head - Pump Inlet, bar (psig)		0.5 (7)	0.5 (7)	0.5 (7)	0.5 (7)

LT Cooling Circuit	See Notes	100% of Rated Load	90% of Rated Load	75% of Rated Load	50% of Rated Load
LT Circuit Engine Coolant Volume, L (gal)		34 (9)	34 (9)	34 (9)	34 (9)
LT Coolant Flow @ Max Ext Restriction, m³/h (gal/min)	13,15	23 (101)	23 (101)	23 (101)	23 (101)
Maximum LT Engine Coolant Inlet Temp, °C (°F)	7	50 (122)	50 (32)	50 (32)	50 (122)
Nominal LT Coolant Outlet Temp, °C (°F)	7	54 (129)	54 (32)	54 (32)	54 (129)
Max Pressure Drop in External LT Circuit, bar (psig)	15	1.0 (14.5)	1.0 (14.5)	1.0 (14.5)	1.0 (14.5)
LT Circuit Maximum Pressure, bar (psig)		4.5 (65)	4.5 (65)	4.5 (65)	4.5 (65)
Minimum Static Head - Pump Inlet, bar (psig)		0.5 (7)	0.5 (7)	0.5 (7)	0.5 (7)

Emissions

NO _x Emissions dry, ppm		This rating is EPA NSPS Certified. Please refer to EPA emissions datasheet for regulation limits.
NO _x Emissions, mg/Nm³ @5% O ₂ (g/hp-h)		
THC Emissions wet, ppm	11	
THC Emissions, mg/Nm³ @5% O ₂ (g/hp-h)	11	
CO Emissions dry, ppm	14	
CO Emissions, mg/Nm³ @5% O ₂ (g/hp-h)	14	
CO ₂ Emissions dry, percent	14	
CO ₂ Emissions, mg/Nm³ @5% O ₂ (g/hp-h)	14	
O ₂ Emissions dry, percent	14	
Particulates PM ₁₀ , g/hp-h	14	

Genset De-rating

Altitude and Temperature Derate Multiplication Factor - On Grid, Soft Start

Barometer		Altitude		Table A									
In Hg	mbar	Feet	Meters	Derate Multiplier									
20.7	701	9843	3000	0.69	0.67	0.66	0.65	0.63	0.61	0.58	0.55	0.52	
21.4	723	9022	2750	0.72	0.70	0.69	0.68	0.66	0.64	0.61	0.58	0.55	
22.1	747	8202	2500	0.75	0.74	0.72	0.71	0.70	0.67	0.64	0.61	0.58	
22.8	771	7382	2250	0.78	0.77	0.75	0.74	0.73	0.70	0.67	0.64	0.62	
23.5	795	6562	2000	0.81	0.80	0.79	0.77	0.76	0.73	0.70	0.68	0.65	
24.3	820	5741	1750	0.84	0.83	0.82	0.80	0.79	0.76	0.74	0.71	0.68	
25.0	846	4921	1500	0.88	0.86	0.85	0.84	0.82	0.79	0.77	0.74	0.71	
25.8	872	4101	1250	0.91	0.89	0.88	0.87	0.85	0.83	0.80	0.77	0.74	
26.6	899	3281	1000	0.94	0.92	0.91	0.90	0.89	0.86	0.83	0.80	0.77	
27.4	926	2461	750	0.97	0.96	0.94	0.93	0.92	0.89	0.86	0.83	0.81	
28.3	954	1640	500	1.00	0.99	0.97	0.96	0.95	0.92	0.89	0.86	0.84	
29.1	983	820	250	1.00	1.00	1.00	0.99	0.98	0.95	0.92	0.90	0.87	
29.5	995	492	150	1.00	1.00	1.00	1.00	0.99	0.96	0.94	0.91	0.88	
30.0	1012	0	0	1.00	1.00	1.00	1.00	1.00	0.98	0.96	0.93	0.90	
				°C	20	25	30	35	40	45	50	55	60
				°F	68	77	86	95	104	113	122	131	140
Air Filter Inlet Temperature													

Altitude and Temperature Derate Multiplication Factor - Off Grid

Barometer		Altitude		Table A									
In Hg	mbar	Feet	Meters	Derate Multiplier									
20.7	701	9843	3000	0.67	0.66	0.64	0.63	0.62	0.58	0.55	0.52	-	
21.4	723	9022	2750	0.70	0.69	0.67	0.66	0.65	0.62	0.58	0.55	0.52	
22.1	747	8202	2500	0.73	0.72	0.71	0.69	0.68	0.65	0.61	0.58	0.55	
22.8	771	7382	2250	0.76	0.75	0.74	0.72	0.71	0.68	0.65	0.61	0.58	
23.5	795	6562	2000	0.80	0.78	0.77	0.76	0.74	0.71	0.68	0.65	0.61	
24.3	820	5741	1750	0.83	0.81	0.80	0.79	0.77	0.74	0.71	0.68	0.64	
25.0	846	4921	1500	0.86	0.85	0.83	0.82	0.81	0.77	0.74	0.71	0.68	
25.8	872	4101	1250	0.89	0.88	0.86	0.85	0.84	0.80	0.77	0.74	0.71	
26.6	899	3281	1000	0.92	0.91	0.90	0.88	0.87	0.84	0.80	0.77	0.74	
27.4	926	2461	750	0.95	0.94	0.93	0.91	0.90	0.87	0.84	0.80	0.77	
28.3	954	1640	500	0.98	0.97	0.96	0.94	0.93	0.90	0.87	0.83	0.80	
29.1	983	820	250	1.00	1.00	0.99	0.98	0.96	0.93	0.90	0.87	0.83	
29.5	995	492	150	1.00	1.00	1.00	0.99	0.98	0.94	0.91	0.88	0.85	
30.0	1012	0	0	1.00	1.00	1.00	1.00	0.99	0.96	0.93	0.90	0.87	
				°C	20	25	30	35	40	45	50	55	60
				°F	68	77	86	95	104	113	122	131	140
Air Filter Inlet Temperature													

Temperature & altitude derate

1. Determine derate multiplier vs. temperature and altitude in Table A.
2. Assumes the LT return temperature is 10 °C above the air filter inlet with a maximum LT temperature of 50 °C.
3. If the LT temperature exceeds 50°C, consult factory for recommendations.
4. Altitude is based upon SAE standard ambient pressure vs. altitude. For low barometric conditions add 150 m (500 ft) to site altitude.

Genset De-rating

Heat Rejection Factor (altitude and ambient) for HT and LT Circuits

Barometer		Altitude		Table B									
In Hg	mbar	Feet	Meters	Multiplier for HT & LT (1/4) Heat Rejection vs Alt & Temp.									
20.7	701	9843	3000	1.11	1.13	1.14	1.15	1.17	1.18	1.19	1.20	1.22	
21.4	723	9022	2750	1.10	1.12	1.13	1.14	1.15	1.17	1.18	1.19	1.21	
22.1	747	8202	2500	1.09	1.10	1.12	1.13	1.14	1.16	1.17	1.18	1.20	
22.8	771	7382	2250	1.08	1.09	1.11	1.12	1.13	1.14	1.16	1.17	1.18	
23.5	795	6562	2000	1.07	1.08	1.09	1.11	1.12	1.13	1.15	1.16	1.17	
24.3	820	5741	1750	1.06	1.07	1.08	1.10	1.11	1.12	1.14	1.15	1.16	
25.0	846	4921	1500	1.05	1.06	1.07	1.09	1.10	1.11	1.12	1.14	1.15	
25.8	872	4101	1250	1.04	1.05	1.06	1.07	1.09	1.10	1.11	1.13	1.14	
26.6	899	3281	1000	1.02	1.04	1.05	1.06	1.08	1.09	1.10	1.12	1.13	
27.4	926	2461	750	1.01	1.03	1.04	1.05	1.07	1.08	1.09	1.10	1.12	
28.3	954	1640	500	1.00	1.02	1.03	1.04	1.05	1.07	1.08	1.09	1.11	
29.1	983	820	250	0.99	1.00	1.02	1.03	1.04	1.06	1.07	1.08	1.10	
29.5	995	492	150	0.99	1.00	1.01	1.03	1.04	1.05	1.06	1.08	1.09	
30.0	1012	0	0	0.98	0.99	1.01	1.02	1.03	1.05	1.06	1.07	1.08	
				°C	20	25	30	35	40	45	50	55	60
				°F	68	77	86	95	104	113	122	131	140
Air Filter Inlet Temperature													

LT & HT Circuit Heat Rejection Calculation

1. Determine derate multiplier vs. temperature and altitude in Table A.
2. Using the multiplier from #1 above as the percent load factor determine the heat rejection from the previous page.
3. From Table B find the LT circuit multiplier. *The HT circuit multiplier is 1/4 of the multiplier shown in the table e.g. if the table says 1.04, the actual factor for HT is 1.01.
4. Multiply the result of step 2 by the result of step 3 to obtain the heat rejection at your altitude and temperature.

Methane Index Derate Multiplication Factor*

Table C

Derate Multiplier

LT Inlet Temp		Derate Factor			
°F	°C	1.00	0.90	0.75	0.50
122	50	78	69	54	45
131	55	82	73	58	49
140	60	86	77	62	53
149	65	90	81	66	57
158	70	94	85	70	61

Methane Index Derate

1. Determine derate multiplier vs. Methane Number in Table C based on MN given your gas analysis input into the Cummins Gas Analysis Tool.
2. Using the multiplier from #1 above as the percent load factor determine the max load in kW using the nominal max rated load.

Alternator Data

Voltage Range	Connection Configuration	Temp Rise Degrees C	Duty ⁹ Cycle	Winding No.	Alternator Data Sheet
380-480	Wye, 3 Phase	80	C	N/A	See Note 16
416-480	Wye, 3 Phase	80	C	N/A	See Note 16
600	Wye, 3 Phase	80	C	N/A	See Note 16
4160	Wye, 3 Phase	80	C	N/A	See Note 16
12470-13800	Wye, 3 Phase	80	C	N/A	See Note 16
380-416	Wye, 3 Phase	105	C	N/A	See Note 16
440-480	Wye, 3 Phase	105	C	N/A	See Note 16
480	Wye, 3 Phase	105	C	N/A	See Note 16
600	Wye, 3 Phase	105	C	N/A	See Note 16
4160	Wye, 3 Phase	105	C	N/A	See Note 16
440-480	Wye, 3 Phase	125	C	N/A	See Note 16

Continuous Rating Definition

Applicable for supplying power continuously to a constant load up to the full output rating for unlimited hours. No sustained overload capability is available for this rating. Consult authorized distributor for rating. (Equivalent to Continuous Power in accordance with ISO8528, ISO3046, AS2789, DIN6271, and BS5514).

Note:

- Weights and set dimensions represent a generator set with its standard features only. See outline drawing for other configurations.
- At ISO3046 reference conditions, altitude 1013 mbar (30in Hg), air inlet temperature 25°C (77°F)
- According to ISO 3046/I with fuel consumption tolerance of +5%, -0%
- With air intake at 25°C (77°F). Tolerance $\pm 10^{\circ}\text{C}$.
- Tested using pipeline natural gas with LHV of 35.64MJ/Nm³ (905BTU/scf).
- Outlet temperature controlled by thermostat. Inlet temperature for reference only. Data taken with 50% Glycol and with outlet temperature at max allowance.
- Inlet temperature controlled by thermostat, outlet temperature for reference only. Data taken with 50% Glycol.
- Without engine driven coolant pumps
- Standby (S), Prime (P), Continuous (C)
- At electrical output of 1.0 Power Factor, 97% Alternator Efficiency
- Tolerance $\pm 15\%$. Values shown are measured using fuel with less than 1% NMHC by volume. Values can vary significantly depending on NMHC found in the fuel.
- Exhaust system back pressure is at rated load and will decrease at lower loads. Minimum restriction/back pressure is 0 mm H₂O.
- Flow including off engine thermostats.
- Tolerance $\pm 10\%$
- Pressure drop external to genset.
- Alternator model and data sheet information available on www.powersuite.cummins.com
- Exhaust gas cooled to 120 °C.
- Fuel pressure capability will vary depending on fuel quality and site conditions.
- Maximum Air Cleaner Restriction based on intake air temperature below 35 °C. If intake air temperature rises above 35 °C, contact Application Engineering for guidance.

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

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2019 EPA Exhaust Emission Compliance Statement C1400 N6C 60 Hz Spark Ignited Generator Set

Compliance Information:

The engine used in this generator set meets U.S. EPA emission limits under 40 CFR Part 60 and 1048 (Stationary and Mobile).

Engine Manufacturer: Cummins Inc.
EPA Certificate Number: KCEXB60.0AAB-010
Effective Date: 12/18/2018
Date Issued: 12/18/2018
EPA Engine Family (Cummins Emissions Family): KCEXB60.0AAB

Engine Information:

Model:	QSK60G	Bore:	6.26 in. (159 mm)
Engine Nameplate HP:	1953	Stroke:	7.48 in. (190 mm)
Type:	4 Cycle, Vee, 16 Cylinder	Displacement:	3671.0 cu. in. (60 liters)
Aspiration:	Turbocharged and Aftercooled	Compression Ratio:	11.4:1
Emission Control Device:	Turbocharged and Aftercooled	Exhaust Stack Diameter:	8.0 in (203 mm)

U.S. Environmental Protection Agency SI Emission Limits

Lean Burn Gas: Non-Road 1048	Grams per BHP-hr		Grams per kW _m -hr	
	<u>NOx+NMHC</u>	<u>CO</u>	<u>NOx+NMHC</u>	<u>CO</u>
Test Results	0.8	2.0	1.1	2.7
EPA Emissions Limit	2.0	3.3	2.7	4.4

Lean Burn Gas: Stationary Part 60	Grams per BHP-hr			Grams per kW _m -hr		
	<u>NOx</u>	<u>CO</u>	<u>VOC</u>	<u>NOx</u>	<u>CO</u>	<u>VOC</u>
Test Results	0.8	2.0	0.1	1.1	2.7	0.1
EPA Emissions Limit	1.0	2.0	0.7	1.3	2.7	0.9

Notes:

Tests conducted using alternate 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.



Chapter 1: Generator Set General Information

1.2. Alternator Datasheet



Alternator data sheet

Frame size: **P734E**

Characteristics

Weights:	Stator assembly:	3851 lb	1747 kg
	Rotor assembly:	3276 lb	1486 kg
	Complete assembly:	7840 lb	3556 kg
Maximum speed:		2250 rpm	
Excitation current:	Full load:	3.6 Amps	
	No load:	0.5 Amps	
Insulation system:	Class H throughout		

3 ∅ Ratings (0.8 power factor)		60 Hz Voltage (winding no)						
(Based on specific temperature rise at 40° C ambient temperature)		<u>220/380</u> (13)	<u>240/416</u> (13)	<u>220/380</u> (312)	<u>240/416</u> (312)	<u>254/440</u> (312)	<u>277/480</u> (312)	<u>347/600</u> (07)
163° C rise ratings	kW			1560	1772	1892	1972	1972
	kVA			1950	2215	2365	2465	2465
150° C rise ratings	kW			1516	1724	1840	1916	1916
	kVA			1895	2155	2300	2395	2395
125° C rise ratings	kW			1460	1656	1768	1840	1840
	kVA			1825	2070	2210	2300	2300
105° C rise ratings	kW			1356	1540	1644	1712	1712
	kVA			1695	1925	2055	2140	2140
80° C rise ratings	kW			1256	1424	1520	1584	1584
	kVA			1570	1780	1900	1980	1980
Reactances (per unit ± 10%)		<u>220/380</u> (13)	<u>240/416</u> (13)	<u>220/380</u> (312)	<u>240/416</u> (312)	<u>254/440</u> (312)	<u>277/480</u> (312)	<u>347/600</u> (07)
(Based on full load at 125° C rise rating)								
Synchronous				4.06	3.85	3.67	3.21	3.21
Transient				0.24	0.23	0.22	0.19	0.12
Subtransient				0.18	0.17	0.16	0.14	0.09
Negative sequence				0.25	0.24	0.23	0.20	0.12
Zero sequence				0.04	0.03	0.03	0.03	0.02
Motor starting		<u>220/380</u> (13)	<u>240/416</u> (13)	<u>220/380</u> (312)	<u>240/416</u> (312)	<u>254/440</u> (312)	<u>277/480</u> (312)	<u>347/600</u> (07)
Maximum kVA (90% sustained voltage)				6716	6716	6716	6716	6716
Time constants (sec)		<u>220/380</u> (13)	<u>240/416</u> (13)	<u>220/380</u> (312)	<u>240/416</u> (312)	<u>254/440</u> (312)	<u>277/480</u> (312)	<u>347/600</u> (07)
Transient				0.149	0.149	0.149	0.149	0.149
Subtransient				0.020	0.020	0.020	0.020	0.020
Open circuit				2.460	2.460	2.460	2.460	2.460
DC				0.020	0.020	0.020	0.020	0.020
Windings (@20° C)		<u>220/380</u> (13)	<u>240/416</u> (13)	<u>220/380</u> (312)	<u>240/416</u> (312)	<u>254/440</u> (312)	<u>277/480</u> (312)	<u>347/600</u> (07)
Stator resistance (Line to Line, Ohms)				0.00093	0.00093	0.00093	0.00093	0.00300
Rotor resistance (Ohms)				2.17	2.17	2.17	2.17	2.17
Number of leads				6	6	6	6	6



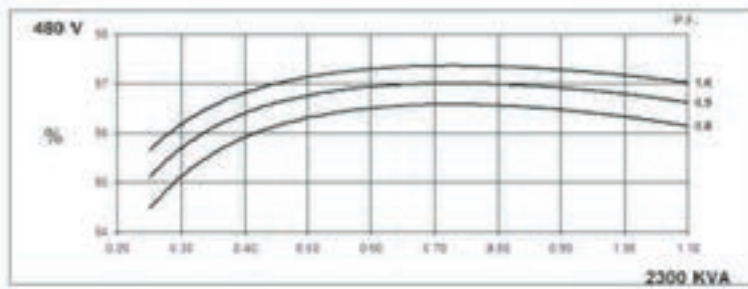
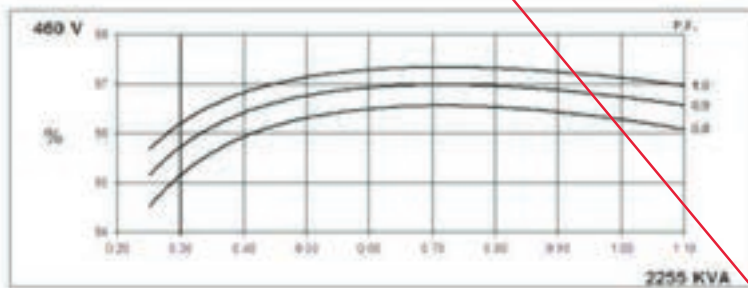
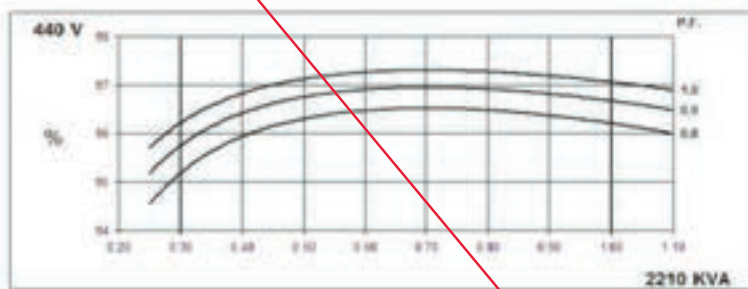
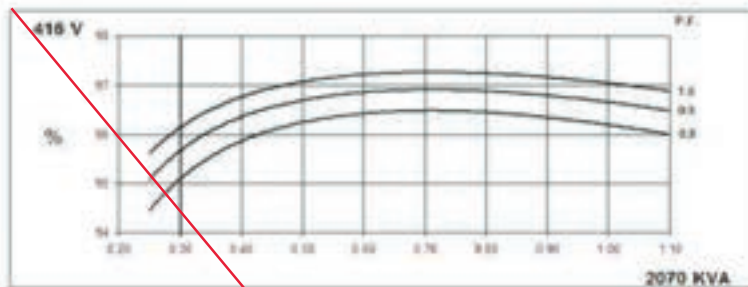
Alternator data sheet

Frame size: P734E

Winding 312

THREE PHASE EFFICIENCY CURVES

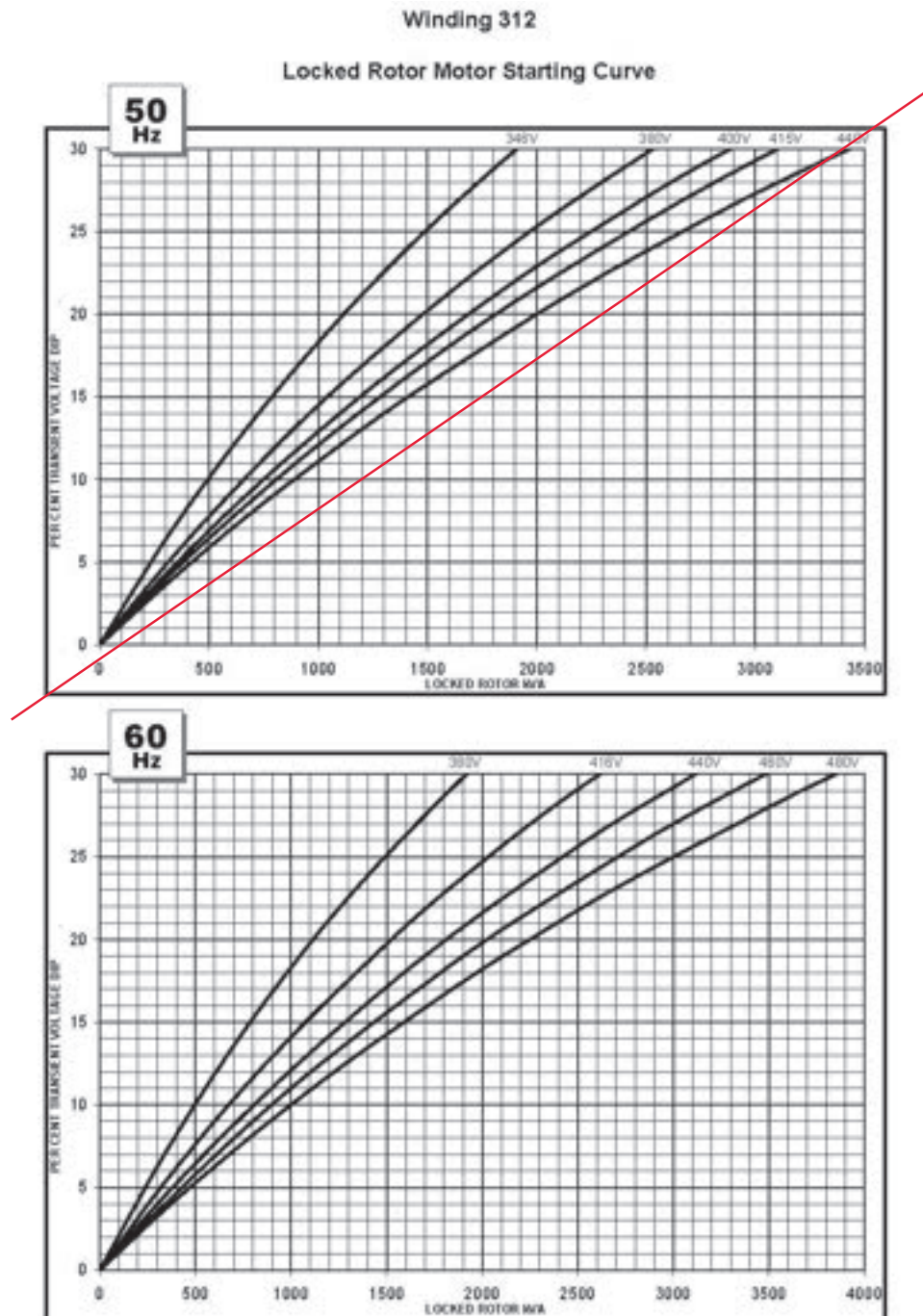
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Alternator data sheet

Frame size: P734E

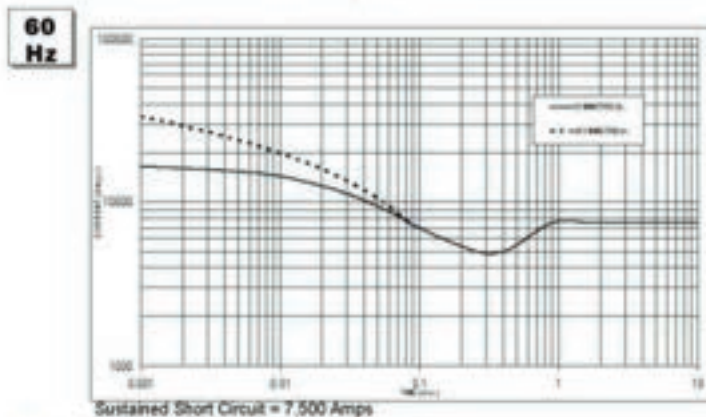
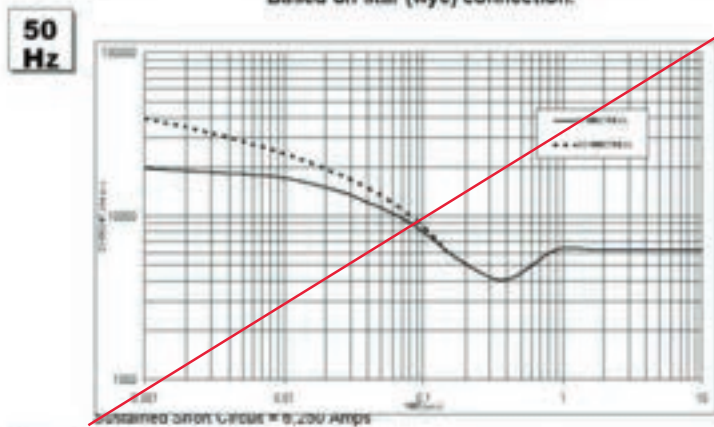




Alternator data sheet

Frame size: P734E

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



Note 1

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

50Hz		60Hz	
Voltage	Factor	Voltage	Factor
200V	x 1.00	470V	x 1.00
400V	x 1.00	480V	x 1.00
675V	x 1.00	480V	x 1.10
600V	x 1.10	480V	x 1.15

The sustained current value is constant irrespective of voltage level

Note 2

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

	3 phase	2 phase L-L	2 phase L-N
Instantaneous	x 1.00	x 0.87	x 1.30
Minimum	x 1.00	x 1.00	x 2.20
Sustained	x 1.00	x 1.00	x 2.00
Max. sustained duration	10 sec	5 sec	2 sec

All other times are unchanged

Note 3

Curves are drawn for Star (Wye) connected machines.



Chapter 1: Generator Set General Information

1.3. Generator Set Controls Datasheet

PowerCommand®

3.3 control system



> Specification sheet

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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 KVAR Control
- Sync Check – 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

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- 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.

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

Remote start mode - It accepts a ground signal from remote devices to automatically start the 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.

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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. 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 a system should be the first to close to the bus. The system includes an independent backup function, so that if the primary system is disabled the required functions are still performed.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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.

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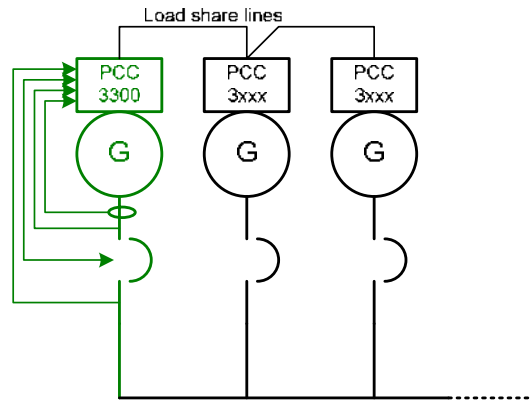
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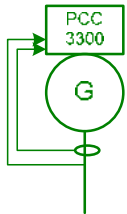


Exerciser clock –The exerciser clock (when enabled) allows the system to be operated at preset times in either test without load, test with load, or extended parallel mode. A Real Time Clock is built in. Up to 12 different programs can be set for day of week, time of day, duration, repeat interval, and 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.

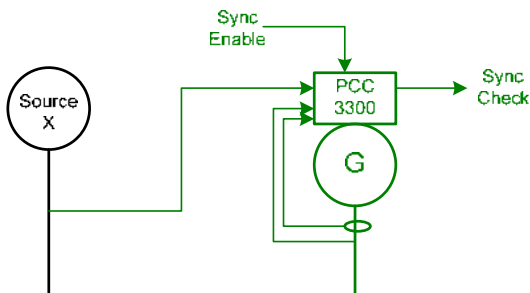
Application types – Controller is configured to operating in one of six possible application types. These topologies are often used in combinations in larger systems, with coordination of the controllers in the system either by external device or by interlocks provided in the control. Topologies that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



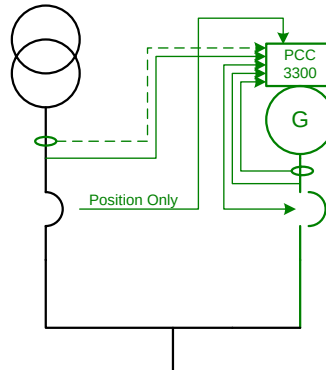
Standalone: Control provides monitoring, protection and control in a non-parallel application.



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



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



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

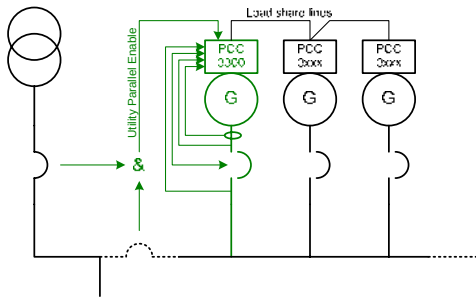
Isolated Bus: allows the genset to perform a dead bus closure or synchronize to the bus and isochronously share kW and kVAR loads with other gensets.

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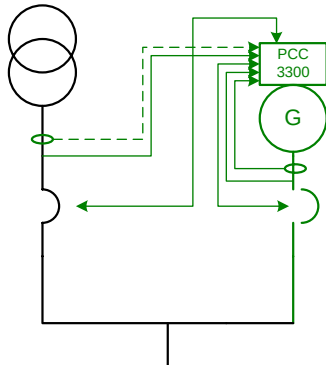
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Power Transfer Control: control operates a single genset/single utility transfer pair in open transition, fast closed transition, or soft closed transition. Extended paralleling functionality also provides base load and peak shave options.



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.

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Configurable alarm and status inputs

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

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

Emergency stop

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

General 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.

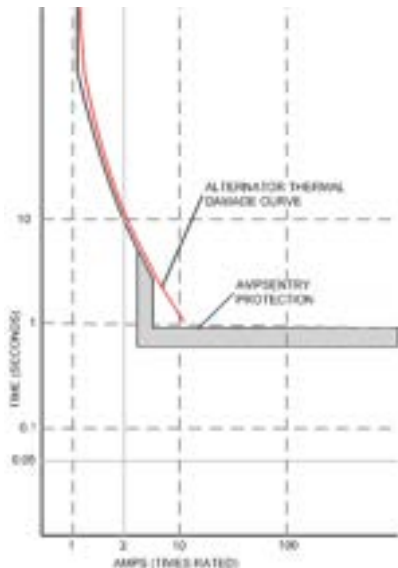
High intake manifold temperature shutdown – Level is preset (configurable with InPower or HMI) to match the capabilities of the engine used. Control includes time delays to prevent nuisance alarms.

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.

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

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

Paralleling protection

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

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

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

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

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

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

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

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

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

Field control interface

Input signals to the PowerCommand control include:

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

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.

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

For Lean Burn Natural Gas Engine applications:

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

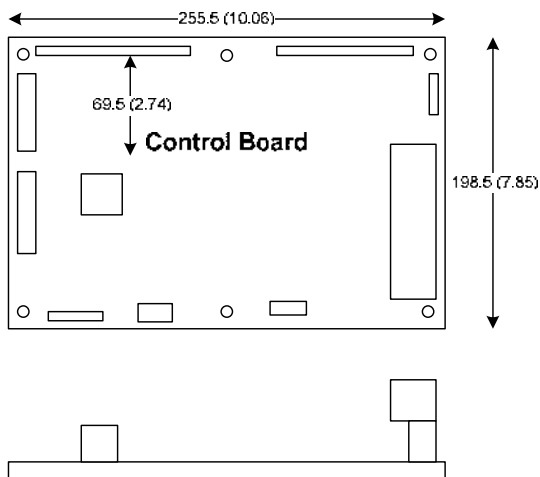
Communications connections include:

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

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

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

Mechanical drawing



PowerCommand human machine interface HMI320



Description

This control system includes an intuitive operator interface panel that allows for complete genset control as well as system metering, fault annunciation, configuration and diagnostics. The interface includes five genset status LED lamps with both internationally accepted symbols and English text to comply with customers 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.

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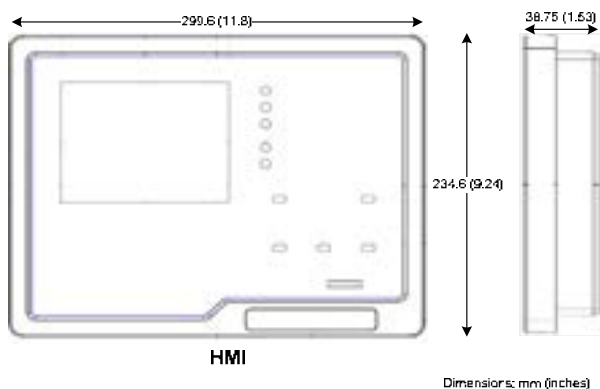


- Six tactile feel membrane switches dedicated to control for auto, stop, manual, manual start, fault reset and lamp test/panel lamps.
- Two tactile feel membrane switches dedicated to control of circuit breaker (where applicable).
- Allows for complete genset control setup.
- Certifications: Suitable 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.

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

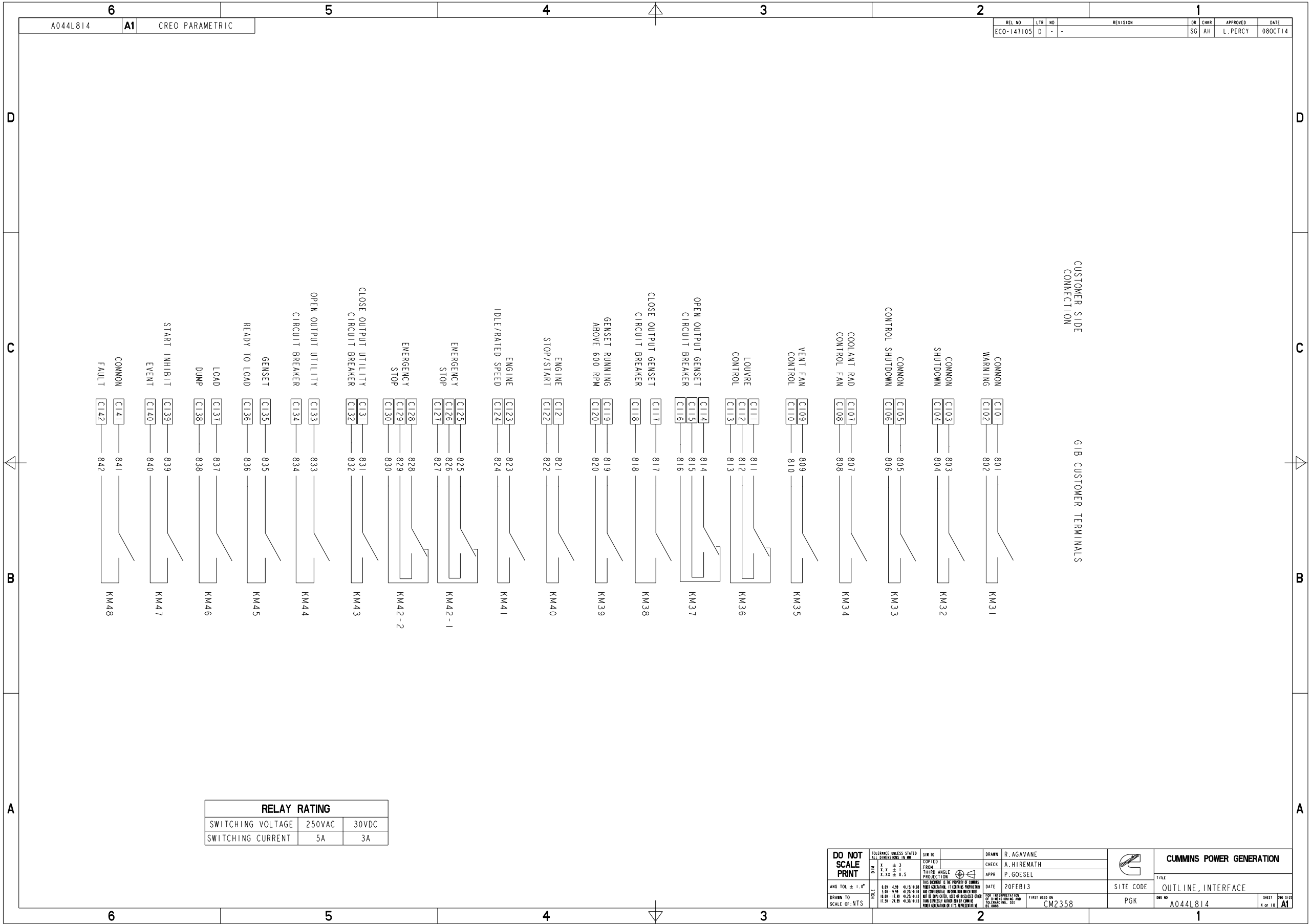
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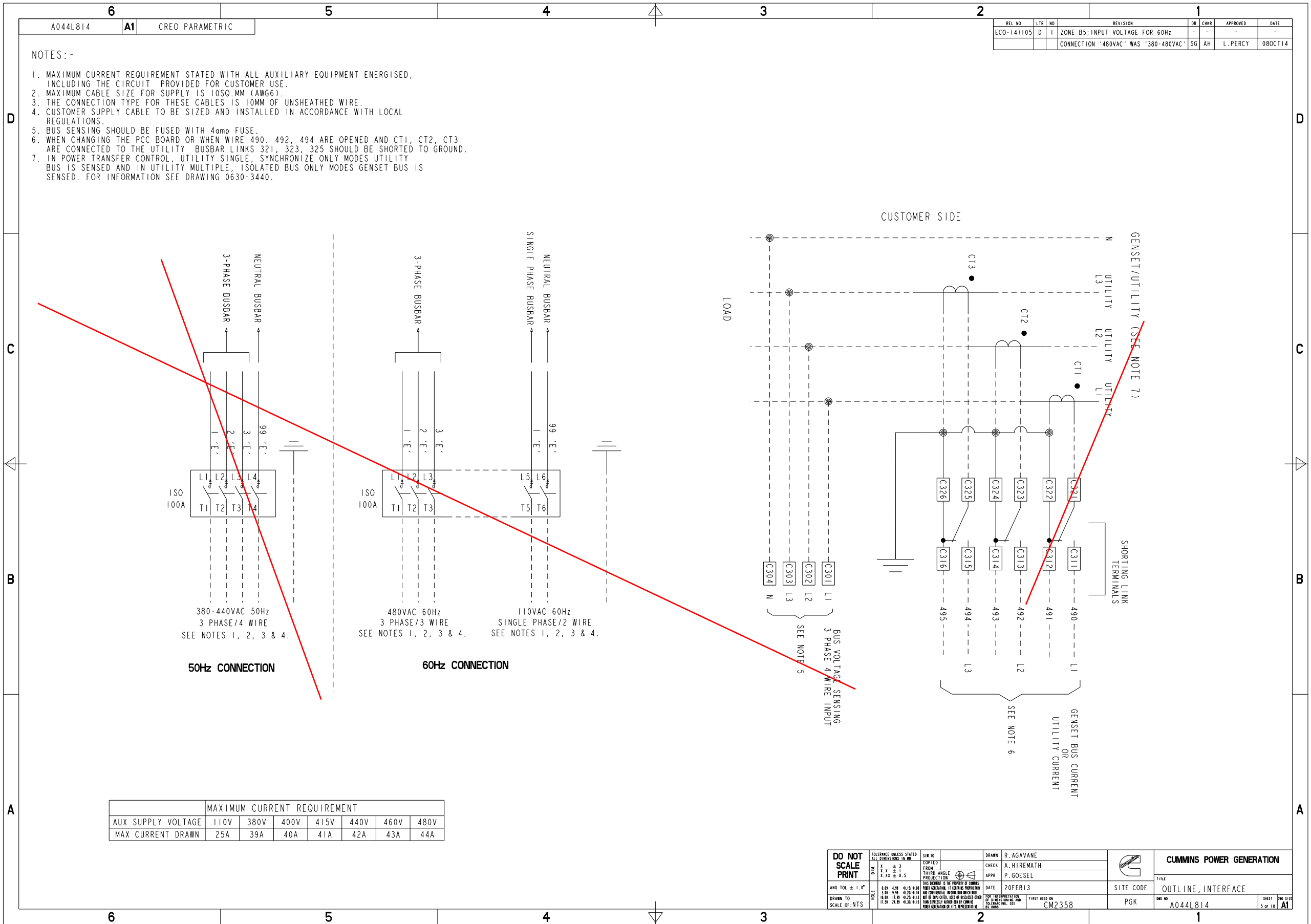
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A1										DR CHKR APPROVED DATE SG AH L. PERCY 08OCT14	
GIB CUSTOMER CONNECTION APPLICATION GUIDE (INPUTS)											
TERMINAL	DESCRIPTION	FUNCTION	CIRCUIT	CONTROL/STATE	WIRE SIZE (mm x)	WIRE SIZE (in in)					
C1	LOUVRES CLOSED WARNING	WARNING FAULT	5VDC, 20mA, PROTECTED GND	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C2	LOUVRES CLOSED WARNING	WARNING FAULT	5VDC, 20mA, PROTECTED GND	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C3	VENTILATOR FAN TRIP	WARNING FAULT	5VDC, 20mA, PROTECTED GND	CLASS 'B', CONTACT OPEN TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C4	VENTILATOR FAN TRIP	WARNING FAULT	5VDC, 20mA, PROTECTED GND	CLASS 'B', CONTACT OPEN TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C5	RADIATOR FAN COMMON TRIP WARNING	WARNING FAULT	5VDC, 20mA, PROTECTED GND	CLASS 'B', CONTACT OPEN TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C6	RADIATOR FAN COMMON TRIP WARNING	WARNING FAULT	5VDC, 20mA, PROTECTED GND	CLASS 'B', CONTACT OPEN TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C7	CUSTOMER INPUT/FAULT NO. 1 WARNING	WARNING FAULT	5VDC, 20mA, PROTECTED GND	CLASS 'B', CONTACT OPEN TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C8	CUSTOMER INPUT/FAULT NO. 1 WARNING	WARNING FAULT	5VDC, 20mA, PROTECTED GND	CLASS 'B', CONTACT OPEN TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C9	CUSTOMER INPUT/FAULT NO. 2 SHUTDOWN	SHUTDOWN FAULT	24VDC, 20mA, PROTECTED GND	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C10	CUSTOMER INPUT/FAULT NO. 2 SHUTDOWN	SHUTDOWN FAULT	24VDC, 20mA, PROTECTED GND	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C11	CUSTOMER INPUT/FAULT NO. 3 CONTROL SHUTDOWN	CONTROL SHUTDOWN FAULT	24VDC, 20mA, PROTECTED GND	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C12	CUSTOMER INPUT/FAULT NO. 3 CONTROL SHUTDOWN	CONTROL SHUTDOWN FAULT	24VDC, 20mA, PROTECTED GND	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C13	CUSTOMER INPUT/FAULT NO. 4 SELECTABLE	CONTROL SHUTDOWN FAULT	24VDC, 20mA, PROTECTED GND	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C14	CUSTOMER INPUT/FAULT NO. 4 SELECTABLE	CONTROL SHUTDOWN FAULT	24VDC, 20mA, PROTECTED GND	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C15	SPARE	-	-	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C16	SPARE	GND	5VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C17	START INHIBIT N1	CONTROLLED STARTUP	5VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C18	START INHIBIT N1	CONTROLLED STARTUP	5VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C19	START INHIBIT N2	CONTROLLED STARTUP	5VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C20	START INHIBIT N2	CONTROLLED STARTUP	5VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C21	START INHIBIT N3	CONTROLLED STARTUP	5VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C22	START INHIBIT N3	CONTROLLED STARTUP	5VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C23	SPARE	-	-	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C24	SPARE	GND	5VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C25	FAULT RESET	SYSTEM RESET	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C26	FAULT RESET	SYSTEM RESET	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C27	REMOTE START	START-UP FUNCTION	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C28	REMOTE START	START-UP FUNCTION	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C29	FIRST START ARBITRATION	START-UP SEQUENCE	11VDC, 20mA, PROTECTED	BIDIRECTIONAL ARBITRATION	2, 55qmm	0, 65qmm (AWG 20)					
C30	FIRST START ARBITRATION	START-UP SEQUENCE	11VDC, 20mA, PROTECTED	BIDIRECTIONAL ARBITRATION	2, 55qmm	0, 65qmm (AWG 20)					
C31	START SYSTEM TRIP WARNING	WARNING FAULT	5VDC, 20mA, PROTECTED	CLASS 'B', CONTACT OPEN TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C32	START SYSTEM TRIP WARNING	WARNING FAULT	5VDC, 20mA, PROTECTED	CLASS 'B', CONTACT OPEN TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C33	START TYPE	EMERGENCY START SELECTION	24VDC, 20mA, PROTECTED	CLASS 'B', CONTACT OPEN TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C34	START TYPE	EMERGENCY START SELECTION	24VDC, 20mA, PROTECTED	CLASS 'B', CONTACT OPEN TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C35	DEBATE AUTHORISATION	CONTROLLED LOAD SHARE	5VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C36	DEBATE AUTHORISATION	CONTROLLED LOAD SHARE	5VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C37	UTILITY CIRCUIT BREAKER POSITION (A)	LOAD GOVERN - SHUTDOWN FAULT	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C38	UTILITY CIRCUIT BREAKER POSITION (A)	LOAD GOVERN - SHUTDOWN FAULT	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C39	UTILITY CIRCUIT BREAKER TRIPPED	SHUTDOWN FAULT	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C40	UTILITY CIRCUIT BREAKER TRIPPED	SHUTDOWN FAULT	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C41	UTILITY CIRCUIT BREAKER CLOSE (TO) INHIBIT	CIRCUIT BREAKER CONTROL	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C42	UTILITY CIRCUIT BREAKER CLOSE (TO) INHIBIT	CIRCUIT BREAKER CONTROL	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C43	GENSET CIRCUIT BREAKER POSITION (A)	GENSET CB POSITION CONFIRMATION	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C44	GENSET CIRCUIT BREAKER POSITION (A)	GENSET CB POSITION CONFIRMATION	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C45	GENSET CIRCUIT BREAKER TRIPPED	SHUTDOWN FAULT	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C46	GENSET CIRCUIT BREAKER TRIPPED	SHUTDOWN FAULT	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C47	GENSET CIRCUIT BREAKER CLOSE (TO) INHIBIT	CIRCUIT BREAKER CONTROL	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C48	GENSET CIRCUIT BREAKER CLOSE (TO) INHIBIT	CIRCUIT BREAKER CONTROL	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C49	UTILITY SINGLE VERIFY	SINGLE/MULTIPLE GENSET SELECTION	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C50	UTILITY SINGLE VERIFY	SINGLE/MULTIPLE GENSET SELECTION	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C51	SYNCHRONISER ENABLE	ENABLES PCS SYNCHRONISER (IE: MAKING RETURN PLE MODE).	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C52	SYNCHRONISER ENABLE	ENABLES PCS SYNCHRONISER (IE: MAKING RETURN PLE MODE).	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C53	LOAD DEMAND STOP	CONTROLLED SHUTDOWN	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C54	LOAD DEMAND STOP	CONTROLLED SHUTDOWN	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C55	RAMP LOAD/UNLOAD	LOAD CONTROL	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C56	RAMP LOAD/UNLOAD	LOAD CONTROL	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C57	TRANSFER INHIBIT	POWER TRANSFER CONTROL	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C58	TRANSFER INHIBIT	POWER TRANSFER CONTROL	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C59	RE-TRANSFER INHIBIT	POWER TRANSFER CONTROL	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C60	RE-TRANSFER INHIBIT	POWER TRANSFER CONTROL	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C61	EARTH FAULT SHUTDOWN	SHUTDOWN FAULT	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C62	EARTH FAULT SHUTDOWN	SHUTDOWN FAULT	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C63	DIFFERENTIAL FAULT SHUTDOWN	SHUTDOWN FAULT	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C64	DIFFERENTIAL FAULT SHUTDOWN	SHUTDOWN FAULT	24VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C65	SPARE	-	-	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C66	SPARE	GND	-	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C67	LUBE OIL TANK LEVEL WARNING	WARNING FAULT	6, 6VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C68	LUBE OIL TANK LEVEL WARNING	WARNING FAULT	6, 6VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C69	HT COOLANT LEVEL WARNING	WARNING FAULT	6, 6VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C70	HT COOLANT LEVEL WARNING	WARNING FAULT	6, 6VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C71	LT COOLANT LEVEL WARNING	WARNING FAULT	6, 6VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					
C72	LT COOLANT LEVEL WARNING	WARNING FAULT	6, 6VDC, 20mA, PROTECTED	CLASS 'A', CONTACT CLOSE TO ACTIVATE	2, 55qmm	0, 65qmm (AWG 20)					

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DRAWN R. AGAVANE

CHECK A. HIREMATH

APPR P. GOESEL

DATE 20FEB13

FIRST USED ON CM2358

CUMMINS POWER GENERATION

SITE CODE OUTLINE, INTERFACE

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SHEET 8 of 10

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GIB CUSTOMER CONNECTION APPLICATION GUIDE (INPUTS)											
TERMINAL		DESCRIPTION		FUNCTION		CIRCUIT		CONTROL/STATE		WIRE SIZE (max) WIRE SIZE (min)	
C73		HT COOLANT LEVEL SHUTDOWN		SHUTDOWN FAULT		6.6VDC, 20mA, PROTECTED				2.55qmm 0.6mm (AWG 20)	
C74		HT COOLANT LEVEL SHUTDOWN		SHUTDOWN FAULT		GND		CLASS 'B' CONTACT OPEN TO ACTIVATE		2.55qmm 0.6mm (AWG 20)	
C75		LT COOLANT LEVEL SHUTDOWN		SHUTDOWN FAULT		6.6VDC, 20mA, PROTECTED				2.55qmm 0.6mm (AWG 20)	
C76		LT COOLANT LEVEL SHUTDOWN		SHUTDOWN FAULT		GND				2.55qmm 0.6mm (AWG 20)	
C77		MASTER CAN H		COMMUNICATION LINES		COMM. NETWORK		COMMUNICATION		0.65qmm 0.6mm (AWG 20)	
C78		MASTER CAN L		COMMUNICATION LINES		COMM. NETWORK				0.65qmm 0.6mm (AWG 20)	
C79		MASTER CAN SHIELD		COMMUNICATION LINES		GND		SCREEN		0.65qmm 0.6mm (AWG 20)	
C80		RETURN SETPOINT/LOAD SHARE SHIELD		GENSET PARALLELING/LOAD SHARING		GND				2.55qmm 0.6mm (AWG 20)	
C81		KW LOAD SETPOINT (0-5Vdc) SENSE		GENSET PARALLELING/LOAD SHARING		0-5VDC, 0-1mA				2.55qmm 0.6mm (AWG 20)	
C82		KW LOAD SETPOINT (0-5Vdc) RETURN		GENSET PARALLELING/LOAD SHARING		0-5VDC, 0-1mA		ANALOG SIGNAL		2.55qmm 0.6mm (AWG 20)	
C83		KVAR LOAD SETPOINT (0-5Vdc) RETURN		GENSET PARALLELING/LOAD SHARING		0-5VDC, 0-1mA				2.55qmm 0.6mm (AWG 20)	
C84		KVAR LOAD SETPOINT (0-5Vdc) SENSE		GENSET PARALLELING/LOAD SHARING		0-5VDC, 0-1mA				2.55qmm 0.6mm (AWG 20)	
C85		VOLTAGE BIAS O/P (+/- 10Vdc) OUTPUT		NON-PCC LOAD SHARE MODE		±10VDC		OUTPUT		2.55qmm 0.6mm (AWG 20)	
C86		VOLTAGE BIAS O/P (+/- 10Vdc) RETURN		NON-PCC LOAD SHARE MODE		±10VDC				2.55qmm 0.6mm (AWG 20)	
C87		SPEED BIAS O/P (+/- 10Vdc) RETURN		NON-PCC LOAD SHARE MODE		±10VDC				2.55qmm 0.6mm (AWG 20)	
C88		SPEED BIAS O/P (+/- 10Vdc) OUTPUT		NON-PCC LOAD SHARE MODE		±10VDC				2.55qmm 0.6mm (AWG 20)	
C89		KW LOAD SHARE (-)		GENSET PARALLELING/LOAD SHARING		0-1mA		BIDIRECTIONAL ANALOG		2.55qmm 1.0mm (AWG 18)	
C90		KW LOAD SHARE (+)		GENSET PARALLELING/LOAD SHARING		0-1mA				2.55qmm 1.0mm (AWG 18)	
C91		KVAR LOAD SHARE (+)		GENSET PARALLELING/LOAD SHARING		0-1mA				2.55qmm 1.0mm (AWG 18)	
C92		KVAR LOAD SHARE (-)		GENSET PARALLELING/LOAD SHARING		0-1mA				2.55qmm 1.0mm (AWG 18)	
C93		EMERGENCY STOP (OPEN TO STOP)		SHUTDOWN FAULT		24VDC, 20mA, 5A FUSE		CLASS 'B' CONTACT OPEN TO ACTIVATE		2.55qmm 1.0mm (AWG 18)	
C94		EMERGENCY STOP (OPEN TO STOP)		SHUTDOWN FAULT		24VDC, 20mA, 5A FUSE				2.55qmm 1.0mm (AWG 18)	
C95		GAS VALVES CLOSE (OPEN TO CLOSE)		CONTROL GAS FLOW		24VDC, 20mA, 5A FUSE		CLASS 'B' CONTACT OPEN TO ACTIVATE		2.55qmm 1.0mm (AWG 18)	
C96		GAS VALVES CLOSE (OPEN TO CLOSE)		CONTROL GAS FLOW		24VDC, 20mA, 5A FUSE				2.55qmm 1.0mm (AWG 18)	
C97		FIRE PROTECTION TRIP SHUTDOWN		SHUTDOWN FAULT		24VDC, 20mA, 5A FUSE		CLASS 'B' CONTACT OPEN TO ACTIVATE		2.55qmm 1.0mm (AWG 18)	
C98		FIRE PROTECTION TRIP SHUTDOWN		SHUTDOWN FAULT		24VDC, 20mA, 5A FUSE				2.55qmm 1.0mm (AWG 18)	
C99		SPARE		-		-				2.55qmm 1.0mm (AWG 18)	
C100		SPARE		-		-				2.55qmm 1.0mm (AWG 18)	
GIB CUSTOMER CONNECTION APPLICATION GUIDE (OUTPUTS)											
TERMINAL		DESCRIPTION		FUNCTION		CIRCUIT		CONTROL/STATE		WIRE SIZE (max) WIRE SIZE (min)	
C101		COMMON WARNING		WARNING FAULT		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C102		COMMON WARNING		WARNING FAULT		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C103		COMMON SHUTDOWN		SHUTDOWN FAULT		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C104		COMMON SHUTDOWN		SHUTDOWN FAULT		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C105		COMMON CONTROL SHUTDOWN		CONTROLLED SHUTDOWN FAULT		5A @ 250 VAC OR 3A @ 30VDC		CLASS 'A' CONTACT CLOSE TO ACTIVATE		2.55qmm 1.0mm (AWG 18)	
C106		COMMON CONTROL SHUTDOWN		CONTROLLED SHUTDOWN FAULT		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C107		COOLANT RAD CONTROL FAN		CONTROL		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C108		COOLANT RAD CONTROL FAN		CONTROL		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C109		VENT FAN CONTROL		CONTROL		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C110		VENT FAN CONTROL		CONTROL		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C111		LOUVER CONTROL		CONTROL		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C112		LOUVER CONTROL		CONTROL		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C113		LOUVER CONTROL		CONTROL		5A @ 250 VAC OR 3A @ 30VDC		CLASS 'C' CONTACT		2.55qmm 1.0mm (AWG 18)	
C114		OPEN OUTPUT GENSET CIRCUIT BREAKER		CONTROL		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C115		OPEN OUTPUT GENSET CIRCUIT BREAKER		CONTROL		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C116		OPEN OUTPUT GENSET CIRCUIT BREAKER		CONTROL		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C117		CLOSE OUTPUT GENSET CIRCUIT BREAKER		CONTROL		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C118		CLOSE OUTPUT GENSET CIRCUIT BREAKER		CONTROL		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C119		GENSET RUNNING ABOVE 600RPM		INDICATES ENGINE SPEED ABOVE 600RPM		5A @ 250 VAC OR 3A @ 30VDC		CLASS 'A' CONTACT CLOSE TO ACTIVATE		2.55qmm 1.0mm (AWG 18)	
C120		GENSET RUNNING ABOVE 600RPM		INDICATES ENGINE SPEED ABOVE 600RPM		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C121		ENGINE START/STOP		INDICATES ENGINE HAS BEEN REQUESTED TO START OR STOP		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C122		ENGINE START/STOP		INDICATES ENGINE HAS BEEN REQUESTED TO START OR STOP		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C123		ENGINE IDLE/RATED SPEED		INDICATES ENGINE IS REQUESTED TO BE AT IDLE OR RATED SPEED		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C124		ENGINE IDLE/RATED SPEED		INDICATES ENGINE IS REQUESTED TO BE AT IDLE OR RATED SPEED		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C125		EMERGENCY STOP		SHUTDOWN FAULT		5A @ 250 VAC OR 3A @ 30VDC		CLASS 'C' CONTACT		2.55qmm 1.0mm (AWG 18)	
C126		EMERGENCY STOP		SHUTDOWN FAULT		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C127		EMERGENCY STOP		SHUTDOWN FAULT		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C128		EMERGENCY STOP		SHUTDOWN FAULT		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C129		EMERGENCY STOP		SHUTDOWN FAULT		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C130		EMERGENCY STOP		SHUTDOWN FAULT		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C131		CLOSE OUTPUT UTILITY CIRCUIT BREAKER		CONTROL		5A @ 250 VAC OR 3A @ 30VDC		CLASS 'A' CONTACT CLOSE TO ACTIVATE		2.55qmm 1.0mm (AWG 18)	
C132		CLOSE OUTPUT UTILITY CIRCUIT BREAKER		CONTROL		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C133		OPEN OUTPUT UTILITY CIRCUIT BREAKER		CONTROL		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C134		OPEN OUTPUT UTILITY CIRCUIT BREAKER		CONTROL		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C135		GENSET READY TO LOAD		SYNCHRONIZATION CONTROL		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C136		GENSET READY TO LOAD		SYNCHRONIZATION CONTROL		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C137		LOAD DUMP		POWER CONTROL FUNCTION		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C138		LOAD DUMP		POWER CONTROL FUNCTION		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C139		START INHIBIT EVENT		STARTUP CONTROL		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C140		START INHIBIT EVENT		STARTUP CONTROL		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C141		COMMON FAULT		WARNING OR SHUTDOWN FAULT		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
C142		COMMON FAULT		WARNING OR SHUTDOWN FAULT		5A @ 250 VAC OR 3A @ 30VDC				2.55qmm 1.0mm (AWG 18)	
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GIB CUSTOMER CONNECTION APPLICATION GUIDE (INPUTS)															
TERMINAL	DESCRIPTION	FUNCTION	CIRCUIT	CONTROL/STATE	WIRE SIZE (max)	WIRE SIZE (min)									
C301	UTILITY VOLTAGE SENSING - L1	VOLTAGE SENSING	FOLLOWS L1 VOLTAGE	PERMANENT CONNECTION	2.53qmm	1.0mm (AWG 18)									
C302	UTILITY VOLTAGE SENSING - L2	VOLTAGE SENSING	FOLLOWS L2 VOLTAGE		2.53qmm	1.0mm (AWG 18)									
C303	UTILITY VOLTAGE SENSING - L3	VOLTAGE SENSING	FOLLOWS L3 VOLTAGE		2.53qmm	1.0mm (AWG 18)									
C304	UTILITY VOLTAGE SENSING - N	VOLTAGE SENSING	FOLLOWS N VOLTAGE		2.53qmm	1.0mm (AWG 18)									
C311	UTILITY CURRENT SENSING - CT1 - POSITIVE	SHORTING LINK TERMINAL	FOLLOWS L1 CURRENT		6.03qmm	2.5mm (AWG 10)									
C312	UTILITY CURRENT SENSING - CT1 - POSITIVE	SHORTING LINK TERMINAL	CONSTANT GND	OPEN TO DEACTIVATE	6.03qmm	2.5mm (AWG 10)									
C313	UTILITY CURRENT SENSING - CT2 - POSITIVE	SHORTING LINK TERMINAL	FOLLOWS L2 CURRENT	CLOSE TO ACTIVATE	6.03qmm	2.5mm (AWG 10)									
C314	UTILITY CURRENT SENSING - CT2 - GND	SHORTING LINK TERMINAL	CONSTANT GND	OPEN TO DEACTIVATE	6.03qmm	2.5mm (AWG 10)									
C315	UTILITY CURRENT SENSING - CT3 - POSITIVE	SHORTING LINK TERMINAL	FOLLOWS L3 CURRENT	CLOSE TO ACTIVATE	6.03qmm	2.5mm (AWG 10)									
C316	UTILITY CURRENT SENSING - CT3 - GND	SHORTING LINK TERMINAL	CONSTANT GND	OPEN TO DEACTIVATE	6.03qmm	2.5mm (AWG 10)									
C321	UTILITY L1 - CT1 - POSITIVE	SHORTING LINK TERMINAL	FOLLOWS L1 CURRENT	FOLLOWS L1 OUTPUT	6.03qmm	2.5mm (AWG 10)									
C322	UTILITY L1 - CT1 - GND	SHORTING LINK TERMINAL	CONSTANT GND	CONSTANT GND	6.03qmm	2.5mm (AWG 10)									
C323	UTILITY L2 - CT2 - POSITIVE	SHORTING LINK TERMINAL	FOLLOWS L2 CURRENT	FOLLOWS L2 OUTPUT	6.03qmm	2.5mm (AWG 10)									
C324	UTILITY L2 - CT2 - GND	SHORTING LINK TERMINAL	CONSTANT GND	CONSTANT GND	6.03qmm	2.5mm (AWG 10)									
C325	UTILITY L3 - CT3 - POSITIVE	SHORTING LINK TERMINAL	FOLLOWS L3 CURRENT	FOLLOWS L3 OUTPUT	6.03qmm	2.5mm (AWG 10)									
C326	UTILITY L3 - CT3 - GND	SHORTING LINK TERMINAL	CONSTANT GND	CONSTANT GND	6.03qmm	2.5mm (AWG 10)									
GIB CUSTOMER CONNECTION APPLICATION GUIDE (METHANE INDEX)															
TERMINAL	DESCRIPTION	FUNCTION	CIRCUIT	CONTROL/STATE	WIRE SIZE (max)	WIRE SIZE (min)									
M1	METHANE ANALYSER - GND	POWER CONNECTION	GND	-	2.53qmm	0.6mm (AWG 20)									
M2	METHANE ANALYSER - SIGNAL (+)	METHANE SENSOR CONNECTION	4-20mA	-	2.53qmm	0.6mm (AWG 20)									
M3	METHANE ANALYSER - SIGNAL (-)	METHANE SENSOR CONNECTION	4-20mA	-	2.53qmm	0.6mm (AWG 20)									
M4	METHANE ANALYSER - +24Vdc	POWER CONNECTION	+24VDC, 3A, FUSED	-	2.53qmm	0.6mm (AWG 20)									
GIB CUSTOMER CONNECTION APPLICATION GUIDE (REMOTE PANEL)															
TERMINAL	DESCRIPTION	FUNCTION	CIRCUIT	CONTROL/STATE	WIRE SIZE (max)	WIRE SIZE (min)									
R1	REMOTE PANEL POWER SUPPLY - GND	POWER CONNECTION	GND	-	2.53qmm	0.6mm (AWG 20)									
R2	REMOTE PANEL POWER SUPPLY - POSITIVE	POWER CONNECTION	+24VDC, 5A, FUSED	-	2.53qmm	0.6mm (AWG 20)									
R3	PCBNET SHIELD	PCBNET COMMUNICATION LINE	GND	-	1.03qmm	0.6mm (AWG 20)									
R4	PCBNET BT (-)	PCBNET COMMUNICATION LINE	5V, 1A, FUSED	-	1.03qmm	0.6mm (AWG 20)									
R5	PCBNET A(+)	PCBNET COMMUNICATION LINE	5V, 1A, FUSED	-	1.03qmm	0.6mm (AWG 20)									
R6	SYSTEM WAKE-UP	CONTROLLED START-UP	24VDC, 2A, FUSED	-	2.53qmm	0.6mm (AWG 20)									
R7	REMOTE START	CONTROLLED START-UP	24VDC, 2A, FUSED	-	2.53qmm	0.6mm (AWG 20)									
R8	FAULT RESET	CONTROLLED RESET	24VDC, 2A, FUSED	-	2.53qmm	0.6mm (AWG 20)									
R9	J1939 - SCREEN	J1939 COMMUNICATION LINE	GND	-	1.03qmm	0.6mm (AWG 20)									
R10	J1939 (+) - RED	J1939 COMMUNICATION LINE	16V, 80mA, FUSED	-	1.03qmm	0.6mm (AWG 20)									
R11	J1939 (-) - BLACK	J1939 COMMUNICATION LINE	16V, 80mA, FUSED	-	1.03qmm	0.6mm (AWG 20)									
R12	RS232 - Rx	RS232 COMMUNICATION LINE	5V, 1A, FUSED	-	1.03qmm	0.6mm (AWG 20)									
R13	RS232 - Tx	RS232 COMMUNICATION LINE	5V, 1A, FUSED	-	1.03qmm	0.6mm (AWG 20)									
R14	RS232 - GND	RS232 COMMUNICATION LINE	GND	-	1.03qmm	0.6mm (AWG 20)									
R15	REMOTE EMERGENCY STOP	CONTROLLED SHUTDOWN	24VDC, 5A, FUSED	OPEN CONTACTS TO ACTIVATE	2.53qmm	0.6mm (AWG 20)									
R16	REMOTE EMERGENCY STOP	CONTROLLED SHUTDOWN	24VDC, 5A, FUSED	OPEN CONTACTS TO ACTIVATE	2.53qmm	0.6mm (AWG 20)									
R17	SPARE (E-STOP EXTENSION)	-	24VDC, 5A, FUSED	CLASS B CONTACT OPEN TO ACTIVATE	2.53qmm	0.6mm (AWG 20)									
R18	SPARE (E-STOP EXTENSION)	-	24VDC, 5A, FUSED	CLASS B CONTACT OPEN TO ACTIVATE	2.53qmm	0.6mm (AWG 20)									
GIB CUSTOMER CONNECTION APPLICATION GUIDE (VALUE CONTROL)															
TERMINAL	DESCRIPTION	FUNCTION	CIRCUIT	CONTROL/STATE	WIRE SIZE (max)	WIRE SIZE (min)									
V1	TEMP CONTROL VALVE TRIP	TEMP SENSOR CONNECTION	GND	-	2.53qmm	0.6mm (AWG 20)									
V2	LT CONTROL VALVE TRIP	MCB FEEDBACK	6.6VDC, 20mA, PROTECTED	CLASS B CONTACT OPEN TO ACTIVATE	2.53qmm	0.6mm (AWG 20)									
V3	HT CONTROL VALVE TRIP	MCB FEEDBACK	6.6VDC, 20mA, PROTECTED	CLASS B CONTACT OPEN TO ACTIVATE	2.53qmm	0.6mm (AWG 20)									
V4	HT TEMP INPUT +	TEMP SENSOR CONNECTION	24VDC, 2A, FUSED	-	2.53qmm	0.6mm (AWG 20)									
V5	HT TEMP INPUT -	TEMP SENSOR CONNECTION	24VDC, 2A, FUSED	-	2.53qmm	0.6mm (AWG 20)									
V6	HT TEMP INPUT SHIELD	TEMP SENSOR CONNECTION	GND	-	2.53qmm	0.6mm (AWG 20)									
V7	LT TEMP INPUT +	TEMP SENSOR CONNECTION	24VDC, 2A, FUSED	-	2.53qmm	0.6mm (AWG 20)									
V8	LT TEMP INPUT -	TEMP SENSOR CONNECTION	24VDC, 2A, FUSED	-	2.53qmm	0.6mm (AWG 20)									
V9	LT TEMP INPUT SHIELD	TEMP SENSOR CONNECTION	GND	-	2.53qmm	0.6mm (AWG 20)									
V10	TEMP CONTROL POWER SUPPLY +VS	TEMP SENSOR CONNECTION	24VDC, 5A, FUSED	-	2.53qmm	0.6mm (AWG 20)									
V11	TEMP CONTROL POWER SUPPLY GND	TEMP SENSOR CONNECTION	24VDC, 5A, FUSED	-	2.53qmm	0.6mm (AWG 20)									
AC18	THERMOSTAT CONTROL SUPPLY	CONTROL	240VAC, 10A	-	2.53qmm	1mm (AWG 18)									
AC19	THERMOSTAT CONTROL SUPPLY	CONTROL	240VAC, 10A	-	2.53qmm	1mm (AWG 18)									
AC20	HT VALVE CONTROLLER (OPEN)	CONTROL	240VAC, 6A	CLASS A CONTACT CLOSE TO ACTIVATE	2.53qmm	1mm (AWG 18)									
AC21	HT VALVE CONTROLLER (CLOSE)	CONTROL	240VAC, 6A	-	2.53qmm	1mm (AWG 18)									
AC22	HT VALVE CONTROLLER (COMMON)	CONTROL	240VAC, 6A	-	2.53qmm	1mm (AWG 18)									
AC23	HT VALVE CONTROLLER (OPEN)	CONTROL	240VAC, 6A	CLASS A CONTACT CLOSE TO ACTIVATE	2.53qmm	1mm (AWG 18)									
AC24	HT VALVE CONTROLLER (CLOSE)	CONTROL	240VAC, 6A	-	2.53qmm	1mm (AWG 18)									
AC25	HT VALVE CONTROLLER (COMMON)	CONTROL	240VAC, 6A	-	2.53qmm	1mm (AWG 18)									
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DO NOT SCALE PRINT		TOLERANCE UNLESS STATED ALL DIMENSIONS IN MM		SIM TO		DRAWN R. AGAVANE		CUMMINS POWER GENERATION	
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								SHEET 10 OF 10	

Modbus Data Points for LBNG Applications, See Note 1
 Bold Parameters Are Typically Used

Modbus Map Alternator Data		Modbus Map Engine Data	
Register		Register	
40018	Genset L1N Voltage	40062	Oil Pressure
40019	Genset L2N Voltage	40277	Pre-filterOil Pressure
40020	Genset L3N Voltage	46129	Post-filter Oil Pressure
40022	Genset L1-L2 Voltage	40063	Oil Temperature
40023	Genset L2-L3 Voltage	46135	Intake Manifold Pressure
40024	Genset L3-L1 Voltage	40065	Intake Manifold Temperature
40026	Genset L1 Current	46136	Compressor Outlet Pressure
40027	Genset L2 Current	46147	Throttle Position
40028	Genset L3 Current	40064	HT Coolant Temperature
40031	Genset L1 kW	46124	HT Coolant Pressure
40032	Genset L2 kW	46127	LT Temperature
40033	Genset L3 kW	46125	LT Pressure
40034	Genset Total kW	46116	Fuel Supply Pressure
40039	Genset Total Power Factor	46145	Gas Mass Flow
40044	Genset Frequency	40068	Average Engine Speed
40048	Genset Total Positive kWh	40070	Engine Run Time
40118	Utility L1N Voltage	46008	Exhaust Temperature 1
40019	Utility L2N Voltage	46009	Exhaust Temperature 2
40120	Utility L3N Voltage	46010	Exhaust Temperature 3
40122	Utility L1L2 Voltage	46011	Exhaust Temperature 4
40123	Utility L2L3 Voltage	46012	Exhaust Temperature 5
40124	Utility L3L1 Voltage	46013	Exhaust Temperature 6
40126	Utility L1 Current	46014	Exhaust Temperature 7
40127	Utility L2 Current	46015	Exhaust Temperature 8
40128	Utility L3 Current	46016	Exhaust Temperature 9
40131	Utility L1 kW	46017	Exhaust Temperature 10
40132	Utility L2 kW	46018	Exhaust Temperature 11
40133	Utility L3 kW	46019	Exhaust Temperature 12
40134	Utility Total kW	46020	Exhaust Temperature 13
40158	Genset Bus L1N Voltage	46021	Exhaust Temperature 14
40159	Genset Bus L2N Voltage	46022	Exhaust Temperature 15
40160	Genset Bus L3N Voltage	46023	Exhaust Temperature 16
40162	Genset Bus L1L2 Voltage	46024	Exhaust Temperature 17
40163	Genset Bus L2L3 Voltage	46025	Exhaust Temperature 18
40164	Genset Bus L3L1 Voltage	46028	Knock Level 1
40166	Genset Bus L1 Current	46029	Knock Level 2
40167	Genset Bus L2 Current	46030	Knock Level 3
40168	Genset Bus L3 Current	46031	Knock Level 4
40171	Genset Bus L1 kW	46032	Knock Level 5
40172	Genset Bus L2 kW	46033	Knock Level 6
40173	Genset Bus L3 kW	46034	Knock Level 7
40174	Genset Bus Total kW	46035	Knock Level 8
43719	Alternator 1 Temperature	46036	Knock Level 9
43720	Alternator 2 Temperature	46037	Knock Level 10
43721	Alternator 3 Temperature	46038	Knock Level 11
43740	Drive End Bearing Temperature	46039	Knock Level 12
43755	Non-Drive End Bearing Temperature	46040	Knock Level 13
		46041	Knock Level 14
		46042	Knock Level 15
		46043	Knock Level 16
		46044	Knock Level 17

Note 1 **Only utility or genbus voltage can be an input.**
Utility and Genbus current is not typically used. For use, external CT's must be connected to input terminals in the GIB.

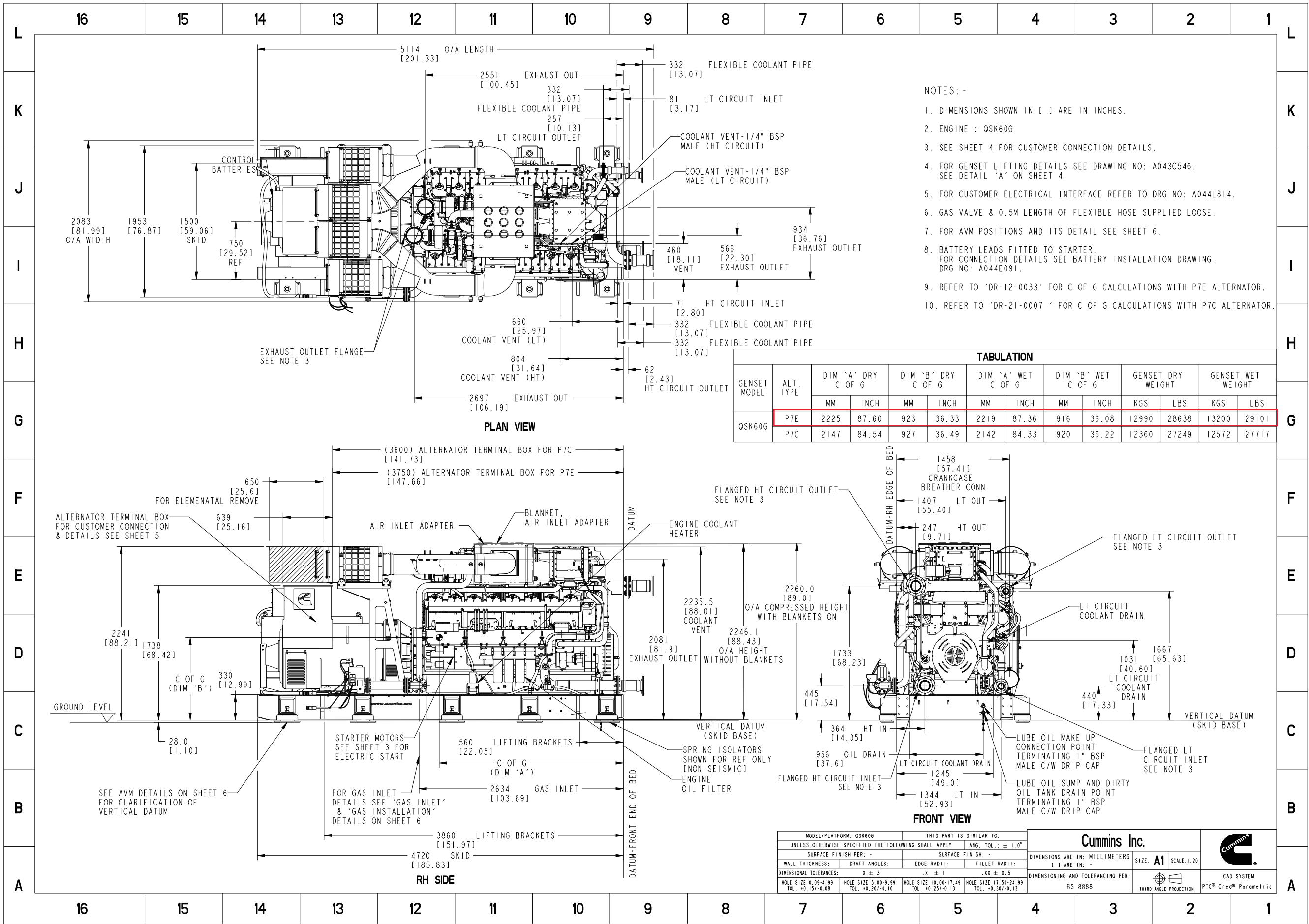
- 46045 Knock Level 18
- 46048 Knock Count 1
- 46049 Knock Count 2
- 46050 Knock Count 3
- 46051 Knock Count 4
- 46052 Knock Count 5
- 46053 Knock Count 6
- 46054 Knock Count 7
- 46055 Knock Count 8
- 46056 Knock Count 9
- 46057 Knock Count 10
- 46058 Knock Count 11
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- 46062 Knock Count 15
- 46063 Knock Count 16
- 46064 Knock Count 17
- 46065 Knock Count 18

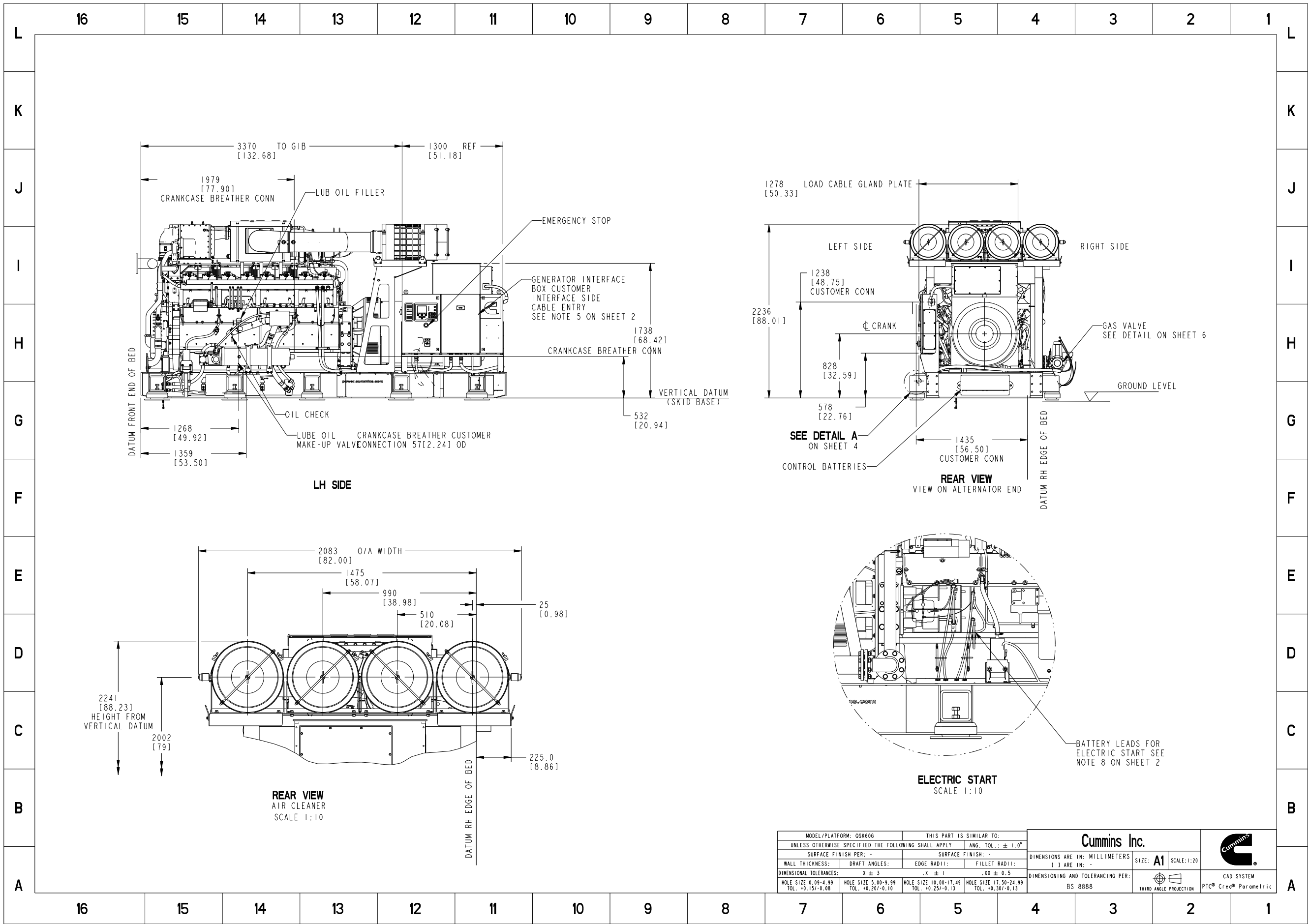


Chapter 1: Generator Set General Information

1.4. Generator Set General Arrangement Drawings

L	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	L																																																					
K	NOTE: - I. REFER TO TABLE FOR REQUIRED DRAWING SHEET NUMBERS.																K																																																					
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H																	H																																																					
G	<table><tr><th>SHEET NO.</th><th>INFORMATION</th></tr><tr><td>2</td><td>PLAN VIEW, RH SIDE & FRONT VIEW</td></tr><tr><td>3</td><td>LH SIDE, REAR VIEW, ELECTRIC START & AIR CLEANER DETAILS</td></tr><tr><td>4</td><td>EXHAUST OUTLET, LIFTING BRACKET & COOLING CONNECTION DETAILS</td></tr><tr><td>5</td><td>P7C/P7E TERMINAL DETAILS</td></tr><tr><td>6</td><td>GAS INLET/VALVE INSTALLATION, AVM AND GENSET FOOT PRINT INSTALLATION DETAILS</td></tr></table>																SHEET NO.	INFORMATION	2	PLAN VIEW, RH SIDE & FRONT VIEW	3	LH SIDE, REAR VIEW, ELECTRIC START & AIR CLEANER DETAILS	4	EXHAUST OUTLET, LIFTING BRACKET & COOLING CONNECTION DETAILS	5	P7C/P7E TERMINAL DETAILS	6	GAS INLET/VALVE INSTALLATION, AVM AND GENSET FOOT PRINT INSTALLATION DETAILS	G																																									
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C																	C																																																					
B	<table><tr><td colspan="2">MODEL/PLATFORM: QSK60G</td><td colspan="2">THIS PART IS SIMILAR TO:</td></tr><tr><td colspan="3">UNLESS OTHERWISE SPECIFIED THE FOLLOWING SHALL APPLY</td><td>ANG. TOL.: ± 1.0°</td></tr><tr><td colspan="2">SURFACE FINISH PER: -</td><td colspan="2">SURFACE FINISH: -</td></tr><tr><td>WALL THICKNESS:</td><td>DRAFT ANGLES:</td><td>EDGE RADII:</td><td>FILLET RADII:</td></tr><tr><td colspan="2">DIMENSIONAL TOLERANCES:</td><td colspan="2"></td></tr><tr><td colspan="2">HOLE SIZE 0.09-4.99</td><td>HOLE SIZE 5.00-9.99</td><td>HOLE SIZE 10.00-17.49</td></tr><tr><td colspan="2">TOL. +0.15/-0.08</td><td>TOL. +0.20/-0.10</td><td>TOL. +0.25/-0.13</td></tr><tr><td colspan="2">HOLE SIZE 17.50-24.99</td><td colspan="2">TOL. +0.30/-0.13</td></tr><tr><td colspan="3">Cummins Inc.</td><td rowspan="4"></td></tr><tr><td colspan="2">DIMENSIONS ARE IN: MILLIMETERS</td><td>SIZE: A1</td></tr><tr><td colspan="2">[] ARE IN: -</td><td>SCALE: 1:20</td></tr><tr><td colspan="2">DIMENSIONING AND TOLERANCING PER:</td><td>THIRD ANGLE PROJECTION</td></tr><tr><td colspan="2">BS 8888</td><td colspan="2">CAD SYSTEM</td></tr><tr><td colspan="2"></td><td colspan="2">PTC® Creo® Parametric</td></tr></table>																MODEL/PLATFORM: QSK60G		THIS PART IS SIMILAR TO:		UNLESS OTHERWISE SPECIFIED THE FOLLOWING SHALL APPLY			ANG. TOL.: ± 1.0°	SURFACE FINISH PER: -		SURFACE FINISH: -		WALL THICKNESS:	DRAFT ANGLES:	EDGE RADII:	FILLET RADII:	DIMENSIONAL TOLERANCES:				HOLE SIZE 0.09-4.99		HOLE SIZE 5.00-9.99	HOLE SIZE 10.00-17.49	TOL. +0.15/-0.08		TOL. +0.20/-0.10	TOL. +0.25/-0.13	HOLE SIZE 17.50-24.99		TOL. +0.30/-0.13		Cummins Inc.				DIMENSIONS ARE IN: MILLIMETERS		SIZE: A1	[] ARE IN: -		SCALE: 1:20	DIMENSIONING AND TOLERANCING PER:		THIRD ANGLE PROJECTION	BS 8888		CAD SYSTEM				PTC® Creo® Parametric		B
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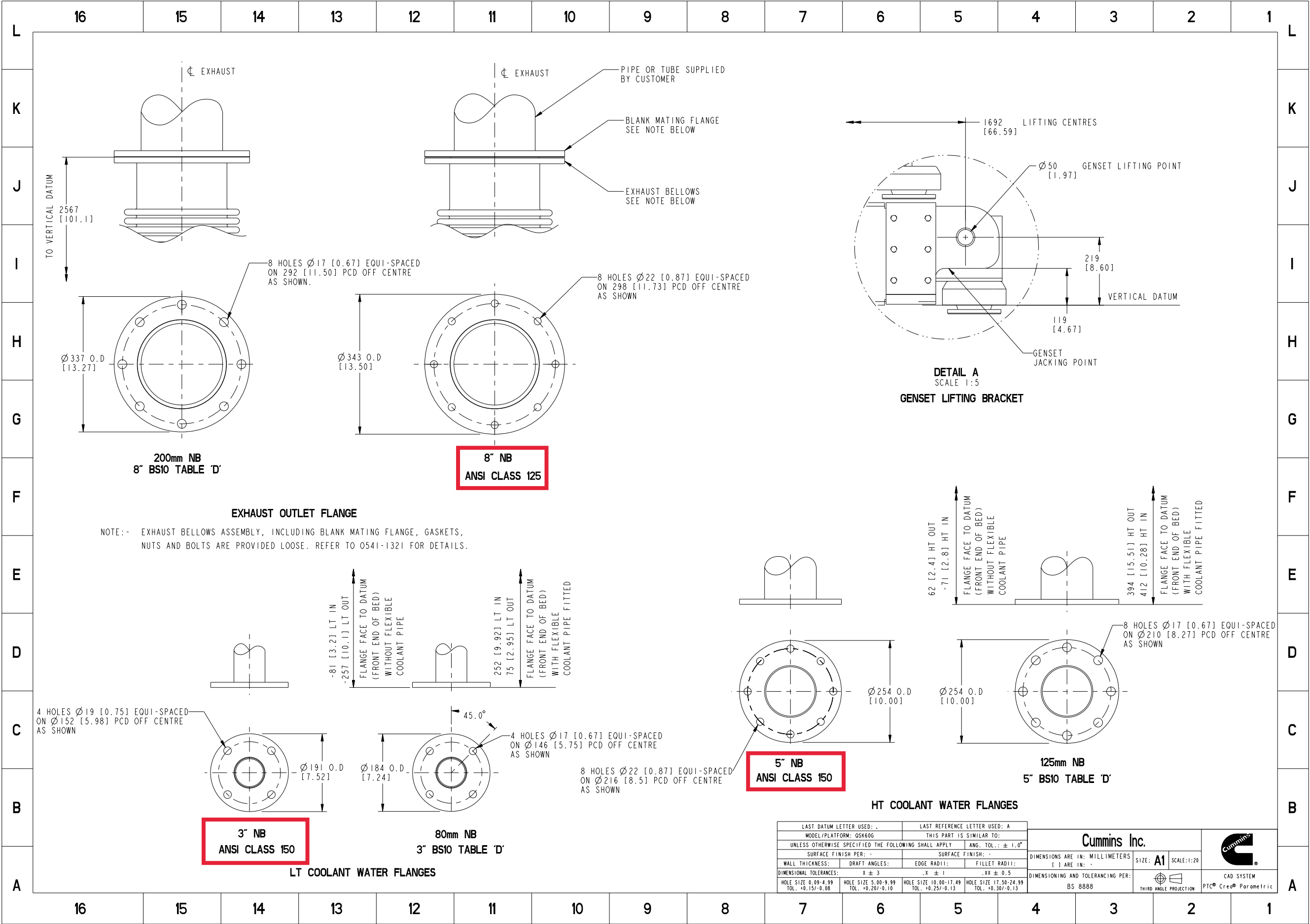


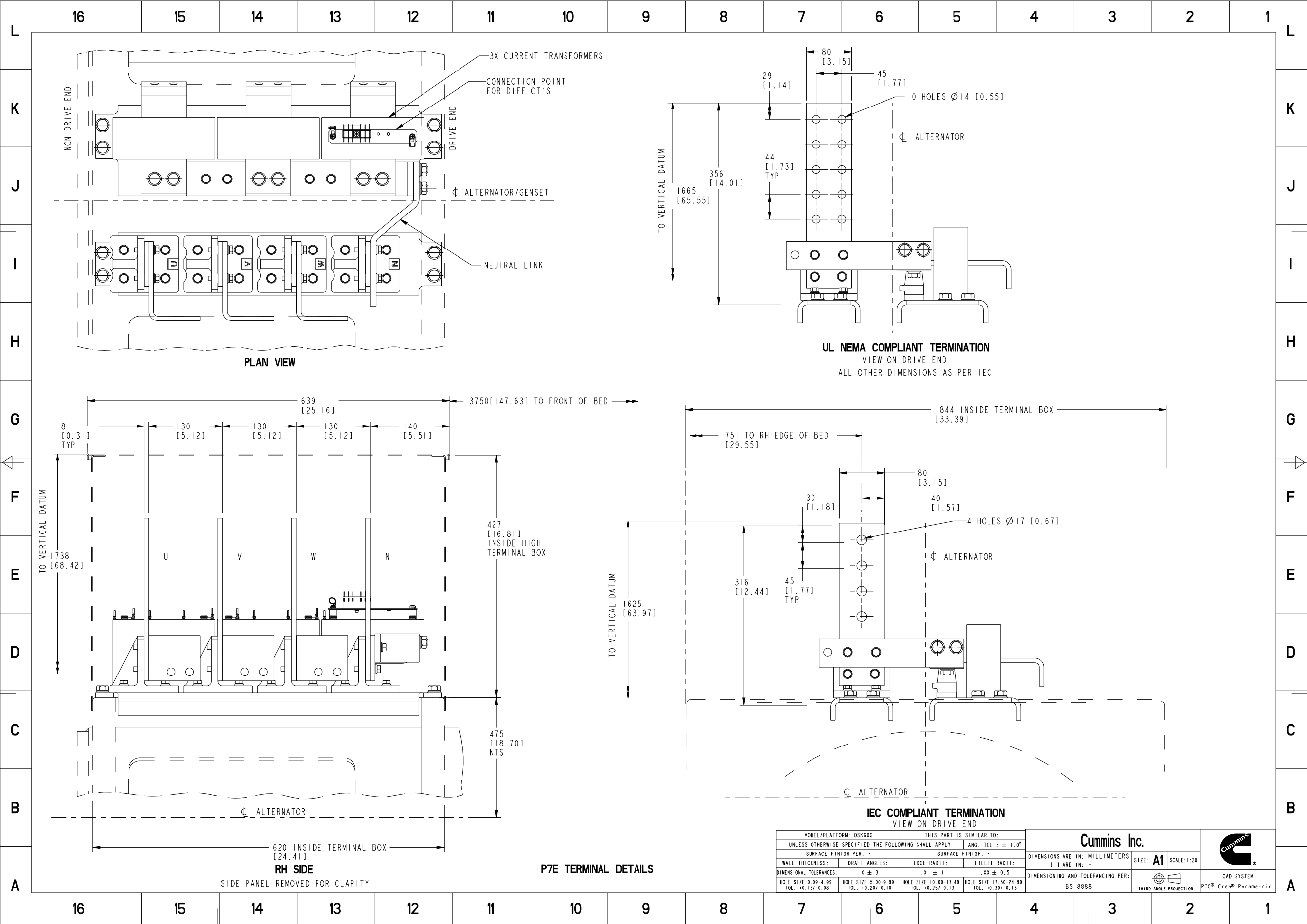


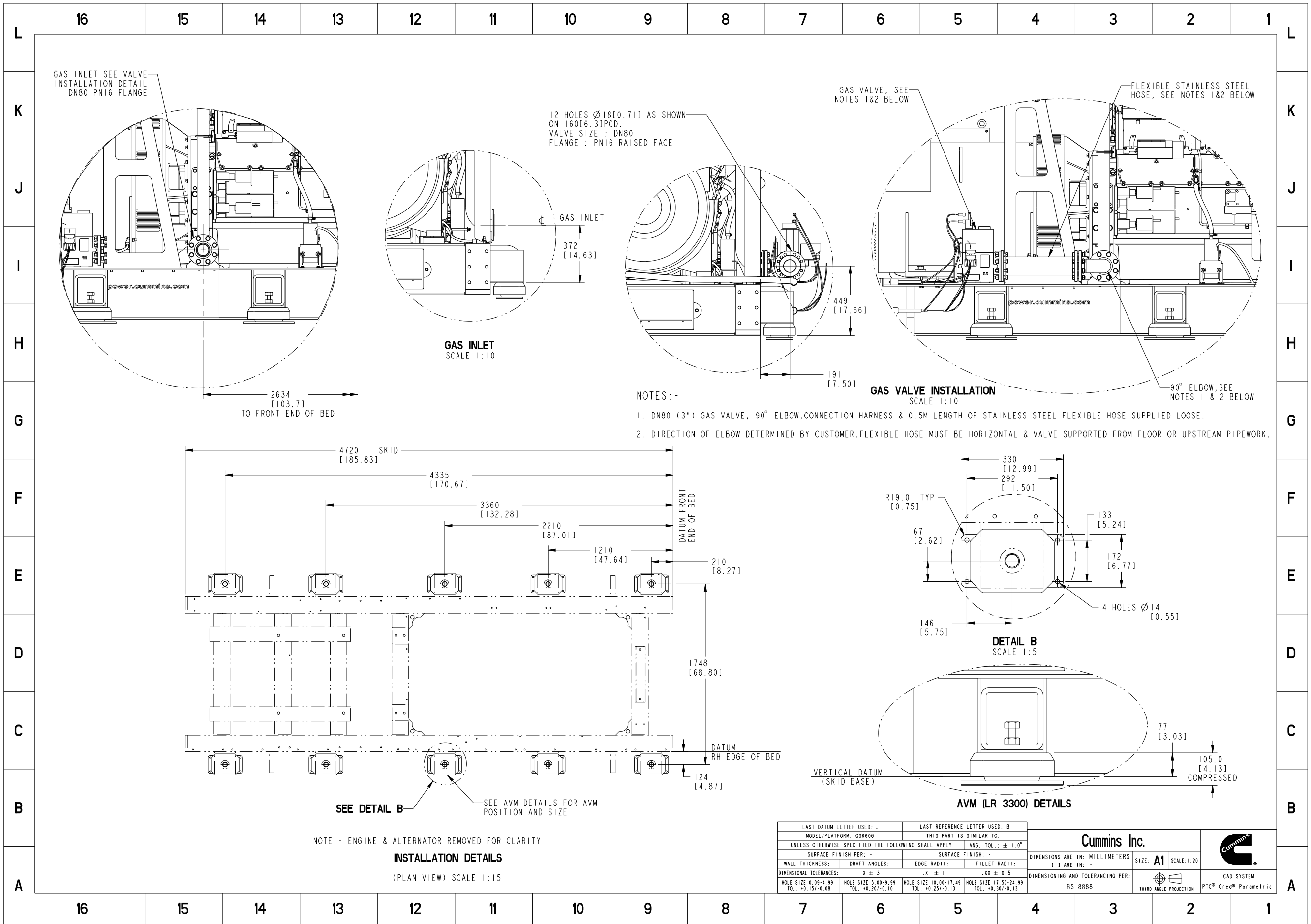
Cummins Data Classification:
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Part Number: **A045W576** Part Revision: **D**
Part Name: **OUTLINE,GENSET**
Drawing Category: **Detail** State: **Released** Sheet **3** of **7**







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Part Number: **A045W576** Part Revision: **D**
Part Name: **OUTLINE, GENSET**
Drawing Category: **Detail** State: **Released** Sheet **6** of **7**



Chapter 1: Generator Set General Information

1.5. Warranty Document



Warranty Statement

Lean-Burn Gaseous Fuel Generator Set

Limited Warranty

Lean-Burn Gaseous fuel Generating Set

This limited warranty applies to all Cummins Inc. branded Lean-Burn Gaseous fuel generating sets and associated accessories (hereinafter referred to as "Product").

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

Warranty Period:

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

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

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

Emergency Standby Power (ESP) is defined as the maximum power available during a variable electrical power sequence, under the stated operating conditions, for which a generating set is capable of delivering in the event of a utility power outage or under test conditions for up to 1000 hours of operation per year. The permissible average power output over 24 hours of operation shall not exceed 70% of the ESP.

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

Rating	Months	Max. Hours
COP	12	Unlimited
PRP	12	Unlimited
ESP	24	1000 hrs

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

Cummins Inc. Responsibilities:

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

- All parts and labor required to repair the Product.
- Reasonable travel expenses to and from the Product site location.
- Maintenance items that are contaminated or damaged by a warrantable failure.
- Reasonable labor costs for Generating Set removal and reinstallation when necessary to make the warranty repair. This is limited to accessible, ground level installation.

Owner Responsibilities:

The owner will be responsible for the following:

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

In addition, the owner will be responsible for:

- Incremental costs and expenses associated with Product removal and reinstallation resulting from non-standard installations.
- Costs associated with rental of power generating equipment used to replace the Product being repaired.
- Costs associated with labor overtime and premium shipping requested by the owner.
- All downtime expenses, fines, all applicable taxes, and other losses resulting from a warrantable failure.
- Communication expenses, meals, lodging and similar costs incurred by Owner as a result of a warrantable failure and not covered under Cummins 'responsibilities'.

Limitations:

This limited warranty does not cover Product failures resulting from:

- Inappropriate use relative to designated power rating.
- Inappropriate use relative to application guidelines.
- Normal wear and tear.
- Improper and/or unauthorized installation.

- Negligence, accidents or misuse.
- Lack of maintenance or unauthorized repair.
- Noncompliance with any Cummins Inc. published guideline or policy.
- Improper storage before and after commissioning.
- Use of unapproved coolant, lubricants or additives.
- Owner's delay in making Product available after notification of potential Product problem.
- Replacement parts and accessories not authorized by Cummins Inc.
- Owner or operator abuse or neglect such as: operation without adequate coolant or lubricants; overfueling; overspeeding; lack of maintenance to lubricating, cooling or air intake systems; late servicing and maintenance; improper storage, starting, warm-up, run-in or shutdown practices, or for progressive damage resulting from a defective shutdown or warning device..
- Damage to parts, fixtures, housings, attachments and accessory items that are not part of the transfer switch or paralleling system.
- This warranty does not apply to accessories not supplied by Cummins Inc.

This limited warranty does not cover costs resulting from:

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

Please contact your local Cummins Inc. Distributor for clarification concerning these limitations.

CUMMINS INC. RIGHT TO FAILED COMPONENTS:

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

Cummins Inc. reserves the right to interrogate Electronic Control Module (ECM), Power Command Control (PCC) or other product monitoring devices for the purpose of failure analysis.

Extended Warranty:

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

<https://power.cummins.com>

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

IN NO EVENT IS CUMMINS INC. LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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

Product Model Number: _____

Product Serial Number: _____

Date in Service: _____

power.cummins.com

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Other company, product, or service names may be trademarks or service marks of others.

Specifications are subject to change without notice.





Chapter 2: Generator Set Enclosure and Trailer

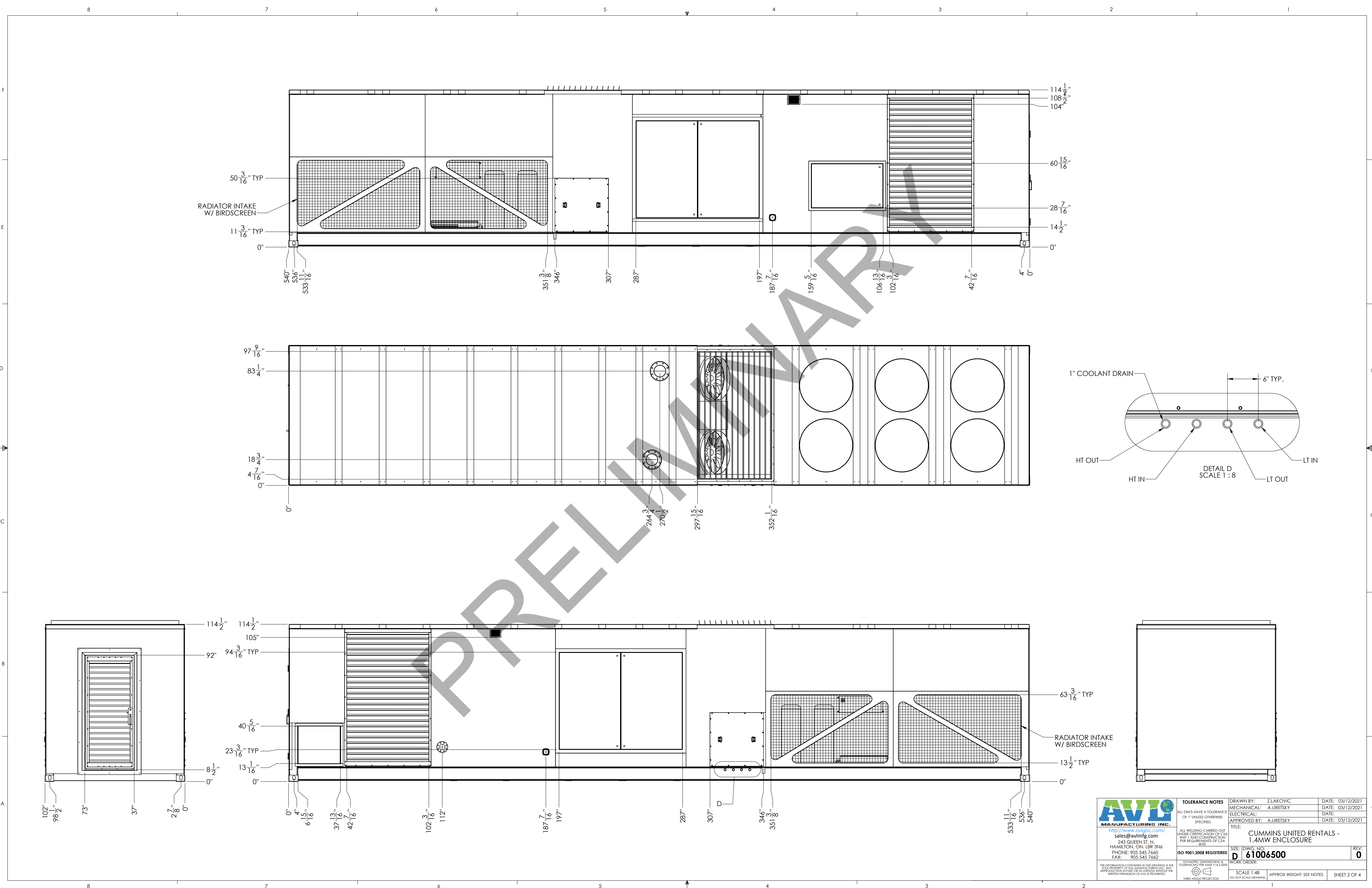
2.1. Enclosure Drawings

2.2. Enclosure Pad Considerations

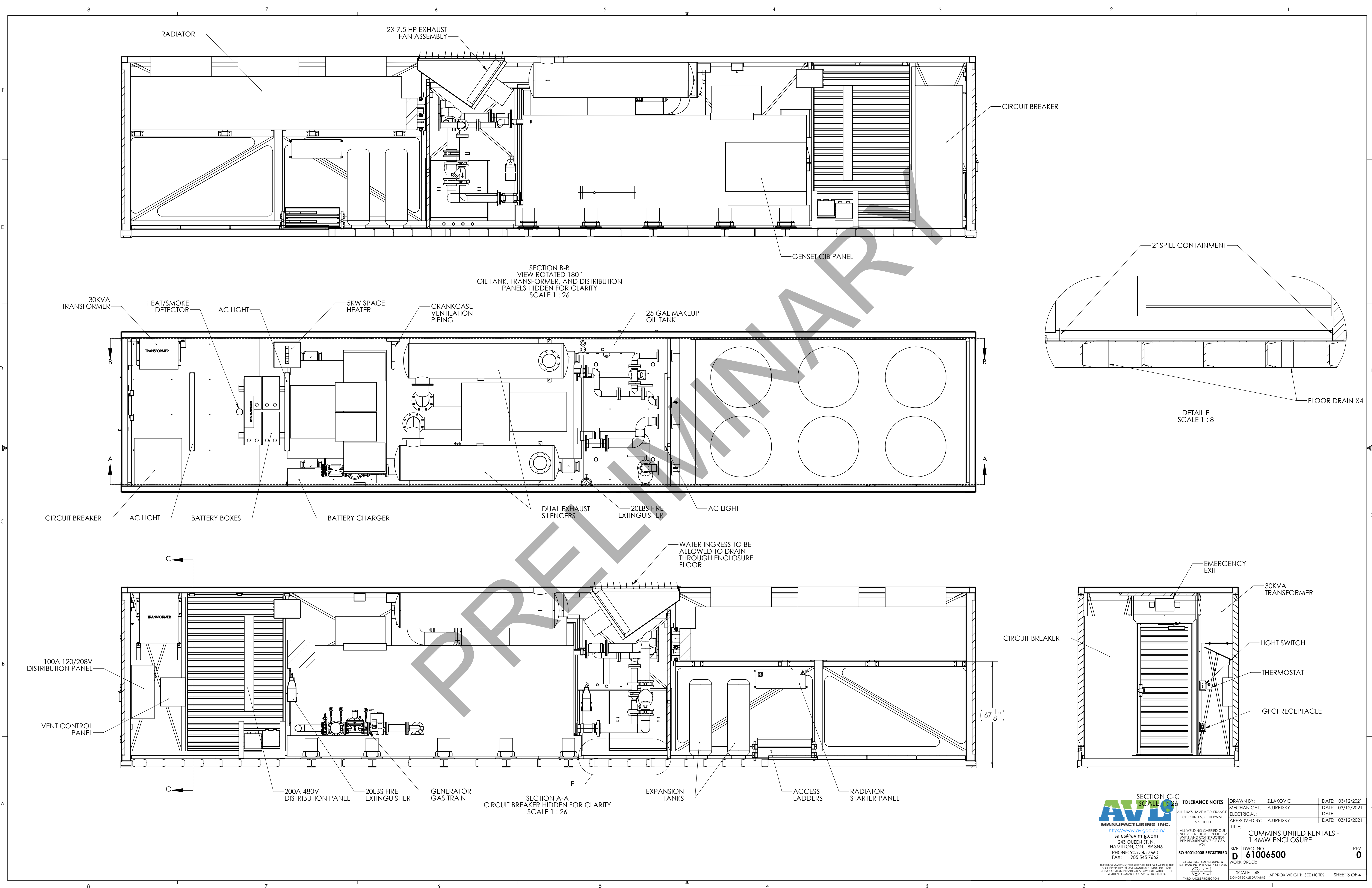


Chapter 2: Generator Set Enclosure

2.1. Enclosure Drawings



 AVLO MANUFACTURING INC. http://www.avlogc.com/ sales@avlmfg.com 243 QUEEN ST. N. HAMILTON, ON. L8R 3N6 PHONE: 905 545 7660 FAX: 905 545 7662	TOLERANCE NOTES		DRAWN BY: ZLAKOVIC	DATE: 03/12/2021	
	ALL DIMS HAVE A TOLERANCE OF .1" UNLESS OTHERWISE SPECIFIED		MECHANICAL: AURETSKY	DATE: 03/12/2021	
	ALL WELDING CARRIED OUT UNDER CERTIFICATION OF CSA W47.1 AND CONSTRUCTION PER REQUIREMENTS OF CSA W59.		ELECTRICAL: AURETSKY	DATE: 03/12/2021	
	ISO 9001:2008 REGISTERED		APPROVED BY: AURETSKY	DATE: 03/12/2021	
	 GEOMETRIC DIMENSIONING & TOLERANCING PER ASME Y14.5-2009		TITLE: CUMMINS UNITED RENTALS - 1.4MW ENCLOSURE		REV: 0
SIZE: DWG: NO. D 61006500					
WORK ORDER:			SCALE 1:48		
THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF AVLO MANUFACTURING INC. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF AVLO IS PROHIBITED.			APPROX WEIGHT: SEE NOTES		SHEET 2 OF 4

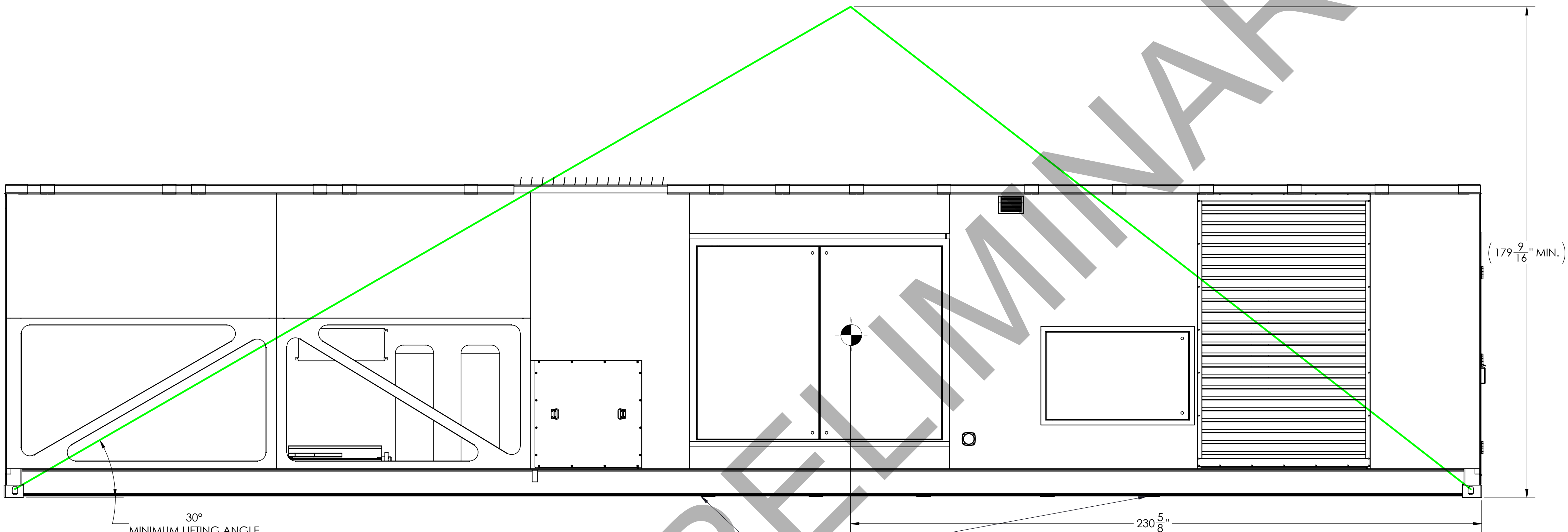


SECTION B-B
VIEW ROTATED 180°
OIL TANK, TRANSFORMER, AND DISTRIBUTION
PANELS HIDDEN FOR CLARITY
SCALE 1 : 26

DETAIL E
SCALE 1 : 8

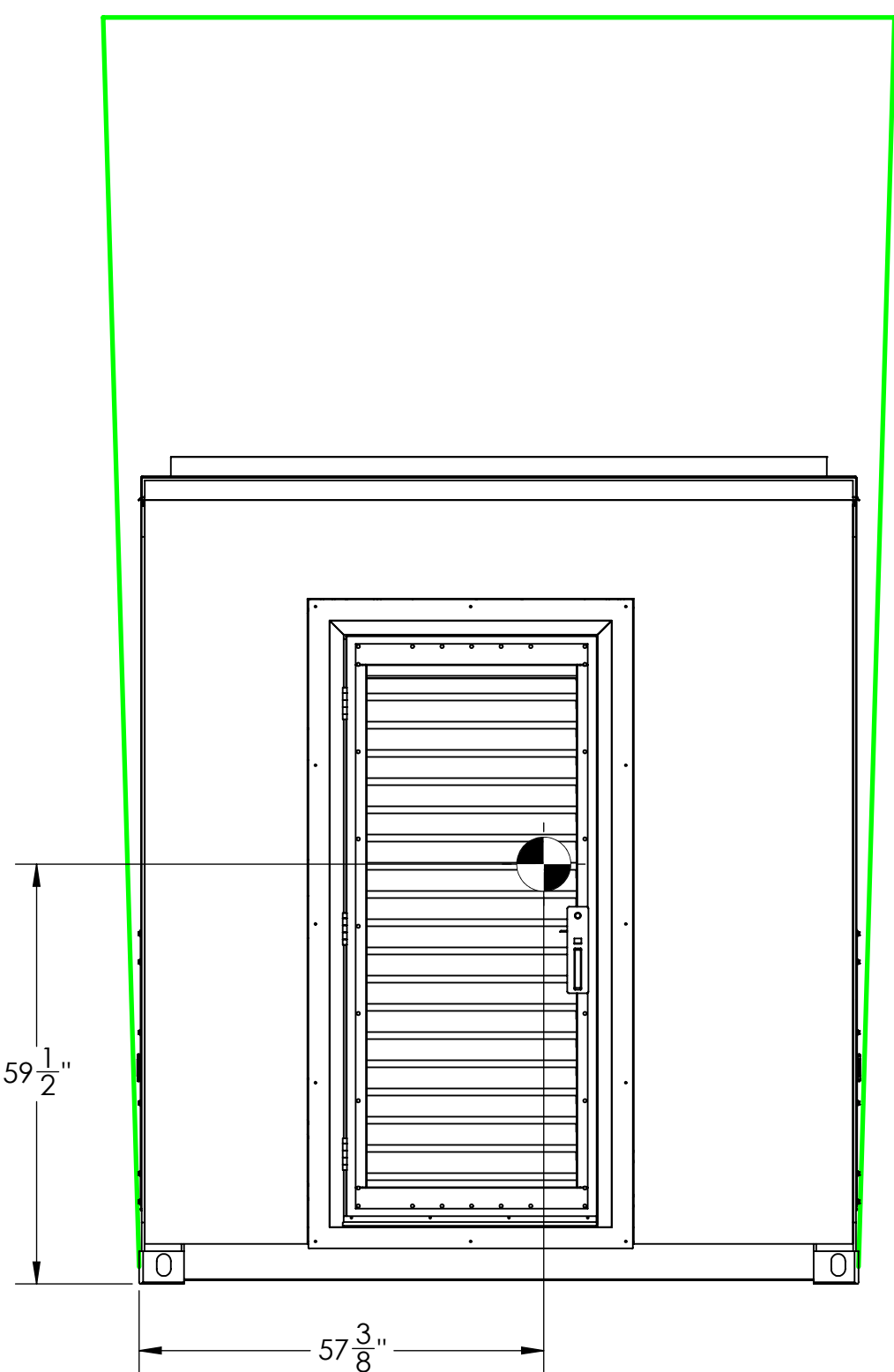
SECTION A-A
CIRCUIT BREAKER HIDDEN FOR CLARITY
SCALE 1 : 26

SECTION C-C SCALE 1 : 24		TOLERANCE NOTES		DRAWN BY: Z.LAKOVIC	DATE: 03/12/2021
 AVI MANUFACTURING INC. http://www.avimfg.com/ sales@avimfg.com 243 QUEEN ST. N. HAMILTON, ON L8R 3N6 PHONE: 905 545 7660 FAX: 905 545 7662		ALL DIMS HAVE A TOLERANCE OF .1" UNLESS OTHERWISE SPECIFIED		MECHANICAL: A.URETSKY	DATE: 03/12/2021
		ALL WELDING CARRIED OUT UNDER CERTIFICATION OF CSA W47.1 AND CONSTRUCTION PER REQUIREMENTS OF CSA W47.1		ELECTRICAL: A.URETSKY	DATE: 03/12/2021
		ISO 9001:2008 REGISTERED		APPROVED BY: A.URETSKY	DATE: 03/12/2021
THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF AVI MANUFACTURING INC. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF AVI IS PROHIBITED.		GEOMETRIC DIMENSIONING & TOLERANCING PER ASME Y14.5-2009		TITLE: CUMMINS UNITED RENTALS - 1.4MW ENCLOSURE	
		THIRD ANGLE PROJECTION		SIZE: DWG: NOS D 61006500	
		SCALE 1:48 DO NOT SCALE DRAWING		WORK ORDER: APPROX WEIGHT: SEE NOTES SHEET 3 OF 4	



ADDITIONAL SUPPORTS PROVIDED BETWEEN ENCLOSURE AND TRAILER CHASSIS

RECOMMENDED LIFTING DIAGRAM

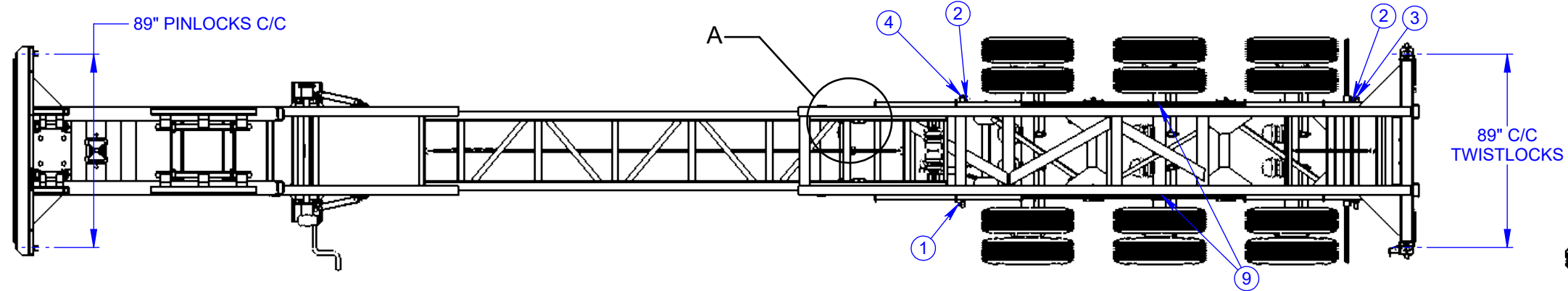


 http://www.avlogoc.com/ sales@avlmfg.com 243 QUEEN ST. N. HAMILTON, ON. L8R 3N6 PHONE: 905 545 7660 FAX: 905 545 7662 THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF AVLO MANUFACTURING INC. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF AVLO IS PROHIBITED.	TOLERANCE NOTES ALL DIMS HAVE A TOLERANCE OF .1" UNLESS OTHERWISE SPECIFIED ALL WELDING CARRIED OUT UNDER CERTIFICATION OF CSA W47.1 AND CONSTRUCTION PER REQUIREMENTS OF CSA W47.1 ISO 9001:2008 REGISTERED  THIRD ANGLE PROJECTION	DRAWN BY: Z.LAKOVIC MECHANICAL: A.LURETSKY ELECTRICAL: A.LURETSKY APPROVED BY: A.LURETSKY TITLE: CUMMINS UNITED RENTALS - 1.4MW ENCLOSURE SIZE: DWG: NC D 61006500 WORK ORDER: SCALE 1:48 DO NOT SCALE DRAWING.	DATE: 03/12/2021 DATE: 03/12/2021 DATE: 03/12/2021 DATE: 03/12/2021 REV: 0 APPROX WEIGHT: SEE NOTES SHEET 4 OF 4
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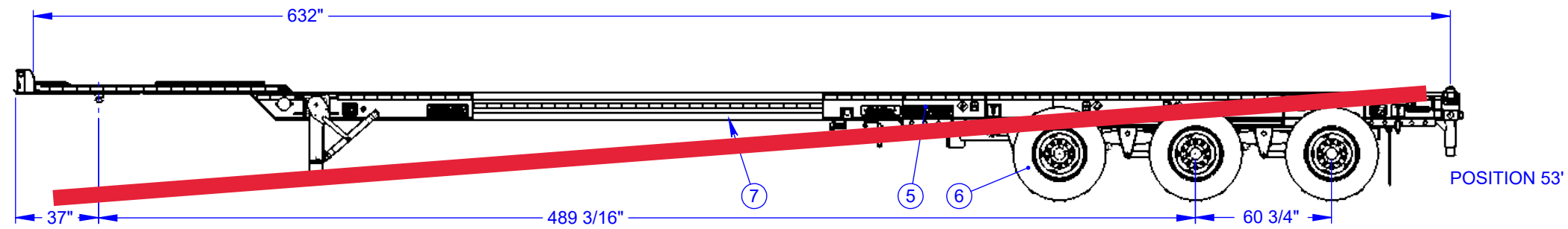
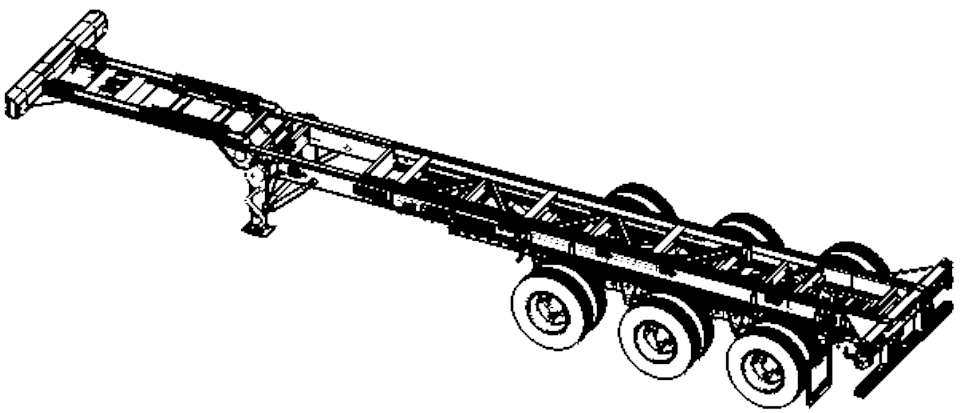


Chapter 2: Generator Set Enclosure

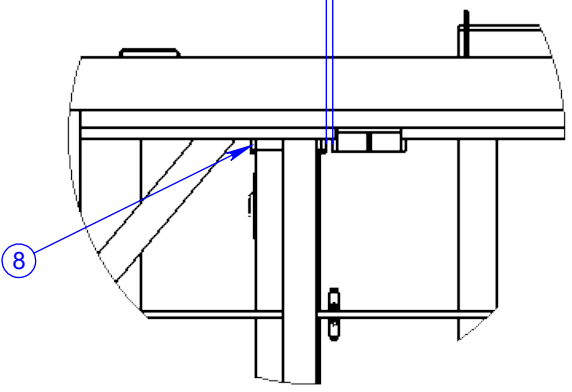
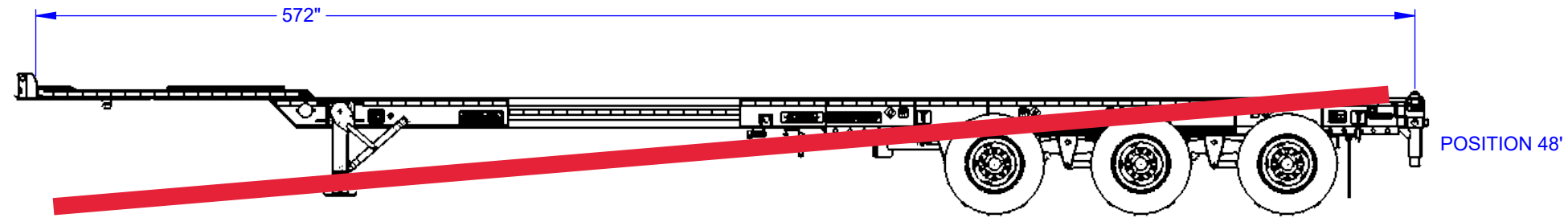
2.2. Trailer Drawing



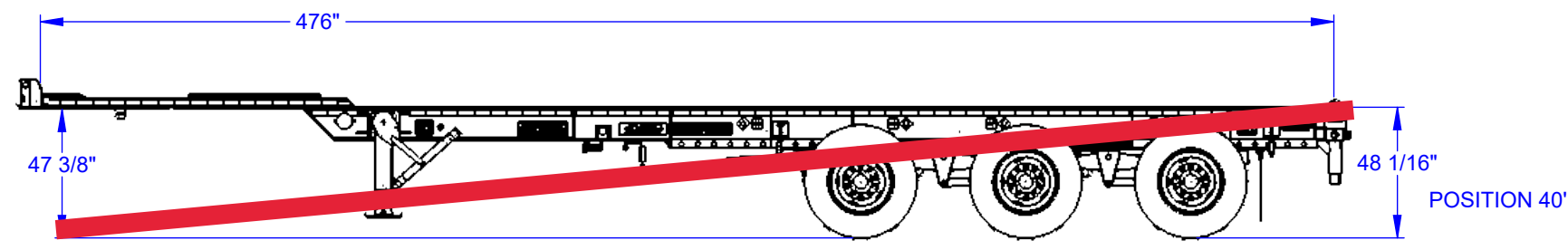
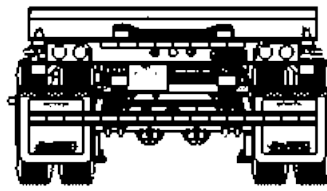
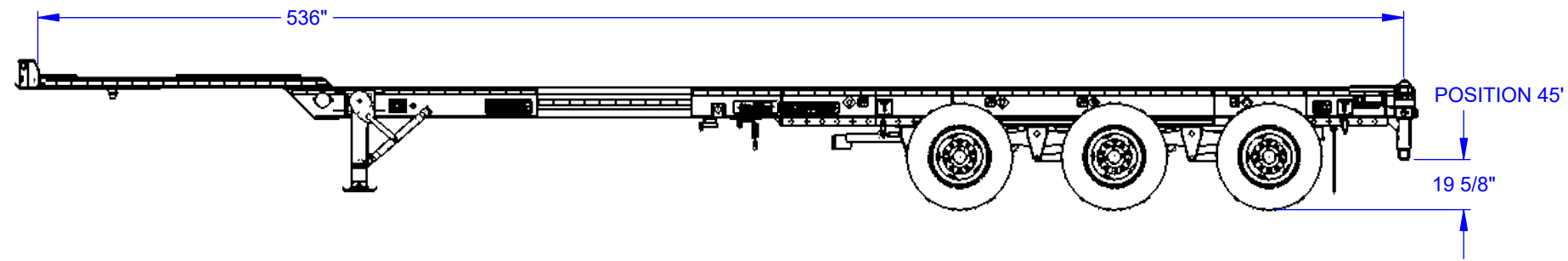
REV:	DESCRIPTION	INIT.	DATE
A	1.MISE AJOUR DU COL DE CYGNE	HB	01/06/12
B	1.MISE A JOUR : NOUVEAU STD	HB	02/05/14
C	1.AJOUT DE LA LISTE DES COMPOSANTES	EL	08/09/11
D	1.ÉPURATION DU MODEL ENLEVER TOUT LES COLLANT	MS	07/12/19
E	1. MISE A JOUR 2017	PS	17/01/11



1/2"
DISTANCE EN
POSITION 53'



DETAIL A
SCALE 1 : 15



9	19990030	2	ASS. ANGLE DE GUIDAGE RENFORCI
8	19990021	2	ASSEMBLAGE STOPPER CHASSIS ARRIERE
7	13030233	1	ASS. FINITION CHASSIS PRINCIPAL CCXT4053-3S-23
6	13030162	1	FINITION CHASSIS COULISSANT CCXT 60" SPREAD / CONTENEUR
5	13030160	1	ASS. FINITION CHASSIS ARRIERE
4	12930021	1	ASSEMBLAGE TIGE DE VERROU
3	12930003	1	ASSEMBLAGE DE TIGE
2	10101210	2	HITCH PIN CLIPS 1/4" X 4 3/8"
1	10101067	1	LYNCH PIN SPRING WIRE 3/8" X 1 3/8"
ITEM	DESSIN	QTEE	DESCRIPTION



371 Grand Bernier Nord
St-Jean sur Richelieu Qc.
J3B 4S2
Tel: (450) 346-8848
Fax: (450) 358-5077

DESSINATEUR : MS
APPROBATION :
DATE : 08/08/05
DATE :

TITRE:
**ASSEMBLAGE GÉNÉRAL
CCXT4053-3S-00**

No DESSIN :
CCXT4053-3S-00

REV: E
ECHELLE: 1:64
PAGE: 1/1

TOLERANCE:
±1/16"
±1°
±0.15"
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Chapter 3: System EBOM & Design Drawings

3.1. Engineering Bill of Material

3.2. Mechanical Piping & Instrumentation Drawing

3.3. Electrical Wiring & Interconnect Diagrams



Chapter 3: System EBOM & Design Drawings

3.1. Engineering Bill of Material



BILL OF MATERIALS

QSK60G PACKAGES - UNITED RENTAL TRAILER PACKAGE - REV 1



Item	Quantity	Description	Model Number	Comments
Generator Set				
1	1	QSK60G engine-based models	C1400N6C	Shipped Enclosed
2	2	O&M Manuals		Shipped Loose
Genset Circuit Breaker Panel				
3	1	Circuit Breaker (Fixed) (LV 1250,1350kW) Standby	2000A Manually Operated, Alternator Mounted, LSIA	Shipped Enclosed
Fuel System				
4	1	Gas Train - Natural Gas	DN80 PN16, 5-7PSI In, 3.8 PSI Out, Dwg. 294219	Shipped Enclosed
Cooling System				
5	1	Initial Fill of Coolant (PG 50%) (5/genset = 275 gal)	Propylene Pre-mixed 50% 55gal/Barrel (CC02826300)	Shipped Loose
6	1	Radiator for 68dBA@23ft (104F & 1000ft)	10229840-01 SRD 3A 09T N6 23H GS PH SP	Shipped Enclosed
Engine Lubrication System				
7	1	First Fill of Oil	55gal drum Premium Blue GEO LA ES (PN 883935)	Ship Loose
Engine Exhaust System				
8	1	Silencer (75dBA @ 23 feet)		Shipped Enclosed
Enclosure Equipment				
9	1	Genset Enclosure	Skin-tight 75dBA@23feet,	Shipped Enclosed
10	1	Trailer	45" Trailer	Shipped Enclosed



Chapter 3: System EBOM & Design Drawings

3.2. Mechanical Piping & Instrumentation Drawing

F

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INSTRUMENTATION & TAGS LEGEND:

INSTRUMENTS AND EQUIPMENT TAG IDENTIFICATIONS ARE CONSTRUCTED AS 4 COMPONENTS.

EXAMPLE: PT-1-2-1
COMPONENT 1
COMPONENT 2
COMPONENT 3
COMPONENT 4

COMPONENT 1

REPRESENTS THE COMPONENT DESCRIPTION.

MISC = MISCELLANEOUS
ENC = ENCLOSURE
G = GENSET
ATT = ATTENUATOR
VIB = VIBRATION ISOLATOR
VF = VENTILATION FAN
VFD = VFD DRIVE PANEL

BAT = BATTERY SYSTEM
TI = TEMPERATURE INDICATOR
PI = PRESSURE INDICATOR
PS = PRESSURE SWITCH
TS = TEMPERATURE SWITCH
TT = TEMPERATURE TRANSMITTER
PT = PRESSURE TRANSMITTER
LT = LEVEL TRANSMITTER
LS = LEVEL SWITCH
FS = FLOW SWITCH
FM = FLOW METER
PNL - PANEL
PLC = PLC PANEL
RAD = RADIATOR
TK = TANK
FC = FLEX CONNECTION
FI = FILTER
DA = DEAERATOR
P = PUMP
PRV = PRESSURE RELIEF VENT
SIL = SILENCER
ES = EXHAUST SILENCER
SP = SAMPLE PORT
RC = RAIN COWL

V = VALVE
CV = CONTROL VALVE
SCR = EXHAUST SCR
UDU = UREA DOSING UNIT
AC = AIR COMPRESSOR
AD = AIR DRYER
OXI = EXHAUST OXICAT
OCM = OXICAT MONITOR PANEL
HRSG = HEAT RECOVERY STEAM GENERATOR
HEX = HEAT EXCHANGER
PHE = PLATE HEAT EXCHANGER
EM = EXHAUST MANIFOLD

COMPONENT 2

REPRESENTS THE GENSET No.
No.1 USED FOR SINGLE SET APPLICATIONS.
No.0 USED FOR EQUIPMENT COMMON TO ALL GENSETS, SUCH AS COMMON TANKS.

COMPONENT 3

REPRESENTS THE SYSTEM No.

- = HT & LT COOLING SYSTEMS SHARED EQUIPMENT.
- = LT COOLING SYSTEM.
- = HT COOLING SYSTEM.
- = PROCESS SYSTEM.
- = LUBE OIL SYSTEM.
- = FUEL GAS SYSTEM.
- = EXHAUST SYSTEM.
- = VENTILATION AIR SYSTEM.
- = CRANK CASE BREATHER SYSTEM.
- = COMPRESSED AIR SYSTEM.
- = FUEL DIESEL SYSTEM.
- = CONDENSATION / DRAINAGE SYSTEM.
- = UREA SUPPLY SYSTEM.
- = STEAM SYSTEM.

COMPONENT 4

REPRESENTS THE COMPONENT INDEX No.

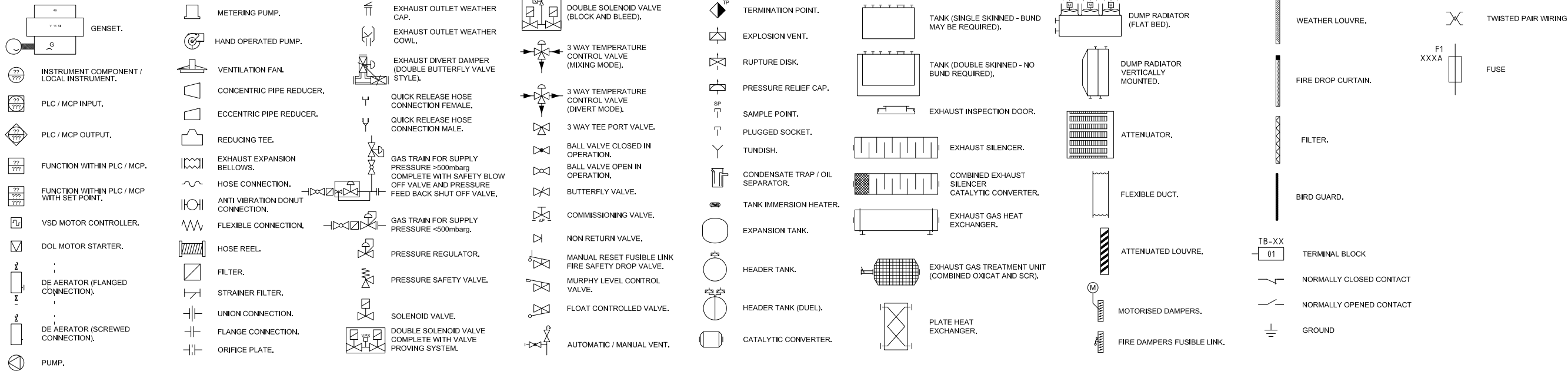
EXAMPLES.
TT-1-2-4 TEMPERATURE TRANSMITTER,
GENSET No.1, LT COOLING SYSTEM,

INSTRUMENT No.4.

PT-1-10-5 PRESSURE TRANSMITTER,
GENSET No.1 COMPRESSED
AIR SYSTEM, INSTRUMENT No.5

FC-2-7-3 FLEX CONNECTION, GENSET No.2
EXHAUST SYSTEM, ITEM No.3.

SYMBOL LEGEND:



SYSTEM OPERATION PHILOSOPHY

NOTE: THIS IS AN OVERVIEW OF THE ENGINE-RELATED SYSTEMS OPERATION ONLY.

COOLING SYSTEM

THE ENGINE IS EQUIPPED WITH TWO COOLING CIRCUITS. THE HIGH TEMPERATURE (HT) LOOP INCORPORATES THE BLOCK COOLING, OIL COOLER AND AFTER COOLER STAGE 1. THE LOW TEMPERATURE (LT) LOOP INCORPORATES THE AFTER COOLER STAGE 2. PUMPS FOR EACH CIRCUIT ARE ENGINE MOUNTED AND MECHANICALLY DRIVEN.

THE ENGINE MOUNTED LT THERMOSTAT IS SET UP FOR INLET CONTROL AND TEMPERATURE CONTROLLED BY AN ACTUATED THREE WAY VALVE. AS THE LT RETURN TEMPERATURE APPROACHES THE MAXIMUM DATA SHEET VALUE THE INLET CONTROL THERMOSTAT BEGINS TO OPEN ALLOWING FLOW THROUGH THE LT COOLING LOOP. THE LT COOLING LOOP CONSIST OF AN AIR COOLED HEAT DUMP RADIATOR.

THE ENGINE MOUNTED HT THERMOSTAT IS SET UP FOR OUTLET CONTROL AND IS TEMPERATURE CONTROLLED BY AN ACTUATED THREE WAY VALVE. AS THE HT OUTLET TEMPERATURE APPROACHES THE MAXIMUM DATA SHEET VALUE THE OUTLET CONTROL THERMOSTAT BEGINS TO OPEN ALLOWING FLOW THROUGH THE HT COOLING LOOP. THE HT COOLING LOOP CONSIST OF AN AIR COOLED HEAT DUMP RADIATOR.

THE THREE- WAY MIXING VALVE ON THE HT AND LT COOLING LOOP, TO BE INSTALLED BETWEEN ENGINE OUTLET LINE, RADIATOR INLET LINE AND ENGINE RETURN LINE, IS DESIGNED TO MAINTAIN OPTIMAL ENGINE RETURN TEMPERATURE, MATCHING DATA SHEET VALUE.

BOTH HT AND LT RETURN TEMPERATURES TO THE GENSET MUST BE MET IN ORDER TO GUARANTEE THAT THE GENSET OPERATES PROPERLY AND EFFICIENTLY.

HT & LT ENGINE VENT LINES ARE LOCATED AT THE ENGINE AFTER COOLER HOUSING. THE

VENTING SYSTEM CONSIST OF AUTOMATIC DEAERATOR VENTS REPRESENTED ON P&ID WITH TAGS DA.X.2.1 & DA.X.3.1. THE COOLANT LEAVING THE VENTS IS TO BE RETURNED TO THE PUMP SUCTION HEADER. MANUAL AIR VENTS ARE TO BE INSTALLED BY OTHERS AT ANY PIPING HIGH POINT, SUCH AS AT THE RADIATOR INLETS TO VENT THE SYSTEM HIGH POINTS.

COOLANT EXPANSION FOR BOTH THE HT & LT IS TO BE ACCOMMODATED THROUGH AN AIR BLADDER TANK. THE TANK TIES INTO BOTH THE HT & LT PUMP INLET PIPING VIA 1" FILL LINES. THE PRESSURE IN THE SYSTEM IS DISPLAYED VIA A 0-60PSI PRESSURE GAUGE AND MONITORED VIA A 3 SET POINT PRESSURE SWITCH. THE LOGIC BELOW DESCRIBES SET POINTS AND FUNCTIONALITY:

- PALL - @ 7PSIG, ENGINE SHUTDOWN
- PAL - @ 9PSIG, ENGINE ALARM
- PAHH - @ 35PSIG, ENGINE SHUTDOWN

OVER PRESSURE RELIEF IS ACCOMMODATED BY A PRESSURE RELIEF VALVE, SET TO OPEN AT 40 PSIG.

ALTERNATIVELY, IF RADIATOR IS ROOF-MOUNTED, EXPANSION AND VENTING WILL BE ACCOMMODATED BY EXPANSION TANK MOUNTED ON TOP OF THE RADIATOR, THE TANK WILL BE EQUIPPED WITH MURPHY LEVEL SWITCHES TO ALARM THE GENSET IN CASE OF LOW COOLANT LEVEL.

LUBE OIL SYSTEM

CLEAN LUBE OIL IS PROVIDED FROM OPTIONAL ELEVATED MAKE-UP LUBE OIL TANK, WALL MOUNTED. TANK ELEVATION MUST BE MINIMUM 4FT ABOVE ENGINE OIL LEVEL, MAXIMUM 15FT. OIL INTAKE TO THE ENGINE IS CONTROLLED BY AN ENGINE MOUNTED MURPHY LEVEL CONTROL VALVE. LOW LEVEL ALARM FROM LEVEL SWITCH AT MAKE-UP TANK TO BE WIRED TO GENSET CONTROL PANEL.

STARTING SYSTEM

THE GENSET IS STARTED WITH A DC BATTERY STARTING SYSTEM CONSISTING OF FOUR 8D LEAD ACID BATTERIES (BAT.1.0.1), TWO (2) BATTERY BOXES (BAT.1.0.2) AND ONE (1) BATTERY CHARGER (BAT.1.0.3). THE BATTERY CHARGER IS EQUIPPED WITH A SUMMARY ALARM CONTACT FOR ANNUNCIATION AT THE GENSET OF CHARGER ALARMS.

THE GENSET STARTING SEQUENCE WILL CONSIST OF THE FOLLOWING STEPS:

- RECEIPT OF STARTING SIGNAL (LOCAL OR REMOTE)
- VERIFICATION NO START INHIBIT CONDITION EXISTS (INTERNAL AND EXTERNAL)
- INITIAL START SEQUENCE
 - 14 SECONDS CRANK WITH FUEL AND SPARK
 - 30 SECONDS REST
 - 6 SECONDS CRANK WITH FUEL AND SPARK
 - 30 SECONDS REST
 - 6 SECONDS CRANK WITH FUEL AND SPARK
- NON START ENGINE LOCKOUT OR PRIOR EMERGENCY STOP
 - 12 SECOND CRANK, NO SPARK, NO FUEL
 - 6 SECOND REST
- ENGINE RUN AT LOW IDLE
- VERIFICATION OIL TEMPERATURE PERMISSIVE
- ENGINE RUNS AT RATED SPEED
- GENSET IS READY TO LOAD

THE GENSET NORMAL SHUTDOWN SEQUENCE WILL CONSIST OF THE FOLLOWING SEQUENCE

- REMOVAL OF RUN SIGNAL (LOCAL OR REMOTE)
- OPENING OF GENSET OUTPUT BREAKER
- ENGINE RUN AT LOW IDLE
- UNIT SHUTDOWN

FUEL SYSTEM

THE CUSTOMER PROVIDED GAS SUPPLY WILL DELIVER 5 TO 7 PSIG OF PIPELINE QUALITY NATURAL GAS TO THE GENSET GAS TRAIN. CUMMINS SUPPLIED GAS TRAIN WILL CONSIST OF AN ISOLATION VALVE, PARTICULATE FILTER, PRESSURE REGULATOR AND DOUBLE SOLENOID VALVE. THE DOUBLE SOLENOID VALVE IS OPERATED BY THE GENSET AND IS EQUIPPED WITH A VALVE PROVING SYSTEM (CV.1.6.1). THIS SYSTEM WILL PROVE PRESSURE INTEGRITY BY PRESSURIZING AND MONITORING THE SPACE BETWEEN THE TWO VALVES. FAILURE TO PROVE VALVE INTEGRITY WILL RESULT IN A FAULT AT THE GENSET PANEL AND PREVENT THE GENSET FROM STARTING. CV.1.6.1 WILL BE SUPPLIED WITHIN THE GENSET PACKAGE TO BE FIELD MOUNTED.

EXHAUST SYSTEM

THE EXHAUST GAS LEAVES THE ENGINE PASSING THROUGH A SET OF EXPANSION JOINTS THAT CONNECT TO AN EXHAUST MANIFOLD TO BRING THE 2 EXHAUST OUTLETS INTO A SINGLE PIPE SYSTEM. THE EXHAUST GAS PASSES THROUGH THE SILENCER THEN GOES OUT TO THE ATMOSPHERE THROUGH THE STACK. THE PIPING, STACK, SAMPLE PORTS, RAIN CAP, INSULATION AND FURTHER EXPANSION JOINTS ARE TO BE DESIGNED AND ASSEMBLED RESPECTING ENGINE MAXIMUM ALLOWABLE BACK PRESSURE AT ANY GIVEN OPERATIONAL CONDITION.

CRANKCASE VENT SYSTEM

CRANKCASE OUTLET FILTRATION IS PROVIDED ON ENGINE THROUGH A COALESCING FILTER AND DRAINED TO A WASTE OIL TANK. THE OUTLET OF THE FILTER IS TO BE VENTED OUT OF THE ENGINE ROOM. THE PRESSURE DROP MUST NOT EXCEED 1" WG. OPTINAL ADDITIONAL FILTER WILL BE ADDED TO ALL APPLICATION THAT ARE NON-STANDBY.

LEGENDS

DWN
SB
CKD
NP
APVD
IC

0 SUBMITTAL
REV DESCRIPTION

SHEET
1 OF 10

30MAR21
DATE

PROJECT:
UNITED RENTALS TRAILER PACKAGE
STANDBY/PEAKING

C1400 N6C

Cummins Inc.

CAD SYSTEM
Autodesk® AutoCAD® Electrical

SIZE: A3



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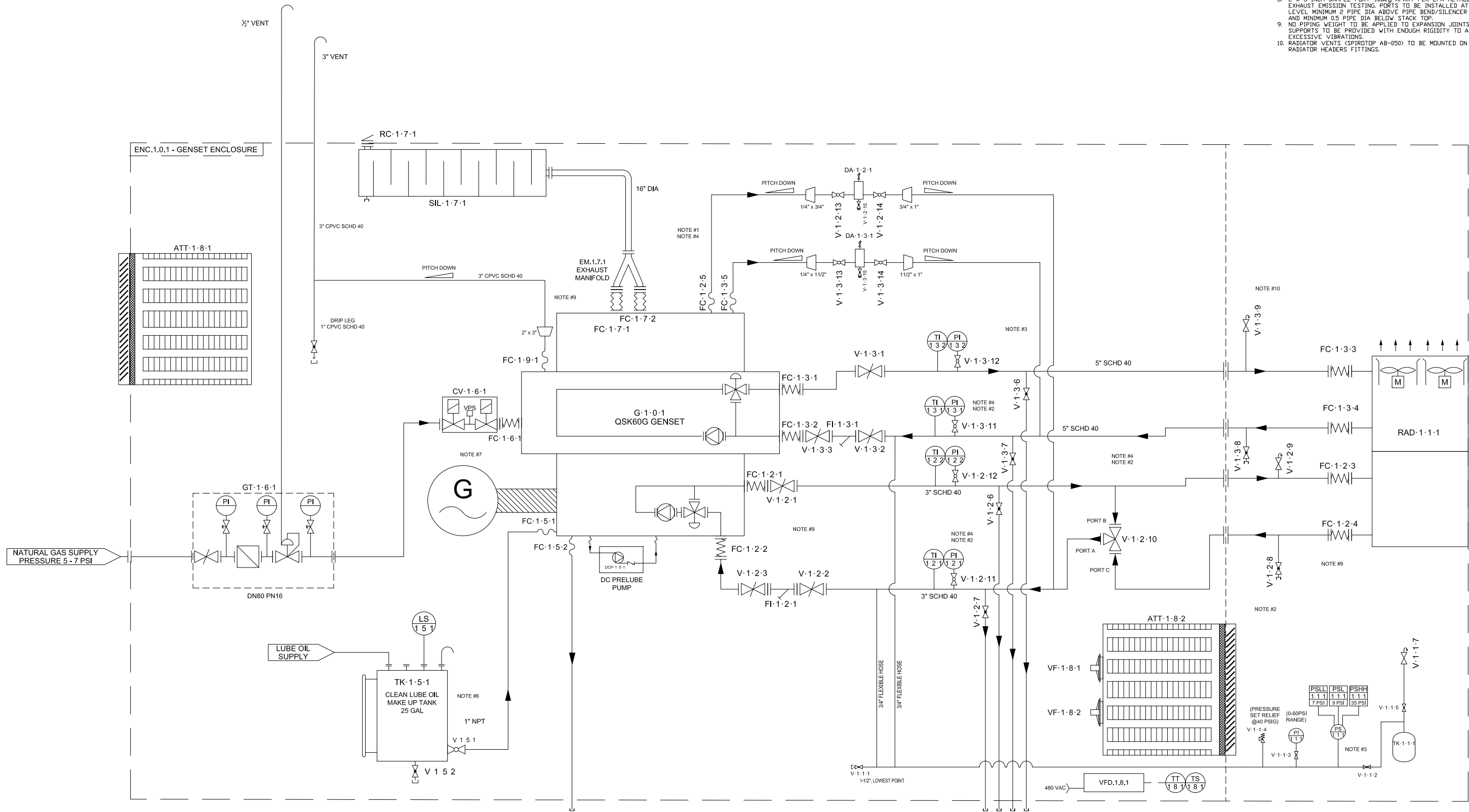
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1. VERIFICATION OF HT, LT & EXHAUST RESTRICTIONS AND COMPLIANCE TO DATA SHEET LIMITS BY CONTRACTOR.
2. ALL PIPING, INSULATION AND DRAINS WITH ISOLATION VALVES BY ENCLOSURE SUPPLIER. ANY LOW POINT IN PIPING REQUIRES A DRAIN VALVE.
3. DA1.2.1 & DA1.3.1 RETURN LINES TO TIE INTO COOLING SUCTION SIDE - PLEASE CONSULT WITH CUMMINS ON EXACT LOCATION.
4. CONSULT BOM FOR DETAILED SCOPE OF SUPPLY.
5. ANY SUDDEN DROP IN PIPING WILL REQUIRE AN AUTO VENT. AUTO/MANUAL VENTS TO BE INSTALLED AT THE HIGH POINTS IN PIPING.
6. OIL MAKE UP TANK TO BE ELEVATED MIN 48 INCHES ABOVE THE ENGINE OIL REGULATOR.
7. CV1.6.1 TO BE PHYSICALLY INSTALLED AS CLOSE AS POSSIBLE TO GENSET. FC1.6.1 TO BE MOUNTED HORIZONTALLY AND SUPPORTED RIGIDLY.
8. 2 x 3 INCH SAMPLE PORT 90deg APART PER EPA METHOD 1 FOR EXHAUST EMISSION TESTING PORTS TO BE INSTALLED AT ANY LEVEL MINIMUM 2 PIPE DIA ABOVE PIPE BEND/SILENCER OUTLET AND MINIMUM 0.5 PIPE DIA BELOW STACK TOP.
9. NO PIPING WEIGHT TO BE APPLIED TO EXPANSION JOINTS. SUPPORTS TO BE PROVIDED WITH ENOUGH RIGIDITY TO AVOID EXCESSIVE VIBRATIONS.
10. RADIATOR VENTS (SPIROTOP AB-050) TO BE MOUNTED ON RADIATOR HEADERS FITTINGS.



ALL SYSTEMS P&ID

SHEET
2 OF 10

PROJECT:
UNITED RENTALS
STANDBY/ PEAKING

C1400 N6C

Cummins Inc.

CAD SYSTEM
Autodesk® AutoCAD® Electrical

SIZE: A3



DWN
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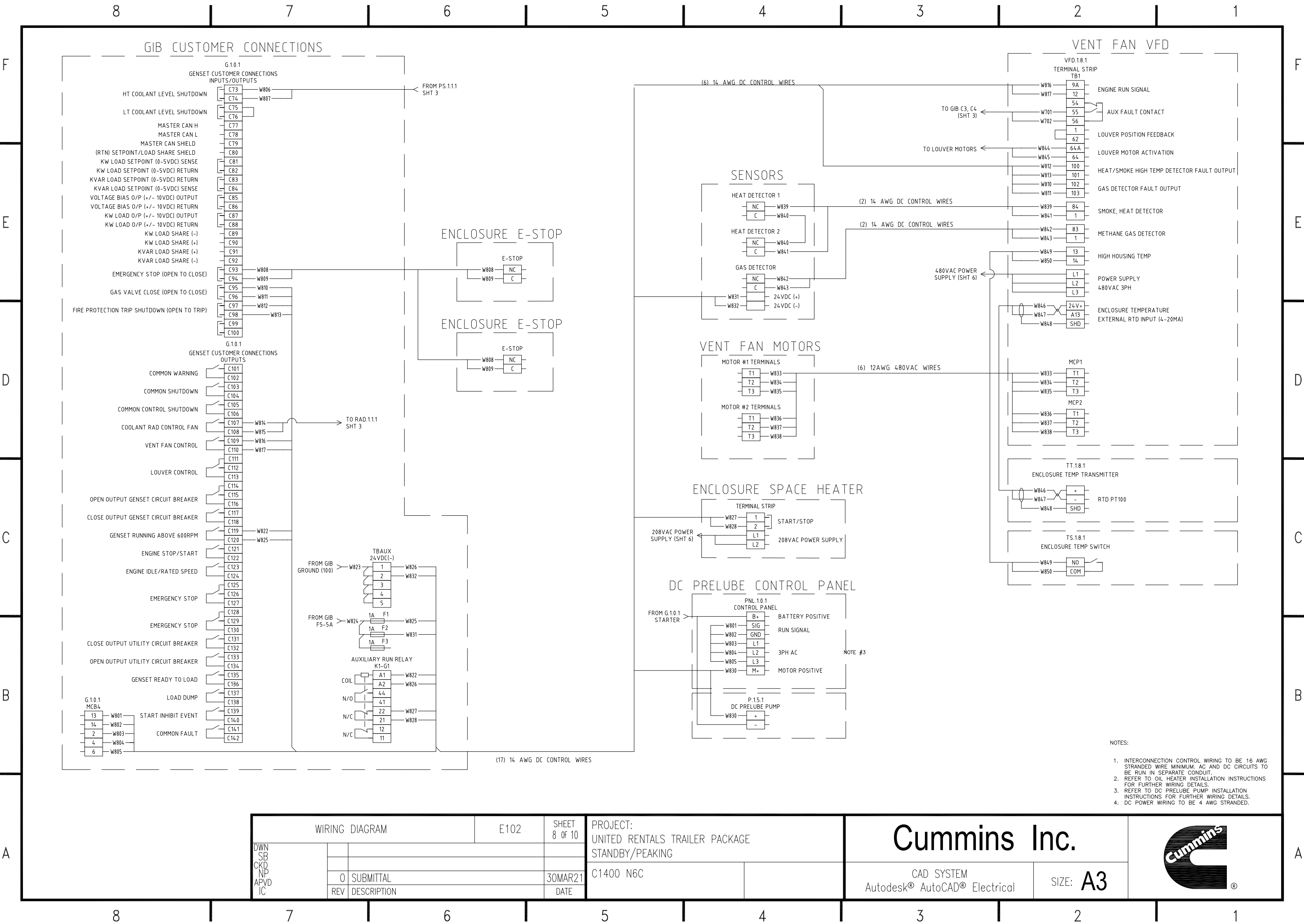
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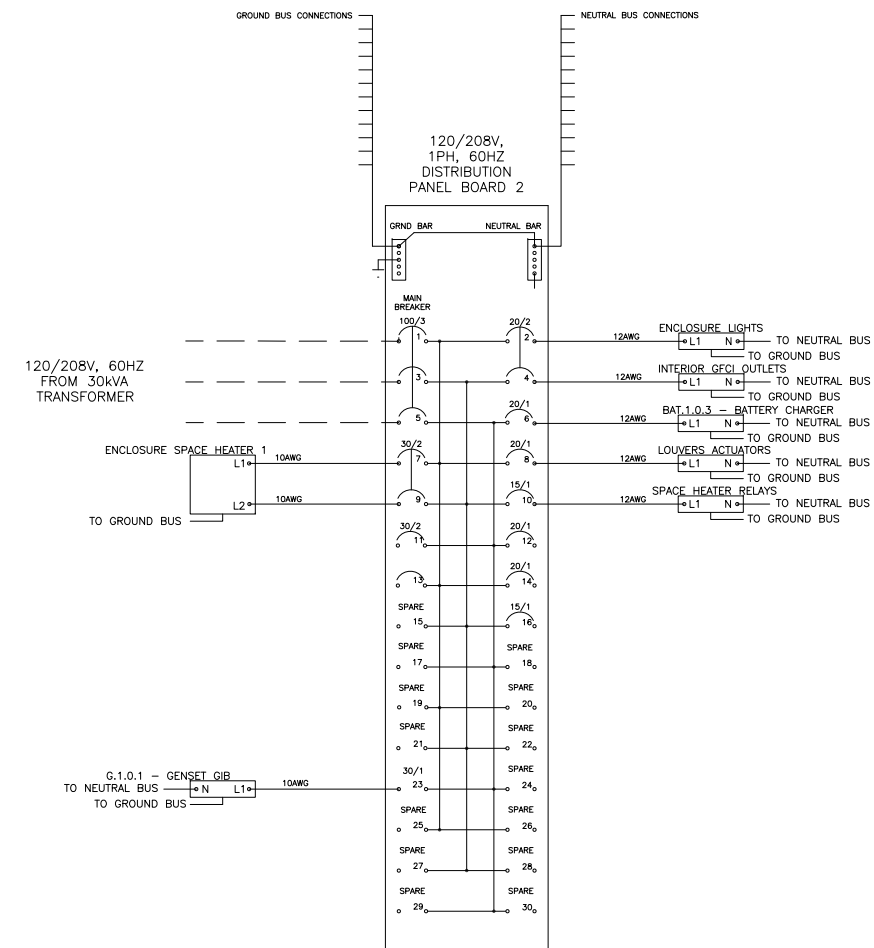
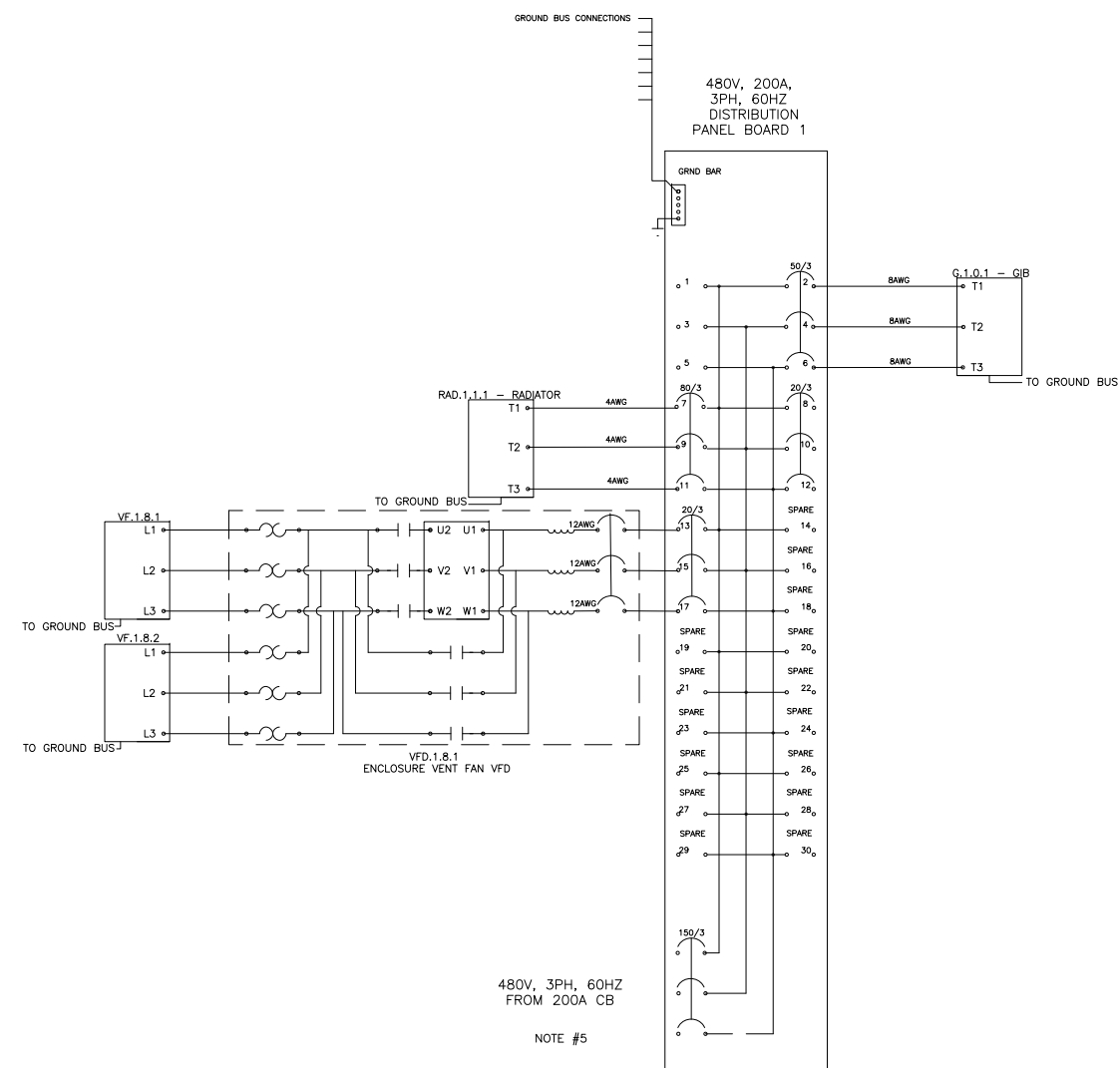
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Chapter 3: System EBOM & Design Drawings

3.3. Electrical Wiring & Interconnect Diagrams





NOTES:

1. 480VAC AND 120VAC DISTRIBUTION BOARDS BY ENCLOSURE MANUFACTURER.
2. ALL WIRING SHOWN IS FIELD WIRING.
3. FINAL WIRING SCHEMATIC TO BE PROVIDED BY ENCLOSURE MANUFACTURER.
4. AUXILIARY POWER TO NON-CUMMINS SUPPLIED EQUIPMENT NOT SHOWN.
5. CUSTOMER POWER SOURCE TO BE ROUTED THROUGH 480V PANELBOARD STUB-UP UNDER THE ENCLOSURE
6. NOT FOR CONSTRUCTION. WIRING DETAILS MAY CHANGE BY GENSET MODEL.

WIRING DIAGRAM			E104	SHEET 10 OF 10	PROJECT: UNITED RENTALS TRAILER PACKAGE STANDBY/PEAKING		Cummins Inc.		
DWN SB CKD NP APVD IC					C1400 N6C		CAD SYSTEM Autodesk® AutoCAD® Electrical	SIZE: A3	
	0	SUBMITTAL	30MAR21						
		REV	DESCRIPTION		DATE				

Chapter 4: Major Balance of Plant Components

- 4.1. Fuel System**
- 4.2. Cooling System**
- 4.3. Electrical System**
- 4.4. Exhaust System**



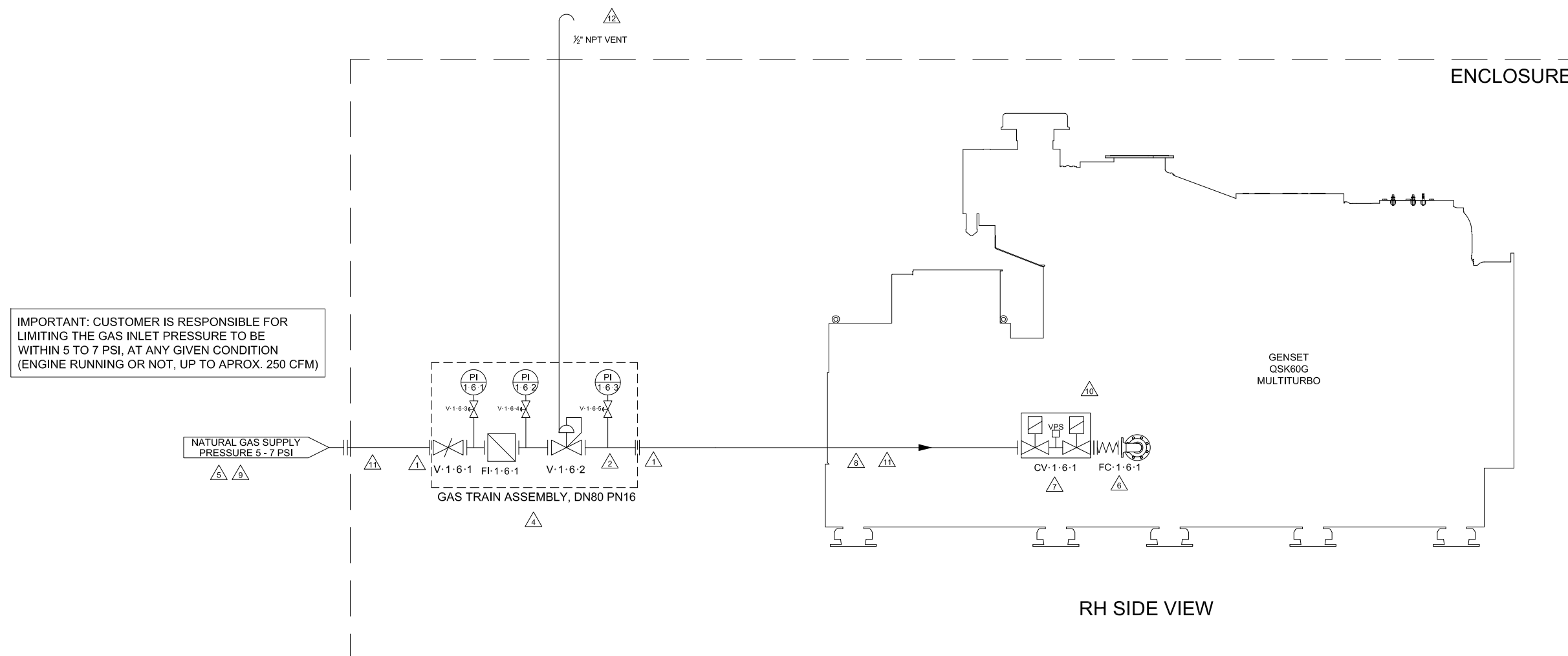
Chapter 4: Major Balance of Plant Components

4.1. Fuel System



Fuel Supply Considerations

- Customer Fuel Requirements:
 - Gas type/temperature: Natural Gas, 60°F
 - Gas LHV: 905 BTU/SCF
 - Inlet pressure at the enclosure: 5 - 7 PSIG
 - Maximum design pressure: 7 PSIG
 - Relative humidity: < 60%
 - Dew point: < 14°F
 - H₂S level: < 0.1% by volume
- Customer flange connection needed to the enclosure: DN80
- The Cummins fuel system is designed for NFPA 37:2015 applications. It is not designed for MA State applications or Canadian installations. Acceptance of the fuel system is subject to the Authority Having Jurisdiction (AHJ).
- Customer fuel supply systems (including design, materials, components, fabrication, assembly, installation, testing, inspection, operation, and maintenance) must comply with the applicable local and national codes. For installations within the US, refer to NFPA Standards 37 and 54.
- When the failure of a single upstream line regulator or service pressure regulator results in a supply pressure exceeding the maximum design pressure at the enclosure, a pressure regulator will have to be used (not in Cummins scope of supply) along with an Over-Pressure Protection Device (OPPD) as defined in the NFPA 37/54/86 or EN 746-2. This OPPD must be set at the maximum (including hysteresis and set point margins) inlet pressure rating of the fuel system.
- Cleanliness is a very important aspect in the fuel system. Arrangements must be made to prevent moisture, dirt or contaminants of any kind from entering the fuel system. All pipework and fuel system should be cleaned and inspected prior to assembly of the system. Schedule 40 iron piping is used as fuel supply lines.
- The sizing of the fuel system should be done in such a way that gas is capable of being supplied to the enclosure at the required flow rate and pressure. Determination of pipe sizes must be based upon the method approved by the authority having jurisdiction. The gas pipe sizing is done based on the guidelines given in the NFPA 54.
- The procedure for sizing natural gas pipes is as follows:
 - 1. Determine the equivalent length of all the fittings in the system.
 - 2. Add the length of straight piping to the equivalent length of all fittings.
 - 3. Determine the maximum gas flow required for the particular generator set.
 - 4. Determine the pipe diameter required for the particular gas flow rate and length of piping in the system.



INSTALLATION NOTES:

1. WELD NECK FLANGES, DN80 PN16, CARBON STEEL UN-PAINTED, SHIPPED LOSE WITH SEALS AND HARDWARE FOR INSTALLATION
2. COUPLING RING, DN80 PN16, CAST STEEL, SHIPPED LOOSE WITH V.1.6.5 AND PI.1.6.3 INSTALLED, SEALS AND HARDWARE INCLUDED FOR INSTALLATION
3. SERVICE PARTS INCLUDED; REPLACEMENT ELEMENT FOR FILTER AND REPAIR KIT FOR REGULATOR, WITH EXTRA SEALS FOR EACH CONNECTION
4. REFER FOR MANUFACTURER DRAWING FOR DIMENSIONS, SPECIFICATIONS AND FURTHER DETAILS
5. WHEN THE FAILURE OF A SINGLE UPSTREAM LINE REGULATOR OR SERVICE PRESSURE REGULATOR RESULTS IN A SUPPLY PRESSURE EXCEEDING THE MAX INLET PRESSURE RATING OF THE GAS TRAIN (7PSI), A PRESSURE REGULATOR WILL HAVE TO BE PROVIDED BY OTHERS ALONG WITH AN OVER-PRESSURE PROTECTION DEVICE AS DEFINED IN THE NFPA 37/54/86, SET AT THE MAXIMUM INLET PRESSURE RATING OF THE GAS TRAIN. PLEASE CONSULT WITH CUMMINS FOR FURTHER INFORMATION.
6. FLEX CONNECTION TO BE MOUNTED HORIZONTALLY ONLY AND RIGIDLY SUPPORTED. FLEX CONNECTION MUST NOT BE TWISTED OR BENT. NO WEIGHT OR MOMENTUM TO BE EXTERNALLY APPLIED TO THE ENGINE FUEL CONNECTION FLANGE.
7. DMV (CV.1.6.1) VALVE TO BE MOUNTED AS CLOSE AS POSSIBLE TO THE ENGINE FUEL CONNECTION
8. PIPING BETWEEN GAS TRAIN AND DMV TO BE AS SHORT AS POSSIBLE. AVOID TURNS AND DO NOT CHANGE PIPING DIAMETER.
9. GAS SUPPLY PRESSURE TO BE MAINTAINED WITHIN GAS TRAIN MAX AND MINIMUM RATINGS AT ANY GIVEN CONDITION (FROM ZERO TO FULL LOAD FUEL FLOW), GAS TEMPERATURE TO BE WITHIN 41F TO 122F.
10. REFER TO CUMMINS' GAS CONNECTION DRAWINGS FOR FURTHER DETAIL AND LIST OF HARDWARE PROVIDED TO MOUNT FLEX CONNECTION (FC.1.6.1) AND DMV VALVE (CV.1.6.1). INSTALL HARNESS PROVIDED WITH DMV AS INDICATED IN THE CUMMINS' GAS CONNECTION DRAWING.
11. ALL PIPING BY OTHERS. ALL GAS TRAIN AND PIPING SUPPORT BY OTHERS.
12. VENT TO BE PIPED TO THE ATMOSPHERE, OUTSIDE GENERATOR ROOM, BY OTHERS. PROVIDE CAP OR NECK TO AVOID INGRESS OF RAIN WATER INTO THE VENT PIPE.

IMPORTANT: CUSTOMER IS RESPONSIBLE FOR LIMITING THE GAS INLET PRESSURE TO BE WITHIN 5 TO 7 PSI, AT ANY GIVEN CONDITION (ENGINE RUNNING OR NOT, UP TO APROX. 250 CFM)

ENCLOSURE

GENSET
QSK60G
MULTITURBO

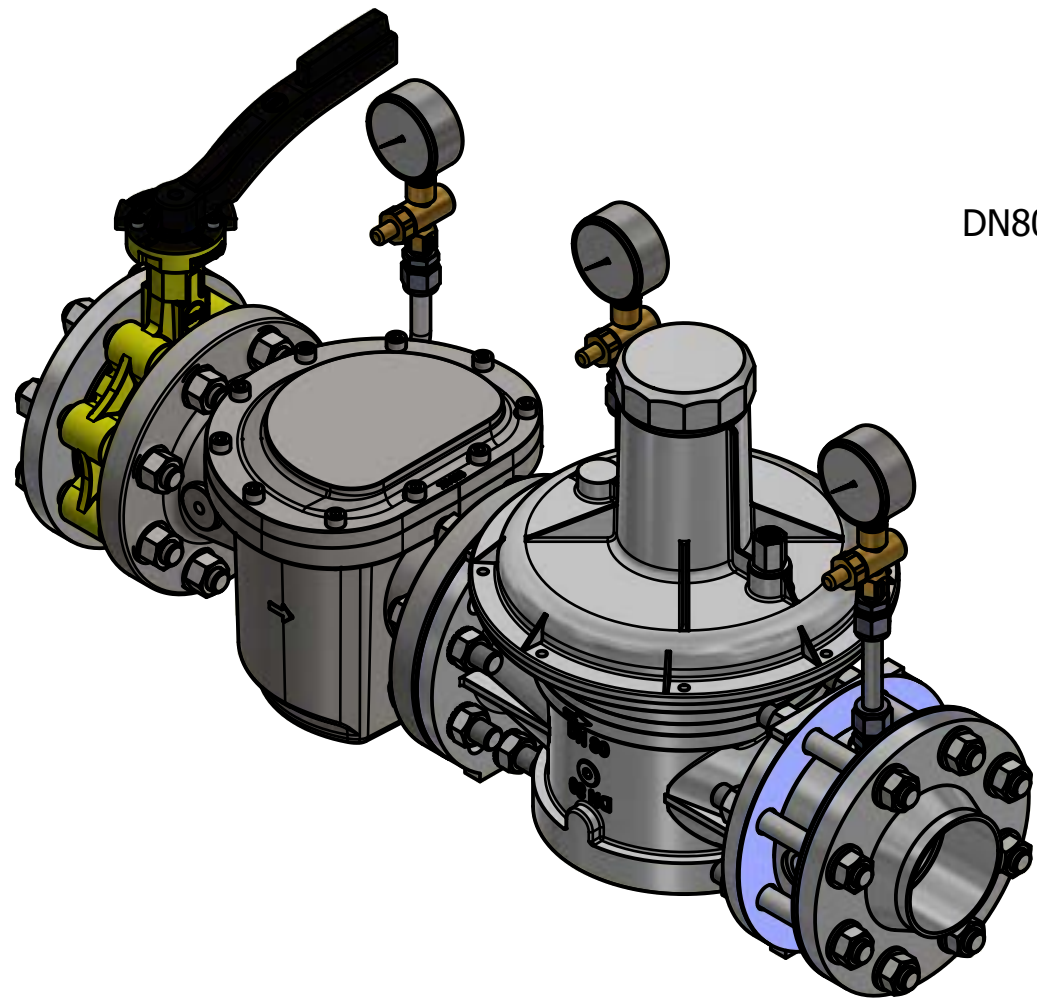
RH SIDE VIEW

_____ SUPPLIED BY CUMMINS

_____ SUPPLIED BY OTHERS

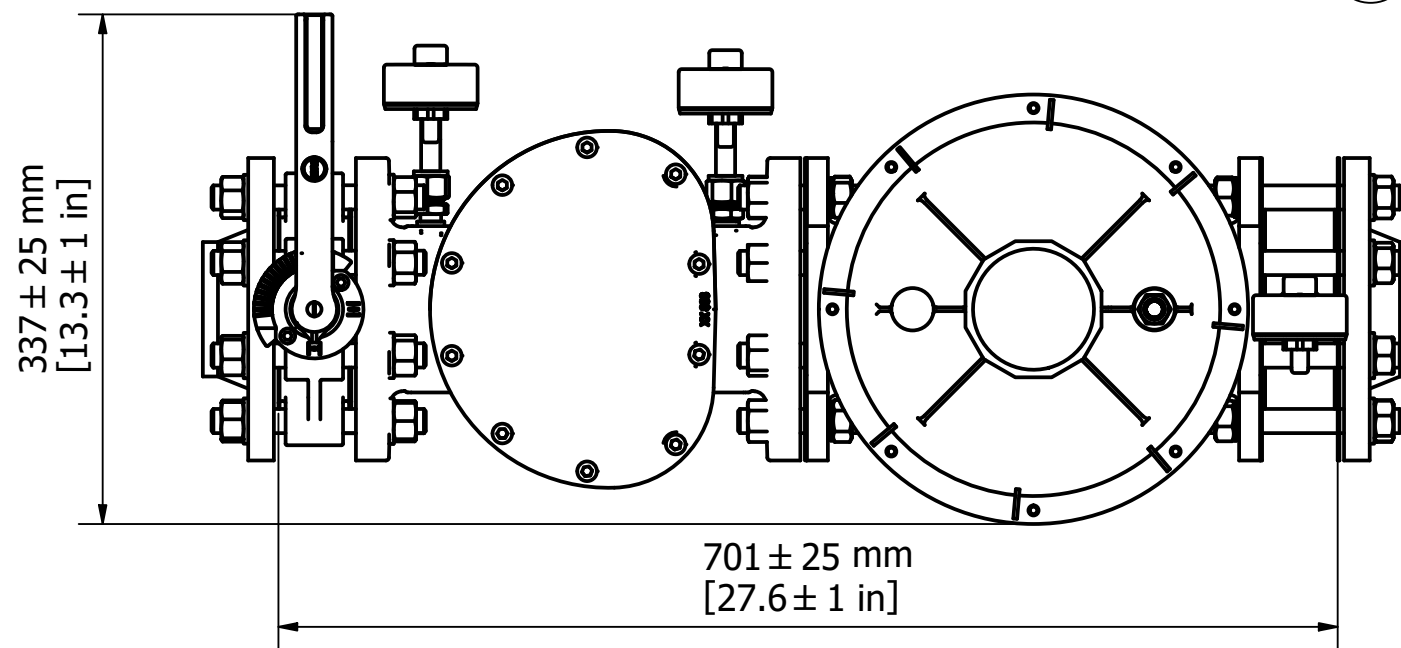
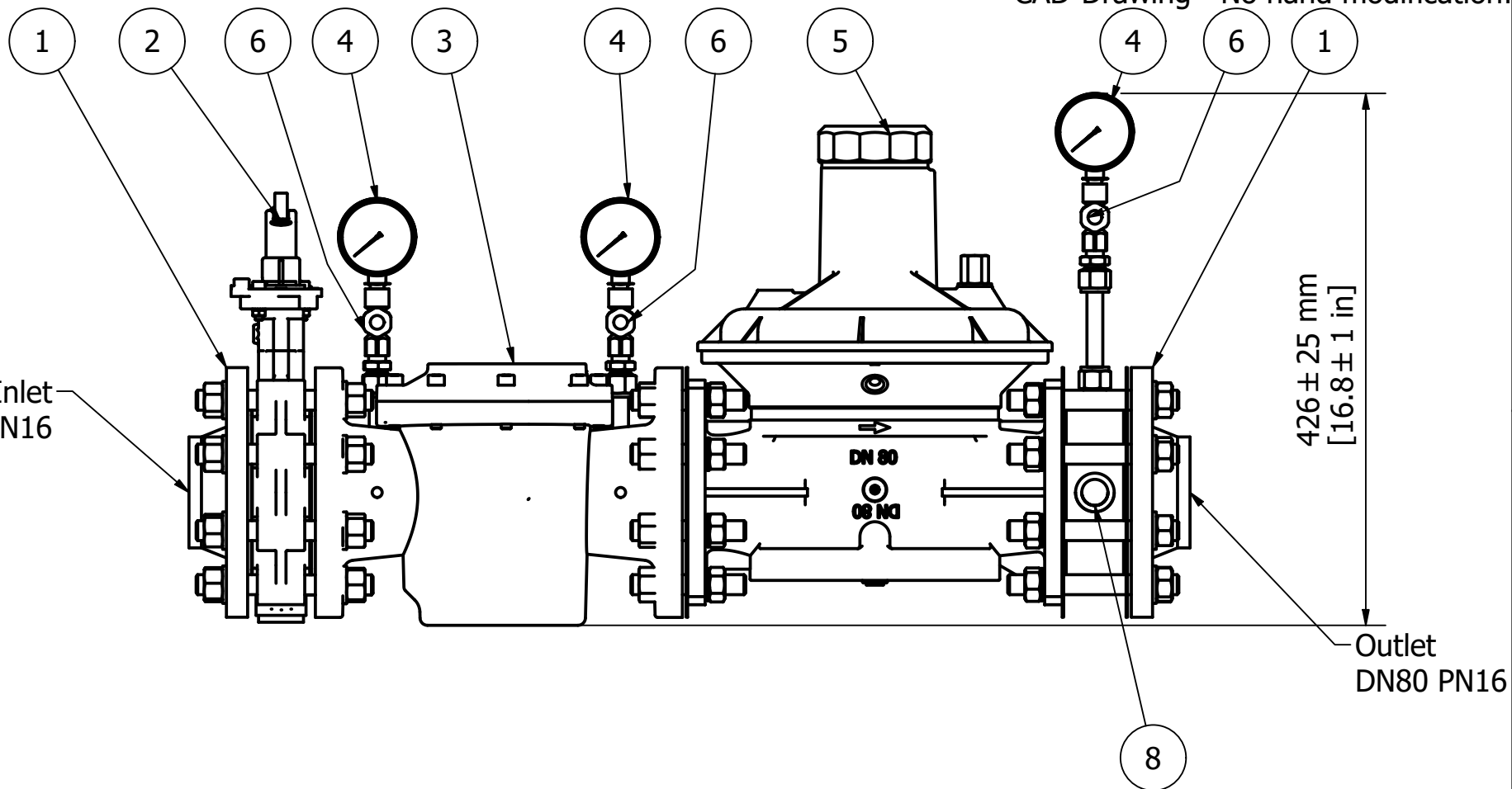
FUEL P&ID			SHEET 4 OF 10		PROJECT: UNITED RENTALS TRAILER PACKAGE STANDBY/PEAKING		Cummins Inc.		
DWN SB CKD NP APVD IC					C1400 N6C		CAD SYSTEM Autodesk® AutoCAD® Electrical	SIZE: A3	
	0	SUBMITTAL	30MAR21						
	REV	DESCRIPTION	DATE						

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Inlet
DN80 PN16

CAD-Drawing - No hand modification!



White Spring (Item 7) installed in Regulator (Item 5)

Following items ship loose with seals and hardware for onsite assembly:

Weld Flanges (Item 1) Qty 2 with hardware (16 studs / 2 gaskets DN80)

Coupling ring (Item 8) w/ pressure gauge assembly (Items 6 & 4)

Service Parts Included:

Replacement Filter Element for filter item 3 (Item 9)

Repair Kit for Regulator item 5 (Item 10)

1 Spare gasket for each Connection:

- 3 x DN80 Gaskets (Item 11)

USER MANUAL AND CERTIFICATES DELIVERED IN ENGLISH AT DELIVERY UNLESS OTHERWISE SPECIFIED **3D**

Gas Type / Temperature	Natural Gas 60F					Not tolerated dimensions are +/- 5mm (.2") or +/- 5°	Scale	1 : 5							
Gas LHV and Density	905 BTU/SCF						Customer Reference			Customer Name Cummins IGB					
Flow Rate (Max/Min)							Drillings H13 EN 20273 Threads 6H/6g - L - DIN ISO 965-1			Description 294219					
Inlet Pressure (Max / Min)	5-7 Psig														
Max Allowable Pres. (HP/LP)	7 PSI														
Outlet Pressure (Max / Min)	3.5 Psig						Date	Name							
Maximum Power	NA					Draw.	3/19/2021	JB							
Voltage / NEMA-IP	NA					Check.	3/19/2021	MH							
Installation	Indoors					Norm									
Ambient temperature	+5F / +140F					DUNGS® Combustion Controls Karl Dungs Inc. 3890 PHEASANT RIDGE DRIVE NE Suite 150 BLAINE, MN 55449, USA				Customer Validation (Date and Signature)			Format	Index 0	Page 1
Normative Base	NFPA 37:2015														
PED 2014/168 / ATEX 94/9	NA														
Paint Finish (Pipework)			Index	Description	Date	Name									
Net Weight	137.6 kg		REVISIONS LIST												

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PARTS LIST				
ITEM	DESCRIPTION	P/N	QTY	RECOMMENDED SPARE PARTS
1	Welding Neck Flange PN16 - DN 80 - Carbon steel	227140	2	NA
2	Butterfly Valve - Z014 DN80 PN 16 - Lug Type - Cast Iron - CSA 3.16 - Pmax: 125 Psig	266015	1	Lever: 278751
3	Gas Filter - DN80 PN16 - Pmax: 4bar (55psig) - Aluminium Housing - 50 microns filtration	256410	1	Element and O'Rings: 222694
4	Pressure gauge - 0-10 psig / kPa DN63 Pressure Gauge - 1/4" NPT connection - Stainless Steel Case - Brass Fittings - Silicon Filled	268247	3	NA
5	Pressure Regulator DN80 PN16 - Pmax: 15 Psig (1 barg) - 5 Psig out (6 Psig max out) - CE	267749	1	Repair Kit: 268194
6	Manual Push Button valve 1/4 inch NPT - 72 Psig	242645	3	NA
7	Spring White - 200-450mbar for Pressure Regulator ST1B DN65/80	267750	1	NA
8	Coupling ring - DN80 PN16 - Carbon Steel - 3 x 1/2" BSP connection	267571	1	Not Applicable
9	Filter Insert for Filter DN80 - 4 Barg	222694	1	NA
10	Spare Parts Kit for STR-ST1B 65/80	268194	1	NA
11	Full Face Gasket - BAU - PN16 - DN80- 2mm Thick	267472	6	NA

Notes:

- For Item 11: 3 Seals for train and 3 seals shipped loose for spare.
- Coupling ring item 8 with gauge assembly shipped loose in same crate
- Items 9/10 shipped loose in same crate

Specific Shipment Requirements: No
Crate Length (Inches): 46
Crate Width (Inches): 40
Crate Height (Inches): 35

USER MANUAL AND CERTIFICATES DELIVERED IN ENGLISH AT DELIVERY UNLESS OTHERWISE SPECIFIED **3D**

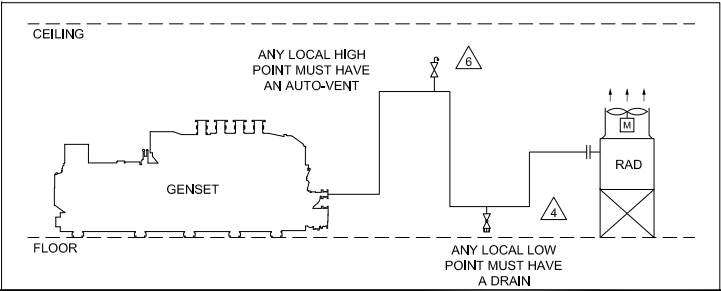
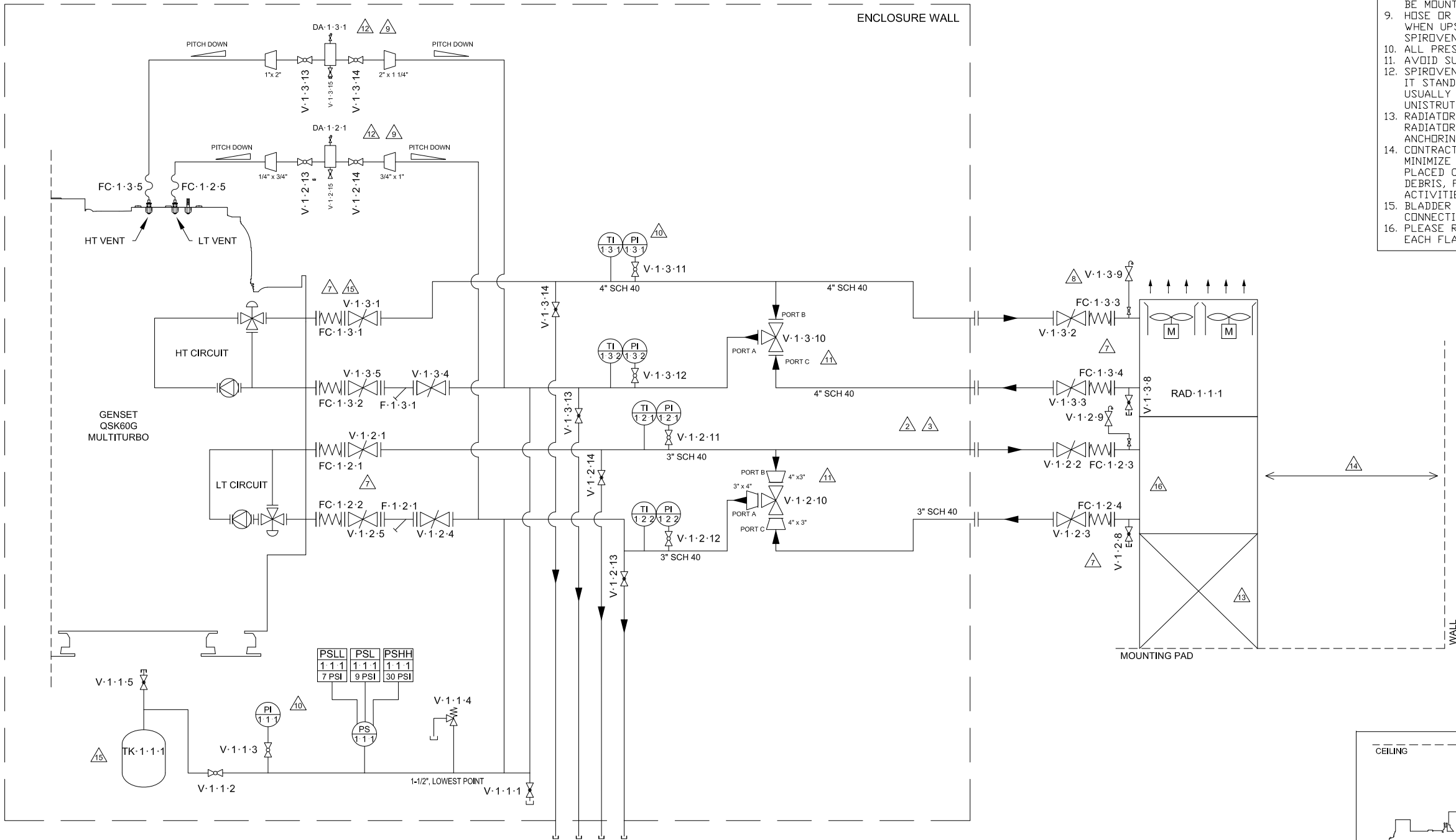
Gas Type / Temperature	Natural Gas 60F					Not tolerated dimensions are +/- 5mm (.2") or +/-5°	Scale 1 : 7							
Gas LHV and Density	905 BTU/SCF						Customer Reference				Customer Name Cummins IGB			
Flow Rate (Max/Min)														
Inlet Pressure (Max / Min)	5-7 Psig													
Max Allowable Pres. (HP/LP)	7 PSI					Drillings H13 EN 20273 Threads 6H/6g - L - DIN ISO 965-1								
Outlet Pressure (Max / Min)	3.5 Psig						Date	Name	Description 294219					
Maximum Power	NA					Draw.	3/19/2021	JB						
Voltage / NEMA-IP	NA					Check.	3/19/2021	MH						
Installation	Indoors					Norm								
Ambient temperature	+5F / +140F					DUNGS® Combustion Controls Karl Dungs Inc. 3890 PHEASANT RIDGE DRIVE NE Suite 150 BLAINE, MN 55449, USA			Customer Validation (Date and Signature)		Format	Index 0	Page 2	
Normative Base	NFPA 37:2015												P.	
PED 2014/168 / ATEX 94/9	NA													
Paint Finish (Pipework)		Index	Description	Date	Name									
Net Weight	137.6 kg	REVISIONS LIST												



Chapter 4: Major Balance of Plant Components

4.2. Cooling System

- INSTALLATION NOTES:
1. REFER TO SCOPE LEGEND FOR SCOPE OF SUPPLY INDICATION. ITEMS NOT LISTED IN THE BOM MIGHT NOT BE PART OF CUMMINS SCOPE OF SUPPLY.
 2. ALL PIPING, INSULATION AND DRAINS WITH ISOLATION VALVES BY CONTRACTOR.
 3. VERIFICATION OF COOLANT FLOW RESTRICTIONS (BACKPRESSURE) AND COMPLIANCE TO DATA SHEET LIMITS BY CONTRACTOR.
 4. ANY LOW POINT IN PIPING REQUIRES A DRAIN VALVE, BY CONTRACTOR.
 5. PLEASE REFER TO CUMMINS DRAWING 0500-5090 FOR EXACT LOCATION AND DETAILS OF VENT CONNECTIONS. CONTRACTOR MAY CHOOSE TO SUPPLY ITS OWN HOSE INSTEAD OF FACTORY HOSES. ANY FURTHER REQUIRED FITTING OR ADAPTER BY CONTRACTOR.
 6. ANY SUDDEN DROP IN PIPING WILL REQUIRE AN AUTO VENT (BY CONTRACTOR). AUTO/MANUAL VENTS TO BE INSTALLED AT THE HIGH POINTS IN PIPING.
 7. NO PIPING WEIGHT OR MOMENTUM TO BE APPLIED TO EXPANSION JOINTS OR EQUIPMENT FLANGES. SUPPORTS TO BE PROVIDED WITH ENOUGH RIGIDITY TO AVOID EXCESSIVE VIBRATIONS IN ALL DIRECTIONS.
 8. RADIATOR VENTS (SPIROTOP AB-050, V.1.3.9/1.2.9) SHIPPED LOSE, TO BE MOUNTED ON RADIATOR HEADERS FITTINGS DIRECTLY.
 9. HOSE OR PIPING MUST NOT SAG (SLOPE MUST BE ALWAYS UPWARD WHEN UPSTREAM SPIROVENTS, AND DOWNWARD WHEN DOWNSTREAM SPIROVENTS, AS INDICATED).
 10. ALL PRESSURE GAUGES SHOULD BE ASSEMBLED VERTICALLY.
 11. AVOID SUPPORTING PIPING FROM VALVE FLANGES.
 12. SPIROVENTS SPOOL SECTIONS TO BE SUPPORTED IN SUCH WAY THAT IT STANDS HIGHER THAN POINT OF CONNECTION AT THE ENGINE. USUALLY SUPPORTED FROM THE ROOF THROUGH THREADED STUDS AND UNISTRUT.
 13. RADIATOR LEGS SHIPPED LOSE FOR CONTRACTOR ASSEMBLY. REFER TO RADIATOR DRAWINGS FOR DETAILS. MOUNTING HARDWARE PROVIDED.
 14. CONTRACTOR RESPONSIBLE FOR PROVISION OF FRESH AIR AND MINIMIZE HOT AIR RE-CIRCULATION, MAINLY WHEN RADIATOR IS PLACED CLOSE TO A WALL OR BUILDING. FRESH AIR TO BE FREE OF DEBRIS, FUMES OR PARTICULATE MATTER FROM VEGETATION OR LOCAL ACTIVITIES.
 15. BLADDER TANK TO BE POSITIONED WITHIN 6FT OF POINT OF CONNECTION TO THE ENGINE.
 16. PLEASE REFER TO RADIATOR DRAWING FOR PHYSICAL LOCATION OF EACH FLANGE.



COOLING P&ID - PAD RADIATOR			SHEET 3 OF 10
DWN			
NP			
CKD			
NP			
APVD	0	SUBMITTAL	18JAN21
IC	REV	DESCRIPTION	DATE

PROJECT:
McAllen
STANDBY

C1350 N6

Cummins Inc.

CAD SYSTEM
Autodesk® AutoCAD® Electrical
SIZE: A3



Radiator Design Data Sheet US-UNITS

Radiator Type: SRD 3A 09T N6D 23H GS PH SW - AL 2.3 CU 66 1xAN2,5" + 99 1xAN4"

Number of radiators: 1 pc / engine

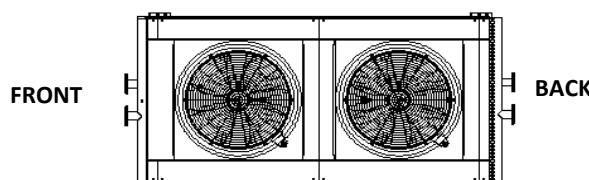
Vendor	Fincoil LU-VE Oy	Customer	Cummins USA
Vendor Reference Number	210419TVA1	Customer Project Name	United Rentals Trailer Package
Date	19.4.2021	Application	Engine cooling
Factory Location	Finland	Engine model	C1400N6C D-6452 (QSK60G)
Design code	PED 2014/68/EU (Art 4.3)	Location	USA
Design pressure (psig)	87	Cooling type	Air Cooled
Test pressure (psig)	131	Cooler type	Flatbed - induced draught
Design temperature (°F)	+230	Service	Liquid

PERFORMANCE DATA

TUBE SIDE LT-Circuit		TUBE SIDE HT-Circuit	
Fluid Name	EG50%	Fluid Name	EG50%
Fluid Flow per Unit (gal/min)	101	Fluid Flow per Unit (gal/min)	365
Pressure Drop (psig)	2,9	Pressure Drop (psig)	5,8
Temperature In (°F)	126	Temperature In (°F)	194
Temperature Out (°F)	118	Temperature Out (°F)	174
Capacity per Unit (MMBTU/h)	0,35	Capacity per Unit (MMBTU/h)	3,16
Fouling margin	+5+10% in kW	Fouling margin	+5+10% in kW
Connection size	1 x AN2,5", PN10/16	Connections size	1 x AN3", PN10/16
Internal volume / unit (gal)	25	Internal volume / unit (gal)	40
Heat transfer area (feet²) / unit	5177	Heat transfer area (feet²) / unit	7761
Inlet / outlet position	Front / Front (**)	Inlet / outlet position	Front / Front (**)

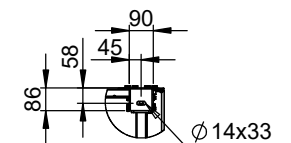
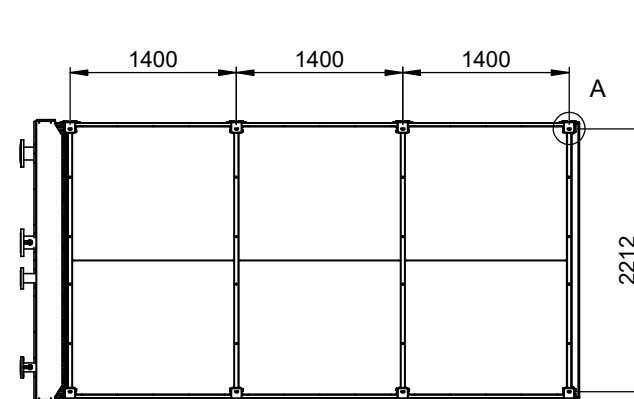
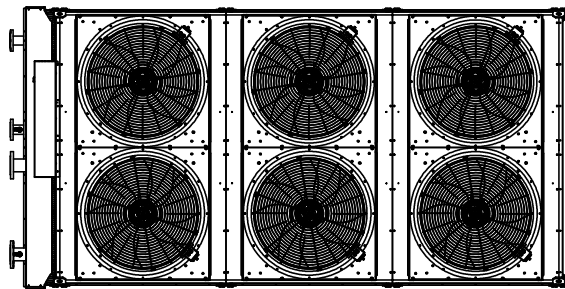
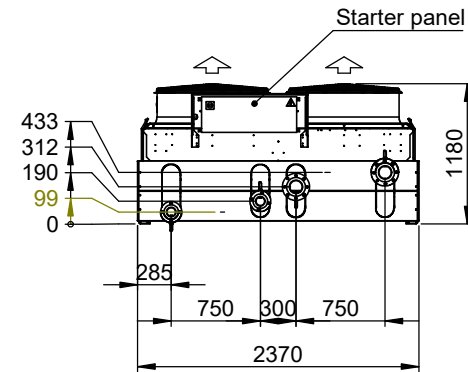
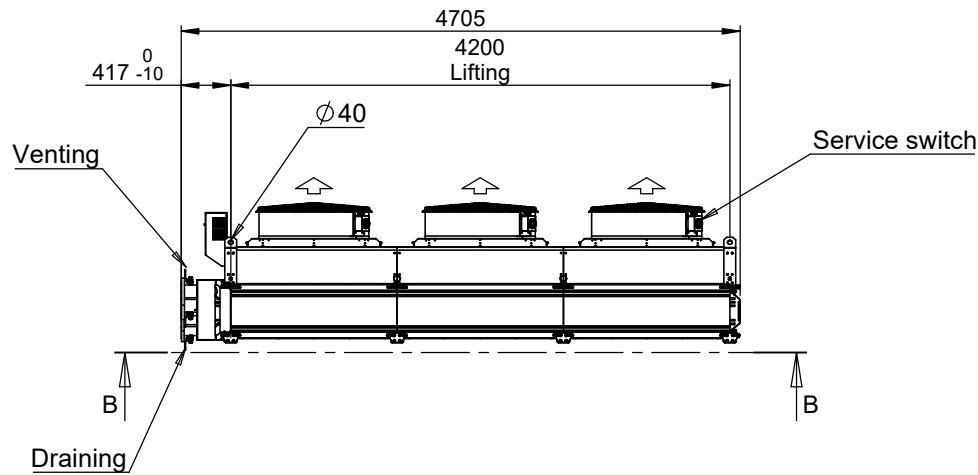
MATERIALS LT-Circuit		MATERIALS HT-Circuit	
Tube (diameter inch)	Copper 0,50	Tube (diameter inch)	Copper 0,50
Header (diameter inch)	Copper 3,00	Header (diameter inch)	Copper 4,25
Fins (thickness inch)	Aluminium (0,006)	Fins (thickness inch)	Aluminium (0,006)
Fins per inch	11	Fins per inch	11

FAN		AIR	
No / radiator (pcs)	6 (3x2)	Air Temperature in (°F)	104
Type	WingFan 910	Air Temperature out (°F)	158
Fan speed in design point (rpm)	1170	Air Flow/Fan (lb/s)	15
Material	PAG	Air Flow/Radiator (lb/s)	88
Sound pressure level / unit	69±2 dB(A) @ 23 feet (*)	Height above sea level (feet)	1001

FAN MOTORS		DIMENSIONS	
Electrical Network	3/480/60Hz	 FRONT BACK Length with connections (inch): 185,0 Width (inch): 94,5 Weight (lb): 3307	
Speed (rpm)	1170		
Motor rating (hp)	4,0		
Power Input (hp)	4,0		
Current (A)	~9		
Electrical Standard	IEC / UL-listed		
Insulation Class	F		
Protection Class	IP55		
Heaters	N/A	CASING Casing: Magnelis / Galvanized Painting (Std RAL colours): Optional	
Klixons	N/A		
PTC-thermistors	N/A		
ELECTRICAL			
Electrical panel (junction box)	Optional		
Safety switches	Standard UL-listed		

(*) Given noise level is sound pressure level measured from the cooler end, at fan plate level.

(**) All four connections can be placed in one end of the radiator.



DETAIL A
SCALE 1 : 20

SECTION B-B

Motors, service switches and starter panel components UL-listed

Flange tightening torque AN 2,5" / 28,8 and AN 4" / 19,7 MB0 (Nm)

- Use std washers (DIN 125) both in the bolt and nut side!

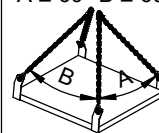
- The tightening of bolts in three steps (30%, 50% and 100%)

- Ensure torques within 24 hours, when the unit is taken into operation

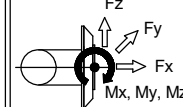
- Otherwise follow the general rules for flange tightening

Casing material	Hot dip galvanized and zinc-coated sheet steel
Coil material	Cu-tubes / Al-fins
Fin spacing	2,3 mm
Motor	6 x 3,0 kW 1180 rpm 3/480 V 60 Hz 5,8 A +20°C
Fan size	Ø910 mm
Internal volume	LT ~91 L / HT ~148 L
Net weight	~ 1350 kg
Max working pressure	6 bar (g)
Test pressure	9 bar (g)
Connection size	LT ANSI 2,5 " / HT ANSI 4", 150LBS S235JR/ZN
Venting / draining	Ball valve G 1/2", brass PN 20 EN 12165 CW 617N

Lifting angles:
 $A \leq 60^\circ$ $B \leq 60^\circ$



Flange maximum loads:
Fx, Fy and
Fz max load: 330 N
Mx, My and Mz max
moment: 67 Nm

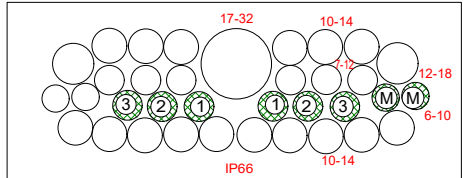


STATUS	DRAWN BY H.Lintunen	CHANGE DATE 25/02/2021	REVISION REASON Distance between flanges	REVISION 02
DIM.TOLERANCE Class M EN 22768-1, 22768-2	PROJECTION Format A3	SCALE 1:45	OLD CODE 10229840	CUSTOMER CUMMINS USA/ S1GB000566
DESCRIPTION SRD 3A 09T N6D 23H GS PH SP SW - AL 2.3 CU 66 1XAN2,5" + 99 1XAN4"	DIMENSION UNIT	ORDER NUMBER 6034380		
WEIGHT	THICKNESS	MATERIAL		
DRAWN DATE 11/02/2021	CREATED BY M.Maatta	APPROVAL DATE	APPROVED BY	

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Electric

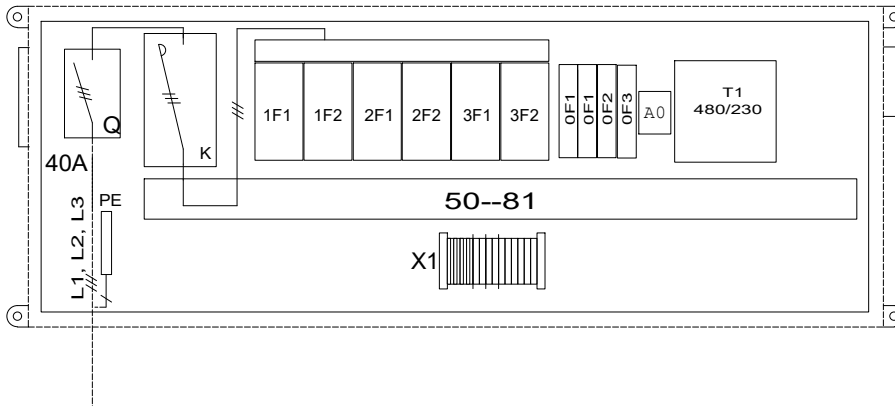
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- LU-VE
- CUSTOMER

Cabinet

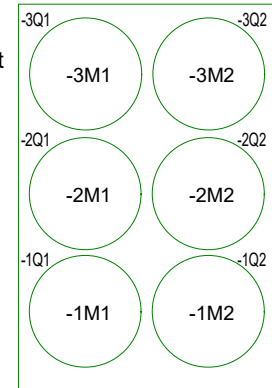
1xM40 (SUPPLY) + 1xMultigate



Un 480V
Fn 60Hz
In 40A
IP 54

NOTE: ALL STARTER PANEL COMPONENTS ARE UL-LISTED

Unit



			date	16/02/2021
			User	matti.hurmerinta
			Proved	matti.hurmerinta
Status	change	date	name	

Fincoil LU-VE Oy



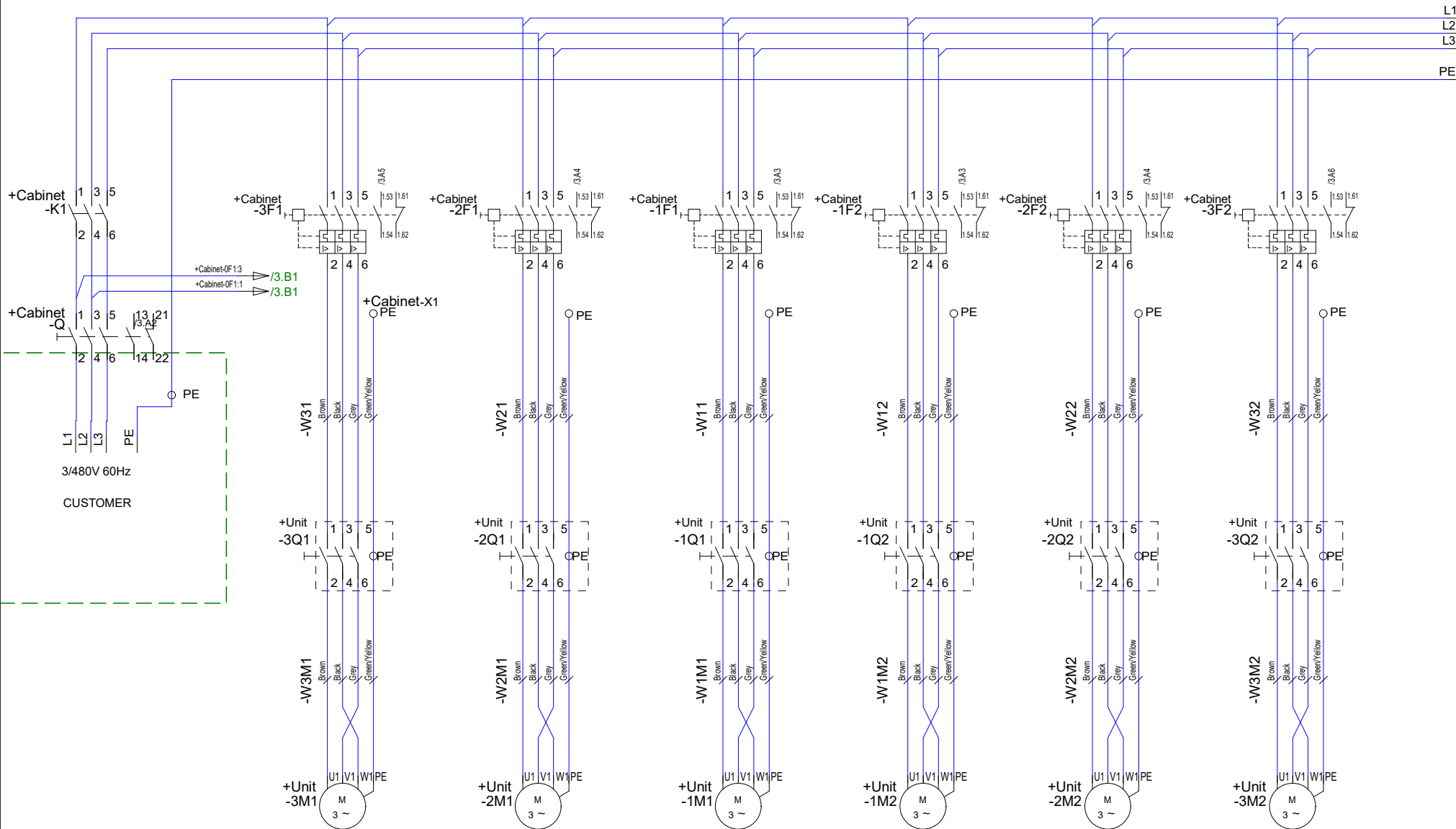
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Sheet 1
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MOTORS 6 pcs
VOLTAGE 3/480V/60Hz
POWER 3 kW
CURRENT 5,8 A (+20°C)
RPM 1170

date	16/02/2021
User	matti.hurmerinta
Proved	matti.hurmerinta
Status change	

Fincoil LU-VE Oy



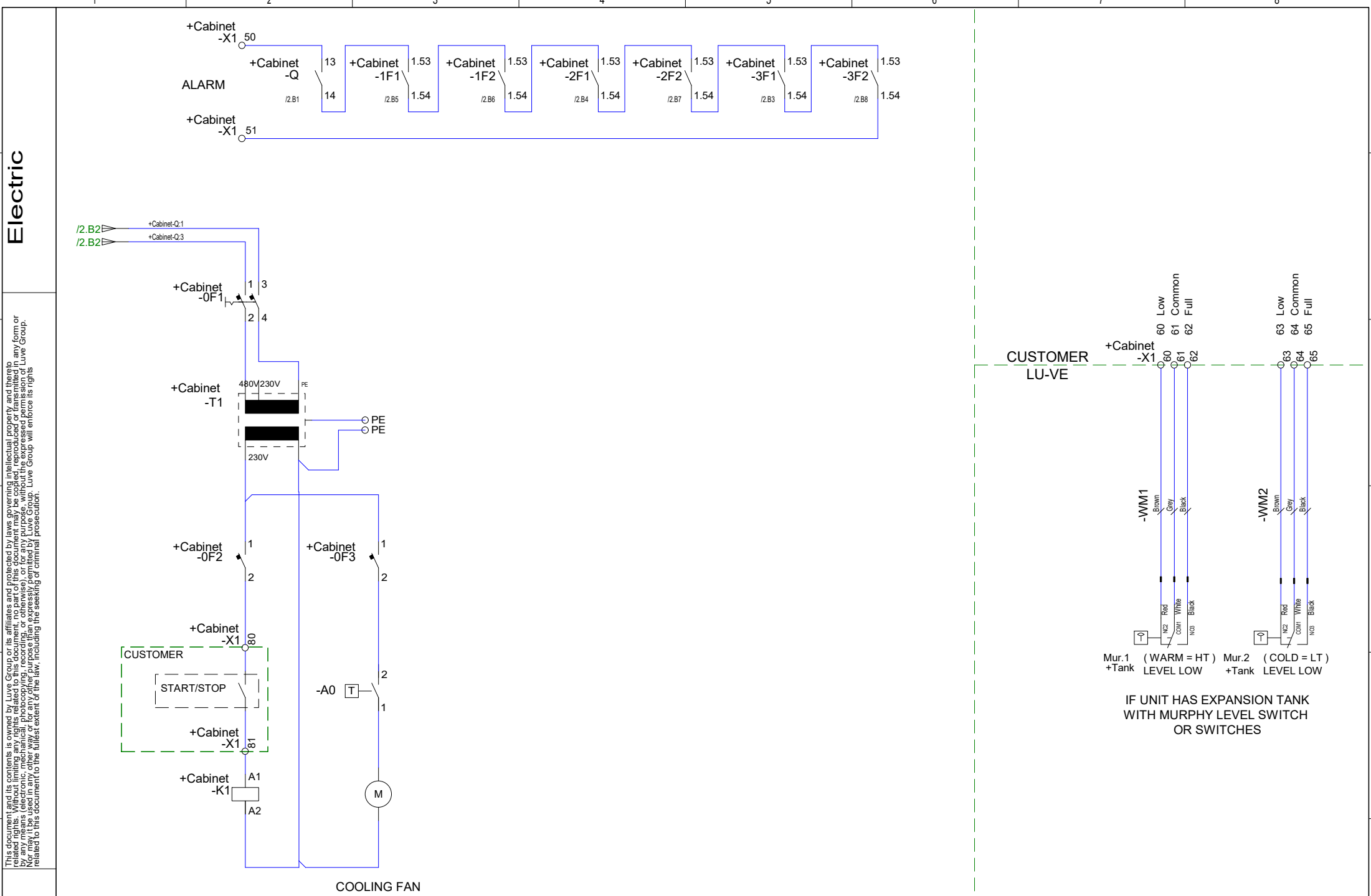
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Sheet 2
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terminal strip

-X1

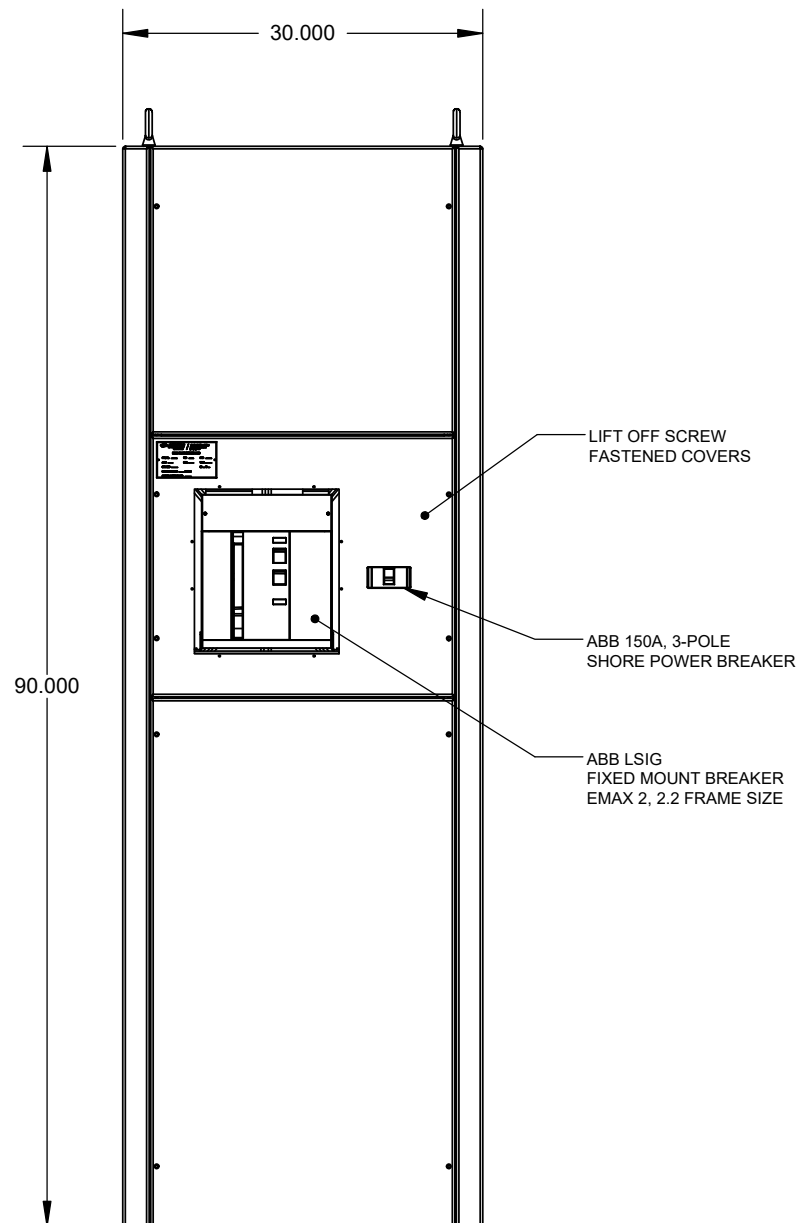
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	PE	+Unit -2Q1 :PE	/2.B4
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	PE	+Unit -1Q2 :PE	/2.B6
	PE	+Unit -2Q2 :PE	/2.B7
	PE	+Unit -3Q2 :PE	/2.B8
	PE	+Cabinet -QF2 :2	/3.D2
	80	+Cabinet -K1 :A1	/3.E2
	81	+Cabinet -Q :13	/3.A2
	50	+Cabinet -3F2 :1.54	/3.A2
	51	+Tank -Murphy1 :Red	/3.C7
	60	+Tank -Murphy1 :White	/3.C7
	61	+Tank -Murphy1 :Black	/3.C7
	62	+Tank -Murphy2 :Red	/3.C8
	63	+Tank -Murphy2 :White	/3.C8
	64	+Tank -Murphy2 :Black	/3.C8
	65		



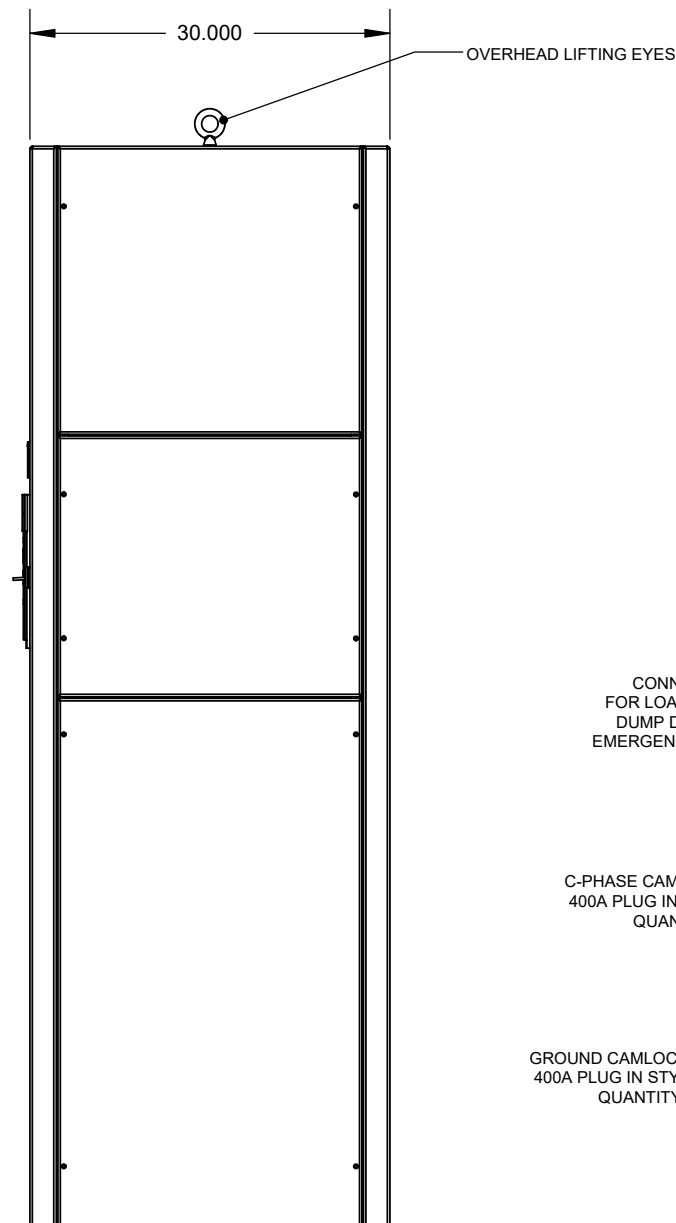
Chapter 4: Major Balance of Plant Components

4.3. Electrical System

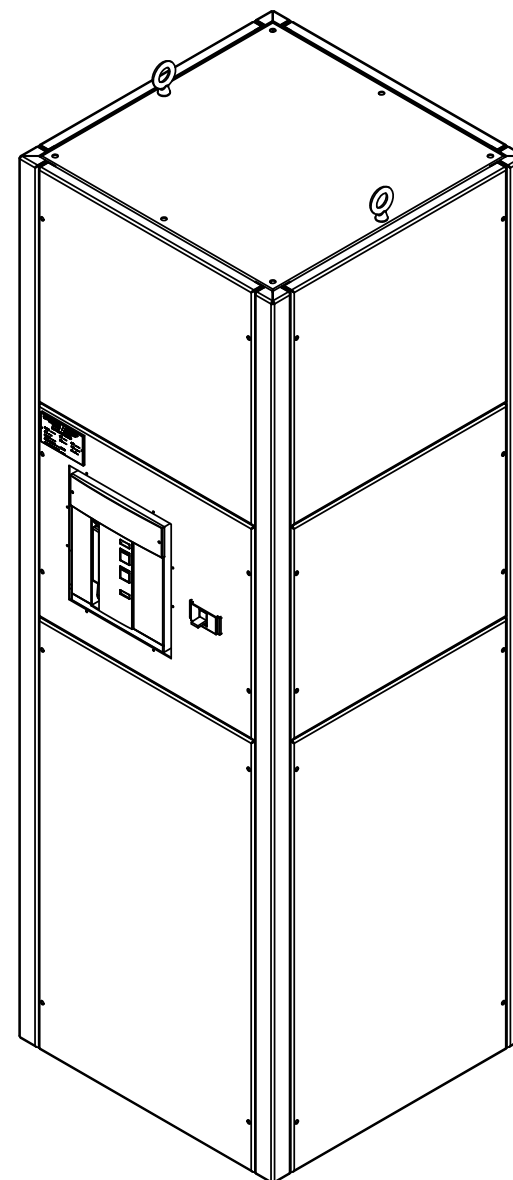
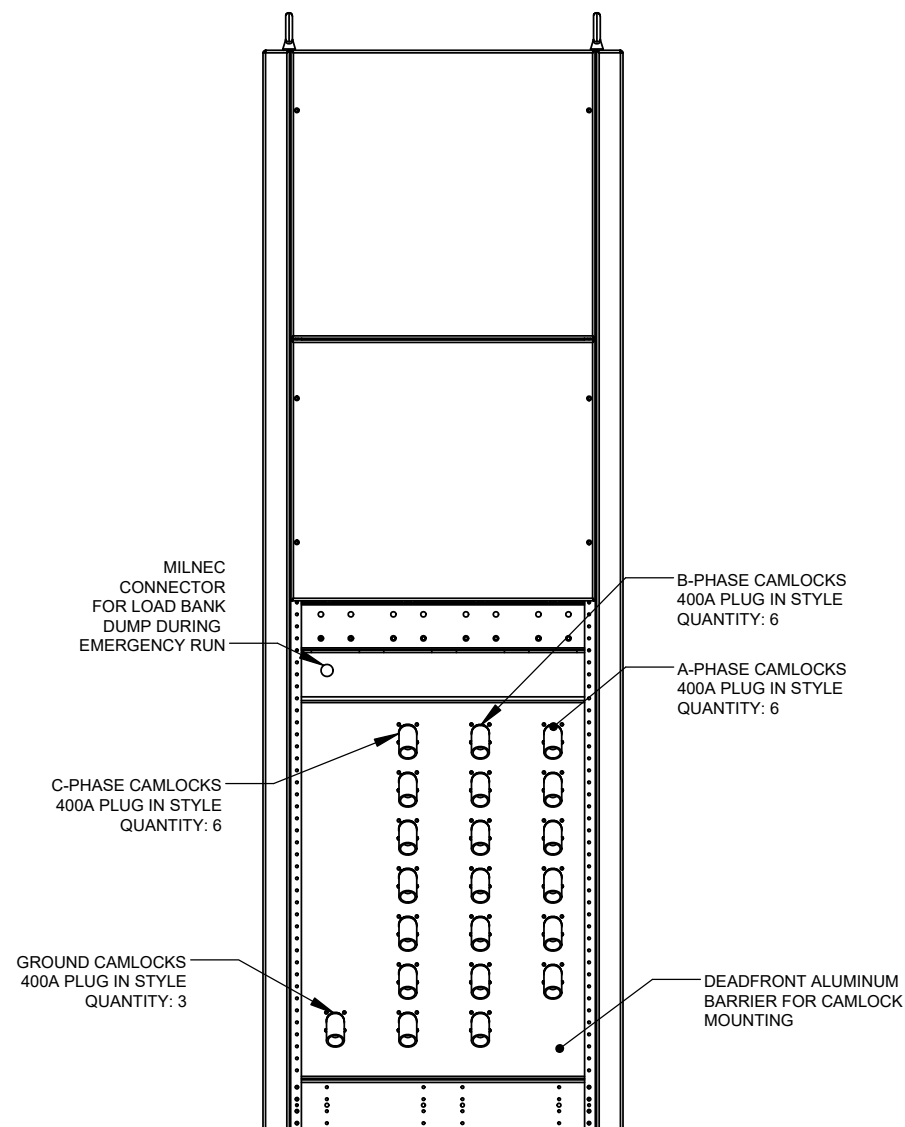
FRONT VIEW



RIGHT VIEW



REAR VIEW



MISCELLANEOUS NOTES

INSTALLATION NOTES:
BUS PHASE ARRANGEMENT WHEN VIEWED FROM THE FRONT OF THE CABINET SHALL BE

- A-B-C-N LEFT TO RIGHT
- A-B-C-N FRONT TO BACK
- A-B-C-N TOP TO BOTTOM

- A-B-C-N LEFT TO RIGHT
- A-B-C-N FRONT TO BACK
- A-B-C-N TOP TO BOTTOM

INTERCONNECTS BETWEEN SWITCHGEAR AND ANY EXTERNAL EQUIPMENT ARE CONTRACTORS RESPONSIBILITY.

ESTIMATED TOTAL WEIGHT: 1.100 LBS.

REMOVABLE LIFTING EYES PROVIDED FOR OVERHEAD LIFTING

[illegible]

CONSTRUCTION NOTES	VOLTAGE	480V	CERTIFICATION	UL 891
	PHASE	3PH	ENCL. TYPE	NEMA 1
	WIRE	4W	ENCL. MATERIAL	12 GA. CRS
	FREQUENCY	60HZ	ENCL. PAINT	ONAN GREEN
	S.C. RATING	65KAIC	CONTROL WIRE TYPE	SIS
	PHASE BUS	2000A	PT/CT WIRE SIZE	NA
	NEUTRAL BUS	2000A	CONTROL WIRE SIZE	NA
	BUS MATERIAL	SILVER WASHED COPPER	WIRE LABELS	NA
GND. BUS	1/4" X 2" COPPER	EXT. LABELS	WHITE WITH BLACK LETTERS	

<u>DRAWN DATE</u>	<u>DRAWN BY</u>	<u>CHECK BY</u>
9/28/2018	ETR	WAS
ENGINEER		
-		
CONTRACTOR		
-		
DISTRIBUTOR		
CUMMINS		

JOB NAME	CUMMINS POWER GEN. BREAKER TERMINATION CABINET MNK ARIES
SHEET TITLE	480V, 3PH, 4W, 2000A, 65KAIC BREAKER TERMINATION CABINET ELEVATION VIEWS

		
SERIAL NUMBER	DRAWING TYPE	SHEET
SE18-73435	EL	1
ORDER NUMBER	SCALE	
73435-1-1	NA	
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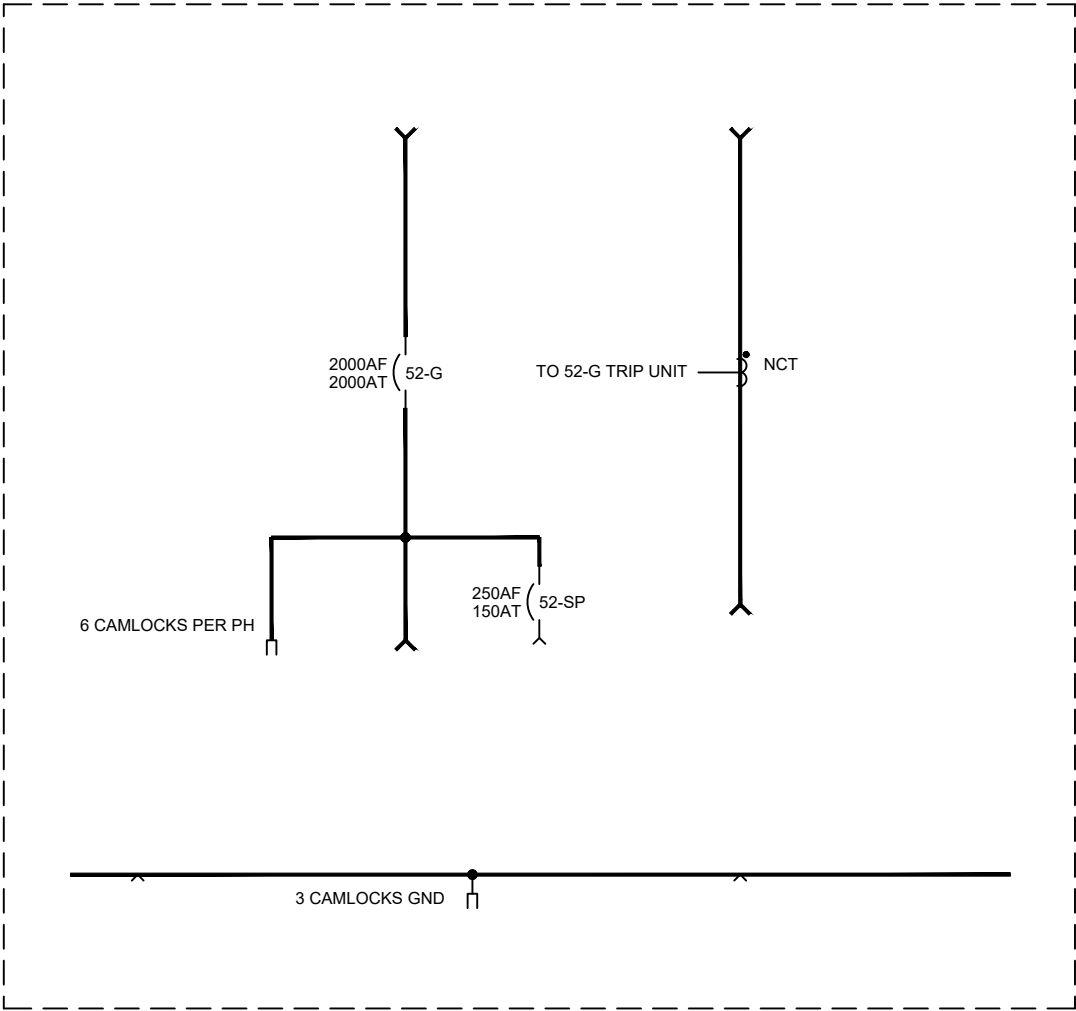
C

B

B

A

A



CIRCUIT BREAKER SCHEDULE

DESIGNATION	MFG	MODEL	FRAME	TRIP	TRIP UNIT	FEATURE	MOTOR	CLOSE	TRIP	UVR
52-G	ABB	EMAX 2	2000A	2000A	Ekip	L.S.I.G.	24VDC	24VDC	24VDC	24VDC
52-SP	ABB	XT4	250A	150A	Ekip	L.S.I.	24VDC	24VDC	24VDC	24VDC

CABLE LUG SCHEDULE

DESIGNATION	TYPE	PHASE	NEUTRAL	GROUND
52-G	NEMA 2-HOLE PATTERN	(12) 2-HOLE □ (4) SINGLE HOLE	(12) 2-HOLE □ (4) SINGLE HOLE	-
52-SP	MECHANICAL	(1) □14 - 1/0 AWG	-	-
LOAD	NEMA 2-HOLE PATTERN	(12) 2-HOLE □ (4) SINGLE HOLE	(12) 2-HOLE □ (4) SINGLE HOLE	-

MISCELLANEOUS NOTES
CUSTOMER RESPONSIBLE TO INSURE ALL SOURCES ARE A-B-C CLOCKWISE ROTATION.

REV. □	DATE	BY	REVISION DESCRIPTION
1	12/19/18	TB	AS BUILT

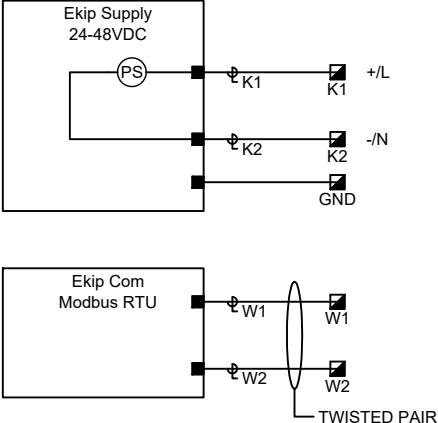
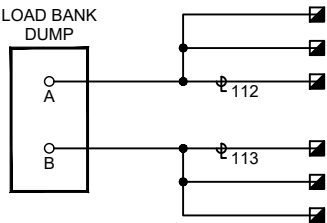
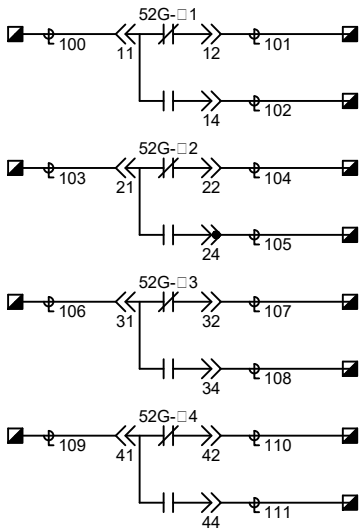
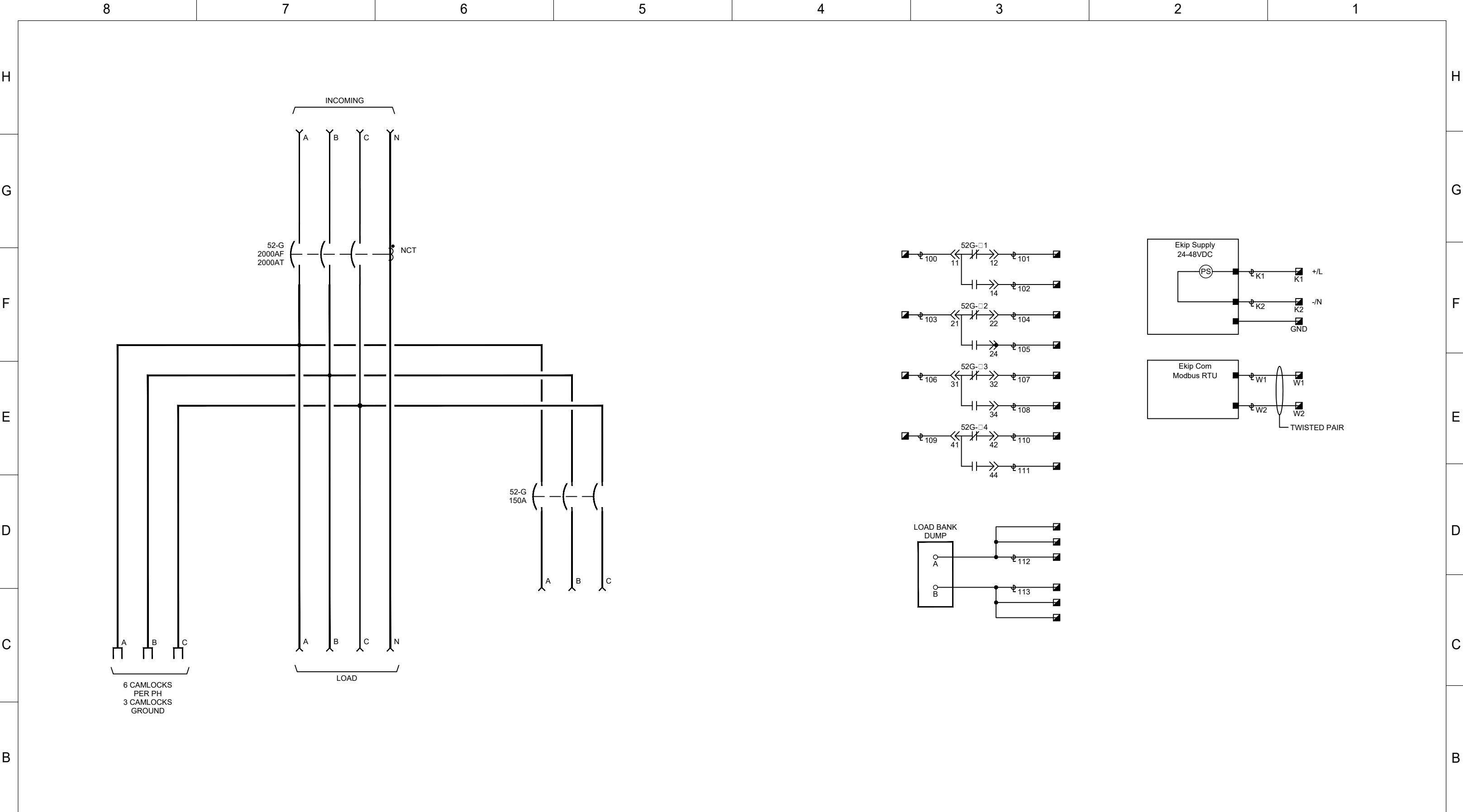
CONSTRUCTION NOTES

VOLTAGE	480V	CERTIFICATION	UL 891	DRAWN DATE	DRAWN BY	CHECK BY
PHASE	3PH	ENCL. TYPE	NEMA 1	11/08/18	TB	WAS
WIRE	4W	ENCL. MATERIAL	12 GA CRS	ENGINEER		
FRE□UENCY	60H□	ENCL. PAINT	ONAN GREEN	-		
S.C. RATING	65KA	CONTROL WIRE TYPE	SIS	CONTRACTOR		
PHASE BUS	2000A	PT/CT WIRE SI□E	NA	-		
NEUTRAL BUS	2000A	CONTROL WIRE SI□E	NA	DISTRIBUTOR		
BUS MATERIAL	SILVER WASHED COPPER	WIRE LABELS	NA	-		
GND. BUS	1/4 X 2" COPPER	EXT. LABELS	WHT/BLK LETTERS	□IEGLER POWER SYSTEMS		

JOB NAME
CUMMINS POWER GEN.
BREAKER TERMINATION CABINET
MNK ARIES

SHEET TITLE
CONNECTION CABINET
LVS-1-480-2000-CU-0-1
ONE LINE DIAGRAM

SERIAL NUMBER SE18-73435	DRAWING TYPE OL	SHEET 1
ORDER NUMBER 073435-1-1	SCALE -	
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A

MISCELLANEOUS NOTES	CUSTOMER RESPONSIBLE TO INSURE ALL SOURCES ARE A-B-C CLOCKWISE ROTATION.				CONSTRUCTION NOTES	VOLTAGE	480V	CERTIFICATION	UL 891	DRAWN DATE	DRAWN BY	CHECK BY	JOB NAME CUMMINS POWER GEN. BREAKER TERMINATION CABINET MNK ARIES	<table><tr><td>SERIAL NUMBER</td><td>DRAWING TYPE</td><td>SHEET</td></tr><tr><td>SE18-73435</td><td>SD</td><td>1</td></tr><tr><td>ORDER NUMBER</td><td colspan="2">SCALE</td></tr><tr><td>073435-1-1</td><td colspan="2">-</td></tr><tr><td colspan="3">THIS DOCUMENT IS THE PROPERTY OF STATES MANUFACTURING. IT CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION WHICH MUST NOT BE DUPLICATED, USED OR DISCLOSED OTHER THAN AS EXPRESSLY AUTHORIZED BY STATES MANUFACTURING LOCATED IN MINNEAPOLIS MINNESOTA.</td></tr></table>	SERIAL NUMBER	DRAWING TYPE	SHEET	SE18-73435	SD	1	ORDER NUMBER	SCALE		073435-1-1	-		THIS DOCUMENT IS THE PROPERTY OF STATES MANUFACTURING. IT CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION WHICH MUST NOT BE DUPLICATED, USED OR DISCLOSED OTHER THAN AS EXPRESSLY AUTHORIZED BY STATES MANUFACTURING LOCATED IN MINNEAPOLIS MINNESOTA.		
	SERIAL NUMBER	DRAWING TYPE	SHEET																										
	SE18-73435	SD	1																										
	ORDER NUMBER	SCALE																											
	073435-1-1	-																											
	THIS DOCUMENT IS THE PROPERTY OF STATES MANUFACTURING. IT CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION WHICH MUST NOT BE DUPLICATED, USED OR DISCLOSED OTHER THAN AS EXPRESSLY AUTHORIZED BY STATES MANUFACTURING LOCATED IN MINNEAPOLIS MINNESOTA.																												
	1	12/1/9/18	TB	AS BUILT		PHASE	3PH	ENCL. TYPE	NEMA 1	11/08/18	TB	WAS			ENGINEER														
						WIRE	4W	ENCL. MATERIAL	12 GA CRS						-														
						FREQUENCY	60Hz	ENCL. PAINT	ONAN GREEN						CONTRACTOR														
						S.C. RATING	65KA	CONTROL WIRE TYPE	SIS						-														
				PHASE BUS	2000A	PT/CT WIRE SIZE	NA				DISTRIBUTOR																		
				NEUTRAL BUS	2000A	CONTROL WIRE SIZE	NA				DIEGLER POWER SYSTEMS																		
				BUS MATERIAL	SILVER WASHED COPPER	WIRE LABELS	NA																						
				GND. BUS	1/4 X 2" COPPER	EXT. LABELS	WHT/BLK LETTERS																						

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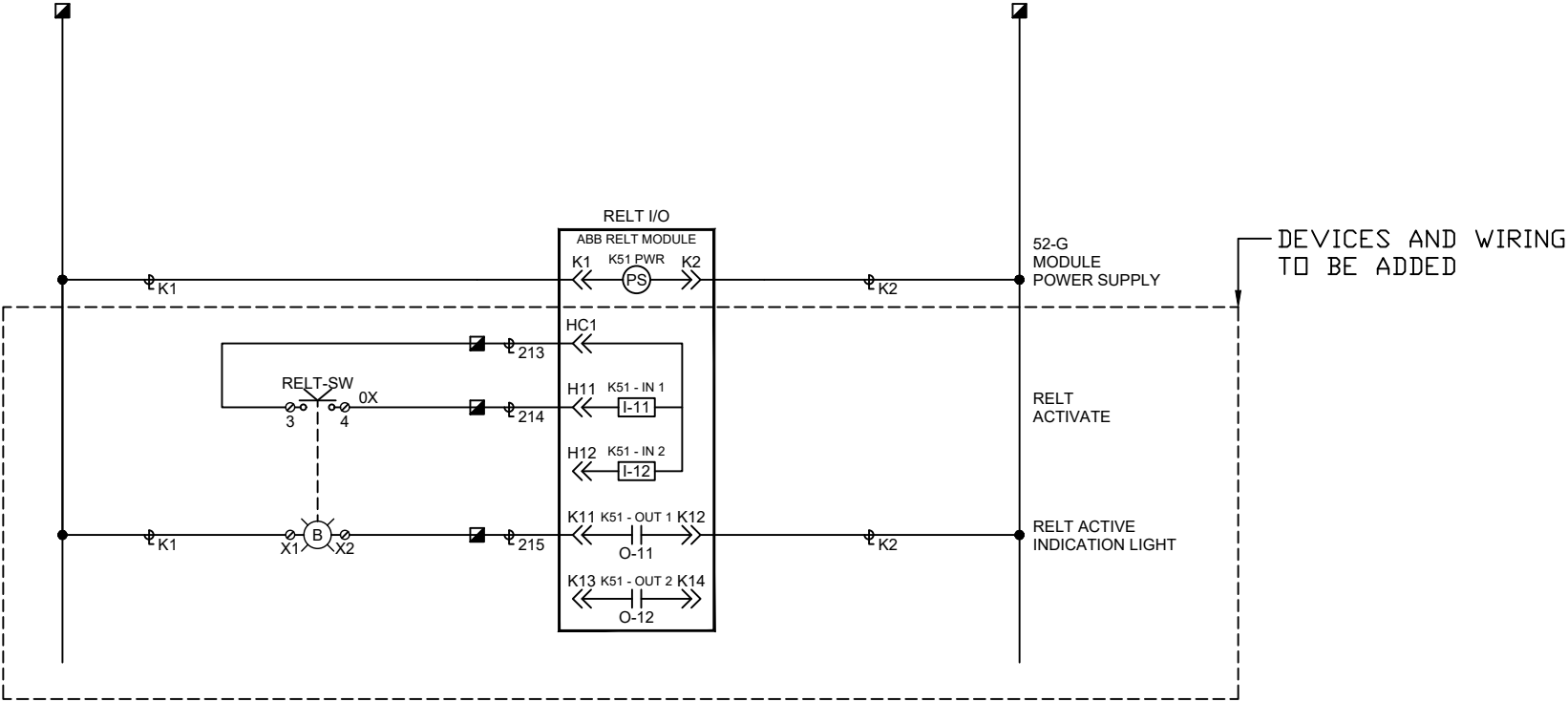
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MISCELLANEOUS NOTES
CUSTOMER RESPONSIBLE TO INSURE ALL SOURCES ARE A-B-C CLOCKWISE ROTATION.

REV.	DATE	BY	REVISION DESCRIPTION
1	04/02/19	WAS	RELT ADDITION

CONSTRUCTION NOTES	VOLTAGE	480V	CERTIFICATION	UL 891
	PHASE	3PH	ENCL. TYPE	NEMA 1
	WIRE	4W	ENCL. MATERIAL	12 GA CRS
	FREQUENCY	60HZ	ENCL. PAINT	ONAN GREEN
	S.C. RATING	65KA	CONTROL WIRE TYPE	SIS
	PHASE BUS	2000A	PT/CT WIRE SIZE	NA
	NEUTRAL BUS	2000A	CONTROL WIRE SIZE	NA
	BUS MATERIAL	SILVER WASHED COPPER	WIRE LABELS	NA
GND. BUS	1/4 X 2" COPPER	EXT. LABELS	WHT/BLK LETTERS	

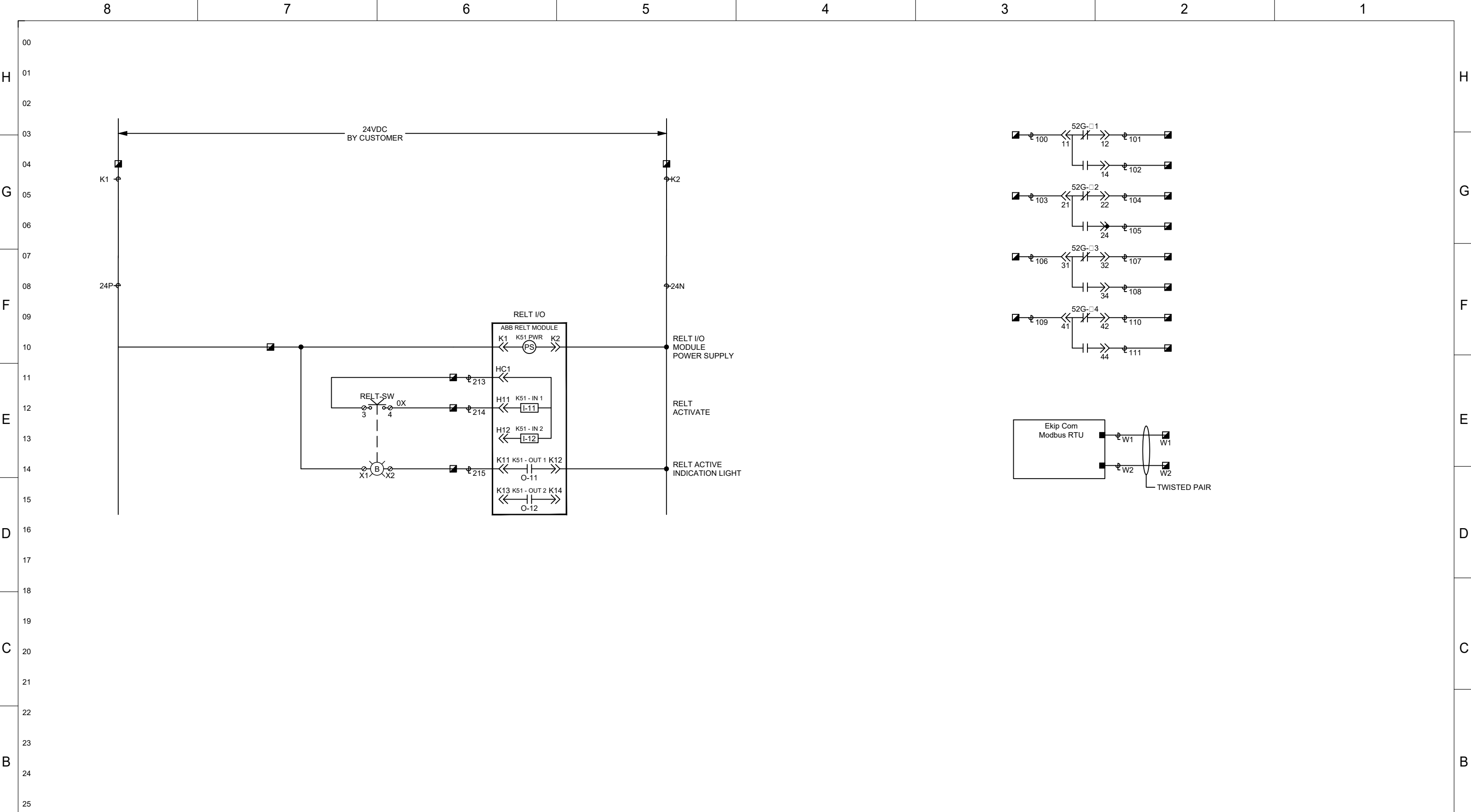
DRAWN DATE	DRAWN BY	CHECK BY
11/08/18	TB	WAS
ENGINEER		
CONTRACTOR		
DISTRIBUTOR		
IEGLER POWER SYSTEMS		

JOB NAME	CUMMINS POWER GEN. BREAKER TERMINATION CABINET MNK ARIES
SHEET TITLE	CONNECTION CABINET LVS-1-480-2000-CU-0-1 RELT I/O MODULE



SERIAL NUMBER	DRAWING TYPE	SHEET
SE18-73435	SD	2
ORDER NUMBER	SCALE	
073435-1-1	-	

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MS0000N0US000S CUSTOMER RESPONSIBLE TO INSURE ALL SOURCES ARE A-B-C CLOCKWISE ROTATION.	R0000	D000	WAS	RELTSND0SR000N	INSRU000N000S	G000	480V	R0000000N	UL 891	DR00ND000		DR00N000	00000000	000N000 CUMMINS POWER GEN. BREAKER TERMINATION CABINET MNK ARIES	S000000000 CONNECTION CABINET LVS-1-480-2000-CU-0-1 BREAKER WIRING COMPLETE	 S00000NUM000R SE18-73435 DR000NG0000 SD S0000 03 THIS DOCUMENT IS THE PROPERTY OF STATES MANUFACTURING IT CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION WHICH MUST NOT BE DUPLICATED, USED OR DISCLOSED OTHER THAN AS EXPRESSLY AUTHORIZED BY STATES MANUFACTURING LOCATED IN MINNEAPOLIS MINNESOTA.
	1	04/02/19		RELT ADDITION		S000	3PH	0N00000000	NEMA 1	01/06/20	TB	WAS				
						R000	4W	0N000M00R000	12 GA CRS	0NGN000R						
						R000UN000	60H000	0N000000N000	ONAN GREEN	-						
						S000R000NG	65KA	000N000000R000000	SIS	000N000000R						
						0000S000US	2000A	0000000R000S000	NA	-						
						N000R0000US	2000A	000N00000R000S000	NA	DSR00U000R						
						0USM000R000	SILVER WASHED COPPER	0R0000000S	NA	0EGLER POWER SYSTEMS						
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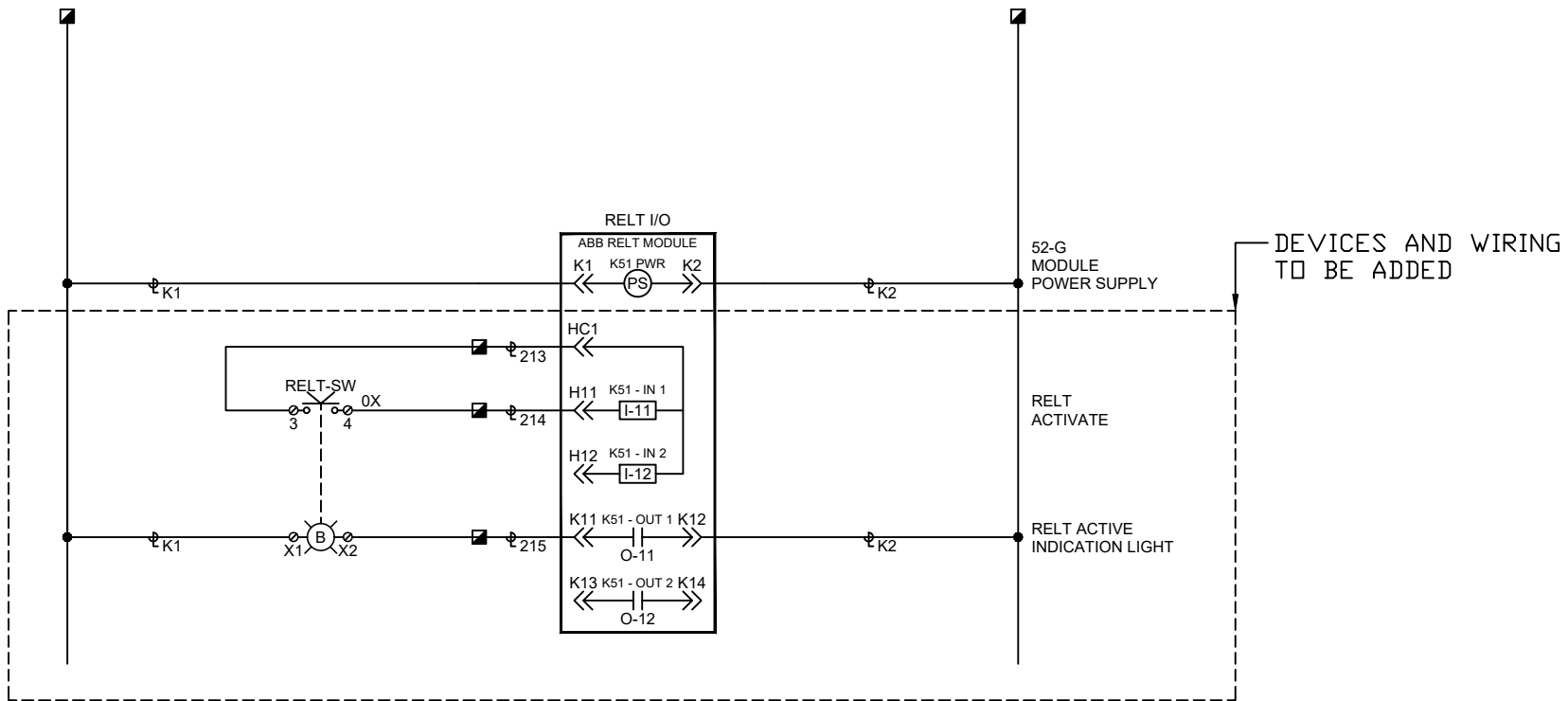
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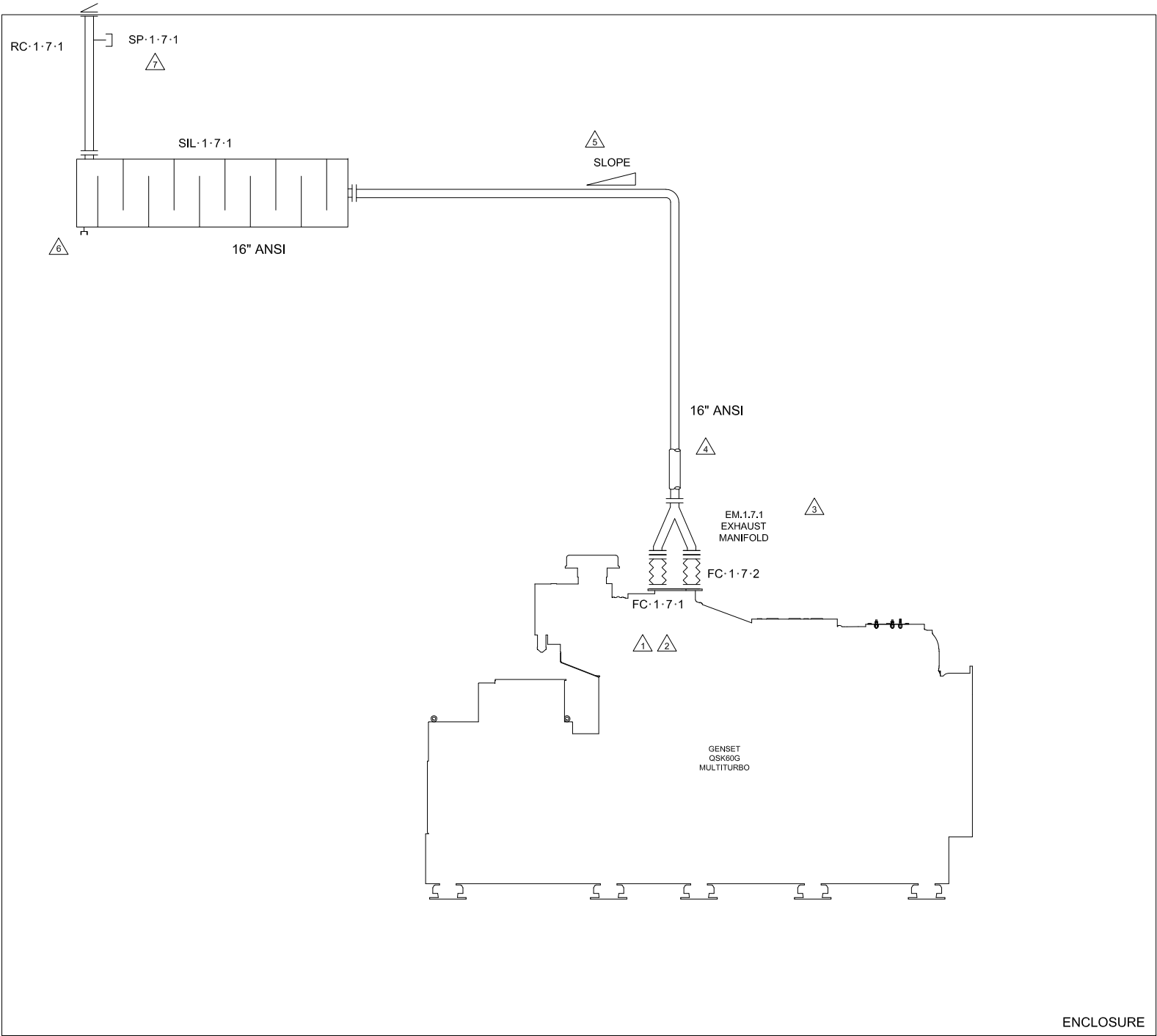
MISCELLANEOUS NOTES		REV. #	DATE	BY	REVISION DESCRIPTION	CONSTRUCTION NOTES	VOLTAGE	480V	CERTIFICATION	UL 891	<u>DRAWN DATE</u>	<u>DRAWN BY</u>	<u>CHECK BY</u>	JOB NAME		
CUSTOMER RESPONSIBLE TO INSURE ALL SOURCES ARE A-B-C CLOCKWISE ROTATION.		1	04/02/19	WAS	RELT ADDITION		PHASE	3PH	ENCL. TYPE	NEMA 1	11/08/18	TB	WAS	CUMMINS POWER GEN.		
							WIRE	4W	ENCL. MATERIAL	12 GA CRS	ENGINEER			BREAKER TERMINATION CABINET		
							FREQUENCY	60HZ	ENCL. PAINT	ONAN GREEN	-			MNK ARIES		
							S.C. RATING	65KA	CONTROL WIRE TYPE	SIS	CONTRACTOR			SHEET TITLE		
							PHASE BUS	2000A	PT/CT WIRE SIZE	NA	-					
							NEUTRAL BUS	2000A	CONTROL WIRE SIZE	NA	DISTRIBUTOR					
							BUS MATERIAL	SILVER WASHED COPPER	WIRE LABELS	NA	ZIEGLER POWER SYSTEMS					
							GND. BUS	1/4 X 2" COPPER	EXT. LABELS	WHT/BLK LETTERS						
SERIAL NUMBER															DRAWING TYPE	SHEET
SE18-73435															SD	2
ORDER NUMBER															SCALE	
073435-1-1															-	
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Chapter 4: Major Balance of Plant Components

4.4. Exhaust System

- INSTALLATION NOTES:**
- GENERAL NOTES:**
- ITEMS NOT LISTED IN THE BDM MIGHT NOT BE PART OF CUMMINS SCOPE OF SUPPLY.
 - ALL PIPING, INSULATION AND ADEQUATE SUPPORTS BY CONTRACTOR.
 - VERIFICATION OF EXHAUST FLOW RESTRICTIONS (BACK-PRESSURE) AND COMPLIANCE TO DATA SHEET LIMITS BY CONTRACTOR.
- DRAWING NOTES:**
- CLAMPS AND HARDWARE ARE INCLUDED FOR ASSEMBLY OF FACTORY PROVIDED EXHAUST BELLOWS, BY CONTRACTOR.
 - CONTRACTOR TO MOUNT EXHAUST BELLOWS (SHIPPED LOOSE). NO EXTERNAL WEIGHT SHOULD BE APPLIED ON BELLOWS. BELLOWS MUST BE VERTICAL, WITHOUT BENDING OR EXTERNAL STRESS APPLIED.
 - EXHAUST MANIFOLD SHOULD BE SUPPORTED AWAY FROM THE ENGINE. ALIGN MANIFOLD FLANGES WITH ENGINE EXHAUST BELLOWS TO AVOID BENDS AND TWISTS. MANIFOLD SHALL BE INSULATED.
 - SUPPORT PIPING TO AVOID EXTERNAL WEIGHT ON MANIFOLD AND BELLOWS. PROVIDE ADEQUATE EXPANSION JOINTS AS REQUIRED DEPENDING ON LENGTH OF VERTICAL PIPE RUN - ENGINE BELLOWS ARE NOT DEISNG TO ABSORB EXPANSION OF EXTERNAL PIPING. PIPING SHOULD BE INSULATED WHENEVER INSIDE THE GENERATOR ROOM.
 - SLOPE EXHAUST PIPING AWAY FROM THE ENGINE TO AVOID CONDENSATION TO RUN BACK INTO THE TURBOCHARGERS.
 - ENSURE SILENCER HAS A DRAIN PORT WITH PLUG.
 - TWO (2) 90DEG 3" EXHAUST PORT PER EPA METHOD 1. PORTS TO BE INSTALLED AT ANY LEVEL MINIMUM 2 PIPE DIA ABOVE PIPE BEND/SILENCER OUTLET AND MINIMUM 0.5 PIPE DIA BELOW STACK TOP (BY OTHERS).



EXHAUST P&ID			SHEET 6 OF 10		PROJECT: UNITED RENTALS TRAILER PACKAGE STANDBY/PEAKING		Cummins Inc.		
DWN SB CKD NP APVD IC					C1400 N6C		CAD SYSTEM Autodesk® AutoCAD® Electrical	SIZE: A3	
	0	SUBMITTAL	30MAR21						
REV		DESCRIPTION	DATE						