APPENDIX B. EQUIPMENT MANUFACTURER DATA SHEETS

Wartsila Steady State Emissions
Wartsila Startup and Shutdown Data
Siemens Simple Cycle Emissions Data Sheet
Siemens Simple Cycle Emissions Estimates
Siemens Simple Cycle Startup and Shutdown Data
Siemens Combined Cycle Steady State Emissions Estimates
Siemens Combined Cycle Startup and Shutdown Estimates
Emergency Generator Specifications
Space Heater Specifications

Doc. Name	NPPD Emission Data Sheet 18V50DF 12/23/2024		
Doc. ID	DESA00027455	**Revision**	c
Doc. Type	Data Sheet	**Pages**	1 (5)
Author	Lövholm, Markus - Energy Business	**Status**	Approved
Opportunity	NPPD_Nebraska, USA_217MW_EEQ (OP879165) Lövholm, Markus 23 Dec. 24		

This document provides flue gas emissions, i.e. maximum average values for emissions measured over a period of minimum 60 minutes. The emissions are based on the site conditions, gas composition and measurement methods specified in this document.

Engine: Wärtsilä® 18V50DF D, 514 rpm (constant speed), CR 12

Site conditions:

Altitude above sea level	1390 ft
Ambient temperature	-40/+107 °F
Wet bulb temperature, design maximum	74.7 °F

Gas composition:

The emissions are valid for following gas composition. It is understood that variations in the gas composition inside this specification will occur and are permitted; however sudden extreme changes in gas temperature, pressure or composition are not allowed.

Methane number:		85		
Methane, min	CH_4	93.28	vol-%	
Ethane, max	C_2H_6	3.57	vol-%	
Propane, max	C_3H_8	0.28	vol-%	Note 1)
i-Butane, max	C_4H_{10}	0.01	vol-%	Note 1)
n-Butane, max	C_4H_{10}	0.03	vol-%	Note 1)
i-Pentane, max	C_5H_{12}	0.01	vol-%	Note 1)
n-Pentane, max	C_5H_{12}	0.01	vol-%	Note 1)
Hexane, max	C_6H_{14}	0.01	vol-%	Note 1)
Heptane and higher hydro carbons, max		0.00	vol-%	
Nitrogen	N_2	2.57	vol-%	
Carbon dioxide	CO_2	0.23	vol-%	
Total sulphur, max S		5	mg/kg	

Other gas parameters according to Wärtsilä's specification. Aromatic hydrocarbons, silicon based compounds or impurities resulting from the operating and maintenance of the gas delivery systems are not allowed.

Note 1) VOC emissions in gas operation depend on the composition of the pipeline natural gas. This document includes a table with corrected VOC emissions after the emission control system for natural gas with concentrations of C_3 to C_6 hydrocarbons in excess of the values specified above.

Pilot and back-up fuel composition:

Ultra-low sulphur diesel with max sulphur content of 15 ppm and max 0.010 wt % ash

Lubricating oil quality according to Wärtsilä specifications for gas engines

SCR reducing agent according to Wärtsilä's specification DBAC197648 (rev d)

Catalyst poisons according to Wärtsilä´s specification DETA00003599 (rev -)

Note! *SCR cannot operate during turbo washing procedures*

Flue gas emissions after emission control system[2] on gas operation at steady load:

Engine load	%	100	75	50	40
NO_X as NO_2	lb/h	3.2	2.5	2.6	2.2
	ppm-v at 15% O_2, dry	6	6	9	9
CO	lb/h	4.9	4.0	2.7	2.3
	ppm-v at 15% O_2, dry	15	15	15	15
VOC (NMNEHC) as CH_4 Note 1)	lb/h	4.9	3.9	3.9	4.2
	ppm-v at 15% O_2, dry	26	26	37	50
CH_2O	ppm-v at 15% O_2, dry	0.7	0.9	1.3	1.6
	lb/h	0.25	0.25	0.25	0.25
NH_3	ppm-v at 15% O_2, dry	10	10	10	10
	lb/h	2.0	1.6	1.1	0.9
PM_{10} (total)*	lb/h	3.9	3.2	3.0	2.8

**$PM_{2.5}$ is a smaller subset of PM_{10}, so its value should be lower. However, for conservative reasons, $PM_{2.5}$ is assumed to be at the same level as PM_{10}.*

[2] Minimum allowed engine load equipped with emission control system is 40%

Correction based upon the influence of gas composition on VOC emissions:

The VOC concentration of the flue gas in the stack is dependent on the composition of the natural gas.If the concentration = sum of propane + butane + pentane + hexane (C_3H_8 + C_4H_{10} + C_5H_{12} + C_6H_{14}) in the pipeline natural gas deviate the values specified in paragraph *"Gas composition"* in this document the VOC emissions shall be corrected according to the table below. In the table the sum of propane + butane + pentane + hexane is denoted C_{GasVOC}.

	VOC guarantee * factor
Concentration of VOC components in feed natural gas	Factor for VOC correction
0 vol-% ≤ C_{GasVOC} < 0.50 vol-%	1
0.50 vol-% ≤ C_{GasVOC} < 1.00 vol-%	1.75
1.00 vol-% ≤ C_{GasVOC} < 1.50 vol-%	2.5

Flue gas emissions after emission control system[3] on back-up fuel operation at steady load:

Engine load	%	100	75	50	40
NO_X as NO_2	lb/h	20.1	15.5	12.0	10.1
	ppm-v at 15% O_2, dry	35	35	40	40
CO	lb/h	7.0	5.3	3.7	3.1
	ppm-v at 15% O_2, dry	20	20	20	20
VOC (NMNEHC) as CH_4 Note 1)	lb/h	8.1	6.1	4.2	3.5
	ppm-v at 15% O_2, dry	40	40	40	40
NH_3	ppm-v at 15% O_2, dry	10	10	10	10
	lb/h	2.2	1.6	1.1	1.0
PM_{10} (total)*	lb/h	5.6	4.4	4.4	4.0

**See note on PM2.5 below the other table.*

Time to reach compliance

The time required to reach compliance with the emission levels specified in this document will depend on operating conditions and on the temperature of the catalyst system at start. Compliance with emission data in this document will for a normal start sequence and under normal conditions be reached within 10 to 30 minutes from start signal when starting to a high load.

[3] Minimum allowed engine load equipped with emission control system is 40%



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Measurement methods

Emission data provided in this document is based upon the emission measurement methods listed below.

Emission data assumes that individual compounds identified above the sensitivity limit, but at concentrations below the lower limit of detection are reported as maximum one-half of the daily lower-limit of calibration. Measurements shall be performed so that minimum feasible detection limits are achieved if this is required for determining compliance with emission guarantees.

The flue gas stack emission measurements will be performed at steady operating condition of the engine. Prior to the start of the flue gas emission (stack) measurements, the engine shall have reached steady state operating conditions and the flue gas temperature measured after the emission control system shall be allowed to reach normal operating temperature.

Sufficiently long measurement sampling periods and number of samples shall be taken in order to get statistically representative results. To ensure accurate particulate matter (PM10) emission results of 3 samples are to be collected with a minimum sampling time of 1 hour per sample. Based on the judgement of the measurement consultant, the results of individual samples with abnormally high deviation shall be excluded.

Oxygen (O_2): EPA Method 3A: Determination of Oxygen and Carbon Dioxide Emissions from Stationary Sources.

Nitrogen oxides (NOx): EPA Method 7E: Determination of nitrogen oxides from stationary sources.

Carbon monoxide (CO): EPA Method 10: Determination of carbon monoxide emissions from stationary sources.

Volatile organic compounds (VOC defined as Non Methane Non Ethane Hydrocarbons) on gas operation: EPA Method 18: Measurement of gaseous organic compound emissions by gas chromatography. VOC is calculated as the sum of relevant components, which for a gas engine equipped with a high efficiency catalyst are considered to be: propane, n-butane, n-pentane and n-hexane (only if existing in NG fuel).

Volatile organic compounds (VOC defined as Non Methane Non Ethane Hydrocarbons) on back-up fuel operation: EPA Method 25A: Determination of total gaseous organic concenration using a flame ionization analyzer.

PM10 (total): Total PM_{10} is defined as the sum of the particulate matter measured with a combination of EPA 5 and 202 methods

EPA Method 5 (front half): Determination of particulate emissions from stationary sources

EPA Method 202 Determination of condensable particulate matter from stationary sources.

Ammonia (NH_3): Bay Area Air Quality Management District (BAAQMD) test Method ST-1B: Ammonia integrated sampling.



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Formaldehyde (HCHO): EPA Method 323: Measurement of formaldehyde emissions from natural gas-fired stationary sources-acetyl acetone derivatization method. In case formaldehyde guarantee is exceeded or if significant interference from acetaldehyde is suspected CARB Method 430: Determination of Formaldehyde and Acetaldehyde in Emissions from stationary sources shall be used.

Exhaust gas flow: EPA Method 19: Determination of sulphur dioxide removal efficiency and particulate matter, sulphur dioxide and nitrogen oxide emission rates. This method is used to determine mass flow (lb/hr) rates in combination with measured concentrations levels.

Based upon mutual written consent, evaluation of emission levels can be made using alternative methods.

Doc. Name	Expected startup and unloading emissions 18V50DF		
Doc. ID	DETA00003581	**Revision**	a
Doc. Type	Data Sheet	**Pages**	1 (2)
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Expected start up and unloading emissions after catalyst system

This document provides engineering estimates on the start-up and unloading emissions for one Wärtsilä® 18V50DF-C/D engine equipped with an efficient emission control system. The system includes a selective catalytic reduction system and an oxidation catalyst. The figures are best estimates only and shall not be considered as guarantee data.

The fast start-up of the engine results in varying exhaust gas flow, nonstable temperature, high and low range emission and oxygen levels which make accurate measurement and prediction of emissions very challenging. The flue gas emission estimates herein are based on emission measurement for steady conditions at different loads together with limited measurements performed during start-up. A standard catalyst volume loading has been selected and more accurate start up values can be estimated when final project specific catalyst design is known. The emission control performance in a start up situation is based on supplier estimates and laboratory data. The data assumes that the engines will reach full load within 5 minutes and continue operating at full engine load. The unloading time is assumed to be 60 seconds.

Furthermore, to calculate the emissions the following assumptions have been made:

Ambient conditions: 25 °C (77 °F), relative humidity:30%

Insulation: 100mm for exhaust gas duct up until reactor (and after reactor to silencer), reactor 200mm

Layout: exhaust gas ducting is assumed to be normal without extra ducting and silencer before mixing duct

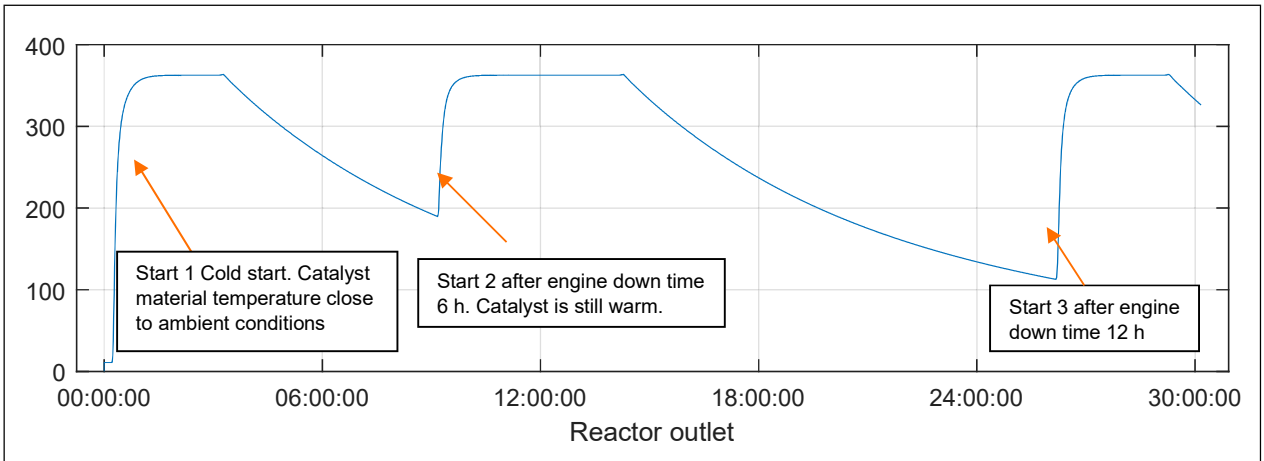


Figure 1. Simulated temperature profile after the catalyst reactor. Assumed peak hour operating profile, 3 hours in the morning and 3 hours in the evening.

The estimated cumulative start up flue gas emissions with optimized reagent injection are expressed as lb per a start period (30 min) of one (1) Wärtsilä® 18V50DF-C/D engine are given for 3 different conditions (see figure 1 above) in the tables 1 and 2 below. The warm startup numbers are given for a restart after 6 and 12 h engine down time. If the engine is expected to have shorter stops the expected emissions will be even lower.

A cold catalyst start is when the temperature of the catalyst material inside the reactor is close to ambient temperature. Cold catalyst starts are expected after overhaul periods or when the engine has not been operated during the last 2-3 days.

The emission control system will reach its full abatement efficiency within 10-30 minutes from the start.

Table 1. Expected flue gas emissions during start up to gas mode:

18V50DF-C/D					
Typical standby time before engine start	unit	**NOx (as NO2)**	**CO**	**VOC** (as CH4)**	**PM 10**
> 2 days	lb / 30 min	20	19	3	4
6 hours	lb / 30 min	9	11	1.7	4
12 hours	lb / 30 min	14	16	1.9	4

***The VOC (volatile organic compounds) emissions depend on the composition of the fuel gas. The VOC emissions in table 1 above are based on max 0.5 vol-% VOC components in the feed fuel gas and are NOT including CH2O.*

Table 2. Expected flue gas emissions during start up to diesel mode:

18V50DF-C/D					
Typical standby time before engine start	unit	**NOx (as NO2)**	**CO**	**VOC (as CH4)**	**PM 10**
> 2 days	lb / 30 min	105	8	4	6
6 hours	lb / 30 min	61	6	3	6
12 hours	lb / 30 min	77	7	3.5	6

Table 3. Expected unloading emissions:

Components	Unit	18V50DF-C/D on gas	18V50DF-C/D on diesel
NOx (as NO2)	lb/min	0.06	0.4
CO	lb/min	0.09	0.12
VOC (as CH4)	lb/min	0.09	0.15

Stack emission measurements during start up sequences or heavy transient loads are challenging and the repeatability of start up emission measurement on site is low. The analyzer response time for the gaseous emissions needs special attention. Moreover, the particulate emissions will stay on a theoretical level since the particulates can not be determinate by an isokinetic sampling reference method.

EMISSIONS DATA SHEET

Three 1X0 SGT6-5000F with DSCR

REFERENCE CONDITIONS		
Fuel Type	Natural Gas	ULSD
Ambient Temperature (°F)	-40 to 107	-40 to 107
Gas Turbine Load	100% to 108 MW*	100% to 50%
Injection – NOx Control	None	Water
NO_X, ppmvd @15% O_2	2.5	5
NH_3 Slip, ppmvd @15% O_2	5	5
CO, ppmvd @15% O_2	2	2
VOC, ppmvd @15% O_2	1	1
Total PM, lbs/hr (Front and Back Half)	11	30

* Minimum load on gas fuel is 111 MW from -40°F to -20°F

Test Requirements

Emissions are based on performing testing at the DSCR exhaust stack in accordance with the following Test Methods for each fuel:

NO_X - USEPA Method 7E

– Demonstration of the NO_X guarantee is based on the average of three (3) test runs at each test point.

CO - USEPA Method 10

– Demonstration of the CO guarantee is based on the average of three (3) test runs at each test point.

VOC – USEPA Methods 25A and 18

– VOC are unburned hydrocarbons (UHC) excluding methane and ethane and are expressed in terms of methane. Demonstration of the VOC guarantee is based on the average of three (3) test runs at each test point, per USEPA Method 25A, utilizing a THC analyzer calibrated using methane (CH4) and a not-to-exceed span of 0-10 ppmvw. If test results per USEPA Method 25A indicate UHC values greater than the VOC guarantees, at least one (1) sample per test run will be collected and analyzed per USEPA Method 18 and the methane and ethane portions subtracted from the Method 25A results.

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Particulate Matter – USEPA Methods 5 (Front Half) and 202 (Back Half)

- Demonstration of the Particulate Matter guarantee is based on the average of three (3) test runs at the maximum GT load in the guaranteed load range. The gas turbine shall be operating at steady state conditions at the initial test load for at least two (2) hours prior to commencement of testing. Each test run shall be of sufficient length to collect a minimum sample volume of 120 cubic feet (~ 4 hours) for operation on gas and 100 cubic feet (~ 3 hours) for operation on ULSD (Ultra Low Sulfur Diesel). A one-piece nozzle and probe assembly lined with borosilicate or quartz glass shall be utilized. Any "back half" (CPM) filters proposed for use in Method 202 shall be subjected to hexane and water rinses and blank analyses prior to use to confirm their suitability, as it has been found that some filters can partially decompose or release material during hexane and/or water rinses. Sample recovery shall only utilize acetone rinsing and NOT a nylon or fluoropolymer brush, as the static charges from the brush could add or subtract particles from the sample. The actual fuel flow rate during particulate testing shall be utilized to determine the exhaust gas flow rate per USEPA Method 19 when converting from units of concentration to the emission rate.

Guarantee Conditions

- Emissions guarantees are on an individual gas turbine basis and do not include ambient air contributions.
- Emission guarantees apply during steady state operation and while ramping the gas turbine within the guaranteed load range at up to 13.4 MW/min on gas fuel and 10 MW/min on fuel oil (based on CEMS data for a 1-hour average).
- If the air permit limits are met and the customer is not prevented from operating, then Siemens Energy emissions guarantees shall not delay substantial completion.
- The following natural gas fuel sulfur limit must not be exceeded: 0.5 grains/100 SCF.
- The following ULSD (Ultra Low Sulfur Diesel) sulfur limit must not be exceeded: 15 ppm.
- O_2 measurements for purposes of correcting emissions concentration must be taken in accordance with USEPA Method 3A.
- NH_3 slip is based on maintaining stack NO_X emissions at no less than 0.2 ppm less than stack NO_X guarantee.
- All emissions testing, and/or emissions monitoring during Thermal Performance testing, shall be the customer's responsibility.
- Should the customer choose to supply the CEMS, Siemens Energy shall have the right to review the customer's CEMS specification, vendor proposals, drawings, documents and certification and reports. In addition, Siemens Energy shall have the right to witness testing and hire a third party stack emissions testing firm to independently corroborate and/or validate the CEMS measurements.

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- CEMS, including the GT Exhaust (SCR Inlet) NO_X/O2 analyzer(s), shall comply with the appropriate sections of 40CFR60 and 40CFR75 (as well as any air permit, State and/or local requirements);
- GT Exhaust (SCR Inlet) NO_X/O2 analyzer shall be placed in a stand-alone climate-controlled cabinet in as close a proximity to the probe port as practical (response time minimized and < 30 seconds);
- CEMS analog signals, including but not limited to the following, shall be provided to the gas turbine control system in the Siemens Energy scope of supply for use in controlling the ammonia injection flow control valve: GT Exhaust (SCR Inlet) NO_X, ppmvd @ 15% O2; Stack Exit NO_X, ppmvd @ 15% O2; and ammonia injection flow rate, lbm/hr.

- Fuels must comply with the Siemens Energy Fuel Specifications.

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US5108 NPPD Princeton Road

Estimated SGT6-5000F Gas Turbine Performance
Gas Turbine in Simple Cycle / Ultra Low NOx Combustor
SGen6-1000A (113/55) / 0.85 Power Factor

Estimated Performance
December 16, 2025

SITE CONDITIONS	CASE 1	CASE 2	CASE 3	CASE 4	CASE 5	CASE 6	CASE 7	CASE 8	CASE 9	CASE 10	CASE 11	CASE 12	CASE 13	CASE 14	CASE 15	CASE 16	CASE 17	CASE 18	CASE 19	CASE 20	CASE 21	CASE 22	CASE 23	CASE 24	CASE 25	CASE 26	CASE 27	CASE 28	CASE 29	CASE 30	CASE 31	CASE 32	CASE 33	CASE 34	CASE 35	CASE 36	CASE 37	CASE 38	CASE 39	CASE 40	CASE 41	CASE 42
FUEL TYPE	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Fuel Oil	Fuel Oil	Fuel Oil	Fuel Oil	Fuel Oil	Fuel Oil	Fuel Oil	Fuel Oil	Fuel Oil	Fuel Oil	Fuel Oil	Fuel Oil	Fuel Oil	Fuel Oil	Fuel Oil	Fuel Oil	Fuel Oil	Fuel Oil	Fuel Oil	Fuel Oil	Fuel Oil	Fuel Oil
LOAD LEVEL	100	75	MEL/40.6	100	75	MEL/40.6	100	75	MEL/40.6	100	100	75	MEL/41.7	100	100	75	MEL/48.3	100	100	75	MEL/51.8	100	75	MEL/50.0	100	75	MEL/50.0	100	75	MEL/50.0	100	100	75	MEL/50.0	100	100	75	MEL/50.0	100	100	75	MEL/50.0	100	100	75	MEL/50.0
NET FUEL HEATING VALUE, Btu/lb$_m$ (LHV)	20,389	20,389	20,389	20,389	20,389	20,389	20,389	20,389	20,389	20,389	20,389	20,389	20,389	20,389	20,389	20,389	20,389	20,389	20,389	20,389	20,389	18,300	18,300	18,300	18,300	18,300	18,300	18,300	18,300	18,300	18,300	18,300	18,300	18,300	18,300	18,300	18,300	18,300	18,300	18,300	18,300	18,300
GROSS FUEL HEATING VALUE, Btu/lb$_m$ (HHV)	22,619	22,619	22,619	22,619	22,619	22,619	22,619	22,619	22,619	22,619	22,619	22,619	22,619	22,619	22,619	22,619	22,619	22,619	22,619	22,619	22,619	19,567	19,567	19,567	19,567	19,567	19,567	19,567	19,567	19,567	19,567	19,567	19,567	19,567	19,567	19,567	19,567	19,567	19,567	19,567	19,567	19,567
AMBIENT DRY BULB TEMPERATURE, °F	-13.9	-13.9	-13.9	-1.9	-1.9	-1.9	6.5	6.5	6.5	59.0	59.0	59.0	59.0	95.2	95.2	95.2	95.2	106.8	106.8	106.8	106.8	-13.9	-13.9	-13.9	-1.9	-1.9	-1.9	6.5	6.5	6.5	59.0	59.0	59.0	59.0	95.2	95.2	95.2	95.2	106.8	106.8	106.8	106.8
AMBIENT WET BULB TEMPERATURE, °F	-14.0	-14.0	-14.0	-2.1	-2.1	-2.1	6.3	6.3	6.3	51.2	51.2	51.2	51.2	76.1	76.1	76.1	76.1	77.7	77.7	77.7	77.7	-14.0	-14.0	-14.0	-2.1	-2.1	-2.1	6.3	6.3	6.3	51.2	51.2	51.2	51.2	76.1	76.1	76.1	76.1	77.7	77.7	77.7	77.7
AMBIENT RELATIVE HUMIDITY, %	95.0	95.0	95.0	95.0	95.0	95.0	96.0	96.0	96.0	60.0	60.0	60.0	60.0	43.2	43.2	43.2	43.2	28.1	28.1	28.1	28.1	95.0	95.0	95.0	95.0	95.0	95.0	96.0	96.0	96.0	60.0	60.0	60.0	60.0	43.2	43.2	43.2	43.2	28.1	28.1	28.1	28.1
AMBIENT PRESSURE, psia	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973	13,973
COMPRESSOR INLET TEMPERATURE, °F	-13.9	-13.9	-13.9	-1.9	-1.9	-1.9	6.5	6.5	6.5	51.8	59.0	59.0	59.0	77.8	95.2	95.2	95.2	80.3	106.8	106.8	106.8	-13.9	-13.9	-13.9	-1.9	-1.9	-1.9	6.5	6.5	6.5	51.8	59.0	59.0	59.0	77.8	95.2	95.2	95.2	80.3	106.8	106.8	106.8
INLET PRESSURE LOSS, in H_2O (Total)	4.1	2.9	1.7	4.2	2.9	1.7	4.3	2.9	1.7	4.8	4.8	4.8	3.0	1.8	4.7	4.2	2.9	2.0	4.7	3.9	2.8	2.0	3.9	2.9	2.2	4.0	3.0	2.2	4.1	3.0	2.3	4.9	4.9	3.2	2.3	4.7	4.2	2.9	2.1	4.7	3.9	2.8
EXHAUST PRESSURE LOSS, in H_2O (Total)	15.3	10.8	6.5	15.3	10.7	6.5	15.3	10.7	6.4	15.7	15.7	10.3	6.3	14.6	13.2	9.2	6.4	14.4	12.2	8.8	6.5	14.4	10.7	8.1	14.4	10.6	8.0	14.5	10.6	8.0	15.6	15.5	10.4	7.5	14.2	12.9	9.1	6.6	14.0	12.0	8.6	6.3
EXHAUST PRESSURE LOSS, in H_2O (Static)	11.7	8.3	5.0	11.7	8.2	4.9	11.7	8.2	4.9	12.0	12.0	7.9	4.8	11.1	10.0	7.0	4.8	10.9	9.3	6.7	4.9	11.0	8.2	6.2	11.0	8.1	6.1	11.1	8.1	6.1	11.9	11.9	7.9	5.8	10.9	9.9	7.0	5.1	10.7	9.1	6.6	4.8
INJECTION FLUID	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	H2O	H2O	H2O	H2O	H2O	H2O	H2O	H2O	H2O	H2O	H2O	H2O	H2O	H2O	H2O	H2O	H2O	H2O	H2O	H2O	H2O	H2O
NO_x WATER MASS FLOW, lb$_m$/hr	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	54,874	27,891	10,158	55,425	28,232	10,328	56,147	28,653	10,476	63,494	63,312	32,490	11,193	72,507	73,592	38,283	13,164	73,571	71,223	37,217	12,815
INJECTION RATIO	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.47	0.29	0.13	0.48	0.30	0.14	0.48	0.30	0.14	0.55	0.55	0.35	0.16	0.65	0.71	0.45	0.20	0.67	0.72	0.46	0.20
INLET AIR COND. (HEATER/COOLER)	No	No	No	No	No	No	No	No	No	Cooler	No	No	No	Cooler	No	No	No	Cooler	No	No	No	No	No	No	No	No	No	No	No	Cooler	No	No	No	Cooler	No	No	No	Cooler	No	No	No	No
EVAPORATIVE COOLER STATUS / EFFECT	---	---	---	---	---	---	---	---	---	90.0	---	---	---	90.0	---	---	---	90.0	---	---	---	---	---	---	---	---	---	---	---	---	90.0	---	---	---	90.0	---	---	---	90.0	---	---	---
EVAPORATIVE COOLER REQ WATER FLOW, lb$_m$/hr	---	---	---	---	---	---	---	---	---	7,074	---	---	---	16,404	---	---	---	25,279	---	---	---	---	---	---	---	---	---	---	---	---	7,161	---	---	---	16,408	---	---	---	25,286	---	---	---
GAS TURBINE PERFORMANCE																																										
POWER OUTPUT, kW	265,382	199,036	108,000	265,383	199,037	108,000	265,383	199,037	108,000	260,339	257,453	193,087	108,000	242,616	221,358	166,018	108,000	239,905	205,816	154,359	108,000	240,559	180,420	125,611	240,556	180,417	125,478	240,558	180,419	125,146	239,073	234,962	176,222	117,481	220,928	201,562	151,171	100,781	218,512	187,000	140,250	93,500
EFFICIENCY, % (LHV)	40.02	37.06	29.08	40.16	37.20	29.24	40.22	37.28	29.34	39.81	39.62	37.13	29.62	38.94	38.09	35.22	29.62	38.62	37.32	34.33	29.62	38.48	35.48	31.02	38.63	35.64	31.18	38.70	35.74	31.24	38.28	38.06	35.76	30.75	37.17	36.15	33.48	28.72	37.02	35.29	32.50	27.78
EFFICIENCY, % (HHV)	36.07	33.41	26.21	36.20	33.53	26.36	36.25	33.60	26.45	35.88	35.72	33.47	26.70	35.10	34.34	31.74	26.70	35.00	33.64	30.94	26.70	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
HEAT RATE, Btu/kWh (LHV)	8,527	9,206	11,733	8,496	9,172	11,668	8,484	9,153	11,629	8,571	8,612	9,189	11,518	8,762	8,958	9,689	11,520	8,789	9,144	9,940	11,518	8,867	9,617	11,001	8,832	9,573	10,945	8,817	9,548	10,921	8,914	8,998	9,543	11,095	9,179	9,439	10,191	11,882	9,217	9,669	10,499	12,282
HEAT RATE, Btu/kWh (HHV)	9,460	10,213	13,016	9,425	10,176	12,944	9,412	10,154	12,901	9,509	9,553	10,194	12,777	9,720	9,938	10,749	12,780	9,750	10,144	11,027	12,778	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
HEAT INPUT, MMBtu/hr (LHV)	2,263	1,832	1,267	2,255	1,826	1,260	2,251	1,822	1,256	2,231	2,217	1,774	1,244	2,126	1,983	1,609	1,244	2,108	1,882	1,534	1,244	2,133	1,735	1,382	2,125	1,727	1,373	2,121	1,723	1,367	2,131	2,107	1,682	1,304	2,028	1,902	1,541	1,197	2,014	1,808	1,472	1,148
HEAT INPUT, MMBtu/hr (HHV)	2,510	2,033	1,406	2,501	2,025	1,398	2,498	2,021	1,393	2,476	2,460	1,968	1,380	2,358	2,200	1,785	1,380	2,339	2,088	1,702	1,380	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
EXHAUST TEMPERATURE, °F	1,088	1,108	1,108	1,094	1,118	1,118	1,099	1,126	1,126	1,124	1,127	1,180	1,180	1,147	1,166	1,198	1,198	1,150	1,182	1,198	1,198	1,029	1,043	1,042	1,030	1,050	1,049	1,031	1,055	1,054	1,034	1,096	1,094	1,094	1,056	1,074	1,131	1,131	1,058	1,090	1,143	1,143
EXHAUST FLOW, lbm/hr	4,571,542	3,798,718	2,935,310	4,556,973	3,771,623	2,910,547	4,554,058	3,755,049	2,894,578	4,573,623	4,573,341	3,617,108	2,807,304	4,361,475	4,117,958	3,393,994	2,808,760	4,326,051	3,936,643	3,318,466	2,833,238	4,517,789	3,864,614	3,344,172	4,521,183	3,844,870	3,323,484	4,531,118	3,832,791	3,308,432	4,695,958	4,682,181	3,733,958	3,167,907	4,441,750	4,203,830	3,449,212	2,934,223	4,407,561	4,019,713	3,340,504	2,846,552
EXHAUST ENERGY, KW	573,024	315,675	242,638	374,205	316,626	243,193	375,658	317,872	243,717	388,941	389,581	324,263	250,366	383,029	366,863	311,016	256,453	381,352	355,401	303,437	258,307	344,222	297,008	255,225	345,003	297,756	255,824	346,109	298,537	255,920	361,919	360,923	304,596	256,501	354,529	341,183	294,657	246,614	353,238	331,362	288,229	243,615
FUEL FLOW, lbm/hr	110,988	89,869	62,150	110,589	89,543	61,808	110,426	89,355	61,599	109,448	108,741	87,026	61,010	104,264	97,255	78,897	61,023	103,413	92,301	75,255	61,011	116,557	94,817	75,512	116,095	94,381	75,045	115,903	94,133	74,684	116,451	115,113	91,891	71,230	110,819	103,960	84,188	65,435	110,060	98,808	80,483	62,750
STACK EXHAUST PARAMETERS DOWNSTREAM OF DSCR																																										
DILUTION SCR AIR FLOW, lb$_m$/hr	1,492,929	1,337,866	1,027,813	1,545,945	1,400,429	1,074,444	1,586,181	1,446,143	1,108,172	1,867,194	1,886,590	1,774,117	1,369,075	2,023,131	2,022,098	1,833,654	1,511,454	2,062,848	2,057,813	1,818,159	1,547,347	1,113,040	1,015,441	868,901	1,136,344	1,059,528	906,489	1,153,816	1,092,739	933,689	1,294,102	1,299,261	1,347,457	1,133,022	1,433,454	1,470,285	1,497,539	1,263,058	1,467,320	1,528,763	1,532,195	1,294,688
TOTAL EXHAUST FLOW, lb$_m$/hr	6,064,470	5,136,583	3,963,123	6,102,918	5,172,052	3,984,991	6,140,239	5,201,192	4,002,750	6,441,018	6,459,930	5,391,225	4,176,379	6,384,606	6,140,056	5,227,648	4,320,214	6,388,899	5,994,456	5,136,626	4,380,585	5,630,829	4,880,054	4,213,074	5,657,527	4,904,398	4,229,973	5,684,933	4,925,530	4,242,121	5,990,060	5,981,442	5,081,415	4,300,929	5,875,204	5,674,115	4,946,752	4,197,281	5,874,881	5,548,476	4,872,699	4,141,239
EXHAUST TEMPERATURE AFTER DSCR, °F	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840
OXYGEN, Vol. %	14.12	14.42	15.13	14.18	14.48	15.18	14.21	14.52	15.21	14.37	14.46	14.72	15.34	14.30	14.54	14.82	15.25	14.35	14.74	15.01	15.36	13.91	14.45	15.03	13.96	14.50	15.08	13.99	14.53	15.11	14.07	14.16	14.67	15.29	13.88	14.11	14.69	15.30	13.91	14.31	14.88	15.47
CARBON DIOXIDE, Vol. %	3.15	3.01	2.69	3.12	2.96	2.66	3.09	2.96	2.64	2.92	2.90	2.78	2.50	2.80	2.72	2.60	2.40	2.77	2.65	2.53	2.37	4.31	4.05	3.75	4.27	4.02	3.71	4.25	3.99	3.68	4.04	4.01	3.77	3.46	3.90	3.80	3.54	3.24	3.87	3.70	3.44	3.16
WATER, Vol. %	6.16	5.89	5.26	6.16	5.89	5.26	6.17	5.90	5.28	6.86	6.63	6.41	5.85	8.27	7.73	7.49	7.11	8.24	7.40	7.16	6.85	5.61	4.73	3.92	5.64	4.75	3.96	5.69	4.80	3.99	5.64	6.41	5.54	4.64	8.43	8.01	6.96	5.98	8.47	7.71	6.66	5.70
NITROGEN, Vol. %	75.67	75.77	76.02	75.65	75.75	76.00	75.62	75.72	75.96	74.95	75.11	75.20	75.41	73.76	74.12	74.21	74.38	73.76	74.32	74.42	74.53	75.26	75.66	76.38	75.23	75.83	76.35	75.18	75.78	76.30	74.37	74.53	75.13	75.71	72.92	73.21	73.93	74.59	72.87	73.41	74.13	74.78
ARGON, Vol. %	0.90	0.90	0.91	0.90	0.90	0.91	0.90	0.90	0.91	0.89	0.90	0.90	0.90	0.88	0.88	0.89	0.89	0.88	0.89	0.89	0.89	0.90	0.90	0.91	0.90	0.90	0.91	0.90	0.90	0.91	0.89	0.89	0.90	0.90	0.87	0.87	0.88	0.89	0.87	0.88	0.88	0.89
MOLECULAR WEIGHT	28.57	28.59	28.63	28.57	28.58	28.62	28.56	28.58	28.62	28.47	28.50	28.51	28.54	28.31	28.36	28.37	28.40	28.31	28.39	28.40	28.42	28.80	28.87	28.93	28.79	28.86	28.92	28.79	28.86	28.91	28.66	28.68	28.75	28.82	28.45	28.49	28.57	28.65	28.44	28.51	28.59	28.67
STACK EMISSIONS (Based on USEPA Test Methods):																																										
NO_x, ppmvd @ 15% O_2	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
NO_x, lb$_m$/hr as NO_2	23.4	18.9	13.0	23.3	18.9	12.9	23.3	18.8	12.9	23.1	23.0	18.4	12.7	22.1	20.6	16.7	12.7	21.9	19.6	15.9	12.7	45.7	37.1	29.5	45.5	36.9	29.3	45.4	36.8	29.2	45.7	45.2	36.0	27.8	43.6	40.9	33.1	25.6	43.3	38.9	31.7	24.6
CO, ppmvd @ 15% O_2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO, lb$_m$/hr	11.4	9.2	6.3	11.4	9.2	6.3	11.3	9.2	6.3	11.3	11.2	9.0	6.2	10.7	10.0	8.1	6.2	10.7	9.5	7.8	6.2	11.1	9.0	7.2	11.1	9.0	7.1	11.1	9.0	7.1	11.1	11.0	8.8	6.8	10.6	10.0	8.1	6.2	10.5	9.5	7.7	6.0
VOC, ppmvd @ 15% O_2 as CH_4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
VOC, lb$_m$/hr as CH_4	6.5	5.3	3.6	6.5	5.3	3.6	6.5	5.2	3.6	6.5	6.4	5.1	3.6	6.2	5.7	4.7	3.6	6.1	5.5	4.4	3.5	6.4	5.2	4.1	6.3	5.1	4.1	6.3	5.1	4.1	6.4	6.3	5.0	3.9	6.1	5.7	4.6	3.6	6.0	5.4	4.4	3.4
Particulate TSP, lb$_m$/hr	10.7	8.9	6.8	10.7	8.9	6.8	10.7	8.8	6.7	10.7	10.7	8.5	6.5	10.1	9.6	7.9	6.5	10.0	9.2	7.7	6.6	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Particulate FRONT HALF, lb$_m$/hr	8.3	6.9	5.2	8.3	6.8	5.2	8.3	6.8	5.2	8.3	8.3	6.6	5.0	7.8	7.4	6.1	5.0	7.7	7.1	5.9	5.0	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Particulate BACK HALF, lb$_m$/hr	8.3	6.9	5.2	8.3	6.8	5.2	8.3	6.8	5.2	8.3	8.3	6.6	5.0	7.8	7.4	6.1	5.0	7.7	7.1	5.9	5.0	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
SO_2, ppmvd @ 15% O2	0.28	0.28	0.29	0.28	0.28	0.29	0.28	0.28	0.29	0.28	0.28	0.28	0.29	0.28	0.28	0.28	0.29	0.28	0.28	0.28	0.29	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
SO_2, lb$_m$/hr	3.7	3.0	2.1	3.7	3.0	2.1	3.7	3.0	2.0	3.6	3.6	2.9	2.0	3.5	3.2	2.6	2.0	3.4	3.1	2.5	2.0	3.6	2.9	2.3	3.6	2.9	2.3	3.6	2.9	2.3	3.6	3.6	2.8	2.2	3.4	3.2	2.6	2.0	3.4	3.0	2.5	1.9

NOTES

- Performance is based on new and clean condition. All data is estimated and not guaranteed.
- Gross power output is at the generator terminals, minus excitation losses. It does not include SGT-PAC™ auxiliary load losses.
- Estimated GT Performance values are dependent upon receiving test tolerances equal to measurement uncertainty calculated in accordance with ASME PTC 19.1-2005.
- IGV schedule may be adjusted during commissioning. Part load performance will be adjusted accordingly.
- The anti-icing system may be in operation at cold ambient in order to maintain emission compliance.
- The performance data are provided WITHOUT considering the anti-icing system in operation.
- With any anti-icing system in operation, GT performance will be lower than what is shown.
- Fuel gas composition, by moles, is 93.2800% CH4, 3.5700% C2H6, 0.2800% C3H8, 0.0300% n-C4H10, 0.0100% i-C4H10, 0.0100% n-C5H12, 0.0100% i-C5H12, 0.0100% n-C6H12, 2.5700% N2, 0.2300% CO2 and 0.5 grains S per 100scf.
- Fuel oil composition, by weight, is 86.469% C, 13.5% H, 0.01% N, 0.0015% S, 0.001% ash.
- Fuels must be in compliance with the Siemens Energy Fuel Specifications.
- Emissions exclude ambient air contributions and are for steady-state conditions.
- VOC consist of total hydrocarbons excluding methane and ethane and are expressed in terms of methane (CH_4).
- Particulate Matter per US EPA Methods 5 and 202 and are assumed to be either all PM_{10} or all $PM_{2.5}$.
- CO_2 mass flow rate is based on 40CFR60 Appendix G, Equation G-4, with Standard F_C.
- Please be advised that the information contained in this transmittal has been prepared and is being transmitted per customer request specifically for information purposes only.
  Data included in any permit application or Environmental Impact Statement are strictly the customer's responsibility. Siemens Energy is available to review permit application data upon request.

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SGT6-5000F in Simple Cycle Operation on Natural Gas with DSCR
Total Estimated Startup & Shutdown Emissions

Mode	Ramp Rate (MW/min)	Time (min)	Total Pounds Per Event			
			NO_X	CO	VOC	PM
Startup Emissions (GT Ignition to 100% Load, Steady-State)	20	28	61	843	73	5
Shutdown Emissions (100% Load to Fuel Cut Off)	20	13	18	173	27	3
Startup Emissions (GT Ignition to 100% Load, Steady-State)	52	20	42	578	50	4
Shutdown Emissions (100% Load to Fuel Cut Off)	52	5	6	67	11	2

General Notes

1.) All data is ESTIMATED, NOT guaranteed and is for ONE unit.

2.) Emissions are at the exhaust stack outlet and exclude ambient air contributions.

3.) Emissions are based on new and clean conditions.

4.) Emissions values based on a 52 MW/min ramp rate should not be used for air permitting purposes and are provided to indicat

5.) Natural Gas Fuel must be in compliance with the Siemens Energy Fuel Specification.

6.) NO_X as NO_2.

7.) VOC consist of total hydrocarbons excluding methane and ethane and are expressed in terms of methane (CH_4).

8.) Particulate (PM) emissions are per USEPA Methods 5/202.

9.) Please be advised that the information contained in this transmittal has been prepared and is being transmitted per customer request specifically for information purposes only. Data included in any permit application or Environmental Impact Statement is strictly the customer's responsibility. Siemens Energy is available to review permit application data upon request.

Startup / Shutdown Notes

1.) Estimated data are based on the ramp rates noted above, time from GT ignition to synchronization in ~5-minutes, and will be higher for longer times and/or slower ramp rates.

2.) Shutdown data is based on the ramp rates noted with no holds at FSNL (Full Speed No Load / 0%) prior to fuel cut off.

3.) All startup prerequisites have been met, including any required equipment to be in operation.

4.) Operator actions do not extend start-up or shutdown.

5.) It is assumed that there is no restriction from the interconnected utility for loading the GT within the SU times considered and the generator can be synchronized to the grid in ≤ 30 seconds.

6.) CEMS may calculate emissions differently.

SGT6-5000F in Simple Cycle Operation on ULSD with DSCR

Total Estimated Startup & Shutdown Emissions

Mode	Ramp Rate (MW/min)	Time (min)	Total Pounds Per Event			
			NO_X	CO	VOC	PM
Startup Emissions (GT Ignition to 100% Load, Steady-State)	13.4	42	148	2,480	317	25
Shutdown Emissions (50% to Fuel Cut Off)	13.4	9	23	180	72	6
Shutdown Emissions (100% Load to Fuel Cut Off)	13.4	18	29	181	73	13

General Notes

1.) All data is ESTIMATED, NOT guaranteed and is for ONE unit.

2.) Emissions are at the exhaust stack outlet and exclude ambient air contributions.

3.) Emissions are based on new and clean conditions.

4.) ULSD (Ultra Low Sulfur Diesel) liquid fuel oil must be in compliance with the Siemens Energy Liquid Fuel Oil Specification.

5.) NO_X as NO_2.

6.) VOC consist of total hydrocarbons excluding methane and ethane and are expressed in terms of methane (CH_4).

7.) Particulate (PM) emissions are per USEPA Methods 5/202.

8.) Please be advised that the information contained in this transmittal has been prepared and is being transmitted per customer request specifically for information purposes only. Data included in any permit application or Environmental Impact Statement is strictly the customer's responsibility. Siemens Energy is available to review permit application data upon request.

Startup / Shutdown Notes

1.) Estimated data are based on a ramp rate of 13.4 MW/min, time from GT ignition to synchronization in ~14-minutes, and will be higher for longer times and/or slower ramp rates.

2.) Shutdown data is based on the ramp rates noted with no holds at FSNL (Full Speed No Load / 0%) prior to fuel cut off.

3.) All startup prerequisites have been met, including any required equipment to be in operation.

4.) Operator actions do not extend start-up or shutdown.

5.) It is assumed that there is no restriction from the interconnected utility for loading the GT within the SU times considered and the generator can be synchronized to the grid in ≤ 30 seconds.

6.) CEMS may calculate emissions differently.

SIEMENS energy

US5108 NPPD Princeton Road

Estimated SGT6-5000F Gas Turbine Performance and Emissions (per turbine)
Gas Turbine in 2x1 Combined Cycle / Ultra Low NOx Combustor
SGen6-1000A (113/55) / 0.85 Power Factor

Estimated Performance
January 23, 2026

SITE CONDITIONS	CASE 1	CASE 2	CASE 3	CASE 4	CASE 5	CASE 6	CASE 7	CASE 8	CASE 9	CASE 10	CASE 11	CASE 12	CASE 13	CASE 14	CASE 15	CASE 16	CASE 17	CASE 18	CASE 19	CASE 20	CASE 21	CASE 22	CASE 23	CASE 24	CASE 25	CASE 26	CASE 27	CASE 28	CASE 29	CASE 30	CASE 31	CASE 32	CASE 33	CASE 34	CASE 35	CASE 36	CASE 37	CASE 38	CASE 39	CASE 40	CASE 41	CASE 42
FUEL TYPE	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Oil	Oil	Oil	Oil	Oil	Oil	Oil	Oil	Oil	Oil	Oil	Oil	Oil	Oil	Oil	Oil	Oil	Oil	Oil	Oil	Oil
LOAD LEVEL	100	75	41	100	75	41	100	75	41	100	100	75	43	100	100	75	50	100	100	75	53	100	75	50	100	75	50	100	75	50	100	100	75	50	100	100	75	50	100	100	75	50
NET FUEL HEATING VALUE, Btu/lb$_m$ (LHV)	20,389	20,389	20,389	20,389	20,389	20,389	20,389	20,389	20,389	20,389	20,389	20,389	20,389	20,389	20,389	20,389	20,389	20,389	20,389	20,389	20,389	18,300	18,300	18,300	18,300	18,300	18,300	18,300	18,300	18,300	18,300	18,300	18,300	18,300	18,300	18,300	18,300	18,300	18,300	18,300	18,300	18,300
GROSS FUEL HEATING VALUE, Btu/lb$_m$ (HHV)	22,617	22,617	22,617	22,617	22,617	22,617	22,617	22,617	22,617	22,617	22,617	22,617	22,617	22,617	22,617	22,617	22,617	22,617	22,617	22,617	22,617	19,532	19,532	19,532	19,532	19,532	19,532	19,532	19,532	19,532	19,532	19,532	19,532	19,532	19,532	19,532	19,532	19,532	19,532	19,532	19,532	19,532
AMBIENT DRY BULB TEMPERATURE, °F	-13.9	-13.9	-13.9	-1.9	-1.9	-1.9	6.5	6.5	6.5	59.0	59.0	59.0	59.0	95.2	95.2	95.2	95.2	106.8	106.8	106.8	106.8	-13.9	-13.9	-13.9	-1.9	-1.9	-1.9	6.5	6.5	6.5	59.0	59.0	59.0	59.0	95.2	95.2	95.2	95.2	106.8	106.8	106.8	106.8
AMBIENT RELATIVE HUMIDITY, %	95.0	95.0	95.0	95.0	95.0	95.0	96.0	96.0	96.0	60.0	60.0	60.0	60.0	43.2	43.2	43.2	43.2	28.1	28.1	28.1	28.1	95.0	95.0	95.0	95.0	95.0	95.0	96.0	96.0	96.0	60.0	60.0	60.0	60.0	43.2	43.2	43.2	43.2	28.1	28.1	28.1	28.1
AMBIENT PRESSURE, psia	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973	13.973
INJECTION FLUID	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	H2O	H2O	H2O	H2O	H2O	H2O	H2O	H2O	H2O	H2O	H2O	H2O	H2O	H2O	H2O	H2O	H2O	H2O	H2O	H2O	H2O	H2O
INLET AIR COND. (COOLER)	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF
GAS TURBINE PERFORMANCE																																										
PLANT POWER OUTPUT, MW	760	598	373	762	600	374	764	602	375	767	762	597	382	722	667	526	380	707	622	490	374	681	539	392	681	541	393	682	542	394	692	683	545	399	648	606	485	355	635	596	453	332
GT POWER OUTPUT, MW	265	199	109	265	199	109	265	199	109	259	256	193	109	241	219	165	109	239	204	153	109	239	180	120	239	180	120	239	180	120	239	234	176	117	220	201	151	101	218	187	140	94
EXHAUST FLOW, lbm/hr	4,597,207	3,810,283	2,948,084	4,582,825	3,785,903	2,925,001	4,582,338	3,771,071	2,910,337	4,599,567	4,596,938	3,629,507	2,829,318	4,379,186	4,131,667	3,385,318	2,828,427	4,345,629	3,948,533	3,308,612	2,854,797	4,516,717	3,889,296	3,281,589	4,519,464	3,852,048	3,284,648	4,530,832	3,841,485	3,254,614	4,722,055	4,706,625	3,747,458	3,177,531	4,460,796	4,218,051	3,458,584	2,939,949	4,428,423	4,032,439	3,349,307	2,851,589
FUEL FLOW, lbm/hr	109,580	88,850	61,540	109,174	88,550	61,215	109,052	88,381	61,028	108,342	107,609	86,202	60,567	103,082	95,675	77,829	60,467	102,284	90,843	74,248	60,400	115,730	94,397	73,348	115,240	93,983	72,951	115,076	93,753	72,725	116,545	115,192	92,018	71,342	110,815	103,958	84,287	65,489	110,096	98,873	80,625	62,838
STACK EXHAUST PARAMETERS																																										
EXHAUST TEMPERATURE,°F	193	183	176	193	182	175	192	181	175	190	189	175	170	202	198	186	180	208	201	192	186	208	200	194	208	199	193	208	199	192	210	209	193	187	224	218	203	195	230	221	207	199
OXYGEN, Vol. %	12.07	12.29	13.22	12.08	12.25	13.19	12.08	12.22	13.16	11.96	12.05	11.98	12.85	11.85	11.88	11.97	12.58	11.63	11.97	12.20	12.69	12.23	12.79	13.81	12.25	12.78	13.80	12.27	12.76	13.59	12.28	12.39	12.53	13.38	11.83	11.96	12.25	13.14	11.80	12.03	12.38	13.25
CARBON DIOXIDE, Vol. %	4.09	3.99	3.56	4.08	4.00	3.57	4.08	4.01	3.57	4.02	4.00	4.05	3.64	4.00	3.95	3.90	3.62	4.00	3.92	3.82	3.59	5.34	5.08	4.66	5.31	5.08	4.65	5.29	5.08	4.65	5.12	5.08	5.09	4.66	5.11	5.09	5.03	4.60	5.12	5.06	4.97	4.56
WATER, Vol. %	8.00	7.80	6.97	8.05	7.88	7.04	8.11	7.96	7.12	9.06	8.75	8.86	8.07	10.76	10.09	10.00	9.46	10.87	9.85	8.64	9.21	6.94	5.92	4.79	6.99	5.99	4.86	7.05	6.08	4.94	8.13	7.86	7.12	5.90	10.29	9.87	8.84	7.43	10.45	9.70	8.61	7.20
NITROGEN, Vol. %	74.96	75.03	75.36	74.91	74.86	75.30	74.87	74.92	75.25	74.08	74.26	74.25	74.56	72.73	73.22	73.25	73.46	72.64	73.38	73.46	73.63	74.61	75.31	76.03	74.56	75.25	75.98	74.50	75.18	75.91	73.59	73.79	74.38	75.17	71.91	72.22	73.01	73.95	71.78	72.34	73.17	74.12
ARGON, Vol. %	0.89	0.89	0.90	0.89	0.89	0.90	0.89	0.89	0.90	0.88	0.88	0.88	0.89	0.86	0.87	0.87	0.87	0.86	0.87	0.87	0.88	0.89	0.90	0.91	0.89	0.90	0.90	0.89	0.90	0.90	0.88	0.88	0.89	0.90	0.86	0.86	0.87	0.88	0.85	0.86	0.87	0.88
MOLECULAR WEIGHT	28.45	28.47	28.52	28.45	28.46	28.51	28.44	28.45	28.50	28.33	28.36	28.35	28.40	28.14	28.21	28.22	28.25	28.13	28.24	28.25	28.28	28.77	28.85	28.93	28.76	28.84	28.92	28.75	28.83	28.91	28.61	28.64	28.72	28.81	28.38	28.42	28.52	28.63	28.36	28.43	28.54	28.65
STACK EMISSIONS (Based on USEPA Test Methods):																																										
NO_x, ppmvd @ 15% O_2	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
NO_x lb$_m$/hr as NO_2	23.2	18.8	12.9	23.2	18.7	12.9	23.1	18.7	12.8	23.0	22.8	18.2	12.7	21.9	20.3	16.5	12.7	21.7	19.3	15.7	12.7	45.5	37.0	28.6	45.4	36.8	28.5	45.3	36.8	28.4	45.9	45.3	36.1	27.8	43.7	41.0	33.1	25.6	43.4	39.0	31.7	24.6
NH_3 SLIP, ppmvd @ 15% O_2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
CO, ppmvd @ 15% O_2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO, lb$_m$/hr	11.3	9.1	6.3	11.3	9.1	6.3	11.3	9.1	6.2	11.2	11.1	8.9	6.2	10.7	9.9	8.0	6.2	10.6	9.4	7.7	6.2	11.1	9.0	7.0	11.0	9.0	6.9	11.0	9.0	6.9	11.2	11.0	8.8	6.8	10.6	10.0	8.1	6.2	10.6	9.5	7.7	6.0
VOC, ppmvd @ 15% O_2 as CH_4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
VOC, lb$_m$/hr as CH_4	6.5	5.2	3.6	6.5	5.2	3.6	6.5	5.2	3.6	6.4	6.4	5.1	3.5	6.1	5.7	4.6	3.6	6.1	5.4	4.4	3.6	6.4	5.2	4.0	6.3	5.1	4.0	6.3	5.1	4.0	6.4	6.3	5.0	3.9	6.1	5.7	4.6	3.6	6.1	5.4	4.4	3.4
Particulate TSP, lb$_m$/hr	10.6	8.8	6.8	10.6	8.7	6.7	10.6	8.7	6.7	10.6	10.6	8.3	6.5	9.9	9.4	7.7	6.4	9.9	9.0	7.5	6.5	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Particulate FRONT HALF, lb$_m$/hr	8.2	6.8	5.2	8.2	6.7	5.2	8.2	6.7	5.1	8.1	8.1	6.4	5.0	7.7	7.3	5.9	4.9	7.6	6.9	5.8	5.0	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Particulate BACK HALF, lb$_m$/hr	8.2	6.8	5.2	8.2	6.7	5.2	8.2	6.7	5.1	8.1	8.1	6.4	5.0	7.7	7.3	5.9	4.9	7.6	6.9	5.8	5.0	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
SO_2, ppmvd @ 15% O2	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
SO_2, lb$_m$/hr	3.6	3.0	2.0	3.6	2.9	2.0	3.6	2.9	2.0	3.6	3.6	2.9	2.0	3.4	3.2	2.6	2.0	3.4	3.0	2.5	2.0	3.6	2.9	2.3	3.6	2.9	2.3	3.6	2.9	2.2	3.6	3.6	2.8	2.2	3.4	3.2	2.6	2.0	3.4	3.1	2.5	1.9

NOTES

- Performance is based on new and clean condition. All data is estimated and not guaranteed.
- Gross power output is at the generator terminals, minus excitation losses. It does not include SGT-PAC™ auxiliary load losses.
- Estimated GT Performance values are dependent upon receiving test tolerances equal to measurement uncertainty calculated in accordance with ASME PTC 19.1-2005.
- IGV schedule may be adjusted during commissioning. Part load performance will be adjusted accordingly.
- The anti-icing system may be in operation at cold ambient in order to maintain emission compliance.
- The performance data are provided WITHOUT considering the anti-icing system in operation.
- With any anti-icing system in operation, GT performance will be lower than what is shown.
- Fuel gas composition, by moles, is: 93.2800% CH4, 3.5700% C2H6, 0.2800% C3H8, 0.0300% n-C4H10, 0.0100% i-C4H10, 0.0100% n-C5H12, 0.0100% i-C5H12, 0.0100% n-C6H12, 2.5700% N2, 0.2300% CO2 and 0.5 grains S per 100scf.
- Fuel oil composition, by weight, is: 86.469% C, 13.5% H, 0.01% N, 0.0015% S, 0.001% ash.
- Fuels must be in compliance with the Siemens Energy Fuel Specifications.
- Emissions exclude ambient air contributions and are for steady-state conditions.
- VOC consist of total hydrocarbons excluding methane and ethane and are expressed in terms of methane (CH_4). UHC are expressed in terms of methane (CH_4).
- Particulate Matter per US EPA Methods 5 and 202 and are assumed to be either all PM_{10} or all $PM_{2.5}$.
- CO_2 mass flow rate is based on 40CFR60 Appendix G, Equation G-4, with Standard F_c.
- Please be advised that the information contained in this transmittal has been prepared and is being transmitted per customer request specifically for information purposes only.
  Data included in any permit application or Environmental Impact Statement are strictly the customer's responsibility. Siemens Energy is available to review permit application data upon request.

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Generic Estimated Startup & Shutdown Emissions
2x1 SCC6-5000F DLN on Natural Gas with Drum HRSG and ACC

Mode	Time (min)	Total Pounds Per Event				
		NO_X	CO	VOC	SO_2	PM
"Cold" SU (GT Ignition to Emissions Compliance @ 60% GT Load)	54	102	812	144	0.6	7
"Cold" SU (GT Ignition to 100% GT Load and STB Valves Closed)	178	124	825	147	2.7	24
"Warm" SU (GT Ignition to Emissions Compliance @ 60% GT Load)	49	90	716	127	0.5	7
"Warm" SU (GT Ignition to 100% GT Load and STB Valves Closed)	110	101	723	129	1.6	15
"Hot" SU (GT Ignition to Emissions Compliance @ 60% GT Load)	44	78	621	109	0.5	6
"Hot" SU (GT Ignition to 100% GT Load and STB Valves Closed)	80	85	625	111	1.1	11
SD (60% GT Load to Fuel Cut Off)	13	16	83	33	0.1	2
SD (100% GT Load to Fuel Cut Off)	25	19	85	34	0.4	4

General Notes

1.) All data is ESTIMATED, NOT guaranteed and is for ONE unit (gas turbine and HRSG).
2.) Emissions are at the HRSG exhaust stack outlet and exclude ambient air contributions.
3.) Emissions are based on new and clean conditions.
4.) VOC consist of total hydrocarbons excluding methane and ethane and are expressed in terms of methane (CH_4).
5.) SO_2 emissions are based on 0.2 gr S/100 scf in the natural gas.
6.) Particulate (PM) emissions are based on the aforementioned fuel sulfur content and are per USEPA Methods 5/202.
7.) Fuel use is based on a fuel heating value of approximately 22,820 Btu/lb_m (HHV).
8.) Gas fuel must be in compliance with the Siemens fuel specification.
9.) Energy outuput (kW-hr) based on total plant (2 GT + ST) power output of ~ 635,282 kW (Base Load with No Evap. Cooler and No Duct Firing at 59 °F).
10.) Please be advised that the information contained in this transmittal has been prepared and is being transmitted per customer request specifically for information purposes only. Data included in any permit application or Environmental Impact Statement is strictly the customer's responsibility. Siemens is available to review permit application data upon request.

Startup / Shutdown Emissions Notes

1.) "Cold" startup (SU) data are based on an extended gas turbine (GT) shutdown (SD), greater than ~ 64 hours, with the steam turbine (ST) rotor temperature less than ~ 485 °F (252 °C).
2.) "Warm" SU data are based on the GT being shutdown between ~ 16 and 64 hours, with the ST rotor temperature between ~ 485 & 685 °F (252 & 363 °C).
3.) "Hot" SU data are based on the GT being shutdown less than ~ 16 hours, with the ST rotor temperature greater than ~ 685 °F (363 °C).
4.) Estimated data are based on the assumed times noted above and will be higher for longer times. A fast start SFC is assumed for 10 minutes from GT ignition to synchronization.
5.) Estimated data are based on an ambient temperature of 59 °F and will be higher at lower ambient temperatures.
6.) Emissions Compliance defined as achieving both NO_X and CO levels of 2 ppmvd @ 15% O_2 or less at the stack.
7.) GT & ST in ready to start mode. GT & ST lube oil systems running and GT & ST are on turning gear (GT at 120 RPM since completion of HRSG purge).
8.) HRSG HP and IP drums have been maintained at or above 125 psig by sparging steam from the auxiliary boiler and HRSG purge credit is established.
9.) Steam chemistry adequate for ST operation (no waiting time included).
10.) All systems run smoothly without upsets.
11.) Auxiliary Boiler is sized to supply pegging steam to HRSGs and seal steam to ST.
12.) ACC vacuum is maintained during shutdown and condenser pressure is < 15-in. HgA prior to GT start.
13.) HRSG stack damper has been closed as soon after SD as possible to maintain heat in the HRSG, and the HRSG has been maintained in a "bottled-up" condition during the SD with drain valves in AUTO to allow removal of condensation.
14.) GT & ST can be synchronized to the grid in 30 seconds and there are no grid problems or operator holds.
15.) After maintenance shutdown, start up times not valid due to chemistry holds.
16.) It is assumed that there is no restriction from the interconnected utility for loading the GT within the SU times considered.
17.) CEMS may record SU emissions (for NO_X and CO) differently than estimated calculations show.

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Estimated Startup & Shutdown Emissions
2x1 SCC6-5000F on ULSD with Drum HRSG and ACC

Mode	Time (min)	Total Pounds Per Event				
		NO_X	CO	VOC	SO_2	PM
"Cold" SU (GT Ignition to Emissions Compliance @ 70% GT Load)	90	157	1,625	237	19	45
"Cold" SU (GT Ignition to STB Valves Closed)	159	209	1,638	242	41	80
"Warm" SU (GT Ignition to Emissions Compliance @ 70% GT Load)	70	146	1,623	236	14	35
"Warm" SU (GT Ignition to STB Valves Closed)	113	178	1,631	239	28	57
"Hot" SU (GT Ignition to Emissions Compliance @ 70% GT Load)	52	128	1,364	235	9	26
"Hot" SU (GT Ignition to STB Valves Closed)	76	146	1,370	238	17	38
SD (70% GT Load to Fuel Cut Off)	18	37	179	68	3	9
SD (100% GT Load to Fuel Cut Off)	25	42	181	69	5	13

General Notes

1.) All data is ESTIMATED, NOT guaranteed and is for ONE unit (gas turbine and HRSG).
2.) Emissions are at the HRSG exhaust stack outlet and exclude ambient air contributions.
3.) Emissions are based on new and clean conditions.
4.) VOC consist of total hydrocarbons excluding methane and ethane and are expressed in terms of methane (CH_4).
5.) SO_2 emissions assume ≤ 0.01% by weight sulfur in the ULSD (ultra low sulfur diesel) liquid fuel oil.
6.) Particulate (PM) emissions are based on the aforementioned fuel sulfur content and are per USEPA Methods 5/202.
7.) Fuel use is based on a fuel heating value of approximately 19,754 Btu/lb_m (HHV).
8.) ULSD liquid fuel oil must be in compliance with the Siemens liquid fuel specification.
9.) Please be advised that the information contained in this transmittal has been prepared and is being transmitted per customer request specifically for information purposes only. Data included in any permit application or Environmental Impact Statement is strictly the customer's responsibility. Siemens is available to review permit application data upon request.

Startup / Shutdown Emissions Notes

1.) "Cold" startup (SU) data are based on an extended gas turbine (GT) shutdown (SD), greater than ~ 64 hours, with the steam turbine (ST) rotor temperature less than ~ 485°F (252°C) and greater than ~ 300°F (149°C).
2.) "Warm" SU data are based on the GT being shutdown between ~ 16 and 64 hours, with the ST rotor temperature between ~ 485 & 685°F (252 & 363°C).
3.) "Hot" SU data are based on the GT being shutdown less than ~ 16 hours, with the ST rotor temperature greater than ~ 685°F (363°C).
4.) Estimated SU data are based on the assumed times noted above.
assuming 95°F ambient temperature and 40% RH with a Condenser back pressure of 1.128 psia (2.297 in Hg), and will be higher for longer times.
5.) Estimated SD data are based on the assumed times noted above .
and will be higher for longer times.
6.) A normal start SFC is assumed for 11 minutes from GT ignition to synchronization.
7.) Estimated data are based on an ambient temperature of 59 °F and will be higher at lower ambient temperatures.
8.) Emissions Compliance defined as achieving NO_X level of 6 and CO level of 2 ppmvd @ 15% O_2 or less at the stack.
9.) All systems run smoothly without upsets.
10.) Air Cooled Condenser receiver tank is filled to start up level and vacuum is maintained at during shut down.
11.) Condenser pressure is below 15 in HgA prior to GT start.
12.) HRSG stack damper has been closed as soon after shutdown as possible to maintain heat in the HRSG.
HRSG has been maintained in a “bottled-up” condition during the shutdown with drain valves in AUTO to allow removal of condensation.
13.) GT and ST can be synchronized to the grid in 30 seconds, no grid problems or operator holds.
14.) After maintenance shutdown, start up times not valid due to chemistry holds.
15.) CEMS may record SU emissions (for NO_X and CO) differently than estimated calculations show.

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Sales and Service

SUBMITTED TO:

For questions or comments regarding this submittal, please contact your Cummins Sales and Service Project Team.

Cummins Sales and Service certifies that these drawings, materials lists, specification and data sheets have been checked prior to submittal and they accurately depict the proposed equipment. Cummins Sales and Service certifies that to the best of our knowledge, the data described in these drawings, materials lists and data sheets is true and correct.

Note: Please note that issuance of these submittals shall not be deemed or interpreted as performance nor acceptance of your Purchase Order Terms and Conditions.

Specification Sheet

Diesel Generator Set QSK23 Series Engine

600 kW - 800 kW 60 Hz

Standby



Description

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

Features

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

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

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

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

Control system - The PowerCommand® electronic control is standard equipment and provides total genset system integration including automatic remote starting/stopping, precise frequency, and voltage regulation, alarm and status message display, AmpSentry™ protection, output metering, auto-shutdown at fault detection and NFPA 110 Level 1 compliance.

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

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

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

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

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

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

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Generator Set Specifications

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

Engine Specifications

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

Alternator Specifications

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

Available Voltages

60 Hz Line-Neutral/Line-Line

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

Note: Consult factory for other voltages.

Generator Set Options and Accessories

Engine

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

Alternator

- 80 °C rise
- 105 °C rise
- 125 °C rise
- 120/240 V anti-condensation heater
- Temperature sensor - alternator bearing RTD

Control panel

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

Cooling system

- 50 °C ambient

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Generator Set Options and Accessories (continued)

Exhaust system

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

Generator set

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

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

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

PowerCommand 2.3 – Control system



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

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

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

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

Control boards - Potted for environmental protection.

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

Prototype tested - UL, CSA, and CE compliant.

AC protection

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

Engine protection

- Overspeed shutdown
- Low oil pressure warning and shutdown
- High coolant temperature warning and shutdown
- Low coolant level warning or shutdown
- Low coolant temperature warning
- High, low and weak battery voltage warning
- Fail to start (over crank) shutdown
- Fail to crank shutdown
- Redundant start disconnect
- Cranking lockout
- Sensor failure indication
- Low fuel level warning or shutdown
- Fuel-in-rupture-basin warning or shutdown

Operator/display panel

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

Alternator data

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

Engine data

- DC voltage
- Lube oil pressure
- Coolant temperature

Other data

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

Digital governing (optional)

- Integrated digital electronic isochronous governor
- Temperature dynamic governing

Digital voltage regulation

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

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Control functions

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

Options

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

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

Ratings Definitions

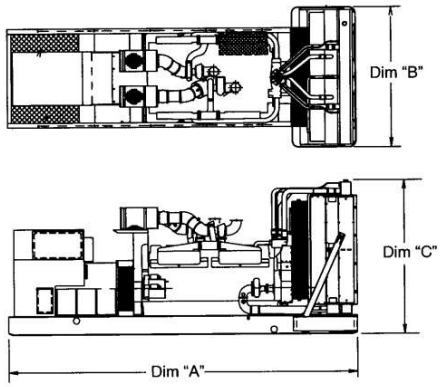
Emergency Standby Power (ESP):
Applicable for supplying power continuously to varying electrical loads for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528 and ISO 3046-1, obtained and corrected in accordance with ISO 15550).

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

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

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

This rating is not applicable to all generator set models.



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

Do not use for installation design

Dimensions and Weights with Standard Cooling System

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

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

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

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

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

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Codes and Standards

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

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

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Generator Set Data Sheet

Model: DQCC
Frequency: 60 Hz
Fuel Type: Diesel
kW Rating: 800 Standby
725 Prime
Emissions level: EPA NSPS Stationary Emergency Tier 2

Exhaust emission data sheet:	**EDS-1088**
Exhaust emission compliance sheet:	**EPA-1122**
Sound data sheet:	**MSP-1160**
Sound data sheet – with seismic feature codes L228-2 (IBC) and/or L225-2 (OSHPD):	**MSP-1014**
Cooling system data in various ambient conditions:	**MCP-249**
Cooling system data in various ambient conditions – with seismic feature codes L228-2 (IBC) and/or L225-2 (OSHPD):	**MCP-175**
Prototype test summary data sheet:	**PTS-160**

Fuel Consumption	**Standby**				**Prime**				**Continuous**
	kW (kVA)				**kW (kVA)**				**kW (kVA)**
Ratings	800 (1000)				725 (906)				
Load	**1/4**	**1/2**	**3/4**	**Full**	**1/4**	**1/2**	**3/4**	**Full**	**Full**
US gph	30.3	17.4	42.6	54.1	16.1	28	39.2	49.8	
L/hr	65.8	114.8	161.1	204.8	61.1	105.8	148.4	188.7	

Engine	**Standby rating**	**Prime rating**	**Continuous rating**
Engine manufacturer	Cummins Inc.		
Engine model	QSK23-G7 NR2		
Configuration	Cast iron, in line 6 cylinder		
Aspiration	Turbocharged and air-to-air after-cooled		
Gross engine power output, kWm (bhp)	910 (1220)	809 (1085)	
BMEP at set rated load, kPa (psi)	2510 (364)	2282 (331)	
Bore, mm (in.)	170 (6.69)		
Stroke, mm (in.)	170 (6.69)		
Rated speed, rpm	1800		
Piston speed, m/s (ft/min)	10.21 (2010)		
Compression ratio	16:1		
Lube oil capacity, L (qt)	102 (108)		
Overspeed limit, rpm	2100		
Regenerative power, kW	93		

Fuel Flow

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

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Air	Standby rating	Prime rating	Continuous rating
Combustion air, m^3/min (scfm)	64 (2265)	62 (2201)	
Maximum air cleaner restriction, kPa (in H_2O)	6.2 (25)		
Alternator cooling air, m^3/min (cfm)	117 (4156)		

Exhaust

Exhaust flow at set rated load, m^3/min (cfm)	155 (5455)	147 (5191)	
Exhaust temperature, °C (°F)	483 (902)	461 (862)	
Maximum back pressure, kPa (in H_2O)	10.1 (40.8)		

Standard Set-mounted Radiator Cooling (non-seismic)

Ambient design, °C (°F)	50 (122)		
Fan load, kW_m (HP)	24 (32)		
Coolant capacity (with radiator), L (US gal)	109.5 (29)		
Cooling system air flow, m^3/min (scfm)	1069.8 (37779.6)		
Total heat rejection, MJ/min (Btu/min)	33.52 (31793)	30.22 (28672)	
Maximum cooling air flow static restriction, kPa (in H_2O)	0.12 (0.5)		
Maximum fuel return line restriction kPa (in Hg)	30.47 (9)		

Optional Set-mounted Radiator Cooling (with seismic feature codes L228-2 (IBC) and/or L225-2 (OSHPD))

Ambient design, °C (°F)	45 (113)		
Fan load, kW_m (HP)	27 (36)		
Coolant capacity (with radiator), L (US gal)	89 (23.5)		
Cooling system air flow, m^3/min (scfm)	1252 (44183)		
Total heat rejection, MJ/min (Btu/min)	33.52 (31793)	30.22 (28672)	
Maximum cooling air flow static restriction, kPa (in H_2O)	0.12 (0.5)		
Maximum fuel return line restriction kPa (in Hg)	30.47 (9)		

Optional Heat Exchanger Cooling

Set coolant capacity, L (US gal)			
Heat rejected, jacket water circuit, MJ/min (Btu/min)			
Heat rejected, aftercooler circuit, MJ/min (Btu/min)			
Heat rejected, fuel circuit, MJ/min (Btu/min)			
Total heat radiated to room, MJ/min (Btu/min)			
Maximum raw water pressure, jacket water circuit, kPa (psi)			
Maximum raw water pressure, aftercooler circuit, kPa (psi)			
Maximum raw water pressure, fuel circuit, kPa (psi)			
Maximum raw water flow, jacket water circuit, L/min (US gal/min)			
Maximum raw water flow, aftercooler circuit, L/min (US gal/min)			
Maximum raw water flow, fuel circuit, L/min (US gal/min)			
Minimum raw water flow at 27 °C (80 °F) inlet temp, jacket water circuit, L/min (US gal/min)			
Minimum raw water flow at 27 °C (80 °F) inlet temp, aftercooler circuit, L/min (US gal/min)			
Minimum raw water flow at 27 °C (80 °F) inlet temp, fuel circuit, L/min (US gal/min)			
Raw water delta P at min flow, jacket water circuit, kPa (psi)			

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	Standby rating	Prime rating	Continuous rating
Raw water delta P at min flow, aftercooler circuit, kPa (psi)			
Raw water delta P at min flow, fuel circuit, kPa (psi)			
Maximum jacket water outlet temp, °C (°F)			
Maximum aftercooler inlet temp, °C (°F)			
Maximum aftercooler inlet temp at 25 °C (77 °F) ambient, °C (°F)			
Maximum fuel return line restriction, kPa (in Hg)			

Optional Remote Radiator Cooling[1]

Set coolant capacity, L (US gal)			
Max flow rate at max friction head, jacket water circuit, L/min (US gal/min)			
Max flow rate at max friction head, aftercooler circuit, L/min (US gal/min)			
Heat rejected, jacket water circuit, MJ/min (Btu/min)			
Heat rejected, aftercooler circuit, MJ/min (Btu/min)			
Heat rejected, fuel circuit, MJ/min (Btu/min)			
Total heat radiated to room, MJ/min (Btu/min)			
Maximum friction head, jacket water circuit, kPa (psi)			
Maximum friction head, aftercooler circuit, kPa (psi)			
Maximum static head, jacket water circuit, m (ft)			
Maximum static head, aftercooler circuit, m (ft)			
Maximum jacket water outlet temp, °C (°F)			
Maximum aftercooler inlet temp at 25 °C (77 °F) ambient, °C (°F)			
Maximum aftercooler inlet temp, °C (°F)			
Maximum fuel flow, L/hr (US gph)			
Maximum fuel return line restriction, kPa (in Hg)			

Weights[2]

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

Notes:

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

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

Derating Factors

Standby	Engine power available up to 1137 m (3730 ft) at ambient temperatures up to 40 °C (104 °F). Above these elevations, derate at 4.4% per 305 m (1000 ft). Above 40 °C (104 °F), derate 10% per 10 °C (18 °F).
Prime	Engine power available up to 754 m (2475 ft) at ambient temperatures up to 40 °C (104 °F). Above these elevations, derate at 4.5% per 305 m (1000 ft). Above 40 °C (104 °F), derate 20.9% per 10 °C (18 °F).
Continuous	

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Ratings Definitions

Emergency Standby Power (ESP):	Limited-Time Running Power (LTP):	Prime Power (PRP):	Base Load (Continuous) Power (COP):
Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.	Applicable for supplying power to a constant electrical load for limited hours. Limited-Time Running Power (LTP) is in accordance with ISO 8528.	Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.	Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) is in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514.

Voltage	Connection[1]	Temp rise degrees C	Duty[2]	Single phase factor[3]	Max surge kVA[4]	Winding No.	Alternator data sheet	Feature code
380	Wye	125	P		3657	311	ADS-631	BC45-2
208/416-480	Wye	125/105	S/P		3657	311	ADS-631	BC39-2
380	Wye	125/105	S/P		4200	311	ADS-632	B872-2
600	Wye	125/105	S/P		2944	7	ADS-309	B550-2
208/416	Wye	105/80	S/P		4200	311	ADS-632	B733-2
380	Wye	105/80	S/P		4234	312	ADS-312	B599-2
480	Wye	105	S		3657	311	ADS-631	B876-2
600	Wye	105/80	S/P		3866	7	ADS-311	B603-2
208/416	Wye	80	S		4234	311	ADS-312	B734-2
480	Wye	80	S		4200	311	ADS-632	B878-2
600	Wye	80	S		3866	7	ADS-311	B604-2
380	Wye	80	P		3866	312	ADS-311	B687-2
480	Wye	80	P		4200	311	ADS-632	BC46-2

Notes:

[1] Limited single phase capability is available from some three phase rated configurations. To obtain single phase rating, multiply the three phase kW rating by the Single Phase Factor[3]. All single phase ratings are at unity power factor.

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

[3] Factor for the *Single phase output from Three phase alternator* formula listed below.

[4] Maximum rated starting kVA that results in a minimum of 90% of rated sustained voltage during starting.

Formulas for Calculating Full Load Currents:

Three phase output

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

Single phase output

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

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

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

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Specification Sheet

PowerCommand® 3.3 Generator Set Digital Integrated Control System



Bargraph Optional

Introduction

The PowerCommand® 3.3 control system is a microprocessor-based generator set monitoring, metering, and control system, which is comprised of PowerCommand® Control 3300 and the Human Machine Interface 320. PCC3300 supports multiple operation modes including:

- Standalone,
- Synchronization only,
- Isolated bus paralleling,
- Utility single generator set paralleling,
- Utility multiple generator set paralleling,
- Utility single generator set paralleling with power transfer control (automatic mains failure),
- Isolated bus paralleling with Masterless Load Demand

PowerCommand® Control 3300 is designed to meet the exacting demands of the harsh and diverse environments of today's typical power generation applications for Full Authority Electronic or Hydromechanical engine power generator sets.

Offering enhanced reliability and performance over more conventional generator set controls via the integration of all generator control functions into a single system, PCC3300 is your Power of One generator set control solution.

Benefits and Features

- 320 x 240 pixels graphical LED backlit LCD
- Multiple languages supported
- AmpSentry™ protection provides industry-leading generator overcurrent protection
- Digital Power Transfer Control (Automatic Mains Failure) 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 Sharing
- 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 automatic voltage regulation is provided using three phase sensing and full wave FET type regulator, which is compatible with either shunt or PMG excited systems with a standard AUX103 AVR or an option for a more powerful high-current field drive capability AUX106 AVR
- Digital engine speed governing is provided on applicable platforms
- Generator set monitoring (including metering) and protection with PCC3300 measuring voltage, current, kW and kVAr offering a measurement accuracy of 1%
- Utility / AC Bus metering and protection with PCC3300 voltage, current, kW and kVAr offering a measurement accuracy of 1%
- 12 V (DC) and 24 V (DC) battery operation
- RS-485 Modbus® interface for interconnecting to customer equipment
- Warranty and service – Cummins Power Generation offers a comprehensive warranty and worldwide distributor service network
- Global regulatory certification and compliance: PCC3300 is suitable for use on gensets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std., UKCA, and CE standards

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PowerCommand® Generator Set Digital Control System PCC 3300



Introduction

PCC3300 is an industry-leading digital generator set control suitable for usage on a wide range of diesel and lean burn natural gas generator sets in both standalone as well as paralleling applications.

PowerCommand® is compatible with either shunt or PMG excitation, and is suitable for usage with reconnectable or non-reconnectable generators. Configuration for any frequency, voltage and power connection from 120 V (AC) to 600 V (AC) line-to-line or 601 V (AC) to 45k V (AC) with an external PT is supported. The PCC3300 derives its own power from the generator set starting batteries and functions over a voltage range of 8 V (DC) to 30 V (DC).

Features

- PCC3300 supports configurable control features via software download using InPower PC-compatible software
- 12 V (DC) and 24 V (DC) battery operation
- Digital automatic voltage regulation is provided using three phase sensing and full wave FET type regulator, which is compatible with either shunt or PMG excited systems with a standard AUX103 AVR or an option for a more powerful high-current field drive capability AUX106 AVR
- Digital engine speed governing on applicable platform is provided, which is capable of providing isochronous frequency regulation
- Full authority J1939 CANBus® prime mover communications and control is provided for platforms with an Engine Control Module (ECM)
- AmpSentry" protection provides industry-leading alternator overcurrent protection:
  - Time-based generator protection applicable to both line-to-line and line-to-neutral, that can detect an unbalanced fault condition and swiftly react appropriately. Balanced faults can also be detected by AmpSentry and appropriate acted upon.
  - Reduces the risk of Arc Flash due to thermal overload or electrical faults by inverse time protection
- Generator set monitoring offers status information for all critical prime mover and generator functions
- AC and DC digital generator set metering is provided. AC measurements are configurable for single or three phase sensing with PCC3300 measuring voltage, current, kW and kVAr offering a measurement accuracy of 1%
- Battery monitoring system continually monitors the battery output and warns of the potential occurrence of a weak battery condition
- Relay drivers for prime mover starter, fuel shutoff (FSO), glow plug/spark ignition power and switched B+ applications are provided
- Integrated generator set protection is offered to protect the prime mover and generator
- 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 (Automatic Mains Failure) 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 Sharing
- Droop kW and kVAr Control
- The synchronization check function provides adjustments for phase angle window, voltage window, frequency window and time delay
- Utility / AC Bus metering and protection with PCC3300 voltage, current, kW and kVAr offering a measurement accuracy of 1%
- Advanced serviceability is offered via InPower™, a PC-based software service tool
- PCC3300 is designed for reliable operation in harsh environments with the unit itself being a fully encapsulated module
- RS-485 ModBus interface for interconnecting to customer equipment
- Native on PCC3300: Four discrete inputs, two dry contact relay outputs and two low-side driver outputs are provided and are all configurable.
  - Optional extra PCC3300 input and output capability available via AUX101
- Warranty and service – Cummins Power Generation offers a comprehensive warranty and worldwide distributor service network
- Global regulatory certification and compliance: PCC3300 is suitable for use on gensets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std., UKCA and CE standards

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Base Control Functions

HMI capability

Options: Local and remote HMI320 options are available

Operator adjustments: The HMI320 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 HMI320 or InPower.

Data logs: Information concerning all of the following parameters is periodically logged and available for viewing; engine run time, controller on time, number of start attempts, total kilowatt hours, and load profile. (Control logs data indicating the operating hours at percent of rated kW load, in 5% increments. The data is presented on the operation panel based on total operating hours on the generator.)

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

Alternator data

- Voltage (single or three phase line-to-line and line-to-neutral)
- Current (single or three phase)
- kW, kVAr, Power Factor, kVA (three phase and total)
- Frequency

For Lean Burn Natural Gas Engine applications:

- Alternator heater status
- Alternator winding temperature (per phase) as well as alternator drive end and non-drive end bearing

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

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

Engine data

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

Lean Burn Natural Gas (LBNG) application parameters include:

- 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 and 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 as well as coolant temperature 1 and 2 for both HT/LT respectively
- Exhaust port temperature (up to 18 cylinders)
- Pre-filter oil pressure
- Exhaust back pressure
- Parent ECM internal temperature and isolated battery voltage
- Speed bias
- Child ECM internal temperature and isolated battery voltage
- Knock level, spark advance, and knock count (for up to 18 cylinders)
- Auxiliary supply disconnector 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 HMI320 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

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Prime Mover 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 V (DC) or 24 V (DC) nominal battery voltage is supported by PCC3300 for normal operation.

Temperature dependant prime mover governing dynamics: This function is supported enabling the engine to be responsive when warm and more stable when operating at lower temperature via providing control and modification over electronic governing parameters as a function of engine temperature.

Isochronous governing is provided in order to control prime mover speed within ±0.25% of nominal rated speed for any steady state load from no load to full load. During operation frequency drift should not exceed ±0.5% of nominal frequency given a 33ºC (or 60ºF) chance in ambient temperature within an eight-hour period.

Droop electronic speed is governing capability is natively offered by PCC3300 to permit droop from 0% to 10% between no load to full load.

Remote start capability is built into the PCC3300 as the unit accepts a ground signal from remote devices to automatically command the starting of the generator set as well as the reaching of rated speed, voltage and frequency or otherwise run at idle speed until prime mover temperature is adequate. The presence of a remote start signal shall cause the PCC3300 to leave sleep mode and return to normal power mode. PCC3300 supports an option for delayed start or stop.

Remote Start Integrity: In compliance with NEC2017 Start Signal Integrity standard – NFPA70 Article 700.10(D)(3), the remote start circuit from ATS to PCC3300 is continuously monitored for signal disturbance due to broken, disconnected or shorted wires via a configurable input. Loss of signal integrity results in activation of a remote start signal.

Remote and local emergency stopping capability: PCC3300 accepts ground signal from a locally or remoted mounted emergency stop switch to cause the generator set to immediately shutdown. The generator set is prevented from either running or cranking with the emergency stop switch engaged. If PCC3300 is in sleep mode, then the activation of any emergency stop switch shall return PCC3300 is normal powered state along with the activation of the corresponding shutdown and run-prevention states.

Sleep mode: PowerCommand 3.3 supports a configurable low current draw state, which is design with consideration to the needs of prime applications or others application without a battery charger (in order to minimize battery current drain).

Automatic prime mover starting: Any generator set controlled by PCC3300 is capable of automatic starting achieved via either magnetic pickup or main alternator output frequency. PCC3300 additionally supports configurable glow plug control where applicable.

Prime mover cycle cranking: PCC3300 supports configurable starting cycles and rest periods. Built in starter protection are incorporated to prevent the operator from specifying a starting sequence that may be damaging.

Configurable time delay functionality: PCC3300 supports time delayed generator set starting and stopping (for cooldown). Permissible time delays are as follows (noting a default setting is 0 seconds):

1. Start delay: 0 seconds to 300 seconds prior to starting after receiving a remote start signal.
2. Stop delay: 0 seconds to 600 seconds prior to shut down after receiving a signal to stop in normal operation modes.

Lean Burn Natural Gas application specific parameters

PCC3300 supports prime mover inhibiting in order to permit application-specific processes (i.e. Auxiliaries) to be started first.

Generator Control

PCC3300 performs both Genset voltage sensing and Genset voltage regulation as follows:

- Voltage sensing is integrated into PCC3300 via three phase line-to-line sensing that is compatible with shunt or PMG excitation systems
- Automatic voltage regulation is accomplished by using a three phase fully rectified input and has a FET output for good motor starting capability.

Major features of generator control 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 ºC (104 ºF) 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.

Cylinder Cut-off System (CCS): PCC 3300 supports Cylinder Cut-off System which is used to operate the engines on half bank at no load and light load conditions. CCS has below benefits on engine

performance- improved emission standards, improved fuel efficiency, reduced hydrocarbons, reduced white smoke, reduced wet stacking and higher exhaust temperature at light loads to improve turbocharger operations and catalyst performance.

Step Timing Control (STC): PCC 3300 supports STC functionality which is used to advance the engine timing of a hydro-mechanical engine during start up and light load conditions. During ADVANCED injection timing, it:

- Improves cold weather idling characteristics
- Reduces cold weather white smoke
- Improves light load fuel economy
- Reduces injector carboning

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 is 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.

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.

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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.

Negative Sequence Current Protection: PCC3300 supports this protection natively in order to determine if the generator is at any point was running subject to negative phase sequencing.

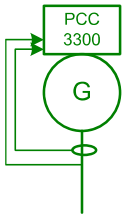
Breaker control – Utility and Genset breaker interfaces include separate relays for opening and closing breaker, as well as inputs for both 'a' and 'b' breaker position contacts and tripped status. Breaker diagnostics include Contact Failure, Fail to Close, Fail to Open, Fail to Disconnect, and Tripped. Upon breaker failure, appropriate control action is taken to maintain system integrity.

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.

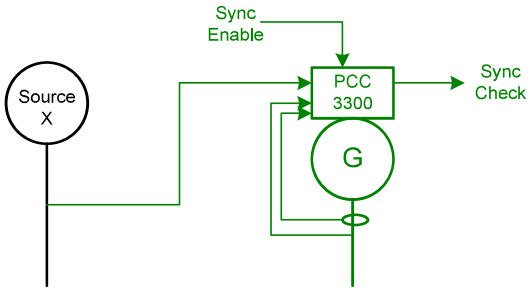
Extended paralleling – In extended paralleling mode (when enabled) the controller will start the genset and parallel to a utility source and then govern the real and reactive power output of the genset based on the desired control point. The control point for the real power (kW) can be configured for 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.

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

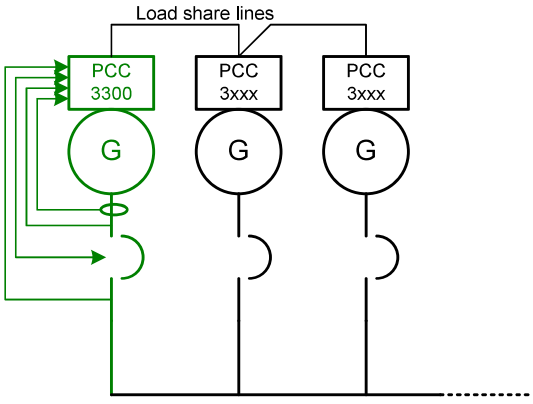
Standalone: Control provides monitoring, protection and control in a non-paralleling application.



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

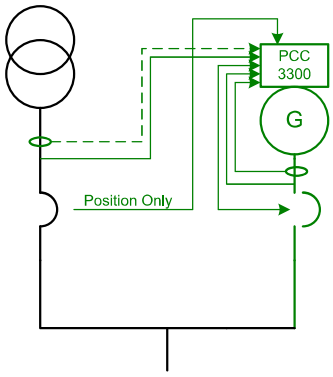


Isolated Bus: allows the genset to perform a dead bus closure or synchronize to the bus and isochronously share kW and kVAR loads with other gensets.

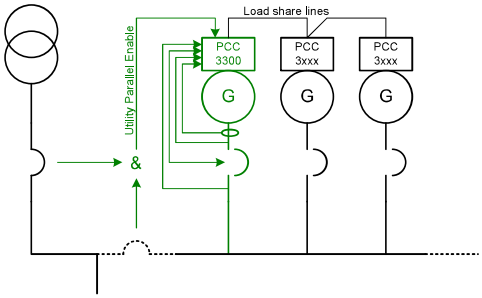


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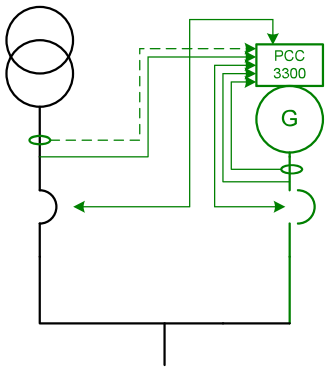
Utility Single: Control monitors one genset and utility. The control will automatically start and provide power to a load if the utility fails. The control will also resynchronize the genset back to the utility and provides extended paralleling capabilities.



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.

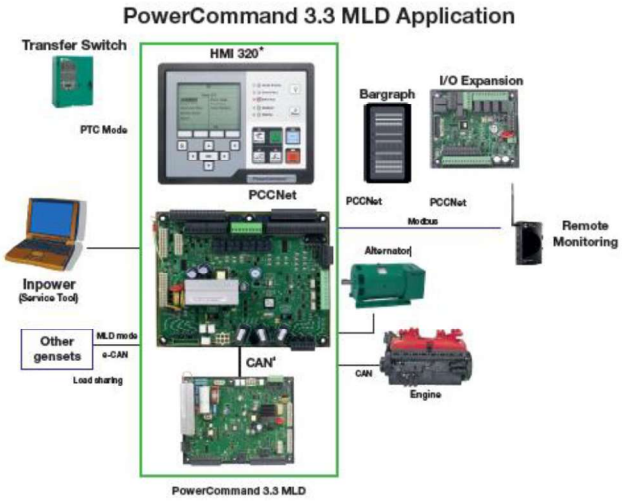


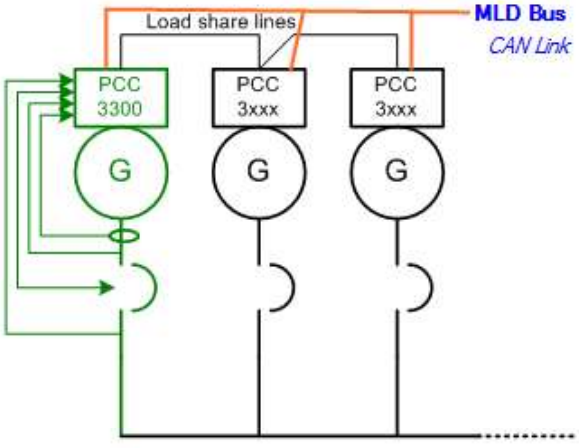
Power Transfer Control: Control operates a single genset/single utility transfer pair in open transition, fast closed transition, or soft closed transition. Extended paralleling functionality also provides base load and peak shave options.



Masterless Load Demand (Optional Feature):

PowerCommand® 3.3 with Masterless Load Demand (MLD) technology enables generator sets to start/stop automatically based on load demand. Masterless Load Demand-capable generators are equipped with an additional s-CAN network connection that allows sharing of information amongst paralleled generator sets. MLD has been designed for hassle-free installation, commissioning and operation. MLD functionality. Integrated on-board system logic provides the MLD topology control without the need for any additional system.





PCC3300 External Voltage and Frequency Biasing Inputs

PCC3300 supports externally driven voltage and frequency biasing capability in order to permit external paralleling (if intending to use this feature please contact your local distributor for further information).

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Protective Functions

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

Battle short mode

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

Derate

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

Configurable alarm and status inputs

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

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

Emergency stop

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

General prime mover 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.

Low coolant level warning – Can be set up to be a warning or shutdown.

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

Fail to start (overcrank) shutdown - The control system will indicate a fault if the genset fails to start by the completion of the engine crack 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.

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.

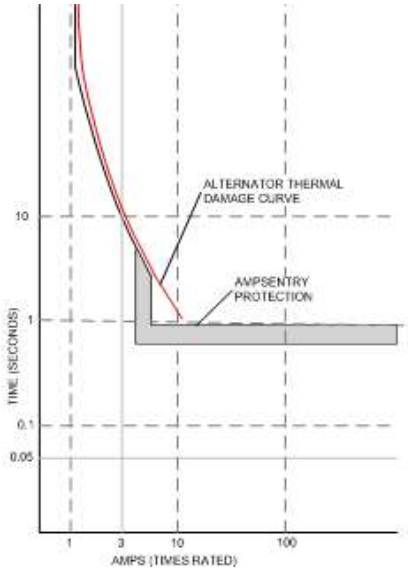
Full authority electronic engine protection:

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

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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 (3x Current) so that downstream protective devices have the maximum current available to quickly clear fault conditions without subjecting the alternator to potentially catastrophic failure conditions. Thermal damage curve (3 phase short) or fixed timer (2sec for 1P short, 5sec for 2P short). See document R1053 for a full-size time over current curve. The control does not included protection required for interconnection to a utility (mains) service.



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

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

Low AC voltage shutdown (27) - Voltage on any phase has dropped below a preset value. Adjustable over a range of 50-95% of reference voltage, time delay 2-20 seconds. Default value is 85% for 10 seconds. Function tracks reference voltage. Control does not nuisance trip when voltage varies due to the control directing voltage to drop, such as during a V/Hz roll-off 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 (40) - Shutdown level is adjustable: 15-50% of rated Var output, delay 10-60 seconds. Default: 20%, 10 seconds.

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

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

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

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

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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 and 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

Input signals for Lean Burn Natural Gas Engine applications:

- Gearbox oil pressure/temperature protection
- Fire fault
- Earth fault support as a discrete input via an appropriate secondary detection device
- 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.

Output Signals for Lean Burn Natural Gas Engine applications:

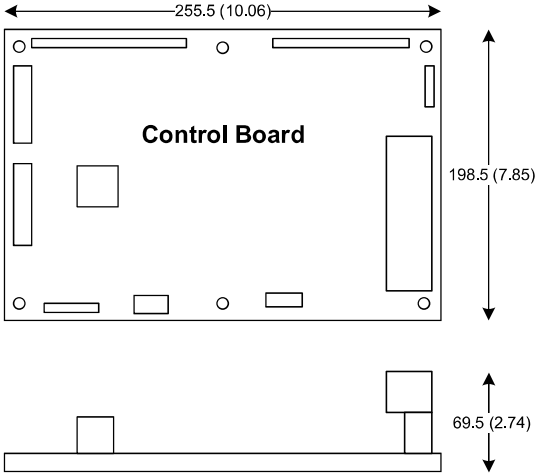
- Start inhibit/enable event
- Emergency stop event
- Ventilator fan run control
- Louvre control
- Radiator fan control
- Alternator heater control
- Engine at idle speed event

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 customer's needs. The interface also includes an LED backlit LCD display with tactile feel soft-switches for easy operation and screen navigation. It is configurable for units of measurement and has adjustable screen contrast and brightness.

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

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

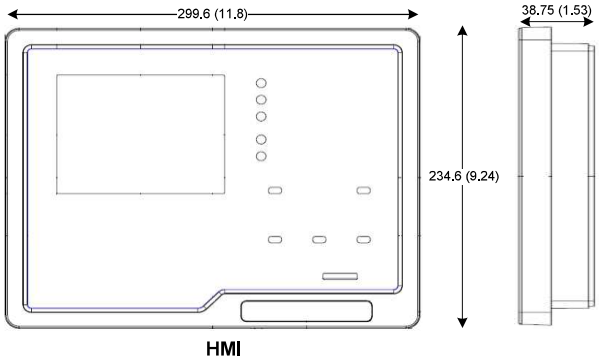
Features:

- LED indicating lamps
  - genset running
  - remote start
  - not in auto
  - shutdown
  - warning
  - auto
  - manual and stop
  - Circuit breaker open (if equipped)
  - Circuit breaker closed (if equipped)
- 320 x 240 pixels graphic LED backlight LCD.
- Four tactile feel membrane switches for LCD defined operation. The functions of these switches are defined dynamically on the LCD.
- Seven tactile feel membrane switches dedicated screen navigation buttons for up, down, left, right, ok, home and cancel.
- Six tactile feel membrane switches dedicated to control for auto, stop, manual, manual start, fault reset and lamp test/panel lamps.
- Two tactile feel membrane switches dedicated to control of circuit breaker (where applicable).
- Allows for complete genset control setup.
- Certifications: Suitable for use on gensets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std., UKCA and CE standards.
- Languages supported: English, Spanish, French, German, Italian, Greek, Portuguese, Finnish, Norwegian, Danish, Russian (Cyrillic), Chinese, Hungarian, Japanese, Polish, Korean, Romanian, Brazilian Portuguese, Turkish, Dutch, and Czech

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



HMI

Dimensions: mm (inches)

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.

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Environment

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

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

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 8528-4:2005 compliance, controls and switchgear (second edition)
- CE marking: The CE marking is only valid when equipment is used in a fixed installation application. Material compliance declaration is available upon request.
- UKCA marking- The UKCA marking is only valid when equipment is used in a fixed installation application. Material compliance declaration is available upon request.
- EN 61000-6-3,4 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 6200 recognized, 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.
- ROHS (Restriction of Hazardous substance) complaint both for HMI 320 & PCC3300v2.

Reference Documents

Please refer to the following reference documents available in the PowerSuite library:

- PowerCommand™ 3.3. Application Guide
- T-037: PowerCommand Control Application Manual (ANSI Protective Functions)
- T-040: PowerCommand 3.3 Paralleling Application Guide

Please refer to the following reference documents available on Cummins Quickserve:

- Service Manuals for PC3.3 (non-MLD) and PC3.3 (MLD)
- Modbus Register Mapping

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.

PCCNet COMPATIBLE

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Alternator Data Sheet
Frame Size: S6L1D-E4

Characteristics

	No of Bearings:	1-bearing		2-bearing	
Weights:	Stator assembly:	2202 lb	999 kg	2202 lb	999 kg
	Rotor assembly:	1881 lb	853 kg	1788 lb	811 kg
	Complete assembly:	4453 lb	2020 kg	4634 lb	2102 kg
Maximum speed:		2250 rpm			
Excitation current:	Full load:	2.8 Amps			
	No load:	0.68 Amps (Wdg 311/312), 0.84 Amps (Wdg 07)			
Insulation system:	Class H throughout				

3 Ø Ratings (0.8 power factor)			**50 Hz** (winding no)						
			110/190 220/380 (311/312)	115/200 230/400 (311/312)	120/208 240/415 (311/312	127/220 254/440 (311/312	110/220 Delta (311/312)	115/230 Delta (311/312)	120/240 Delta (311/312)
150° C rise ratings	@ 40° C	kW	848	880	880	848	848	880	880
		kVA	1060	1100	1100	1060	1060	1100	1100
125° C rise ratings	@ 40° C	kW	800	840	840	808	800	840	840
		kVA	1000	1050	1050	1010	1000	1050	1050
105° C rise ratings	@ 40° C	kW	720	756	756	720	720	756	756
		kVA	900	945	945	900	900	945	945
80° C rise ratings	@ 40° C	kW	640	672	672	640	640	672	672
		kVA	800	840	840	800	800	840	840

Reactances (per unit ± 10%)	110/190 220/380 (311/312)	115/200 230/400 (311/312)	120/208 240/415 (311/312	127/220 254/440 (311/312	110/220 Delta (311/312)	115/230 Delta (311/312)	120/240 Delta (311/312)
(Based on full load at 125° C rise rating)							
Synchronous	2.79	2.64	2.45	2.1	2.79	2.64	2.45
Transient	0.18	0.17	0.16	0.13	0.18	0.17	0.16
Subtransient	0.14	0.14	0.13	0.11	0.14	0.14	0.13
Negative sequence	0.2	0.19	0.18	0.15	0.2	0.19	0.18
Zero sequence	0.08	0.07	0.07	0.06	0.08	0.07	0.07

Motor starting	110/190 220/380 (311/312)	115/200 230/400 (311/312)	120/208 240/415 (311/312	127/220 254/440 (311/312	110/220 Delta (311/312)	115/230 Delta (311/312)	120/240 Delta (311/312)
Maximum kVA (90% sustained voltage)	3375	3375	3375	3375	3375	3375	3375

Time constants (sec)	110/190 220/380 (311/312)	115/200 230/400 (311/312)	120/208 240/415 (311/312	127/220 254/440 (311/312	110/220 Delta (311/312)	115/230 Delta (311/312)	120/240 Delta (311/312)
Transient	0.101	0.101	0.101	0.101	0.101	0.101	0.101
Subtransient	0.0161	0.0161	0.0161	0.0161	0.0161	0.0161	0.0161
Open circuit	3.57	3.57	3.57	3.57	3.57	3.57	3.57
DC	0.0236	0.0236	0.0236	0.0236	0.0236	0.0236	0.0236

Windings (@22° C)		110/190 220/380 (311/312)	115/200 230/400 (311/312)	120/208 240/415 (311/312	127/220 254/440 (311/312	110/220 Delta (311/312)	115/230 Delta (311/312)	120/240 Delta (311/312)
Stator resistance	(L-L Ohms)	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Rotor resistance	(Ohms)	1.91	1.91	1.91	1.91	1.91	1.91	1.91
Number of leads		12/6	12/6	12/6	12/6	12/6	12/6	12/6

* Parallel Star connection only available with Wdg 311

Alternator Data Sheet
Frame Size: S6L1D-E4

Characteristics

	No of Bearings:	1-bearing		2-bearing	
Weights:	Stator assembly:	2202 lb	999 kg	2202 lb	999 kg
	Rotor assembly:	1881 lb	853 kg	1788 lb	811 kg
	Complete assembly:	4453 lb	2020 kg	4634 lb	2102 kg
Maximum speed:		2250 rpm			
Excitation current:	Full load:	2.8 Amps			
	No load:	0.68 Amps (Wdg 311/312), 0.84 Amps (Wdg 07)			
Insulation system:	Class H throughout				

3 Ø Ratings (0.8 power factor)			**60 Hz** (winding no)					
			120/208 240/416 (311/312)	127/220 254/440 (311/312)	133/230 266/460 (311/312)	139/240 277/480 (311/312)	120/240 Delta (311/312)	347/600 (07)
150° C rise ratings	@ 40° C	kW	965	1000	1040	1080	965	1080
		kVA	1206	1250	1300	1350	1206	1350
125° C rise ratings	@ 40° C	kW	920	960	1000	1040	920	1040
		kVA	1150	1200	1250	1300	1150	1300
105° C rise ratings	@ 40° C	kW	850	880	920	950	850	950
		kVA	1063	1100	1150	1188	1063	1188
80° C rise ratings	@ 40° C	kW	740	760	800	828	740	828
		kVA	925	950	1000	1035	925	1035

Reactances (per unit ± 10%)	120/208 240/416 (311/312)	127/220 254/440 (311/312)	133/230 266/460 (311/312)	139/240 277/480 (311/312)	120/240 Delta (311/312)	347/600 (07)
(Based on full load at 125° C rise rating)						
Synchronous	3.21	2.99	2.85	2.72	3.21	2.09
Transient	0.2	0.19	0.18	0.17	0.2	0.14
Subtransient	0.16	0.15	0.15	0.14	0.16	0.11
Negative sequence	0.23	0.21	0.2	0.2	0.23	0.14
Zero sequence	0.09	0.08	0.08	0.08	0.09	0.01

Motor starting	120/208 240/416 (311/312)	127/220 254/440 (311/312)	133/230 266/460 (311/312)	139/240 277/480 (311/312)	120/240 Delta (311/312)	347/600 (07)
Maximum kVA (90% sustained voltage)	4200	4200	4200	4200	4200	4200

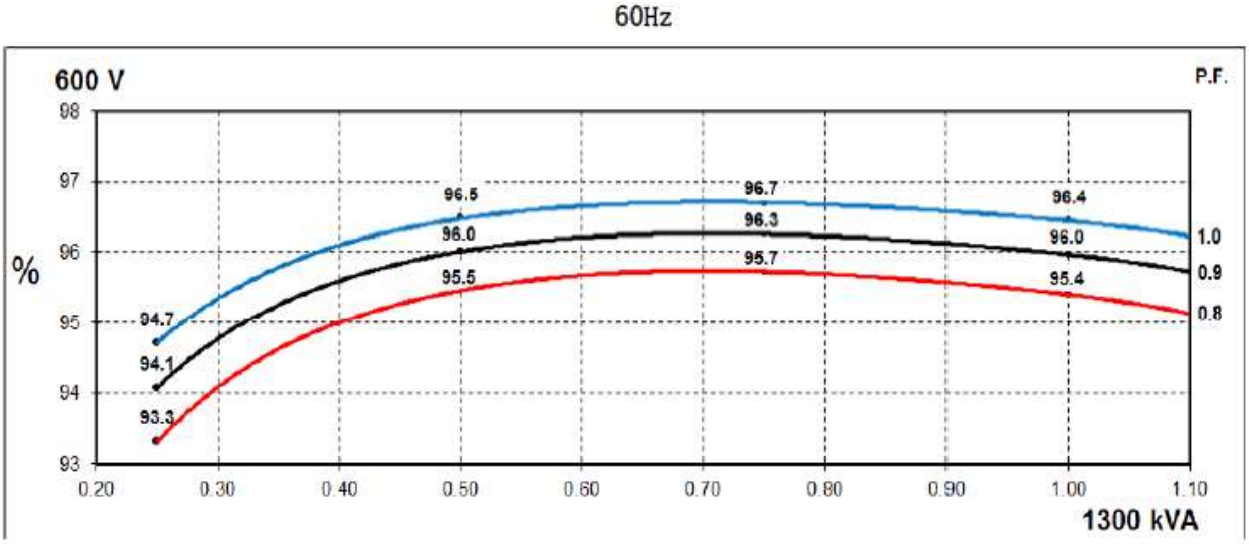
Time constants (sec)	120/208 240/416 (311/312)	127/220 254/440 (311/312)	133/230 266/460 (311/312)	139/240 277/480 (311/312)	120/240 Delta (311/312)	347/600 (07)
Transient	0.101	0.101	0.101	0.101	0.101	0.093
Subtransient	0.0161	0.0161	0.0161	0.0161	0.0161	0.013
Open circuit	3.57	3.57	3.57	3.57	3.57	3.529
DC	0.0236	0.0236	0.0236	0.0236	0.0236	0.020

Windings (@22° C)		120/208 240/416 (311/312)	127/220 254/440 (311/312)	133/230 266/460 (311/312)	139/240 277/480 (311/312)	120/240 Delta (311/312)	347/600 (07)
Stator resistance	(L-L Ohms)	0.0022	0.0022	0.0022	0.0022	0.0022	0.0064
Rotor resistance	(Ohms)	1.91	1.91	1.91	1.91	1.91	1.91
Number of leads		12/6	12/6	12/6	12/6	12/6	6

* Parallel Star connection only available with Wdg 311

S6L1D-E4 Wdg.07

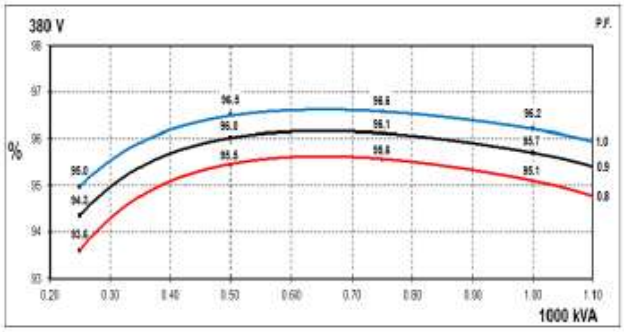
THREE PHASE EFFICIENCY CURVES

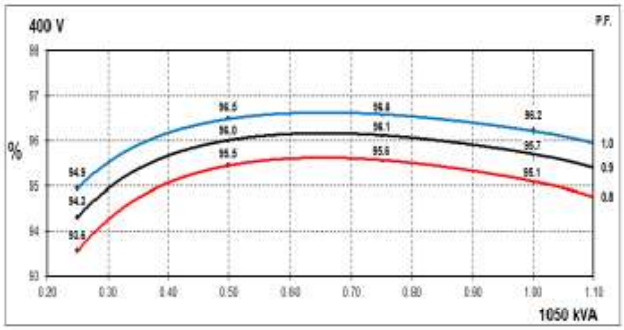


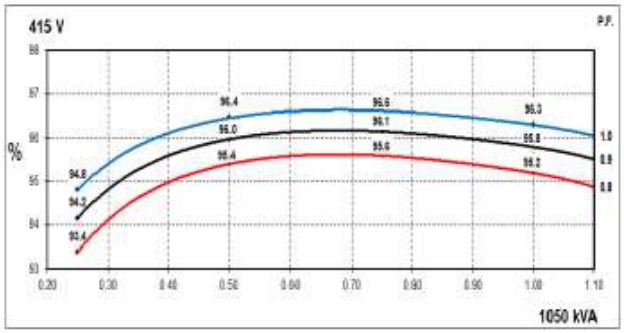
S6L1D-E4 Wdg.311/312

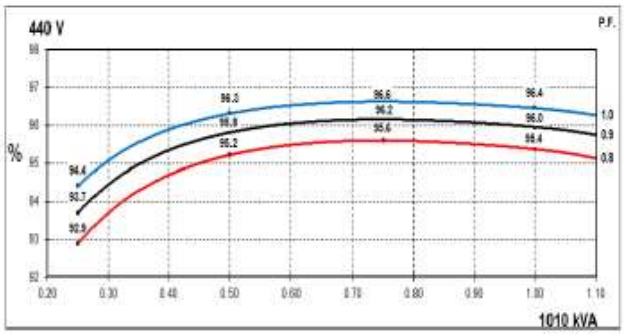
THREE PHASE EFFICIENCY CURVES

50Hz

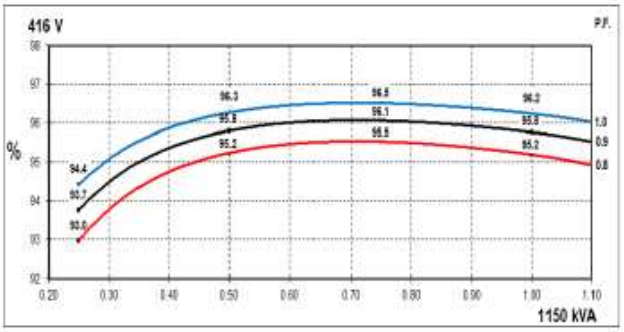


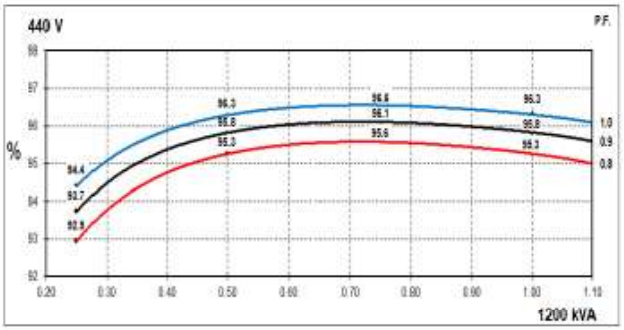


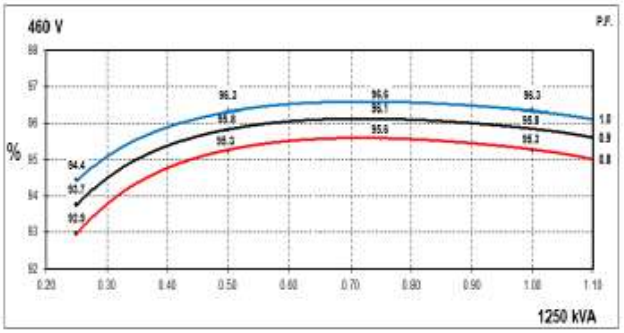


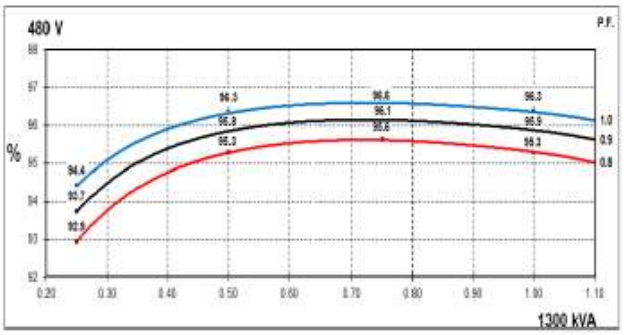


60Hz





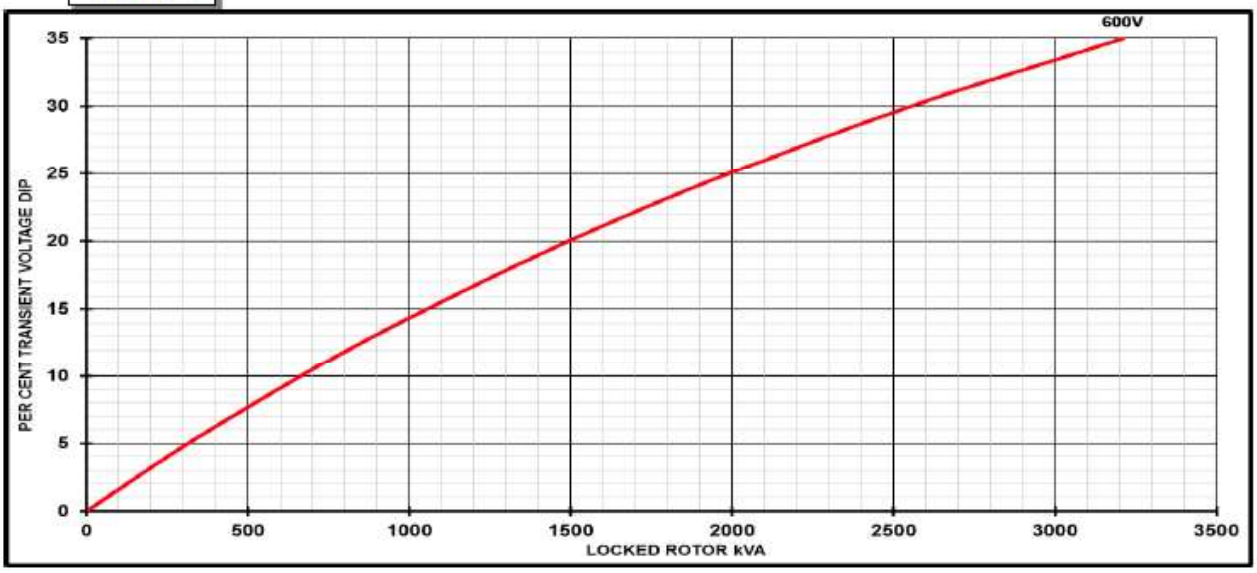




S6L1D-E4 Wdg.07

Locked Rotor Motor Starting Curves - Separately Excited

60Hz



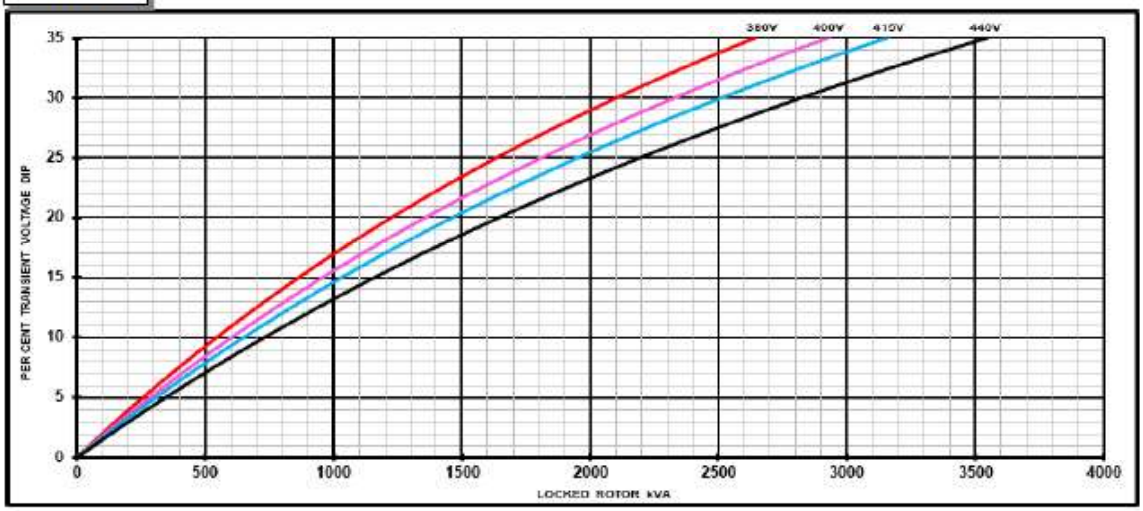
Transient Voltage Dip Scaling Factor	
PF	Factor
< 0.5	1
0.5	0.97
0.6	0.93
0.7	0.9
0.8	0.85
0.9	0.83

Transient Voltage Rise Scaling Factor
For voltage rise multiply voltage dip by 1.25

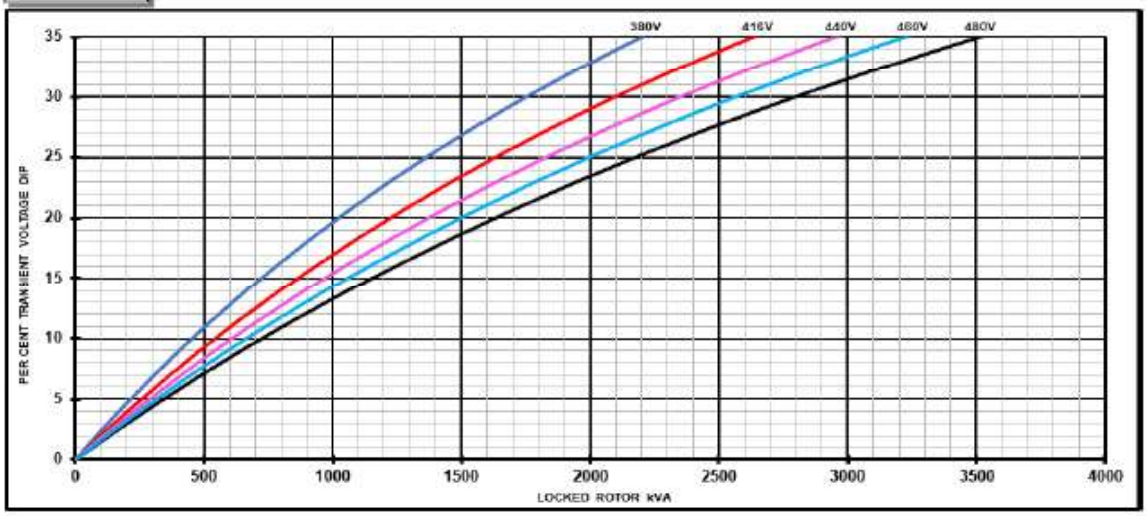
S6L1D-E4 Wdg.311/312

Locked Rotor Motor Starting Curves - Separately Excited

50Hz



60Hz



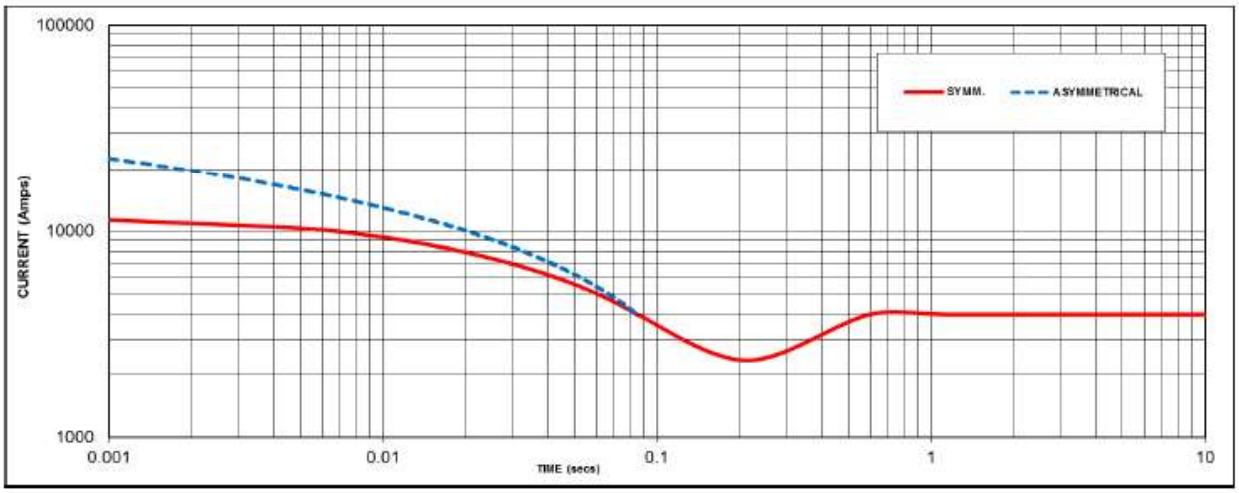
Transient Voltage Dip Scaling Factor	
PF	Factor
< 0.5	1
0.5	0.97
0.6	0.93
0.7	0.9
0.8	0.85
0.9	0.83

Transient Voltage Rise Scaling Factor
For voltage rise multiply voltage dip by 1.25

S6L1D-E4 Wdg.07

Three-phase Short Circuit Decrement Curve - Separately Exited

60Hz



Sustained Short Circuit = 3964 Amps

Note 1
The following multiplication factors should be used to adjust the values from curve between time 0.001 seconds and the minimum current point in respect of nominal operating voltage :

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

The sustained current value is constant irrespective of voltage level

Note 2
The following multiplication factor should be used to convert the values calculated in accordance with NOTE 1 to those applicable to the various types of short circuit :

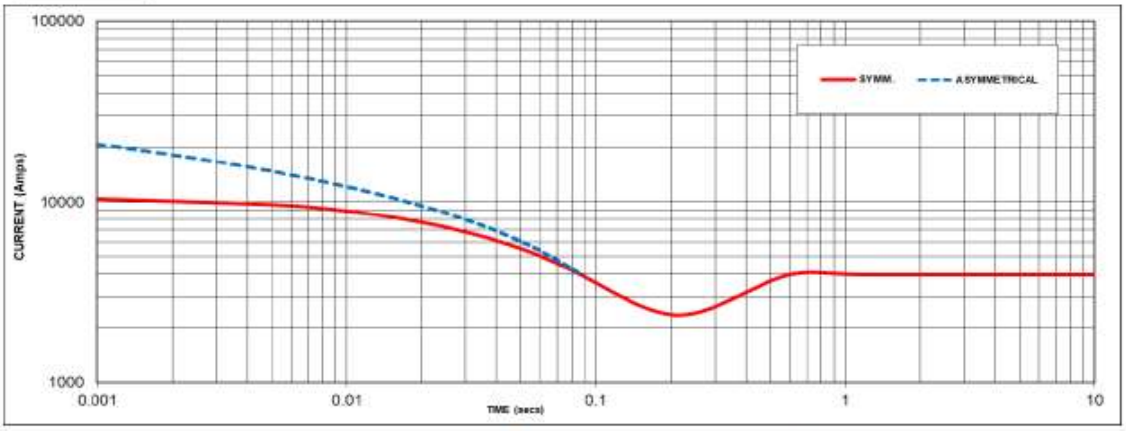
	3-phase	2-phase L-L	1-phase L-N
Instantaneous	x 1.00	x 0.87	x 1.30
Minimum	x 1.00	x 1.80	x 3.20
Sustained	x 1.00	x 1.50	x 2.50
Max. sustained duration	10 sec.	5 sec.	2 sec.

All other times are unchanged

Note 3
Curves are drawn for Star connected machines under no-load excitation at rated speeds. For other connection the following multipliers should be applied to current values as shown :
Parallel Star = Curve current value X 2
Series Delta = Curve current value X 1.732

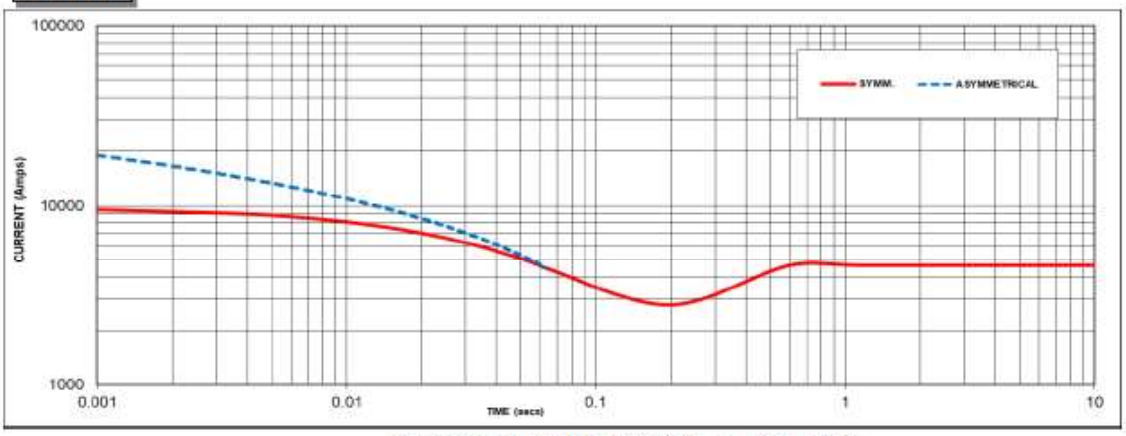
Three-phase Short Circuit Decrement Curve - Separately Excited

50Hz



Sustained Short Circuit = 3963 Amps

60Hz



Sustained Short Circuit = 4624 Amps

Note 1
The following multiplication factors should be used to adjust the values from curve between time 0.001 seconds and the minimum current point in respect of nominal operating voltage :

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

The sustained current value is constant irrespective of voltage level

Note 2
The following multiplication factor should be used to convert the values calculated in accordance with NOTE 1 to those applicable to the various types of short circuit :

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

All other times are unchanged

Note 3
Curves are drawn for Star connections under no-load excitation at rated speeds. For other connection (where applicable) the following multipliers should be applied to current values as shown :
Parallel Star = Curve current value X 2
Series Delta = Curve current value X 1.732

Exhaust Emission Data Sheet
800DQCC
60 Hz Diesel Generator Set
EPA NSPS Stationary Emergency

Engine Information:

Model:	Cummins Inc QSK23-G7 NR2	Bore:	6.69 in. (170 mm)
Type:	4 Cycle, In Line, 6 Cylinder Diesel	Stroke:	6.69 in. (170 mm)
Aspiration:	Turbocharged and CAC	Displacement:	1413 cu. in. (23.1 liters)
Compression Ratio:	16.0:1		
Emission Control Device:	Turbocharged with Charge Air Cooled		

	1/4	1/2	3/4	Full	Full
PERFORMANCE DATA	**Standby**	**Standby**	**Standby**	**Standby**	**Prime**
Engine HP @ Stated Load (1800 RPM)	305	610	915	1183	1085
Fuel Consumption (gal/hr)	16.5	30.3	43.3	53.8	49.5
Exhaust Gas Flow (CFM)	2401	3725	4768	5337	5089
Exhaust Temperature (°F)	649	746	803	861	830
EXHAUST EMISSION DATA					
HC (Total Unburned Hydrocarbons)	0.59	0.27	0.16	0.10	0.12
NOx (Oxides of Nitrogen as NO2)	2.86	3.42	4.45	6.51	5.89
CO (Carbon Monoxide)	0.79	0.27	0.16	0.33	0.28
PM (particular Matter)	0.24	0.06	0.04	0.05	0.05
SO2 (Sulfur Dioxide)	0.12	0.11	0.10	0.10	0.10
Smoke (Bosch)	0.86	0.41	0.32	0.40	0.37

All values are Grams per HP-Hour

TEST CONDITIONS

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

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

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

2024 EPA Tier 2 Exhaust Emission Compliance Statement
800DQCC
Stationary Emergency
60 Hz Diesel Generator Set

Compliance Information:

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

Engine Manufacturer:	Cummins Inc.
EPA Certificate Number:	RCEXL023.AAB-010
Effective Date:	5/1/2023
Date Issued:	5/1/2023
EPA Engine Family (Cummins Emissions Family):	RCEXL023.AAB

Engine Information:

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

Diesel Fuel Emission Limits

D2 Cycle Exhaust Emissions

	Grams per BHP-hr			Grams per kWm-hr		
	NO_X + NMHC	CO	PM	NO_X + NMHC	CO	PM
EPA Emissions Limit	4.8	2.6	0.15	6.4	3.5	0.20

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

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

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

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

Prototype Test Support (PTS)
60 Hz test summary

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

The following summarizes prototype testing conducted on the designated representative prototype of the specified models. This testing is conducted to verify the complete generator set electrical and mechanical design integrity.
Prototype testing is conducted only on generator sets not sold as new equipment.

Maximum surge power: 833 kW

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

Torsional analysis and testing:

The generator set was tested to verify that the design is not subjected to harmful torsional stresses. A spectrum analysis of the transducer output was conducted over the speed range of 1350 to 1950 RPM.

Cooling system: 50 °C ambient
0.50 in H2O restriction

The cooling system was tested to determine ambient temperature and static restriction capabilities. The test was performed at full rated load in elevated ambient temperature under stated static restriction conditions.

Durability:

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

Electrical and mechanical strength:

The generator set was tested to several single phase and three phase faults to verify that the generator can safely withstand the forces associated with short circuit conditions. The generator set was capable of producing full rated output at the conclusion of the testing.

Steady state performance:

The generator set was tested to verify steady state operating performance was within the specified maximum limits.

Voltage regulation:	± 0.50%
Random voltage variation:	± 0.50%
Frequency regulation:	Isochronous
Random frequency variation:	± 0.25%

Transient performance:

The generator set was tested with the standard alternator to verify single step loading capability as required by NFPA 110. Voltage and frequency response on load: addition and rejection were evaluated. The following results were recorded at 0.8 PF:

Full load acceptance:

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

Full load rejection:

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

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

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

Cooling system data
DQCC
EPA NSPS stationary
Emergency: Tier 2

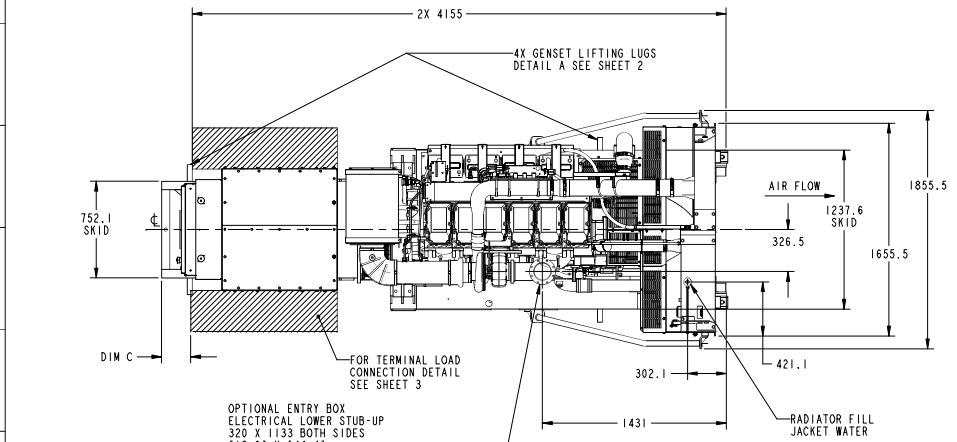
"Cooling system data - with seismic feature codes L228-2 (IBC) and/or L225-2 (OSHPD)"

High ambient air temperature radiator cooling system

			Max cooling @ air flow static restriction, unhoused (inches water/mm water)				Housed in free air, no air discharge restriction
			0.0/0.0	0.25/6.4	0.5/12.7	0.75/19.1	
	Duty	Rating (kW)	Maximum allowable ambient temperature, degree C				
60 Hz	Standby	800	55	53	50	43	
	Prime	725	N/A	N/A	N/A	N/A	
	Continuous						

Notes:

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

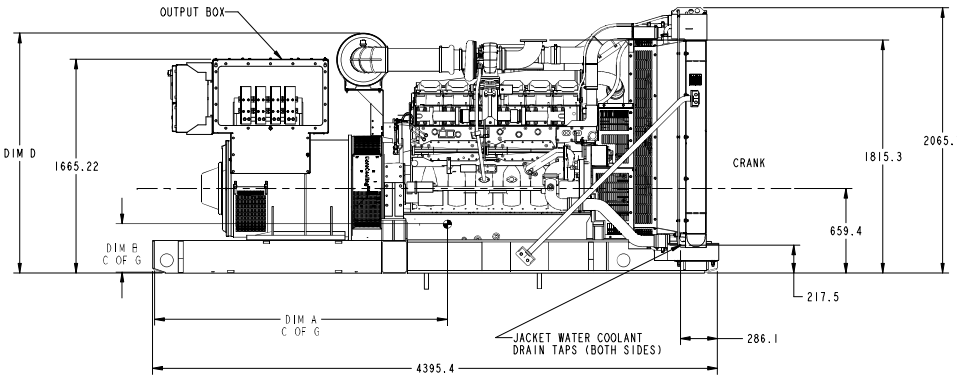


NOTES:

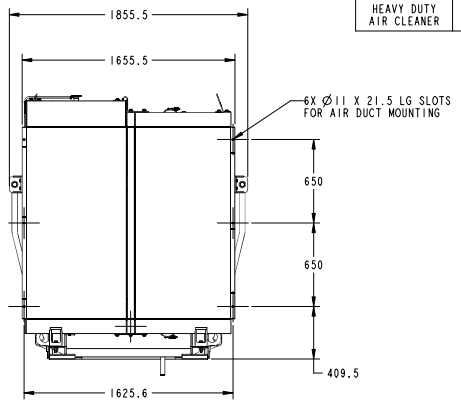
1. DIMENSIONS SHOWN IN [ ] BRACKETS ARE INCHES.
2. FUEL INLET HOSE-1650 [65] LONG WITH 1"-11.5 NPT EXTERNAL FITTING.
3. FUEL RETURN HOSE-2000 [79] LONG WITH 1"-11.5 NPT EXTERNAL FITTING.
4. GENSET SHIPPED FILLED WITH ENGINE OIL.
5. ALL DIMENSIONS ARE REFERENCE, UNLESS SPECIFICALLY TOLERANCED.

C OF G AND WEIGHT TABLE, FOR REFERENCE ONLY							
GEN FRAME SIZE	DIM A C OF G	DIM B C OF G	DIM C	GENSET WT W/O COOLANT		GENSET WT W/COOLANT	
				KGS	LBS	KGS	LBS
S6D	2025 [79.7]	767 [30.2]	227	6063	13367	6325	13945
S6E	2064 [81.2]	761 [30]	107	6225	13726	6487	14304

AIR CLEANER REFERENCE TABLE	
AIR CLEANER OPTION	DIM D HEIGHT
STANDARD AIR CLEANER	1867 [74]
HEAVY DUTY AIR CLEANER	2479 [97.6]



ALTERNATOR MOUNTED CONTROL



RADIATOR END VIEW

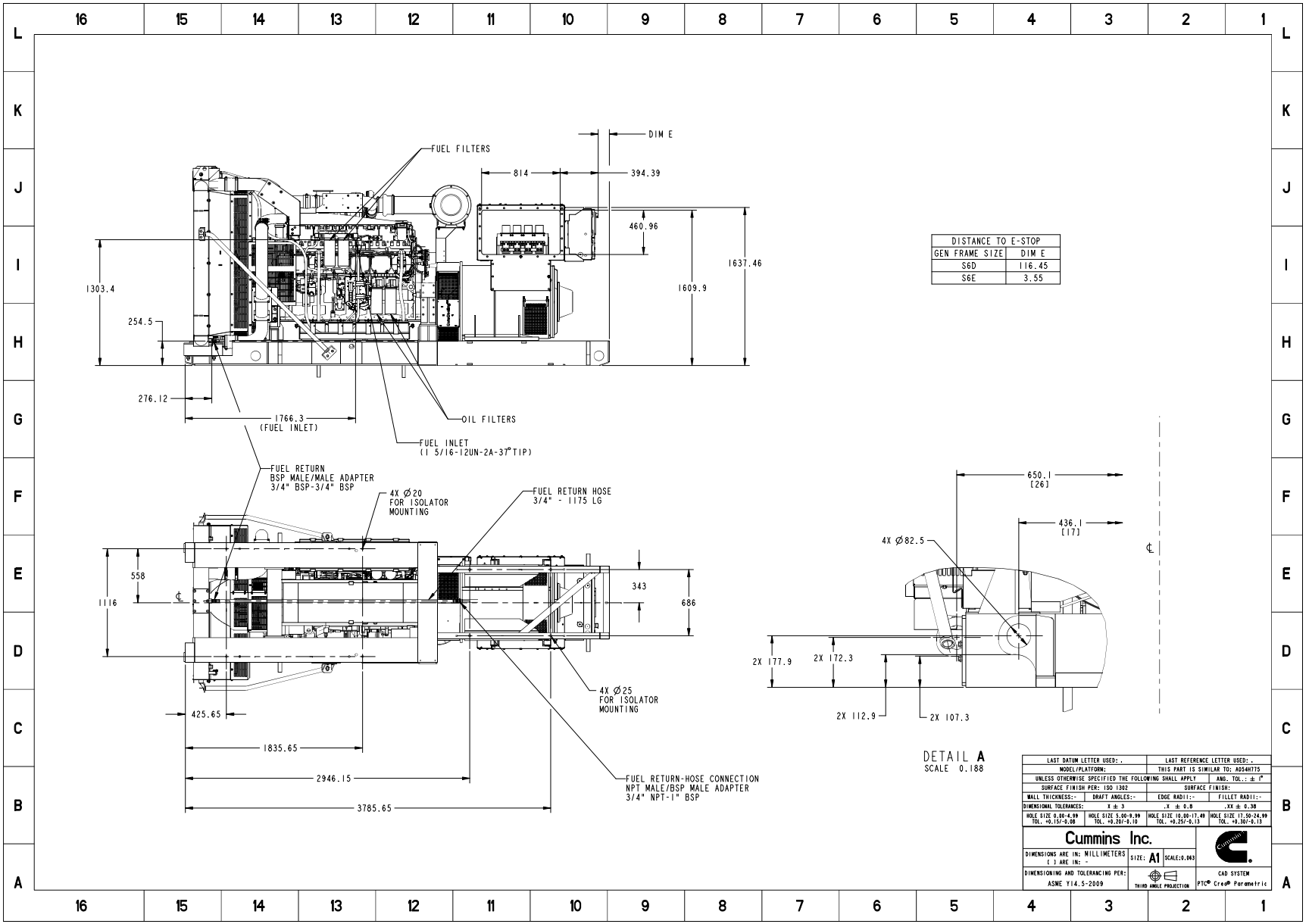
LAST DATUM LETTER USED: .		LAST REFERENCE LETTER USED: .	
MODEL/PLATFORM:		THIS PART IS SIMILAR TO: A054H775	
UNLESS OTHERWISE SPECIFIED THE FOLLOWING SHALL APPLY			ANG. TOL.: ± 1°
SURFACE FINISH PER: ISO 1302		SURFACE FINISH:	
WALL THICKNESS:-	DRAFT ANGLES:-	EDGE RADII:-	FILLET RADII:-
DIMENSIONAL TOLERANCES:	X ± 3	.X ± 0.8	.XX ± 0.38
HOLE SIZE 0.00-4.99 TOL. +0.15/-0.08	HOLE SIZE 5.00-9.99 TOL. +0.20/-0.10	HOLE SIZE 10.00-17.49 TOL. +0.25/-0.13	HOLE SIZE 17.50-24.99 TOL. +0.30/-0.13
Cummins Inc.			
DIMENSIONS ARE IN: MILLIMETERS ( ) ARE IN: -	SIZE: A1	SCALE:0.063	
DIMENSIONING AND TOLERANCING PER: ASME Y14.5-2009	THIRD ANGLE PROJECTION	CAD SYSTEM PTC® Creo® Parametric	

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



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

Cat® 3516C

Diesel Generator Sets



Image shown may not reflect actual configuration

Bore – mm (in)	170 (6.69)
Stroke – mm (in)	215 (8.46)
Displacement – L (in^3)	78.1 (4766)
Compression Ratio	14.7:1
Aspiration	TA
Fuel System	EUI
Governor Type	ADEM™ A3

Standby 60 Hz ekW (kVA)	Mission Critical 60 Hz ekW (kVA)	Prime 60 Hz ekW (kVA)	Emissions Performance
2250 (2813)	2250 (2813)	2045 (2556)	U.S. EPA Stationary Emergency Use Only (Tier 2)

Features

Cat® Diesel Engine

- Meets U.S. EPA Stationary Emergency Use Only (Tier 2) emission standards
- Reliable performance proven in thousands of applications worldwide
- Certified alternative fuels including Hydrotreated Vegetable Oil (HVO), Renewable Diesel (RD) and Hydrotreated Renewable Diesel (HRD) which meet EN 15940 or ASTM D975 can be used or blended with EN 590 diesel

Generator Set Package

- Accepts 100% block load in one step
- Meets NFPA 110 loading requirements
- Conforms to ISO 8528-5 G3 load acceptance requirements
- Reliability verified through torsional vibration, fuel consumption, oil consumption, transient performance, and endurance testing

Alternators

- Superior motor starting capability minimizes need for oversizing generator
- Designed to match performance and output characteristics of Cat diesel engines

Cooling System

- Cooling systems available to operate in ambient temperatures up to 50°C (122°F)
- Tested to ensure proper generator set cooling

Cat Energy Control System (ECS)

- User-friendly interface and navigation
- Scalable system to meet a wide range of installation requirements
- Expansion modules and site specific programming for specific customer requirements
- Graphical touchscreen display
- Easily upgradeable

Warranty

- 24 months/1000-hour warranty for standby and mission critical ratings
- 12 months/unlimited hour warranty for prime and continuous ratings
- Extended service protection is available to provide extended coverage options

Worldwide Product Support

- Cat dealers have over 1,800 dealer branch stores operating in 200 countries
- Your local Cat dealer provides extensive post-sale support, including maintenance and repair agreements

Financing

- Caterpillar offers an array of financial products to help you succeed through financial service excellence
- Options include loans, finance lease, operating lease, working capital, and revolving line of credit
- Contact your local Cat dealer for availability in your region

Standard and Optional Equipment

Engine

Air Cleaner
- ❑ Single element
- ❑ Dual element

Muffler
- ❑ Industrial grade (15 dB)

Starting
- ❑ Standard batteries
- ❑ Oversized batteries
- ❑ Standard electric starter(s)
- ❑ Heavy duty electric starter(s)
- ❑ Air starter(s)
- ❑ Jacket water heater

Alternator

Output voltage
- ❑ 480V ❑ 6900V
- ❑ 600V ❑ 12470V
- ❑ 4160V ❑ 13200V
- ❑ 6300V ❑ 13800V
- ❑ 6600V

Temperature Rise (over 40°C ambient)
- ❑ 150°C
- ❑ 125°C/130°C
- ❑ 105°C
- ❑ 80°C

Winding type
- ❑ Random wound
- ❑ Form wound

Excitation
- ❑ Permanent magnet (PM)

Attachments
- ❑ Anti-condensation heater
- ❑ Stator and bearing temperature monitoring and protection

Power Termination

Type
- ❑ Bus bar
- ❑ Circuit breaker
- ❑ 1600A ❑ 2000A
- ❑ 2500A ❑ 3000A
- ❑ 3200A ❑ 4000A
- ❑ 5000A
- ❑ IEC ❑ UL
- ❑ 3-pole ❑ 4-pole
- ❑ Manually operated
- ❑ Electrically operated

Trip Unit
- ❑ LSI ❑ LSI-G
- ❑ LSIG-P

Control System

Controller
- ❑ Cat ECS 100
- ❑ Cat ECS 200
- ❑ EMCP 4.4

Attachments
- ❑ Local annunciator module
- ❑ Remote annunciator module
- ❑ Expansion I/O module
- ❑ Remote monitoring software

Charging

- ❑ Battery charger – 10A
- ❑ Battery charger – 20A
- ❑ Battery charger – 35A

Vibration Isolators

- ❑ Rubber
- ❑ Spring
- ❑ Seismic rated

Cat Connect

Connectivity
- ❑ Ethernet
- ❑ Cellular

Extended Service Options

Terms
- ❑ 2 year (prime)
- ❑ 3 year
- ❑ 5 year
- ❑ 10 year

Coverage
- ❑ Silver
- ❑ Gold
- ❑ Platinum
- ❑ Platinum Plus

Ancillary Equipment

- ❑ Automatic transfer switch (ATS)
- ❑ Paralleling switchgear
- ❑ Paralleling controls

Certifications

- ❑ ULC 2200 Listed
- ❑ IBC seismic certification
- ❑ OSHPD pre-approval

Note: *Some options may not be available on all models. Certifications may not be available with all model configurations. Consult factory for availability.*

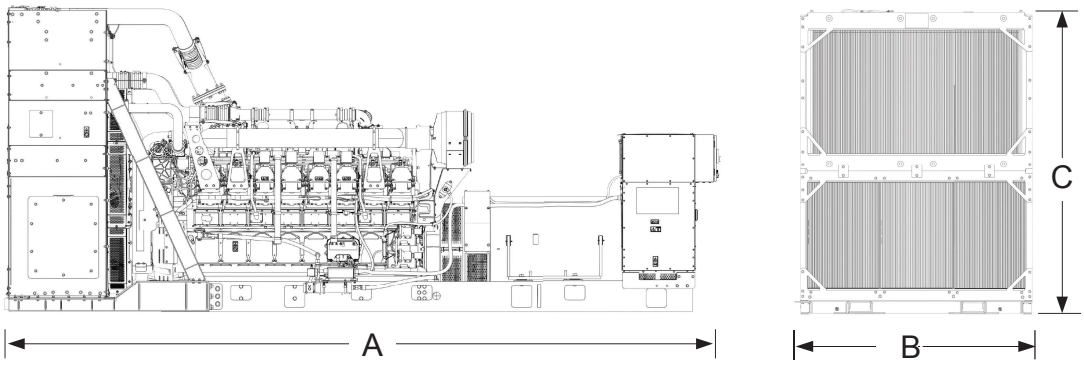
Package Performance

Performance	Standby		Mission Critical		Prime	
Frequency	60 Hz		60 Hz		60 Hz	
Gen set power rating with fan	2250 ekW		2250 ekW		2045 ekW	
Gen set power rating with fan @ 0.8 power factor	2813 kVA		2813 kVA		2556 kVA	
Emissions	EPA ESE (TIER 2)		EPA ESE (TIER 2)		EPA ESE (TIER 2)	
Performance number	EM6221-01		EM6222-01		EM6223-01	
Fuel Consumption						
100% load with fan – L/hr (gal/hr)	591.2	(156.2)	591.2	(156.2)	543.6	(143.6)
75% load with fan – L/hr (gal/hr)	464.3	(122.7)	464.3	(122.7)	430.2	(113.6)
50% load with fan – L/hr (gal/hr)	337.8	(89.2)	337.8	(89.2)	312.3	(82.5)
25% load with fan – L/hr (gal/hr)	196.9	(52.0)	196.9	(52.0)	182.8	(48.3)
Cooling System						
Radiator air flow restriction (system) – kPa (in. water)	0.12	(0.48)	0.12	(0.48)	0.12	(0.48)
Radiator air flow – m^3/min (cfm)	2356	(83201)	2356	(83201)	2356	(83201)
Engine coolant capacity – L (gal)	233.0	(61.6)	233.0	(61.6)	233.0	(61.6)
Radiator coolant capacity – L (gal)	180.0	(47.6)	180.0	(47.6)	180.0	(47.6)
Total coolant capacity – L (gal)	413.0	(109.2)	413.0	(109.2)	413.0	(109.2)
Inlet Air						
Combustion air inlet flow rate – m^3/min (cfm)	194.2	(6858.2)	194.2	(6858.2)	184.7	(6523.4)
Exhaust System						
Exhaust stack gas temperature – °C (°F)	444.0	(831.1)	444.0	(831.1)	435.3	(815.6)
Exhaust gas flow rate – m^3/min (cfm)	493.0	(17407.1)	493.0	(17407.1)	460.5	(16259.2)
Exhaust system backpressure (maximum allowable) – kPa (in. water)	6.7	(27.0)	6.7	(27.0)	6.7	(27.0)
Heat Rejection						
Heat rejection to jacket water – kW (Btu/min)	791	(44961)	791	(44961)	750	(42626)
Heat rejection to exhaust (total) – kW (Btu/min)	2312	(131476)	2312	(131476)	2132	(121263)
Heat rejection to aftercooler – kW (Btu/min)	717	(40758)	717	(40758)	638	(36308)
Heat rejection to atmosphere from engine – kW (Btu/min)	153	(8695)	153	(8695)	146	(8308)
Heat rejection from alternator – kW (Btu/min)	99	(5607)	99	(5607)	94	(5368)
Emissions* (Nominal)						
NOx mg/Nm^3 (g/hp-h)	2253.1	(5.06)	2253.1	(5.06)	2090.7	(4.72)
CO mg/Nm^3 (g/hp-h)	153.8	(0.33)	153.8	(0.33)	128.0	(0.28)
HC mg/Nm^3 (g/hp-h)	43.4	(0.11)	43.4	(0.11)	47.7	(0.12)
PM mg/Nm^3 (g/hp-h)	11.5	(0.03)	11.5	(0.03)	10.8	(0.03)
Emissions* (Potential Site Variation)						
NOx mg/Nm^3 (g/hp-h)	2703.7	(6.07)	2703.7	(6.07)	2508.9	(5.66)
CO mg/Nm^3 (g/hp-h)	276.9	(0.60)	276.9	(0.60)	230.4	(0.50)
HC mg/Nm^3 (g/hp-h)	57.8	(0.14)	57.8	(0.14)	63.4	(0.16)
PM mg/Nm^3 (g/hp-h)	16.1	(0.04)	16.1	(0.04)	15.1	(0.04)

**mg/Nm^3 levels are corrected to 5% O_2. Contact your local Cat dealer for further information.*

3516C Diesel Generator Sets
Electric Power

Weights and Dimensions



Dim "A" mm (in)	Dim "B" mm (in)	Dim "C" mm (in)	Dry Weight kg (lb)
7019 (276.3)	2339 (92.1)	2997 (118.0)	17 590 (38,780)

Note: *For reference only. Do not use for installation design. Contact your local Cat dealer for precise weights and dimensions.*

Ratings Definitions

Standby
Output available with varying load for the duration of the interruption of the normal source power. Average power output is 70% of the standby rated ekW. Typical operation is 200 hours per year, with maximum expected usage of 500 hours per year.

Mission Critical
Output available with varying load for the duration of the interruption of the normal source power. Average power output is 85% of the mission critical rated ekW. Typical peak demand up to 100% of rated ekW for up to 5% of the operating time. Typical operation is 200 hours per year, with maximum expected usage of 500 hours per year.

Prime
Output available with varying load for an unlimited time. Average power output is 70% of the prime rated ekW. Typical peak demand is 100% of prime rated ekW with 10% overload capability for emergency use for a maximum of 1 hour in 12. Overload operation cannot exceed 25 hours per year.

Applicable Codes and Standards
AS 1359, ULC 2200 3rd edition, UL 489, UL 869A, IBC, IEC 60034-1, ISO 3046, ISO 8528, NEMA MG1-22, NEMA MG1-33, 2014/35/EU, 2006/42/EC, 2014/30/EU and facilitates compliance to NFPA 37, NFPA 70, NFPA 99, NFPA 110.

Note: Codes may not be available in all model configurations. Please consult your local Cat dealer for availability.

Data Center Applications
- All ratings Tier III/Tier IV compliant per Uptime Institute requirements.
- All ratings ANSI/TIA-942 compliant for Rated-1 through Rated-4 data centers.

Fuel Rates
Fuel consumption reported in accordance with ISO 3046-1, based on fuel oil of 35° API [16°C (60°F)] gravity having an LHV of 42,780 kJ/kg (18,390 Btu/lb) when used at 15°C (59°F) and weighing 850 g/liter (7.0936 lbs/U.S. gal.) All fuel consumption values refer to rated engine power.

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Materials and specifications are subject to change without notice.
The International System of Units (SI) is used in this publication.

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3516 PGJL
LEHE21065-01 (05/23)

PERFORMANCE DATA[EM6221]

April 18, 2024

Performance Number: EM6221 **Change Level: 01**

SALES MODEL:	3516C	**COMBUSTION:**	DIRECT INJECTION
BRAND:	CAT	**ENGINE SPEED (RPM):**	1,800
MACHINE SALES MODEL:		**HERTZ:**	60
ENGINE POWER (BHP):	3,379	**FAN POWER (HP):**	130.1
GEN POWER WITH FAN (EKW):	2,250.0	**ASPIRATION:**	TA
COMPRESSION RATIO:	14.7	**AFTERCOOLER TYPE:**	ATAAC
RATING LEVEL:	STANDBY	**AFTERCOOLER CIRCUIT TYPE:**	JW+OC, ATAAC
PUMP QUANTITY:	1	**INLET MANIFOLD AIR TEMP (F):**	122
FUEL TYPE:	DIESEL	**JACKET WATER TEMP (F):**	219.2
MANIFOLD TYPE:	DRY	**TURBO CONFIGURATION:**	PARALLEL
GOVERNOR TYPE:	ADEM3	**TURBO QUANTITY:**	4
ELECTRONICS TYPE:	ADEM3	**TURBOCHARGER MODEL:**	GT6041BN-48T-1.10
CAMSHAFT TYPE:	STANDARD	**CERTIFICATION YEAR:**	2022
IGNITION TYPE:	CI	**CRANKCASE BLOWBY RATE (FT3/HR):**	3,619.4
INJECTOR TYPE:	EUI	**FUEL RATE (RATED RPM) NO LOAD (GAL/HR):**	16.0
FUEL INJECTOR:	3920221	**PISTON SPD @ RATED ENG SPD (FT/MIN):**	2,539.4
UNIT INJECTOR TIMING (IN):	64.34		
REF EXH STACK DIAMETER (IN):	12		
MAX OPERATING ALTITUDE (FT):	2,953		

INDUSTRY	SUBINDUSTRY	APPLICATION
ELECTRIC POWER	STANDARD	PACKAGED GENSET
OIL AND GAS	LAND PRODUCTION	PACKAGED GENSET

General Performance Data

THIS STANDBY RATING IS FOR A STANDBY ONLY ENGINE ARRANGEMENT. RERATING THE ENGINE TO A PRIME OR CONTINUOUS RATING IS NOT PERMITTED.

THE INLET MANIFOLD AIR TEMP LISTED IN THE HEADER, AND IN THE GENERAL PERFORMANCE DATA, IS THE AVERAGE INLET MANIFOLD TEMP FRONT TO REAR ON THE ENGINE.

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	BRAKE MEAN EFF PRES (BMEP)	BRAKE SPEC FUEL CONSUMPTN (BSFC)	ISO BRAKE SPEC FUEL CONSUMPTN (BSFC)	VOL FUEL CONSUMPTN (VFC)	ISO VOL FUEL CONSUMPTN (VFC)	ELEC SPEC FUEL CONSUMPTN (ESFC)	ISO ELEC SPEC FUEL CONSUMPTN (ESFC)
EKW	%	BHP	PSI	LB/BHP-HR	LB/BHP-HR	GAL/HR	GAL/HR	LB/EKW-HR	LB/EKW-HR
2,250.0	100	3,374	312	0.335	0.328	159.2	156.2	0.502	0.492
2,025.0	90	3,050	282	0.338	0.331	145.2	142.4	0.509	0.499
1,800.0	80	2,726	252	0.343	0.336	131.8	129.2	0.519	0.509
1,687.5	75	2,563	237	0.346	0.339	125.0	122.7	0.526	0.516
1,575.0	70	2,401	222	0.350	0.343	118.3	116.1	0.533	0.523
1,350.0	60	2,077	192	0.358	0.351	104.9	102.9	0.551	0.541
1,125.0	50	1,752	162	0.368	0.361	91.0	89.2	0.574	0.563
900.0	40	1,428	132	0.377	0.370	75.9	74.4	0.598	0.587
675.0	30	1,103	102	0.390	0.383	60.7	59.5	0.637	0.625
562.5	25	941	87	0.400	0.392	53.0	52.0	0.669	0.656
450.0	20	779	72	0.407	0.399	44.7	43.8	0.704	0.691
225.0	10	455	42	0.453	0.444	29.0	28.5	0.914	0.897

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	INLET MFLD PRES	INLET MFLD TEMP	EXH MFLD TEMP	EXH MFLD PRES	ENGINE OUTLET TEMP	COMPRESSOR OUTLET PRES	COMPRESSOR OUTLET TEMP
EKW	%	BHP	IN-HG	DEG F	DEG F	IN-HG	DEG F	IN-HG	DEG F
2,250.0	100	3,374	73.1	120.0	1,200.9	62.9	831.1	79	449.4
2,025.0	90	3,050	66.7	117.7	1,168.2	57.3	814.6	73	426.3
1,800.0	80	2,726	60.0	115.6	1,143.1	51.7	803.6	66	402.1
1,687.5	75	2,563	56.6	114.5	1,131.8	48.9	798.2	62	389.5
1,575.0	70	2,401	53.1	113.6	1,121.5	46.1	792.6	58	376.7
1,350.0	60	2,077	45.8	111.9	1,103.7	40.3	781.6	51	350.5
1,125.0	50	1,752	37.5	110.4	1,081.5	34.0	773.0	42	321.2
900.0	40	1,428	27.9	108.8	1,047.3	26.6	767.3	32	282.4
675.0	30	1,103	19.1	107.5	987.7	20.1	741.8	23	234.7
562.5	25	941	14.9	106.8	942.3	17.1	717.7	18	209.9
450.0	20	779	10.8	106.0	863.4	14.1	672.8	14	186.4
225.0	10	455	4.1	103.8	674.7	9.4	542.9	7	149.6

General Performance Data (Continued)

PERFORMANCE DATA[EM6221]

April 18, 2024

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	WET INLET AIR VOL FLOW RATE	ENGINE OUTLET WET EXH GAS VOL FLOW RATE	WET INLET AIR MASS FLOW RATE	WET EXH GAS MASS FLOW RATE	WET EXH VOL FLOW RATE (32 DEG F AND 29.98 IN HG)	DRY EXH VOL FLOW RATE (32 DEG F AND 29.98 IN HG)
EKW	%	BHP	CFM	CFM	LB/HR	LB/HR	FT3/MIN	FT3/MIN
2,250.0	100	3,374	6,858.2	17,407.1	30,365.3	31,494.0	6,630.5	6,037.5
2,025.0	90	3,050	6,489.6	16,154.5	28,654.3	29,680.3	6,233.1	5,692.3
1,800.0	80	2,726	6,087.8	15,004.0	26,862.9	27,791.8	5,839.4	5,345.3
1,687.5	75	2,563	5,872.3	14,427.7	25,926.6	26,809.3	5,639.6	5,167.8
1,575.0	70	2,401	5,647.2	13,834.3	24,963.3	25,801.3	5,431.5	4,981.7
1,350.0	60	2,077	5,158.9	12,527.3	22,833.7	23,578.6	4,962.2	4,559.4
1,125.0	50	1,752	4,572.7	11,023.3	20,251.8	20,897.8	4,396.8	4,044.9
900.0	40	1,428	3,860.7	9,269.3	17,111.4	17,649.6	3,714.5	3,419.8
675.0	30	1,103	3,239.5	7,617.3	14,362.7	14,794.6	3,117.1	2,877.2
562.5	25	941	2,947.8	6,779.0	13,070.3	13,446.6	2,830.8	2,618.8
450.0	20	779	2,658.3	5,843.7	11,787.4	12,106.6	2,537.2	2,356.0
225.0	10	455	2,196.2	4,258.9	9,730.2	9,935.9	2,088.6	1,962.8

Heat Rejection Data

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	REJECTION TO JACKET WATER	REJECTION TO ATMOSPHERE	REJECTION TO EXH	EXHAUST RECOVERY TO 350F	FROM OIL COOLER	FROM AFTERCOOLER	WORK ENERGY	LOW HEAT VALUE ENERGY	HIGH HEAT VALUE ENERGY
EKW	%	BHP	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN
2,250.0	100	3,374	44,961	8,695	131,476	63,993	18,438	40,758	143,102	346,181	368,770
2,025.0	90	3,050	42,398	8,278	120,387	58,091	16,816	35,879	129,344	315,723	336,324
1,800.0	80	2,726	39,796	7,978	110,538	53,009	15,259	31,108	115,585	286,488	305,182
1,687.5	75	2,563	38,475	7,859	105,617	50,468	14,481	28,765	108,706	271,872	289,612
1,575.0	70	2,401	37,140	7,759	100,698	47,928	13,702	26,451	101,827	257,256	274,043
1,350.0	60	2,077	34,339	7,618	90,867	42,630	12,145	22,036	88,068	228,026	242,905
1,125.0	50	1,752	31,319	7,440	80,442	36,985	10,536	17,258	74,310	197,807	210,714
900.0	40	1,428	27,975	7,134	68,114	30,787	8,786	11,958	60,551	164,955	175,718
675.0	30	1,103	24,301	6,592	55,504	24,155	7,025	7,409	46,792	131,892	140,498
562.5	25	941	22,280	6,232	48,971	20,544	6,140	5,467	39,913	115,281	122,803
450.0	20	779	19,891	5,781	40,969	16,154	5,174	3,811	33,033	97,146	103,485
225.0	10	455	15,117	4,928	26,069	7,803	3,359	1,778	19,275	63,071	67,186

Sound Data

EXHAUST:SOUND PRESSURE(OBCF) DISTANCE:1.5 METER

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	OVERALL SOUND	63 HZ	125 HZ	250 HZ	500 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
2,250.0	100	3,374	118.0	108.0	123.0	119.0	111.0
2,025.0	90	3,050	117.0	107.0	122.0	118.0	110.0
1,800.0	80	2,726	116.0	106.0	121.0	117.0	109.0
1,687.5	75	2,563	115.0	106.0	120.0	116.0	108.0
1,575.0	70	2,401	115.0	105.0	120.0	116.0	108.0
1,350.0	60	2,077	114.0	104.0	119.0	115.0	107.0
1,125.0	50	1,752	112.0	103.0	117.0	113.0	105.0
900.0	40	1,428	111.0	101.0	116.0	112.0	104.0
675.0	30	1,103	109.0	99.0	114.0	110.0	102.0
562.5	25	941	108.0	98.0	113.0	109.0	101.0
450.0	20	779	107.0	97.0	112.0	108.0	100.0
225.0	10	455	105.0	95.0	110.0	106.0	98.0

EXHAUST:SOUND PRESSURE(OBCF) DISTANCE:1.5 METER

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	1000 HZ	2000 HZ	4000 HZ	8000 HZ

PERFORMANCE DATA[EM6221]

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EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)
2,250.0	100	3,374	110.0	111.0	111.0	109.0
2,025.0	90	3,050	109.0	110.0	110.0	108.0
1,800.0	80	2,726	107.0	109.0	109.0	107.0
1,687.5	75	2,563	107.0	108.0	108.0	106.0
1,575.0	70	2,401	106.0	108.0	107.0	105.0
1,350.0	60	2,077	105.0	106.0	106.0	104.0
1,125.0	50	1,752	104.0	105.0	105.0	103.0
900.0	40	1,428	102.0	104.0	103.0	101.0
675.0	30	1,103	101.0	102.0	102.0	100.0
562.5	25	941	100.0	101.0	101.0	99.0
450.0	20	779	99.0	100.0	100.0	98.0
225.0	10	455	96.0	98.0	97.0	96.0

EXHAUST:SOUND PRESSURE(OBCF) DISTANCE:7 METER

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	OVERALL SOUND	63 HZ	125 HZ	250 HZ	500 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
2,250.0	100	3,374	105.0	96.0	113.0	107.0	98.0
2,025.0	90	3,050	104.0	95.0	112.0	106.0	97.0
1,800.0	80	2,726	103.0	94.0	111.0	105.0	96.0
1,687.5	75	2,563	102.0	93.0	110.0	104.0	96.0
1,575.0	70	2,401	101.0	93.0	109.0	104.0	95.0
1,350.0	60	2,077	100.0	92.0	108.0	102.0	94.0
1,125.0	50	1,752	99.0	90.0	107.0	101.0	92.0
900.0	40	1,428	97.0	89.0	105.0	100.0	91.0
675.0	30	1,103	96.0	87.0	104.0	98.0	89.0
562.5	25	941	95.0	86.0	103.0	97.0	88.0
450.0	20	779	94.0	85.0	102.0	96.0	87.0
225.0	10	455	91.0	83.0	99.0	94.0	85.0

EXHAUST:SOUND PRESSURE(OBCF) DISTANCE:7 METER

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	1000 HZ	2000 HZ	4000 HZ	8000 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)
2,250.0	100	3,374	97.0	97.0	97.0	95.0
2,025.0	90	3,050	96.0	96.0	96.0	93.0
1,800.0	80	2,726	95.0	95.0	95.0	92.0
1,687.5	75	2,563	94.0	95.0	95.0	92.0
1,575.0	70	2,401	93.0	94.0	94.0	91.0
1,350.0	60	2,077	92.0	93.0	93.0	90.0
1,125.0	50	1,752	91.0	92.0	91.0	89.0
900.0	40	1,428	89.0	90.0	90.0	87.0
675.0	30	1,103	88.0	88.0	88.0	86.0
562.5	25	941	87.0	87.0	87.0	85.0
450.0	20	779	86.0	87.0	86.0	84.0
225.0	10	455	83.0	84.0	84.0	81.0

EXHAUST:SOUND PRESSURE(OBCF) DISTANCE:15 METER

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	OVERALL SOUND	63 HZ	125 HZ	250 HZ	500 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
2,250.0	100	3,374	98.0	89.0	106.0	100.0	92.0
2,025.0	90	3,050	97.0	88.0	105.0	99.0	91.0
1,800.0	80	2,726	96.0	87.0	104.0	98.0	90.0
1,687.5	75	2,563	95.0	87.0	103.0	98.0	89.0
1,575.0	70	2,401	95.0	86.0	103.0	97.0	88.0
1,350.0	60	2,077	94.0	85.0	102.0	96.0	87.0
1,125.0	50	1,752	92.0	84.0	100.0	94.0	86.0
900.0	40	1,428	91.0	82.0	99.0	93.0	84.0
675.0	30	1,103	89.0	80.0	97.0	91.0	83.0
562.5	25	941	88.0	80.0	96.0	90.0	82.0
450.0	20	779	87.0	79.0	95.0	89.0	81.0
225.0	10	455	85.0	76.0	93.0	87.0	78.0

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EXHAUST:SOUND PRESSURE(OBCF) DISTANCE:15 METER

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	1000 HZ	2000 HZ	4000 HZ	8000 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)
2,250.0	100	3,374	90.0	91.0	91.0	88.0
2,025.0	90	3,050	89.0	90.0	90.0	87.0
1,800.0	80	2,726	88.0	89.0	88.0	86.0
1,687.5	75	2,563	87.0	88.0	88.0	85.0
1,575.0	70	2,401	87.0	87.0	87.0	85.0
1,350.0	60	2,077	86.0	86.0	86.0	83.0
1,125.0	50	1,752	84.0	85.0	85.0	82.0
900.0	40	1,428	83.0	83.0	83.0	81.0
675.0	30	1,103	81.0	82.0	82.0	79.0
562.5	25	941	80.0	81.0	81.0	78.0
450.0	20	779	79.0	80.0	80.0	77.0
225.0	10	455	77.0	78.0	77.0	75.0

MECHANICAL:SOUND PRESSURE(OBCF) DISTANCE:1 METER

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	OVERALL SOUND	63 HZ	125 HZ	250 HZ	500 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
2,250.0	100	3,374	105.0	92.0	100.0	101.0	99.0
2,025.0	90	3,050	105.0	92.0	100.0	101.0	99.0
1,800.0	80	2,726	105.0	92.0	100.0	101.0	99.0
1,687.5	75	2,563	105.0	92.0	100.0	101.0	99.0
1,575.0	70	2,401	105.0	92.0	100.0	101.0	99.0
1,350.0	60	2,077	105.0	92.0	100.0	101.0	99.0
1,125.0	50	1,752	105.0	92.0	100.0	101.0	99.0
900.0	40	1,428	105.0	92.0	100.0	101.0	99.0
675.0	30	1,103	105.0	92.0	100.0	101.0	99.0
562.5	25	941	105.0	92.0	100.0	101.0	99.0
450.0	20	779	105.0	92.0	100.0	101.0	99.0
225.0	10	455	105.0	92.0	100.0	101.0	99.0

MECHANICAL:SOUND PRESSURE(OBCF) DISTANCE:1 METER

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	1000 HZ	2000 HZ	4000 HZ	8000 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)
2,250.0	100	3,374	100.0	101.0	99.0	103.0
2,025.0	90	3,050	100.0	101.0	99.0	103.0
1,800.0	80	2,726	100.0	101.0	99.0	103.0
1,687.5	75	2,563	100.0	101.0	99.0	103.0
1,575.0	70	2,401	100.0	101.0	99.0	103.0
1,350.0	60	2,077	100.0	101.0	99.0	103.0
1,125.0	50	1,752	100.0	101.0	99.0	103.0
900.0	40	1,428	100.0	101.0	99.0	103.0
675.0	30	1,103	100.0	101.0	99.0	103.0
562.5	25	941	100.0	101.0	99.0	103.0
450.0	20	779	100.0	101.0	99.0	103.0
225.0	10	455	100.0	101.0	99.0	103.0

MECHANICAL:SOUND PRESSURE(OBCF) DISTANCE:7 METER

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	OVERALL SOUND	63 HZ	125 HZ	250 HZ	500 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
2,250.0	100	3,374	94.0	81.0	88.0	89.0	87.0
2,025.0	90	3,050	94.0	81.0	88.0	89.0	87.0
1,800.0	80	2,726	94.0	81.0	88.0	89.0	87.0
1,687.5	75	2,563	94.0	81.0	88.0	89.0	87.0
1,575.0	70	2,401	94.0	81.0	88.0	89.0	87.0
1,350.0	60	2,077	94.0	81.0	88.0	89.0	87.0
1,125.0	50	1,752	94.0	81.0	88.0	89.0	87.0
900.0	40	1,428	94.0	81.0	88.0	89.0	87.0
675.0	30	1,103	94.0	81.0	88.0	89.0	87.0
562.5	25	941	94.0	81.0	88.0	89.0	87.0

450.0	20	779	94.0	81.0	88.0	89.0	87.0
225.0	10	455	94.0	81.0	88.0	89.0	87.0

MECHANICAL:SOUND PRESSURE(OBCF) DISTANCE:7 METER

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	1000 HZ	2000 HZ	4000 HZ	8000 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)
2,250.0	100	3,374	89.0	90.0	87.0	91.0
2,025.0	90	3,050	89.0	90.0	87.0	91.0
1,800.0	80	2,726	89.0	90.0	87.0	91.0
1,687.5	75	2,563	89.0	90.0	87.0	91.0
1,575.0	70	2,401	89.0	90.0	87.0	91.0
1,350.0	60	2,077	89.0	90.0	87.0	91.0
1,125.0	50	1,752	89.0	90.0	87.0	91.0
900.0	40	1,428	89.0	90.0	87.0	91.0
675.0	30	1,103	89.0	90.0	87.0	91.0
562.5	25	941	89.0	90.0	87.0	91.0
450.0	20	779	89.0	90.0	87.0	91.0
225.0	10	455	89.0	90.0	87.0	91.0

MECHANICAL:SOUND PRESSURE(OBCF) DISTANCE:15 METER

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	OVERALL SOUND	63 HZ	125 HZ	250 HZ	500 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
2,250.0	100	3,374	88.0	76.0	83.0	84.0	82.0
2,025.0	90	3,050	88.0	76.0	83.0	84.0	82.0
1,800.0	80	2,726	88.0	76.0	83.0	84.0	82.0
1,687.5	75	2,563	88.0	76.0	83.0	84.0	82.0
1,575.0	70	2,401	88.0	76.0	83.0	84.0	82.0
1,350.0	60	2,077	88.0	76.0	83.0	84.0	82.0
1,125.0	50	1,752	88.0	76.0	83.0	84.0	82.0
900.0	40	1,428	88.0	76.0	83.0	84.0	82.0
675.0	30	1,103	88.0	76.0	83.0	84.0	82.0
562.5	25	941	88.0	76.0	83.0	84.0	82.0
450.0	20	779	88.0	76.0	83.0	84.0	82.0
225.0	10	455	88.0	76.0	83.0	84.0	82.0

MECHANICAL:SOUND PRESSURE(OBCF) DISTANCE:15 METER

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	1000 HZ	2000 HZ	4000 HZ	8000 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)
2,250.0	100	3,374	83.0	84.0	82.0	86.0
2,025.0	90	3,050	83.0	84.0	82.0	86.0
1,800.0	80	2,726	83.0	84.0	82.0	86.0
1,687.5	75	2,563	83.0	84.0	82.0	86.0
1,575.0	70	2,401	83.0	84.0	82.0	86.0
1,350.0	60	2,077	83.0	84.0	82.0	86.0
1,125.0	50	1,752	83.0	84.0	82.0	86.0
900.0	40	1,428	83.0	84.0	82.0	86.0
675.0	30	1,103	83.0	84.0	82.0	86.0
562.5	25	941	83.0	84.0	82.0	86.0
450.0	20	779	83.0	84.0	82.0	86.0
225.0	10	455	83.0	84.0	82.0	86.0

Emissions Data

DIESEL

RATED SPEED NOMINAL DATA: 1800 RPM

GENSET POWER WITH	EKW	2,250.0	1,687.5	1,125.0	562.5	225.0

PERFORMANCE DATA[EM6221]

April 18, 2024

FAN							
PERCENT LOAD		**%**	**100**	**75**	**50**	**25**	**10**
ENGINE POWER		**BHP**	**3,374**	**2,563**	**1,752**	**941**	**455**
TOTAL NOX (AS NO2)		G/HR	16,908	10,163	5,286	2,744	2,641
TOTAL CO		G/HR	1,114	674	628	861	1,201
TOTAL HC		G/HR	361	388	396	303	339
TOTAL CO2		KG/HR	1,614	1,257	902	517	278
PART MATTER		G/HR	100.9	89.2	98.5	97.9	96.6
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	2,253.1	1,706.2	1,248.8	1,114.3	1,971.4
TOTAL CO	(CORR 5% O2)	MG/NM3	153.8	118.7	153.7	368.3	948.1
TOTAL HC	(CORR 5% O2)	MG/NM3	43.4	60.0	84.2	112.2	233.9
PART MATTER	(CORR 5% O2)	MG/NM3	11.5	12.9	20.7	35.9	64.2
TOTAL NOX (AS NO2)	(CORR 15% O2)	MG/NM3	836.1	633.1	463.4	413.5	731.5
TOTAL CO	(CORR 15% O2)	MG/NM3	57.1	44.1	57.0	136.6	351.8
TOTAL HC	(CORR 15% O2)	MG/NM3	16.1	22.3	31.3	41.6	86.8
PART MATTER	(CORR 15% O2)	MG/NM3	4.3	4.8	7.7	13.3	23.8
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	1,097	831	608	543	960
TOTAL CO	(CORR 5% O2)	PPM	123	95	123	295	759
TOTAL HC	(CORR 5% O2)	PPM	81	112	157	209	437
TOTAL NOX (AS NO2)	(CORR 15% O2)	PPM	407	308	226	201	356
TOTAL CO	(CORR 15% O2)	PPM	46	35	46	109	281
TOTAL HC	(CORR 15% O2)	PPM	30	42	58	78	162
TOTAL NOX (AS NO2)		G/HP-HR	5.06	4.00	3.04	2.94	5.86
TOTAL CO		G/HP-HR	0.33	0.27	0.36	0.92	2.67
TOTAL HC		G/HP-HR	0.11	0.15	0.23	0.32	0.75
PART MATTER		G/HP-HR	0.03	0.04	0.06	0.11	0.21
TOTAL NOX (AS NO2)		G/KW-HR	6.88	5.44	4.14	4.00	7.97
TOTAL CO		G/KW-HR	0.45	0.36	0.49	1.26	3.63
TOTAL HC		G/KW-HR	0.15	0.21	0.31	0.44	1.02
PART MATTER		G/KW-HR	0.04	0.05	0.08	0.14	0.29
TOTAL NOX (AS NO2)		LB/HR	37.28	22.40	11.65	6.05	5.82
TOTAL CO		LB/HR	2.46	1.49	1.39	1.90	2.65
TOTAL HC		LB/HR	0.80	0.85	0.87	0.67	0.75
TOTAL CO2		LB/HR	3,558	2,772	1,989	1,140	612
PART MATTER		LB/HR	0.22	0.20	0.22	0.22	0.21
OXYGEN IN EXH		%	9.7	10.6	11.4	12.4	14.7
DRY SMOKE OPACITY		%	1.2	1.5	2.1	2.7	3.7
BOSCH SMOKE NUMBER			0.78	0.81	0.87	0.98	1.11

RATED SPEED POTENTIAL SITE VARIATION: 1800 RPM

GENSET POWER WITH FAN		**EKW**	**2,250.0**	**1,687.5**	**1,125.0**	**562.5**	**225.0**
PERCENT LOAD		**%**	**100**	**75**	**50**	**25**	**10**
ENGINE POWER		**BHP**	**3,374**	**2,563**	**1,752**	**941**	**455**
TOTAL NOX (AS NO2)		G/HR	20,290	12,195	6,343	3,293	3,170
TOTAL CO		G/HR	2,006	1,214	1,131	1,550	2,162
TOTAL HC		G/HR	480	516	527	403	451
PART MATTER		G/HR	141.2	124.9	137.9	137.1	135.2
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	2,703.7	2,047.4	1,498.6	1,337.2	2,365.7
TOTAL CO	(CORR 5% O2)	MG/NM3	276.9	213.7	276.6	662.9	1,706.6
TOTAL HC	(CORR 5% O2)	MG/NM3	57.8	79.8	112.1	149.2	311.0
PART MATTER	(CORR 5% O2)	MG/NM3	16.1	18.1	28.9	50.3	89.8
TOTAL NOX (AS NO2)	(CORR 15% O2)	MG/NM3	1,003.3	759.7	556.1	496.2	877.8
TOTAL CO	(CORR 15% O2)	MG/NM3	102.7	79.3	102.7	246.0	633.3
TOTAL HC	(CORR 15% O2)	MG/NM3	21.4	29.6	41.6	55.4	115.4
PART MATTER	(CORR 15% O2)	MG/NM3	6.0	6.7	10.7	18.7	33.3
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	1,317	997	730	651	1,152
TOTAL CO	(CORR 5% O2)	PPM	222	171	221	530	1,365
TOTAL HC	(CORR 5% O2)	PPM	108	149	209	278	581
TOTAL NOX (AS NO2)	(CORR 15% O2)	PPM	489	370	271	242	428
TOTAL CO	(CORR 15% O2)	PPM	82	63	82	197	507
TOTAL HC	(CORR 15% O2)	PPM	40	55	78	103	215
TOTAL NOX (AS NO2)		G/HP-HR	6.07	4.80	3.65	3.53	7.04
TOTAL CO		G/HP-HR	0.60	0.48	0.65	1.66	4.80
TOTAL HC		G/HP-HR	0.14	0.20	0.30	0.43	1.00
PART MATTER		G/HP-HR	0.04	0.05	0.08	0.15	0.30
TOTAL NOX (AS NO2)		G/KW-HR	8.25	6.53	4.97	4.80	9.57
TOTAL CO		G/KW-HR	0.82	0.65	0.89	2.26	6.53
TOTAL HC		G/KW-HR	0.20	0.28	0.41	0.59	1.36
PART MATTER		G/KW-HR	0.06	0.07	0.11	0.20	0.41
TOTAL NOX (AS NO2)		LB/HR	44.73	26.89	13.98	7.26	6.99
TOTAL CO		LB/HR	4.42	2.68	2.49	3.42	4.77
TOTAL HC		LB/HR	1.06	1.14	1.16	0.89	0.99

PART MATTER	LB/HR	0.31	0.28	0.30	0.30	0.30

Regulatory Information

EPA EMERGENCY STATIONARY		2011 - ----		
GASEOUS EMISSIONS DATA MEASUREMENTS PROVIDED TO THE EPA ARE CONSISTENT WITH THOSE DESCRIBED IN EPA 40 CFR PART 60 SUBPART IIII AND ISO 8178 FOR MEASURING HC, CO, PM, AND NOX. THE "MAX LIMITS" SHOWN BELOW ARE WEIGHTED CYCLE AVERAGES AND ARE IN COMPLIANCE WITH THE EMERGENCY STATIONARY REGULATIONS.				
Locality	**Agency**	**Regulation**	**Tier/Stage**	**Max Limits - G/BKW - HR**
U.S. (INCL CALIF)	EPA	STATIONARY	EMERGENCY STATIONARY	CO: 3.5 NOx + HC: 6.4 PM: 0.20

Altitude Derate Data

STANDARD

ALTITUDE CORRECTED POWER CAPABILITY (BHP)

AMBIENT OPERATING TEMP (F)	30	40	50	60	70	80	90	100	110	120	130	140	NORMAL
ALTITUDE (FT)													
0	3,379	3,379	3,379	3,379	3,379	3,379	3,379	3,379	3,379	3,379	3,379	3,244	3,379
1,000	3,379	3,379	3,379	3,379	3,379	3,379	3,379	3,379	3,379	3,356	3,299	3,176	3,379
2,000	3,379	3,379	3,379	3,379	3,379	3,379	3,379	3,351	3,292	3,236	3,176	2,872	3,379
3,000	3,373	3,373	3,373	3,373	3,373	3,350	3,289	3,230	3,173	3,119	2,872	2,500	3,373
4,000	3,258	3,258	3,258	3,258	3,258	3,228	3,169	3,113	3,058	2,906	2,534	2,061	3,258
5,000	3,147	3,147	3,147	3,147	3,147	3,110	3,053	2,999	2,940	2,568	2,061	1,690	3,147
6,000	3,040	3,040	3,040	3,040	3,040	2,995	2,941	2,888	2,568	2,095	1,690	1,419	3,040
7,000	2,937	2,937	2,937	2,937	2,937	2,884	2,831	2,602	2,129	1,723	1,453	1,250	2,937
8,000	2,838	2,838	2,838	2,838	2,828	2,776	2,534	2,163	1,723	1,453	1,250	1,115	2,838
9,000	2,743	2,743	2,743	2,743	2,669	2,433	2,095	1,757	1,487	1,284	1,115	1,014	2,743
10,000	2,651	2,651	2,651	2,568	2,298	1,960	1,723	1,487	1,284	1,149	1,014	912	2,651
11,000	2,563	2,563	2,433	2,129	1,825	1,622	1,453	1,284	1,149	1,047	946	879	2,500
12,000	2,478	2,298	1,994	1,723	1,554	1,385	1,284	1,149	1,047	946	879		2,163
13,000	2,163	1,858	1,622	1,453	1,318	1,216	1,149	1,047	946	879			1,858
14,000	1,757	1,554	1,385	1,284	1,183	1,115	1,014	946	879				1,622
15,000	1,487	1,352	1,216	1,149	1,081	1,014	946	879					1,419

Cross Reference

Test Spec	Setting	Engine Arrangement	Engineering Model	Engineering Model Version	Start Effective Serial Number	End Effective Serial Number
5958065	LL2882	6250804	PG243	-	LYM00001	

Supplementary Data

Type	Classification	Performance Number
SOUND	SOUND PRESSURE	DM8779

Performance Parameter Reference

Parameters Reference:DM9600-15

PERFORMANCE DEFINITIONS

PERFORMANCE DATA[EM6221]

PERFORMANCE DEFINITIONS DM9600
APPLICATION:
Engine performance tolerance values below are representative of a typical production engine tested in a calibrated dynamometer test cell at SAE J1995 standard reference conditions. Caterpillar maintains ISO9001:2000 certified quality management systems for engine test Facilities to assure accurate calibration of test equipment. Engine test data is corrected in accordance with SAE J1995. Additional reference material SAE J1228, J1349, ISO 8665, 3046-1:2002E, 3046-3:1989, 1585, 2534, 2288, and 9249 may apply in part or are similar to SAE J1995. Special engine rating request (SERR) test data shall be noted.
PERFORMANCE PARAMETER TOLERANCE FACTORS:
Power +/- 3%
Torque +/- 3%
Exhaust stack temperature +/- 8%
Inlet airflow +/- 5%
Intake manifold pressure-gage +/- 10%
Exhaust flow +/- 6%
Specific fuel consumption +/- 3%
Specific fuel consumption (C7-C18) +/- 4%
Fuel rate +/- 5%
Specific DEF consumption +/- 3%
DEF rate +/- 5%
Heat rejection +/- 5%
Heat rejection exhaust only +/- 10%
Heat rejection CEM only +/- 10%
Heat Rejection values based on using treated water.
Torque is included for truck and industrial applications, do not use for Gen Set or steady state applications.
On C7 - C18 engines, at speeds of 1100 RPM and under these values are provided for reference only, and may not meet the tolerance listed.
On 3500 and C175 engines, at speeds below Peak Torque these values are provided for reference only, and may not meet the tolerance listed.
These values do not apply to C280/3600. For these models, see the tolerances listed below.
C280/3600 HEAT REJECTION TOLERANCE FACTORS:
Heat rejection +/- 10%
Heat rejection to Atmosphere +/- 50%
Heat rejection to Lube Oil +/- 20%
Heat rejection to Aftercooler +/- 5%
TEST CELL TRANSDUCER TOLERANCE FACTORS:
Torque +/- 0.5%
Speed +/- 0.2%
Fuel flow +/- 1.0%
Temperature +/- 2.0 C degrees
Intake manifold pressure +/- 0.1 kPa
OBSERVED ENGINE PERFORMANCE IS CORRECTED TO SAE J1995 REFERENCE
AIR AND FUEL CONDITIONS.
REFERENCE ATMOSPHERIC INLET AIR
FOR 3500 ENGINES AND SMALLER
SAE J1228 AUG2002 for marine engines, and J1995 JAN2014 for other engines, reference atmospheric pressure is 100 KPA (29.61 in hg), and standard temperature is 25deg C (77 deg F) at 30% relative humidity at the stated aftercooler water temp, or inlet manifold temp.
FOR 3600 ENGINES
Engine rating obtained and presented in accordance with ISO 3046/1 and SAE J1995 JANJAN2014 reference atmospheric pressure is 100 KPA (29.61 in hg), and standard temperature is 25deg C (77 deg F) at 30% relative humidity and 150M altitude at the stated aftercooler water temperature.
MEASUREMENT LOCATION FOR INLET AIR TEMPERATURE
Location for air temperature measurement air cleaner inlet at stabilized operating conditions.
REFERENCE EXHAUST STACK DIAMETER
The Reference Exhaust Stack Diameter published with this dataset is only used for the calculation of Smoke Opacity values displayed in this dataset. This value does not necessarily represent the actual stack diameter of the engine due to the variety of exhaust stack adapter options available. Consult the price list, engine order or general dimension drawings for the actual stack diameter size ordered or options available.
REFERENCE FUEL
DIESEL
Reference fuel is #2 distillate diesel with a 35API gravity;
A lower heating value is 42,780 KJ/KG (18,390 BTU/LB) when used at 15 deg C (59 deg F), where the density is 850 G/Liter (7.0936 Lbs/Gal).
GAS
Reference natural gas fuel has a lower heating value of 33.74 KJ/L (905 BTU/CU Ft). Low BTU ratings are based on 18.64 KJ/L (500 BTU/CU FT) lower heating value gas. Propane ratings are based on 87.56 KJ/L (2350 BTU/CU Ft) lower heating value gas.
ENGINE POWER (NET) IS THE CORRECTED FLYWHEEL POWER

PERFORMANCE DATA[EM6221]

(GROSS) LESS
EXTERNAL AUXILIARY LOAD
Engine corrected gross output includes the power required to drive standard equipment; lube oil, scavenge lube oil, fuel transfer, common rail fuel, separate circuit aftercooler and jacket water pumps. Engine net power available for the external (flywheel) load is calculated by subtracting the sum of auxiliary load from the corrected gross flywheel out put power. Typical auxiliary loads are radiator cooling fans, hydraulic pumps, air compressors and battery charging alternators. For Tier 4 ratings additional Parasitic losses would also include Intake, and Exhaust Restrictions.
ALTITUDE CAPABILITY
Altitude capability is the maximum altitude above sea level at standard temperature and standard pressure at which the engine could develop full rated output power on the current performance data set.
Standard temperature values versus altitude could be seen on TM2001.
When viewing the altitude capability chart the ambient temperature is the inlet air temp at the compressor inlet.
Engines with ADEM MEUI and HEUI fuel systems operating at conditions above the defined altitude capability derate for atmospheric pressure and temperature conditions outside the values defined, see TM2001.
Mechanical governor controlled unit injector engines require a setting change for operation at conditions above the altitude defined on the engine performance sheet. See your Caterpillar technical representative for non standard ratings.
REGULATIONS AND PRODUCT COMPLIANCE
TMI Emissions information is presented at 'nominal' and 'Potential Site Variation' values for standard ratings. No tolerances are applied to the emissions data. These values are subject to change at any time. The controlling federal and local emission requirements need to be verified by your Caterpillar technical representative.
Customer's may have special emission site requirements that need to be verified by the Caterpillar Product Group engineer.
EMISSION CYCLE LIMITS:
Cycle emissions Max Limits apply to cycle-weighted averages only. Emissions at individual load points may exceed the cycle-weighted limit.
WET & DRY EXHAUST/EMISSIONS DESCRIPTION:
Wet - Total exhaust flow or concentration of total exhaust flow
Dry - Total exhaust flow minus water vapor or concentration of exhaust flow with water vapor excluded
EMISSIONS DEFINITIONS:
Emissions : DM1176
EMISSION CYCLE DEFINITIONS
1. For constant-speed marine engines for ship main propulsion, including,diesel-electric drive, test cycle E2 shall be applied, for controllable-pitch propeller sets
test cycle E2 shall be applied.
2. For propeller-law-operated main and propeller-law-operated auxiliary engines the test cycle E3 shall be applied.
3. For constant-speed auxiliary engines test cycle D2 shall be applied.
4. For variable-speed, variable-load auxiliary engines, not included above, test cycle C1 shall be applied.
HEAT REJECTION DEFINITIONS:
Diesel Circuit Type and HHV Balance : DM9500
HIGH DISPLACEMENT (HD) DEFINITIONS:
3500: EM1500
RATING DEFINITIONS:
Agriculture : TM6008
Fire Pump : TM6009
Generator Set : TM6035
Generator (Gas) : TM6041
Industrial Diesel : TM6010
Industrial (Gas) : TM6040
Irrigation : TM5749
Locomotive : TM6037
Marine Auxiliary : TM6036
Marine Prop (Except 3600) : TM5747
Marine Prop (3600 only) : TM5748
MSHA : TM6042
Oil Field (Petroleum) : TM6011
Off-Highway Truck : TM6039
On-Highway Truck : TM6038
SOUND DEFINITIONS:
Sound Power : DM8702
Sound Pressure : TM7080
Date Released : 03/12/24

4600 GALLON UL SUB BASE TANK

TANK PRIME & FINISH PAINT: BLACK

CUSTOMER TO VERIFY STUB UP, MOUNTING HOLES & FITTINGS

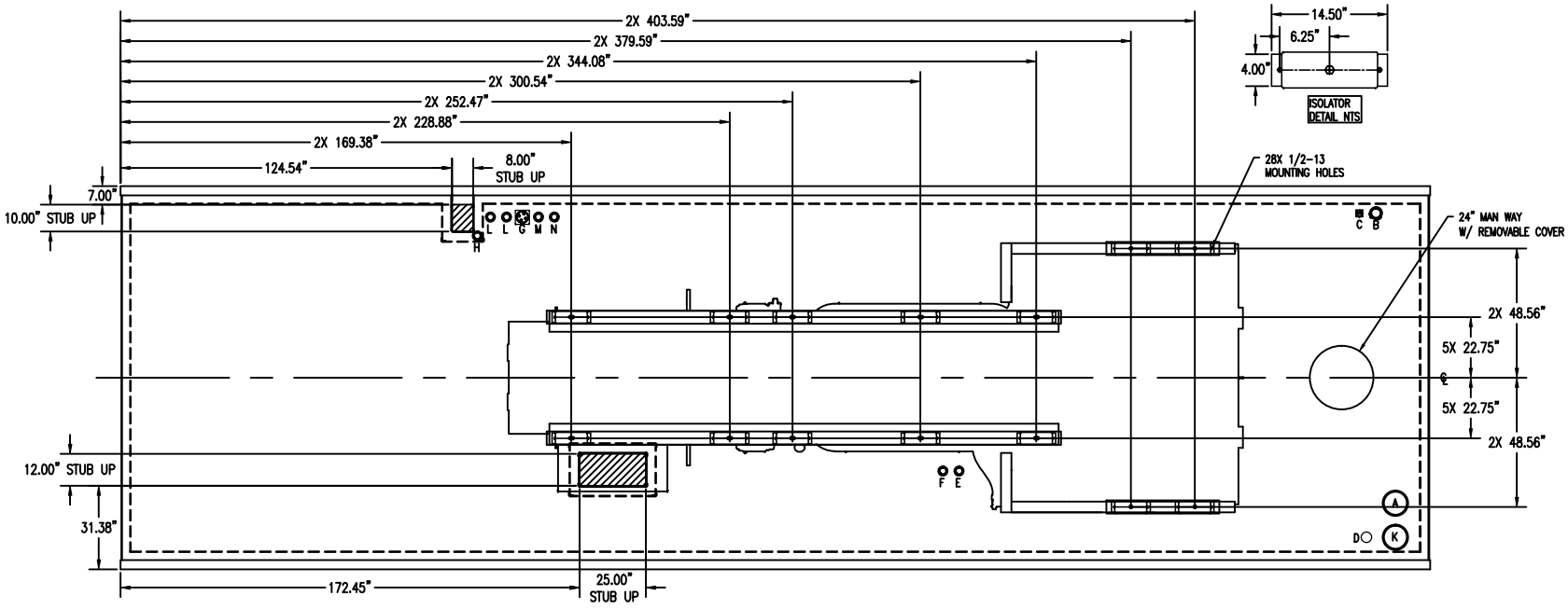
3" 14 GA GALVANEAL WALL PANELS

BUILT TO MDEQ SPECS

Reference Drawings Only. Not for Construction. Design varies per location and specifications.

TANK FITTINGS

ITEM #	PART #	QTY	LABEL'S	DESCRIPTION
Ⓐ	8" NPT	1	EMERGENCY VENT	8" NPT PRIMARY EMERGENCY VENT
Ⓑ	3" NPT	1	FILL PORT	3" NIPPLE W/ 90 ELBOW, PLUG & 95% OVERFILL PREVENTION VALVE
Ⓒ	2" NPT	1	FUEL LEVEL	2" NPT FUEL LEVEL GAUGE
Ⓓ	2" NPT	1	VENT	2" NPT MUSHROOM VENT
Ⓔ	2" NPT	1	FUEL RETURN	3/4" PIPE W/ DOUBLE TAP
Ⓕ	2" NPT	1	FUEL SUPPLY	3/4" PIPE W/ DOUBLE TAP
Ⓖ	4" NPT	1	ALARM FLOATS	4" NPT ALARM FLOATS (PAGE 8 OF 9)
Ⓗ	2" NPT	1	RUPTURE BASIN ALARM	2" NPT BASIN ALARM LEAK DETECTION
Ⓙ	1/2" NPT	1	BASIN DRAIN	1/2" BASIN DRAIN W/ PLUG (SHEET 2 OF 9)
Ⓚ	8" NPT	1	EMERGENCY VENT	8" NPT SECONDARY EMERGENCY VENT
Ⓛ	2" NPT	2	EXTRA FITTING	2" NPT EXTRA FITTINGS
Ⓜ	2" NPT	1	4-20MA FUEL SENDER	2" NPT 4-20MA FUEL LEVEL SENDER
Ⓝ	2" NPT	1	TMS 2000	2" NPT TANK MONITORING SYSTEM



E.K. MACHINE CO. INC. POWER PRODUCTS

871 S. Main Street, P.O. Box 67 • Fall River, WI 53932

REVISIONS:

REV. A: DRAWN ON 02-04-15 JMT.

4600 GALLON UL SUB BASE TANK

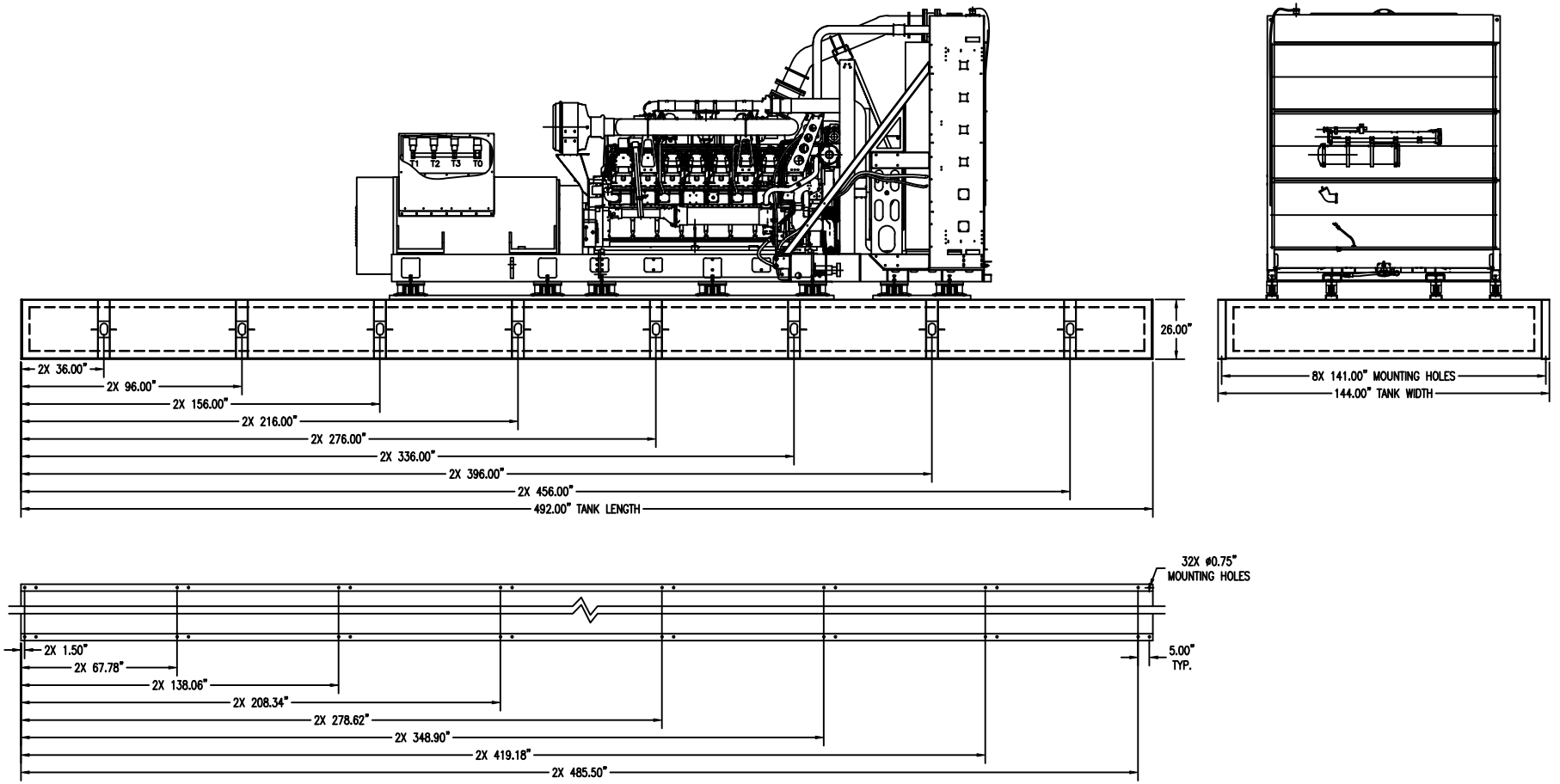
TANK PRIME & FINISH PAINT: BLACK

CUSTOMER TO VERIFY STUB UP, MOUNTING HOLES & FITTINGS

3" 14 GA GALVANEAL WALL PANELS

BUILT TO MDEQ SPECS

Reference Drawings Only. Not for Construction.
Design varies per location and specifications.



E.K. MACHINE CO. INC.
POWER PRODUCTS
871 S. Main Street, P.O. Box 87 • Fall River, WI 53932

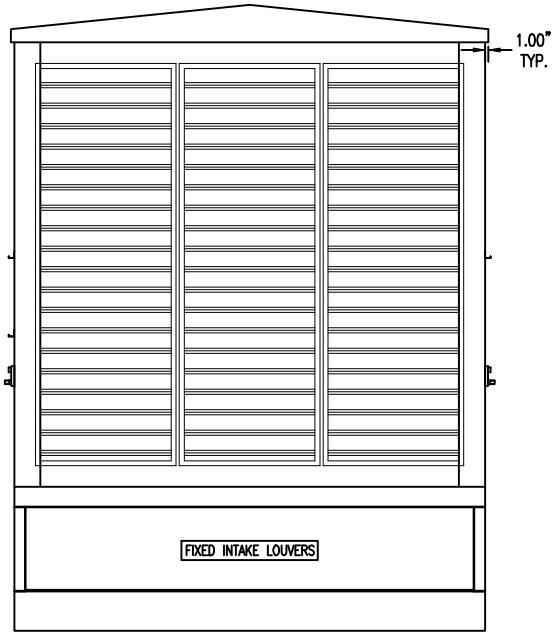
REVISIONS:
REV. A: DRAWN ON 02-04-15 JMT.

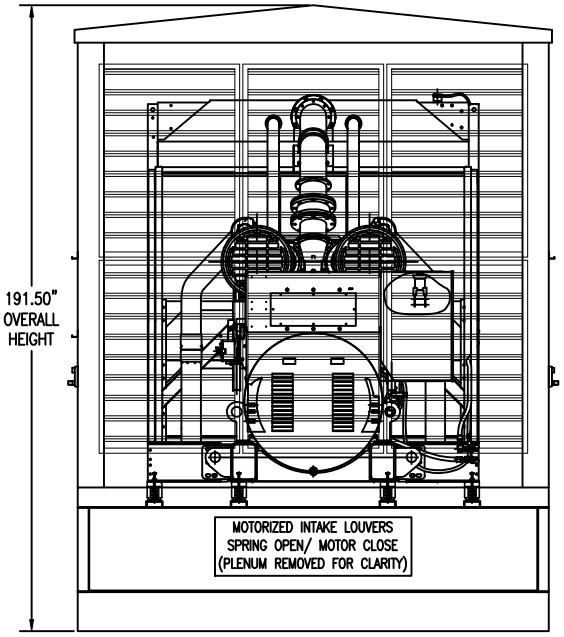
ENCLOSURE EXTERIOR POWDER PAINT COLOR: CUSTOMER TO SPECIFY

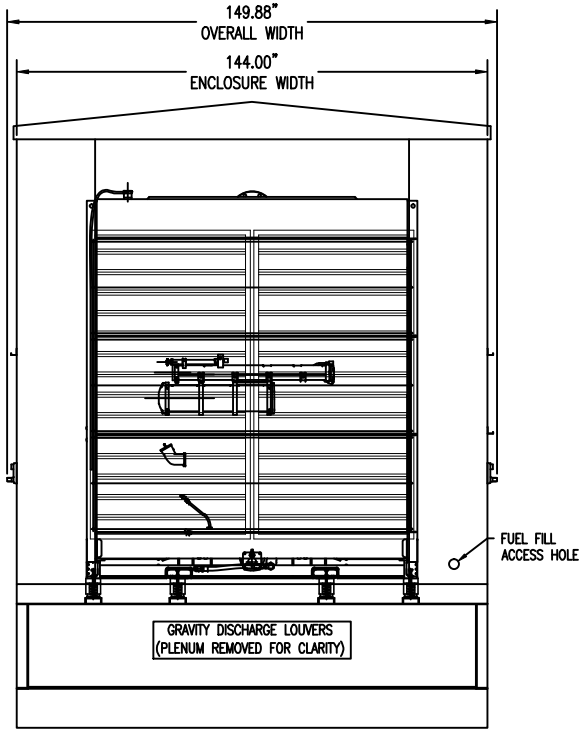
3" 14 GA GALVANEAL WALL PANELS

DOOR WITH GM BEST LOCK CORE PANIC PUSH BAR RELEASE HANDLES

Reference Drawings Only. Not for Construction.
Design varies per location and specifications.







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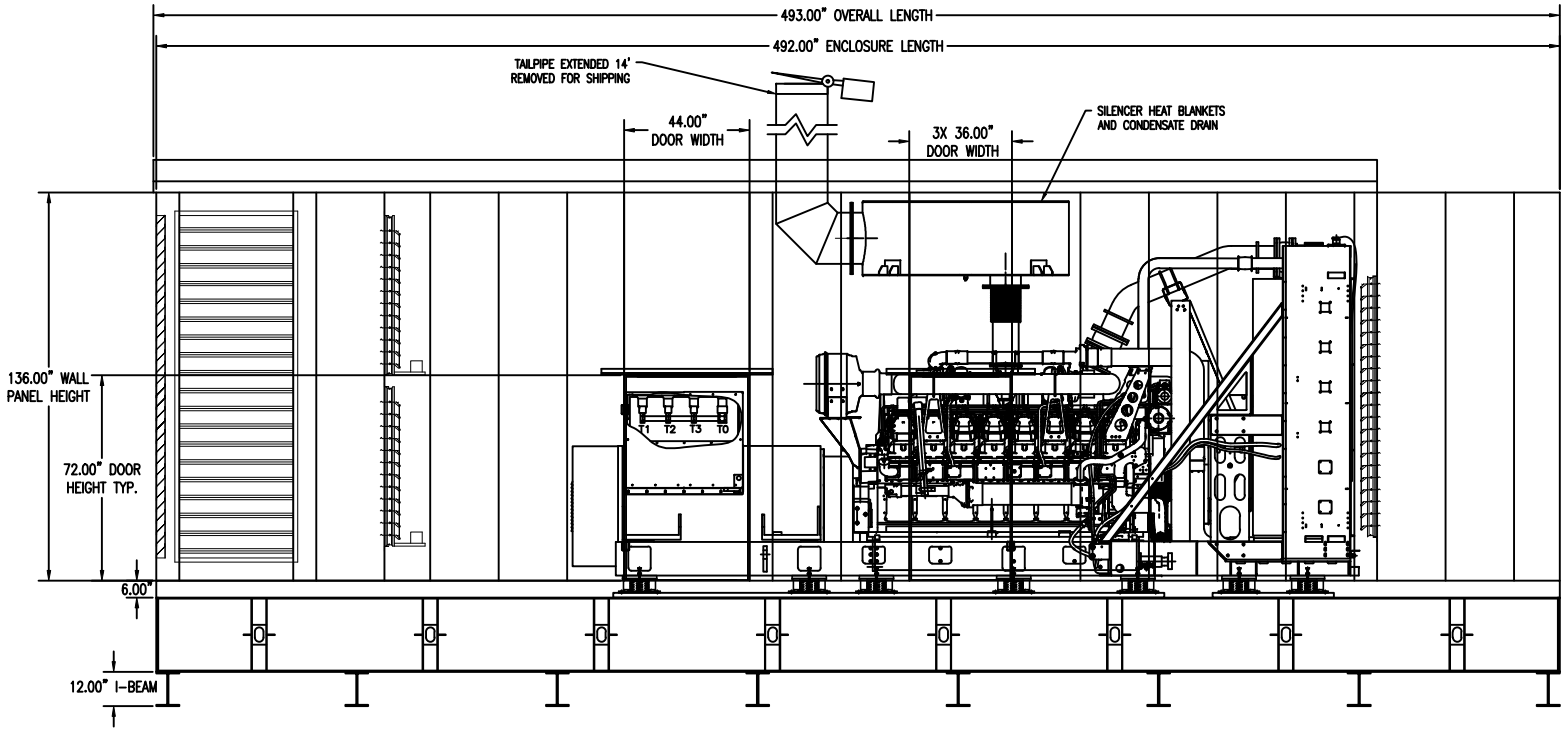
REVISIONS:
REV. A: DRAWN ON 02-04-15 JMT.

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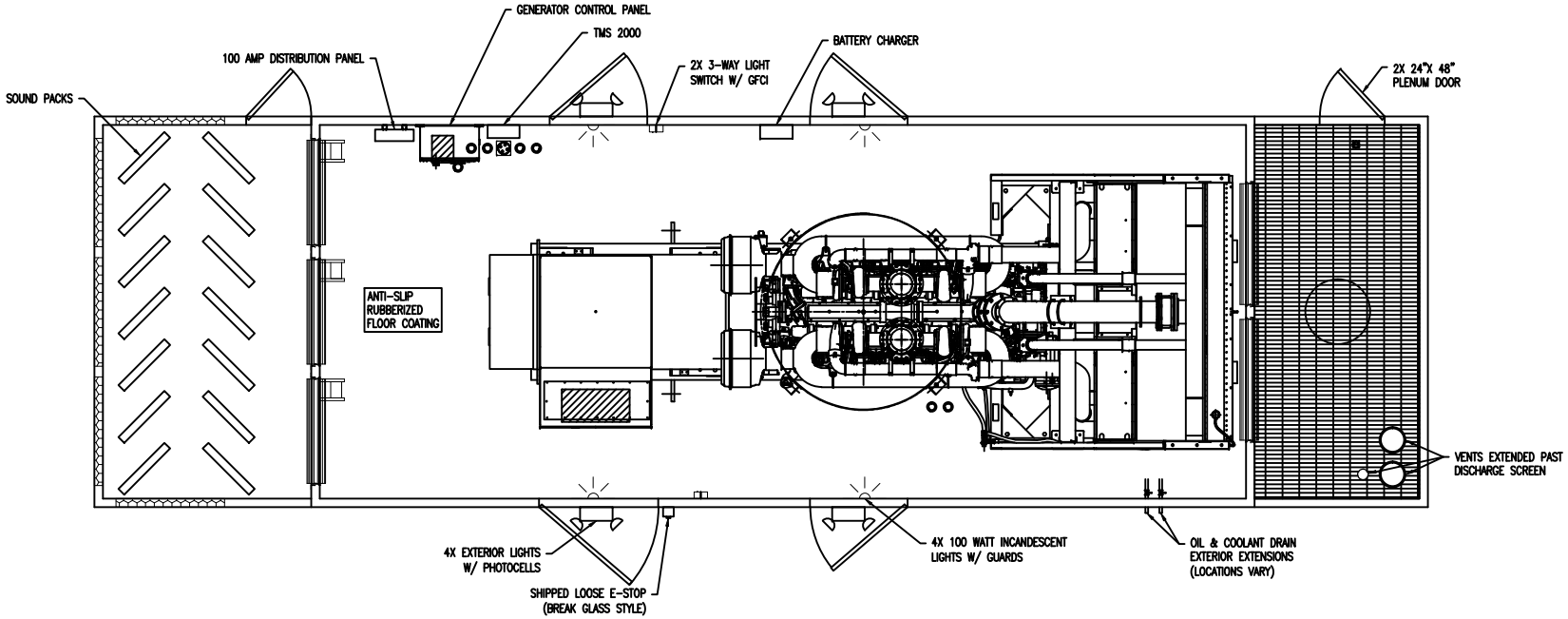
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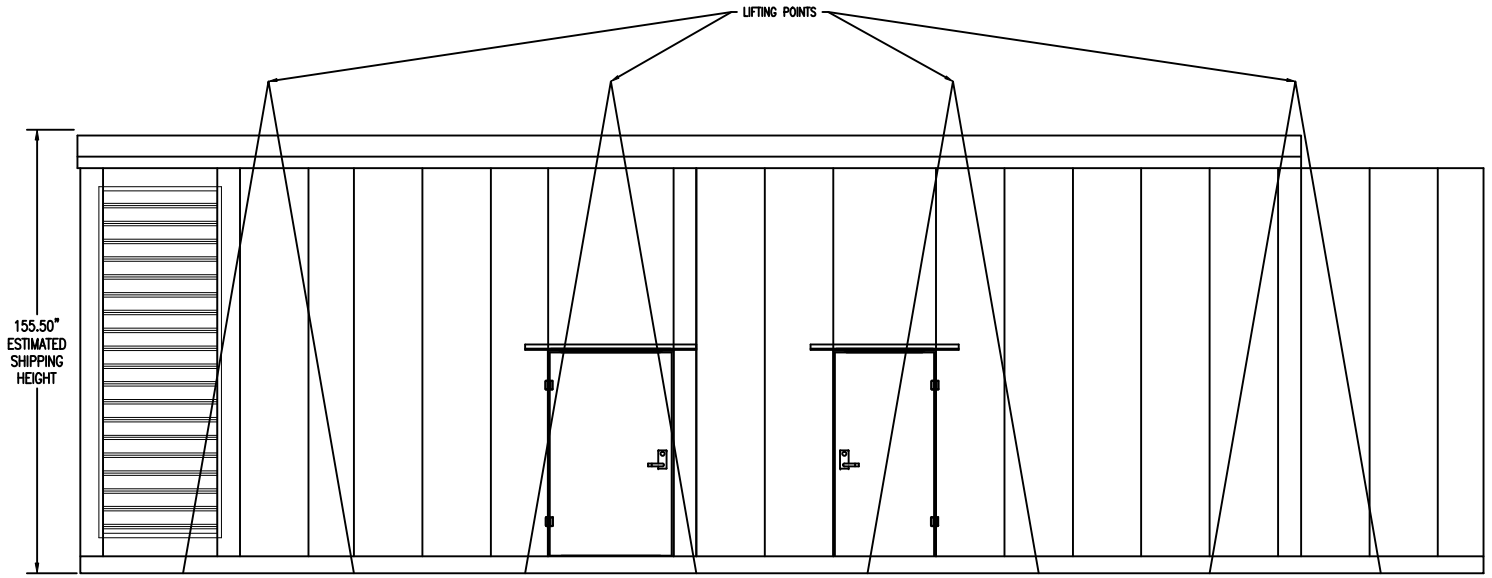
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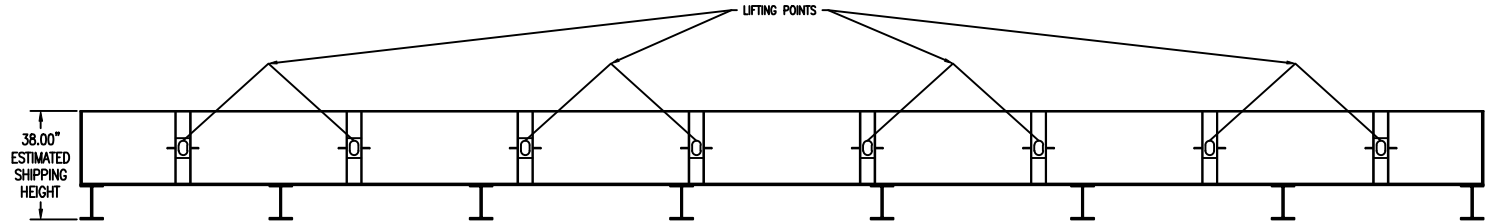
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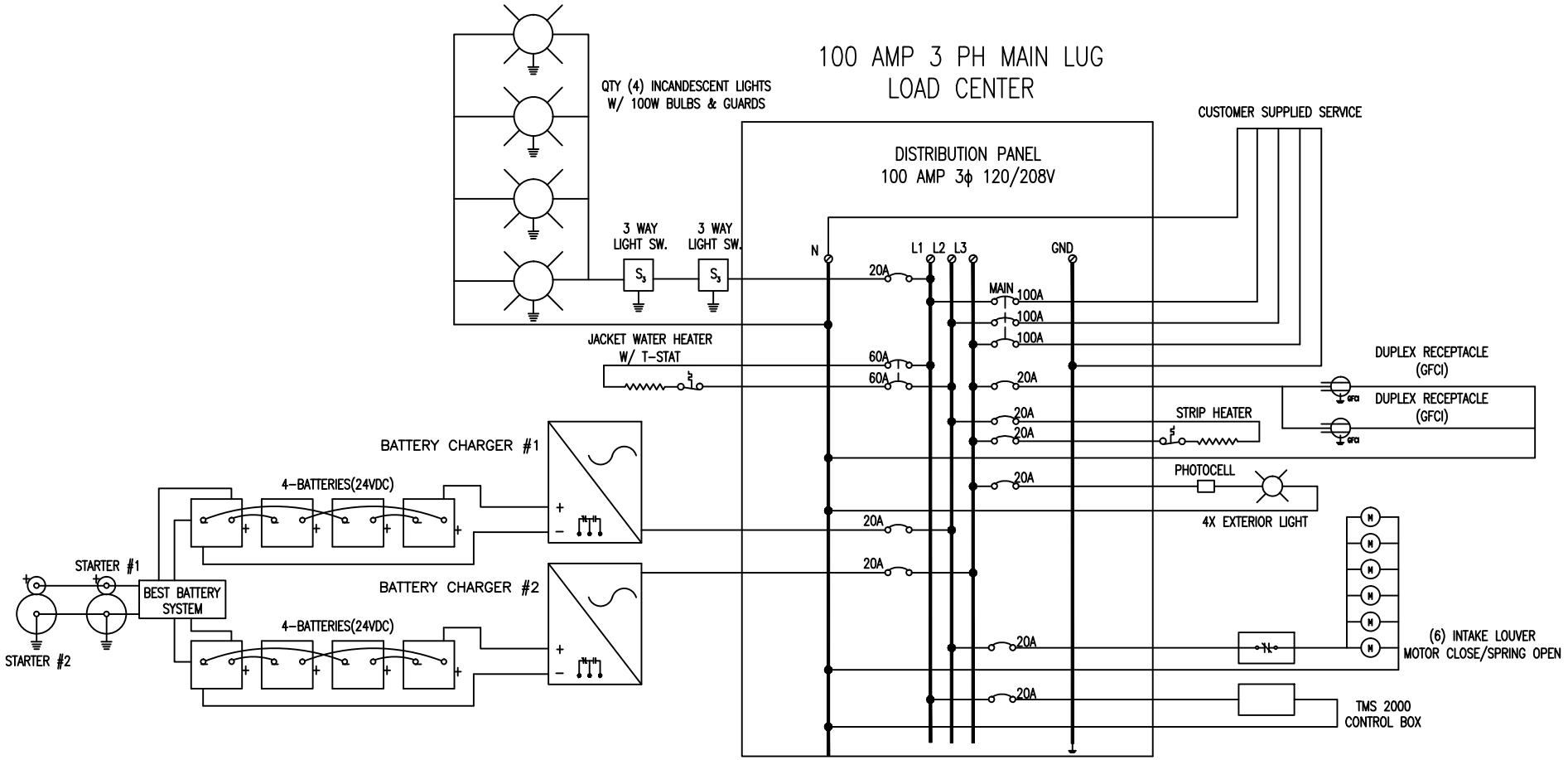
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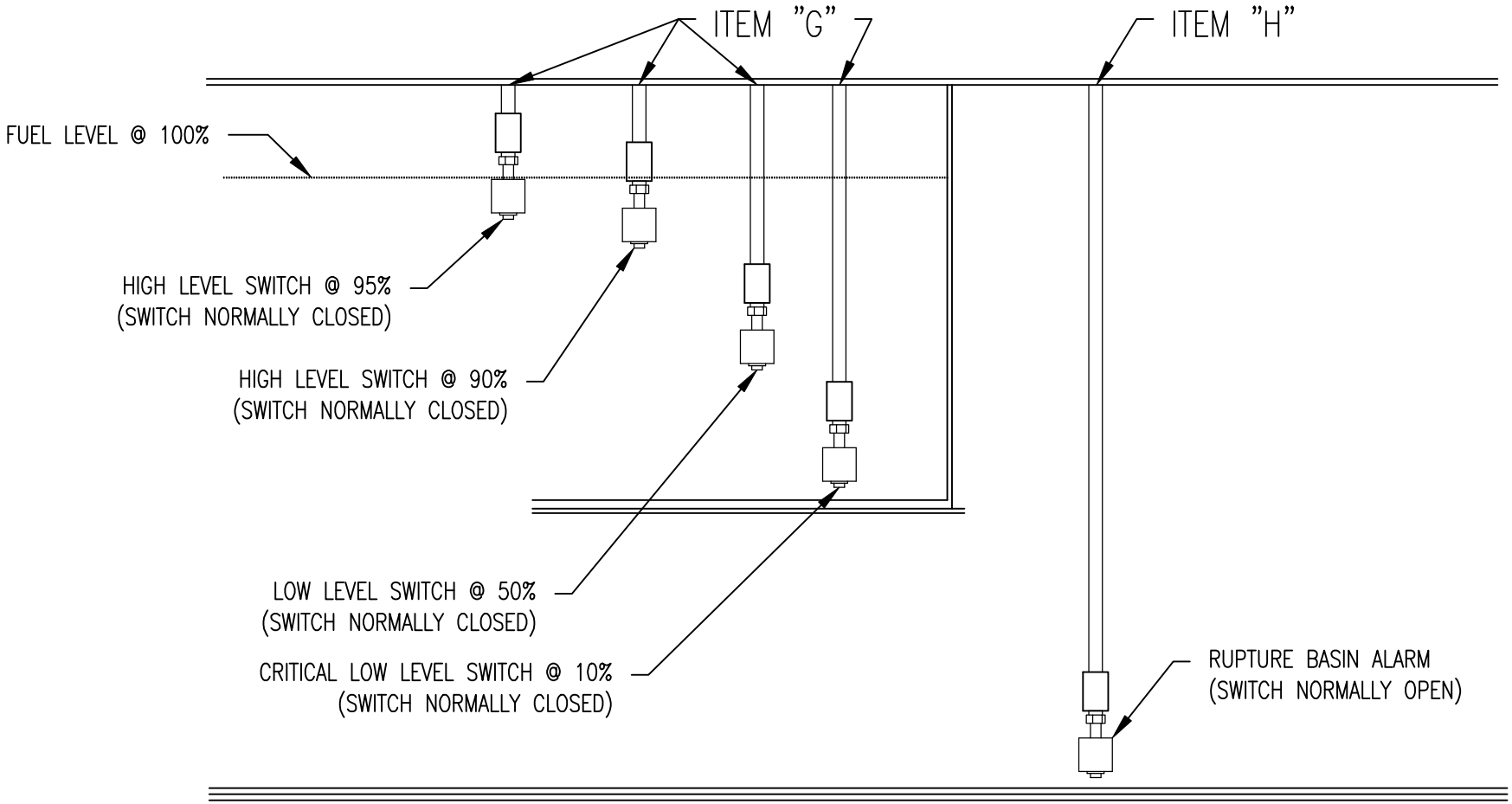
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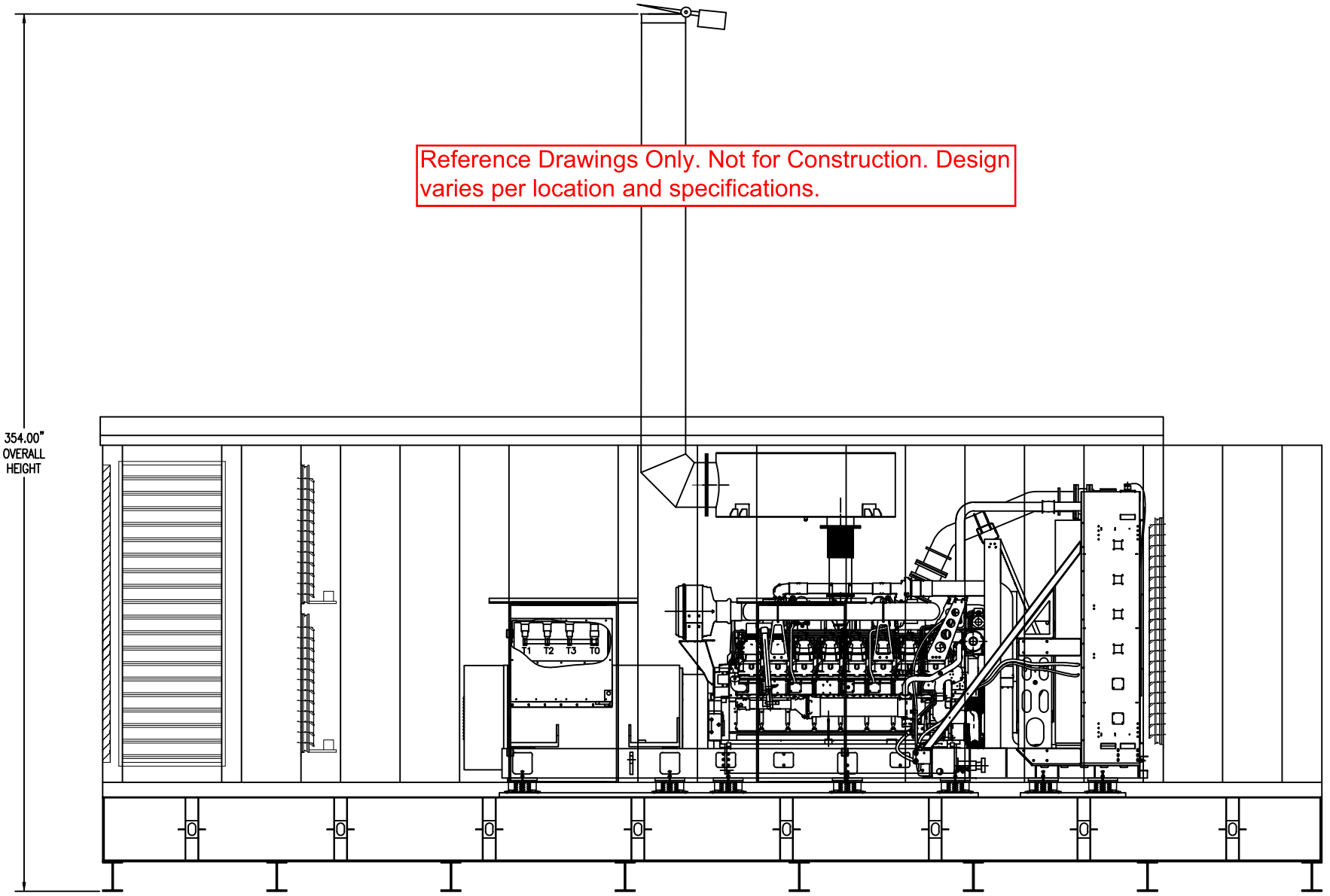
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FM-UL-cUL APPROVED RATINGS BHP/*KW*

JU6H MODEL ♦	RATED SPEED 1760		2100		2350		2400		US-EPA (NSPS) Available Until ●
~~UFADMG~~			175	*131*	175	*131*			*No Expiration*
~~UFAD58~~	183	*137*							*No Expiration*
~~UFADNG~~	190	*142*	181	*135*	183	*137*	183	*137*	*No Expiration*
~~UFADN0~~	197	*147*	197	*147*	200	*149*	200	*149*	*No Expiration*
~~UFADP0~~			209	*156*	211	*157*	211	*157*	*No Expiration*
~~UFADP8~~	220	*164*							*No Expiration*
~~UFADQ0~~			224	*167*	226	*169*	226	*169*	*No Expiration*
~~UFAD88~~	237	*177*							*No Expiration*
~~UFADR0~~			238	*177.5*	240	*179*	240	*179*	*No Expiration*
~~UFADR8~~	250	*187*							*No Expiration*
~~UFADS8~~	260	*194*							*No Expiration*
~~UFADS0~~			260	*194*	268	*200*	268	*200*	*No Expiration*
~~UFADT0~~			274	*204*	275	*205*	275	*205*	*No Expiration*
~~UFADW8~~	282	*211*							*No Expiration*
~~UFADX8~~	305	*227.5*							*No Expiration*
UFAD98	315	*235*							*No Expiration*



Picture represents JU6H-TRWA Power Tech Plus Engine Series

● USA EPA (NSPS) Tier 3 Emissions Certified Off-Road (40 CFR Part 89) and NSPS Stationary (40 CFR Part 60 Sub Part IIII). Meet EU Stage IIIA emission levels.

♦ All Models available for Export

SPECIFICATIONS

ITEM	JU6H MODELS MG	58	NG	N0	P8	88	P0	Q0	R0	S0	T0	R8	S8	W8	X8	98
Number of Cylinders	6															
Aspiration	TRWA															
Rotation*	CW															
Overall Dimensions – in. (mm)	59.8 (1519) H x 56.7 (1414) L x 36.7 (933) W						60.9 (1547) H x 58.6 (1488) L x 40.0 (1015) W									
Crankshaft Centerline Height – in. (mm)	14 (356)															
Weight – lb (kg)	1747 (791)															
Compression Ratio	19.0:1						17.0:1									
Displacement – cu. in. (L)	415 (6.8)															
Engine Type	4 Stroke Cycle – Inline Construction															
Bore & Stroke – in. (mm)	4.19 x 5.00 (106 x 127)															
Installation Drawing	D628															
Wiring Diagram AC	C07651															
Wiring Diagram DC	C071367, C072146, C071361						C071368, C072146, C071761									
Engine Series	John Deere 6068 Series Power Tech E						John Deere 6068 Series Power Tech Plus									
Speed Interpolation	N/A															

Abbreviations: CW – Clockwise TRWA – Turbocharged with Raw Water Aftercooling N/A - Not Available L – Length W – Width H - Height

*Rotation viewed from Heat Exchanger / Front of engine

CERTIFIED POWER RATING

- Each engine is factory tested to verify power and performance.
- FM-UL power ratings are shown at specific speeds, Clarke engines can be applied at a single rated RPM setting ± 50 RPM.

ENGINE RATINGS BASELINES

- Engines are to be used for stationary emergency standby fire pump service only. Engines are to be tested in accordance with NFPA 25.
- Engines are rated at standard SAE conditions of 29.61 in. (752.1 mm) Hg barometer and 77°F (25°C) inlet air temperature [approximates 300 ft. (91.4 m) above sea level] by the testing laboratory (see SAE Standard J 1349).
- A deduction of 3 percent from engine horsepower rating at standard SAE conditions shall be made for diesel engines for each 1000 ft. (305 m) altitude above 300 ft. (91.4 m)
- A deduction of 1 percent from engine horsepower rating as corrected to standard SAE conditions shall be made for diesel engines for every 10°F (5.6°C) above 77°F (25°C) ambient temperature.

ENGINE EQUIPMENT

EQUIPMENT	STANDARD	OPTIONAL
Air Cleaner	Direct Mounted, Washable, Indoor Service with Drip Shield	~~Disposable, Drip Proof, Indoor Service Outdoor Type, Single or Two Stage (Cyclonic)~~
Alarms	Overspeed Alarm & Shutdown, Low Oil Pressure, Low & High Coolant Temperature, Low Raw Water Flow, High Raw Water Temperature, Alternate ECM Warning, Fuel Injection Malfunction, ECM Warning and Failure with Automatic Switching	~~Low Coolant Level, Low Oil Level, Oil Filter Differential Pressure, Fuel Filter Differential Pressure, Air Filter Restriction~~
Alternator	12V-DC, 42 Amps with Poly-Vee Belt and Guard	~~24V-DC, 40 Amps with Poly-Vee Belt and Guard~~
Coupling	Bare Flywheel	UL Listed Driveshaft and Guard, JU6H-UFAD58/NG/ADMG/ADM8/K0/N0/Q0/R0-CDS30-S1; JU6H-UFADP8/P0/T0/88/R8/S8/S0/W8/X8/98- CDS50-SC at 1760/2100 RPM only
Electronic Control Module	12V-DC, Energized to Stop, Primary ECM always Powered on	~~24V-DC, Energized to Stop, Primary ECM always Powered on~~
Engine Heater	115V-AC, 1360 Watt	~~230V-AC, 1360 Watt~~
Exhaust Flex Connection	SS Flex, 150# ANSI Flanged Connection, 5" for JU6H-UFAD58/MG/NG/N0/P8/88; SS Flex, 150# ANSI Flanged Connection, 6" for JU6H-UFADP0/Q0/R0/S0/T0/R8/S8/W8/X8/98 (w/ orifice plate)	~~SS Flex, 150# ANSI Flanged Connection, 6" for JU6H-UFAD58/MG/NG/N0/P8/88;~~ ~~SS Flex, 150# ANSI Flanged Connection, 8" for JU6H-UFADP0/Q0/R0/S0/T0/R8/S8/W8/X8/98 (w/ orifice plate)~~
Exhaust Protection	Metal Guards on Manifolds and Turbocharger	
Flywheel Housing	SAE #3	
Flywheel Power Take Off	11.5" SAE Industrial Flywheel Connection	
Fuel Connections	Fire Resistant, Flexible, USA Coast Guard Approved, Supply and Return Lines	~~SS, Braided, cUL Listed, Supply and Return Lines~~
Fuel Filter	Primary Filter with Priming Pump	
Fuel Injection System	High Pressure Common Rail	
Governor, Speed	Dual Electronic Control Modules	
Heat Exchanger	Tube and Shell Type, 60 PSI (4 BAR), NPT(F) Connections – Sea Water Compatible	
Instrument Panel	Multimeter to Display English and Metric, Tachometer, Hourmeter, Water Temperature, Oil Pressure and One (1) Voltmeter with Toggle Switch, Front Opening	
Junction Box	Integral with Instrument Panel; For DC Wiring Interconnection to Engine Controller	
Lube Oil Cooler	Engine Water Cooled, Plate Type	
Lube Oil Filter	Full Flow with By-Pass Valve	
Lube Oil Pump	Gear Driven, Gear Type	
Manual Start Control	On Instrument Panel with Control Position Warning Light	
Overspeed Control	Electronic, Factory Set, Not Field Adjustable	
Raw Water Cooling Loop w/Alarms	Galvanized	~~Seawater, All 316SS, High Pressure~~
Raw Water Cooling Loop Solenoid Operation	Automatic from Fire Pump Controller and from Engine Instrument Panel (for Horizontal Fire Pump Applications)	~~Not Supplied (for Vertical Turbine Fire Pump Applications)~~
Run – Stop Control	On Instrument Panel with Control Position Warning Light	
Starters	Two (2) 12V-DC	~~Two (2) 24V-DC~~
Throttle Control	Adjustable Speed Control by Increase/Decrease Button, Tamper Proof in Instrument Panel	
Water Pump	Centrifugal Type, Poly-Vee Belt Drive with Guard	

Abbreviations: DC – Direct Current, AC – Alternating Current, SAE – Society of Automotive Engineers, NPT(F) – National Pipe Tapered Thread (Female), ANSI – American National Standards Institute, SS – Stainless Steel

MODEL NOMENCLATURE: (10 Digit Models)

JU6H - UFADR0

- JU6H: John Deere Base Engine, 350 Series, 6 Cylinders, Heat Exchanger Cooled
- UFAD: UL Listed, FM Approved, Built in USA, EPA Tier 3 Certified
- R0: Power Curve Number

CLARKE®

CLARKE Fire Protection Products, Inc.
100 Progress Place, Cincinnati, Ohio 45246
United States of America
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CLARKE UK, Ltd.
Grange Works, Lomond Rd., Coatbridge, ML5-2NN
United Kingdom
Tel +44-1236-429946 Fax +44-1236-427274
www.clarkefire.com

C133421 revR
19JUN15

Specifications and information contained in this brochure subject to change without notice.

CLARKE
Fire Protection Products, Inc.

JU6H-UFAD98
INSTALLATION & OPERATION DATA (I&O Data)
USA Produced

Basic Engine Description

Engine Manufacturer	John Deere Co.
Ignition Type	Compression (Diesel)
Number of Cylinders	6
Bore and Stroke - in (mm)	4.19 (106) X 5 (127)
Displacement - in³ (L)	415 (6.8)
Compression Ratio	17.0:1
Valves per cylinder	
Intake	2
Exhaust	2
Combustion System	Direct Injection
Engine Type	In-Line, 4 Stroke Cycle
Fuel Management Control	Electronic, High Pressure Common Rail
Firing Order (CW Rotation)	1-5-3-6-2-4
Aspiration	Turbocharged
Charge Air Cooling Type	Raw Water
Rotation, viewed from front of engine, Clockwise (CW)	Standard
Engine Crankcase Vent System	Open
Installation Drawing	D628
Weight - lb (kg)	1747 (792)

Power Rating	**1760**
Nameplate Power - HP (kW)	315 (235)

Cooling System - [C051386]	**1760**
Engine Coolant Heat - Btu/sec (kW)	101.5 (107)
Engine Radiated Heat - Btu/sec (kW)	56.2 (59.3)
Heat Exchanger Minimum Flow	
60°F (15°C) Raw H_20 - gal/min (L/min)	28 (106)
100°F (37°C) Raw H_20 - gal/min (L/min)	38 (144)
Heat Exchanger Maximum Cooling Raw Water	
Inlet Pressure - psi (bar)	60 (4.1)
Flow - gal/min (L/min)	40 (151)
Typical Engine H_20 Operating Temp - °F (°C)[1]	180 (82.2) - 195 (90.6)
Thermostat	
Start to Open - °F (°C)	180 (82.2)
Fully Opened - °F (°C)	203 (95)
Engine Coolant Capacity - qt (L)	22.2 (21)
Coolant Pressure Cap - lb/in² (kPa)	15 (103)
Maximum Engine Coolant Temperature - °F (°C)	230 (110)
Minimum Engine Coolant Temperature - °F (°C)	160 (71.1)
High Coolant Temp Alarm Switch - °F (°C)[2]	235 (113) - 241 (116)

Electric System - DC	**Standard**	
System Voltage (Nominal)	12	
Battery Capacity for Ambients Above 32°F (0°C)		
Voltage (Nominal)	12	[C07633]
Qty. Per Battery Bank	1	
SAE size per J537	8D	
CCA @ 0°F (-18°C)	1400	
Reserve Capacity - Minutes	430	
Battery Cable Circuit, Max Resistance - ohm	0.0012	
Battery Cable Minimum Size		
0-120 in. Circuit Length[3]	00	
121-160 in. Circuit Length[3]	000	
161-200 in. Circuit Length[3]	0000	
Charging Alternator Maximum Output - Amp,	40	[C071363]
Starter Cranking Amps, Rolling - @60°F (15°C)	440	[RE69704/RE70404]

NOTE: This engine is intended for indoor installation or in a weatherproof enclosure. [1]Engine H_2O temperature is dependent on raw water temperature and flow. [2]High Coolant Switch threshold varies with engine load. [3]Positive and Negative Cables Combined Length.

CLARKE
Fire Protection Products, Inc.

JU6H-UFAD98
INSTALLATION & OPERATION DATA (I&O Data)
USA Produced

Exhaust System	**1760**
Exhaust Flow - ft.³/min (m³/min)	1400 (39.6)
Exhaust Temperature - °F (°C)	961 (516)
Maximum Allowable Back Pressure - in H_20 (kPa)	30 (7.5)
Minimum Exhaust Pipe Dia. - in (mm)[4]	6 (152)

Fuel System	**1760**
Fuel Consumption - gal/hr (L/hr)	15 (56.8)
Fuel Return - gal/hr (L/hr)	21.3 (80.6)
Fuel Supply - gal/hr (L/hr)	36.3 (137)
Fuel Pressure - lb/in² (kPa)	3 (20.7) - 6 (41.4)
Minimum Line Size - Supply - in.	.50 Schedule 40 Steel Pipe
Pipe Outer Diameter - in (mm)	0.848 (21.5)
Minimum Line Size - Return - in.	.375 Schedule 40 Steel Pipe
Pipe Outer Diameter - in (mm)	0.675 (17.1)
Maximum Allowable Fuel Pump Suction Lift with clean Filter - in H_20 (mH_20)	80 (2)
Maximum Allowable Fuel Head above Fuel pump, Supply or Return - ft (m)	6.6 (2)
Fuel Filter Micron Size	2 (Secondary)

Heater System	**Standard**
Engine Coolant Heater	
Wattage (Nominal)	1360
Voltage - AC, 1 Phase	115 (+5% -10%)
Part Number	[C123640]

Air System	**1760**
Combustion Air Flow - ft.³/min (m³/min)	547 (15.5)
Air Cleaner	**Standard**
Part Number	[C03244]
Type	Indoor Service Only, with Shield
Cleaning method	Washable
Air Intake Restriction Maximum Limit	
Dirty Air Cleaner - in H_20 (kPa)	14 (3.5)
Clean Air Cleaner - in H_20 (kPa)	7 (1.7)
Maximum Allowable Temperature (Air To Engine Inlet) - °F (°C)[5]	130 (54.4)

Lubrication System	
Oil Pressure - normal - lb/in² (kPa)	40 (276) - 60 (414)
Low Oil Pressure Alarm Switch - lb/in² (kPa)[6]	30 (207) to 35 (241)
In Pan Oil Temperature - °F (°C)	220 (104) - 245 (118)
Total Oil Capacity with Filter - qt (L)	34.3 (32.5)

Performance	**1760**
BMEP - lb/in² (kPa)	342 (2360)
Piston Speed - ft/min (m/min)	1467 (447)
Mechanical Noise - dB(A) @ 1m	C133381
Power Curve	C132618

[4]Based on Nominal System. Back pressure flow analysis must be done to assure maximum allowable back pressure is not exceeded. (Note: minimum exhaust Pipe diameter is based on: 15 feet of pipe, one 90° elbow, and a silencer pressure drop no greater than one half of the maximum allowable back pressure.) [5]Review for horsepower derate if ambient air entering engine exceeds 77°F (25°C). [6]Low Oil Pressure Switch threshold varies w/engine speed. [ ] indicates component reference part number.

Rating Specific Emissions Data - John Deere Power Systems

JOHN DEERE

Nameplate Rating Information

Clarke Model	JU6H-UFAD98
Power Rating (BHP / kW)	315 / 235
Certified Speed (RPM)	1760

Rating Data

Rating	6068HFC48A	
Certified Power (kW)	235	
Rated Speed	1760	
Vehicle Model Number	Clarke Fire Pump	
Units	g/kW-hr	g/hp-hr
NOx	3.61	2.69
HC	0.08	0.06
NOx + HC	N/A	N/A
Pm	0.07	0.06
CO	0.6	0.4

Certificate Data

Engine Model Year	2015
EPA Family Name	FJDXL13.5103
EPA JD Name	650HAA
EPA Certificate Number	FJDXL13.5103-008
CARB Executive Order	Not Applicable
Parent of Family	6135HF485A

Units	g/kW-hr
NOx	3.31
HC	0.11
NOx + HC	N/A
Pm	0.10
CO	0.6

* The emission data listed is measured from a laboratory test engine according to the test procedures of 40 CFR 89 or 40 CFR 1039, as applicable. The test engine is intended to represent nominal production hardware, and we do not guarantee that every production engine will have identical test results. The family parent data represents multiple ratings and this data may have been collected at a different engine speed and load. Emission results may vary due to engine manufacturing tolerances, engine operating conditions, fuels used, or other conditions beyond our control.

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DO NOT SCALE

DATUMS:

-A- - MOUNTING FACE OF FLYWHEEL

-B- - ENGINE CRANKSHAFT HORIZONTAL CENTERLINE

-C- - ENGINE CRANKSHAFT VERTICAL CENTERLINE

- CENTER OF GRAVITY OF ENGINE

- CLOCKWISE ROTATION WHEN VIEWED FROM FRONT OF ENGINE

DRAWING SUBJECT TO CHANGE WITHOUT NOTICE

CAUTION:

ALL PLUMBING MUST BE SUPPORTED AND/OR ISOLATED SO THAT NO WEIGHT OR STRESS IS APPLIED TO ANY ENGINE COMPONENT

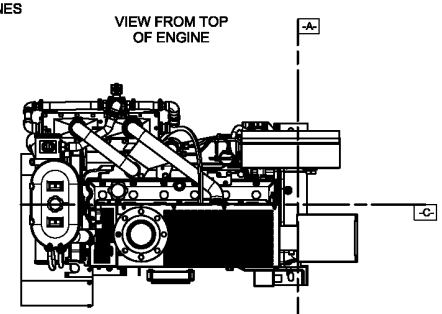
ATTENTION

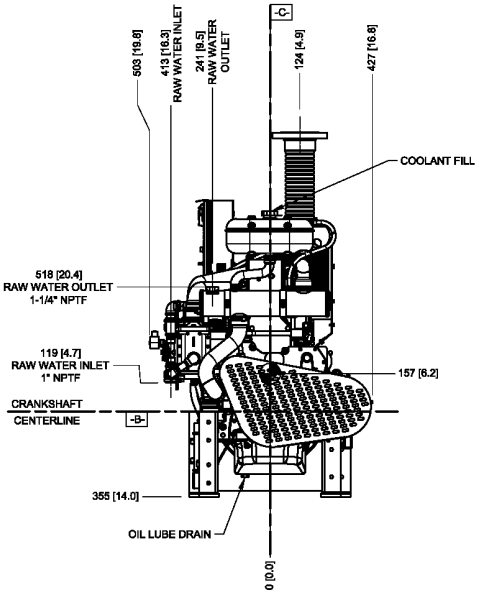
REFER TO THE SPECIFIC MODEL "INSTALLATION AND OPERATION DATA" FOR INSTALLATION GUIDELINES

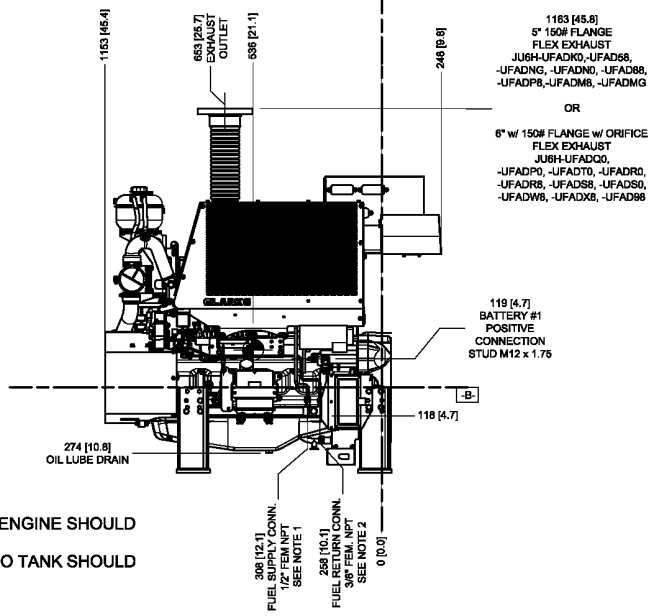
"TRWA" (TURBOCHARGED w/ RAW WATER AFTERCOOLING) MODELS	~~JU6H-UFAD58, -UFAD88 JU6H-UFADK0, -UFADNG JU6H-UFADP8, -UFADN0 JU6H-UFADM8, -UFADMG JU6H-UFADP6~~ (MODELS SHOWN)
	JU6H-UFAD98 ~~-UFADP0 JU6H-UFADQ0, -UFADR0 JU6H-UFADR8, -UFADS0 JU6H-UFADS8, -UFADT0 JU6H-UFADW8, -UFADX8~~

***FOR ENGINES BUILT IN USA BEGINNING DECEMBER 2012**

VIEW FROM TOP OF ENGINE







NOTES:
1. FUEL SUPPLY PIPING FROM TANK TO ENGINE SHOULD BE 1/2"MINIMUM PIPE DIAMETER.
2. FUEL RETURN PIPING FROM ENGINE TO TANK SHOULD BE 3/8" MINIMUM PIPE DIAMETER.

REV	DESCRIPTION	ECN#	DWN	APVD	DATE
B	ADDED NEW TIER 3 ENGINE MODELS	1645	KJM	KJE	06JAN09
C	ADDED JU6H-UFADP6 ENGINE MODEL	1645	MAL	KJE	23FEB09
D	REVISED EXH FLEX CONNECTION DATA	1645	DMP	KJE	09NOV09
E	REVISED EXH FLEX CONNECTION DATA	1997	JCA	KJE	23JUN10
F	REVISED ENGINE FOOT MOUNTING HOLE LOCATIONS - PAGE 2	1901	JCA	ASC	28JUL10
G	ADDED DIMENSIONS FRONT VIEW ZONE D8 PG1	2108	DMP	KJE	28OCT10
H	ADDED ENGINE MODELS: JU6H-UFADM8 & JU6H-UFADMG	2173	JCA	KJE	09DEC10
J	UPDATED MOUNTING FEET AND HEATER SETUP	2063	AMC	KJE	19JUL12
K	RAW WATER OUTLET WAS 1" NPTF	2649	MOH	KJE	04DEC12

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UNLESS OTHERWISE NOTED:

DECIMAL	mm	Inch
X	±1.5	
XX	±0.8	±0.06
XXX	±0.3	±0.03
XXXX	± 0.025	±0.01
XXXXX		±0.001

ANGULAR: ± 0.5°

FABRICATION TOLERANCE:

DECIMAL	mm	Inch
X	±3	
XX	±1.6	±0.13
XXX		±0.05

ANGULAR: ± 1.0°

CONTROLLED DRAWING: YES / NO

CLARKE Fire Protection Products, Inc.

DRWN	MWLEMING
DATE	2/25/2009
ENGR	KJKUNKLER
MATERIAL	
ASSEMBLY	

NAME: INSTALLATION DRAWING, FIRE PUMP ENGINE JU6H TIER 3 MODELS

PART NO. D628 REV K

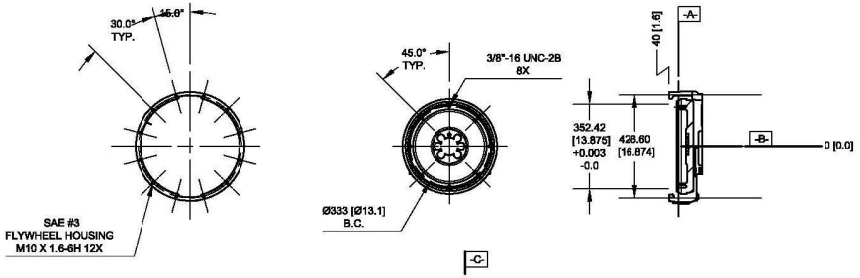
SCALE NTS UNITS MM [INCH] PAGE 1 OF 2

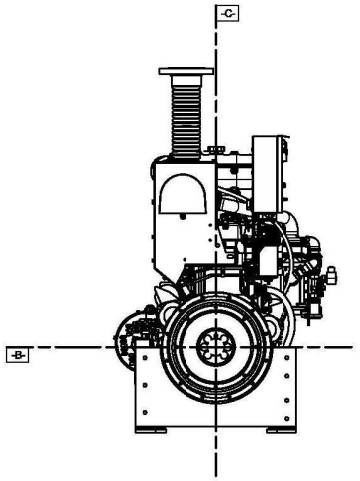
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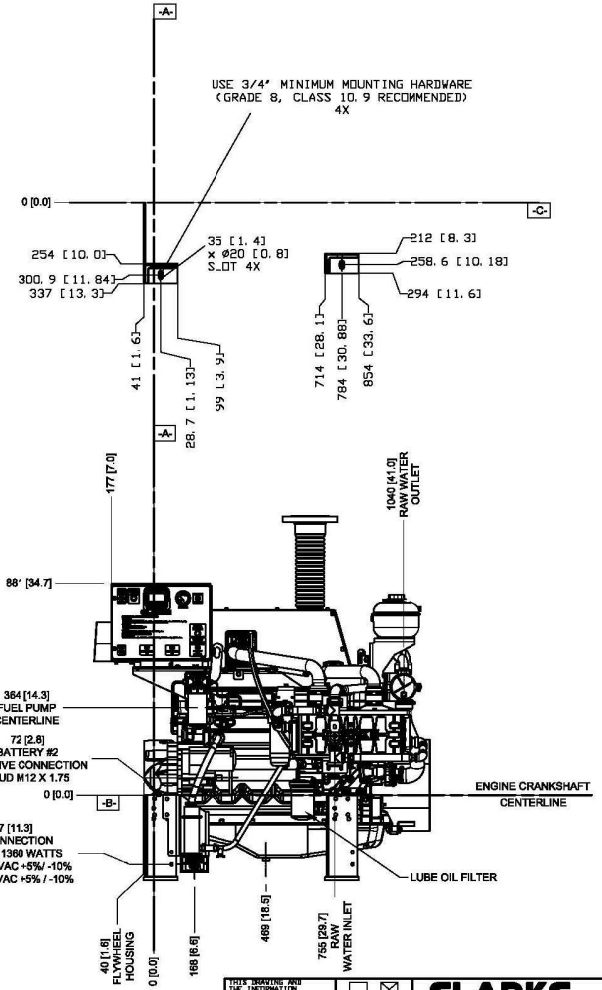
DO NOT SCALE

FOR ENGINE SPECIFIC OPTIONS
SEE www.CLARKEFIRE.com

DETAIL DATUM -A-
BARE FLYWHEEL







***FOR ENGINES BUILT IN USA BEGINNING DECEMBER 2012**

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Fire Protection Products, Inc.

DRAWN	MWLEMING
DATE	2/25/2009
ENGR	KKUNKLER
MATERIAL	
ASSEMBLY	

NAME: INSTALLATION DRAWING, FIRE PUMP ENGINE JU6H TIER 3 MODELS

PART NO. D628 REV K

SCALE NTS UNITS MM [INCH] PAGE 2 OF 2

9927097909-DWDE rev 00

REZNOR®

Revision: UDXC-TSL (07-25) REV-D

Supersedes: UDXC-TSL (02-25) REV-C

TECHNICAL SPECIFICATIONS FOR MODEL UDXC

COMMERCIAL/INDUSTRIAL/RESIDENTIAL POWER-VENTED LOW-STATIC AXIAL FAN CONVERTIBLE GAS-FIRED UNIT HEATER



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In keeping with our policy of continuous product improvement, we reserve the right to alter, at any time, the design, construction, dimensions, weights, etc., of equipment information shown here.

TECHNICAL SPECIFICATIONS—CONTINUED

Unit Sizes

These heaters are available in fourteen unit sizes based on 30,000–400,000 BTUh input.

Features

- 115/1/60 voltage/phase/Hz
- 82–83% thermal efficient
- May be converted to separated-combustion for use in installation locations where dirt, dust, or other airborne contaminants are present in the indoor environment
- Natural gas standard (propane conversion kit available)
- Integrated circuit board with seven-segment display
- Easily-viewed status-indicating LED
- Hinged access door panel with quarter-turn latch
- Improved cabinet design with removable front face
- Painted galvanized-steel cabinet with two-toned black and white glossy, scratch-resistant paint scheme
- Patented single-burner combustion system
- TCORE²® titanium-stabilized aluminized-steel heat exchanger
- External terminal strip for 24V wiring
- Built in disconnect switch
- Four-point suspension standard on all unit sizes (two-point suspension available on unit sizes 30–125 when installed without downturn nozzle or stepdown transformer)

Factory-Installed Options

Option	Description
AC1	Aluminized-steel heat exchanger
AC2	409 SST heat exchanger
AC4	316 SST heat exchanger
AG1	Single-stage combination gas valve
AG2	Two-stage combination gas valve
AL1	Open drip-proof motor
AL14	Totally-enclosed motor

Field-Installed Options

Option	Description
CC1	Vent cap
CC21	SST vent cap
CD1	Vertical louvers, direct discharge air to provide wider throw pattern
CD2	Downturn nozzle, 25- to 65-degree variable air deflection range
CD3	Downturn nozzle, 50- to 90-degree variable air deflection range
CD4	Downturn nozzle, 25- to 65-degree variable air deflection range with vertical louvers
CD5	Downturn nozzle, 50- to 90-degree variable air deflection range with vertical louvers
CE1	Manual shutoff valve, natural gas or propane
CG1	208V–115V stepdown transformer
CG4	230V–115V or 460V–115V stepdown transformer
CG5	575V–115V stepdown transformer
CK8	Adapts 3/8-inch hangers for two-point suspension from 1-inch threaded pipe
CK10	Adapts 3/8-inch hangers for four-point suspension from 1-inch threaded pipe
CK22	Angle brackets for low ceiling mounting (does not include hanger rods)

Option	Description
CL1	Single-stage thermostat
CL22, CL23, CL83, CL84, CL90	Two-stage thermostat
CL31, CL32	Multiple unit control: option CL31 includes components for one control unit and one additional unit—option CL32 includes components for each additional non-control unit
CM1	Locking cover for CL1 thermostat
CM1B	Locking cover for CL22 thermostat
CM3	Bracket assembly for mounting thermostat on unit
DJ20	High-elevation pressure switch
DL2	Propane conversion
SC1	Separated-combustion conversion (requires either vertical (option CC2) or horizontal (option CC6) vent/combustion air inlet terminal kit)

Technical Data

Parameter	Unit of Measure	Unit Size (MBTUh)					
		30	45	60	75	100	125
Thermal efficiency	%	82	83	83		83	
Input heating capacity	BTUh	30,000	45,000	60,000	75,000	105,000	120,000
	kW	8.8	13.2	17.6	22.0	30.8	35.2
Output heating capacity, low fire*	BTUh	—		34,860	43,575	61,005	69,720
	kW			10.2	12.7	17.9	20.4
Output heating capacity, high fire*	BTUh	24,600	37,350	49,800	62,250	87,150	99,600
	kW	7.2	10.9	14.6	18.2	25.5	29.2
Gas connection**	inch	1/2					
Vent connection diameter***		4					
Control, 24V	amp	1.0					
Full load amps, 115V		1.9	2.4	2.4	3.7	4.3	5.6
Maximum overcurrent protection, 115V†		15					
Normal power consumption	watt	109	155	155	217	276	354
Discharge air temperature rise	°F	50	55	60		60	
	°C	27.8	30.6	33.3		33.3	
Air volume	CFM	456	629	769	961	1345	1537
	meter^3/minute	12.9	17.8	21.8	27.5	36.7	45.9
Discharge air opening area	foot^2	0.96		1.25		2.01	
	meter^2	0.09		0.12		0.19	
Output velocity	FPM	475	656	616	770	668	763
	meter/minute	145	200	188	235	204	233
Open fan motor horsepower	HP	0.02	0.03	0.03	0.06	1/30	1/20
Totally-enclosed fan motor horsepower		0.06		0.06		1/4	
Fan motor speed	RPM	1550		1550		1050	
Fan diameter	inch	10		12		16	
Sound level @ 15 feet	dBa	40		40	49	54	55
*ETL ratings for elevations up to 2,000 feet.							
**Size shown is for natural gas or propane gas connection to a single-stage gas valve—not supply line size.							
***Smaller and/or larger vent and combustion air pipe diameters may be permissible.							
†MOCP = 2.25 × (largest motor FLA) + smallest motor FLA. Answer is rounded to the next lower standard circuit breaker size.							

Parameter	Unit of Measure	Unit Size (MBTUh)							
		150	175	200	225	250	300	350	400
Thermal efficiency	%				83				
Input heating capacity	BTUh	150,000	175,000	200,000	225,000	250,000	300,000	350,000	400,000
	kW	44.0	51.3	58.6	65.9	73.3	87.9	102.6	117.2
Output heating capacity, low fire*	BTUh	87,150	101,675	116,200	130,725	145,250	174,300	203,350	232,400
	kW	25.5	29.8	34.0	38.3	42.6	51.0	59.6	68.1
Output heating capacity, high fire*	BTUh	124,500	145,250	166,000	186,750	207,500	249,000	290,500	332,000
	kW	36.5	42.6	48.7	54.7	60.8	73.0	85.1	97.3
*ETL ratings for elevations up to 2,000 feet.									

TECHNICAL SPECIFICATIONS—CONTINUED

Technical Data—Continued

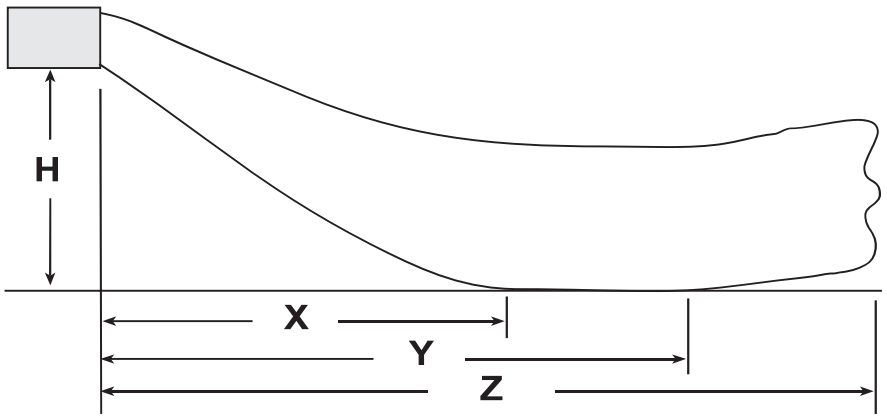
Parameter	Unit of Measure	Unit Size (MBTUh)							
		150	175	200	225	250	300	350	400
Gas connection**	inch		1/2		3/4		3/4		
Vent connection diameter***			5			5		6	
Control, 24V	amp				1.0				
Full load amps, 115V		3.8		4.6	7.5	7.5		11.0	
Maximum overcurrent protection, 115V†			15			15		20	
Normal power consumption	watt	392		491	747	747		1086	
Discharge air temperature rise	°F				60				
	°C				33.3				
Air volume	CFM	1921	2242	2562	2882	3202	3843	4483	5123
	meter^3/minute	54.4	63.5	72.5	81.6	90.7	108.8	126.9	145.1
Discharge air opening area	foot^2		2.56		3.51	3.51		4.79	
	meter^2		0.24		0.33	0.33		0.45	
Output velocity	FPM	752	877	1003	820	911	802	936	1069
	meter/minute	229	267	306	250	278	244	285	326
Open fan motor horsepower	HP		1/6		1/4	1/4		1/2	
Totally-enclosed fan motor horsepower			1/4						
Fan motor speed	RPM				1050				
Fan diameter	inch		18		20	20		24	
Sound level @ 15 feet	dBa	51	52	53	56	56	59	61	62
**Size shown is for natural gas or propane gas connection to a single-stage gas valve—not supply line size.									
***Smaller and/or larger vent and combustion air pipe diameters may be permissible.									
†MOCP = 2.25 × (largest motor FLA) + smallest motor FLA. Answer is rounded to the next lower standard circuit breaker size.									

Certification

These unit heaters are listed by Intertek for use in industrial and commercial installations in the United States and Canada. In addition, unit sizes 30, 45, 60, 75, 100, and 125 are listed in the United States and Canada as utility heaters for use in non-living spaces that are attached to, adjacent to, or part of a structure that contains space for family living quarters.

Heater Throw Distances with Standard Horizontal Louvers

The graphic shows throw patterns and the table lists throw distances for heaters suspended at varying mounting heights. The louver angles listed are relative to the top of the heater. The throw pattern changes with the addition of optional vertical louvers and/or downturn nozzles.



H = Distance from bottom of heater to the floor
X = Distance from heater to start of floor coverage
Y = Distance to end of floor coverage
Z = Distance at which air velocity drops below 50 feet (15.2 meters) per minute

H* (Feet (Meters))	Distance* or Angle	Unit Size (MBTUh)						
		30	45	60	75	100	125	150
		Feet (Meters)						
5 (1.5)	X	6 (1.8)	7 (2.1)	8 (2.4)	9 (2.7)	9 (2.7)	10 (3.0)	—
	Y	14 (4.3)	16 (4.9)	18 (5.5)	20 (6.1)	20 (6.1)	22 (6.7)	
	Z	30 (9.1)	40 (12.2)	45 (13.8)	57 (17.4)	59 (18.0)	65 (19.9)	
	Downward louver angle	21°	20°	16°	14°	18°	14°	
8 (2.4)	X	7 (2.1)	9 (2.7)	10 (3.0)	12 (3.7)	11 (3.4)	12 (3.7)	13 (4.0)
	Y	13 (4.0)	16 (4.9)	18 (5.5)	22 (6.7)	21 (6.4)	23 (7.0)	24 (7.3)
	Z	26 (7.9)	37 (11.3)	42 (12.8)	54 (16.5)	56 (17.1)	63 (19.2)	73 (22.3)
	Downward louver angle	39°	34°	29°	25°	28°	24°	26°
10 (3.0)	X	6 (1.8)	9 (2.7)	10 (3.0)	12 (3.7)	12 (3.7)	13 (4.0)	14 (4.3)
	Y	11 (3.4)	15 (4.6)	17 (5.2)	22 (6.7)	20 (6.1)	24 (7.3)	24 (7.3)
	Z	22 (6.7)	33 (10.0)	39 (11.9)	52 (15.8)	52 (15.8)	60 (18.3)	69 (21.0)
	Downward louver angle	52°	43°	37°	32°	36°	30°	32°
12 (3.7)	X	—	8 (2.4)	10 (3.0)	12 (3.7)	11 (3.4)	14 (4.3)	14 (4.3)
	Y		12 (3.7)	16 (4.9)	21 (6.4)	19 (5.8)	23 (7.0)	24 (7.3)
	Z		27 (8.2)	34 (10.4)	48 (14.6)	47 (14.3)	57 (17.4)	64 (19.5)
	Downward louver angle		55°	46°	39°	44°	36°	39°
14 (4.3)	X	—		9 (2.7)	12 (3.7)	11 (3.4)	14 (4.3)	14 (4.3)
	Y			14 (4.3)	19 (5.8)	17 (5.2)	22 (6.7)	22 (6.7)
	Z			29 (8.8)	44 (13.4)	42 (12.8)	53 (16.1)	59 (18.0)
	Downward louver angle			56°	46°	51°	43°	45°
16 (4.9)	X	—			11 (3.4)	10 (3.0)	13 (4.0)	13 (4.0)
	Y				17 (5.2)	14 (4.3)	20 (6.1)	20 (6.1)
	Z				38 (11.6)	34 (10.4)	47 (14.3)	53 (16.2)
	Downward louver angle				54°	58°	50°	51°
18 (5.5)	X	—					11 (3.4)	11 (3.4)
	Y						17 (5.2)	17 (5.2)
	Z						40 (12.2)	44 (13.4)
	Downward louver angle						57°	58°

H* (Feet (Meters))	Distance* or Angle	Unit Size (MBTUh)						
		175	200	225	250	300	350	400
		Feet (Meters)						
8 (2.4)	X	15 (4.6)	16 (4.9)	14 (4.3)	16 (4.9)	15 (4.6)	17 (5.2)	18 (5.5)
	Y	28 (8.5)	30 (9.1)	27 (8.2)	29 (8.8)	28 (8.5)	31 (9.4)	34 (11.3)
	Z	90 (27.4)	93 (28.0)	86 (26.2)	93 28.3	94 (28.7)	105 (32.0)	113 (34.4)
	Downward louver angle	22°	20°	24°	21°	24°	20°	17°
10 (3.0)	X	17 (5.2)	17 (5.2)	15 (4.6)	17 (5.2)	16 (4.9)	18 (5.5)	20 (6.1)
	Y	29 (8.8)	31 (9.4)	27 (8.2)	30 (9.1)	28 (8.5)	32 (9.8)	35 (10.7)
	Z	87 (26.6)	91 (27.7)	82 (25.0)	90 27.4	89 (27.1)	103 (31.4)	110 (33.5)
	Downward louver angle	27°	25°	30°	26°	29°	25°	21°
12 (3.7)	X	18 (5.5)	18 (5.5)	16 (4.9)	18 (5.5)	17 (5.2)	19 (5.8)	21 (6.4)
	Y	29 (8.8)	31 (9.4)	27 (8.2)	30 (9.1)	28 (8.5)	32 (9.8)	36 (11.0)
	Z	84 (25.6)	88 (26.8)	78 (23.8)	87 26.5	85 (25.9)	98 (29.9)	108 (32.9)
	Downward louver angle	32°	30°	35°	31°	34°	30°	25°
14 (4.3)	X	18 (5.5)	19 (5.8)	16 (4.9)	18 (5.5)	17 (5.2)	20 (6.1)	23 (7.0)
	Y	28 (8.5)	30 (9.1)	26 (7.9)	30 (9.1)	27 (8.2)	32 (9.8)	35 (10.7)
	Z	79 (24.1)	84 (25.6)	73 (22.3)	83 25.3	80 (24.4)	95 (29.0)	105 (32.0)
	Downward louver angle	37°	34°	41°	36°	40°	34°	29°
16 (4.9)	X	18 (5.5)	19 (5.8)	16 (4.9)	19 (5.8)	17 (5.2)	21 (6.4)	23 (7.0)
	Y	27 (8.2)	29 (8.8)	24 (7.3)	28 (8.5)	25 (7.6)	31 (9.4)	35 (10.7)
	Z	74 (22.6)	79 (24.1)	67 (20.4)	78 23.8	74 (22.6)	90 (27.4)	101 (30.8)
	Downward louver angle	42°	39°	47°	41°	45°	38°	33°
18 (5.5)	X	17 (5.2)	19 (5.8)	14 (4.3)	18 (5.5)	16 (4.9)	20 (6.1)	23 (7.0)
	Y	26 (7.9)	28 (8.5)	22 (6.7)	27 (8.2)	24 (7.3)	30 (9.1)	35 (10.7)
	Z	68 (20.7)	74 (22.6)	60 (18.3)	72 (21.9)	66 (20.1)	85 (25.9)	97 (26.9)
	Downward louver angle	48°	44°	53°	46°	51°	43°	37°

*See graphic above.

Installation Codes

- These units must be installed in accordance with local building codes. In the absence of local codes, in the United States, the unit must be installed in accordance with the *National Fuel Gas Code* (ANSI Z223.1, latest edition). A Canadian installation must be in accordance with the *Natural Gas and Propane Installation Code* (CSA B149, latest edition). This code is available from CSA Information Services, 1-800-463-6727. Local authorities having jurisdiction should be consulted before installation is made to verify local codes and installation procedure requirements.
- Installations in aircraft hangars should be in accordance with the *Standard for Aircraft Hangars* (ANSI/NFPA 409, latest edition). Installations in public garages should be in accordance with the *Standard for Parking Structures* (ANSI/NFPA 88A, latest edition). Installations in repair garages should be in accordance with the *Standard for Repair Garages* (NFPA 88B), which has been incorporated into the *Code for Motor Fuel Dispensing Facilities and Repair Garages* (NFPA 30A, latest edition). In Canada, installations in aircraft hangars and public garages should be in accordance with CSA B149.
- If the heater is being installed in the Commonwealth of Massachusetts, installation must be performed by a licensed plumber or licensed gas fitter.

Clearances

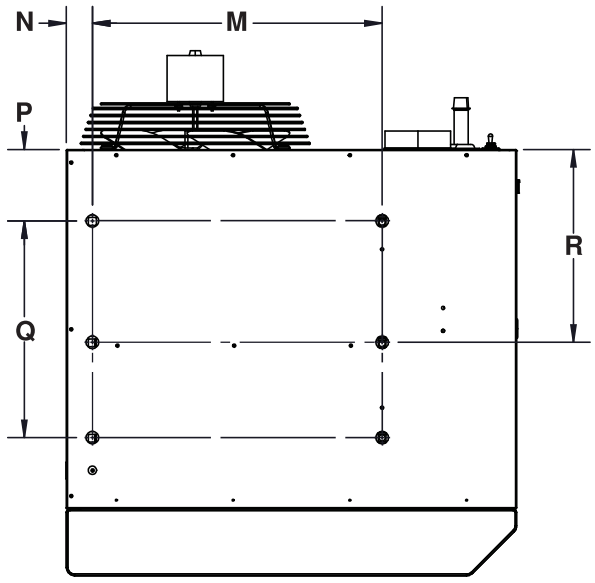
Units must be located so that clearances are provided for with regards to combustion air space, inspection, and service and for proper spacing from combustible construction. Clearance to combustibles is defined as the minimum distance from the heater to a surface or object for which it is necessary to ensure that a surface temperature of 90°F (50°C) above the surrounding ambient temperature is not exceeded.

Heater Surface	Unit Size (MBTUh)	
	30–125	150–400
	Minimum Clearance (Inches (mm))	
Top	1 (25)	4 (102)
Flue connector	6 (152)	6 (152)
Access panel	18 (457)	18 (457)
Non-access side	1 (25)	2 (51)
Bottom*	1 (25)	1 (25)
Rear**	18 (457)	18 (457)
Front	Refer to values for variable X (distance from heater to start of floor coverage) in **Heater Throw Distances with Standard Horizontal Louvers** section	
*Suspend the heater so that the bottom is a minimum of 5 feet (1.5 meters) above the floor.		
**Measure rear clearance from the fan motor.		

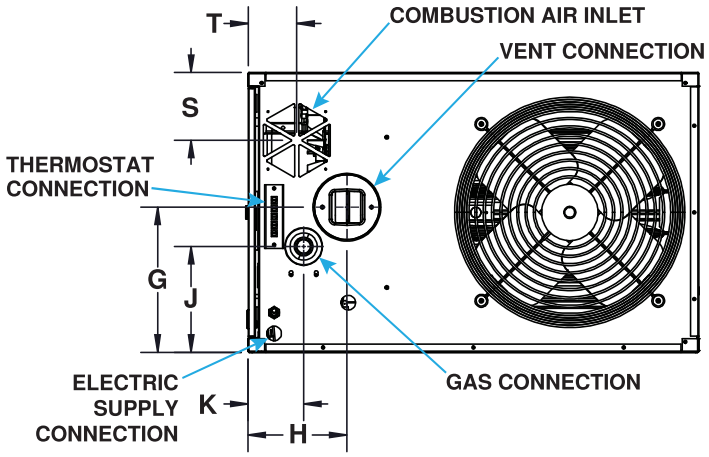
Weights

Type	Unit Size (MBTUh)												
	30	45	60	75	100	125	150	175, 200	225	250	300	350	400
	Pounds (kg)												
Unit	57 (26)	62 (28)	71 (32)	76 (34)	101 (46)	106 (48)	178 (81)	193 (88)	211 (96)	223 (101)	277 (126)	303 (137)	316 (143)
Shipping	63 (29)	68 (31)	76 (34)	81 (37)	120 (54)	125 (57)	206 (93)	221 (100)	247 (112)	259 (117)	323 (147)	348 (158)	360 (163)

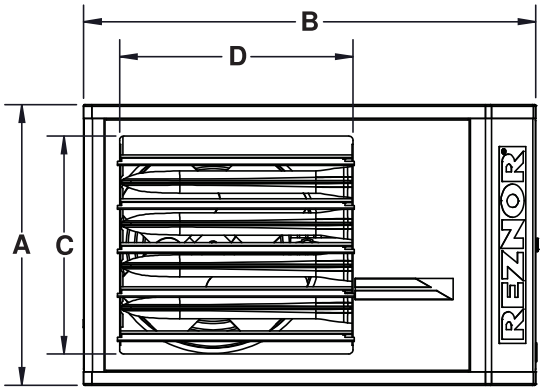
Dimensions



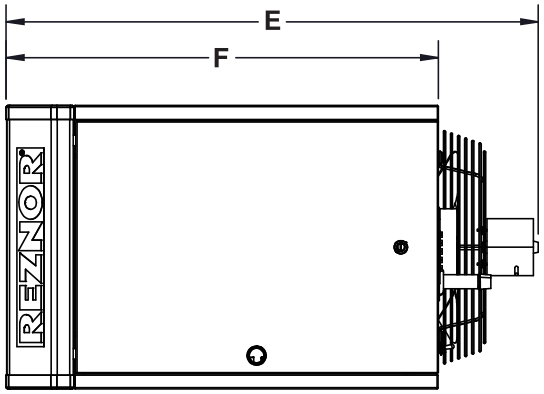
TOP VIEW



REAR VIEW



FRONT VIEW



SIDE VIEW

Dimension (See Graphic Above)	Unit Size (MBTUh)							
	30, 45	60	75	100	125	150, 175, 200	225, 250	300, 350, 400
	Inches (mm)							
A	13-3/4 (349)	16-3/4 (425)		24-3/4 (629)		20-1/8 (511)	26-1/8 (664)	34-1/8 (867)
B	27 (686)					38-3/16 (970)		41 (1041)
C	10 (254)	13 (330)		21 (533)		16 (406)	22 (559)	30 (762)
D	13-13/16 (351)					23 (584)		
E	29-3/4 (756)	32-23/32 (831)	31-29/32 (810)	34-9/32 (871)	34-9/32 (871)	48-7/16 (1230)		48-29/32 (1243)
F	25-9/16 (649)					40 (1016)		
G	6 (152)	8-11/16 (221)		15-5/16 (389)		9-5/8 (244)	13-1/16 (332)	17-1/16 (433)
H	5-15/16 (151)					8-5/16 (211)		8-1/2 (216)
J	3-1/2 (89)	6 (152)		8-29/32 (226)		5-3/8 (137)	9 (229)	11-13/16 (300)
K	3-11/32 (85)					6-1/2 (165)		7-5/16 (186)
M*	17-3/8 (441)					25-11/16 (652)		27-11/16 (703)
N*	1-9/16 (40)					1-13/32 (36)		
P*	4-9/32 (109)					8-1/8 (206)		
Q*	13 (330)					22-3/16 (564)		
R**	11-9/16 (294)					16-3/8 (416)	15-5/8 (397)	16-1/4 (413)
S	3-3/4 (95)	4-1/16 (103)		5-15/32 (139)		5-1/2 (140)	8-1/16 (205)	11-9/16 (294)
T	2-15/16 (75)					4-1/4 (108)	4-5/16 (110)	4-1/2 (114)

*Heater suspension points (3/8-16 FEM).

**Heater suspension points for two-point suspension (3/8-16 FEM).

Halogenated Hydrocarbons

Halogenated hydrocarbons are a family of chemical compounds characterized by the presence of halogen elements (fluorine, chlorine, bromine, etc.). These compounds are used in refrigerants, cleaning agents, and solvents and are heavier than air, a fact that should be kept in mind when determining the installation location of heaters and building exhaust systems.

⚠ CAUTION ⚠

CORROSION HAZARD: Halogenated hydrocarbons, when exposed to flame, precipitate with any condensation present in the heater to form hydrochloric acid, which readily attacks all metals, including 300 grade stainless steel. Care should be taken to separate these vapors from the combustion process. An outside air supply MUST BE provided to the burner whenever the presence of these compounds is suspected.

Gas Supply Pressure

- The unit is equipped for a maximum gas supply pressure of 1/2 psi, 3.5 kPa, or 14 IN WC for natural gas or propane. The minimum supply pressure, as measured while the unit is operating at full fire, is 5 IN WC for natural gas or 11 IN WC for propane.
- Supply pressure higher than 1/2 psi requires the installation of an additional service regulator external to the unit.
- **Pressure testing supply piping:** For test pressures ***above*** 1/2 psi, disconnect the heater and manual valve from the gas supply line to be tested and cap or plug the supply line. For test pressures ***below*** 1/2 psi, before testing, close the manual valve on the heater.

Gas Supply Piping

- All piping must be in accordance with requirements outlined in the *National Fuel Gas Code* (ANSI/Z223.1, latest edition) or the *Natural Gas and Propane Installation Code* (CSA B149.1, latest edition).
- The heater is orificed for operation with natural gas having a heating value of 1,050 (±50) BTU per cubic foot or with propane gas having a heating value of 2,550 (±100) BTU per cubic foot. Sizing of gas supply lines depends on piping capacity and is based on cubic feet per hour based on a 0.3 IN WC pressure drop, a 0.6 specific gravity for natural gas at 1,050 BTU per cubic feet, and a 1.6 specific gravity for propane at 2,550 BTU per cubic feet. If the gas at the installation does not meet this specification, consult the factory for proper orificing.
- Variables for sizing gas supply lines are listed in the table below. When sizing supply lines, consider the possibility of future expansion and increased requirements. Refer to the *National Fuel Gas Code* for additional information on line sizing.

Pipe Length (Feet)	Natural Gas						Propane					
	Pipe Diameter (Inches)											
	1/2	3/4	1	1-1/4	1-1/2	2	1/2	3/4	1	1-1/4	1-1/2	2
	Cubic Feet per Hour											
20	92	190	350	730	1100	2100	56	116	214	445	671	1281
30	73	152	285	590	890	1650	45	93	174	360	543	1007
40	63	130	245	500	760	1450	38	79	149	305	464	885
50	56	115	215	440	670	1270	34	70	131	268	409	775
60	50	105	195	400	610	1105	31	64	119	244	372	674
70	46	96	180	370	560	1050	28	59	110	226	342	641
80	43	90	170	350	530	990	26	55	104	214	323	604
90	40	84	160	320	490	930	24	51	98	195	299	567
100	38	79	150	305	460	870	23	48	92	186	281	531
125	34	72	130	275	410	780	21	44	79	168	250	476
150	31	64	120	250	380	710	19	39	73	153	232	433
175	28	59	110	225	350	650	17	36	67	137	214	397
200	26	55	100	210	320	610	16	34	61	128	195	372

Vent Connections

Vent system methods vary depending on whether the installation is residential or commercial/industrial, whether the vent is dedicated or common, and whether the unit is standard or separated-combustion. Refer to the installation manual provided with the unit and select and follow the venting instructions that apply to the installation only. For venting separated-combustion units, refer to the installation manual provided with the unit as well as the separated-combustion conversion instructions provided with the conversion kit.

⚠ CAUTION ⚠

- **When an existing appliance is removed or replaced in a venting system, verify that the venting system is properly sized to vent the new appliance. An improperly sized venting system may result in the formation of condensate, leakage, and/or spillage.**
- **Do not intermix different vent system parts from different manufacturers in the same venting system.**

NOTE: Venting must be in accordance with local codes and with the *National Fuel Gas Code* (ANSI Z223.1) or the *Installation Code for Gas Burning Appliances and Equipment* (CSA B149.1). Local requirements supersede national requirements.

⚠ DANGER ⚠

FIRE OR EXPLOSION HAZARD

- **Failure to follow safety warnings exactly could result in serious injury, death, or property damage.**
- **Improper installation, adjustment, alteration, service, or maintenance can cause serious injury, death, or property damage.**
- **Installation and service must be performed by a qualified installer, service agency, or the gas supplier.**
- **Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.**

WHAT TO DO IF YOU SMELL GAS

- **Do not try to light any appliance.**
- **Do not touch any electrical switch; do not use any phone in your building.**
- **Leave the building immediately.**
- **Immediately call your gas supplier from a phone remote from the building. Follow the gas supplier's instructions.**
- If you cannot reach your gas supplier, call the fire department.

For more information on Reznor HVAC products:

- **Contact your local Reznor representative at 1-800-695-1901**
- **Refer to the manuals and additional consumer materials found at www.reznorhvac.com**

Intertek

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