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Appendix E

Air Quality

Appendix E-1

Air Quality Technical Reports

Prepared for
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Santa Clara, California

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AIR QUALITY AND GREENHOUSE GAS TECHNICAL REPORT – BACKUP GENERATORS ONLY

VANTAGE DATA CENTERS
SANTA CLARA, CALIFORNIA

RAMBOLL ENVIRON

CONTENTS

EXECUTIVE SUMMARY		**ES 1**
1.	**INTRODUCTION**	**1**
1.1	Project Description	1
1.2	Objective and Methodology	1
1.3	Thresholds Evaluated	1
1.4	Report Organization	3
2.	**EMISSION ESTIMATES**	**4**
2.1	Calculation Methodologies for Operational Emissions	4
2.1.1	Stationary Sources	4
2.1.2	Summary of Project Operational GHG Emissions	5
3.	**ESTIMATED AIR CONCENTRATIONS**	**6**
3.1	Chemical Selection	6
3.2	Sources of Emissions	6
3.3	Air Dispersion Modeling	7
4.	**RISK CHARACTERIZATION METHODS**	**10**
4.1	Project Sources Evaluated	10
4.2	Exposure Assessment	10
4.3	Toxicity Assessment	11
4.4	Age Sensitivity Factors	11
4.5	Risk Characterization	11
4.5.1	Estimation of Cancer Risks	11
4.5.2	Estimation of Chronic and Acute Noncancer Hazard Quotients/Indices	12
5.	**PROJECT HEALTH RISK ASSESSMENT**	**14**
5.1	Operational HRA	14
5.2	Cumulative HRA	14
6.	**REFERENCES**	**16**

TABLES

Table ES-1: Summary of Project Construction and Operational Emissions
Table ES-2: Summary of Project Construction and Operational Health Impacts at the Maximally Exposed Individual Sensitive Receptor (MEISR)
Table 1a: Emergency Generator Emission Factors
Table 1b: Life Safety Generator Emissions Factors
Table 2: Controlled Engine Emissions, Daily
Table 3: Controlled Engine Emissions, Annual
Table 4: Operational Mass Emissions of Criteria Air Pollutants
Table 5: Operational Mass Emissions of Greenhouse Gases
Table 6: Modeling Parameters
Table 7: Exposure Parameters, 2015 OEHHA Methodology
Table 8: Speciation Values
Table 9: Toxicity Values
Table 10: Age Sensitivity Factors
Table 11: Carbon Monoxide Analysis
Table 12: Concentrations at the Construction and Operational MEISRs
Table 13: Project-related Operational Health Risk Impacts to the MEISR
Table 14: Summary of Cumulative Health Risk Impacts to the MEISR

FIGURES

Figure 1: Project Boundary
Figure 2: Generator Locations
Figure 3: Receptor Grid

ACRONYMS AND ABBREVIATIONS

AERMOD	American Meteorological Society/Environmental Protection Agency regulatory air dispersion model
AQ	Air Quality
ARB	California Air Resources Board
aREL	Acute Reference Exposure Level
ASF	Age Sensitivity Factor
BAAQMD	Bay Area Air Quality Management District
Cal/EPA	California Environmental Protection Agency
CAP	Criteria Air Pollutant
CEQA	California Environmental Quality Act
CH_4	Methane
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide equivalent
CPF	Cancer Potency Factor
cREL	Chronic Reference Exposure Level
DPF	Diesel Particulate Filter
DPM	Diesel Particulate Matter
GHG	Greenhouse Gas
HI	Hazard Index
HQ	Hazard Quotient
HRA	Health Risk Assessment
MAF	Modelling Adjustment Factor
MEISR	Maximally Exposed Individual Sensitive Receptor
N_2O	Nitrogen Dioxide
NOx	Nitrous Oxide
OEHHA	Office of Environmental Health Hazard Assessment
$PM_{2.5}$	Fine Particulate Matter Less than 2.5 Micrometers in Aerodynamic Diameter
PM_{10}	Respirable Particulate Matter Less than 10 Micrometers in Aerodynamic Diameter
ppm	part per million
REL	Reference Exposure Level

ROG	Reactive Organic Gas
RPS	Renewables Portfolio Standard
TAC	Toxic Air Contaminant
TOG	Total Organic Gas
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

Units

g	Gram
kg	Kilogram
m	Meter
MT	Metric Ton
MW	Megawatts
MWh	Megawatts Hour
µg	Microgram
µg/m^3	Micrograms per cubic meter
m^3/kg-day	Milligrams per kilogram per day
m^3	Cubic meters
mg	Milligram
s	Second
tpy	Ton per Year
yr	Year

EXECUTIVE SUMMARY

Vantage Data Centers' Mathew Street development ("the Project") is a proposed new data center in Santa Clara, California. The Project would be located on a 8.97-acre plot bounded by existing occupied buildings to the West, rail tracks to the East, a Home Depot location to the North and Mathew Street to the South. The proposed plan for the Project includes forty-seven (47) 3-megawatts (MW) emergency generators and one (1) 500-kilowatts (kW) life safety generator to provide back-up power for the data center which may draw up to 74 MW critical and 99.8 MW total of power from the grid. This report evaluates the air quality (AQ) and greenhouse gas (GHG) impacts, together with risks and hazards associated with the Project backup generators (the "power plant").

At the request of Vantage Data Centers, Ramboll Environ US Corporation (Ramboll Environ) conducted a California Environmental Quality Act (CEQA) analysis of criteria air pollutants (CAPs) and precursor emissions associated with the proposed operation of the backup generators in 2016. Ramboll Environ also estimated GHG emissions from operation of the backup generators and performed a health risk assessment (HRA) of operation of the backup generators. This report serves as an update to the previous analysis in 2016 using updated project descriptions and characteristics and only evaluates the changes associated with the Project power plant. The local air agency, the Bay Area Air Quality Management District (BAAQMD) has published CEQA Guidelines for use in determining significance, which will apply here for AQ and GHG (BAAQMD 2011).[1] As shown in **Table ES-1**, the relevant thresholds for the Project are:

- Operational CAP and precursor emissions
- Local carbon monoxide (CO) concentrations
- Operational GHG emissions
- Excess lifetime cancer risk, chronic HI, acute HI, and $PM_{2.5}$ concentrations from operation on off-site receptors; and
- Cumulative excess lifetime cancer risk, chronic HI, and $PM_{2.5}$ concentration from construction and surrounding sources on off-site receptors.

Since construction emissions associated with the grading, concrete pad construction, and placement of the backup generators are negligible, construction emissions and relevant thresholds are not being evaluated. Project health impacts from diesel particulate matter and speciated on-road total organic gas (TOG) emissions were calculated consistent with guidance in BAAQMD's 2011 CEQA guidelines (BAAQMD 2011) and the 2015 California Environmental Protection Agency (Cal/EPA) Office of Environmental Health Hazard Assessment (OEHHA) Hot Spots Guidance (2015). Consistent with BAAQMD and OEHHA Hot Spots guidance, health impacts were based on emissions of toxic air contaminants (TACs). Concentrations of TACs were estimated using AERMOD, a Gaussian air dispersion model recommended by United States Environmental Protection Agency (USEPA), California Air

[1] A March 2012 Alameda County Superior Court judgment determined that the BAAQMD had failed to evaluate the environmental impacts of the land use development patterns that would result from adoption of the thresholds and ordered the thresholds set aside. The Court of Appeal reversed that judgment and the California Supreme Court decided the limited issue that CEQA does not require an analysis of the environment's impact on a project, with the exception of schools.

Resources Board (ARB), and BAAQMD for use in preparing environmental documentation for stationary or construction sources. Health impacts were calculated using the TAC concentrations and TAC toxicities and exposure assumptions consistent with the 2015 OEHHA Hot Spots guidance.

Table ES-1 shows the previous and updated Project emissions and the BAAQMD CEQA thresholds. Updated Project operational GHG emissions are 5,460 metric tonnes per year (MT/yr), a 32% percent change from the previous Project description.

Table ES-1: Summary of Backup Generator Operational Emissions

	ROG	NOx [2]	PM_{10}	$PM_{2.5}$
Operational Daily Emissions (lb/day)				
Previous Generator Emissions	2.1	178	0.43	0.43
Updated Generator Emissions	3.3	263	0.63	0.63
Percent change from MND	57%	48%	47%	47%
BAAQMD CEQA Thresholds	***54***	***54***	***82***	***54***
Operational Annual Emissions (tpy)				
Previous Generator Emissions	0.38	33	0.08	0.08
Updated Generator Emissions	0.60	48	0.12	0.12
Percent change from MND	58%	45%	50%	50%
BAAQMD CEQA Thresholds	***10***	***10***	***15***	***10***

Project operations would contribute maximum local CO concentrations of 0.67 parts per million (ppm) on a 1-hour average and 0.39 ppm on an 8-hour average. These impacts are below the respective BAAQMD thresholds of significance of 20.0 ppm and 9.0 ppm.

[2] NOx emissions will be capped or offset through the air permitting process with the BAAQMD.

Table ES-2 shows the previous and updated Project health impacts and the BAAQMD CEQA thresholds. Only the Executive Summary of this report outlines the changes in results due to changes in the project description/master plan (comparing to numbers from the Mitigated Negative Declaration (MND)). The remainder of this report only discusses methodologies and results of the updated Project description.

Table ES-2: Summary of Backup Generator Operational Health Impacts at the Maximally Exposed Individual Sensitive Receptor (MEISR)

	Excess Lifetime Cancer Risk in one million	**Noncancer Chronic HI (unitless)**	**Noncancer Acute HI (unitless)**	**$PM_{2.5}$ Concentration ($\mu g/m^3$)**
Project Operational Health Impacts				
Previous Generator Impact	0.30	0.000079	0.67	0.00039
Updated Generator Impact	0.42	0.00011	0.84	0.00055
Percent change from MND	40%	39%	25%	41%
BAAQMD CEQA Thresholds	***10***	***1***	***1***	***0.3***

1. INTRODUCTION

At the request of Vantage Data Centers, Ramboll Environ US Corporation (Ramboll Environ) has prepared this technical report documenting air quality (AQ) and greenhouse gas (GHG) analyses for the construction and operational activities of the proposed data center, located on three land parcels on Mathew Street, in Santa Clara, California (referred to as the "Project"). The analyses follows the Bay Area Air Quality Management District (BAAQMD) California Environmental Quality Act (CEQA) Guidelines released in 2011 (BAAQMD 2011).[3]

1.1 Project Description

The proposed Project spans from 651 to 825 Mathew Street and is bounded by Lafayette Street to the West, rail tracks to the East, a Home Depot location to the North and Mathew Street to the South in Santa Clara, California. The property is an approximately 8.97-acre lot. The proposed location and boundary are shown in **Figure 1**. The proposed Project will be a data center developed over four construction phases from 2017 to 2022. At full build-out, the project will include forty-seven (47) 3-megawatts (MW) capacity Tier-2 emergency generators with diesel particulate filters (DPF) (a total backup capacity of 96 MW), one 500-kilowatts (kW) life safety generator, three office buildings, surface street parking spaces, 72 adiabatic air-cooled chillers , and 12 direct expansion make-up air units This report is only assessing impacts from operations of the backup generators (the "power plant").

1.2 Objective and Methodology

The BAAQMD 2011 CEQA Guidelines contain recommended thresholds for operational criteria air pollutant (CAP) and precursor emissions, GHG emissions, and risks and hazards associated with toxic air contaminant (TAC) emissions from an individual project (BAAQMD 2011). This report evaluates the AQ and GHG impacts, together with risks and hazards associated with backup generator operational activities, on off-site receptors and the cumulative impact to off-site sensitive receptors from backup generator operations and surrounding sources.

1.3 Thresholds Evaluated

The AQ analysis of this report evaluates the daily and annual regional emissions of criteria pollutants and precursors from operation of the backup generators and evaluates these emissions against BAAQMD's May 2011 significance thresholds for emissions (BAAQMD 2011). These thresholds are as follows:

Operational CAP Emissions:

- Average daily emissions of ROG greater than 54 lb/day, or maximum annual emissions of 10 tons per year (tpy);
- Average daily emissions of NOx greater than 54 lb/day, or maximum annual emissions of 10 tpy;

[3] A March 2012 Alameda County Superior Court judgment determined that the BAAQMD had failed to evaluate the environmental impacts of the land use development patterns that would result from adoption of the thresholds and ordered the thresholds set aside. The Court of Appeal reversed that judgment and the California Supreme Court decided the limited issue that CEQA does not require an analysis of the environment's impact on a project, with the exception of schools.

- Average daily emissions of PM_{10} greater than 82 lb/day, or maximum annual emissions of 10 tpy; and
- Average daily emissions of $PM_{2.5}$ greater than 54 lb/day, or maximum annual emissions of 10 tpy.

Local carbon monoxide (CO) concentrations:

- 8-hour average concentration of 9.0 parts per million (ppm)
- 1-hour average concentration of 20.0 ppm

The GHG analysis of this report evaluates the GHG emissions from operation of the Project and evaluates these emissions against BAAQMD's May 2011 significance thresholds for emissions. These thresholds are as follows:

- Stationary source direct GHG emissions of 10,000 metric tonnes per year (MT/yr)

The health risk assessment (HRA) in this report evaluates the estimated cancer risk, noncancer chronic hazard index (HI), acute HI, and $PM_{2.5}$ concentration associated with construction and operation of the Project's emissions of Toxic Air Contaminants (TACs). The Toxic Air Contaminants considered are those included in BAAQMD Rule 2-5, New Source Review of Toxic Air Contaminants. No chronic or acute health impacts are shown for CAPs, including NO_2, consistent with BAAQMD CEQA guidance. The HRA evaluates potential sensitive receptor locations including:

- "Residential dwellings, including apartments, houses, condominiums;
- Schools, colleges, and universities;
- Daycares;
- Hospitals; and
- Senior-care facilities." (BAAQMD 2012a)

Ramboll Environ conducted a sensitive receptor search within the 1,000-foot zone of influence, and determined that the only sensitive receptors are residential dwellings to the southwest of the Project site. However, for completeness, Ramboll Environ also included a nearby soccer facility directly south of the Project site as a potential sensitive receptor.

To meet the above stated objectives, this HRA was conducted consistent with the following guidance:

- Air Toxics Hot Spots Program Risk Assessment Guidelines (Office of Environmental Health Hazard Assessment [OEHHA] 2015);
- May 2011 BAAQMD CEQA Guidelines (BAAQMD 2011); and
- BAAQMD Recommended Methods for Screening and Modeling Local Risks and Hazards (BAAQMD 2012a).

Ramboll Environ compared the results of emissions and health risk analyses to the BAAQMD 2011 CEQA significance thresholds. Operational health impacts of the backup generators were compared against the BAAQMD 2011 CEQA single source thresholds. The thresholds are:

Single Source Impacts:

- An excess lifetime cancer risk level of more than 10 in one million;
- A noncancer chronic HI greater than 1.0;
- A noncancer acute HI greater than 1.0; and
- An incremental increase in the annual average $PM_{2.5}$ concentration of greater than 0.3 micrograms per cubic meter (μg/m^3).

If a project does not exceed the identified significance thresholds, its emissions would not be cumulatively considerable. For reference, the BAAQMD 2011 cumulative CEQA significance thresholds are:

- An excess lifetime cancer risk level of more than 100 in one million;
- A noncancer chronic HI greater than 10.0; and
- An annual average $PM_{2.5}$ concentration of greater than 0.8 micrograms per cubic meter (μg/m^3).

1.4 Report Organization

This technical report is divided into eight sections as follows:

Section 1.0 – Introduction: describes the purpose and scope of this technical report, the objectives and methodology used in this technical report, and the report organization.

Section 2.0 – Emission Estimates: describes the methods used to estimate the emissions of CAPs, GHGs, and TACs from the Project;

Section 3.0 – Estimated Air Concentrations: discusses the air dispersion modeling, the selection of the dispersion models, the data used in the dispersion models (e.g., terrain, meteorology, source characterization), and the identification of residential and sensitive locations evaluated in this technical report.

Section 4.0 – Risk Characterization Methods: provides an overview of the methodology for conducting the HRA.

Section 5.0 – Project Health Risk Assessment: presents the estimated emissions of CAPs and GHGs, estimated excess lifetime cancer risks, chronic noncancer HIs, acute noncancer HIs, and $PM_{2.5}$ concentrations for the Project.

Section 6.0 – References: includes a listing of all references cited in this report.

2. EMISSION ESTIMATES

Ramboll Environ estimated CAP, GHG, and TAC emissions from the operation of the backup generators. The CAPs of interest include ROG, NOx, $PM_{2.5}$ and PM_{10}. There is no mass emissions threshold for CO, although the mass emissions are necessary for CO concentration impact modeling, so Ramboll Environ also estimated CO emissions from operation of the Project. The GHGs of interest include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), which are commonly combined by global warming potential-weighted average into carbon dioxide equivalents (CO_2e). One of the TACs of interest is diesel particulate matter (DPM), emissions of which are assumed to be equal to exhaust PM_{10} from backup diesel engines during operation. Other TACs are speciated from TOG from on-road emissions from gasoline vehicles. These emissions estimates were used to compare to BAAQMD thresholds and as inputs to the HRA. The methodologies used by Ramboll Environ are summarized below.

Tables 8a and **8b** present the backup generator characteristics and assumptions used in the emissions estimation.

2.1 Calculation Methodologies for Operational Emissions

Emissions from backup generator operations were estimated using manufacturer’s data for stationary sources (emergency generators).

2.1.1 Stationary Sources

The proposed Project includes 48 diesel back-up generators including one life safety generator, the locations of which are shown in **Figure 3**. **Table 1a and Table 1b** presents controlled emission factors used to calculate daily and annual criteria pollutant emission rates as well as uncontrolled emission factors and DPF abatement efficiencies used to calculate the controlled emission factors. Ramboll Environ used United States Environmental Protection Agency (USEPA) D2 Certification Cycle emissions factors with reductions, based on the information provided by project sponsor. Engine emissions are based on non-emergency operations (primarily the schedule of testing that is required for the generators) and the planned number of hours of non-emergency operations (in accordance with BAAQMD Regulation 2, Rule 5). Consistent with BAAQMD permitting methods, no load factor is applied. Annual non-emergency operation is limited to 50 hours, as stated in the Airborne Toxic Control Measure for Stationary Toxic Compression Ignition Engines (Section 93115, Title 17, CCR). Emission rates were averaged over the period of a year since the emergency generators could potentially be tested at any time of day or day of year. **Tables 2** and **3** present the daily and annual CAP emissions from non-emergency operation of the backup engines, with annual GHG emissions also presented in **Table 5**. GHG emissions were calculated following the same methodology as described above for CAPs. The USEPA engine certification emission factors include CO_2. Ramboll Environ used the USEPA Mandatory Reporting Rule emission factors for CH_4 and N_2O emissions (USEPA 2013), which were added to develop a carbon dioxide equivalent (CO_2e) emission factor using the same global warming potentials as in CalEEMod®.

2.1.2 Summary of Project Operational GHG Emissions

GHG emissions from the emergency generators are subject to the BAAQMD CEQA threshold for stationary sources. GHG emissions for backup generator operations are presented in **Table 5**. Based on the maximum allowable hours of operation annually, generators are estimated to emit 5,460 MT CO_2e/yr, below the BAAQMD stationary source threshold of 10,000 MT CO_2e/yr.

3. ESTIMATED AIR CONCENTRATIONS

Backup generator operational activities will generate emissions that will be transported outside of the physical boundaries of the Project site, potentially impacting nearby sensitive receptors such as residential areas. Methodologies to estimate concentrations resulting from generator operational activities are provided below. Ramboll Environ performed a refined HRA for non-emergency operation of the emergency generators.

3.1 Chemical Selection

The cancer risk, chronic, and acute hazards in the HRA for the Project construction and stationary source operation were based on TAC emissions from the Project. Modeled sources of TACs include on-road construction traffic, off-road construction equipment, and diesel-powered emergency generators. Accordingly, the chemicals to be evaluated in the HRA were DPM, speciated total organic gases (TOG) in diesel exhaust, and speciated evaporative and exhaust TOGs from gasoline vehicles. DPM emissions are assumed to be equal to Exhaust PM_{10} from on- and off-road construction equipment, and exhaust PM_{10} from backup diesel engines during operation. Other TACs are speciated from total organic gases (TOG) from on-road emissions from gasoline vehicles.

Diesel exhaust, a complex mixture that includes hundreds of individual constituents, is identified by the State of California as a known carcinogen (California Environmental Protection Agency [Cal/EPA] 1998). Under California regulatory guidelines, DPM is used as a surrogate measure of exposure for the mixture of chemicals that make up diesel exhaust as a whole. Cal/EPA and other proponents of using the surrogate approach to quantifying cancer risks associated with the diesel mixture indicate that this method is preferable to use of a component-based approach. A component-based approach involves estimating risks for each of the individual components of a mixture. Critics of the component-based approach believe it will underestimate the risks associated with diesel as a whole mixture because the identity of all chemicals in the mixture may not be known and/or exposure and health effects information for all chemicals identified within the mixture may not be available. Furthermore, Cal/EPA has concluded that “potential cancer risk from inhalation exposure to whole diesel exhaust will outweigh the multi-pathway cancer risk from the speciated components” (OEHHA 2003). The DPM analyses for cancer and chronic hazards will be based on the surrogate approach, as recommended by Cal/EPA. In the absence of an acute toxicity value for diesel exhaust, speciated TOG will be used as a conservative estimate.

For the analysis of local CO concentrations, Ramboll Environ used operational CO emissions from stationary sources during project operation.

3.2 Sources of Emissions

The relevant emissions sources of TACs for the refined HRA are off-road equipment and on-road trucks during construction and emergency generators during operation. Emissions estimates for operational mobile sources are not included in the refined HRA since BAAQMD screening tools are used to assess operational mobile source health impacts. Emissions of CO from project operation are from emergency generators only. The screening level for operational traffic is 44,000 vehicles per hour (BAAQMD 2011), which is 100 times higher than total daily trip generation from the project. As such operational traffic is a *de minimis* contributor to operational CO emissions. **Table 11** shows the maximum CO emissions per generator, using the USEPA engine certification emission factor. The CO concentrations analysis is conservative in that it assumes all 48 emergency generators are in use at the same time during the worst meteorological conditions for the respective averaging periods.

3.3 Air Dispersion Modeling

The most recent version of AERMOD (Version 15181) was used to evaluate ambient air concentrations of CO, DPM, $PM_{2.5}$ and TOG at off-site receptors from both Project construction sources and the non-emergency use of the backup generators. For each receptor location, the model generates air concentrations that result from emissions from multiple sources. If unit emissions (i.e., 1 g/s) are modelled, the resultant value for each receptor location is called the air dispersion factor.

Air dispersion models such as AERMOD require a variety of inputs such as source parameters, meteorological conditions, topographical information, and receptor parameters. Modeling parameters are shown in **Table 6**. Construction source parameters are from BAAQMD modeling performed in support of the San Francisco Community Risk Reduction Plan (SF CRRP) (Bay Area Air Quality Management District, San Francisco Department of Public health, San Francisco Planning Department 2012). The Project boundary is shown in **Figure 1**.

Meteorological data: Air dispersion modeling requires the use of meteorological data that ideally are spatially and temporally representative of conditions in the immediate vicinity of the site under consideration. Ramboll Environ used surface meteorological data from the San Jose Airport for years 2009 through 2013, with upper air data collected at the Oakland Airport for the same time period.

Terrain considerations: Elevation and land use data were imported from the National Elevation Dataset maintained by the United States Geological Survey (USGS 2013). An important consideration in an air dispersion modeling analysis is the selection of whether or not to model an urban area. Here the model assumes an urban land use as has been done for similar projects in the area. Ramboll Environ will use 126,215, the 2014 population of the City of Santa Clara, as the urban population in AERMOD (US Census Bureau 2014). This is a conservative underestimate of the population that contributes to the urban heat island effect in the vicinity of the Project.

Emission rates: Emissions were modeled using the unit rate emissions method for all but CO, such that each source has a unit emission rate (i.e., 1 gram per second [g/s]) and the model estimates dispersion factors with units of $(\mu g/m^3)/(g/s)$. Actual emissions were multiplied by the dispersion factors to obtain concentrations. CO modeling used actual emission rates in g/s.

Emitting activities were modeled to reflect the actual hours of operation. For Project construction, emissions were modeled to occur between 7 AM and 4 PM, a span of 9 hours, although equipment operation may total less than 9 hours. For Project operation, generators were modeled as if they could operate at any hour of the day.

For annual average ambient air concentrations, the estimated annual average dispersion factors were multiplied by the annual average emission rates. For maximum hourly ambient air concentrations, the estimated maximum hourly dispersion factors were multiplied by the maximum hourly emission rates.

Source parameters: Source locations and parameters are necessary to model the dispersion of air emissions. Operational source locations are shown in **Figure 2**. At full buildout, there are twenty-three generators that will be stacked at double height on top of ground-level generators twenty-four generators on ground-level and the life safety generator will be single stacked, so **Figure 2** shows locations for all 48 generators. Source parameters are detailed in **Table 6**.

The operational sources (i.e., emergency generators) were represented by point sources with identical exit temperatures, exit velocities and exit diameters (750.85 degrees K, 59.2 meter (m)/s and 0.51 m, respectively), based on manufacturer information. The emergency generator was represented as an individual point source with a stack temperature of 809.81 degrees K, stack velocity of 8.33 m/s and exit diameter of 0.51 meters, based on manufacturer information. The stack heights for the generators were provided by Project Sponsor. Some of the Project generators will be stacked on top of one another. For single storied generators, the modeled stack height is 6.12 m. For double storied generators, the modeled stack height is 12.24 m.

Receptors: Nearby sensitive receptor populations were identified within a 1,000-m buffer of the Project site, which is larger than the Project's 1,000-foot zone of influence. As discussed above, sensitive receptors include residents to the southwest of the Project site and a soccer facility south of the Project site. A receptor grid was created to cover all potential sensitive receptors within 1,000-m of the Project site. A fine grid of receptors with 25-m spacing was modeled out to 500 m, and a coarse grid with 50-m spacing was modeled out to 1,000 m. Modeled off-site receptors are shown in Figure 4. Receptors were modeled at 1.8 meters of height, consistent with BAAQMD guidance for breathing height. As discussed previously, average annual and maximum hourly dispersion factors were estimated for each receptor location.

Concentrations: As discussed above, for all but CO modeling emissions were modeled using the unit rate emission factor method, such that the model estimates dispersion factors based on an emission rate of 1 g/s and the dispersion factors have units of [$\mu g/m^3$]/[g/s]. Estimated emissions were multiplied by the dispersion factors to obtain concentrations. CO modeling used maximum 1-hour and 8-hour emissions from emergency generator use.

Modeling Adjustment Factor: OEHHA (2015) recommends applying an adjustment factor to the annual average concentration modeled assuming continuous emissions (i.e., 24 hours per day, seven days per week), when the actual emissions are less than 24 hours per day and exposures are concurrent with the emitting activities. Operational emissions for the Project are modeled with the assumption that they can occur at any hour of the day, but construction activities are only modeled between 7 AM and 4 PM. Thus, a modeling adjustment factor (MAF) was only applied to the construction HRA.

Construction emissions only impact receptors during the 9 hours per day and five days per week during which construction activities are occurring. However, the emissions modeled during those hours were annualized assuming 24 hour per day in the modeling outputs. Thus, an MAF must be applied to the annual average concentration used in the evaluation to account for an emissions schedule that is not occurring 24 hours per day, seven days per week if the exposure takes place preferentially during construction hours.

Residents were assumed to be exposed to annual average construction emissions (averaged from actual construction hours[4]) 24 hours per day, seven days per week. This assumption is consistent with the modeled annual average air concentration (24 hours per day, seven days per week). Thus, the annual average concentration was not adjusted for the residential population.

The MAF for the recreational soccer receptors assumes receptors may be present throughout the hours of the day emissions are occurring but may be present on the weekends when emissions do not occur. Therefore, a modeling adjustment factor of 2.67 was applied to the annual average concentration ([24 hours/9 hours]) for the recreational population. The MAF is shown in **Table 7**.

[4] Construction is assumed to occur up to 9 hours per day for the Project; however, AERMOD (air dispersion model) will average the predicted concentration over hours when construction is not occurring, assuming zero emissions during that period. Therefore, the average annual concentration for construction is representative of a 24-hour concentration.

4. RISK CHARACTERIZATION METHODS

The following sections discuss in detail the various components required to conduct the HRA.

4.1 Project Sources Evaluated

As discussed in Section 1.3, excess lifetime cancer risk, chronic and acute HIs, and $PM_{2.5}$ concentrations were evaluated for off-site sensitive receptor exposures to emissions from Project construction and operation. The TACs of concern are those in BAAQMD Rule 2-5, so no health impacts from CAPs are considered in this analysis, consistent with BAAQMD CEQA Guidance.

4.2 Exposure Assessment

Potentially Exposed Populations: This assessment evaluated off-site receptors potentially exposed to Project emissions from construction and operational activities. These exposed populations include residential and recreational receptors at a nearby soccer field. Both long-term health impacts (cancer risk, chronic HI, and $PM_{2.5}$ concentration) and acute hazards were evaluated for the residential and recreational locations.

Exposure Assumptions: The exposure parameters used to estimate excess lifetime cancer risks due to construction and operational activities were obtained using risk assessment guidelines from OEHHA (2015) and draft guidelines from the BAAQMD that indicate how the BAAQMD would integrate the 2015 OEHHA Guidelines (BAAQMD 2016), unless otherwise noted, and are presented in **Table 7**. Based on the TACs considered, the only relevant exposure pathway is inhalation, so this HRA considers inhalation exposure only.

For offsite residential receptors, Ramboll Environ selected conservative exposure parameters assuming that exposure would begin during the third trimester of a residential child's life. Ramboll Environ used 95th percentile breathing rates up to age 2, and 80th percentile breathing rates above age 2, consistent with BAAQMD guidance (2016). For construction, off-site child residents were assumed to be present at one location during the entire construction period (six years). For operation, off-site residents were assumed to be present at one location for a 30-year period, beginning with exposure in the third trimester.

For offsite recreational soccer receptors, Ramboll Environ selected exposure parameters using the conservative assumption that a child would be located at the soccer facility starting at age 2, then that same child would continue to be exposed by participating in activities at the facility as they got older. For construction, the off-site recreational child was assumed to be present one day a week for one hour per day during construction hours for the six-year construction period. For operation, the child was assumed to be present one day a week for one hour per day for a full 30 years. Both the construction and operational exposures used the 95th percentile 8-hour moderate intensity breathing rate from the OEHHA guidelines.

Calculation of Intake: The dose estimated for each exposure pathway is a function of the concentration of a chemical and the intake of that chemical. The intake factor for inhalation, IF_{inh}, can be calculated as follows:

$$IF_{inh} = \frac{DBR * FAH * EF * ED * CF}{AT}$$

Where:

IF_{inh}	=	Intake Factor for Inhalation (m^3/kg-day)
DBR	=	Daily Breathing Rate (L/kg-day)
FAH	=	Fraction of Time at Home (unitless)
EF	=	Exposure Frequency (days/year)
ED	=	Exposure Duration (years)
AT	=	Averaging Time (days)
CF	=	Conversion Factor, 0.001 (m^3/L)

The chemical intake or dose is estimated by multiplying the inhalation intake factor, IF_{inh}, by the chemical concentration in air, C_i. When coupled with the chemical concentration, this calculation is mathematically equivalent to the dose algorithm given in the OEHHA Hot Spots guidance (2015).

4.3 Toxicity Assessment

The toxicity assessment characterizes the relationship between the magnitude of exposure and the nature and magnitude of adverse health effects that may result from such exposure. For purposes of calculating exposure criteria to be used in risk assessments, adverse health effects are classified into two broad categories – cancer and non-cancer endpoints. Toxicity values used to estimate the likelihood of adverse effects occurring in humans at different exposure levels are identified as part of the toxicity assessment component of a risk assessment.

Excess lifetime cancer risk and chronic HI calculations for both project construction and operation utilized the toxicity values for DPM from diesel generators and on-road construction traffic and TACs from speciated on-road gasoline TOGs. The on-road construction trips considered are worker, vendor, and haul truck trips. Acute HI calculations utilized the toxicity values for TACs from both speciated diesel TOG for diesel generators and on-road construction traffic and TOGs from on-road gasoline-powered vehicles. The speciation profiles used are presented in **Table 8**. The toxicities of each chemical are shown in **Table 9**. The TACs of concern have inhalation health effects only.

4.4 Age Sensitivity Factors

The estimated excess lifetime cancer risks for a resident child was adjusted using the age sensitivity factors (ASFs) recommended by OEHHA (2015). This approach accounts for an "anticipated special sensitivity to carcinogens" of infants and children. Cancer risk estimates are weighted by a factor of 10 for exposures that occur from the third trimester of pregnancy to two years of age and by a factor of three for exposures that occur from two years through 15 years of age. No weighting factor (i.e., an ASF of one, which is equivalent to no adjustment) is applied to ages 16 to 30 years. **Table 10** shows the ASFs used for children during the construction period.

4.5 Risk Characterization

4.5.1 Estimation of Cancer Risks

Excess lifetime cancer risks are estimated as the upper-bound incremental probability that an individual will develop cancer over a lifetime as a direct result of exposure to potential carcinogens. The estimated risk is expressed as a unitless probability. The cancer risk attributed to a chemical is calculated by multiplying the chemical intake or dose at the human exchange boundaries (e.g., lungs) by the chemical-specific cancer potency factor (CPF).

The equation used to calculate the potential excess lifetime cancer risk for the inhalation pathway is as follows:

$$Risk_{inh} = C_i \times CF \times IF_{inh} \times CPF \times ASF$$

Where:

$Risk_{inh}$	=	Cancer risk; the incremental probability of an individual developing cancer as a result of inhalation exposure to a particular potential carcinogen (unitless)
C_i	=	Annual average air concentration for chemical during construction activities$_i$ (µg/m^3)
CF	=	Conversion factor (mg/µg)
IF_{inh}	=	Intake factor for inhalation (m^3/kg-day)
CPF_i	=	Cancer potency factor for chemical$_i$ (mg chemical/kg body weight-day)$^{-1}$
ASF	=	Age sensitivity factor (unitless)

4.5.2 Estimation of Chronic and Acute Noncancer Hazard Quotients/Indices

Chronic HQ

The potential for exposure to result in adverse chronic noncancer effects is evaluated by comparing the estimated annual average air concentration (which is equivalent to the average daily air concentration) to the noncancer chronic reference exposure level (cREL) for each chemical. When calculated for a single chemical, the comparison yields a ratio termed a hazard quotient (HQ). To evaluate the potential for adverse chronic noncancer health effects from simultaneous exposure to multiple chemicals, the chronic HQs for all chemicals are summed, yielding a chronic HI.

$$HQi = Ci / cREL$$

Where:

HQi	=	Chronic hazard quotient for chemical i
HI	=	Hazard index
Ci	=	Annual average concentration of chemical i (µg/m3)
cRELi	=	Chronic noncancer reference exposure level for chemical i (µg/m^3)

Acute HI

The potential for exposure to result in adverse acute effects is evaluated by comparing the estimated one-hour maximum air concentration of chemical to the acute reference exposure level (aREL) for each chemical evaluated in this analysis. When calculated for a single chemical, the comparison yields an HQ. To evaluate the potential for adverse acute health effects from simultaneous exposure to multiple chemicals, the acute HQs for all chemicals are summed, yielding an acute HI.

$$HQi = Ci / aREL$$

Where:

HQi	=	Acute hazard quotient for chemical i
HI	=	Hazard index
Ci	=	One-hour maximum concentration of chemical i (µg/m3)
aRELi	=	Acute reference exposure level for chemical i (µg/m^3)

5. PROJECT HEALTH RISK ASSESSMENT

In this section, the Project HRA results are presented for each of the BAAQMD CEQA thresholds.

As discussed in Section 1.3, the single source significance thresholds for health risks and hazards from both Project construction and operation are:

- An excess lifetime cancer risk level of more than 10 in one million;
- A chronic noncancer HI greater than 1.0;
- A noncancer acute HI greater than 1.0; and
- An incremental increase in the annual average $PM_{2.5}$ of greater than 0.3 µg/m^3.

5.1 Operational HRA

Table 13 shows the excess lifetime cancer risk, chronic noncancer HI, acute noncancer HI and annual $PM_{2.5}$ concentration at the MEISR during backup generator operation. The incremental increase in cancer risk due to Project operation is 0.42 in one million at the MEISR. The chronic and acute noncancer HIs at the respective MEISRs, which are not in the same location, are 0.000113 and 0.84. The annual $PM_{2.5}$ concentration due to Project operation is 0.00055 µg/m^3. **Table 13** gives the coordinates of each MEISR.

As noted in Section 3.4, Local CO concentrations over both 1-hour and 8-hour averaging times are shown in **Table 11**. Pollutant concentrations at the 1-hour and annual MEISRs for Project operation are listed in **Table 12**.

5.2 Cumulative HRA

The BAAQMD CEQA Guidelines establish numerical criteria for determining when an emissions increase is considered cumulatively considerable and thus triggers the need for a quantitative cumulative impacts assessment.

In developing thresholds of significance for air pollutants, BAAQMD considered the emission levels for which a project's individual emissions would be cumulatively considerable. If a project does not exceed the identified significance thresholds, its emissions would not be cumulatively considerable, resulting in less-than-significant air quality impacts to the region's existing air quality conditions. Therefore, additional analysis to assess cumulative impacts is unnecessary, but an analysis of cumulative sources is performed here for completeness. Ramboll Environ used the BAAQMD Stationary Source Screening Tool for Santa Clara County (BAAQMD 2012b) to identify existing permitted stationary sources within 1,000 feet of the MEISR. Ramboll Environ submitted a stationary source inquiry form to the BAAQMD to request updates and received the response in **Appendix B**. **Table 12** summarizes the risks and hazards at the MEISR from existing stationary sources. Some existing stationary source addresses do not match the location shown in the tool's Google Earth interface. Any source identified as being within 1,000 feet of the MEISR in the Google Earth interface is included in this analysis. When the BAAQMD provided updated HRSA results, as for Facility #19686, the updated HRSA results are used in **Table 12**.

BAAQMD on-road traffic tools were used along with existing trip count data to estimate health-risk impacts and $PM_{2.5}$ concentrations from on-road traffic. Traffic count data for Lafayette Street, the largest roadway in the vicinity of the Project, were taken from the Kimley Horn traffic study for the intersection of Lafayette Street and Walsh Avenue. The

BAAQMD Roadway Screening Analysis Calculator (BAAQMD 2015) provides screening risk estimates for traffic for north-south roadways and east-west roadways in Santa Clara County. The peak hour traffic volume of 1,515 vehicles was conservatively used as the average daily traffic value input into the BAAQMD tool. Lafayette Street was treated as a north-south roadway with the MEISR to the west at a distance of 10 feet. As shown in **Table 14** the cancer risk from on-road traffic is 1.60 in one million and the $PM_{2.5}$ concentration is 0.033 $\mu g/m^3$. Caltrain was not considered in this cumulative assessment as the trains will be electric by Project operation in 2020,[5] so there will be no exhaust emissions impacts.

For TACs, the project would have a cumulatively considerable impact if project emissions would result in:

- Non-compliance with a qualified risk reduction plan; or
- An excess lifetime cancer risk level of more than 100 in one million;
- A chronic noncancer HI greater than 10; and
- An incremental increase in the annual average $PM_{2.5}$ of greater than 0.8 $\mu g/m^3$.

Based on the project-level analysis included above, the project would not have a cumulatively considerable impact based on these BAAQMD criteria:

- There is no qualified risk reduction plan in effect for the City of Santa Clara.
- The Project would not exceed the BAAQMD cumulatively considerable thresholds relative to the region's existing air quality conditions per the BAAQMD criteria.

Because the project would not meet the BAAQMD CEQA Guidelines criteria for a contribution to any potential adverse cumulative air health risk impacts from either construction or operation, it would not contribute to any potential adverse cumulative air impact on sensitive receptors.

As shown in **Table 12**, existing stationary sources contribute levels of $PM_{2.5}$ above the BAAQMD CEQA threshold of significance for $PM_{2.5}$ concentrations, although the Project contribution is less than significant.

[5] www.caltrain.com/projectsplans/CaltrainModernization/Modernization/PeninsulaCorridorElectrificationProject.html

6. REFERENCES

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TABLES

Table 1a
Emergency Generator Emission Factors
McLaren Project
Santa Clara, California

Generator Information

Make	Caterpillar
Model	C175-16
USEPA Tier	2
USEPA Engine Family	HCPXL106.NZS
Generator Output at 100% Load (kilowatt)	3,000
Engine Output at 100% Load (horsepower)	4,423

Control Efficiency (DPF) Information

Make	Johnson Matthey
Model	CRT® Particulate Filter System

Pollutant	Uncontrolled Emission Factors[1] (g/hp-hr)	Control Efficiency at 100% Load	Controlled Emission Factors[2] (g/hp-hr)
NOx	4.2	0%	4.2
ROG	0.18	70%	0.05
CO	1.3	80%	0.25
PM	0.067	85%	0.010
$PM_{2.5}$	0.067	85%	0.010
CO_2[3]	522	0%	522
CH_4[4]	0.021	0%	0.021
N_2O[4]	0.0042	0%	0.0042
CO_2e[5]	523	0%	523

Notes:

1. Uncontrolled Emission Factors are from USEPA Engine Family Certification.
2. Controlled Emission Factors are the USEPA Engine Family Certification emission factors with reductions assuming a Johnson Matthey CRT® Particulate Filter System on each engine.
3. Emissions factor from AP-42, Vol. I, Section 3.3, Table 3.3-1 for Uncontrolled Gasoline and Diesel Industrial Engines.
4. Emissions factors from 40 CFR 98, Subpart C, Table C-2. Petroleum emissions listed as 3 g CH_4/mmBtu and 0.6 g N_2O/mmBtu. Assumed conversion factor of 7000 Btu/hp-hr per AP-42 Vol I, Table 3.3-1.
5. Global warming potential values of 1 for CO_2, 21 for CH_4, and 310 for N_2O from 40 CFR Part 98 Table A-1 (2011 version) as referenced in the CA MRR, were used to convert emissions to metric tones of carbon dioxide equivalents in accordance with 40 CFR Part 98.2.

Table 1a
Emergency Generator Emission Factors
McLaren Project
Santa Clara, California

Abbreviations:

CH_4 - methane
CO - carbon monoside
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
g - gram
hp - horsepower
hr - hour
N_2O - nitrous oxide
NMHC - Non-methane hydrocarbon
NOx - oxides of nitrogen
PM - Particulate Matter
USEPA - United States Environmental Protection Agency

References:

Peterson Power Systems. 2015. Manufacturer's Performance Data for Model C175-16.
Johnson Matthey Proposal No. GR-394 to Peterson
USEPA. 2015. Large Engine Certification Data for Model Year 2015. Available at: https://www3.epa.gov/otaq/documents/eng-cert/nrci-cert-ghg-2015.xls.

Table 1b
Life Safety Generator Emission Factors
McLaren Project
Santa Clara, California

Generator Information

Make	Perkins
Model	SD/MD500
USEPA Tier	2
USEPA Engine Family	HCPXL15.2NZS
Generator Output at 100% Load (kilowatt)	500
Engine Output at 100% Load (horsepower)	762

Control Efficiency (DPF) Information

Make	Johnson Matthey
Model	CRT® Particulate Filter System

Pollutant	Uncontrolled Emission Factors[1] (g/hp-hr)	Control Efficiency at 100% Load	Controlled Emission Factors[2] (g/hp-hr)
NOx	4.0	0%	4.0
ROG	0.072	70%	0.022
CO	1.2	80%	0.24
PM	0.067	85%	0.010
$PM_{2.5}$	0.067	85%	0.010
CO_2[3]	522	0%	522
CH_4[4]	0.021	0%	0.021
N_2O[4]	0.0042	0%	0.0042
CO_2e[5]	523	0%	523

Notes:

1. Uncontrolled Emission Factors are from USEPA Engine Family Certification.
2. Controlled Emission Factors are the USEPA Engine Family Certification emission factors with reductions assuming a Johnson Matthey CRT® Particulate Filter System on each engine.
3. Emissions factor from AP-42, Vol. I, Section 3.3, Table 3.3-1 for Uncontrolled Gasoline and Diesel Industrial Engines.
4. Emissions factors from 40 CFR 98, Subpart C, Table C-2. Petroleum emissions listed as 3 g CH_4/mmBtu and 0.6 g N_2O/mmBtu. Assumed conversion factor of 7000 Btu/hp-hr per AP-42 Vol I, Table 3.3-1.
5. Global warming potential values of 1 for CO_2, 21 for CH_4, and 310 for N_2O from 40 CFR Part 98 Table A-1 (2011 version) as referenced in the CA MRR, were used to convert emissions to metric tones of carbon dioxide equivalents in accordance with 40 CFR Part 98.2.

Table 1b
Life Safety Generator Emission Factors
McLaren Project
Santa Clara, California

Abbreviations:

CH_4 - methane
CO - carbon monoside
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
g - gram
hp - horsepower
hr - hour
N_2O - nitrous oxide
NMHC - Non-methane hydrocarbon
NOx - oxides of nitrogen
PM - Particulate Matter
USEPA - United States Environmental Protection Agency

References:

Peterson Power Systems. 2015. Manufacturer's Performance Data for Model C175-16.

Johnson Matthey Proposal No. GR-394 to Peterson

USEPA. 2015. Large Engine Certification Data for Model Year 2015. Available at: https://www3.epa.gov/otaq/documents/eng-cert/nrci-cert-ghg-2015.xls.

Table 2
Engine Emissions, Daily
McLaren Project
Santa Clara, California

Engine Model	Engine Horsepower	Controlled Emissions by Pollutant				
		Quantity of Engines	Operational Hours per Engine per Year	Pollutant	Average Daily Emissions (lb/day)	CEQA Threshold (lb/day)
C175-16	4,423	47	50	NOx	262	54
				ROG	3.3	54
				CO	16	-
				PM_{10} [1]	0.63	82
				$PM_{2.5}$ [1]	0.63	54
C15	762	1	50	NOx	0.92	54
				ROG	0.0050	54
				CO	0.055	-
				PM_{10} [1]	0.0023	82
				$PM_{2.5}$ [1]	0.0023	54

Notes:

1. Emission factors for PM10 and PM2.5 are conservatively assumed to be equal to the PM emission factor, and are multiplied by (100% - 85%) to account for the proposed DPF, which has a minimum PM abatement efficiency of 85%.
2. Controlled Emission Factors are the 100% Load emission factors from the USEPA Engine Family Certification with reductions assuming a Johnson Matthey CRT® Particulate Filter System on each engine.

Abbreviations:

CH_4 - methane
CO - carbon monoside
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
N_2O - nitrous oxide
NMHC - Non-methane hydrocarbon
NOx - oxides of nitrogen
PM - Particulate Matter
USEPA - United States Environmental Protection Agency

References:

Peterson Power Systems. 2015. Manufacturer's Performance Data for Model C175-16.
Johnson Matthey Proposal No. GR-394 to Peterson
USEPA. 2015. Large Engine Certification Data for Model Year 2015. Available at: https://www3.epa.gov/otaq/documents/eng-cert/nrci-cert-ghg-2015.xls.

Table 3
Engine Emissions, Annual
McLaren Project
Santa Clara, California

Engine Model	Engine Horsepower	Controlled Emissions by Pollutant[2]				
		Quantity of Engines	Operational Hours per Engine per Year	Pollutant	Average Annual Emissions (ton/year)	CEQA Threshold (ton/year)
C175-16	4,423	47	50	NOx	48	10
				ROG	0.60	10
				CO	2.9	-
				PM_{10}[1]	0.12	15
				$PM_{2.5}$[1]	0.12	10
C15	762	1	50	NOx	0.17	10
				ROG	9.0E-04	10
				CO	0.010	-
				PM_{10}[1]	4.2E-04	15
				$PM_{2.5}$[1]	4.2E-04	10

Notes:

1. Emission factors for PM10 and PM2.5 are conservatively assumed to be equal to the PM emission factor, and are multiplied by (100% - 85%) to account for the proposed DPF, which has a minimum PM abatement efficiency of 85%.
2. Controlled Emission Factors are the 100% Load emission factors from the USEPA Engine Family Certification with reductions assuming a Johnson Matthey CRT® Particulate Filter System on each engine.

Abbreviations:

CH_4 - methane
CO - carbon monoxide
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
N_2O - nitrous oxide
NMHC - Non-methane hydrocarbon
NOx - oxides of nitrogen
PM - Particulate Matter
USEPA - United States Environmental Protection Agency

References:

Peterson Power Systems. 2015. Manufacturer's Performance Data for Model C175-16.
Johnson Matthey Proposal No. GR-394 to Peterson
USEPA. 2015. Large Engine Certification Data for Model Year 2015. Available at: https://www3.epa.gov/otaq/documents/eng-cert/nrci-cert-ghg-2015.xls.

RAMBOLL ENVIRON

Table 4
Operational Mass Emissions of Criteria Air Pollutants
McLaren Project
Santa Clara, California

Emissions Source	CAP Emissions [ton/year]				CAP Emissions [lb/day]			
	ROG	NO_x	PM_{10} Total	$PM_{2.5}$ Total	ROG	NO_x	PM_{10} Total	$PM_{2.5}$ Total
Emergency Generators	0.60	48	0.12	0.12	3.3	263	0.63	0.63
BAAQMD Stationary Source Offsets	-	-48	-	-	-	-263	-	-
Total Project Emissions	**0.60**	**0**	**0.12**	**0.12**	**3.3**	**0**	**0.63**	**0.63**
BAAQMD Significance Threshold	10	10	15	10	54	54	82	54

Abbreviations:

BAAQMD - Bay Area Air Quality Management District

CAP - Criteria Air Pollutant

lb - pounds

NOx - nitrogen oxides

ROG - reactive organic gases

PM_{10} - particulate matter less than 10 microns

$PM_{2.5}$ - particulate matter less than 2.5 microns

Table 5
Operational Mass Emissions of Greenhouse Gases
McLaren Project
Santa Clara, California

Emissions Source	GHG Emissions	Units
Emergency Generators	5,460	MT CO_2e/yr
BAAQMD Stationary Source Threshold	**10,000**	

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
MT - metric ton
SP - service population
yr - year

Table 6
Modeling Parameters
McLaren Project
Santa Clara, California

Emergency Generator Model

Source	Source Type	Number of Sources	Release Height (m)	Exit Temperature (K)	Exit Velocity (m/s)	Exit Diameter (m)
Back-Up Generators[1]	Point	47	6.121 for single stacked, 12.24 for double stacked	750.9	59.22	0.51

Life Safety Generator Model

Source	Source Type	Number of Sources	Release Height (m)	Exit Temperature (K)	Exit Velocity (m/s)	Exit Diameter (m)
Life-Safety Generator[2]	Point	1	6.121	809.81	8.332	0.51

1. Forty-seven identical generators will be installed at the Project site. Actual stack locations are unknown so they were assumed to be one third from the outside edge of the generator. Single generator stacks were assumed to be 6 meters and stacked/overlaid generators were assumed at two heights - 12 meters for the bottom generators based on the information provided by the project sponsor.

2. The life safety generator is assumed to be single stacked with a height of 6 meters

Abbreviations:

ARB - California Air Resources board
CRRP - Community Risk Reduction Plan
K - Kelvin
m - meter
LST - Localized Significance Threshold
s - second
SCAQMD - South Coast Air Quality Management District
SF - San Francisco

Table 6
Modeling Parameters
McLaren Project
Santa Clara, California

References:

Bay Area Air Quality Management District, San Francisco Department of Public health, San Francisco Planning Department (SF CRRP). 2012. The San Francisco Community Risk Reduction Plan: Technical Support Documentation. December.

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Table 7
Exposure Parameters, 2015 OEHHA Methodology
McLaren Project
Santa Clara, California

Period	Receptor Type	Receptor Age Group	Exposure Parameters						
			Daily Breathing Rate (DBR)[1] (Resident: L/kg-day, Soccer Child L/kg-hr)	Exposure Duration (ED)[2] (years)	Fraction of Time at Home (FAH)[3] (unitless)	Exposure Frequency (EF)[4] (days/year)	Averaging Time (AT) (days)	Modeling Adjustment Factor (MAF) (unitless)	Intake Factor, Inhalation (IF_{inh}) (m^3/kg-day)
Operation	Offsite Resident	3rd Trimester	361	0.25	1	350	25,550	1	0.0012
		Age 0-<2 Years	1,090	2	1	350	25,550	1	0.030
		Age 2-<16 Years	572	14	1	350	25,550	1	0.11
		Age 16-30 Years	261	14	1	350	25,550	1	0.050
	Soccer Child	Age 2-<16 Years	65	14	N/A	52	25,550	1	0.0019
		Age 16-30 Years[5]	30	16	N/A	52	25,550	1	9.8E-04

Notes:

1. Daily breathing rates reflect default breathing rates from OEHHA 2015 as follows: Resident: 95th percentile for 3rd trimester and age 0-<2 years; 80th percentile for ages 2-<9 years, 2-<16 years, and 16-30 years. Soccer Child: 95th percentile moderate intensity for all ages.
2. The total exposure duration for operation reflects the default residential exposure duration from Cal/EPA 2015.
3. Fraction of time at home (FAH) was conservatively assumed to be 1 for all age groups for residential exposure. FAH is not applicable to recreational soccer receptors.
4. Exposure frequency reflects default exposure frequency for residents from Cal/EPA 2015. For Soccer Child receptors, it was assumed that children would attend the soccer facility once a week for 52 weeks.
5. Exposure for children using the soccer facility was assumed to start at age 2 since children younger than 2 cannot participate in the activities at this facility. For operational exposures, 30-year exposure was evaluated starting at age 2 and the 16-30 year breathing rate was assumed for ages 16-32.

Calculation:

Resident:

IF_{inh} = DBR * ED * FAH * EF * CF / AT

CF = 0.001 (m^3/L)

Table 7
Exposure Parameters, 2015 OEHHA Methodology
McLaren Project
Santa Clara, California

Abbreviations:

Cal/EPA - California Environmental Protection Agency

L - liter

kg - kilogram

m^3 - cubic meter

Reference:

Cal/EPA. 2015. Air Toxics Hot Spots Program. Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. Office of Environmental Health Hazard Assessment (OEHHA). February.

Available online at: http://oehha.ca.gov/air/hot_spots/hotspots2015.html.

Table 8
Speciation Values
McLaren Project
Santa Clara, California

Source	Emission Type	Fraction	Chemical[1]
Diesel Offroad Equipment (Generators)	Exhaust PM	1.0	Diesel PM
	Exhaust TOG	0.0019	1,3-Butadiene
		0.074	Acetaldehyde
		0.020	Benzene
		0.0031	Ethylbenzene
		0.15	Formaldehyde
		0.0016	n-Hexane
		3.0E-04	Methanol
		0.015	Methyl Ethyl Ketone
		9.0E-04	Naphthalene
		0.026	Propylene
		6.0E-04	Styrene
		0.015	Toluene
		0.0061	m-Xylene
		0.0034	o-Xylene
		0.0010	p-Xylene

Notes:

1. Compounds presented in this table are only those air toxic contaminants with toxicity values from Cal/EPA (2015) evaluated in the health risk assessment. Speciation profiles presented in this table are from the following sources:

   Diesel offroad exhaust, TOG: ARB 818 / EPA 3161

Abbreviations:

ARB - Air Resources Board
BAAQMD - Bay Area Air Quality Management District
Cal/EPA - California Environmental Protection Agency
PM - particulate matter
TOG - total organic gas
USEPA - United States Environmental Protection Agency

References:

ARB. Speciation Profiles Used in ARB Modeling. Available online at: http://www.arb.ca.gov/ei/speciate/speciate.htm#specprof

BAAQMD. 2011. Recommended Methods for Screening and Modeling Local Risks and Hazards. May.

Cal/EPA. 2015. OEHHA/ARB Consolidated Table of Approved Risk Assessment Health Values. May 13.

USEPA. SPECIATE 4.3. Available online at: http://cfpub.epa.gov/si/speciate/

Table 9
Toxicity Values
McLaren Project
Santa Clara, California

Chemical[1]	Cancer Potency Factor $(mg/kg\text{-}day)^{-1}$	Chronic REL ($\mu g/m^3$)	Acute REL ($\mu g/m^3$)
Diesel PM	1.1	5.0	-
Acetaldehyde	0.010	140	470
Benzene	0.10	3.0	27
1,3-Butadiene	0.60	2.0	660
Chlorine	-	0.20	210
Copper	-	-	100
Ethylbenzene	0.0087	2,000	-
Formaldehyde	0.021	9.0	55
n-Hexane	-	7,000	-
Manganese	-	0.090	-
Methanol	-	4,000	28,000
Methyl Ethyl Ketone	-	-	13,000
Naphthalene	0.12	9.0	-
Propylene	-	3,000	-
Styrene	-	900	21,000
Toluene	-	300	37,000
Xylenes	-	700	22,000

Notes:

1. Chemicals presented in this table reflect air toxic contaminants in the proposed fuel types that are expected from off-road equipment, on-road truck trips, automobile traffic, and propane generators.

Abbreviations:

- - not available or not applicable
$\mu g/m^3$ - micrograms per cubic meter
ARB - Air Resources Board
Cal/EPA - California Environmental Protection Agency
$(mg/kg\text{-}day)^{-1}$ - per milligram per kilogram-day
OEHHA - Office of Environmental Health Hazard Assessment
PM - particulate matter
REL - reference exposure level

Reference:

Cal/EPA. 2015. OEHHA/ARB Consolidated Table of Approved Risk Assessment Health Values. May 13.

Table 10
Age Sensitivity Factors
McLaren Project
Santa Clara, California

Receptor Age Group	Age Sensitivity Factor[1] (ASF)
3rd Trimester	10
Age 0-<2 Years	10
Age 2-<16 Years	3
Age 16-30 Years	1

Notes:

1. Based on Cal/EPA 2015.

Abbreviation:

Cal/EPA: California Environmental Protection Agency

References:

Cal/EPA. 2015. Air Toxics Hot Spots Program. Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. Office of Environmental Health Hazard Assessment (OEHHA). February.

Available online at: http://oehha.ca.gov/air/hot_spots/hotspots2015.html.

Table 11
Carbon Monoxide Analysis
McLaren Project
Santa Clara, California

Averaging Period	Generator Type	Maximum Dispersion Factor[1]	CO Emission Rate	Concentration
		µg/m³ / g/s	lb/hr / gen	ppm
1-hr	Emergency Generators	2,421	2.5	0.67
	Life Safety Generator	188	0.40	
8-hr	Emergency Generators	1,402	2.5	0.39
	Life Safety Generator	82	0.40	

Notes:

[1.] This concentration reflects the highest modeled concentration for the respective averageing periods.

Abbreviations:

CO - carbon monoxide
gen - generator
$\mu g/m^3$ - microgram per meter cubed
g/s - gram per second
lb - pound
hr - hour
ppm - parts per million

Table 12
Concentrations at the Operational MEISRs
McLaren Project
Santa Clara, California

Pollutant	Generators[4]
Annual Concentration (µg/m³)[1,2]	
Diesel PM	5.5E-04
$PM_{2.5}$[2]	5.5E-04
1-hr Concentration (µg/m³)[2]	
1,3-butadiene	0.45
acetaldehyde	17
Acrolein	--
benzene	4.7
ethylbenzene	0.73
formaldehyde	34
n-hexane	0.37
methanol	0.070
methyl ethyl ketone (mek) (2-butanone)	3.5
naphthalene	0.21
o-xylene	0.80
propene	6.1
styrene	0.14
toluene	3.4
Xylenes[5]	2.5

Notes:

1. Maximum annual emissions were reported for the scenario receptors with the highest cancer risk, chronic HI, and $PM_{2.5}$ concentration (Annual MEISRs).
2. Note that the presented PM2.5 concentration includes estimated fugitive dust emissions.
3. Maximum one hour emissions were reported for the scenario receptors with the highest Acute HI (Acute MEISRs).
4. The table below lists the 2 MEISR locations:

Generators	UTMx	UTMy
Annual	593075	4135550
1-hr	593125	4135700

5. Xylene 1-hr concentrations include o-xylene concentrations shown above.

Table 12
Concentrations at the Operational MEISRs
McLaren Project
Santa Clara, California

Abbreviations:

HI - health index
MEISR - Maximally Exposed Individual Sensitive Receptor
$PM_{2.5}$ - fine particulate matter less than 2.5 microns
UTM - Universal Transverse Mercator coordinate system
$\mu g/m^3$ - micrograms per cubic meter
hr - hour
m - meter

Table 13
Project-Related Operational Health Risk Impacts to the MEISR
McLaren Project
Santa Clara, California

Emission Source	Cancer Risk Impact (in one million)	Chronic Non-Cancer Hazard Index	Acute Non-Cancer Hazard Index	Annual $PM_{2.5}$ Concentration ($\mu g/m^3$)
Emergency Generators	0.42	1.1E-04	0.84	5.5E-04
Project Operational Total	0.42	1.1E-04	0.84	5.5E-04
BAAQMD Significance Threshold	10	1	1	0.3

Notes:

1. The cancer risk, chronic HI, and annual PM2.5 MEISR is located at UTM coordinates: UTMx = 593075, UTMy = 4135550
2. The acute HI MEISR is located at UTM coordinates: UTMx = 593125, UTMy = 4135700

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
HI - health index
MEISR - Maximally Exposed Individual Sensitive Receptor
$PM_{2.5}$ - fine particulate matter less than 2.5 microns
UTM - Universal Transverse Mercator coordinate system
$\mu g/m^3$ - micrograms per cubic meter

Table 14
Summary of Cumulative Health Risk Impacts to the MEISR
McLaren Project
Santa Clara, California

Emission Source	Cancer Risk Impact (in one million)	Chronic Non-Cancer Hazard Index	Acute Non-Cancer Hazard Index	Annual $PM_{2.5}$ Concentration (ug/m^3)
Project Operational Generators	0.42	1.1E-04	0.84	5.5E-04
Subtotal, Project Impacts	0.42	1.1E-04	0.84	5.5E-04
Existing Stationary Sources				
M's Refinishing (Facility #5269)	1.63	0.06	N/A	0
Bay Area Surgical Group (Facility #16964)	2.72	0.001	N/A	0.001
Microsoft Corporation (Facility #19686)	11	0.008	N/A	0.033
FMG Enterprises Inc (Facility #4400)	0.03	0	N/A	0
Memorex Dirve LLC (Facility #10299)	2.43	0.006	N/A	0
Mission Trail Waste Systems (Facility #8313)	0.43	0.003	N/A	29.5
Process Stainless Lab, Inc (Facility #17041)	0	0	N/A	0
Vivid Inc (Facility #11467)	0	0	N/A	0.037
Byington Steel Treating, Inc (Facility #4712)	0	0	N/A	0
West Coast Vanities (Facility #15355)	0	0	N/A	0
AMCO Auto Body & Painting (Facility #16494)	0	0	N/A	0
HGM (Facility #14667)	0	0	N/A	0
Choice Auto Body (Facility #17000)	0	0	N/A	0
Lafayette Street	1.60	NA	NA	0.033
Subtotal, Background Sources	19.4	0.08	0.00	29.6
Total Cumulative Impact	**20**	**0.078**	**0.84**	**30**
BAAQMD Significance Threshold	100	10	10	0.8

Table 14
Summary of Cumulative Health Risk Impacts to the MEISR
McLaren Project
Santa Clara, California

Notes:

1. The existing residential locations experiencing maximum project impacts are presented in the previous two tables.

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
HI - health index
MEISR - Maximally Exposed Individual Sensitive Receptor
$PM_{2.5}$ - fine particulate matter
ug/m^3 - micrograms per cubic meter
UTM - Universal Transverse Mercator coordinate system

FIGURES

RAMBOLL ENVIRON

DRAFTED BY: DATE:

Project Boundary
McLaren Project
Vantage Data Centers
Santa Clara, California

FIGURE
1

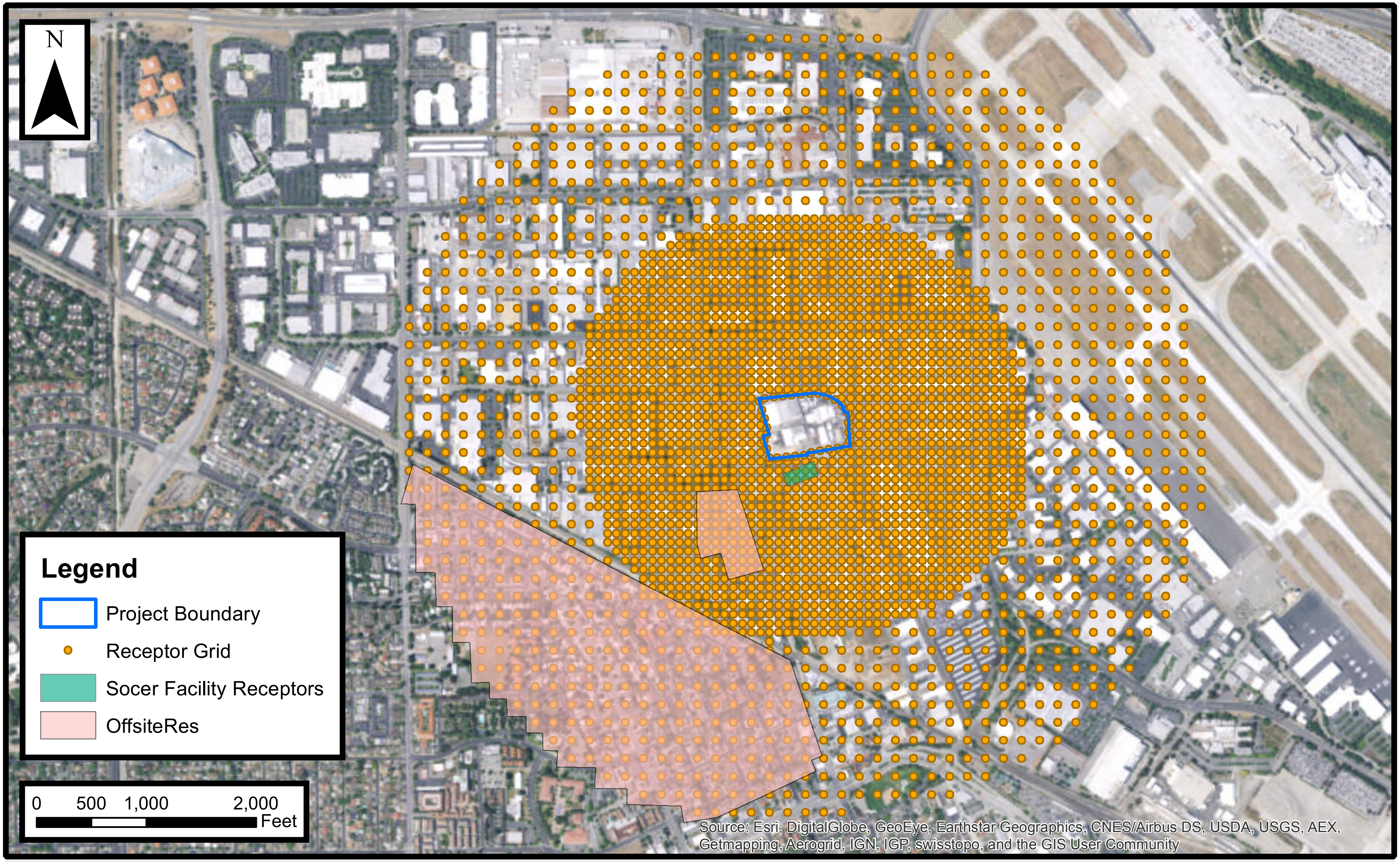
PROJECT

RAMBOLL ENVIRON

DRAFTED BY: DATE:

Generator Locations
McLaren Project
Vantage Data Centers
Santa Clara, California

FIGURE
2
PROJECT



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DRAFTED BY: | DATE:

Receptor Grid
McLaren Project
Vantage Data Centers
Santa Clara, California

FIGURE
3
PROJECT

Intended for
California Energy Commission

Date
November 2017

MCLAREN DATA CENTER: AIR DISPERSION MODELING REPORT FOR ONE-HOUR NO2 CAAQS AND NAAQS

RAMBOLL ENVIRON

CONTENTS

1.	**INTRODUCTION**	**1**
2.	**AIR QUALITY ANALYSIS APPROACH**	**2**
2.1	NAAQS and CAAQS Analysis	2
2.1.1	Background Concentrations	3
3.	**MODELING METHODOLOGY, SETTINGS, AND INPUTS**	**4**
3.1	Model Selection and Settings	4
3.1.1	NO_2 Modeling Approach	4
3.2	Modeled Sources and Release Parameters	4
3.2.1	Proposed Facility Sources	4
3.3	Building Downwash	5
3.4	Good Engineering Practice Stack Height Analysis	5
3.5	Terrain Data and Land Use	5
3.6	Meteorological Data	6
3.7	Receptor Grid	6
4.	**SUMMARY OF MODELING RESULTS**	**7**
4.1	NAAQS and CAAQS Analyses	7

TABLES

Table 1. Applicable NAAQS, and CAAQS	2
Table 2. Modeling Output for NAAQS Compliance Demonstration	3
Table 3. NO_2 NAAQS and CAAQS Results	7

ATTACHMENT

Attachment A
Figures

Attachment B
Tables

Attachment C
Manufactuer Performance Data Sheets

Attachment D
CD-ROM of Electronic Modeling Files

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1. INTRODUCTION

Vantage Data Centers (the applicant) has proposed to develop a data center in Santa Clara, California. The data center will install up to forty eight (48) backup emergency diesel generators over the course of 10 years.

The applicant is submitting this air dispersion modeling report to the California Energy Commission (CEC) in support of its application for a Small Power Plant Exemption (SPPE). The SPPE application provides a detailed facility description, the quantification of emissions from facility sources, a review of applicability of federal and state air regulations, and the manufacturer's specification sheets for the proposed emergency generators. There are no stationary combustion sources at the facility other than the emergency standby generators.

A list of generator models at the facility and the generator ID numbers for the proposed generators at the applicant's facility are included in **Attachment B, Table B-1**.

2. AIR QUALITY ANALYSIS APPROACH

An air dispersion modeling analysis was completed to reflect the normal operating conditions of the facility and analyze potential air quality impacts in relation to the 1-hour nitrogen dioxide (NO_2) National Ambient Air Quality Standard (NAAQS) and the California Ambient Air Quality Standard (CAAQS). The analyses were conducted consistent with the following federal and state guidance documents:

- U.S. EPA's Guideline on Air Quality Models 40 CFR 51, Appendix W (Revised, January 17, 2017), herein referred to as Appendix W;
- U.S. EPA's AERMOD Implementation Guide (Revised, August 3, 2015);
- California Air Pollution Control Officers Association (CAPCOA) Guidance Document "Modeling Compliance of the Federal 1-Hour NO2 NAAQS" (Dated October 27, 2011)

The applicable values for the NO_2 NAAQS and CAAQS for the 1-hour averaging period are provided in **Table 1**.

Table 1. Applicable NAAQS and CAAQS

Pollutant	Averaging Period	NAAQS ($\mu g/m^3$)	CAAQS ($\mu g/m^3$)
NO_2	1-Hour	188 (a)	339 (b)

Notes:

(a) Standard of 100 ppb converted to $\mu g/m^3$. 98th percentile of 1-hour daily maximum concentrations, averaged over three years.

(c) Standard of 180 ppm converted to $\mu g/m^3$. Maximum 1-hour.

2.1 NAAQS and CAAQS Analysis

The NAAQS and CAAQS modeling evaluation incorporates all proposed sources at the project site (all 48 backup generators). An hour-by-hour representative background concentration from historical NO_2 monitoring data near the site is then added to the modeled concentrations on an hour-by-hour basis for comparison against the applicable NAAQS and CAAQS to represent the contribution of sources not explicitly modeled. The model outputs that were used for assessing compliance with the NAAQS and CAAQS are summarized in **Table 2**.

Table 2. Modeling Output for NAAQS & CAAQS Compliance Demonstration

Pollutant and Averaging Period	Model Output
1-Hour NAAQS NO_2	Daily maximum 1-hour average of the 8^{th} high across 5 years, on a receptor-by-receptor basis
1-Hour CAAQS NO_2	Single maximum 1-hour concentration across 5 years on a receptor-by-receptor basis

2.1.1 Background Concentrations

NO_2 background data for the 1-hour NO_2 NAAQS and CAAQS analyses were obtained from the AQS Monitoring Station in San Jose (Jackson, 06-085-0005), the nearest station to the facility. These values ranged from 0.0 to 69.0 ppb. Missing values for one or two consecutive hours were replaced by the larger value of the preceding or following hour for both NAAQS and CAAQS analyses. For periods where 3 or more consecutive hours were missing, 40.6 ppb, the 98^{th} percentile value for the 5 year period, was used to replace the missing values in the NAAQS model. In the CAAQS model, periods where 3 or more consecutive hours were missing were replaced with the single maximum 1-hour concentration for the 5 year period, 69.0 ppb.

3. MODELING METHODOLOGY, SETTINGS, AND INPUTS

This section outlines the technical approach used in the NO_2 modeling evaluations. Figures and tables supporting this modeling evaluation and outlining the model inputs are provided in **Attachment A** and **Attachment B**, respectively. A CD-ROM with the electronic modeling files is included in **Attachment C**.

3.1 Model Selection and Settings

To estimate off-property ambient concentrations of NO_2, the applicant used the latest version (16216r) of the AERMOD modeling system. AERMOD is U.S. EPA's recommended air dispersion model for near-field (within 50 kilometers [km]) modeling analyses. AERMOD is appropriate for use in estimating ground-level, short-term ambient air concentrations resulting from non-reactive buoyant emissions from sources located in simple and complex terrain. This analysis was conducted using AERMOD's regulatory default settings, except for the NO_2/NO_X in stack ratio (discussed in Section 3.1.1).

Ambient concentrations were estimated using AERMOD in conjunction with information about the site, the locations of the NO_X-emitting stacks, representative meteorological data, and nearby receptors. The North American Datum of 1983 (NAD83) of the Universal Transverse Mercator (UTM) Coordinate System (Zone 10) was used, which provides a constant distance relationship anywhere on the map or domain. The units of the coordinates are in meters.

3.1.1 NO_2 Modeling Approach

The applicant used the Tier 3 Plume Volume Molar Ratio Method (PVMRM) for the NO_2 Significance Analyses and to demonstrate compliance with the NO_2 NAAQS and PSD Increment standards. As part of the recent Appendix W updates, U.S. EPA incorporated the PVMRM as a regulatory default method for NO_2 modeling.

The applicant used a NO_2/NO_X in stack ratio of 0.10 for the facility's proposed backup emergency generators. This value was selected based on data from onsite generators of the same make and model as the proposed generators, and from U.S. EPA's In-Stack Ratio Database for diesel/kerosene-fired reciprocating internal combustion engines (RICE).[1] The U.S. EPA database has data for 57 diesel-fired RICE that indicate a median, mean, and even a second-high value, that are less than a 0.10 NO_2/NO_X ratio. Further, stack testing results from two of the facility's existing emergency generators showed a NO_2/NO_X ratio of less than 0.10.

Hourly ozone data from the San Jose AQS Monitoring Station were used (Jackson, 06-085-0005) with missing data substituted with the 98th percentile value of 50 ppb.

3.2 Modeled Sources and Release Parameters

The NAAQS and CAAQS analyses included cumulative assessments of the NO_2 impacts from the applicant's facility sources and the impacts from nearby NO_2-emitting sources (background). The following sections describe the release parameters that were used in the model.

3.2.1 Proposed Facility Sources

This assessment included an assessment of 1-hour NO_2 impacts from the facility's proposed sources (**Attachment A, Figure 1**). The emissions from the generators at the site exhaust through vertical stacks with barometric rain covers. The generator stacks have flapper-style rain caps that open with the exhaust flow such that they do not obstruct the exhaust from the release point. The site's

[1] https://www3.epa.gov/scram001/no2_isr_database.htm

emission sources were modeled as point sources using manufacturer-provided stack parameters (**Attachment B, Table B-2**).

For the 1-hour NO_2 NAAQS and CAAQS analyses, a typical operating scenario was modeled that includes one 4-hour load banking test that is conducted for one generator at a time, once annually, for maintenance and readiness testing.[2] During this 4-hour test, the generator is ramped up in load. The first hour of testing is at 50% load, the second hour is at 75% load, and the last two hours are at 100% load. Generators are also testing monthly for 5 minutes at 0% load, but this scenario was not modeled since the annual 4-hour test is the more conservative scenario. For comparison with the NAAQS and CAAQS, the most conservative hourly emission rate was used in both models, assuming one hour of testing at 100% load.

Though not utilized in this analysis, an example of another representative emission rate would be an average hourly emission rate from the 4-hour test. The average hourly emission rate would calculated by taking the average emission rate over the 4-hour test using load-specific emission rates from the manufacturer's specification sheet in **Attachment C**.

A detailed derivation of the modeled hourly NO_X emission rates used in the models is provided in **Attachment B, Table B-3**.

3.3 Building Downwash

The AERMOD model incorporates Plume Rise Modeling Enhancements (PRIME) to account for downwash. The direction-specific building downwash dimensions used as inputs were determined by the latest version (04274) of the Building Profile Input Program, PRIME (BPIP PRIME). BPIP PRIME uses building downwash algorithms incorporated into AERMOD to account for the plume dispersion effects of the aerodynamic wakes and eddies produced by buildings and structures.

The applicant evaluated onsite buildings at the facility for downwash effects on each modeled point source, as well as nearby offsite buildings. Each generator is located inside its own weather-proof enclosure, with the generator stack extending from the top of the enclosure. Each generator enclosure was included as a building in the model. Three onsite buildings were included and 16 offsite buildings were included. The modeled parameters for the buildings and the weather-proof enclosures for the generators are provided in **Attachment B, Table B-4**.

3.4 Good Engineering Practice Stack Height Analysis

U.S. EPA has promulgated regulations that limit the maximum stack height one may use in a modeling analysis to no more than the Good Engineering Practice (GEP) stack height. The purpose of this requirement is to prevent the use of excessively tall stacks to reduce the modeled concentrations of a pollutant. GEP stack height is impacted by the heights of nearby structures. In general, the minimum value for GEP stack height is 65 meters. The stack heights for the facility's generator stacks do not exceed the GEP stack height.

3.5 Terrain Data and Land Use

Per U.S. EPA guidance, terrain elevations were incorporated into the model using the most recent version (11103) of AERMAP, AERMOD's terrain preprocessor. Terrain elevation data for the entire modeling domain was extracted from 1/3 arc-second National Elevation Data (NED) files with a resolution of approximately 10 meters. The NED files were obtained from the United States Geological Survey (USGS) Multi-Resolution Land Characteristics Consortium (MRLC).[3] AERMAP was

---

[2] Emergency operation is not included.

[3] http://www.mrlc.gov

configured to assign elevations for the sources, buildings, property line receptors, and discrete gridded receptors in the modeling domain.

Land use classification determines the type of area to be modeled. The different classifications, urban or rural, incorporate distinct pollutant dispersion characteristics and affect the estimation of downwind concentrations when used in the model. Based on the land use around the facility, the urban boundary layer option in the model was selected. The population for the urban mode was based on the population of the city of Santa Clara (126,251).

3.6 Meteorological Data

AERMOD requires a meteorological input file to characterize the transport and dispersion of pollutants in the atmosphere. Surface and upper air meteorological data inputs, as well as surface parameter data describing the land use and surface characteristics near the site, are processed using AERMET, the meteorological preprocessor to AERMOD. The output file generated by AERMET is the meteorological input file required by AERMOD.

A representative meteorological data set was developed using a combination of surface data from the National Weather Service (NWS) station at the San Jose Airport (KSJC, located approximately 2 km west of the facility) and NWS upper air data from the Oakland Airport (KOAK, located approximately 50 km northwest of the facility).

Per Appendix W, five years of representative meteorological data are considered adequate for dispersion modeling applications. Hourly and 1-minute wind speed and wind direction data from January 2009 through December 2013 were processed using the latest version of AERMINUTE (15272) and AERMET (16216). The meteorological data was processed using the ADJ_U* option that reduces overprediction of modeled concentrations that occur in stable conditions with low wind speeds due to underprediction of the surface friction velocity (u*). Underprediction of u* results in an underestimation of the mechanical mixing height and thus overprediction of ambient concentrations. The ADJ_U* option is now considered a regulatory default option with the recent update to Appendix W.

Additional meteorological variables and geophysical parameters are required for use in the AERMOD dispersion modeling analysis to estimate the surface energy fluxes and construct boundary layer profiles. Surface characteristics including albedo, Bowen ratio, and surface roughness length were determined for the area surrounding the San Jose Airport meteorological station using the AERMET surface characteristic preprocessor, AERSURFACE (13016), and the USGS 1992 National Land Cover (NLCD92) land use data set. The NLCD92 data set used in the analysis has a 30 meter resolution and 21 land use categories. Monthly surface parameters were determined using AERSURFACE according to U.S. EPA’s guidance.

Monthly albedo and Bowen ratio values were based on averaging over a 10-km by 10-km region centered on the San Jose Airport meteorological site. Monthly surface roughness values were calculated for twelve 30 degree sectors within 1 km of the San Jose Airport meteorological station.

3.7 Receptor Grid

Ground-level concentrations were calculated at receptors placed along the facility fence line and on a circular, Cartesian grid. For this analysis, receptors extending up to 1 km from the fence line, as needed, were modeled using the following resolutions (**Attachment A, Figure 2**):

- 25 meter resolution for fence line receptors;
- 25 meter resolution extending from the fence line to 500 meters;
- 50 meter resolution extending from 500 meters to 1 km.

4. SUMMARY OF MODELING RESULTS

The following sections summarize the results of the NO_2 dispersion modeling analyses and demonstrate that the proposed project will not will not cause or contribute to a violation of the NAAQS or CAAQS.

4.1 NAAQS and CAAQS Analyses

Modeling was conducted to demonstrate compliance with the 1-hour and NO_2 NAAQS and CAAQS. The results of these analyses are presented in **Table 3** and demonstrate that there are no predicted violations of the NO_2 NAAQS or CAAQS.

Table 3. NO_2 NAAQS and CAAQS Results

Standard	Year	UTM East (m)	UTM North (m)	Total Ambient Conc.[(a,b)] (µg/m³)	Threshold (µg/m³)	Above Threshold?
1-Hour NAAQS	5Y AVG	593375.00	4135725.00	170.94	188	No
1-Hour CAAQS	H1H	593325.00	4135700.00	314.72	339	No

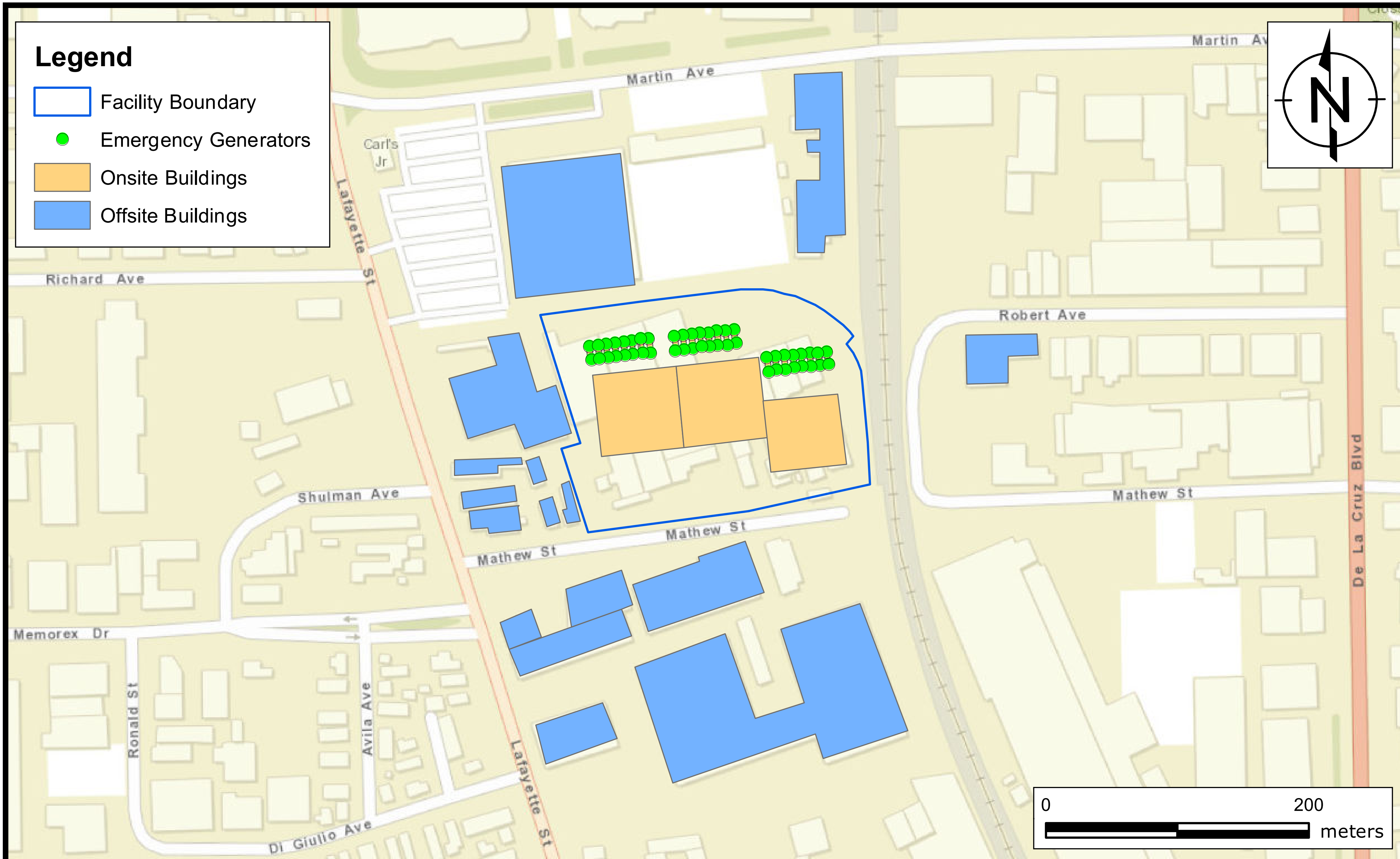
Notes:

(a) The value shown is the maximum from any of the generators being tested for 1-hour at 100% load.

(b) Total ambient concentration represents the modeled concentration plus the background concentration. An hour-by-hour background file was included in the model so the model output represents the total ambient concentration at each receptor.

The maximum ambient concentration for the 1-hour NO_2 NAAQS analysis and the contributing generator are presented in **Attachment A, Figure 3**. The maximum ambient concentration for the 1-hour NO_2 CAAQS analysis and the contributing generator are presented in **Attachment A, Figure 4**. The modeled 1-hour NO_2 concentrations shown in **Table 3** are representative of the maximum value from all of the modeled generators. A full summary of the model results for the 1-hour NO_2 NAAQS and CAAQS analyses are provided in **Attachment B, Table B-5 and B-6,** respectively.

ATTACHMENT A
FIGURES



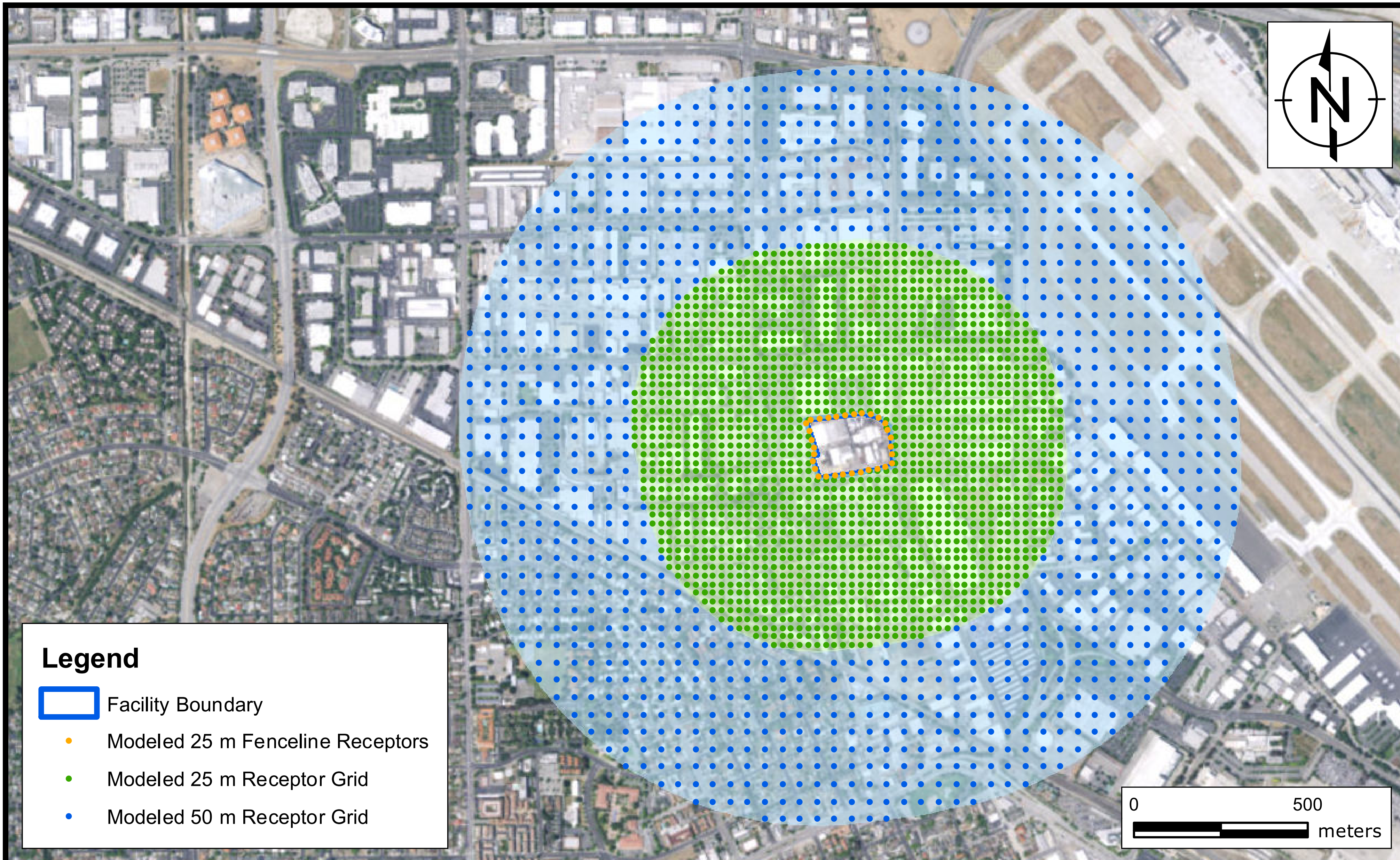
RAMBOLL ENVIRON

DRAFTED BY: DCW | DATE: 11/17/2017

Project Location and Facility Layout
Vantage McLaren Campus
Sanat Clara, California

FIGURE
1

1690001414



RAMBOLL ENVIRON

Modelled Receptor Location
Vantage McLaren Campus
Sanat Clara, California

FIGURE
2

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RAMBOLL ENVIRON

Maximum 1-Hour NO2 Concentration (NAAQS) and Contributing Generator
Vantage McLaren Campus
Sanat Clara, California

FIGURE
3

DRAFTED BY: DCW | DATE: 11/29/2017

1690001414

RAMBOLL ENVIRON

Maximum 1-Hour NO2 Concentration (CAAQS) and Contributing Generator
Vantage McLaren Campus
Sanat Clara, California

FIGURE
4

DRAFTED BY: DCW | DATE: 11/29/2017

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ATTACHMENT B
TABLES

Table B-1. Source Descriptions for the Mclaren Facility Sources

Model ID	Description	Specifications				
		Make	Model	USEPA Tier	Rated Power Output (kW)	Rated Power Output (HP)
GEN01_00	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN01_01	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN02_02	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN02_03	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN03_04	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN03_05	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN04_06	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN04_07	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN05_08	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN05_09	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN06_10	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN06_11	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN07_12	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN08_14	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN08_15	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN09_16	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN09_17	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN10_18	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN10_19	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN11_20	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN11_21	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN12_22	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN12_23	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN13_24	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN13_25	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN14_26	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN14_27	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423

Table B-1. Source Descriptions for the Mclaren Facility Sources

Model ID	Description	Specifications				
		Make	Model	USEPA Tier	Rated Power Output (kW)	Rated Power Output (HP)
GEN15_28	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN15_29	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN16_30	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN16_31	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN17_46	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN17_47	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN18_44	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN18_45	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN19_42	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN19_43	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN20_40	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN20_41	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN21_38	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN21_39	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN22_36	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN22_37	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN23_34	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN23_35	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN24_32	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
GEN24_33	3 MW CAT C175-16 Generator	Caterpillar	C175-16	2	3,000	4,423
SFTGEN13	500 kW Life Safety Generator	Generac	SD/MD500	2	500	835

Table B-2. Point Source Parameters for the Mclaren Facility Sources

Model ID	Description	UTM Zone 10 Coordinates (m)		Elevation (m)	NO_X Emission Rate (1-Hour Max.) (g/s)	Stack Height (m)	Stack Temp. (K)	Stack Velocity (m/s)	Stack Diameter (m)
		X	Y						
GEN01_00	3 MW CAT C175-16 Generator	593,153.30	4,135,823.97	14.91	7.408	13.77	750.85	59.23	0.51
GEN01_01	3 MW CAT C175-16 Generator	593,154.79	4,135,814.09	14.89	7.408	13.77	750.85	59.23	0.51
GEN02_02	3 MW CAT C175-16 Generator	593,159.93	4,135,824.52	14.94	7.408	13.77	750.85	59.23	0.51
GEN02_03	3 MW CAT C175-16 Generator	593,160.84	4,135,814.81	14.92	7.408	13.77	750.85	59.23	0.51
GEN03_04	3 MW CAT C175-16 Generator	593,166.30	4,135,825.62	14.95	7.408	13.77	750.85	59.23	0.51
GEN03_05	3 MW CAT C175-16 Generator	593,167.46	4,135,815.26	14.93	7.408	13.77	750.85	59.23	0.51
GEN04_06	3 MW CAT C175-16 Generator	593,172.81	4,135,826.47	14.94	7.408	13.77	750.85	59.23	0.51
GEN04_07	3 MW CAT C175-16 Generator	593,173.83	4,135,816.07	14.93	7.408	13.77	750.85	59.23	0.51
GEN05_08	3 MW CAT C175-16 Generator	593,179.36	4,135,827.58	14.92	7.408	13.77	750.85	59.23	0.51
GEN05_09	3 MW CAT C175-16 Generator	593,180.41	4,135,816.92	14.92	7.408	13.77	750.85	59.23	0.51
GEN06_10	3 MW CAT C175-16 Generator	593,185.69	4,135,828.41	14.90	7.408	13.77	750.85	59.23	0.51
GEN06_11	3 MW CAT C175-16 Generator	593,186.88	4,135,818.03	14.91	7.408	13.77	750.85	59.23	0.51
GEN07_12	3 MW CAT C175-16 Generator	593,192.24	4,135,829.54	14.87	7.408	13.77	750.85	59.23	0.51
GEN08_14	3 MW CAT C175-16 Generator	593,198.77	4,135,829.94	14.85	7.408	13.77	750.85	59.23	0.51
GEN08_15	3 MW CAT C175-16 Generator	593,200.10	4,135,819.09	14.86	7.408	13.77	750.85	59.23	0.51
GEN09_16	3 MW CAT C175-16 Generator	593,217.80	4,135,831.79	14.78	7.408	13.77	750.85	59.23	0.51
GEN09_17	3 MW CAT C175-16 Generator	593,219.07	4,135,820.58	14.79	7.408	13.77	750.85	59.23	0.51
GEN10_18	3 MW CAT C175-16 Generator	593,224.26	4,135,832.57	14.75	7.408	13.77	750.85	59.23	0.51
GEN10_19	3 MW CAT C175-16 Generator	593,225.52	4,135,821.53	14.76	7.408	13.77	750.85	59.23	0.51
GEN11_20	3 MW CAT C175-16 Generator	593,231.28	4,135,833.25	14.69	7.408	13.77	750.85	59.23	0.51
GEN11_21	3 MW CAT C175-16 Generator	593,232.25	4,135,822.46	14.71	7.408	13.77	750.85	59.23	0.51
GEN12_22	3 MW CAT C175-16 Generator	593,237.64	4,135,834.00	14.60	7.408	13.77	750.85	59.23	0.51
GEN12_23	3 MW CAT C175-16 Generator	593,238.64	4,135,823.54	14.63	7.408	13.77	750.85	59.23	0.51
GEN13_24	3 MW CAT C175-16 Generator	593,243.76	4,135,834.48	14.51	7.408	13.77	750.85	59.23	0.51
GEN13_25	3 MW CAT C175-16 Generator	593,245.29	4,135,823.86	14.51	7.408	13.77	750.85	59.23	0.51
GEN14_26	3 MW CAT C175-16 Generator	593,250.40	4,135,835.51	14.37	7.408	13.77	750.85	59.23	0.51
GEN14_27	3 MW CAT C175-16 Generator	593,251.25	4,135,824.42	14.46	7.408	13.77	750.85	59.23	0.51
GEN15_28	3 MW CAT C175-16 Generator	593,256.74	4,135,836.13	14.26	7.408	13.77	750.85	59.23	0.51
GEN15_29	3 MW CAT C175-16 Generator	593,258.11	4,135,824.92	14.30	7.408	13.77	750.85	59.23	0.51
GEN16_30	3 MW CAT C175-16 Generator	593,263.39	4,135,836.63	14.22	7.408	13.77	750.85	59.23	0.51

Table B-2. Point Source Parameters for the Mclaren Facility Sources

Model ID	Description	UTM Zone 10 Coordinates (m)		Elevation (m)	NO_X Emission Rate (1-Hour Max.) (g/s)	Stack Height (m)	Stack Temp. (K)	Stack Velocity (m/s)	Stack Diameter (m)
		X	Y						
GEN16_31	3 MW CAT C175-16 Generator	593,264.87	4,135,826.03	14.20	7.408	13.77	750.85	59.23	0.51
GEN17_46	3 MW CAT C175-16 Generator	593,288.40	4,135,815.10	14.26	7.408	13.77	750.85	59.23	0.51
GEN17_47	3 MW CAT C175-16 Generator	593,289.46	4,135,804.76	14.29	7.408	13.77	750.85	59.23	0.51
GEN18_44	3 MW CAT C175-16 Generator	593,294.80	4,135,816.05	14.30	7.408	13.77	750.85	59.23	0.51
GEN18_45	3 MW CAT C175-16 Generator	593,296.11	4,135,805.80	14.30	7.408	13.77	750.85	59.23	0.51
GEN19_42	3 MW CAT C175-16 Generator	593,301.24	4,135,816.96	14.33	7.408	13.77	750.85	59.23	0.51
GEN19_43	3 MW CAT C175-16 Generator	593,302.66	4,135,806.41	14.33	7.408	13.77	750.85	59.23	0.51
GEN20_40	3 MW CAT C175-16 Generator	593,308.01	4,135,817.39	14.37	7.408	13.77	750.85	59.23	0.51
GEN20_41	3 MW CAT C175-16 Generator	593,309.14	4,135,807.84	14.38	7.408	13.77	750.85	59.23	0.51
GEN21_38	3 MW CAT C175-16 Generator	593,314.55	4,135,818.09	14.42	7.408	13.77	750.85	59.23	0.51
GEN21_39	3 MW CAT C175-16 Generator	593,315.59	4,135,808.45	14.44	7.408	13.77	750.85	59.23	0.51
GEN22_36	3 MW CAT C175-16 Generator	593,320.88	4,135,818.76	14.47	7.408	13.77	750.85	59.23	0.51
GEN22_37	3 MW CAT C175-16 Generator	593,322.08	4,135,808.49	14.51	7.408	13.77	750.85	59.23	0.51
GEN23_34	3 MW CAT C175-16 Generator	593,327.23	4,135,819.23	14.51	7.408	13.77	750.85	59.23	0.51
GEN23_35	3 MW CAT C175-16 Generator	593,328.65	4,135,809.32	14.54	7.408	13.77	750.85	59.23	0.51
GEN24_32	3 MW CAT C175-16 Generator	593,333.90	4,135,819.97	14.39	7.408	13.77	750.85	59.23	0.51
GEN24_33	3 MW CAT C175-16 Generator	593,335.27	4,135,809.94	14.48	7.408	13.77	750.85	59.23	0.51
SFTGEN13	500 kW Life Safety Generator	593,193.74	4,135,818.75	14.88	0.822	13.77	809.81	49.34	0.2

Table B-3. Modeled NO_X Emission Rates for Mclaren Facility Sources

Generator Model	Number of Generators	Load-Specific Emission Rates (g/s/gen)			NAAQS	CAAQS
		50%	75%	100%	Hourly NO_X Emissions per Generator[1] (g/s/gen)	Hourly NO_X Emissions per Generator[2] (g/s/gen)
3 MW CAT C175-16 Generator	47	2.170	4.961	7.408	7.408	7.408
500 kW Life Safety Generator	1			0.822	0.822	0.822

Notes:

1. Hourly NOx emission rates for the NAAQS analysis assumed the worst case scenario of operating at 100% load for the full hour.
2. Hourly NOx emission rates for the CAAQS analysis assumed the worst case scenario of operating at 100% load for the full hour.
3. Generators are tested one at a time.

Table B-4. Modeled Buildings for the Vantage McLaren Facility

Model ID	Description	UTM Zone 10 Coordinates (m)		Elevation (m)	Height (m)
		X	Y		
BLDG01	Onsite Data Center Buidling	593191.09	4135774.31	14.94	32.31
BLDG02	Onsite Data Center Buidling	593254.09	4135781.23	14.68	32.31
BLDG03	Onsite Data Center Buidling	593317.24	4135758.03	14.74	32.31
GENBLG01	Generator Enclosure	593154.02	4135819.01	14.90	12.19
GENBLG02	Generator Enclosure	593160.41	4135819.95	14.92	12.19
GENBLG03	Generator Enclosure	593166.93	4135820.32	14.94	12.19
GENBLG04	Generator Enclosure	593173.42	4135821.28	14.94	12.19
GENBLG05	Generator Enclosure	593180.10	4135821.92	14.92	12.19
GENBLG06	Generator Enclosure	593186.42	4135822.42	14.90	12.19
GENBLG07	Generator Enclosure	593192.96	4135823.31	14.88	6.10
GENBLG08	Generator Enclosure	593199.50	4135824.03	14.88	12.19
GENBLG09	Generator Enclosure	593218.80	4135825.97	14.86	12.19
GENBLG10	Generator Enclosure	593225.29	4135826.74	14.78	12.19
GENBLG11	Generator Enclosure	593231.71	4135827.49	14.75	12.19
GENBLG12	Generator Enclosure	593238.26	4135828.10	14.69	12.19
GENBLG13	Generator Enclosure	593244.75	4135828.83	14.60	12.19
GENBLG14	Generator Enclosure	593251.18	4135829.59	14.48	12.19
GENBLG15	Generator Enclosure	593257.62	4135830.29	14.42	12.19
GENBLG16	Generator Enclosure	593264.25	4135830.92	14.29	12.19
GENBLG17	Generator Enclosure	593289.15	4135809.84	14.27	12.19
GENBLG18	Generator Enclosure	593295.57	4135810.69	14.30	12.19
GENBLG19	Generator Enclosure	593302.10	4135811.32	14.33	12.19
GENBLG20	Generator Enclosure	593308.68	4135812.11	14.38	12.19
GENBLG21	Generator Enclosure	593315.15	4135812.70	14.43	12.19
GENBLG22	Generator Enclosure	593321.48	4135813.47	14.48	12.19
GENBLG23	Generator Enclosure	593328.10	4135814.30	14.51	12.19
GENBLG24	Generator Enclosure	593334.64	4135814.79	14.43	12.19
SG_BLDG	Safety Generator Enclosure	593193.44	4135823.15	14.88	12.19
HOMEDEPOT	Offsite Building	593137.34	4135915.47	14.71	9.70

Table B-4. Modeled Buildings for the Vantage McLaren Facility

Model ID	Description	UTM Zone 10 Coordinates (m)		Elevation (m)	Height (m)
		X	Y		
B01	Offsite Building	593092.76	4135784.80	14.83	6.44
B02	Offsite Building	593138.79	4135703.82	15.36	2.70
B03	Offsite Building	593123.58	4135698.42	15.18	4.00
B04	Offsite Building	593113.36	4135729.54	15.04	3.90
B05	Offsite Building	593072.28	4135732.90	15.18	3.90
B06	Offsite Building	593077.07	4135709.25	15.25	4.90
B07	Offsite Building	593082.90	4135692.22	15.30	4.40
B08	Offsite Building	593329.84	4135965.42	13.29	6.40
B09	Offsite Building	593462.44	4135816.68	14.24	3.50
B10	Offsite Building	593237.02	4135640.99	15.57	6.40
B11	Offsite Building	593139.22	4135598.86	15.91	7.00
B12	Offsite Building	593101.20	4135608.64	15.71	4.90
B13	Offsite Building	593291.96	4135556.92	16.37	15.60
B14	Offsite Building	593142.83	4135530.12	16.75	7.40
B15	Offsite Building	593159.86	4135632.55	15.89	5.00

Table B-5. 1-hour NO_2 NAAQS Results

Averaging Period	Source ID	UTM Zone 10 Coordinates (m)		5Y Average H8H Modeled Conc. (µg/m³)	NAAQS (µg/m³)	Above NAAQS?
		X	Y			
1-Hour	GEN01_00	593262.27	4135696.70	158.83	188	No
	GEN01_01	593262.27	4135696.70	155.91		No
	GEN02_02	593262.27	4135696.70	153.84		No
	GEN02_03	593262.27	4135696.70	151.98		No
	GEN03_04	593262.27	4135696.70	150.40		No
	GEN03_05	593262.27	4135696.70	147.52		No
	GEN04_06	593262.27	4135696.70	144.43		No
	GEN04_07	593262.27	4135696.70	143.61		No
	GEN05_08	593262.27	4135696.70	138.30		No
	GEN05_09	593262.27	4135696.70	138.51		No
	GEN06_10	593237.64	4135693.57	133.96		No
	GEN06_11	593262.27	4135696.70	133.90		No
	GEN07_12	593262.27	4135696.70	131.54		No
	GEN08_14	593262.27	4135696.70	136.75		No
	GEN08_15	593213.01	4135690.45	124.58		No
	GEN09_16	593262.27	4135696.70	131.12		No
	GEN09_17	593262.27	4135696.70	139.23		No
	GEN10_18	593335.21	4135711.60	126.08		No
	GEN10_19	593262.27	4135696.70	142.80		No
	GEN11_20	593335.21	4135711.60	122.59		No
	GEN11_21	593335.21	4135711.60	123.84		No
	GEN12_22	593335.21	4135711.60	118.36		No
	GEN12_23	593335.21	4135711.60	117.25		No
	GEN13_24	593125.00	4135800.00	116.51		No
	GEN13_25	593335.21	4135711.60	113.42		No
	GEN14_26	593122.77	4135827.42	122.36		No
	GEN14_27	593359.45	4135716.94	110.45		No
	GEN15_28	593122.77	4135827.42	124.23		No
	GEN15_29	592650.00	4136700.00	107.63		No
	GEN16_30	593122.77	4135827.42	122.65		No
	GEN16_31	593100.00	4135800.00	107.75		No
	GEN17_46	593100.00	4135775.00	114.48		No
	GEN17_47	592200.00	4136100.00	117.51		No
	GEN18_44	593225.00	4135875.00	122.57		No
	GEN18_45	592200.00	4136100.00	118.13		No
	GEN19_42	593350.00	4135700.00	132.66		No
	GEN19_43	593325.00	4135700.00	126.41		No
	GEN20_40	593359.45	4135716.94	146.72		No
	GEN20_41	593335.21	4135711.60	143.00		No
	GEN21_38	593375.00	4135725.00	161.79		No

RAMBOLL ENVIRON

Table B-5. 1-hour NO_2 NAAQS Results

Averaging Period	Source ID	UTM Zone 10 Coordinates (m)		5Y Average H8H Modeled Conc. (µg/m³)	NAAQS (µg/m³)	Above NAAQS?
		X	Y			
	GEN21_39	593335.21	4135711.60	141.21		No
	GEN22_36	593359.45	4135716.94	159.41		No
	GEN22_37	593335.21	4135711.60	139.26		No
	GEN23_34	593359.45	4135716.94	152.76		No
	GEN23_35	593375.00	4135725.00	170.94		No
	GEN24_32	593350.00	4135700.00	137.32		No
	GEN24_33	593359.45	4135716.94	161.60		No
	SFTGEN13	593262.27	4135696.70	130.82		No
	Maximum NAAQS	593375.00	4135725.00	170.94		No

Table B-6. 1-hour NO_2 CAAQS Results

Averaging Period	Source ID	UTM Zone 10 Coordinates (m)		5Y Single Maximum H1H Modeled Conc. (µg/m³)	CAAQS (µg/m³)	Above CAAQS?
		X	Y			
1-Hour	GEN01_00	593144.58	4135851.31	297.54	339	No
	GEN01_01	593144.58	4135851.31	265.11		No
	GEN02_02	593144.58	4135851.31	287.76		No
	GEN02_03	593213.01	4135690.45	276.00		No
	GEN03_04	593169.21	4135854.48	287.54		No
	GEN03_05	593213.01	4135690.45	287.04		No
	GEN04_06	593169.21	4135854.48	286.03		No
	GEN04_07	593213.01	4135690.45	292.78		No
	GEN05_08	593213.01	4135690.45	286.89		No
	GEN05_09	593213.01	4135690.45	295.63		No
	GEN06_10	593213.01	4135690.45	286.37		No
	GEN06_11	593213.01	4135690.45	295.59		No
	GEN07_12	593169.21	4135854.48	284.87		No
	GEN08_14	593169.21	4135854.48	281.47		No
	GEN08_15	593213.01	4135690.45	288.55		No
	GEN09_16	593193.83	4135857.65	259.55		No
	GEN09_17	593213.01	4135690.45	247.98		No
	GEN10_18	593213.01	4135690.45	230.27		No
	GEN10_19	593213.01	4135690.45	238.75		No
	GEN11_20	593213.01	4135690.45	228.17		No
	GEN11_21	593213.01	4135690.45	238.12		No
	GEN12_22	593275.00	4135675.00	236.84		No
	GEN12_23	593262.27	4135696.70	229.96		No
	GEN13_24	593275.00	4135675.00	236.68		No
	GEN13_25	593262.27	4135696.70	229.97		No
	GEN14_26	593275.00	4135675.00	236.20		No
	GEN14_27	593262.27	4135696.70	228.53		No
	GEN15_28	593275.00	4135675.00	227.69		No
	GEN15_29	593262.27	4135696.70	226.84		No
	GEN16_30	593300.00	4135675.00	222.23		No
	GEN16_31	593262.27	4135696.70	223.48		No
	GEN17_46	593262.27	4135696.70	222.24		No
	GEN17_47	593262.27	4135696.70	225.68		No
	GEN18_44	593225.00	4135875.00	267.78		No
	GEN18_45	593225.00	4135875.00	238.57		No
	GEN19_42	593325.00	4135700.00	294.14		No
	GEN19_43	593325.00	4135700.00	314.46		No
	GEN20_40	593325.00	4135700.00	298.11		No
	GEN20_41	593325.00	4135700.00	314.72		No
	GEN21_38	593325.00	4135700.00	294.68		No

Table B-6. 1-hour NO_2 CAAQS Results

Averaging Period	Source ID	UTM Zone 10 Coordinates (m)		5Y Single Maximum H1H Modeled Conc. ($\mu g/m^3$)	CAAQS ($\mu g/m^3$)	Above CAAQS?
		X	Y			
	GEN21_39	593325.00	4135700.00	313.75		No
	GEN22_36	593325.00	4135700.00	287.66		No
	GEN22_37	593325.00	4135700.00	308.49		No
	GEN23_34	593325.00	4135700.00	280.09		No
	GEN23_35	593325.00	4135700.00	296.97		No
	GEN24_32	593325.00	4135700.00	267.37		No
	GEN24_33	593325.00	4135700.00	281.46		No
	SFTGEN13	593213.01	4135690.45	254.12		No
	Maximum CAAQS	593325.00	4135700.00	314.72		No

ATTACHMENT C
MANUFACTUER PERFORMANCE DATA SHEETS

MANUFACTURER'S PERFORMANCE DATA

MODEL: C175-16 DI SCAC DRY MANIFOLD
DATA REF NO.: DM8448-06
GENSET RATING (W/F FAN): 3000.0 EKW STANDBY 60 HERTZ @ 1800 RPM
CERTIFICATION YEAR: 2015 CERT AGENCY: EPA
SERVICE CLASS: STATIONARY EMERGENCY >560 BKW

GENERAL PERFORMANCE DATA

GEN W/F EKW	ENG PWR BHP	FUEL RATE LB/BHP-HR	FUEL RATE GPH	EXHAUST STACK TEMP DEG F	EXHAUST GAS FLOW CFM	O2 (DRY) IN EXH (VOL) %	H2O IN EXH (VOL) %
3000.0	4423	0.339	214.2	891.9	24620.0	9.6	8.85

EMISSIONS DATA

Gaseous emissions data measurements are consistent with those described in EPA 40 CFR PART 89 SUBPART D and ISO 8178 for measuring HC, CO, PM, and NOx.

Gaseous emissions values are WEIGHTED CYCLE AVERAGES and are in compliance with the following non-road regulations:

EPA and CARB Tier 2

MAX Limit - GM/HP-HR		
CO	NOX + HC	PM
2.6	4.8	0.15

EPA ENGINE FAMILY NAME: FCPXL106.NZS

“D2 CYCLE CERT LEVELS” for the engine family are:

GM/HP-HR				
CO	HC	NOX	NOX + HC	PM
1.1	0.36	3.97	4.3	0.08

CALCULATION OF SOX

SOX = 2.997E-5 * FUEL RATE (LB//HR)

Generator Data from Project Applicant

Description	Value
Make	Caterpillar
Model Type	C175-16
Generator Output (at 100% load) (kW)	3000
Engine Output at 100% Load (horsepower)	4,423
Engine Output at 25% Load (horsepower)	1,246
KVA	3,750
Voltage	12,000V-4P-3W
Temp Rise	130degC
Overall Dimension	720"x156"x260"
Fuel	
Fuel Type	Diesel
Fuel Flow (gal hr)	571 maximum
Fuel Consumption@ 100% (gal/hr)	213.2
Fuel Consumption@ 25% (gal/hr)	82.9
Fuel Tank Capacity (gal)	6,000
Diesel Fuel Sulfur Content	0.0015%
Air Flow	
Cooling Air (SCFM)	103,578
Combustion Air (SCFM)	9,354.6
Exhaust Flow	
Flow Rate at 100% Load (cfm)	24,561.2
Flow Rate at 25% Load (cfm)	12,165.9
Exhaust Gas Temperature at 100% Load (C)	894.9
Exhaust Gas Temperature at 25% Load (C)	817.8
Back Pressure (kPa)	6.7 max allowable
Emissions Data	
EPA Tier	2
NOx + NMHC (g/hp-hr) [g/ kw-hr)	4.3
CO (g/hp- hr)	1.1
PM (g/hp-hr)	0.08
Particulate Filter System	Johnson Matthey
NOx Reduction (g/hp-hr)	N/A
CO Reduction (g/hp-hr)	0.22 (80%)
PM Reduction (g/hp-hr)	0.01 (85%)
Stack Data	
Stack Height (feet)	22
Stack Inside Diameter (inches)	28
Testing Data	

Engine Testing Duration (normal testing) **Annual number of hours of testing at 100% Load** **Annual number of hours of testing at 25% Load** **Annual number of days that testing would occur on - 100% Load** **Annual number of days that teting would occur on - 25% Load**	year round - all engines are required to be available 24/7/365, and maintenance can occur on any day and at varying load levels. To the extent possible, allowance of 50 hours per year, as provided by the CARB ATCM, Section 93115, title 17, CA Code of Regulations, Executive Order, and acceptable by the District is desired. Hourly or daily limits, and any limits of how many engine tests can be performed on would be problematic. TBACT and BACT is being satisfied by use of diesel particulate filters and CARB certified engines to achieve applicable short term standards for PT, NOx, POC and CO. Ultra low sulfur fuel (CARB certified) is being used to minimize SO_2. NSPS and NESHAP short term emission standards will also be met. BAAQMD Significance Threshold for project operations (NOx < 10 tons/year, ROG < 10 tons/year, PM10 < 15 tons/year, PM2.5 < 10 tons/year) will also be met.

PETERSON **CAT**

Submittal for Approval

Prepared for Rosendin Electric Inc.
P.O. #280142-2002

Vantage V6 Data Center

VANTAGE™ DATA CENTERS

(6) CAT Model C175-16 – 3000kW, 12470V, 60Hz Stationary Emergency Diesel Genset, (3) Upper/Lower Stacked Sound Attenuated Enclosure, (3) 12,000 Gallon UL2085 Lower/Base Fuel Tank, (3) 500 Gallon UL-142 Upper Enclosure Day Tank, (6) Passive Diesel Particulate Filter, (6) Neutral Grounding Resistor, (6) Service Disconnect Switch

Peterson Project No. 16-0543
November 23, 2016

Since 1936
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Power Systems manufactured by Caterpillar and engineered, installed and serviced by Peterson Power, supply emergency stand-by power for hospitals, data and telecommunication centers, office buildings and industrial applications. Our engine systems also power workboats, pleasure craft, on-highway trucks, and provide clean dependable prime power for distributed generation used in local businesses and remote construction projects.

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As a result of our green efforts, Peterson Power Systems is now a certified Bay Area Green Business. This certification demonstrates our dedication to reducing our impact on the environment with the following programs: solid waste reduction, energy efficiency, water conservation, and pollution prevention. We have received recognition for each of these sustainability efforts, and, more importantly, we've made significant steps toward reducing our environmental footprint. In 2012, Peterson diverted 640 tons of waste from the landfill through recycling and waste reduction programs; in 2009, we reduced our water consumption by 30,000 gallons over the previous year; and we are happy to announce that Peterson University now composts its food scraps from customer training classes. Visit our website to learn more about our green programs and how you can receive Cat Dealer support from a company that cares about the community it serves–your community.

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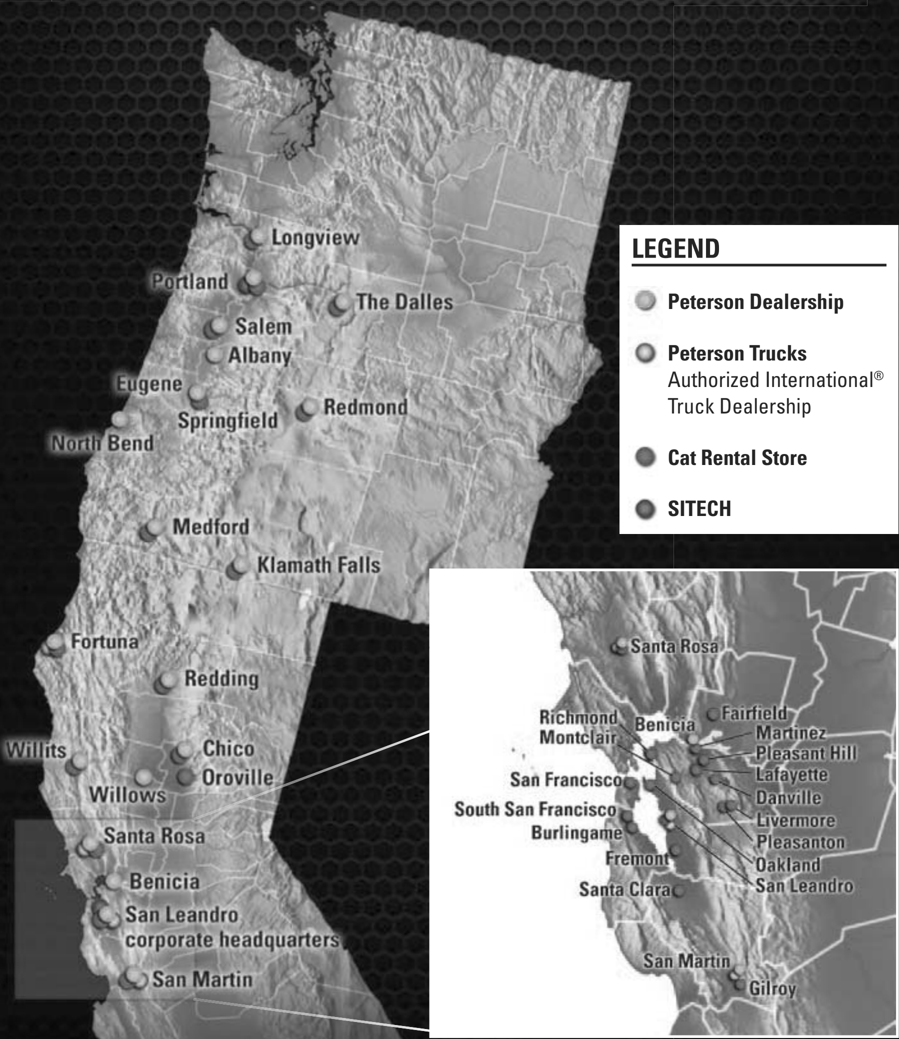

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Peterson Power Systems also serves our entire territory of Northern California, western Oregon, and southern washington, offering Cat generators and industrial engines; parts and service for all makes and models of industrial power equipment and on-highway trucks; and rental power systems including generators, air compressors, dewatering pumps, and temperature control systems.

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Cresco, which serves Northern California, and **Peterson - The Cat Rental Store**, which serves Oregon and southern Washington, provides equipment rental to contractors and homeowners throughout Northern California for projects as diverse as remodeling, major construction, movie and concert productions.

SITECH NorCal & **SITECH Oregon** (your dealer for Trimble, Apache, Crain, Seco and Laserline products) serves the construction and agriculture markets technology needs from our San Leandro, CA and Portland, OR offices. SITECH NorCal & SITECH Oregon are independent Trimble dealers and factory direct stores.

With 20 locations and over 1,000 employees, Peterson's reputation is built upon solving our customer's problems and providing world-class service. Peterson's heritage of innovation and relentless pursuit of continuous improvement is focused on improving our customer's business and being an asset to the communities that we serve.

Peterson's efforts to support the stewardship of the environment through our Green Business Initiatives as well as our ongoing support of community events through Peterson in the Community, demonstrates our belief that we give back to the communities we are a part of.

AWARDS AND CERTIFICATIONS

Green Business Program Peterson San Leandro

WRAP Waste Reduction Awards Program 2011 Winner

2009 TRASHBUSTER OF THE YEAR LANE COUNTY, OREGON

CAT® FIVE STAR CONTAMINATION CONTROL

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Table of Contents

Title Page 1
We're Ready 3
Exceptions to Specifications 9
Section I (Documentation) 13
Bill of Material 15
Field Inspection Checklist 23
IBC Certificate 25
Warranty 29
Section II (Engine/Genset) 31
Genset Spec Sheet 33
Genset Performance Data 41
Exhaust Emissions Data 49
Governor 51
Radiator Data 55
CAT C175-16 Vibration Data 57
Section III (Generator) 59
Generator Spec Sheet 61
Generator Performance Data 63
Voltage Regulator 70
Differential CTs 75
Section IV (Control Panel) 77
EMCP 4.2 79
Alarm Module 83
Remote Annunciator 85
Section V (Accessories) 87
Batteries 89
Battery Charger 93
Jacket Water Heater 95
Lube Oil Heater 99

Fuel Polisher 101
Fuel Polisher Bill of Material 112
Modbus Gateway 115
Diesel Particulate Filter 119
Neutral Grounding Resistor 128
Section VI (Generator Enclosure) 129
Altech Smart Relay ASR-B24DC 132
Arrow Backdraft Dampers 136
Emergency Stop Button 137
Emergency Vent (6 inch) 140
Emergency Vent (10 inch) 141
Flame Arrestor (ProtectoSeal) 144
Fuel Float (IBI) 146
Fuel Float (Madison C Series) 147
Fuel Float Switch (Madison M5000) 149
Fuel Gauge (Rochester) 151
Fuel Leak Detect (Madison) 153
Gear Pump (Fuel Supply/Return) 154
1 HP Electric Motor (Fuel Supply/Return) 157
GFCI Receptacle 158
LED Light Fixture 159
LED Emergency Exit Light 162
Mineral Wool Insulation (Roxul AFB) 163
Overfill Prevention Valve (9095C OPV) 165
Panel LH 480/277V 168
Panel UH 480/277V 169
Panel LL 120/240V 170
Panel UL 120/240V 171
Recessed Handle 173
Refrigerator Latch 174
Transformer 15KVA 480V - 120/240V 175

3-Way Light Switch 177
Section VII (Disconnect Switch) 179
HVLcc Medium Volatge Disconnect 181
HVLcc Bill of Material 191
HVLcc Motor Option 198
12KV Surge Supressor 199
Disconnect Switch Layout Drawings 201
Air Temperature RTD Probe 207
Section VIII (Drawings) 209
Shop Drawings 211
General Assembly 213
12,000 Gallon UL-2085 Fuel Tank 217
General Reassembly 220
500 Gallon UL-142 Day-Tank 223
Electrical Panel One Line Diagram 224
Fuel System & EMCP Control Wiring 234
Fuel Transfer Panel 235
Engine/EMCP Wiring Diagram 238
Vibration Isolators 263
Lube Oil Heater Layout 264
Lube Oil Heater Wiring Diagram 266
Post Glover Neutral Grounding Resistor 268
Harco Exhaust Collector 271
Johnson Matthey DPF Unit #1 (Lower) 272
Johnson Matthey DPF Unit #2 (Upper) 273

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Comments, Deviations and Exceptions

Project: Vantage V6
PPSI #: 16-0543

Key: C- Comment
D- Deviation
E- Exception

Specification: 15.23 Generators
Basis of Design for Vantage Data Centers (Date: 06/30/2016)

Reference	C or D or E	Specification	Comment
1.B.II	E	The "off" position of the same switch shall initiate a cool down…	There is no cool down when the switch is placed to "OFF".
1.B.IV	D	Maximum total time period for a cold start, with ambient temperature at the low end of the specified range, shall be 10 seconds.	Engine start time and total load restoration times cannot be guaranteed to meet the requirements set forth in this document. Rosendin will provide 5 days of tuning to have all loads restored in under 40 seconds. (See Notes 1 & 2 below)
1.D.I	D	Generators shall be provided with a dedicated belly tank sized for 24 hrs…	The bulk fuel tank is not dedicated to each generator.
1.E.I	D	High Resistance Ground (HRG) via transformer ground shall be implemented with the generators and rated at continuous duty.	Generator resistors are as shown on the contract documents and protection diagram. Non-continuous duty resistors are provided.
1.F.III	E	Modeling or calculations shall be provided where exhaust is close to the building intake…	Provided by others.
7.C	E	Nameplates: - shall include address and factory order number…	Address and factory order are not on the nameplates, serial number will link to this in the Caterpillar system.
8.B	D	Transient Voltage Performance: Not more than 10% variation for a 50% step-load increase.	The transient voltage dip can be as high as 11% for a 0 – 50% load step.
8.C	D	Steady-State Frequency Operational Bandwidth: 0.25% of rated frequency…	Actual steady state performance is 0.33% of rated frequency.
8.E	D	Transient Frequency Performance: Less than 1.5 Hz variation for 50% step load increase or decrease.	The transient frequency dip for a 50% step-load increase is greater than 1.5 Hz.
8.H	D	Block Load: Engine generator shall be capable of accepting a 100% block load – without exceeding 30% voltage dip & 5 Hz frequency dip…	31% voltage dip and 6.6Hz dip for 100% block load at 0.8 PF – recover time >5 sec.
10.E	D	The engine block shall be made from GC Copper Chrome Iron Alloy…	Engine block is grey iron casting.

Reference	C or D or E	Specification	Comment
10.I	D	Jacket Coolant Heaters – immersion type & 2/9,000 watts…	Jacket water heater is single element with forced circulation. The heater is sufficient to maintain 110 degF coolant temperature.
10.J	D	The engine shall be full compression ignition, 20 cylinder…	This is a 16 cylinder C175
10.U	D	Electronic Governor - Steady state speed band shall not exceed +/- 0.25%…	Governot steady state speed band is 0.33% of rated frequency – not 0.25%
11.E	D	Coolant: Solution of 50 percent propylene glycol and 50 percent water.	Coolant is Caterpillar extended life coolant on initial fill from factory.
13.A.III	E	Engine Exhaust System – 20" vertical exhaust collector.	DPF/Silencer will have 4 inlets; 20 inch exhaust collector
13.A.IV	C	Diesel Particulate Filter (DPF) a. DPF shall be passive emission control system. b. DPF shall meet the performance…to comply with Tier 2 Standards.	Engine Emissions with the DPF exceeds Tier 2 standards. Please note the passive DPF is sized to handle 24 cold starts with 30 minutes of operation at 0% load or 12 hours of continuous operation at 0% load, before regeneration.
13.A.V.b	C	Modbus TCP/IP, communications protocol shall be available…	The Johnson Matthey diagnostic module will be connected to a Modbus Gateway which will provide a single Modbus TCP connection for the EMCP & DPF.
15.A.VI	D	Battery Compartments - with thermal insulation.	Since the enclosure is insulated the battery compartment will not require insulation.
16.B	E	Transfer switch control, automatic synchronizing, and managed Ethernet switch.	These items provided by others. Each genset will have an RS485 to Ethernet TCP/IP Gateway.
16.C.I	D	Crank disconnect shall have three means for determining the engine has started – generator output voltage or oil pressure…	The redundant sensors for the C175 are secondary speed and timing sensors.
16.D.II.b	D	Weak Battery	High and Low voltage alarms are provided.
16.D.III	D	Generator protection "" SEL700G relays…	Provided by others.
16.F.I	D	The genset controller shall have 17 contact inputs.	The genset controller has 8 digital inputs.
16.G.I	D	There shall be (3) 30Adc rated contacts…	All the DO contacts are rated 2Adc.
16.J.I	D	The PC software – must include programmable logic…	The PC software allows for extensive configuration to accommodate the majority of standby generator requirements.
17.A	D	- the voltage regulator shall be Basler, Woodward or approved equal…	CAT supplies an integrated digital voltage regulator considered an approved equal.
17.D.I	D	The stator winding shall be given multiple dips and bakes of varnish…	Stator insulation system is vacuum pressure impregnated epoxy.
18.A.XIV thru 18.A.XVI	D	Heaters, jacket water and or lube oil/Safety shutdowns/Accessories.	Heaters/Safety Shutdowns/Accessories will be tested at Packager.
18.C	E	Factory Test per MIL-STD-705 tests.	MIL 705B testing is not included.
19.A	D	Manufacturer shall provide one day of factory witness testing…	Caterpillar Factory tests are not available for customer witness – testing can be witnessed at Packager Facility.
19.B.III.a	D	Load Carry Test – Heat run, 4 hours…	The 4 hour heat run will be performed on site.
19.B.XII	E	Exhaust Emissions Test: Comply with applicable government test criteria and requirements.	Exhaust emissions tests not included.

Reference	C or D or E	Specification	Comment
19.B.XIII	E	Noise Level Tests: Measure A-weighted level of noise…	Noise level testing is not included.
15.2.1.A	C	Concurrent maintainability of stacked engine design.	See Note #3 below.

Notes

1. "Time to Start"

Peterson's specification clarification comment was made in reference to the undefined steady state condition. There is significant time after speed and voltage reaches 98% of nominal before the voltage remains within +/- 0.25% and frequency +/- 0.33% bands.

The Caterpillar C175-16 3MW genset package is compliant with NFPA110 which is the maximum duration of power loss to life safety loads of 10 seconds. This includes time before remote start signal initiate, cranking time, acceleration to typically 90% speed, voltage build-up to 90% voltage plus time delay transfer from normal source to emergency source. Caterpillar test data confirms generators comparably equipped will comfortably see cold starting times at or under 10sec (7.5 to 8.5sec) from remote start initiate to 90% of rated voltage and +/-1hz.

Further reduction in start times can be achieved with elevated thermostat settings on the JW heater and by adding larger space heaters and intake and discharge dampers to the enclosure, however the energy consumption will be significantly higher as a result.

2. "Time to Sync"

Several variables and settings in the generator and switchgear can influence the time to synchronize and support load with all generators. Given proper design coordination and site commissioning, meeting the specified requirement to have generators synchronized and all loads supported should be attainable thru testing and tuning. Peterson has a similar project of this scale utilizing the 20cylinder engine closing to a dead bus where we're seeing results in the 30-40sec range.

It's important to note that the synchronizing time of each generator to the bus is independent so the time to have all available generators connected to the bus is not dependent on the number of gensets. At this point, the settings in the PSG controls will have the most impact on the additional time it takes for the load acceptance and load sharing.

Sync and Close Sequence:

When the bus voltage and frequency reaches the DSLCII minimum set-points and a dead bus condition is sensed the 1st generator to reach minimum voltage & frequency will trigger a dead bus closure lockout signal which is sent to all the other generator DSLCII's and breaker close command is sent to 1st generator's GCB. The remaining generators DSLCII's analog output 1 PWM signal duty cycle will change to match the frequency and phase angle difference between bus & generator. Simultaneously analog output 2 voltage (-10 to +10 VDC) changes to match generator voltage to bus voltage. Once the synchronizing criteria is met the breaker close command is sent. Once a generator's circuit breaker is closed the DSLCII switches to load and reactive sharing mode. Since, there is no load on the bus there will be no load ramping after the circuit breaker closes.

3. Concurrent Maintainability

The design for the stacked generators accounts for concurrent maintainability in as many respects as possible while providing a footprint that we can fit into the existing space available on the property.

From the perspective of catastrophic failure, the design includes servicing access doors that will allow removal of the radiator and alternator out thru doors in the side of the enclosure without the need to remove components from the system that would impact the online condition of the other generator in the stack. An engine block of the lower generator is the only failure that would require the pair of generators be taken offline for repair or replacement. In this case the enclosure would need to be removed from the base to gain complete access to the engine block. If the failure were on the lower genset the upper genset package would need to be removed first.

From the perspective of routine servicing, the design incorporates many features identified below to allow service technicians to gain access to each upper and lower generator without the need to take a pair of generators offline.

Design Features for Concurrent Maintainability:

- Dedicated panelboards in each respective enclosure for shorepower distribution feed.
- Dedicated, Double-wall, fuel supply and return piping between the fuel tank base and the generator day tank as required by the AHJ. Piping to the upper generator to be routed such that it will not impede service work in the lower genset.
- Lube oil and coolant drains will be plumbed to the lower level base rail accessible from the exterior for easy access by a servicing technician.
- Removable side access doors for removing a radiator core (see removal example drawing).
- Removable side access doors for removing an alternator (see removal example drawing).

Submittal for Approval

Section I
Documentation

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Bill of Material

Vantage V6
PPSI Job #16-0543
November 28, 2016

(6) C175-16 3000kW, 12470V, Standby Generator Set consisting of:

Standard Items:

AIR INLET SYSTEM

Air Cleaner; 4 x single element canister type with service indicator(s).

CONTROL SYSTEM

EMCP 4 controls including:
- Run / Auto / Stop Control
- Speed Adjust
- Voltage Adjust
- Engine Cycle Crank
- Alarm Acknowledge
- Emergency stop pushbutton

EMCP 4.2 controller features:
- 24-volt DC operation
- Environmental sealed front face
- Text alarm/event descriptions
- True RMS AC metering, 3-phase, +/-2% accuracy.

Digital indication for:
- RPM
- DC volts
- Operating hours
- Oil pressure (psi, kPa or bar)
- Coolant temperature
- Volts (L-L & L-N), frequency (Hz)
- Amps (per phase & average)
- Power Factor (per phase & average)
- kW (per phase, average & percent)
- kVA (per phase, average & percent)
- kVAr (per phase, average & percent)
- kW-hr (total)
- kVAr-hr (total)

Warning/shutdown with common LED indication of shutdowns for:
- Low oil pressure
- High/Low coolant temperature
- Overspeed
- Emergency stop
- Failure to start (overcrank)
- Low coolant level

Programmable protective relaying functions:

- Generator phase sequence
- Over/Under voltage (27/59)
- Over/Under Frequency (81 O/U)
- Reverse Power (kW) (32)
- Reverse Reactive Power (kVAr) (32RV)
- Overcurrent (50/51)

Communications

- Customer data link (Modbus RTU)
- Accessory module data link
- Serial annunciator module data link
- 6 programmable digital inputs
- 4 programmable relay outputs (Form A)
- 2 programmable relay outputs (Form C)
- 2 programmable digital outputs

COOLING SYSTEM

SCAC cooling.
Radiator Group Shipped loose.
Fan and belt guards.
Coolant drain line and valves.
Coolant level sensor – (2 x shipped loose: 1/4-18 & 1/2-14 NPTF).

EXHAUST SYSTEM

Exhaust Manifold - dry
Bolted Flange (ANSI 6" & DIN 150) with bellows for each turbo (Qty 4).

FUEL SYSTEM

Primary Fuel Filter w / Fuel Water Separator
10 Micron Spin-On Type
Shipped loose - 3 Filters
Can be mounted on Frame Rails (Requires dealer provided flex)
Secondary / tertiary fuel filters
4 Micron Spin-On Type
Engine Mounted - 3 Filters

GENERATORS AND GENERATOR ATTACHMENTS

3 Phase Brushless, Salient Pole.
6 lead.
IEC Platinum Stator RTDs (.00385 Temp coefficient).

Caterpillar's Digital Voltage Regulator (CDVR).

- CDVR includes reactive droop capability.
- 3-Phase voltage sensing.
- KVAR/PF modes.
- RFI suppression, min/max exciter limiter.
- Exciter diode monitor.

1800 Frame Generators (LV/MV)
Form wound.

Permanent magnet.
NEMA Class H insulation, Class H temperature rise at 40 C ambient (125C prime/150C standby).
(MV) Bus bar connections, right side extension box, bottom cable entry.
60 Hz models: NEMA standard hole pattern.
Anti-condensation space heater.
NEMA Class H insulation, Class F temperature rise at 40C ambient (105C prime/130C standby).

GOVERNING SYSTEM

ADEM(tm) A4.
Redundant shutdown (over-speed protection through a duplicate speed sensing system).

LITERATURE

English

LUBE SYSTEM

Lubricating oil.
Gear type lube oil pump.
Integral lube oil cooler.
Oil filter, filler and dipstick.
Oil drain lines and valve.
Fumes disposal.
Prelube – required with prime, continuous, and standby.

MOUNTING SYSTEM

Rails - engine/generator/radiator mounting.
Rubber anti-vibration mounts – (shipped loose).

STARTING/CHARGING SYSTEM

Redundant Dual 24-volt electric starting motors.
Battery, rack and cables – (shipped-loose).
Battery Charger 35A (Qty. 2).
Battery disconnect switch.

GENERAL

Paint: Caterpillar Yellow with high gloss black rails & radiator.
RH Service (except oil filter service 60 Hz models: left hand service).
Flywheel and flywheel housing-SAE No. 00.
SAE Standard Rotation.

Additional Items:

(3) Stacked Enclosure Pair Sound Attenuated, Weather Protected
- Lower Genset Enclosure
- Upper Genset Enclosure with 500gal UL142 Fuel Day Tank
- Sound rated for 75dB @ 25ft
- Exhaust System with vanity screen
- Interior Lights
- Load Distribution Center
- Transformer, 480V – 120/240V
- Duplex Fuel Supply & Return Pumps for Upper Genset
- Double wall fuel piping

(3) 12,000 Gallon UL2085 Fuel Base Tank
- 24 hours runtime, 11,000 gallons useable
- 5 gallon spill containment with fill drop tube, overfill prevention valve
- Level and leak alarms
- Vent extension with flame arrestor

(6) Service Disconnect Switch
- HVLcc Disconnect switch with motor operator and electrical interlock
- 600A, 15kV rated, NEMA 3R
- 15KV Distribution Class Surge Arrestor (Lineside)

(6) Neutral Grounding Transformer Resistor
- 12,000V L-L/6,930V L-N
- 5A Primary, 175A Secondary
- Mounted above Genset inside enclosure

(6) Lube Oil Heater
- 11 GPM
- 6kW @ 480V, 3 Phase

(6) Diesel Particulate Filter
- Mounted above Genset inside enclosure

(6) Modbus Ethernet Gateway Server
- 2 Independent Serial Ports
- 1 Modbus Ethernet TCP Port

(3) Fuel Polishing System
- Installed inside lower enclosure
- 11 GPM filters fuel in 12,000 gallon base tank

(6) Individual Genset Full Load Factory Tests & Reports
- Lead (0.95 PF), Lag (0.9 PF) and Unity Tests to be performed at Packager Facility
- Manual Start and run-in: stand-alone configuration
- Reactive & Capacitive Load banks

Quote-Specific Items (Installed):

Feature Code	Part Number	Qty	Extended Description
CERTESE	3662120	1	EPA STATIONARY EMERGENCY
60H12K4	3408118	1	60HZ 12470 VOLTS / INDICATOR
STANDBY	9Y8156	1	STANDBY POWER APPLICATION
STDBYNM		1	STANDBY POWER - NORMAL
KW03000	LL6018	1	4423 BHP 3000 GEN KW W/F 60 HZ
EMCP42	LF1184	1	EMCP 4.2 CONTROL PANEL
PCKRAD1		1	PACKAGE MOUNTED RADIATOR
IBCCERT	4709233	1	IBC CERTIFICATION
175DR84	C175-16EL LF0890 LF0084 3079788	1	C175-16 Package Gen Set C175-16 T2 1800 RPM HV CORE ENGINE IRON 60 HZ - T2 SCAC ENGINE AR - C175-16 REF 175DE84, LF0890, LF0084 84
GENT130		1	130 DEG GENERATOR TEMP RISE
MSEPGGN	0V5560	1	GENERAL EPG
LANENGO	LF0231	1	ENGLISH LANGUAGE OPTION
LANENGC	3559019	1	ENGLISH LANGUAGE-GENSET CNTL
OGPM547	 LF1925 3753666	1	GENERATOR AR-SR5-3020 12470V-FW-2B2B GENERATOR 3020 FRAME PM 2B 547 GENERATOR AR - POWER
CVR0054	3756776	1	COVER GP-GEN EXCITER-3000
GENRTD3	4186656	1	GENERATOR MONITORING PKG
SHKTHM0	LF0247	1	THERMOSTAT FOR SPACE HEATER
CUSTCN3	2813199	1	CUST CONN MTG - TERM BOX RH
EMCSDP3	4186653	1	SPARE DISCRETE I/O PACKAGE
ANNR009	LF1562	1	1ST LOCAL ANNUNCIATOR
ESTOP01	3886283	1	ESTOP - ENGINE MOUNTED
CCT8713	LF0250	1	CCCT, 200:5 RATIO 87
PLUG006	2853954	1	PLUG GP (NO AIR INLET SHUTOFF)
ACLSS04	LF0245	1	AIR CLEANER - SINGLE ELEMENT
WIRGP06	LF0093	1	WIRING GP (W/O CYL TEMP SEN)
PLUG003	2853955	1	PLUG (NO TURBO SPEED SENSORS)
RADTF47	LF2066	1	RAD TUBE + FIN 73 SQ FT 47
FFFWS01	LF0788	1	PRIMARY FUEL FILTER W/FW SEP 1
FULCO10	2599198	1	FUEL COOLER - REMOTE

Feature Code	Part Number	Qty	Extended Description
SWP0001	0P7607	1	SHRINK WRAP PROTECTION
ELSM241	LF0215	1	ELEC STARTING MOTOR-REDUNDANT (4)
BAT1207	LF0186	1	BATTERY SET 12 - 12 VOLT DRY
BTC3500	3534423	2	BATTERY CHG 35 AMP (1-2)
CVR0026	LF0839	1	COVER GP - NO ALTERNATOR
HCPD003	LF0798	1	HI CURRENT DISTRIBUTION BOX
JWH0119	LF1765	1	JWH W/PUMP 480V
OILPN01	LF0092	1	STANDARD SUMP OIL PAN W/RAD
ELEPP05	LF0212	1	ELEC PRELUBE PUMP 24 VOLT 05
LUBOIL1	LF0089	1	LUBE OIL
LUBOD03	2474907	1	DRAIN GP - OIL PAN 3 SL
SPLEX02	LF0099	1	SIMPLEX OIL FILTER
CVR0021	3660382	1	COVER GP - CRANKCASE
FUMDIS1	LF0242	1	FUMES DISPOSAL S1
TRSGEN1	0P1530	1	GENERATOR TEST REPORT
TRSGEN7	0P1793	1	PGS TEST REPORT @ 0.8 PF
EXHC002	LF0558	1	16" VERTICLE EXHAUST COLLECTOR
AFTP001	3096470	1	PLUG W/O AFTERCOOLER DRAIN
HRNCN17	3880368	1	INTERCONNECT HARNESS-7.5M
HRNCN19	3886278	1	INTERCONNECT HARNESS-7.5M
VIBIS99	4716563	1	VIBRATION ISOLATORS - IBC 99
ANNC001	3752303	1	CUSTOM NFPA REMOTE ANNUNCIATOR
EMCSD17	4259346	1	SPARE DISCRETE I/O PACKAGE

Additional Items:

Reference #	Qty	Extended Description
SA-ENCL	3	Double Stacked Sound Attenuated Enclosures with Fuel Tanks
DISC-HVLcc	6	Schneider HVLcc Disconnect with Surge Capacitor
PR-25AP-A-0600-3/8-M12	12	Omega Air Temperature RTD Probe for HVLcc Enclosure
N-GTR	6	Neutral Grounding Transformer & Resistor
OMM30604-00	6	HotStart Lube Oil Heater with Circulating Pump (480VAC)
JM-CRT(+)-28-H-BITO-CS-22/22/28-RT	6	Passive Diesel Particulate Filter
MB3270	6	Moxa Modbus Gateway (2 serial ports to 1 Ethernet Port)
FRS 11-OF	3	Fuel Polishing System 11 gallon/minute 480VAC

Note:
Caterpillar Application and Installation Guides provide information regarding system design and installation considerations to which you must adhere in order for this equipment to function properly. Please consult with the project specific design engineer or your Caterpillar representative if you have any questions.

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GENERATOR SET (RETAIL DIESEL) PRE-START-UP CHECKLIST

CUSTOMER TO RETURN PRIOR TO SCHEDULING PETERSON START-UP.

This form must be completed by the electrical contractor; customer and returned to the project manager listed below prior to start-up and testing by any representative of Peterson Power Systems. If any items on this checklist are found to be incomplete and/or incorrectly performed, additional charges will be assessed for any and all charges incurred in the correction and completion of this checklist (including travel time to site).

Return to:
Peterson Power Systems
Attn: Project Manager
ProjectManager@PetersonPower.com
Fax #: 503.280.1552 Oregon, 510.352.2064 California

Customer contact Information:

Project Name: Site Contact:
Phone: Email:
*Requested Date of Start-up on site:

	YES	NO	N/A	(not applicable)
1.	( )	( )	( )	Power conductors connected between generator set & ATS
2.	( )	( )	( )	Normal power available at line side of ATS.
3.	( )	( )	( )	Building load connected to load side of ATS.
4.	( )	( )	( )	Control wiring in separate conduit ran to ATS. **
5.	( )	( )	( )	AC Accessories Circuit ran to Generator connection; breaker box. **
6.	( )	( )	( )	Remote Communications and DC power conductors run to annunciator. **
7.	( )	( )	( )	Fuel tank filled (DO NOT FILL TANK IF PRESSURE TEST IS REQUIRED).
8.	( )	( )	( )	Exhaust system installed (may include insulation & additional piping if required)
9.	( )	( )	( )	Fuel day tank pump circuit installed and connected.
10.	( )	( )	( )	Fuel supply & return lines connected to engine (hose or black pipe).
11.	( )	( )	( )	Generator set anchored securely to pad.
12.	( )	( )	( )	Radiator air ductwork installed and operational (if applicable).
13.	( )	( )	( )	Generator set is free of all construction debris and encumbrances.
14.	( )	( )	( )	Battery installed, filled, and secured to rack. (If needs to be filled check here___)
15.	( )	( )	( )	Witnesses required (inspectors, fire marshal, etc.) have been notified.

* Date and time of start-up is NOT guaranteed until confirmation by the project manger listed above.
**CUSTOMER INTERCONNECT WIRING: Power conductor and communication cable requirements and additional information are shown on the Peterson Power Systems provided interconnect drawing.

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THE VMC GROUP

The Power of Together ™

CATERPILLAR®

CERTIFICATE OF COMPLIANCE

SEISMIC DESIGN OF NONSTRUCTURAL COMPONENTS AND SYSTEMS

IBC CERTIFIED

THE VMC GROUP

Certification No.

VMA-45800-01C C175 (Revision 6)

Expiration Date: 01/31/2016

Certification Parameters:

The nonstructural products (mechanical and/or electrical components) listed on this certificate are CERTIFIED[1] FOR SEISMIC APPLICATIONS in accordance with the following building code[2] releases.

IBC 2000, IBC 2003, IBC 2006, IBC 2009

The following model designations, options, and accessories are included in this certification. Reference report number **VMA-45800-01** as issued by The VMC Group for a complete list of certified models, included accessories/options, and certified installation methods.

Cat® Diesel Engine Generator Set

The above referenced equipment is **APPROVED** for seismic application when properly installed,[3] used as intended, and contains a Seismic Certification Label referencing this Certificate of Compliance[4]. As limited by the tabulated values, below grade, grade, and roof-level installations, installations in essential facilities, for life safety applications, and/or of equipment containing hazardous contents are permitted and included in this certification with an Equipment Importance Factor assigned as I_P=1.5.

Certified Seismic Design Levels	
S_{DS} <= 2.20	S_{DS} <= 0.73
z/h <= 0.0 (Equipment at Grade)	z/h <= 1.0 (Equipment on Roof)
Soil Classes A, B, C, D, Seismic Risk Category I, II, III, IV, and Seismic Design Categories A, B, C, D, E, and F are all covered under this certification, limited by the S_{DS} value stated above.	

Certified Seismic Installation Methods
External isolation mounting from unit base to rigid structure

Shake Test of Active and Energized Components, Non-Active Components, and Equipment Structure:

Qualified by successful seismic shake table testing at the nationally recognized University of California San Diego Charles Lee Powell Structural Research Laboratories Seismic Response Modification Device (SRMD) Test Facility and at Trentec under the witness of the Certified Seismic Qualification Agency, The VMC Group. Testing was conducted in accordance with ICC-ES AC-156 to envelope the required response spectrum (RRS) of maximum horizontal flexible acceleration (A_{FLEX}) of 2.20 g and a rigid acceleration (A_{RIG}) of 0.88 g. This test level corresponds to an S_{DS} = 2.20 g with a z/h of 0.0. Functionality was verified before and after the shake test.

Basis of Design for Supports and Attachments to the Building:

For calculations and analysis of the equipment attachment to the building structure, the equivalent static force method was employed using the Seismic Design Acceleration, F_P/W_P,[5] for Load Resistance Factored Design (LRFD) methods. This includes but is not limited to the unit anchoring requirements and external isolation calculations.

Seismic Design Acceleration Equation, $F_P/W_P = 0.4 \times (S_{DS}=2.20) \times (I_P=1.5) \times (a_P/R_P=1.25) \times (1+2(z/h=0.0)) = 1.65$ g

a_P/R_P is representative of the worst-case shake tested condition, as determined from Table 13.6-1 in ASCE7-05 Chapter 13.

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SEISMIC DESIGN OF NONSTRUCTURAL COMPONENTS AND SYSTEMS

Certified Product Table:

<table>
<tr><th>Model Designation</th><th>Standby Rating</th><th>Prime Rating</th><th>Continuous Rating</th><th>EPA Rating</th><th>Open Genset (with package mounted radiator)</th><th>Open Genset (without package mounted radiator)</th><th>Remote Control Panel Option</th><th>Remote Battery Rack Option</th></tr>
<tr><td>C175-16 LV</td><td>3000 & 3100 ekW</td><td>2725 & 2825 ekW</td><td>2500 & 2600 ekW</td><td rowspan="5">Tier 2</td><td rowspan="5">Permitted radiators
3587625
2960410
As package mounted
to the units listed at right</td><td rowspan="8">3269429
3269430
3269431
3269432</td><td rowspan="8">N/A</td><td rowspan="5">2599110
2599111
3502550
3502551</td></tr>
<tr><td>C175-16 MV</td><td>3000 & 3100 ekW</td><td>2725 ekW</td><td>2500 ekW</td></tr>
<tr><td>C175-16 MV</td><td>3000 & 3100 ekW</td><td>2725 & 2825 ekW</td><td>2500 & 2600 ekW</td></tr>
<tr><td>C175-16 HV</td><td>3000 & 3100 ekW</td><td>2725 ekW</td><td>2500 ekW</td></tr>
<tr><td>C175-16 HV</td><td>3000 & 3100 ekW</td><td>2725 & 2825 ekW</td><td>2500 & 2600 ekW</td></tr>
<tr><td>C175-16 LV</td><td>3000 & 3100 ekW</td><td>2725 & 2825 ekW</td><td>2500 & 2600 ekW</td><td rowspan="3">Tier 4i</td><td rowspan="3">Permitted Radiator
3587625
As package mounted
to the units listed at right</td><td rowspan="3">3502550
3502551</td></tr>
<tr><td>C175-16 MV</td><td>3000 & 3100 ekW</td><td>2725 & 2825 ekW</td><td>2500 & 2600 ekW</td></tr>
<tr><td>C175-16 HV</td><td>3000 & 3100 ekW</td><td>2725 & 2825 ekW</td><td>2500 & 2600 ekW</td></tr>
</table>

This certification **includes** the open generator set only. The generator set and included options must be a catalogue design and factory supplied. The generator set and applicable options shall be installed and attached to the building structure per the manufacturer supplied seismic installation instructions. This certification **excludes** all non-factory supplied accessories, including but not limited to mufflers, isolation/restraint devices, non-factory fuel tanks, remote control panels, remote radiators, pumps and other electrical/mechanical components.

Issue Date: February 15, 2011
Revision Date: March 14, 2013
Expiration Date: January 31, 2016

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CERTIFICATE OF COMPLIANCE

SEISMIC DESIGN OF NONSTRUCTURAL COMPONENTS AND SYSTEMS

Notes and Comments:

1. All equipment listed herein successfully passed the seismic acceptance criteria for shake testing non-structural components and systems as set forth in the ICC AC-156. The Test Response Spectrum (TRS) enveloped the required response spectrum (RRS) for all units tested. The units cited in this certification were representative sample(s) of a contingent of models and all remained captive and structurally sound after the seismic shake simulation. The units also remained functionally operational after the simulation testing as functional testing was completed by the equipment manufacturer before and after the seismic simulations. Although a seismic qualified unit inherently contains some wind resisting capacity, that capacity is undetermined and is excluded from this certification. Snow/Ice loads have been neglected and thus limit the unit to be installed both indoors (covered by an independent protective structure) and out of doors (exposed to accumulating snow/ice) for ground snow loads no greater than 30 psf for all applications.

2. The following building codes are addressed under this certification:

IBC 2009	– referencing ASCE7-05 and ICC AC-156
IBC 2006	– referencing ASCE7-05 and ICC AC-156
IBC 2003	– referencing ASCE7-02 and ICC AC-156
IBC 2000	– referencing ASCE7-98 and ICC AC-156

3. Refer to the manufacturer supplied installation drawings for anchor requirements and mounting considerations for seismic applications. Required anchor locations, size, style, and load capacities (tension and shear) are specified on the installation drawings. Mounting requirement details such as anchor brand, type, embedment depth, edge spacing, anchor-to-anchor spacing, concrete strength, special inspection, wall design, and attachment to non-building structures must be outlined and approved by the Engineer of Record for the project or building. Structural walls, structural floors, and housekeeping pads must also be seismically designed and approved by the project or building Structural Engineer of Record to withstand the seismic anchor loads as defined on the installation drawings. The installing contractor is responsible for observing the installation detailed in the seismic installation drawings and the proper installation of all anchors and mounting hardware.

4. For this certificate and certification to remain valid, this certificate must correspond to the "Seismic Certification Label" found affixed to the unit by the factory. The label ensures the manufacturer built the unit in conformance to the IBC seismic design criteria set forth by the Certified Seismic Qualification Agency, The VMC Group, and meets the seismic design levels claimed by this certificate.

5. When the site soil properties or final equipment installation location are not known, the soil site coefficient, F_A, defaults to the Soil Site Class D coefficient. Soil Classes A, B, C, D, Seismic Risk Category I, II, III, IV, and Seismic Design Categories A, B, C, D, E, and F are all covered under this certification, limited by the S_{DS} values on page 1, respective to the applicable building code, Importance factor, and z/h ratio.

6. Mechanical, Electrical, and Plumbing connections to the equipment must be flexibly attached as to not transfer load through the connection. The structural integrity of any conduit, cable trays, piping, ductwork and/or flexible connections is the responsibility of others. This certification does not guarantee the equipment will remain compliant to UL or NEMA standards after a seismic event.

John P. Giuliano, PE
President, The VMC Group

IBC CERTIFIED
THE VMC GROUP

Issue Date: February 15, 2011
Revision Date: March 14, 2013
Expiration Date: January 31, 2016

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Effective with sales to the first user on or after August 1, 2014

CATERPILLAR LIMITED WARRANTY

Industrial, Petroleum, Locomotive, and Agriculture Engine Products and Electric Power Generation Products

Worldwide

Caterpillar Inc. or any of its subsidiaries (“Caterpillar”) warrants new and remanufactured engines and electric power generation products sold by it (including any products of other manufacturers packaged and sold by Caterpillar), to be free from defects in material and workmanship.

This warranty does not apply engines sold for use in on-highway vehicle or marine applications; engines in machines manufactured by or for Caterpillar; C175, 3500 and 3600 series engines used in locomotive applications; 3000 Family engines, C0.5 through C4.4 and ACERT™ (C6.6, C7, C7.1, C9, C9.3, C11, C13, C15, C18, C27, and C32) engines used in industrial, mobile agriculture and locomotive applications; or Cat® batteries. These products are covered by other Caterpillar warranties.

This warranty is subject to the following:

Warranty Period

- For industrial engines, engines in a petroleum applications or Petroleum Power Systems (excluding petroleum fire pump application), or engines in a Locomotive application, or Uninterruptible Power Supply (UPS) systems, the warranty period is 12 months after date of delivery to the first user.
- For engines used in petroleum fire pump and mobile agriculture applications the warranty period is 24 months after date of delivery to the first user.
- For controls only (EPIC), configurable and custom switchgear products, and automatic transfer switch products, the warranty period is 24 months after date of delivery to the first user.
- For new CG132, CG170 and CG260 series power generation products the warranty period is 24 months/16,000 hours, whichever comes first, after date of delivery to first user.
- For electric power generation products other than CG132, CG170 and CG260 series in prime or continuous applications the warranty period is 12 months. For standby applications the warranty period is 24 months/1000 hours. For emergency standby applications the warranty period is 24 months/400 hours. All terms begin after date of delivery to the first user.
- For all other applications the warranty period is 12 months after date of delivery to the first user.

Caterpillar Responsibilities

If a defect in material or workmanship is found during the warranty period, Caterpillar will, during normal working hours and at a place of business of a Cat dealer or other source approved by Caterpillar:

- Provide (at Caterpillar’s choice) new, Remanufactured, or Caterpillar approved repaired parts or assembled components needed to correct the defect.

Note: New, remanufactured, or Caterpillar approved repaired parts or assembled components provided under the terms of this warranty are warranted for the remainder of the warranty period applicable to the product in which installed as if such parts were original components of that product. Items replaced under this warranty become the property of Caterpillar.

- Replace lubricating oil, filters, coolant, and other service items made unusable by the defect.
- Provide reasonable and customary labor needed to correct the defect, including labor to disconnect the product from and reconnect the product to its attached equipment, mounting, and support systems, if required.

For new 3114, 3116, and 3126 engines and electric power generation products (including any new products of other manufacturers packaged and sold by Caterpillar):

- Provide travel labor, up to four hours round trip, if in the opinion of Caterpillar, the product cannot reasonably be transported to a place of business of a Cat dealer or other source approved by Caterpillar (travel labor in excess of four hours round trip, and any meals, mileage, lodging, etc. is the user’s responsibility).

For all other products:

- Provide reasonable travel expenses for authorized mechanics, including meals, mileage, and lodging, when Caterpillar chooses to make the repair on-site.

User Responsibilities

The user is responsible for:

- Providing proof of the delivery date to the first user.
- Labor costs, except as stated under “Caterpillar Responsibilities,” including costs beyond those required to disconnect the product from and reconnect the product to its attached equipment, mounting, and support systems.
- Travel or transporting costs, except as stated under “Caterpillar Responsibilities.”
- Premium or overtime labor costs.
- Parts shipping charges in excess of those that are usual and customary.
- Local taxes, if applicable.
- Costs to investigate complaints, unless the problem is caused by a defect in Caterpillar material or workmanship.
- Giving timely notice of a warrantable failure and promptly making the product available for repair.
- Performance of the required maintenance (including use of proper fuel, oil, lubricants, and coolant) and items replaced due to normal wear and tear.
- Allowing Caterpillar access to all electronically stored data.

Limitations

Caterpillar is not responsible for:

- Failures resulting from any use or installation that Caterpillar judges improper.
- Failures resulting from attachments, accessory items, and parts not sold or approved by Caterpillar.
- Failures resulting from abuse, neglect, and/or improper repair.
- Failures resulting from user’s delay in making the product available after being notified of a potential product problem.
- Failures resulting from unauthorized repairs or adjustments, and unauthorized fuel setting changes.
- Damage to parts, fixtures, housings, attachments, and accessory items that are not part of the engine, Cat Selective Catalytic Reduction System or electric power generation product (including any products of other manufacturers packaged and sold by Caterpillar).
- Repair of components sold by Caterpillar that is warranted directly to the user by their respective manufacturer. Depending on type of application, certain exclusions may apply. Consult your Cat dealer for more information.

(Continued on reverse side…)

This warranty covers every major component of the products. Claims under this warranty should be submitted to a place of business of a Cat dealer or other source approved by Caterpillar. For further information concerning either the location to submit claims or Caterpillar as the issuer of this warranty, write Caterpillar Inc., 100 N. E. Adams St., Peoria, IL USA 61629.

Caterpillar's obligations under this Limited Warranty are subject to, and shall not apply in contravention of, the laws, rules, regulations, directives, ordinances, orders, or statutes of the United States, or of any other applicable jurisdiction, without recourse or liability with respect to Caterpillar.

A) For products operating outside of Australia, Fiji, Nauru, New Caledonia, New Zealand, Papua New Guinea, the Solomon Islands and Tahiti, the following is applicable:

NEITHER THE FOREGOING EXPRESS WARRANTY NOR ANY OTHER WARRANTY BY CATERPILLAR, EXPRESS OR IMPLIED, IS APPLICABLE TO ANY ITEM CATERPILLAR SELLS THAT IS WARRANTED DIRECTLY TO THE USER BY ITS MANUFACTURER.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, EXCEPT CATERPILLAR EMISSION-RELATED COMPONENTS WARRANTIES FOR NEW ENGINES, WHERE APPLICABLE. REMEDIES UNDER THIS WARRANTY ARE LIMITED TO THE PROVISION OF MATERIAL AND SERVICES, AS SPECIFIED HEREIN.

CATERPILLAR IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

CATERPILLAR EXCLUDES ALL LIABILITY FOR OR ARISING FROM ANY NEGLIGENCE ON ITS PART OR ON THE PART OF ANY OF ITS EMPLOYEES, AGENTS OR REPRESENTATIVES IN RESPECT OF THE MANUFACTURE OR SUPPLY OF GOODS OR THE PROVISION OF SERVICES RELATING TO THE GOODS.

IF OTHERWISE APPLICABLE, THE VIENNA CONVENTION ON CONTRACTS FOR THE INTERNATIONAL SALE OF GOODS IS EXCLUDED IN ITS ENTIRETY.

For personal or family use engines or electric power generation products, operating in the USA, its territories and possessions, some states do not allow limitations on how long an implied warranty may last nor allow the exclusion or limitation of incidental or consequential damages. Therefore, the previously expressed exclusion may not apply to you. This warranty gives you specific legal rights and you may also have other rights, which vary by jurisdiction. To find the location of the nearest Cat dealer or other authorized repair facility, call (800) 447-4986. If you have questions concerning this warranty or its applications, call or write:

In USA and Canada: Caterpillar Inc., Engine Division, P. O. Box 610, Mossville, IL 61552-0610, Attention: Customer Service Manager, Telephone (800) 447-4986. Outside the USA and Canada: Contact your Cat dealer.

B) For products operating in Australia, Fiji, Nauru, New Caledonia, New Zealand, Papua New Guinea, the Solomon Islands and Tahiti, the following is applicable:

THIS WARRANTY IS IN ADDITION TO WARRANTIES AND CONDITIONS IMPLIED BY STATUTE AND OTHER STATUTORY RIGHTS AND OBLIGATIONS THAT BY ANY APPLICABLE LAW CANNOT BE EXCLUDED, RESTRICTED OR MODIFIED ("MANDATORY RIGHTS"). ALL OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED (BY STATUTE OR OTHERWISE), ARE EXCLUDED. WITHOUT LIMITING THE FOREGOING PROVISIONS OF THIS PARAGRAPH, WHERE A PRODUCT IS SUPPLIED FOR BUSINESS PURPOSES, THE CONSUMER GUARANTEES UNDER THE CONSUMER GUARANTEES ACT 1993 (NZ) WILL NOT APPLY.

NEITHER THIS WARRANTY NOR ANY OTHER CONDITION OR WARRANTY BY CATERPILLAR, EXPRESS OR IMPLIED (SUBJECT ONLY TO THE MANDATORY RIGHTS), IS APPLICABLE TO ANY ITEM CATERPILLAR SELLS THAT IS WARRANTED DIRECTLY TO THE USER BY ITS MANUFACTURER.

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IF OTHERWISE APPLICABLE, THE VIENNA CONVENTION ON CONTRACTS FOR THE INTERNATIONAL SALE OF GOODS IS EXCLUDED IN ITS ENTIRETY.

C) For products supplied in Australia:

IF THE PRODUCTS TO WHICH THIS WARRANTY APPLIES ARE:

I. PRODUCTS OF A KIND ORDINARILY ACQUIRED FOR PERSONAL, DOMESTIC OR HOUSEHOLD USE OR CONSUMPTION; OR

II. PRODUCTS THAT COST AUD 40,000 OR LESS,

WHERE THOSE PRODUCTS WERE NOT ACQUIRED FOR THE PURPOSE OF RE-SUPPLY OR FOR THE PURPOSE OF USING THEM UP OR TRANSFORMING THEM IN THE COURSE OF PRODUCTION OR MANUFACTURE OR IN THE COURSE OF REPAIRING OTHER GOODS OR FIXTURES, THEN THIS SECTION C APPLIES.

THE FOLLOWING MANDATORY TEXT IS INCLUDED PURSUANT TO THE AUSTRALIAN CONSUMER LAW AND INCLUDES REFERENCES TO RIGHTS THE USER MAY HAVE AGAINST THE DIRECT SUPPLIER OF THE PRODUCTS: OUR GOODS COME WITH GUARANTEES THAT CANNOT BE EXCLUDED UNDER THE AUSTRALIAN CONSUMER LAW. YOU ARE ENTITLED TO A REPLACEMENT OR REFUND FOR A MAJOR FAILURE AND COMPENSATION FOR ANY OTHER REASONABLY FORESEEABLE LOSS OR DAMAGE. YOU ARE ALSO ENTITLED TO HAVE THE GOODS REPAIRED OR REPLACED IF THE GOODS FAIL TO BE OF ACCEPTABLE QUALITY AND THE FAILURE DOES NOT AMOUNT TO A MAJOR FAILURE. THE INCLUSION OF THIS TEXT DOES NOT CONSTITUTE ANY REPRESENTATION OR ACCEPTANCE BY CATERPILLAR OF LIABILITY TO THE USER OR ANY OTHER PERSON IN ADDITION TO THAT WHICH CATERPILLAR MAY HAVE UNDER THE AUSTRALIAN CONSUMER LAW.

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THE WARRANTY SET OUT IN THIS DOCUMENT IS GIVEN BY CATERPILLAR INC. OR ANY OF ITS SUBSIDIARIES, 100 N. E. ADAMS ST, PEORIA, IL USA 61629, TELEPHONE 1 309 675 1000, THE USER IS RESPONSIBLE FOR ALL COSTS ASSOCIATED WITH MAKING A CLAIM UNDER THE WARRANTY SET OUT IN THIS DOCUMENT, EXCEPT AS EXPRESSLY STATED OTHERWISE IN THIS DOCUMENT, AND THE USER IS REFERRED TO THE BALANCE OF THE DOCUMENT TERMS CONCERNING CLAIM PROCEDURES, CATERPILLAR RESPONSIBILITIES AND USER RESPONSIBILITIES.

TO THE EXTENT PERMISSIBLE BY LAW, THE TERMS SET OUT IN THE REMAINDER OF THIS WARRANTY DOCUMENT (INCLUDING SECTION B) CONTINUE TO APPLY TO PRODUCTS TO WHICH THIS SECTION C APPLIES.

Submittal for Approval

Section II
Engine/Genset

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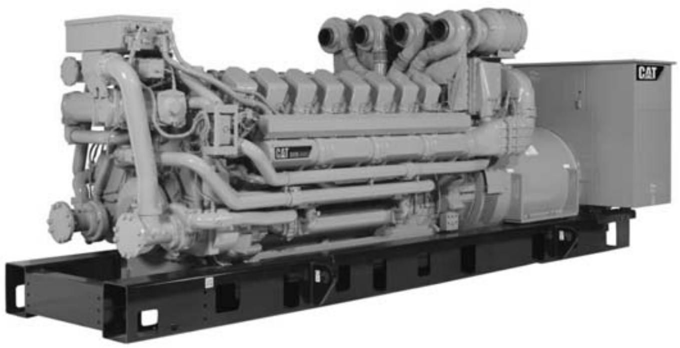

Caterpillar is leading the power generation marketplace with Power Solutions engineered to deliver unmatched flexibility, expandability, reliability, and cost-effectiveness.

Specifications

Generator Set Specifications	
Minimum Rating	2500 ekW (2500 kVA)
Maximum Rating	3100 ekW (3100 kVA)
Voltage	220 - 13800 Volts
Frequency	50 Hz or 60 Hz
Speed	1500 or 1800 RPM

Generator Set Configurations	
Emissions/Fuel Strategy	Low Fuel Consumption, U.S. EPA Certified for Stationary Emergency Use Only (Tier 2 Nonroad Equivalent Emission Standards)

Engine Specifications		
Engine Model	C175-16 SCAC, V-16, 4-Stroke Water-Cooled Diesel	
Compression Ratio 50 Hz	16:7:1	
Compression Ratio 60 Hz	15:3:1	
Aspiration	Turbo Aftercooled	
Governor Type	ADEM™ A4	
Fuel System	Common Rail	
Bore	175 mm	8.89 in
Displacement	84.67 L	5155.88 in³
Stroke	220 mm	8.66 in

Benefits And Features

Cat Diesel Engine

- Reliable, rugged, durable design
- Field-proven in thousands of applications worldwide
- Four-stroke-cycle diesel engine combines consistent performance and excellent fuel economy with minimum weight

Generator

- Matched to the performance and output characteristics of Cat engines
- Industry leading mechanical and electrical design
- Industry leading motor starting capabilities
- High Efficiency

Cat EMCP Control Panel

The EMCP controller features the reliability and durability you have come to expect from your Cat equipment. EMCP4 is a scalable control platform designed to ensure reliable generator set operation, providing extensive information about power output and engine operation. EMCP4 systems can be further customized to meet your needs through programming and expansion modules.

Seismic Certification

- Seismic Certification available.
- Anchoring details are site specific, and are dependent on many factors such as generator set size, weight, and concrete strength.
- IBC Certification requires that the anchoring system used is reviewed and approved by a Professional Engineer
- Seismic Certification per Applicable Building Codes: IBC 2000, IBC 2003, IBC 2006, IBC 2009, CBC 2007, CBC 2010
- Pre-approved by OSHPD and carries an OSP-0321-10 for use in healthcare projects in California

Design Criteria

The generator set accepts 100% rated load in one step per NFPA 110 and meets ISO 8528-5 transient response.

UL 2200 / CSA - Optional

- UL 2200 listed packages
- CSA Certified
- Certain restrictions may apply.
- Consult with your Cat® Dealer.

Single-Source Supplier

Fully prototype tested with certified torsional vibration analysis available

World Wide Product Support

Cat Dealers provide extensive post sale support including maintenance and repair agreements. Cat dealers have over 1,800 dealer branch stores operating in 200 countries. The Cat® SOSSM program cost effectively detects internal engine component condition, even the presence of unwanted fluids and combustion by-products.

Standard Equipment

Air Inlet

- Air Cleaner

Exhaust

- Exhaust flange outlet

Fuel

- Primary fuel filter with integral water separator
- Secondary fuel filter
- Fuel priming pump

Generator

- Matched to the performance and output characteristics of Cat engines
- IP23 Protection

Power Termination

- Bus Bar

Control Panel

- EMCP 4 Genset Controller

General

- Paint - Caterpillar Yellow except rails and radiators gloss black

Optional Equipment

Exhaust

- Exhaust mufflers

Generator

- Anti-condensation heater
- Internal excitation (IE)
- Permanent magnet excitation (PMG)
- Oversize and premium generators

Power Termination

- Circuit breakers, UL listed
- Circuit breakers, IEC compliant

Control Panels

- EMCP 4.2
- EMCP 4.3
- EMCP 4.4
- Generator temperature monitoring & protection
- Load share module
- Digital I/O module
- Remote monitoring software

Mounting

- Rubber anti-vibration mounts
- Spring-type vibration isolator
- IBC isolators

Starting/Charging

- Battery chargers
- Oversize batteries
- Jacket water heater
- Heavy-duty starting system
- Charging alternator
- Air starting motor with control and silencer

General

- The following options are based on regional and product configuration:
- Seismic Certification per applicable building codes: IBC 2000, IBC 2003, IBC 2006, IBC 2009, CBC 2007
- UL 2200 package
- EU Certificate of Conformance (CE)
- CSA Certification
- EEC Declaration of Conformity
- Enclosures: sound attenuated, weather protective
- Automatic transfer switches (ATS)
- Integral & sub-base fuel tanks
- Integral & sub-base UL listed dual wall fuel tanks

Rating Type: STANDBY

Emissions: U.S. EPA Certified for Stationary Emergency Use Only (Tier 2 Nonroad Equivalent Emission Standards)

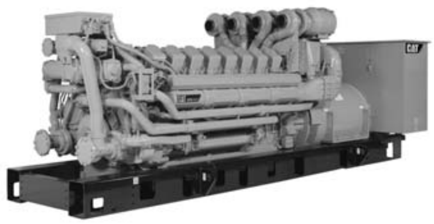

Image shown may not reflect actual configuration

C175-16 ACERT

3000 ekW/ 3750 kVA
60 Hz/ 1800 rpm/ 12470 V

	Metric	English
Package Performance		
Genset Power Rating with Fan @ 0.8 Power Factor	3000 ekW	
Genset Power Rating	3750 kVA	
Aftercooler (Separate Circuit)	46.0 ° C	114.8 ° F
Fuel Consumption		
100% Load with Fan	810.7 L/hr	214.2 gal/hr
75% Load with Fan	625.8 L/hr	165.3 gal/hr
50% Load with Fan	493.6 L/hr	130.4 gal/hr
25% Load with Fan	305.0 L/hr	80.6 gal/hr
Cooling System[1]		
Engine Coolant Capacity	303.5 L	80.2 gal
Inlet Air		
Combustion Air Inlet Flow Rate	276.7 m³/min	9772.2 cfm
Max. Allowable Combustion Air Inlet Temp	55 ° C	131 ° F
Exhaust System		
Exhaust Stack Gas Temperature	477.7 ° C	891.9 ° F
Exhaust Gas Flow Rate	725.6 m³/min	25620.0 cfm
Exhaust System Backpressure (Maximum Allowable)	6.7 kPa	27.0 in. water

C175-16 ACERT
3000 ekW/ 3750 kVA/ 60 Hz/ 1800 rpm/ 12470 V/ 0.8 Power Factor

Rating Type: STANDBY

Emissions: U.S. EPA Certified for Stationary Emergency Use Only (Tier 2 Nonroad Equivalent Emission Standards)

Heat Rejection		
Heat Rejection to Jacket Water	1379 kW	78436 Btu/min
Heat Rejection to Exhaust (Total)	3149 kW	179063 Btu/min
Heat Rejection to Aftercooler	N/A	N/A
Heat Rejection to Atmosphere from Engine	147 kW	8336 Btu/min
Heat Rejection to Atmosphere from Generator	178 kW	10123 Btu/min

Alternator[2]	
Motor Starting Capability @ 30% Voltage Dip	7879 skVA
Current	174 amps
Frame Size	3020
Excitation	PM
Temperature Rise	130 ° C

Emissions (Nominal)[3]		
NOx	3113.9 mg/Nm³	6.1 g/hp-hr
CO	325.6 mg/Nm³	0.7 g/hp-hr
HC	40.7 mg/Nm³	0.1 g/hp-hr
PM	13.0 mg/Nm³	0.0 g/hp-hr

DEFINITIONS AND CONDITIONS

1. For ambient and altitude capabilities consult your Cat dealer. Air flow restriction (system) is added to existing restriction from factory.

2. UL 2200 Listed packages may have oversized generators with a different temperature rise and motor starting characteristics. Generator temperature rise is based on a 40° C ambient per NEMA MG1-32.

3. Emissions data measurement procedures are consistent with those described in EPA CFR 40 Part 89, Subpart D & E and ISO8178-1 for measuring HC, CO, PM, NOx. Data shown is based on steady state operating conditions of 77° F, 28.42 in HG and number 2 diesel fuel with 35° API and LHV of 18,390 btu/lb. The nominal emissions data shown is subject to instrumentation, measurement, facility and engine to engine variations. Emissions data is based on 100% load and thus cannot be used to compare to EPA regulations which use values based on a weighted cycle.

C175-16 ACERT
3000 ekW/ 3750 kVA/ 60 Hz/ 1800 rpm/ 12470 V/ 0.8 Power Factor

Rating Type: STANDBY

Emissions: U.S. EPA Certified for Stationary Emergency Use Only (Tier 2 Nonroad Equivalent Emission Standards)

Applicable Codes and Standards:
AS1359, CSA C22.2 No100-04, UL142,UL489, UL869, UL2200,
NFPA37, NFPA70, NFPA99, NFPA110, IBC, IEC60034-1, ISO3046, ISO8528,
NEMA MG1-22,NEMA MG1-33, 2006/95/EC, 2006/42/EC, 2004/108/EC.

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

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 power rating. Typical operation is 200 hours per year, with maximum expected usage of 500 hours per year.

Ratings are based on SAE J1349 standard conditions. These ratings also apply at ISO3046 standard conditions

Fuel Rates are based on fuel oil of 35º API [16º C (60º F)] gravity having an LHV of 42 780 kJ/kg (18,390 Btu/lb) when used at 29º C (85º F) and weighing 838.9 g/liter (7.001 lbs/U.S. gal.). Additional ratings may be available for specific customer requirements, contact your Cat representative for details. For information regarding Low Sulfur fuel and Biodiesel capability, please consult your Cat dealer.

www.Cat-ElectricPower.com

Performance No.: DM8448-06

Feature Code: 175DR84

Generator Arrangement: 3753666

Date: 07/04/2016

Source Country: U.S.

Performance Number: DM8448 **Change Level: 06**

SALES MODEL:	C175-16	**COMBUSTION:**	DI
BRAND:	CAT	**ENGINE SPEED (RPM):**	1,800
ENGINE POWER (BHP):	4,423	**HERTZ:**	60
GEN POWER WITH FAN (EKW):	3,000.0	**FAN POWER (HP):**	187.7
COMPRESSION RATIO:	15.3	**ASPIRATION:**	TA
RATING LEVEL:	STANDBY	**AFTERCOOLER TYPE:**	SCAC
PUMP QUANTITY:	2	**AFTERCOOLER CIRCUIT TYPE:**	JW+OC+1AC, 2AC
FUEL TYPE:	DIESEL	**AFTERCOOLER TEMP (F):**	115
MANIFOLD TYPE:	DRY	**JACKET WATER TEMP (F):**	210.2
GOVERNOR TYPE:	ADEM4	**TURBO CONFIGURATION:**	PARALLEL
ELECTRONICS TYPE:	ADEM4	**TURBO QUANTITY:**	4
CAMSHAFT TYPE:	STANDARD	**TURBOCHARGER MODEL:**	GTB6251BN-48T-1.38
IGNITION TYPE:	CI	**CERTIFICATION YEAR:**	2008
INJECTOR TYPE:	CR	**CRANKCASE BLOWBY RATE (FT3/HR):**	2,436.4
FUEL INJECTOR:	3198470	**FUEL RATE (RATED RPM) NO LOAD (GAL/HR):**	25.1
REF EXH STACK DIAMETER (IN):	14	**PISTON SPD @ RATED ENG SPD (FT/MIN):**	2,598.4

INDUSTRY	SUBINDUSTRY	APPLICATION
ELECTRIC POWER	STANDARD	PACKAGED GENSET

General Performance Data

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	BRAKE MEAN EFF PRES (BMEP)	BRAKE SPEC FUEL CONSUMPTN (BSFC)	VOL FUEL CONSUMPTN (VFC)	INLET MFLD PRES	INLET MFLD TEMP	EXH MFLD TEMP	EXH MFLD PRES	ENGINE OUTLET TEMP
EKW	%	BHP	PSI	LB/BHP-HR	GAL/HR	IN-HG	DEG F	DEG F	IN-HG	DEG F
3,000.0	100	4,423	377	0.339	214.2	91.5	131.3	1,229.8	64.3	891.9
2,700.0	90	3,999	341	0.338	192.9	81.4	129.6	1,193.4	56.5	879.2
2,400.0	80	3,576	305	0.340	173.9	73.0	128.3	1,163.0	50.0	869.4
2,250.0	75	3,364	286	0.344	165.3	69.5	127.8	1,150.7	47.5	865.8
2,100.0	70	3,152	268	0.351	158.2	67.1	127.6	1,142.6	45.8	864.2
1,800.0	60	2,729	232	0.371	144.5	62.7	127.3	1,127.7	42.8	861.6
1,500.0	50	2,305	196	0.396	130.4	57.5	126.9	1,109.9	39.5	858.0
1,200.0	40	1,882	160	0.417	112.2	46.4	125.8	1,083.9	32.9	848.4
900.0	30	1,458	124	0.440	91.6	34.8	124.5	1,041.6	25.3	834.7
750.0	25	1,246	106	0.453	80.6	29.0	123.8	1,014.2	21.3	826.5
600.0	20	1,035	88	0.467	69.1	23.2	123.2	961.6	17.6	797.3
300.0	10	611	52	0.514	44.9	11.7	122.1	752.4	10.6	649.3

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	COMPRESSOR OUTLET PRES	COMPRESSOR OUTLET TEMP	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	IN-HG	DEG F	CFM	CFM	LB/HR	LB/HR	FT3/MIN	FT3/MIN
3,000.0	100	4,423	92	451.5	9,772.2	25,620.0	42,761.1	44,259.6	9,320.0	8,667.2
2,700.0	90	3,999	82	414.6	8,943.0	23,086.1	38,888.2	40,238.8	8,477.9	7,889.0
2,400.0	80	3,576	74	384.7	8,243.6	20,980.8	35,642.2	36,860.0	7,761.6	7,230.7
2,250.0	75	3,364	70	373.0	7,953.8	20,121.0	34,304.6	35,462.7	7,463.6	6,958.6
2,100.0	70	3,152	68	366.1	7,753.3	19,531.3	33,379.1	34,486.9	7,254.0	6,770.2
1,800.0	60	2,729	65	354.0	7,382.3	18,480.5	31,695.8	32,707.6	6,876.9	6,433.3
1,500.0	50	2,305	60	339.0	6,952.0	17,314.7	29,788.0	30,700.3	6,460.8	6,059.1
1,200.0	40	1,882	50	308.0	6,076.8	15,264.4	25,920.8	26,704.4	5,737.4	5,392.5
900.0	30	1,458	39	267.2	5,160.3	12,786.8	21,909.9	22,550.1	4,857.0	4,574.5
750.0	25	1,246	33	243.5	4,701.8	11,409.7	19,919.4	20,483.0	4,361.8	4,112.2
600.0	20	1,035	27	217.8	4,243.2	9,964.4	17,938.9	18,422.6	3,897.7	3,682.5
300.0	10	611	14	160.9	3,325.6	6,901.7	14,007.7	14,322.1	3,060.0	2,917.8

PERFORMANCE DATA[DM8448]

Heat Rejection Data

PUMP POWER IS INCLUDED IN HEAT REJECTION BALANCE, BUT IS NOT SHOWN.

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	REJECTION TO JACKET WATER	REJECTION TO ATMOSPHERE	REJECTION TO EXH	EXHUAST RECOVERY TO 350F	FROM OIL COOLER	FROM 2ND STAGE 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
3,000.0	100	4,423	78,436	8,336	179,063	101,475	24,486	28,224	187,548	459,719	489,716
2,700.0	90	3,999	70,525	7,773	161,695	89,988	22,085	23,040	169,590	414,639	441,694
2,400.0	80	3,576	63,777	7,308	147,071	80,799	19,915	18,972	151,631	373,899	398,296
2,250.0	75	3,364	60,840	7,112	140,788	77,146	18,917	17,358	142,651	355,157	378,331
2,100.0	70	3,152	58,599	6,984	136,398	74,726	18,070	16,328	133,672	339,264	361,402
1,800.0	60	2,729	54,754	6,750	128,972	70,419	16,496	14,928	115,714	309,709	329,917
1,500.0	50	2,305	50,870	6,524	120,720	65,533	14,875	13,738	97,755	279,270	297,493
1,200.0	40	1,882	45,639	6,304	106,679	55,828	12,823	11,188	79,796	240,744	256,453
900.0	30	1,458	38,952	6,092	88,655	45,754	10,475	8,227	61,838	196,664	209,497
750.0	25	1,246	35,102	5,988	78,431	40,805	9,211	6,848	52,858	172,945	184,229
600.0	20	1,035	30,773	5,789	67,509	34,336	7,896	5,681	43,879	148,253	157,927
300.0	10	611	20,277	4,828	43,873	17,588	5,132	4,028	25,920	96,361	102,649

Sound Data

SOUND DATA REPRESENTATIVE OF NOISE PRODUCED BY THE "ENGINE ONLY"

EXHAUST: Sound Power (1/3 Octave Frequencies)

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	OVERALL SOUND	100 HZ	125 HZ	160 HZ	200 HZ	250 HZ	315 HZ	400 HZ	500 HZ	630 HZ	800 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
3,000.0	100	4,423	134.5	109.7	115.8	113.7	115.5	116.0	119.0	119.9	121.5	120.4	121.2
2,700.0	90	3,999	133.2	110.2	116.1	112.6	114.3	114.5	117.3	118.4	120.1	118.3	119.5
2,400.0	80	3,576	132.0	111.6	116.6	111.0	112.7	113.0	115.6	116.9	118.4	116.5	117.7
2,250.0	75	3,364	131.4	112.4	116.8	110.2	111.9	112.3	114.8	116.2	117.6	115.6	116.8
2,100.0	70	3,152	130.7	113.2	117.1	109.3	111.1	111.6	114.0	115.5	116.8	114.7	115.9
1,800.0	60	2,729	129.5	114.8	117.6	107.5	109.4	110.2	112.3	114.1	115.1	113.0	114.0
1,500.0	50	2,305	128.2	116.3	118.1	105.8	107.8	108.7	110.6	112.6	113.4	111.2	112.2
1,200.0	40	1,882	127.0	117.9	118.6	104.1	106.1	107.3	108.9	111.2	111.8	109.5	110.3
900.0	30	1,458	125.7	119.5	119.1	102.3	104.4	105.9	107.3	109.8	110.1	107.7	108.5
750.0	25	1,246	125.1	120.2	119.3	101.4	103.6	105.2	106.4	109.1	109.3	106.8	107.6
600.0	20	1,035	124.4	121.0	119.6	100.6	102.8	104.5	105.6	108.4	108.4	105.9	106.7
300.0	10	611	123.2	122.6	120.0	98.8	101.1	103.0	103.9	106.9	106.8	104.2	104.8

EXHAUST: Sound Power (1/3 Octave Frequencies)

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	1000 HZ	1250 HZ	1600 HZ	2000 HZ	2500 HZ	3150 HZ	4000 HZ	5000 HZ	6300 HZ	8000 HZ	10000 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
3,000.0	100	4,423	122.2	122.6	123.5	124.9	124.7	123.1	122.4	121.6	120.1	119.0	123.4
2,700.0	90	3,999	120.7	121.0	122.2	123.5	123.2	121.5	120.8	120.0	118.7	117.8	123.8
2,400.0	80	3,576	119.4	119.7	120.8	122.5	121.9	120.4	119.8	119.0	117.7	117.1	123.5
2,250.0	75	3,364	118.8	119.1	120.1	122.0	121.3	119.9	119.4	118.6	117.2	116.8	123.3
2,100.0	70	3,152	118.1	118.5	119.4	121.5	120.6	119.3	119.0	118.2	116.7	116.5	123.1
1,800.0	60	2,729	116.9	117.3	118.0	120.4	119.4	118.3	118.1	117.3	115.6	115.9	122.6
1,500.0	50	2,305	115.6	116.2	116.6	119.4	118.1	117.3	117.2	116.4	114.6	115.3	122.1
1,200.0	40	1,882	114.3	115.0	115.1	118.4	116.8	116.3	116.4	115.6	113.6	114.7	121.6
900.0	30	1,458	113.1	113.8	113.7	117.4	115.6	115.3	115.5	114.7	112.6	114.1	121.1
750.0	25	1,246	112.4	113.2	113.0	116.9	114.9	114.8	115.1	114.3	112.1	113.8	120.9
600.0	20	1,035	111.8	112.6	112.3	116.4	114.3	114.2	114.7	113.9	111.6	113.5	120.7
300.0	10	611	110.5	111.4	110.9	115.4	113.0	113.2	113.8	113.0	110.6	112.9	120.2

Sound Data (Continued)

MECHANICAL: Sound Power (1/3 Octave Frequencies)

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	OVERALL SOUND	100 HZ	125 HZ	160 HZ	200 HZ	250 HZ	315 HZ	400 HZ	500 HZ	630 HZ	800 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
3,000.0	100	4,423	125.9	89.8	105.6	98.4	100.6	104.5	108.3	111.6	113.3	112.5	114.1
2,700.0	90	3,999	125.8	89.4	105.5	97.9	100.9	103.3	108.7	111.1	112.7	112.2	113.8
2,400.0	80	3,576	126.0	89.0	105.0	97.8	99.8	102.4	108.0	111.0	111.8	111.9	113.0
2,250.0	75	3,364	126.1	88.8	104.7	97.8	99.1	102.1	107.5	111.0	111.3	111.7	112.6
2,100.0	70	3,152	126.2	88.5	104.3	97.8	98.4	101.7	107.0	111.0	110.8	111.6	112.2
1,800.0	60	2,729	126.5	88.1	103.7	97.8	96.9	100.9	106.0	111.0	109.8	111.2	111.4
1,500.0	50	2,305	126.7	87.7	103.0	97.8	95.4	100.2	105.1	111.0	108.8	110.9	110.5
1,200.0	40	1,882	127.0	87.3	102.4	97.7	94.0	99.4	104.1	110.9	107.8	110.6	109.7
900.0	30	1,458	127.2	86.9	101.7	97.7	92.5	98.6	103.1	110.9	106.8	110.2	108.9
750.0	25	1,246	127.3	86.7	101.4	97.7	91.8	98.2	102.6	110.9	106.3	110.1	108.5
600.0	20	1,035	127.4	86.4	101.0	97.7	91.0	97.9	102.1	110.9	105.8	109.9	108.1
300.0	10	611	127.7	86.0	100.4	97.7	89.6	97.1	101.2	110.9	104.8	109.6	107.2

MECHANICAL: Sound Power (1/3 Octave Frequencies)

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	1000 HZ	1250 HZ	1600 HZ	2000 HZ	2500 HZ	3150 HZ	4000 HZ	5000 HZ	6300 HZ	8000 HZ	10000 HZ
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
3,000.0	100	4,423	112.7	113.9	114.6	115.3	115.0	112.7	110.9	111.9	114.3	113.4	117.8
2,700.0	90	3,999	112.5	113.7	114.5	115.0	114.5	112.3	110.4	111.1	113.6	112.9	119.2
2,400.0	80	3,576	112.2	113.2	113.8	114.4	114.2	111.9	110.0	110.7	113.2	112.6	121.4
2,250.0	75	3,364	112.0	112.9	113.4	114.0	114.2	111.7	109.8	110.5	112.9	112.6	122.6
2,100.0	70	3,152	111.8	112.6	113.0	113.7	114.1	111.4	109.6	110.3	112.7	112.5	123.8
1,800.0	60	2,729	111.3	112.1	112.2	113.1	113.9	111.0	109.3	110.0	112.3	112.3	126.2
1,500.0	50	2,305	110.9	111.5	111.4	112.4	113.7	110.6	109.0	109.6	111.9	112.1	128.6
1,200.0	40	1,882	110.5	110.9	110.5	111.7	113.5	110.2	108.6	109.3	111.5	111.9	131.0
900.0	30	1,458	110.1	110.3	109.7	111.1	113.4	109.8	108.3	109.0	111.0	111.8	133.4
750.0	25	1,246	109.9	110.0	109.3	110.7	113.3	109.6	108.1	108.8	110.8	111.7	134.6
600.0	20	1,035	109.7	109.7	108.9	110.4	113.2	109.3	107.9	108.6	110.6	111.6	135.8
300.0	10	611	109.3	109.2	108.1	109.7	113.0	108.9	107.6	108.3	110.2	111.4	138.2

Emissions Data

RATED SPEED POTENTIAL SITE VARIATION: 1800 RPM

GENSET POWER WITH FAN		EKW	3,000.0	2,250.0	1,500.0	750.0	300.0
PERCENT LOAD		%	100	75	50	25	10
ENGINE POWER		BHP	4,423	3,364	2,305	1,246	611
TOTAL NOX (AS NO2)		G/HR	32,004	21,429	9,376	3,795	3,518
TOTAL CO		G/HR	5,743	6,479	3,534	5,489	3,566
TOTAL HC		G/HR	647	597	1,048	1,031	1,300
PART MATTER		G/HR	210.2	221.1	203.5	409.7	343.1
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	3,736.7	3,329.4	1,866.7	1,263.6	2,259.3
TOTAL CO	(CORR 5% O2)	MG/NM3	586.2	854.4	602.3	1,594.3	1,701.1
TOTAL HC	(CORR 5% O2)	MG/NM3	54.2	69.1	157.2	265.0	625.2
PART MATTER	(CORR 5% O2)	MG/NM3	18.2	25.6	31.4	103.5	158.0
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	1,820	1,621	909	616	1,101
TOTAL CO	(CORR 5% O2)	PPM	469	684	482	1,275	1,361
TOTAL HC	(CORR 5% O2)	PPM	101	129	294	495	1,167
TOTAL NOX (AS NO2)		G/HP-HR	7.28	6.40	4.08	3.05	5.76
TOTAL CO		G/HP-HR	1.31	1.93	1.54	4.41	5.84
TOTAL HC		G/HP-HR	0.15	0.18	0.46	0.83	2.13
PART MATTER		G/HP-HR	0.05	0.07	0.09	0.33	0.56
TOTAL NOX (AS NO2)		LB/HR	70.56	47.24	20.67	8.37	7.75
TOTAL CO		LB/HR	12.66	14.28	7.79	12.10	7.86
TOTAL HC		LB/HR	1.43	1.32	2.31	2.27	2.87
PART MATTER		LB/HR	0.46	0.49	0.45	0.90	0.76

RATED SPEED NOMINAL DATA: 1800 RPM

PERFORMANCE DATA[DM8448]

October 7, 2016

GENSET POWER WITH FAN		EKW	3,000.0	2,250.0	1,500.0	750.0	300.0
PERCENT LOAD		%	100	75	50	25	10
ENGINE POWER		BHP	4,423	3,364	2,305	1,246	611
TOTAL NOX (AS NO2)		G/HR	26,670	17,858	7,813	3,162	2,931
TOTAL CO		G/HR	3,190	3,599	1,963	3,050	1,981
TOTAL HC		G/HR	486	449	788	776	977
TOTAL CO2		KG/HR	2,143	1,609	1,236	751	416
PART MATTER		G/HR	150.1	157.9	145.3	292.7	245.1
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	3,113.9	2,774.5	1,555.6	1,053.0	1,882.8
TOTAL CO	(CORR 5% O2)	MG/NM3	325.6	474.7	334.6	885.7	945.0
TOTAL HC	(CORR 5% O2)	MG/NM3	40.7	51.9	118.2	199.3	470.1
PART MATTER	(CORR 5% O2)	MG/NM3	13.0	18.3	22.5	73.9	112.8
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	1,517	1,351	758	513	917
TOTAL CO	(CORR 5% O2)	PPM	261	380	268	709	756
TOTAL HC	(CORR 5% O2)	PPM	76	97	221	372	878
TOTAL NOX (AS NO2)		G/HP-HR	6.07	5.33	3.40	2.54	4.80
TOTAL CO		G/HP-HR	0.73	1.07	0.85	2.45	3.24
TOTAL HC		G/HP-HR	0.11	0.13	0.34	0.62	1.60
PART MATTER		G/HP-HR	0.03	0.05	0.06	0.24	0.40
TOTAL NOX (AS NO2)		LB/HR	58.80	39.37	17.22	6.97	6.46
TOTAL CO		LB/HR	7.03	7.94	4.33	6.72	4.37
TOTAL HC		LB/HR	1.07	0.99	1.74	1.71	2.15
TOTAL CO2		LB/HR	4,723	3,547	2,724	1,655	917
PART MATTER		LB/HR	0.33	0.35	0.32	0.65	0.54
OXYGEN IN EXH		%	9.9	10.6	11.8	12.6	14.4
DRY SMOKE OPACITY		%	0.5	0.7	0.6	4.8	4.7
BOSCH SMOKE NUMBER			0.19	0.28	0.24	1.25	1.24

Regulatory Information

EPA TIER 2		2006 - 2010		
GASEOUS EMISSIONS DATA MEASUREMENTS PROVIDED TO THE EPA ARE CONSISTENT WITH THOSE DESCRIBED IN EPA 40 CFR PART 89 SUBPART D 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 NON-ROAD REGULATIONS.				
Locality	**Agency**	**Regulation**	**Tier/Stage**	**Max Limits - G/BKW - HR**
U.S. (INCL CALIF)	EPA	NON-ROAD	TIER 2	CO: 3.5 NOx + HC: 6.4 PM: 0.20

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

ALTITUDE DERATE DATA IS BASED ON THE ASSUMPTION OF A 20 DEGREES CELSIUS(36 DEGREES FAHRENHEIT) DIFFERENCE BETWEEN AMBIENT OPERATING TEMPERATURE AND ENGINE INLET MANIFOLD TEMPERATURE (IMAT). AMBIENT OPERATING TEMPERATURE IS DEFINED AS THE AIR TEMPERATURE MEASURED AT THE TURBOCHARGER COMPRESSOR INLET.

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	4,423	4,423	4,423	4,423	4,423	4,423	4,423	4,423	4,423	4,423	4,423	4,413	4,423
1,000	4,423	4,423	4,423	4,423	4,423	4,423	4,423	4,423	4,423	4,423	4,423	4,362	4,423
2,000	4,423	4,423	4,423	4,423	4,423	4,423	4,423	4,423	4,423	4,382	4,323	4,233	4,423
3,000	4,360	4,360	4,360	4,360	4,360	4,360	4,360	4,360	4,359	4,294	4,200	4,107	4,360
4,000	4,185	4,185	4,185	4,185	4,185	4,185	4,184	4,182	4,181	4,139	4,080	4,021	4,185
5,000	4,019	4,019	4,019	4,019	4,019	4,019	4,018	4,015	4,013	3,992	3,963	3,935	4,019
6,000	3,867	3,867	3,867	3,867	3,867	3,867	3,866	3,862	3,858	3,853	3,846	3,839	3,867
7,000	3,746	3,746	3,746	3,746	3,746	3,746	3,745	3,741	3,737	3,731	3,725	3,718	3,746
8,000	3,626	3,626	3,626	3,626	3,626	3,626	3,624	3,620	3,615	3,610	3,604	3,597	3,626
9,000	3,511	3,511	3,511	3,511	3,511	3,511	3,509	3,505	3,500	3,495	3,489	3,483	3,511
10,000	3,401	3,401	3,401	3,401	3,401	3,401	3,399	3,394	3,390	3,384	3,379	3,373	3,401
11,000	3,290	3,290	3,290	3,290	3,290	3,290	3,288	3,284	3,279	3,274	3,269	3,264	3,290
12,000	3,180	3,180	3,180	3,180	3,180	3,180	3,178	3,173	3,169	3,164	3,159	3,154	3,180
13,000	3,080	3,080	3,080	3,080	3,080	3,080	3,079	3,075	3,071	3,067	3,063	3,059	3,080
14,000	2,982	2,982	2,982	2,982	2,982	2,982	2,981	2,978	2,976	2,973	2,970	2,967	2,982
15,000	2,885	2,885	2,885	2,885	2,885	2,885	2,884	2,882	2,881	2,879	2,877	2,876	2,885

Cross Reference

Test Spec	Setting	Engine Arrangement	Engineering Model	Engineering Model Version	Start Effective Serial Number	End Effective Serial Number
0K8532	LL6018	3079788	GS265	-	WYB00001	WYB00619

Performance Parameter Reference

Parameters Reference:DM9600-08
PERFORMANCE DEFINITIONS

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%
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.

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 29 (84.2), where the density is 838.9 G/Liter (7.001 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 (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.

EMISSIONS DEFINITIONS:
Emissions : DM1176

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 : 7/7/15

MANUFACTURER'S EMISSIONS DATA

CERTIFICATION YEAR: 2016   CERT AGENCY: EPA
EPA ENGINE FAMILY NAME: GCPXL106.NZS

MODEL: C175-16
GENSET RATING (W/ FAN): 3000.0 EKW STANDBY 60 HERTZ @ 1800 RPM
ENGINE DISCPLACEMENT: 5167 CU IN
EMISSIONS POWER CATEGORY: >560 BKW
ENGINE TYPE: 4 Stroke Compression Ignition (Diesel)

GENERAL PERFORMANCE DATA

GEN W/F	ENG PWR	FUEL RATE	FUEL RATE	EXHAUST STACK TEMP	EXHAUST GAS FLOW
EKW	BHP	LB/BHP-HR	GPH	DEF F	CFM
3000.0	4423	0.339	214.2	891.9	25620

DATA REF NO.: DM8448-06

EPA D2 CYCLE CERTIFICATION

	UNITS	CO	HC	NOX	NOX + HC	PM
CERTIFICATION TEST LEVELS	GM/BHP-HR	1.27	0.16	4.17	4.33	0.07
	GM/BKW-HR	1.7	0.22	5.59	5.8	0.09
EPA Tier 2 Max limits*	GM/BHP-HR	2.6	-	-	4.7	0.15
	GM/BKW-HR	3.5	-	-	6.4	0.2

DATA REF: https://www3.epa.gov/otaq/documents/eng-cert/nrci-cert-ghg-2016.xls
REF DATE: 05/10/2016

Gaseous emissions data measurements are consistent with those described in EPA 40 CFR PART 89 SUBPART D and ISO 8178 for measuring HC, CO, PM, and NOx.

***Gaseous emissions values are WEIGHTED CYCLE AVERAGES and are in compliance with the EPA non-road regulations.**

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SD500 | 15.2L | 500 kW

INDUSTRIAL DIESEL GENERATOR SET

EPA Certified Stationary Emergency

GENERAC INDUSTRIAL POWER

Standby Power Rating

500 kW, 625 kVA, 60 Hz

Prime Power Rating*

450 kW, 563 kVA, 60 Hz

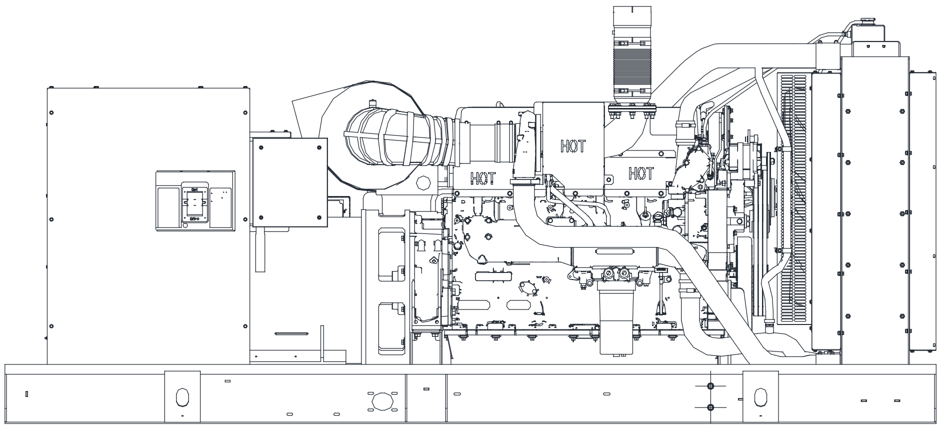

Image used for illustration purposes only

*Built in the USA using domestic and foreign parts

*EPA Certified Prime ratings are not available in the US or its Territories
*Built in the USA using domestic and foreign parts

Codes and Standards

Generac products are designed to the following standards:

UL2200, UL508, UL142, UL489

NFPA 37, 70, 99, 110

NEC700, 701, 702, 708

ISO 3046, 7637, 8528, 9001

NEMA ICS10, MG1, 250, ICS6, AB1

ANSI C62.41

IBC 2009, CBC 2010, IBC 2012, ASCE 7-05, ASCE 7-10, ICC-ES AC-156 (2012)

Powering Ahead

For over 50 years, Generac has provided innovative design and superior manufacturing.

Generac ensures superior quality by designing and manufacturing most of its generator components, including alternators, enclosures and base tanks, control systems and communications software.

Generac gensets utilize a wide variety of options, configurations and arrangements, allowing us to meet the standby power needs of practically every application.

Generac searched globally to ensure the most reliable engines power our generators. We choose only engines that have already been proven in heavy-duty industrial applications under adverse conditions.

Generac is committed to ensuring our customers' service support continues after their generator purchase.

SD500 | 15.2L | 500 kW

INDUSTRIAL DIESEL GENERATOR SET

EPA Certified Stationary Emergency

GENERAC | INDUSTRIAL POWER

STANDARD OPTIONS

ENGINE SYSTEM

- Oil Drain Extension
- Air Cleaner
- Fan Guard
- Stainless Steel Flexible Exhaust Connection
- Critical Exhaust Silencer (Enclosed Only)
- Factory Filled Oil & Coolant
- Radiator Duct Adapter (Open Set Only)

Fuel System

- Primary Fuel Filter

Cooling System

- Closed Coolant Recovery System
- UV/Ozone Resistant Hoses
- Factory-Installed Radiator
- 50/50 Ethylene Glycol Antifreeze
- Radiator Drain Extension
- 120 VAC Coolant Heater

Electrical System

- Battery Charging Alternator
- Battery Cables
- Battery Tray
- Rubber-Booted Engine Electrical Connections
- Solenoid Activated Starter Motor

ALTERNATOR SYSTEM

- UL2200 GENprotect™
- Class H Insulation Material
- Vented Rotor
- 2/3 Pitch
- Skewed Stator
- Amortisseur Winding
- Permanent Magnet Excitation
- Sealed Bearings
- Full Load Capacity Alternator
- Protective Thermal Switch

GENERATOR SET

- Rust-Proof Fasteners with Nylon Washer to Protect Finish
- High Performance Sound-Absorbing Material
- Gasketed Doors
- Air Discharge Hoods for Radiator-Upward Pointing
- Stainless Steel Lift off Door Hinges
- Stainless Steel Lockable Handles
- Rhino Coat™ - Textured Polyester Powder Coat

ENCLOSURE (if selected)

- Rust-Proof Fasteners with Nylon Washers to Protect Finish
- High Performance Sound-Absorbing Material (L1 & L2)
- Gasketed Doors
- Stamped Air-Intake Louvers
- Air Discharge Hoods for Radiator-Upward Pointing
- Stainless Steel Lift Off Door Hinges
- Stainless Steel Lockable Handles
- Rhino Coat™ - Textured Polyester Powder Coat

TANK (if selected)

- UL 142
- Double Wall
- Vents
- Sloped Top
- Sloped Bottom
- Factory Pressure Tested (2 psi)
- Rupture Basin Alarm
- Fuel Level
- Check Valve in Supply and Return Lines
- Rhino Coat™ - Textured Polyester Powder Coat
- Stainless Hardware

CONTROL SYSTEM

Control Panel

- Digital H Control Panel - Dual 4x20 Display
- Programmable Crank Limiter
- 7-Day Programmable Exerciser
- Special Applications Programmable PLC
- RS-232/485
- All-Phase Sensing DVR
- Full System Status
- Utility Monitoring
- 2-Wire Start Compatible
- Power Output (kW)
- Power Factor
- kW Hours, Total & Last Run
- Real/Reactive/Apparent Power
- All Phase AC Voltage
- All Phase Currents
- Oil Pressure
- Coolant Temperature
- Coolant Level
- Engine Speed
- Battery Voltage
- Frequency
- Date/Time Fault History (Event Log)
- Isochronous Governor Control
- Waterproof/Sealed Connectors
- Audible Alarms and Shutdowns
- Not in Auto (Flashing Light)
- Auto/Off/Manual Switch
- E-Stop (Red Mushroom-Type)
- NFPA110 Level I and II (Programmable)
- Customizable Alarms, Warnings, and Events
- Modbus protocol
- Predictive Maintenance Algorithm
- Sealed Boards
- Password Parameter Adjustment Protection
- Single Point Ground
- 15 Channel Data Logging
- 0.2 msec High Speed Data Logging
- Alarm Information Automatically Comes Up On the Display

Alarms

- Oil Pressure (Pre-Programmable Low Pressure Shutdown)
- Coolant Temperature (Pre-Programmed High Temp Shutdown)
- Coolant Level (Pre-Programmed Low Level Shut-down)
- Low Fuel Alarm
- Engine Speed (Pre-Programmed Over Speed Shut-down)
- Battery Voltage Warning
- Alarms & Warnings Time and Date Stamped
- Alarms & Warnings for Transient and Steady State Conditions
- Snap Shots of Key Operation Parameters During Alarms & Warnings
- Alarms and Warnings Spelled Out (No Alarm Codes)

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CONFIGURABLE OPTIONS

ENGINE SYSTEM

- Block Heater (Coolant)
- Crankcase Heater (Oil)
- Critical Grade Silencers
- Fan and Belt Guard (Optional)
- Flexible Fuel Lines Included with Base Tank
- Stone Guard (Open Set Only)

ELECTRICAL SYSTEM

- Battery
- 10A UL Battery Charger
- Battery Warmer

ALTERNATOR SYSTEM

- Alternator Upsizing
- Anti-Condensation Heater

CIRCUIT BREAKER OPTIONS

- Main Line Circuit Breaker
- 2nd Main Line Circuit Breaker
- Shunt Trip and Auxiliary Contact
- Electronic Trip Breakers

GENERATOR SET

- Gen-Link Communications Software (English Only)
- 8 Position Load Center
- Alarm Horn
- Extended Factory Testing
- 2 Year Extended Warranty
- 5 Year Warranty
- 5 Year Extended Warranty
- 7 Year Extended Warranty
- 10 Year Extended Warranty

ENCLOSURE

- Standard Enclosure (Weather)
- Level 1 Sound Attenuation
- Level 2 Sound Attenuation
- Steel Enclosure
- Aluminum Enclosure
- IBC Seismic Certification
- 180 MPH Wind Kit
- AC/DC Enclosure Lighting Kit

CONTROL SYSTEM

- 21-Light Remote Annunciator
- Ground Fault Indication and Protection Functions
- Engine Run Relay 10A (1-NO, 1- NC)
- 120 VAC GFCI outlet
- Oil Temperature Indication
- Remote Relay Panel (8 or 16)
- Remote E-Stop (Break Glass-Type, Surface Mount)
- Remote E-Stop (Red Mushroom-Type, Surface Mount)
- Remote E-Stop (Red Mushroom-Type, Flush Mount)
- Remote Communication - Modem

TANKS (Size On Last Page)

- Electronic Fuel Level
- Mechanical Fuel Level

ENGINEERED OPTIONS

ENGINE SYSTEM

- Fluid Containment Pans
- Coolant Heater Ball Valves

ALTERNATOR SYSTEM

- 3rd Breaker Systems
- Unit Mounted Load Banks

CONTROL SYSTEM

- Spare Inputs (x4) / Outputs (x4) - H Panel Only

GENERATOR SET

- Special Testing
- Battery Box

ENCLOSURE

- Motorized Dampers
- Intrusion Alert Door Switch
- Customer Color

TANKS

- Overfill Protection Valve
- UL 2085 Tank
- ULC S-601 Tank
- Stainless Steel Tank
- Special Fuel Tanks
- Vent Extensions
- 5 Gallon Spill Containment Box
- Dealer Supplied AHJ Requirements

RATING DEFINITIONS

Standby - Applicable for a varying emergency load for the duration of a utility power outage with no overload capability.

Prime - Applicable for supplying power to a varying load in lieu of utility for an unlimited amount of running time. A 10% overload capacity is available for 1 out of every 12 hours. The Prime Power option is only available on International applications. Power ratings in accordance with ISO 8528-1, Second Edition.

APPLICATION AND ENGINEERING DATA

ENGINE SPECIFICATIONS

General

Make	Perkins
Cylinder #	6
Type	In-Line
Displacement - L (cu in)	15.2 (927.56)
Bore - mm (in)	137 (5.39)
Stroke - mm (in)	171 (6.73)
Compression Ratio	16.0:1
Intake Air Method	Turbocharged/Aftercooled
Cylinder Head Type	4-Valve
Piston Type	Aluminum
Crankshaft Type	I-Beam Section

Engine Governing

Governor	Electronic Isochronous
Frequency Regulation (Steady State)	±0.25%

Lubrication System

Oil Pump Type	Gear
Oil Filter Type	Full Flow
Crankcase Capacity - L (qts)	45 (47.55)

Cooling System

Cooling System Type	Closed Recovery
Water Pump Type	Centrifugal Type, Belt-Driven
Fan Type	Pusher
Fan Speed (rpm)	1658
Fan Diameter - mm (in)	927 (36.5)
Coolant Heater Wattage	1500
Coolant Heater Standard Voltage	120 V

Fuel System

Fuel Type	Ultra Low Sulfur Diesel #2
Carburetor	ASTM
Fuel Filtering (microns)	Primary 10 - Secondary 2
Fuel Inject Pump Make	Electronic
Injector Type	MEUI
Engine Type	Pre-Combustion
Fuel Supply Line - mm (in)	12.7 (0.5) NPT
Fuel Return Line - mm (in)	12.7 (0.5) NPT

Engine Electrical System

System Voltage	24 VDC
Battery Charger Alternator	Standard
Battery Size	See Battery Index 0161970SBY
Battery Voltage	(2) 12 VDC
Ground Polarity	Negative

ALTERNATOR SPECIFICATIONS

Standard Model	WEG
Poles	4
Field Type	Revolving
Insulation Class - Rotor	H
Insulation Class - Stator	H
Total Harmonic Distortion	<3%
Telephone Interference Factor (TIF)	<50
Standard Excitation	Permanent Magnet
Bearings	Single Sealed Cartridge
Coupling	Direct, Flexible Disc
Prototype Short Circuit Test	Yes
Voltage Regulator Type	Full Digital
Number of Sensed Phases	All
Regulation Accuracy (Steady State)	±0.25%

OPERATING DATA

POWER RATINGS

	Standby	
Three-Phase 120/208 VAC @0.8pf	500 kW	Amps: 1735
Three-Phase 120/240 VAC @0.8pf	500 kW	Amps: 1504
Three-Phase 277/480 VAC @0.8pf	500 kW	Amps: 752
Three-Phase 346/600 VAC @0.8pf	500 kW	Amps: 601

STARTING CAPABILITIES (sKVA)

sKVA vs. Voltage Dip

480 VAC								208/240 VAC							
Alternator	kW	10%	15%	20%	25%	30%	35%	Alternator	kW	10%	15%	20%	25%	30%	35%
Standard	500	457	686	914	1143	1371	1600	Standard	500	429	643	857	1071	1286	1500
Upsize 1	642	471	707	943	1179	1414	1650	Upsize 1	689	543	814	1086	1357	1629	1900
Upsize 2	832	757	1136	1514	1893	2271	2650	Upsize 2	723	571	857	1143	1429	1714	2000

FUEL CONSUMPTION RATES*

Fuel Pump Lift - ft (m)
12 (3.7)

Total Fuel Pump Flow (Combustion + Return) gph (lph)
121 (457)

Diesel - gph (lph)

Percent Load	Standby
25%	10.5 (39.7)
50%	19.5 (73.8)
75%	23.7 (89.7)
100%	31.2 (118.1)

* Fuel supply installation must accommodate fuel consumption rates at 100% load.

COOLING

		Standby
Coolant Flow per Minute	gpm (lpm)	114.1 (432)
Coolant System Capacity	gal (L)	264 (999)
Heat Rejection to Coolant	BTU/hr	1,198,080
Inlet Air	cfm (m^3/min)	30,582 (866)
Max. Operating Ambient Temperature (Before Derate)	°F (°C)	104 (40)
Maximum Radiator Backpressure	in H_2O	0.50

COMBUSTION AIR REQUIREMENTS

	Standby
Flow at Rated Power cfm (m^3/min)	1483 (42)

ENGINE

		Standby
Rated Engine Speed	rpm	1800
Horsepower at Rated kW**	hp	835
Piston Speed	ft/min	2020
BMEP	psi	366

** Refer to “Emissions Data Sheet” for maximum bHP for EPA and SCAQMD permitting purposes.

EXHAUST

		Standby
Exhaust Flow (Rated Output)	cfm (m^3/min)	3400 (96)
Max. Backpressure (Post Silencer)	in Hg (Kpa)	2.01 (6.8)
Exhaust Temp (Rated Output - Post Silencer)	°F (°C)	1022 (550)
Exhaust Outlet Size (Open Set)	mm (in)	127 (5)

Deration – Operational characteristics consider maximum ambient conditions. Derate factors may apply under atypical site conditions.
Please consult a Generac Power Systems Industrial Dealer for additional details. All performance ratings in accordance with ISO3046, BS5514, ISO8528 and DIN6271 standards.

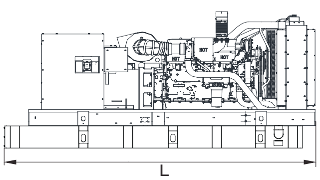
SD500 | 15.2L | 500 kW

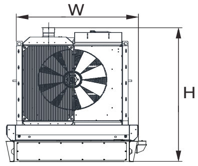
INDUSTRIAL DIESEL GENERATOR SET

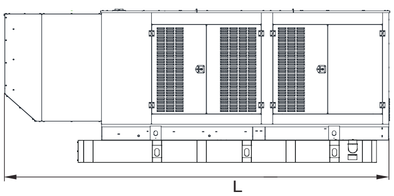
EPA Certified Stationary Emergency

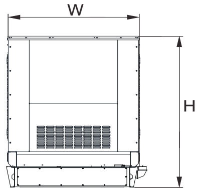
GENERAC | INDUSTRIAL POWER

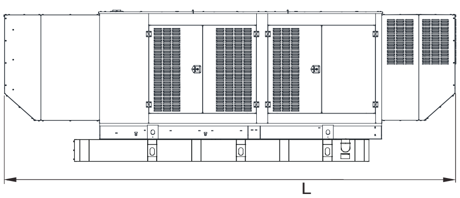
DIMENSIONS AND WEIGHTS*

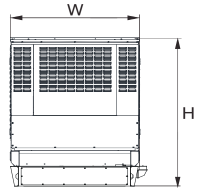


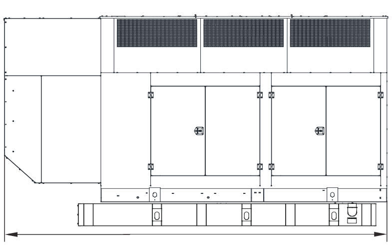


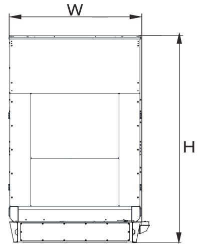












OPEN SET (Includes Exhaust Flex)

Run Time Hours	Usable Capacity Gal (L)	L x W x H (in (mm)	Weight lbs (kg)
No Tank	-	154.4 (3923) x 71 (1803) x 67 (1702)	10580 (4799)
10	334	158.5 (4026) x 71 (1803) x 81 (2057)	12255 (5559)
32	1001	158.5 (4026) x 71 (1803) x 103 (2616)	13180 (6228)
32	1001	228 (5791) x 71 (1803) x 103 (2616)	13730 (6228)
64	2002	290 (7366) x 71 (1803) x 103 (2616)	15430 (6999)

STANDARD ENCLOSURE

Run Time Hours	Usable Capacity Gal (L)	L x W x H (in (mm)	Weight lbs (kg) Enclosure Only	
			Steel	Aluminum
No Tank	-	207.4 (5268) x 71 (1803) x 80 (2032)		
10	334	207.4 (5268) x 71 (1803) x 94 (2388)		
32	1001	207.4 (5268) x 71 (1803) x 116 (2946)	1999 (907)	869 (394)
32	1001	228 (5791) x 71 (1803) x 105 (2667)		
64	2002	290 (7366) x 71 (1803) x 116 (2946)		

LEVEL 1 ACOUSTIC ENCLOSURE

Run Time Hours	Usable Capacity Gal (L)	L x W x H (in (mm)	Weight lbs (kg) Enclosure Only	
			Steel	Aluminum
No Tank	-	247.5 (6285) x 71 (1803) x 80 (2032)		
10	334	247.5 (6285) x 71 (1803) x 94 (2388)		
32	1001	247.5 (6285) x 71 (1803) x 116 (2946)	2782 (1262)	1291 (586)
32	1001	247.5 (6285) x 71 (1803) x 105 (2667)		
64	2002	290 (7366) x 71 (1803) x 116 (2946)		

LEVEL 2 ACOUSTIC ENCLOSURE

Run Time Hours	Usable Capacity Gal (L)	L x W x H (in (mm)	Weight lbs (kg) Enclosure Only	
			Steel	Aluminum
No Tank	-	207.4 (5268) x 71 (1803) x 114 (2899)		
10	334	207.4 (5268) x 71 (1803) x 128 (3251)		
32	1001	207.4 (5268) x 71 (1803) x 150 (3810)	3330 (1510)	1522 (692)
32	1001	228 (5791) x 71 (1803) x 139 (3531)		
64	2002	290 (7366) x 71 (1803) x 150 (3810)		

* All measurements are approximate and for estimation purposes only.

YOUR FACTORY RECOGNIZED GENERAC INDUSTRIAL DEALER

Specification characteristics may change without notice. Dimensions and weights are for preliminary purposes only. Please consult a Generac Power Systems Industrial Dealer for detailed installation drawings.

ATTACHMENT D
CD-ROM OF ELECTRONIC MODELING FILES

Appendix E-2

BAAQMD Application for ATC

To be submitted under separate cover