

June 14, 2018

Colorado Department of Public Health and Environment
Air Pollution Control Division
APCD-SS-B1
4300 Cherry Creek Drive South
Denver, CO 80246-1530

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**Subject: Project Sycamore - Broomfield
Application for Synthetic Minor Source Permit to Construct and Operate
Compression Ignition Engines**

Dear CDPHE:

JP Morgan Chase & Co. (JPMC) is submitting the attached Synthetic Minor Source Permit Application to request authorization to install 16 diesel-fired emergency generators at a new data center located at 2701 W. 160th Ave. Broomfield, CO 80023. Each of the 16 proposed emergency generators (GEN 01-16), is rated at 2,500 kilowatts (kW). Additionally, each generator will have an associated 14,230-gallon capacity above ground storage tank (AST) which will be exempt from Air Pollutant Emission Notice (APEN) requirements per the Code of Colorado Regulations (CCR) 1001-5 Part A Regulation No. 3, Section II.D.1.fff.

All emergency generators at the facility will operate primarily for maintenance and testing purposes and as needed to provide emergency backup power in the event of utility power or onsite power system interruptions. The potential-to-emit (PTE) for the site exceeds 100 tons per year for nitrogen oxides (NO_x), using the 500 hours per year of total operation as a calculation basis. However, the total annual operation of each generator will not exceed 200 hours per year to limit the PTE for the site to less than 100 tpy of any criteria pollutant. Thus, the data center will be considered a synthetic minor source as described in CCR 1001-5 Part G Regulation No. 3, Section IL.5. The facility will maintain monthly records of operating hours and emissions on-site for annual reporting requirements. Additionally, this facility will be located within the Denver ozone nonattainment area and as such, an air dispersion modeling demonstration will be submitted under separate cover. Enclosed with this application package is the following documentation:

- Project description, emission calculation methodology, and regulatory applicability analysis;
- APEN forms for compression ignition engines for GEN 01 through 16 (Appendix A);
- Detailed emission calculations (Appendix B); and
- Engine Performance Data Sheets (Appendix C).

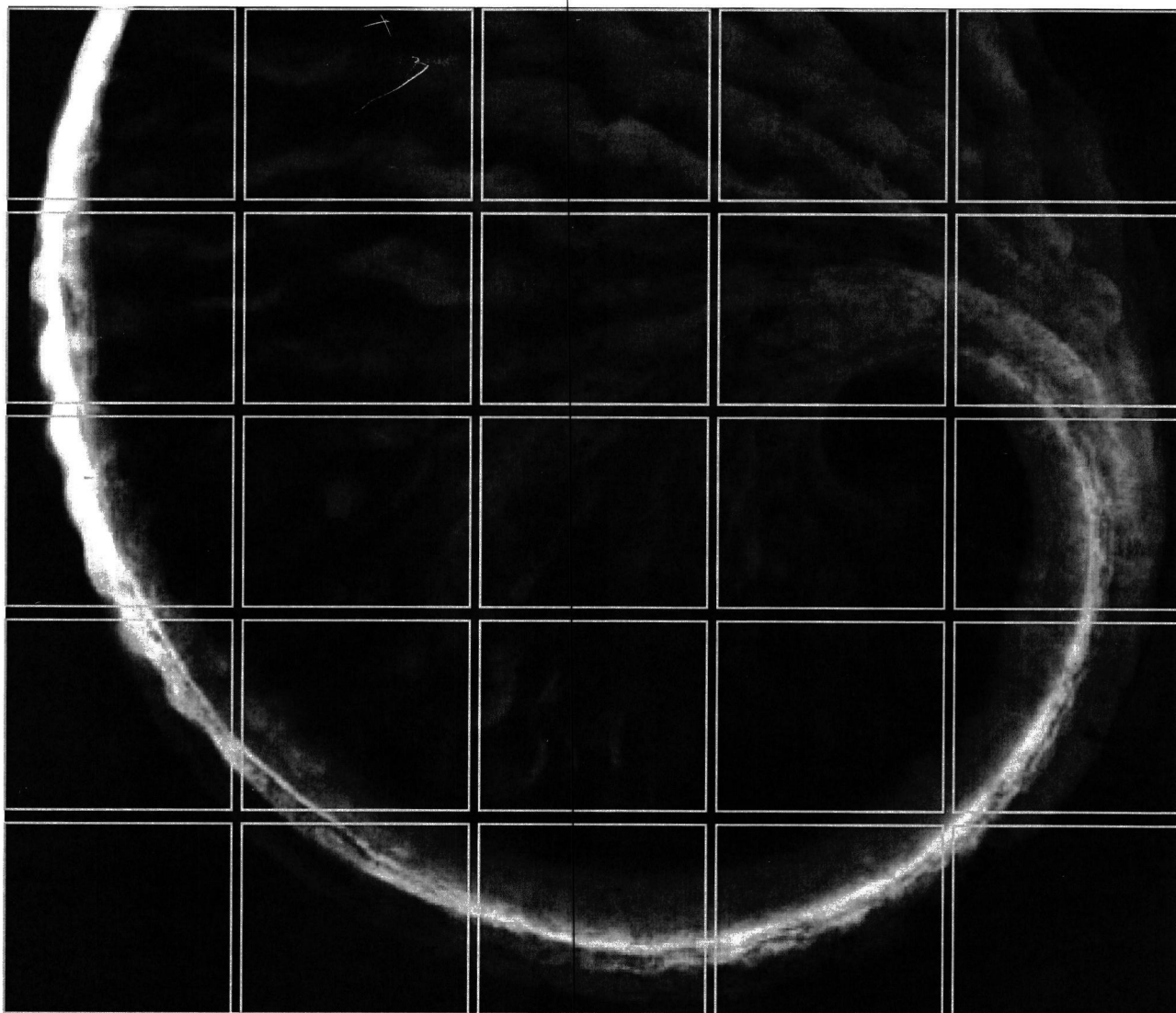
The facility proposes to install the new emergency generators and associated diesel storage tanks at the data center starting September 2018. Operation of these units will begin in the fourth quarter of 2018.

We appreciate your assistance in this matter. Should you have any questions or need any additional information regarding this application, please contact me at (404) 455-1307 or Tiffany Johnston of Environmental Resources Management Inc. (ERM) at (513) 830-9062. Thank you.

Sincerely,

Glen Stewart, MEP Manager

cc: Tiffany Johnston - ERM
Stuart Love - Holder Construction



**Project Sycamore - Broomfield
JP Morgan Chase & Co.**

**Application for Synthetic Minor Source Permit to
Construct and Operate**

June 2018

ERM Project No. 0461225

Project Sycamore – Broomfield
JP Morgan Chase & Co.

Application for Synthetic Minor Source Permit to Construct and Operate

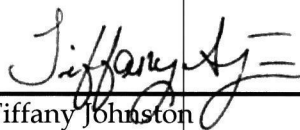
June 2018

2701 W. 160th Ave.
Broomfield, CO 80023



Sid Rajmohan

Partner-in-Charge



Tiffany Johnston

Project Manager

Environmental Resources Management
9825 Kenwood Road, Suite 100
Cincinnati, Ohio 45242
513-830-9030

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1.0 INTRODUCTION

Project Sycamore - Broomfield ("the facility", "the data center") is located at 2701 W. 160th Avenue, Broomfield, CO, 80023 in Broomfield County. Broomfield County is classified as a nonattainment area for 8-hour ozone. With this submittal, JP Morgan Chase & Co. (JPMC) requests the authorization to construct and operate 16 2,500 kilowatt (kW) emergency generators through the submittal of this application. The proposed units result in a facility-wide potential to emit (PTE) of more than 100 tons per year (tpy) of any criteria pollutant. However the facility will limit the hours of each generator to limit the PTE for the site to less than 100 tpy to be considered a synthetic minor source. Additionally, this facility will be located within the Denver ozone nonattainment area and as such, an air dispersion modeling demonstration will be submitted under separate cover.

2.0 PROJECT DESCRIPTION

With this application, the facility seeks to authorize the construction and operation of 16 Cummins Model QSK78-G12 diesel-fired emergency standby generators each rated at 3,028 kWm (4,060 BHP). Each generator will have an associated 14,230-gallon capacity above ground storage tank (AST), which will be exempt from APEN requirements per the Code of Colorado Regulations (CCR) 1001-5 Part A Regulation No. 3, Section II.D.1.fff and therefor exempt from construction permit requirements per CCR 1001-5 Part B Regulation No. 3 Section II.D.1.a. Aside from operation for maintenance and testing purposes, the generators will be used to provide emergency power to support data center operations in the event of utility power interruption or on site equipment failure.

Each generator will typically operate for less than 100 hours per year for non-emergency use at a load of 50% or less. The generators will not be used as part of an Emergency Demand Response program or for peak shaving purposes. Title 40 of the Code of Federal Regulations Part 60 (40 CFR 60) Subpart IIII - *New Source Performance Standards for Stationary Compression Ignition Internal Combustion Engines (NSPS IIII)* requires that each applicable engine will fire only ultra-low sulfur diesel fuel and be operated for no more than 100 hours per year for maintenance and testing or other permissible non-emergency purposes. These engines will comply with the applicable NSPS IIII fuel sulfur content limitations, operational limitations applicable to emergency engines, and manufacturer operating requirements. All of the generators are considered new sources located at an area source of Hazardous Air Pollutants (HAPs). As such, the units will comply with 40 CFR 63 Subpart ZZZZ - *National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines (NESHAP ZZZZ)* requirements by complying with the requirements of NSPS IIII. No further requirements for such engines apply under NESHAP ZZZZ, per 40 CFR 63.6590(c) (1).

Based on the generators' PTE, which is calculated at 500 hours per year and 100% load, the site will emit more than 100 tons of NO_x each year. However, JPMC will limit total annual operation of each generator to a maximum of 200 hours per

year resulting in the PTE for the site to be less than 100 tpy of any criteria pollutant. Thus they will be considered a synthetic minor source as described in CCR 1001-5 Part G Regulation No. 3, Section IL.5. The facility will maintain monthly records of operating hours and emissions on site for annual reporting requirements.

A table summarizing the applicability and requirements for the engines is included as Table 4-1 in Section 4.3.

3.0 EMISSION CALCULATION METHODOLOGY

This section discusses emission calculation methodologies for the proposed diesel storage tanks and emergency generators. A summary of the facility-wide PTE is included in Table B-1 of Appendix B.

3.1.1 EMERGENCY ENGINES

Emissions from the 16 emergency generators (GEN01 through GEN16) were calculated using a combination of manufacturer-supplied emission factors from the specification sheets in Appendix C and emission factors for large diesel engines from AP-42 Chapter 3, Table 3.4-1. Detailed emission calculations and emission factors for the emergency engines are included in Table 2 of Appendix B. The actual facility-wide PTE will not exceed 100 tpy of any major criteria pollutant nor will the actual PTE exceed 250 pounds (lbs) per year of any non-criteria pollutant as summarized in the table below.

Table 1: Emissions Summary

Pollutant	Limited PTE (tpy) ^[1]		PTE (tpy) ^[2]	
	Per Generator	Facility-Wide	Per Generator	Facility-Wide
TSP (PM) ^[3,4]	0.09	1.43	0.22	3.58
PM ₁₀ ^[3,4]	0.09	1.43	0.22	3.58
PM _{2.5} ^[3,4]	0.09	1.43	0.22	3.58
SO _x ^[5]	4.9E-03	0.08	0.01	0.20
NO _x ^[4]	3.76	60.15	9.40	150.37
CO ^[4]	0.63	10.02	1.57	25.06
VOC ^[5]	0.29	4.58	0.72	11.45
Total HAP ^[5]	3.5E-03	0.06	8.6E-03	0.14

1. Limited potential emissions for the site are estimated based on a total of 200 operating hours per year, per generator.
2. Potential emissions for the site are estimated based on a maximum of 500 operating hours per year, per generator.
3. It is conservatively assumed that Total Suspended Particles (TSP, or PM), PM₁₀, and PM_{2.5} are equivalent.
4. Based on manufacturer specifications for Cummins QSK78-G12 for standby operation. Emission factors were converted from (g/hp-hr) to (lb/hp-hr) by multiplying by the corresponding brake horsepower (BHP) and converting from grams to pounds.
5. SO₂, VOC, and HAP emission factors are based on AP-42 Section 3.4 (10/96). Sulfur content of ultra-low sulfur diesel is 15 ppm.

4.0 REGULATORY APPLICABILITY

The following regulatory analysis identifies potentially applicable local and federal air quality regulations and explains why each regulation is or is not considered applicable to the proposed project.

4.1 STATE APPLICABILITY

4.1.1 1001-5 APPENDICES REGULATION NO. 3, STATIONARY SOURCE PERMITTING AND AIR CONTAMINANT EMISSION NOTICE REQUIREMENTS PART A: CONCERNING GENERAL PROVISIONS APPLICABLE TO REPORTING AND PERMITTING

Under CCR 1001-5 Part A of Regulation No. 3, a stationary source is required to submit an APEN for each individual emission point in a nonattainment area with uncontrolled actual emissions of one tpy or more of any individual criteria pollutant. For non-criteria reportable pollutants, an APEN is required for each individual emission point with uncontrolled actual emissions equal to or greater than 250 lbs per year or more of any individual non-criteria reportable pollutant.

The data center consists of 16 diesel-fired emergency generators rated at 2,500 kW each. Each generator will have uncontrolled emissions of greater than one tpy of NO_x and will not emit more than 250 lbs of any non-criteria reportable pollutants. Therefore, the facility is submitting this APEN specific for compression ignition engines.

Each engine will also have an associated AST for diesel fuel storage with an annual throughput of 42,000 gallons per year. Pursuant Section II.D.1.fff of this regulation, storage tanks whose annual throughput is less than 400,000 gallons of certain liquids including diesel fuel are exempt from APEN requirements. Thus, these tanks will be exempt.

4.1.2 1001-5 REGULATION NO. 3, STATIONARY SOURCE PERMITTING AND AIR CONTAMINANT EMISSION NOTICE REQUIREMENTS PART B: CONCERNING CONSTRUCTION PERMITS

Under CCR 1001-5 Part B of Regulation No. 3, no person shall commence construction of any stationary source or modification of a stationary source without first obtaining or having a valid construction permit from the Division.

As previously mentioned, the data center will operate 16 diesel-fired emergency generators rated at 2,500 kW each and is submitting this application to obtain a construction permit. The associated diesel storage tanks are exempt from this section per Section II.D.1.a.

4.1.3 1001-5 REGULATION NO. 3, STATIONARY SOURCE PERMITTING AND AIR CONTAMINANT EMISSION NOTICE REQUIREMENTS PART C: CONCERNING OPERATING PERMITS

The provisions of this Regulation Number 3, Part C shall apply statewide to all sources of air pollutants that are required to obtain an operating permit as specified in Section II of this part.

JPMC will limit total annual operation of each generator to a maximum of 200 hours per year resulting in the PTE for the site to be less than 100 tpy of any criteria pollutant. Thus they will be considered a synthetic minor source as described in CCR 1001-5 Part G Regulation No. 3, Section II.5. Additionally, the associated diesel storage tanks are exempt pursuant to Part C Section II.E.3.fff. The facility will maintain monthly records of operating hours and emissions on site for annual reporting requirements.

4.1.4 1001-8 REGULATION NO. 6, STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Certain regulations promulgated by the United States Environmental Protection Agency (EPA) found in 40 CFR 60 are adopted by the Colorado Air Quality Control Commission and are hereby incorporated by reference.

Applicability to adopted regulations in CCR 1001-8 Regulation No. 6 are included as part of the Federal Regulatory Applicability in Section 4.2 below.

4.1.5 1001-9 REGULATION NUMBER 7 CONTROL OF OZONE VIA OZONE PRECURSORS AND CONTROL OF HYDROCARBONS VIA OIL AND GAS EMISSIONS (EMISSIONS OF VOLATILE ORGANIC COMPOUNDS AND NITROGEN OXIDES)

The provisions of this regulation apply to any ozone nonattainment area, which includes areas designated nonattainment for either the 1-hour or 8-hour ozone standard. The provisions set operational and control requirements for applicable sources.

The 16 diesel-fired emergency engines are not subject to the RACT requirements as they are not an affected source as identified in this regulation. Pursuant Section VI.B.1(a) of this regulation, the tanks are exempt as they store Fuel Oil #2.

4.1.6 1001-10 REGULATION NO. 8, CONTROL OF HAZARDOUS AIR POLLUTANTS

Certain provisions promulgated by the United States Environmental Protection Agency (EPA) found in 40 CFR 61 are adopted by the Colorado Air Quality Control Commission and are hereby incorporated by reference in this regulation.

No adopted regulations adopted by the Colorado Air Quality Control Commission are applicable to the diesel-fired emergency engines or associated fuel tanks included in this application. Any applicable federal provisions are included in the Section 4.2 below.

4.2 FEDERAL APPLICABILITY

4.2.1 New Source Performance Standards

NSPS require new, modified, or reconstructed sources to control emissions to the level achievable by the best demonstrated technology as specified in the applicable provisions. The NSPS regulations may be found in 40 CFR 60. An analysis of potentially applicable NSPS subparts is presented below.

4.2.1.1 Subpart A – General Provisions

Facilities subject to source-specific NSPS are also subject to the general provisions of NSPS Subpart A. Because the facility is subject to another 40 CFR 60 subpart, as discussed in Section 4.1.1.2, the provisions of Subpart A are applicable. NSPS Subpart A may require the following of facilities subject to a source-specific NSPS:

- Initial construction/reconstruction notifications
- Initial startup notifications
- Performance tests
- Performance test date initial notifications
- General monitoring requirements
- General recordkeeping requirements
- Semiannual monitoring system and/or excess emissions reports.

The facility will comply with the provisions of NSPS Subpart A, as applicable.

4.2.1.2 Subpart IIII – Standards of Performance for Stationary Compression Ignition Internal Combustion Engines

New Source Performance Standard (NSPS) Subpart IIII applies to owners and operators of stationary compression ignition (CI) Internal Combustion Engines (ICE) that commence construction after July 11, 2005, where the stationary CI ICE are:

- Manufactured after April 1, 2006, and are not fire pump engines, or
- Manufactured as a certified National Fire Protection Association (NFPA) fire pump engine after July 1, 2006.
- Owners and operators of any stationary CI ICE that are modified or reconstructed after July 11, 2005 and any person that modifies or reconstructs any stationary CI ICE after July 11, 2005.

None of the engines are fire pump engines. All of the engines commenced construction after July 11, 2005 and were manufactured after April 1, 2006. Therefore, the facility has 16 diesel-fired emergency engines (GEN01 through

GEN16) that qualify as CI ICE. The data center will comply with all applicable NSPS Subpart IIII requirements for the emergency CI ICE. They will be equipped with a non-resettable hour meter and will not operate for greater than 100 hours per year for maintenance and testing purposes including 50 hours per year for other permissible non-emergency usage. The engines will comply with EPA Tier 2 emission standards, maximum fuel sulfur content of 15 ppm, and manufacturer operating requirements.

4.2.2 *National Emission Standards for Hazardous Air Pollutants*

National Emission Standards for Hazardous Air Pollutants (NESHAP) are emission standards for HAPs that are generally applicable to major sources of HAPs, but also apply to certain area sources of HAPs. A major HAP source is defined as having potential emissions in excess of 10 tons per year for any individual HAP and/or 25 tons per year for total HAPs. NESHAP apply to specific pollutant sources (40 CFR 61), or to sources in specifically regulated industrial source categories (CAA Section 112(d)), or on a case-by-case basis (Section 112(g) or 112(j)) for facilities not regulated as a specific industrial source type (40 CFR 63). The facility will be an area source for HAPs. An applicability analysis of potentially applicable NESHAP (Part 63) subparts is presented below.

4.2.2.1 *Subpart A – General Provisions*

All affected sources are subject to the general provisions of NESHAP Subpart A unless specifically excluded by the source-specific NESHAP. NESHAP Subpart A requires initial notification, performance testing, recordkeeping, and monitoring, provides reference methods, and mandates general control device requirements for all other subparts as applicable.

4.2.2.2 *Subpart ZZZZ – National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines*

National Emissions Standards for Hazardous Air Pollutants (NESHAP) Subpart ZZZZ regulates HAPs emitted from stationary reciprocating internal combustion engines (RICE) located at major and area sources of HAP emissions. The data center is considered an area source of HAP emissions and will contain 16 emergency generators that are all subject to the requirements of Subpart ZZZZ.

Stationary RICE located at an area source of HAP emissions are considered new if construction or reconstruction of the stationary RICE is commenced on or after June 12, 2006. All 16 emergency generators (GEN01 through GEN16) will be constructed after June 12, 2006 and are considered new stationary RICE for purposes of NESHAP ZZZZ. As new stationary RICE located at an area source, the emergency generators must meet the requirements of NESHAP ZZZZ by complying with the requirements of NSPS Subpart IIII, discussed in Section 4.2.1, in accordance with 40 CFR 63.6590(c)(1). There are no further requirements under NESHAP ZZZZ that are applicable to these engines.

4.3 *Summary of Applicable Regulations*

A summary of the applicable state and federal regulations are provided in Table 4-1 below.

Table 4-1: Summary Table

Authorization	Title	Unit/Process Authorized	Registration Requirement	Ongoing Recordkeeping Requirement
CCR 1001-5	Part A: Concerning General Provisions Applicable to Reporting and Permitting	Emergency Diesel Generators	Air Pollutant Emissions Notice as a Synthetic Minor Source	Annual Emissions Report
40 CFR 60 Subpart IIII	Standards of Performance for Stationary Compression Ignition Internal Combustion Engines	Emergency Diesel Generators	None	Annual Operating Hours & Usage
40 CFR 63 Subpart ZZZZ	National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines	Emergency Diesel Generators	None	Compliance achieved through compliance with 40 CFR Subpart IIII

APEN Forms
Appendix A

June 2018
Project Sycamore - Broomfield

Environmental Resources Management
9825 Kenwood Road, Suite 100
Cincinnati, Ohio 45242
(513) 890-9030

Emissions Calculations
Appendix B

June 2018
Project Sycamore - Broomfield

Environmental Resources Management
9825 Kenwood Road, Suite 100
Cincinnati, Ohio 45242
(513) 890-9030

Emission Calculations: Emergency Standby Generators
Engine Specifications**Table 1 Emergency Standby Generator Specifications**

Manufacturer	Cummins
Model	QSK78-G12
Rating ^[1]	2,500 kWe
EPN	GEN 01-16
Power generation per unit @ 100% load ^[1]	3,028 kWm
	4,060 hp
Number of units	16
Potential to Emit operating hours ^[2]	500
Limited potential to emit operating hours ^[3]	200
Fuel type	Diesel
Fuel high heat value	0.138 MMBtu/gal
Fuel consumption ^[1]	168 gal/hr
	23 MMBtu/hr
Diesel AST Annual Throughput	84,000 gal/year

1. Based on manufacturer specifications for Cummins QSK78-G12.
2. Per APEN requirements, PTE is calculated at 500 total operating hours per year for emergency standby generators.
3. Projected actual operating hours per year for use when determining emissions limitation.

Table 2: Emergency Standby Generator Emissions Summary

Pollutant	Emission Factors ^[1]		Limited PTE (tpy) ^[2]		Potential To Emit (tpy) ^[3]	
	(lb/hp-hr)	(lb/hr)	Per Generator	Facility-Wide	Per Generator	Facility-Wide
PM ^[4,5]	2.2E-04	0.90	0.09	1.43	0.22	3.58
PM ₁₀ ^[4,5]	2.2E-04	0.90	0.09	1.43	0.22	3.58
PM _{2.5} ^[4,5]	2.2E-04	0.90	0.09	1.43	0.22	3.58
SO _x ^[6]	1.2E-05	0.05	4.9E-03	0.08	0.012	0.20
NO _x ^[5]	9.3E-03	37.59	3.76	60.15	9.40	150.37
CO ^[5]	1.5E-03	6.27	0.63	10.02	1.57	25.06
VOC ^[6]	7.1E-04	2.86	0.29	4.58	0.72	11.45
Acetaldehyde	1.4E-07	5.8E-04	5.8E-05	9.3E-04	1.5E-04	2.3E-03
Acrolein	4.5E-08	1.8E-04	1.8E-05	2.9E-04	4.6E-05	7.3E-04
Benzene	4.4E-06	0.02	1.8E-03	0.03	4.5E-03	0.07
Formaldehyde	4.5E-07	1.8E-03	1.8E-04	2.9E-03	4.6E-04	7.3E-03
Naphthalene	7.4E-07	3.0E-03	3.0E-04	4.8E-03	7.5E-04	0.01
Toluene	1.6E-06	6.5E-03	6.5E-04	0.01	1.6E-03	0.03
Xylene (Total)	1.1E-06	4.5E-03	4.5E-04	7.2E-03	1.1E-03	0.02
Total HAP ^[6]	8.5E-06	0.03	3.5E-03	0.06	8.6E-03	0.14

1. Emission factors are per generator.
2. Limited potential emissions for the site are estimated based on a total of 200 operating hours per year, per generator.
3. Potential emissions for the site are estimated based on a maximum of 500 operating hours per year, per generator.
4. It is conservatively assumed that the PM, PM₁₀, and PM_{2.5} are equivalent.
5. Based on manufacturer specifications for Cummins QSK78-G12 for standby operation. Emission factors were converted from (g/hp-hr) to (lb/hp-hr) by multiplying by the corresponding brake horsepower (BHP) and converting from grams to pounds.
6. SO₂, VOC, and HAP emission factors are based on AP-42 Section 3.4 (10/96). Sulfur content of ultra-low sulfur diesel is 15 ppm.

Table 3: Generator Identification Information

Generator Name	Manufacture Date		Serial No.	Location (Lat, Long)
GEN 01	TBD		TBD	TBD
GEN 02	TBD		TBD	TBD
GEN 03	TBD		TBD	TBD
GEN 04	TBD		TBD	TBD
GEN 05	TBD		TBD	TBD
GEN 06	TBD		TBD	TBD
GEN 07	TBD		TBD	TBD
GEN 08	TBD		TBD	TBD
GEN 09	TBD		TBD	TBD
GEN 10	TBD		TBD	TBD
GEN 11	TBD		TBD	TBD
GEN 12	TBD		TBD	TBD
GEN 13	TBD		TBD	TBD
GEN 14	TBD		TBD	TBD
GEN 15	TBD		TBD	TBD
GEN 16	TBD		TBD	TBD

Engine Performance Data Sheets
Appendix C

June 2018
Project Sycamore - Broomfield

Environmental Resources Management
9825 Kenwood Road, Suite 100
Cincinnati, Ohio 45242
(513) 890-9030

Specification sheet

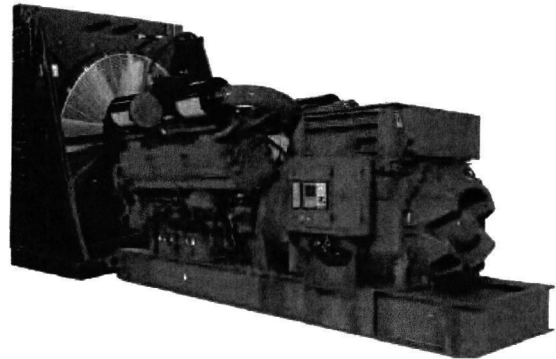
DQLE 2500 kW / 3125 kVA EMERGENCY STANBY



Diesel generator set QSK78 series engine

EPA emissions

2000 kW - 2750 kW 60 Hz



Description

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

Features

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

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

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

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

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

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

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

Generator set specifications

Transient performance	ISO 8528-5 compliant
Steady state voltage regulation, no load to full load	± 1.0%
Random voltage variation	± 1.0%
Frequency regulation	Isochronous
Steady state frequency band	± 0.5%
Radio frequency emissions compliance	BS EN61000-6-4:2001 emissions-industrial
Immunity frequency emissions compliance	BS EN61000-6-2:2001 immunity-industrial IEC 801.2 through IEC 801.5; MIL STD 461C, Part 9

Engine specifications

Bore	170.0 mm (6.69 in)
Stroke	190.0 mm (7.48 in)
Displacement	77.6 litres (4735 in ³)
Configuration	Cast iron, V 18 cylinder
Battery capacity	2200 amps minimum at ambient temperature of -18 °C to 0 °C (0 °F to 32 °F)
Battery charging alternator	55 amps
Starting voltage	24 volt, negative ground
Fuel system	Direct injection: number 2 diesel fuel, fuel filter, automatic electric fuel shutoff
Fuel filter	Triple element, 10 micron filtration, spin-on fuel filter with water separator
Air cleaner type	Dry replaceable element standard; heavy duty optional
Lube oil filter type(s)	Six spin-on, combination full flow filter and bypass filters; Eliminator™ option available
Standard cooling system	High ambient cooling system

Alternator specifications

Design	Brushless, 4 pole, drip proof, revolving field
Stator	2/3 pitch
Rotor	Two bearing, flexible coupling
Insulation system	Class H on low voltage and medium, Class F on high voltage
Standard temperature rise	125 °C Standby at 40 °C ambient
Exciter type	Permanent Magnet Generator (PMG)
Phase rotation	A (U), B (V), C (W)
Alternator cooling	Direct drive centrifugal blower fan
AC waveform Total Harmonic Distortion (THDV)	< 5% no load to full linear load, < 3% for any single harmonic
Telephone Influence Factor (TIF)	< 50 per NEMA MG1-22.43
Telephone Harmonic Factor (THF)	< 3%

Generator set options and accessories

Engine

- 208/240/480 V coolant heater for ambient below 4.5 °C (40 °F) - 12,840 W max.

Control panel

- User-configurable relays
- 2x digital input/output

Exhaust system

- Critical grade exhaust silencer

Cooling system

-

Generator set

- Battery
- Vibration isolators
- 3 year warranty

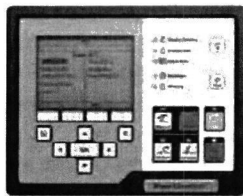
Control panel

- Left facing mounting

Alternator

- 105 °C rise
- 120/240 V 300 W anti-condensation heater

PowerCommand 3.3 – control system



The PowerCommand control system is an integrated microprocessor based generator set control system providing voltage regulation, engine protection, alternator protection, operator interface and isochronous governing.

AmpSentry – Includes integral AmpSentry protection, which provides a full range of alternator protection functions that are matched to the alternator provided.

Power management – Control function provides battery monitoring and testing features and smart starting control system.

Advanced control methodology – Three phase sensing, full wave rectified voltage regulation, with a PWM output for stable operation with all load types.

Communications interface – Control comes standard with PCCNet and Modbus interface.

Regulation compliant – Prototype tested: UL, CSA and CE compliant.

Service - InPower™ PC-based service tool available for detailed diagnostics, setup, data logging and fault simulation.

Reliable design – The control system is designed for reliable operation in harsh environment.

Multi-language support

Operator panel features

Operator panel features – The operator panel, in addition to the alternator, displays the Utility/AC bus data.

Operator/display functions

- 320 x 240 pixels graphic LED backlight LCD
- Auto, manual, start, stop, fault reset and lamp test/panel lamp switches
- Alpha-numeric display with pushbuttons
- LED lamps indicating genset running, remote start, not in auto, common shutdown, common warning, manual run mode, auto mode and stop.

Paralleling control functions

- Digital frequency synchronization and voltage matching
- Isochronous kW and kVar load sharing controls
- Droop kW and kVar control
- Sync check
- Extended paralleling (peak shave/base load)
- Digital power transfer control (AMF) provides load transfer operation in open or closed transition or soft (ramping) transfer mode

Alternator data

- Line-to-Neutral and Line-to-Line AC volts
- 3-phase AC current
- Frequency
- kW, kVar, power factor kVA (three phase and total)

Engine data

- DC voltage
- Engine speed
- Lube oil pressure and temperature
- Coolant temperature
- Comprehensive FAE data (where applicable)

Other data

- Genset model data
- Start attempts, starts, running hours, kW hours
- Load profile (operating hours at % load in 5% increments)
- Fault history
- Data logging and fault simulation (requires InPower)

Standard control functions

Digital governing

- Integrated digital electronic isochronous governor
- Temperature dynamic governing

Digital voltage regulation

- Integrated digital electronic voltage regulator
- 3-phase, 4-wire Line-to-Line sensing
- Configurable torque matching

Standard control functions (continued)**AmpSentry AC protection**

- AmpSentry protective relay
- Over current and short circuit shutdown
- Over current warning
- Single and three phase fault regulation
- Over and under voltage shutdown
- Over and under frequency shutdown
- Overload warning with alarm contact
- Reverse power and reverse Var shutdown
- Field overload

Engine protection

- Battery voltage monitoring, protection and testing
- Overspeed shutdown
- Low oil pressure warning and shutdown
- High coolant temperature warning and shutdown
- Low coolant level warning or shutdown
- Low coolant temperature warning
- Fail to start (overcrank) shutdown
- Fail to crank shutdown

- Cranking lockout
- Sensor failure indication
- Low fuel level warning or shutdown
- Fuel-in-rupture-basin warning or shutdown
- Full authority electronic engine protection

Control functions

- Time delay start and cool down
- Real time clock for fault and event time stamping
- Exerciser clock and time of day start/stop
- Data logging
- Cycle cranking
- Load shed
- Configurable inputs and outputs (4)
- Remote emergency stop

Ratings definitions**Emergency Standby Power (ESP):**

Applicable for supplying power to varying electrical loads for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

Codes and standards

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

	This generator set is designed in facilities certified to ISO 9001 and manufactured in facilities certified to ISO 9001 or ISO 9002.	U.S. EPA	Engine certified to Stationary Emergency U.S. EPA New Source Performance Standards, 40 CFR 60 subpart IIII Tier 2 exhaust emission levels. U.S. applications must be applied per this EPA regulation.
	All models are CSA certified to product class 4215-01.	International Building Code	The genset package is certified for seismic application in accordance with the following International Building Code: IBC2012.
	The generator set is available listed to UL 2200 for all 60 Hz low voltage models, Stationary Engine Generator Assemblies. The PowerCommand control is Listed to UL 508 - Category NITW7 for U.S. and Canadian usage.		The Prototype Test Support (PTS) program verifies the performance integrity of the generator set design. Cummins products bearing the PTS symbol meet the prototype test requirements of NFPA 110 for Level 1 systems.

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

Generator set data sheet

Model: DQLE
Frequency: 60 H□
Fuel type: Diesel
□W rating: 2500 Standby

Emissions level: EPA NSPS Stationary Emergency Tier 2

Exhaust emission data sheet:	EDS-1116
Exhaust emission compliance sheet:	EPA-1174
Sound performance data sheet:	MSP-1099
Cooling performance data sheet:	MCP-203
Prototype test summary data sheet:	PTS-299
High ambient air temperature radiator cooling outline (ship loose):	A049A845

Fuel consumption	Standby			
	□W (□VA)			
Ratings	2500 (3125)			
Load	1/4	1/2	3/4	Full
US gph	59.5	95.7	132	168
L/hr	225	362	499	636

Engine	Standby rating
Engine manufacturer	Cummins Inc.
Engine model	QSK78-G12
Configuration	Cast Iron, V 18 cylinder
Aspiration	Turbocharged and low temperature after-cooled
Gross engine power output, kWm (bhp)	3028 (4060)
BMEP at set rated load, kPa (psi)	2372 (344)
Bore, mm (in.)	170.0 (6.69)
Stroke, mm (in.)	190.0 (7.48)
Rated speed, rpm	1800
Piston speed, m/s (ft/min)	11.4 (2243)
Compression ratio	15.5:1
Lube oil capacity, L (qt)	413 (436)
Overspeed limit, rpm	2100
Regenerative power, kW	266

Fuel flow	Standby rating
Maximum fuel flow, L/hr (US gph)	2234 (590)
Maximum fuel restriction at injection pump with clean filter, kPa (in Hg)	17 (5)
Maximum fuel inlet temperature, °C (°F)	71 (160)

Air	
Combustion air, m ³ /min (scfm)	228 (8044)
Maximum air cleaner restriction, kPa (in H ₂ O)	3.7 (15)
Alternator cooling air, m ³ /min (cfm)	178 (6278)

Exhaust	
Exhaust flow at set rated load, m ³ /min (cfm)	535 (18908)
Exhaust temperature, °C (°F)	457 (853)
Maximum back pressure, kPa (in H ₂ O)	7 (28)

High ambient air temperature radiator cooling	
Ambient design, °C (°F)	45 (113)
Fan load, kW _m (HP)	90 (121)
Coolant capacity (with radiator), L (US gal)	738 (195)
Cooling system air flow, m ³ /min (scfm)	3060 (108000)
Total heat rejection, MJ/min (Btu/min)	95.4 (90416)
Maximum cooling air flow static restriction, kPa (in H ₂ O)	0.12 (0.5)

Alternator data

Voltage	Connection ¹	Temp rise degrees C	Duty ²	Single phase factor ³	Max surge kVA ⁴	Winding No.	Alternator data sheet	Feature code
220/380	Wye	105	S		10049	13	ADS-517	B408-2
220/380	Wye	125	S		7944	13	ADS-516	B407-2
380	Wye	150	S		7944	13	ADS-516	B814-2
440	Wye	150	S/P/C		8412	12	ADS-516	B813-2
440	Wye	125	S/P/C		9719	12	ADS-517	B663-2
440	Wye	105	S/P		13024	12	ADS-531	B664-2
440	Wye	80	S		14781	12	ADS-532	B688-2
480	Wye	150	S		7267	12	ADS-515	B816-2
480	Wye	125	S/P/C		8412	12	ADS-516	B801-2
480	Wye	105	S		9719	12	ADS-517	B280-2

Notes:

¹ Single phase power can be taken from three phase generator sets at up to the value listed in the single phase factor column for the generator set nameplate kW rating at unity power factor.

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

³ Factor for the *single phase output from three phase alternator* formula listed below.

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

Formulas for calculating full load currents:

Three phase output

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

Single phase output

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

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

Derating factors**Standby**

Standard cooling system: Full rated power available up to 1744 m (5721 ft) elevation at ambient temperatures up to 40 °C (104 °F). Above these conditions, derate by 7.5% per 305 m (1000 ft), and derate by an additional 17.8% per 10 °C (18 °F).

Enhanced cooling system: Full rated power available up to 1906 m (6252 ft) at ambient temperatures up to 40 °C (104 °F). Above this elevation, at 40 °C (104 °F), derate by 7.5% per 305 m (1000 ft). Full rated power available up to 1053 m (3454 ft) elevation at ambient temperatures up to 50 °C (122 °F). Above this elevation, at 50 °C (122 °F), derate by 7.5% per 305m (1000 ft). At higher ambient temperatures, derate by an additional 21.3% per 10 °C (18 °F).

Remote radiator cooling option: Full rated power available up to 1042 m (3419 ft) elevation at ambient temperature up to 40 °C (104 °F). Above these elevations, at 40 °C (104 °F), derate by 8.25% per 305 m (1000 ft). Full rated power available up to 259 m (851 ft) elevation at ambient temperatures up to 50 °C (122 °F). Above these elevations, at 50 °C (122 °F), derate by 8.25% per 305 m (1000 ft). At higher ambient temperatures, derate by an additional 21.2% per 10 °C (18 °F).

Prime

Full rated power available up to 702 m (2303 ft) elevation at ambient temperature up to 40 °C (104 °F). Above these elevations, at 40 °C (104 °F), derate by 9.11% per 305 m (1000 ft). Derate by 3.41% at sea level at ambient temperatures up to 50 °C (122 °F). Above these elevations, at 50 °C (122 °F), derate by an additional 9.11% per 305 m (1000 ft). At higher ambient temperatures, derate by an additional 24.4% per 10 °C (18 °F).

Continuous

Full rated power available up to 57 m (187 ft) elevation at ambient temperature up to 40 °C (104 °F). Above these elevations, at 40 °C (104 °F), derate by 10.38% per 305 m (1000 ft). Derate by 26.57% at sea level at ambient temperatures up to 50 °C (122 °F). Above these elevations, at 50 °C (122 °F), derate by an additional 10.38% per 305 m (1000 ft). At higher ambient temperatures, derate by an additional 28.5% per 10 °C (18 °F).

Ratings definitions**Emergency standby power (ESP):**

Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

Limited-time running power (LTP):

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

Prime power (PRP):

Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

Base load (continuous) power (COP):

Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) is in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514.



EPA Tier 2 exhaust emission compliance statement 2500DQLE Stationary Emergency 60 H□ Diesel generator set

Compliance information:

The engine used in this generator set complies with Tier 2 emissions limit of U.S. EPA new source performance standards for stationary emergency engines under the provisions of 40 CFR 60 Subpart IIII when tested per ISO8178 D2.

Engine manufacturer: Cummins Inc.
EPA certificate number: HCEXL060.AAD-025
Effective date: 11/15/2016
Date Issued: 11/15/2016
EPA engine family (Cummins emissions family): HCEXL060.AAD (D593)

Engine information:

Model:	QSK78/QSK78-G/QSK78-G12	Bore:	6.69 in. (170 mm)
Engine nameplate HP:	4060	Stroke:	7.48 in. (190 mm)
Type:	4 cycle, 60°V, 18 cylinder diesel	Displacement:	4735 cu. in. (77.6 liters)
Aspiration:	Turbocharged and low temperature after-cooled	Compression ratio:	15.5:1
Emission control device:	Turbocharged and low temperature after-cooled	Exhaust stack diameter:	2 - 14 in.

Diesel fuel emissions limits

D2 cycle exhaust emissions

	Grams per BHP-hr			Grams per □W _m -hr		
	NO _x □ NMHC	CO	PM	NO _x □ NMHC	CO	PM
Test results - diesel fuel (300-4000 ppm sulfur)	4.2	0.7	0.10	5.6	1.0	0.14
EPA emissions limit	4.8	2.6	0.15	6.4	3.5	0.20
Test results - CARB diesel fuel (<15 ppm sulfur)	3.8	0.7	0.09	5.1	1.0	0.12
CARB emissions limit	4.8	2.6	0.15	6.4	3.5	0.20

The CARB emission values are based on CARB approved calculations for converting EPA (500 ppm) fuel to CARB (15 ppm) fuel.

Test methods: EPA/CARB nonroad emissions recorded per 40CFR89 (ref. ISO8178-1) and weighted at load points prescribed in Subpart E, Appendix A for constant speed engines (ref. ISO8178-4, D2)

Diesel fuel specifications: Cetane number: 40-48. Reference: ASTM D975 No. 2-D.

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

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



Cooling system data

DQLE

High ambient air temperature radiator cooling system

	Duty	Rating (kW)	Max cooling □ air flow static restriction, unhoused (inches water/mm water)						
			0.0/0.0	0.25/6.4	0.5/12.7	0.75/19.1	1.0/25.4	1.25/31.8	1.5/38.1
			Maximum allowable ambient temperature, degree C						
60 Hz	Standby	2500	53	52	50	48	46	43	40
	Data Center Continuous	2275	53	52	50	48	46	43	40
	Prime	2275	49	46	44	42	39	37	35
	Continuous	2000	52	50	48	45	44	41	38

Notes:

1. Data shown are anticipated cooling performance for typical generator set.
2. Cooling data is based on 1000 ft (305 m) site test location. See generator Spec Sht D-3507
3. Generator set power output may need to be reduced at high ambient conditions. Consult generator set data sheet for derate schedules.
4. Cooling performance may be reduced due to several factors including but not limited to: Incorrect installation, improper operation, fouling of the cooling system, and other site installation variables.