Intended for
Utah Division for Air Quality

Prepared for
eBay
South Jordan, Utah

Prepared by
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Salt Lake City, UT

Project Number
1690013291

Date
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NOTICE OF INTENT TO CONSTRUCT APPLICATION

EBAY SLC DATA CENTER
SOUTH JORDAN, UTAH

RAMBOLL

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1. INTRODUCTION

eBay Inc. ("eBay" or "the applicant") is submitting this Notice of Intent (NOI) to the Utah Department of Environmental Quality – Division of Air Quality (UDAQ) to request authority to construct and operate an additional six diesel-fired emergency backup generators at eBay's SLC Data Center[1] (facility) located in South Jordan, Salt Lake County, Utah. The facility currently includes 27 diesel-fired emergency backup generators that provide electricity to the facility in the event of an emergency, two fire pump engines, two cooling towers, and 50 bloom energy servers (DAQE-AN141800010-19). A site location map is provided in **Appendix 1**.

The facility is currently classified as a synthetic minor source of air emissions with respect to the Title V and New Source Review (NSR) permitting programs. Since potential emissions of nitrogen oxides (NO_X) and carbon monoxide (CO) would each exceed 5 tons per year (tpy), the applicant is hereby requesting an Approval Order (AO) from UDAQ for construction and operation of the six proposed generators at the facility, in accordance with the requirements of the Utah Administrative Code (UAC) Rule R307-401-8.[2] The NOI application forms are included in **Appendix 2** of this report.

[1] DAQE-AN141800010-19 lists the source name as "Topaz (South Jordan) Data Center". eBay is requesting a source name change to "SLC Data Center" as part of this NOI.

[2] Utah Administrative Code. R307-401-8. Permit: New and Modified Sources. Approval Order. https://rules.utah.gov/publicat/code/r307/r307-401.htm#T8

2. FACILITY DESCRIPTION

The applicant is proposing to construct and operate an additional six diesel-fired emergency generators at a data center located in Salt Lake County, Utah. A list of the existing and proposed generator identification (ID) numbers is provided in **Table 1**, and the manufacturer's specification sheets for the generators are provided in **Appendix 3**.[3]

Table 1. Generator IDs

Emission Point ID Numbers for Generators	Generator Manufacturer and Engine Size (per engine)[4]
G1-G7	Detroit Diesel - 3.25 Megawatts (MW)
G8-G14[5]	Caterpillar - 3.1 MW
G15-G16; G19-G22; G26-G27	Caterpillar - 2.0 MW
G17-G18	Caterpillar - 1.5 MW
G23	Caterpillar - 1.0 MW
G24-G25	Caterpillar - 2.5 MW
FP1	Caterpillar - 100 kilowatts (kW)
FP2	John Deere - 64 kW
Proposed G28-G31	Caterpillar - 2.0 MW
Proposed G32-G33	Caterpillar - 750 kW

Other sources of emissions at the facility consist of diesel storage tanks for each generator, two cooling towers, and 50 bloom energy servers. The cooling towers and bloom energy servers would not be modified as part of this application, and emissions from diesel storage tanks are negligible.

[3] Emission specification sheets are included for all existing and proposed generators at the facility since emissions of existing engines were revised to conservatively utilize not-to-exceed factors instead of nominal emissions factors, which were previously used in potential emissions calculations.

[4] Generator sizes are listed in electrical kilowatts (kWe).

[5] Section II.A.6 of DAQE-AN141800010-19 identifies G9-G14 as having a maximum capacity of 3.0 MW. However, the capacity listed in DAQE-AN141800010-19 does not include the additional 100 kW required to operate the engine radiator fan. As such, eBay is requesting to revise the identified generator size of G9-G14 listed in the AO to 3.1 MW for accuracy. The revision would be administrative in nature and does not reflect a modification to the generators.

3. EMISSIONS CALCULATIONS

Pollutants emitted from the facility include NO_X; CO; VOCs; sulfur dioxide (SO_2); particulate matter (PM); PM less than 10 microns in diameter (PM_{10}); PM less than 2.5 microns in diameter ($PM_{2.5}$); hazardous air pollutants (HAPs); and greenhouse gases, represented in terms of carbon dioxide equivalents (CO_2e).

The methodology used to estimate the potential emissions from each source is discussed in the following sections. The manufacturer's specification sheet for the generators is provided in **Appendix 3**, and detailed calculations are provided for all emissions sources in **Appendix 4**.

3.1 Diesel-Fired Emergency Standby Generators

Operation of the diesel-fired emergency generator engines would result in emissions of byproducts of combustion. The derivation of potential hourly and annual emissions is presented below.

3.1.1 Derivation of Potential Hourly Emissions

The following emission factors were used to estimate the potential hourly emissions from the emergency generators:

- Except as noted below, the manufacturer's not-to-exceed, engine-specific emission factors for NO_X, VOC (hydrocarbons), CO, and filterable PM were used to estimate the emissions of those pollutants at each generator load. It was conservatively assumed that all particulate matter in the engine exhaust is $PM_{2.5}$. Potential hourly emissions were based on the maximum hourly emission rate for each pollutant at any engine load for each engine group.
  - Note, for engines G1-G7, the manufacturer provided emissions on a mechanical kilowatt (kWm) basis. Therefore, the engine rating used for emissions calculations is 3,490 kWm. However, the engine rating in the current AO is in electrical megawatt (MWe). Thus, **Table 1** lists the engine rating in MWe (i.e. 3.25 MW), which is consistent with all other engines.
- For all engines except the fire pumps, emissions of SO_2, condensable PM, and HAP were estimated based on the diesel fuel emission factors in the USEPA's AP-42, Chapter 3.4, *Large Stationary Diesel and All Stationary Dual-fuel Engines* (October 1996). The emission factor for SO_2 was calculated based on the maximum allowable diesel fuel sulfur content of 0.0015% by weight, per 40 CFR 60 Subpart IIII (see Section 4.3.5 of this report). The emissions calculations assumed a diesel high heating value of 0.137 MMBtu/gal, based on AP-42, Table 3.4-1, footnote a.
- For fire pump engines, emissions of SO_2 and HAP were estimated based on the diesel fuel emission factors in the USEPA's AP-42, Chapter 3.3, Gasoline and Diesel Industrial Engines, Table 3.3-2 (October 1996). It was conservatively assumed that the fire pumps have the same condensable PM emissions factor as Large Stationary Diesel and All Stationary Dual-fuel Engines.
- Emissions of CO_2e from diesel fuel combustion were estimated based on the GHG emission factors and global warming potentials provided in 40 CFR 98.

3.1.2 Derivation of Potential Annual Emissions

Potential annual emissions from the facility were estimated assuming 66 hours per year per engine for all existing and proposed generators, and 100 hours per year for the two fire pump engines. eBay is requesting limits of 66 hours per year for the generators, which is below the 100 hours per year maximum allowable non-emergency run time per 40 CFR 60 Subpart IIII, to remain a synthetic minor source of emissions with respect to the Title V and NSR Permitting Programs.[6]

3.2 Diesel Storage Tanks

Emissions of VOC from the diesel tanks would result from the standing and working losses. Consistent with previous permitting applications, these emissions are considered negligible and are not included as part of this application.

3.3 Cooling Towers

Emissions of PM from the two cooling towers are the result of the cooling water coming into direct contact with the air through the tower and causing water droplets to carry PM from the cooling towers. The emissions are based on the cooling tower recirculation rate, total dissolved solids content in the cooling water, the drift loss from the tower, and the particle size after evaporation of the water. These emissions were estimated by using the method from *Calculating Realistic PM_{10} Emissions from Cooling Towers*.[7] Potential annual emissions were based on 8,760 hours per year of operation. Cooling tower emissions have not changed as a result of this application.

3.4 Bloom Energy Servers

The facility operates 30 Model ES-5700, 200 kW Bloom Energy Servers and 20 Model ES-5710, 250 kW Bloom Energy Servers. The Bloom Energy Servers are designed to reduce the amount of electricity the facility needs from the electric grid, and is a more reliable source, as they operate on natural gas. Potential emissions from the energy servers were estimated using manufacturer provided specification sheets for NO_x, CO, VOC (hydrocarbons), and carbon dioxide (CO_2). Emissions of nitrous oxide (N_2O) and methane (CH_4) were not provided by the manufacturer but are expected to be negligible based on USEPA's *Emission Factors for Greenhouse Gas Inventories*, as shown in **Appendix 4**. Potential annual emissions were based on 8,760 hours per year of operation. Bloom Energy Server emissions have not changed as a result of this application.

3.5 Potential Emissions

A summary of the potential emissions for the facility are provided in **Table 2**, and indicate that the facility would be a minor source of air emissions.[8]

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[6] As confirmed via phone conversation with UDAQ, the agency does not regulate run time or emissions resulting from emergency operations of the generators. Additionally, the agency does not regulate run time or emissions during the initial shakedown period of new engines prior to the engines becoming operational, not to exceed 180 days, in accordance with the definition of "Net Emissions Increase" in UAC Rule R307-101-2.

[7] Joel Reisman and Gordon Frisbie. Calculating Realistic PM10 Emissions from Cooling Towers. Available at: https://ww2.energy.ca.gov/sitingcases/palomar/documents/applicants_files/Data_Request_Response/Air%20Quality/Attachment%204-1.pdf

[8] In previous NOI submittals, nominal emissions data was used to calculate potential emissions. As part of this application, emissions from existing emergency generators were updated to use not-to-exceed manufacturer emissions data for a more conservative approach.

Table 2. Facility-Wide Potential Emissions

Pollutant	Potential Annual Emissions (tpy)[1]				Facility-Wide Potential Annual Emissions (tpy)	Title V Major Source Threshold[2,3,4] (tpy)	Above Threshold?
	Existing Emergency Generators & Fire Pumps	Proposed Emergency Generators	Cooling Towers	Bloom Energy Servers			
NO_X	49.26	6.61	--	0.48	56.35	70	No
CO	5.94	0.62	--	4.82	11.38	100	No
VOC	1.13	0.17	--	0.96	2.26	50	No
PM	0.60	0.11	3.04	0.00	3.75	100	No
PM_{10}	0.60	0.11	2.29	0.00	3.00	100	No
$PM_{2.5}$	0.60	0.11	6.84E-03	0.00	0.71	70	No
SO_2	0.06	4.50E-03	--	0.00	0.06	70	No
Maximum Individual HAP (Benzene)	0.02	2.31E-03	--	0.00	0.02	10	No
Total HAP	0.04	4.68E-03	--	0.00	0.04	25	No
CO_2e	3,626	486.09	--	37,243.14	41,355	N/A	N/A

Notes:

1) Potential emissions from the existing equipment does not match those in the AO (DAQE-AN141800010-19) since emissions from existing emergency generators were updated to use not-to-exceed manufacturer emissions data and the annual operating hour limits were updated.
2) UAC R307-420 applies when Salt Lake County is designated as a maintenance area with respect to the 2015 8-hr Ozone National Ambient Air Quality Standard (NAAQS). Salt Lake County is currently classified as Marginal nonattainment for the Ozone standard. However, UAC does not have regulations codified for when Salt Lake County is designated as nonattainment, and therefore, the Major Source classification for VOC from UAC R307-420 was used.
3) Utah Administrative Code. R307-403. Permit: New and Modified Sources in Nonattainment Areas and Maintenance Areas. https://rules.utah.gov/publicat/code/r307/r307-403.htm#E2.
4) UDAQ submitted a $PM_{2.5}$ maintenance plan and with that proposed a Rule change whereby $PM_{2.5}$ and precursors will maintain a 100 tpy major source threshold.

4. FEDERAL AND STATE REGULATORY APPLICABILITY

The following sections outline the federal and state air regulations that are potentially applicable to the facility. Specifically, requirements under the federal NSR permitting program, Title V of the Clean Air Act Amendments, New Source Performance Standards (NSPS), National Emission Standards for Hazardous Air Pollutants (NESHAP), Chemical Accident Prevention Provisions, and the UAC are discussed herein.

4.1 New Source Review

The federal NSR permitting program regulates emissions from major stationary sources of regulated air pollutants. NSR is comprised of two elements: Nonattainment NSR (NNSR) and Prevention of Significant Deterioration (PSD). NNSR permitting is applicable in areas that have been designated as nonattainment for a regulated pollutant under the National Ambient Air Quality Standards (NAAQS). PSD permitting applies in areas that have been designated as attainment or unclassifiable. The facility is located in Salt Lake County, which has been designated as serious nonattainment for $PM_{2.5}$, marginal nonattainment for ozone, and as attainment or unclassifiable for all other criteria pollutants.[9,10] As such, NNSR is the potentially applicable program for ground-level ozone formation (VOCs and NO_X), $PM_{2.5}$, and to precursors for the formation of $PM_{2.5}$, which include NO_X, SO_2, and VOC. PSD is the applicable permitting program for all other criteria pollutants at the facility.

The NSR major source threshold for Salt Lake County is 70 tpy for $PM_{2.5}$ and each of its precursor pollutants (NO_X, SO_2, and VOC).[11] Additionally, pursuant to UAC R307-420, the Major Source threshold for VOC is 50 tpy in Salt Lake County. Although UAC R307-420 is only applicable when Salt Lake County is classified as in attainment for ozone, eBay has conservatively assumed the Major Source threshold for VOC is 50 tpy. As shown in **Table 2**, the potential emissions from operations at the facility for each of these pollutants would be less than the applicable major source thresholds.

The facility is also classified as a minor source with respect to PSD, and the facility-wide potential emissions for all NSR-regulated criteria pollutants would be less than the major source threshold of 100 tpy, pursuant UAC R307-101-2.[12]

4.2 Title V Operating Permits

The Title V operating permits program, promulgated in 40 CFR 70, requires a facility to obtain a Title V operating permit if it has potential emissions of a regulated criteria pollutant exceeding 100 tpy, of any single HAP exceeding 10 tpy, or of the aggregate of all HAPs exceeding 25 tpy. However, as discussed in Section 4.1, the Title V major source thresholds for $PM_{2.5}$ and its precursor pollutants are at a lower threshold of 70 tpy in Salt Lake County since the area is designated as serious non-attainment for $PM_{2.5}$. Additionally, pursuant to UAC R307-420, the Major Source threshold for VOC is 50 tpy in Salt Lake County. Although UAC R307-420 is only applicable when Salt Lake County is classified as in attainment for ozone, eBay has conservatively assumed the Major Source threshold for VOC is 50 tpy.

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[9] 40 CFR 81.345

[10] Salt Lake County was redesignated to a maintenance area for PM_{10} on March 27, 2020.

[11] Utah Administrative Code. R307-403. Permit: New and Modified Sources in Nonattainment Areas and Maintenance Areas. https://rules.utah.gov/publicat/code/r307/r307-403.htm#E2.

[12] Utah Administrative Code. R307-101: General Requirements. https://rules.utah.gov/publicat/code/r307/r307-101.htm

With the proposed limited hours of operation for the generators, facility-wide potential emissions would be less than 100 tpy each for all criteria pollutants, less than 70 tpy each for $PM_{2.5}$ and its precursors, less than 50 tpy for VOC, and less than the applicable major source thresholds for HAPs. As such, the facility would continue to be classified as a synthetic minor source of air emissions with respect to the Title V program.

4.3 New Source Performance Standards

NSPS, promulgated in 40 CFR 60, provide emissions standards for criteria pollutant emissions from new, modified, and reconstructed sources. The following sections discuss the NSPS that are potentially applicable to the proposed generators (G28-G33).

4.3.1 40 CFR 60 Subpart A – General Provisions

NSPS Subpart A provides generally applicable requirements for testing, monitoring, notifications, and recordkeeping. Any source that is subject to another subpart under 40 CFR 60 is also subject to Subpart A, unless otherwise stated in the specific subpart.

4.3.2 40 CFR 60 Subpart K – Storage Vessels for Petroleum Liquids for Which Construction, Reconstruction, or Modification Commenced After June 11, 1973, and Prior to May 19, 1978

NSPS Subpart K is applicable to petroleum storage tanks which were constructed, reconstructed, or modified between June 1973 and May 1978, and which have a storage capacity greater than 40,000 gallons.[13] The facility would maintain diesel belly tanks for its proposed generators; however, each of these tanks would be new units constructed after 1978. Further, none of the belly tanks would have a storage capacity greater than 40,000 gallons. Therefore, NSPS Subpart K provisions do not apply.

4.3.3 40 CFR 60 Subpart Ka – Storage Vessels for Petroleum Liquids for Which Construction, Reconstruction, or Modification Commenced After May 18, 1978, and Prior to July 23, 1984

Similar to NSPS Subpart K, NSPS Subpart Ka is applicable to petroleum storage tanks which were constructed, reconstructed, or modified between May 1978 and July 1984, and which have a storage capacity greater than 40,000 gallons.[14] As previously, discussed the proposed diesel belly tanks would be new units constructed after 1984. Further, none of the belly tanks would have a storage capacity greater than 40,000 gallons. Therefore, NSPS Subpart Ka is also not applicable.

4.3.4 40 CFR 60 Subpart Kb – Volatile Organic Liquid Storage Vessels (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced After July 23, 1984

NSPS Subpart Kb applies to volatile organic liquid (VOL) storage vessels which were constructed, reconstructed, or modified after July 1984. VOL storage tanks are only subject to this rule if they meet one of the following criteria:[15]

- The storage vessel has a maximum storage capacity greater than or equal to 151 m^3 (39,890 gallons) and which stores a VOL with a maximum true vapor pressure exceeding 3.5 kPa (0.51 psia); or

[13] 40 CFR 60.110

[14] 40 CFR 60.110a

[15] 40 CFR 60.110b(b)

- The storage vessel has a maximum storage capacity greater than or equal to 75 m^3 (19,812.9 gallons) but less than 151 m^3 and which stores a VOL with a maximum true vapor pressure exceeding 15.0 kPa (2.2 psia).

The new diesel belly tanks for the proposed generators each would have a storage capacity less than 19,812.9 gallons. In addition, diesel fuel has a maximum true vapor pressure less than 2.2 psia. Therefore, NSPS Subpart Kb does not apply.

4.3.5 40 CFR 60 Subpart IIII – Stationary Compression Ignition Internal Combustion Engines

NSPS Subpart IIII applies to new, modified, and reconstructed compression ignition (CI) internal combustion engines (ICE). New engines are subject to this regulation if construction of the CI ICE commenced after July 11, 2005, and if the engine was manufactured after April 1, 2006, for CI ICE that are not fire pump engines, or July 1, 2006, for CI ICE that are fire pump engines.[16] This rule is applicable to the proposed CI ICE that would be operated at the facility.

The proposed generators would meet the definition of emergency stationary ICE in 40 CFR 60.4219 and would not operate as fire pump engines.

4.3.5.1 Emission Standards

The proposed generators would each be classified as emergency generators under this regulation and would each have a displacement of less than 10 liters per cylinder. Per 40 CFR 60.4205(b), each generator would be subject to the applicable emission standards in 40 CFR 89.112-113. The Tier 2 emission standards for nonroad engines with a rated power greater than 560 kW are summarized in **Table 3**.[17] The USEPA Tier 2 standards for nonroad engines are based on a weighted cycle and cannot be used for comparison to the actual emissions from the engine at a specific load.

Table 3. Tier 2 Emission Standards

Pollutant	Emission Standard (g/kW-hr)
NO_X + Non-Methane Hydrocarbons (NMHC)	6.4
CO	3.5
PM	0.20

Additionally, the facility is required to only combust in its generators fuel that complies with the following requirements in 40 CFR 80.510(b) for nonroad diesel fuel:[18]

- Maximum sulfur content of 15 ppm; and

[16] 40 CFR 60.4200(a)(2)

[17] 40 CFR 89.112(a), Table 1.

[18] 40 CFR 60.4207(b)

- Either a minimum cetane index of 40 or a maximum aromatic content of 35 volume percent.

The applicant would comply with the emission standards in 40 CFR 89.112-113 by purchasing engines certified by the manufacturer to comply with the Tier 2 emission standards.[19] Further, the site would operate and maintain each engine according to the manufacturer's emission-related written instructions and only change those emission-related settings that are permitted by the manufacturer.[20]

4.3.5.2 Run Time Restrictions for Emergency ICE

In order for a stationary engine to be considered an emergency ICE under NSPS Subpart IIII, it must meet the run time restrictions in 40 CFR 60.4211(f).

There is no restriction on usage of an emergency ICE in emergency situations.[21] Each engine is restricted to a maximum of 100 hours per calendar year of operation for maintenance checks and readiness testing.[22] Each engine is allowed up to 50 hours per calendar year of non-emergency operation other than maintenance and testing; however, any non-emergency run time must be counted as part of the 100 hours per calendar year for maintenance and testing.[23] Any other operations are prohibited.

The facility would equip each emergency ICE with a non-resettable hour meter prior to startup of the unit in order to verify compliance with the run time restrictions for emergency and non-emergency runs.[24]

4.3.5.3 Notifications, Reporting, and Recordkeeping

An Initial Notification under NSPS Subpart A is not required for emergency stationary ICE. The facility would retain records of the emergency and non-emergency runs for each engine for a minimum of two years, as recorded through the engine's non-resettable hour meter. The records would indicate the time of operation of the engine and the reason the engine was in operation during that time.[25]

4.3.6 40 CFR 60 Subpart JJJJ – Stationary Spark Ignition Internal Combustion Engines

NSPS Subpart JJJJ is applicable to new, modified, and reconstructed stationary spark ignition (SI) ICE. All of the proposed generators would be categorized as CI ICE. As such, NSPS Subpart JJJJ does not apply.

4.4 National Emission Standards for Hazardous Air Pollutants

NESHAP, promulgated in 40 CFR 63, regulate emissions of HAP from specific source categories. A facility that has potential emissions exceeding 10 tpy for any individual HAP

[19] 40 CFR 60.4211(c)

[20] 40 CFR 60.4211(a)

[21] 40 CFR 60.4211(f)(1)

[22] 40 CFR 60.4211(f)(2)(i). The U.S. Court of Appeals for the DC Circuit vacated 40 CFR 60.4211(f)(ii)-(iii) in a May 2015 ruling. https://www.epa.gov/sites/production/files/2016-06/documents/ricevacaturguidance041516.pdf

[23] 40 CFR 60.4211(f)(3)

[24] 40 CFR 60.4209(a)

[25] 40 CFR 60.4214(b)

and/or emissions exceeding 25 tpy for the sum of all HAP is classified as a major source of HAP emissions. A facility that is not a major source of HAP is classified as an area source.

The facility would continue to be classified as an area source with the proposed generators since it has potential HAP emissions less than the major source thresholds. The following sections discuss the potentially applicable NESHAP standards to the proposed generators.

4.4.1 40 CFR 63 Subpart A – General Provisions

NESHAP Subpart A provides generally applicable requirements for testing, monitoring, notifications, and recordkeeping. Any source that is subject to another subpart under 40 CFR 63 is also subject to Subpart A, unless otherwise stated in the specific subpart.

4.4.2 40 CFR 63 Subpart EEEE – Organic Liquids Distribution (Non-Gasoline)

NESHAP Subpart EEEE is applicable to organic liquids distribution operations, including organic liquid storage tanks, located at major sources of HAP emissions.[26] This regulation does not apply since the facility would continue to be an area source of HAP emissions.

4.4.3 40 CFR 63 Subpart ZZZZ – Stationary Reciprocating Internal Combustion Engines

NESHAP Subpart ZZZZ applies to new and existing stationary reciprocating internal combustion engines (RICE) located at both major and area sources of HAP emissions. Per 40 CFR 63.6590(c), for new or reconstructed stationary RICE located at an area source of HAP emissions, the only requirement under NESHAP Subpart ZZZZ is to meet the requirements of NSPS Subpart IIII for CI ICE and of NSPS Subpart JJJJ for SI ICE. Since the proposed CI ICE at the facility would be in compliance with NSPS Subpart IIII, the units would also be in compliance with NESHAP Subpart ZZZZ. No further requirements apply for these engines under this regulation.

4.5 Chemical Accident Prevention Provisions

The Chemical Accident Prevention Provisions, promulgated in 40 CFR 68, provide requirements for the development of risk management prevention (RMP) plans for regulated substances. Applicability to RMP plan requirements is based on the types and amounts of chemicals stored at a facility. Diesel fuel is not on the list of regulated substances in Subpart F of this rule; therefore, the facility is not required to develop an RMP plan under 40 CFR 68.

4.6 Utah Administrative Code, Title R307 – Environmental Quality, Air Quality

In addition to the federal regulations, Title R307 of the UAC establishes regulations applicable at the emission unit level and at the facility level. The state regulations in Chapter 2 also include general requirements for facilities, such as the requirement to obtain permits to construct and operate. Source-specific standards in R307 that are potentially applicable to the proposed generators are discussed in the following sections.

4.6.1 R307-203 – Emission Standards: Sulfur Content of Fuels

This regulation provides emission standards for fuel burning equipment that combusts coal, oil, or a mixture thereof. The rule does not apply to sources covered by a NSPS for sulfur emissions. While the NSPS that regulates the emergency generator engines, 40 CFR 60 Subpart IIII, does not specifically regulate sulfur emissions, it does provide a requirement for the fuel sulfur content of the diesel fuel combusted in the engines (maximum sulfur content

[26] 40 CFR 63.2330

of 0.0015% by weight). The NSPS Subpart IIII fuel sulfur content limit is more stringent than that contained in this regulation (i.e., 0.85 pounds per million British thermal unit [lb/MMBtu]). Therefore, the NSPS Subpart IIII fuel sulfur content limitation applies in lieu of the R307-203 limitation.

4.6.2 R307-305-3 – Nonattainment and Maintenance Areas for PM_{10}: Emission Standards – Visible Emissions

This rule sets standards for visible emissions in PM_{10} nonattainment and maintenance areas, including Salt Lake County. R307-305-3(3) states that visible emissions from diesel engines in stationary operation shall be of a shade or density no darker than 20% opacity, not exceeding three minutes in any hour.[27] As stationary diesel engines, the proposed emergency generators at the facility would be subject to this standard. R307-305-3(4) further clarifies that visible emissions exceeding the opacity standards for short time periods as the result of initial warm-up, caused by start-up or shutdown of a facility, installation or operation, or unavoidable combustion irregularities which do not exceed three minutes in length shall not be deemed in violation, provided that UDAQ finds that adequate control technology has been applied. The applicant would be required to minimize visible and non-visible emissions during start-up or shutdown, installation, or operation through the use of adequate control technology and proper procedures. Such requirements would be satisfied through exclusive use of ultra-low sulfur diesel fuel in all generator engines onsite consistent with NSPS Subpart IIII requirements.

4.6.3 R307-309 – Nonattainment and Maintenance Areas for PM_{10} and $PM_{2.5}$: Fugitive Emissions and Fugitive Dust

This rule sets standards for control of fugitive dust and fugitive emissions in PM_{10} and $PM_{2.5}$ nonattainment and maintenance areas, including Salt Lake County. R307-309-4 states that fugitive emissions from any source shall not exceed 15% opacity. During operation, the proposed facility would not be a source of fugitive dust since it would not have unpaved roads in operational areas and would not engage in the handling of dust generating bulk materials. However, the applicant would comply with the requirements of this rule as it relates to submittal of a construction fugitive dust control plan to UDAQ prior to construction, as specified in R307-309-6.

4.6.4 R307-401 – Permits: New and Modified Sources

R307-401 establishes application and permitting requirements for new installations and modifications to existing installations throughout the State of Utah. As a minor source for all criteria pollutants (and associated precursor pollutants) located in a nonattainment area, the facility is categorically subject to the provisions of R307-401. The applicant would continue to comply with all generally applicable requirements found under R307-401 as evidenced in the supporting sections of this NOI application. Additional provisions that apply to modifications to existing installations located in nonattainment areas are found under R307-403, discussed subsequently.

[27] Unavoidable combustion irregularities which exceed three minutes in length must be handled in accordance with R307-107.

4.6.5 R307-403 – Permits: New and Modified Sources in Nonattainment Areas and Maintenance Areas

R307-403 implements the provisions of the federal nonattainment area permitting program for major sources as required by 40 CFR 51.165. The requirements under R307-403-5(1) apply to new or modified sources located in a PM_{10} nonattainment area that have the potential to emit more than 25 tpy of combined PM_{10}, SO_2, and NO_X emissions. Salt Lake County is currently designated as attainment for PM_{10}, so R307-403-5(1) is not applicable.

Per R307-403-5(2), major sources or major modifications to existing sources located in a $PM_{2.5}$ nonattainment area must obtain ERCs. As demonstrated in Table 2, the proposed generators would not cause the facility to be classified as a major source and the project itself would not meet the definition of a major modification to existing sources. Therefore, the requirement to obtain ERCs prior to initiating construction does not apply.

4.6.6 R307-410 – Emissions Impact Analysis

The provisions of R307-410 establishes the procedures and requirements for evaluating the emissions impact of new and modified sources that require an approval order under R307-401 to ensure that the source would not interfere with the attainment or maintenance of any NAAQS in the state of Utah. The facility's potential emissions with the newly proposed generators would exceed the modeling threshold for oxides of nitrogen under R307-410-4 Table 1 and, therefore, eBay has conducted an air dispersion modeling analysis using USEPA's recommended short-range transport dispersion model (i.e., AERMOD). This analysis was conducted in accordance with the air dispersion modeling protocol submitted to UDAQ, which was approved on May 1, 2020. The facility's demonstration of compliance with the 1-hour NO_2 and annual NAAQS is shown in the final modeling report, provided to UDAQ under separate cover, and is summarized in Section 6.

4.6.7 R307-420 – Permits: Ozone Offset Requirements in Davis and Salt Lake County Counties

Section R307-420-1 indicates that this regulation becomes effective only when Salt Lake and Utah counties are redesignated into attainment for ozone. Additionally, this regulation only applies to major sources or major modifications as defined in R307-420-2. Since the facility is not a major source and this project is not considered a major modification, the facility is not subject to this regulation.

4.6.8 R307-421 – Permits: PM_{10} Offset Requirements in Salt Lake County and Utah County

Section R307-421-5 indicates that this regulation becomes effective only when Salt Lake and Utah counties are redesignated into attainment for PM_{10}. Salt Lake County was redesignated as attainment for PM_{10} on March 27, 2020, and so this regulation is applicable. The combined emissions increase of PM_{10}, SO_2, and NO_X attributable to the proposed generators at the facility is less than the 25 tpy threshold; therefore, the requirement to obtain ERCs prior to initiating construction does not apply.

5. EVALUATION OF BEST AVAILABLE CONTROL TECHNOLOGY

New and modified sources of air emissions in Utah are required to implement best available control technology (BACT) for control of emissions when applying for an AO.[28] Determination of BACT accounts for the technical feasibility of potential air pollution control technologies, as well as factors such as the energy, environmental, and economic impacts of the technology. This section evaluates BACT for emissions of criteria pollutants from the emergency generators, specifically NO_X, CO, VOC, PM_{10}, $PM_{2.5}$, and SO_2.

The emergency backup generators to be installed at the facility would be certified by the manufacturer to meet the requirements of USEPA's Tier 2 emission standards, in accordance with the requirements of 40 CFR 60 Subpart IIII. The primary pollutant of concern is NO_X, as indicated by the potential emissions of the emergency backup generators and local attainment considerations (i.e., NO_X is a precursor pollutant for secondary formation of ozone, PM_{10}, and $PM_{2.5}$). Because the emergency backup generators would operate in standby mode the majority of the time, the use of engines certified by the manufacturer to meet the Tier 2 standards satisfies BACT requirements for this scenario. However, to be proactive, the applicant has evaluated additional potential control technologies that are capable of reducing NO_X emissions.

5.1 BACT Determination for NO_X

In accordance with the USEPA's top-down approach for conducting BACT analyses, the applicant has reviewed potential control technologies for reducing NO_X emissions from diesel-fired ICE. Of all potential technologies, those technically capable of reducing NO_X emissions from diesel-fired ICE of equivalent capacity to those used at the facility include the use of (1) SCRs, (2) engines certified by the manufacturer to the USEPA's Tier 4 emissions standards under 40 CFR 60 Subpart IIII, and (3) engines certified by the manufacturer to the USEPA's Tier 2 emission standards under 40 CFR 60 Subpart IIII. The following sections evaluate these potential NO_X control technologies for determination of BACT.

5.1.1 Evaluation of SCR

SCR achieves a reduction in NO_X emissions by passing a stream of urea solution into the generator exhaust, in the presence of a fixed, solid catalyst. The urea reacts with the NO_X yielding nitrogen, water, and CO_2. The applicant has evaluated the control effectiveness and potential energy, environmental, and economic impacts in the following subsections.

SCR Control Effectiveness

The control efficiency of this technology is dependent on several factors including generator load, catalyst state, and exhaust temperature. The SCR controls evaluated are estimated to achieve up to a 90% reduction in NO_X emissions[29], which would equate to a NO_X emissions rate of 0.66 g/bhp-hr (4.25 lb/hr/generator) for G28-G31 and 0.62 g/bhp-hr (1.51 lb/hr/generator) for G32-G33. To ensure the SCR systems operate effectively, the units must be operated and maintained in accordance with the manufacturer's recommendations. However, per the California Air Resources Board's (ARB) review on

[28] R307-401-5(d)

[29] Based on the maximum control efficiency from USEPA's *Air Pollution Control Technology Fact Sheet, Selective Catalytic Reduction (SCR)*, USEPA-452/F-03-032. https://www3.epa.gov/ttn/catc/cica/files/fscr.pdf

stationary compression ignition engines, it is stated that since SCR's require exhaust temperatures of 260°C to 540°C (500°F-1,004°F), it may be difficult for emergency generators to meet these temperatures since most of their operations are on low loads and for short periods of time[30]. Therefore, if the exhaust temperature was not met for these runs, the SCR would not activate, and the desired NO_X reduction would not be met. Additionally, an increase in load size or run duration for the activation of the SCR would result in additional emissions from the engines.

Evaluation of Energy Impacts of SCR

The energy required to operate SCR after-treatment is minimal relative to that of a generator. During the winter months, there would be a small input of energy into the SCR unit to prevent freezing of the urea solution.

Evaluation of Environmental Impacts of SCR

During operation of the SCR unit, the reaction of NO_X, urea, and oxygen would result in the formation of CO_2 emissions to the atmosphere, in addition to the formation of nitrogen and water vapor emissions. However, the amount of CO_2 emissions from urea usage is a minor contributor to the overall GHG emissions from the engines resulting from diesel combustion, and the environmental impact of the additional CO_2 emissions is more than offset by the benefit of NO_X reduction. Additionally, the SCR process requires the installation of reagent storage facilities, a system capable of metering and diluting the stock reagent into the appropriate solution, and an atomization/injection system at the appropriate locations in the combustion unit.

Evaluation of Economic Impacts of SCR

The economic impact of installing SCR technology is significant. The procurement and installation process would consume a large amount of capital, and there would also be long-term costs associated with the maintenance, repair, consumables, and catalyst storage and regeneration associated with operating the SCR units. California's ARB also researched the cost associated with installing diesel particulate filters (DPF) and SCRs on new Tier 2 or Tier 3 engines[31]. The following costs were determined based on engine size and eBay has conservatively assumed that the cost for SCR installation, without DPF, is equal to the difference in cost between the DPF and DPF/SCR scenario, as shown in **Table 4** below.

[30] California Air Resources Board, Proposed Amendments to the Airborne Toxic Control Measure for Stationary Compression Ignition Engines. https://ww3.arb.ca.gov/regact/2010/atcm2010/atcmisor.pdf

[31] California Air Resources Board, Proposed Amendments to the Airborne Toxic Control Measure for Stationary Compression Ignition Engines. https://ww3.arb.ca.gov/regact/2010/atcm2010/atcmisor.pdf

Table 4. SCR Cost Analysis

HP Range	Cost of New Tier 2/3 Gen-Set ($)	Scenario 1 – DPF Only Additional Costs	Scenario 2 – DPF and SCR Additional Costs	eBay Estimate – SCR Only Additional Costs
50-174	$29,000	$4,000	$13,000	$9,000
175-749	$67,000	$18,000	$55,000	$37,000
750-1209	$141,000	$37,000	$115,000	$78,000
1207-2000	$309,000	$61,000	$189,000	$128,000
>2,000	$523,000	$100,000	$310,000	$210,000

Note:
These numbers have not been updated to reflect 2020 $ amount and would increase if added to the analysis.

According to CARB data, SCR would result in an additional $210,000 for each 2 MW (2,937 hp) engine, and $78,000 for each new 750 kW (1,114 hp) engine. This would result in a ~$166,000/ton NO_X removed for the 2 MW engines (G28-G31) and ~$174,000/ton NOx removed for the 750 kW engines (G32-G33). Additionally, this does not take into account the ongoing operation and maintenance costs for the SCR system.

5.1.2 Evaluation of USEPA Tier 4 Certification

40 CFR 60 Subpart IIII requires owners and operators of new non-emergency diesel-fired ICE with a rated power output of greater than 560 kW to purchase engines that are certified by the manufacturer to the USEPA's Tier 4 nonroad engine emission standards. As such, the proposed diesel-fired emergency backup generators to be installed at the site are not subject to Tier 4 certification. However, for completeness, the applicant has reviewed the potential use of Tier 4-certified engines at the site as a means of demonstrating BACT-level NO_X emissions.

Although the applicant has conservatively proposed emission factors for the site based on the manufacturer's "Not to Exceed" values at 100% load, the use of Tier 2-certified engines with SCR would likely result in a NO_X emissions profile more consistent with the "Nominal" emissions performance data provided by the manufacturer (included in **Appendix 4**), scaled down by 90% to account for the use of SCR, which is effectively equivalent to the USEPA Tier 4 NO_X emissions standard of 0.67 g/kWh. Therefore, for the purposes of evaluating potential NO_X emissions control technologies, the applicant considers the use of Tier 4-certified engines to be effectively equivalent from an emissions performance perspective to the use of Tier 2-certified engines utilizing SCR for NO_X emissions control. Furthermore, according to the California ARB, a Tier 4 engine supplied by a manufacturer with a DPF and SCR would be an additional $329,000 for the 2 MW engines and $156,000 for the 750 kW engines.[32]

[32] California Air Resources Board, Proposed Amendments to the Airborne Toxic Control Measure for Stationary Compression Ignition Engines. https://ww3.arb.ca.gov/regact/2010/atcm2010/atcmisor.pdf

5.1.3 Evaluation of USEPA Tier 2 Certification

40 CFR 60 Subpart IIII requires owners and operators of new emergency diesel-fired ICE to purchase engines certified by the manufacturer to the USEPA's nonroad engine emission standards. Since the use of Tier 2-certified engines does not involve an exhaust stream control technique, there are no associated adverse environmental, energy, or economic impacts.

5.1.4 Selection of BACT for NO_X

Based on a limited review of USEPA's RACT/BACT/LAER Clearinghouse (RBLC) database for diesel generators, the use of either Tier 4 engines or Tier 2 engines with SCR represents the lowest achievable emission rate (LAER) level of emission control for emergency backup generators and exceeds the BACT requirements of this minor source project. In reviewing the control techniques described above, eBay has determined that the Tier 2 engines meet BACT for NO_X by implementing good operating practices and through purchasing an engine certified to the required Tier 2 emissions standards. Although the Tier 4 engine and Tier 2 engines with SCR are technically feasible, due to the low potential emission reduction for the generators and the high capital and annual operating costs, these options were determined to be economically infeasible.

5.2 BACT Determination for Other Criteria Pollutants

Emissions of all other criteria pollutants would be less than 1 tpy for each emergency generator. Due to the low emission rates of these pollutants, they do not warrant control technology beyond those inherent to Tier 2 generators, which is considered BACT for this facility. This conclusion is consistent with the USEPA's determination in the development of 40 CFR 60 Subpart IIII that add-on controls are not economically viable for emergency ICE.

While the use of Tier 4-certified engines could potentially lower emissions of PM, the conservatively estimated potential generator emissions of PM are already minimal (0.11 tpy versus a major source threshold of 70 tpy), and are based on the maximum ratio of the manufacturer's "Not to Exceed" emission factor, which is approximately 25% higher than the manufacturer's "nominal" or expected emission factors. As such, the use of and significant costs associated with installing Tier 4-certified engines would be expected to result in only minimal reductions of PM emissions (e.g., less than 0.5 tpy) at the site. Consequently, the applicant considers the use of Tier 2-certified engines to represent BACT for all other criteria pollutants.

The applicant would purchase engines that are certified by the manufacturer to the USEPA's Tier 2 emissions standards, and the site would operate and maintain each engine according to the manufacturer's emission-related written instructions and only change those emission-related settings that are permitted by the manufacturer. Further, the applicant would only combust ultra-low sulfur diesel fuel in its generators, with a maximum fuel sulfur content of 0.0015% by weight consistent with the requirements of NSPS Subpart IIII.

5.3 Conclusion

The emergency generator engines to be installed at the facility would be certified by the manufacturer to meet the requirements of USEPA's Tier 2 emission standards, in accordance with the requirements of 40 CFR 60 Subpart IIII. The primary pollutant of concern from these generators is NO_X, as indicated by the potential emissions of the generators and local attainment considerations as a precursor for ozone, PM_{10}, and $PM_{2.5}$. Because these emergency generators would be in standby mode the majority of the time and typically run

for short periods of time, the use of engines certified by the manufacturer to meet the Tier 2 standards satisfies BACT requirements for this scenario.

6. SUMMARY OF AIR DISPERSION MODELING EVALUATION

Pursuant to UDAQ's Emissions Impact Assessment Guidelines, new sources with total controlled emissions greater than those listed in Table 1 of the Guidelines are required to submit an air dispersion modeling analysis as part of a complete NOI application. A comparison of the facility-wide potential-to-emit (PTE) with the Table 1 values requiring an air dispersion modeling analysis is provided in **Table 5**.

Table 5. Comparison of Facility-Wide Potential Emissions to UDAQ Modeling Thresholds

Pollutant	Facility-Wide Potential Emissions[(a)(b)] (tpy)	Emissions Levels to Require Modeling[(c)] (tpy)	Exceeds?
Nitrogen Oxides (NO_x)	56.35	40	Yes
Sulfur Dioxide (SO_2)	0.06	40	No
Fugitive Emissions: Particulate Matter Less than 10 Microns in Diameter (PM_{10})	--	5	No
Non-Fugitive Emissions: Particulate Matter Less than 10 Microns in Diameter (PM_{10})	3.00	15	No
Carbon Monoxide (CO)	11.38	100	No

Notes:

a) Pollutants emission rates are based on the maximum short-term emission rate of that pollutant provided by the chosen engine vendor in the engine specification sheet. Additional detail on potential short-term and annual emissions expected from the proposed facility are discussed in **Section 3**.

b) Based on 100 operating hours per year for Fire Pump generators and 66 hours per year for all other generators

c) Utah Office of Administrative Rules. 2020. R307-410-4. Permits: Emissions Impact Analysis. https://rules.utah.gov/publicat/code/r307/r307-410.htm#E4

Per Table 5, the modeling thresholds for NO_x would be exceeded for the proposed project and therefore, UDAQ requires dispersion modeling for annual NO_2.[33] Additionally, the application understands that UDAQ would like the proposed facility to demonstrate compliance with the 1-hour NO_2 NAAQS since the proposed facility's NO_X emission would potentially exceed 10 pounds per hour.[34] Consistent with UDAQ's Emissions Impact Assessment Guidelines, some facilities must evaluate emissions of HAPs against UDAQ's

[33] UDAQ. Emissions Impact Assessment Guidelines. https://deq.utah.gov/legacy/permits/air-quality/docs/2013/03Mar/EmissionsImpactAssessmentGuideline.pdf

[34] Refer to Pre-NOI meeting held between eBay, Ramboll, and UDAQ on July 23, 2019.

Emission Threshold Values (ETVs) for each pollutant. However, since the engines are subject to NSPS IIII, they are exempt from R307-410-5[35], as noted below:

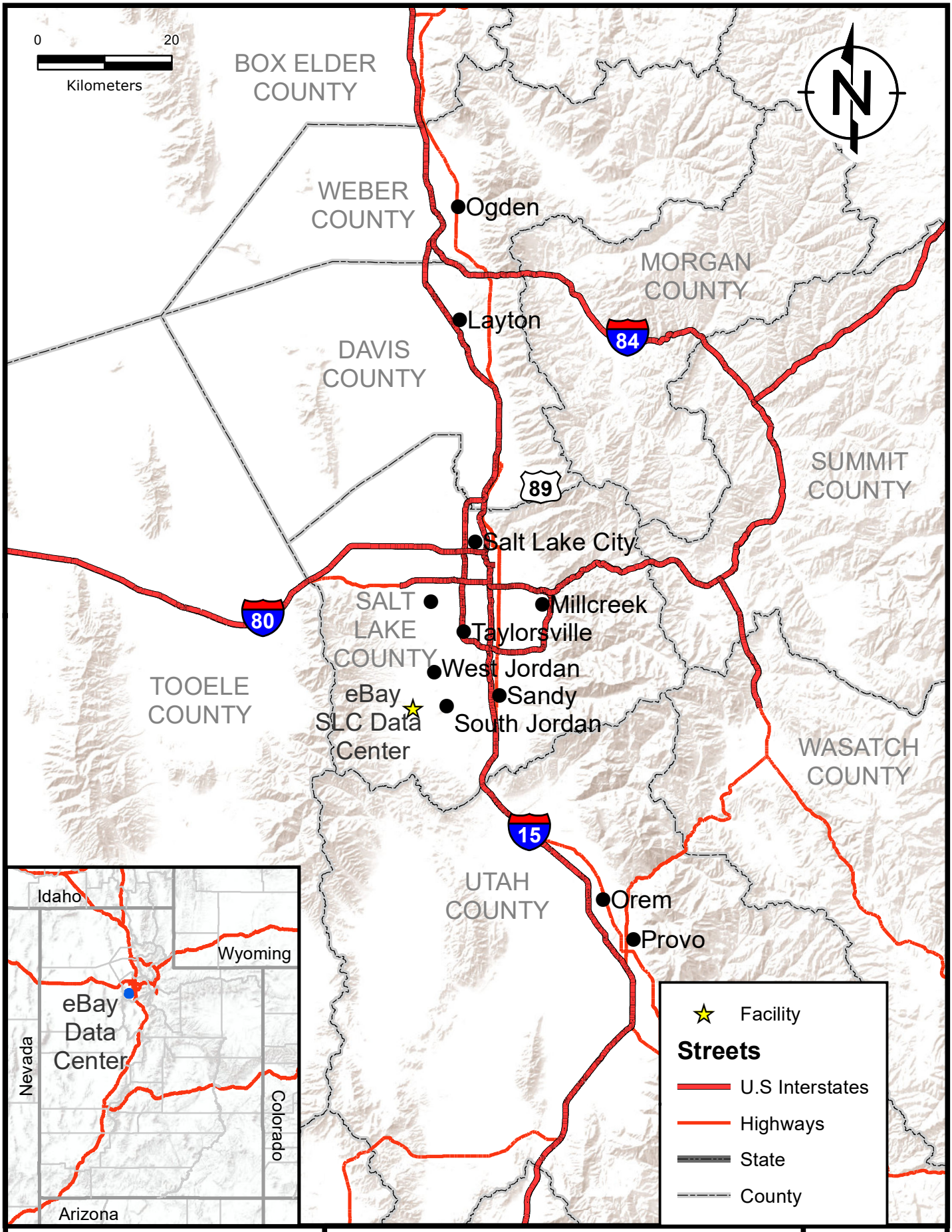
> *"The requirements of R307-410-5 do not apply to installations which are subject to or are scheduled to be subject to an emission standard promulgated under 42 U.S.C. 7412 at the time a notice of intent is submitted, [unless the director determines the delay in the implementation of an emission standard might post an unacceptable risk to public health]. This exemption does not affect requirements otherwise applicable to the source, including requirements under R307-401.[36]"*

Air dispersion modeling for 1-hour and annual NO_2 was conducted using USEPA's AERMOD modeling software (version 19191), and the results indicate that the cumulative modeled impacts from the facility would be less than the NAAQS. A detailed modeling evaluation report, including the electronic modeling files, will be provided to UDAQ under separate cover.

[35] Utah Office of Administrative Rules. 2020. R307-410-5. Permits: Emissions Impact Analysis. https://rules.utah.gov/publicat/code/r307/r307-410.htm

[36] Utah Administrative Code. R307-401. Permit: New and Modified Sources. https://rules.utah.gov/publicat/code/r307/r307-401.htm

APPENDIX 1
SITE LOCATION MAP



RAMBOLL

50 West Broadway, Suite 300
Salt Lake City, UT 84101

Facility Location and Surrounding Areas
eBay SLC Data Center
South Jordan, Utah

FIGURE
A1

APPENDIX 2
UDAQ APPROVAL ORDER MODIFICATION FORMS

Form 1
Notice of Intent (NOI) Application Checklist

Date: *5/7/2020*
Company: *eBay Inc.*

Utah Division of Air Quality
New Source Review Section

Source Identification Information [R307-401-5]

1	Company name, mailing address, physical address, and telephone number.	☑
2	Company contact (name, mailing address, telephone number).	☑
3	Name and contact of person submitting NOI application (if different than 2).	☑
4	Source Universal Transverse Mercator (UTM) coordinates.	☑
5	Source Standard Industrial Classification (SIC) Code.	☑
6	Area designation (attainment, maintenance, or nonattainment).	☑
7	Federal/State requirement applicability (NAAQS, NSPS, MACT, SIP, etc.)	☑
8	Source size determination (Major, Minor, PSD).	☑
9	Current Approval Order(s) and/or Title V Permit Numbers.	☑

NOI Application Information [R307-401]

1	Detailed description of the project and source process.	☑
2	Discussion of fuels, raw materials, and products consumed/produced.	☑
3	Description of equipment used in the process and operating schedule.	☑
4	Description of changes in the process, production rates, etc.	☑ ☐ N/A
5	Site plan of source with building dimensions, stack parameters, etc.	☑
6	Best Available Control Technology (BACT) Analysis [R307-401-8]	
	A BACT analysis for all new and modified equipment.	☑
7	Emissions Related Information [R307-401-2(b)]	
	A Emission calculations for each new/modified units and site-wide (Include PM_{10}, $PM_{2.5}$, NO_X, SO_2, CO, VOCs, HAPs, and GHG).	☑
	B References/assumptions, SDS, for each calculation and pollutant.	☑
	C All speciated HAP emissions (list in lbs/hr).	☑
8	Emissions Impact Analysis - Approved Modeling Protocol [R307-410]	
	A Composition and physical characteristics of effluent (Emission rates, temperature, volume, pollutant types, and concentration).	☑
9	Nonattainment/Maintenance Areas - Major NSR/Minor (Offsetting Only) [R307-403]	
	A NAAQS Demonstration, Lowest Achievable Emission Rate, Offset Requirements.	☐ ☑ N/A
	B Alternate site analysis, Major source ownership compliance certification.	☐ ☑ N/A
10	Major Sources in Attainment or Unclassified Area (PSD) [R307-405, R307-406]	
	A Air quality analysis (air model, met data, background data, source impact analysis).	☐ ☑ N/A
	B Visibility impact analysis, Class I area impact.	☐ ☑ N/A

Signature on Application ☑

Note: The Division for Air Quality will not accept documents containing confidential information or data. Documents containing confidential information will be returned to the Source submitting the application.

Form 2
Company Information/Notice of Intent (NOI)

Utah Division of Air Quality
New Source Review Section

Date: *5/7/2020*

Application For: ☐ **Initial Approval Order** ☑ **Approval Order Modification**

General Owner and Source Information

1. Company name and mailing address:
   - Company Name: *eBay Inc.*
   - Mailing Address: *2145 Hamilton Ave*, *San Jose, CA 95125*
   - Phone No.: *(408) 376-8488*
   - Fax No.: *(408) 376-5945*

2. Company** contact for environmental matters:
   - Contact: *Eileen Ovrahim*
   - Title: *Regional Facilities Operations Manager*
   - Phone No.: *(415) 301-1016*
   - Email: *eovrahim@ebay.com*

   **Company contact only; consultant or independent contractor contact information can be provided in a cover letter.

3. Source name and physical address (if different from above):
   - Company Name: *SLC Data Center*
   - Mailing Address: *6614 West Crimson View Drive*, *South Jordan, UT 84095*
   - Phone No.:
   - Fax No.:

4. Source Property Universal Transverse Mercator Coordinates (UTM), including System and Datum:
   - UTM E: *411299.0* meters
   - UTM N: *4490858.0* meters
   - System & Datum: *NAD83, Zone 12 N*

5. The Source is located in: *Salt Lake* County.

6. Standard Industrial Classification Code: *7374*

7. If request for modification, AO# to be modified:
   - DAQE #: *DAQE-AN141800010-19*
   - Dated: *7-May-19*

8. Brief (50 words or less) description of process:
   Please see Section 2 of the enclosed NOI application report.

Electronic NOI

9. A completed and accurate electronic NOI submitted to DAQ Permitting Managers Jon Black (jblack@utah.gov) or Alan Humpherys (ahumperys@utah.gov) can expedite review process. Please mark application type.

Hard Copy Submittal: ☐ Electronic Copy Submittal: ☑ Both: ☐

General Owner and Source Information

I hereby certify that the information and data submitted in and with this application is completely true, accurate, and complete, based on reasonable inquiry made by me and to the best of my knowledge and belief.

Signature: _____ Title: Regional Facilities Operations Manager

Eileen Ovrahim	Telephone No: *(415) 301-1016*	Date:
Name (Type or Print)	Email: *eovrahim@ebay.com*	

Form 4
Emissions Information
Criteria / GHGs

Utah Division of Air Quality
New Source Review Section

Company: *eBay Inc.*
Site: *SLC Data Center*

Process Data - For Modification/Amendment ONLY		
1. Permit Number *DAQE-AN141800010-19* If submitting a new permit, then use Form 3		
Requested Changes		
2. Name of process to be modified/added: ***Emergency generator***	3. Permit Change Type:	New / Increase*
	Equipment	☑ / ☑
	Process	☐ / ☐
End product of this process: ***Addition of six emergency generators to the overall operation of facility; Non-Emergency runtime hour limits modified for existing permitted generators and fire pump engines***	Condition Change: ***Additional 6 generators to be installed at the facility*** Other: ***Non-Emergency runtime hours limits change for existing permitted generators to 66 hrs/yr/ generator and for fire pump engines to 100 hrs/yr/engine***	
4. Does new emission unit affect existing permitted process limits? Yes ☑ No ☐	5. Condition(s) Changing: ***Hours limits for generators G1-G27 and FP1 and FP2***	
6. Description of Permit/Process Change** **See details in application report**		
7. New or modified materials and quantities used in process. **		

Material	Quantity Annually
G1-G27 hours of operation	***66 hrs/yr/generator for Non-Emergency Operations***
G28-G33	***66 hrs/yr/generator for Non-Emergency Operations***
FP1-FP2	***100 hrs/yr/generator for Non-Emergency Operations***

8. New or modified process emitting units **

Emitting Unit(s)	Capacity(s)	Manufacture Date(s)
CAT 3516C Diesel Generator	***2.0 MW***	***2020+***
CAT 3516C Diesel Generator	***2.0 MW***	***2020+***
CAT 3516C Diesel Generator	***2.0 MW***	***2020+***
CAT 3516C Diesel Generator	***2.0 MW***	***2020+***
CAT C27 Diesel Generator	***750 kW***	***2020+***
CAT C27 Diesel Generator	***750 kW***	***2020+***

**If the permit being modified does not include CO2e or PM2.5, the emissions need to be calculated and submitted to DAQ, which may result in an emissions increase and a public comment period.*
***If additional space is required, please generate a document to accommodate and attach to form.*

Form 5
Emissions Information
Criteria / GHGs

Utah Division of Air Quality
New Source Review Section

Company: *eBay Inc.*
Source: *Facility-Wide*

Potential to Emit* - Criteria Pollutants & GHGs			
Criteria Pollutants	**Permitted Emissions (tons / year)**	**Emissions Increases (tons/year)**	**Proposed Emissions (tons/year)**
PM_{10} (Total)	*2.66*	*0.34*	*3.00*
PM_{10} (Fugitive)	--	--	--
$PM_{2.5}$	*2.62*	*-1.91*	*0.71*
NO_X	*54.57*	*1.78*	*56.35*
SO_2	*0.12*	*-0.06*	*0.06*
CO	*8.79*	*2.59*	*11.38*
VOC	*1.75*	*0.51*	*2.26*
VOC (Fugitive)	--	--	--
NH_3	--	--	--

Greenhouse Gases	**Mass Basis**	**CO_2e**	**Mass Basis**	**CO_2e**	**Mass Basis**	**CO_2e**
CO_2	--	--	--	--	*41,341.38*	*41,341.38*
CH_4	--	--	--	--	*0.17*	*4.16*
N_2O	--	--	--	--	*0.03*	*9.91*
HFCs	--	--	--	--	--	--
PFCs	--	--	--	--	--	--
SF_6	--	--	--	--	--	--
Total CO_2e	*42,494.00*	*42,494.00*	*-1,138.56*	*-1,138.56*	*41,355.44*	*41,355.44*

*Potential to Emit to include pollution control equipment as defined by R307-401-2.

Form 5
Emissions Information
HAP's

Utah Division of Air Quality
New Source Review Section

Company: *eBay Inc.*
Source: *Facility-Wide*

Hazardous Air Pollutants**				
Hazardous Air Pollutants* **	**Permitted Emissions (tons/year)**	**Emissions Increases (tons/year)**	**Proposed Emissions (tons/year)**	**Emissions Increase (pounds/hour)**
Benzene	--	--	*0.020*	--
Toluene	--	--	*7.07E-03*	--
Xylenes	--	--	*4.86E-03*	--
1,3-Butadiene	--	--	*3.04E-06*	--
Formaldehyde	--	--	*2.07E-03*	--
Acetaldehyde	--	--	*6.91E-04*	--
Acrolein	--	--	*2.05E-04*	--
Total HAP	*0.12*	*-0.08*	*0.04*	--

**Defined in Section 112(b) of the Clean Air Act.

***Use additional sheets for pollutants if needed.

Form 11
Internal Combustion Engines

Utah Division of Air Quality
New Source Review Section

Company: *eBay Inc.*
Source: *G1-G7*
Date: *5/8/2020*

Equipment Information

1. Manufacturer / Model:

Manufacturer: *Detroit Diesel*
Model No.: *20V4000G83L*

2. Operating Time of Emissions Source

	Average		*Maximum*	
	N/A	hr/day	*N/A*	hr/day
	N/A	day/wk	*N/A*	day/wk
	N/A	wk/yr	*N/A*	wk/yr

Date Engine Was Constructed / Reconstructed: *--*

66 hrs/yr/generator for non-emergency operations.

3. Manufacturer's Rated Output at Baseload (ISO): *4,678.00* bhp *3,250.00* kWe
Proposed Site Operated Range: *4,678.00* bhp *3,250.00* kWe

Gas-Firing

4. Are you operating site equipment on pipeline quality natural gas? ☐ Yes ☐ No ☑ N/A

5. Are you on an interruptible gas supply? ☐ Yes ☐ No
If Yes, Alternate Fuel? *N/A*

6. Annual Consumption of Fuel: *N/A* MMscf/yr

7. Maximum Firing Rate: *N/A* Btu/hr

8. Average Firing Rate: *N/A* Btu/hr

Oil-Firing

9. Type of Oil: ☐ No. 1 ☐ No. 2 ☐ No. 4 ☐ No. 5 ☐ No. 6 Other? *ULSD*

10. Annual Fuel Consumption: *15,642* gallons/year/engine

11. Heat Content: *--* Btu/lb ***OR*** *137,030* Btu/gal

12. Sulfur Content. *< 0.0015* wt.%

13. Ash Content *Neg.* wt.%

14. Average Firing Rate *--* gal/hr/engine

15. Maximum Firing Rate *237* gal/hr/engine

16. Direction of Firing: ☐ Horizontal ☐ Tangential ☐ Other (Specify)

Operation

17. Application of Internal Combustion Engine:
- ☐ Electric Generation (Base Load)
- ☐ Electric Generation (Peaking)
- ☑ Emergency Generator
- ☐ Driving Pump / Compressor
- ☐ Exhaust Heat Recovery
- ☐ Other (Specify)

18. Cycle
- ☐ Simple Cycle
- ☐ Regenerative Cycle
- ☐ Cogeneration
- ☐ Combined Cycle
- ☑ N/A

Emissions Data

19. Manufacturer's Emissions Data (Provided in Grams per Brake-Horsepower-Hour):

*--**	NO_X	*--**	VOC
*--**	CO	*No Data*	Formaldehyde

Please refer to Appendix 4 of the enclosed NOI application for detailed engine-specific emissions information.

20. Attach manufacturer's information showing emissions of NO_X, CO, VOC, SO_2, CH_2O, PM_{10}, $PM_{2.5}$, CO_2, CH_4, and N_2O for each proposed fuel at engine loads and site ambient temperatures representative of the range of proposed operation. The information must be sufficient to determine maximum hourly and annual emission rates. Annual emissions may be based on a conservatively low approximation of site annual average temperature. Provide emissions in pounds per hour and except for PM_{10} and $PM_{2.5}$ parts per million by volume (ppmv) at actual conditions and corrected to dry, 15% oxygen conditions.

Method of Emissions Control:

☐ Lean Premix Combustors ☐ Oxidation Catalyst ☐ Water Injection ☐ Other?
☐ Other Low-NO_X Combustor ☐ SCR Catalyst ☐ Steam Injection

Form 11
Internal Combustion Engines

Utah Division of Air Quality
New Source Review Section

Company: *eBay Inc.*
Source: *G1-G7*
Date: *5/8/2020*

Additional Information
21. On separate sheets provide the following: A Details regarding principle of operation of emission controls. If add-on equipment is used, provide make and model and manufacturer's information. Example details include: controller input variables and operational algorithms for water or ammonia injection systems, combustion mode versus engine load for variable mode combustors, etc. B Exhaust parameter information on attached form. C All calculations used for the annual emission estimates must be submitted with this form to be deemed complete. D All formaldehyde emissions must be modeled as per Utah Administrative Code R307-410-5 using SCREEN3. E If this form is filled out for a new source, forms 1 and 2 must be submitted also.

Internal Combustion Engine
Form 11 (Continued)
Emissions Sources

AIR CONTAMINANT DATA						EMISSION POINT DISCHARGE PARAMETERS							
Emission Point (1)		Chemical Composition of Total Stream		Air Contaminant Emission Rate		UTM Coordinates of Emission Point (6)			Stack Sources (7)				
											Exit Data		
Number	Name	Component / Air Contaminant Name (2)	Conc. (Vol.%) (3)	LB/HR (4)	TPY (5)	Zone	East (m)	North (m)	Height Above Ground (ft.)	Height Above Structure (ft.)	Diameter (ft.)	Velocity (ft/sec)	Temp. (deg. F)
G1-G7 Detroit Diesel Generators		*NO_X*	--	*Refer to Appendix 4 to this NOI application for detailed engine-specific emissions information.*		*See NOI Report and associated Modeling Report Table B1.*							
		CO	--										
		VOC	--										
		PM	--										
		PM_{10}	--										
		$PM_{2.5}$	--										
		SO_2	--										
		CO_2	--										
		CH_4	--										
		N_2O	--										
		CO_2e	--										
		Benzene	--										
		Toluene	--										
		Xylenes	--										
		Formaldehyde	--										
		Acetaldehyde	--										
		Acrolein	--										
		Total PAH	--										
		Total HAP	--										

GROUND ELEVATION OF FACILITY ABOVE MEAN SEA LEVEL: *Approx. 5,100* feet.
UTAH AIR CONSERVATION BOARD STANDARD CONDITIONS ARE 680 F AND 14.7 PSIA

General Instructions for this form:

1 Identify each emission; point with a unique number for this plant site on plot plan, previous permits and emission inventory questionnaire. Limit emission point number to 8 character spaces. For each emission point use as many lines as necessary to list air contaminant data. Typical emission point names are: heater, vent, boiler, tank, reactor, separator, baghouse, fugitive, etc. Abbreviations are OK.

2 Typical component names are: air, H2O, nitrogen, oxygen, CO2, CO, NOx, SOx, hexane, particulate matter (PM10 and PM2.5), etc. Abbreviations are OK.
3 Concentration data is required for all gaseous components. Show concentration in volume percent of total gas stream.
4 Pounds per hour. (#/hr) is maximum emission rate expected by applicant.
5 Tons per year (T/Y) is annual maximum emission rate expected by applicant, which takes into account process operating schedule.
6 As a minimum applicant must furnish a facility plot plan drawn to scale showing a plant benchmark, latitude and longitude correct to the nearest second for the benchmark, and all emission points dimensioned with respect to the benchmark. Please show emission point UTM coordinates if known.
7 Supply additional information as follows if appropriate:
(a) Stack exit configuration other than a round vertical stack. Show length and width for a rectangular stack. Indicate if horizontal discharge with a note.
(b) Stack's height above supporting or adjacent structures if structure is within three "stack heights above ground" of stack.

Form 11
Internal Combustion Engines

Utah Division of Air Quality
New Source Review Section

Company: *eBay Inc.*
Source: *G8-G14*
Date: *5/8/2020*

Equipment Information

1. Manufacturer / Model:

Manufacturer: *Caterpillar*
Model No.: *C175-16*

2. Operating Time of Emissions Source

	Average		*Maximum*	
	N/A	hr/day	*N/A*	hr/day
	N/A	day/wk	*N/A*	day/wk
	N/A	wk/yr	*N/A*	wk/yr

66 hrs/yr/generator for non-emergency operations.

Date Engine Was Constructed / Reconstructed: *--*

3. Manufacturer's Rated Output at Baseload (ISO):	*4,376.00*	bhp	*3,100.00*	kWe
Proposed Site Operated Range:	*4,376.00*	bhp	*3,100.00*	kWe

Gas-Firing

4. Are you operating site equipment on pipeline quality natural gas? ☐ Yes ☐ No ☑ N/A

5. Are you on an interruptible gas supply? ☐ Yes ☐ No
If Yes, Alternate Fuel? *N/A*

6. Annual Consumption of Fuel: *N/A* MMscf/yr

7. Maximum Firing Rate: *N/A* Btu/hr

8. Average Firing Rate: *N/A* Btu/hr

Oil-Firing

9. Type of Oil: ☐ No. 1 ☐ No. 2 ☐ No. 4 ☐ No. 5 ☐ No. 6 Other? *ULSD*

10. Annual Fuel Consumption: *13,906* gallons/year/engine

11. Heat Content: *--* Btu/lb ***OR*** *137,030* Btu/gal

12. Sulfur Content. *< 0.0015* wt.%

13. Ash Content *Neg.* wt.%

14. Average Firing Rate *122* gal/hr/engine

15. Maximum Firing Rate *211* gal/hr/engine

16. Direction of Firing: ☐ Horizontal ☐ Tangential ☐ Other (Specify)

Operation

17. Application of Internal Combustion Engine:
- ☐ Electric Generation (Base Load)
- ☐ Electric Generation (Peaking)
- ☑ Emergency Generator
- ☐ Driving Pump / Compressor
- ☐ Exhaust Heat Recovery
- ☐ Other (Specify)

18. Cycle
- ☐ Simple Cycle
- ☐ Regenerative Cycle
- ☐ Cogeneration
- ☐ Combined Cycle
- ☑ N/A

Emissions Data

19. Manufacturer's Emissions Data (Provided in Grams per Brake-Horsepower-Hour):

*--**	NO_X	*--**	VOC
*--**	CO	*No Data*	Formaldehyde

Please refer to Appendix 4 of the enclosed NOI application for detailed engine-specific emissions information.

20. Attach manufacturer's information showing emissions of NO_X, CO, VOC, SO_2, CH_2O, PM_{10}, $PM_{2.5}$, CO_2, CH_4, and N_2O for each proposed fuel at engine loads and site ambient temperatures representative of the range of proposed operation. The information must be sufficient to determine maximum hourly and annual emission rates. Annual emissions may be based on a conservatively low approximation of site annual average temperature. Provide emissions in pounds per hour and except for PM_{10} and $PM_{2.5}$ parts per million by volume (ppmv) at actual conditions and corrected to dry, 15% oxygen conditions.

Method of Emissions Control:

☐ Lean Premix Combustors ☐ Oxidation Catalyst ☐ Water Injection ☐ Other?

☐ Other Low-NO_X Combustor ☐ SCR Catalyst ☐ Steam Injection

Form 11
Internal Combustion Engines

Utah Division of Air Quality
New Source Review Section

Company: *eBay Inc.*
Source: *G8-G14*
Date: *5/8/2020*

Additional Information
21. On separate sheets provide the following: A Details regarding principle of operation of emission controls. If add-on equipment is used, provide make and model and manufacturer's information. Example details include: controller input variables and operational algorithms for water or ammonia injection systems, combustion mode versus engine load for variable mode combustors, etc. B Exhaust parameter information on attached form. C All calculations used for the annual emission estimates must be submitted with this form to be deemed complete. D All formaldehyde emissions must be modeled as per Utah Administrative Code R307-410-5 using SCREEN3. E If this form is filled out for a new source, forms 1 and 2 must be submitted also.

Internal Combustion Engine
Form 11 (Continued)
Emissions Sources

AIR CONTAMINANT DATA						EMISSION POINT DISCHARGE PARAMETERS							
Emission Point (1)		Chemical Composition of Total Stream		Air Contaminant Emission Rate		UTM Coordinates of Emission Point (6)			Stack Sources (7)				
											Exit Data		
Number	Name	Component / Air Contaminant Name (2)	Conc. (Vol.%) (3)	LB/HR (4)	TPY (5)	Zone	East (m)	North (m)	Height Above Ground (ft.)	Height Above Structure (ft.)	Diameter (ft.)	Velocity (ft/sec)	Temp. (deg. F)
G8-G14 CAT Diesel Generators		*NO_X*	--	*Refer to Appendix 4 to this NOI application for detailed engine-specific emissions information.*		*See NOI Report and associated Modeling Report Table B1.*							
		CO	--										
		VOC	--										
		PM	--										
		PM_{10}	--										
		$PM_{2.5}$	--										
		SO_2	--										
		CO_2	--										
		CH_4	--										
		N_2O	--										
		CO_2e	--										
		Benzene	--										
		Toluene	--										
		Xylenes	--										
		Formaldehyde	--										
		Acetaldehyde	--										
		Acrolein	--										
		Total PAH	--										
		Total HAP	--										

GROUND ELEVATION OF FACILITY ABOVE MEAN SEA LEVEL: *Approx. 5,100* feet.
UTAH AIR CONSERVATION BOARD STANDARD CONDITIONS ARE 680 F AND 14.7 PSIA

General Instructions for this form:

1 Identify each emission; point with a unique number for this plant site on plot plan, previous permits and emission inventory questionnaire. Limit emission point number to 8 character spaces. For each emission point use as many lines as necessary to list air contaminant data. Typical emission point names are: heater, vent, boiler, tank, reactor, separator, baghouse, fugitive, etc. Abbreviations are OK.

2 Typical component names are: air, H2O, nitrogen, oxygen, CO2, CO, NOx, SOx, hexane, particulate matter (PM10 and PM2.5), etc. Abbreviations are OK.

3 Concentration data is required for all gaseous components. Show concentration in volume percent of total gas stream.

4 Pounds per hour. (#/hr) is maximum emission rate expected by applicant.

5 Tons per year (T/Y) is annual maximum emission rate expected by applicant, which takes into account process operating schedule.

6 As a minimum applicant must furnish a facility plot plan drawn to scale showing a plant benchmark, latitude and longitude correct to the nearest second for the benchmark, and all emission points dimensioned with respect to the benchmark. Please show emission point UTM coordinates if known.

7 Supply additional information as follows if appropriate:

(a) Stack exit configuration other than a round vertical stack. Show length and width for a rectangular stack. Indicate if horizontal discharge with a note.

(b) Stack's height above supporting or adjacent structures if structure is within three "stack heights above ground" of stack.

Form 11
Internal Combustion Engines

Utah Division of Air Quality
New Source Review Section

Company: *eBay Inc.*
Source: *G15-G16, G19-G22, G26-G27*
Date: *5/8/2020*

Equipment Information

1. Manufacturer / Model:

Manufacturer: *Caterpillar*
Model No.: *3516C*

Date Engine Was Constructed / Reconstructed: *--*

2. Operating Time of Emissions Source

	Average		*Maximum*	
	N/A	hr/day	*N/A*	hr/day
	N/A	day/wk	*N/A*	day/wk
	N/A	wk/yr	*N/A*	wk/yr

66 hrs/yr/generator for non-emergency operations.

3. Manufacturer's Rated Output at Baseload (ISO):	*2,937.00*	bhp	*2,000.00*	kWe
Proposed Site Operated Range:	*2,937.00*	bhp	*2,000.00*	kWe

Gas-Firing

4. Are you operating site equipment on pipeline quality natural gas? ☐ Yes ☐ No ☑ N/A

5. Are you on an interruptible gas supply?
☐ Yes ☐ No
If Yes, Alternate Fuel? *N/A*

6. Annual Consumption of Fuel: *N/A* MMscf/yr

7. Maximum Firing Rate: *N/A* Btu/hr

8. Average Firing Rate: *N/A* Btu/hr

Oil-Firing

9. Type of Oil:
☐ No. 1 ☐ No. 2 ☐ No. 4 ☐ No. 5 ☐ No. 6 Other? *ULSD*

10. Annual Fuel Consumption: *9,108* gallons/year/engine

11. Heat Content: *--* Btu/lb ***OR*** *137,030* Btu/gal

12. Sulfur Content. *< 0.0015* wt.%

13. Ash Content *Neg.* wt.%

14. Average Firing Rate *79* gal/hr/engine

15. Maximum Firing Rate *138* gal/hr/engine

16. Direction of Firing:
☐ Horizontal ☐ Tangential ☐ Other (Specify)

Operation

17. Application of Internal Combustion Engine:
☐ Electric Generation (Base Load)
☐ Electric Generation (Peaking)
☑ Emergency Generator
☐ Driving Pump / Compressor
☐ Exhaust Heat Recovery
☐ Other (Specify)

18. Cycle
☐ Simple Cycle
☐ Regenerative Cycle
☐ Cogeneration
☐ Combined Cycle
☑ N/A

Emissions Data

19. Manufacturer's Emissions Data (Provided in Grams per Brake-Horsepower-Hour):

*--**	NO_X	*--**	VOC
*--**	CO	*No Data*	Formaldehyde

Please refer to Appendix 4 of the enclosed NOI application for detailed engine-specific emissions information.

20. Attach manufacturer's information showing emissions of NO_X, CO, VOC, SO_2, CH_2O, PM_{10}, $PM_{2.5}$, CO_2, CH_4, and N_2O for each proposed fuel at engine loads and site ambient temperatures representative of the range of proposed operation. The information must be sufficient to determine maximum hourly and annual emission rates. Annual emissions may be based on a conservatively low approximation of site annual average temperature. Provide emissions in pounds per hour and except for PM_{10} and $PM_{2.5}$ parts per million by volume (ppmv) at actual conditions and corrected to dry, 15% oxygen conditions.

Method of Emissions Control:

☐ Lean Premix Combustors ☐ Oxidation Catalyst ☐ Water Injection ☐ Other?
☐ Other Low-NO_X Combustor ☐ SCR Catalyst ☐ Steam Injection

Form 11
Internal Combustion Engines

Utah Division of Air Quality
New Source Review Section

Company: *eBay Inc.*
Source: *G15-G16, G19-G22, G26-G27*
Date: *5/8/2020*

Additional Information
21. On separate sheets provide the following: A Details regarding principle of operation of emission controls. If add-on equipment is used, provide make and model and manufacturer's information. Example details include: controller input variables and operational algorithms for water or ammonia injection systems, combustion mode versus engine load for variable mode combustors, etc. B Exhaust parameter information on attached form. C All calculations used for the annual emission estimates must be submitted with this form to be deemed complete. D All formaldehyde emissions must be modeled as per Utah Administrative Code R307-410-5 using SCREEN3. E If this form is filled out for a new source, forms 1 and 2 must be submitted also.

Internal Combustion Engine
Form 11 (Continued)
Emissions Sources

AIR CONTAMINANT DATA						EMISSION POINT DISCHARGE PARAMETERS							
Emission Point (1)		Chemical Composition of Total Stream		Air Contaminant Emission Rate		UTM Coordinates of Emission Point (6)			Stack Sources (7)				
											Exit Data		
Number	Name	Component / Air Contaminant Name (2)	Conc. (Vol.%) (3)	LB/HR (4)	TPY (5)	Zone	East (m)	North (m)	Height Above Ground (ft.)	Height Above Structure (ft.)	Diameter (ft.)	Velocity (ft/sec)	Temp. (deg. F)
G15-G16; G19-G22; G26-G27 CAT Diesel Generators		*NO_X*	--	*Refer to Appendix 4 to this NOI application for detailed engine-specific emissions information.*		*See NOI Report and associated Modeling Report Table B1.*							
		CO	--										
		VOC	--										
		PM	--										
		PM_{10}	--										
		$PM_{2.5}$	--										
		SO_2	--										
		CO_2	--										
		CH_4	--										
		N_2O	--										
		CO_2e	--										
		Benzene	--										
		Toluene	--										
		Xylenes	--										
		Formaldehyde	--										
		Acetaldehyde	--										
		Acrolein	--										
		Total PAH	--										
		Total HAP	--										

GROUND ELEVATION OF FACILITY ABOVE MEAN SEA LEVEL: *Approx. 5,100* feet.
UTAH AIR CONSERVATION BOARD STANDARD CONDITIONS ARE 680 F AND 14.7 PSIA

General Instructions for this form:

1 Identify each emission; point with a unique number for this plant site on plot plan, previous permits and emission inventory questionnaire. Limit emission point number to 8 character spaces. For each emission point use as many lines as necessary to list air contaminant data. Typical emission point names are: heater, vent, boiler, tank, reactor, separator, baghouse, fugitive, etc. Abbreviations are OK.

2 Typical component names are: air, H2O, nitrogen, oxygen, CO2, CO, NOx, SOx, hexane, particulate matter (PM10 and PM2.5), etc. Abbreviations are OK.

3 Concentration data is required for all gaseous components. Show concentration in volume percent of total gas stream.

4 Pounds per hour. (#/hr) is maximum emission rate expected by applicant.

5 Tons per year (T/Y) is annual maximum emission rate expected by applicant, which takes into account process operating schedule.

6 As a minimum applicant must furnish a facility plot plan drawn to scale showing a plant benchmark, latitude and longitude correct to the nearest second for the benchmark, and all emission points dimensioned with respect to the benchmark. Please show emission point UTM coordinates if known.

7 Supply additional information as follows if appropriate:

(a) Stack exit configuration other than a round vertical stack. Show length and width for a rectangular stack. Indicate if horizontal discharge with a note.

(b) Stack's height above supporting or adjacent structures if structure is within three "stack heights above ground" of stack.

Form 11
Internal Combustion Engines

Utah Division of Air Quality
New Source Review Section

Company: *eBay Inc.*
Source: *G17-G18*
Date: *5/8/2020*

Equipment Information

1. Manufacturer / Model:

Manufacturer: *Caterpillar*
Model No.: *3512C*

2. Operating Time of Emissions Source

	Average		*Maximum*	
	N/A	hr/day	*N/A*	hr/day
	N/A	day/wk	*N/A*	day/wk
	N/A	wk/yr	*N/A*	wk/yr

66 hrs/yr/generator for non-emergency operations.

Date Engine Was Constructed / Reconstructed: *--*

3. Manufacturer's Rated Output at Baseload (ISO): *2,206.00* bhp *1,500.00* kWe
Proposed Site Operated Range: *2,206.00* bhp *1,500.00* kWe

Gas-Firing

4. Are you operating site equipment on pipeline quality natural gas? ☐ Yes ☐ No ☑ N/A

5. Are you on an interruptible gas supply?
☐ Yes ☐ No
If Yes, Alternate Fuel? *N/A*

6. Annual Consumption of Fuel: *N/A* MMscf/yr

7. Maximum Firing Rate: *N/A* Btu/hr

8. Average Firing Rate: *N/A* Btu/hr

Oil-Firing

9. Type of Oil:
☐ No. 1 ☐ No. 2 ☐ No. 4 ☐ No. 5 ☐ No. 6 Other? *ULSD*

10. Annual Fuel Consumption: *6,904* gallons/year/engine

11. Heat Content: *--* Btu/lb ***OR*** *137,030* Btu/gal

12. Sulfur Content. *< 0.0015* wt.%

13. Ash Content *Neg.* wt.%

14. Average Firing Rate *60* gal/hr/engine

15. Maximum Firing Rate *105* gal/hr/engine

16. Direction of Firing:
☐ Horizontal ☐ Tangential ☐ Other (Specify)

Operation

17. Application of Internal Combustion Engine:
☐ Electric Generation (Base Load)
☐ Electric Generation (Peaking)
☑ Emergency Generator
☐ Driving Pump / Compressor
☐ Exhaust Heat Recovery
☐ Other (Specify)

18. Cycle
☐ Simple Cycle
☐ Regenerative Cycle
☐ Cogeneration
☐ Combined Cycle
☑ N/A

Emissions Data

19. Manufacturer's Emissions Data (Provided in Grams per Brake-Horsepower-Hour):

*--**	NO_X	*--**	VOC
*--**	CO	*No Data*	Formaldehyde

**Please refer to Appendix 4 of the enclosed NOI application for detailed engine-specific emissions information.*

20. Attach manufacturer's information showing emissions of NO_X, CO, VOC, SO_2, CH_2O, PM_{10}, $PM_{2.5}$, CO_2, CH_4, and N_2O for each proposed fuel at engine loads and site ambient temperatures representative of the range of proposed operation. The information must be sufficient to determine maximum hourly and annual emission rates. Annual emissions may be based on a conservatively low approximation of site annual average temperature. Provide emissions in pounds per hour and except for PM_{10} and $PM_{2.5}$ parts per million by volume (ppmv) at actual conditions and corrected to dry, 15% oxygen conditions.

Method of Emissions Control:

☐ Lean Premix Combustors ☐ Oxidation Catalyst ☐ Water Injection ☐ Other?
☐ Other Low-NO_X Combustor ☐ SCR Catalyst ☐ Steam Injection

Form 11
Internal Combustion Engines

Utah Division of Air Quality
New Source Review Section

Company: *eBay Inc.*
Source: *G17-G18*
Date: *5/8/2020*

Additional Information
21. On separate sheets provide the following: A Details regarding principle of operation of emission controls. If add-on equipment is used, provide make and model and manufacturer's information. Example details include: controller input variables and operational algorithms for water or ammonia injection systems, combustion mode versus engine load for variable mode combustors, etc. B Exhaust parameter information on attached form. C All calculations used for the annual emission estimates must be submitted with this form to be deemed complete. D All formaldehyde emissions must be modeled as per Utah Administrative Code R307-410-5 using SCREEN3. E If this form is filled out for a new source, forms 1 and 2 must be submitted also.

Internal Combustion Engine
Form 11 (Continued)
Emissions Sources

AIR CONTAMINANT DATA						EMISSION POINT DISCHARGE PARAMETERS							
Emission Point (1)		Chemical Composition of Total Stream		Air Contaminant Emission Rate		UTM Coordinates of Emission Point (6)			Stack Sources (7)				
											Exit Data		
Number	Name	Component / Air Contaminant Name (2)	Conc. (Vol.%) (3)	LB/HR (4)	TPY (5)	Zone	East (m)	North (m)	Height Above Ground (ft.)	Height Above Structure (ft.)	Diameter (ft.)	Velocity (ft/sec)	Temp. (deg. F)
G17-G18 CAT Diesel Generators		*NO_X*	--	*Refer to Appendix 4 to this NOI application for detailed engine-specific emissions information.*		*See NOI Report and associated Modeling Report Table B1.*							
		CO	--										
		VOC	--										
		PM	--										
		PM_{10}	--										
		$PM_{2.5}$	--										
		SO_2	--										
		CO_2	--										
		CH_4	--										
		N_2O	--										
		CO_2e	--										
		Benzene	--										
		Toluene	--										
		Xylenes	--										
		Formaldehyde	--										
		Acetaldehyde	--										
		Acrolein	--										
		Total PAH	--										
		Total HAP	--										

GROUND ELEVATION OF FACILITY ABOVE MEAN SEA LEVEL: *Approx. 5,100* feet.
UTAH AIR CONSERVATION BOARD STANDARD CONDITIONS ARE 680 F AND 14.7 PSIA

General Instructions for this form:

1 Identify each emission; point with a unique number for this plant site on plot plan, previous permits and emission inventory questionnaire. Limit emission point number to 8 character spaces. For each emission point use as many lines as necessary to list air contaminant data. Typical emission point names are: heater, vent, boiler, tank, reactor, separator, baghouse, fugitive, etc. Abbreviations are OK.

2 Typical component names are: air, H2O, nitrogen, oxygen, CO2, CO, NOx, SOx, hexane, particulate matter (PM10 and PM2.5), etc. Abbreviations are OK.

3 Concentration data is required for all gaseous components. Show concentration in volume percent of total gas stream.

4 Pounds per hour. (#/hr) is maximum emission rate expected by applicant.

5 Tons per year (T/Y) is annual maximum emission rate expected by applicant, which takes into account process operating schedule.

6 As a minimum applicant must furnish a facility plot plan drawn to scale showing a plant benchmark, latitude and longitude correct to the nearest second for the benchmark, and all emission points dimensioned with respect to the benchmark. Please show emission point UTM coordinates if known.

7 Supply additional information as follows if appropriate:

(a) Stack exit configuration other than a round vertical stack. Show length and width for a rectangular stack. Indicate if horizontal discharge with a note.

(b) Stack's height above supporting or adjacent structures if structure is within three "stack heights above ground" of stack.

Form 11
Internal Combustion Engines

Utah Division of Air Quality
New Source Review Section

Company: *eBay Inc.*
Source: *G23*
Date: *5/8/2020*

Equipment Information

1. Manufacturer / Model:

Manufacturer: *Caterpillar*
Model No.: *C32*

2. Operating Time of Emissions Source

	Average		*Maximum*	
	N/A	hr/day	*N/A*	hr/day
	N/A	day/wk	*N/A*	day/wk
	N/A	wk/yr	*N/A*	wk/yr

66 hrs/yr/generator for non-emergency operations.

Date Engine Was Constructed / Reconstructed: *--*

3. Manufacturer's Rated Output at Baseload (ISO):	*1,483.00*	bhp	*1,000.00*	kWe
Proposed Site Operated Range:	*1,483.00*	bhp	*1,000.00*	kWe

Gas-Firing

4. Are you operating site equipment on pipeline quality natural gas? ☐ Yes ☐ No ☑ N/A

5. Are you on an interruptible gas supply? ☐ Yes ☐ No
If Yes, Alternate Fuel? *N/A*

6. Annual Consumption of Fuel: *N/A* MMscf/yr

7. Maximum Firing Rate: *N/A* Btu/hr

8. Average Firing Rate: *N/A* Btu/hr

Oil-Firing

9. Type of Oil: ☐ No. 1 ☐ No. 2 ☐ No. 4 ☐ No. 5 ☐ No. 6 Other? *ULSD*

10. Annual Fuel Consumption: *4,778* gallons/year/engine

11. Heat Content: *--* Btu/lb ***OR*** *137,030* Btu/gal

12. Sulfur Content. *< 0.0015* wt.%

13. Ash Content *Neg.* wt.%

14. Average Firing Rate *40* gal/hr/engine

15. Maximum Firing Rate *72* gal/hr/engine

16. Direction of Firing: ☐ Horizontal ☐ Tangential ☐ Other (Specify)

Operation

17. Application of Internal Combustion Engine:
- ☐ Electric Generation (Base Load)
- ☐ Electric Generation (Peaking)
- ☑ Emergency Generator
- ☐ Driving Pump / Compressor
- ☐ Exhaust Heat Recovery
- ☐ Other (Specify)

18. Cycle
- ☐ Simple Cycle
- ☐ Regenerative Cycle
- ☐ Cogeneration
- ☐ Combined Cycle
- ☑ N/A

Emissions Data

19. Manufacturer's Emissions Data (Provided in Grams per Brake-Horsepower-Hour):

*--**	NO_X	*--**	VOC
*--**	CO	*No Data*	Formaldehyde

Please refer to Appendix 4 of the enclosed NOI application for detailed engine-specific emissions information.

20. Attach manufacturer's information showing emissions of NO_X, CO, VOC, SO_2, CH_2O, PM_{10}, $PM_{2.5}$, CO_2, CH_4, and N_2O for each proposed fuel at engine loads and site ambient temperatures representative of the range of proposed operation. The information must be sufficient to determine maximum hourly and annual emission rates. Annual emissions may be based on a conservatively low approximation of site annual average temperature. Provide emissions in pounds per hour and except for PM_{10} and $PM_{2.5}$ parts per million by volume (ppmv) at actual conditions and corrected to dry, 15% oxygen conditions.

Method of Emissions Control:

☐ Lean Premix Combustors ☐ Oxidation Catalyst ☐ Water Injection ☐ Other?

☐ Other Low-NO_X Combustor ☐ SCR Catalyst ☐ Steam Injection

Form 11
Internal Combustion Engines

Utah Division of Air Quality
New Source Review Section

Company: *eBay Inc.*
Source: *G23*
Date: *5/8/2020*

Additional Information
21. On separate sheets provide the following: A Details regarding principle of operation of emission controls. If add-on equipment is used, provide make and model and manufacturer's information. Example details include: controller input variables and operational algorithms for water or ammonia injection systems, combustion mode versus engine load for variable mode combustors, etc. B Exhaust parameter information on attached form. C All calculations used for the annual emission estimates must be submitted with this form to be deemed complete. D All formaldehyde emissions must be modeled as per Utah Administrative Code R307-410-5 using SCREEN3. E If this form is filled out for a new source, forms 1 and 2 must be submitted also.

Internal Combustion Engine
Form 11 (Continued)
Emissions Sources

AIR CONTAMINANT DATA						EMISSION POINT DISCHARGE PARAMETERS							
Emission Point (1)		Chemical Composition of Total Stream		Air Contaminant Emission Rate		UTM Coordinates of Emission Point (6)			Stack Sources (7)				
											Exit Data		
Number	Name	Component / Air Contaminant Name (2)	Conc. (Vol.%) (3)	LB/HR (4)	TPY (5)	Zone	East (m)	North (m)	Height Above Ground (ft.)	Height Above Structure (ft.)	Diameter (ft.)	Velocity (ft/sec)	Temp. (deg. F)
G23 CAT Diesel Generator		*NO_X*	--	*Refer to Appendix 4 to this NOI application for detailed engine-specific emissions information.*		*See NOI Report and associated Modeling Report Table B1.*							
		CO	--										
		VOC	--										
		PM	--										
		PM_{10}	--										
		$PM_{2.5}$	--										
		SO_2	--										
		CO_2	--										
		CH_4	--										
		N_2O	--										
		CO_2e	--										
		Benzene	--										
		Toluene	--										
		Xylenes	--										
		Formaldehyde	--										
		Acetaldehyde	--										
		Acrolein	--										
		Total PAH	--										
		Total HAP	--										

GROUND ELEVATION OF FACILITY ABOVE MEAN SEA LEVEL: *Approx. 5,100* feet.
UTAH AIR CONSERVATION BOARD STANDARD CONDITIONS ARE 680 F AND 14.7 PSIA

General Instructions for this form:

1 Identify each emission; point with a unique number for this plant site on plot plan, previous permits and emission inventory questionnaire. Limit emission point number to 8 character spaces. For each emission point use as many lines as necessary to list air contaminant data. Typical emission point names are: heater, vent, boiler, tank, reactor, separator, baghouse, fugitive, etc. Abbreviations are OK.

2 Typical component names are: air, H2O, nitrogen, oxygen, CO2, CO, NOx, SOx, hexane, particulate matter (PM10 and PM2.5), etc. Abbreviations are OK.

3 Concentration data is required for all gaseous components. Show concentration in volume percent of total gas stream.

4 Pounds per hour. (#/hr) is maximum emission rate expected by applicant.

5 Tons per year (T/Y) is annual maximum emission rate expected by applicant, which takes into account process operating schedule.

6 As a minimum applicant must furnish a facility plot plan drawn to scale showing a plant benchmark, latitude and longitude correct to the nearest second for the benchmark, and all emission points dimensioned with respect to the benchmark. Please show emission point UTM coordinates if known.

7 Supply additional information as follows if appropriate:

(a) Stack exit configuration other than a round vertical stack. Show length and width for a rectangular stack. Indicate if horizontal discharge with a note.

(b) Stack's height above supporting or adjacent structures if structure is within three "stack heights above ground" of stack.

Form 11
Internal Combustion Engines

Utah Division of Air Quality
New Source Review Section

Company: *eBay Inc.*
Source: *G24-G25*
Date: *5/8/2020*

Equipment Information

1. Manufacturer / Model:

Manufacturer: *Caterpillar*
Model No.: *3516C*

2. Operating Time of Emissions Source

	Average		*Maximum*	
	N/A	hr/day	*N/A*	hr/day
	N/A	day/wk	*N/A*	day/wk
	N/A	wk/yr	*N/A*	wk/yr

66 hrs/yr/generator for non-emergency operations.

Date Engine Was Constructed / Reconstructed: *--*

3. Manufacturer's Rated Output at Baseload (ISO):	*3,633.00*	bhp	*2,500.00*	kWe
Proposed Site Operated Range:	*3,633.00*	bhp	*2,500.00*	kWe

Gas-Firing

4. Are you operating site equipment on pipeline quality natural gas? ☐ Yes ☐ No ☑ N/A

5. Are you on an interruptible gas supply? ☐ Yes ☐ No
If Yes, Alternate Fuel? *N/A*

6. Annual Consumption of Fuel: *N/A* MMscf/yr

7. Maximum Firing Rate: *N/A* Btu/hr

8. Average Firing Rate: *N/A* Btu/hr

Oil-Firing

9. Type of Oil: ☐ No. 1 ☐ No. 2 ☐ No. 4 ☐ No. 5 ☐ No. 6 Other? *ULSD*

10. Annual Fuel Consumption: *11,550* gallons/year/engine

11. Heat Content: *--* Btu/lb ***OR*** *137,030* Btu/gal

12. Sulfur Content. *< 0.0015* wt.%

13. Ash Content *Neg.* wt.%

14. Average Firing Rate *99* gal/hr/engine

15. Maximum Firing Rate *175* gal/hr/engine

16. Direction of Firing: ☐ Horizontal ☐ Tangential ☐ Other (Specify)

Operation

17. Application of Internal Combustion Engine:
- ☐ Electric Generation (Base Load)
- ☐ Electric Generation (Peaking)
- ☑ Emergency Generator
- ☐ Driving Pump / Compressor
- ☐ Exhaust Heat Recovery
- ☐ Other (Specify)

18. Cycle
- ☐ Simple Cycle
- ☐ Regenerative Cycle
- ☐ Cogeneration
- ☐ Combined Cycle
- ☑ N/A

Emissions Data

19. Manufacturer's Emissions Data (Provided in Grams per Brake-Horsepower-Hour):

*--**	NO_X	*--**	VOC
*--**	CO	*No Data*	Formaldehyde

****Please refer to Appendix 4 of the enclosed NOI application for detailed engine-specific emissions information.***

20. Attach manufacturer's information showing emissions of NO_X, CO, VOC, SO_2, CH_2O, PM_{10}, $PM_{2.5}$, CO_2, CH_4, and N_2O for each proposed fuel at engine loads and site ambient temperatures representative of the range of proposed operation. The information must be sufficient to determine maximum hourly and annual emission rates. Annual emissions may be based on a conservatively low approximation of site annual average temperature. Provide emissions in pounds per hour and except for PM_{10} and $PM_{2.5}$ parts per million by volume (ppmv) at actual conditions and corrected to dry, 15% oxygen conditions.

Method of Emissions Control:

☐ Lean Premix Combustors ☐ Oxidation Catalyst ☐ Water Injection ☐ Other?

☐ Other Low-NO_X Combustor ☐ SCR Catalyst ☐ Steam Injection

Form 11
Internal Combustion Engines

Utah Division of Air Quality
New Source Review Section

Company: *eBay Inc.*
Source: *G24-G25*
Date: *5/8/2020*

Additional Information
21. On separate sheets provide the following: A Details regarding principle of operation of emission controls. If add-on equipment is used, provide make and model and manufacturer's information. Example details include: controller input variables and operational algorithms for water or ammonia injection systems, combustion mode versus engine load for variable mode combustors, etc. B Exhaust parameter information on attached form. C All calculations used for the annual emission estimates must be submitted with this form to be deemed complete. D All formaldehyde emissions must be modeled as per Utah Administrative Code R307-410-5 using SCREEN3. E If this form is filled out for a new source, forms 1 and 2 must be submitted also.

Internal Combustion Engine
Form 11 (Continued)
Emissions Sources

AIR CONTAMINANT DATA						EMISSION POINT DISCHARGE PARAMETERS							
Emission Point (1)		Chemical Composition of Total Stream		Air Contaminant Emission Rate		UTM Coordinates of Emission Point (6)			Stack Sources (7)				
											Exit Data		
Number	Name	Component / Air Contaminant Name (2)	Conc. (Vol.%) (3)	LB/HR (4)	TPY (5)	Zone	East (m)	North (m)	Height Above Ground (ft.)	Height Above Structure (ft.)	Diameter (ft.)	Velocity (ft/sec)	Temp. (deg. F)
G24-G25 CAT Diesel Generators		*NO_X*	--	*Refer to Appendix 4 to this NOI application for detailed engine-specific emissions information.*		*See NOI Report and associated Modeling Report Table B1.*							
		CO	--										
		VOC	--										
		PM	--										
		PM_{10}	--										
		$PM_{2.5}$	--										
		SO_2	--										
		CO_2	--										
		CH_4	--										
		N_2O	--										
		CO_2e	--										
		Benzene	--										
		Toluene	--										
		Xylenes	--										
		Formaldehyde	--										
		Acetaldehyde	--										
		Acrolein	--										
		Total PAH	--										
		Total HAP	--										

GROUND ELEVATION OF FACILITY ABOVE MEAN SEA LEVEL: *Approx. 5,100* feet.
UTAH AIR CONSERVATION BOARD STANDARD CONDITIONS ARE 680 F AND 14.7 PSIA

General Instructions for this form:

1 Identify each emission; point with a unique number for this plant site on plot plan, previous permits and emission inventory questionnaire. Limit emission point number to 8 character spaces. For each emission point use as many lines as necessary to list air contaminant data. Typical emission point names are: heater, vent, boiler, tank, reactor, separator, baghouse, fugitive, etc. Abbreviations are OK.

2 Typical component names are: air, H2O, nitrogen, oxygen, CO2, CO, NOx, SOx, hexane, particulate matter (PM10 and PM2.5), etc. Abbreviations are OK.

3 Concentration data is required for all gaseous components. Show concentration in volume percent of total gas stream.

4 Pounds per hour. (#/hr) is maximum emission rate expected by applicant.

5 Tons per year (T/Y) is annual maximum emission rate expected by applicant, which takes into account process operating schedule.

6 As a minimum applicant must furnish a facility plot plan drawn to scale showing a plant benchmark, latitude and longitude correct to the nearest second for the benchmark, and all emission points dimensioned with respect to the benchmark. Please show emission point UTM coordinates if known.

7 Supply additional information as follows if appropriate:

(a) Stack exit configuration other than a round vertical stack. Show length and width for a rectangular stack. Indicate if horizontal discharge with a note.

(b) Stack's height above supporting or adjacent structures if structure is within three "stack heights above ground" of stack.

Form 11
Internal Combustion Engines

Utah Division of Air Quality
New Source Review Section

Company: *eBay Inc.*
Source: *G28-G31*
Date: *5/8/2020*

Equipment Information

1. Manufacturer / Model:

Manufacturer: *Caterpillar*
Model No.: *3516C*

2. Operating Time of Emissions Source

	Average		*Maximum*	
	N/A	hr/day	*N/A*	hr/day
	N/A	day/wk	*N/A*	day/wk
	N/A	wk/yr	*N/A*	wk/yr

66 hrs/yr/generator for non-emergency operations.

Date Engine Was Constructed / Reconstructed: *2020+*

3. Manufacturer's Rated Output at Baseload (ISO):	*2,937.00*	bhp	*2,000.00*	kWe
Proposed Site Operated Range:	*2,937.00*	bhp	*2,000.00*	kWe

Gas-Firing

4. Are you operating site equipment on pipeline quality natural gas? ☐ Yes ☐ No ☑ N/A

5. Are you on an interruptible gas supply?
☐ Yes ☐ No
If Yes, Alternate Fuel? *N/A*

6. Annual Consumption of Fuel:
N/A MMscf/yr

7. Maximum Firing Rate:
N/A Btu/hr

8. Average Firing Rate:
N/A Btu/hr

Oil-Firing

9. Type of Oil:
☐ No. 1 ☐ No. 2 ☐ No. 4 ☐ No. 5 ☐ No. 6 Other? *ULSD*

10. Annual Fuel Consumption:
9,108 gallons/year/engine

11. Heat Content:
-- Btu/lb ***OR***
137,030 Btu/gal

12. Sulfur Content. *< 0.0015* wt.%

13. Ash Content *Neg.* wt.%

14. Average Firing Rate *79* gal/hr/engine

15. Maximum Firing Rate *138* gal/hr/engine

16. Direction of Firing:
☐ Horizontal ☐ Tangential ☐ Other (Specify)

Operation

17. Application of Internal Combustion Engine:
☐ Electric Generation (Base Load)
☐ Electric Generation (Peaking)
☑ Emergency Generator
☐ Driving Pump / Compressor
☐ Exhaust Heat Recovery
☐ Other (Specify)

18. Cycle
☐ Simple Cycle
☐ Regenerative Cycle
☐ Cogeneration
☐ Combined Cycle
☑ N/A

Emissions Data

19. Manufacturer's Emissions Data (Provided in Grams per Brake-Horsepower-Hour):

*--**	NO_X	*--**	VOC
*--**	CO	*No Data*	Formaldehyde

Please refer to Appendix 4 of the enclosed NOI application for detailed engine-specific emissions information.

20. Attach manufacturer's information showing emissions of NO_X, CO, VOC, SO_2, CH_2O, PM_{10}, $PM_{2.5}$, CO_2, CH_4, and N_2O for each proposed fuel at engine loads and site ambient temperatures representative of the range of proposed operation. The information must be sufficient to determine maximum hourly and annual emission rates. Annual emissions may be based on a conservatively low approximation of site annual average temperature. Provide emissions in pounds per hour and except for PM_{10} and $PM_{2.5}$ parts per million by volume (ppmv) at actual conditions and corrected to dry, 15% oxygen conditions.

Method of Emissions Control:

☐ Lean Premix Combustors ☐ Oxidation Catalyst ☐ Water Injection ☐ Other?
☐ Other Low-NO_X Combustor ☐ SCR Catalyst ☐ Steam Injection

Form 11
Internal Combustion Engines

Utah Division of Air Quality
New Source Review Section

Company: *eBay Inc.*
Source: *G28-G31*
Date: *5/8/2020*

Additional Information
21. On separate sheets provide the following: A Details regarding principle of operation of emission controls. If add-on equipment is used, provide make and model and manufacturer's information. Example details include: controller input variables and operational algorithms for water or ammonia injection systems, combustion mode versus engine load for variable mode combustors, etc. B Exhaust parameter information on attached form. C All calculations used for the annual emission estimates must be submitted with this form to be deemed complete. D All formaldehyde emissions must be modeled as per Utah Administrative Code R307-410-5 using SCREEN3. E If this form is filled out for a new source, forms 1 and 2 must be submitted also.

Internal Combustion Engine
Form 11 (Continued)
Emissions Sources

AIR CONTAMINANT DATA						EMISSION POINT DISCHARGE PARAMETERS							
Emission Point (1)		Chemical Composition of Total Stream		Air Contaminant Emission Rate		UTM Coordinates of Emission Point (6)			Stack Sources (7)				
											Exit Data		
Number	Name	Component / Air Contaminant Name (2)	Conc. (Vol.%) (3)	LB/HR (4)	TPY (5)	Zone	East (m)	North (m)	Height Above Ground (ft.)	Height Above Structure (ft.)	Diameter (ft.)	Velocity (ft/sec)	Temp. (deg. F)
G28-G31 CAT Diesel Generators		*NO_X*	--	*Refer to Appendix 4 to this NOI application for detailed engine-specific emissions information.*		*See NOI Report and associated Modeling Report Table B1.*							
		CO	--										
		VOC	--										
		PM	--										
		PM_{10}	--										
		$PM_{2.5}$	--										
		SO_2	--										
		CO_2	--										
		CH_4	--										
		N_2O	--										
		CO_2e	--										
		Benzene	--										
		Toluene	--										
		Xylenes	--										
		Formaldehyde	--										
		Acetaldehyde	--										
		Acrolein	--										
		Total PAH	--										
		Total HAP	--										

GROUND ELEVATION OF FACILITY ABOVE MEAN SEA LEVEL: *Approx. 5,100* feet.
UTAH AIR CONSERVATION BOARD STANDARD CONDITIONS ARE 680 F AND 14.7 PSIA

General Instructions for this form:

1 Identify each emission; point with a unique number for this plant site on plot plan, previous permits and emission inventory questionnaire. Limit emission point number to 8 character spaces. For each emission point use as many lines as necessary to list air contaminant data. Typical emission point names are: heater, vent, boiler, tank, reactor, separator, baghouse, fugitive, etc. Abbreviations are OK.

2 Typical component names are: air, H2O, nitrogen, oxygen, CO2, CO, NOx, SOx, hexane, particulate matter (PM10 and PM2.5), etc. Abbreviations are OK.

3 Concentration data is required for all gaseous components. Show concentration in volume percent of total gas stream.

4 Pounds per hour. (#/hr) is maximum emission rate expected by applicant.

5 Tons per year (T/Y) is annual maximum emission rate expected by applicant, which takes into account process operating schedule.

6 As a minimum applicant must furnish a facility plot plan drawn to scale showing a plant benchmark, latitude and longitude correct to the nearest second for the benchmark, and all emission points dimensioned with respect to the benchmark. Please show emission point UTM coordinates if known.

7 Supply additional information as follows if appropriate:

(a) Stack exit configuration other than a round vertical stack. Show length and width for a rectangular stack. Indicate if horizontal discharge with a note.

(b) Stack's height above supporting or adjacent structures if structure is within three "stack heights above ground" of stack.

Form 11
Internal Combustion Engines

Utah Division of Air Quality
New Source Review Section

Company: *eBay Inc.*
Source: *G32-G33*
Date: *5/8/2020*

Equipment Information

1. Manufacturer / Model:

Manufacturer: *Caterpillar*
Model No.: *C27*

2. Operating Time of Emissions Source

	Average		*Maximum*	
	N/A	hr/day	*N/A*	hr/day
	N/A	day/wk	*N/A*	day/wk
	N/A	wk/yr	*N/A*	wk/yr

66 hrs/yr/generator for non-emergency operations.

Date Engine Was Constructed / Reconstructed: *2020+*

3. Manufacturer's Rated Output at Baseload (ISO):	*1,114.00*	bhp	*750.00*	kWe
Proposed Site Operated Range:	*1,114.00*	bhp	*750.00*	kWe

Gas-Firing

4. Are you operating site equipment on pipeline quality natural gas? ☐ Yes ☐ No ☑ N/A

5. Are you on an interruptible gas supply?
☐ Yes ☐ No
If Yes, Alternate Fuel? *N/A*

6. Annual Consumption of Fuel: *N/A* MMscf/yr

7. Maximum Firing Rate: *N/A* Btu/hr

8. Average Firing Rate: *N/A* Btu/hr

Oil-Firing

9. Type of Oil:
☐ No. 1 ☐ No. 2 ☐ No. 4 ☐ No. 5 ☐ No. 6 Other? *ULSD*

10. Annual Fuel Consumption: *3,465* gallons/year/engine

11. Heat Content: *--* Btu/lb ***OR*** *137,030* Btu/gal

12. Sulfur Content. *< 0.0015* wt.%

13. Ash Content *Neg.* wt.%

14. Average Firing Rate *30* gal/hr/engine

15. Maximum Firing Rate *53* gal/hr/engine

16. Direction of Firing:
☐ Horizontal ☐ Tangential ☐ Other (Specify)

Operation

17. Application of Internal Combustion Engine:
☐ Electric Generation (Base Load)
☐ Electric Generation (Peaking)
☑ Emergency Generator
☐ Driving Pump / Compressor
☐ Exhaust Heat Recovery
☐ Other (Specify)

18. Cycle
☐ Simple Cycle
☐ Regenerative Cycle
☐ Cogeneration
☐ Combined Cycle
☑ N/A

Emissions Data

19. Manufacturer's Emissions Data (Provided in Grams per Brake-Horsepower-Hour):

*--**	NO_X	*--**	VOC
*--**	CO	*No Data*	Formaldehyde

Please refer to Appendix 4 of the enclosed NOI application for detailed engine-specific emissions information.

20. Attach manufacturer's information showing emissions of NO_X, CO, VOC, SO_2, CH_2O, PM_{10}, $PM_{2.5}$, CO_2, CH_4, and N_2O for each proposed fuel at engine loads and site ambient temperatures representative of the range of proposed operation. The information must be sufficient to determine maximum hourly and annual emission rates. Annual emissions may be based on a conservatively low approximation of site annual average temperature. Provide emissions in pounds per hour and except for PM_{10} and $PM_{2.5}$ parts per million by volume (ppmv) at actual conditions and corrected to dry, 15% oxygen conditions.

Method of Emissions Control:

☐ Lean Premix Combustors ☐ Oxidation Catalyst ☐ Water Injection ☐ Other?
☐ Other Low-NO_X Combustor ☐ SCR Catalyst ☐ Steam Injection

Form 11
Internal Combustion Engines

Utah Division of Air Quality
New Source Review Section

Company: *eBay Inc.*
Source: *G32-G33*
Date: *5/8/2020*

Additional Information
21. On separate sheets provide the following: A Details regarding principle of operation of emission controls. If add-on equipment is used, provide make and model and manufacturer's information. Example details include: controller input variables and operational algorithms for water or ammonia injection systems, combustion mode versus engine load for variable mode combustors, etc. B Exhaust parameter information on attached form. C All calculations used for the annual emission estimates must be submitted with this form to be deemed complete. D All formaldehyde emissions must be modeled as per Utah Administrative Code R307-410-5 using SCREEN3. E If this form is filled out for a new source, forms 1 and 2 must be submitted also.

Internal Combustion Engine
Form 11 (Continued)
Emissions Sources

AIR CONTAMINANT DATA						EMISSION POINT DISCHARGE PARAMETERS							
Emission Point (1)		Chemical Composition of Total Stream		Air Contaminant Emission Rate		UTM Coordinates of Emission Point (6)			Stack Sources (7)				
											Exit Data		
Number	Name	Component / Air Contaminant Name (2)	Conc. (Vol.%) (3)	LB/HR (4)	TPY (5)	Zone	East (m)	North (m)	Height Above Ground (ft.)	Height Above Structure (ft.)	Diameter (ft.)	Velocity (ft/sec)	Temp. (deg. F)
G32-G33 CAT Diesel Generators		*NO_X*	--	*Refer to Appendix 4 to this NOI application for detailed engine-specific emissions information.*		*See NOI Report and associated Modeling Report Table B1.*							
		CO	--										
		VOC	--										
		PM	--										
		PM_{10}	--										
		$PM_{2.5}$	--										
		SO_2	--										
		CO_2	--										
		CH_4	--										
		N_2O	--										
		CO_2e	--										
		Benzene	--										
		Toluene	--										
		Xylenes	--										
		Formaldehyde	--										
		Acetaldehyde	--										
		Acrolein	--										
		Total PAH	--										
		Total HAP	--										

GROUND ELEVATION OF FACILITY ABOVE MEAN SEA LEVEL: *Approx. 5,100* feet.
UTAH AIR CONSERVATION BOARD STANDARD CONDITIONS ARE 680 F AND 14.7 PSIA

General Instructions for this form:

1 Identify each emission; point with a unique number for this plant site on plot plan, previous permits and emission inventory questionnaire. Limit emission point number to 8 character spaces. For each emission point use as many lines as necessary to list air contaminant data. Typical emission point names are: heater, vent, boiler, tank, reactor, separator, baghouse, fugitive, etc. Abbreviations are OK.

2 Typical component names are: air, H2O, nitrogen, oxygen, CO2, CO, NOx, SOx, hexane, particulate matter (PM10 and PM2.5), etc. Abbreviations are OK.

3 Concentration data is required for all gaseous components. Show concentration in volume percent of total gas stream.

4 Pounds per hour. (#/hr) is maximum emission rate expected by applicant.

5 Tons per year (T/Y) is annual maximum emission rate expected by applicant, which takes into account process operating schedule.

6 As a minimum applicant must furnish a facility plot plan drawn to scale showing a plant benchmark, latitude and longitude correct to the nearest second for the benchmark, and all emission points dimensioned with respect to the benchmark. Please show emission point UTM coordinates if known.

7 Supply additional information as follows if appropriate:

(a) Stack exit configuration other than a round vertical stack. Show length and width for a rectangular stack. Indicate if horizontal discharge with a note.

(b) Stack's height above supporting or adjacent structures if structure is within three "stack heights above ground" of stack.

Form 11
Internal Combustion Engines

Utah Division of Air Quality
New Source Review Section

Company: *eBay Inc.*
Source: *FP1*
Date: *5/8/2020*

Equipment Information

1. Manufacturer / Model:

Manufacturer: *Caterpillar*
Model No.: *D4B01369*

2. Operating Time of Emissions Source

	Average		*Maximum*	
	N/A	hr/day	*N/A*	hr/day
	N/A	day/wk	*N/A*	day/wk
	N/A	wk/yr	*N/A*	wk/yr

Date Engine Was Constructed / Reconstructed: *--*

100 hrs/yr/generator for non-emergency operations.

3. Manufacturer's Rated Output at Baseload (ISO): *--* bhp *100.00* kWe
Proposed Site Operated Range: *--* bhp *100.00* kWe

Gas-Firing

4. Are you operating site equipment on pipeline quality natural gas? ☐ Yes ☐ No ☑ N/A

5. Are you on an interruptible gas supply?
☐ Yes ☐ No
If Yes, Alternate Fuel? *N/A*

6. Annual Consumption of Fuel: *N/A* MMscf/yr

7. Maximum Firing Rate: *N/A* Btu/hr

8. Average Firing Rate: *N/A* Btu/hr

Oil-Firing

9. Type of Oil:
☐ No. 1 ☐ No. 2 ☐ No. 4 ☐ No. 5 ☐ No. 6 Other? *ULSD*

10. Annual Fuel Consumption: *610** gallons/year/engine
* Engineering Estimate

11. Heat Content: *--* Btu/lb ***OR*** *137,030* Btu/gal

12. Sulfur Content. *< 0.0015* wt.%

13. Ash Content *Neg.* wt.%

14. Average Firing Rate *14.6** gal/hr/engine

15. Maximum Firing Rate *6.1** gal/hr/engine

16. Direction of Firing:
☐ Horizontal ☐ Tangential ☐ Other (Specify)

Operation

17. Application of Internal Combustion Engine:
☐ Electric Generation (Base Load)
☐ Electric Generation (Peaking)
☐ Emergency Generator
☑ Driving Pump / Compressor
☐ Exhaust Heat Recovery
☐ Other (Specify)

18. Cycle
☐ Simple Cycle
☐ Regenerative Cycle
☐ Cogeneration
☐ Combined Cycle
☑ N/A

Emissions Data

19. Manufacturer's Emissions Data (Provided in Grams per Brake-Horsepower-Hour):

*--**	NO_X	*--**	VOC
*--**	CO	*No Data*	Formaldehyde

Please refer to Appendix 4 of the enclosed NOI application for detailed engine-specific emissions information.

20. Attach manufacturer's information showing emissions of NO_X, CO, VOC, SO_2, CH_2O, PM_{10}, $PM_{2.5}$, CO_2, CH_4, and N_2O for each proposed fuel at engine loads and site ambient temperatures representative of the range of proposed operation. The information must be sufficient to determine maximum hourly and annual emission rates. Annual emissions may be based on a conservatively low approximation of site annual average temperature. Provide emissions in pounds per hour and except for PM_{10} and $PM_{2.5}$ parts per million by volume (ppmv) at actual conditions and corrected to dry, 15% oxygen conditions.

Method of Emissions Control:

☐ Lean Premix Combustors ☐ Oxidation Catalyst ☐ Water Injection ☐ Other?
☐ Other Low-NO_X Combustor ☐ SCR Catalyst ☐ Steam Injection

Form 11
Internal Combustion Engines

Utah Division of Air Quality
New Source Review Section

Company: *eBay Inc.*
Source: *FP1*
Date: *5/8/2020*

Additional Information
21. On separate sheets provide the following: A Details regarding principle of operation of emission controls. If add-on equipment is used, provide make and model and manufacturer's information. Example details include: controller input variables and operational algorithms for water or ammonia injection systems, combustion mode versus engine load for variable mode combustors, etc. B Exhaust parameter information on attached form. C All calculations used for the annual emission estimates must be submitted with this form to be deemed complete. D All formaldehyde emissions must be modeled as per Utah Administrative Code R307-410-5 using SCREEN3. E If this form is filled out for a new source, forms 1 and 2 must be submitted also.

Internal Combustion Engine
Form 11 (Continued)
Emissions Sources

AIR CONTAMINANT DATA						EMISSION POINT DISCHARGE PARAMETERS							
Emission Point (1)		Chemical Composition of Total Stream		Air Contaminant Emission Rate		UTM Coordinates of Emission Point (6)			Stack Sources (7)				
											Exit Data		
Number	Name	Component / Air Contaminant Name (2)	Conc. (Vol.%) (3)	LB/HR (4)	TPY (5)	Zone	East (m)	North (m)	Height Above Ground (ft.)	Height Above Structure (ft.)	Diameter (ft.)	Velocity (ft/sec)	Temp. (deg. F)
FP1 CAT Fire Pump		*NO_X*	--	*Refer to Appendix 4 to this NOI application for detailed engine-specific emissions information.*		*See NOI Report and associated Modeling Report Table B1.*							
		CO	--										
		VOC	--										
		PM	--										
		PM_{10}	--										
		$PM_{2.5}$	--										
		SO_2	--										
		CO_2	--										
		CH_4	--										
		N_2O	--										
		CO_2e	--										
		Benzene	--										
		Toluene	--										
		Xylenes	--										
		Formaldehyde	--										
		Acetaldehyde	--										
		Acrolein	--										
		Total PAH	--										
		Total HAP	--										

GROUND ELEVATION OF FACILITY ABOVE MEAN SEA LEVEL: *Approx. 5,100* feet.
UTAH AIR CONSERVATION BOARD STANDARD CONDITIONS ARE 680 F AND 14.7 PSIA

General Instructions for this form:

1 Identify each emission; point with a unique number for this plant site on plot plan, previous permits and emission inventory questionnaire. Limit emission point number to 8 character spaces. For each emission point use as many lines as necessary to list air contaminant data. Typical emission point names are: heater, vent, boiler, tank, reactor, separator, baghouse, fugitive, etc. Abbreviations are OK.

2 Typical component names are: air, H2O, nitrogen, oxygen, CO2, CO, NOx, SOx, hexane, particulate matter (PM10 and PM2.5), etc. Abbreviations are OK.

3 Concentration data is required for all gaseous components. Show concentration in volume percent of total gas stream.

4 Pounds per hour. (#/hr) is maximum emission rate expected by applicant.

5 Tons per year (T/Y) is annual maximum emission rate expected by applicant, which takes into account process operating schedule.

6 As a minimum applicant must furnish a facility plot plan drawn to scale showing a plant benchmark, latitude and longitude correct to the nearest second for the benchmark, and all emission points dimensioned with respect to the benchmark. Please show emission point UTM coordinates if known.

7 Supply additional information as follows if appropriate:

(a) Stack exit configuration other than a round vertical stack. Show length and width for a rectangular stack. Indicate if horizontal discharge with a note.

(b) Stack's height above supporting or adjacent structures if structure is within three "stack heights above ground" of stack.

Form 11
Internal Combustion Engines

Utah Division of Air Quality
New Source Review Section

Company: *eBay Inc.*
Source: *FP2*
Date: *5/8/2020*

Equipment Information

1. Manufacturer / Model:

Manufacturer: *John Deere*
Model No.: *JU4H-UFADJ8*

2. Operating Time of Emissions Source

	Average		*Maximum*	
	N/A	hr/day	*N/A*	hr/day
	N/A	day/wk	*N/A*	day/wk
	N/A	wk/yr	*N/A*	wk/yr

Date Engine Was Constructed / Reconstructed: *--*

100 hrs/yr/generator for non-emergency operations.

3. Manufacturer's Rated Output at Baseload (ISO): *86.00* bhp *64.00* kWe
Proposed Site Operated Range: *86.00* bhp *64.00* kWe

Gas-Firing

4. Are you operating site equipment on pipeline quality natural gas? ☐ Yes ☐ No ☑ N/A

5. Are you on an interruptible gas supply? ☐ Yes ☐ No
If Yes, Alternate Fuel? *N/A*

6. Annual Consumption of Fuel: *N/A* MMscf/yr

7. Maximum Firing Rate: *N/A* Btu/hr

8. Average Firing Rate: *N/A* Btu/hr

Oil-Firing

9. Type of Oil: ☐ No. 1 ☐ No. 2 ☐ No. 4 ☐ No. 5 ☐ No. 6 Other? *ULSD*

10. Annual Fuel Consumption: *450* gallons/year/engine

11. Heat Content: *--* Btu/lb ***OR*** *137,030* Btu/gal

12. Sulfur Content. *< 0.0015* wt.%

13. Ash Content *Neg.* wt.%

14. Average Firing Rate *4.5* gal/hr/engine

15. Maximum Firing Rate *4.5* gal/hr/engine

16. Direction of Firing: ☐ Horizontal ☐ Tangential ☐ Other (Specify)

Operation

17. Application of Internal Combustion Engine:
- ☐ Electric Generation (Base Load)
- ☐ Electric Generation (Peaking)
- ☐ Emergency Generator
- ☑ Driving Pump / Compressor
- ☐ Exhaust Heat Recovery
- ☐ Other (Specify)

18. Cycle
- ☐ Simple Cycle
- ☐ Regenerative Cycle
- ☐ Cogeneration
- ☐ Combined Cycle
- ☑ N/A

Emissions Data

19. Manufacturer's Emissions Data (Provided in Grams per Brake-Horsepower-Hour):

*--**	NO_X	*--**	VOC
*--**	CO	*No Data*	Formaldehyde

**Please refer to Appendix 4 of the enclosed NOI application for detailed engine-specific emissions information.*

20. Attach manufacturer's information showing emissions of NO_X, CO, VOC, SO_2, CH_2O, PM_{10}, $PM_{2.5}$, CO_2, CH_4, and N_2O for each proposed fuel at engine loads and site ambient temperatures representative of the range of proposed operation. The information must be sufficient to determine maximum hourly and annual emission rates. Annual emissions may be based on a conservatively low approximation of site annual average temperature. Provide emissions in pounds per hour and except for PM_{10} and $PM_{2.5}$ parts per million by volume (ppmv) at actual conditions and corrected to dry, 15% oxygen conditions.

Method of Emissions Control:

☐ Lean Premix Combustors ☐ Oxidation Catalyst ☐ Water Injection ☐ Other?

☐ Other Low-NO_X Combustor ☐ SCR Catalyst ☐ Steam Injection

Form 11
Internal Combustion Engines

Utah Division of Air Quality
New Source Review Section

Company: *eBay Inc.*
Source: *FP2*
Date: *5/8/2020*

Additional Information
21. On separate sheets provide the following: A Details regarding principle of operation of emission controls. If add-on equipment is used, provide make and model and manufacturer's information. Example details include: controller input variables and operational algorithms for water or ammonia injection systems, combustion mode versus engine load for variable mode combustors, etc. B Exhaust parameter information on attached form. C All calculations used for the annual emission estimates must be submitted with this form to be deemed complete. D All formaldehyde emissions must be modeled as per Utah Administrative Code R307-410-5 using SCREEN3. E If this form is filled out for a new source, forms 1 and 2 must be submitted also.

Internal Combustion Engine
Form 11 (Continued)
Emissions Sources

AIR CONTAMINANT DATA						EMISSION POINT DISCHARGE PARAMETERS							
Emission Point (1)		Chemical Composition of Total Stream		Air Contaminant Emission Rate		UTM Coordinates of Emission Point (6)			Stack Sources (7)				
											Exit Data		
Number	Name	Component / Air Contaminant Name (2)	Conc. (Vol.%) (3)	LB/HR (4)	TPY (5)	Zone	East (m)	North (m)	Height Above Ground (ft.)	Height Above Structure (ft.)	Diameter (ft.)	Velocity (ft/sec)	Temp. (deg. F)
FP2 John Deere Fire Pump		*NO_X*	--	*Refer to Appendix 4 to this NOI application for detailed engine-specific emissions information.*		*See NOI Report and associated Modeling Report Table B1.*							
		CO	--										
		VOC	--										
		PM	--										
		PM_{10}	--										
		$PM_{2.5}$	--										
		SO_2	--										
		CO_2	--										
		CH_4	--										
		N_2O	--										
		CO_2e	--										
		Benzene	--										
		Toluene	--										
		Xylenes	--										
		Formaldehyde	--										
		Acetaldehyde	--										
		Acrolein	--										
		Total PAH	--										
		Total HAP	--										

GROUND ELEVATION OF FACILITY ABOVE MEAN SEA LEVEL: *Approx. 5,100* feet.
UTAH AIR CONSERVATION BOARD STANDARD CONDITIONS ARE 680 F AND 14.7 PSIA

General Instructions for this form:

1 Identify each emission; point with a unique number for this plant site on plot plan, previous permits and emission inventory questionnaire. Limit emission point number to 8 character spaces. For each emission point use as many lines as necessary to list air contaminant data. Typical emission point names are: heater, vent, boiler, tank, reactor, separator, baghouse, fugitive, etc. Abbreviations are OK.

2 Typical component names are: air, H2O, nitrogen, oxygen, CO2, CO, NOx, SOx, hexane, particulate matter (PM10 and PM2.5), etc. Abbreviations are OK.

3 Concentration data is required for all gaseous components. Show concentration in volume percent of total gas stream.

4 Pounds per hour. (#/hr) is maximum emission rate expected by applicant.

5 Tons per year (T/Y) is annual maximum emission rate expected by applicant, which takes into account process operating schedule.

6 As a minimum applicant must furnish a facility plot plan drawn to scale showing a plant benchmark, latitude and longitude correct to the nearest second for the benchmark, and all emission points dimensioned with respect to the benchmark. Please show emission point UTM coordinates if known.

7 Supply additional information as follows if appropriate:

(a) Stack exit configuration other than a round vertical stack. Show length and width for a rectangular stack. Indicate if horizontal discharge with a note.

(b) Stack's height above supporting or adjacent structures if structure is within three "stack heights above ground" of stack.

APPENDIX 3
GENERATOR MANUFACTURER SPECIFICATIONS AND EMISSIONS DATA SHEETS

Appendix 3.1
G1 – G7 Specification Sheets

Inhaltsverzeichnis
Contents

	Genset	Marine	O & G	Rail	C & I
Application	X				
Engine model	20V4000G83L (6ETC)				
Application group	3D, 3H				
Emission Stage/Optimisation	EPA Tier 2				
Test cycle	D2				
Data Set	EPA Tier 2				
Fuel sulphur content [ppm]	5				

				MTU Friedrichshafen GmbH			Benennung/Title **Emissionsdatenblatt** **Emission Data Sheet**
b	Überarbeitung „Not-to-exceed“-Werte	23.04.15	Lenhof		Datum/Date	Name/Name	Zeichnungs-Nr./Drawing No.
a	Hinzufügen „Not to exceed“ Werte	21.01.14	Lenhof	Bearbeiter/Drawn by	09.05.2012	Lenhof	
-	Freigabe	06.06.12	Zwisler	Geprüft/Checked	04.06.2012	Rehm	**EDS 4000 0527**
Buchstabe/ Revision	Änderung Modifikation	Datum Date	Name Name	Org.-Einheit/Dept.	TKF	Veser	

Vers.2.0

Revision *Change index*					

Motordaten
engine data

	Genset	Marine	O & G	Rail	C & I
Application	X				
Engine model	20V4000G83L (6ETC)				
Application group	3D, 3H				
Emission Stage/Optimisation	EPA Tier 2				
Test cycle	D2				
fuel sulphur content [ppm]	5				
mg/mN³ values base on residual oxygen value of [%]	measured				

Motor Rohemissionen*
*Engine raw emissions**

Cycle point	[-]	n1	n2	n3	n4	n5	n6	n7	n8
Power (P/PN)	[-]	1	0,75	0,50	0,25	0,10			
Power	[kW]	3490	2618	1745	872	349			
Speed (n/nN)	[-]	1	1	1	1	1			
Speed	[rpm]	1800	1800	1800	1800	1800			
Exhaust temperature after turbine	[°C]	495	431	386	350	255			
Exhaust massflow	[kg/h]	19529	17631	14079	9354	6616			
Exhaust back pressure	[mbar]	64	43	25	10	4			
NOx	[g/kWh]	6,7	5,4	4,6	4,1	7,5			
	[mg/mN³]	1869	1238	881	581	595			
CO	[g/kWh]	0,8	0,7	0,9	1,9	3,7			
	[mg/mN³]	197	148	155	239	259			
HC	[g/kWh]	0,14	0,19	0,29	0,45	1,66			
	[mg/mN³]	34	39	49	57	117			
O2	[%]	9,1	11,0	12,4	13,7	15,8			
Particulate measured	[g/kWh]	0,04	0,06	0,14	0,30	0,74			
	[mg/mN³]	11	11	24	37	52			
Particulate calculated	[g/kWh]	-	-	-	-	-			
	[mg/mN³]	-	-	-	-	-			
Dust (only TA-Luft)	[mg/mN³]	-	-	-	-	-			
FSN	[-]	0,3	0,4	0,7	1,0	0,3			
NO/NO2**	[-]	-	-	-	-	-			
CO2	[g/kWh]	647,9	659,8	684,6	776,3	973,6			
	[mg/mN³]	162461	135829	116579	98698	69093			
SO2	[g/kWh]	0,002	0,002	0,002	0,002	0,003			
	[mg/mN³]	0,5	0,4	0,4	0,3	0,2			

* Emission data measurement procedures are consistent with the respective emission evaluation process. Noncertified engines are measured to sales data (TVU/TEN) standard conditions.
These boundary conditions might not be representative for detailed dimensioning of exhaust gas aftertreatment, in this case it is recommended to contact the responsible department for more information.
Measurements are subject to variation. The nominal emission data shown is subject to instrumentation, measurement, facility, and engine-to-engine variations.
All data applies to an engine in new condition. Over extended operating time deterioration may occur which might have an impact on emission.
Exhaust temperature depends on engine ambient conditions.

** No standard test. To be measured on demand.

				MTU Friedrichshafen GmbH			Benennung/Title **Emissionsdatenblatt** **Emission Data Sheet**
b	Überarbeitung „Not-to-exceed“-Werte	23.04.15	Lenhof		Datum/Date	Name/Name	Zeichnungs-Nr./Drawing No.
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Buchstabe/ Revision	Änderung Modifikation	Datum Date	Name Name	Org.-Einheit/Dept.	TKF	Veser	

Vers.2.0

Revision *Change index*	a	b			

Motordaten
engine data

	Genset	Marine	O & G	Rail	C & I
Application	X				
Engine model	20V4000G83L (6ETC)				
Application group	3D, 3H				
Emission Stage/Optimisation	EPA Tier 2				
Test cycle	D2				
fuel sulphur content [ppm]	5				
mg/mN³ values base on residual oxygen value of [%]	measured				

Not to exceed Werte*
*not to exceed values**

Cycle point	[-]	n1	n2	n3	n4	n5	n6	n7	n8
Power (P/PN)	[-]	1	0,75	0,50	0,25				
Power	[kW]	3490	2618	1745	872				
Speed (n/nN)	[-]	1	1	1	1				
Speed	[rpm]	1800	1800	1800	1800				
Exhaust back pressure	[mbar]	64	43	25	10				
NOx	[g/kWh]	8,7	7,0	6,0	6,2				
	[mg/mN³]	2430	1609	1145	871				
CO	[g/kWh]	1,3	1,2	1,7	3,8				
	[mg/mN³]	335	251	294	477				
HC	[g/kWh]	0,23	0,32	0,55	0,90				
	[mg/mN³]	58	67	94	115				
O2	[%]	9,1	11,0	12,4	13,7				
Particulate measured	[g/kWh]	0,07	0,09	0,21	0,44				
	[mg/mN³]	16	18	35	56				

* Calculated values are not proven by tests and therefore the accuracy cannot be guaranteed.
Emissions data measurement procedures are consistent with those described in the applicable rules and standards.
The NOx, CO, HC and PM emission data tabulated here were taken from a single new engine under the test conditions shown above and are valid for the following conditions:
• Ambient air pressure 1 bar
• Air intake temperature approx. 25°C
• Rel. Humidity 30%-60%
• New Engine
• New standard- air filter
• Exhaust gas back pressure according the given value in this EDS
• Fuel according to EN 590 or US EPA 40CFR89
• Coolant and Lubricants according MTU Fuels and Lubricants Specification
The nominal emissions data shown is subject to instrumentation, measurement, facility and engine to engine variations. Emissions data is based on single operating points and thus cannot be used to compare to EPA regulations which use values based on a weighted cycle. Emissions data may vary depending on the type of exhaust gas aftertreatment that may be installed on the engine, therefore it is suggested that the engine manufacturer be contacted directly for further information.
Field emission test data are not guaranteed to these levels. Actual field test results may vary due to test site conditions, installation, fuel specification, test procedures, and instrumentation. Over time deterioration may occur which may have an impact on emission levels. Engine operation with excessive air intake or exhaust restriction beyond published maximum limits, or with improper maintenance, may results in elevated emission levels.
MTU Friedrichshafen GmbH has made efforts to ensure that the information in this data sheet is accurate, but reserves the right to amend specifications and information without notice and without obligation or liability. No liability for any errors, facts or opinions is accepted. Customers must satisfy themselves as to the suitability of this product for their application. No responsibility for any loss as a result of any person placing reliance on any material contained in this data sheet will be accepted.

GASEOUS EMISSIONS DATA MEASUREMENTS ARE CONSISTENT WITH THOSE DESCRIBED IN EPA 40 CFR PART 60 SUBPART IIII FOR MEASURING HC, CO, PM, AND NOX.					
Locality	**Agency**	**Regulation**	**Tier/Stage**	**Max. Limit G/(kW -HR)**	
				T2	T3
U.S. (INCL CALIF)	EPA	Stationary	Emergency Stationary Tier 2 (>560kW) Tier 3 (<560kW)	NOx+ NMHC: CO: PM:	 6,4 3,5 0,20	 4,0 3,5 0,20

** No standard test. To be measured on demand.

				MTU Friedrichshafen GmbH			Benennung/Title **Emissionsdatenblatt** **Emission Data Sheet**
b	Überarbeitung „Not-to-exceed"-Werte	23.04.15	Lenhof		Datum/Date	Name/Name	Zeichnungs-Nr./Drawing No.
a	Hinzufügen „Not to exceed" Werte	21.01.14	Lenhof	Bearbeiter/Drawn by	09.05.2012	Lenhof	
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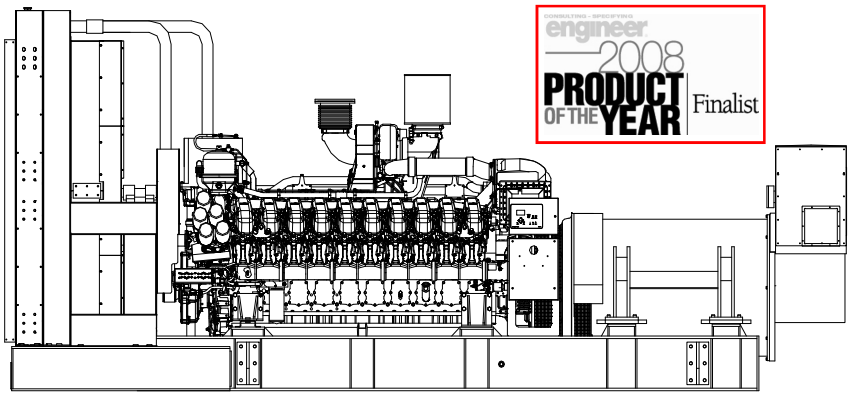
Buchstabe/ Revision	Änderung Modifikation	Datum Date	Name Name	Org.-Einheit/Dept.	TKF	Veser	

Vers.2.0

3250-XC6DT2

3250 ekW 60 Hz Standby
2800 ekW 60 Hz Prime
480 - 13.8kV



- EPA Tier 2 Certified
- Generator Set Tested to ISO 8528-5 for Transient Response
- CSA Listing Offered
- All gen-sets are prototype and factory tested
- MTU Onsite Energy is a single source supplier
- Global Product Support
- 2 Year Standard Warranty
- Complete Range of Accessories

Note:
Project Topaz Generator Rating: 3180KW

20V4000 G83L Diesel Engine
- 95.4 Liter Displacement
- Common Rail Injection
- 4-Cycle

Permanent Magnet Generator (PMG)
- Brushless, Rotating Field
- 300% Short Circuit Capability
- 2/3 Pitch Windings

Digital Control Panel(s)
- UL Recognized, c UL us , NFPA 110
- Complete System Metering
- LCD Display

Cooling System
- Integral Set-mounted
- Engine Driven Fan

GEN-SET RATINGS

Standby

Voltage (L-L)	Phase	PF	Hz	kW	kVA	AMPS	skVA @ 30% voltage dip	Generator Model*	Temp Rise	Connection
480v	3	0.8	60	3250	4062.5	4887	C/F	C/F	130°C/27°C	6 LEAD WYE
600v	3	0.8	60	3250	4062.5	3909	C/F	C/F	125°C/40°C	6 LEAD WYE
4160v	3	0.8	60	3250	4062.5	564	C/F	C/F	130°C/27°C	6 LEAD WYE
12470v	3	0.8	60	3200	4000	185	C/F	C/F	130°C/27°C	6 LEAD WYE
13200v	3	0.8	60	3200	4000	175	C/F	C/F	130°C/27°C	6 LEAD WYE
13800v	3	0.8	60	3200	4000	167	C/F	C/F	130°C/27°C	6 LEAD WYE

Prime

Voltage (L-L)	Phase	PF	Hz	kW	kVA	AMPS	skVA @ 30% voltage dip	Generator Model*	Temp Rise	Connection
480v	3	0.8	60	2800	3500	4210	C/F	C/F	105°C/40°C	6 LEAD WYE
600v	3	0.8	60	2800	3500	3368	C/F	C/F	105°C/40°C	6 LEAD WYE
4160v	3	0.8	60	2800	3500	486	C/F	C/F	105°C/40°C	6 LEAD WYE
12470v	3	0.8	60	2750	3437.5	159	C/F	C/F	105°C/40°C	6 LEAD WYE
13200v	3	0.8	60	2750	3437.5	150	C/F	C/F	105°C/40°C	6 LEAD WYE
13800v	3	0.8	60	2750	3437.5	144	C/F	C/F	105°C/40°C	6 LEAD WYE

* The Generator Model Number identified in the table is for standard C Series Configuration. Consult the factory for alternate configuration.
** UL2200 Offered

STANDARD EQUIPMENT

ENGINE

- Air Cleaners
- Oil Pump
- Full Flow Oil Filter
- Jacket Water Pump
- Inter Cooler Water Pump
- Thermostats
- Exhaust Manifold – dry
- Blower Fan & Fan Drive
- Radiator - Unit Mounted
- Electric Starting Motor - 24V
- Governor – Electric Isochronous
- Base - Structural Steel
- SAE Flywheel & Bell Housing
- Charging Alternator - 24V
- Battery Box & Cables
- Flexible Fuel Connectors
- Flexible Exhaust Connection
- EPA Certified Engine

DIGITAL CONTROL PANEL(S)

- Digital Metering
- Engine Parameters
- Generator Protection Functions
- Engine Protection
- SAE J1939 Engine ECU Communications
- Windows-based Software
- Multilingual Capability
- Remote Communications to our RDP-110 Remote Annunciator
- 16 Programmable Contact Inputs
- 7 contact outputs
- UL Recognized, c UL us , CE approved
- Event Recording
- IP 54 Front Panel Rating with Integrated Gasket
- NFPA110 Level Compatible

GENERATOR

- NEMA MG1, IEEE and ANSI standards compliance for temperature rise and motor starting
- Sustained short circuit current of up to 300% of the rated current for up to 10 seconds
- Self Ventilated and Drip-proof
- Superior Voltage Waveform
- Digital, Solid State, Volts-per-hertz Regulator
- No Load to Full Load Regulation
- Brushless Alternator with Brushless Pilot Exciter
- 4 pole, Rotating Field
- 130°C Standby Temperature Rise
- 2 Bearing, Sealed
- Flexible Coupling
- Full Amortisseur Windings
- 125% Rotor Balancing
- 3-phase Voltage Sensing
- ±.25% Voltage Regulation
- 3% Maximum Harmonic Content

APPLICATION DATA

Engine

Manufacturer:	MTU Detroit Diesel
Model:	20V4000 G83L
Type:	4-Cycle
Arrangement:	20-V
Displacement: in.³ (lit)	5,822 (95.4)
Bore: in. (cm)	6.69 (17.0)
Stoke: in. (cm)	8.27 (21.0)
Compression Ratio:	16.5:1
Rated RPM:	1800
Engine Governor:	ADEC
Max Power: **Standby:** bhp (kWm)	4,678 (3,490)
Prime: bhp (kWm)	4,035 (3,010)
Speed Regulation:	±.25%
Frequency:	60 Hz
Air Cleaner:	Dry

Liquid Capacity (Lubrication)

Total oil system: gal (lit)	103 (390)
Engine Jacket water capacity: gal (lit)	54.2 (205)
After Cooler water capacity: gal (lit)	14.5 (55)
System Coolant capacity: gal (lit)	231 (873)

Electrical

Electric volts DC:	24
Cold cranking Amps under 0°F (-17.8°C):	3,000

Fuel System

Fuel Supply Connection Size:	1" NPT
Fuel Return Connection Size:	1" NPT
Maximum Fuel Lift: ft (m)	3 (1)
Recommended Fuel:	Diesel #2
Total Fuel Flow: gal/hr (lit/hr)	349 (1,320)

Fuel Consumption

	Standby	Prime
100% Power Rating: gal/hr (lit/hr)	237 (897)	200 (757)
75% Power Rating: gal/hr (lit/hr)	192 (727)	149 (564)
50% Power Rating: gal/hr (lit/hr)	133 (504)	103 (390)

Cooling - Radiator System

	Standby	Prime
Ambient Capacity of Radiator: °F (°C)	108 (42)	108 (42)
Maximum Allowable Static Pressure on Radiator Exhaust: in. H_20 (kPa)	0.5 (0.12)	0.5 (0.12)
Water Pump Capacity: gal/min (lit/min)	440 (1,667)	440 (1,667)
After Cooler Pump Capacity: gal/min (lit/min)	163 (617)	163 (617)
Heat Rejection to Coolant: BTUM (kW)	83,030 (1,460)	67,675 (1,190)
Heat Rejection to After Cooler: BTUM (kW)	61,988 (1,090)	51,183 (900)
Heat Radiated to Ambient: BTUM (kW)	15,241 (268)	13,933 (245)

Air Requirements

	Standby	Prime
Aspirating: CFM (m^3min)	9,111 (258)	8,687 (246)
Air Flow Required for Radiator Cooled Unit: CFM (m^3min)	137,228 (3,886)	137,228 (3,886)
Air Flow Required for Heat Exchanger/ Remote Radiator based on 25°F Rise: CFM (m^3min)	29,698 (841)	27,551 (780)

Exhaust System

	Standby	Prime
Gas Temp.(Stack): °F (°C)	1,013 (545)	914 (490)
Gas Volume at Stack Temp: CFM (m^3min)	26,062(738)	22,884 (648)
Maximum Allowable Back Pressure: in. H_20 (kPa)	34.1 (8.5)	34.1(8.5)

EMISSIONS DATA

NOx + NMHC	CO	PM
4.19	0.82	0.14

All units are in g/hp-hr and are EPA D2 cycle values.

Emission levels of the engine may vary as a function of ambient temperature, barometric pressure, humidity, fuel type and quality, installation parameters, measuring instrumentation, etc. The data provided are laboratory results from one engine representing this rating. The data was obtained under controlled environmental conditions with calibrated instrumentation traceable to the United States National Bureau of Standards and in compliance with US EPA regulations found within 40 CFR Part 89. The weighted cycle value from each engine is guaranteed to be below the US EPA Standards at the US EPA defined conditions.

SOUND DATA

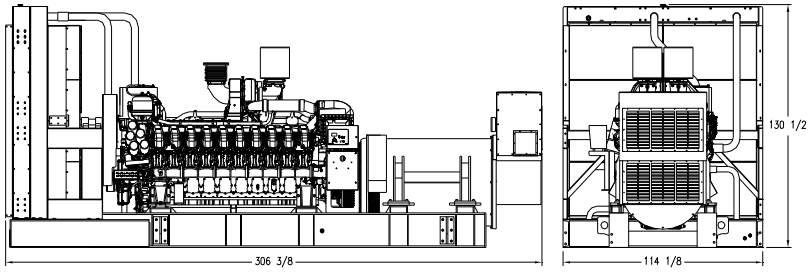
	Standby Full Load	Standby No Load	Prime Full Load	Prime No Load
23 ft (7m) OPU w/ critical grade muffler (dBA)	108	100	106.5	100

RATING DEFINITIONS and CONDITIONS

- Ambient capability factor at 984 ft (300m). Consult your local MTU Onsite Energy Power Generation Distributor for other altitudes.
- Standby ratings apply to installations served by a reliable utility source. The standby rating is applicable to varying loads for the duration of a power outage. No overload capability for this rating. Ratings are in accordance with ISO-3046/1, BS 5514, AS 2789, and DIN 6271.
- Prime power ratings apply to installations where utility power is unavailable or unreliable. At varying load, the number of generator set operating hours is unlimited. A 10% overload capacity is available for one hour in twelve. Ratings are in accordance with ISO-8528/1, overload power in accordance with ISO-3046/1, BS 5514, AS 2789, and DIN 6271. For limited running time and base load ratings, consult the factory.
- Deration Factors:
  Altitude: No power decrease with increased elevation up to 4,921 ft (1,500m) at 77°F (25°C); max permissible elevation is 5,905 ft (1,800m). Consult factory for altitudes between 4,921 ft (1,500m) and 5,905 ft (1,800m).
  Temperature: No power decrease with increased intake combustion temperature up to 107°F (42°C) at 328 ft (100m). Consult factory for performance at higher temperatures.

Weights & Dimensions

Length: in. (cm)	306.38 (778)
Width: in. (cm)	114.13 (290)
Height: in. (cm)	130.5 (331)
Weight (dry): lb. (kg)	63,264 (28,696)



Drawing above for illustration purposes only, based on standard open power 480 volt generator. Lengths may vary with other voltages.
*Do Not Use for Installation Design

DISTRIBUTED BY:

100 Power Drive, Mankato, MN 56001
Phone: 800-325-5450
www.mtu-online.com

Appendix 3.2
G8 – G14 Specification Sheets

PERFORMANCE DATA[DM9239]

June 13, 2019

Performance Number: DM9239 **Change Level: 04**

SALES MODEL:	C175-16	**COMBUSTION:**	DIRECT INJECTION
BRAND:	CAT	**ENGINE SPEED (RPM):**	1,800
ENGINE POWER (BHP):	4,376	**HERTZ:**	60
GEN POWER W/O FAN (EKW):	3,100.0	**ASPIRATION:**	TA
COMPRESSION RATIO:	15.3	**AFTERCOOLER TYPE:**	SCAC
RATING LEVEL:	MISSION CRITICAL STANDBY	**AFTERCOOLER CIRCUIT TYPE:**	JW+OC+1AC, 2AC
PUMP QUANTITY:	2	**AFTERCOOLER TEMP (F):**	115
FUEL TYPE:	DIESEL	**JACKET WATER TEMP (F):**	210.2
MANIFOLD TYPE:	DRY	**TURBO CONFIGURATION:**	PARALLEL
GOVERNOR TYPE:	ADEM4	**TURBO QUANTITY:**	4
ELECTRONICS TYPE:	ADEM4	**TURBOCHARGER MODEL:**	GTB6251BN-48T-1.38
CAMSHAFT TYPE:	STANDARD	**CERTIFICATION YEAR:**	2010
IGNITION TYPE:	CI	**CRANKCASE BLOWBY RATE (FT3/HR):**	2,436.4
INJECTOR TYPE:	CR	**FUEL RATE (RATED RPM) NO LOAD (GAL/HR):**	25.1
FUEL INJECTOR:	4439455	**PISTON SPD @ RATED ENG SPD (FT/MIN):**	2,598.4
REF EXH STACK DIAMETER (IN):	14		

INDUSTRY	SUBINDUSTRY	APPLICATION
ELECTRIC POWER	STANDARD	GENERATOR SET

General Performance Data

GENSET POWER WITHOUT 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
3,100.0	100	4,376	373	0.337	210.7	90.7	121.5	1,204.7	62.1	892.7
2,790.0	90	3,938	335	0.334	188.1	80.7	121.3	1,155.4	53.8	873.9
2,480.0	80	3,501	298	0.337	168.4	72.6	121.1	1,116.8	47.3	859.2
2,325.0	75	3,282	279	0.341	159.8	69.4	121.1	1,102.6	44.8	853.8
2,170.0	70	3,063	261	0.349	152.7	67.4	121.2	1,093.5	43.3	850.2
1,860.0	60	2,626	224	0.371	139.3	63.4	121.4	1,079.0	40.8	844.7
1,550.0	50	2,188	186	0.400	125.1	57.9	121.5	1,063.1	37.5	839.3
1,240.0	40	1,750	149	0.427	106.9	46.6	121.1	1,034.3	30.4	830.3
930.0	30	1,313	112	0.460	86.2	34.5	120.7	998.5	23.2	819.5
775.0	25	1,094	93	0.480	75.0	28.2	120.7	974.1	19.6	810.6
620.0	20	875	75	0.504	63.1	21.9	120.8	902.3	15.9	766.3
310.0	10	438	37	0.599	37.4	8.9	121.4	706.0	8.7	640.0

GENSET POWER WITHOUT 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
3,100.0	100	4,376	90	445.6	9,273.3	24,296.2	40,791.3	42,266.1	8,833.4	8,053.0
2,790.0	90	3,938	80	408.8	8,581.1	22,048.1	37,500.0	38,818.1	8,129.1	7,426.2
2,480.0	80	3,501	72	379.4	8,017.1	20,236.9	34,828.9	36,008.9	7,544.3	6,908.9
2,325.0	75	3,282	69	368.5	7,806.4	19,559.6	33,830.6	34,950.7	7,322.0	6,714.9
2,170.0	70	3,063	67	362.0	7,678.5	19,133.1	33,216.8	34,286.4	7,182.0	6,597.4
1,860.0	60	2,626	63	350.0	7,429.0	18,357.1	32,048.0	33,022.1	6,919.7	6,378.1
1,550.0	50	2,188	58	332.5	7,035.8	17,288.9	30,262.9	31,137.8	6,543.9	6,049.9
1,240.0	40	1,750	47	296.6	6,180.3	15,170.1	26,388.4	27,142.7	5,782.1	5,350.6
930.0	30	1,313	35	251.1	5,230.5	12,595.9	22,202.2	22,809.7	4,841.3	4,490.0
775.0	25	1,094	28	224.9	4,722.5	11,143.7	20,000.1	20,524.8	4,313.3	4,008.9
620.0	20	875	22	197.1	4,216.9	9,643.8	17,813.6	18,255.1	3,867.8	3,607.2
310.0	10	438	9	135.1	3,161.9	6,371.4	13,304.1	13,565.9	2,848.7	2,681.3

Heat Rejection Data

GENSET POWER WITHOUT 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

PERFORMANCE DATA[DM9239]

June 13, 2019

EKW	%	BHP	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN
3,100.0	100	4,376	77,079	10,265	175,510	97,180	24,081	27,356	185,573	452,113	481,614
2,790.0	90	3,938	68,674	9,652	155,505	85,959	21,506	22,077	167,015	403,771	430,117
2,480.0	80	3,501	61,729	9,188	139,739	77,324	19,247	18,045	148,458	361,362	384,941
2,325.0	75	3,282	58,955	9,026	133,914	74,165	18,272	16,609	139,179	343,060	365,445
2,170.0	70	3,063	56,876	8,928	130,176	72,152	17,456	15,731	129,901	327,733	349,118
1,860.0	60	2,626	53,227	8,797	124,059	68,578	15,919	14,476	111,343	298,886	318,389
1,550.0	50	2,188	49,411	8,680	117,110	63,840	14,300	13,183	92,786	268,478	285,997
1,240.0	40	1,750	44,005	8,463	104,802	54,521	12,215	10,300	74,229	229,338	244,303
930.0	30	1,313	37,225	8,151	88,182	44,714	9,854	7,429	55,672	184,999	197,070
775.0	25	1,094	33,267	7,945	78,149	39,422	8,568	6,178	46,393	160,871	171,368
620.0	20	875	28,325	7,533	65,780	31,522	7,209	5,244	37,114	135,351	144,182
310.0	10	438	16,748	6,451	36,503	16,106	4,278	3,828	18,557	80,318	85,559

Sound Data

EXHAUST: Sound Power (1/3 Octave Frequencies)

GENSET POWER WITHOUT 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
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
3,100.0	100	4,376	134.4	109.7	115.8	113.6	115.4	115.8	118.8	119.7	121.4	120.2
2,790.0	90	3,938	133.1	110.4	116.2	112.4	114.1	114.3	117.1	118.2	119.8	118.1
2,480.0	80	3,501	131.8	111.9	116.7	110.7	112.5	112.8	115.3	116.7	118.2	116.2
2,325.0	75	3,282	131.1	112.7	116.9	109.8	111.6	112.0	114.5	115.9	117.3	115.3
2,170.0	70	3,063	130.5	113.5	117.2	108.9	110.7	111.3	113.6	115.2	116.4	114.4
1,860.0	60	2,626	129.2	115.1	117.7	107.1	109.0	109.8	111.9	113.7	114.7	112.6
1,550.0	50	2,188	127.9	116.8	118.2	105.3	107.3	108.4	110.2	112.3	113.0	110.7
1,240.0	40	1,750	126.6	118.4	118.7	103.5	105.6	106.9	108.4	110.8	111.3	108.9
930.0	30	1,313	125.3	120.0	119.2	101.7	103.9	105.4	106.7	109.3	109.5	107.1
775.0	25	1,094	124.6	120.8	119.5	100.8	103.0	104.7	105.8	108.6	108.7	106.2
620.0	20	875	124.0	121.6	119.7	99.9	102.1	103.9	105.0	107.8	107.8	105.3
310.0	10	438	122.7	123.2	120.3	98.1	100.4	102.5	103.2	106.4	106.1	103.4

EXHAUST: Sound Power (1/3 Octave Frequencies)

GENSET POWER WITHOUT 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
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
3,100.0	100	4,376	122.0	122.4	123.4	124.7	124.5	122.9	122.2	121.4	119.9	118.8
2,790.0	90	3,938	120.5	120.8	122.0	123.4	123.0	121.3	120.6	119.8	118.6	117.7
2,480.0	80	3,501	119.2	119.5	120.6	122.3	121.7	120.2	119.7	118.9	117.5	117.0
2,325.0	75	3,282	118.5	118.9	119.8	121.8	121.0	119.7	119.2	118.4	117.0	116.7
2,170.0	70	3,063	117.9	118.3	119.1	121.2	120.4	119.1	118.8	118.0	116.4	116.4
1,860.0	60	2,626	116.5	117.1	117.6	120.2	119.0	118.1	117.9	117.1	115.4	115.8
1,550.0	50	2,188	115.2	115.8	116.2	119.1	117.7	117.0	117.0	116.2	114.3	115.1
1,240.0	40	1,750	113.9	114.6	114.7	118.1	116.4	116.0	116.1	115.3	113.3	114.5
930.0	30	1,313	112.6	113.4	113.2	117.0	115.1	114.9	115.2	114.4	112.2	113.9
775.0	25	1,094	112.0	112.8	112.5	116.5	114.5	114.4	114.8	114.0	111.7	113.6
620.0	20	875	111.3	112.2	111.8	116.0	113.8	113.9	114.4	113.6	111.2	113.3
310.0	10	438	110.0	110.9	110.3	115.0	112.5	112.8	113.5	112.7	110.2	112.6

Sound Data (Continued)

MECHANICAL: Sound Power (1/3 Octave Frequencies)

GENSET POWER WITHOUT 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
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
3,100.0	100	4,376	125.9	89.8	105.6	98.3	100.7	104.3	108.4	111.5	113.2	112.5
2,790.0	90	3,938	125.8	89.3	105.5	97.9	100.9	103.2	108.7	111.1	112.6	112.2
2,480.0	80	3,501	126.0	88.9	104.9	97.8	99.6	102.3	107.8	111.0	111.6	111.8
2,325.0	75	3,282	126.1	88.7	104.5	97.8	98.8	101.9	107.3	111.0	111.1	111.7
2,170.0	70	3,063	126.3	88.5	104.2	97.8	98.0	101.5	106.8	111.0	110.6	111.5

PERFORMANCE DATA[DM9239]

1,860.0	60	2,626	126.5	88.0	103.5	97.8	96.5	100.7	105.8	111.0	109.5	111.1
1,550.0	50	2,188	126.8	87.6	102.8	97.8	95.0	99.9	104.8	111.0	108.5	110.8
1,240.0	40	1,750	127.0	87.2	102.2	97.7	93.5	99.2	103.8	110.9	107.5	110.5
930.0	30	1,313	127.3	86.7	101.5	97.7	92.0	98.4	102.8	110.9	106.5	110.1
775.0	25	1,094	127.4	86.5	101.1	97.7	91.2	98.0	102.3	110.9	105.9	109.9
620.0	20	875	127.5	86.3	100.8	97.7	90.5	97.6	101.8	110.9	105.4	109.8
310.0	10	438	127.8	85.9	100.1	97.7	89.0	96.8	100.8	110.9	104.4	109.4

MECHANICAL: Sound Power (1/3 Octave Frequencies)

GENSET POWER WITHOUT 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
EKW	%	BHP	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
3,100.0	100	4,376	112.7	113.9	114.6	115.3	114.9	112.7	110.8	111.8	114.2	113.3
2,790.0	90	3,938	112.5	113.7	114.4	114.9	114.4	112.2	110.3	111.0	113.6	112.8
2,480.0	80	3,501	112.1	113.1	113.7	114.3	114.2	111.8	109.9	110.6	113.1	112.6
2,325.0	75	3,282	111.9	112.8	113.3	113.9	114.1	111.6	109.8	110.4	112.9	112.5
2,170.0	70	3,063	111.7	112.5	112.8	113.6	114.0	111.4	109.6	110.3	112.6	112.4
1,860.0	60	2,626	111.2	111.9	112.0	112.9	113.8	110.9	109.2	109.9	112.2	112.2
1,550.0	50	2,188	110.8	111.3	111.1	112.2	113.7	110.5	108.9	109.6	111.8	112.1
1,240.0	40	1,750	110.4	110.7	110.3	111.5	113.5	110.1	108.5	109.2	111.3	111.9
930.0	30	1,313	110.0	110.1	109.4	110.8	113.3	109.6	108.2	108.8	110.9	111.7
775.0	25	1,094	109.7	109.8	109.0	110.5	113.2	109.4	108.0	108.7	110.7	111.6
620.0	20	875	109.5	109.5	108.6	110.2	113.1	109.2	107.8	108.5	110.5	111.5
310.0	10	438	109.1	108.9	107.8	109.5	112.9	108.8	107.5	108.1	110.0	111.3

Emissions Data

RATED SPEED POTENTIAL SITE VARIATION: 1800 RPM

GENSET POWER WITHOUT FAN		EKW	3,100.0	2,325.0	1,550.0	775.0	310.0
PERCENT LOAD		%	100	75	50	25	10
ENGINE POWER		BHP	4,376	3,282	2,188	1,094	438
TOTAL NOX (AS NO2)		G/HR	31,683	20,556	8,412	3,523	3,586
TOTAL CO		G/HR	2,743	3,359	1,704	1,822	1,827
TOTAL HC		G/HR	238	195	372	378	330
PART MATTER		G/HR	162.5	167.1	120.5	135.6	125.3
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	3,729.4	3,245.7	1,732.0	1,314.5	2,738.0
TOTAL CO	(CORR 5% O2)	MG/NM3	284.3	453.8	295.6	579.5	1,199.1
TOTAL HC	(CORR 5% O2)	MG/NM3	20.3	23.4	57.6	103.9	188.1
PART MATTER	(CORR 5% O2)	MG/NM3	14.4	19.7	18.8	38.6	76.0
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	1,817	1,581	844	640	1,334
TOTAL CO	(CORR 5% O2)	PPM	227	363	236	464	959
TOTAL HC	(CORR 5% O2)	PPM	38	44	108	194	351
TOTAL NOX (AS NO2)		G/HP-HR	7.26	6.28	3.85	3.22	8.18
TOTAL CO		G/HP-HR	0.63	1.03	0.78	1.66	4.17
TOTAL HC		G/HP-HR	0.05	0.06	0.17	0.35	0.75
PART MATTER		G/HP-HR	0.04	0.05	0.06	0.12	0.29
TOTAL NOX (AS NO2)		LB/HR	69.85	45.32	18.54	7.77	7.91
TOTAL CO		LB/HR	6.05	7.41	3.76	4.02	4.03
TOTAL HC		LB/HR	0.52	0.43	0.82	0.83	0.73
PART MATTER		LB/HR	0.36	0.37	0.27	0.30	0.28

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 CORRECTED POWER CAPABILITY (BHP)

AMBIENT OPERATING TEMP (F)	30	40	50	60	70	80	90	100	110	120	130	140	NORMAL
ALTITUDE (FT)													
0	4,376	4,376	4,376	4,376	4,376	4,376	4,376	4,376	4,376	4,376	4,376	4,376	4,376
1,000	4,376	4,376	4,376	4,376	4,376	4,376	4,376	4,376	4,376	4,376	4,376	4,376	4,376
2,000	4,376	4,376	4,376	4,376	4,376	4,376	4,376	4,376	4,376	4,376	4,376	4,355	4,376
3,000	4,376	4,376	4,376	4,376	4,376	4,376	4,376	4,376	4,376	4,376	4,309	4,216	4,376
4,000	4,345	4,345	4,345	4,345	4,345	4,345	4,344	4,344	4,343	4,280	4,190	4,100	4,345
5,000	4,174	4,174	4,174	4,174	4,174	4,174	4,173	4,172	4,170	4,130	4,073	4,017	4,174
6,000	4,015	4,015	4,015	4,015	4,015	4,015	4,013	4,011	4,008	3,988	3,960	3,933	4,015
7,000	3,868	3,868	3,868	3,868	3,868	3,868	3,866	3,863	3,859	3,853	3,847	3,840	3,868
8,000	3,751	3,751	3,751	3,751	3,751	3,751	3,749	3,745	3,742	3,736	3,729	3,723	3,751
9,000	3,634	3,634	3,634	3,634	3,634	3,634	3,633	3,628	3,624	3,618	3,612	3,606	3,634
10,000	3,523	3,523	3,523	3,523	3,523	3,523	3,521	3,517	3,512	3,506	3,500	3,495	3,523
11,000	3,417	3,417	3,417	3,417	3,417	3,417	3,415	3,411	3,406	3,400	3,394	3,388	3,417
12,000	3,312	3,312	3,312	3,312	3,312	3,312	3,310	3,304	3,299	3,294	3,288	3,282	3,312
13,000	3,206	3,206	3,206	3,206	3,206	3,206	3,204	3,198	3,193	3,188	3,182	3,176	3,206
14,000	3,100	3,100	3,100	3,100	3,100	3,100	3,098	3,093	3,088	3,083	3,079	3,074	3,100
15,000	2,993	2,993	2,993	2,993	2,993	2,993	2,991	2,988	2,984	2,981	2,977	2,974	2,993

Cross Reference

Test Spec	Setting	Engine Arrangement	Engineering Model	Engineering Model Version	Start Effective Serial Number	End Effective Serial Number
3704738	LL6318	3079788	GS265	-	WYB00620	

Performance Parameter Reference

Parameters Reference:DM9600-11

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 deg C (84.2 deg F), 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

PERFORMANCE DATA[DM9239]

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
EMISSION CYCLE DEFINITIONS
1. For constant-speed marine engines for ship main propulsion, including,diesel-electric drive, test cycle E2 shall be applied, for controllable-pitch propeller sets
test cycle E2 shall be applied.
2. For propeller-law-operated main and propeller-law-operated auxiliary engines the test cycle E3 shall be applied.
3. For constant-speed auxiliary engines test cycle D2 shall be applied.
4. For variable-speed, variable-load auxiliary engines, not included above, test cycle C1 shall be applied.
HEAT REJECTION DEFINITIONS:
Diesel Circuit Type and HHV Balance : DM9500
HIGH DISPLACEMENT (HD) DEFINITIONS:
3500: EM1500
RATING DEFINITIONS:
Agriculture : TM6008
Fire Pump : TM6009
Generator Set : TM6035
Generator (Gas) : TM6041
Industrial Diesel : TM6010
Industrial (Gas) : TM6040
Irrigation : TM5749
Locomotive : TM6037
Marine Auxiliary : TM6036
Marine Prop (Except 3600) : TM5747
Marine Prop (3600 only) : TM5748
MSHA : TM6042
Oil Field (Petroleum) : TM6011
Off-Highway Truck : TM6039
On-Highway Truck : TM6038
SOUND DEFINITIONS:
Sound Power : DM8702
Sound Pressure : TM7080
Date Released : 11/29/18

Appendix 3.3
G15 – G16, G19-G22, and G26-31 Specification Sheets

3516C Generator Set

Electric Power

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

2000kW
1745kW @ site conditions

Specifications

Generator Set Specifications	
Minimum Rating	1650 ekW (2500 kVA)
Maximum Rating	2500 ekW (2750 kVA)
Voltage	480 volts
Frequency	60 Hz
Speed	1800 RPM

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

Engine Specifications		
Engine Model	3516C, ATAAC, V-16,4-Stroke Water-Cooled Diesel	
Compression Ratio	14.7:1	
Aspiration	TA	
Governor Type	Adem™3	
Fuel System	Electronic unit injection	
Bore	170 mm	6.69 in
Stroke (Std)	190 mm	7.48 in
Stroke (HD)	215 mm	8.46 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

Cooling

- Package mounted radiator

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
- ~~Excitation: [ ] Permanent Magnet Excited (PM)~~ [ ] Internally Excited (IE)
- Oversize and premium generators

Power Termination

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

Control Panels

- EMCP ~~(4.2) (4.3)~~ (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

3516C
2000 ekW/ 2500 kVA/ 60 Hz/ 1800 rpm/ 480 V/ 0.8 Power Factor

Rating Type: STANDBY

Emissions: U.S. EPA Stationary Emergency Use Only

Image shown may not reflect actual configuration

3516C

2000 ekW/ 2500 kVA
60 Hz/ 1800 rpm/ 480 V

	Metric	English
Package Performance		
Genset Power Rating with Fan @ 0.8 Power Factor	2000 ekW	
Genset Power Rating	2500 kVA	
Aftercooler (Separate Circuit)	N/A	N/A
Fuel Consumption		
100% Load with Fan	522.5 L/hr	138.0 gal/hr
75% Load with Fan	406.8 L/hr	107.5 gal/hr
50% Load with Fan	293.6 L/hr	77.5 gal/hr
25% Load with Fan	169.7 L/hr	44.8 gal/hr
Cooling System[1]		
Engine Coolant Capacity	233.0 L	61.6 gal
Inlet Air		
Combustion Air Inlet Flow Rate	185.5 m³/min	6548.9 cfm
Max. Allowable Combustion Air Inlet Temp	50 ° C	121 ° F
Exhaust System		
Exhaust Stack Gas Temperature	400.1 ° C	752.1 ° F
Exhaust Gas Flow Rate	433.1 m³/min	15292.8 cfm
Exhaust System Backpressure (Maximum Allowable)	6.7 kPa	27.0 in. water

Rating Type: STANDBY

Emissions: U.S. EPA Stationary Emergency Use Only

Heat Rejection		
Heat Rejection to Jacket Water	759 kW	43150 Btu/min
Heat Rejection to Exhaust (Total)	1788 kW	101696 Btu/min
Heat Rejection to Aftercooler	672 kW	38240 Btu/min
Heat Rejection to Atmosphere from Engine	133 kW	7564 Btu/min
Heat Rejection to Atmosphere from Generator	96 kW	5482 Btu/min

Alternator[2]	
Motor Starting Capability @ 30% Voltage Dip	5925 skVA
Current	3007 amps
Frame Size	1625
Excitation	IE
Temperature Rise	125 ° C

Emissions (Nominal)[3]		
NOx	2754.3 mg/Nm³	5.5 g/hp-hr
CO	143.3 mg/Nm³	0.3 g/hp-hr
HC	44.7 mg/Nm³	0.1 g/hp-hr
PM	10.4 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.

Rating Type: STANDBY

Emissions: U.S. EPA Stationary Emergency Use Only

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.: DM8263-04

Feature Code: 516DEA9

Generator Arrangement: 2523854

Date: 07/05/2016

Source Country: U.S.

GENERATOR SET PACKAGE
PERFORMANCE DATA

PERFORMANCE DATA[EM1897]

August 11, 2016

Performance Number: EM1897 **Change Level: 00**

SALES MODEL:	3516C	**COMBUSTION:**	DI
ENGINE POWER (BHP):	2,937	**ENGINE SPEED (RPM):**	1,800
GEN POWER WITH FAN (EKW):	2,000.0	**HERTZ:**	60
COMPRESSION RATIO:	14.7	**FAN POWER (HP):**	114.0
RATING LEVEL:	MISSION CRITICAL STANDBY	**ASPIRATION:**	TA
PUMP QUANTITY:	1	**AFTERCOOLER TYPE:**	ATAAC
FUEL TYPE:	DIESEL	**AFTERCOOLER CIRCUIT TYPE:**	JW+OC, ATAAC
MANIFOLD TYPE:	DRY	**INLET MANIFOLD AIR TEMP (F):**	122
GOVERNOR TYPE:	ADEM3	**JACKET WATER TEMP (F):**	210.2
ELECTRONICS TYPE:	ADEM3	**TURBO CONFIGURATION:**	PARALLEL
CAMSHAFT TYPE:	STANDARD	**TURBO QUANTITY:**	4
IGNITION TYPE:	CI	**TURBOCHARGER MODEL:**	GTA5518BN-56T-1.12
INJECTOR TYPE:	EUI	**CERTIFICATION YEAR:**	2010
FUEL INJECTOR:	3920220	**CRANKCASE BLOWBY RATE (FT3/HR):**	2,937.9
UNIT INJECTOR TIMING (IN):	64.34	**FUEL RATE (RATED RPM) NO LOAD (GAL/HR):**	13.7
REF EXH STACK DIAMETER (IN):	12	**PISTON SPD @ RATED ENG SPD (FT/MIN):**	2,244.1
MAX OPERATING ALTITUDE (FT):	3,117		

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

General Performance Data

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

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
2,000.0	100	2,937	307	0.329	138.0	78.3	121.2	1,118.5	71.5	752.1
1,800.0	90	2,641	276	0.331	124.9	73.1	119.6	1,067.5	65.7	716.0
1,600.0	80	2,353	246	0.337	113.1	68.0	118.2	1,027.0	60.0	693.3
1,500.0	75	2,212	231	0.340	107.5	65.2	117.5	1,008.1	57.2	684.6
1,400.0	70	2,071	216	0.344	101.8	62.3	116.8	989.4	54.4	676.9
1,200.0	60	1,795	188	0.352	90.1	55.5	115.4	952.0	48.0	662.8
1,000.0	50	1,521	159	0.357	77.5	46.5	113.7	913.4	40.1	654.0
800.0	40	1,250	131	0.357	63.8	34.8	111.8	863.8	30.3	655.0
600.0	30	977	102	0.365	50.9	24.2	110.6	803.8	22.0	650.0
500.0	25	839	88	0.374	44.8	19.7	110.2	767.0	18.7	641.7
400.0	20	699	73	0.388	38.8	15.7	109.8	724.6	15.7	629.0
200.0	10	411	43	0.450	26.4	9.0	109.1	596.9	10.9	552.8

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
2,000.0	100	2,937	83	454.3	6,548.9	15,292.8	28,512.8	29,478.4	6,205.0	5,738.7
1,800.0	90	2,641	77	428.8	6,318.7	14,243.0	27,390.5	28,264.7	5,956.5	5,533.7
1,600.0	80	2,353	72	404.5	6,073.3	13,331.0	26,220.6	27,012.9	5,685.0	5,301.6
1,500.0	75	2,212	69	392.7	5,932.2	12,897.9	25,568.0	26,319.7	5,542.0	5,176.6
1,400.0	70	2,071	66	380.9	5,777.2	12,448.0	24,862.1	25,573.8	5,384.8	5,037.5
1,200.0	60	1,795	59	353.9	5,397.2	11,422.5	23,141.0	23,771.1	5,003.4	4,694.0
1,000.0	50	1,521	50	318.8	4,857.3	10,138.7	20,731.5	21,274.5	4,476.2	4,208.4
800.0	40	1,250	38	271.1	4,090.0	8,488.8	17,357.1	17,803.6	3,744.5	3,524.2
600.0	30	977	27	225.0	3,394.1	6,989.6	14,328.5	14,684.4	3,097.0	2,920.6
500.0	25	839	22	204.1	3,103.5	6,328.1	13,075.2	13,388.4	2,825.1	2,668.8
400.0	20	699	18	184.1	2,840.4	5,696.0	11,947.2	12,218.4	2,572.5	2,435.7
200.0	10	411	11	148.5	2,409.4	4,478.2	10,105.7	10,290.7	2,174.6	2,076.8

PERFORMANCE DATA[EM1897]

August 11, 2016

Heat Rejection Data

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 AFTERCOOLER	WORK ENERGY	LOW HEAT VALUE ENERGY	HIGH HEAT VALUE ENERGY
EKW	%	BHP	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN
2,000.0	100	2,937	43,150	7,564	101,696	49,615	15,778	38,240	124,558	296,234	315,563
1,800.0	90	2,641	40,179	7,175	92,069	43,106	14,280	34,105	111,977	268,102	285,596
1,600.0	80	2,353	37,427	6,907	84,225	38,510	12,931	30,201	99,774	242,774	258,615
1,500.0	75	2,212	36,092	6,791	80,632	36,523	12,286	28,303	93,784	230,664	245,715
1,400.0	70	2,071	34,737	6,671	77,064	34,629	11,640	26,432	87,835	218,548	232,809
1,200.0	60	1,795	31,877	6,341	69,432	30,722	10,302	22,179	76,103	193,426	206,048
1,000.0	50	1,521	28,631	6,026	60,835	26,675	8,865	17,129	64,508	166,434	177,294
800.0	40	1,250	24,910	5,810	50,784	22,387	7,288	11,280	53,005	136,837	145,766
600.0	30	977	21,252	5,496	41,420	18,139	5,820	6,677	41,431	109,268	116,397
500.0	25	839	19,405	5,303	37,082	16,055	5,124	4,986	35,574	96,210	102,488
400.0	20	699	17,492	5,098	32,738	13,986	4,431	3,593	29,634	83,193	88,622
200.0	10	411	13,286	4,670	23,481	8,473	3,022	1,516	17,448	56,745	60,447

Emissions Data

RATED SPEED POTENTIAL SITE VARIATION: 1800 RPM

Generator will not exceed these values.

GENSET POWER WITH FAN		EKW	2,000.0	1,500.0	1,000.0	500.0	200.0
PERCENT LOAD		%	100	75	50	25	10
ENGINE POWER		BHP	2,937	2,212	1,521	839	411
TOTAL NOX (AS NO2)		G/HR	19,256	10,318	5,811	4,222	2,933
TOTAL CO		G/HR	1,581	854	894	1,773	1,794
TOTAL HC		G/HR	422	514	512	410	442
PART MATTER		G/HR	105.4	99.5	122.5	256.7	203.2
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	3,305.2	2,333.8	1,849.4	2,378.8	2,855.1
TOTAL CO	(CORR 5% O2)	MG/NM3	258.0	181.8	272.6	895.6	1,714.4
TOTAL HC	(CORR 5% O2)	MG/NM3	59.5	93.5	131.7	194.1	379.0
PART MATTER	(CORR 5% O2)	MG/NM3	14.6	18.4	34.4	119.9	161.2
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	1,610	1,137	901	1,159	1,391
TOTAL CO	(CORR 5% O2)	PPM	206	145	218	716	1,371
TOTAL HC	(CORR 5% O2)	PPM	111	175	246	362	708
TOTAL NOX (AS NO2)		G/HP-HR	6.56	4.67	3.82	5.03	7.13
TOTAL CO		G/HP-HR	0.54	0.39	0.59	2.11	4.36
TOTAL HC		G/HP-HR	0.14	0.23	0.34	0.49	1.08
PART MATTER		G/HP-HR	0.04	0.04	0.08	0.31	0.49
TOTAL NOX (AS NO2)		LB/HR	42.45	22.75	12.81	9.31	6.47
TOTAL CO		LB/HR	3.48	1.88	1.97	3.91	3.95
TOTAL HC		LB/HR	0.93	1.13	1.13	0.90	0.98
PART MATTER		LB/HR	0.23	0.22	0.27	0.57	0.45

RATED SPEED NOMINAL DATA: 1800 RPM

Data generator typically has, but can be +/- a small amount.

GENSET POWER WITH FAN		EKW	2,000.0	1,500.0	1,000.0	500.0	200.0
PERCENT LOAD		%	100	75	50	25	10
ENGINE POWER		BHP	2,937	2,212	1,521	839	411
TOTAL NOX (AS NO2)		G/HR	16,047	8,598	4,842	3,518	2,444
TOTAL CO		G/HR	878	474	497	985	996
TOTAL HC		G/HR	317	386	385	308	333
TOTAL CO2		KG/HR	1,393	1,073	765	430	250
PART MATTER		G/HR	75.3	71.0	87.5	183.4	145.2
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	2,754.3	1,944.8	1,541.2	1,982.3	2,379.2
TOTAL CO	(CORR 5% O2)	MG/NM3	143.3	101.0	151.4	497.5	952.4
TOTAL HC	(CORR 5% O2)	MG/NM3	44.7	70.3	99.0	145.9	285.0
PART MATTER	(CORR 5% O2)	MG/NM3	10.4	13.1	24.6	85.6	115.2
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	1,342	947	751	966	1,159
TOTAL CO	(CORR 5% O2)	PPM	115	81	121	398	762
TOTAL HC	(CORR 5% O2)	PPM	83	131	185	272	532
TOTAL NOX (AS NO2)		G/HP-HR	5.46	3.89	3.18	4.19	5.94
TOTAL CO		G/HP-HR	0.30	0.21	0.33	1.17	2.42
TOTAL HC		G/HP-HR	0.11	0.17	0.25	0.37	0.81

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PART MATTER	G/HP-HR	0.03	0.03	0.06	0.22	0.35
TOTAL NOX (AS NO2)	LB/HR	35.38	18.96	10.68	7.76	5.39
TOTAL CO	LB/HR	1.94	1.05	1.09	2.17	2.20
TOTAL HC	LB/HR	0.70	0.85	0.85	0.68	0.73
TOTAL CO2	LB/HR	3,070	2,365	1,687	949	552
PART MATTER	LB/HR	0.17	0.16	0.19	0.40	0.32
OXYGEN IN EXH	%	10.8	12.3	13.3	14.2	15.8
DRY SMOKE OPACITY	%	0.3	0.5	1.2	3.7	3.0
BOSCH SMOKE NUMBER		0.15	0.21	0.42	1.25	1.12

Regulatory Information

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

Altitude Derate Data

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	2,937	2,937	2,937	2,937	2,937	2,937	2,937	2,937	2,937	2,937	2,849	2,731	2,937
1,000	2,937	2,937	2,937	2,937	2,937	2,937	2,937	2,937	2,937	2,931	2,820	2,702	2,937
2,000	2,937	2,937	2,937	2,937	2,937	2,937	2,937	2,927	2,876	2,826	2,761	2,614	2,937
3,000	2,937	2,937	2,937	2,937	2,937	2,926	2,873	2,822	2,772	2,724	2,673	2,526	2,937
4,000	2,849	2,849	2,849	2,849	2,849	2,820	2,768	2,719	2,671	2,625	2,581	2,438	2,849
5,000	2,752	2,752	2,752	2,752	2,752	2,716	2,667	2,619	2,573	2,529	2,486	2,350	2,752
6,000	2,659	2,659	2,659	2,659	2,659	2,616	2,569	2,523	2,478	2,436	2,379	2,261	2,659
7,000	2,570	2,570	2,570	2,570	2,567	2,519	2,473	2,429	2,386	2,345	2,261	2,144	2,570
8,000	2,484	2,484	2,484	2,484	2,471	2,425	2,381	2,338	2,297	2,257	2,144	2,027	2,484
9,000	2,401	2,401	2,401	2,401	2,377	2,333	2,291	2,250	2,211	2,144	2,027	1,909	2,401
10,000	2,321	2,321	2,321	2,321	2,287	2,245	2,204	2,165	2,127	2,027	1,909	1,792	2,321
11,000	2,244	2,244	2,244	2,242	2,200	2,159	2,120	2,082	2,027	1,909	1,792	1,703	2,244
12,000	2,171	2,171	2,171	2,156	2,115	2,076	2,038	1,997	1,880	1,792	1,674	1,586	2,171
13,000	2,100	2,100	2,100	2,072	2,033	1,995	1,959	1,850	1,762	1,674	1,586	1,498	2,100
14,000	2,027	2,027	2,027	1,991	1,954	1,917	1,821	1,733	1,645	1,557	1,439	1,351	2,027
15,000	1,938	1,938	1,938	1,913	1,877	1,792	1,703	1,615	1,498	1,410	1,292	1,204	1,938

Cross Reference

Engine Arrangement			
Arrangement Number	**Effective Serial Number**	**Engineering Model**	**Engineering Model Version**
5084279	SBJ02000	GS334	-

Test Specification Data						
Test Spec	**Setting**	**Effective Serial Number**	**Engine Arrangement**	**Governor Type**	**Default Low Idle Speed**	**Default High Idle Speed**
4577178	LL1860	SBJ02000	5084279			

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:

PERFORMANCE DATA[EM1897]

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

PERFORMANCE DATA[EM1897]

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

PERFORMANCE DATA[EM1897]

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

Appendix 3.4
G17 – G18 Specification Sheets

PERFORMANCE DATA[EM1898]

January 10, 2017

Performance Number: EM1898 **Change Level: 00**

SALES MODEL:	3512C	**COMBUSTION:**	DI
BRAND:	CAT	**ENGINE SPEED (RPM):**	1,800
ENGINE POWER (BHP):	2,206	**HERTZ:**	60
GEN POWER WITH FAN (EKW):	1,500.0	**FAN POWER (HP):**	88.5
COMPRESSION RATIO:	14.7	**ASPIRATION:**	TA
RATING LEVEL:	STANDBY	**AFTERCOOLER TYPE:**	ATAAC
PUMP QUANTITY:	1	**AFTERCOOLER CIRCUIT TYPE:**	JW+OC, ATAAC
FUEL TYPE:	DIESEL	**INLET MANIFOLD AIR TEMP (F):**	122
MANIFOLD TYPE:	DRY	**JACKET WATER TEMP (F):**	210.2
GOVERNOR TYPE:	ADEM3	**TURBO CONFIGURATION:**	PARALLEL
ELECTRONICS TYPE:	ADEM3	**TURBO QUANTITY:**	4
CAMSHAFT TYPE:	STANDARD	**TURBOCHARGER MODEL:**	GTB4708BN-52T-0.96
IGNITION TYPE:	CI	**CERTIFICATION YEAR:**	2006
INJECTOR TYPE:	EUI	**CRANKCASE BLOWBY RATE (FT3/HR):**	2,203.4
FUEL INJECTOR:	3920220	**FUEL RATE (RATED RPM) NO LOAD (GAL/HR):**	9.9
UNIT INJECTOR TIMING (IN):	64.34	**PISTON SPD @ RATED ENG SPD (FT/MIN):**	2,244.1
REF EXH STACK DIAMETER (IN):	10		
MAX OPERATING ALTITUDE (FT):	3,937		

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

General Performance Data

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

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
1,500.0	100	2,206	307	0.332	104.6	77.5	120.9	1,145.6	74.6	756.6
1,350.0	90	1,983	276	0.336	95.2	72.2	116.1	1,102.7	68.8	727.5
1,200.0	80	1,768	246	0.343	86.6	66.9	113.2	1,069.1	63.0	713.4
1,125.0	75	1,662	232	0.346	82.0	63.4	111.5	1,052.3	59.5	706.7
1,050.0	70	1,556	217	0.348	77.4	59.7	109.8	1,035.2	55.8	700.0
900.0	60	1,349	188	0.352	67.9	51.1	107.1	1,000.5	47.6	687.3
750.0	50	1,144	159	0.355	58.0	40.6	107.5	963.6	38.4	696.7
600.0	40	940	131	0.359	48.2	30.0	108.4	921.9	29.4	702.2
450.0	30	736	103	0.368	38.6	20.9	107.1	856.0	21.9	685.3
375.0	25	632	88	0.376	33.9	16.9	106.2	809.5	18.8	664.9
300.0	20	527	73	0.388	29.2	13.3	105.2	754.5	16.0	636.4
150.0	10	312	43	0.443	19.7	7.3	103.2	609.7	11.4	540.6

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
1,500.0	100	2,206	82	449.8	4,937.2	11,734.1	21,796.5	22,529.1	4,743.3	4,317.6
1,350.0	90	1,983	77	428.8	4,734.5	10,945.3	20,885.8	21,551.9	4,532.9	4,136.4
1,200.0	80	1,768	71	409.0	4,506.7	10,265.9	19,853.4	20,459.8	4,302.7	3,938.4
1,125.0	75	1,662	68	396.6	4,371.2	9,868.8	19,223.0	19,797.6	4,160.2	3,812.8
1,050.0	70	1,556	64	382.6	4,218.1	9,442.4	18,511.1	19,053.3	4,003.2	3,672.9
900.0	60	1,349	55	350.3	3,862.4	8,508.3	16,857.2	17,332.4	3,647.3	3,352.3
750.0	50	1,144	44	309.9	3,375.7	7,435.0	14,666.1	15,072.5	3,161.3	2,907.1
600.0	40	940	33	266.6	2,868.4	6,329.0	12,406.6	12,744.3	2,678.2	2,465.5
450.0	30	736	23	224.6	2,431.9	5,278.8	10,481.3	10,752.0	2,266.9	2,093.3
375.0	25	632	19	204.3	2,243.0	4,776.5	9,654.1	9,891.7	2,088.3	1,933.3
300.0	20	527	15	184.2	2,069.9	4,283.3	8,899.4	9,103.9	1,921.3	1,784.5
150.0	10	312	9	148.8	1,782.1	3,338.5	7,648.3	7,786.4	1,641.0	1,539.0

Heat Rejection Data

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 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
1,500.0	100	2,206	28,541	7,072	79,477	38,355	11,956	29,539	93,547	224,476	239,123
1,350.0	90	1,983	26,761	6,706	72,346	33,940	10,882	26,874	84,110	204,315	217,647
1,200.0	80	1,768	25,085	6,393	66,713	30,942	9,897	24,071	74,958	185,825	197,950
1,125.0	75	1,662	24,176	6,249	63,549	29,350	9,376	22,404	70,466	176,039	187,526
1,050.0	70	1,556	23,227	6,110	60,309	27,693	8,845	20,631	66,004	166,069	176,905
900.0	60	1,349	21,222	5,841	53,634	24,225	7,759	16,788	57,205	145,683	155,189
750.0	50	1,144	19,059	5,564	46,826	21,662	6,636	12,311	48,509	124,586	132,716
600.0	40	940	16,790	5,286	39,874	18,604	5,512	8,066	39,882	103,489	110,241
450.0	30	736	14,427	4,840	32,601	14,897	4,416	4,955	31,201	82,917	88,327
375.0	25	632	13,189	4,570	28,900	12,838	3,876	3,774	26,809	72,772	77,520
300.0	20	527	11,900	4,299	25,149	10,707	3,336	2,793	22,353	62,628	66,715
150.0	10	312	9,090	3,818	17,468	6,020	2,253	1,375	13,214	42,301	45,061

Sound Data

SOUND PRESSURE DATA FOR THIS RATING CAN BE FOUND IN PERFORMANCE NUMBER - DM8779.

Emissions Data

RATED SPEED POTENTIAL SITE VARIATION: 1800 RPM

GENSET POWER WITH FAN		EKW	1,500.0	1,125.0	750.0	375.0	150.0
PERCENT LOAD		%	100	75	50	25	10
ENGINE POWER		BHP	2,206	1,662	1,144	632	312
TOTAL NOX (AS NO2)		G/HR	14,366	7,266	4,835	3,673	2,831
TOTAL CO		G/HR	1,890	1,176	1,665	1,965	1,898
TOTAL HC		G/HR	351	381	358	283	329
PART MATTER		G/HR	97.6	99.1	150.9	184.0	112.2
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	2,848.7	1,803.1	1,671.1	2,214.1	2,967.2
TOTAL CO	(CORR 5% O2)	MG/NM3	427.2	336.3	712.5	1,486.6	2,381.4
TOTAL HC	(CORR 5% O2)	MG/NM3	68.8	95.6	123.3	175.3	360.2
PART MATTER	(CORR 5% O2)	MG/NM3	18.2	23.5	54.8	110.0	115.7
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	1,388	878	814	1,078	1,445
TOTAL CO	(CORR 5% O2)	PPM	342	269	570	1,189	1,905
TOTAL HC	(CORR 5% O2)	PPM	128	178	230	327	672
TOTAL NOX (AS NO2)		G/HP-HR	6.58	4.41	4.26	5.85	9.14
TOTAL CO		G/HP-HR	0.87	0.71	1.47	3.13	6.13
TOTAL HC		G/HP-HR	0.16	0.23	0.32	0.45	1.06
PART MATTER		G/HP-HR	0.04	0.06	0.13	0.29	0.36
TOTAL NOX (AS NO2)		LB/HR	31.67	16.02	10.66	8.10	6.24
TOTAL CO		LB/HR	4.17	2.59	3.67	4.33	4.18
TOTAL HC		LB/HR	0.77	0.84	0.79	0.62	0.73
PART MATTER		LB/HR	0.22	0.22	0.33	0.41	0.25

RATED SPEED NOMINAL DATA: 1800 RPM

GENSET POWER WITH FAN		EKW	1,500.0	1,125.0	750.0	375.0	150.0
PERCENT LOAD		%	100	75	50	25	10
ENGINE POWER		BHP	2,206	1,662	1,144	632	312
TOTAL NOX (AS NO2)		G/HR	11,972	6,055	4,029	3,061	2,359
TOTAL CO		G/HR	1,050	653	925	1,092	1,055
TOTAL HC		G/HR	264	286	269	213	248
TOTAL CO2		KG/HR	1,096	853	602	352	204
PART MATTER		G/HR	69.7	70.8	107.8	131.4	80.1
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	2,373.9	1,502.6	1,392.6	1,845.1	2,472.7
TOTAL CO	(CORR 5% O2)	MG/NM3	237.3	186.8	395.9	825.9	1,323.0
TOTAL HC	(CORR 5% O2)	MG/NM3	51.7	71.9	92.7	131.8	270.9

PERFORMANCE DATA[EM1898]

January 10, 2017

PART MATTER	(CORR 5% O2)	MG/NM3	13.0	16.8	39.1	78.6	82.6
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	1,156	732	678	899	1,204
TOTAL CO	(CORR 5% O2)	PPM	190	149	317	661	1,058
TOTAL HC	(CORR 5% O2)	PPM	97	134	173	246	506
TOTAL NOX (AS NO2)		G/HP-HR	5.48	3.68	3.55	4.87	7.62
TOTAL CO		G/HP-HR	0.48	0.40	0.81	1.74	3.40
TOTAL HC		G/HP-HR	0.12	0.17	0.24	0.34	0.80
PART MATTER		G/HP-HR	0.03	0.04	0.09	0.21	0.26
TOTAL NOX (AS NO2)		LB/HR	26.39	13.35	8.88	6.75	5.20
TOTAL CO		LB/HR	2.32	1.44	2.04	2.41	2.32
TOTAL HC		LB/HR	0.58	0.63	0.59	0.47	0.55
TOTAL CO2		LB/HR	2,417	1,881	1,327	776	449
PART MATTER		LB/HR	0.15	0.16	0.24	0.29	0.18
OXYGEN IN EXH		%	11.2	12.3	12.9	13.9	15.8
DRY SMOKE OPACITY		%	1.0	1.3	2.9	5.0	3.0
BOSCH SMOKE NUMBER			0.37	0.45	1.06	1.60	1.11

Regulatory Information

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

Altitude Derate Data

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	2,206	2,206	2,206	2,206	2,206	2,206	2,206	2,206	2,206	2,206	2,206	2,096	2,206
1,000	2,206	2,206	2,206	2,206	2,206	2,206	2,206	2,206	2,206	2,206	2,162	2,074	2,206
2,000	2,206	2,206	2,206	2,206	2,206	2,206	2,206	2,206	2,206	2,176	2,118	2,007	2,206
3,000	2,206	2,206	2,206	2,206	2,206	2,206	2,206	2,173	2,135	2,098	2,052	1,919	2,206
4,000	2,201	2,201	2,201	2,201	2,201	2,171	2,132	2,094	2,057	2,021	1,963	1,831	2,201
5,000	2,129	2,129	2,129	2,129	2,129	2,092	2,054	2,017	1,982	1,947	1,875	1,743	2,129
6,000	2,059	2,059	2,059	2,059	2,053	2,015	1,978	1,943	1,909	1,876	1,765	1,677	2,059
7,000	1,992	1,992	1,992	1,992	1,976	1,940	1,904	1,870	1,838	1,787	1,677	1,588	1,992
8,000	1,927	1,927	1,927	1,927	1,902	1,867	1,833	1,800	1,769	1,699	1,610	1,522	1,927
9,000	1,865	1,865	1,865	1,865	1,831	1,797	1,764	1,733	1,699	1,610	1,522	1,412	1,865
10,000	1,805	1,805	1,805	1,795	1,761	1,729	1,697	1,667	1,610	1,522	1,368	1,279	1,805
11,000	1,522	1,522	1,522	1,522	1,522	1,522	1,522	1,522	1,434	1,324	1,213	1,125	1,522
12,000	1,478	1,478	1,478	1,478	1,478	1,478	1,478	1,390	1,279	1,169	1,081	993	1,478
13,000	1,434	1,434	1,434	1,434	1,434	1,434	1,346	1,235	1,147	1,037	971	882	1,434
14,000	1,390	1,390	1,390	1,390	1,390	1,279	1,191	1,103	1,015	927	860	794	1,390
15,000	1,346	1,346	1,346	1,346	1,235	1,147	1,059	971	882	816	772	728	1,346

Cross Reference

Test Spec	Setting	Engine Arrangement	Engineering Model	Engineering Model Version	Start Effective Serial Number	End Effective Serial Number
4577179	LL1861	5084278	GS656	LS	CT200463	
4577179	LL1861	5157729	PG242	-	LYH00001	

Supplementary Data

Type	Classification	Performance Number
SOUND	SOUND PRESSURE	DM8779

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,

PERFORMANCE DATA[EM1898]

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:

PERFORMANCE DATA[EM1898]

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

Appendix 3.5
FP1 Specification Sheet

Emissions Information CAT D4B01369 100 kW Genset

According to our record the Engine Serial No: E5M01465 which is installed in Genset Serial No:D4B01369 has the following Emission data values as shown in the screenshot.

	Cycle Total, g/kW.h
CO:	1.1500
HC:	0.2100
NOx, Corrected:	3.5200
NOx + HC, Corrected:	3.7300
Parts., Corrected:	0.2100

Regards
Engine Certification 1

Appendix 3.6
FP2 Specification Sheet

CLARKE®

FIRE PUMP ENGINES

MODELS

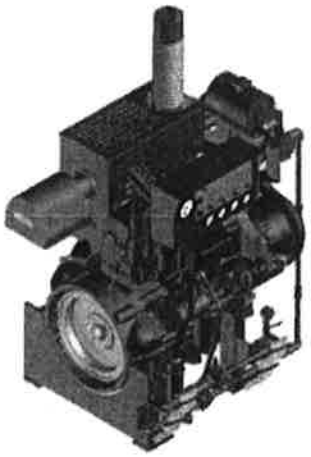
JU4H-UFAEA0 JU4H-UFAEE8 JU4H-UFADJ8
JU4H-UFAEF2 JU4H-UFADJ2

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

JU4H MODEL ♦	RATED SPEED 1760		2100		2350		US-EPA (NSPS) Available Until ●
UFAEA0	37	27.5	42	31	46	34	No Expiration [1]
UFAEE8	64	48					No Expiration [1]
UFAEF2			74	55	74	55	No Expiration [1]
UFADJ8	86	64					No Expiration [2]
UFADJ2			99	74	99	74	No Expiration [2]

● USA EPA (NSPS) Interim Tier 4 [1] or Tier 3 [2] Emissions Certified Off-Road (40 CFR Part 89) and NSPS Stationary (40 CFR Part 60 Sub Part IIII). Meet EU Stage IIIA emission levels.

♦ All Models are available for Export



Picture shown represents JU4H- IT4 – T engine model

SPECIFICATIONS

ITEM	JU4H MODELS UFAEA0	UFAEE8	UFAEF2	UFADJ8	UFADJ2
Number of Cylinders	4				
Aspiration	T			TRWA	
Rotation*	CW				
Overall Dimensions In. (mm)	60 (1524) H x 50 (1270) L x 36.1 (917) W			60 (1524) H x 50.7 (1288) L x 36.1 (917) W	
Crankshaft Centerline Height – In. (mm)	14 (356)				
Weight – lb (kg)	935 (424)			985 (474)	
Compression Ratio	19.0:1				
Displacement – cu. In. (L)	275 (4.5)				
Engine Type	4 Stroke Cycle – Inline Construction				
Bore & Stroke – In. (mm)	4.19 x 5.00 (106 x 127)				
Installation Drawing	D653			D654	
Wiring Diagram AC	C07651				
Wiring Diagram DC	C072128				
Engine Series	John Deere 4045 Series Power Tech M				
Speed Interpolation	N/A				

Abbreviations: CW – Clockwise NA – Naturally Aspirated T – Turbocharged TRWA – Turbocharged with Raw Water Aftercooling L – Length W – Width H - Height
*Rotation viewed from Heat Exchanger / Front of engine

CERTIFIED POWER RATING

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

c UL us

Meets NFPA 20 Requirements

FM C US APPROVED

ENGINE RATINGS BASELINES

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

CLARKE®

FIRE PUMP ENGINES

MODELS

JU4H-UFAEA0 JU4H-UFAEE8 JU4H-UFADJ8
JU4H-UFAEF2 JU4H-UFADJ2

ENGINE EQUIPMENT

EQUIPMENT	STANDARD	OPTIONAL
Air Cleaner	Direct Mounted, Washable, Indoor Service with Drip Shield	Disposable, Drip Proof, Indoor Service Outdoor Type, Single or Two Stage (Cyclonic)
Alarms	Overspeed Alarm & Shutdown, Low Oil Pressure, Low & High Coolant Temperature, Low Raw Water Flow, High Raw Water Temperature	Low Coolant Level, Low Oil Level, Oil Filter Differential Pressure, Fuel Filter Differential Pressure, Air Filter Restriction
Alternator	12V-DC, 42 Amps with Poly-Vee Belt and Guard	24V-DC, 40 Amps with Poly-Vee Belt and Guard
Coupling	Bare Flywheel	Listed Driveshaft and Guard, AEA0 – CDS10-SC; AEE8, AEF2, ADJ8, ADJ2 – CDS20-SC
Engine Heater	115V-AC, 1000 Watt	230V-AC, 1000 Watt
Exhaust Flex Connection	SS Flex, NPT(M) Connection, 3"	SS Flex, NPT(M) Connection, 4"
Exhaust Protection	Metal Guards on Manifolds and Turbocharger	
Flywheel Housing	SAE #3	
Flywheel Power Take Off	11.5" SAE Industrial Flywheel Connection	
Fuel Connections	Fire Resistant, Flexible, USA Coast Guard Approved, Supply and Return Lines	SS, Braided, cUL Listed, Supply and Return Lines
Fuel Filter	Primary Filter with Priming Pump	
Fuel Injection System	Stanadyne, Direct Injection	
Fuel Solenoid	12V-DC Energized to Run (ETR)	12V-DC Energized to Stop (ETS); 24V-DC Energized to Run; 24V-DC Energized to Stop (ETS)
Governor, Speed	Constant Speed, Mechanical	
Heat Exchanger	Tube and Shell Type, 60 PSI (4 BAR), NPT(F) Connections – Sea Water Compatible	
Instrument Panel	English and Metric, Tachometer, Hourmeter, Water Temperature, Oil Pressure and Two (2) Voltmeters	
Junction Box	Integral with Instrument Panel; For DC Wiring Interconnection to Engine Controller	
Lube Oil Cooler	Engine Water Cooled, Plate Type	
Lube Oil Filter	Full Flow with By-Pass Valve	
Lube Oil Pump	Gear Driven, Gear Type	
Manual Start Control	On Instrument Panel with Control Position Warning Light	
Overspeed Control	Electronic with Reset and Test on Instrument Panel	
Raw Water Cooling Loop – wlAlarms	Galvanized	Seawater, All 316SS, High Pressure
Raw Water Cooling Loop – Solenoid Operation	Automatic from Fire Pump Controller and from Engine Instrument Panel (for Horizontal Fire Pump Applications)	Not Supplied (for Vertical Turbine Fire Pump Applications)
Run – Stop Control	On Instrument Panel with Control Position Warning Light	
Starters	Two (2) 12V-DC	Two (2) 24V-DC
Throttle Control	Adjustable Speed Control, Tamper Proof	
Water Pump	Centrifugal Type, Poly-Vee Belt Drive with Guard	

Abbreviations: DC –Direct Current, AC – Alternating Current, SAE – Society of Automotive Engineers, NPT(F) – National Pipe Tapered Thread (Female), NPT(M) – National Pipe Tapered Thread (Male), NA – Naturally Aspirated, T- Turbocharged, ANSI – American National Standards Institute, TRWA – Turbocharged with Raw Water Aftercooling, SS – Stainless Steel

MODEL NOMENCLATURE (10 Digit Models)

JU4H UFAEE8

- JU4H: John Deere Base Engine, 350 Series, 4 Cylinder, Heat Exchanger Cooled
- UF: Built in USA
- A: EPA Interim Tier 4 Certified
- E: UL Listed and FM Approved
- E8: Power Curve Number

CLARKE

CLARKE Fire Protection Products, Inc.
100 Progress Place, Cincinnati, Ohio 45246
United States of America
Tel +1-513-475-FIRE (3473) Fax +1-513-771-8930
www.clarkefire.com

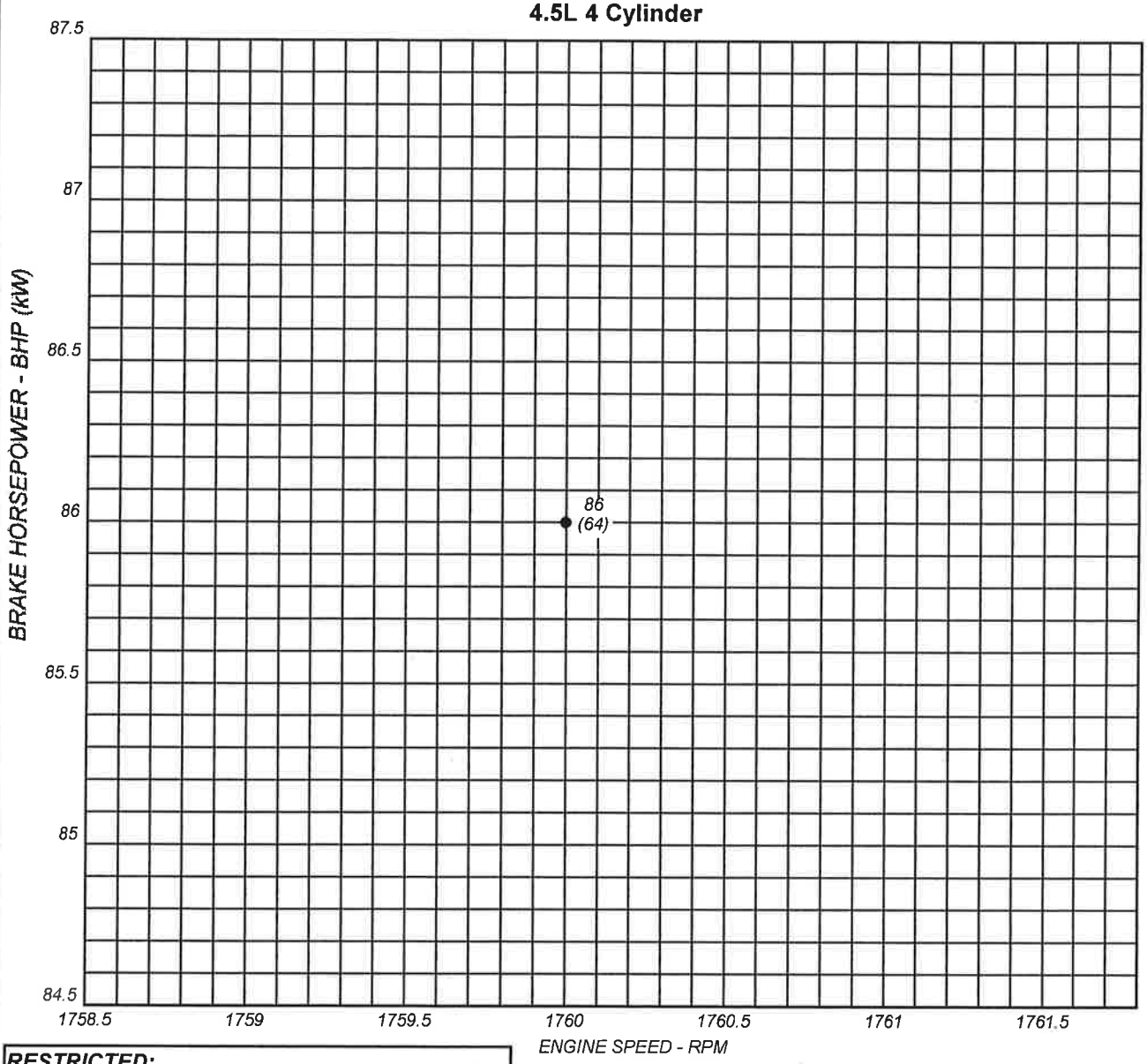
CLARKE UK, Ltd.
Grange Works, Lomond Rd., Coatbridge, ML5-2NN
United Kingdom
Tel +44-1236-429946 Fax +44-1236-427274
www.clarkefire.com

C134083 revF
3JUN15

CLARKE

Fire Protection Products, Inc.

FIRE PUMP MODEL: JU4H-UFADJ8
Heat Exchanger
Turbocharged
4.5L 4 Cylinder



RESTRICTED:
USE ONLY FOR STAND-BY FIRE PUMP APPLICATIONS

ENGINE PERFORMANCE:
STANDARD CONDITIONS: (SAE J1349, ISO 3046)
77°F (25°C) AIR INLET TEMPERATURE
29.61 IN. (751.1MM) HG BAROMETRIC PRESSURE
#2 DIESEL FUEL (SEE C13940)

KEVIN KUNKLER 10AUG10

●——● *NAMEPLATE BHP (MAXIMUM PUMP LOAD)*

CREATED	DATE CREATED
KK	08/10/10

ENGINE MODEL JU4H-UFADJ8

DRAWING NO.	REV
C133643	A

CLARKE

Fire Protection Products, Inc.

JU4H-UFADJ8
INSTALLATION & OPERATION DATA (I&O Data)
USA Produced

Basic Engine Description

Engine Manufacturer	John Deere Co.
Ignition Type	Compression (Diesel)
Number of Cylinders	4
Bore and Stroke - in (mm)	4.19 (106) X 5 (127)
Displacement - in^3 (L)	275 (4.5)
Compression Ratio	19.0:1
Valves per cylinder	
Intake	1
Exhaust	1
Combustion System	Direct Injection
Engine Type	In-Line, 4 Stroke Cycle
Fuel Management Control	Mechanical, Rotary Pump
Firing Order (CW Rotation)	1-3-4-2
Aspiration	Turbocharged
Charge Air Cooling Type	Raw Water Cooled
Rotation, viewed from front of engine, Clockwise (CW)	Standard
Engine Crankcase Vent System	Open
Installation Drawing	D654
Weight - lb (kg)	873 (396)

Power Rating	**1760**
Nameplate Power - HP (kW)[1]	86 (64)

Cooling System - [C051128]	**1760**
Engine Coolant Heat - Btu/sec (kW)	33 (34.8)
Engine Radiated Heat - Btu/sec (kW)	9.5 (10)
Heat Exchanger Minimum Flow	
60°F (15°C) Raw H_20 - gal/min (L/min)	8 (30.3)
100°F (37°C) Raw H_20 - gal/min (L/min)	10 (37.9)
Heat Exchanger Maximum Cooling Raw Water	
Inlet Pressure - psi (bar)	60 (4.1)
Flow - gal/min (L/min)	40 (151)
Typical Engine H_20 Operating Temp - °F (°C)	180 (82.2) - 195 (90.6)
Thermostat	
Start to Open - °F (°C)	180 (82.2)
Fully Opened - °F (°C)	201 (93.9)
Engine Coolant Capacity - qt (L)	15.3 (14.5)
Coolant Pressure Cap - lb/in^2 (kPa)	8.5 (58.6)
Maximum Engine Coolant Temperature - °F (°C)	221 (105)
Minimum Engine Coolant Temperature - °F (°C)	105 (40.6)
High Coolant Temp Alarm Switch - °F (°C)	205 (96.1)

Electric System - DC	**Standard**		**Optional**	
System Voltage (Nominal)	12		24	
Battery Capacity for Ambients Above 32°F (0°C)				
Voltage (Nominal)	12	{C07633}	24	{C07633}
Qty. Per Battery Bank	1		2	
SAE size per J537	8D		8D	
CCA @ 0°F (-18°C)	1400		1400	
Reserve Capacity - Minutes	430		430	
Battery Cable Circuit, Max Resistance - ohm	0.0012		0.0012	
Battery Cable Minimum Size				
0-120 in. Circuit Length[2]	00		00	
121-160 in. Circuit Length[2]	000		000	
161-200 in. Circuit Length[2]	0000		0000	
Charging Alternator Maximum Output - Amp,	40	{C07639}	18	{C071048}
Starter Cranking Amps, Rolling - @60°F (15°C)	345	{RE59595/RE59589}	250	{C07819/C07820}

NOTE: This engine is intended for indoor installation or in a weatherproof enclosure. [1]Derate 3% per every 1000 ft. [304.8 m] above 300 ft. [91.4 m] and derate 1% for every 10 °F [5.55 °C] above 77° [25°C]. [2]Positive and Negative Cables Combined Length.

CLARKE

Fire Protection Products, Inc.

JU4H-UFADJ8

INSTALLATION & OPERATION DATA (I&O Data)

USA Produced

Exhaust System (Single Exhaust Outlet)	1760
Exhaust Flow - ft.³/min (m³/min)	461 (13.1)
Exhaust Temperature - °F (°C)	880 (471)
Maximum Allowable Back Pressure - in H_20 (kPa)	30 (7.5)
Minimum Exhaust Pipe Dia. - in (mm)[3]	3 (76.2)

Fuel System	1760
Fuel Consumption - gal/hr (L/hr)	4.5 (17)
Fuel Return - gal/hr (L/hr)	17.5 (66.2)
Fuel Supply - gal/hr (L/hr)	22 (83.3)
Fuel Pressure - lb/in² (kPa)	3 (20.7) - 6 (41.4)
Minimum Line Size - Supply - in.	.50 Schedule 40 Steel Pipe
Pipe Outer Diameter - in (mm)	0.848 (21.5)
Minimum Line Size - Return - in.	.375 Schedule 40 Steel Pipe
Pipe Outer Diameter - in (mm)	0.675 (17.1)
Maximum Allowable Fuel Pump Suction Lift with clean Filter - in H_20 (mH_20)	31 (0.8)
Maximum Allowable Fuel Head above Fuel pump, Supply or Return - ft (m)	4.5 (1.4)
Fuel Filter Micron Size	5

Heater System	Standard	Optional
Engine Coolant Heater		
Wattage (Nominal)	1000	1000
Voltage - AC, 1 Phase	115 (+5%, -10%)	230 (+5%, -10%)
Part Number	{C122188}	{C122192}

Air System	1760	
Combustion Air Flow - ft.³/min (m³/min)	185 (5.2)	
Air Cleaner	Standard	Optional
Part Number	{C03396}	{C03327}
Type	Indoor Service Only, with Shield	Canister, Single-Stage
Cleaning method	Washable	Disposable
Air Intake Restriction Maximum Limit		
Dirty Air Cleaner - in H_20 (kPa)	10 (2.5)	10 (2.5)
Clean Air Cleaner - in H_20 (kPa)	5 (1.2)	5 (1.2)
Maximum Allowable Temperature (Air To Engine Inlet) - °F (°C)<*>	130 (54.4)	

Lubrication System	
Oil Pressure - normal - lb/in² (kPa)	35 (241) - 50 (345)
Low Oil Pressure Alarm Switch - lb/in² (kPa)	30 (207)
In Pan Oil Temperature - °F (°C)	220 (104) - 245 (118)
Total Oil Capacity with Filter - qt (L)	15.5 (14.7)

Lube Oil Heater	Optional	Optional
Wattage (Nominal)	150	150
Voltage	120V (+5%, -10%)	240V (+5%, -10%)
Part Number	C04430	C04431

Performance	1760
BMEP - lb/in² (kPa)	141 (972)
Piston Speed - ft/min (m/min)	1467 (447)
Mechanical Noise - dB(A) @ 1m	C133763
Power Curve	C133643

[3]Minimum Exhaust Pipe Diameter is based on: 15 feet of pipe, one 90° elbow, and one Industrial silencer. A Back-pressure flow analysis must be performed on the actual field installed exhaust system to assure engine maximum allowable back pressure is not exceeded. See Exhaust Sizing Calculator on www.clarkefire.com.

{ } indicates component reference part number.

JU4H, JU4R & JU6H, JU6R ENGINE MODELS
ENGINE MATERIALS AND CONSTRUCTION

Air Cleaner
Type..... Indoor Usage Only
Oiled Fabric Pleats
Material..... Surgical Cotton
Aluminum Mesh

Air Cleaner - Optional
Type..... Canister
Material..... Pleated Paper
Housing..... Enclosed

Camshaft
Material..... Cast Iron
Chill Hardened
Location..... In Block
Drive..... Gear, Spur
Type of Cam..... Ground

Charge Air Cooler (JU6H-60,62,68,74,84, ADK0, AD58, ADNG, ADN0, ADQ0, ADR0, AAQ8, AARG, ADP8, ADP0, ADT0, AD88, ADR8, AD98, ADS0, ADW8, ADX8, AD98 only)
Type..... Raw Water Cooled
Materials (in contact with raw water)
Tubes..... 90/10 CU/NI
Headers..... 36500 Muntz
Covers..... 83600 Red Brass
Plumbing..... 316 Stainless Steel/ Brass
90/10 Silicone

Charge Air Cooler (JU6R-AA67, 59, 61, PF, Q7, RF, S9, 83 only)
Type..... Air to Air Cooled
Materials
Core..... Aluminum

Coolant Pump
Type..... Centrifugal
Drive..... Poly Vee Belt

Coolant Thermostat
Type..... Non Blocking
Qty..... 1

Cooling Loop (Galvanized)
Tees, Elbows, Pipe..... Galvanized Steel
Ball Valves..... Brass ASTM B 124,
Solenoid Valve..... Brass
Pressure Regulator..... Bronze
Strainer..... Cast Iron (1/2" - 1" loops) or
Bronze (1.25" - 2" loops)

Cooling Loop (Sea Water)
Tees, Elbows, Pipe..... 316 Stainless Steel
Ball Valves..... 316 Stainless Steel
Solenoid Valve..... 316 Stainless Steel
Pressure Regulator/Strainer Cast Brass ASTM B176
C87800

Cooling Loop (316SS)
Tees, Elbows, Pipe..... 316 Stainless Steel
Ball Valves..... 316 Stainless Steel
Solenoid Valve..... 316 Stainless Steel
Pressure Regulator/Strainer 316 Stainless Steel

Connecting Rod
Type..... I-Beam Taper
Material..... Forged Steel Alloy

Crank Pin Bearings
Type..... Precision Half Shell
Number..... 1 Pair Per Cylinder
Material..... Wear-Guard

Crankshaft
Material..... Forged Steel
Type of Balance..... Dynamic

Cylinder Block
Type..... One Piece with
Non-Siamese Cylinders
Material..... Annealed Gray Iron

Cylinder Head
Type..... Slab 2 Valve
Material..... Annealed Gray Iron

Cylinder Liners
Type..... Centrifugal Cast, Wet Liner
Material..... Alloy Iron Plateau, Honed

Fuel Pump
Type..... Diaphragm
Drive..... Cam Lobe

Heat Exchanger (USA) - JU4H & JU6H Only
Type..... Tube & Shell
Materials
Tube & Headers..... Copper
Shell..... Copper
Electrode..... Zinc

Heat Exchanger (UK) - JU4H & JU6H Only
Type..... Tube & Bundle

Materials
Tube & Headers..... Copper
Shell..... Aluminum

Injection Pump
Type..... Rotary
Drive..... Gear

Lubrication Cooler
Type..... Plate

Lubrication Pump
Type..... Gear
Drive..... Gear

Main Bearings
Type..... Precision Half Shells
Material..... Steel Backed-Aluminum
Lined

Piston
Type and Material..... Aluminum Alloy with
Reinforced Top Ring Groove
Cooling..... Oil Jet Spray

Piston Pin
Type..... Full Floating - Offset

Piston Rings
Number/Piston..... 3
Top..... Keystone Barrel Faced -
Plasma Coated
Second..... Tapered Cast Iron
Third..... Double Rail Type
w/Expander Spring

Radiator - JU4R & JU6R Only
Type..... Plate Fin
Materials
Core..... Copper & Brass
Tank & Structure..... Steel

Valves
Type..... Poppet
Arrangement..... Overhead Valve
Number/Cylinder..... 1 intake
1 exhaust
Operating Mechanism..... Mechanical Rocker Arm
Type of Lifter..... Large Head
Valve Seat Insert..... Replaceable

DATUMS:

- -A- - MOUNTING FACE OF FLYWHEEL
- -B- - ENGINE CRANKSHAFT HORIZONTAL CENTERLINE
- -C- - ENGINE CRANKSHAFT VERTICAL CENTERLINE
- CENTER OF GRAVITY OF ENGINE
- CLOCKWISE ROTATION WHEN VIEWED FROM FRONT OF ENGINE

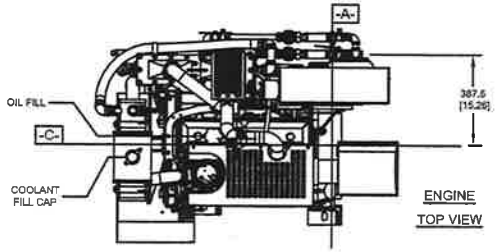
CAUTION:
ALL PLUMBING MUST BE SUPPOERTED AND/OR ISOLATED SO THAT NO WEIGHT OR STRESS IS APPLIED TO ANY ENGINE COMPONENT

ATTENTION:
REFER TO THE SPECIFIC MODEL 'INSTALLATION AND OPERATION DATA' FOR INSTALLATION GUIDELINES

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

NOTE:
THE LOOP SHOWN IS BASED ON STANDARD LOOP CONSTRUCTION AND FM SIZING CONDITIONS

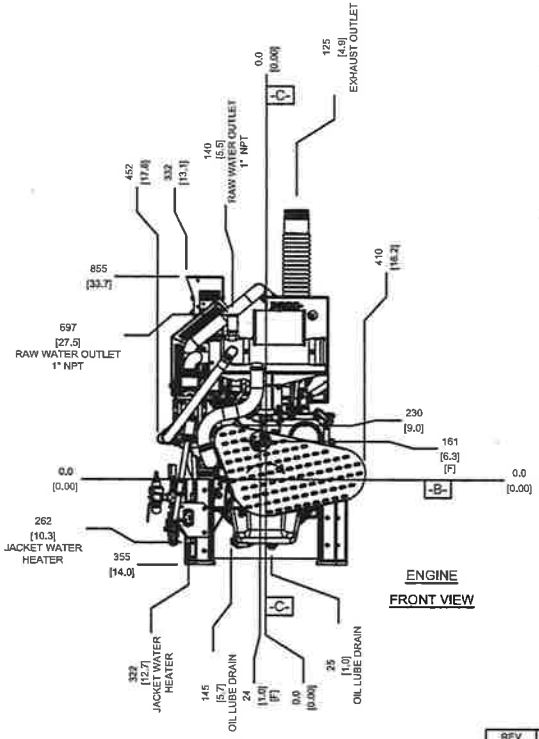
FOR ALTERNATE LOOP CONSTRUCTION (STAINLESS STEEL, SEA WATER, AND HIGH PRESSURE) SIZES MAY VARY



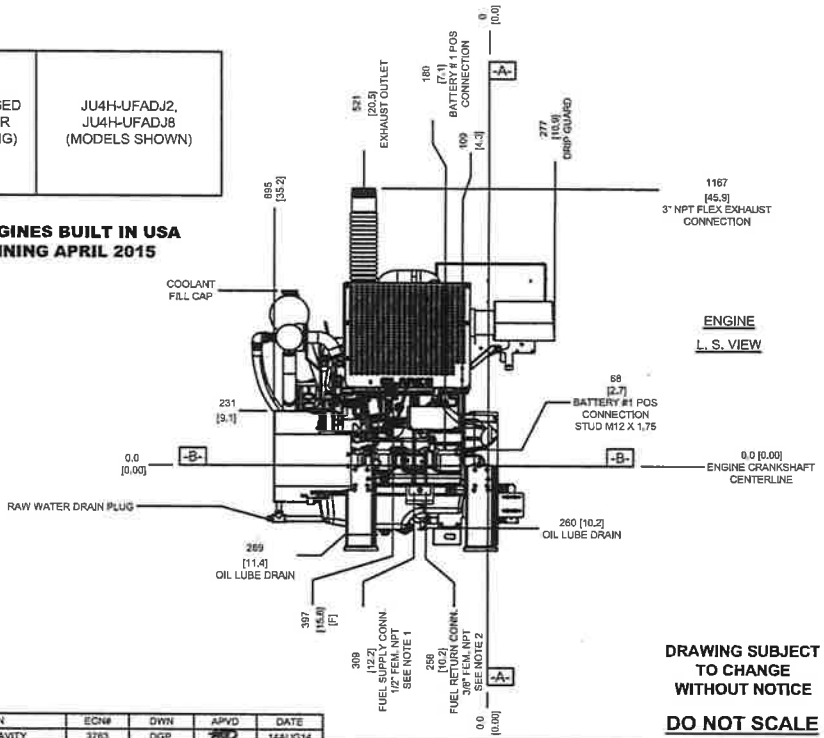
ENGINE TOP VIEW

"TRWA" (TURBOCHARGED w/RAW WATER AFTERCOOLING) MODELS	JU4H-UFADJ2, JU4H-UFADJ8 (MODELS SHOWN)

***FOR ENGINES BUILT IN USA BEGINNING APRIL 2015**



ENGINE FRONT VIEW



ENGINE L. S. VIEW

DRAWING SUBJECT TO CHANGE WITHOUT NOTICE

DO NOT SCALE

REV	DESCRIPTION	ECN#	DWN	APVD	DATE
F	ADDED CENTER OF GRAVITY	3763	DGP		14AUG14
G	ADDED PIPING KIT/COOLING LOOP	3631	BKK		21NOV14
H	ADDED FLYWHEEL INFORMATION	4179	JGV		04AUG15
J	ADDED INDICATOR PLATES & UPDATED VALVE HAND, TO COOL. LOOP AND ADDED GROUND STUD LOC. AND BRACKET	4359	PMK	ASC	11JAN16
K	CHANGED FLEX EXHAUST CLAMP FITTINGS TO NPT.	4482	MJM	JCA	14MAR16
L	REVISED 4" NPT EXHAUST FITTING TO 3" NPT EXHAUST FITTING.	4482	MJM	JCA	30MAR16

CONTROLLED DRAWING

CLARKE
Fire Protection Products, Inc.

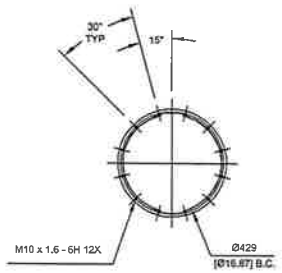
DRAWN	JAUGENSTEIN
DATE	05AUG10
APVD	KKUNKLER
MATERIAL	
REFERENCE	EC1627

INSTALLATION DRAWING
DIESEL FIRE PUMP
JU4H-H T3 MECHANICAL

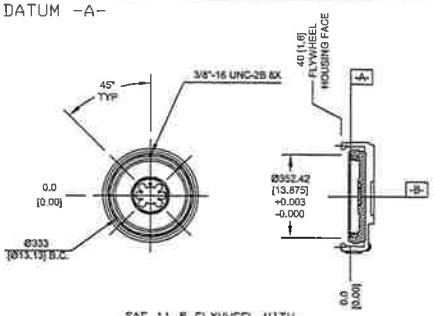
PART NO. D654 REV L

SCALE NTS | UNITS MM [INCH] | SHEET 1 OF 2

DETAIL DATUM -A-

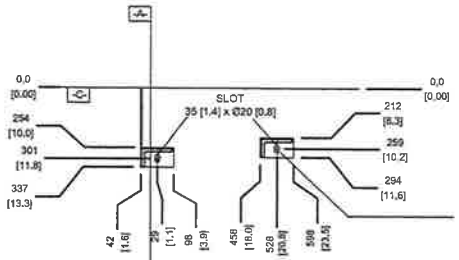


SAE #3
FLYWHEEL HOUSING



SAE 11.5 FLYWHEEL WITH
129 TEETH AND 8/10 PITCH RING GEAR

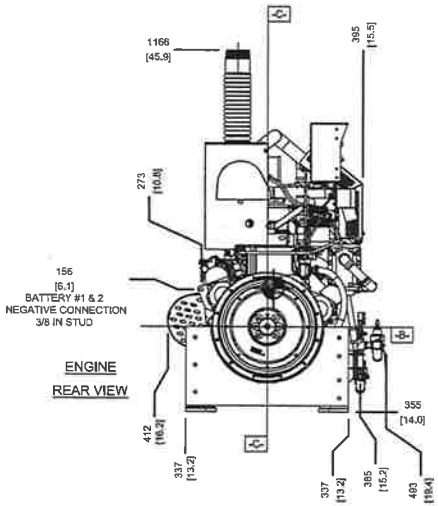
ENGINE MOUNTING FEET
SYMMETRICAL ABOUT CRANKSHAFT
CENTERLINE: DATUM - C -



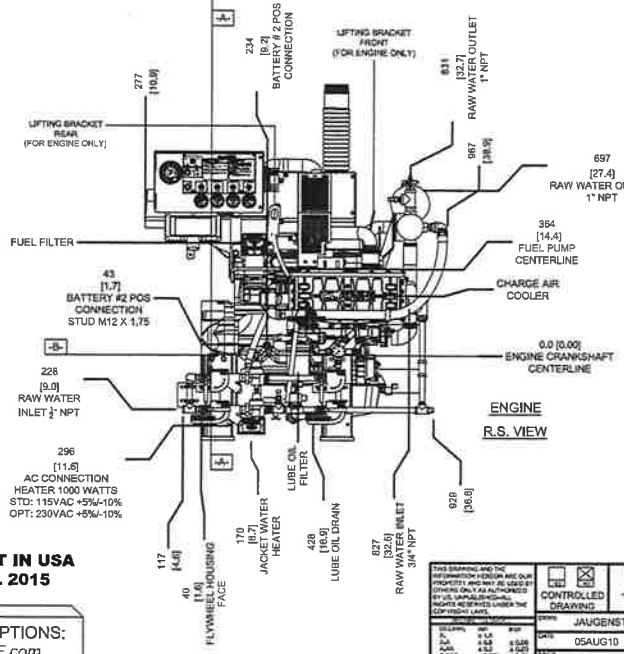
USE 3/4" MINIMUM MOUNTING HARDWARE
(GRADE 8, CLASS 10.9 RECOMMENDED)
ALL FEET

DRAWING SUBJECT TO CHANGE WITHOUT NOTICE

DO NOT SCALE



ENGINE
REAR VIEW



ENGINE
R.S. VIEW

***FOR ENGINES BUILT IN USA BEGINNING APRIL 2015**

FOR ENGINE SPECIFIC OPTIONS:
SEE www.CLARKEFIRE.com

CONTROLLED DRAWING

CLARKE
Fire Protection Products, Inc.

DRWN	JAUGENSTEIN
DATE	05AUG10
ENGR	KKUNKLER
MATERIAL	
REFERENCE	EC1627

INSTALLATION DRAWING
DIESEL FIRE PUMP
JU4H-H T3 MECHANICAL

PART NO.	D654
SCALE	NTS
UNITS	MM [INCH]
PAGE	2
OF	2

Rating Specific Emissions Data - John Deere Power Systems

JOHN DEERE

Nameplate Rating Information

Clarke Model	JU4H-UFADJ8
Power Rating (BHP / kW)	86 / 64
Certified Speed (RPM)	1760

Rating Data

Rating	4045HF280G
Certified Power (kW)	64
Rated Speed	1760
Vehicle Model Number	Clarke Fire Pump

Units	g/kW-hr	g/hp-hr
NOx	4.10	3.06
HC	0.22	0.16
NOx + HC	N/A	N/A
Pm	0.23	0.17
CO	0.8	0.6

Certificate Data

Engine Model Year	2016
EPA Family Name	GJDXL04.5141
EPA JD Name	350HAM
EPA Certificate Number	GJDXL04.5141-005
CARB Executive Order	Not Required
Parent of Family	4045HFG81

Units	g/kW-hr
NOx	4.18
HC	0.24
NOx + HC	N/A
Pm	0.22
CO	0.6

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

Appendix 3.7
G23 Specification Sheet

PERFORMANCE DATA[DM9933]

June 13, 2019

Performance Number: DM9933 **Change Level: 04**

SALES MODEL:	C32	**COMBUSTION:**	DIRECT INJECTION
BRAND:	CAT	**ENGINE SPEED (RPM):**	1,800
ENGINE POWER (BHP):	1,474	**HERTZ:**	60
GEN POWER WITH FAN (EKW):	1,000.0	**FAN POWER (HP):**	56.3
COMPRESSION RATIO:	15.0	**ASPIRATION:**	TA
RATING LEVEL:	STANDBY	**AFTERCOOLER TYPE:**	ATAAC
PUMP QUANTITY:	1	**AFTERCOOLER CIRCUIT TYPE:**	JW+OC, ATAAC
FUEL TYPE:	DIESEL	**INLET MANIFOLD AIR TEMP (F):**	120
MANIFOLD TYPE:	DRY	**JACKET WATER TEMP (F):**	210.2
GOVERNOR TYPE:	ADEM4	**TURBO CONFIGURATION:**	PARALLEL
ELECTRONICS TYPE:	ADEM4	**TURBO QUANTITY:**	2
IGNITION TYPE:	CI	**TURBOCHARGER MODEL:**	GTB45518BS-52T-1.37
INJECTOR TYPE:	EUI	**CERTIFICATION YEAR:**	2007
REF EXH STACK DIAMETER (IN):	8	**PISTON SPD @ RATED ENG SPD (FT/MIN):**	1,913.4
MAX OPERATING ALTITUDE (FT):	997		

INDUSTRY	SUBINDUSTRY	APPLICATION
OIL AND GAS	LAND PRODUCTION	PACKAGED GENSET
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
1,000.0	100	1,483	333	0.342	72.4	70.8	118.8	1,214.1	58.6	892.5
900.0	90	1,338	301	0.341	65.1	64.3	111.4	1,153.5	52.2	856.8
800.0	80	1,195	268	0.348	59.5	60.6	106.7	1,117.9	48.8	833.4
750.0	75	1,124	252	0.353	56.7	58.4	104.2	1,102.3	47.0	822.2
700.0	70	1,053	237	0.354	53.3	54.2	100.0	1,080.1	43.6	811.1
600.0	60	912	205	0.353	46.0	44.3	90.6	1,028.7	35.7	789.8
500.0	50	772	173	0.350	38.6	33.5	81.3	968.0	27.4	769.5
400.0	40	635	143	0.351	31.8	24.3	74.9	899.7	20.8	733.5
300.0	30	496	111	0.357	25.3	16.1	70.5	816.3	15.3	679.6
250.0	25	426	96	0.363	22.1	12.3	69.0	768.2	12.9	646.0
200.0	20	355	80	0.373	18.9	8.9	67.9	713.3	10.7	605.3
100.0	10	209	47	0.424	12.6	4.5	67.5	572.6	7.8	491.3

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
1,000.0	100	1,483	76	424.5	3,105.2	8,115.3	13,517.7	14,024.8	2,950.9	2,698.6
900.0	90	1,338	70	392.7	2,944.7	7,443.4	12,775.8	13,231.6	2,780.0	2,550.6
800.0	80	1,195	66	375.9	2,860.8	7,069.3	12,380.1	12,796.7	2,687.9	2,475.7
750.0	75	1,124	63	366.1	2,799.4	6,858.4	12,094.1	12,491.0	2,630.6	2,427.3
700.0	70	1,053	59	345.5	2,654.6	6,439.5	11,425.3	11,795.7	2,491.4	2,301.6
600.0	60	912	49	304.7	2,369.9	5,618.4	10,126.3	10,445.3	2,210.8	2,046.3
500.0	50	772	37	264.3	2,090.3	4,815.2	8,871.8	9,141.4	1,926.2	1,786.0
400.0	40	635	27	224.9	1,819.3	4,039.9	7,654.2	7,876.2	1,664.7	1,547.4
300.0	30	496	19	185.5	1,549.9	3,272.7	6,487.7	6,664.2	1,412.4	1,317.4
250.0	25	426	15	165.6	1,414.6	2,888.8	5,920.9	6,075.3	1,284.6	1,200.7
200.0	20	355	11	147.2	1,292.4	2,528.2	5,413.4	5,545.9	1,167.2	1,094.3
100.0	10	209	6	123.0	1,149.4	1,989.9	4,805.1	4,893.7	1,028.8	975.8

Heat Rejection Data

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 AFTERCOOLER	WORK ENERGY	LOW HEAT VALUE ENERGY	HIGH HEAT VALUE ENERGY

PERFORMANCE DATA[DM9933]

June 13, 2019

EKW	%	BHP	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN
1,000.0	100	1,483	20,153	7,292	58,664	32,275	8,277	16,551	62,887	155,406	165,547
900.0	90	1,338	18,470	6,522	52,678	28,324	7,440	14,394	56,743	139,692	148,807
800.0	80	1,195	16,970	5,949	49,043	26,036	6,799	13,345	50,677	127,654	135,984
750.0	75	1,124	16,223	6,124	47,027	24,781	6,486	12,683	47,666	121,777	129,723
700.0	70	1,053	15,326	6,876	43,772	22,824	6,093	11,231	44,653	114,394	121,858
600.0	60	912	13,529	6,786	37,588	19,231	5,263	8,681	38,675	98,811	105,259
500.0	50	772	11,822	5,357	31,812	16,013	4,411	6,504	32,735	82,825	88,230
400.0	40	635	10,869	4,421	25,935	12,562	3,637	4,598	26,908	68,277	72,732
300.0	30	496	9,934	3,738	20,129	9,084	2,892	2,986	21,049	54,294	57,837
250.0	25	426	9,352	3,463	17,322	7,412	2,525	2,290	18,081	47,414	50,508
200.0	20	355	8,620	3,178	14,651	5,809	2,162	1,718	15,065	40,584	43,232
100.0	10	209	6,683	2,334	9,950	2,795	1,444	1,067	8,853	27,118	28,888

Emissions Data

RATED SPEED POTENTIAL SITE VARIATION: 1800 RPM

GENSET POWER WITH FAN		**EKW**	**1,000.0**	**750.0**	**500.0**	**250.0**	**100.0**
PERCENT LOAD		**%**	**100**	**75**	**50**	**25**	**10**
ENGINE POWER		**BHP**	**1,483**	**1,124**	**772**	**426**	**209**
TOTAL NOX (AS NO2)		G/HR	8,780	5,143	3,360	2,272	1,341
TOTAL CO		G/HR	359	231	495	813	1,256
TOTAL HC		G/HR	36	104	100	76	151
PART MATTER		G/HR	52.5	38.7	66.9	104.7	83.8
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	2,839.3	2,113.6	2,037.0	2,424.8	2,418.8
TOTAL CO	(CORR 5% O2)	MG/NM3	116.2	92.7	298.2	879.0	2,541.0
TOTAL HC	(CORR 5% O2)	MG/NM3	10.2	37.3	52.3	69.3	278.9
PART MATTER	(CORR 5% O2)	MG/NM3	14.2	13.4	34.8	104.9	135.3
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	1,383	1,030	992	1,181	1,178
TOTAL CO	(CORR 5% O2)	PPM	93	74	239	703	2,033
TOTAL HC	(CORR 5% O2)	PPM	19	70	98	129	521
TOTAL NOX (AS NO2)		G/HP-HR	5.97	4.60	4.37	5.34	6.43
TOTAL CO		G/HP-HR	0.24	0.21	0.64	1.91	6.03
TOTAL HC		G/HP-HR	0.02	0.09	0.13	0.18	0.73
PART MATTER		G/HP-HR	0.04	0.03	0.09	0.25	0.40
TOTAL NOX (AS NO2)		LB/HR	19.36	11.34	7.41	5.01	2.96
TOTAL CO		LB/HR	0.79	0.51	1.09	1.79	2.77
TOTAL HC		LB/HR	0.08	0.23	0.22	0.17	0.33
PART MATTER		LB/HR	0.12	0.09	0.15	0.23	0.18

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 CORRECTED POWER CAPABILITY (BHP)

AMBIENT OPERATING TEMP (F)	50	60	70	80	90	100	110	120	130	NORMAL
ALTITUDE (FT)										
0	1,474	1,474	1,474	1,474	1,474	1,468	1,442	1,417	1,393	1,474
1,000	1,474	1,474	1,474	1,466	1,439	1,413	1,388	1,364	1,341	1,474
2,000	1,474	1,465	1,438	1,411	1,385	1,360	1,336	1,314	1,291	1,434
3,000	1,438	1,410	1,383	1,358	1,333	1,309	1,286	1,264	1,242	1,389
4,000	1,383	1,356	1,331	1,306	1,282	1,259	1,237	1,216	1,195	1,345
5,000	1,330	1,304	1,280	1,256	1,233	1,211	1,190	1,169	1,149	1,302
6,000	1,278	1,254	1,230	1,207	1,185	1,164	1,144	1,124	1,105	1,260
7,000	1,228	1,205	1,182	1,160	1,139	1,119	1,099	1,080	1,062	1,220
8,000	1,180	1,157	1,135	1,114	1,094	1,074	1,056	1,037	1,020	1,180
9,000	1,133	1,111	1,090	1,070	1,050	1,032	1,014	996	979	1,141
10,000	1,087	1,066	1,046	1,027	1,008	990	973	956	940	1,103
11,000	1,043	1,023	1,004	985	967	950	933	917	902	1,066
12,000	1,001	981	963	945	928	911	895	880	865	1,029
13,000	959	941	923	906	889	874	858	843	829	994
14,000	919	901	884	868	852	837	822	808	794	959
15,000	880	863	847	831	816	802	788	774	761	926

Cross Reference

Test Spec	Setting	Engine Arrangement	Engineering Model	Engineering Model Version	Start Effective Serial Number	End Effective Serial Number
0K8987	PP6050	2537557	GS277	-	SYC00001	
0K7838	GG0346	3208618	GS490	-	JDB00001	
0K8987	PP6050	3249750	GS277	-	SYC00001	
0K8987	PP6050	3367659	GS471	-	PRH00001	
0K8987	PP6050	3801431	GS471	-	PRH00001	
0K8987	PP6050	4391323	GS471	-	PRH03719	
0K8987	PP6050	4447558	GS471	-	PRH00001	
0K8987	PP6050	4447562	GS471	-	PRH00001	
0K8987	PP6050	5233431	GS471	-	PRH00001	
0K8987	PP6050	5612763	GS471	DK	PRH00001	

Performance Parameter Reference

Parameters Reference:DM9600-11

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 deg C (84.2 deg F), 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

EMISSION CYCLE DEFINITIONS

1. For constant-speed marine engines for ship main propulsion, including,diesel-electric drive, test cycle E2 shall be applied, for controllable-pitch propeller sets
test cycle E2 shall be applied.
2. For propeller-law-operated main and propeller-law-operated auxiliary engines the test cycle E3 shall be applied.
3. For constant-speed auxiliary engines test cycle D2 shall be applied.
4. For variable-speed, variable-load auxiliary engines, not included above, test cycle C1 shall be applied.

HEAT REJECTION DEFINITIONS:

Diesel Circuit Type and HHV Balance : DM9500

HIGH DISPLACEMENT (HD) DEFINITIONS:

3500: EM1500

RATING DEFINITIONS:

Agriculture : TM6008
Fire Pump : TM6009
Generator Set : TM6035
Generator (Gas) : TM6041
Industrial Diesel : TM6010
Industrial (Gas) : TM6040
Irrigation : TM5749
Locomotive : TM6037
Marine Auxiliary : TM6036
Marine Prop (Except 3600) : TM5747
Marine Prop (3600 only) : TM5748
MSHA : TM6042
Oil Field (Petroleum) : TM6011
Off-Highway Truck : TM6039
On-Highway Truck : TM6038

SOUND DEFINITIONS:

Sound Power : DM8702
Sound Pressure : TM7080
Date Released : 11/29/18

Appendix 3.8
G24 – G25 Specification Sheets

Cat® 3516C
Diesel Generator Sets

Image shown may not reflect actual configuration

Bore – mm (in)	170 (6.69)
Stroke – mm (in)	215 (8.46)
Displacement – L (in^3)	78 (4764.73)
Compression Ratio	14.7:1
Aspiration	TA
Fuel System	EUI
Governor Type	ADEM™ A3

Standby 60 Hz ekW (kVA)	Mission Critical 60 Hz ekW (kVA)	Prime 60 Hz ekW (kVA)	Continuous 60 Hz ekW (kVA)	Emissions Performance
2500 (3125)	2500 (3125)	2250 (2812)	2050 (2562)	U.S. EPA Stationary Emergency Use Only (Tier 2)

Standard Features

Cat® Diesel Engine
- Meets U.S. EPA Stationary Emergency Use Only (Tier 2) emission standards
- Reliable performance proven in thousands of applications worldwide

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

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

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

EMCP 4 Control Panels
- User-friendly interface and navigation
- Scalable system to meet a wide range of installation requirements
- Expansion modules and site specific programming for specific customer requirements

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

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

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

Optional Equipment

Engine

Air Cleaner
- ❑ Single element
- ■ Dual element

Muffler
- ■ Industrial grade (15 dB)

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

Alternator

Output voltage
- ❑ 380V
- ❑ 440V
- ■ 480V
- ❑ 600V
- ❑ 2400V
- ❑ 4160V
- ❑ 6300V
- ❑ 6600V
- ❑ 6900V
- ❑ 12470V
- ❑ 13200V
- ❑ 13800V

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

Winding type
- ❑ Random wound
- ■ Form wound

Excitation
- ❑ Internal excitation (IE)
- ■ Permanent magnet (PM)

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

Power Termination

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

Trip Unit
- ❑ LSI
- ❑ LSI-G
- ■ LSIG-P

Control System

Controller
- ❑ EMCP 4.2B
- ■ EMCP 4.3
- ❑ EMCP 4.4

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

Charging

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

Vibration Isolators

- ❑ Rubber
- ❑ Spring
- ■ Seismic rated

Cat Connect

Connectivity
- ■ Ethernet
- ❑ Cellular
- ❑ Satellite

Extended Service Options

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

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

Ancillary Equipment

- ❑ Automatic transfer switch (ATS)
- ❑ Uninterruptible power supply (UPS)
- ❑ Paralleling switchgear
- ❑ Paralleling controls

Certifications

- ■ UL2200
- ❑ CSA
- ■ IBC seismic certification
- ❑ OSHPD pre-approval

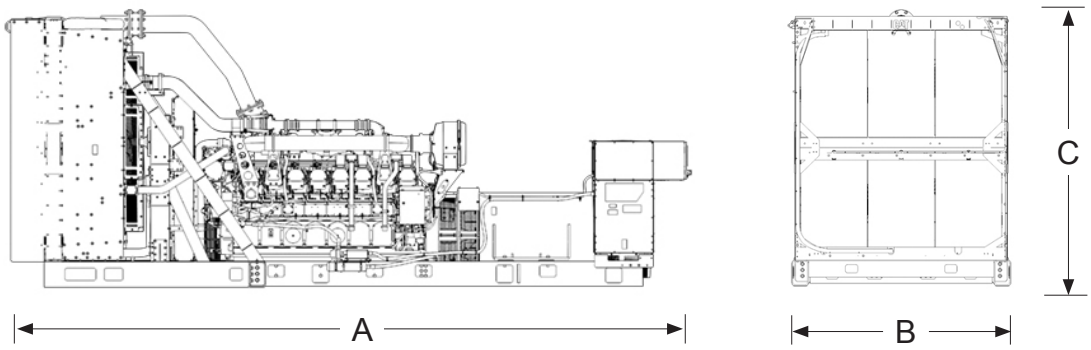
Note: *Some options may not be available on all models. Certifications may not be available with all model configurations. Consult factory for availability.*

Package Performance

Performance	Standby		Mission Critical		Prime		Continuous	
Frequency	60 Hz		60 Hz		60 Hz		60 Hz	
Gen set power rating with fan	2500 ekW		2500 ekW		2250 ekW		2050 ekW	
Gen set power rating with fan @ 0.8 power factor	3125 kVA		3125 kVA		2812 kVA		2562 kVA	
Emissions	EPA ESE (TIER 2)		EPA ESE (TIER 2)		EPA ESE (TIER 2)		EPA ESE (TIER 2)	
Performance number	EM1894-01		EM1895-02		DM8447-04		DM8268-03	
Fuel Consumption								
100% load with fan – L/hr (gal/hr)	656.8	(175.3)	656.8	(175.3)	593.0	(156.6)	549.3	(145.1)
75% load with fan – L/hr (gal/hr)	510.8	(134.9)	510.8	(134.9)	467.8	(123.6)	435.6	(115.1)
50% load with fan – L/hr (gal/hr)	372.4	(98.4)	372.4	(98.4)	341.9	(90.3)	316.8	(83.7)
25% load with fan – L/hr (gal/hr)	219.3	(57.9)	219.3	(57.9)	203.0	(53.6)	188.9	(49.9)
Cooling System								
Radiator air flow restriction (system) – kPa (in. water)	0.12	(0.48)	0.12	(0.48)	0.12	(0.48)	0.12	(0.48)
Radiator air flow – m^3/min (cfm)	2800.0	(98881)	2800.0	(98881)	2800.0	(98881)	2800.0	(98881)
Engine coolant capacity – L (gal)	233.0	(61.6)	233.0	(61.6)	233.0	(61.6)	233.0	(61.6)
Radiator coolant capacity – L (gal)	268.8	(71.0)	268.8	(71.0)	268.8	(71.0)	268.8	(71.0)
Total coolant capacity – L (gal)	501.8	(132.6)	501.8	(132.6)	501.8	(132.6)	501.8	(132.6)
Inlet Air								
Combustion air inlet flow rate – m^3/min (cfm)	242.2	(7212.2)	242.2	(7212.2)	193.1	(6819.8)	183.8	(6491.7)
Exhaust System								
Exhaust stack gas temperature – °C (°F)	490.7	(915.2)	490.7	(915.2)	471.3	(880.4)	463.6	(866.5)
Exhaust gas flow rate – m^3/min (cfm)	554.5	(19578.8)	554.5	(19578.8)	507.9	(17935.1)	476.5	(16826.7)
Exhaust system backpressure (maximum allowable) – kPa (in. water)	6.7	(27.0)	6.7	(27.0)	6.7	(27.0)	6.7	(27.0)
Heat Rejection								
Heat rejection to jacket water – kW (Btu/min)	826	(46992)	826	(46992)	777	(44160)	739	(42021)
Heat rejection to exhaust (total) – kW (Btu/min)	2502	(142265)	2502	(142265)	2243	(127532)	2092	(118949)
Heat rejection to aftercooler – kW (Btu/min)	786	(44723)	786	(44723)	690	(39224)	619	(35176)
Heat rejection to atmosphere from engine – kW (Btu/min)	161	(9146)	161	(9146)	150	(8542)	145	(8229)
Heat rejection from alternator – kW (Btu/min)	121	(6853)	121	(6853)	99	(5607)	94	(5368)
Emissions (Nominal)								
NOx mg/Nm^3 (g/hp-h)	2349.1	(5.32)	2349.1	(5.32)	2206.7	(4.95)	2038.1	(4.62)
CO mg/Nm^3 (g/hp-h)	195.4	(0.42)	195.4	(0.42)	141.2	(0.30)	124.8	(0.27)
HC mg/Nm^3 (g/hp-h)	42.1	(0.10)	42.1	(0.10)	44.4	(0.11)	49.2	(0.12)
PM mg/Nm^3 (g/hp-h)	14.1	(0.04)	14.1	(0.04)	10.9	(0.03)	11.0	(0.03)
Emissions (Potential Site Variation)								
NOx mg/Nm^3 (g/hp-h)	2818.9	(6.38)	2818.9	(6.38)	2648.0	(5.94)	2445.8	(5.55)
CO mg/Nm^3 (g/hp-h)	351.8	(0.76)	351.8	(0.76)	254.2	(0.55)	224.6	(0.49)
HC mg/Nm^3 (g/hp-h)	55.9	(0.14)	55.9	(0.14)	59.1	(0.15)	65.5	(0.16)
PM mg/Nm^3 (g/hp-h)	19.7	(0.05)	19.7	(0.05)	15.2	(0.04)	15.3	(0.04)

3516C Diesel Generator Sets
Electric Power

Weights and Dimensions



Dim "A" mm (in)	Dim "B" mm (in)	Dim "C" mm (in)	Dry Weight kg (lb)
7495 (295.1)	2569 (101.2)	3009 (118.5)	17 590 (38,780)

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

Ratings Definition

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.

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

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

Continuous
Output available with non-varying load for an unlimited time. Average power output is 70-100% of the continuous power rating. Typical peak demand is 100% of continuous rated kW for 100% of the operating hours.

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, 2014/35/EU, 2006/42/EC, 2014/30/EU.

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

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

Fuel Rates
Fuel rates are based on fuel oil of 35º API [16°C (60ºF)] gravity having an LHV of 42,780 kJ/kg (18,390 Btu/lb) when used at 29ºC (85ºF) and weighing 838.9 g/liter (7.001 lbs/U.S. gal.)

FINAL DIMENSIONS INCLUDED IN ENCLOSURE PACKAGE

www.cat.com/electricpower

3516 PGFL
LEHE1377-00 (8-17)

ENGINE PERFORMANCE DATA

PERFORMANCE DATA[EM1895]

July 12, 2018

Performance Number: EM1895 **Change Level: 03**

SALES MODEL:	3516C	**COMBUSTION:**	DI
BRAND:	CAT	**ENGINE SPEED (RPM):**	1,800
ENGINE POWER (BHP):	3,634	**HERTZ:**	60
GEN POWER WITH FAN (EKW):	2,500.0	**FAN POWER (HP):**	130.1
COMPRESSION RATIO:	14.7	**ASPIRATION:**	TA
RATING LEVEL:	MISSION CRITICAL STANDBY	**AFTERCOOLER TYPE:**	ATAAC
PUMP QUANTITY:	1	**AFTERCOOLER CIRCUIT TYPE:**	JW+OC, ATAAC
FUEL TYPE:	DIESEL	**INLET MANIFOLD AIR TEMP (F):**	122
MANIFOLD TYPE:	DRY	**JACKET WATER TEMP (F):**	210.2
GOVERNOR TYPE:	ADEM3	**TURBO CONFIGURATION:**	PARALLEL
ELECTRONICS TYPE:	ADEM3	**TURBO QUANTITY:**	4
CAMSHAFT TYPE:	STANDARD	**TURBOCHARGER MODEL:**	GTA5523N-51T-1.40
IGNITION TYPE:	CI	**CERTIFICATION YEAR:**	2006
INJECTOR TYPE:	EUI	**CRANKCASE BLOWBY RATE (FT3/HR):**	3,619.4
FUEL INJECTOR:	3920221	**FUEL RATE (RATED RPM) NO LOAD (GAL/HR):**	16.2
UNIT INJECTOR TIMING (IN):	64.34	**PISTON SPD @ RATED ENG SPD (FT/MIN):**	2,539.4
REF EXH STACK DIAMETER (IN):	12		
MAX OPERATING ALTITUDE (FT):	2,953		

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

General Performance Data

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

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
2,500.0	100	3,633	336	0.337	175.0	78.7	121.9	1,257.5	73.7	850.7
2,250.0	90	3,283	303	0.336	157.4	73.1	117.9	1,187.0	67.7	805.1
2,000.0	80	2,935	271	0.337	141.1	66.8	113.9	1,130.0	60.6	771.3
1,875.0	75	2,760	255	0.339	133.8	63.5	112.3	1,106.1	57.1	759.0
1,750.0	70	2,586	239	0.342	126.2	60.0	109.9	1,084.8	53.7	748.2
1,500.0	60	2,237	207	0.348	111.3	52.3	105.5	1,044.3	46.2	730.5
1,250.0	50	1,889	174	0.358	96.5	44.3	101.5	1,006.8	39.1	717.5
1,000.0	40	1,547	143	0.366	80.7	34.0	95.7	965.0	30.7	702.1
750.0	30	1,203	111	0.378	64.9	24.0	91.0	909.0	22.9	675.7
625.0	25	1,029	95	0.388	57.1	19.5	90.1	870.4	19.6	654.6
500.0	20	854	79	0.400	48.8	14.9	88.7	812.8	16.1	619.1
250.0	10	497	46	0.454	32.2	7.4	84.4	639.9	11.1	500.7

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
2,500.0	100	3,633	85	461.5	7,287.6	18,807.6	32,267.8	33,492.3	7,056.8	6,459.6
2,250.0	90	3,283	79	433.3	7,010.4	17,355.6	30,953.6	32,055.8	6,747.1	6,203.5
2,000.0	80	2,935	73	406.1	6,677.5	15,977.0	29,330.8	30,320.5	6,381.7	5,888.1
1,875.0	75	2,760	69	392.8	6,521.0	15,366.6	28,518.9	29,454.2	6,199.4	5,732.7
1,750.0	70	2,586	66	379.8	6,305.6	14,697.2	27,541.4	28,424.8	5,982.7	5,533.7
1,500.0	60	2,237	58	349.2	5,845.1	13,330.2	25,384.7	26,164.1	5,507.0	5,109.3
1,250.0	50	1,889	49	316.2	5,360.5	11,961.2	23,064.3	23,735.1	4,995.9	4,651.4
1,000.0	40	1,547	38	274.9	4,652.6	10,183.4	19,911.6	20,477.1	4,309.7	4,018.2
750.0	30	1,203	28	230.7	3,911.5	8,341.7	16,706.6	17,160.9	3,612.2	3,375.1
625.0	25	1,029	23	208.3	3,596.5	7,490.0	15,294.6	15,694.5	3,304.9	3,093.1
500.0	20	854	18	184.2	3,261.8	6,551.0	13,823.8	14,165.6	2,985.9	2,801.6
250.0	10	497	10	140.3	2,772.6	5,002.5	11,496.9	11,723.3	2,561.1	2,425.3

Heat Rejection Data

PERFORMANCE DATA[EM1895]

July 12, 2018

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 AFTERCOOLER	WORK ENERGY	LOW HEAT VALUE ENERGY	HIGH HEAT VALUE ENERGY
EKW	%	BHP	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN
2,500.0	100	3,633	46,119	9,196	141,970	70,970	20,037	49,407	154,077	376,192	400,739

Sound Data

SOUND PRESSURE DATA FOR THIS RATING CAN BE FOUND IN PERFORMANCE NUMBER - DM8779.

Emissions Data

RATED SPEED POTENTIAL SITE VARIATION: 1800 RPM

GENSET POWER WITH FAN		EKW	2,500.0	1,875.0	1,250.0	625.0	250.0
PERCENT LOAD		%	100	75	50	25	10
ENGINE POWER		BHP	3,633	2,760	1,889	1,029	497
TOTAL NOX (AS NO2)		G/HR	24,359	14,666	7,549	3,839	3,385
TOTAL CO		G/HR	3,155	1,707	1,218	2,036	2,477
TOTAL HC		G/HR	400	482	483	405	413
PART MATTER		G/HR	156.4	114.7	129.5	225.4	118.9
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	2,915.5	2,261.4	1,598.4	1,357.3	2,093.9
TOTAL CO	(CORR 5% O2)	MG/NM3	372.5	258.7	253.4	710.3	1,516.7
TOTAL HC	(CORR 5% O2)	MG/NM3	41.0	63.3	86.9	122.3	220.3
PART MATTER	(CORR 5% O2)	MG/NM3	15.5	14.9	23.4	69.9	65.9
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	1,420	1,101	779	661	1,020
TOTAL CO	(CORR 5% O2)	PPM	298	207	203	568	1,213
TOTAL HC	(CORR 5% O2)	PPM	77	118	162	228	411
TOTAL NOX (AS NO2)		G/HP-HR	6.77	5.36	4.02	3.74	6.83
TOTAL CO		G/HP-HR	0.88	0.62	0.65	1.99	5.00
TOTAL HC		G/HP-HR	0.11	0.18	0.26	0.40	0.83
PART MATTER		G/HP-HR	0.04	0.04	0.07	0.22	0.24
TOTAL NOX (AS NO2)		LB/HR	53.70	32.33	16.64	8.46	7.46
TOTAL CO		LB/HR	6.95	3.76	2.69	4.49	5.46
TOTAL HC		LB/HR	0.88	1.06	1.06	0.89	0.91
PART MATTER		LB/HR	0.34	0.25	0.29	0.50	0.26

RATED SPEED NOMINAL DATA: 1800 RPM

GENSET POWER WITH FAN		EKW	2,500.0	1,875.0	1,250.0	625.0	250.0
PERCENT LOAD		%	100	75	50	25	10
ENGINE POWER		BHP	3,633	2,760	1,889	1,029	497
TOTAL NOX (AS NO2)		G/HR	20,299	12,222	6,291	3,199	2,821
TOTAL CO		G/HR	1,753	948	677	1,131	1,376
TOTAL HC		G/HR	301	362	363	305	311
TOTAL CO2		KG/HR	1,793	1,368	987	581	328
PART MATTER		G/HR	111.7	81.9	92.5	161.0	85.0
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	2,429.5	1,884.5	1,332.0	1,131.1	1,744.9
TOTAL CO	(CORR 5% O2)	MG/NM3	206.9	143.7	140.8	394.6	842.6
TOTAL HC	(CORR 5% O2)	MG/NM3	30.8	47.6	65.3	92.0	165.6
PART MATTER	(CORR 5% O2)	MG/NM3	11.0	10.6	16.7	49.9	47.1
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	1,183	918	649	551	850
TOTAL CO	(CORR 5% O2)	PPM	166	115	113	316	674
TOTAL HC	(CORR 5% O2)	PPM	58	89	122	172	309
TOTAL NOX (AS NO2)		G/HP-HR	5.64	4.46	3.35	3.12	5.70
TOTAL CO		G/HP-HR	0.49	0.35	0.36	1.10	2.78
TOTAL HC		G/HP-HR	0.08	0.13	0.19	0.30	0.63
PART MATTER		G/HP-HR	0.03	0.03	0.05	0.16	0.17
TOTAL NOX (AS NO2)		LB/HR	44.75	26.94	13.87	7.05	6.22
TOTAL CO		LB/HR	3.86	2.09	1.49	2.49	3.03
TOTAL HC		LB/HR	0.66	0.80	0.80	0.67	0.68
TOTAL CO2		LB/HR	3,952	3,017	2,175	1,281	723
PART MATTER		LB/HR	0.25	0.18	0.20	0.35	0.19
OXYGEN IN EXH		%	8.4	10.0	11.1	12.1	14.0
DRY SMOKE OPACITY		%	1.3	1.1	1.6	3.5	2.7
BOSCH SMOKE NUMBER			0.46	0.40	0.55	1.21	1.01

Regulatory Information

EPA EMERGENCY STATIONARY		2011 - ----		
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

A BLANK IN THE ALTITUDE DERATE TABLE SIGNIFIES THAT NO RATING IS AVAILABLE AT THAT SPECIFIED ALTITUDE AND AMBIENT TEMPERATURE.

ALTITUDE CORRECTED POWER CAPABILITY (BHP)

AMBIENT OPERATING TEMP (F)	30	40	50	60	70	80	90	100	110	120	130	140	NORMAL
ALTITUDE (FT)													
0	3,634	3,634	3,634	3,634	3,634	3,634	3,634	3,634	3,561	3,489	3,343	3,198	3,634
1,000	3,634	3,634	3,634	3,634	3,634	3,634	3,634	3,634	3,561	3,452	3,307	3,162	3,634
2,000	3,634	3,634	3,634	3,634	3,634	3,634	3,634	3,561	3,489	3,380	3,234	3,053	3,634
3,000	3,628	3,628	3,628	3,628	3,628	3,603	3,537	3,474	3,413	3,234	3,053	2,871	3,628
4,000	3,504	3,504	3,504	3,504	3,504	3,472	3,408	3,347	3,234	3,089	2,907	2,689	3,504
5,000	3,384	3,384	3,384	3,384	3,384	3,344	3,284	3,225	3,089	2,907	2,689	2,471	3,384
6,000	3,269	3,269	3,269	3,269	3,269	3,221	3,162	3,089	2,907	2,726	2,471	2,217	3,269
7,000	3,159	3,159	3,159	3,159	3,159	3,101	3,045	2,944	2,726	2,471	2,217	1,962	3,159
8,000	3,052	3,052	3,052	3,052	3,042	2,985	2,871	2,726	2,507	2,253	1,999	1,708	3,052
9,000	2,950	2,950	2,950	2,950	2,927	2,835	2,689	2,507	2,253	1,999	1,708	1,454	2,950
10,000	2,851	2,851	2,851	2,851	2,762	2,616	2,435	2,289	2,035	1,708	1,490	1,272	2,851
11,000	2,756	2,756	2,756	2,689	2,544	2,362	2,217	2,035	1,744	1,490	1,308	1,163	2,756
12,000	2,665	2,665	2,616	2,471	2,289	2,144	1,962	1,744	1,526	1,308	1,163	1,018	2,665
13,000	2,577	2,544	2,398	2,217	2,071	1,853	1,672	1,526	1,308	1,163	1,054	945	2,544
14,000	2,471	2,326	2,144	1,962	1,744	1,635	1,454	1,345	1,163	1,054	945		2,362
15,000	2,253	2,071	1,890	1,708	1,563	1,417	1,272	1,199	1,054	945			2,180

Cross Reference

Test Spec	Setting	Engine Arrangement	Engineering Model	Engineering Model Version	Start Effective Serial Number	End Effective Serial Number
4577176	LL1858	5084280	GS336	-	SBK02483	
4581567	LL6760	5157721	PG243	-	LYM00001	

Supplementary Data

Type	Classification	Performance Number
SOUND	SOUND PRESSURE	DM8779

Performance Parameter Reference

Parameters Reference:DM9600-10

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 deg C (84.2 deg F), 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

Appendix 3.9
G32 – G33 Specification Sheets

PERFORMANCE DATA[DM9071]

August 1, 2019

Performance Number: DM9071 **Change Level: 04**

SALES MODEL:	C27	**COMBUSTION:**	DIRECT INJECTION
BRAND:	CAT	**ENGINE SPEED (RPM):**	1,800
ENGINE POWER (BHP):	1,141	**HERTZ:**	60
GEN POWER WITH FAN (EKW):	750.0	**FAN POWER (HP):**	37.5
COMPRESSION RATIO:	16.5	**ASPIRATION:**	TA
RATING LEVEL:	STANDBY	**AFTERCOOLER TYPE:**	ATAAC
PUMP QUANTITY:	1	**AFTERCOOLER CIRCUIT TYPE:**	JW+OC, ATAAC
FUEL TYPE:	DIESEL	**INLET MANIFOLD AIR TEMP (F):**	120
MANIFOLD TYPE:	DRY	**JACKET WATER TEMP (F):**	210.2
GOVERNOR TYPE:	ADEM4	**TURBO CONFIGURATION:**	PARALLEL
ELECTRONICS TYPE:	ADEM4	**TURBO QUANTITY:**	2
IGNITION TYPE:	CI	**TURBOCHARGER MODEL:**	GTA5008BS-56T-1.60
INJECTOR TYPE:	EUI	**CERTIFICATION YEAR:**	2006
REF EXH STACK DIAMETER (IN):	10	**PISTON SPD @ RATED ENG SPD (FT/MIN):**	1,800.0
MAX OPERATING ALTITUDE (FT):	10,000		

INDUSTRY	SUBINDUSTRY	APPLICATION
ELECTRIC POWER	STANDARD	PACKAGED GENSET
OIL AND GAS	LAND PRODUCTION	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
750.0	100	1,114	297	0.330	52.5	51.5	119.8	1,204.2	35.8	945.7
675.0	90	1,004	268	0.335	48.0	46.8	116.4	1,176.6	32.4	931.7
600.0	80	896	239	0.341	43.6	42.0	113.3	1,148.2	29.0	914.7
562.5	75	843	225	0.344	41.4	39.3	111.4	1,132.6	27.2	905.1
525.0	70	789	211	0.345	38.9	36.1	109.0	1,113.1	25.1	894.3
450.0	60	683	182	0.347	33.9	29.4	103.9	1,064.7	20.7	866.4
375.0	50	578	154	0.348	28.7	22.7	99.1	1,003.6	16.3	830.2
300.0	40	474	127	0.352	23.9	16.8	96.8	923.0	12.8	774.0
225.0	30	371	99	0.360	19.1	11.5	94.9	822.7	9.7	698.7
187.5	25	318	85	0.367	16.7	9.0	94.1	764.6	8.4	653.4
150.0	20	264	71	0.378	14.3	6.8	93.3	700.1	7.2	601.6
75.0	10	153	41	0.439	9.6	3.7	91.8	548.5	5.5	474.1

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
750.0	100	1,114	54	335.3	2,047.9	5,523.3	8,813.1	9,180.6	1,932.4	1,751.0
675.0	90	1,004	49	316.3	1,943.4	5,168.6	8,352.2	8,688.5	1,826.5	1,659.7
600.0	80	896	44	298.2	1,842.2	4,822.6	7,905.6	8,211.2	1,725.3	1,572.8
562.5	75	843	41	286.8	1,785.4	4,620.1	7,641.5	7,931.0	1,664.4	1,519.5
525.0	70	789	38	272.2	1,711.2	4,361.8	7,314.5	7,586.8	1,583.9	1,447.8
450.0	60	683	31	243.3	1,549.1	3,852.2	6,603.9	6,840.9	1,428.3	1,308.9
375.0	50	578	24	214.7	1,379.7	3,349.0	5,865.3	6,066.5	1,276.5	1,173.4
300.0	40	474	18	186.6	1,228.7	2,857.7	5,210.7	5,377.9	1,138.9	1,051.3
225.0	30	371	13	158.4	1,085.8	2,365.3	4,598.2	4,731.8	1,004.0	932.2
187.5	25	318	10	144.1	1,016.7	2,116.4	4,304.7	4,421.4	934.9	871.2
150.0	20	264	8	131.1	955.9	1,883.0	4,046.4	4,146.4	872.4	816.6
75.0	10	153	5	113.2	875.3	1,504.7	3,701.7	3,769.1	792.3	751.1

Heat Rejection Data

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 AFTERCOOLER	WORK ENERGY	LOW HEAT VALUE ENERGY	HIGH HEAT VALUE ENERGY

PERFORMANCE DATA[DM9071]

August 1, 2019

EKW	%	BHP	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN
750.0	100	1,114	18,168	6,121	41,248	23,382	6,001	7,653	47,258	112,670	120,022
675.0	90	1,004	16,830	5,599	38,360	21,557	5,489	6,721	42,591	103,055	109,779
600.0	80	896	15,354	5,086	35,666	19,722	4,986	5,885	38,003	93,613	99,721
562.5	75	843	14,621	4,822	34,127	18,699	4,728	5,431	35,732	88,766	94,559
525.0	70	789	13,886	4,536	32,294	17,513	4,447	4,898	33,459	83,488	88,936
450.0	60	683	12,429	3,947	28,414	14,931	3,870	3,801	28,962	72,655	77,396
375.0	50	578	10,977	3,350	24,232	12,266	3,285	2,735	24,499	61,668	65,692
300.0	40	474	10,408	2,784	19,378	9,542	2,730	1,876	20,121	51,252	54,597
225.0	30	371	9,659	2,224	14,770	6,845	2,180	1,164	15,715	40,931	43,602
187.5	25	318	9,060	1,943	12,725	5,538	1,904	861	13,480	35,756	38,089
150.0	20	264	8,158	1,664	11,023	4,279	1,631	608	11,205	30,622	32,620
75.0	10	153	5,369	1,121	8,709	1,888	1,099	302	6,505	20,638	21,985

Emissions Data

RATED SPEED POTENTIAL SITE VARIATION: 1800 RPM

GENSET POWER WITH FAN		**EKW**	**750.0**	**562.5**	**375.0**	**187.5**	**75.0**
PERCENT LOAD		**%**	**100**	**75**	**50**	**25**	**10**
ENGINE POWER		**BHP**	**1,114**	**843**	**578**	**318**	**153**
TOTAL NOX (AS NO2)		G/HR	6,801	3,884	2,480	1,700	1,133
TOTAL CO		G/HR	531	693	642	531	581
TOTAL HC		G/HR	51	88	96	89	109
PART MATTER		G/HR	45.0	68.8	161.0	104.2	70.2
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	3,087.7	2,249.5	2,097.2	2,536.5	3,084.9
TOTAL CO	(CORR 5% O2)	MG/NM3	241.6	405.2	545.4	830.3	1,691.5
TOTAL HC	(CORR 5% O2)	MG/NM3	19.7	44.5	70.6	121.6	276.9
PART MATTER	(CORR 5% O2)	MG/NM3	16.7	34.3	115.9	132.9	176.2
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	1,504	1,096	1,022	1,235	1,503
TOTAL CO	(CORR 5% O2)	PPM	193	324	436	664	1,353
TOTAL HC	(CORR 5% O2)	PPM	37	83	132	227	517
TOTAL NOX (AS NO2)		G/HP-HR	6.16	4.64	4.31	5.37	7.41
TOTAL CO		G/HP-HR	0.48	0.83	1.12	1.68	3.80
TOTAL HC		G/HP-HR	0.05	0.10	0.17	0.28	0.71
PART MATTER		G/HP-HR	0.04	0.08	0.28	0.33	0.46
TOTAL NOX (AS NO2)		LB/HR	14.99	8.56	5.47	3.75	2.50
TOTAL CO		LB/HR	1.17	1.53	1.42	1.17	1.28
TOTAL HC		LB/HR	0.11	0.19	0.21	0.20	0.24
PART MATTER		LB/HR	0.10	0.15	0.36	0.23	0.15

RATED SPEED NOMINAL DATA: 1800 RPM

GENSET POWER WITH FAN		**EKW**	**750.0**	**562.5**	**375.0**	**187.5**	**75.0**
PERCENT LOAD		**%**	**100**	**75**	**50**	**25**	**10**
ENGINE POWER		**BHP**	**1,114**	**843**	**578**	**318**	**153**
TOTAL NOX (AS NO2)		G/HR	5,621	3,210	2,049	1,405	936
TOTAL CO		G/HR	284	371	344	284	311
TOTAL HC		G/HR	27	46	51	47	58
TOTAL CO2		KG/HR	514	404	279	161	93
PART MATTER		G/HR	23.1	35.3	82.6	53.4	36.0
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	2,551.8	1,859.1	1,733.2	2,096.3	2,549.5
TOTAL CO	(CORR 5% O2)	MG/NM3	129.2	216.7	291.7	444.0	904.6
TOTAL HC	(CORR 5% O2)	MG/NM3	10.4	23.5	37.4	64.3	146.5
PART MATTER	(CORR 5% O2)	MG/NM3	8.6	17.6	59.4	68.1	90.3
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	1,243	906	844	1,021	1,242
TOTAL CO	(CORR 5% O2)	PPM	103	173	233	355	724
TOTAL HC	(CORR 5% O2)	PPM	19	44	70	120	273
TOTAL NOX (AS NO2)		G/HP-HR	5.09	3.83	3.56	4.43	6.12
TOTAL CO		G/HP-HR	0.26	0.44	0.60	0.90	2.03
TOTAL HC		G/HP-HR	0.02	0.06	0.09	0.15	0.38
PART MATTER		G/HP-HR	0.02	0.04	0.14	0.17	0.24
TOTAL NOX (AS NO2)		LB/HR	12.39	7.08	4.52	3.10	2.06
TOTAL CO		LB/HR	0.63	0.82	0.76	0.63	0.68
TOTAL HC		LB/HR	0.06	0.10	0.11	0.10	0.13
TOTAL CO2		LB/HR	1,133	891	615	354	204
PART MATTER		LB/HR	0.05	0.08	0.18	0.12	0.08
OXYGEN IN EXH		%	9.0	10.2	11.4	13.7	16.3
DRY SMOKE OPACITY		%	0.4	1.6	3.1	4.6	3.4
BOSCH SMOKE NUMBER			0.20	0.55	1.16	1.56	1.24

PERFORMANCE DATA[DM9071]

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 CORRECTED POWER CAPABILITY (BHP)

AMBIENT OPERATING TEMP (F)	30	40	50	60	70	80	90	100	110	120	130	140	NORMAL
ALTITUDE (FT)													
0	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141
1,000	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141
2,000	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141
3,000	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141
4,000	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141
5,000	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141
6,000	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141
7,000	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141
8,000	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,127	1,108	1,141
9,000	1,141	1,141	1,141	1,141	1,141	1,141	1,141	1,140	1,120	1,101	1,082	1,064	1,141
10,000	1,141	1,141	1,141	1,141	1,141	1,135	1,114	1,094	1,075	1,056	1,038	1,021	1,141
11,000	1,141	1,141	1,141	1,131	1,109	1,089	1,069	1,050	1,031	1,014	996	980	1,141
12,000	1,141	1,128	1,106	1,084	1,064	1,044	1,025	1,007	989	972	956	940	1,137
13,000	1,103	1,081	1,060	1,039	1,020	1,001	983	965	948	932	916	901	1,098
14,000	1,057	1,036	1,016	996	977	959	942	925	909	893	878	863	1,060
15,000	1,012	992	973	954	936	919	902	886	870	855	841	827	1,023

Cross Reference

Test Spec	Setting	Engine Arrangement	Engineering Model	Engineering Model Version	Start Effective Serial Number	End Effective Serial Number
0K7492	PP5659	2671232	GS327	-	MJE00001	
3704840	GG0522	3495619	GS603	LS	MJE00001	
0K4032	GG0384	3541450	GS582	-	PEN00001	
3704840	GG0522	3884919	GS603	-	MJE00001	

Performance Parameter Reference

Parameters Reference:DM9600-11

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 deg C (84.2 deg F), 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.

PERFORMANCE DATA[DM9071]

ALTITUDE CAPABILITY
Altitude capability is the maximum altitude above sea level at standard temperature and standard pressure at which the engine could develop full rated output power on the current performance data set.
Standard temperature values versus altitude could be seen on TM2001.
When viewing the altitude capability chart the ambient temperature is the inlet air temp at the compressor inlet.
Engines with ADEM MEUI and HEUI fuel systems operating at conditions above the defined altitude capability derate for atmospheric pressure and temperature conditions outside the values defined, see TM2001.
Mechanical governor controlled unit injector engines require a setting change for operation at conditions above the altitude defined on the engine performance sheet. See your Caterpillar technical representative for non standard ratings.
REGULATIONS AND PRODUCT COMPLIANCE
TMI Emissions information is presented at 'nominal' and 'Potential Site Variation' values for standard ratings. No tolerances are applied to the emissions data. These values are subject to change at any time. The controlling federal and local emission requirements need to be verified by your Caterpillar technical representative.
Customer's may have special emission site requirements that need to be verified by the Caterpillar Product Group engineer.
EMISSION CYCLE LIMITS:
Cycle emissions Max Limits apply to cycle-weighted averages only. Emissions at individual load points may exceed the cycle-weighted limit.
EMISSIONS DEFINITIONS:
Emissions : DM1176
EMISSION CYCLE DEFINITIONS
1. For constant-speed marine engines for ship main propulsion, including,diesel-electric drive, test cycle E2 shall be applied, for controllable-pitch propeller sets
test cycle E2 shall be applied.
2. For propeller-law-operated main and propeller-law-operated auxiliary engines the test cycle E3 shall be applied.
3. For constant-speed auxiliary engines test cycle D2 shall be applied.
4. For variable-speed, variable-load auxiliary engines, not included above, test cycle C1 shall be applied.
HEAT REJECTION DEFINITIONS:
Diesel Circuit Type and HHV Balance : DM9500
HIGH DISPLACEMENT (HD) DEFINITIONS:
3500: EM1500
RATING DEFINITIONS:
Agriculture : TM6008
Fire Pump : TM6009
Generator Set : TM6035
Generator (Gas) : TM6041
Industrial Diesel : TM6010
Industrial (Gas) : TM6040
Irrigation : TM5749
Locomotive : TM6037
Marine Auxiliary : TM6036
Marine Prop (Except 3600) : TM5747
Marine Prop (3600 only) : TM5748
MSHA : TM6042
Oil Field (Petroleum) : TM6011
Off-Highway Truck : TM6039
On-Highway Truck : TM6038
SOUND DEFINITIONS:
Sound Power : DM8702
Sound Pressure : TM7080
Date Released : 07/10/19

APPENDIX 4
POTENTIAL EMISSIONS CALCULATIONS

Facility-Wide Potential Emissions

Pollutant	Potential Annual Emissions (tpy)				Facility-Wide Potential Emissions[1] (tpy)	Title V Major Source Threshold (tpy)	Above Thresholds?
	Existing Emergency Generators	Proposed Emergency Generators	Cooling Towers	Bloom Energy Servers			
NO_X	49.26	6.61	--	0.48	56.35	70	No
CO	5.94	0.62	--	4.82	11.38	100	No
VOC	1.13	0.17	--	0.96	2.26	50	No
PM	0.60	0.11	3.04	--	3.75	100	No
PM_{10}	0.60	0.11	2.29	--	3.00	100	No
$PM_{2.5}$	0.60	0.11	6.84E-03	--	0.71	70	No
SO_2	0.06	4.50E-03	--	--	0.06	70	No
Max. Individual HAP (Benzene)	0.02	2.31E-03	--	--	0.02	10	No
Total HAP	0.04	4.68E-03	--	--	0.04	25	No
CO_2e	3,626	486.09	--	37,243.14	41,355	--	--

Notes:
(1) Refer to the definition of "Major Source" found in Rule R307-101 of the Utah Administrative Code. The Major Source thresholds for NOX, VOC, PM10, PM2.5, and SO2 have been set in Rule R307-420 in accordance with the severity of the surrounding nonattainment areas consistent with the relevant section of the Clean Air Act. Please note, in some cases these pollutants are regulated as precursor pollutants to the pollutant for which Salt Lake County has been designated with "nonattainment" status.

Number of Generator Engines

G1-G7 (3.25 MW) Engines	7
G8-G14 (3.1 MW) Engines	7
G15-G16; G19-G22; G26-G27 (2.0 MW) Engines	8
G17-G18 (1.5 MW) Engines	2

Power Output by Load

Engines Group	Power Output (bhp/engine) [1]					Power Output (kWm/engine) [1]				
	10% Load	25% Load	50% Load	75% Load	Full Standby	10% Load	25% Load	50% Load	75% Load	Full Standby
G1-G7	--	--	--	--	--	349.0	872.0	1,745.0	2,618.0	3,490.0
G8-G14	438.0	1,094.0	2,188.0	3,282.0	4,376.0	--	--	--	--	--
G15-G16; G19-G22; G26-G27	411.0	839.0	1,521.0	2,212.0	2,937.0	--	--	--	--	--
G17-G18	312.0	632.0	1,144.0	1,662.0	2,206.0	--	--	--	--	--

Notes:
1 Per the manufacturer specification sheets and performance data for each engine model.

Engines Group	Diesel Fuel Consumption (gal/hr/engine) [1]					Heat Input (MMBtu/hr/engine) [2,3]				
	10% Load	25% Load	50% Load	75% Load	Full Standby	10% Load	25% Load	50% Load	75% Load	Full Standby
G1-G7	--	--	133.0	192.0	237.0	3.28	8.19	16.38	24.58	32.76
G8-G14	37.4	75.0	125.1	159.8	210.7	5.12	10.28	17.14	21.90	28.87
G15-G16; G19-G22; G26-G27	26.4	44.8	77.5	107.5	138.0	3.62	6.14	10.62	14.73	18.91
G17-G18	19.7	33.9	58.0	82.0	104.6	2.70	4.65	7.95	11.24	14.33

Notes:
(1) Refer to enclosed manufacturer specification sheets and performance data for each engine model.
G1-G7 diesel fuel consumption was not available from manufacturer specification sheets. Heat Input was calculated using conversion factors from
(2) USEPA's AP-42, Chapter 3.4, Large Stationary Diesel and All Stationary Dual-fuel Engines, Table 3.4-1, footnote e (October 1996) and Appendix-A:

7,000 Btu/hp-hr
1.341 hp/kWm

(3) Diesel fuel consumption was converted to heat input based on the diesel high heating value from the USEPA's AP-42, Chapter 3.4, Large Stationary Diesel and All Stationary Dual-fuel Engines, Table 3.4-1, footnote a (October 1996):

Diesel HHV = 0.137 MMBtu/gal

Pollutant	Uncontrolled Emission Factors for G1-G7 Engines (g/kW-hr) [1]					Uncontrolled Emission Factors for G8-G14 Engines (g/bhp-hr) [1]				
	10% Load	25% Load	50% Load	75% Load	Full Standby	10% Load	25% Load	50% Load	75% Load	Full Standby
NO_X	--	6.20	6.00	7.00	8.70	8.18	3.22	3.85	6.28	7.26
CO	--	3.80	1.70	1.20	1.30	4.17	1.66	0.78	1.03	0.63
VOC[2]	--	0.90	0.55	0.32	0.23	0.75	0.35	0.17	0.06	0.05
Filterable PM[3]	--	0.44	0.210	0.090	0.070	0.29	0.12	0.06	0.05	0.04

Notes:

(1) Refer to enclosed manufacturer performance data for each engine model. Emission factors are conservatively based on the manufacturer's not-to-exceed or "Rated Speed Potential Site Variation" (i.e., not-to-exceed equivalent) emissions data.

(2) Assumes that all hydrocarbons (HC) are VOC.

(3) Assumes that all filterable PM is less than 2.5 microns in diameter (i.e., PM = PM_{10} = $PM_{2.5}$).

Pollutant	Uncontrolled Emission Factors for G15-G16; G19-G22; G26-G27 Engines (g/bhp-hr) [1]					Uncontrolled Emission Factors for G17-G18 Engines (g/bhp-hr) [1]				
	10% Load	25% Load	50% Load	75% Load	Full Standby	10% Load	25% Load	50% Load	75% Load	Full Standby
NO_X	7.13	5.03	3.82	4.67	6.56	9.14	5.85	4.26	4.41	6.58
CO	4.36	2.11	0.59	0.39	0.54	6.13	3.13	1.47	0.71	0.87
VOC[2]	1.08	0.49	0.34	0.23	0.14	1.06	0.45	0.32	0.23	0.16
Filterable PM[3]	0.49	0.31	0.080	0.040	0.040	0.36	0.29	0.13	0.06	0.04

Notes:

(1) Refer to enclosed manufacturer performance data for each engine model. Emission factors are conservatively based on the manufacturer's not-to-exceed or "Rated Speed Potential Site Variation" (i.e., not-to-exceed equivalent) emissions data.

(2) Assumes that all hydrocarbons (HC) are VOC.

(3) Assumes that all filterable PM is less than 2.5 microns in diameter (i.e., PM = PM_{10} = $PM_{2.5}$).

AP-42 Emission Factors

Pollutant	Emission Factor (lb/MMBtu)[1]
SO_2[2]	1.52E-03
Condensable PM	7.70E-03
Benzene	7.76E-04
Toluene	2.81E-04
Xylenes	1.93E-04
Formaldehyde	7.89E-05
Acetaldehyde	2.52E-05
Acrolein	7.88E-06
Total PAH[3]	2.12E-04

Notes:

1 Emission factors are from the U.S. EPA's AP-42, Chapter 3.4, Large Stationary Diesel And All Stationary Dual-fuel Engines, Tables 3.4-1, 3.4-2, 3.4-3, and 3.4-4 (October 1996).

2 The SO_2 emission factor was calculated based on the maximum allowable diesel fuel sulfur content under NSPS Subpart IIII:

Diesel Sulfur Content = 0.0015 wt.% Sulfur

3 PAH = Polycyclic Aromatic Hydrocarbons

GHG Emission Factors

Pollutant	Emission Factor (lb/MMBtu)[1]
CO_2	163.05
CH_4	6.61E-03
N_2O	1.32E-03
CO_2e[2]	163.61

Notes:

1 Per 40 CFR 98, Subpart C, Tables C-1 and C-2 for No. 2 fuel oil combustion. The emission factors were converted from kg/MMBtu to lb/MMBtu.

2 The CO_2e emission factor is calculated as the sum of each GHG pollutant multiplied by its global warming potential, per 40 CFR 98, Subpart A, Table A-1:

CO_2: 1
CH_4: 25
N_2O: 298

Hourly Emission Rates

Pollutant	G1-G7 Engines - Hourly Emissions (lb/hr/engine) [1, 2]						G8-G14 Engines - Hourly Emissions (lb/hr/engine) [2, 3]					
	10% Load	25% Load	50% Load	75% Load	Full Standby	Maximum	10% Load	25% Load	50% Load	75% Load	Full Standby	Maximum
Criteria Pollutants												
NO_X	--	11.92	23.08	40.40	66.94	**66.94**	7.90	7.77	18.57	45.44	70.04	**70.04**
CO	--	7.31	6.54	6.93	10.00	**10.00**	4.03	4.00	3.76	7.45	6.08	**7.45**
VOC	--	1.73	2.12	1.85	1.77	**2.12**	0.72	0.84	0.82	0.43	0.48	**0.84**
$PM/PM_{10}/PM_{2.5}$ [4]	--	0.91	0.93	0.71	0.79	**0.93**	0.32	0.37	0.42	0.53	0.61	**0.61**
SO_2	--	0.012	0.025	0.037	0.050	**0.050**	0.008	0.016	0.026	0.033	0.044	**0.044**
Hazardous Air Pollutants												
Benzene	2.54E-03	6.35E-03	1.27E-02	1.91E-02	2.54E-02	**2.54E-02**	3.98E-03	7.98E-03	1.33E-02	1.70E-02	2.24E-02	**2.24E-02**
Toluene	9.21E-04	2.30E-03	4.60E-03	6.91E-03	9.21E-03	**9.21E-03**	1.44E-03	2.89E-03	4.82E-03	6.15E-03	8.11E-03	**8.11E-03**
Xylenes	6.32E-04	1.58E-03	3.16E-03	4.74E-03	6.32E-03	**6.32E-03**	9.89E-04	1.98E-03	3.31E-03	4.23E-03	5.57E-03	**5.57E-03**
Formaldehyde	2.58E-04	6.46E-04	1.29E-03	1.94E-03	2.58E-03	**2.58E-03**	4.04E-04	8.11E-04	1.35E-03	1.73E-03	2.28E-03	**2.28E-03**
Acetaldehyde	8.26E-05	2.06E-04	4.13E-04	6.19E-04	8.26E-04	**8.26E-04**	1.29E-04	2.59E-04	4.32E-04	5.52E-04	7.28E-04	**7.28E-04**
Acrolein	2.58E-05	6.45E-05	1.29E-04	1.94E-04	2.58E-04	**2.58E-04**	4.04E-05	8.10E-05	1.35E-04	1.73E-04	2.28E-04	**2.28E-04**
Total PAH	6.95E-04	1.74E-03	3.47E-03	5.21E-03	6.95E-03	**6.95E-03**	1.09E-03	2.18E-03	3.63E-03	4.64E-03	6.12E-03	**6.12E-03**
Total HAP	5.16E-03	1.29E-02	2.58E-02	3.87E-02	5.16E-02	**5.16E-02**	8.07E-03	1.62E-02	2.70E-02	3.45E-02	4.54E-02	**4.54E-02**
Greenhouse Gases												
CO_2	534.17	1,334.67	2,670.87	4,007.08	5,341.75	**5,341.75**	835.64	1,675.75	2,795.14	3,570.46	4,707.73	**4,707.73**
CH_4	0.02	0.05	0.11	0.16	0.22	**0.22**	0.03	0.07	0.11	0.14	0.19	**0.19**
N_2O	0.00	0.01	0.02	0.03	0.04	**0.04**	0.007	0.014	0.023	0.029	0.038	**0.04**
CO_2e	536.01	1,339.25	2,680.04	4,020.83	5,360.08	**5,360.08**	838.51	1,681.50	2,804.74	3,582.71	4,723.88	**4,723.88**

Notes:

1 For engine-specific emission factors:
Hourly Emissions at Load *X* (lb/hr/gen) = Emission Factor at Load *X* (g/kWm-hr) x Engine Power at Load *X* (kWm/engine) / (453.6 g/lb)

2 For AP-42 & GHG emission factors:
Hourly Emissions at Load *X* (lb/hr/engine) = Emission Factor (lb/MMBtu) x Heat Input at Load *X* (MMBtu/hr/engine)

3 For engine-specific emission factors:
Hourly Emissions at Load *X* (lb/hr/engine) = Emission Factor at Load *X* (g/hp-hr) x Engine Power at Load *X* (bhp/engine) / (453.6 g/lb)

4 Total $PM/PM_{10}/PM_{2.5}$ is the sum of filterable $PM/PM_{10}/PM_{2.5}$ and condensable PM.

Hourly Emission Rates

Pollutant	G15-G16; G19-G22; G26-G27 Engines - Hourly Emissions (lb/hr/engine) [1, 2]						G17-G18 Engines - Hourly Emissions (lb/hr/engine) [1, 2]					
	10% Load	25% Load	50% Load	75% Load	Full Standby	Maximum	10% Load	25% Load	50% Load	75% Load	Full Standby	Maximum
Criteria Pollutants												
NO_X	6.46	9.30	12.81	22.77	42.48	**42.48**	6.29	8.15	10.74	16.16	32.00	**32.00**
CO	3.95	3.90	1.98	1.90	3.50	**3.95**	4.22	4.36	3.71	2.60	4.23	**4.36**
VOC	0.98	0.91	1.14	1.12	0.91	**1.14**	0.73	0.63	0.81	0.84	0.78	**0.84**
$PM/PM_{10}/PM_{2.5}$ [4]	0.47	0.62	0.35	0.31	0.40	**0.62**	0.27	0.44	0.39	0.31	0.30	**0.44**
SO_2	0.005	0.009	0.016	0.022	0.029	**0.029**	0.004	0.007	0.012	0.017	0.022	**0.022**
Hazardous Air Pollutants												
Benzene	2.81E-03	4.76E-03	8.24E-03	1.14E-02	1.47E-02	**1.47E-02**	2.09E-03	3.60E-03	6.17E-03	8.72E-03	1.11E-02	**1.11E-02**
Toluene	1.02E-03	1.73E-03	2.98E-03	4.14E-03	5.31E-03	**5.31E-03**	7.59E-04	1.31E-03	2.23E-03	3.16E-03	4.03E-03	**4.03E-03**
Xylenes	6.98E-04	1.18E-03	2.05E-03	2.84E-03	3.65E-03	**3.65E-03**	5.21E-04	8.97E-04	1.53E-03	2.17E-03	2.77E-03	**2.77E-03**
Formaldehyde	2.85E-04	4.84E-04	8.38E-04	1.16E-03	1.49E-03	**1.49E-03**	2.13E-04	3.67E-04	6.27E-04	8.87E-04	1.13E-03	**1.13E-03**
Acetaldehyde	9.12E-05	1.55E-04	2.68E-04	3.71E-04	4.77E-04	**4.77E-04**	6.80E-05	1.17E-04	2.00E-04	2.83E-04	3.61E-04	**3.61E-04**
Acrolein	2.85E-05	4.84E-05	8.37E-05	1.16E-04	1.49E-04	**1.49E-04**	2.13E-05	3.66E-05	6.26E-05	8.85E-05	1.13E-04	**1.13E-04**
Total PAH	7.67E-04	1.30E-03	2.25E-03	3.12E-03	4.01E-03	**4.01E-03**	5.72E-04	9.85E-04	1.68E-03	2.38E-03	3.04E-03	**3.04E-03**
Total HAP	5.69E-03	9.66E-03	1.67E-02	2.32E-02	2.98E-02	**2.98E-02**	4.25E-03	7.31E-03	1.25E-02	1.77E-02	2.26E-02	**2.26E-02**
Greenhouse Gases												
CO_2	589.86	1,000.98	1,731.60	2,401.90	3,083.37	**3,083.37**	440.16	757.44	1,295.91	1,832.15	2,337.11	**2,337.11**
CH_4	0.02	0.04	0.07	0.10	0.13	**0.13**	0.02	0.03	0.05	0.07	0.09	**0.09**
N_2O	0.005	0.008	0.014	0.019	0.025	**0.03**	0.004	0.006	0.011	0.015	0.019	**0.02**
CO_2e	591.89	1,004.41	1,737.55	2,410.14	3,093.95	**3,093.95**	441.67	760.04	1,300.36	1,838.44	2,345.13	**2,345.13**

Notes:

1 For engine-specific emission factors:
Hourly Emissions at Load *X* (lb/hr/engine) = Emission Factor at Load *X* (g/hp-hr) x Engine Power at Load *X* (bhp/engine) / (453.6 g/lb)

2 For AP-42 & GHG emission factors:
Hourly Emissions at Load *X* (lb/hr/engine) = Emission Factor (lb/MMBtu) x Heat Input at Load *X* (MMBtu/hr/engine)

3 Total PM/PM10/PM2.5 is the sum of filterable PM/PM10/PM2.5 and condensable PM.

Potential to Emit - All Pollutants

Pollutant	Potential Annual Emissions G1-G7 (tpy)	Potential Annual Emissions G8-G14 (tpy)	Potential Annual Emissions G15-G16; G19-G22; G26-27 (tpy)	Potential Annual Emissions G17-G18 (tpy)
Maximum Engine Operation (hr/yr/engine)	**66**	**66**	**66**	**66**
Criteria Pollutants				
NO_X	15.46	16.18	11.21	2.11
CO	2.31	1.72	1.04	0.29
VOC	0.49	0.19	0.30	0.06
$PM/PM_{10}/PM_{2.5}$	0.22	0.14	0.16	0.03
SO_2	0.01	0.01	0.01	1.43E-03
Hazardous Air Pollutants				
Benzene	5.87E-03	5.18E-03	3.87E-03	7.34E-04
Toluene	2.13E-03	1.87E-03	1.40E-03	2.66E-04
Xylenes	1.46E-03	1.29E-03	9.64E-04	1.83E-04
Formaldehyde	5.97E-04	5.26E-04	3.94E-04	7.46E-05
Acetaldehyde	1.91E-04	1.68E-04	1.26E-04	2.38E-05
Acrolein	5.96E-05	5.26E-05	3.93E-05	7.45E-06
Total PAH	1.60E-03	1.41E-03	1.06E-03	2.01E-04
Total HAP	1.19E-02	1.05E-02	7.86E-03	1.49E-03
Greenhouse Gases				
CO_2	1,233.94	1,087.49	814.01	154.25
CH_4	0.05	0.04	0.03	0.01
N_2O	0.010	0.009	0.007	0.001
CO_2e	1,238.18	1,091.22	816.80	154.78

Notes:

1 Total potential annual emissions of all pollutants were based on the maximum hourly emission rate (as determined using the emissions data summarized above) for each engine grouping conservatively assuming the maximum annual operating rate shown for each engine group.

Number of Generator Engines

FP1 (100 kW) Engine	1
FP2 (64 kW) Engine	1
G23 (1.0 MW) Engine	1
G24-G25 (2.5 MW) Engines	2

Power Output by Load

Engines Group	Power Output (bhp/engine) [1]					Power Output (kWe/engine) [1]				
	10% Load	25% Load	50% Load	75% Load	Full Standby	10% Load	25% Load	50% Load	75% Load	Full Standby
FP1	--	--	--	--	--	--	--	--	--	100.0
FP2	--	--	--	--	86.0	--	--	--	--	--
G23	209.0	426.0	772.0	1,124.0	1,483.0	--	--	--	--	--
G24-G25	497.0	1,029.0	1,889.0	2,760.0	3,633.0	--	--	--	--	--

Notes:
1 Per the manufacturer specification sheets and performance data for each engine model.

Engines Group	Diesel Fuel Consumption (gal/hr/engine) [1]					Heat Input (MMBtu/hr/engine) [2,3]				
	10% Load	25% Load	50% Load	75% Load	Full Standby	10% Load	25% Load	50% Load	75% Load	Full Standby
FP1	--	--	--	--	--	--	--	--	--	0.94
FP2	--	--	--	--	4.5	--	--	--	--	0.62
G23	12.6	22.1	38.6	56.7	72.4	1.73	3.03	5.29	7.77	9.92
G24-G25	32.2	57.1	96.5	133.8	175.0	4.41	7.82	13.22	18.33	23.98

Notes:
(1) Refer to enclosed manufacturer specification sheets and performance data for each engine model.
G1-G7 diesel fuel consumption was not available from manufacturer specification sheets. Heat Input was calculated using conversion factors from
(2) USEPA's AP-42, Chapter 3.4, Large Stationary Diesel and All Stationary Dual-fuel Engines, Table 3.4-1, footnote e (October 1996) and Appendix-A:

7,000 Btu/hp-hr
1.3407 hp/kWe

(3) Diesel fuel consumption was converted to heat input based on the diesel high heating value from the USEPA's AP-42, Chapter 3.4, Large Stationary Diesel and All Stationary Dual-fuel Engines, Table 3.4-1, footnote a (October 1996):

Diesel HHV = 0.137 MMBtu/gal

Pollutant	Uncontrolled Emission Factors for FP1 Engine (g/kW-hr) [1]					Uncontrolled Emission Factors for FP2 Engine (g/bhp-hr) [1]				
	10% Load	25% Load	50% Load	75% Load	Full Standby	10% Load	25% Load	50% Load	75% Load	Full Standby
NO_X	--	--	--	--	3.52	--	--	--	--	3.06
CO	--	--	--	--	1.15	--	--	--	--	0.60
VOC[2]	--	--	--	--	0.21	--	--	--	--	0.16
Filterable PM[3]	--	--	--	--	0.21	--	--	--	--	0.17

Notes:

(1) Refer to enclosed manufacturer performance data for each engine model. Emission factors are conservatively based on the manufacturer's not-to-exceed or "Rated Speed Potential Site Variation" (i.e., not-to-exceed equivalent) emissions data.

(2) Assumes that all hydrocarbons (HC) are VOC.

(3) Assumes that all filterable PM is less than 2.5 microns in diameter (i.e., PM = PM_{10} = $PM_{2.5}$).

Pollutant	Uncontrolled Emission Factors for G23 Engine (g/bhp-hr) [1]					Uncontrolled Emission Factors for G24-G25 Engines (g/bhp-hr) [1]				
	10% Load	25% Load	50% Load	75% Load	Full Standby	10% Load	25% Load	50% Load	75% Load	Full Standby
NO_X	6.43	5.34	4.37	4.60	5.97	6.83	3.74	4.02	5.36	6.77
CO	6.03	1.91	0.64	0.21	0.24	5.00	1.99	0.65	0.62	0.88
VOC[2]	0.73	0.18	0.13	0.09	0.02	0.83	0.40	0.26	0.18	0.11
Filterable PM[3]	0.40	0.25	0.09	0.03	0.04	0.24	0.22	0.07	0.04	0.04

Notes:

(1) Refer to enclosed manufacturer performance data for each engine model. Emission factors are conservatively based on the manufacturer's not-to-exceed or "Rated Speed Potential Site Variation" (i.e., not-to-exceed equivalent) emissions data.

(2) Assumes that all hydrocarbons (HC) are VOC.

(3) Assumes that all filterable PM is less than 2.5 microns in diameter (i.e., PM = PM_{10} = $PM_{2.5}$).

AP-42 Emission Factors

Pollutant	Emission Factor (>600 hp)	Emission Factor (≤600 hp)
	(lb/MMBtu)[1,2]	(lb/MMBtu)[3]
SO_2	1.52E-03	0.29
Condensable PM	7.70E-03	7.70E-03
Benzene	7.76E-04	9.33E-04
Toluene	2.81E-04	4.09E-04
Xylenes	1.93E-04	2.85E-04
1,3-Butadiene	--	3.91E-05
Formaldehyde	7.89E-05	1.18E-03
Acetaldehyde	2.52E-05	7.67E-04
Acrolein	7.88E-06	9.25E-05
Total PAH[4]	2.12E-04	1.68E-04

Notes:

1 Emission factors are from the U.S. EPA's AP-42, Chapter 3.4, Large Stationary Diesel And All Stationary Dual-fuel Engines, Tables 3.4-1, 3.4-2, 3.4-3, and 3.4-4 (October 1996).

2 The SO_2 emission factor was calculated based on the maximum allowable diesel fuel sulfur content under NSPS Subpart IIII:

Diesel Sulfur Content = 0.0015 wt.% Sulfur

3 Emission factors are from the U.S. EPA's AP-42, Chapter 3.3, Gasoline and Diesel Industrial Engines, Table 3.3-2 (October 1996). It was conservatively assumed the condensable PM factor for engines >600 hp is equivalent to engines ≤600 hp.

4 PAH = Polycyclic Aromatic Hydrocarbons

GHG Emission Factors

Pollutant	Emission Factor
	(lb/MMBtu)[1]
CO_2	163.05
CH_4	6.61E-03
N_2O	1.32E-03
CO_2e^2	163.61

Notes:

1 Per 40 CFR 98, Subpart C, Tables C-1 and C-2 for No. 2 fuel oil combustion. The emission factors were converted from kg/MMBtu to lb/MMBtu.

2 The CO_2e emission factor is calculated as the sum of each GHG pollutant multiplied by its global warming potential, per 40 CFR 98, Subpart A, Table A-1:

CO_2:	1
CH_4:	25
N_2O:	298

Hourly Emission Rates

Pollutant	FP1 Engine - Hourly Emissions (lb/hr/engine) [1, 2]						FP2 Engine - Hourly Emissions (lb/hr/engine) [2, 3]					
	10% Load	25% Load	50% Load	75% Load	Full Standby	Maximum	10% Load	25% Load	50% Load	75% Load	Full Standby	Maximum
Criteria Pollutants												
NO_X	--	--	--	--	0.78	**0.78**	--	--	--	--	0.58	**0.58**
CO	--	--	--	--	0.25	**0.25**	--	--	--	--	0.11	**0.11**
VOC	--	--	--	--	0.05	**0.05**	--	--	--	--	0.03	**0.03**
$PM/PM_{10}/PM_{2.5}$ [4]	--	--	--	--	0.05	**0.05**	--	--	--	--	0.04	**0.04**
SO_2	--	--	--	--	0.27	**0.27**	--	--	--	--	0.18	**0.18**
Hazardous Air Pollutants												
Benzene	--	--	--	--	8.76E-04	**8.76E-04**	--	--	--	--	5.75E-04	**5.75E-04**
Toluene	--	--	--	--	3.84E-04	**3.84E-04**	--	--	--	--	2.52E-04	**2.52E-04**
Xylenes	--	--	--	--	2.67E-04	**2.67E-04**	--	--	--	--	1.76E-04	**1.76E-04**
1,3-Butadiene	--	--	--	--	3.67E-05	**3.67E-05**	--	--	--	--	2.41E-05	**2.41E-05**
Formaldehyde	--	--	--	--	1.11E-03	**1.11E-03**	--	--	--	--	7.28E-04	**7.28E-04**
Acetaldehyde	--	--	--	--	7.20E-04	**7.20E-04**	--	--	--	--	4.73E-04	**4.73E-04**
Acrolein	--	--	--	--	8.68E-05	**8.68E-05**	--	--	--	--	5.70E-05	**5.70E-05**
Total PAH	--	--	--	--	1.58E-04	**1.58E-04**	--	--	--	--	1.04E-04	**1.04E-04**
Total HAP	--	--	--	--	0.00E+00	**3.64E-03**	--	--	--	--	0.00E+00	**2.39E-03**
Greenhouse Gases												
CO_2	--	--	--	--	153.02	**153.02**	--	--	--	--	100.54	**100.54**
CH_4	--	--	--	--	0.01	**0.01**	--	--	--	--	0.00	**0.00**
N_2O	--	--	--	--	0.00	**0.00**	--	--	--	--	0.001	**0.00**
CO_2e	--	--	--	--	153.55	**153.55**	--	--	--	--	100.89	**100.89**

Notes:

1 For engine-specific emission factors:
Hourly Emissions at Load *X* (lb/hr/gen) = Emission Factor at Load *X* (g/kWe-hr) x Engine Power at Load *X* (kWe/engine) / (453.6 g/lb)

2 For AP-42 & GHG emission factors:
Hourly Emissions at Load *X* (lb/hr/engine) = Emission Factor (lb/MMBtu) x Heat Input at Load *X* (MMBtu/hr/engine)

3 For engine-specific emission factors:
Hourly Emissions at Load *X* (lb/hr/engine) = Emission Factor at Load *X* (g/hp-hr) x Engine Power at Load *X* (bhp/engine) / (453.6 g/lb)

4 Total $PM/PM_{10}/PM_{2.5}$ is the sum of filterable $PM/PM_{10}/PM_{2.5}$ and condensable PM.

Hourly Emission Rates

Pollutant	G23 Engine - Hourly Emissions (lb/hr/engine) [1, 2]						G24-G25 Engines - Hourly Emissions (lb/hr/engine) [1, 2]					
	10% Load	25% Load	50% Load	75% Load	Full Standby	Maximum	10% Load	25% Load	50% Load	75% Load	Full Standby	Maximum
Criteria Pollutants												
NO_X	2.96	5.02	7.44	11.40	19.52	**19.52**	7.48	8.48	16.74	32.61	54.22	**54.22**
CO	2.78	1.79	1.09	0.52	0.78	**2.78**	5.48	4.51	2.71	3.77	7.05	**7.05**
VOC	0.34	0.17	0.22	0.22	0.07	**0.34**	0.91	0.91	1.08	1.10	0.88	**1.10**
$PM/PM_{10}/PM_{2.5}$ [4]	0.20	0.26	0.19	0.13	0.21	**0.26**	0.30	0.56	0.39	0.38	0.51	**0.56**
SO_2	0.003	0.005	0.008	0.012	0.015	**0.015**	0.007	0.012	0.020	0.028	0.036	**0.036**
Hazardous Air Pollutants												
Benzene	1.34E-03	2.35E-03	4.10E-03	6.03E-03	7.70E-03	**7.70E-03**	3.42E-03	6.07E-03	1.03E-02	1.42E-02	1.86E-02	**1.86E-02**
Toluene	4.85E-04	8.51E-04	1.49E-03	2.18E-03	2.79E-03	**2.79E-03**	1.24E-03	2.20E-03	3.72E-03	5.15E-03	6.74E-03	**6.74E-03**
Xylenes	3.33E-04	5.84E-04	1.02E-03	1.50E-03	1.91E-03	**1.91E-03**	8.52E-04	1.51E-03	2.55E-03	3.54E-03	4.63E-03	**4.63E-03**
Formaldehyde	1.36E-04	2.39E-04	4.17E-04	6.13E-04	7.83E-04	**7.83E-04**	3.48E-04	6.17E-04	1.04E-03	1.45E-03	1.89E-03	**1.89E-03**
Acetaldehyde	4.35E-05	7.63E-05	1.33E-04	1.96E-04	2.50E-04	**2.50E-04**	1.11E-04	1.97E-04	3.33E-04	4.62E-04	6.04E-04	**6.04E-04**
Acrolein	1.36E-05	2.39E-05	4.17E-05	6.12E-05	7.82E-05	**7.82E-05**	3.48E-05	6.17E-05	1.04E-04	1.44E-04	1.89E-04	**1.89E-04**
Total PAH	3.66E-04	6.42E-04	1.12E-03	1.65E-03	2.10E-03	**2.10E-03**	9.35E-04	1.66E-03	2.80E-03	3.89E-03	5.08E-03	**5.08E-03**
Total HAP	2.72E-03	4.77E-03	8.33E-03	1.22E-02	1.56E-02	**1.56E-02**	6.94E-03	1.23E-02	2.08E-02	2.89E-02	3.77E-02	**3.77E-02**
Greenhouse Gases												
CO_2	281.53	493.79	862.45	1,266.86	1,617.65	**1,617.65**	719.45	1,275.80	2,156.13	2,989.53	3,910.07	**3,910.07**
CH_4	0.01	0.02	0.03	0.05	0.07	**0.07**	0.03	0.05	0.09	0.12	0.16	**0.16**
N_2O	0.002	0.004	0.007	0.010	0.013	**0.01**	0.006	0.010	0.017	0.024	0.032	**0.03**
CO_2e	282.49	495.48	865.41	1,271.21	1,623.20	**1,623.20**	721.92	1,280.18	2,163.52	2,999.79	3,923.49	**3,923.49**

Notes:

1 For engine-specific emission factors:
Hourly Emissions at Load *X* (lb/hr/engine) = Emission Factor at Load *X* (g/hp-hr) x Engine Power at Load *X* (bhp/engine) / (453.6 g/lb)

2 For AP-42 & GHG emission factors:
Hourly Emissions at Load *X* (lb/hr/engine) = Emission Factor (lb/MMBtu) x Heat Input at Load *X* (MMBtu/hr/engine)

3 Total PM/PM10/PM2.5 is the sum of filterable PM/PM10/PM2.5 and condensable PM.

Potential to Emit - All Pollutants

Pollutant	Potential Annual Emissions FP1 (tpy)	Potential Annual Emissions FP2 (tpy)	Potential Annual Emissions G23 (tpy)	Potential Annual Emissions G24-G25 (tpy)
Maximum Engine Operation (hr/yr/engine)	**100**	**100**	**66**	**66**
Criteria Pollutants				
NO_X	0.04	0.03	0.64	3.58
CO	0.01	0.01	0.09	0.47
VOC	0.002	0.002	0.01	0.07
$PM/PM_{10}/PM_{2.5}$	0.003	0.002	0.01	0.04
SO_2	0.01	0.01	4.96E-04	2.40E-03
Hazardous Air Pollutants				
Benzene	4.38E-05	2.88E-05	2.54E-04	1.23E-03
Toluene	1.92E-05	1.26E-05	9.20E-05	4.45E-04
Xylenes	1.34E-05	8.79E-06	6.32E-05	3.05E-04
1,3-Butadiene	1.83E-06	1.21E-06	0.00E+00	0.00E+00
Formaldehyde	5.54E-05	3.64E-05	2.58E-05	1.25E-04
Acetaldehyde	3.60E-05	2.36E-05	8.25E-06	3.99E-05
Acrolein	4.34E-06	2.85E-06	2.58E-06	1.25E-05
Total PAH	7.88E-06	5.18E-06	6.94E-05	3.36E-04
Total HAP	1.82E-04	1.19E-04	5.15E-04	2.49E-03
Greenhouse Gases				
CO_2	7.65	5.03	53.38	258.06
CH_4	3.10E-04	2.04E-04	0.002	0.01
N_2O	6.21E-05	4.08E-05	4.33E-04	0.002
CO_2e	7.68	5.04	53.57	258.95

Notes:

1 Total potential annual emissions of all pollutants were based on the maximum hourly emission rate (as determined using the emissions data summarized above) for each engine grouping conservatively assuming the maximum annual operating rate shown for each engine group.

Number of Generator Engines

Proposed G28-G31 (2.0 MW) Engines	4
Proposed G32-G33 (750 kW) Engines	2

Power Output by Load

Engines Group	Power Output (bhp/engine) [1]				
	10% Load	25% Load	50% Load	75% Load	Full Standby
G28-G31	411.0	839.0	1,521.0	2,212.0	2,937.0
G32-G33	153.0	318.0	578.0	843.0	1,114.0

Notes:
1 Per the manufacturer specification sheets and performance data for each engine model.

Engines Group	Diesel Fuel Consumption (gal/hr/engine) [1]					Heat Input (MMBtu/hr/engine) [2]				
	10% Load	25% Load	50% Load	75% Load	Full Standby	10% Load	25% Load	50% Load	75% Load	Full Standby
G28-G31	26.4	44.8	77.5	107.5	138.0	3.62	6.14	10.62	14.73	18.91
G32-G33	9.6	16.7	28.7	41.4	52.5	1.32	2.29	3.93	5.67	7.19

Notes:
(1) Refer to enclosed manufacturer specification sheets and performance data for each engine model.
(2) Diesel fuel consumption was converted to heat input based on the diesel high heating value from the USEPA's AP-42, Chapter 3.4, Large Stationary Diesel and All Stationary Dual-fuel Engines, Table 3.4-1, footnote a (October 1996):

Diesel HHV = 0.137 MMBtu/gal

Pollutant	Uncontrolled Emission Factors for G28-G31 Engines (g/bhp-hr) [1]					Uncontrolled Emission Factors for G32-G33 Engine (g/bhp-hr) [1]				
	10% Load	25% Load	50% Load	75% Load	Full Standby	10% Load	25% Load	50% Load	75% Load	Full Standby
NO_X	7.13	5.03	3.82	4.67	6.56	7.41	5.37	4.31	4.64	6.16
CO	4.36	2.11	0.59	0.39	0.54	3.80	1.68	1.12	0.83	0.48
VOC[2]	1.08	0.49	0.34	0.23	0.14	0.71	0.28	0.17	0.10	0.05
Filterable PM[3]	0.49	0.31	0.08	0.04	0.04	0.46	0.33	0.28	0.08	0.04

Notes:

(1) Refer to enclosed manufacturer performance data for each engine model. Emission factors are conservatively based on the manufacturer's not-to-exceed or "Rated Speed Potential Site Variation" (i.e., not-to-exceed equivalent) emissions data.

(2) Assumes that all hydrocarbons (HC) are VOC.

(3) Assumes that all filterable PM is less than 2.5 microns in diameter (i.e., PM = PM_{10} = $PM_{2.5}$).

AP-42 Emission Factors

Pollutant	Emission Factor (lb/MMBtu)[1]
SO_2[2]	1.52E-03
Condensable PM	7.70E-03
Benzene	7.76E-04
Toluene	2.81E-04
Xylenes	1.93E-04
Formaldehyde	7.89E-05
Acetaldehyde	2.52E-05
Acrolein	7.88E-06
Total PAH[3]	2.12E-04

Notes:

1 Emission factors are from the U.S. EPA's AP-42, Chapter 3.4, Large Stationary Diesel And All Stationary Dual-fuel Engines, Tables 3.4-1, 3.4-2, 3.4-3, and 3.4-4 (October 1996).

2 The SO_2 emission factor was calculated based on the maximum allowable diesel fuel sulfur content under NSPS Subpart IIII:

Diesel Sulfur Content = 0.0015 wt.% Sulfur

3 PAH = Polycyclic Aromatic Hydrocarbons

GHG Emission Factors

Pollutant	Emission Factor (lb/MMBtu)[1]
CO_2	163.05
CH_4	6.61E-03
N_2O	1.32E-03
CO_2e[2]	163.61

Notes:

1 Per 40 CFR 98, Subpart C, Tables C-1 and C-2 for No. 2 fuel oil combustion. The emission factors were converted from kg/MMBtu to lb/MMBtu.

2 The CO_2e emission factor is calculated as the sum of each GHG pollutant multiplied by its global warming potential, per 40 CFR 98, Subpart A, Table A-1:

CO_2: 1
CH_4: 25
N_2O: 298

Hourly Emission Rates

Pollutant	G28-G31 Engines - Hourly Emissions (lb/hr/engine) [1, 2]						G32-G33 Engine - Hourly Emissions (lb/hr/engine) [1, 2]					
	10% Load	25% Load	50% Load	75% Load	Full Standby	Maximum	10% Load	25% Load	50% Load	75% Load	Full Standby	Maximum
Criteria Pollutants												
NO_X	6.46	9.30	12.81	22.77	42.48	**42.48**	2.50	3.76	5.49	8.62	15.13	**15.13**
CO	3.95	3.90	1.98	1.90	3.50	**3.95**	1.28	1.18	1.43	1.54	1.18	**1.54**
VOC	0.98	0.91	1.14	1.12	0.91	**1.14**	0.24	0.20	0.22	0.19	0.12	**0.24**
$PM/PM_{10}/PM_{2.5}$ [4]	0.47	0.62	0.35	0.31	0.40	**0.62**	0.17	0.25	0.39	0.19	0.15	**0.39**
SO_2	0.005	0.009	0.016	0.022	0.029	**0.029**	0.002	0.003	0.006	0.009	0.011	**0.011**
Hazardous Air Pollutants												
Benzene	2.81E-03	4.76E-03	8.24E-03	1.14E-02	1.47E-02	**1.47E-02**	1.02E-03	1.78E-03	3.05E-03	4.40E-03	5.58E-03	**5.58E-03**
Toluene	1.02E-03	1.73E-03	2.98E-03	4.14E-03	5.31E-03	**5.31E-03**	3.70E-04	6.43E-04	1.11E-03	1.59E-03	2.02E-03	**2.02E-03**
Xylenes	6.98E-04	1.18E-03	2.05E-03	2.84E-03	3.65E-03	**3.65E-03**	2.54E-04	4.42E-04	7.59E-04	1.09E-03	1.39E-03	**1.39E-03**
Formaldehyde	2.85E-04	4.84E-04	8.38E-04	1.16E-03	1.49E-03	**1.49E-03**	1.04E-04	1.81E-04	3.10E-04	4.48E-04	5.68E-04	**5.68E-04**
Acetaldehyde	9.12E-05	1.55E-04	2.68E-04	3.71E-04	4.77E-04	**4.77E-04**	3.32E-05	5.77E-05	9.91E-05	1.43E-04	1.81E-04	**1.81E-04**
Acrolein	2.85E-05	4.84E-05	8.37E-05	1.16E-04	1.49E-04	**1.49E-04**	1.04E-05	1.80E-05	3.10E-05	4.47E-05	5.67E-05	**5.67E-05**
Total PAH	7.67E-04	1.30E-03	2.25E-03	3.12E-03	4.01E-03	**4.01E-03**	2.79E-04	4.85E-04	8.34E-04	1.20E-03	1.53E-03	**1.53E-03**
Total HAP	5.69E-03	9.66E-03	1.67E-02	2.32E-02	2.98E-02	**2.98E-02**	2.07E-03	3.60E-03	6.19E-03	8.93E-03	1.13E-02	**1.13E-02**
Greenhouse Gases												
CO_2	589.86	1,000.98	1,731.60	2,401.90	3,083.37	**3,083.37**	214.50	373.13	641.25	925.01	1,173.02	**1,173.02**
CH_4	0.02	0.04	0.07	0.10	0.13	**0.13**	0.01	0.02	0.03	0.04	0.05	**0.05**
N_2O	0.005	0.008	0.014	0.019	0.025	**0.03**	0.002	0.003	0.005	0.008	0.010	**0.01**
CO_2e	591.89	1,004.41	1,737.55	2,410.14	3,093.95	**3,093.95**	215.23	374.41	643.45	928.19	1,177.05	**1,177.05**

Notes:

1 For engine-specific emission factors:
Hourly Emissions at Load *X* (lb/hr/engine) = Emission Factor at Load *X* (g/hp-hr) x Engine Power at Load *X* (bhp/engine) / (453.6 g/lb)

2 For AP-42 & GHG emission factors:
Hourly Emissions at Load *X* (lb/hr/engine) = Emission Factor (lb/MMBtu) x Heat Input at Load *X* (MMBtu/hr/engine)

3 Total PM/PM10/PM2.5 is the sum of filterable PM/PM10/PM2.5 and condensable PM.

Potential to Emit - All Pollutants

Pollutant	Potential Annual Emissions G28-G31 (tpy)	Potential Annual Emissions G32-G33 (tpy)
Maximum Engine Operation (hr/yr/engine)	**66**	**66**
Criteria Pollutants		
NO_X	5.61	1.00
CO	0.52	0.10
VOC	0.15	0.02
$PM/PM_{10}/PM_{2.5}$	0.08	0.03
SO_2	3.78E-03	7.19E-04
Hazardous Air Pollutants		
Benzene	1.94E-03	3.68E-04
Toluene	7.01E-04	1.33E-04
Xylenes	4.82E-04	9.16E-05
Formaldehyde	1.97E-04	3.75E-05
Acetaldehyde	6.29E-05	1.20E-05
Acrolein	1.97E-05	3.74E-06
Total PAH	5.29E-04	1.01E-04
Total HAP	3.93E-03	7.47E-04
Greenhouse Gases		
CO_2	407.01	77.42
CH_4	0.02	0.00
N_2O	0.003	0.001
CO_2e	408.40	77.69

Notes:

1 Total potential annual emissions of all pollutants were based on the maximum hourly emission rate (as determined using the emissions data summarized above) for each engine grouping conservatively assuming the maximum annual operating rate shown for each engine group.

SLC01 COOLING TOWER PM10 AND PM2.5 EMISSIONS

1) Using Drift Particle Size Analysis, Determine the Percent of Drift that Results as PM10 and PM2.5 after Evaporation:

Assumptions:
Assume PM10 density = 2.2 g/cm3 = 0.0000022 ug/um3
Assume H2O density = 1 g/cm3 = 0.000001 ug/um3

Circulating Water TDS = 1330 ppm *(Input Value)*
(Total Dissolved Solids)

Calculational Method Applied to Determine Particle Size After Evaporation of Water:
EPRI*

Droplet Diam (um)	Droplet Vol (um^3)	Droplet Mass (ug)	Particle Mass (ug)	Particle Vol (um^3)	Particle Diam (um)	EPRI % Mass Smaller	Mass Fraction in bin		Interpolate to find mass percent of PM10:	Interpolate to find mass percent of PM2.5:
10	524	0.0005	0.00000	0.32	0.85	0.000	0.0000	0.85		
20	4189	0.0042	0.00001	2.53	1.69	0.196	0.1960	1.69		
30	14137	0.0141	0.00002	8.55	2.54	0.226	0.0300	2.54		**0.22**
40	33510	0.0335	0.00004	20.26	3.38	0.514	0.2880	3.38		
50	65450	0.0654	0.00009	39.57	4.23	1.816	1.3020	4.23		
60	113097	0.1131	0.00015	68.37	5.07	5.702	3.8860	5.07		
70	179594	0.1796	0.00024	108.57	5.92	21.348	15.6460	5.92		
90	381704	0.3817	0.00051	230.76	7.61	49.812	28.4640	7.61		
110	696910	0.6969	0.00093	421.31	9.30	70.509	20.6970	9.30		
130	1150347	1.1503	0.00153	695.44	10.99	82.023	11.5140	10.99	**75.27**	
150	1767146	1.7671	0.00235	1068.32	12.68	88.012	5.9890	12.68		
180	3053628	3.0536	0.00406	1846.06	15.22	91.032	3.0200	15.22		
210	4849048	4.8490	0.00645	2931.47	17.76	92.468	1.4360	17.76		
240	7238229	7.2382	0.00963	4375.84	20.29	94.091	1.6230	20.29		
270	10305995	10.3060	0.01371	6230.44	22.83	94.689	0.5980	22.83		
300	14137167	14.1372	0.01880	8546.56	25.37	96.288	1.5990	25.37		
350	22449298	22.4493	0.02986	13571.62	29.59	97.011	0.7230	29.59		
400	33510322	33.5103	0.04457	20258.51	33.82	98.340	1.3290	33.82		
450	47712938	47.7129	0.06346	28844.64	38.05	99.071	0.7310	38.05		
500	65449847	65.4498	0.08705	39567.41	42.28	99.071	0.0000	42.28		
600	113097336	113.0973	0.15042	68372.48	50.73	100.000	0.9290	50.73		

*EPRI Data - Test Cell, Drift Efficiency = 0.0003%

2) Calculate the <u>Total</u> PM in the Cooling Tower Drift:
Circulating Water Rate: 20,520 gpm *(Input Value)*
Drift Rate: 0.005 % *(Input Value)*
Hours per year operation 8760 hr/yr *(Input Value)*

Total PM = 0.68 lb/hr
(On annual basis =) 2.99 tpy

3) Multiply Total PM by PM10 fraction to obtain PM10 emissions:

0.68 x 0.7527 = <u>0.514</u> <u>lb/hr PM10</u>

or, <u>2.25</u> <u>tpy</u>

4) Multiply Total PM by PM2.5 fraction to obtain PM2.5 emissions:

0.68 x 0.0022 = <u>0.002</u> <u>lb/hr PM10</u>

or, <u>0.007</u> <u>tpy</u>

Reference: Joel Reisman et al, 2002. Calculating Realistic PM10 Emissions from Cooling Towers. Environmental Progress, Volume 21, Issue 2, pages 127–130, July 2002

RAMBOLL

SLC02 PHASE 1 COOLING TOWER PM10 AND PM2.5 EMISSIONS

1) Using Drift Particle Size Analysis, Determine the Percent of Drift that Results as PM10 and PM2.5 after Evaporation:

Assumptions:
Assume PM10 density = 2.2 g/cm3 = 0.0000022 ug/um3
Assume H2O density = 1 g/cm3 = 0.000001 ug/um3

Circulating Water TDS = 1330 ppm *(Input Value)*
(Total Dissolved Solids)

Calculational Method Applied to Determine Particle Size After Evaporation of Water:
EPRI*

Droplet Diam (um)	Droplet Vol (um^3)	Droplet Mass (ug)	Particle Mass (ug)	Particle Vol (um^3)	Particle Diam (um)	EPRI % Mass Smaller	Mass Fraction in bin		Interpolate to find mass percent of PM10:	Interpolate to find mass percent of PM2.5:
10	524	0.0005	0.00000	0.32	0.85	0.000	0.0000	0.85		
20	4189	0.0042	0.00001	2.53	1.69	0.196	0.1960	1.69		
30	14137	0.0141	0.00002	8.55	2.54	0.226	0.0300	2.54		**0.22**
40	33510	0.0335	0.00004	20.26	3.38	0.514	0.2880	3.38		
50	65450	0.0654	0.00009	39.57	4.23	1.816	1.3020	4.23		
60	113097	0.1131	0.00015	68.37	5.07	5.702	3.8860	5.07		
70	179594	0.1796	0.00024	108.57	5.92	21.348	15.6460	5.92		
90	381704	0.3817	0.00051	230.76	7.61	49.812	28.4640	7.61		
110	696910	0.6969	0.00093	421.31	9.30	70.509	20.6970	9.30		
130	1150347	1.1503	0.00153	695.44	10.99	82.023	11.5140	10.99	**75.27**	
150	1767146	1.7671	0.00235	1068.32	12.68	88.012	5.9890	12.68		
180	3053628	3.0536	0.00406	1846.06	15.22	91.032	3.0200	15.22		
210	4849048	4.8490	0.00645	2931.47	17.76	92.468	1.4360	17.76		
240	7238229	7.2382	0.00963	4375.84	20.29	94.091	1.6230	20.29		
270	10305995	10.3060	0.01371	6230.44	22.83	94.689	0.5980	22.83		
300	14137167	14.1372	0.01880	8546.56	25.37	96.288	1.5990	25.37		
350	22449298	22.4493	0.02986	13571.62	29.59	97.011	0.7230	29.59		
400	33510322	33.5103	0.04457	20258.51	33.82	98.340	1.3290	33.82		
450	47712938	47.7129	0.06346	28844.64	38.05	99.071	0.7310	38.05		
500	65449847	65.4498	0.08705	39567.41	42.28	99.071	0.0000	42.28		
600	113097336	113.0973	0.15042	68372.48	50.73	100.000	0.9290	50.73		

*EPRI Data - Test Cell, Drift Efficiency = 0.0003%

2) Calculate the <u>Total</u> PM in the Cooling Tower Drift:
Circulating Water Rate: 3,600 gpm *(Input Value)*
Drift Rate: 0.0005 % *(Input Value)*
Hours per year operation 8760 hr/yr *(Input Value)*

Total PM = 0.012 lb/hr
(On annual basis =) 0.052 tpy

3) Multiply Total PM by PM10 fraction to obtain PM10 emissions:

0.012 x 0.7527 = <u>0.009</u> <u>lb/hr PM10</u>

or, <u>0.04</u> <u>tpy</u>

4) Multiply Total PM by PM2.5 fraction to obtain PM2.5 emissions:

0.012 x 0.0022 = <u>0.000027</u> <u>lb/hr PM2.5</u>

or, <u>0.00012</u> <u>tpy</u>

Reference: Joel Reisman et al, 2002. Calculating Realistic PM10 Emissions from Cooling Towers. Environmental Progress, Volume 21, Issue 2, pages 127–130, July 2002

SLC02 Phase 1 - Bloom Energy Servers - Air Emissions for 6 MW of Power

Model:	**ES-5700**	
Output Power	6	MW
Number of Servers:	30	
Power Output per Box	200	kW
Number of Hours/Year	8760	hr

Criteria Pollutant	Emission Factor	Hourly Emission Rate - Single Server	Annual Emissions - Single Server	Annual Emissions - All Servers
	(lb/MWh)	(lbs/hr)	(tons/yr)	(tons/yr)
Particulate Material - PM_{10} (and $PM_{2.5}$)	0.00	0.00	**0.00**	**0.00**
Sulfur Dioxide - SO2	0.00	0.00	**0.00**	**0.00**
Nitrogen Oxides - NO_x	0.01	0.00	**0.01**	**0.26**
Hydrocarbons - HC	0.02	0.00	**0.02**	**0.53**
Carbon Monoxide - CO	0.10	0.02	**0.09**	**2.63**
Carbon Dioxide - CO2	773.00	154.60	**677.15**	**20,314.44**

There are no data for CH4 or N2O emissions available from Bloom Energy. However, by examining the ratios of the emission factors of CH4 and N2O to CO2 for natural gas combustion of
in EPA's "Emission Factors for Greenhouse Gas Inventories,"
(available at http://www.epa.gov/climateleadership/documents/emission-factors.pdf),
and considering the GWP values of 21 and 310, respectively, we can see that the contribution to CO2eq is <0.1%:

	Ratio	GWP	Percent CO2eq
CH4 = (1.0 g)/(53.02 kg) =	1.88608E-05	21	0.040%
N2O = (0.1 g)/(53.02 kg) =	1.88608E-06	310	0.058%

SLC02 Phase 2 - Additional Bloom Energy Servers - Air Emissions for 5.0 MW of Power

Model:	**ES-5710**	
Output Power	5.0	MW
Number of Servers:	20	
Power Output per Box	250	kW
Number of Hours/Year	8760	hr

Criteria Pollutant	Emission Factor	Hourly Emission Rate - Single Server	Annual Emissions - Single Server	Annual Emissions - All Servers
	(lb/MWh)	(lbs/hr)	(tons/yr)	(tons/yr)
Particulate Material - PM_{10} (and $PM_{2.5}$)	0.00	0.00	**0.00**	**0.00**
Sulfur Dioxide - SO2	0.00	0.00	**0.00**	**0.00**
Nitrogen Oxides - NO_x	0.01	0.00	**0.01**	**0.22**
Hydrocarbons - HC	0.02	0.01	**0.02**	**0.44**
Carbon Monoxide - CO	0.10	0.03	**0.11**	**2.19**
Carbon Dioxide - CO2	773.00	193.25	**846.44**	**16,928.70**

There are no data for CH4 or N2O emissions available from Bloom Energy. However, by examining the ratios of the emission factors of CH4 and N2O to CO2 for natural gas combustion of EPA's "Emission Factors for Greenhouse Gas Inventories," (available at http://www.epa.gov/climateleadership/documents/emission-factors.pdf), and considering the GWP values of 21 and 310, respectively, we can see that the contribution to CO2eq is <0.1%:

	Ratio	**GWP**	**Percent CO2eq**
CH4 = (1.0 g)/(53.02 kg) =	1.88608E-05	21	0.040%
N2O = (0.1 g)/(53.02 kg) =	1.88608E-06	310	0.058%

State of Utah

GARY R. HERBERT
Governor

SPENCER J. COX
Lieutenant Governor

Department of
Environmental Quality

L. Scott Baird
Executive Director

DIVISION OF AIR QUALITY
Bryce C. Bird
Director

RN141800011

October 28, 2020

Charlie Hill
eBay Inc.
6614 West Crimson View Drive
South Jordan, UT 84095

Dear Charlie Hill,

Re: Engineer Review:
Modification of AO DAQE-AN141800010-19 to Add Six Emergency Generators and Update the Site Name
Project Number: N141800011

The DAQ requests a company representative (Title V Responsible Official for enhanced Approval Order application) review and sign the attached Engineer Review (ER). This ER identifies all applicable elements of the New Source Review permitting program. eBay Inc. should complete this review within **10 business days** of receipt.

eBay Inc. should contact **John Jenks** at (385) 306-6510 if there are questions or concerns with the review of the draft permit conditions. Upon resolution of your concerns, please email jjenks@utah.gov the signed cover letter to John Jenks. Upon receipt of the signed cover letter, the DAQ will prepare an ITA for a 30-day public comment period. At the completion of the comment period, the DAQ will address any comments and will prepare an AO for signature by the DAQ Director.

If eBay Inc. does not respond to this letter within **10 business days,** the project will move forward without source concurrence. If eBay Inc. has concerns that cannot be resolved and the project becomes stagnant, the DAQ Director may issue an Order prohibiting construction.

Approval Signature _____
(Signature & Date)

☐ By (Title V responsible official) initialing this box and signing this document, this document serves as an enhanced application and the public comment period will serve as the required comment period for Title V purposes.

The Title V responsible official certifies: based on information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate, and complete.

UTAH DIVISION OF AIR QUALITY
ENGINEER REVIEW

SOURCE INFORMATION

Project Number	N141800011
Owner Name	eBay Inc.
Mailing Address	6614 West Crimson View Drive South Jordan, UT, 84095
Source Name	eBay Inc.- SLC Data Center
Source Location	6614 West Crimson View Drive South Jordan, UT 84095
UTM Projection	411,299 m Easting, 4,490,858 m Northing
UTM Datum	NAD83
UTM Zone	UTM Zone 12
SIC Code	7374 (Computer Processing & Data Preparation & Processing Services)
Source Contact	Charlie Hill
Phone Number	(480) 217-8872
Email	charlhill@ebay.com
Project Engineer	John Jenks, Engineer
Phone Number	(385) 306-6510
Email	jjenks@utah.gov
Notice of Intent (NOI) Submitted	June 1, 2020
Date of Accepted Application	June 26, 2020

SOURCE DESCRIPTION

General Description
eBay SLC Data Center (eBay), is a computer data center located in South Jordan. The facility consists of diesel-fired emergency backup generators that provide electricity to the facility's data servers and backup storage devices in the event of an emergency, diesel-powered fire pump engines, cooling towers, and a number of bloom energy servers.

NSR Classification:
Minor Modification at Minor Source

Source Classification
Located in , Salt Lake City UT $PM_{2.5}$ NAA, Salt Lake County SO_2 NAA,
Salt Lake County
Airs Source Size: B

Applicable Federal Standards
NSPS (Part 60), A: General Provisions
NSPS (Part 60), IIII: Standards of Performance for Stationary Compression Ignition Internal Combustion Engines
MACT (Part 63), A: General Provisions
MACT (Part 63), ZZZZ: National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines

Project Proposal
Modification of AO DAQE-AN141800010-19 to Add Six Emergency Generators and Update the Site Name

Project Description
eBay has submitted a NOI for the addition of six additional diesel-fired emergency back-up generators at its existing data center in South Jordan. eBay has also requested a name change for the facility, currently listed as "Topaz (South Jordan) Data Center" to "SLC Data Center".

EMISSION IMPACT ANALYSIS

eBay Inc. is seeking a modified approval order for their South Jordan Data Center,
The Staff of the New Source Review Section (NSR), prepared a modeling report (DAQE-MN141800011-20), which contains a review of the air quality impact analysis (AQIA) including the information, data, assumptions and modeling results used to determine if the facility would be in compliance with State and Federal concentration standards. The full report is included in the source file for this project.

As a result of the modeling and, based on additional information provided by the source on June 30, 2020, the following suggested permit language should be included under the Terms and Conditions in the AO:
1. Testing of each generator (G1-through G7) may occur once per month from 8 am to 6 pm for 30 minutes, with a maximum of four (4) of these generators tested simultaneously.
2. Testing of each generator (G8-through G33) may occur once per month from 8 am to 6 pm for 30 minutes, with a maximum of two (2) of these generators tested simultaneously.
3. In addition to monthly testing, each generator may be tested for one (1) hour once per year from 8 am to 6 pm. [Last updated October 28, 2020]

SUMMARY OF EMISSIONS

The emissions listed below are an estimate of the total potential emissions from the source. Some rounding of emissions is possible.

Criteria Pollutant	Change (TPY)	Total (TPY)
CO_2 Equivalent	-1139	41355.00
Carbon Monoxide	2.59	11.38
Nitrogen Oxides	1.78	56.35
Particulate Matter - PM_{10}	0.34	3.00
Particulate Matter - $PM_{2.5}$	-1.91	0.71
Sulfur Oxides	-0.06	0.06
Volatile Organic Compounds	0.51	2.26

Hazardous Air Pollutant	Change (lbs/yr)	Total (lbs/yr)
Generic HAPs (CAS #GHAPS)	-160	80
	Change (TPY)	**Total (TPY)**
Total HAPs	-0.08	0.04

Note: Change in emissions indicates the difference between previous AO and proposed modification.

Review of BACT for New/Modified Emission Units

1. **BACT review regarding emergency generators**

Prior to obtaining an AO, all new and modified sources of air pollution are required to implement best available control technology or BACT (R307-401-8(1)(a), plus the definition in R307-401-2). In the NOI for this project, eBay opted to evaluate BACT using a combination of a minimum required analysis and a modified "top-down" approach based on USEPA's suggested methodology. The emergency backup generators to be installed at the facility would be certified by the manufacturer to meet the requirements of USEPA's Tier 2 emission standards, in accordance with the requirements of 40 CFR 60 Subpart IIII. The primary pollutant of concern is NO_x, as indicated by the potential emissions of the emergency backup generators and local attainment considerations (i.e., NO_x is a precursor pollutant for secondary formation of ozone, PM_{10}, and $PM_{2.5}$).

In its analysis, eBay evaluated potential control technologies for reducing NO_x emissions from diesel-fired engines. Of all potential technologies, those technically capable of reducing NO_x emissions from diesel-fired engines of equivalent capacity to those used at the facility include the use of (1) SCRs, (2) engines certified by the manufacturer to the USEPA's Tier 4 emissions standards under 40 CFR 60 Subpart IIII, and (3) engines certified by the manufacturer to the USEPA's Tier 2 emission standards under 40 CFR 60 Subpart IIII.

SCR Control Effectiveness

The control efficiency of this technology is dependent on several factors including generator load, catalyst state, and exhaust temperature. The SCR controls evaluated are estimated to achieve up to a 90% reduction in NO_x emissions, which would equate to a NO_x emission rate of 0.66 g/bhp-hr (4.25 lb/hr/generator) for G28-G31 and 0.62 g/bhp-hr (1.51 lb/hr/generator) for G32-G33. To ensure the SCR systems operate effectively, the units must be operated and maintained in accordance with the manufacturer's recommendations. However, since SCR's require exhaust temperatures of 260°C to 540°C (500°F-1,004°F), it may be difficult for emergency generators to meet these temperatures since most of their operations are on low loads and for short periods of time. Therefore, if the exhaust temperature was not met for these runs, the SCR would not activate, and the desired NO_x reduction would not be met. Additionally, an increase in load size or run duration for the activation of the SCR would result in additional emissions from the engines.

Evaluation of Energy Impacts of SCR

The energy required to operate SCR after-treatment is minimal relative to that of a generator. During the winter months, there would be a small input of energy into the SCR unit to prevent freezing of the urea solution.

Evaluation of Environmental Impacts of SCR

During operation of the SCR unit, the reaction of NO_x, urea, and oxygen would result in the formation of CO_2 emissions to the atmosphere, in addition to the formation of nitrogen and water vapor emissions. However, the amount of CO_2 emissions from urea usage is a minor contributor to the overall GHG emissions from the engines resulting from diesel combustion, and the environmental impact of the additional CO_2 emissions is more than offset by the benefit of NO_x reduction. Additionally, the SCR process requires the installation of reagent storage facilities, a system capable of metering and diluting the stock reagent into the appropriate solution, and an atomization/injection system at the appropriate locations in the combustion unit. [Last updated August 21, 2020]

2. **BACT review regarding emergency engines cont.**

Evaluation of Economic Impacts of SCR

The economic impact of installing SCR technology is significant. The procurement and installation process would consume a large amount of capital, and there would also be long term costs associated with the maintenance, repair, consumables, and catalyst storage and regeneration associated with operating the SCR units.

Most SCR units would require the installation of a diesel particulate filter (DPF) to prevent fouling and potential poisoning of the catalyst bed from diesel particulates. The cost of the DPF is variable, based on the power range of the engine - but can add as much as $100,000 to the initial cost of the SCR to a larger engine. In terms of cost per ton, SCR can run as much as $175,000/ton of NO_x removed.

Evaluation of USEPA Tier 4 Certification

40 CFR 60 Subpart IIII requires owners and operators of new non-emergency diesel-fired ICE with a rated power output of greater than 560 kW to purchase engines that are certified by the manufacturer to the USEPA's Tier 4 nonroad engine emission standards. As such, the proposed diesel-fired emergency backup generators to be installed at the site are not subject to Tier 4 certification. Based on the analysis provided, the applicant considers the use of Tier 4-certified engines to be effectively equivalent from an emissions performance perspective to the use of Tier 2-certified engines utilizing SCR for NO_x emissions control. The emission profile is effectively equivalent - yielding a NO_x emission value of 0.67 g/kWh. The purchase and operation of Tier 4 engines would require an additional $156,000/ton of NO_x removed for the 750 kW engines, and $329,000/ton of NO_x removed for the 2.0 MW engines.

Evaluation of USEPA Tier 2 Certification

40 CFR 60 Subpart IIII requires owners and operators of new emergency diesel-fired ICE to purchase engines certified by the manufacturer to the USEPA's nonroad engine emission standards. Since the use of Tier 2-certified engines does not involve an exhaust stream control technique, there are no associated adverse environmental, energy, or economic impacts. As this represents the base case of the applicant's evaluation, no additional control cost is associated with this option.

Selection of BACT for NO_x.

In reviewing the control techniques described above, eBay has determined that the Tier 2 engines meet BACT for NO_x by implementing good operating practices and through purchasing an engine certified to the required Tier 2 emissions standards. Although the Tier 4 engine and Tier 2 engines with SCR are technically feasible, due to the low potential emission reduction for the generators and the high capital and annual operating costs, these options were determined to be economically infeasible.

BACT Determination for Other Criteria Pollutants

Emissions of all other criteria pollutants would be less than 1 tpy for each emergency generator. Due to the low emission rates of these pollutants, they do not warrant control technology beyond those inherent to Tier 2 generators, which is considered BACT for this facility. This conclusion is consistent with the USEPA's determination in the development of 40 CFR 60 Subpart IIII that add-on controls are not economically viable for emergency ICE.

UDAQ has reviewed the analysis submitted by eBay and agrees with this determination. It is the recommendation of the NSR section that the use of Tier 2 engines be accepted as BACT. [Last updated July 28, 2020]

SECTION I: GENERAL PROVISIONS

The intent is to issue an air quality AO authorizing the project with the following recommended conditions and that failure to comply with any of the conditions may constitute a violation of the AO. **(New or Modified conditions are indicated as "New" in the Outline Label):**

I.1	All definitions, terms, abbreviations, and references used in this AO conform to those used in the UAC R307 and 40 CFR. Unless noted otherwise, references cited in these AO conditions refer to those rules. [R307-101]
I.2	The limits set forth in this AO shall not be exceeded without prior approval. [R307-401]
I.3	Modifications to the equipment or processes approved by this AO that could affect the emissions covered by this AO must be reviewed and approved. [R307-401-1]
I.4	All records referenced in this AO or in other applicable rules, which are required to be kept by the owner/operator, shall be made available to the Director or Director's representative upon request, and the records shall include the two-year period prior to the date of the request. Unless otherwise specified in this AO or in other applicable state and federal rules, records shall be kept for a minimum of two (2) years. [R307-401-8]
I.5	At all times, including periods of startup, shutdown, and malfunction, owners and operators shall, to the extent practicable, maintain and operate any equipment approved under this AO, including associated air pollution control equipment, in a manner consistent with good air pollution control practice for minimizing emissions. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Director which may include, but is not limited to, monitoring results, opacity observations, review of operating and maintenance procedures, and inspection of the source. All maintenance performed on equipment authorized by this AO shall be recorded. [R307-401-4]
I.6	The owner/operator shall comply with UAC R307-107. General Requirements: Breakdowns. [R307-107]
I.7	The owner/operator shall comply with UAC R307-150 Series. Emission Inventories. [R307-150]
I.8	The owner/operator shall submit documentation of the status of construction/installation of the new emergency generators listed in II.A.8 to the Director within 18 months from the date of this AO. This AO may become invalid if construction/installation is not commenced within 18 months from the date of this AO or if construction/installation is discontinued for 18 months or more. To ensure proper credit when notifying the Director, send the documentation to the Director, attn.: NSR Section. [R307-401-18]

SECTION II: PERMITTED EQUIPMENT

The intent is to issue an air quality AO authorizing the project with the following recommended conditions and that failure to comply with any of the conditions may constitute a violation of the AO. **(New or Modified conditions are indicated as "New" in the Outline Label):**

II.A THE APPROVED EQUIPMENT

II.A.1	**Data Center** Computer data center
II.A.2	**Cooling Tower Plants (2)** 1. 35 MW cooling capacity 2. 6 MW cooling capacity
II.A.3	**Bloom Energy Servers** Number of servers: thirty (30) Rating: 200 kW - each Number of servers: twenty (20) Rating: 250 kW - each
II.A.4	**Fire System Pump Engines (2)** Rating: 148 hp and 86 hp Fuel: Diesel
II.A.5	**Emergency Generator Engines - SLC01** Fuel: Diesel G1 rating 3.25 MW G2 rating 3.25 MW G3 rating 3.25 MW G4 rating 3.25 MW G5 rating 3.25 MW G6 rating 3.25 MW G7 rating 3.25 MW

II.A.6	**Emergency Generator Engines - SLC02** Type: Tier 2 or better Fuel: Diesel G8 rating 3.1 MW G9 rating 3.0 MW G10 rating 3.0 MW G11 rating 3.0 MW G12 rating 3.0 MW G13 rating 3.0 MW G14 rating 3.0 MW G24 rating 2.5 MW G25 rating 2.5 MW G26 rating 2.0 MW G27 rating 2.0 MW
II.A.7	**Emergency Generator Engines - SLC03** Type: Tier 2 or better with manufacturer year October 2016 or newer. Fuel: Diesel G15 rating 2.0 MW G16 rating 2.0 MW G17 rating 1.5 MW G18 rating 1.5 MW G19 rating 2.0 MW G20 rating 2.0 MW G21 rating 2.0 MW G22 rating 2.0 MW G23 rating 1.0 MW
II.A.8 NEW	**Emergency Generator Engines - SLC03 Phase 2** Type: Tier 2 or better with manufacturer year October 2016 or newer. Fuel: Diesel G28 rating 2.0 MW G29 rating 2.0 MW G30 rating 2.0 MW G31 rating 2.0 MW G32 rating 750 kW G33 rating 750 kW

SECTION II: SPECIAL PROVISIONS

The intent is to issue an air quality AO authorizing the project with the following recommended conditions and that failure to comply with any of the conditions may constitute a violation of the AO. **(New or Modified conditions are indicated as "New" in the Outline Label):**

II.B REQUIREMENTS AND LIMITATIONS

II.B.1	**Source-Wide Requirements**

II.B.1.a	Visible emissions from any stationary point associated with the source or with the control facilities shall not exceed 20% opacity. [R307-305-3, R307-401-8]
II.B.1.a.1	Opacity observations of emissions from stationary sources shall be conducted in accordance with 40 CFR 60, Appendix A, Method 9. [R307-305-5]
II.B.2	**Emergency Generator Engine Requirements**
II.B.2.a NEW	The owner/operator shall not operate each emergency engine listed in II.A.4 for more than 100 hours per calendar year during non-emergency situations. The owner/operator shall not operate each emergency engine listed in II.A.5 through II.A.8 for more than 66 hours per calendar year during non-emergency situations. There is no time limit on the use of the engines during emergencies. [40 CFR 60 Subpart ZZZZ, R307-401-8]
II.B.2.b NEW	For the emergency generator engines listed in II.A.5 through II.A.8, operations during engine operator training, engine maintenance, and engine compliance testing (OMT operations) shall be conducted as follows: 1. All engine compliance testing shall be conducted as outlined in 40 CFR 60 Subpart IIII or 40 CFR 63 Subpart ZZZZ as appropriate. 2. OMT operation of each generator (G1-through G7) may occur once per month from 8 am to 6 pm for 30 minutes, with a maximum of four (4) of these generators in operation simultaneously. 3. OMT operation of each generator (G8-through G33) may occur once per month from 8 am to 6 pm for 30 minutes, with a maximum of two (2) of these generators in operation simultaneously. 4. In addition to monthly OMT operation, each generator may be tested for one (1) hour once per calendar year from 8 am to 6 pm. [R307-401-8]
II.B.2.c	A non-resettable hour meter shall be installed and operational on all engines. [R307-401-8, 40 CFR 63 Subpart ZZZZ]
II.B.2.d NEW	To determine compliance with the calendar year total, the owner/operator shall calculate a monthly total by the 20th day of each month. The sum of these monthly totals from January through December of any given year, inclusive, shall constitute the calendar year total. Records documenting the operation of each emergency engine shall be kept in a log and shall include the following: a. The date the emergency engine was used b. The duration of operation in hours c. The reason for the emergency engine usage. [40 CFR 60 Subpart ZZZZ, R307-401-8]
II.B.2.e	The owner/operator shall only use diesel fuel (fuel oil #1, #2 or diesel fuel oil additives) in any emergency generator engines located on site. All diesel burned shall meet the definition of ultra-low sulfur diesel (ULSD), and contain no more than 15 ppm sulfur. [40 CFR 60 Subpart IIII]

II.B.2.e.1 NEW	To demonstrate compliance with the ULSD fuel requirement, the owner/operator shall maintain records of diesel fuel purchase invoices or obtain certification of sulfur content from the diesel fuel supplier. The diesel fuel purchase invoices shall indicate that the diesel fuel meets the ULSD requirements. [R307-401-8]

PERMIT HISTORY

When issued, the approval order shall supersede (if a modification) or will be based on the following documents:

Is Derived From	Source Submitted NOI dated June 1, 2020
Incorporates	Additional Information Received dated June 8, 2020
Incorporates	Additional Information Received dated July 24, 2020

REVIEWER COMMENTS

1. **Comment regarding change in AO conditions:**
There were a few slight changes in AO conditions as a result of this project. The changes are summarized as follows:

1. The equipment list was updated to include the new emergency generators listed in II.A.8.
2. The "new" labels associated with the equipment authorized on previous incarnations of this AO (DAQE-AN141800010-19 and earlier) have been removed as they are no longer relevant - the equipment has been installed and would now be considered "existing". The new equipment from this project includes the new generators included in item #1 above.
3. The general conditions I.1 through I.8 have been relisted to ensure that the most recent version of these conditions is included.
4. Small updates in the wording and numerical order of the emergency engine requirements in section II.B.2 were made to match UDAQ's most recent template. The only substantive changes include a correction to the testing language to match the language requirement provided by modeling (see the modeling review section of this document and DAQE-MN141800011-20 for details), and a change in the general hours of operation restriction previously found in Condition II.B.2.a to match what is allowed under 40 CFR 60 Subpart IIII and 40 CFR 63 Subpart ZZZZ.
5. A number of duplicated conditions, made redundant by the changes listed in item #4, have been removed for clarity.
6. The requested change to the name of the site was made - the new name is now listed as "eBay Inc. SLC Data Center"
7. Other small consistency changes in the equipment listing were also included.
8. The format and structure of the document now matches UDAQ's latest Source Plan Review style.
[Last updated October 28, 2020]

2. **Comment regarding changes in emission totals:**
The emissions for the facility are shown in the "Summary of Emissions" table on page 3 of this document. Normally, the change in emissions column - marked as "Change (TPY)" in the table - shows the difference between this current project and the previously permitted values. The difference in emissions should therefore represent only the change in emissions from the effects of the current project - the addition of the new emergency generators.

In this case (as is standard procedure), the original permitted values were taken from the previous AO - DAQE-AN141800010-19. However, the emissions values included in DAQE-AN141800010-19 were based on certain assumptions which are no longer correct: specifically, 1) that emissions are calculated based on generic emission factors from AP-42, and 2) that these emission factors are then multiplied by the operating hours listed in that AO as appropriate for testing and maintenance of each engine. The source has submitted updated information for both assumptions. Potential

emissions from the existing equipment were updated to use not-to-exceed manufacturer emissions data. The source has also updated the annual operating hour limits as shown in the new proposed conditions II.B.2.a and II.B.2.b.

Thus, the Summary of Emissions table shows the combined effect of both adding the new generators as well as the changes in the underlying assumptions for the existing equipment. What is not shown is the effect on potential emissions from only the addition of the new engines. The source did provide this information on page 5 of the NOI. The increase in potential emissions for the addition of the new engines is as follows (all values listed are in tons per year): PM_{10}: 0.11, $PM_{2.5}$: 0.11, NO_x: 6.61, SO_2: 4.5E-03, CO: 0.62, VOC: 0.17, HAPs: 4.7E-03, and CO_2e: 486.09. The column labelled "Total (TPY)" in the Summary of Emissions table does reflect the final change in facility-wide potential emissions following all changes related to this project and to the recalculation of emissions from existing equipment.

The source is not an existing major source for any pollutant, and the increase in emissions does not trigger any provisions of R307-403 or R307-405. This project is classified as a minor modification under both the attainment area (PSD) and nonattainment/maintenance area NSR rules. [Last updated October 27, 2020]

ACRONYMS

The following lists commonly used acronyms and associated translations as they apply to this document:

40 CFR	Title 40 of the Code of Federal Regulations
AO	Approval Order
BACT	Best Available Control Technology
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CDS	Classification Data System (used by EPA to classify sources by size/type)
CEM	Continuous emissions monitor
CEMS	Continuous emissions monitoring system
CFR	Code of Federal Regulations
CMS	Continuous monitoring system
CO	Carbon monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent - 40 CFR Part 98, Subpart A, Table A-1
COM	Continuous opacity monitor
DAQ/UDAQ	Division of Air Quality
DAQE	This is a document tracking code for internal UDAQ use
EPA	Environmental Protection Agency
FDCP	Fugitive dust control plan
GHG	Greenhouse Gas(es) - 40 CFR 52.21 (b)(49)(i)
GWP	Global Warming Potential - 40 CFR Part 86.1818-12(a)
HAP or HAPs	Hazardous air pollutant(s)
ITA	Intent to Approve
LB/HR	Pounds per hour
LB/YR	Pounds per year
MACT	Maximum Achievable Control Technology
MMBTU	Million British Thermal Units
NAA	Nonattainment Area
NAAQS	National Ambient Air Quality Standards
NESHAP	National Emission Standards for Hazardous Air Pollutants
NOI	Notice of Intent
NO_x	Oxides of nitrogen
NSPS	New Source Performance Standard
NSR	New Source Review
PM_{10}	Particulate matter less than 10 microns in size
$PM_{2.5}$	Particulate matter less than 2.5 microns in size
PSD	Prevention of Significant Deterioration
PTE	Potential to Emit
R307	Rules Series 307
R307-401	Rules Series 307 - Section 401
SO_2	Sulfur dioxide
Title IV	Title IV of the Clean Air Act
Title V	Title V of the Clean Air Act
TPY	Tons per year
UAC	Utah Administrative Code
VOC	Volatile organic compounds

State of Utah
GARY R. HERBERT
Governor
SPENCER J. COX
Lieutenant Governor

Department of
Environmental Quality
L. Scott Baird
Executive Director
DIVISION OF AIR QUALITY
Bryce C. Bird
Director

RN141800011

August 21, 2020

Eileen Ovrahim
eBay Inc.
6614 West Crimson View Drive
South Jordan, UT 84095

Dear Eileen Ovrahim,

Re: Engineer Review:
Modification of AO DAQE-AN141800010-19 to Add Six Emergency Generators and Update the Site Name
Project Number: N141800011

The DAQ requests a company representative (Title V Responsible Official for enhanced Approval Order application) review and sign the attached Engineer Review (ER). This ER identifies all applicable elements of the New Source Review permitting program. eBay Inc. should complete this review within **10 business days** of receipt.

eBay Inc. should contact **John Jenks** at (385) 306-6510 if there are questions or concerns with the review of the draft permit conditions. Upon resolution of your concerns, please email jjenks@utah.gov the signed cover letter to John Jenks. Upon receipt of the signed cover letter, the DAQ will prepare an ITA for a 30-day public comment period. At the completion of the comment period, the DAQ will address any comments and will prepare an AO for signature by the DAQ Director.

If eBay Inc. does not respond to this letter within **10 business days,** the project will move forward without source concurrence. If eBay Inc. has concerns that cannot be resolved and the project becomes stagnant, the DAQ Director may issue an Order prohibiting construction.

Approval Signature _____
(Signature & Date)

☐ By (Title V responsible official) initialing this box and signing this document, this document serves as an enhanced application and the public comment period will serve as the required comment period for Title V purposes.

The Title V responsible official certifies: based on information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate, and complete.

UTAH DIVISION OF AIR QUALITY
ENGINEER REVIEW

SOURCE INFORMATION

Project Number	N141800011
Owner Name	eBay Inc.
Mailing Address	6614 West Crimson View Drive South Jordan, UT 84095
Source Name	eBay Inc.- SLC Data Center
Source Location	6614 West Crimson View Drive South Jordan, UT 84095
UTM Projection	411,299 m Easting, 4,490,858 m Northing
UTM Datum	NAD83
UTM Zone	UTM Zone 12
SIC Code	7374 (Computer Processing & Data Preparation & Processing Services)
Source Contact	Eileen Ovrahim
Phone Number	(415) 301-1016
Email	eovrahim@ebay.com
Project Engineer	John Jenks, Engineer
Phone Number	(385) 306-6510
Email	jjenks@utah.gov
Notice of Intent (NOI) Submitted	June 1, 2020
Date of Accepted Application	June 26, 2020

SOURCE DESCRIPTION

General Description
eBay SLC Data Center (eBay), is a computer data center located in South Jordan. The facility consists of diesel-fired emergency backup generators that provide electricity to the facility's data servers and backup storage devices in the event of an emergency, diesel-powered fire pump engines, cooling towers, and a number of bloom energy servers.

NSR Classification:
Minor Modification at Minor Source

Source Classification
Located in Salt Lake City UT $PM_{2.5}$ NAA, Salt Lake County SO_2 NAA
Airs Source Size: B

Applicable Federal Standards
NSPS (Part 60), A: General Provisions
NSPS (Part 60), IIII: Standards of Performance for Stationary Compression Ignition Internal Combustion Engines
MACT (Part 63), A: General Provisions
MACT (Part 63), ZZZZ: National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines

Project Proposal
Modification of AO DAQE-AN141800010-19 to Add Six Emergency Generators and Update the Site Name

Project Description
eBay has submitted a NOI for the addition of six additional diesel-fired emergency back-up generators at its existing data center in South Jordan. eBay has also requested a name change for the facility, currently listed as "Topaz (South Jordan) Data Center" to "SLC Data Center".

EMISSION IMPACT ANALYSIS

eBay Inc. is seeking a modified approval order for their South Jordan Data Center,
The Staff of the New Source Review Section (NSR), prepared a modeling report (DAQE-MN141800011-20), which contains a review of the air quality impact analysis (AQIA) including the information, data, assumptions and modeling results used to determine if the facility would be in compliance with State and Federal concentration standards. The full report is included in the source file for this project.

As a result of the modeling, and based on additional information provided by the source on June 30, 2020, the following suggested permit language should be included under the Terms and Conditions in the AO:
1. Testing of each generator (G1-through G7) may occur once per month from 8 am to 6 pm for 30 minutes, with a maximum of four (4) of these generators tested simultaneously.
2. Testing of each generator (G8-through G33) may occur once per month from 8 am to 6 pm for 30 minutes, with a maximum of two (2) of these generators tested simultaneously.
3. In addition to monthly testing, each generator may be tested for one (1) hour once per year from 8 am to 6 pm. [Last updated July 28, 2020]

SUMMARY OF EMISSIONS

The emissions listed below are an estimate of the total potential emissions from the source. Some rounding of emissions is possible.

Criteria Pollutant	Change (TPY)	Total (TPY)
CO_2 Equivalent	-1139	41355.00
Carbon Monoxide	2.59	11.38
Nitrogen Oxides	1.78	56.35
Particulate Matter - PM_{10}	0.34	3.00
Particulate Matter - $PM_{2.5}$	-1.91	0.71
Sulfur Oxides	-0.06	0.06
Volatile Organic Compounds	0.51	2.26

Hazardous Air Pollutant	Change (lbs/yr)	Total (lbs/yr)
Generic HAPs (CAS #GHAPS)	-160	80
	Change (TPY)	**Total (TPY)**
Total HAPs	-0.08	0.04

Note: Change in emissions indicates the difference between previous AO and proposed modification.

Review of BACT for New/Modified Emission Units

1. **BACT review regarding emergency generators**

Prior to obtaining an AO, all new and modified sources of air pollution are required to implement best available control technology or BACT (R307-401-8(1)(a), plus the definition in R307-401-2). In the NOI for this project, eBay opted to evaluate BACT using a combination of a minimum required analysis and a modified "top-down" approach based on USEPA's suggested methodology. The emergency backup generators to be installed at the facility would be certified by the manufacturer to meet the requirements of USEPA's Tier 2 emission standards, in accordance with the requirements of 40 CFR 60 Subpart IIII. The primary pollutant of concern is NO_x, as indicated by the potential emissions of the emergency backup generators and local attainment considerations (i.e., NO_x is a precursor pollutant for secondary formation of ozone, PM_{10}, and $PM_{2.5}$).

In its analysis, eBay evaluated potential control technologies for reducing NO_x emissions from diesel-fired engines. Of all potential technologies, those technically capable of reducing NO_x emissions from diesel-fired engines of equivalent capacity to those used at the facility include the use of (1) SCRs, (2) engines certified by the manufacturer to the USEPA's Tier 4 emissions standards under 40 CFR 60 Subpart IIII, and (3) engines certified by the manufacturer to the USEPA's Tier 2 emission standards under 40 CFR 60 Subpart IIII.

SCR Control Effectiveness

The control efficiency of this technology is dependent on several factors including generator load, catalyst state, and exhaust temperature. The SCR controls evaluated are estimated to achieve up to a 90% reduction in NO_x emissions, which would equate to a NO_x emission rate of 0.66 g/bhp-hr (4.25 lb/hr/generator) for G28-G31 and 0.62 g/bhp-hr (1.51 lb/hr/generator) for G32-G33. To ensure the SCR systems operate effectively, the units must be operated and maintained in accordance with the manufacturer's recommendations. However, since SCR's require exhaust temperatures of 260°C to 540°C (500°F-1,004°F), it may be difficult for emergency generators to meet these temperatures since most of their operations are on low loads and for short periods of time. Therefore, if the exhaust temperature was not met for these runs, the SCR would not activate, and the desired NO_x reduction would not be met. Additionally, an increase in load size or run duration for the activation of the SCR would result in additional emissions from the engines.

Evaluation of Energy Impacts of SCR

The energy required to operate SCR after-treatment is minimal relative to that of a generator. During the winter months, there would be a small input of energy into the SCR unit to prevent freezing of the urea solution.

Evaluation of Environmental Impacts of SCR

During operation of the SCR unit, the reaction of NO_x, urea, and oxygen would result in the formation of CO_2 emissions to the atmosphere, in addition to the formation of nitrogen and water vapor emissions. However, the amount of CO_2 emissions from urea usage is a minor contributor to the overall GHG emissions from the engines resulting from diesel combustion, and the environmental impact of the additional CO_2 emissions is more than offset by the benefit of NO_x reduction. Additionally, the SCR process requires the installation of reagent storage facilities, a system capable of metering and diluting the stock reagent into the appropriate solution, and an atomization/injection system at the appropriate locations in the combustion unit. [Last updated August 21, 2020]

2. **BACT review regarding emergency engines cont.**

Evaluation of Economic Impacts of SCR
The economic impact of installing SCR technology is significant. The procurement and installation process would consume a large amount of capital, and there would also be long term costs associated with the maintenance, repair, consumables, and catalyst storage and regeneration associated with operating the SCR units.

Most SCR units would require the installation of a diesel particulate filter (DPF) to prevent fouling and potential poisoning of the catalyst bed from diesel particulates. The cost of the DPF is variable, based on the power range of the engine - but can add as much as $100,000 to the initial cost of the SCR to a larger engine. In terms of cost per ton, SCR can run as much as $175,000/ton of NO_x removed.

Evaluation of USEPA Tier 4 Certification
40 CFR 60 Subpart IIII requires owners and operators of new non-emergency diesel-fired ICE with a rated power output of greater than 560 kW to purchase engines that are certified by the manufacturer to the USEPA's Tier 4 nonroad engine emission standards. As such, the proposed diesel-fired emergency backup generators to be installed at the site are not subject to Tier 4 certification. Based on the analysis provided, the applicant considers the use of Tier 4-certified engines to be effectively equivalent from an emissions performance perspective to the use of Tier 2-certified engines utilizing SCR for NO_x emissions control. The emission profile is effectively equivalent - yielding a NO_x emission value of 0.67 g/kWh. The purchase and operation of Tier 4 engines would require an additional $156,000/ton of NO_x removed for the 750 kW engines, and $329,000/ton of NO_x removed for the 2.0 MW engines.

Evaluation of USEPA Tier 2 Certification
40 CFR 60 Subpart IIII requires owners and operators of new emergency diesel-fired ICE to purchase engines certified by the manufacturer to the USEPA's nonroad engine emission standards. Since the use of Tier 2-certified engines does not involve an exhaust stream control technique, there are no associated adverse environmental, energy, or economic impacts. As this represents the base case of the applicant's evaluation, no additional control cost is associated with this option.

Selection of BACT for NO_x.
In reviewing the control techniques described above, eBay has determined that the Tier 2 engines meet BACT for NO_X by implementing good operating practices and through purchasing an engine certified to the required Tier 2 emissions standards. Although the Tier 4 engine and Tier 2 engines with SCR are technically feasible, due to the low potential emission reduction for the generators and the high capital and annual operating costs, these options were determined to be economically infeasible.

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BACT Determination for Other Criteria Pollutants
Emissions of all other criteria pollutants would be less than 1 tpy for each emergency generator. Due to the low emission rates of these pollutants, they do not warrant control technology beyond those inherent to Tier 2 generators, which is considered BACT for this facility. This conclusion is consistent with the USEPA's determination in the development of 40 CFR 60 Subpart IIII that add-on controls are not economically viable for emergency ICE.

UDAQ has reviewed the analysis submitted by eBay and agrees with this determination. It is the recommendation of the NSR section that the use of Tier 2 engines be accepted as BACT. [Last updated July 28, 2020]

SECTION I: GENERAL PROVISIONS

The intent is to issue an air quality AO authorizing the project with the following recommended conditions and that failure to comply with any of the conditions may constitute a violation of the AO. **(New or Modified conditions are indicated as "New" in the Outline Label):**

I.1	All definitions, terms, abbreviations, and references used in this AO conform to those used in the UAC R307 and 40 CFR. Unless noted otherwise, references cited in these AO conditions refer to those rules. [R307-101]
I.2	The limits set forth in this AO shall not be exceeded without prior approval. [R307-401]
I.3	Modifications to the equipment or processes approved by this AO that could affect the emissions covered by this AO must be reviewed and approved. [R307-401-1]
I.4	All records referenced in this AO or in other applicable rules, which are required to be kept by the owner/operator, shall be made available to the Director or Director's representative upon request, and the records shall include the two-year period prior to the date of the request. Unless otherwise specified in this AO or in other applicable state and federal rules, records shall be kept for a minimum of two (2) years. [R307-401-8]
I.5	At all times, including periods of startup, shutdown, and malfunction, owners and operators shall, to the extent practicable, maintain and operate any equipment approved under this AO, including associated air pollution control equipment, in a manner consistent with good air pollution control practice for minimizing emissions. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Director which may include, but is not limited to, monitoring results, opacity observations, review of operating and maintenance procedures, and inspection of the source. All maintenance performed on equipment authorized by this AO shall be recorded. [R307-401-4]
I.6	The owner/operator shall comply with UAC R307-107. General Requirements: Breakdowns. [R307-107]
I.7	The owner/operator shall comply with UAC R307-150 Series. Emission Inventories. [R307-150]
I.8	The owner/operator shall submit documentation of the status of construction/installation of the new emergency generators listed in II.A.~~9~~8 to the Director within 18 months from the date of this AO. This AO may become invalid if construction/installation is not commenced within 18 months from the date of this AO or if construction/installation is discontinued for 18 months or more. To ensure proper credit when notifying the Director, send the documentation to the Director, attn.: NSR Section. [R307-401-18]

SECTION II: PERMITTED EQUIPMENT

The intent is to issue an air quality AO authorizing the project with the following recommended conditions and that failure to comply with any of the conditions may constitute a violation of the AO. **(New or Modified conditions are indicated as "New" in the Outline Label):**

II.A **THE APPROVED EQUIPMENT**

II.A.1	**Data Center** Computer data center
II.A.2	**Cooling Tower Plants (2)** 1. 35 MW cooling capacity 2. 6 MW cooling capacity
II.A.3	**Bloom Energy Servers** Number of servers: thirty (30) Rating: 200 kW - each Number of servers: twenty (20) Rating: 250 kW – each
II.A.4	**Fire System Pump Engines (2)** Rating: 148 hp and 86 hp Fuel: Diesel
II.A.5	**Emergency Generator Engines - SLC01** Fuel: Diesel G1 rating 3.25 MW G2 rating 3.25 MW G3 rating 3.25 MW G4 rating 3.25 MW G5 rating 3.25 MW G6 rating 3.25 MW G7 rating 3.25 MW

II.A.6	**Emergency Generator Engines - SLC02** Type: Tier 2 or better Fuel: Diesel G8 rating 3.1 MW G9 rating 3.0 MW G10 rating 3.0 MW G11 rating 3.0 MW G12 rating 3.0 MW G13 rating 3.0 MW G14 rating 3.0 MW G24 rating 2.5 MW G25 rating 2.5 MW G26 rating 2.0 MW G27 rating 2.0 MW
II.A.7	**Emergency Generator Engines - SLC03** Type: Tier 2 or better with manufacturer year October 2016 or newer. Fuel: Diesel G15 rating 2.0 MW G16 rating 2.0 MW G17 rating 1.5 MW G18 rating 1.5 MW G19 rating 2.0 MW G20 rating 2.0 MW G21 rating 2.0 MW G22 rating 2.0 MW G23 rating 1.0 MW
II.A.8 NEW	**Emergency Generator Engines - SLC03 Phase 2** Type: _____Tier 2 or better with manufacturer year October 2016 or newer. Fuel: _____Diesel G28 rating ____2.0 MW G29 rating ____2.0 MW G30 rating ____2.0 MW G31 rating ____2.0 MW G32 rating ____750 kW G33 rating ____750 kW

SECTION II: SPECIAL PROVISIONS

The intent is to issue an air quality AO authorizing the project with the following recommended conditions and that failure to comply with any of the conditions may constitute a violation of the AO. **(New or Modified conditions are indicated as "New" in the Outline Label):**

II.B **REQUIREMENTS AND LIMITATIONS**

II.B.1	**Source-Wide Requirements**
II.B.1.a	Visible emissions from any stationary point associated with the source or with the control facilities shall not exceed 20% opacity. [R307-305-3, R307-401-8]
II.B.1.a.1	Opacity observations of emissions from stationary sources shall be conducted in accordance with 40 CFR 60, Appendix A, Method 9. [R307-305-5]
II.B.2	**Emergency Generator Engine Requirements**
II.B.2.a NEW	The owner/operator shall not operate each emergency engine on site for more than 100 hours per calendar year during non-emergency situations. There is no time limit on the use of the engines during emergencies. [40 CFR 60 Subpart ZZZZ, R307-401-8]
II.B.2.b NEW	For the emergency generator engines listed in II.A.5 through II.A.8, operations during engine operator training, engine maintenance, and engine compliance testing (OMT operations) shall be conducted as follows: 1. All engine compliance testing shall be conducted as outlined in 40 CFR 60 Subpart IIII or _____40 CFR 63 Subpart ZZZZ as appropriate. 2. OMT operation of each generator (G1-through G7) may occur once per month from 8 am to _____6 pm for 30 minutes, with a maximum of four (4) of these generators in operation _____simultaneously. 3. OMT operation of each generator (G8-through G33) may occur once per month from 8 am _____to 6 pm for 30 minutes, with a maximum of two (2) of these generators in operation _____simultaneously. 4. In addition to monthly OMT operation, each generator may be tested for one (1) hour once _____per calendar year from 8 am to 6 pm. [R307-401-8]
II.B.2.c	A non-resettable hour meter shall be installed and operational on all engines. [R307-401-8, 40 CFR 63 Subpart ZZZZ]
II.B.2.d NEW	To determine compliance with the calendar year total, the owner/operator shall calculate a monthly total by the 20th day of each month. The sum of these monthly totals from January through December of any given year, inclusive, shall constitute the calendar year total. Records documenting the operation of each emergency engine shall be kept in a log and shall include the following: a. The date the emergency engine was used b. The duration of operation in hours c. The reason for the emergency engine usage. [40 CFR 60 Subpart ZZZZ, R307-401-8]

II.B.2.e	The owner/operator shall only use diesel fuel (fuel oil #1, #2 or diesel fuel oil additives) in any emergency generator engines located on site. All diesel burned shall meet the definition of ultra-low sulfur diesel (ULSD), and contain no more than 15 ppm sulfur. [40 CFR 60 Subpart IIII]
II.B.2.e.1 NEW	To demonstrate compliance with the ULSD fuel requirement, the owner/operator shall maintain records of diesel fuel purchase invoices or obtain certification of sulfur content from the diesel fuel supplier. The diesel fuel purchase invoices shall indicate that the diesel fuel meets the ULSD requirements. [R307-401-8]

PERMIT HISTORY

When issued, the approval order shall supersede (if a modification) or will be based on the following documents:

Is Derived From	Source Submitted NOI dated June 1, 2020
Incorporates	Additional Information Received dated June 8, 2020
Incorporates	Additional Information Received dated July 24, 2020

REVIEWER COMMENTS

1. **Comment regarding change in AO conditions:**
There were a few slight changes in AO conditions as a result of this project. The changes are summarizes as follows:

1. The equipment list was updated to include the new emergency generators listed in II.A.8~~9~~
2. The "new" labels associated with the equipment authorized on previous incarnations of this AO (DAQE-AN141800010-19 and earlier) have been removed as they are no longer relevant - the equipment has been installed and would now be considered "existing". The new equipment from this project includes the new generators included in item #1 above.
3. The general conditions I.1 through I.8 have been relisted to ensure that the most recent version of these conditions is included.
4. Small updates in the wording and numerical order of the emergency engine requirements in section II.B.2 were made to match UDAQ's most recent template. The only substantive changes include a correction to the testing language to match the language requirement provided by modeling (see the modeling review section of this document and DAQE-MN141800011-20 for details), and a change in the general hours of operation restriction previously found in Condition II.B.2.a to match what is allowed under 40 CFR 60 Subpart IIII and 40 CFR 63 Subpart ZZZZ.
5. A number of duplicated conditions, made redundant by the changes listed in item #4, have been removed for clarity.
6. The requested change to the name of the site was made - the new name is now listed as "eBay Inc. SLC Data Center"
7. Other small consistency changes in the equipment listing were also included.
8. The format and structure of the document now matches UDAQ's latest Source Plan Review style.
[Last updated August 21, 2020]

2. **Comment regarding changes in emission totals:**
The emissions for the facility are shown in the "Summary of Emissions" table on page 3 of this document. Normally, the change in emissions column - marked as "Change (TPY)" in the table - shows the difference between this current project and the previously permitted values. The difference in emissions should therefore represent only the change in emissions from the effects of the current project - the addition of the new emergency generators.

In this case (as is standard procedure), the original permitted values were taken from the previous AO - DAQE-AN141800010-19. However, the emissions values included in DAQE-AN141800010-19 were based on certain assumptions which are no longer correct: specifically, 1) that emissions are calculated based on generic emission factors from AP-42, and 2) that these emission factors are then multiplied by the operating hours listed in that AO as appropriate for testing and maintenance of each engine. The source has submitted updated information for both assumptions. Potential

emissions from the existing equipment- were updated to use not-to-exceed manufacturer emissions data. The source has also updated the annual operating hour limits as shown in the new proposed conditions II.B.2.a and II.B.2.b.

Thus, the Summary of Emissions table shows the combined effect of both adding the new generators as well as the changes in the underlying assumptions for the existing equipment. What is not shown is the effect on potential emissions from only the addition of the new engines. The source did provide this information on page 5 of the NOI. The increase in potential emissions for the addition of the new engines, is as follows (all values listed are in tons per year): PM_{10}: 0.11, $PM_{2.5}$: 0.11, NO_x: 6.61, SO_2: 4.5E-03, CO: 0.62, VOC: 0.17, HAPs: 4.7E-03, and CO_2e: 486.09. The column labelled "Total (TPY)" in the Summary of Emissions table does reflect the final change in facility-wide potential emissions following all changes related to this project and to the recalculation of emissions from existing equipment.

The source is not an existing major source for any pollutant, and the increase in emissions does not trigger any provisions of R307-403 or R307-405. This project is classified as a minor modification under both the attainment area (PSD) and nonattainment/maintenance area NSR rules. [Last updated August 20, 2020]

ACRONYMS

The following lists commonly used acronyms and associated translations as they apply to this document:

40 CFR	Title 40 of the Code of Federal Regulations
AO	Approval Order
BACT	Best Available Control Technology
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CDS	Classification Data System (used by EPA to classify sources by size/type)
CEM	Continuous emissions monitor
CEMS	Continuous emissions monitoring system
CFR	Code of Federal Regulations
CMS	Continuous monitoring system
CO	Carbon monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent - 40 CFR Part 98, Subpart A, Table A-1
COM	Continuous opacity monitor
DAQ/UDAQ	Division of Air Quality
DAQE	This is a document tracking code for internal UDAQ use
EPA	Environmental Protection Agency
FDCP	Fugitive dust control plan
GHG	Greenhouse Gas(es) - 40 CFR 52.21 (b)(49)(i)
GWP	Global Warming Potential - 40 CFR Part 86.1818-12(a)
HAP or HAPs	Hazardous air pollutant(s)
ITA	Intent to Approve
LB/HR	Pounds per hour
LB/YR	Pounds per year
MACT	Maximum Achievable Control Technology
MMBTU	Million British Thermal Units
NAA	Nonattainment Area
NAAQS	National Ambient Air Quality Standards
NESHAP	National Emission Standards for Hazardous Air Pollutants
NOI	Notice of Intent
NO_x	Oxides of nitrogen
NSPS	New Source Performance Standard
NSR	New Source Review
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$PM_{2.5}$	Particulate matter less than 2.5 microns in size
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RN141800011

August 21, 2020

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6614 West Crimson View Drive
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eBay Inc. should contact **John Jenks** at (385) 306-6510 if there are questions or concerns with the review of the draft permit conditions. Upon resolution of your concerns, please email jjenks@utah.gov the signed cover letter to John Jenks. Upon receipt of the signed cover letter, the DAQ will prepare an ITA for a 30-day public comment period. At the completion of the comment period, the DAQ will address any comments and will prepare an AO for signature by the DAQ Director.

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Approval Signature _____
(Signature & Date)

☐ By (Title V responsible official) initialing this box and signing this document, this document serves as an enhanced application and the public comment period will serve as the required comment period for Title V purposes.

The Title V responsible official certifies: based on information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate, and complete.

UTAH DIVISION OF AIR QUALITY
ENGINEER REVIEW

SOURCE INFORMATION

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Mailing Address	6614 West Crimson View Drive South Jordan, UT 84095
Source Name	eBay Inc.- SLC Data Center
Source Location	6614 West Crimson View Drive South Jordan, UT 84095
UTM Projection	411,299 m Easting, 4,490,858 m Northing
UTM Datum	NAD83
UTM Zone	UTM Zone 12
SIC Code	7374 (Computer Processing & Data Preparation & Processing Services)
Source Contact	Eileen Ovrahim
Phone Number	(415) 301-1016
Email	eovrahim@ebay.com
Project Engineer	John Jenks, Engineer
Phone Number	(385) 306-6510
Email	jjenks@utah.gov
Notice of Intent (NOI) Submitted	June 1, 2020
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NSR Classification:
Minor Modification at Minor Source

Source Classification
Located in Salt Lake City UT $PM_{2.5}$ NAA, Salt Lake County SO_2 NAA
Airs Source Size: B

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NSPS (Part 60), IIII: Standards of Performance for Stationary Compression Ignition Internal Combustion Engines
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eBay Inc. is seeking a modified approval order for their South Jordan Data Center,
The Staff of the New Source Review Section (NSR), prepared a modeling report (DAQE-MN141800011-20), which contains a review of the air quality impact analysis (AQIA) including the information, data, assumptions and modeling results used to determine if the facility would be in compliance with State and Federal concentration standards. The full report is included in the source file for this project.

As a result of the modeling, and based on additional information provided by the source on June 30, 2020, the following suggested permit language should be included under the Terms and Conditions in the AO:
1. Testing of each generator (G1-through G7) may occur once per month from 8 am to 6 pm for 30 minutes, with a maximum of four (4) of these generators tested simultaneously.
2. Testing of each generator (G8-through G33) may occur once per month from 8 am to 6 pm for 30 minutes, with a maximum of two (2) of these generators tested simultaneously.
3. In addition to monthly testing, each generator may be tested for one (1) hour once per year from 8 am to 6 pm. [Last updated July 28, 2020]

SUMMARY OF EMISSIONS

The emissions listed below are an estimate of the total potential emissions from the source. Some rounding of emissions is possible.

Criteria Pollutant	Change (TPY)	Total (TPY)
CO_2 Equivalent	-1139	41355.00
Carbon Monoxide	2.59	11.38
Nitrogen Oxides	1.78	56.35
Particulate Matter - PM_{10}	0.34	3.00
Particulate Matter - $PM_{2.5}$	-1.91	0.71
Sulfur Oxides	-0.06	0.06
Volatile Organic Compounds	0.51	2.26

Hazardous Air Pollutant	Change (lbs/yr)	Total (lbs/yr)
Generic HAPs (CAS #GHAPS)	-160	80
	Change (TPY)	**Total (TPY)**
Total HAPs	-0.08	0.04

Note: Change in emissions indicates the difference between previous AO and proposed modification.

Review of BACT for New/Modified Emission Units

1. **BACT review regarding emergency generators**

Prior to obtaining an AO, all new and modified sources of air pollution are required to implement best available control technology or BACT (R307-401-8(1)(a), plus the definition in R307-401-2). In the NOI for this project, eBay opted to evaluate BACT using a combination of a minimum required analysis and a modified "top-down" approach based on USEPA's suggested methodology. The emergency backup generators to be installed at the facility would be certified by the manufacturer to meet the requirements of USEPA's Tier 2 emission standards, in accordance with the requirements of 40 CFR 60 Subpart IIII. The primary pollutant of concern is NO_x, as indicated by the potential emissions of the emergency backup generators and local attainment considerations (i.e., NO_x is a precursor pollutant for secondary formation of ozone, PM_{10}, and $PM_{2.5}$).

In its analysis, eBay evaluated potential control technologies for reducing NO_x emissions from diesel-fired engines. Of all potential technologies, those technically capable of reducing NO_x emissions from diesel-fired engines of equivalent capacity to those used at the facility include the use of (1) SCRs, (2) engines certified by the manufacturer to the USEPA's Tier 4 emissions standards under 40 CFR 60 Subpart IIII, and (3) engines certified by the manufacturer to the USEPA's Tier 2 emission standards under 40 CFR 60 Subpart IIII.

SCR Control Effectiveness

The control efficiency of this technology is dependent on several factors including generator load, catalyst state, and exhaust temperature. The SCR controls evaluated are estimated to achieve up to a 90% reduction in NO_x emissions, which would equate to a NO_x emission rate of 0.66 g/bhp-hr (4.25 lb/hr/generator) for G28-G31 and 0.62 g/bhp-hr (1.51 lb/hr/generator) for G32-G33. To ensure the SCR systems operate effectively, the units must be operated and maintained in accordance with the manufacturer's recommendations. However, since SCR's require exhaust temperatures of 260°C to 540°C (500°F-1,004°F), it may be difficult for emergency generators to meet these temperatures since most of their operations are on low loads and for short periods of time. Therefore, if the exhaust temperature was not met for these runs, the SCR would not activate, and the desired NO_x reduction would not be met. Additionally, an increase in load size or run duration for the activation of the SCR would result in additional emissions from the engines.

Evaluation of Energy Impacts of SCR

The energy required to operate SCR after-treatment is minimal relative to that of a generator. During the winter months, there would be a small input of energy into the SCR unit to prevent freezing of the urea solution.

Evaluation of Environmental Impacts of SCR

During operation of the SCR unit, the reaction of NO_x, urea, and oxygen would result in the formation of CO_2 emissions to the atmosphere, in addition to the formation of nitrogen and water vapor emissions. However, the amount of CO_2 emissions from urea usage is a minor contributor to the overall GHG emissions from the engines resulting from diesel combustion, and the environmental impact of the additional CO_2 emissions is more than offset by the benefit of NO_x reduction. Additionally, the SCR process requires the installation of reagent storage facilities, a system capable of metering and diluting the stock reagent into the appropriate solution, and an atomization/injection system at the appropriate locations in the combustion unit. [Last updated August 21, 2020]

2. **BACT review regarding emergency engines cont.**

Evaluation of Economic Impacts of SCR

The economic impact of installing SCR technology is significant. The procurement and installation process would consume a large amount of capital, and there would also be long term costs associated with the maintenance, repair, consumables, and catalyst storage and regeneration associated with operating the SCR units.

Most SCR units would require the installation of a diesel particulate filter (DPF) to prevent fouling and potential poisoning of the catalyst bed from diesel particulates. The cost of the DPF is variable, based on the power range of the engine - but can add as much as $100,000 to the initial cost of the SCR to a larger engine. In terms of cost per ton, SCR can run as much as $175,000/ton of NO_x removed.

Evaluation of USEPA Tier 4 Certification

40 CFR 60 Subpart IIII requires owners and operators of new non-emergency diesel-fired ICE with a rated power output of greater than 560 kW to purchase engines that are certified by the manufacturer to the USEPA's Tier 4 nonroad engine emission standards. As such, the proposed diesel-fired emergency backup generators to be installed at the site are not subject to Tier 4 certification. Based on the analysis provided, the applicant considers the use of Tier 4-certified engines to be effectively equivalent from an emissions performance perspective to the use of Tier 2-certified engines utilizing SCR for NO_x emissions control. The emission profile is effectively equivalent - yielding a NO_x emission value of 0.67 g/kWh. The purchase and operation of Tier 4 engines would require an additional $156,000/ton of NO_x removed for the 750 kW engines, and $329,000/ton of NO_x removed for the 2.0 MW engines.

Evaluation of USEPA Tier 2 Certification

40 CFR 60 Subpart IIII requires owners and operators of new emergency diesel-fired ICE to purchase engines certified by the manufacturer to the USEPA's nonroad engine emission standards. Since the use of Tier 2-certified engines does not involve an exhaust stream control technique, there are no associated adverse environmental, energy, or economic impacts. As this represents the base case of the applicant's evaluation, no additional control cost is associated with this option.

Selection of BACT for NO_x.

In reviewing the control techniques described above, eBay has determined that the Tier 2 engines meet BACT for NO_X by implementing good operating practices and through purchasing an engine certified to the required Tier 2 emissions standards. Although the Tier 4 engine and Tier 2 engines with SCR are technically feasible, due to the low potential emission reduction for the generators and the high capital and annual operating costs, these options were determined to be economically infeasible.

BACT Determination for Other Criteria Pollutants

Emissions of all other criteria pollutants would be less than 1 tpy for each emergency generator. Due to the low emission rates of these pollutants, they do not warrant control technology beyond those inherent to Tier 2 generators, which is considered BACT for this facility. This conclusion is consistent with the USEPA's determination in the development of 40 CFR 60 Subpart IIII that add-on controls are not economically viable for emergency ICE.

UDAQ has reviewed the analysis submitted by eBay and agrees with this determination. It is the recommendation of the NSR section that the use of Tier 2 engines be accepted as BACT. [Last updated July 28, 2020]

SECTION I: GENERAL PROVISIONS

The intent is to issue an air quality AO authorizing the project with the following recommended conditions and that failure to comply with any of the conditions may constitute a violation of the AO. **(New or Modified conditions are indicated as "New" in the Outline Label):**

I.1	All definitions, terms, abbreviations, and references used in this AO conform to those used in the UAC R307 and 40 CFR. Unless noted otherwise, references cited in these AO conditions refer to those rules. [R307-101]
I.2	The limits set forth in this AO shall not be exceeded without prior approval. [R307-401]
I.3	Modifications to the equipment or processes approved by this AO that could affect the emissions covered by this AO must be reviewed and approved. [R307-401-1]
I.4	All records referenced in this AO or in other applicable rules, which are required to be kept by the owner/operator, shall be made available to the Director or Director's representative upon request, and the records shall include the two-year period prior to the date of the request. Unless otherwise specified in this AO or in other applicable state and federal rules, records shall be kept for a minimum of two (2) years. [R307-401-8]
I.5	At all times, including periods of startup, shutdown, and malfunction, owners and operators shall, to the extent practicable, maintain and operate any equipment approved under this AO, including associated air pollution control equipment, in a manner consistent with good air pollution control practice for minimizing emissions. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Director which may include, but is not limited to, monitoring results, opacity observations, review of operating and maintenance procedures, and inspection of the source. All maintenance performed on equipment authorized by this AO shall be recorded. [R307-401-4]
I.6	The owner/operator shall comply with UAC R307-107. General Requirements: Breakdowns. [R307-107]
I.7	The owner/operator shall comply with UAC R307-150 Series. Emission Inventories. [R307-150]
I.8	The owner/operator shall submit documentation of the status of construction/installation of the new emergency generators listed in II.A.8 to the Director within 18 months from the date of this AO. This AO may become invalid if construction/installation is not commenced within 18 months from the date of this AO or if construction/installation is discontinued for 18 months or more. To ensure proper credit when notifying the Director, send the documentation to the Director, attn.: NSR Section. [R307-401-18]

SECTION II: PERMITTED EQUIPMENT

The intent is to issue an air quality AO authorizing the project with the following recommended conditions and that failure to comply with any of the conditions may constitute a violation of the AO. **(New or Modified conditions are indicated as "New" in the Outline Label):**

II.A THE APPROVED EQUIPMENT

II.A.1	**Data Center** Computer data center
II.A.2	**Cooling Tower Plants (2)** 1. 35 MW cooling capacity 2. 6 MW cooling capacity
II.A.3	**Bloom Energy Servers** Number of servers: thirty (30) Rating: 200 kW - each Number of servers: twenty (20) Rating: 250 kW – each
II.A.4	**Fire System Pump Engines (2)** Rating: 148 hp and 86 hp Fuel: Diesel
II.A.5	**Emergency Generator Engines - SLC01** Fuel: Diesel G1 rating 3.25 MW G2 rating 3.25 MW G3 rating 3.25 MW G4 rating 3.25 MW G5 rating 3.25 MW G6 rating 3.25 MW G7 rating 3.25 MW

II.A.6	**Emergency Generator Engines - SLC02** Type: Tier 2 or better Fuel: Diesel G8 rating 3.1 MW G9 rating 3.0 MW G10 rating 3.0 MW G11 rating 3.0 MW G12 rating 3.0 MW G13 rating 3.0 MW G14 rating 3.0 MW G24 rating 2.5 MW G25 rating 2.5 MW G26 rating 2.0 MW G27 rating 2.0 MW
II.A.7	**Emergency Generator Engines - SLC03** Type: Tier 2 or better with manufacturer year October 2016 or newer. Fuel: Diesel G15 rating 2.0 MW G16 rating 2.0 MW G17 rating 1.5 MW G18 rating 1.5 MW G19 rating 2.0 MW G20 rating 2.0 MW G21 rating 2.0 MW G22 rating 2.0 MW G23 rating 1.0 MW
II.A.8 NEW	**Emergency Generator Engines - SLC03 Phase 2** Type: Tier 2 or better with manufacturer year October 2016 or newer. Fuel: Diesel G28 rating 2.0 MW G29 rating 2.0 MW G30 rating 2.0 MW G31 rating 2.0 MW G32 rating 750 kW G33 rating 750 kW

SECTION II: SPECIAL PROVISIONS

The intent is to issue an air quality AO authorizing the project with the following recommended conditions and that failure to comply with any of the conditions may constitute a violation of the AO. **(New or Modified conditions are indicated as "New" in the Outline Label):**

II.B REQUIREMENTS AND LIMITATIONS

II.B.1	**Source-Wide Requirements**
II.B.1.a	Visible emissions from any stationary point associated with the source or with the control facilities shall not exceed 20% opacity. [R307-305-3, R307-401-8]
II.B.1.a.1	Opacity observations of emissions from stationary sources shall be conducted in accordance with 40 CFR 60, Appendix A, Method 9. [R307-305-5]
II.B.2	**Emergency Generator Engine Requirements**
II.B.2.a NEW	The owner/operator shall not operate each emergency engine on site for more than 100 hours per calendar year during non-emergency situations. There is no time limit on the use of the engines during emergencies. [40 CFR 60 Subpart ZZZZ, R307-401-8]
II.B.2.b NEW	For the emergency generator engines listed in II.A.5 through II.A.8, operations during engine operator training, engine maintenance, and engine compliance testing (OMT operations) shall be conducted as follows: 1. All engine compliance testing shall be conducted as outlined in 40 CFR 60 Subpart IIII or 40 CFR 63 Subpart ZZZZ as appropriate. 2. OMT operation of each generator (G1-through G7) may occur once per month from 8 am to 6 pm for 30 minutes, with a maximum of four (4) of these generators in operation simultaneously. 3. OMT operation of each generator (G8-through G33) may occur once per month from 8 am to 6 pm for 30 minutes, with a maximum of two (2) of these generators in operation simultaneously. 4. In addition to monthly OMT operation, each generator may be tested for one (1) hour once per calendar year from 8 am to 6 pm. [R307-401-8]
II.B.2.c	A non-resettable hour meter shall be installed and operational on all engines. [R307-401-8, 40 CFR 63 Subpart ZZZZ]
II.B.2.d NEW	To determine compliance with the calendar year total, the owner/operator shall calculate a monthly total by the 20th day of each month. The sum of these monthly totals from January through December of any given year, inclusive, shall constitute the calendar year total. Records documenting the operation of each emergency engine shall be kept in a log and shall include the following: a. The date the emergency engine was used b. The duration of operation in hours c. The reason for the emergency engine usage. [40 CFR 60 Subpart ZZZZ, R307-401-8]

II.B.2.e	The owner/operator shall only use diesel fuel (fuel oil #1, #2 or diesel fuel oil additives) in any emergency generator engines located on site. All diesel burned shall meet the definition of ultra-low sulfur diesel (ULSD), and contain no more than 15 ppm sulfur. [40 CFR 60 Subpart IIII]
II.B.2.e.1 NEW	To demonstrate compliance with the ULSD fuel requirement, the owner/operator shall maintain records of diesel fuel purchase invoices or obtain certification of sulfur content from the diesel fuel supplier. The diesel fuel purchase invoices shall indicate that the diesel fuel meets the ULSD requirements. [R307-401-8]

PERMIT HISTORY

When issued, the approval order shall supersede (if a modification) or will be based on the following documents:

Is Derived From	Source Submitted NOI dated June 1, 2020
Incorporates	Additional Information Received dated June 8, 2020
Incorporates	Additional Information Received dated July 24, 2020

REVIEWER COMMENTS

1. **Comment regarding change in AO conditions:**
There were a few slight changes in AO conditions as a result of this project. The changes are summarizes as follows:

1. The equipment list was updated to include the new emergency generators listed in II.A.8
2. The "new" labels associated with the equipment authorized on previous incarnations of this AO (DAQE-AN141800010-19 and earlier) have been removed as they are no longer relevant - the equipment has been installed and would now be considered "existing". The new equipment from this project includes the new generators included in item #1 above.
3. The general conditions I.1 through I.8 have been relisted to ensure that the most recent version of these conditions is included.
4. Small updates in the wording and numerical order of the emergency engine requirements in section II.B.2 were made to match UDAQ's most recent template. The only substantive changes include a correction to the testing language to match the language requirement provided by modeling (see the modeling review section of this document and DAQE-MN141800011-20 for details), and a change in the general hours of operation restriction previously found in Condition II.B.2.a to match what is allowed under 40 CFR 60 Subpart IIII and 40 CFR 63 Subpart ZZZZ.
5. A number of duplicated conditions, made redundant by the changes listed in item #4, have been removed for clarity.
6. The requested change to the name of the site was made - the new name is now listed as "eBay Inc. SLC Data Center"
7. Other small consistency changes in the equipment listing were also included.
8. The format and structure of the document now matches UDAQ's latest Source Plan Review style.
[Last updated August 21, 2020]

2. **Comment regarding changes in emission totals:**
The emissions for the facility are shown in the "Summary of Emissions" table on page 3 of this document. Normally, the change in emissions column - marked as "Change (TPY)" in the table - shows the difference between this current project and the previously permitted values. The difference in emissions should therefore represent only the change in emissions from the effects of the current project - the addition of the new emergency generators.

In this case (as is standard procedure), the original permitted values were taken from the previous AO - DAQE-AN141800010-19. However, the emissions values included in DAQE-AN141800010-19 were based on certain assumptions which are no longer correct: specifically, 1) that emissions are calculated based on generic emission factors from AP-42, and 2) that these emission factors are then multiplied by the operating hours listed in that AO as appropriate for testing and maintenance of each engine. The source has submitted updated information for both assumptions. Potential

emissions from the existing equipment were updated to use not-to-exceed manufacturer emissions data. The source has also updated the annual operating hour limits as shown in the new proposed conditions II.B.2.a and II.B.2.b.

Thus, the Summary of Emissions table shows the combined effect of both adding the new generators as well as the changes in the underlying assumptions for the existing equipment. What is not shown is the effect on potential emissions from only the addition of the new engines. The source did provide this information on page 5 of the NOI. The increase in potential emissions for the addition of the new engines, is as follows (all values listed are in tons per year): PM_{10}: 0.11, $PM_{2.5}$: 0.11, NO_x: 6.61, SO_2: 4.5E-03, CO: 0.62, VOC: 0.17, HAPs: 4.7E-03, and CO_2e: 486.09. The column labelled "Total (TPY)" in the Summary of Emissions table does reflect the final change in facility-wide potential emissions following all changes related to this project and to the recalculation of emissions from existing equipment.

The source is not an existing major source for any pollutant, and the increase in emissions does not trigger any provisions of R307-403 or R307-405. This project is classified as a minor modification under both the attainment area (PSD) and nonattainment/maintenance area NSR rules. [Last updated August 20, 2020]

ACRONYMS

The following lists commonly used acronyms and associated translations as they apply to this document:

40 CFR	Title 40 of the Code of Federal Regulations
AO	Approval Order
BACT	Best Available Control Technology
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CDS	Classification Data System (used by EPA to classify sources by size/type)
CEM	Continuous emissions monitor
CEMS	Continuous emissions monitoring system
CFR	Code of Federal Regulations
CMS	Continuous monitoring system
CO	Carbon monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent - 40 CFR Part 98, Subpart A, Table A-1
COM	Continuous opacity monitor
DAQ/UDAQ	Division of Air Quality
DAQE	This is a document tracking code for internal UDAQ use
EPA	Environmental Protection Agency
FDCP	Fugitive dust control plan
GHG	Greenhouse Gas(es) - 40 CFR 52.21 (b)(49)(i)
GWP	Global Warming Potential - 40 CFR Part 86.1818-12(a)
HAP or HAPs	Hazardous air pollutant(s)
ITA	Intent to Approve
LB/HR	Pounds per hour
LB/YR	Pounds per year
MACT	Maximum Achievable Control Technology
MMBTU	Million British Thermal Units
NAA	Nonattainment Area
NAAQS	National Ambient Air Quality Standards
NESHAP	National Emission Standards for Hazardous Air Pollutants
NOI	Notice of Intent
NO_x	Oxides of nitrogen
NSPS	New Source Performance Standard
NSR	New Source Review
PM_{10}	Particulate matter less than 10 microns in size
$PM_{2.5}$	Particulate matter less than 2.5 microns in size
PSD	Prevention of Significant Deterioration
PTE	Potential to Emit
R307	Rules Series 307
R307-401	Rules Series 307 - Section 401
SO_2	Sulfur dioxide
Title IV	Title IV of the Clean Air Act
Title V	Title V of the Clean Air Act
TPY	Tons per year
UAC	Utah Administrative Code
VOC	Volatile organic compounds

State of Utah

GARY R. HERBERT
Governor

SPENCER J. COX
Lieutenant Governor

Department of
Environmental Quality

L. Scott Baird
Executive Director

DIVISION OF AIR QUALITY
Bryce C. Bird
Director

DAQE-MN141800011-20

M E M O R A N D U M

TO: John Jenks, NSR Engineer JJ

FROM: Dave Prey, Air Quality Modeler DP

DATE: June 26, 2020

SUBJECT: Modeling Analysis Review for the Notice of Intent for eBay Inc. – South Jordan Data Center, Salt Lake County, Utah

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This is not a Major Prevention of Significant Deterioration (PSD) Source.

I. OBJECTIVE

eBay Inc. (Applicant) is seeking a modified approval order for their South Jordan Data Center, located in Salt Lake County, Utah.

This report, prepared by the Staff of the New Source Review Section (NSR), contains a review of the air quality impact analysis (AQIA) including the information, data, assumptions and modeling results used to determine if the facility would be in compliance with State and Federal concentration standards.

II. APPLICABLE RULE(S)

Utah Air Quality Rules:

R307-401-6	Condition for Issuing an Approval Order
R307-410-3	Use of Dispersion Models
R307-410-4	Modeling of Criteria Pollutants in Attainment Areas

III. MODELING METHODOLOGY

A. Applicability

Emissions from the facility include PM_{10}, NO_x, CO, SO_2, and HAPs. This modeling is part of a modified approval order. The total emission rate for NO_x warranted a modeling review to demonstrate compliance with the NAAQS. Modeling was performed by the applicant.

B. Assumptions

1. Topography/Terrain

The Plant is at an elevation 5077 feet with terrain features that have little affect on concentration predictions.

a. Zone: 12

b. Approximate Location:

UTM (NAD83): 411308 meters East
4490965 meters North

2. Urban or Rural Area Designation

After a review of the appropriate 7.5 minute quadrangles, it was concluded the area is "rural" for air modeling purposes.

3. Ambient Air

It was determined the Plant boundary used in the AQIA meets the State's definition of ambient air.

4. Building Downwash

The source was modeled with the AERMOD model. All structures at the plant were used in the model to account for their influence on downwash.

5. Meteorology

Five (5) years of off-site surface and upper air data were used in the analysis consisting of the following:

Surface – Salt Lake Airport, UT NWS: 2008-2012
Upper Air – Salt Lake Airport, UT NWS: 2008-2012

6. Background

The background concentrations were based on a three-year average seasonal-diurnal NO_2 concentration measured in Herriman, Utah.

7. Receptor and Terrain Elevations

The modeling domain used by the Applicant consisted of receptors including property boundary receptors. This area of the state contains mountainous terrain and the modeling domain has simple and complex terrain features in the near and far fields. Therefore, receptor points representing actual terrain elevations from the area were used in the analysis.

8. Model and Options

The State-accepted AERMOD model was used by the Applicant to predict air pollutant concentrations under a simple/complex terrain/wake effect situation. In quantifying concentrations, the regulatory default option was selected by the Applicant.

9. Air Pollutant Emission Rates

Modeling was performed for the worst case scenario, which was determined to be when four (4) engines (G02-G05) are tested for 30 minutes on a monthly basis. For modeling, the hourly emission rate was halved to simulate a 30-minute test. The following hourly emission were used in the analysis:

Source	UTM Coordinates		Modeled Emission Rates		
	Easting (m)	Northing (m)	No_x (lb/hr)	No_x (tons/yr)	hrs/year
SLC1_G01	411272	4490966	14.4953	0.725	100
SLC1_G02	411284	4490966	14.4953	0.725	100
SLC1_G03	411295	4490966	14.4953	0.725	100
SLC1_G04	411308	4490966	14.4953	0.725	100
SLC1_G05	411319	4490966	14.4953	0.725	100
SLC1_G06	411331	4490966	14.4953	0.725	100
SLC1_G07	411343	4490966	14.4953	0.725	100
SLC2_G08	411326	4490763	11.3679	0.568	100
SLC2_G09	411213	4490751	11.3679	0.568	100
SLC2_G10	411195	4490755	11.3679	0.568	100
SLC2_G11	411383	4490796	11.3679	0.568	100
SLC2_G12	411383	4490802	11.3679	0.568	100
SLC2_G13	411383	4490822	11.3679	0.568	100
SLC2_G14	411383	4490828	11.3679	0.568	100
SLC3_G15	411130	4490924	9.6545	0.483	100
SLC3_G16	411130	4490918	9.6545	0.483	100
SLC3_G17	411131	4490911	8.3239	0.416	100
SLC3_G18	411131	4490905	8.3239	0.416	100
SLC3_G19	411130	4490899	9.6545	0.483	100
SLC3_G20	411130	4490892	9.6545	0.483	100
SLC3_G21	411130	4490886	9.6545	0.483	100
SLC3_G22	411130	4490879	9.6545	0.483	100
SLC3_G23	411131	4490873	5.4997	0.275	100
SLC2_G24	411315	4490726	8.8147	0.441	100
SLC2_G25	411321	4490726	8.8147	0.441	100
SLC2_G26	411326	4490727	9.6545	0.483	100
SLC2_G27	411332	4490727	9.6545	0.483	100
SLC3_G28	411130	4490971	9.6545	0.483	100

SLC3_G29	411130	4490964	9.6545	0.483	100
SLC3_G30	411130	4490957	9.6545	0.483	100
SLC3_G31	411130	4490951	9.6545	0.483	100
SLC3_G32	411131	4490944	5.2618	0.263	100
SLC3_G33	411131	4490937	5.2618	0.263	100
Total			347.1970	17.3599	

10. Source Location and Parameters

Source	Type	Source Parameters					
		Elev (ft)	Ht (m)	Ht (ft)	Temp (K)	Flow (m/s)	Dia (ft)
SLC1_G01	POINT	5087.5	5.7	18.7	668	16.56	0.71
SLC1_G02	POINT	5087.5	5.7	18.7	668	16.56	0.71
SLC1_G03	POINT	5087.5	5.7	18.7	668	16.56	0.71
SLC1_G04	POINT	5087.5	5.7	18.7	668	16.56	0.71
SLC1_G05	POINT	5087.5	5.7	18.7	668	16.56	0.71
SLC1_G06	POINT	5087.5	5.7	18.7	668	16.56	0.71
SLC1_G07	POINT	5087.5	5.7	18.7	668	16.56	0.71
SLC2_G08	POINT	5087.5	8.7	28.5	713	21.76	0.61
SLC2_G09	POINT	5087.5	6.7	22.0	713	21.76	0.61
SLC2_G10	POINT	5087.5	6.7	22.0	713	21.76	0.61
SLC2_G11	POINT	5087.5	6.7	22.0	713	21.76	0.61
SLC2_G12	POINT	5087.5	6.7	22.0	713	21.76	0.61
SLC2_G13	POINT	5087.5	6.7	22.0	713	21.76	0.61
SLC2_G14	POINT	5087.5	6.7	22.0	713	21.76	0.61
SLC3_G15	POINT	5103.4	8.2	27.0	614	19.14	0.46
SLC3_G16	POINT	5103.4	8.2	27.0	614	19.14	0.46
SLC3_G17	POINT	5103.4	7.2	23.5	629	14.21	0.46
SLC3_G18	POINT	5103.4	7.2	23.5	629	14.21	0.46
SLC3_G19	POINT	5103.4	8.2	27.0	614	19.14	0.46
SLC3_G20	POINT	5103.4	8.2	27.0	614	19.14	0.46
SLC3_G21	POINT	5103.4	8.2	27.0	614	19.14	0.46
SLC3_G22	POINT	5103.4	8.2	27.0	614	19.14	0.46
SLC3_G23	POINT	5103.4	6.7	22.0	633	4.46	0.46
SLC2_G24	POINT	5087.5	6.1	20.0	621	22.02	0.46
SLC2_G25	POINT	5087.5	6.1	20.0	621	22.02	0.46
SLC2_G26	POINT	5087.5	6.1	20.0	614	19.14	0.46
SLC2_G27	POINT	5087.5	6.1	20.0	614	19.14	0.46
SLC3_G28	POINT	5103.4	8.2	27.0	614	19.14	0.46
SLC3_G29	POINT	5103.4	8.2	27.0	614	19.14	0.46

SLC3_G30	POINT	5103.4	8.2	27.0	614	19.14	0.46
SLC3_G31	POINT	5103.4	8.2	27.0	614	19.14	0.46
SLC3_G32	POINT	5103.4	3.8	12.6	706	7.42	0.46
SLC3_G33	POINT	5103.4	3.8	12.6	706	7.42	0.46

IV. RESULTS AND CONCLUSIONS

A. National Ambient Air Quality Standards

The below table provides a comparison of the predicted total air quality concentrations with the NAAQS. The predicted total concentrations are less than the NAAQS.

Air Pollutant	**Period**	**Prediction ($\mu g/m^3$)**	**Class II Significant Impact Level ($\mu g/m^3$)**	**Background ($\mu g/m^3$)**	**Nearby Sources* ($\mu g/m^3$)**	**Total ($\mu g/m^3$)**	**NAAQS ($\mu g/m^3$)**	**Percent NAAQS**
NO_2	1-Hour	90.6	8	69.6	0.0	160.2	188	85.2%

V. PERMIT CONDITIONS

The following suggested permit language should be included under the Terms and Conditions in the AO.

- Testing of up to four (4) generators (G1- through G7) may occur once per month from 8 am to 6 pm for 30 minutes.
- Testing of up to two (2) generators (G8- through G33) may occur once per month from 8 am to 6 pm for 30 minutes.
- In addition to monthly testing, each generator may be tested for one (1) hour once per year from 8 am to 6 pm.

DP:sa

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