FEDERAL SYNTHETIC MINOR NEW SOURCE REVIEW PERMIT
ISSUED PURSUANT TO THE REQUIREMENTS OF 40 CFR PART 49
The Pueblo of Sandia - Sandia Resort and Casino

PERMITTING AUTHORITY:	U.S. Environmental Protection Agency, Region 6
PERMITEE:	The Pueblo of Sandia Albuquerque, New Mexico
PERMIT NUMBER:	R6NSR-NM-001
FACILITY NAME:	Sandia Resort and Casino
FACILITY LOCATION:	30 Rainbow Road N.E. Bernalillo County Albuquerque, New Mexico Latitude 35°12'23.32"N and Longitude 106°33'59.04"W

Pursuant to the provisions of the Clean Air Act (CAA), Subchapter I, Part A (42 U.S.C. Section 7410(a)(2)(c)), and 40 Code of Federal Regulations (CFR) Sections 49.151 - 49.161, the U.S. Environmental Protection Agency, Region 6 is issuing a *Synthetic Minor New Source Review Permit* for an existing operating source to the Pueblo of Sandia (Sandia) for its Sandia Resort and Casino. This permit places enforceable restrictions on the potential to emit of the source so that the provisions and requirements for major sources in 40 CFR §§ 52.21 and 71.2 will not apply to the source.

This authorization is for an existing stationary source consisting of three diesel-fired reciprocating internal combustion engine (RICE) units, seventeen natural gas-fired boilers, three existing diesel storage tanks, two new 4600kw stationary internal combustion engines (ICE), and three new diesel storage tanks at the Sandia Resort and Casino, located on the Pueblo of Sandia. Sandia is authorized to operate as a synthetic minor source in accordance with the terms and conditions set forth in this permit. Failure to comply with any term or conditions set forth in this permit may result in enforcement action pursuant to Section 113 of the CAA. The permit does not relieve Sandia of the responsibility to comply with any other applicable provisions of the CAA or other federal and tribal requirements.

In accordance with 40 CFR § 49.159(a), this synthetic minor new source review permit becomes effective 30 days after the service of notice of the final permit decision, unless review is requested on the final permit pursuant to 40 CFR § 49.159(d).

_____ _____

Wren Stenger, Director — Date
Multimedia Planning and Permitting Division

DRAFT

I. PROJECT DESCRIPTION

Sandia operates three existing diesel-fired RICE units, seventeen boilers, and three existing diesel storage tanks at its resort and casino in Albuquerque, New Mexico. This permit only authorizes the three existing RICE units to operate as emergency stationary RICE. Additionally, a new project will add two emergency Caterpillar 4000 kW diesel-fired ICE units and three new diesel storage tanks. The two new ICE units will comply with EPA's Tier II emissions standards, and will be used only for emergency events. The existing RICE units and new ICE units shall use low sulfur diesel of less than 0.0015% weight (wt.) sulfur content, and emissions limits for these units (EPN Numbers E1 – E5) are based on limited hours of operation as indicated in Table 2 and the specific conditions of the permit. The emission limits for the seventeen boilers are based on the use of natural gas and each can operate continuously for 8760 hours per year.

II. EQUIPMENT LIST

The permit covers the following pieces of equipment:

Table 1

Equipment Type	Emission Point Identification Number (EPN)	Construction Date, Serial Number, or Manufacturer Name	Capacity
2 new Caterpillar 4000Kw, Certified Tier II Model C-1750-4000Kw diesel-powered emergency stationary ICE	E4, E5	2014 EXP XL 106 NZS	5646 BHP
2 existing Detroit Diesel Model DDC 16V-4000 diesel-powered emergency stationary RICE	E1, E2	Serial # 0694871 & 0694868	2190 BHP
1 existing diesel-powered emergency stationary RICE Model: MTV-1000	E3	Serial # 2033753	1676 BHP
13 natural gas-fired boilers, each having a heat input rate of 2.07MMbtu/hr	B1	Lochinvar	2.07 MMbtu/hr each
4 natural gas-fired boilers, each having a heat input rate of 0.99MMbtu/hr	B2	Domestic hot water boilers Lochinvar	0.99 MMbtu/hr each
3 existing diesel storage tanks	D-TK	Diesel storage	1,000 gallons each
2 new 410 gallons diesel tanks		Diesel storage	410 gallons each
1 new 12,000 gallon diesel tank		Diesel storage	12,000 gallons

DRAFT

III. REGULATORY APPLICABILITY

1) The applicant is limited through this synthetic minor permit under 40 CFR § 49.158 to meet the standards and limitations and emissions in Table 2. The total emission limits from this facility for all emission units shall be less than the applicable Part 71 major source threshold of 100 tpy and below the NSR major source threshold of 250 tpy for all NSR pollutants.

2) The permitted emissions from the facility listed in Table 2 of this permit do not include emergency events. An emergency event is a sudden unexpected event or series of events that will need immediate response to avoid further damage to property, people and the environment [e.g., power for critical networks or equipment, including power supplied to portions of the facility, when electric power from the local utility (or the normal power source) is interrupted, or for power use to pump water in case of a fire or flood].

3) The three existing stationary RICE (E1, E2, and E3) shall comply with the applicable requirements for emergency stationary RICE, as set forth in 40 CFR Part 63, Subpart ZZZZ.

4) The two new stationary emergency ICE (E4 and E5) shall comply with the applicable requirements for emergency stationary internal combustion engines, as set forth in 40 CFR Part 60, Subpart IIII.

5) The boilers are below the fuel combustion rates for any applicable new source performance standard at 40 CFR § 60.40 (a), (b), or (c), and the emission rates are estimated on an annual fuel rate of 265,118 MSCF pipeline quality natural gas.

6) The issuance of this permit does not provide relief for any federal applicable regulations that the facility may have been subject to prior to issuance of the permit, including 40 CFR Parts 52, 60, 63, or 71.

IV. GENERAL CONDITIONS

1) This permit and any required attachments shall be retained and made available for inspection upon request at the site.

2) The Permittee shall abide by all representations, statements of intent and agreements contained in the application submitted by the Permittee. The EPA shall be notified ten (10) days in advance of any significant deviation from the permit application as well as any plans, specifications or supporting data furnished to EPA.

3) The Permittee shall comply with all conditions of this permit, including emission limitations that apply to the affected emissions units at the permitted source. Noncompliance with any permit term or condition is a violation of the permit and may constitute a violation of the Clean Air Act and is grounds for enforcement action and for a permit termination or revocation.

DRAFT

4) The permitted source must not cause or contribute to a National Ambient Air Quality Standard (NAAQS) violation or in an attainment area, must not cause or contribute to a Prevention of Significant Deterioration (PSD) increment violation as described in 40 CFR § 49.155(a)(7).

5) Issuance of this permit does not relieve the Permittee, the owner, and/or the operator of the responsibility to comply fully with all other applicable Federal and Tribal rules, regulations, and orders now or hereafter in effect.

6) It is not a defense for the Permittee, in an enforcement action, to claim that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

7) For proposed modifications, as defined at 40 CFR § 49.152(d), that would increase an emissions unit's allowable emissions of a regulated NSR pollutant above its existing permitted annual allowable emissions limit, the Permittee shall first obtain a permit modification pursuant to 40 CFR §§ 49.154 and 49.155 approving the increase. For a proposed modification that is not otherwise subject to review under major NSR or under the program established under 40 CFR Part 49, such proposed increase in the annual allowable emissions limit shall be approved through an administrative permit revision as provided at 40 CFR § 49.159(f).

8) At such time that a new or modified source at the permitted facility or modification of the permitted facility becomes a major stationary source or major modification solely by virtue of a relaxation in any legally and practically enforceable limitation which was established after August 7, 1980, on the capacity of the permitted facility otherwise to emit a pollutant, such as a restriction on hours of operation, then the requirements of 40 CFR § 52.21 shall apply to the source or modification as though construction had not yet commenced on the source or modification.

9) *Revise, Reopen, Revoke and Reissue, or Terminate for Cause:* The permit may be revised, reopened, revoked and reissued, or terminated for cause pursuant to 40 CFR § 49.155(a)(7)(iv). The filing of a request by the Permittee for a permit revision, revocation and reissuance, termination, or of a notification of planned changes or anticipated noncompliance does not stay any permit condition. The EPA may reopen a permit for a cause on its own initiative, e.g., if the permit contains a material mistake or the Permittee fails to assure compliance with the applicable requirements.

10) *Severability Clause:* The provisions of this permit are severable, and in the event of any challenge to any portion of this permit, or if any portion is held invalid, the remaining permit conditions shall remain valid and in force.

11) *Property Rights:* The permit does not convey any property rights of any sort or any exclusive privilege.

12) *Information Requests:* The Permittee shall furnish to the EPA, within a reasonable time, any information that the EPA may request in writing to determine whether cause exists for revising, revoking and reissuing, or terminating the permit or to determine compliance with the permit. For any such information claimed to be confidential, the Permittee shall also submit a claim of confidentiality in accordance with 40 CFR Part 2, Subpart B.

13) *Inspection and Entry:* The EPA or its authorized representatives may inspect the permitted facility during normal business hours for the purpose of ascertaining compliance with all conditions of this permit. Upon presentation of proper credentials, the Permittee shall allow the EPA or its authorized representatives to:

a) Enter upon the premises where a source is located or emissions-related activity is conducted, or where records are required to be kept under the conditions of this permit;

b) Have access to and copy, at reasonable times, any records that are required to be kept under the conditions of this permit;

c) Inspect, during normal business hours or while the source is in operation, any facilities, equipment (including monitoring and air pollution control equipment), practices, or operations regulated or required under this permit;

d) Sample or monitor, at reasonable times, substances or parameters for the purpose of assuring compliance with this permit or other applicable requirements; and

e) Record any inspection by use of written, electronic, magnetic and photographic media.

14) *Permit Effective Date:* This permit is effective immediately upon issuance unless comments resulted in a change in the draft permit, in which case the permit is effective 30 days after issuance.

15) *Permit Transfers:* Permit transfers shall be made in accordance with 40 CFR § 49.159(f). The Air Program Director shall be notified in writing at the address shown below if the Permittee is sold or changes its name.

U.S. Environmental Protection Agency
Region 6 Air Permitting,
Multimedia Planning and Permitting Division
Tribal Air Permitting, 6MM-AP
1445 Ross Ave
Dallas TX 75202

16) This permit will become invalid for the new construction unless construction commences within 18 months after the effective date of this permit or the Permittee discontinues

construction activities for 18 months, or if the Permittee does not complete construction within a reasonable time.

V. SPECIAL CONDITIONS

1) The emission limits set forth in Table 2 below are based on the calculations provided in the August 12, 2014 permit application.

Table 2
Emission Limits and Standards

Equipment Description	(EPN)*	Standard or Emission Limit	Cumulative Emissions[4] (for all EPN) in tpy
3 RICE Units Diesel Fuel[1]	E1, E2 ,E3	1. Each RICE unit is limited to 100 hours per year, based on a 12-month rolling average, for the purposes specified in 40 CFR § 63.6640(f)(2)(i) through (iii), as further limited by 40 CFR § 63.6640(f)(4). 2. Use of ultra-low sulfur diesel not to exceed 0.0015 wt % sulfur. 3. Work practice standards for maintenance and operation of the engines.	NO_x= 6.48 SO_2= 0.004 PM= 0.33 PM_{10}=0.33 $PM_{2.5}$=0.33 CO = 5.96 VOC = 0.78
2 New Caterpillar ICE Units Diesel Fuel[1]	E4, E5	1. Each ICE unit is limited to 100 hours per year, based on a 12-month rolling average, for the purposes specified in and limited by 40 CFR § 60.4211(f)((1) – (3). Testing of the engines is to be less than one hour per event. See Special Conditions V.3 and V.4 of this permit. 2. Use of ultra-low sulfur diesel not to exceed 0.0015 wt. % sulfur. 3. Work practice standards for maintenance and operation of the engines.	NOx = 8.2 SO_2 = 0.05 CO = 0.75 PM=0.07 PM_{10}=0.07 $PM_{2.5}$=0.07 VOC=0.08
Boilers 1-17[2,3]	B1, B2	1. Use of pipeline natural gas. 2. Monthly rate of 22.1MMSCF based on a 12-month rolling average. 3. No visible emissions. 4. Work practice standard for maintenance of the boilers.	NO_x = 13.26 SO_2 = 0.08 PM= 1.01 PM_{10}=1.01 $PM_{2.5}$=1.01 VOC = 0.73 CO = 11.14
Diesel Storage Tanks[3]	D-TK	1. Low sulfur diesel < 0.0015 wt. % sulfur 2. Filling rates not to exceed an annual 12- month rolling average of 457,812 gallons.	VOC ≤ 0.82

* Emission Point Number

1) Emission rates are based on a maximum diesel input of 457,812 gallons for all generators and are for non-emergency use.
2) Cumulative emissions based on the natural gas used for the boilers. These are insignificant emission units that do not require monitoring for individual boiler operations.
3) Insignificant emissions and units will not require monitoring for emissions. Emissions will be calculated based on diesel filling rates not to exceed 457,812 gals/year for all tanks.
4) Cumulative emissions for the specific category of units and EPN

DRAFT

2) Readiness testing includes maintenance, startup and shutdown for EPN E1, E2, E3, E4 and E5. E1, E2, and E3 must meet the requirements of 40 CFR § 63.6640(f) while E4 and E5 must meet the requirements of 40 CFR § 60.4211(f).

3) The operation for readiness testing for EPNs E4 and E5 shall take place only during 1:00 pm - 3:00 pm, and will be less than one hour per event test per engine. EPNs E4 and E5 shall be tested sequentially and not combined with the other engines to ensure that the one hour NO_2 NAAQS is not exceeded.

4) The owner/operator shall only conduct readiness testing for EPNs E1 – E5, during days when the hourly ambient NO_2 level measured by the NO_2 air quality monitor in Bernalillo-Albuquerque County operated by the City of Albuquerque is 53 ppb or lower. Readings are available at: http://www.cabq.gov/airquality/todays-status and should be recorded prior to any testing.

5) EPNs E4 and E5 are Tier II certified, and must meet the applicable requirements of 40 CFR Part 60, Subpart IIII, including the compliance requirements set forth in 40 CFR § 60.4211. EPNs E4 and E5 shall only be operated as emergency stationary ICE, in accordance with 40 CFR § 60.4211(f).

6) The annual emission limits in Table 2 are estimates from the operation of the emission units and include periods of maintenance, startup and shutdown.

7) For the all the engines and any respective control system, the Permittee shall follow the manufacturer's maintenance schedule and procedures to ensure good air pollution control practices for minimizing emissions.

8) Emissions shall be calculated based on AP-42 factors for the boilers (EPNs B1 and B2) utilizing natural gas, and using manufacturer's data for the RICE and ICE units using ultra low sulfur diesel (EPNs E1-E5).

9) The emissions from the new 12,000 gallon diesel-storage tank (D-TK) shall be calculated using the method in Appendix A of this permit. The combined annual diesel deliveries to the all storage tanks shall not exceed 457,812 gallons per year based on a 12-month rolling average.

VI. MONITORING AND OPERATIONAL REQUIREMENTS

1) For EPNs E1 – E5, operate and maintain the equipment according to the manufacturer's recommendations.

2) For EPNs E1 – E5, monitor and document the NO_2 level in Bernalillo County and time period when the readiness tests are performed, pursuant to Specific Conditions V.3 and V.4 of this permit.

DRAFT

3) For EPNs E1 – E5, monitor and record the hourly use, operation, startup and shutdown and readiness tests. Compliance with the annual rate shall be calculated monthly as the sum of each consecutive month period. Compliance for the consecutive 12-month rolling average shall be demonstrated monthly by adding the total for the most recently completed calendar month to the individual monthly totals for the preceding 11 months.

4) E1-E3 must meet all applicable requirements 40 CFR Part 63, Subpart ZZZZ for emergency stationary RICE, including the monitoring and operational requirements of Table 2d, section 4, and the requirements in 40 CFR § 63.6625(e) and (f).

5) E4 and E5 must meet all applicable requirements of 40 CFR Part 60, Subpart IIII for emergency stationary ICE, including the requirements in 40 CFR § 60.4209 and the monitoring requirements specified in 40 CFR § 60.4211.

6) For EPNs B1 and B2, monitor natural gas fuel rates on a monthly basis, and calculate fuel usage based on a 12-month rolling basis to determine compliance with the annual limit in Table 1. Compliance for the consecutive 12-month rolling average shall be demonstrated monthly by adding the total for the most recently completed calendar month to the individual monthly totals for the preceding 11 months.

7) For EPN D-TK, monitor the diesel fuel filling rates, and for EPNs E1 – E5, monitor the fuel to the diesel engines on a monthly basis, and calculate the 12-month rolling average for compliance with the annual limits in Table 2. The 12-month rolling average should be computed as stated in monitoring requirement V.6.

8) The Permittee shall obtain certification from the fuel supplier with each shipment of diesel fuel to certify the name of the fuel supplier, the volume delivered, and the sulfur content of the fuel.

VII. RECORDKEEPING REQUIREMENTS

1) Maintain records of the natural gas flow rate in MMSCF to the boilers using the natural gas flow meter on a monthly basis.

2) For EPN E1 – E3, maintain records as required for emergency stationary RICE, as required by 40 CFR § 63.6655(f). For EPN E4- E5, maintain records as required for emergency stationary ICE, as required by 40 CFR § 60.4214.

3) Maintain records detailing the amount of diesel fuel used by EPN E1 – E5 on a calendar basis not to exceed 457,812 gallons of ultra-low sulfur diesel (not to exceed 0.0015% sulfur by weight). Sulfur content of diesel will be determined either from vendor information or by annual sampling.

4) Maintain all maintenance records of the engines and boilers to ensure good pollution practices. These records shall be kept on-site.

5) Record the time periods when the generators associated with EPN E1 – E5 provide power to the grid.

6) The Permittee shall submit records of emergency events utilizing the emergency generators. These events should include the date, time period, fuel rates and emissions for each event.

7) All records shall be retained for a minimum of 5 years from the time such record was created.

VIII. REPORTING REQUIREMENTS

Reports should be sent electronically to EPA Compliance and Enforcement Division at R6TribalNSRCompliance@epa.gov with a copy to R6AirPermits@epa.gov . The subject line on the report must have "Compliance Report for Sandia, Permit No. R6NSR-NM-001, and the type of report (annual, emergency etc.)

1) The Permittee shall promptly submit to EPA a written report of any deviations of emission or operational limits and a description of any corrective actions or preventative measures taken. A "prompt" deviation report is one that is date marked via electronic mail
   a) Thirty (30) days from the discovery of a deviation that would cause the Permittee to exceed the facility-wide emission limits if left un-corrected for more than five (5) days after discovering the deviation; and
   b) Twelve (12) months from the discovery of a deviation of recordkeeping or other permit conditions that do not affect the permittee's ability to meet the facility-wide emission limits.

2) The Permittee shall submit records of emergency events utilizing the emergency engines and associated generators. These events should include the date, time period, fuel used and emissions for each event.

3) The Permittee shall submit an annual report documenting the twelve (12) month annual emissions and/or limits for each previous calendar year to EPA no later than April 1st (the Annual Report). For the first calendar year the Permittee shall submit the cumulative facility-wide limits. If there were no deviations from the permit limits, then the Annual Report shall document that no operational restriction has been exceeded.

4) The Permittee shall submit certified vendor report(s) of sulfur concentration in the diesel and the quantities delivered to the facility. An annual average sulfur emissions in the diesel should be calculated, as well as the 12-month rolling average.

5) Annual emissions shall be calculated using the emission equation below:
   $E = EF \times OP \times Hr \times K$

Where:
E = pollutant emissions in tons/year
EF = emission factor
OP = operational rate such as the BHP of the engines or MMBTU/hr for natural gas
Hr = Number of hours of operation/year
K = 1 ton/2000 lbs for conversion from pounds per year to tons per year.

a. For the diesel engines use the manufacturer-specific factors. Emission factors from the manufacturers' specification sheets and the AP-42 factors are included in Appendix B.

b. For sulfur emissions, use the annual % sulfur in the diesel fuel purchased.

c. For the boilers, use the 12-month rolling average natural gas usage and the AP-42 factors in "Emission Factors for Criteria Pollutants," Fifth Edition, Chapter 1, Table 1.4-2.

6) Provide any other reports, as requested by EPA.

Table of Acronyms

bhp	Brake Horse Power
Btu/hr	British Thermal Units per Hour
CFR	Code of Federal Regulations
CH_4	Methane
CO	Carbon Monoxide
dscf	Dry Standard Cubic Foot
FIP	Federal Implementation Plan
FR	Federal Register
HHV	High Heating Value
HAP	Hazardous Air Pollutants
hr	Hour
ICE	Internal Combustion Engine
kW	Kilowatt
lb	Pound
lb/yr	Pounds Per Year
MMBtu/hr	Million British Thermal Units per Hour
NSPS	New Source Performance Standards
NOx	Nitrogen Oxides
PSD	Prevention of Significant Deterioration
PTE	Potential to Emit
RICE	Reciprocating Internal Combustion Engine
SCF	Standard Cubic Feet
tpy	Tons per Year
VOC	Volatile Organic Compounds

APPENDIX A

EMISSIONS FROM FIXED ROOF TANKS

$$L_W = 0.024 * M_V * P_{VA} * Q * K_N * K_P \qquad (Eq.\ 7)$$

where:

L_W = working loss, lbs/yr

M_V = average vapor molecular weight, lb/lb-mole

[See Appendix 1 for vapor molecular weight of selected materials]

P_{VA} = true vapor pressure of stored liquid at average liquid surface temperature, psia

[See Appendix 1 for true vapor pressure of selected materials]

Q = annual throughput, Mgallon/yr

K_N = turn over factor, dimensionless, dependent of annual throughput, Q *(Mgallon/yr)*, and tank capacity, C *(Mgallons)*. K_N is calculated as follows:

If $Q/C \leq 36$ then $K_N = 1.0$

If $Q/C > 36$ then

$$K_N = \frac{180 * C + Q}{6 * Q} \qquad (Eq.\ 8)$$

K_P = working loss product factor, dimensionless, $K_P = 0.75$ for **crude oil** and $K_P = 1.0$ for **other materials**

Standing Loss - Fixed roof tank standing loss can be estimated from:

$$L_S = U * V_V * W_V * K_E * K_S \qquad (Eq.\ 9)$$

where:

L_S = standing storage loss, lbs/yr

U = number of days of the year that the tank is used to store liquid material. This number must not be more than 365 days. If not known, assume 365 days.

V_V = vapor space volume can be calculated as:

$$V_V = 66.84 * C + V_F \qquad (Eq.\ 10)$$

where:

C = tank capacity, Mgallons

V_F = vapor space function, depending on tank diameter

[See Appendix 2 for selected vapor space function]

W_V = vapor density, lb/ft^3

[See Appendix 1 for vapor density of selected materials]

K_E = vapor space expansion factor, dimensionless

[See Appendix 1 for vapor space expansion factors for selected materials]

K_S = vented vapor saturation factor, dimensionless, can be calculated as follows:

$$K_S = \frac{1}{1 + (S_A * H) + (S_B * D)} \qquad (Eq.\ 11)$$

where:

S_A, S_B = vapor saturation functions

[See Appendix 1 for vapor saturation function of selected materials]

D = tank diameter, ft

H = tank height, ft

SPECIAL CASES

For **horizontal tank** :

$$V_V = \frac{H * D^2}{2} \qquad (Eq.\ \ 10-a)$$

and

$$K_S = \frac{1}{1+(0.0265 * P_{VA} * D)} \qquad (Eq.\ \ 11-a)$$

$$V_V = \frac{0.393 * H * L_1 * L_2}{(L_1 + L_2)} \qquad (Eq.\ \ 10-b)$$

For **rectangular tank**:

and

where:

$$K_S = \frac{1}{1+(0.0133 * P_{VA} * H)} \qquad (Eq.\ \ 11-b)$$

L_1 , L_2 = side 1 and side 2 of rectangular tank, ft

D = tank diameter, ft

H = tank height, ft

P_{VA} = true vapor pressure of stored liquid at average liquid surface temperature, psia

[See Appendix 1 for true vapor pressure of selected materials]

APPENDIX 1 - Properties and Parameters for Selected Materials

Product		Chemical Name	CAS	Vapor		Liquid Density	P_{VA}	F_P	K_E	S_A	S_B	Small Tank Loss Factors		
Category	Code			M_V	W_V	W_L						f	a	b
Crude Oils	001	Crude oil (RVP 5)		50	0.028	7.10	3.181	0.061	0.094	0.0843	0.0115	2.863	0.378	0.084
Petroleum Dist	002	Distillate fuel oil #2		130	0.00018	7.10	0.0077	0.00013	0.034	0.0002	0.00003	0.0241	0.0009	0.0002
Petroleum Dist	003	Residual oil #6		190	0.000002	7.90	0.00005	0.000001	0.034	0.000001	0.0000002	0.000241	0.00001	0.000001
Petroleum Dist	004	Jet naphtha (JP-4)		80	0.02	6.40	1.419	0.025	0.056	0.0376	0.0052	2.725	0.162	0.038
Petroleum Dist	005	Jet kerosene		130	0.0002	7.00	0.0098	0.00017	0.034	0.0003	0.00004	0.0306	0.0011	0.0003
Petroleum Dist	006	Gasoline (RVP 6)		69	0.04	5.60	3.275	0.063	0.091	0.0868	0.0119	5.423	0.522	0.087
Petroleum Dist	007	Gasoline (RVP 7)		68	0.047	5.60	3.880	0.076	0.106	0.1028	0.0141	6.332	0.714	0.103
Petroleum Dist	008	Gasoline (RVP 8)		68	0.054	5.60	4.494	0.091	0.118	0.1191	0.0163	7.334	0.918	0.119
Petroleum Dist	009	Gasoline (RVP 9)		67	0.061	5.60	5.116	0.107	0.134	0.1356	0.0186	8.226	1.171	0.136
Petroleum Dist	010	Gasoline (RVP 10)		66	0.067	5.60	5.744	0.123	0.143	0.1522	0.0209	9.099	1.379	0.152
Petroleum Dist	011	Gasoline (RVP 11)		65	0.074	5.60	6.379	0.141	0.174	0.1691	0.0232	9.952	1.835	0.169
Petroleum Dist	012	Gasoline (RVP 12)		64	0.08	5.60	7.020	0.161	0.199	0.1860	0.0255	10.783	2.272	0.186
Petroleum Dist	013	Gasoline (RVP 13)		62	0.084	5.60	7.667	0.182	0.229	0.2032	0.0278	11.408	2.764	0.203

APPENDIX 2 - Storage Tank Factors by Diameter

TANK DIAMETER	FLOATING											FIXED ROOF
	External Roof					Internal Roof						
			F_F					F_F		K_D	S_D	
(ft)	N_C	K_R	Pontoon	Double	K_D	N_C	K_R	Bolted	Welded	Bolted	Bolded	V_F
10	0.0	20.1	1628.6	1634.5	0.0	0.100	6.7	245.5	244.5	0.14	0.2	54
12	0.0	20.1	1630.2	1634.8	0.0	0.083	6.7	245.3	243.9	0.14	0.2	93
14	0.0	20.1	1631.8	1635.1	0.0	0.071	6.7	245.6	243.7	0.14	0.2	148
16	0.0	20.1	1633.4	1635.5	0.0	0.063	6.7	246.4	243.9	0.14	0.2	220
18	0.0	20.1	1635.1	1635.8	0.0	0.056	6.7	247.6	244.5	0.14	0.2	314
20	0.0	20.1	1636.8	1636.2	0.0	0.050	6.7	249.3	245.5	0.14	0.2	430
22	0.0	20.1	1638.5	1636.6	0.0	0.045	6.7	251.5	246.8	0.14	0.2	573
24	0.0	20.1	1640.2	1637.1	0.0	0.042	6.7	254.1	248.6	0.14	0.2	744
26	0.0	20.1	1641.9	1637.6	0.0	0.038	6.7	257.2	250.8	0.14	0.2	946
28	0.0	20.1	1643.7	1638.1	0.0	0.036	6.7	260.8	253.3	0.14	0.2	1181
30	0.0	20.1	1645.5	1638.7	0.0	0.033	6.7	264.9	256.2	0.14	0.2	1453
32	0.0	20.1	1647.3	1639.2	0.0	0.031	6.7	269.4	259.6	0.14	0.2	1763
34	0.0	20.1	1649.1	1639.8	0.0	0.029	6.7	274.4	263.3	0.14	0.2	2115
36	0.0	20.1	1650.9	1640.5	0.0	0.028	6.7	279.9	267.4	0.14	0.2	2510
38	0.0	20.1	1652.8	1641.2	0.0	0.026	6.7	285.8	271.9	0.14	0.2	2952
40	0.0	20.1	1654.7	1641.9	0.0	0.025	6.7	292.2	276.9	0.14	0.2	3443
42	0.0	20.1	1656.6	1642.6	0.0	0.024	6.7	299.1	282.2	0.14	0.2	3986
44	0.0	20.1	1658.5	1643.4	0.0	0.023	6.7	306.4	287.9	0.14	0.2	4583
46	0.0	20.1	1660.4	1644.2	0.0	0.022	6.7	314.3	293.9	0.14	0.2	5237
48	0.0	20.1	1662.4	1645.0	0.0	0.021	6.7	322.5	300.4	0.14	0.2	5950

APPENDIX B

EMISSION FACTORS FOR THE GENERATORS

DIESEL GENERATOR SET

CAT®

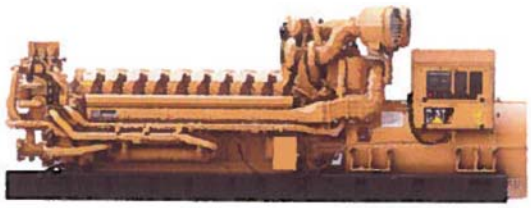


Image shown may not reflect actual package

STANDBY
4000 ekW 5000 kVA
60 Hz 1800 rpm 12470 Volts

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

FUEL/EMISSIONS STRATEGY
- EPA Certified for Stationary Emergency Applications (EPA Tier 2 emissions level)

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

FULL RANGE OF ATTACHMENTS
- Wide range of bolt-on system expansion attachments, factory designed and tested
- Flexible packaging options for easy and cost effective installation

SINGLE-SOURCE SUPPLIER
- Fully prototype tested with certified torsional vibration analysis available

CAT C175-20 DIESEL ENGINE
- Reliable, rugged, durable design
- Four-stroke diesel engine combines consistent performance and excellent fuel economy with minimum weight

CAT SR5 GENERATOR
- Designed to match performance and output characteristics of Cat diesel engines
- Single point access to accessory connections

CAT EMCP 4 CONTROL PANELS
- Simple user friendly interface and navigation
- Scalable system to meet a wide range of customer needs
- Integrated Control System and Communications Gateway

Technical Data

Open Generator Set - 1800 rpm/60 Hz/12 470 Volts	DM8854	
Stationary Emergency (EPA Tier 2)		
Generator Set Package Performance		
Genset Power rating @ 0.8 pf	5000 kVA	
Genset Power Rating without fan	4000 ekW	
Fuel Consumption		
100% Load with fan	1039.3 L/hr	274.6 Gal/hr
75% Load with fan	770.6 L/hr	203.6 Gal/hr
50% Load with fan	615.0 L/hr	162.5 Gal/hr
Inlet Air		
Combustion air inlet flow rate	339.1 m^3/min	11975 cfm
Exhaust System		
Exhaust stack gas temperature (engine out)	473.9 °C	885 °F
Exhaust gas flow rate	871.4 m^3/min	30771 cfm
Exhaust system backpressure (maximum allowable)	6.7 kPA	26.9 in water
Heat Rejection		
Heat rejection to coolant (total)	2148 kW	122133 Btu/min
Heat rejection to exhaust (total)	3928 kW	223338 Btu/min
Heat rejection to aftercooler	447 kW	25437 Btu/min
Heat rejection to atmosphere from engine	304 kW	17303 Btu/min
Heat rejection to atmosphere from generator	197 kW	11213 Btu/min
Alternator		
Motor starting capabiliy @30% voltage dip	10728 skVA	
Frame	3055	
Temperature Rise	130 °C	234 °F
Lube System		
Sump refil with filter	675 L	178.3 gal
Emissions (Nominal)[2]		
NOx g/hp-hr	5.07 g/hp-hr	
CO g/hp-hr	0.52 g/hp-hr	
HC g/hp-hr	0.17 g/hp-hr	
PM g/hp-hr	0.04 g/hp-hr	

Emissions Data

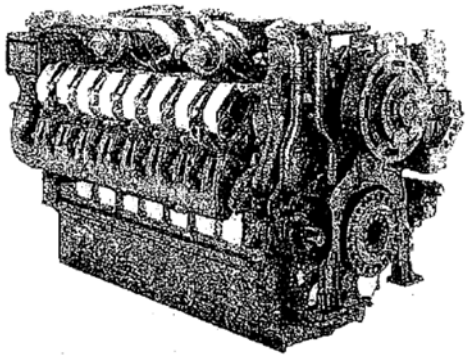
RATED SPEED POTENTIAL SITE VARIATION: 1800 RPM

GENSET POWER WITHOUT FAN		EKW	4,000.0	3,000.0	2,000.0	1,000.0	400.0
PERCENT LOAD		%	100	75	50	25	10
ENGINE POWER		BHP	5,646	4,280	2,853	1,427	571
TOTAL NOX (AS NO2)		G/HR	37,883	30,781	9,984	4,384	2,820
TOTAL CO		G/HR	3,618	4,085	9,251	2,355	3,016
TOTAL HC		G/HR	354	318	610	824	698
PART MATTER		G/HR	310 9	246.1	180 7	155.3	179.0
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	3,184.5	3,438.7	1,401.7	1,116.9	1,496 4
TOTAL CO	(CORR 5% O2)	MG/NM3	269.1	434.3	1,216.8	565.4	1,503.0
TOTAL HC	(CORR 5% O2)	MG/NM3	23.1	28.9	69.7	170.9	301.6
PART MATTER	(CORR 5% O2)	MG/NM3	20.7	22.3	20.8	32.8	80 6
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	1,551	1,675	683	544	729
TOTAL CO	(CORR 5% O2)	PPM	215	347	973	452	1,202
TOTAL HC	(CORR 5% O2)	PPM	43	54	130	319	563
TOTAL NOX (AS NO2)		G/HP-HR	6.81	7.25	3.51	3.08	4.95
TOTAL CO		G/HP-HR	0.65	0.96	3.25	1.65	5.29
TOTAL HC		G/HP-HR	0.06	0.07	0.21	0.58	1.23
PART MATTER		G/HP-HR	0.06	0 06	0 06	0.11	0.31
TOTAL NOX (AS NO2)		LB/HR	83.52	67.86	22.01	9.67	6.22
TOTAL CO		LB/HR	7.98	9.01	20.40	5.19	6.65
TOTAL HC		LB/HR	0.78	0.70	1.35	1.82	1.54
PART MATTER		LB/HR	0.69	0.54	0.40	0.34	0.39

RATED SPEED NOMINAL DATA: 1800 RPM

GENSET POWER WITHOUT FAN		EKW	4,000.0	3,000.0	2,000.0	1,000.0	400.0
PERCENT LOAD		%	100	75	50	25	10
ENGINE POWER		BHP	5,646	4,280	2,853	1,427	571
TOTAL NOX (AS NO2)		G/HR	31,569	25,651	8,320	3,654	2,350
TOTAL CO		G/HR	2,010	2,269	5,140	1,308	1,675
TOTAL HC		G/HR	266	239	459	619	525
TOTAL CO2		KG/HR	2,976	2,183	1,732	958	484
PART MATTER		G/HR	222 1	175.8	129.1	111.0	127.8
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	2,653.8	2,865.5	1,168.1	930.8	1,247.0
TOTAL CO	(CORR 5% O2)	MG/NM3	149 5	241.3	676 0	314.1	835.0
TOTAL HC	(CORR 5% O2)	MG/NM3	17.4	21.7	52.4	128 5	226.8
PART MATTER	(CORR 5% O2)	MG/NM3	14.8	15.9	14.9	23.4	57.5
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	1,293	1,396	569	453	607
TOTAL CO	(CORR 5% O2)	PPM	120	193	541	251	668
TOTAL HC	(CORR 5% O2)	PPM	32	41	98	240	423
TOTAL NOX (AS NO2)		G/HP-HR	5.87	6.04	2.93	2.57	4.12
TOTAL CO		G/HP-HR	0.36	0.53	1.81	0.92	2.94
TOTAL HC		G/HP-HR	0.05	0.06	0.16	0 43	0.92
PART MATTER		G/HP-HR	0.04	0.04	0.05	0.08	0.22
TOTAL NOX (AS NO2)		LB/HR	69.60	56.55	18.34	8.05	5.18
TOTAL CO		LB/HR	4.43	5.00	11.33	2.88	3.69
TOTAL HC		LB/HR	0.59	0.53	1.01	1.37	1.16
TOTAL CO2		LB/HR	6,561	4,813	3,819	2,112	1,024
PART MATTER		LB/HR	0.49	0.39	0.28	0.24	0.28
OXYGEN IN EXH		%	10.0	10.7	12.0	13.0	15.2
DRY SMOKE OPACITY		%	1.5	1.5	0.6	0.5	2.3
BOSCH SMOKE NUMBER			0.53	0.51	0.25	0.18	0.73

DDC 16V-4000 Generator Set Power



(Shown with optional equipment)

Specifications

Engine	16V-4000
Description	Turbocharged – Aftercooled
Number of Cylinders	16
Bore and Stroke	6.50 in x 7.50 in (165 mm x 190 mm)
Displacement	3967 CID (65 L)
Compression Ratio	13.7:1
Fluid Capacity, Coolant	160 qts (150 L)
Lube Oil	264 qts (250 L)
Engine Control	DDEC
Dimensions	
Length	113.3 in (2879 mm)
Width	55.1 in (1400 mm)
Height	68.3 in (1735 mm)
Weight (dry)	14558 lbs (6603 kg)

16V-4000 Performance Chart

Model	T1637K38-G21		T1637K38-G41		T1637K38-G60			T1637K38-G80		
RPM	1500	1500	1800	1800	1500	1500	1500	1800	1800	1800
Rating HP (BKW)	2260(1686)	2055(1533)	2560(1900)	2320(1730)	2600(1940)	2360(1760)	1945(1450)	2935(2190)	2670(1990)	2000(1495)
Charge Air Cooling	SCCC	SCCC	SCCC	SCCC	SCCC	SCCC	SCCC	SCCC	SCCC	SCCC
Duty Cycle	Standby	Prime	Standby	Prime	Standby	Prime	Continuous	Standby	Prime	Continuous
Fuel Consumption										
@ 50% load (gal/hr)	52.70	48.70	62.60	56.10	58.90	54.00	46.10	67.20	62.60	49.10
(l/min)	3.32	3.07	3.83	3.54	3.72	3.41	2.91	4.24	3.91	3.10
@ 75% load (gal/hr)	75.80	69.20	86.50	79.40	86.20	78.20	65.50	96.70	88.90	68.50
(l/min)	4.78	4.36	5.46	5.01	5.44	4.93	4.13	6.10	5.61	4.32
@100% load (gal/hr)	102.60	92.40	114.90	104.10	118.90	106.70	85.90	133.20	119.10	88.90
(l/min)	6.48	5.83	7.25	6.57	7.50	6.73	5.42	8.40	7.51	5.61

All Detroit Diesel Series 4000 engines operating at 1800rpm have been certified to meet the US EPA Year 2000 Non-road Mobile Emission Requirements, which are as follows:

NOx	HC	CO	PM
6.9 g/bhp/hr	0.97 g/bhp/hr	8.5 g/bhp/hr	0.40 g/bhp/hr

Rated power output shown represents engine performance capabilities at ambient conditions equivalent to ISO 3046, BS5514: 100 kPa total barometric pressure, 25°C air inlet temperature, 30% relative humidity.

Standby Power Rating: This rating is applicable to heavy duty diesel generator sets and is subject to varying load factors used in the event of a utility power failure. In this and other emergency applications, the generator set may be operated at rated power until normal power is restored. Power loss may be experienced at elevated ambient temperature and high altitude. The generator set in standby applications will operate an average of less than 5% of the time over the course of a year and at an average load factor not to exceed 70% of the Standby Rating.

Prime Power Rating: This rating is applicable to heavy duty diesel generator sets when used as a utility type power source and is subject to varying load conditions, with an intermittent overload (of 10%) up to the standby power rating, for no more than one hour in every 12 hours of operation. When averaged over a 24 hour period, this load factor will not exceed 70% of the Prime Power Rating. Under these conditions, the generator set may be operated continuously for an unlimited number of hours. Power loss may be experienced at elevated ambient temperature and high altitude.

Continuous Power Rating: This rating is applicable to heavy duty diesel generator sets when used as a utility type power source. The engine is expected to be operated with non-varying load factors of up to 100% of the continuous power rating and/or constant dedicated loads. Under these conditions it may be operated for an unlimited number of hours per year. Power loss may be experienced at elevated temperatures and high altitude.

TECHNICAL DATA SHEET
MTU 2000

GEN SET MODEL	MTU 2000		
FREQUENCY:	60 HZ		
P.R.P. KVA:	2323		
P.R.P. KW:	1858,4		
STAND-BY KVA:	2555		
STAND-BY KW:	2044		
VOLTAGE:	480/277		
COSφ:	0,8		
FUEL TANK CAPACITY LT.:	N/A		
CONTROL PANEL TYPE:	AUTO		
CONTROL PANEL MODEL:	EVOLUTION		
TYPE OF ENCLOSURE:	COVER	SILENT	S SILENT
SIZE OF ENCLOSURE:	N.A.	N.A.	N.A.

Table 3.3-1

EMISSION FACTORS FOR UNCONTROLLED GASOLINE AND DIESEL INDUSTRIAL ENGINES[a]
(From AP-42, Supplement B, October 1996)

Pollutant	Gasoline Fuel (SCC 2-02-003-01, 2-03-003-01)		Diesel Fuel (SCC 2-02-001-02, 2-03-001-01)		EMISSION FACTOR RATING
	Emission Factor (lb/hp-hr) (power output)	Emission Factor (lb/MMBtu) (fuel input)	Emission Factor (lb/hp-hr) (power output)	Emission Factor (lb/MMBtu) (fuel input)	
NO_x	0.011	1.63	0.031	4.41	D
CO	6.96 E-03[d]	0.99[d]	6.68 E-03	0.95	D
SO_x	5.91 E-04	0.084	2.05 E-03	0.29	D
PM-10[b]	7.21 E-04	0.10	2.20 E-03	0.31	D
CO_2 [c]	1.08	154	1.15	164	B
Aldehydes	4.85 E-04	0.07	4.63 E-04	0.07	D
TOC					
Exhaust	0.015	2.10	2.47 E-03	0.35	D
Evaporative	6.61 E-04	0.09	0.00	0.00	E
Crankcase	4.85 E-03	0.69	4.41 E-05	0.01	E
Refueling	1.08 E-03	0.15	0.00	0.00	E

a. References 2, 5-6,9-14. When necessary, an average brake-specific fuel consumption (BSFC) of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr. To convert from lb/hp-hr to kg/kw- hr, multiply by 0.608. To convert from lb/MMBtu to ng/J, multiply by 430. SCC = Source Classification Code. TOC = total organic compounds.

b. PM-10 = particulate matter less than or equal to 10µg/m^3 aerodynamic diameter.

c. Assumes 99% conversion of carbon in fuel to CO_2 with 87 weight % carbon in diesel, 86 weight % carbon in gasoline, average BSFC of 7,000 Btu/hp-hr, diesel heating value of 19,300 Btu/lb and gasoline heating value of 20,300 Btu/lb.

d. Instead of 0.439 lb/hp-hr (power output) and 62.7 lb/mmBtu (fuel input), the correct emissions factors values are 6.96 E-03 lb/hp-hr (power output) and 0.99 lb/mmBtu (fuel input), respectively. This is an editorial correction. March 24, 2009.

DRAFT