January 24, 2025

Amy DeVita-McBride
Cleaner Air Oregon Project Engineer
Oregon Department of Environmental Quality
700 NE Multnomah St. Ste 600
Portland, OR 97232
Amy.devita-mcbride@deq.oregon.gov

RE: 25-0008 – PDX-4 – Cleaner Air Oregon Emission Inventory Additional Information Request Response

Amy DeVita-McBride:

Amazon Data Services, Inc. (ADS) submitted the Cleaner Air Oregon (CAO) Emissions Inventory (Inventory) for the existing data center campus, Source Number 25-0008 (PDX-4), to the Oregon Department of Environmental Quality (Oregon DEQ) in accordance with Oregon Administrative Rule (OAR) 340-245-0030 on September 23, 2024. ADS received a response letter from Oregon DEQ on January 6, 2024, requesting additional information be submitted to Oregon DEQ by January 24, 2024.

REQUESTED INFORMATION

1. **Submit to DEQ a revised Inventory (AQ520), along with all supporting calculations in Excel format, as well as all information required under OAR 340-245-0040(4). Include the following updates to the AQ 520:**
   a. **Cold starts:**
      i. **For all engines and applicable Toxic Air Contaminants (TACs), update the reference in Column I of Worksheet 3 to note that PTE and Capacity emission estimates include cold start emission estimates.**

      The reference in Column I of Worksheet 3 has been updated to reflect that all PTE and Capacity emission estimates for all engines and applicable TACs include cold start emission estimates.

      ii. **Update maximum daily PTE emission estimates for all engines to include cold start calculations.**

      The maximum daily PTE emission estimates for all engines have been updated to include cold start calculations.

      iii. **To aid in DEQ's review, include an active version of the cold start emissions worksheet "Screening Emission Calculations" to supplement the AQ520.**

      An active version of the cold start emission worksheet titled "Screening Emission Calculations" has been included as part of a larger workbook used as a reference for completing the CAO review.

   b. **Pyrene (CASRN 129-00-0): Include the DEQ-approved emission factor of 0.00125 pounds per thousand gallons diesel fuel for all engines types, excluding Type F.**

The DEQ-approved Pyrene emission factor of 0.00125 lb/1000 gal has been updated for all engine types, excluding Type F.

c. **Type A Engines (TEU ID: Type A): Confirm fuel usage rate at 100 percent load against manufacturer engine specifications provided to DEQ.**

The manufacturer engine specification sheet previously provided to the DEQ was issued by the manufacturer in 2023 however, the specification sheet used as a reference for the permitting of this facility was the version issued in 2017. A copy of the 2017 manufacturer specification sheet used as reference for the engines currently permitted at this facility is included in attachment 2 of this document. The fuel usage rate at 100% load has been confirmed against this version of the manufacturer engine specifications.

d. **Type F Engines (TEU ID: Type F):**

i. **Update fuel usage for Type F engines to match Facility Wide Limitation of 269,503 gallons per year. Also ensure the appropriate fuel usage is used for annual emission estimates in worksheet "Screening Emission Calculations."**

The fuel usage for Type F engines has been updated to match the Facility Wide Limit of 269,503 gallons per year, additionally the appropriate fuel usage has been implemented in the annual emission estimates in the "Screening Emission Calculations" worksheet.[1]

ii. **Update calculations for annual PTE and Capacity emission estimates for the Type F engines to include all 79 engines in this category. As presented, calculations are for 15.53 engines.**

Calculations historically indicated that to remain within the facility wide fuel limitation, 15.53 Type F engines would be allowed to operate at their individual full capacity. The facility wide fuel limit is meant to ensure flexibility between generators to operate as necessary without limiting a single generator beyond the New Source Performance Standard (NSPS) requirements of 100 hours per year. Each generator assumes 30 cold starts per year.

The AQ520 form has been updated to assume 30 cold starts per engine and equal fuel use across any generator of a specified type. In the following stages of the Risk Assessment, the risk will be determined based on the capacity of a subset of single units to ensure each engine can operate without additional limitation.

iii. **Update calculations for maximum daily PTE and Capacity emission estimates for the Type F engines to include all 79 engines in this category. As presented, calculations are for 5 engines. Alternatively, provide supporting information describing the assumption of only 5 cold starts per day.**

Calculations historically indicated that to remain within the facility wide fuel limitation, 5 Type F engines would be allowed to operate at their individual full capacity. The facility wide fuel limit is meant to ensure flexibility between generators to operate as necessary without limiting a single generator to less than 24 hours of operation. Each generator assumes 1 cold start per day.

[1] This was completed by updating the function from "ROUNDUP" to "ROUND." All other chronic Requested PTE values have similarly been altered. Rounding for daily shows "ROUNDUP" as to ensure conservatism.

The AQ520 form has been updated to assume 1 cold start per engine and equal fuel use across any generator of a specified type. In the following stages of the Risk Assessment, the risk will be determined based on the capacity of a subset of single units to ensure each engine can operate without additional limitation.

e. **Facility Wide Limitation (TEU ID: FWL):**
   i. **Update TEU ID in Column A of Worksheet 3 to match TEU ID in Column A of Worksheet 2.**

The TEU ID has been updated in Column A of Worksheet 3 to match the TEU ID in column A of Worksheet 2.

   ii. **Update reference in Column I of Worksheet 3 to remove language referencing the Modeling Protocol and Work Plan as these documents have not yet been submitted.**

The language referencing the Modeling Protocol and Work Plan in Column I of Worksheet 3 has been removed as the documents have not yet been submitted.

2. **Facility Wide Limitation (TEU ID: FWL): Provide explanation supporting the annual and maximum daily PTE fuel emission estimates for the facility-wide fuel use limitation. Please include how this calculation method was developed and why it represents a conservative estimate of emissions.**

Emission factors vary between emission units and the facility wide fuel usage may be utilized in any one of these types. The highest possible chronic emission rate for the facility with use of fuel in any generator will either be:

i. All fuel use in the Type F generators (269,503 gallons/yr), or
ii. All fuel allowable used in the other generator types to reach individual unit capacity and the remaining available fuel (68,283 gallons/yr) used in the Type F generators.

Cold start emissions for all generators at 30 cold starts per year are also included in the above scenarios. The facility wide calculation reviews both for these potential scenarios and selects the highest overall emission rate from the facility for each pollutant. The Diesel Particulate Matter (DPM) emission factor for the Type H generator is higher than other generator types and unique from other pollutants. The above scenarios capture this difference in determination of the highest potential facility-wide emission rate.

For the daily emission calculation, the potential facility-wide fuel throughput is 20,000 gallons. Following the same logic as the chronic determination, the following scenarios are used to determine potential facility wide daily emissions:

iii. All fuel use in the Type F generators (20,000 gallons/day), or
iv. All fuel allowable per day is attributed to Type A, B, C, D, H, and I, the remaining fuel use is attributed to Type G (3,442 gallons/day).

Cold start emissions for all generators at one start per day are also included for all generators.

If you have any questions or comments about the information presented in this letter, please do not hesitate to call me at 541.303.2380 or Beth Ryder at 458.206.6770.

Sincerely,
Jason Bowker, Senior Air Quality Engineer

Amazon Data Services, Inc
cc: JR Giska, Oregon DEQ
Ania Loyd, Oregon DEQ
Tracy Drouin, Oregon DEQ
Owen Rudloff, Oregon DEQ
Garrett Koehler, Amazon
Shannon Moore, Amazon
Doka Bui, Amazon
Darren Wilton, Amazon
Beth Ryder, Trinity Consultants

ATTACHMENT 1

PDX04 AQ520 Worksheet

ATTACHMENT 2

Generator Manufacturer Specification Sheet

PERFORMANCE DATA[DM9071]

July 28, 2017

SALES MODEL:	C27	**COMBUSTION:**	DI
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	**ADDITIONAL PARASITICS (HP):**	52.7
RATING LEVEL:	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):**	120
GOVERNOR TYPE:	ADEM4	**JACKET WATER TEMP (F):**	210.2
ELECTRONICS TYPE:	ADEM4	**TURBO CONFIGURATION:**	PARALLEL
IGNITION TYPE:	CI	**TURBO QUANTITY:**	2
INJECTOR TYPE:	EUI	**TURBOCHARGER MODEL:**	GTA5008BS-56T-1.60
REF EXH STACK DIAMETER (IN):	10	**CERTIFICATION YEAR:**	2006
MAX OPERATING ALTITUDE (FT):	10,000	**PISTON SPD @ RATED ENG SPD (FT/MIN):**	1,800.0

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
750.0	100	1,141	305	0.329	53.6	52.6	120.7	1,210.7	36.7	948.7
675.0	90	1,036	276	0.333	49.3	48.2	117.3	1,184.5	33.3	935.9
600.0	80	931	248	0.339	45.0	43.6	114.3	1,157.5	30.1	920.5
562.5	75	878	234	0.342	42.9	41.2	112.8	1,143.4	28.5	911.5
525.0	70	826	220	0.344	40.6	38.3	110.7	1,127.0	26.5	902.0
450.0	60	722	193	0.346	35.7	31.9	105.8	1,084.0	22.3	877.6
375.0	50	618	165	0.348	30.7	25.3	100.8	1,028.5	18.0	845.1
300.0	40	516	138	0.350	25.8	19.1	97.6	957.6	14.1	798.9
225.0	30	413	110	0.356	21.0	13.6	95.6	866.3	10.9	731.9
187.5	25	361	96	0.361	18.7	11.0	94.8	813.1	9.5	691.2
150.0	20	309	82	0.368	16.3	8.6	94.0	754.4	8.2	645.3
75.0	10	201	54	0.403	11.6	4.9	92.4	617.0	6.1	532.3

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
750.0	100	1,141	55	340.2	2,073.6	5,610.2	8,929.7	9,304.9	1,958.6	1,773.7
675.0	90	1,036	51	321.4	1,972.9	5,269.2	8,478.1	8,823.2	1,856.4	1,685.5
600.0	80	931	46	304.2	1,874.4	4,932.9	8,053.0	8,368.4	1,757.3	1,600.2
562.5	75	878	43	295.1	1,825.8	4,766.3	7,827.5	8,127.9	1,709.1	1,558.8
525.0	70	826	40	282.3	1,763.3	4,540.6	7,544.0	7,828.2	1,639.5	1,497.3
450.0	60	722	34	253.9	1,610.3	4,039.0	6,871.8	7,121.9	1,485.0	1,359.5
375.0	50	618	27	225.6	1,444.6	3,541.1	6,147.8	6,362.8	1,334.4	1,225.1
300.0	40	516	21	197.9	1,288.0	3,054.4	5,467.1	5,647.9	1,193.2	1,099.5
225.0	30	413	15	170.0	1,143.5	2,567.6	4,844.7	4,992.1	1,059.4	981.2
187.5	25	361	12	155.9	1,073.8	2,322.4	4,546.8	4,677.5	992.1	921.8
150.0	20	309	10	141.7	1,005.3	2,074.6	4,256.4	4,370.3	923.1	860.8
75.0	10	201	6	120.2	905.7	1,659.5	3,831.9	3,913.1	822.6	775.2

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

PERFORMANCE DATA[DM9071]

July 28, 2017

750.0	100	1,141	18,441	6,249	41,994	23,831	6,126	7,898	48,396	115,016	122,520
675.0	90	1,036	17,256	5,747	39,140	22,066	5,635	6,971	43,919	105,788	112,691
600.0	80	931	15,826	5,250	36,542	20,327	5,147	6,151	39,470	96,630	102,935
562.5	75	878	15,112	5,002	35,207	19,404	4,904	5,747	37,253	92,071	98,078
525.0	70	826	14,395	4,735	33,573	18,346	4,642	5,270	35,034	87,162	92,850
450.0	60	722	12,964	4,166	29,877	15,903	4,084	4,206	30,613	76,677	81,680
375.0	50	618	11,533	3,579	25,870	13,283	3,509	3,134	26,205	65,876	70,174
300.0	40	516	10,625	3,010	21,327	10,638	2,951	2,202	21,876	55,406	59,021
225.0	30	413	10,020	2,453	16,594	7,940	2,405	1,439	17,528	45,159	48,105
187.5	25	361	9,569	2,175	14,401	6,617	2,133	1,109	15,330	40,038	42,650
150.0	20	309	8,939	1,895	12,407	5,323	1,858	813	13,103	34,888	37,164
75.0	10	201	6,694	1,353	9,559	2,900	1,326	406	8,541	24,900	26,525

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	1,141	878	618	361	201
TOTAL NOX (AS NO2)		G/HR	7,181	4,159	2,639	1,824	1,310
TOTAL CO		G/HR	520	683	655	540	554
TOTAL HC		G/HR	55	82	96	88	101
PART MATTER		G/HR	47.2	59.4	150.5	116.9	78.8
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	3,190.9	2,326.7	2,078.5	2,424.5	2,904.0
TOTAL CO	(CORR 5% O2)	MG/NM3	231.7	383.5	519.6	772.5	1,347.1
TOTAL HC	(CORR 5% O2)	MG/NM3	21.1	40.7	65.9	111.3	214.7
PART MATTER	(CORR 5% O2)	MG/NM3	17.2	27.7	103.8	128.4	160.0
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	1,554	1,133	1,012	1,181	1,414
TOTAL CO	(CORR 5% O2)	PPM	185	307	416	618	1,078
TOTAL HC	(CORR 5% O2)	PPM	39	76	123	208	401
TOTAL NOX (AS NO2)		G/HP-HR	6.35	4.76	4.29	5.06	6.52
TOTAL CO		G/HP-HR	0.46	0.78	1.07	1.50	2.76
TOTAL HC		G/HP-HR	0.05	0.09	0.16	0.24	0.50
PART MATTER		G/HP-HR	0.04	0.07	0.24	0.32	0.39
TOTAL NOX (AS NO2)		LB/HR	15.83	9.17	5.82	4.02	2.89
TOTAL CO		LB/HR	1.15	1.51	1.45	1.19	1.22
TOTAL HC		LB/HR	0.12	0.18	0.21	0.19	0.22
PART MATTER		LB/HR	0.10	0.13	0.33	0.26	0.17

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	1,141	878	618	361	201
TOTAL NOX (AS NO2)		G/HR	5,935	3,437	2,181	1,507	1,082
TOTAL CO		G/HR	278	365	351	289	296
TOTAL HC		G/HR	29	43	51	47	53
TOTAL CO2		KG/HR	525	419	298	180	112
PART MATTER		G/HR	24.2	30.5	77.2	59.9	40.4
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	2,637.1	1,922.9	1,717.8	2,003.7	2,400.0
TOTAL CO	(CORR 5% O2)	MG/NM3	123.9	205.1	277.9	413.1	720.4
TOTAL HC	(CORR 5% O2)	MG/NM3	11.2	21.5	34.9	58.9	113.6
PART MATTER	(CORR 5% O2)	MG/NM3	8.8	14.2	53.2	65.9	82.0
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	1,285	937	837	976	1,169
TOTAL CO	(CORR 5% O2)	PPM	99	164	222	330	576
TOTAL HC	(CORR 5% O2)	PPM	21	40	65	110	212
TOTAL NOX (AS NO2)		G/HP-HR	5.25	3.94	3.54	4.18	5.39
TOTAL CO		G/HP-HR	0.25	0.42	0.57	0.80	1.48
TOTAL HC		G/HP-HR	0.03	0.05	0.08	0.13	0.27
PART MATTER		G/HP-HR	0.02	0.03	0.13	0.17	0.20
TOTAL NOX (AS NO2)		LB/HR	13.08	7.58	4.81	3.32	2.39
TOTAL CO		LB/HR	0.61	0.81	0.77	0.64	0.65
TOTAL HC		LB/HR	0.06	0.10	0.11	0.10	0.12
TOTAL CO2		LB/HR	1,157	924	658	397	246
PART MATTER		LB/HR	0.05	0.07	0.17	0.13	0.09
OXYGEN IN EXH		%	8.9	10.1	11.2	13.2	15.4
DRY SMOKE OPACITY		%	0.4	1.4	2.9	4.4	3.8
BOSCH SMOKE NUMBER			0.18	0.48	1.07	1.51	1.40

PERFORMANCE DATA[DM9071]

July 28, 2017

Regulatory Information

EPA TIER 2		2006 - 2010		
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 - ----		
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			MJE00001	

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[DM9071]

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.

PERFORMANCE DATA[DM9071]

July 28, 2017

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