

**Air Quality Permit Renewal Application**

**Place ID #133569**

**Current Permit #74201 (exp. 2/5/2024)**

**Desert Gas LP**

**50660 Colorado River Rd.**

**Ehrenberg, Arizona 85334**

**Submitted to:**

**Arizona Department of Environmental Quality**

**1110 West Washington Street**

**Phoenix, Arizona 85007**

***September 19, 2023***

Attachment A  
Application Forms

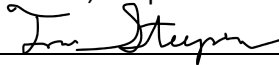
**SECTION 3.1**  
**ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY**  
Air Quality Division  
1110 West Washington • Phoenix, AZ 85007 • Phone: (602) 771-2338

**STANDARD CLASS II PERMIT APPLICATION FORM**

(As required by A.R.S. § 49-426, and Chapter 2, Article 3, Arizona Administrative Code)

1. Permit to be issued to (Business license name of organization that is to receive permit):  
Desert Gas LP, LLC
2. Mailing Address: PO Box 240168  
City: Anchorage State: Alaska ZIP: 99524
3. Name (or names) of Responsible Official: Thomas Steeper  
Phone: 928-923-7850 Fax: \_\_\_\_\_ Email: Tom@spectrumlng.com
4. Facility Manager/Contact Person and Title: Thomas Steeper, Plant Manager  
Phone: 928-923-7850 Fax: \_\_\_\_\_ Email: Tom@spectrumlng.com
5. Facility Name: Desert Gas LP (DG)  
Facility Location/Address (Current/Proposed): 50660 Colorado River Road (S16,T3N,R22W) Place ID 133569  
City: Ehrenberg County: La Paz ZIP: 85334  
Indian Reservation (if applicable, which one): \_\_\_\_\_  
Latitude/Longitude, Elevation: 33o35'44.83"N; 114o31'43.70"W; Elevation 322ft
6. General Nature of Business: Natural Gas Liquefaction
7. Type of Organization:  
 Corporation     Individual Owner     Partnership     Government Entity     LLC  
 Other \_\_\_\_\_
8. Permit Application Basis:     New Source     Revision     Renewal of Existing Permit  
For renewal or modification, include existing permit number (and exp. date): 74201 exp 02-05-2024  
Date of Commencement of Construction or Modification: \_\_\_\_\_  
Primary Standard Industrial Classification Code: 1321
9. I certify that I have knowledge of the facts herein set forth, that the same are true, accurate and complete to the best of my knowledge and belief, and that all information not identified by me as confidential in nature shall be treated by ADEQ as public record. I also attest that I am in compliance with the applicable requirements of the Permit and will continue to comply with such requirements and any future requirements that become effective during the life of the Permit. I will present a certification of compliance to ADEQ no less than annually and more frequently if specified by ADEQ. I further state that

I will assume responsibility for the construction, modification, or operation of the source in accordance with Arizona Administrative Code, Title 18, Chapter 2 and any permit issued thereof.

Signature of Responsible Official: 

Printed Name of Signer/Official Title: Thomas Steeper - Plant Manager

Date: 9/19/2024 Telephone Number: (928) 923-7850

### Section 3.5 - Equipment List

Type of Equipment	Maximum Rated Capacity	Make	Model	Serial Number	Date of Manufacture	Equipment ID Number
Engine	814 HP	Caterpillar	G3512	4KC00449	1993	4KC00449
Engine	approx 1367 HP	Caterpillar	G3516	4EK02793	2001	4EK02793
Engine	approx 1113 HP	Gauscor/Dresser Rand	SFGLD480	283286	2001	283286
Boiler	1.5 MMBtu/hr	Honeywell	Eclipse	HTP1679	2015	0809 365
Boiler	4.2 MMBtu/hr	Gordon-Piatt	S10.1-G0-30		2009	S10.1-G0-30
Glycol Heater	0.2 MMBtu/hr					

All relevant equipment utilized at the facility should be included in the equipment list. Please complete all fields.  
**The date of manufacture must be included in order to determine applicability of regulations.**  
 Indicate the units (tons/hour, horsepower, etc.) when recording the maximum rated capacity.  
 Make additional copies of this form if necessary.

**SECTION 3.6 - EMISSION SOURCE FORM**

Emission Point		Regulated Air Pollutant Name	PTE		PTE AFTER MODIFICATION		CHANGE IN PTE
Number	Name		lbs/hr	tons/yr	lbs/hr	tons/yr	tons/yr
	Caterpillar G 3512	NOx	4.84	21.2		85.2	26.2
		CO	2.64	11.54		43.7	10.62
		VOC	5.92	25.93		36.0	25.14
		SOx	0.0036	0.016		0.1	0.02
		PM10/2.5	0.0005	0.002		0.3	0.03
	See Attached for additional pollutants and units						

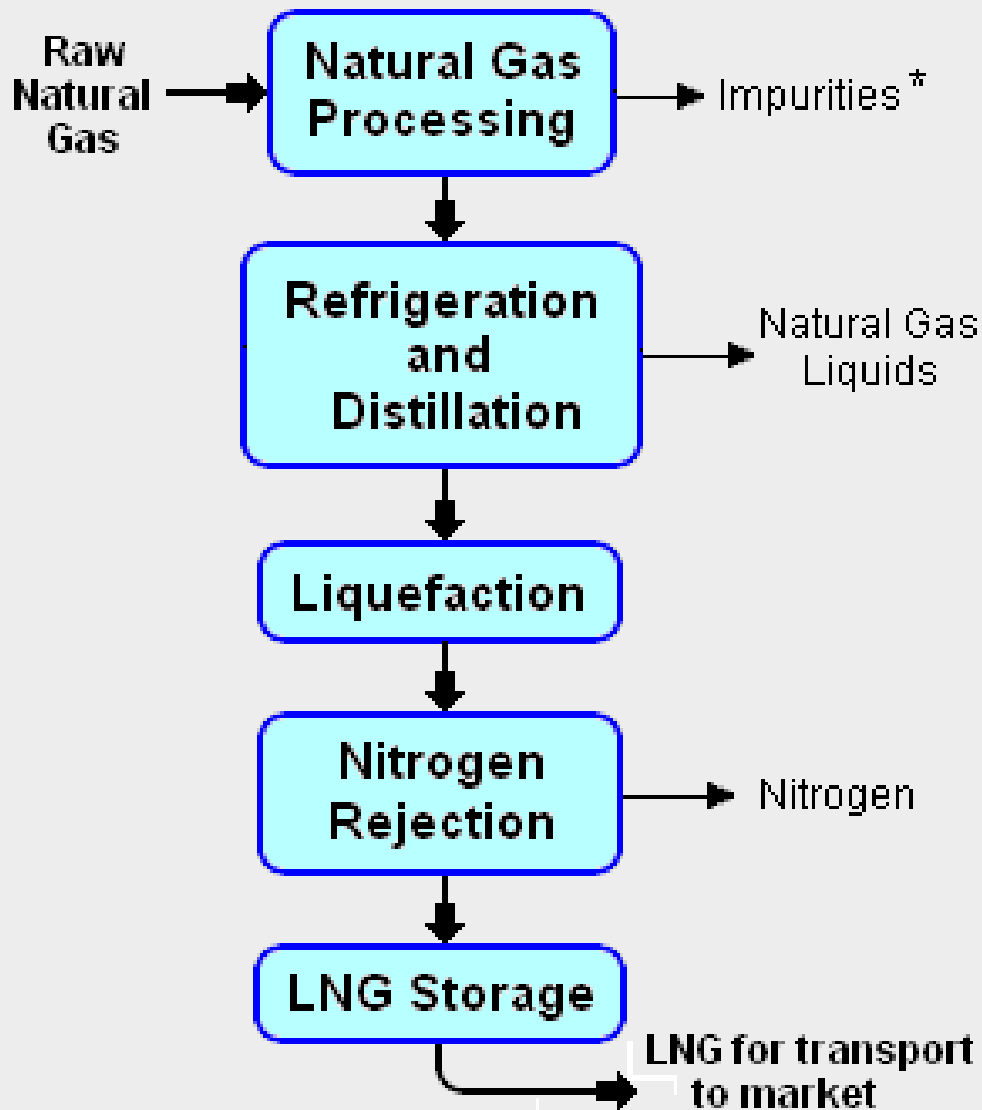
## SECTION 5.0 -APPLICATION ADMINISTRATIVE COMPLETENESS CHECKLIST

	REQUIREMENT	MEETS REQUIREMENTS			COMMENT
		YES	NO	N/A	
1	Has the standard application form been completed?	X			
2	Has the responsible official signed the standard application form?	X			
3	Has a process description been provided?	X			
4	Are the facility's emissions documented with all appropriate supporting information?	X			
5	Is the facility subject to Minor NSR requirements? If the answer is "YES", answer 6a, 6b and 6c as applicable. If the answer is "NO", skip to 7.	X			
6.a	If the facility chooses to implement RACT, is the RACT determination included for the affected pollutants for all affected emission units?		X		
6.b	If the facility chooses to demonstrate compliance with NAAQS by screen modeling, is the modeling analysis included?	X			
6.c	If refined modeling has been conducted, is a comprehensive modeling report along with all modeling files included?	X			
7	Does the application include an equipment list with the type, name, make, model, serial number, maximum rated capacity, and date of manufacture?	X			
8	Does the application include an identification and description of Pollution Controls? (if applicable)	X			
9	For any application component claimed as confidential, are the requirements of AR.S. 49-432 and A.A.C. R18-2-305 addressed?			X	
10	For any current non-compliance issue, is a compliance schedule attached?			X	
11	For minor permit revision that will make a modification upon submittal of application, has a suggested draft permit been attached?			X	

Attachment B

Process Flow Diagram





\* Impurities: raw natural gas condensate, water, hydrogen sulfide, carbon dioxide, mercury

(PD) Milton Beychok

**Block flow diagram of LNG Liquefaction**

Attachment C  
Emission Calculations

### Desert Gas Emission Summary

Pollutant	Cat G3516 with cattox (ton/yr)	Gauscor SFGLD 480 with cattox (ton/yr)	Cat 3512 LE with cattox (ton/yr)	Boilers (ton/yr)	Amine Plant and Process Emissions (ton/yr)	Total Emissions (ton/yr)
CO2	4,872	3,928	2,949	3,040	8,452	23,242
CH4	55.4	44.6	33.5	0	384	517
N2O				0.056		0.056
CO2eq	6,035	4,866	3,653	3,059	16,511	34,123
Nox	26.85	23.6	18.1	2.53		71.1
CO	14.6	12.89	11.54	2.13		41.2
VOC	5.23	4.21	3.16	0.14		12.7
Sox	0.026	0.021	0.016	0.0152		0.1
PM2.5&PM10	0.003	0.003	0.002	0.1925		0.2
Formaldehyde	2.339	1.885	1.416	0.0019		5.64
Benzene	0.019	0.016	0.012	0.000053		0.05
Toluene	0.018	0.015	0.011	0.000086		0.04
Acetaldehyde	0.370	0.299	0.224			0.89
Acrolein	0.228	0.184	0.138			0.55
Methanol	0.111	0.089	0.067			0.27
n-hexane	0.049	0.040	0.030	0.0456		0.16
Xylene	0.008	0.007	0.005			0.02
Total HAPs	3.1	2.5	1.9	0.0476		7.6

<sup>1</sup> Current potential emission rate from Technical Support Document from current permit.

\* CO2 equivalent for methane is 21 times mass emissions of methane; for N2O, the CO2 equivalent is 310 times the mass emissions of N2O.

Fuel Combustion:	MMscf/hr	MMscf/yr
Caterpillar G3516	0.0099	87
Guascor SFGLD480	0.0080	70
Caterpillar G3512	0.0060	53
Boilers	0.0058	51

**Caterpillar G3512 Emissions**

Capacity 814 HP                      Hours of Operation 8760 hr/yr                      Runtime 100%

6,756	ft3/hr fuel use at 100% load		
7520	Btu/HP-hr at 100% load (approx)		
6,121,280	Btu/hr		
6.12	MMBtu/hr	53622	MMBtu/yr
0.0060	MMscf/hr	53	MMscf/yr
1020.00	Btu/scf (approx)		

Emission Factors for CO2, VOC, Methane, Sox, and PM are from AP 42 Table 3.2-2 for 4-stroke lean burn engines. Other emission factors are from vendor data with a safety margin added. CO assumed to have a minimum 70% removal from catalytic oxidizer.

	CO (with catox at 70% removal min)			Nox			VOC		
	g/BHP-hr (with catox)	lb/hr (70% removal)	ton/yr	g/BHP-hr	lb/hr	ton/yr	lb/MMBtu	lb/hr	ton/yr
Caterpillar 3516 (with catox at 70% eff)	4.9	2.64	11.54	2.3	4.12	18.06	0.118	0.72	3.16

	Sox			PM2.5/PM10 (filterable + condensable)			Methane			CO2		
	lb/MMBtu (AP42)	lb/hr	ton/yr	lb/MMBtu (AP42)	lb/hr	ton/yr	lb/MMBtu (AP42)	lb/hr	ton/yr	lb/MMBtu (AP42)	lb/hr	ton/yr
Caterpillar 3516	5.88E-04	0.0036	0.016	7.71E-05	0.0005	0.002	1.25E+00	7.6516	33.514	1.10E+02	673	2,949

**HAP Emissions from Caterpillar - from AP42 Table 3.2-2**

Pollutant	lb/mmBtu	lb/hr	ton/yr
Acetaldehyde	8.36E-03	0.05	0.2241
Acrolein	5.14E-03	0.03	0.1378
Benzene	4.40E-04	0.00	0.0118
Formaldehyde	5.28E-02	0.32	1.4156
Methanol	2.50E-03	0.02	0.0670
n-hexane	1.11E-03	0.01	0.0298
Toluene	4.08E-04	0.00	0.0109
Xylene	1.84E-04	0.00	0.0049

Other HAP emissions are negligible.

**Caterpillar G3516 Emissions**

Capacity

1265 HP

Hours of Operation

8760 hr/yr

Runtime 100%

9,914	ft <sup>3</sup> /hr fuel use at 100% load		
7994	Btu/HP-hr at 100% load (approx)		
10,112,410	Btu/hr		
10.11	MMBtu/hr	88585	MMBtu/yr
0.010	MMscf/hr	87	MMscf/yr
1020.00	Btu/scf (approx)		

Calculation of Btu/HP-hr:

11.3 MJ/kW-hr

947.8 Btu/MJ

1.34 HP/kw

7993 Btu/hp-hr

Fuel consumption (Attachment E of application submitted in 2013)

Conversion from MJ to Btu

Conversion from kW to HP

Engine fuel consumption per horsepower at 100% load.

Emission Factors for CO<sub>2</sub>, VOC, Methane, Sox, and PM are from AP 42 Table 3.2-2 for 4-stroke lean burn engines.

Other emission factors are from vendor data with a safety margin added. CO assumed to have a minimum 70% removal from catalytic oxidizer.

	CO (with catox at 70% removal min)			Nox			VOC		
	g/BHP-hr (with catox)	lb/hr (70% removal)	ton/yr	g/BHP-hr	lb/hr	ton/yr	lb/MMBtu	lb/hr	ton/yr
Caterpillar 3516 (with catox at 70% eff)	4	3.34	14.65	2.2	6.13	26.85	0.118	1.19	5.23

	Sox			PM2.5/PM10 (filterable + condensable)			Methane			CO <sub>2</sub>		
	lb/MMBtu (AP42)	lb/hr	ton/yr	lb/MMBtu (AP42)	lb/hr	ton/yr	lb/MMBtu (AP42)	lb/hr	ton/yr	lb/MMBtu (AP42)	lb/hr	ton/yr
Caterpillar 3516	5.88E-04	0.0059	0.026	7.71E-05	0.0008	0.003	1.25E+00	12.6405	55.365	1.10E+02	1,112	4,872

**HAP Emissions from Caterpillar - from AP42 Table 3.2-2**

Pollutant	lb/mmBtu	lb/hr	ton/yr
Acetaldehyde	8.36E-03	0.08	0.3703
Acrolein	5.14E-03	0.05	0.2277
Benzene	4.40E-04	0.00	0.0195
Formaldehyde	5.28E-02	0.53	2.3386
Methanol	2.50E-03	0.03	0.1107
n-hexane	1.11E-03	0.01	0.0492
Toluene	4.08E-04	0.00	0.0181
Xylene	1.84E-04	0.00	0.0081

Other HAP emissions are negligible.

**Gauscor SFGLD 480**

Continuous rating 838 kWb

Capacity

1113 HP

Hours of Operation

8760 hr/yr

Runtime 100%

7,993.14	ft <sup>3</sup> /hr fuel use at 100% load		
	Btu/HP-hr at 100% load (approx)		
8,153,000	Btu/hr		
8.15	MMBtu/hr	71420	MMBtu/yr
0.0080	MMscf/hr	70	MMscf/yr
1020.00	Btu/scf (approx)		

Emission Factors for CO<sub>2</sub>, Methane, VOC, Sox, and PM are from AP 42 Table 3.2-2 for 4-stroke lean burn engines.

Emission factors for CO and Nox are from vendor data with a safety margin added. CO assumed to have minimum 70% removal efficiency from catalytic oxidizer.

	CO (with catox at 70% removal min)			Nox			VOC		
	g/BHP-hr	lb/hr	ton/yr	g/BHP-hr	lb/hr	ton/yr	lb/MMBtu (AP 42)	lb/hr	ton/yr
Caterpillar 3516 with catox	4	2.94	12.89	2.2	5.39	23.6	0.118	0.96	4.21

	Sox			PM2.5/PM10 (filterable + condensable)			Methane			CO <sub>2</sub>		
	lb/MMBtu (AP42)	lb/hr	ton/yr	lb/MMBtu (AP42)	lb/hr	ton/yr	lb/MMBtu (AP42)	lb/hr	ton/yr	lb/MMBtu (AP42)	lb/hr	ton/yr
Caterpillar 3516	5.88E-04	0.0048	0.021	7.71E-05	0.0006	0.003	1.25	10.1913	44.638	1.10E+02	896.8300	3,928

HAP Emissions from Caterpillar - from AP42 Table 3.2-2

Pollutant	lb/mmBtu	lb/hr	ton/yr
Acetaldehyde	8.36E-03	0.068	0.2985
Acrolein	5.14E-03	0.042	0.1836
Benzene	4.40E-04	0.0036	0.0157
Formaldehyde	5.28E-02	0.43	1.8855
Methanol	2.50E-03	0.020	0.0893
n-hexane	1.11E-03	0.0090	0.0396
Toluene	4.08E-04	0.0033	0.0146
Xylene	1.84E-04	0.0015	0.0066

Other HAP emissions are negligible.

**Desert Gas**

**Boiler Fuel Data and Emission Calculations**

**Fuel Use**

Amine 2 Boiler	0.0015	MMscf/hr	12.882	MMscf/yr	13140	MMBtu/yr
Regen Heater	0.0041	MMscf/hr	36.071	MMscf/yr	36792	MMBtu/yr
Glycol Heater	0.0002	MMscf/hr	1.718	MMscf/yr	1752	MMBtu/yr
Total:	0.0058	MMscf/hr	50.671	MMscf/yr	51684	MMBtu/yr

Fuel Heating value 1020 Btu/scf

Emission factors from AP42 Table 1.4-1 and 1.4-2 (units converted) with no control

	Boiler		Nox			CO			VOC		
	mmBTU/HR	hr/yr	lb/mmbtu	lb/hr	ton/year	lb/MMBtu	lb/hr	ton/year	lb/MMBtu	lb/hr	ton/yr
Amine2 Boiler	1.5	8760	0.10	0.15	0.64	0.08	0.12	0.54	0.0054	0.0081	0.0354
Regen Heater	4.2	8760	0.10	0.41	1.80	0.08	0.35	1.51	0.0054	0.0226	0.0992
Glycol Heater	0.2	8760	0.10	0.02	0.09	0.08	0.02	0.07	0.0054	0.0011	0.0047
Total:				0.58	2.53		0.49	2.13		0.03	0.14

	Sox			PM and PM10			Methane			CO2			N2O		
	lb/mmbtu	lb/hr	ton/year	lb/mmbtu	lb/hr	ton/year	lb/MMBtu (AP42)	lb/hr	ton/yr	lb/MMBtu (AP42)	lb/hr	ton/yr	lb/MMBtu (AP42)	lb/hr	ton/yr
Boiler	0.001	0.001	0.004	0.007	0.011	0.049	2.25E-03	0.0034	0.015	1.18E+02	176	773	2.16E-03	0.0032	0.014
Regen Heater	0.001	0.002	0.011	0.007	0.031	0.137	2.25E-03	0.0095	0.041	1.18E+02	494	2,164	2.16E-03	0.0091	0.040
Glycol Heater	0.001	0.00012	0.001	0.007	0.001	0.007	2.25E-03	0.0005	0.002	1.18E+02	24	103	2.16E-03	0.0004	0.002
Total:		0.003	0.015		0.044	0.193		0.013	0.058		694	3,040		0.013	0.056

	Formaldehyde			Benzene			Toluene			Hexane		
	lb/MMBtu	lb/hr	ton/yr	lb/MMBtu	lb/hr	ton/yr	lb/MMBtu	lb/hr	ton/yr	lb/MMBtu	lb/hr	ton/yr
Boiler	7.35E-05	0.00011	4.83E-04	2.06E-06	3.0882E-06	1.35E-05	3.33E-06	0.000005	2.19E-05	1.76E-03	0.0026	1.16E-02
Regen Heater	7.35E-05	0.00031	1.35E-03	2.06E-06	8.65E-06	3.79E-05	3.33E-06	1.40E-05	6.13E-05	1.76E-03	0.0074	3.25E-02
Glycol Heater	7.35E-05	0.00001	6.44E-05	2.06E-06	4.12E-07	1.80E-06	3.33E-06	6.67E-07	2.92E-06	1.76E-03	0.0004	1.55E-03
Total:		0.00043	0.00190		0.00001	0.00005		0.00002	0.00009		0.01041	0.04560

(HAPs with negligible emission rates have been excluded)

**Process Emission Calculations (Greenhouse Gases)**

Feed gas 20 MMscf/day (max)  
 7,300,000,000 scf/yr  
 7,300 MMscf/yr  
 938 Gas Higher heating value Btu/scf  
 Standard Temp 60F or 15.55 C  
 Molecular Weight (MW) CO2 44.01  
 Molecular Weight H2S 34.1  
 Equation for converting ppm to mg/m3 at 1 atm pressure:  
 $mg/m^3 = ppmv (12.187)(MW)/(273.5 + C)$   
 Conversion to lb/ft3:  $1 mg/m^3 = 6.24e-8 lb/ft^3$

**Amine Plant Emissions CO2:**

2 mole percent  
 0.02 volume fraction CO2  
 20000 ppm CO2  
 37,111.22 milligrams CO2 per cubic meter of gas @ 60F & 1 atm  
 0.0023 lb CO2 per scf of gas  
 16,904,902 lb CO2 emitted per year  
**8,452 ton CO2 emitted per year**

**Amine Plant CH4 Emissions**  
 Table 5-5 of [api.org/ehs/climate/new/upload/2009\\_ghg\\_compendium.pdf](http://api.org/ehs/climate/new/upload/2009_ghg_compendium.pdf)  
 0.0185 tonnes/10<sup>6</sup> scf treated gas  
 tonnes CH4/yr 135  
 tonsCH4/yr 149

**LNG Production Fugitive Emissions of CH4**

lbs CH4/MMscf processed	MMscf processed /yr	CH4 Emitted ton/yr
64.43	7,300	235

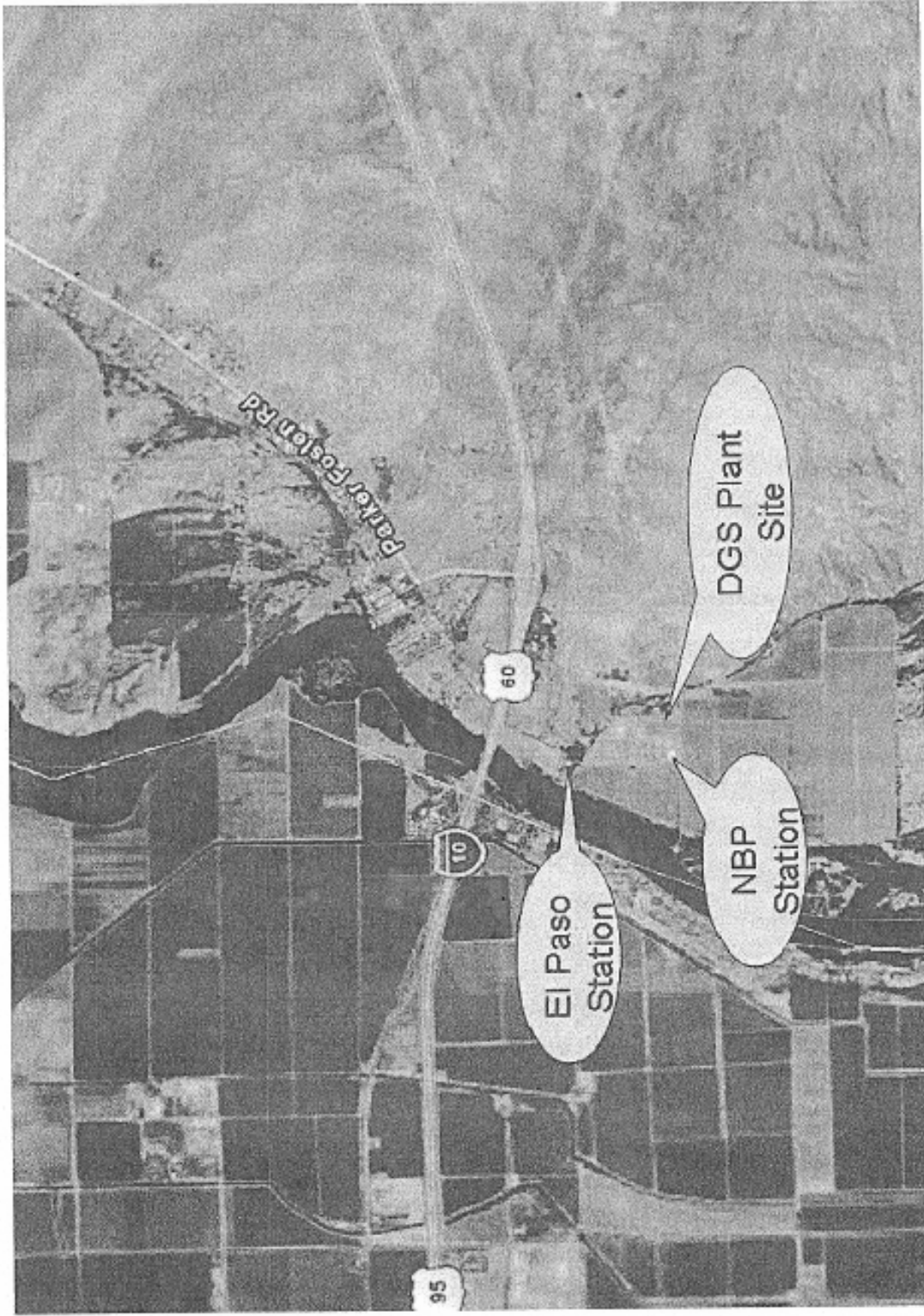
Emission factor from Table 6-2 of Compendium of Greenhouse Gas Emissions Estimation Methodologies for the Oil and Natural Gas Industry  
 Global warming potential of methane = 25  
 American Petroleum Institute reference: [http://www.api.org/ehs/climate/new/upload/2009\\_ghg\\_compendium.pdf](http://www.api.org/ehs/climate/new/upload/2009_ghg_compendium.pdf)

**Total CO2 Equivalent**  
 18,045.56 ton/yr

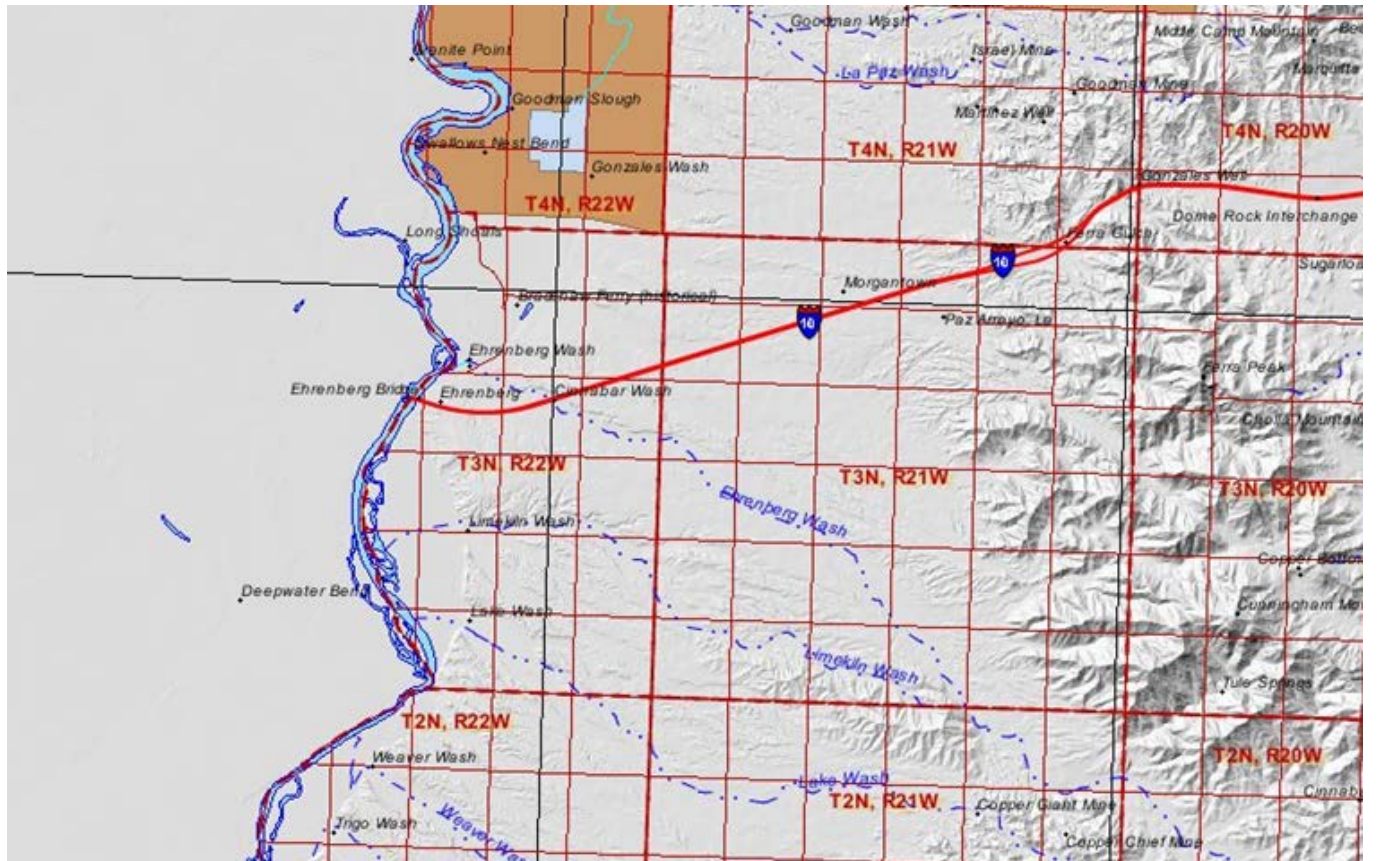


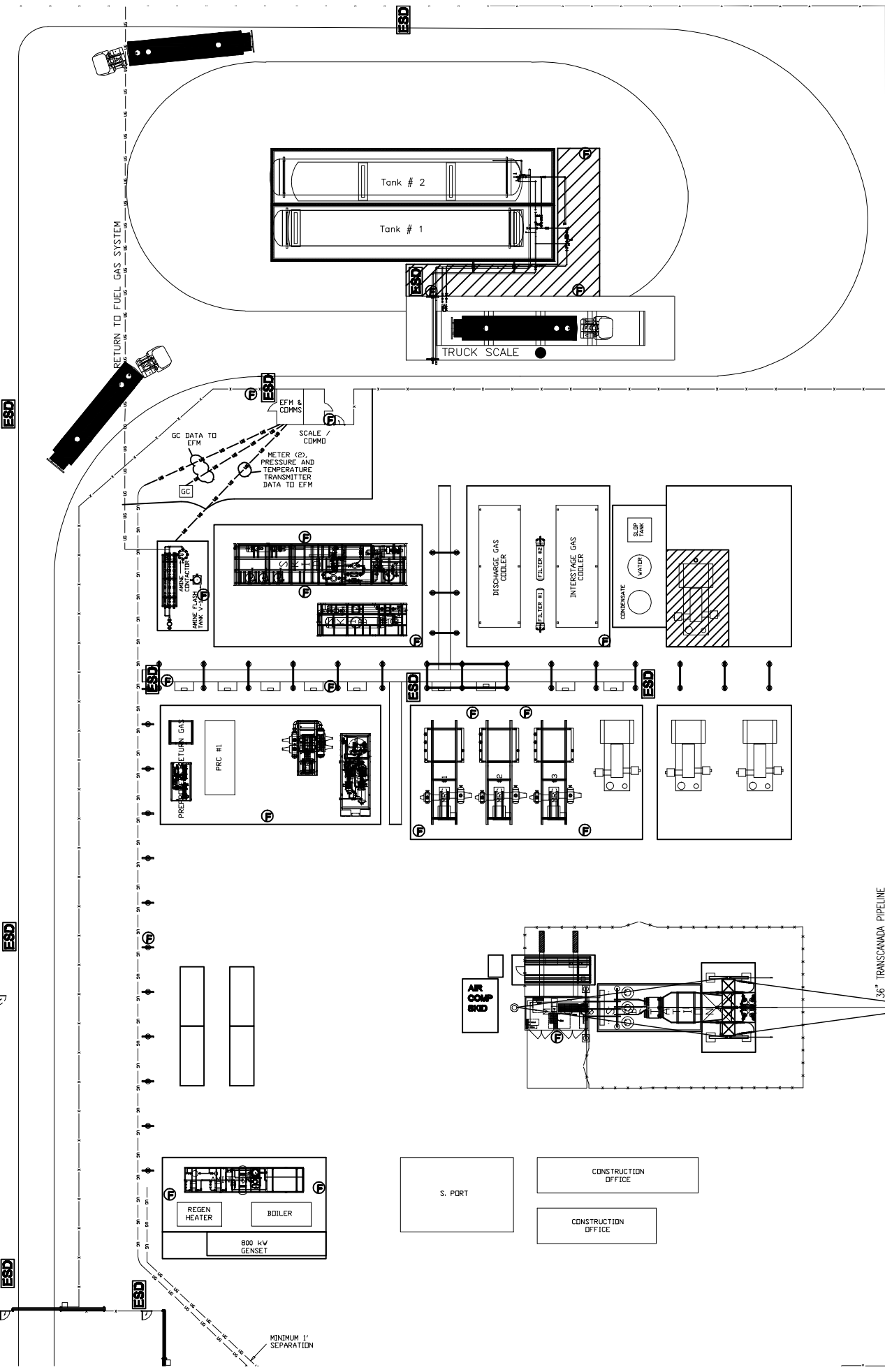
Attachment D

Site Maps and Site Diagram



REV	DESCRIPTION	DATE	BY
A	ISSUED FOR PERMIT		BL





RETURN TO FUEL GAS SYSTEM

Tank # 2  
Tank # 1

TRUCK SCALE

EFM & COMMS

SCALE / COMMO

METER (2),  
PRESSURE AND  
TEMPERATURE  
TRANSMITTER  
DATA TO EFM

GC DATA TO EFM

PRC #1

DISCHARGE GAS COOLER  
FILTER #1  
INTERSTAGE GAS COOLER

CONDENSATE  
WATER  
SLIP TANK

PREF. RETURN GAS  
PRC #1

S. PORT

CONSTRUCTION OFFICE

AIR COMP SKD

REGEN HEATER  
BOILER  
800 kW GENSET

S. PORT

CONSTRUCTION OFFICE

CONSTRUCTION OFFICE

MINIMUM 1' SEPARATION

36" TRANSCANADA PIPELINE

36" TRANSCANADA PIPELINE  
DGS FENCELINE

ESD

ESD

ESD

ESD

ESD

ESD

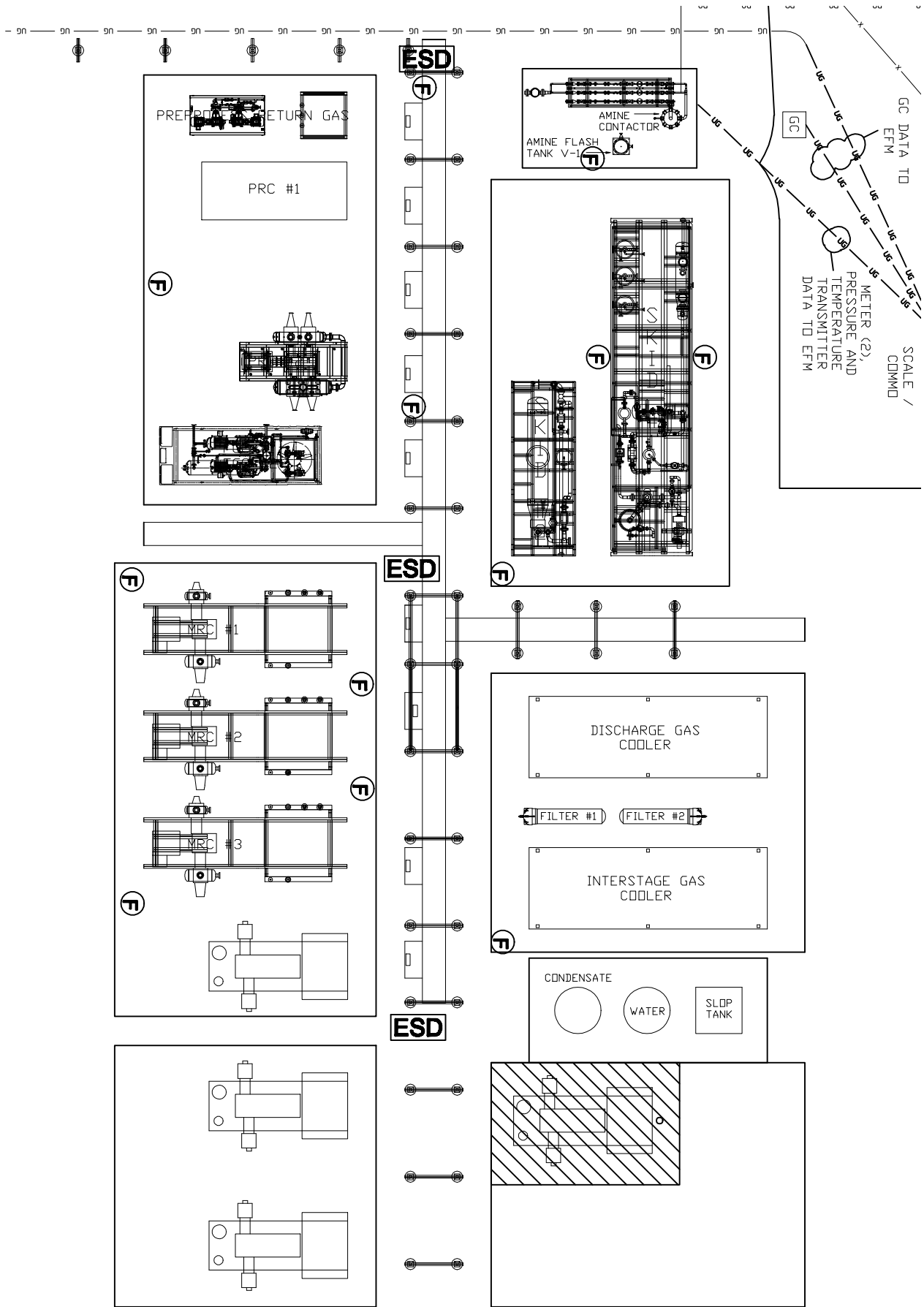
ESD

ESD

ESD

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Attachment E

Manufacturer's Information

**ENGINE TEST [4KC00449]****JULY 31, 2015**For Help Desk Phone Numbers [Click here](#)

Sales Model: 3512

Built Date: 02Dec1993

Tested Date: 12Dec1993

Shipped Date: 22Dec1993

Tested: LB

Plant: Lafayette

Cell Number: 510

Test Element	Eng Updates	Test Value	Test Spec Value	Measure
Spec Number		0T8837	0T8837	
Arrangement Number		9Y4110	9Y4110	
CORR FL PWR		811	813	HP
Speed		1,197	1,200	RPM
CORR FL FUEL RATE				BTU/MIN
CSFC		76	74	BTU/HP-H
Jacket Water Temp				F
IN SCAC H2O				F
Compressor Out Pressure				PSIA
Inlet Manifold Pressure				PSIA
Excess Oxygen				%
NOx Level				PPM
FL Oil Press		58	61	PSI
High Speed		1,247	1,248	RPM
Diff Fuel Pressure High				PSI
Low Idle Speed		913	900	RPM
Low Idle Oil Pressure		59	59	PSI
Fuel Pressure		49		PSIA
Timing BTDC				DEG
Advertised Power			813	hp
Advertised Speed			1,200	RPM
Advertised Torque				LB.FT
Adjusted Boost (Gas Blending)				HG
Corrected Fuel Rate - Gas (Gas Blending)				BTU/MIN
Corrected Fuel Rate - Diesel (Gas Blending)				GAL/HR
Full Load Fueling (Gas Blending)				MM3/ST
Gas Substitution Ratio (Gas Blending)				%
Corr Full Load Power (Gas Blending)				HP
Full Load Speed (Gas Blending)				RPM
Exhaust Back Pressure				PSI
TQ CK Exhaust Back Pressure				PSI
Ataac Delta Pressure				PSI

Caterpillar Confidential: **Green**

Content Owner: Commercial Processes Division

Web Master(s): [PSG Web Based Systems Support](#)

Current Date: Friday, July 31, 2015 2:04:00 PM

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[Data Privacy Statement.](#)Caterpillar Confidential: **Green**

Content Owner: Commercial Processes Division

Web Master(s): [PSG Web Based Systems Support](#)

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**ENGINE TEST [4KC00449]****JULY 31, 2015**For Help Desk Phone Numbers [Click here](#)

Sales Model: 3512

Built Date: 02Dec1993

Tested Date: 12Dec1993

Shipped Date: 22Dec1993

Tested: LB

Plant: Lafayette

Cell Number: 510

Test Element	Eng Updates	Test Value	Test Spec Value	Measure
Spec Number		0T8837	0T8837	
Arrangement Number		9Y4110	9Y4110	
CORR FL PWR		811	813	HP
Speed		1,197	1,200	RPM
CORR FL FUEL RATE				BTU/MIN
CSFC		76	74	BTU/HP-H
Jacket Water Temp				F
IN SCAC H2O				F
Compressor Out Pressure				PSIA
Inlet Manifold Pressure				PSIA
Excess Oxygen				%
NOx Level				PPM
FL Oil Press		58	61	PSI
High Speed		1,247	1,248	RPM
Diff Fuel Pressure High				PSI
Low Idle Speed		913	900	RPM
Low Idle Oil Pressure		59	59	PSI
Fuel Pressure		49		PSIA
Timing BTDC				DEG
Advertised Power			813	hp
Advertised Speed			1,200	RPM
Advertised Torque				LB.FT
Adjusted Boost (Gas Blending)				HG
Corrected Fuel Rate - Gas (Gas Blending)				BTU/MIN
Corrected Fuel Rate - Diesel (Gas Blending)				GAL/HR
Full Load Fueling (Gas Blending)				MM3/ST
Gas Substitution Ratio (Gas Blending)				%
Corr Full Load Power (Gas Blending)				HP
Full Load Speed (Gas Blending)				RPM
Exhaust Back Pressure				PSI
TQ CK Exhaust Back Pressure				PSI
Ataac Delta Pressure				PSI

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# INDUSTRIAL ENGINE PERFORMANCE DATA

## [4KC00348]

JULY 31, 2015

For Help Desk Phone Numbers [Click here](#)

Performance Number: TM9494

Change Level:

<b>Sales Model:</b> 3512 SITA	<b>Combustion:</b> SI	<b>Aspr:</b> TA
<b>Engine Power:</b> 814 HP	<b>Speed:</b> 1,200 RPM	<b>After Cooler:</b> SCAC
<b>Manifold Type:</b> ASWC	<b>Governor Type:</b> WOOD-	<b>After Cooler Temp(F):</b> 129
<b>Turbo Quantity:</b>	<b>Engine App:</b> IN	<b>Turbo Arrangement:</b>
<b>Application Type:</b> IND-CONT	<b>Engine Rating:</b> IN	<b>Strategy:</b>
<b>Rating Type:</b> CONTINUOUS	<b>Certification:</b>	
<b>Fuel:</b> PIPELINE	<b>Fuel Press (PSI):</b> 35	<b>NOx Level:</b> LE - 2.0 G/HPH
<b>IGN:</b>	<b>JW Temp (F):</b> 210	<b>ELEK A/F CONT:</b>
<b>Cam Type:</b>	<b>Piston:</b>	
<b>CARB:</b>	<b>C/R:</b> 9.0:1	

### General Performance Data

ENGINE SPEED RPM	ENGINE POWER BHP	ENGINE TORQUE LB.FT	ENGINE BMEP PSI	FUEL BSFC BTU- BHP/HR	FUEL RATE CFH	INTAKE MFLD TEMP DEG F	INTAKE MFLD P IN-HG	INTAKE AIR FLOW CFM	EXH MFLD TEMP DEG F	EXH STACK TEMP DEG F	EXH GAS FLOW CFM
1,200	814	3,562.41	170.13	7,520.21	6,755.7	140	30.77	1,642.13	1,118.3	820.4	4,304.86
1,200	733	3,206.17	153.16	7,583.82	6,137.69	138.74	25.47	1,476.15	1,108.76	817.34	3,870.49
1,200	651	2,849.93	136.05	7,668.64	5,512.62	138.2	20.02	1,313.71	1,095.8	814.64	3,443.18
1,200	611	2,672.18	127.64	7,718.11	5,205.39	138.2	17.29	1,236.01	1,088.06	813.2	3,231.3
1,200	570	2,493.69	119.08	7,781.73	4,894.62	138.74	14.57	1,158.32	1,079.96	812.12	3,026.47
1,200	488	2,137.45	102.11	7,958.42	4,290.74	139.82	9.12	1,006.47	1,060.7	809.96	2,623.88
1,200	407	1,781.21	84.99	8,234.07	3,700.98	140.9	3.67	858.15	1,037.66	807.8	2,228.36
1,200	326	1,424.97	68.02	8,728.82	3,135.95	141.62	-1.33	713.36	1,008.68	792.14	1,836.36
1,200	244	1,068.72	51.05	9,612.3	2,592.1	142.34	-6.04	575.63	975.02	768.56	1,458.5
1,200	204	890.97	42.5	10,347.36	2,323.71	142.7	-8.29	508.53	956.3	753.8	1,271.33
1,200	163	712.48	34.08	11,464.08	2,058.85	144.32	-10.42	448.5	936.68	737.42	1,105.35
1,200	81	356.24	16.97	17,160.79	1,543.25	149	-14.48	335.49	893.66	698.9	798.11

**General Performance Data 2**

ENGINE SPEED RPM	ENGINE POWER BHP	COMPRESS OUT PRESS IN-HG	COMPRESS OUT TEMP DEG F
1,200	814	38.65	293
1,200	733	36.84	285.8
1,200	651	33.64	271.4
1,200	611	31.57	262.4
1,200	570	28.49	246.2
1,200	488	22.3	217.4
1,200	407	16.11	186.8
1,200	326	11.08	158
1,200	244	6.9	132.8
1,200	204	5.09	122
1,200	163	3.58	111.2
1,200	81	1.27	98.6

**Engine Heat Rejection Data**

ENGINE SPEED RPM	ENGINE POWER BHP	REJ TO JW BTU/MN	REJ TO ATMOS BTU/MN	REJ TO EXHAUST BTU/MN	EXH RCOV TO BTU/MN	FROM OIL CLR BTU/MN	FROM AFT CLR BTU/MN	WORK ENERGY BTU/MN	LHV ENERGY BTU/MN	HHV ENERGY BTU/MN
1,200	814	32,757.1	6,653.8	35,088.7	15,639.22	5,516.4	4,322.1	34,520.0	101,967.7	113,341.7
1,200	733	31,107.8	5,687.0	31,619.7	13,989.99	5,004.5	3,525.9	31,051.0	92,641.0	102,991.4
1,200	651	29,344.9	4,606.5	28,150.6	12,397.63	4,492.7	2,729.8	27,638.8	83,200.6	92,470.4
1,200	611	28,434.9	4,208.4	26,444.5	11,601.46	4,265.2	2,331.7	25,875.8	78,537.3	87,295.3
1,200	570	27,468.2	3,753.4	24,795.3	10,862.15	3,980.9	1,990.4	24,169.7	73,930.8	82,177.0
1,200	488	25,534.6	2,900.4	21,496.8	9,383.53	3,525.9	1,364.9	20,700.6	64,774.8	71,997.3
1,200	407	23,487.3	2,104.2	18,369.0	7,961.78	3,014.1	853.0	17,288.4	55,846.2	62,101.9
1,200	326	21,383.1	1,763.0	15,298.0	6,426.3	2,559.1	398.1	13,819.4	47,372.6	52,661.5
1,200	244	19,165.2	1,592.4	12,283.9	4,890.81	2,104.2	56.9	10,350.3	39,126.5	43,448.6
1,200	204	17,970.9	1,535.5	10,862.2	4,151.5	1,876.7	.0	8,644.2	35,088.7	39,012.7
1,200	163	16,833.5	1,535.5	9,440.4	3,525.93	1,706.1	-113.7	6,881.3	31,107.8	34,576.9
1,200	81	14,445.0	1,478.6	6,710.6	2,331.67	1,251.1	-227.5	3,469.1	23,259.8	25,875.8

**EXHAUST Sound Data: 4.92 FEET**

ENGINE SPEED RPM	ENGINE POWER BHP	OVERALL SOUND DB(A)	OBCF 63HZ DB	OBCF 125HZ DB	OBCF 250HZ DB	OBCF 500HZ DB	OBCF 1000HZ DB	OBCF 2000HZ DB	OBCF 4000HZ DB	OBCF 8000HZ DB
1,200	814	109	97	101	103	100	100	102	104	98

**EXHAUST Sound Data: 22.97 FEET**

ENGINE SPEED RPM	ENGINE POWER BHP	OVERALL SOUND DB(A)	OBCF 63HZ DB	OBCF 125HZ DB	OBCF 250HZ DB	OBCF 500HZ DB	OBCF 1000HZ DB	OBCF 2000HZ DB	OBCF 4000HZ DB	OBCF 8000HZ DB
1,200	814	96	87	89	91	87	89	89	90	83

**EXHAUST Sound Data: 49.21 FEET**

ENGINE SPEED RPM	ENGINE POWER BHP	OVERALL SOUND DB(A)	OBCF 63HZ DB	OBCF 125HZ DB	OBCF 250HZ DB	OBCF 500HZ DB	OBCF 1000HZ DB	OBCF 2000HZ DB	OBCF 4000HZ DB	OBCF 8000HZ DB
1,200	814	89	80	83	84	80	83	83	83	76

**MECHANICAL Sound Data: 3.28 FEET**

ENGINE SPEED RPM	ENGINE POWER BHP	OVERALL SOUND DB(A)	OBCF 63HZ DB	OBCF 125HZ DB	OBCF 250HZ DB	OBCF 500HZ DB	OBCF 1000HZ DB	OBCF 2000HZ DB	OBCF 4000HZ DB	OBCF 8000HZ DB
1,200	814	98	97	93	88	89	91	93	90	81

**MECHANICAL Sound Data: 22.97 FEET**

ENGINE SPEED RPM	ENGINE POWER BHP	OVERALL SOUND DB(A)	OBCF 63HZ DB	OBCF 125HZ DB	OBCF 250HZ DB	OBCF 500HZ DB	OBCF 1000HZ DB	OBCF 2000HZ DB	OBCF 4000HZ DB	OBCJ 8000HZ DB
1,200	814	86	85	81	76	77	79	81	78	69

**MECHANICAL Sound Data: 49.21 FEET**

ENGINE SPEED RPM	ENGINE POWER BHP	OVERALL SOUND DB(A)	OBCF 63HZ DB	OBCF 125HZ DB	OBCF 250HZ DB	OBCF 500HZ DB	OBCF 1000HZ DB	OBCF 2000HZ DB	OBCF 4000HZ DB	OBCF 8000HZ DB
1,200	814	80	79	76	70	71	74	75	72	64

**EMISSIONS DATA****Certification:**

EMISSIONS DATA MEASUREMENT IS CONSISTENT WITH THOSE DESCRIBED IN EPA CFR 40 PART 89 SUBPART D & E AND ISO 8178-1 FOR MEASURING HC, CO, CO2 AND NOX. THESE PROCEDURES ARE VERY SIMILAR TO THE METHODS DESCRIBED IN EPA CFR 40 PART 60 APPENDIX A METHOD 25A FOR HYDROCARBONS, METHOD 10 FOR CO, METHOD 7E FOR NOX. DATA SHOWN IS BASED ON STEADY STATE ENGINE OPERATING CONDITIONS OF 77 DEG F, 28.43 INCHES HG AND FUEL HAVING A LHV OF 911 BTU PER CUBIC FOOT AT 30.00 INCHES HG ABSOLUTE AND 32 DEG F. FUEL RATE IS BASED ON A STANDARD CUBIC FOOT AT 30.00 INCHES HG ABSOLUTE AND 32 DEG F.

To properly apply this data you must refer to performance parameter DM1176 for additional information...

REFERENCE EXHAUST STACK DIAMETER	0 IN
WET EXHAUST MASS	7,619.2 LB/HR
WET EXHAUST FLOW (820.40 F STACK TEMP )	4,255.42 CFM
WET EXHAUST FLOW RATE ( 32 DEG F AND 29.98 IN HG )	1,514.00 STD CFM
DRY EXHAUST FLOW RATE ( 32 DEG F AND 29.98 IN HG )	1,386.81 STD CFM
FUEL FLOW RATE	113 CFM

**RATED SPEED "Potential site variation"**

ENGINE SPEED RPM	PERCENT LOAD	ENGINE POWER BHP	TOTAL NOX (AS NO2) LB/HR	TOTAL CO LB/HR	TOTAL HC LB/HR	OXYGEN IN EXHAUST PERCENT
1,200	100	814	3.7200	3.2100	5.9200	7.8000
1,200	75	610	5.0700	2.5400	4.1100	6.8100
1,200	50	408	4.7000	1.9200	2.7600	6.0000
1,200	25	204	1.9200	1.2900	1.5000	5.3000
1,200	10	82	.4400	.9800	1.4000	5.1900

**Altitude Capability Data(Corrected Power Altitude Capability)**

<b>Ambient Operating Temp.</b>	<b>50 F</b>	<b>68 F</b>	<b>86 F</b>	<b>104 F</b>	<b>122 F</b>	<b>NORMAL</b>
<b>Altitude</b>						
0 FT	814 hp	814 hp	814 hp	814 hp	814 hp	814 hp
984.25 FT	814 hp	814 hp	814 hp	814 hp	814 hp	814 hp
1,640.42 FT	814 hp	814 hp	814 hp	814 hp	814 hp	814 hp
3,280.84 FT	814 hp	814 hp	814 hp	811.32 hp	787.18 hp	814 hp
4,921.26 FT	814 hp	815.34 hp	788.52 hp	763.04 hp	740.24 hp	814 hp
6,561.68 FT	793.88 hp	767.06 hp	741.58 hp	717.45 hp	695.99 hp	773.77 hp
8,202.1 FT	745.61 hp	720.13 hp	697.33 hp	674.53 hp	653.08 hp	734.88 hp
9,842.52 FT	700.01 hp	675.87 hp	654.42 hp	632.96 hp	614.19 hp	698.67 hp
10,498.69 FT	682.58 hp	659.78 hp	638.33 hp	616.87 hp	598.09 hp	683.92 hp

**The powers listed above and all the Powers displayed are Corrected Powers**

**Identification Reference and Notes**

<b>Engine Arrangement:</b>	9Y4110	<b>Lube Oil Press @ Rated Spd(PSI):</b>	67.6
<b>Effective Serial No:</b>		<b>Piston Speed @ Rated Eng SPD (FT/Min):</b>	1,389.8
<b>Primary Engine Test Spec:</b>		<b>Max Operating Altitude(FT):</b>	4,921.3
<b>Performance Parm Ref:</b>	TM0001	<b>PEEC Elect Control Module Ref</b>	
<b>Performance Data Ref:</b>	TM9494	<b>PEEC Personality Cont Mod Ref</b>	
<b>Aux Coolant Pump Perf Ref:</b>			
<b>Cooling System Perf Ref:</b>		<b>Turbocharger Model</b>	TW8114-1.03VO
<b>Certification Ref:</b>		<b>Fuel Injector</b>	
<b>Certification Year:</b>		<b>Timing-Static (DEG):</b>	25.00
<b>Compression Ratio:</b>	9.0	<b>Timing-Static Advance (DEG):</b>	--
<b>Combustion System:</b>	SI	<b>Timing-Static (MM):</b>	--
<b>Aftercooler Temperature (F):</b>	129	<b>Unit Injector Timing (MM):</b>	--
<b>Crankcase Blowby Rate(CFH):</b>	10.6	<b>Torque Rise (percent)</b>	--
<b>Fuel Rate (Rated RPM) No Load (Gal/HR):</b>	--	<b>Peak Torque Speed RPM</b>	--
<b>Lube Oil Press @ Low Idle Spd(PSI):</b>	37.0	<b>Peak Torque (LB.FT):</b>	--



**Reference  
Number: TM9494**

CHANGE 01:  
UPDATED USING IMPROVED SPECIFIC HEAT CALCULATION

**Parameters  
Reference: TM0001**

## **GAS ENGINE PERFORMANCE**

### **TOLERANCES:**

AMBIENT AIR CONDITIONS AND FUEL USED WILL AFFECT THESE VALUES.  
EACH OF THE VALUES MAY VARY IN ACCORDANCE WITH THE FOLLOWING  
TOLERANCES:

>  
>

POWER	+/- 3%
EXHAUST STACK TEMPERATURE	+/- 8%
INLET AIR FLOW	+/- 5%
INTAKE MANIFOLD ABSOLUTE PRESSURE - NA	+/- 5%
INTAKE MANIFOLD ABSOLUTE PRESSURE - TA	+/- 5%
INTAKE MANIFOLD TEMPERATURE	+/- 5 DEG C
EXHAUST GAS FLOW	+/- 6%
SPECIFIC FUEL CONSUMPTION	+/- 5%
FUEL RATE	+/- 5%

### **CONDITIONS:**

POWER FOR GAS ENGINES IS BASED ON FUEL HAVING A LHV OF 33.74 KJ/L (905 BTU/CU FT) AT 101 KPA (29.91 IN HG) AND 15 DEG C (59 DEG F). FUEL RATE IS BASED ON A CUBIC METER AT 100 KPA (29.61 IN HG) AND 15.6 DEG C (60.1 DEG F). AIR FLOW IS BASED ON A CUBIC FOOT AT 100 KPA (29.61 IN HG) AND 25 DEG C (77 DEG F). EXHAUST FLOW IS BASED ON A CUBIC FOOT AT 100 KPA (29.61 IN HG) AND STACK TEMPERATURE.

ENGINE PERFORMANCE IS OBTAINED IN ACCORDANCE WITH SAE J1995, ISO 3046/1, BS5514/1 AND DIN 6271/1 STANDARDS.

TRANSIENT RESPONSE DATA IS ACQUIRED FROM AN ENGINE/GENERATOR COMBINATION AT NORMAL OPERATING TEMPERATURE AND IN ACCORDANCE WITH ISO 3046/1 STANDARD AMBIENT CONDITIONS. ALSO IN ACCORDANCE WITH SAE J1995, BS5514/1 AND DIN 6271/1 STANDARD REFERENCE CONDITIONS.

ENGINES ARE EQUIPPED WITH STANDARD ACCESSORIES; LUBE OIL PUMP, JACKET WATER PUMP, SEPARATE CIRCUIT AFTERCOOLER WATER PUMP AND MAGNETO (EXCEPT EIS). POWER REQUIRED TO DRIVE AUXILIARIES MUST BE DEDUCTED FROM THE GROSS OUTPUT TO ARRIVE AT THE NET POWER AVAILABLE FOR THE EXTERNAL (FLYWHEEL OR GENERATOR) LOAD. TYPICAL AUXILIARIES INCLUDE COOLING FANS, AIR COMPRESSORS AND CHARGING ALTERNATORS. RATINGS MUST BE REDUCED TO COMPENSATE FOR ALTITUDE AND/OR AMBIENT TEMPERATURE CONDITIONS ACCORDING TO THE APPLICABLE DATA SHOWN ON THE PERFORMANCE DATA SET.

### **DEFINITIONS:**

INDUSTRIAL CONTINUOUS - THE POWER AND SPEED CAPABILITY OF THE ENGINE WHICH CAN BE USED WITHOUT INTERRUPTION OR LOAD CYCLING.  
GENERATOR SET CONTINUOUS - OUTPUT WHICH MAY BE UTILIZED CONTINUOUSLY WITHOUT LOAD CYCLING.

### **ALTITUDE:**

ALTITUDE CAPABILITY - THE RECOMMENDED POWER VALUES FOR SUSTAINED ENGINE OPERATION AT SPECIFIC LEVELS AND AMBIENT TEMPERATURES.  
COLUMN "N" DATA - THE FLYWHEEL POWER OUTPUT AT NORMAL AMBIENT TEMPERATURE.

AMBIENT TEMPERATURE - TO BE MEASURED AT THE AIR CLEANER AIR INLET DURING NORMAL ENGINE OPERATION.  
 NORMAL TEMPERATURE - THE NORMAL TEMPERATURE AT VARIOUS SPECIFIC ALTITUDE LEVELS FOUND ON TM2001.

**HEAT REJECTION**

**TOLERANCES:**

LHV OR HHV ENERGY	+/- 5%
WORK ENERGY	+/- 3%
REJECTION TO COOLANT	+/- 10%
REJECTION TO EXHAUST	+/- 10%
EXHAUST RECOVERY	+/- 10%
FROM OIL COOLER	+/- 20%
FROM AFTERCOOLER	+/- 5%
REJECTION TO ATMOSPHERE	+/- 50%

THE FOLLOWING FORMULAS APPLY WHEN DOING AN ENERGY BALANCE:  
 STANDARD TEMPERATURE SYSTEM

HHV ENERGY = REJ TO COOLANT + REJ TO ATMOS + REJ TO EXH + FROM AFTCLR + WORK ENERGY

COGENERATION (HIGH TEMPERATURE) SYSTEM AND G3600

HHV ENERGY = REJ TO COOLANT + REJ TO ATMOS + REJ TO EXH + FROM OIL CLR + FROM AFTCLR + WORK ENERGY

**DEFINITIONS:**

REJ TO COOLANT (JACKET WATER) - TOTAL AMOUNT OF HEAT PICKED UP BY THE ENGINE COOLING SYSTEM. FOR STANDARD TEMPERATURE SYSTEMS THE OIL COOLER HEAT REJECTION IS INCLUDED. FOR COGENERATION SYSTEM AND G3600 THE OIL COOLER IS SEPARATE FROM THE JACKET WATER. THEREFORE, THE OIL COOLER HEAT REJECTION IS NOT INCLUDED IN THE REJ TO COOLANT.

REJECTION TO EXHAUST - IS BASED ON COOLING EXHAUST STACK FLOW TO 25 DEG C (77 DEG F) AND IS USED IN THE ENERGY BALANCE.

EXHAUST RECOVERY - IS THE ENERGY AVAILABLE IF THE EXHAUST STACK FLOW IS COOLED TO 177 DEG C (350.6 DEG F).

**SOUND DEFINITIONS:**

Sound Power : [DM8702](#)

Sound Pressure : [TM7080](#)

Date Released : 10/04/11

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 Content Owner: Commercial Processes Division  
 Web Master(s): [PSG Web Based Systems Support](#)  
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Engles, Brian

To: Suzanne Kennedy <suzanne.kennedy@hotmail.com>;

You replied on 7/31/2015 3:30 PM.

4KC00449 Engine Test ...

113 KB

1 attachment (113 KB)

Suzanne, That is misleading. The sheet I gave you covers a test spec, in this case 0T8837, which is the test spec for your serial applied to X number of engines, with the effective serial number of 4KC00348. In other words, they started using test spec 0T 4KC00348 and went up in serial number from there. I have attached the Engine Test Data for clarity. Hope this helps.

Brian Engles

Technical Communicator

Empire Cat Power Systems

Office (602) 333-5689

Mobile (602) 622-5678

[Brian.Engles@Empire-Cat.com](mailto:Brian.Engles@Empire-Cat.com)

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**From:** Suzanne Kennedy [mailto:suzanne.kennedy@hotmail.com]

**Sent:** Friday, July 31, 2015 1:49 PM

**To:** Engles, Brian

**Subject:** Re: 4KC00449 Performance Data

Hi Brian,

The document you sent shows a serial number of 4KC00348. The engine I need info on is 4KC00449. It is a Caterpil engine.

If you have info on that engine, that would be great.

Thanks!

Suzanne

602-460-8173