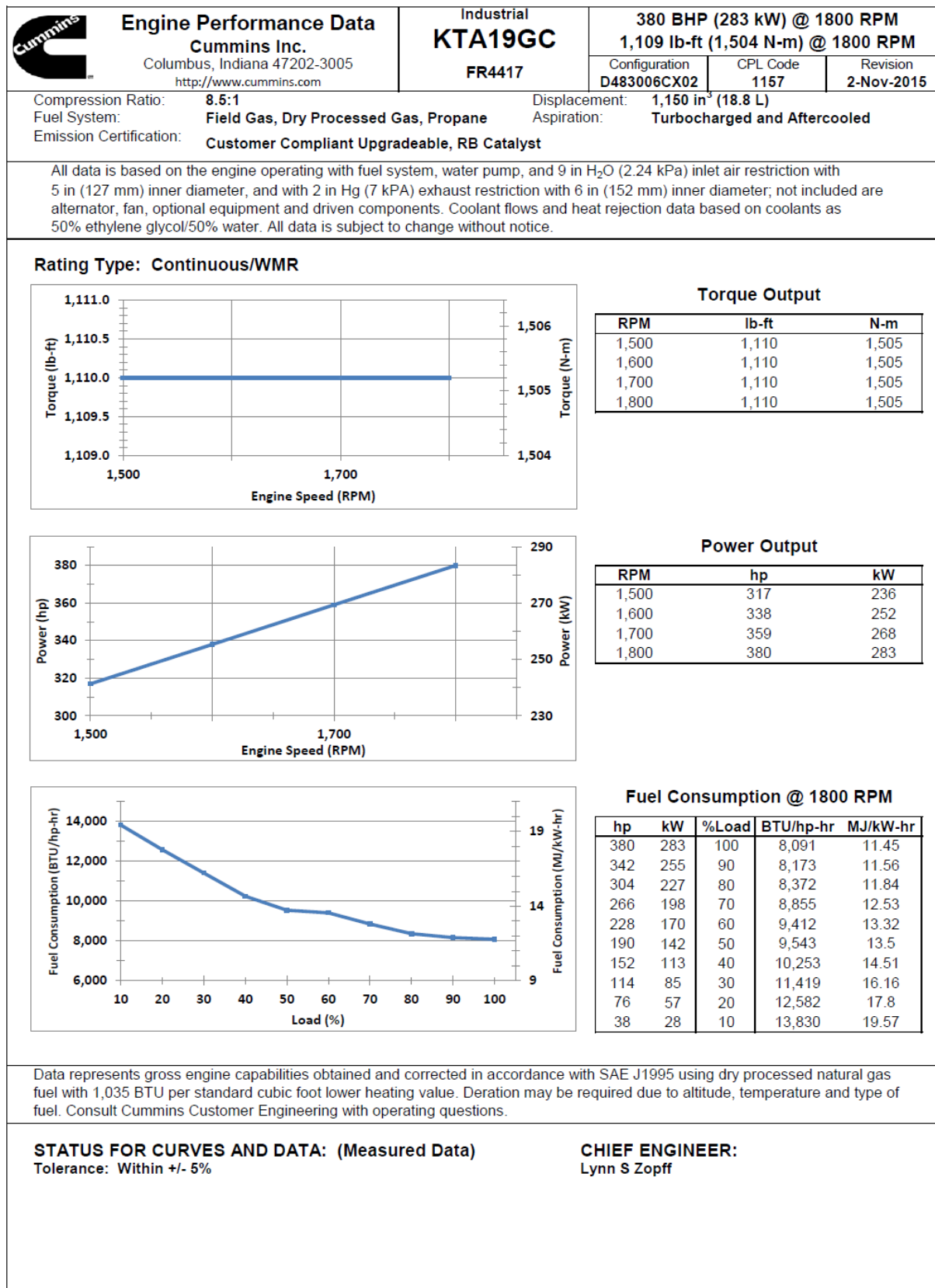


**LEGEND**

- Mixed Fluids
- Oil
- Gas
- Water
- Continuous
- Intermittent

FUG-1  
HR-1  
SSM



Maximum allowable air temperature rise over ambient at Intake Manifold  
(Naturally Aspirated Engines) or Turbo Compressor inlet (Turbo-charged  
(This parameter impacts emissions, LAT and/or altitude capability)

15 delta deg F      8.3 delta deg C

Coolant temperature from the Aftercooler outlet @ Maximum engine coolant out temperature at Limiting Ambient Temperature

Maximum coolant temperature into the Aftercooler @25C (77F) ambient

Maximum coolant temperature into Aftercooler @ Limiting Ambient conditions

Maximum coolant temperature for engine protection controls

Maximum coolant operating temperature at engine outlet (use for LAT):

130 deg F                      54 deg C

212 deg F                      100 deg C

204 deg F                      96 deg C

Maximum exhaust back pressure:

2 in-Hg      7 kPa

Recommended exhaust piping size (inner diameter):

6 in 152 mm

Nominal operating oil pressure

@ minimum low idle:

20 psi                      138 kPa

@ maximum rated speed:

70 psi                      483 kPa

Minimum engine oil pressure for engine protection devices

@ minimum low idle:

10 psi                      69 kPa

Minimum fuel inlet pressure

7 psi      48 kPa

Maximum fuel inlet pressure

25 psi                      172 kPa

Maximum low idle speed:

1.200 RPM

Minimum low idle speed:

900 RPM

Rated engine speed for full load sustain operation:

1,800 RPM

Maximum torque available at closed throttle low idle speed:

50 lb-ft                      68 N-m

100% Load				75% Load		50% Load	
Engine Rating							
Engine Speed	1,800 RPM			1,800 RPM		1,800 RPM	
Output Power	380 hp	283 kW		285 hp	213 kW	190 hp	142 kW
Torque	1,109 lb-ft	1,504 N-m		832 lb-ft	1,128 N-m	554 lb-ft	751 N-m
Performance Data							
Intake Manifold Pressure	13 in-Hg	44 kPa		5 in-Hg	17 kPa	-3 in-Hg	-10 kPa
Turbo Comp. Outlet Pressure	23 in-Hg	78 kPa		15 in-Hg	51 kPa	8 in-Hg	27 kPa
Turbo Comp. Outlet Temperature	229 deg F	109 deg C		186 deg F	86 deg C	148 deg F	64 deg C
Inlet Air Flow	564 ft³/min	266 L/s		448 ft³/min	211 L/s	335 ft³/min	158 L/s
Charge Air Flow	41 lb/min	19 kg/min		33 lb/min	15 kg/min	25 lb/min	11 kg/min
Exhaust Gas Flow	1,941 ft³/min	916 L/s		1,534 ft³/min	724 L/s	1,136 ft³/min	536 L/s
Exhaust Gas Temperature (Stack)	1,341 deg F	727 deg C		1,326 deg F	719 deg C	1,290 deg F	699 deg C
Fuel Consumption	8,091 BTU/hp-hr	11 MJ/kW-hr		8,506 BTU/hp-hr	12 MJ/kW-hr	9,543 BTU/hp-hr	13 MJ/kW-hr
Air Fuel Ratio (Dry)	16.7 vol/vol			16.7 vol/vol		16.7 vol/vol	
Ignition Timing (BTDC)	32 deg			32 deg		32 deg	
Heat Balance							
Heat Rejection to Coolant	14,677 BTU/min	258 kW		12,972 BTU/min	228 kW	11,096 BTU/min	195 kW
Heat Rejection to Aftercooler Coolant	1,316 BTU/min	23 kW		785 BTU/min	14 kW	434 BTU/min	8 kW
Heat Rejection to Exhaust	15,302 BTU/min	269 kW		11,806 BTU/min	208 kW	8,439 BTU/min	148 kW
Heat Rejection to Ambient	5,012 BTU/min	88 kW		3,916 BTU/min	69 kW	2,827 BTU/min	50 kW
Emissions							
Volatile Organic Compounds (VOC)	0.94 g/hp-hr			1.12 g/hp-hr		1.42 g/hp-hr	
VOC ppm without Catalyst							
VOC ppm with Catalyst							
NO <sub>x</sub> (BS)	12.80 g/hp-hr	17.16 g/kW-hr		12.00 g/hp-hr	16.09 g/kW-hr	11.30 g/hp-hr	15.15 g/kW-hr
NO <sub>x</sub> ppm without Catalyst							
NO <sub>x</sub> ppm with Catalyst							
CO (BS)	6.10 g/hp-hr	8.18 g/kW-hr		8.10 g/hp-hr	10.86 g/kW-hr	6.20 g/hp-hr	8.31 g/kW-hr
CO ppm without Catalyst							
CO ppm with Catalyst							
CO <sub>2</sub> (BS)	510 g/hp-hr	684 g/kW-hr		538 g/hp-hr	721 g/kW-hr	606 g/hp-hr	813 g/kW-hr
HCHO (BS Formaldehyde*)	0.004 g/hp-hr	0.005 g/kW-hr		0.004 g/hp-hr	0.005 g/kW-hr	0.005 g/hp-hr	0.007 g/kW-hr
HCHO ppm without Catalyst							
HCHO ppm with Catalyst							
O <sub>2</sub> %	0.48 %			0.46 %		0.47 %	

\*Formaldehyde (HCHO) value is an estimate based upon EPA's AP-42 emissions factor and an assumed representative fuel flow.

**Cranking System (Cold Starting Capability)**

Unaided Cold Start:

Minimum Cranking Speed

110 RPM

Cold Starting aids available

None

Maximum parasitic load at 10 deg F @

**Noise Emissions**

Top

100.1 dBa

Right Side

99.1 dBa

Left Side

98.2 dBa

Front

97.9 dBa

Exhaust noise emissions

106.1 dBa

Estimated Free Field Sound Pressure Level at 3.28 ft (1m) and Full-Load Governed Speed  
(Excludes Noise from Intake, Exhaust, Cooling System and Driven Components)

**Aftercooler Heat Rejection - Heat Load on Aftercooler**

BTU/min (kW)

	Ambient Temp deg F (deg C)					
	120 (49)	110 (43)	100 (38)	90 (32)	80 (27)	70 (21)
<b>Altitude</b>						
<b>ft (m)</b>						
<b>0 (0)</b>	1,428 (25.1)	1,401 (24.6)	1,372 (24.1)	1,344 (23.6)	1,317 (23.2)	1,260 (22.2)
<b>1000 (305)</b>	1,479 (26.0)	1,454 (25.6)	1,426 (25.1)	1,399 (24.6)	1,372 (24.1)	1,343 (23.6)
<b>2000 (610)</b>	1,544 (27.2)	1,517 (26.7)	1,489 (26.2)	1,462 (25.7)	1,435 (25.2)	1,407 (24.7)
<b>3000 (914)</b>	1,607 (28.3)	1,580 (27.8)	1,552 (27.3)	1,525 (26.8)	1,498 (26.3)	1,471 (25.9)
<b>4000 (1219)</b>	1,675 (29.5)	1,647 (29.0)	1,619 (28.5)	1,593 (28.0)	1,565 (27.5)	1,538 (27.0)
<b>5000 (1524)</b>	1,745 (30.7)	1,718 (30.2)	1,690 (29.7)	1,663 (29.2)	1,636 (28.8)	1,609 (28.3)
<b>6000 (1829)</b>	1,849 (32.5)	1,822 (32.0)	1,795 (31.6)	1,767 (31.1)	1,764 (31.0)	1,738 (30.6)
<b>7000 (2134)</b>	1,927 (33.9)	1,900 (33.4)	1,872 (32.9)	1,845 (32.4)	1,818 (32.0)	1,791 (31.5)
<b>8000 (2438)</b>	2,008 (35.3)	1,980 (34.8)	1,953 (34.3)	1,925 (33.8)	1,897 (33.4)	1,870 (32.9)
<b>9000 (2743)</b>	2,083 (36.6)	2,049 (36.0)	2,022 (35.6)	1,995 (35.1)	1,968 (34.6)	1,941 (34.1)
<b>10000 (3048)</b>	1,939 (34.1)	2,019 (35.5)	2,010 (35.3)	1,990 (35.0)	1,967 (34.6)	2,014 (35.4)

End of Report

## EICS Emissions Performance Specification Summary

### Engine Data

Engine Manufacturer: Cummins  
 Model Number: KTA19GC380, 4-stroke-cycle, gas engine (SCAC)  
 Power Output: 380 bhp  
 Load: 100%  
 Rated Speed: 1800 RPM  
 Type of Fuel: Natural Gas @ 8091 BTU/hp-hr  
 Exhaust Flow Rate (Wet): 1,941 ft<sup>3</sup>/min  
 Exhaust Temperature: 1341°F  
 Engine Data Source Information: Cummins Engine Performance Data Sheet (Attached)  
 Industrial: KTA19GC, FR4417  
 Configuration: D483006CX02  
 CPL Code: 1157  
 Revision: 2-Nov-15

### NSCR Catalytic Converter Details

Murphy Part Number: E2379055  
 Material: Stainless Steel  
 Diameter: 13"  
 Overall Length: 24"  
 Inlet Pipe Size & Connection: 5" FF Flange, 125/150# ANSI standard bolt  
 Outlet Pipe Size & Connection: 5" FF Flange, 125/150# ANSI standard bolt  
 Weight: (± 2 lbs.) 59 lbs +/- 2 lbs  
 System Pressure Loss (estimated): 6.0 inches of WC (Fresh)  
 Exhaust Temperature Limits:  
     Inlet Min: 750°F  
     Inlet Max: 1285°F  
 Lubrication Oil Requirements: 0.6 wt% sulfated ash or less

EICS Catalyst Emissions Calculations		
	Raw Engine Emissions <sup>1,2</sup>	Targeted Outlet Emissions <sup>3</sup>
	g/bhp-hr	g/bhp-hr
<b>NOx</b>	12.8	<b>0.5</b>
<b>CO</b>	6.10	<b>2</b>
<b>NMNEHC</b>	0.94	<b>0.7</b>
<b>HCHO</b>	0.004	<b>0.05</b>
<b>Oxygen %</b>	0.48	---

<sup>1</sup> As provided by the Engine Data Source Information above: Calculated using dry processed natural gas fuel.

<sup>2</sup> Raw engine out emissions may vary with different fuel quality.

<sup>3</sup> The Murphy EICS product line is an Engine Integrated Control System offered for specific engine models. When operated with the optional emission package (which includes a Murphy catalyst), the system is designed to keep the engine at or below the above targeted outlet emissions. Components and equipment must be in proper operating condition in accordance with accepted standards.

Prepared by: Darrell Schmitt  
 Technical Sales Manager - Emissions & Ignition Controls  
 Murphy (by Enovation Controls)



# Engine Performance Data

Cummins Inc

Columbus, Indiana 47202-3005  
<http://www.cummins.com>

Industrial

**G8.3E**

**FR93002**

**118 BHP (88 kW) @ 1800 RPM**  
**344 lb-ft (466 N-m) @ 1800 RPM**

Configuration  
**D551015CX03**

CPL Code  
**3150**

Revision  
**18-Nov-2008**

Compression Ratio: **10.5:1**

Fuel System: **Field Gas, Dry Processed Nat Gas, NG**

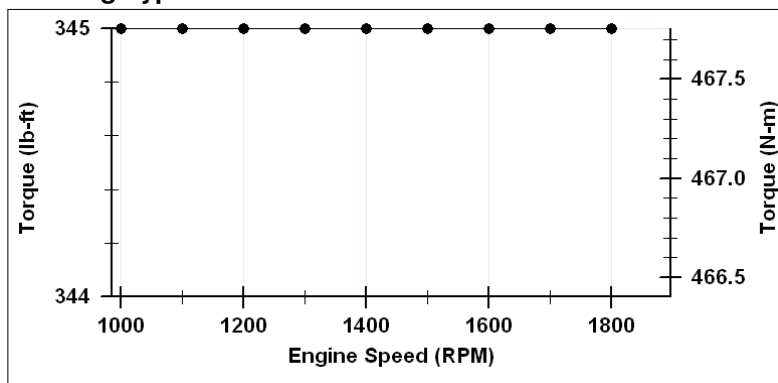
Displacement: **505 in3 (8.3 L)**

Aspiration: **Naturally Aspirated**

Emission Certification: **Catalyst, 2008 NSPS Standards using factory supplied ECM, AFR and Catalyst Option PE9159, Dry Exhaust**

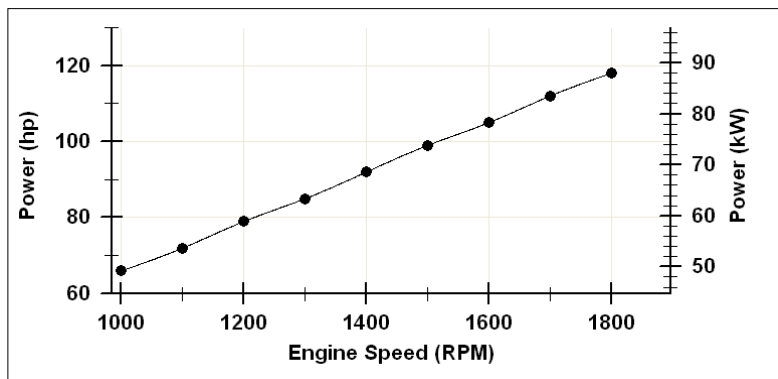
All data is based on the engine operating with fuel system, water pump, and 6 in H<sub>2</sub>O (1.49 kPa) inlet air restriction with 3 in (76 mm) inner diameter, and with 1 in Hg (3 kPa) exhaust restriction with 3 in (76 mm) inner diameter; not included are alternator, fan, optional equipment and driven components. Coolant flows and heat rejection data based on coolants as 50% ethylene glycol/50% water. All data is subject to change without notice.

## Rating Type: Continuous/WMR



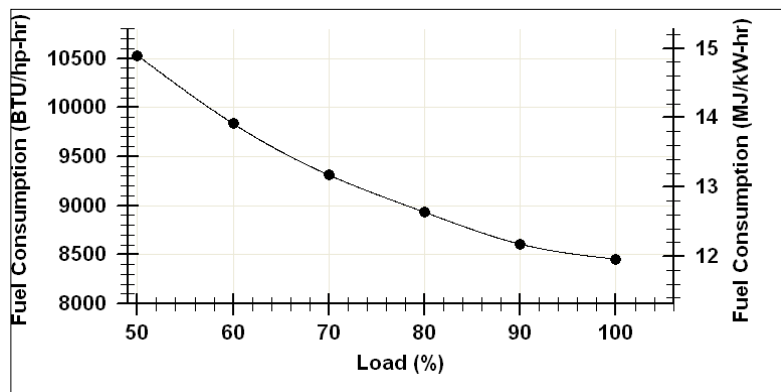
## Torque Output

RPM	lb-ft	N-m
1,000	345	468
1,100	345	468
1,200	345	468
1,300	345	468
1,400	345	468
1,500	345	468
1,600	345	468
1,700	345	468
1,800	345	468



## Power Output

RPM	hp	kW
1,000	66	49
1,100	72	54
1,200	79	59
1,300	85	63
1,400	92	69
1,500	99	74
1,600	105	78
1,700	112	84
1,800	118	88



## Fuel Consumption @ 1,800 RPM

hp	kW	% Load	BTU/hp-hr	MJ/kW-hr
118	88	100	8,455	11.96
106	79	90	8,608	12.18
94	70	80	8,933	12.64
83	62	70	9,312	13.17
71	53	60	9,835	13.91
59	44	50	10,529	14.9

Data represents gross engine capabilities obtained and corrected in accordance with SAE J1995 and ISO 3046 conditions of 29.61 in Hg (100 kPa) barometric pressure [500 ft (152 m) altitude], 77 °F (25 °C) inlet air temperature and 0.30 in Hg (1 kPa) water vapor pressure using dry processed natural gas fuel with 935 BTU per standard cubic foot lower heating value. Deration may be required due to altitude, temperature and type of fuel. Consult Cummins Customer Engineering for operation above this altitude.

**STATUS FOR CURVES AND DATA: Preliminary-(Estimated data)**

**TOLERANCE: Within +/- 5 %**

**CHIEF ENGINEER:**

**Alfred S Weber**

**Intake Air System**

Maximum allowable air temperature rise over ambient at Intake Manifold (Naturally Aspirated Engines) or Turbo Compressor inlet (Turbo-charged Engines): (This parameter impacts emissions, LAT and/or altitude capability)

15 delta deg F                      8.3 delta deg C

**Cooling System**

Maximum coolant temperature for engine protection controls

215 deg F                      102 deg C

Maximum coolant operating temperature at engine outlet (max. top tank temp):

212 deg F                      100 deg C

**Exhaust System**

Maximum exhaust back pressure:

2 in-Hg                      7 kPa

Recommended exhaust piping size (inner diameter):

3 in                      76 mm

**Lubrication System**

Nominal operating oil pressure

@ minimum low idle

10 psi                      69 kPa

@ maximum rated speed

50 psi                      345 kPa

Minimum engine oil pressure for engine protection devices

@ minimum low idle

10 psi                      69 kPa

**Fuel System**

Minimum fuel inlet pressure:

7 psi                      48 kPa

Maximum fuel inlet pressure:

25 psi                      172 kPa

**Performance Data**

Engine low idle speed:

1,200 RPM

Maximum low idle speed:

1,800 RPM

Minimum low idle speed:

900 RPM

Engine high idle speed

1,800 RPM

Governor break speed:

Maximum torque available at closed throttle low idle speed:

50 lb-ft                      68 N-m

	100% Load		75% Load		50% Load	
Engine Speed	1,800 RPM		1,800 RPM		1,800 RPM	
Output Power	118 hp	88 kW	89 hp	66 kW	59 hp	44 kW
Torque	344 lb-ft	466 N-m	260 lb-ft	353 N-m	172 lb-ft	233 N-m
Intake Manifold Pressure	-1 in-Hg	-5 kPa	-5 in-Hg	-16 kPa	-8 in-Hg	-26 kPa
Inlet Air Flow	174 ft <sup>3</sup> /min	82 L/s	142 ft <sup>3</sup> /min	67 L/s	111 ft <sup>3</sup> /min	52 L/s
Exhaust Gas Flow	442 ft <sup>3</sup> /min	209 L/s	332 ft <sup>3</sup> /min	157 L/s	235 ft <sup>3</sup> /min	111 L/s
Exhaust Gas Temperature	1,342 deg F	728 deg C	1,320 deg F	716 deg C	1,290 deg F	699 deg C
Heat Rejection to Coolant	4,592 BTU/min	81 kW	3,907 BTU/min	69 kW	3,222 BTU/min	57 kW
Heat Rejection to Ambient	763 BTU/min	13 kW	1,503 BTU/min	26 kW	2,581 BTU/min	45 kW
Heat Rejection to Exhaust	4,101 BTU/min	72 kW	3,296 BTU/min	58 kW	2,491 BTU/min	44 kW
Fuel Consumption	8,455 BTU/hp-hr	12 MJ/kW-hr	9,110 BTU/hp-hr	13 MJ/kW-hr	10,529 BTU/hp-hr	15 MJ/kW-hr
Air Fuel Ratio (dry)	15.4 vol/vol		15.7 vol/vol		15.7 vol/vol	
Ignition timing (BTDC)	26 deg	26 deg	26 deg	26 deg	26 deg	26 deg
Total Hydrocarbons	2.5 g/hp-hr		3.41 g/hp-hr		4.55 g/hp-hr	
Volatile Organic Compounds (VOC)	1 g/hp-hr					
VOC ppm with Catalyst	451					
NOx	0.5 g/hp-hr	0.67 g/kW-hr				
NOx ppm w/o Catalyst	2683					
NOx ppm with Catalyst	100					
CO	4 g/hp-hr	5.36 g/kW-hr				
CO ppm w/o Catalyst	9787					
CO ppm with Catalyst	1283					
CO <sub>2</sub>	560 g/hp-hr	751 g/kW-hr	606 g/hp-hr	813 g/kW-hr	705 g/hp-hr	945 g/kW-hr
O <sub>2</sub>	0.84 %		0.57 %		0.59 %	

**Cranking System (Cold Starting Capability)**

Unaided Cold Start:

Minimum cranking speed

250 RPM

Breakaway torque at minimum unaided cold start temperature:

480 lb-ft

651 N-m

Cold starting aids available

Maximum parasitic load at 10 deg F @

**Noise Emissions**

Top

89.8 dBA

Right Side

91.2 dBA

Left Side

91.7 dBA

Front

90.3 dBA

Exhaust noise emissions

105.3 dBA

Estimated Free Field Sound Pressure Level at 3.28ft (1m) and Full-Load Governed Speed  
 (Excludes Noise from Intake, Exhaust, Cooling System and Driven Components)

**Aftercooler Heat Rejection - Heat Load on Aftercooler**

BTU/min (kW)

Ambient Temp deg F (deg C)

Altitude ft (m)	Ambient Temp deg F (deg C)					
	120 (49)	110 (43)	100 (38)	90 (32)	80 (27)	70 (21)
0 (0)	(.0)	(.0)	(.0)	(.0)	(.0)	(.0)
1000 (305)	(.0)	(.0)	(.0)	(.0)	(.0)	(.0)
2000 (610)	(.0)	(.0)	(.0)	(.0)	(.0)	(.0)
3000 (914)	(.0)	(.0)	(.0)	(.0)	(.0)	(.0)
4000 (1219)	(.0)	(.0)	(.0)	(.0)	(.0)	(.0)
5000 (1524)	(.0)	(.0)	(.0)	(.0)	(.0)	(.0)
6000 (1829)	(.0)	(.0)	(.0)	(.0)	(.0)	(.0)
7000 (2134)	(.0)	(.0)	(.0)	(.0)	(.0)	(.0)
8000 (2438)	(.0)	(.0)	(.0)	(.0)	(.0)	(.0)
9000 (2743)	(.0)	(.0)	(.0)	(.0)	(.0)	(.0)
10000 (3048)	(.0)	(.0)	(.0)	(.0)	(.0)	(.0)

End of Report





EMIT Technologies, Inc  
772 Airfield Lane  
Sheridan, WY 82801  
307.673.0883 Office  
307.673.0886 Fax  
[cdosborn@emittechnologies.com](mailto:cdosborn@emittechnologies.com)

**PREPARED FOR:**  
Natural Gas Services Group

**A. INFORMATION PROVIDED BY CUMMINS**

Engine:	G8.3C118
DIM Sheet:	FR 92224
Compression Ratio:	10.5:1
RPM:	1800
Horsepower:	118
Fuel:	Natural Gas
Piping size:	3"
Annual Operating Hours:	8760
Exhaust Flow:	604 CFM
Exhaust Temperature:	1374 °F
Allowable Engine Backpressure:	27" WC

**Emission Data**

NO <sub>x</sub> :	11.60	g/bhp-hr
CO:	11.00	g/bhp-hr
THC:	2.75	g/bhp-hr
NMHC:	0.17	g/bhp-hr
HCHO:	N/A	g/bhp-hr
Oxygen:	0.52	%

**B. POST CATALYST EMISSIONS TO BE ACHIEVED BY EMISSION CONTROL EQUIPMENT**

NO <sub>x</sub> :	<0.5 g/bhp-hr
CO:	<0.5 g/bhp-hr
VOC:	<0.5 g/bhp-hr

## C. CONTROL EQUIPMENT

### CATALYTIC CONVERTER/SILENCER UNIT

Model	<b>EAS-1200T-0303F-D1S4E</b>
Catalyst Type	NSCR, Precious group metals
Manufacturer	EMIT Technologies, Inc.
Element Size	12" x 3.5"
Catalyst Elements	1
Housing Type	Dual Bed
Catalyst Installation	Accessible Housing
Construction	10 ga 304 Stainless Steel
Sample Ports	6 (0.5" NPT)
Inlet Connections	3" flat face flange
Outlet Connections	3" flat face flange
Configuration	Assume Side In / End Out
Silencer	Integrated
Silencer Grade	Critical
Insertion Loss	20-25 dBA

### AIR FUEL RATIO CONTROLLER

Part Number	<b>ENG-S-075</b>
Manufacturer	EMIT Technologies, Inc.
Description	<b>MODEL EDGE NG</b> CSA certified AFR controller kit complete with: <i>EDGE NG Air Fuel Ratio Controller enclosure featuring: graphical display of oxygen sensor voltage, position of the digital power valve and thermocouple temperatures. Multiscreen digital display of controller and engine parameters. Integrated high temperature shutdown, Modbus enabled, 4 wire heated O2 sensor, O2 weldment, 25' Wiring harnesses, Digital power valve, Operations manual</i> <b>SINGLE BANK ENGINE</b>
Digital Power Valve Size	0.75" NPT

## D. WARRANTY

EMIT Technologies, Inc. warrants that the goods supplied will be free from defects in workmanship by EMIT Technologies, Inc. for a period of one (1) year from date of shipment. EMIT Technologies, Inc. will not be responsible for any defects which result from improper use, neglect, failure to properly maintain or which are attributable to defects, errors or omissions in any drawings, specifications, plans or descriptions, whether written or oral, supplied to EMIT Technologies, Inc. by Buyer.

Catalyst performance will be guaranteed for a period of 1 year from installation, or 8760 operating hours, whichever comes first. The catalyst shall be operated with an automatic air/fuel ratio controller. The performance guarantee shall not cover the effects of excessive ash masking due to operation at low load, improper engine maintenance, or inappropriate lubrication oil. The performance guarantee shall not cover the effects of continuous engine misfires (cylinder or ignition) exposing the catalyst to excessive exothermic reaction temperatures.

The exhaust temperature operating range at the converter inlet is 600°F minimum for oxidation catalyst and 750°F for NSCR catalyst and 1250°F maximum.

If a high temperature shut down switch is not installed, thermal deactivation of catalyst at temperatures above 1300°F is not covered.

The catalyst conversion efficiencies (% reduction) will be guaranteed for engine loads of 50 to 100 percent.

Engine lubrication oil shall contain less than 0.6% ash (by weight) with a maximum allowable specific oil consumption of 0.01 gal/bhp-hr. The maximum ash loading on the catalyst shall be limited to 350 g/m<sup>3</sup>. Phosphorous and zinc additives are limited to 0.03% (by weight).

The catalyst must not be exposed to the following known poisoning agents, including: iron, nickel, sodium, chromium, arsenic, zinc, lead, phosphorous, silicon, potassium, magnesium, copper, tin, and mercury. Total poison concentrations in the gas are limited to 0.3 ppm.



## Largo Canyon West 8 Part 1 Registration Attachments

### **Regulatory Analysis**

**NSPS Subpart Kb** – The storage tanks at this facility will not be subject to this subpart as they are located prior to custody transfer.

**NSPS Subpart IIII** – There are no compression ignition engines planned for this facility. Therefore, this subpart will not apply.

**NSPS Subpart JJJJ** – The engines at this facility may be subject to this subpart dependent on their manufacture date. This will be determined at the time of installation.

**NSPS Subpart OOOOa** – The facility will be subject to this subpart as it will be constructed after the effective date of September 18, 2015. The storage tanks, fugitive components, and control device will be affected facilities.

**NESHAP Subpart ZZZZ** – The engines at this facility will be subject to this subpart as they are newly constructed units located at an area source for HAPs.