

LEGEND

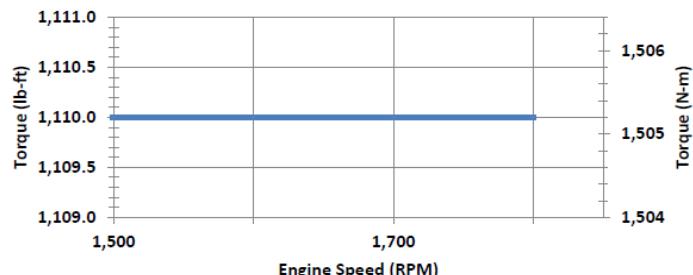
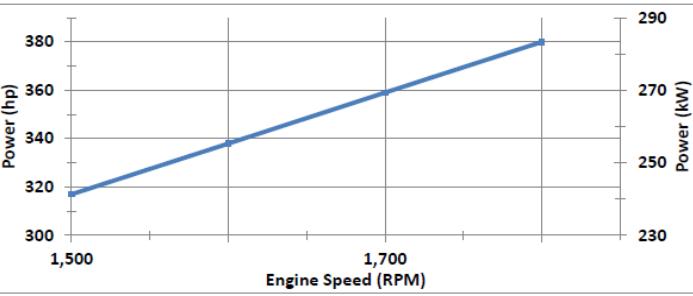
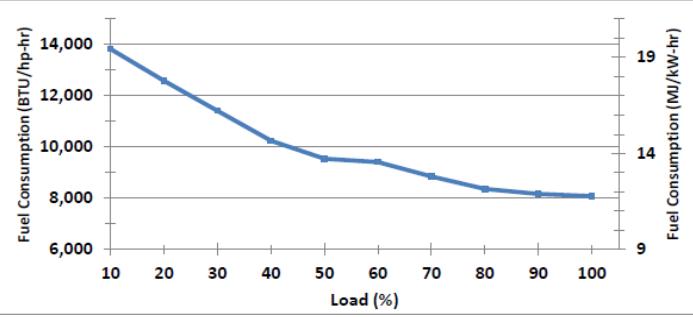
- Mixed Fluids
- Oil
- Gas
- Water
- Continuous
- Intermittent

FUG-1
HR-1
SSM

CDH Consulting, LLC
Thornton, CO

Process Flow Diagram
September 2022

DJR Operating, LLC
Largo Canyon West 8

 Engine Performance Data Cummins Inc. Columbus, Indiana 47202-3005 http://www.cummins.com	Industrial KTA19GC FR4417	380 BHP (283 kW) @ 1800 RPM 1,109 lb-ft (1,504 N·m) @ 1800 RPM																																																									
Compression Ratio: 8.5:1	Displacement: 1,150 in ³ (18.8 L)	Configuration: D483006CX02	CPL Code: 1157	Revision: 2-Nov-2015																																																							
Fuel System: Field Gas, Dry Processed Gas, Propane	Aspiration: Turbocharged and Aftercooled																																																										
Emission Certification: Customer Compliant Upgradeable, RB Catalyst																																																											
All data is based on the engine operating with fuel system, water pump, and 9 in H ₂ O (2.24 kPa) inlet air restriction with 5 in (127 mm) inner diameter, and with 2 in Hg (7 kPa) exhaust restriction with 6 in (152 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																																																											
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STATUS FOR CURVES AND DATA: (Measured Data) Tolerance: Within +/- 5%		CHIEF ENGINEER: Lynn S Zopff																																																									

FR 4417 (Continued) Page: 2

Intake System						
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 deg F 8.3 deg C					
Cooling System						
Coolant temperature from the Aftercooler outlet @ Maximum engine coolant out temperature at Limiting Ambient Temperature						
Maximum coolant temperature into the Aftercooler @ 25C (77F) ambient	130 deg F 54 deg C					
Maximum coolant temperature into Aftercooler @ Limiting Ambient conditions	212 deg F 100 deg C					
Maximum coolant temperature for engine protection controls	204 deg F 96 deg C					
Maximum coolant operating temperature at engine outlet (use for LAT):						
Exhaust System						
Maximum exhaust back pressure:	2 in-Hg 7 kPa					
Recommended exhaust piping size (inner diameter):	6 in 152 mm					
Lubrication System						
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					
Fuel System						
Minimum fuel inlet pressure	7 psi 48 kPa					
Maximum fuel inlet pressure	25 psi 172 kPa					
Performance Data						
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	285 hp	190 hp			
Torque	1,109 lb-ft	832 lb-ft	554 lb-ft			
Performance Data						
Intake Manifold Pressure	13 in-Hg	5 in-Hg	-3 in-Hg			
Turbo Comp. Outlet Pressure	23 in-Hg	15 in-Hg	8 in-Hg			
Turbo Comp. Outlet Temperature	229 deg F	109 deg C	86 deg C			
Inlet Air Flow	564 ft ³ /min	266 L/s	211 L/s			
Charge Air Flow	41 lb/min	19 kg/min	15 kg/min			
Exhaust Gas Flow	1,941 ft ³ /min	916 L/s	724 L/s			
Exhaust Gas Temperature (Stack)	1,341 deg F	727 deg C	719 deg C			
Fuel Consumption	8,091 BTU/hp-hr	8,506 BTU/hp-hr	9,543 BTU/hp-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	11,096 BTU/min	195 kW		
Heat Rejection to Aftercooler Coolant	1,316 BTU/min	23 kW	434 BTU/min	8 kW		
Heat Rejection to Exhaust	15,302 BTU/min	269 kW	8,439 BTU/min	148 kW		
Heat Rejection to Ambient	5,012 BTU/min	88 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 _x (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 _x ppm without Catalyst						
NO _x 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 ₂ (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 ₂ %	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)

Altitude ft (m)	Ambient Temp deg F (deg C)					
	120 (49)	110 (43)	100 (38)	90 (32)	80 (27)	70 (21)
0 (0)	1,428 (25.1)	1,401 (24.6)	1,372 (24.1)	1,344 (23.6)	1,317 (23.2)	1,260 (22.2)
1000 (305)	1,479 (26.0)	1,454 (25.6)	1,426 (25.1)	1,399 (24.6)	1,372 (24.1)	1,343 (23.6)
2000 (610)	1,544 (27.2)	1,517 (26.7)	1,489 (26.2)	1,462 (25.7)	1,435 (25.2)	1,407 (24.7)
3000 (914)	1,607 (28.3)	1,580 (27.8)	1,552 (27.3)	1,525 (26.8)	1,498 (26.3)	1,471 (25.9)
4000 (1219)	1,675 (29.5)	1,647 (29.0)	1,619 (28.5)	1,593 (28.0)	1,565 (27.5)	1,538 (27.0)
5000 (1524)	1,745 (30.7)	1,718 (30.2)	1,690 (29.7)	1,663 (29.2)	1,636 (28.8)	1,609 (28.3)
6000 (1829)	1,849 (32.5)	1,822 (32.0)	1,795 (31.6)	1,767 (31.1)	1,744 (31.0)	1,738 (30.6)
7000 (2134)	1,927 (33.9)	1,900 (33.4)	1,872 (32.9)	1,845 (32.4)	1,818 (32.0)	1,791 (31.5)
8000 (2438)	2,008 (35.3)	1,980 (34.8)	1,953 (34.3)	1,925 (33.8)	1,897 (33.4)	1,870 (32.9)
9000 (2743)	2,083 (36.6)	2,049 (36.0)	2,022 (35.6)	1,995 (35.1)	1,968 (34.6)	1,941 (34.1)
10000 (3048)	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 ³ /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:	<table> <tr> <td>Inlet Min:</td> <td>750°F</td> </tr> <tr> <td>Inlet Max:</td> <td>1285°F</td> </tr> </table>	Inlet Min:	750°F	Inlet Max:	1285°F
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 ^{1,2}	Targeted Outlet Emissions ³
	g/bhp-hr	g/bhp-hr
NOx	12.8	0.5
CO	6.10	2
NMNEHC	0.94	0.7
HCHO	0.004	0.05
Oxygen %	0.48	---

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

² Raw engine out emissions may vary with different fuel quality.

³ 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.



Engine Performance Data

Cummins Inc

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

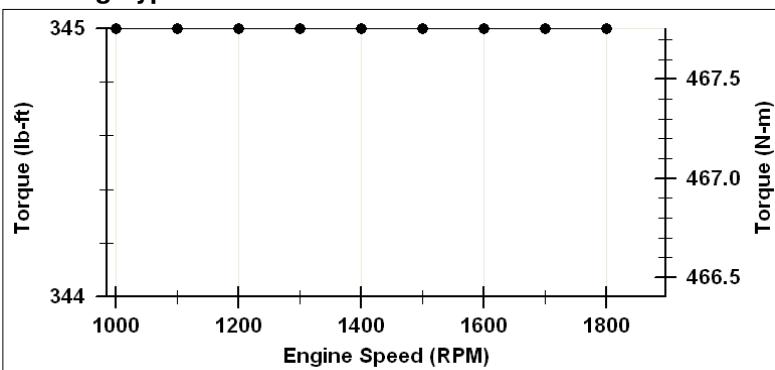
Industrial

G8.3E

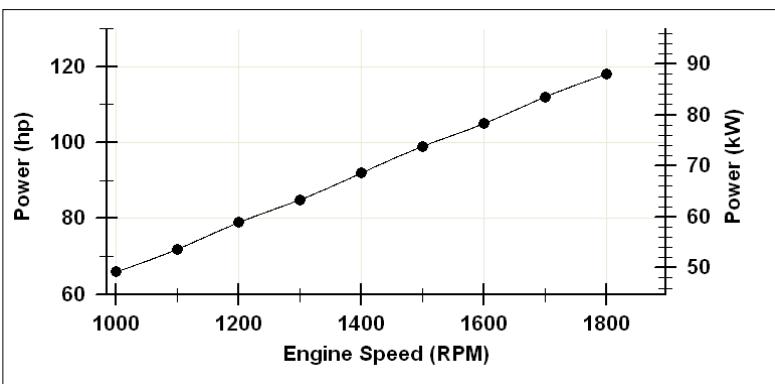
FR93002

118 BHP (88 kW) @ 1800 RPM**344 lb-ft (466 N·m) @ 1800 RPM**Configuration
D551015CX03CPL Code
3150Revision
18-Nov-2008Compression Ratio: **10.5:1**Fuel System: **Field Gas, Dry Processed Nat Gas, NG**Emission Certification: **Catalyst, 2008 NSPS Standards using factory supplied ECM, AFR and Catalyst Option PE9159, Dry Exhaust**

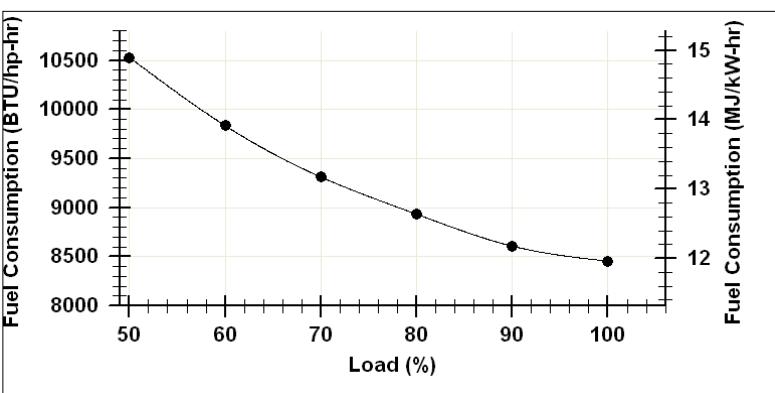
All data is based on the engine operating with fuel system, water pump, and 6 in H₂O (1.49 kPa) inlet air restriction with 3 in (76 mm) inner diameter, and with 1 in Hg (3 kPa) exhaust restriction with 3 in (76 mm) inner diameter; not included are alternator, fan, optional equipment and driven components. 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
Maximum coolant operating temperature at engine outlet (max. top tank temp):

215 deg F

102 deg C

212 deg F

100 deg C

Exhaust System

Maximum exhaust back pressure:
Recommended exhaust piping size (inner diameter):

2 in-Hg

7 kPa

3 in

76 mm

Lubrication System

Nominal operating oil pressure
@ minimum low idle
@ maximum rated speed
Minimum engine oil pressure for engine protection devices
@ minimum low idle

10 psi

69 kPa

50 psi

345 kPa

10 psi

69 kPa

Fuel System

Minimum fuel inlet pressure:
Maximum fuel inlet pressure:

7 psi

48 kPa

25 psi

172 kPa

Performance Data

Engine low idle speed:
Maximum low idle speed:
Minimum low idle speed:
Engine high idle speed
Governor break speed:
Maximum torque available at closed throttle low idle speed:

1,200 RPM

1,800 RPM

900 RPM

1,800 RPM

50 lb-ft

68 N-m

	100% Load		75% Load		50% Load	
	1,800 RPM	88 kW	1,800 RPM	66 kW	1,800 RPM	44 kW
Engine Speed	1,800 RPM	88 kW	1,800 RPM	66 kW	1,800 RPM	44 kW
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 ³ /min	82 L/s	142 ft ³ /min	67 L/s	111 ft ³ /min	52 L/s
Exhaust Gas Flow	442 ft ³ /min	209 L/s	332 ft ³ /min	157 L/s	235 ft ³ /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					
CO2	560 g/hp-hr	751 g/kW-hr	606 g/hp-hr	813 g/kW-hr	705 g/hp-hr	945 g/kW-hr
O2	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)

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

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 _x :	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 _x :	<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	EAS-1200T-0303F-D1S4E
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	ENG-S-075
Manufacturer	EMIT Technologies, Inc.
Description	MODEL EDGE NG 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>
	SINGLE BANK ENGINE

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/m³. 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.



CDH Consulting, LLC
Thornton, Colorado
720.431.7468
www.CDHConsult.com

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 OOOa – 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.