G3406 NA

GAS ENGINE TECHNICAL DATA

CATERPILLAR®

ENGINE SPEED:	1800	FUEL:	NATURAL GAS
COMPRESSION RATIO:	10.3:1	FUEL SYSTEM:	LPG IMPCO
AFTERCOOLER (°F):	NA		
JACKET WATER (°F):	210	MIN. FUEL PRESS. (psig):	1.5
COOLING SYSTEM:	COMBINED	MIN. METHANE NUMBER:	80
IGNITION SYSTEM:	CDIS	MAX. RATED ALTITUDE (ft):	500
EXHAUST MANIFOLD:	WET	AT AMBIENT TEMP (°F):	77
COMBUSTION:	STOICH	NOx EMISSION LEVEL:	STD

RATING AND EFFICIENCY	NOTES	LOAD	100%	75%	50%
LHV OF FUEL		btu/scf	919.6	919.6	919.6
ENGINE POWER		bhp	231	173	116
ENGINE EFFICIENCY	(1)	%	33.4	30.4	26.6
THERMAL EFFICIENCY	(5)	%	54.8	57.8	60.8
TOTAL EFFICIENCY	(6)	%	88.3	88.2	87.4

ENGINE DATA					
FUEL CONSUMPTION	(1)	btu/bhp-hr	7612	8375	9548
AIR FLOW	(WET)	lb/hr	1470	1186	913
AIR FLOW	(WET)	scfm	321	259	199
INLET MAN. PRESS.		in. Hg (abs)	27.8	24	18.7
INLET MAN. TEMP.	(10)	°F	91	88	90
TIMING	(11)	°BTDC	26	26	26
EXHAUST STACK TEMP.		°F	1161	1117	1072
EXHAUST FLOW (@STACK TEMP)	(WET)	cfm	1102	893	642
EXHAUST FLOW	(WET)	lb/hr	1557	1258	968

EMISSIONS					
NOx (as NO2)	(9)	g/bhp-hr	21.6	22.5	22.5
CO	(9)	g/bhp-hr	1.6	1.6	1.7
THC	(9)	g/bhp-hr	2.8	2.7	3
NMHC	(9)	g/bhp-hr	0.42	0.41	0.45
EXHAUST O2 (DRY)		%	2.0	2.2	1.5
LAMBDA			1.05	1.06	1.03

HEAT BALANCE DATA					
LHV INPUT	(1)	btu/min	29306	24183	18380
HEAT REJ. TO JACKET	(2) (7)	btu/min	10146	9461	7897
HEAT REJ. TO ATMOSPHERE	(4)	btu/min	1172	967	735
HEAT REJ. TO EXH (LHV to 77°F)	(2)	btu/min	8192	6408	4849
HEAT REJ. TO EXH (LHV to 350°F)	(2)	btu/min	5926	4518	3272

CONDITIONS AND DEFINITIONS

ENGINE RATING OBTAINED AND PRESENTED IN ACCORDANCE WITH ISO 3046/1 (STD. REF. CONDITIONS OF 25°C, 100 KPA). NO OVERLOAD PERMITTED AT RATING SHOWN. CONSULT ALTITUDE CURVES FOR APPLICATIONS ABOVE MAXIMUM RATED ALTITUDE AND/OR TEMPERATURE.

1) FUEL CONSUMPTION TOLERANCE ACCORDING TO ISO 3046/1. TOLERANCE IS ±5% OF FULL LOAD DATA
2) HEAT REJECTION TO JACKET AND EXHAUST TOLERANCE IS ±10% OF FULL LOAD DATA.
3) HEAT REJECTION TO A/C TOLERANCE IS ±5% OF FULL LOAD DATA.
4) HEAT REJECTION TO ATMOSPHERE TOLERANCE IS ±50% OF FULL LOAD DATA.
5) THERMAL EFFICIENCY: JACKET WATER +EXH. HEAT TO 350°F
6) TOTAL EFFICIENCY: ENGINE EFF. + THERMAL EFF. TOLERANCE IS +/- 10% OF FULL LOAD DATA
7) TOTAL JW HEAT: JACKET HEAT + OIL COOLER HEAT (HEAT RATE BASED ON TREATED WATER)
8) TOTAL A/C HEAT: A/C HEAT x A/C HEAT REJ. FACTOR (HEAT RATE BASED ON TREATED WATER)
9) EMISSION DATA SHOWN ARE NOT TO EXCEED VALUES.
PUBLISHED PART LOAD DATA MAY REQUIRE ENGINE ADJUSTMENT.
10) MEASURED BETWEEN AFTERCOOLER OUTLET AND PLENUM ENTRY.
11) TIMING INDICATED IS FOR USE WITH A MINIMUM FUEL METHANE NUMBER SPECIFIED. CONSULT THE APPROPRIATE FUEL USAGE GUIDE FOR TIMING AT OTHER METHANE NUMBERS.

FUEL USAGE GUIDE

DERATE FACTOR/ENGINE TIMING vs METHANE NUMBER

<30	30	35	40	45	50	55	60	65	70	75	80 to 100
0	1.0/16	1.0/17	1.0/18	1.0/19	1.0/20	1.0/21	1.0/22	1.0/23	1.0/24	1.0/25	1.0/26

ALTITUDE DERATION FACTORS

A	**130**	0.93	0.89	0.86	0.83	0.80	0.77	0.74	0.71	0.68	0.65	0.63	0.60	0.58
M	**120**	0.94	0.91	0.87	0.84	0.81	0.78	0.75	0.72	0.69	0.66	0.64	0.61	0.59
B	**110**	0.96	0.92	0.89	0.86	0.82	0.79	0.76	0.73	0.70	0.68	0.65	0.62	0.60
I	**100**	0.98	0.94	0.91	0.87	0.84	0.81	0.78	0.75	0.72	0.69	0.66	0.63	0.61
E	**90**	0.99	0.96	0.92	0.89	0.85	0.82	0.79	0.76	0.73	0.70	0.67	0.65	0.62
N	**80**	1.00	0.98	0.94	0.90	0.87	0.84	0.80	0.77	0.74	0.71	0.69	0.66	0.63
T	**70**	1.00	0.99	0.96	0.92	0.89	0.85	0.82	0.79	0.76	0.73	0.70	0.67	0.64
	60	1.00	1.00	0.98	0.94	0.90	0.87	0.84	0.80	0.77	0.74	0.71	0.68	0.66
(°F)	**50**	1.00	1.00	0.99	0.96	0.92	0.89	0.85	0.82	0.79	0.76	0.73	0.70	0.67
		0	**1000**	**2000**	**3000**	**4000**	**5000**	**6000**	**7000**	**8000**	**9000**	**10000**	**11000**	**12000**

ALTITUDE (FEET ABOVE SEA LEVEL)

FUEL USAGE GUIDE:

This table shows the derate factor required for a given fuel and what engine timing to use. Note that deration occurs as the methane number decreases. Methane number is a scale to measure ignition and burning characteristics of various fuels. Representative values are shown below.

Methane	100.00
Ethane	44.00
Propane	34.00
n-Butane	10.00
Hydrogen	0.00

Most dry pipeline natural gas has a methane number of 67 or above. The gas quality should be analyzed to determine the percentage of each constituent and then determine the methane number. Consult the dealer or factory for assistance.

ALTITUDE DERATION FACTORS:

This table shows the deration required for various ambient temperatures and altitudes. Use this information to help determine actual engine power for your site.

ACTUAL ENGINE RATING:

It is important to note that the Altitude/Temperature deration and the Fuel Usage Guide deration are not cumulative, i.e., they are not to be added together. The same is true for the Low Energy Fuel deration (reference the Caterpillar Methane Number Program) and the Fuel Usage Guide deration. However, the Altitude/Temperature deration and Low Energy Fuel deration are cumulative; and they must be added together in the

1) (Altitude/Temperature Deration) + (Low Energy Fuel Deration)
2) Fuel Usage Guide Deration

Note: For NA's always add the Low Energy Fuel deration to the Altitude/Temperature deration. For TA engines only add the Low Energy Fuel deration to the Altitude/Temperature deration whenever the Altitude/Temperature deration is less than 1.0 (100%). This will give the actual rating for the engine at the conditions specified.

AFTERCOOLER HEAT REJECTION FACTORS:

Aftercooler heat rejection is given for standard conditions of 77°F and 500 ft altitude. To maintain a constant inlet air manifold temperature, as the ambient air temperature goes up, so must the heat rejection. As altitude increases, the turbocharger must work harder to overcome the lower atmospheric pressure. This increases the amount of heat that must be removed from the inlet air by the aftercooler. Use the aftercooler heat rejection factor to adjust for ambient and altitude conditions. Multiply this factor by the standard aftercooler heat rejection. Failure to properly account for these factors could result in detonation and cause the engine to shut down or fail.