G3516 LE GAS ENGINE TECHNICAL DATA

CATERPILLAR®

ENGINE SPEED:	1200	FUEL:	NAT GAS
COMPRESSION RATIO:	11.0:1	FUEL SYSTEM:	LPG DELTEC
AFTERCOOLER (°C)	54	WITH CUSTOMER SUPPLIED AIR FUEL RATIO CONTROL	
JACKET WATER (°C)	110	MIN. FUEL PRESS. (KPAg):	10
COOLING SYSTEM:	2-CIRCUIT	MIN. METHANE NUMBER:	80
IGNITION SYSTEM:	EIS	RATED ALTITUDE (m):	1523
EXHAUST MANIFOLD:	DRY	AT AMBIENT TEMP (°C):	25
COMBUSTION:	LEAN BURN	NOx EMISSION LEVEL:	0.7 g/bhp-hr

RATING AND EFFICIENCY	NOTES	LOAD	100%	75%	50%
LHV OF FUEL		MJ/Nm3	36.2	36.2	36.2
ENGINE POWER		KW	809	607	405
ENGINE EFFICIENCY	(1)	%	36.7	35.6	33.3
THERMAL EFFICIENCY	(6)	%	38.9	39.4	42.3
TOTAL EFFICIENCY	(7)	%	75.6	75.0	75.6

ENGINE DATA					
FUEL CONSUMPTION	(1)	MJ/bkW-hr	9.8	10.11	10.81
AIR FLOW (0 °C, 101.3 kPa)	(WET)	Nm3/bkW-hr	4.53	4.7	4.88
AIR FLOW	(WET)	kg/bkW-hr	5.86	6.07	6.3
COMPRESSOR OUT PRESS.		KPAa	245	228	173
COMPRESSOR OUT TEMP.		°C	143	129	92
INLET MAN. PRESS.		KPAa	231	180	123
INLET MAN. TEMP.	(11)	°C	67	66	66
TIMING	(12)	°BTDC	20	20	20
NOISE - MECH @ 1m		dB(A)	100	99	98
NOISE - EXH @ 1.5 m		dB(A)	111	110	109
EXHAUST STACK TEMP.		°C	478	480	512
EXHAUST GAS FLOW (0 °C, 101.3 kPa)	(WET)	Nm3/bkW-hr	4.85	5.03	5.22
EXHAUST MASS	(WET)	kg/bkW-hr	6.06	6.29	6.53

EMISSIONS DATA					
NOx (as NO2)	(10)	g/bhp-hr	0.7	0.7	0.7
CO	(10)	g/bhp-hr	4.5	4.7	4.7
THC	(10)	g/bhp-hr	9.5	10.5	12.2
NMHC	(10)	g/bhp-hr	1.43	1.58	1.83
EXHAUST O2	(10)	%	10.1	9.9	9.6
LAMBDA			1.74	1.71	1.69

HEAT BALANCE DATA					
LHV INPUT	(1)	KW	2203	1703	1215
HEAT REJ. TO JACKET	(2) (8)	KW	310	243	190
HEAT REJ. TO ATMOSPHERE	(4)	KW	106	88	70
HEAT REJ. TO LUBE OIL	(5)	KW	85	78	69
HEAT REJ. TO EXH. (LHV to 25°C)	(2)	KW	770	605	452
HEAT REJ. TO EXH. (LHV to 120°C)	(2)	KW	547	429	324
HEAT REJ. TO A/C	(3) (9)	KW	123	82	29

CONDITIONS AND DEFINITIONS

ENGINE RATING OBTAINED AND PRESENTED IN ACCORDANCE WITH ISO 3046/1 (STD. REF. CONDITIONS OF 25°C, 100 KPA, 152 m). NO OVERLOAD PERMITTED AT RATING SHOWN. CONSULT ALTITUDE CURVES FOR APPLICATIONS ABOVE MAXIMUM RATED ALTITUDE AND/OR TEMPERATURE.

NOTES

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) HEAT REJECTION TO LUBE OIL TOLERANCE IS ± 20% OF FULL LOAD DATA.
6) THERMAL EFFICIENCY: JACKET HEAT + EXH. HEAT TO 120°C.
7) TOTAL EFFICIENCY: ENGINE EFF. + THERMAL EFF. TOLERANCE IS ± 10% OF FULL LOAD DATA.
8) TOTAL JW HEAT: COMBINED = JACKET HEAT + OIL COOLER HEAT (heat rate based on treated water)
   2-CIRCUIT AND 3 CIRCUIT = JACKET HEAT (heat rate based on treated water)
9) TOTAL A/C HEAT: COMBINED AND 3-CIRCUIT = A/C HEAT x A/C HEAT REJ. FACTOR (heat rate based on treated water)
   2-CIRCUIT = A/C HEAT x A/C HEAT REJ. FACTOR + O/C HEAT

10) EMISSION DATA SHOWN ARE DRY AND NOT TO EXCEED VALUES.
    PUBLISHED PART LOAD DATA REQUIRES LAMBDA CONTROL.
11) MEASURED IN THE INTAKE MANIFOLD PLENUM.
12) TIMING INDICATED IS FOR USE WITH THE 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/--	0/--	0/--	0/--	0/--	0/--	0/--	0/--	0.97/15	1.0/15	1.0/18	1.0/20

* Denotes Air Fuel Ratio Control Required for Maximum Rating Shown

ALTITUDE DERATION FACTORS

A														
M	**50**	1.00	1.00	1.00	1.00	0.99	0.96	0.93	0.90	0.87	0.84	0.81	0.79	0.76
B	**45**	1.00	1.00	1.00	1.00	1.00	0.97	0.94	0.91	0.88	0.85	0.83	0.80	0.77
I	**40**	1.00	1.00	1.00	1.00	1.00	0.99	0.96	0.92	0.90	0.87	0.84	0.81	0.78
E	**35**	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.94	0.91	0.88	0.85	0.82	0.80
N	**30**	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.96	0.92	0.90	0.87	0.84	0.81
T	**25**	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.94	0.91	0.88	0.85	0.82
	20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.96	0.93	0.90	0.87	0.84
	15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.94	0.91	0.88	0.85
(°C)	**10**	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.96	0.93	0.90	0.87
		0	**250**	**500**	**750**	**1000**	**1250**	**1500**	**1750**	**2000**	**2250**	**2500**	**2750**	**3000**

ALTITUDE (METERS ABOVE SEA LEVEL)

AFTERCOOLER HEAT REJECTION FACTORS

A														
M	**50**	1.37	1.43	1.49	1.54	1.60	1.66	1.72	1.73	1.73	1.73	1.73	1.73	1.73
B	**45**	1.29	1.35	1.40	1.46	1.52	1.58	1.64	1.64	1.64	1.64	1.64	1.64	1.64
I	**40**	1.21	1.27	1.32	1.38	1.43	1.49	1.55	1.56	1.56	1.56	1.56	1.56	1.56
E	**35**	1.13	1.18	1.24	1.29	1.35	1.41	1.46	1.47	1.47	1.47	1.47	1.47	1.47
N	**30**	1.05	1.10	1.16	1.21	1.27	1.32	1.38	1.38	1.38	1.38	1.38	1.38	1.38
T	**25**	1.00	1.02	1.07	1.13	1.18	1.24	1.29	1.30	1.30	1.30	1.30	1.30	1.30
	20	1.00	1.00	1.00	1.04	1.10	1.15	1.21	1.21	1.21	1.21	1.21	1.21	1.21
	15	1.00	1.00	1.00	1.00	1.01	1.07	1.12	1.12	1.12	1.12	1.12	1.12	1.12
(°C)	**10**	1.00	1.00	1.00	1.00	1.00	1.00	1.03	1.04	1.04	1.04	1.04	1.04	1.04
		0	**250**	**500**	**750**	**1000**	**1250**	**1500**	**1750**	**2000**	**2250**	**2500**	**2750**	**3000**

ALTITUDE (METERS 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
Ethane	44
Propane	34
n-Butane	10
Hydrogen	0

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 method shown below. To determine the actual power available, take the lowest rating between 1) and 2).

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 25°C and 152 m 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.