G3516B LE

GAS ENGINE TECHNICAL DATA

CATERPILLAR®

ENGINE SPEED:	1800	FUEL:	NAT GAS
COMPRESSION RATIO:	11:1	FUEL SYSTEM:	Cat Low Pressure WITH AIR FUEL RATIO CONTROL
AFTERCOOLER INLET (°F)	90		
JACKET WATER OUTLET (°F)	198	FUEL PRESS. RANGE (PSIG):	1.5 - 5
COOLING SYSTEM:	COMBINED	MIN. METHANE NUMBER:	80
IGNITION SYSTEM:	ADEM3	RATED ALTITUDE (FT):	1812
EXHAUST MANIFOLD:	Dry	AT AMBIENT TEMP (°F):	77
COMBUSTION:	LEAN BURN	NOx EMISSION LEVEL:	0.5 g/bhp-hr

RATING AND EFFICIENCY		NOTES	LOAD	100%	75%	50%
LHV OF FUEL			BTU/SCF	924	924	924
ENGINE POWER			BHP	1971	1478	986
ENGINE EFFICIENCY	**(ISO 3046/1)**	**(1)**	**%**	**36.5**	**34.9**	**32.5**
ENGINE EFFICIENCY		(2)	%	35.4	34.0	31.7
THERMAL EFFICIENCY		(7)	%	43.8	44.2	45.8
TOTAL EFFICIENCY		(8)	%	79.2	78.2	77.4

ENGINE DATA						
FUEL CONSUMPTION	**(ISO 3046/1)**	**(1)**	**BTU/bhp-hr**	**6974**	**7293**	**7837**
FUEL CONSUMPTION		(2)	BTU/bhp-hr	7178	7490	8032
AIR FLOW (77 °F, 14.7 psi)		(WET)	SCFM	4290	3305	2337
AIR FLOW		(WET)	lb/hr	19025	14657	10363
COMPRESSOR OUT PRESS.			in. HG (abs)	90.8	86.8	63.3
COMPRESSOR OUT TEMP.			°F	356	328	244
INLET MAN. PRESS.			in. HG (abs)	83.9	65.3	45.4
INLET MAN. TEMP.		(12)	°F	109	109	109
TIMING		(13)	°BTDC	22	22	22
EXHAUST STACK TEMP.			°F	985	1000	1020
EXHAUST GAS FLOW (@ stack temp.)		(WET)	CFM, 14.5 psi	12525	9752	6994
EXHAUST MASS		(WET)	lb/hr	19706	15190	10746

EMISSIONS DATA					
NOx (as NO2)	(11)	g/bhp-hr	0.5	0.5	0.5
CO	(14)	g/bhp-hr	2.4	2.6	3
THC	(14)	g/bhp-hr	4.8	5.2	6.5
NMHC	(14)	g/bhp-hr	0.72	0.78	0.98
EXHAUST O2	(15)	%	9.1	9.0	9.1
LAMBDA			1.69	1.67	1.64

HEAT BALANCE DATA					
LHV INPUT	(2)	BTU/min	235819	184551	131939
HEAT REJ. TO JACKET	(3) (9)	BTU/min	27834	23169	19663
HEAT REJ. TO ATMOSPHERE	(5)	BTU/min	7838	6701	5531
HEAT REJ. TO LUBE OIL	(6)	BTU/min	9338	7773	6597
HEAT REJ. TO EXH. (LHV to 77°F)	(3)	BTU/min	86431	69908	51797
HEAT REJ. TO EXH. (LHV to 350°F)	(3)	BTU/min	56262	44439	32472
HEAT REJ. TO A/C - STAGE1	(4) (10)	BTU/min	9824	6227	1645
HEAT REJ. TO A/C - STAGE2	(4) (10)	BTU/min	10956	8074	4906

CONDITIONS AND DEFINITIONS

ENGINE RATING OBTAINED AND PRESENTED IN ACCORDANCE WITH ISO 3046/1. DATA REPRESENTS CONDTIONS OF 77°F, 29.6" HG BAROMETRIC PRESSURE, 30% RELATIVE HUMIDITY, 10" H2O AIR FILTER RESTRICTION, AND 20" H20 EXHAUST STACK PRESSURE. NO OVERLOAD PERMITTED AT RATING SHOWN. DATA NOTED AS ISO 3046/1 REPRESENTS THE SAME AMBIENT CONDTIONS WITH 5" H2O AIR FILTER RESTRICTION AND 0" H20 EXHAUST STACK PRESSURE. CONSULT ALTITUDE CURVES FOR APPLICATIONS ABOVE MAXIMUM RATED ALTITUDE AND/OR TEMPERATURE.
ENGINE RATING IS WITH 2 ENGINE DRIVEN WATER PUMPS.

NOTES

1) ISO 3046/1 FUEL CONSUMPTION TOLERANCE IS 0, + 5% OF FULL LOAD DATA.
2) FUEL CONSUMPTION TOLERANCE IS ± 3 % OF FULL LOAD DATA.
3) HEAT REJECTION TO JACKET AND EXHAUST TOLERANCE IS ± 10% OF FULL LOAD DATA. (heat rate based on treated water)
4) HEAT REJECTION TO AFTERCOOLER TOLERANCE IS ± 5% OF FULL LOAD DATA. (heat rate based on treated water)
5) HEAT REJECTION TO ATMOSPHERE TOLERANCE IS ± 50% OF FULL LOAD DATA. (heat rate based on treated water)
6) HEAT REJECTION TO LUBE OIL TOLERANCE IS ± 20% OF FULL LOAD DATA. (heat rate based on treated water)
7) THERMAL EFFICIENCY: JACKET HEAT + LUBE OIL HEAT + STAGE 1 A/C HEAT + EXH. HEAT TO 350°F.
8) TOTAL EFFICIENCY: ENGINE EFF. + THERMAL EFF. TOLERANCE IS ± 10% OF FULL LOAD DATA.
9) TOTAL JW HEAT: COMBINED = JACKET HEAT + OIL COOLER HEAT + (A/C STG 1 HEAT+.764 x (STG 1 + STG 2) x (ACHRF-1)) : (heat rate based on treated water)
10) TOTAL A/C HEAT: COMBINED = A/C STG 2 HEAT + (STG1+ STG 2) x .236 x (ACHRF - 1) : (heat rate based on treated water)
11) NOx VALUE SHOWN IS DRY. FULL LOAD NOx VALUE IS SET AT SITE. CONTROL TOLERANCE IS ± 30% OF FULL LOAD DATA.
12) MEASURED IN THE INTAKE MANIFOLD PLENUM.
13) TIMING INDICATED IS FOR USE WITH THE MINIMUM FUEL METHANE NUMBER SPECIFIED. CONSULT THE APPROPRIATE FUEL USAGE GUIDE FOR TIMING AT OTHER METHANE NUMBERS.
14) EMISSION DATA SHOWN ARE DRY AND NOT TO EXCEED.
15) EXHAUST O2 IS NOMINAL ± 0.5 % O2.

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/--	.87/22	.93/21	1.0/21	1.0/21	1.0/22

* Denotes Air Fuel Ratio Control Required for Maximum Rating Shown.

ALTITUDE DERATION FACTORS

(°F)	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
130	0.97	0.94	0.90	0.87	0.84	0.80	0.77	0.74	0.71	0.69	0.66	0.63	0.61
120	0.99	0.95	0.92	0.88	0.85	0.82	0.79	0.76	0.73	0.70	0.67	0.64	0.62
110	1.00	0.97	0.94	0.90	0.87	0.83	0.80	0.77	0.74	0.71	0.68	0.65	0.63
100	1.00	0.99	0.95	0.92	0.88	0.85	0.82	0.78	0.75	0.72	0.69	0.67	0.64
90	1.00	1.00	0.97	0.93	0.90	0.86	0.83	0.80	0.77	0.74	0.71	0.68	0.65
80	1.00	1.00	0.99	0.95	0.91	0.88	0.85	0.81	0.78	0.75	0.72	0.69	0.66
70	1.00	1.00	1.00	0.97	0.93	0.90	0.86	0.83	0.80	0.76	0.73	0.70	0.68
60	1.00	1.00	1.00	0.99	0.95	0.91	0.88	0.84	0.81	0.78	0.75	0.72	0.69
50	1.00	1.00	1.00	1.00	0.97	0.93	0.90	0.86	0.83	0.79	0.76	0.73	0.70

AMBIENT (°F) — ALTITUDE (FEET ABOVE SEA LEVEL)

AFTERCOOLER HEAT REJECTION FACTORS

(°F)	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
130	1.28	1.33	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36
120	1.23	1.27	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30
110	1.17	1.21	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
100	1.11	1.15	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19
90	1.05	1.10	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
80	1.00	1.04	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
70	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
60	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

AMBIENT (°F) — 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
Ethane	44
Propane	34
n-Butane	10
Hydrogen	0

(2)

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 at reference inlet restriction and exhaust stack backpressure (If site inlet restriction and/or exhaust stack backpressure differ from reference conditions, refer to inlet and exhaust restriction corrections section for appropriate adjustment). Use this information to help determine actual engine power for your site.

INLET AND EXHAUST RESTRICTION CORRECTIONS FOR ALTITUDE CAPABILITY:

To determine the appropriate altitude derate factor to be applied to this engine for inlet or exhaust restrictions differering from the standard conditions on page 1, a correction to the site altitude can be made to adjust for this difference. Add 88 meters to the site altitude for each additional KPA of stack pressure greater than spec sheet conditions. Add 136 meters to the site altitude for each additional KPA of inlet restriction greater than spec sheet conditions. If site inlet restriction or exhaust stack backpressure are less than spec sheet conditions, the same trends apply to lower the site altitude.

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 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.