G3516C

GAS ENGINE TECHNICAL DATA

CATERPILLAR®

ENGINE SPEED:	1800	FUEL:	NAT GAS
COMPRESSION RATIO:	11.3:1	FUEL SYSTEM:	CAT LOW PRESSURE WITH AIR FUEL RATIO CONTROL
AFTERCOOLER - STAGE 1 MAX. INLET (°F):	198		
AFTERCOOLER - STAGE 2 MAX. INLET (°F):	90	FUEL PRESS. RANGE (PSIG):	0.7 - 5.0
JACKET WATER - MAX. OUTLET (°F):	210	MIN. METHANE NUMBER:	80
COOLING SYSTEM:	JW+OC+1AC, 2AC	RATED ALTITUDE (FT):	2330
IGNITION SYSTEM:	ADEM3	AT AIR TO TURBO. TEMP. (°F):	77
EXHAUST MANIFOLD:	DRY	NOx EMISSION LEVEL:	1.0 g/bhp-hr
COMBUSTION:	LOW EMISSION	FUEL LHV (BTU/SCF):	905
EFFECTIVE SERIAL NUMBER:	GSB00113	APPLICATION:	GENSET

RATING AND EFFICIENCY		NOTES	LOAD	100%	75%	50%
ENGINE POWER	(WITHOUT FAN)	(1)	BHP	2311	1733	1155
GENERATOR POWER	(WITHOUT FAN)	(2)	EKW	1660	1245	830
ENGINE EFFICIENCY	**(ISO 3046/1)**	**(3)**	**%**	**39.2**	**37.8**	**36.0**
ENGINE EFFICIENCY	(NOMINAL)	(3)	%	38.2	36.9	35.2
THERMAL EFFICIENCY	(NOMINAL)	(4)	%	42.3	42.7	44.5
TOTAL EFFICIENCY	(NOMINAL)	(5)	%	80.5	79.6	79.7

ENGINE DATA						
FUEL CONSUMPTION	**(ISO 3046/1)**	**(6)**	**BTU/bhp-hr**	**6500**	**6734**	**7066**
FUEL CONSUMPTION	(NOMINAL)	(6)	BTU/bhp-hr	6658	6898	7238
AIR FLOW (77 °F, 14.7 psi)		(7)	SCFM	4749	3567	2502
AIR FLOW		(7)	lb/hr	21057	15816	11093
COMPRESSOR OUT PRESSURE			in. HG (abs)	95.2	73.4	51.2
COMPRESSOR OUT TEMPERATURE			°F	371	291	207
AFTERCOOLER AIR OUT TEMPERATURE			°F	97	95	94
INLET MAN. PRESSURE		(8)	in. HG (abs)	82.1	63.1	44.7
INLET MAN. TEMPERATURE	(MEASURED IN PLENUM)	(9)	°F	97	95	94
TIMING		(10)	°BTDC	30	30	30
EXHAUST STACK TEMPERATURE		(11)	°F	919	960	987
EXHAUST GAS FLOW (@ stack temp.)		(12)	CFM	13142	10182	7280
EXHAUST MASS FLOW		(12)	lb/hr	21833	16419	11514

EMISSIONS DATA					
NOx (as NO2)	(13)	g/bhp-hr	1	1	1
CO	(14)	g/bhp-hr	2.35	2.3	2.27
THC (molecular weight of 15.84)	(14)	g/bhp-hr	4.99	5.74	6.7
NMHC (molecular weight of 15.84)	(14)	g/bhp-hr	0.75	0.87	1.01
CO2	(14)	g/bhp-hr	456	459	491
EXHAUST O2	(15)	% DRY	9.1	8.9	8.8
LAMBDA	(15)		1.71	1.65	1.65

HEAT BALANCE DATA					
LHV INPUT	(16)	BTU/min	256395	199217	139362
HEAT REJECTION TO JACKET	(17)	BTU/min	28311	27298	21279
HEAT REJECTION TO ATMOSPHERE	(18)	BTU/min	7856	6573	5290
HEAT REJECTION TO LUBE OIL	(19)	BTU/min	6764	6053	5181
HEAT REJECTION TO EXHAUST (LHV to 77°F)	(20)	BTU/min	88094	70214	51186
HEAT REJECTION TO EXHAUST (LHV to 350°F)	(20)	BTU/min	55660	45022	33066
HEAT REJECTION TO A/C - STAGE 1	(21)	BTU/min	13666	5529	378
HEAT REJECTION TO A/C - STAGE 2	(22)	BTU/min	11741	8083	5078

CONDITIONS AND DEFINITIONS

ENGINE RATING OBTAINED AND PRESENTED IN ACCORDANCE WITH ISO 3046/1. DATA REPRESENTS CONDITIONS OF 77°F, 29.6 IN HG BAROMETRIC PRESSURE, 30% RELATIVE HUMIDITY, 10 IN H2O AIR FILTER RESTRICTION, AND 20 IN H2O EXHAUST STACK PRESSURE. ENGINE EFFICIENCY AND FUEL CONSUMPTION SPECIFICALLY NOTED AS ISO 3046/1 ARE REPRESENTED WITH 5 IN H2O AIR FILTER RESTRICTION AND 0 IN H2O EXHAUST STACK PRESSURE. CONSULT ALTITUDE CURVES FOR APPLICATIONS ABOVE MAXIMUM RATED ALTITUDE AND/OR TEMPERATURE. NO OVERLOAD PERMITTED AT RATING SHOWN.

EMISSION LEVELS ARE BASED ON THE ENGINE OPERATING AT STEADY STATE CONDITIONS AND ADJUSTED TO THE SPECIFIED NOx LEVEL AT 100% LOAD. EMISSION TOLERANCES SPECIFIED ARE DEPENDENT UPON FUEL QUALITY. METHANE NUMBER CANNOT VARY MORE THAN ± 3. PUBLISHED PART LOAD DATA IS WITH AIR FUEL RATIO CONTROL.

ENGINE RATING IS WITH 2 ENGINE DRIVEN WATER PUMPS. PUMP POWER IS NOT INCLUDED IN HEAT BALANCE DATA.

FOR NOTES INFORMATION CONSULT PAGE THREE.

FUEL USAGE GUIDE

CAT METHANE NUMBER	30	35	40	45	50	55	60	65	70	75	80	85
IGNITION TIMING	-	-	-	-	-	22	24	26	28	29	30	32
DERATION FACTOR	0	0	0	0	0	0.90	0.95	1.00	1.00	1.00	1.00	1.00

ALTITUDE DERATION FACTORS

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

ALTITUDE (FEET ABOVE SEA LEVEL)

AFTERCOOLER HEAT REJECTION FACTORS

AIR TO TURBO (°F)	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
130	1.28	1.32	1.36	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38
120	1.22	1.26	1.31	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32
110	1.16	1.21	1.25	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26
100	1.11	1.15	1.19	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21
90	1.05	1.09	1.13	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
80	1.00	1.04	1.08	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09
70	1.00	1.00	1.02	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03
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

ALTITUDE (FEET ABOVE SEA LEVEL)

FUEL USAGE GUIDE:

This table shows the derate factor required for a given fuel. Note that deration occurs as the methane number decreases. Methane number is a scale to measure detonation characteristics of various fuels. The methane number of a fuel is determined by using the Caterpillar Methane Number Calculation program.

ALTITUDE DERATION FACTORS:

This table shows the deration required for various air inlet temperatures and altitudes. Use this information along with the fuel usage guide chart 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 listed on page 1, a correction to the site altitude can be made to adjust for this difference. Add 036 feet to the site altitude for each additional inch of H2O of exhaust stack pressure greater than spec sheet conditions. Add 072 feet to the site altitude for each additional inch of H2O of inlet restriction greater than spec sheet conditions. If site inlet restriction or exhaust stack pressure 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. 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 air inlet manifold temperature, as the air to turbo 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 shutdown or fail. For 2 Stage Aftercoolers with separate circuits, the 1st stage will collect 85% of the additional heat.

SOUND DATA:

Sound Power Data can be found in DM8888.

NOTES

1 ENGINE RATING IS WITH 2 ENGINE DRIVEN WATER PUMPS. TOLERANCE IS ± 3% OF FULL LOAD.

2 FACTOR OF 0.8 [GENERATOR POWER = ENGINE POWER x GENERATOR EFFICIENCY].

3 ISO 3046/1 ENGINE EFFICIENCY TOLERANCE IS (+)0, (-)5% OF FULL LOAD % EFFICIENCY VALUE. NOMINAL ENGINE EFFICIENCY TOLERANCE IS ± 2.5% OF FULL LOAD % EFFICIENCY VALUE.

4 THERMAL EFFICIENCY: JACKET HEAT + LUBE OIL HEAT + STAGE 1 A/C HEAT + EXH. HEAT TO 350°F.

5 TOTAL EFFICIENCY = ENGINE EFF. + THERMAL EFF. TOLERANCE IS ± 10% OF FULL LOAD DATA.

6 ISO 3046/1 FUEL CONSUMPTION TOLERANCE IS (+)5, (-)0% OF FULL LOAD DATA. NOMINAL FUEL CONSUMPTION TOLERANCE IS ± 2.5 % OF FULL LOAD DATA.

7 UNDRIED AIR. FLOW TOLERANCE IS ± 5 %

8 INLET MANIFOLD PRESSURE TOLERANCE IS ± 5 %

9 INLET MANIFOLD TEMPERATURE TOLERANCE IS ± 9°F.

10 TIMING INDICATED IS FOR USE WITH THE MINIMUM FUEL METHANE NUMBER SPECIFIED. CONSULT THE APPROPRIATE FUEL USAGE GUIDE FOR TIMING AT OTHER METHANE NUMBERS.

11 EXHAUST STACK TEMPERATURE TOLERANCE IS (+)63°F, (-)54°F.

12 WET EXHAUST. FLOW TOLERANCE IS ± 6 %

13 NOX TOLERANCES ARE ± 18 % OF SPECIFIED VALUE.

14 CO, CO2, THC, and NMHC VALUES ARE "NOT TO EXCEED".

15 O2% TOLERANCE IS ± 0.5; LAMBDA TOLERANCE IS ± 0.05. LAMBDA AND O2 LEVEL ARE THE RESULT OF ADJUSTING THE ENGINE TO OPERATE AT THE SPECIFIED NOX LEVEL.

16 LHV RATE TOLERANCE IS ± 2.5%.

17 (STAGE 1 + STAGE 2) x (ACHRF-1). TOLERANCE IS ± 10 % OF FULL LOAD DATA.

18 RADIATION HEAT RATE BASED ON TREATED WATER. TOLERANCE IS ± 50% OF FULL LOAD DATA.

19 LUBE OIL HEAT RATE BASED ON TREATED WATER. TOLERANCE IS ± 20% OF FULL LOAD DATA.

20 EXHAUST HEAT RATE BASED ON TREATED WATER. TOLERANCE IS ± 10% OF FULL LOAD DATA.

21 TOLERANCE IS ± 5 % OF FULL LOAD DATA.

22 TOLERANCE IS ± 5 % OF FULL LOAD DATA.