G3516

GAS ENGINE TECHNICAL DATA

CATERPILLAR®

ENGINE SPEED:	1500	FUEL:	NAT GAS
COMPRESSION RATIO:	11:1	FUEL SYSTEM:	LPG IMPCO
AFTERCOOLER - MAX. INLET (°C):	54		
JACKET WATER - MAX. OUTLET (°C):	99	FUEL PRESS. RANGE (KPAg):	10.0 - 34.5
ASPIRATION:	TA	MIN. METHANE NUMBER:	80
COOLING SYSTEM:	JW+OC, AC	RATED ALTITUDE (m):	1524
IGNITION SYSTEM:	ADEM4	AT AIR TO TURBO. TEMP. (°C):	25
EXHAUST MANIFOLD:	ASWC	NOx EMISSION LEVEL:	834.0 mg/Nm3
COMBUSTION:	LOW EMISSION	FUEL LHV (MJ/Nm3):	35.6
		APPLICATION:	50 Hz GENSET

RATING AND EFFICIENCY		NOTES	LOAD	100%	75%	50%
ENGINE POWER	(WITHOUT FAN)	(1)	KW	1011	758	506
GENERATOR POWER	(WITHOUT FAN)	(2)	EKW	975	731	487
ENGINE EFFICIENCY	**(ISO 3046/1)**	**(3)**	**%**	**35.7**	**34.0**	**31.9**
ENGINE EFFICIENCY	(NOMINAL)	(3)	%	35.1	33.3	31.3
THERMAL EFFICIENCY	(NOMINAL)	(4)	%	48.3	51.3	55.8
TOTAL EFFICIENCY	(NOMINAL)	(5)	%	83.4	84.6	87.1

ENGINE DATA						
FUEL CONSUMPTION	**(ISO 3046/1)**	**(6)**	**MJ/bkW-hr**	**10.07**	**10.59**	**11.29**
FUEL CONSUMPTION	(NOMINAL)	(6)	MJ/bkW-hr	10.27	10.8	11.51
AIR FLOW (0 °C, 101.3 kPa)		(7)	Nm3/bkW-hr	4.26	4.3	4.09
AIR FLOW		(7)	kg/bkW-hr	5.5	5.55	5.29
COMPRESSOR OUT PRESSURE			kPa (abs)	242	226	164
COMPRESSOR OUT TEMPERATURE			°C	150	130	89
AFTERCOOLER AIR OUT TEMPERATURE			°C	56	56	55
INLET MAN. PRESSURE		(8)	KPAa	221	169	111
INLET MAN. TEMPERATURE	(MEASURED IN PLENUM)	(9)	°C	61	57	56
TIMING		(10)	°BTDC	18	18	18
EXHAUST STACK TEMPERATURE		(11)	°C	453	453	463
EXHAUST GAS FLOW (0 °C, 101.3 kPa)		(12)	Nm3/bkW-hr	4.55	4.61	4.42
EXHAUST MASS FLOW		(12)	kg/bkW-hr	5.72	5.79	5.54

EMISSIONS DATA					
NOx (as NO2) (corr. 5% O2)	(13)	mg/Nm3 (dry)	834	925	2532
CO (corr. 5% O2)	(14)	mg/Nm3 (dry)	810	850	853
THC (corr. 5% O2), molecular weight of 15.84)	(14)	mg/Nm3 (dry)	1162	1111	895
NMHC (corr. 5% O2, molecular weight of 15.84)	(14)	mg/Nm3 (dry)	174	167	134
EXHAUST O2	(15)	% DRY	8.1	7.6	5.9
LAMBDA	(15)		1.55	1.49	1.33

HEAT BALANCE DATA					
LHV INPUT	(16)	KW	2884	2276	1616
HEAT REJECTION TO JACKET (JW)	(17) (22)	KW	688	617	521
HEAT REJECTION TO ATMOSPHERE	(18)	KW	100	83	67
HEAT REJECTION TO LUBE OIL (OC)	(19) (22)	KW	103	92	78
HEAT REJECTION TO EXHAUST (LHV to 25°C)	(20)	KW	804	611	400
HEAT REJECTION TO EXHAUST (LHV to 120°C)	(20)	KW	603	459	304
HEAT REJECTION TO A/C (AC)	(21) (23)	KW	161	97	28
HEAT REJECTION TO ENGINE PUMPS		KW	17.6	17.6	17.6

CONDITIONS AND DEFINITIONS

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

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 DEPENDANT UPON FUEL QUALITY. METHANE NUMBER CANNOT VARY MORE THAN ± 3. PUBLISHED PART LOAD DATA MAY REQUIRE ENGINE

ENGINE RATING IS WITH 2 ENGINE DRIVEN WATER PUMPS.

FOR NOTES INFORMATION CONSULT PAGE THREE.

FUEL USAGE GUIDE

CAT METHANE NUMBER	30	35	40	45	50	55	60	65	70	75	80	85-100
IGNITION TIMING	-	-	-	-	-	-	-	-	15	16	17	18
DERATION FACTOR	0	0	0	0	0	0	0	0	1.00	1.00	1.00	1.00

ALTITUDE DERATION FACTORS

AIR TO TURBO (°C)	0	250	500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000
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
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
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
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
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
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
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

ALTITUDE (METERS ABOVE SEA LEVEL)

AFTERCOOLER HEAT REJECTION FACTORS (ACHRF)

AIR TO TURBO (°C)	0	250	500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000
50	1.34	1.40	1.45	1.51	1.57	1.62	1.68	1.69	1.69	1.69	1.69	1.69	1.69
45	1.27	1.32	1.38	1.43	1.49	1.55	1.60	1.61	1.61	1.61	1.61	1.61	1.61
40	1.19	1.25	1.30	1.35	1.41	1.47	1.52	1.53	1.53	1.53	1.53	1.53	1.53
35	1.12	1.17	1.22	1.28	1.33	1.39	1.44	1.45	1.45	1.45	1.45	1.45	1.45
30	1.04	1.10	1.15	1.20	1.25	1.31	1.36	1.37	1.37	1.37	1.37	1.37	1.37
25	1.00	1.02	1.07	1.12	1.18	1.23	1.28	1.29	1.29	1.29	1.29	1.29	1.29
20	1.00	1.00	1.00	1.05	1.10	1.15	1.20	1.21	1.21	1.21	1.21	1.21	1.21
15	1.00	1.00	1.00	1.00	1.02	1.07	1.12	1.13	1.13	1.13	1.13	1.13	1.13
10	1.00	1.00	1.00	1.00	1.00	1.00	1.04	1.05	1.05	1.05	1.05	1.05	1.05

ALTITUDE (METERS ABOVE SEA LEVEL)

FREE FIELD MECHANICAL & EXHAUST NOISE

100% Load Data			dB(A)	(dB)							
Free Field Mechanical	DISTANCE FROM THE ENGINE (METERS)	1	98.1	93.8	95.3	91.5	90.0	93.1	92.8	88.8	83.2
		7	88.5	84.2	85.7	81.9	80.4	83.5	83.2	79.2	73.6
		15	83.2	78.9	80.4	76.6	75.1	78.2	77.9	73.9	68.3
Free Field Exhaust	DISTANCE FROM THE ENGINE (METERS)	1.5	113.5	102.9	105.5	109.5	105.6	106.9	106.6	107.1	104.0
		7	100.1	88.1	94.6	94.9	91.6	94.3	93.2	93.8	89.1
		15	93.5	81.5	87.9	88.2	84.9	87.6	86.6	87.2	82.5
			Overal SPL	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 khz

Octave Band Center Frequency (OBCF)

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.

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 (ACHRF):

Aftercooler heat rejection is given for standard conditions of 25°C and 152 m 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 (ACHRF) 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.

SOUND DATA:

Data determined by methods according to TM7080. SPL = Sound Pressure Level.

NOTES

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

2 GENERATOR POWER DETERMINED WITH AN ASSUMED GENERATOR EFFICIENCY OF 96.4% AND POWER 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 ± 3% OF FULL LOAD % EFFICIENCY VALUE.

4 THERMAL EFFICIENCY: JACKET HEAT + LUBE OIL HEAT + EXH. HEAT TO 120°C.

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 ± 3 % OF FULL LOAD DATA.

7 UNDRIED AIR. FLOW TOLERANCE IS ± 5 %

8 INLET MANIFOLD PRESSURE TOLERANCE IS ± 5 %

9 INLET MANIFOLD TEMPERATURE TOLERANCE IS ± 5°C.

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 (+)35°C, (-)30°C.

12 WET EXHAUST. FLOW TOLERANCE IS ± 6 %

13 NOX VALUES ARE SET POINTS AND WILL VARY WITH OPERATING CONDITIONS.

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 INPUT TOLERANCE IS ± 3%.

17 HEAT REJECTION TO JACKET TOLERANCE IS ± 10 % OF FULL LOAD DATA, BASED ON TREATED WATER.

18 HEAT REJECTION TO ATMOSPHERE TOLERANCE IS ± 50% OF FULL LOAD DATA, BASED ON TREATED WATER.

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

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

21 HEAT REJECTION TO A/C TOLERANCE IS ± 5 % OF FULL LOAD DATA, BASED ON TREATED WATER.

SITE SPECIFIC COOLING SYSTEM SIZING EQUATIONS (WITH TOLERANCES)

22 TOTAL JACKET CIRCUIT (JW+OC) = (JW x 1.1) + (OC x 1.2).

23 TOTAL AFTERCOOLER CIRCUIT (AC) = AC x ACHRF x 1.05.