G3520C

GAS ENGINE TECHNICAL DATA

CATERPILLAR®

ENGINE SPEED:	1500	FUEL:	NAT GAS
COMPRESSION RATIO:	11.3:1	FUEL SYSTEM:	CAT LOW PRESSURE WITH AIR FUEL RATIO CONTROL
AFTERCOOLER - STAGE 1 MAX. INLET (°C):	92		
AFTERCOOLER - STAGE 2 MAX. INLET (°C):	54	FUEL PRESS. RANGE (KPAg):	3.4 - 34.5
JACKET WATER - MAX. OUTLET (°C):	99	MIN. METHANE NUMBER:	80
COOLING SYSTEM:	JW+OC+1AC , 2AC	RATED ALTITUDE (m):	350
IGNITION SYSTEM:	ADEM3	AT AIR TO TURBO. TEMP. (°C):	25
EXHAUST MANIFOLD:	DRY	NOx EMISSION LEVEL:	250 mg/Nm3
COMBUSTION:	LOW EMISSION	FUEL LHV (MJ/Nm3):	35.6
		APPLICATION:	GENSET

RATING AND EFFICIENCY		NOTES	LOAD	100%	75%	50%
ENGINE POWER	(WITHOUT FAN)	(1)	KW	2070	1553	1035
GENERATOR POWER	(WITHOUT FAN)	(2)	EKW	2000	1500	1000
ENGINE EFFICIENCY	**(ISO 3046/1)**	**(3)**	**%**	**41.0**	**40.1**	**38.4**
ENGINE EFFICIENCY	(NOMINAL)	(3)	%	40.0	39.1	37.5
THERMAL EFFICIENCY	(NOMINAL)	(4)	%	45.0	45.9	47.5
TOTAL EFFICIENCY	(NOMINAL)	(5)	%	85.1	85.0	85.0

ENGINE DATA						
FUEL CONSUMPTION	**(ISO 3046/1)**	**(6)**	**MJ/bkW-hr**	**8.78**	**8.98**	**9.37**
FUEL CONSUMPTION	(NOMINAL)	(6)	MJ/bkW-hr	9	9.2	9.6
AIR FLOW (0 °C, 101.3 kPa)		(7)	Nm3/bkW-hr	4.36	4.41	4.5
AIR FLOW		(7)	kg/bkW-hr	5.63	5.69	5.82
COMPRESSOR OUT PRESSURE			kPa (abs)	349	267	180
COMPRESSOR OUT TEMPERATURE			°C	191	149	100
AFTERCOOLER AIR OUT TEMPERATURE			°C	56	56	56
INLET MAN. PRESSURE		(8)	KPAa	308	235	163
INLET MAN. TEMPERATURE	(MEASURED IN PLENUM)	(9)	°C	57	57	56
TIMING		(10)	°BTDC	24	24	24
EXHAUST STACK TEMPERATURE		(11)	°C	469	495	522
EXHAUST GAS FLOW (0 °C, 101.3 kPa)		(12)	Nm3/bkW-hr	4.62	4.68	4.78
EXHAUST MASS FLOW		(12)	kg/bkW-hr	5.83	5.89	6.03

EMISSIONS DATA					
NOx (as NO2) (corr. 5% O2)	(13)	mg/Nm3 (dry)	250	250	250
CO (corr. 5% O2)	(14)	mg/Nm3 (dry)	960	938	892
THC (corr. 5% O2), molecular weight of 15.84)	(14)	mg/Nm3 (dry)	2139	2360	2469
NMHC (corr. 5% O2, molecular weight of 15.84)	(14)	mg/Nm3 (dry)	321	354	371
CO2 (corr. 5% O2)	(14)	mg/Nm3 (dry)	203961	206299	207221
EXHAUST O2	(15)	% DRY	9.4	9.4	9.3
LAMBDA	(15)		1.80	1.78	1.74

HEAT BALANCE DATA					
LHV INPUT	(16)	KW	5171	3967	2760
HEAT REJECTION TO JACKET	(17)	KW	581	503	420
HEAT REJECTION TO ATMOSPHERE	(18)	KW	138	115	92
HEAT REJECTION TO LUBE OIL	(19)	KW	124	110	93
HEAT REJECTION TO EXHAUST (LHV to 25°C)	(20)	KW	1778	1434	1039
HEAT REJECTION TO EXHAUST (LHV to 120°C)	(20)	KW	1307	1067	784
HEAT REJECTION TO A/C - STAGE 1	(21)	KW	317	139	13
HEAT REJECTION TO A/C - STAGE 2	(22)	KW	163	113	68

CONDITIONS AND DEFINITIONS

ENGINE RATING OBTAINED AND PRESENTED IN ACCORDANCE WITH ISO 3046/1. DATA REPRESENTS CONDITIONS OF 25°C, 100 KPA BAROMETRIC PRESSURE, 30% RELATIVE HUMIDITY, 2.5 KPA AIR FILTER RESTRICTION, AND 5 KPA EXHAUST STACK PRESSURE. ENGINE EFFICIENCY AND FUEL CONSUMPTION SPECIFICALLY NOTED AS ISO 3046/1 ARE REPRESENTED WITH 1.25 KPA AIR FILTER RESTRICTION AND 0 KPA 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 DEPENDANT UPON FUEL QUALITY. METHANE NUMBER CANNOT VARY MORE THAN ± 3. PUBLISHED PART LOAD DATA IS WITH LAMBDA CONTROL.

ENGINE RATING IS WITHOUT 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 to 100
IGNITION TIMING	-	-	-	-	-	16	16	16	16	17	24	24
DERATION FACTOR	0	0	0	0	0	0.69	0.78	0.86	0.95	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	0.96	0.93	0.91	0.88	0.85	0.83	0.80	0.77	0.75	0.73	0.70	0.68	0.66
45	0.98	0.95	0.92	0.89	0.86	0.84	0.81	0.79	0.76	0.74	0.71	0.69	0.67
40	0.99	0.96	0.93	0.91	0.88	0.85	0.82	0.80	0.77	0.75	0.73	0.70	0.68
35	1.00	0.98	0.95	0.92	0.89	0.87	0.84	0.81	0.79	0.76	0.74	0.71	0.69
30	1.00	1.00	0.97	0.94	0.91	0.88	0.85	0.83	0.80	0.77	0.75	0.73	0.70
25	1.00	1.00	0.98	0.95	0.92	0.89	0.87	0.84	0.81	0.79	0.76	0.74	0.71
20	1.00	1.00	1.00	0.97	0.94	0.91	0.88	0.85	0.83	0.80	0.78	0.75	0.73
15	1.00	1.00	1.00	0.98	0.95	0.93	0.90	0.87	0.84	0.81	0.79	0.76	0.74
10	1.00	1.00	1.00	1.00	0.97	0.94	0.91	0.88	0.86	0.83	0.80	0.78	0.75

ALTITUDE (METERS ABOVE SEA LEVEL)

AFTERCOOLER HEAT REJECTION FACTORS

AIR TO TURBO (°C)	0	250	500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000
50	1.27	1.30	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32
45	1.21	1.25	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26
40	1.15	1.19	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
35	1.09	1.13	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
30	1.04	1.07	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09
25	1.00	1.01	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03
20	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
15	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
10	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 (METERS 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 42 meters to the site altitude for each additional KPA of exhaust stack pressure greater than spec sheet conditions. Add 37 meters to the site altitude for each additional KPA 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 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 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 90% of the additional heat.

NOTES

1 ENGINE RATING IS WITHOUT ENGINE DRIVEN WATER PUMPS. TOLERANCE IS ± 3% OF FULL LOAD.

2 GENERATOR POWER DETERMINED WITH AN ASSUMED GENERATOR EFFICIENCY OF 96.6% 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 ± 2.5% OF FULL LOAD % EFFICIENCY VALUE.

4 THERMAL EFFICIENCY: JACKET HEAT + LUBE OIL HEAT + STAGE 1 A/C 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 ± 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 ± 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 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 TOTAL JW HEAT (based on treated water) = JACKET HEAT + LUBE OIL HEAT + STAGE 1 A/C HEAT + 0.90 x (STAGE 1 + STAGE 2) x (ACHRF-1). TOLERANCE IS ± 10 % OF FULL LOAD DATA. HEAT REJECTION BASED ON 2310 LITERS/MIN WATER FLOW.

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 STAGE 1 A/C HEAT (based on treated water) = STAGE 1 A/C HEAT + 0.90 x (STAGE 1 + STAGE 2) x (ACHRF-1). TOLERANCE IS ± 5 % OF FULL LOAD DATA.

22 STAGE 2 A/C HEAT (based on treated water) = STAGE 2 A/C HEAT + (STAGE 1 + STAGE 2) x 0.10 x (ACHRF - 1). TOLERANCE IS ± 5 % OF FULL LOAD DATA. HEAT REJECTION BASED ON 570 LITERS/MIN WATER FLOW.