G3412C

GAS ENGINE TECHNICAL DATA

CATERPILLAR®

ENGINE SPEED (rpm):	1800	RATING STRATEGY:	STANDARD
COMPRESSION RATIO:	11.4:1	APPLICATION:	Packaged Genset
AFTERCOOLER TYPE:	SCAC	RATING LEVEL:	STANDBY
AFTERCOOLER WATER INLET (°F):	130	FUEL:	Nat Gas
JACKET WATER OUTLET (°F):	210	FUEL SYSTEM:	LPG IMPCO
ASPIRATION:	TA		WITH AIR FUEL RATIO CONTROL
COOLING SYSTEM:	JW+OC, AC	FUEL PRESSURE RANGE(psig):	1.5-5.0
CONTROL SYSTEM:	EIS	FUEL METHANE NUMBER:	80
EXHAUST MANIFOLD:	WC	FUEL LHV (Btu/scf):	905
COMBUSTION:	Low Emission	ALTITUDE CAPABILITY AT 77°F INLET AIR TEMP. (ft):	2000
NOx EMISSION LEVEL (g/bhp-hr NOx):	2.0	POWER FACTOR:	0.8
FAN POWER (bhp):	46	VOLTAGE(V):	400-11600

RATING		NOTES	LOAD	100%	75%	50%
PACKAGE POWER	(WITH FAN)	(1)(2)	ekW	500	375	250
PACKAGE POWER		(1)(2)	kVA	625	469	312
ENGINE POWER	(WITHOUT FAN)	(2)	bhp	755	577	400
GENERATOR EFFICIENCY		(1)	%	94.6	94.8	94.7
PACKAGE EFFICIENCY(@ 1.0 Power Factor)	(ISO 3046/1)	(3)	%	32.4	30.7	27.7
THERMAL EFFICIENCY		(4)	%	43.5	46.8	51.6
TOTAL EFFICIENCY (@ 1.0 Power Factor)		(5)	%	75.9	77.5	79.3

ENGINE DATA						
PACKAGE FUEL CONSUMPTION	(ISO 3046/1)	(6)	Btu/ekW-hr	10694	11285	12434
PACKAGE FUEL CONSUMPTION	(NOMINAL)	(6)	Btu/ekW-hr	10901	11504	12675
ENGINE FUEL CONSUMPTION	(NOMINAL)	(6)	Btu/bhp-hr	7216	7477	7911
AIR FLOW (77°F, 14.7 psia)	(WET)	(7) (8)	ft3/min	1575	1193	809
AIR FLOW	(WET)	(7) (8)	lb/hr	6985	5292	3587
FUEL FLOW (60ºF, 14.7 psia)			scfm	100	79	58
COMPRESSOR OUT PRESSURE			in Hg(abs)	78.7	74.2	57.0
COMPRESSOR OUT TEMPERATURE			°F	354	311	242
AFTERCOOLER AIR OUT TEMPERATURE			°F	141	139	137
INLET MAN. PRESSURE		(9)	in Hg(abs)	69.7	54.1	39.1
INLET MAN. TEMPERATURE	(MEASURED IN PLENUM)	(10)	°F	150	148	144
TIMING		(11)	°BTDC	22	22	22
EXHAUST TEMPERATURE - ENGINE OUTLET		(12)	°F	769	738	715
EXHAUST GAS FLOW (@engine outlet temp, 14.5 psia)	(WET)	(13) (8)	ft3/min	3904	2892	1933
EXHAUST GAS MASS FLOW	(WET)	(13) (8)	lb/hr	7259	5509	3747

EMISSIONS DATA - ENGINE OUT					
NOx (as NO2)	(14)(15)	g/bhp-hr	2.00	2.00	2.00
CO	(14)(16)	g/bhp-hr	1.76	1.92	1.85
THC (mol. wt. of 15.84)	(14)(16)	g/bhp-hr	5.23	5.43	5.49
NMHC (mol. wt. of 15.84)	(14)(16)	g/bhp-hr	0.79	0.82	0.82
NMNEHC (VOCs) (mol. wt. of 15.84)	(14)(16)(17)	g/bhp-hr	0.52	0.54	0.55
HCHO (Formaldehyde)	(14)(16)	g/bhp-hr	0.27	0.27	0.27
CO2	(14)(16)	g/bhp-hr	474	469	459
EXHAUST OXYGEN	(14)(18)	% DRY	8.6	8.4	8.1
LAMBDA	(14)(18)		1.59	1.52	1.41

ENERGY BALANCE DATA					
LHV INPUT	(19)	Btu/min	90807	71870	52793
HEAT REJECTION TO JACKET WATER (JW)	(20)(26)	Btu/min	20861	19531	17397
HEAT REJECTION TO ATMOSPHERE	(21)	Btu/min	3632	2875	2112
HEAT REJECTION TO LUBE OIL (OC)	(22)(26)	Btu/min	3299	3088	2751
HEAT REJECTION TO EXHAUST (LHV TO 77°F)	(23)(24)	Btu/min	24444	17901	11874
HEAT REJECTION TO EXHAUST (LHV TO 350°F)	(23)	Btu/min	13561	9547	6129
HEAT REJECTION TO AFTERCOOLER (AC)	(25)(27)	Btu/min	6554	4016	1680

CONDITIONS AND DEFINITIONS

Engine rating obtained and presented in accordance with ISO 3046/1. (Standard reference conditions of 77°F, 29.60 in Hg barometric pressure.) No overload permitted at rating shown. Consult the altitude deration factor chart for applications that exceed the rated altitude or temperature.

Emission levels are at engine exhaust flange prior to any after treatment. Values are based on engine operating at steady state conditions, adjusted to the specified NOx level at 100% load. Tolerances specified are dependent upon fuel quality. Fuel methane number cannot vary more than ± 3.

For notes information consult page three.

FUEL USAGE GUIDE

CAT METHANE NUMBER	70	75	80	100
SET POINT TIMING	18	20	22	22
DERATION FACTOR	1	1	1	1

ALTITUDE DERATION FACTORS AT RATED SPEED

INLET AIR TEMP °F	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
130	0.98	0.95	0.91	0.88	0.84	0.81	0.78	0.75	0.72	0.69	0.66	0.64	0.61
120	1	0.96	0.93	0.89	0.86	0.82	0.79	0.76	0.73	0.70	0.68	0.65	0.62
110	1	0.98	0.94	0.91	0.87	0.84	0.81	0.78	0.75	0.72	0.69	0.66	0.63
100	1	1	0.96	0.92	0.89	0.85	0.82	0.79	0.76	0.73	0.70	0.67	0.64
90	1	1	0.98	0.94	0.90	0.87	0.84	0.80	0.77	0.74	0.71	0.68	0.66
80	1	1	0.99	0.96	0.92	0.89	0.85	0.82	0.79	0.76	0.73	0.70	0.67
70	1	1	1	0.98	0.94	0.90	0.87	0.83	0.80	0.77	0.74	0.71	0.68
60	1	1	1	0.99	0.96	0.92	0.88	0.85	0.82	0.78	0.75	0.72	0.69
50	1	1	1	1	0.98	0.94	0.90	0.87	0.83	0.80	0.77	0.74	0.71

ALTITUDE (FEET ABOVE SEA LEVEL)

AFTERCOOLER HEAT REJECTION FACTORS (ACHRF)

INLET AIR TEMP °F	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
130	1.35	1.41	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47
120	1.28	1.34	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40
110	1.20	1.26	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32
100	1.13	1.19	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
90	1.06	1.12	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18
80	1	1.05	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
70	1	1	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03
60	1	1	1	1	1	1	1	1	1	1	1	1	1
50	1	1	1	1	1	1	1	1	1	1	1	1	1

ALTITUDE (FEET ABOVE SEA LEVEL)

FUEL USAGE GUIDE:

This table shows the derate factor and full load set point timing required for a given fuel. Note that deration and set point timing reduction may be required 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:

To determine the actual rating of the engine at site conditions, one must consider separately, limitations due to fuel characteristics and air system limitations. The Fuel Usage Guide deration establishes fuel limitations. The Altitude/Temperature deration factors and RPC (reference the Caterpillar Methane Program) establish air system limitations. RPC comes into play when the Altitude/Temperature deration is less than 1.0 (100%). Under this condition, add the two factors together. When the site conditions do not require an Altitude/ Temperature derate (factor is 1.0), it is assumed the turbocharger has sufficient capability to overcome the low fuel relative power, and RPC is ignored. To determine the actual power available, take the lowest rating between 1) and 2).

1) Fuel Usage Guide Deration
2) 1-((1-Altitude/Temperature Deration) + (1-RPC))

AFTERCOOLER HEAT REJECTION FACTORS(ACHRF):

To maintain a constant air inlet manifold temperature, as the inlet 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 (ACHRF) to adjust for inlet air temp and altitude conditions. See note 27 for application of this factor in calculating the heat exchanger sizing criteria. Failure to properly account for these factors could result in detonation and cause the engine to shutdown or fail.

NOTES:

1. Generator efficiencies, power factor, and voltage are based on standard generator. [Package Power (ekW) is calculated as: (Engine Power (bkW) - Fan Power (bkW)) x Generator Efficiency], [Package Power (kVA) is calculated as: (Engine Power (bkW) - Fan Power (bkw)) x Generator Efficiency / Power Factor]
2. Rating is with two engine driven water pumps. Tolerance is (+)3, (-)0% of full load.
3. ISO 3046/1 Package efficiency tolerance is (+)0, (-)5% of full load % efficiency value based on a 1.0 power factor.
4. Thermal Efficiency is calculated based on energy recovery from the jacket water, lube oil, and exhaust to 350ºF with engine operation at ISO 3046/1 Package Efficiency, and assumes unburned fuel is converted in an oxidation catalyst.
5. Total efficiency is calculated as: Package Efficiency + Thermal Efficiency. Tolerance is ±10% of full load data.
6. ISO 3046/1 Package fuel consumption tolerance is (+)5, (-)0% of full load data. Nominal package and engine fuel consumption tolerance is ± 3.0% of full load data.
7. Air flow value is on a 'wet' basis. Flow is a nominal value with a tolerance of ± 5 %.
8. Inlet and Exhaust Restrictions must not exceed A&I limits based on full load flow rates from the standard technical data sheet.
9. Inlet manifold pressure is a nominal value with a tolerance of ± 5 %.
10. Inlet manifold temperature is a nominal value with a tolerance of ± 9°F.
11. Timing indicated is for use with the minimum fuel methane number specified. Consult the appropriate fuel usage guide for timing at other methane numbers.
12. Exhaust temperature is a nominal value with a tolerance of (+)63°F, (-)54°F.
13. Exhaust flow value is on a 'wet' basis. Flow is a nominal value with a tolerance of ± 6 %.
14. Emissions data is at engine exhaust flange prior to any after treatment.
15. NOx tolerances are ± 18% of specified value.
16. CO, CO2, THC, NMHC, NMNEHC, and HCHO values are "Not to Exceed" levels. THC, NMHC, and NMNEHC do not include aldehydes. An oxidation catalyst may be required to meet Federal, State or local CO or HC requirements.
17. VOCs - Volatile organic compounds as defined in US EPA 40 CFR 60, subpart JJJJ
18. Exhaust Oxygen tolerance is ± 0.5; Lambda tolerance is ± 0.05. Lambda and Exhaust Oxygen level are the result of adjusting the engine to operate at the specified NOx level.
19. LHV rate tolerance is ± 3.0%.
20. Heat rejection to jacket water value displayed includes heat to jacket water alone. Value is based on treated water. Tolerance is ± 10% of full load data.
21. Heat rejection to atmosphere based on treated water. Tolerance is ± 50% of full load data.
22. Lube oil heat rate based on treated water. Tolerance is ± 20% of full load data.
23. Exhaust heat rate based on treated water. Tolerance is ± 10% of full load data.
24. Heat rejection to exhaust (LHV to 77°F) value shown includes unburned fuel and is not intended to be used for sizing or recovery calculations.
25. Heat rejection to aftercooler based on treated water. Tolerance is ±5% of full load data.
26. Total Jacket Water Circuit heat rejection is calculated as: (JW x 1.1) + (OC x 1.2). Heat exchanger sizing criterion is maximum circuit heat rejection at site conditions, with applied tolerances. A cooling system safety factor may be multiplied by the total circuit heat rejection to provide additional margin.
27. Total Aftercooler Circuit heat rejection is calculated as: AC x ACHRF x 1.05. Heat exchanger sizing criterion is maximum circuit heat rejection at site conditions, with applied tolerances. A cooling system safety factor may be multiplied by the total circuit heat rejection to provide additional margin.