

GENSET APPLICATION

ENGINE SPEED (rpm): 1500
 COMPRESSION RATIO: 11.3:1
 AFTERCOOLER TYPE: SCAC
 AFTERCOOLER - STAGE 2 INLET (°F): 130
 AFTERCOOLER - STAGE 1 INLET (°F): 219
 JACKET WATER OUTLET (°F): 230
 ASPIRATION: TA
 COOLING SYSTEM: JW+1AC, OC+2AC+GB
 CONTROL SYSTEM: ADEM3
 EXHAUST MANIFOLD: DRY
 COMBUSTION: LOW EMISSION
 NOx EMISSION LEVEL (mg/Nm3 NOx): 500
 SET POINT TIMING: 32

RATING STRATEGY: STANDARD
 RATING LEVEL: CONTINUOUS
 FUEL SYSTEM: CAT LOW PRESSURE
 WITH AIR FUEL RATIO CONTROL

SITE CONDITIONS:

FUEL: Low Energy
 FUEL PRESSURE RANGE(psig): 1.5-5.0
 FUEL METHANE NUMBER: 143.0
 FUEL LHV (Btu/scf): 500
 ALTITUDE(ft): 500
 MAXIMUM INLET AIR TEMPERATURE(°F): 77
 STANDARD RATED POWER: 2741 bhp@1500rpm
 POWER FACTOR: 1.0
 VOLTAGE(V): 380-1100

RATING	NOTES	LOAD	SITE RATING AT MAXIMUM INLET AIR TEMPERATURE			
			100%	100%	75%	50%
GENSET POWER (WITH GEARBOX, WITHOUT FAN)	(1)(2)	ekW	1965	1965	1473	982
GENSET POWER (WITH GEARBOX, WITHOUT FAN)	(1)(2)	kVA	1965	1965	1473	982
ENGINE POWER (WITHOUT GEARBOX, WITHOUT FAN)	(2)	bhp	2741	2741	2060	1382
INLET AIR TEMPERATURE		°F	77	77	77	77
GENERATOR EFFICIENCY	(1)	%	97.1	97.1	96.9	96.3
GENSET EFFICIENCY (ISO 3046/1)	(3)	%	38.8	38.8	37.2	35.0
THERMAL EFFICIENCY	(4)	%	41.4	41.4	42.5	43.3
TOTAL EFFICIENCY	(5)	%	80.2	80.2	79.7	78.3

ENGINE DATA						
GENSET FUEL CONSUMPTION (ISO 3046/1)	(6)	Btu/ekW-hr	8803	8803	9177	9745
GENSET FUEL CONSUMPTION (NOMINAL)	(6)	Btu/ekW-hr	9018	9018	9400	9983
ENGINE FUEL CONSUMPTION (NOMINAL)	(6)	Btu/bhp-hr	6464	6464	6725	7097
AIR FLOW (@inlet air temp, 14.7 psia) (WET)	(7)	ft3/min	5261	5261	4033	2770
AIR FLOW (WET)	(7)	lb/hr	23328	23328	17884	12281
FUEL FLOW (60°F, 14.7 psia)		scfm	591	591	462	327
INLET MANIFOLD PRESSURE	(8)	in Hg(abs)	90.2	90.2	69.0	47.9
EXHAUST TEMPERATURE - ENGINE OUTLET	(9)	°F	939	939	982	1015
EXHAUST GAS FLOW (@engine outlet temp, 14.5 psia) (WET)	(10)	ft3/min	15505	15505	12283	8651
EXHAUST GAS MASS FLOW (WET)	(10)	lb/hr	25964	25964	19945	13740
MAX INLET RESTRICTION	(11)	in H2O	10.04	10.04	10.04	10.04
MAX EXHAUST RESTRICTION	(11)	in H2O	20.07	20.07	20.07	20.07

EMISSIONS DATA - ENGINE OUT						
NOx (as NO2)	(12)(13)	g/bhp-hr	1.14	1.14	1.18	1.22
CO	(12)(13)	g/bhp-hr	5.07	5.07	4.77	4.59
THC (mol. wt. of 15.84)	(12)(13)	g/bhp-hr	5.10	5.10	6.34	7.42
NMHC (mol. wt. of 15.84)	(12)(13)	g/bhp-hr	0.76	0.76	0.95	1.11
NMNEHC (VOCs) (mol. wt. of 15.84)	(12)(13)(14)	g/bhp-hr	0.51	0.51	0.63	0.74
HCHO (Formaldehyde)	(12)(13)	g/bhp-hr	0.44	0.44	0.48	0.50
CO2	(12)(13)	g/bhp-hr	753	753	794	825
EXHAUST OXYGEN	(12)(15)	% DRY	8.6	8.6	8.4	8.3

HEAT REJECTION						
LHV INPUT	(16)	Btu/min	295262	295262	230842	163430
HEAT REJ. TO JACKET WATER (JW)	(17)	Btu/min	37631	37631	31410	26632
HEAT REJ. TO ATMOSPHERE	(17)	Btu/min	8782	8782	7327	5880
HEAT REJ. TO LUBE OIL (OC)	(17)	Btu/min	12813	12813	11576	10244
HEAT REJECTION TO EXHAUST (LHV TO 248°F)	(17)	Btu/min	66546	66546	56488	40683
HEAT REJ. TO A/C - STAGE 1 (1AC)	(17)(19)	Btu/min	13826	13826	5708	-219
HEAT REJ. TO A/C - STAGE 2 (2AC)	(17)(19)	Btu/min	11972	11972	8334	4768
HEAT REJECTION FROM GEARBOX (GB)	(17)	Btu/min	1162	1162	873	586
PUMP POWER	(18)	Btu/min	2023	2023	2023	2023

COOLING SYSTEM SIZING CRITERIA						
TOTAL JACKET WATER CIRCUIT (JW+1AC)	(20)	Btu/min	55918	55918		
TOTAL STAGE 2 AFTERCOOLER CIRCUIT (OC+2AC+GB)	(20)	Btu/min	29169	29169		
HEAT REJECTION TO EXHAUST (LHV TO 248°F)	(20)	Btu/min	73201	73201		
A cooling system safety factor of 0% has been added to the cooling system sizing criteria.						

MINIMUM HEAT RECOVERY						
TOTAL JACKET WATER CIRCUIT (JW+1AC)	(21)	Btu/min	47002	47002		
TOTAL STAGE 2 AFTERCOOLER CIRCUIT (OC+2AC+GB)	(21)	Btu/min	22728	22728		
HEAT REJECTION TO EXHAUST(LHV TO 248°F)	(21)	Btu/min	59470	59470		

CONDITIONS AND DEFINITIONS

Engine rating obtained and presented in accordance with ISO 3046/1, adjusted for fuel, site altitude and site inlet air temperature. 100% rating at maximum inlet air temperature is the maximum engine capability for the specified fuel at site altitude and maximum site inlet air temperature. Maximum rating is the maximum capability at the specified aftercooler inlet temperature for the specified fuel at site altitude and reduced inlet air temperature. Lowest load point is the lowest continuous duty operating load allowed. No overload permitted at rating shown.

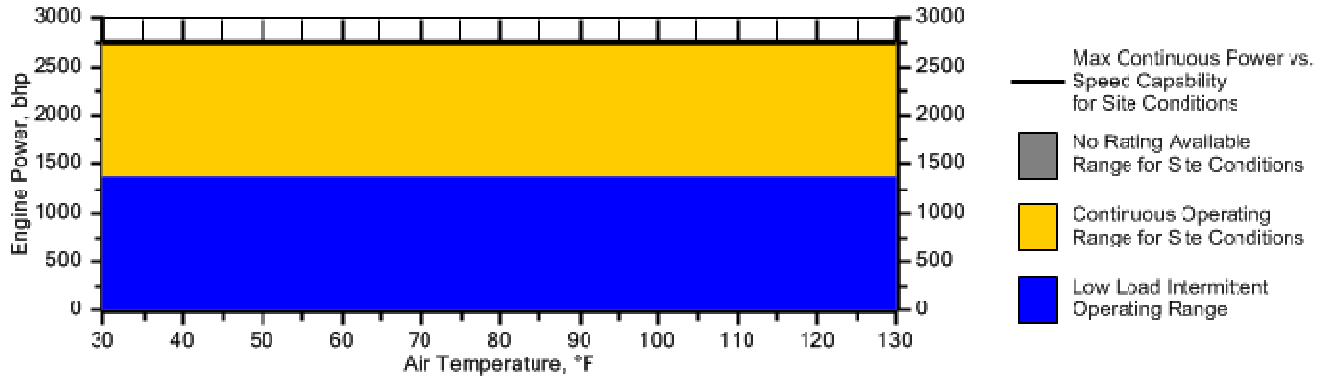
For notes information consult page three.

PREPARED BY:

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Engine Power vs. Inlet Air Temperature

Data represents temperature sweep at 500 ft and 1500 rpm



NOTES

1. Generator efficiencies, power factor, and voltage are based on specified generator. [Genset Power (ekW) is calculated as: (Engine Power (bkW) - Gearbox Power (bkW)) x Generator Efficiency], [Genset Power (kVA) is calculated as: (Engine Power (bkW) - Gearbox 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 Genset efficiency tolerance is (+)0, (-)5% of full load % efficiency value.
4. Thermal Efficiency is calculated based on energy recovery from the jacket water, 1st stage aftercooler, and exhaust to 248°F with engine operation at ISO 3046/1 Genset Efficiency, and assumes unburned fuel is converted in an oxidation catalyst.
5. Total efficiency is calculated as: Genset Efficiency + Thermal Efficiency. Tolerance is ±10% of full load data.
6. Fuel consumption tolerance is ± 2.5% 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 manifold pressure is a nominal value with a tolerance of ± 5 %.
9. Exhaust temperature is a nominal value with a tolerance of (+)63°F, (-)54°F.
10. Exhaust flow value is on a "wet" basis. Flow is a nominal value with a tolerance of ± 6 %.
11. Inlet and Exhaust Restrictions are maximum allowed values at the corresponding loads. Increasing restrictions beyond what is specified will result in a significant engine derate.
12. Emissions data is at engine exhaust flange prior to any after treatment.
13. Emission values are based on engine operating at steady state conditions, adjusted to the specified NOx level at 100% load. Fuel methane number cannot vary more than ± 3. NOx tolerances are ± 18 % of specified value. All other emission values listed are higher than nominal levels to allow for instrumentation, measurement, and engine-to-engine variations. They indicate "Not to Exceed" values. THC, NMHC, and NMNEHC do not include aldehydes.
14. VOCs - Volatile organic compounds as defined in US EPA 40 CFR 60, subpart JJJJ
15. Exhaust Oxygen level is the result of adjusting the engine to operate at the specified NOx level. Tolerance is ± 0.5.
16. LHV rate tolerance is ± 2.5%.
17. Heat rejection values are representative of site conditions. Tolerances, based on treated water, are ± 10% for jacket water circuit, ± 50% for atmosphere, ± 20% for lube oil circuit, ± 10% for exhaust, ± 5% for aftercooler circuit, and ± 5% for Gearbox.
18. Pump power includes engine driven jacket water and aftercooler water pumps. Engine brake power includes effects of pump power.
19. Aftercooler heat rejection is nominal for site conditions and does not include an aftercooler heat rejection factor. Aftercooler heat rejection values at part load are for reference only.
20. Cooling system sizing criteria represent the expected maximum circuit heat rejection for the ratings at site, with applied plus tolerances. Total circuit heat rejection is calculated using formulas referenced in the notes on the standard tech data sheet with the following qualifications. Aftercooler heat rejection data (1AC & 2AC) is based on the standard rating. Jacket Water (JW), Oil Cooler (OC), and Gearbox (GB) heat rejection values are based on the respective site or maximum column. Aftercooler heat rejection factors (ACHRF) are specific for the site elevation and inlet air temperature specified in the site or maximum column, referenced from the table on the standard data sheet
21. Minimum heat recovery values represent the expected minimum heat recovery for the site, with applied minus tolerances. Do not use these values for cooling system sizing.

Constituent	Abbrev	Mole %	Norm
Water Vapor	H2O	0.0000	0.0000
Methane	CH4	54.8000	54.8000
Ethane	C2H6	0.0000	0.0000
Propane	C3H8	0.0000	0.0000
Isobutane	iso-C4H10	0.0000	0.0000
Norbutane	nor-C4H10	0.0000	0.0000
Isopentane	iso-C5H12	0.0000	0.0000
Norpentane	nor-C5H12	0.0000	0.0000
Hexane	C6H14	0.0000	0.0000
Heptane	C7H16	0.0000	0.0000
Nitrogen	N2	2.2000	2.2000
Carbon Dioxide	CO2	43.0000	43.0000
Hydrogen Sulfide	H2S	0.0000	0.0000
Carbon Monoxide	CO	0.0000	0.0000
Hydrogen	H2	0.0000	0.0000
Oxygen	O2	0.0000	0.0000
Helium	HE	0.0000	0.0000
Neopentane	neo-C5H12	0.0000	0.0000
Octane	C8H18	0.0000	0.0000
Nonane	C9H20	0.0000	0.0000
Ethylene	C2H4	0.0000	0.0000
Propylene	C3H6	0.0000	0.0000
TOTAL (Volume %)		100.0000	100.0000

Fuel Makeup: Low Energy
 Unit of Measure: English

Calculated Fuel Properties

Caterpillar Methane Number:	143.0
Lower Heating Value (Btu/scf):	500
Higher Heating Value (Btu/scf):	555
WOBBE Index (Btu/scf):	505
THC: Free Inert Ratio:	1.212
Total % Inerts (% N2, CO2, He):	45.2%
RPC (%) (To 905 Btu/scf Fuel):	93%
Compressibility Factor:	0.997
Stoich A/F Ratio (Vol/Vol):	5.22
Stoich A/F Ratio (Mass/Mass):	5.34
Specific Gravity (Relative to Air):	0.978
Specific Heat Constant (K):	1.308

CONDITIONS AND DEFINITIONS

Caterpillar Methane Number represents the knock resistance of a gaseous fuel. It should be used with the Caterpillar Fuel Usage Guide for the engine and rating to determine the rating for the fuel specified. A Fuel Usage Guide for each rating is included on page 2 of its standard technical data sheet.

RPC always applies to naturally aspirated (NA) engines, and turbocharged (TA or LE) engines only when they are derated for altitude and ambient site conditions.

Project specific technical data sheets generated by the Caterpillar Data Maintenance Utility program take the Caterpillar Methane Number and RPC into account when generating a site rating.

Fuel properties for Btu/scf calculations are at 60F and 14.696 psia.

Caterpillar shall have no liability in law or equity, for damages, consequently or otherwise, arising from use of program and related material or any part thereof.

FUEL LIQUIDS

Field gases, well head gases, and associated gases typically contain liquid water and heavy hydrocarbons entrained in the gas. To prevent detonation and severe damage to the engine, hydrocarbon liquids must not be allowed to enter the engine fuel system. To remove liquids, a liquid separator and coalescing filter are recommended, with an automatic drain and collection tank to prevent contamination of the ground in accordance with local codes and standards.

To avoid water condensation in the engine or fuel lines, limit the relative humidity of water in the fuel to 80% at the minimum fuel operating temperature.