G3520C

GENSET - WITHOUT RADIATOR

GAS ENGINE SITE SPECIFIC TECHNICAL DATA
Astra Zeneca

CATERPILLAR®

ENGINE SPEED (rpm):	1800	RATING STRATEGY:	STANDARD
COMPRESSION RATIO:	11.3	RATING LEVEL:	CONTINUOUS
AFTERCOOLER TYPE:	SCAC	FUEL SYSTEM:	CAT LOW PRESSURE WITH AIR FUEL RATIO CONTROL
AFTERCOOLER - STAGE 2 INLET (°F):	130		
AFTERCOOLER - STAGE 1 INLET (°F):	180	**SITE CONDITIONS:**	
JACKET WATER OUTLET (°F):	194	FUEL:	Nat Gas
ASPIRATION:	TA	FUEL PRESSURE RANGE(psig): (See note 1)	1.5-5.0
COOLING SYSTEM:	JW+OC+1AC, 2AC	FUEL METHANE NUMBER:	84.7
CONTROL SYSTEM:	ADEM3 W/ IM	FUEL LHV (Btu/scf):	905
EXHAUST MANIFOLD:	DRY	ALTITUDE(ft):	600
COMBUSTION:	LOW EMISSION	INLET AIR TEMPERATURE(°F):	100
NOx EMISSION LEVEL (g/bhp-hr NOx):	1.0	STANDARD RATED POWER:	2882 bhp@1800rpm
SET POINT TIMING:	28	POWER FACTOR:	1.0
		VOLTAGE(V):	480-13800

RATING		NOTES	LOAD	MAXIMUM RATING 100%	SITE RATING AT MAXIMUM INLET AIR TEMPERATURE 100%	75%	55%
GENSET POWER	(WITHOUT FAN)	(2)(3)	ekW	2082	1856	1392	1028
GENSET POWER	(WITHOUT FAN)	(2)(3)	kVA	2082	1856	1392	1028
ENGINE POWER	(WITHOUT FAN)	(3)	bhp	2882	2572	1938	1441
INLET AIR TEMPERATURE			°F	82	100	100	100
GENERATOR EFFICIENCY		(2)	%	96.9	96.8	96.3	95.7
GENSET EFFICIENCY	(ISO 3046/1)	(4)	%	38.2	37.5	35.9	34.5
THERMAL EFFICIENCY		(5)	%	49.4	50.0	51.1	51.8
TOTAL EFFICIENCY		(6)	%	87.6	87.5	87.0	86.3
ENGINE DATA							
GENSET FUEL CONSUMPTION	(ISO 3046/1)	(7)	Btu/ekW-hr	8938	9102	9500	9904
GENSET FUEL CONSUMPTION	(NOMINAL)	(7)	Btu/ekW-hr	9156	9324	9732	10145
ENGINE FUEL CONSUMPTION	(NOMINAL)	(7)	Btu/bhp-hr	6616	6730	6992	7241
AIR FLOW (@inlet air temp, 14.7 psia)	(WET)	(8)	ft3/min	6152	5711	4401	3390
AIR FLOW	(WET)	(8)	lb/hr	27031	24284	18711	14414
FUEL FLOW (60ºF, 14.7 psia)			scfm	351	319	249	192
INLET MANIFOLD PRESSURE		(9)	in Hg(abs)	84.6	76.2	59.1	46.0
EXHAUST TEMPERATURE - ENGINE OUTLET		(10)	°F	909	928	961	981
EXHAUST GAS FLOW (@engine outlet temp, 14.5 psia)	(WET)	(11)	ft3/min	16719	15229	12028	9398
EXHAUST GAS MASS FLOW	(WET)	(11)	lb/hr	27994	25158	19395	14941
MAX INLET RESTRICTION		(12)	in H2O	10.04	8.31	5.07	2.94
MAX EXHAUST RESTRICTION		(12)	in H2O	20.07	16.61	10.13	5.89
EMISSIONS DATA - ENGINE OUT							
NOx (as NO2)		(13)(14)	g/bhp-hr	1.00	1.00	1.00	1.00
CO		(13)(14)	g/bhp-hr	2.36	2.36	2.37	2.38
THC (mol. wt. of 15.84)		(13)(14)	g/bhp-hr	4.82	5.25	6.10	6.80
NMHC (mol. wt. of 15.84)		(13)(14)	g/bhp-hr	0.72	0.79	0.92	1.02
NMNEHC (VOCs) (mol. wt. of 15.84)		(13)(14)(15)	g/bhp-hr	0.48	0.53	0.61	0.68
HCHO (Formaldehyde)		(13)(14)	g/bhp-hr	0.55	0.56	0.60	0.63
CO2		(13)(14)	g/bhp-hr	463	467	482	504
EXHAUST OXYGEN		(13)(16)	% DRY	9.4	9.4	9.3	9.2
HEAT REJECTION							
LHV INPUT		(17)	Btu/min	317738	288428	225772	173886
HEAT REJ. TO JACKET WATER (JW)		(18)	Btu/min	36972	36137	32184	26927
HEAT REJ. TO ATMOSPHERE	(INCLUDES GENERATOR)	(18)	Btu/min	12562	11649	9862	8475
HEAT REJ. TO LUBE OIL (OC)		(18)	Btu/min	9636	9321	8522	7750
HEAT REJECTION TO EXHAUST (LHV TO 248°F)		(18)	Btu/min	81584	75778	61776	48520
HEAT REJ. TO A/C - STAGE 1 (1AC)		(18)(20)	Btu/min	23226	17392	7770	2422
HEAT REJ. TO A/C - STAGE 2 (2AC)		(18)(20)	Btu/min	5529	5053	4063	3267
PUMP POWER		(19)	Btu/min	1549	1549	1549	1549
COOLING SYSTEM SIZING CRITERIA							
TOTAL JACKET WATER CIRCUIT (JW+OC+1AC)		(21)	Btu/min	77708	79888		
TOTAL AFTERCOOLER CIRCUIT (2AC)		(21)	Btu/min	5817	5852		
HEAT REJECTION TO EXHAUST (LHV TO 248°F)		(21)	Btu/min	89743	83355		
A cooling system safety factor of 0% has been added to the cooling system sizing criteria.							
MINIMUM HEAT RECOVERY							
TOTAL JACKET WATER CIRCUIT (JW+OC+1AC)		(22)	Btu/min	63049	56502		
TOTAL AFTERCOOLER CIRCUIT (2AC)		(22)	Btu/min	5253	4801		
HEAT REJECTION TO EXHAUST(LHV TO 248°F)		(22)	Btu/min	72401	64934		

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: Ronnie Tyler, Holt-Cat
Data generated by Gas Engine Rating Pro Version 6.09.01
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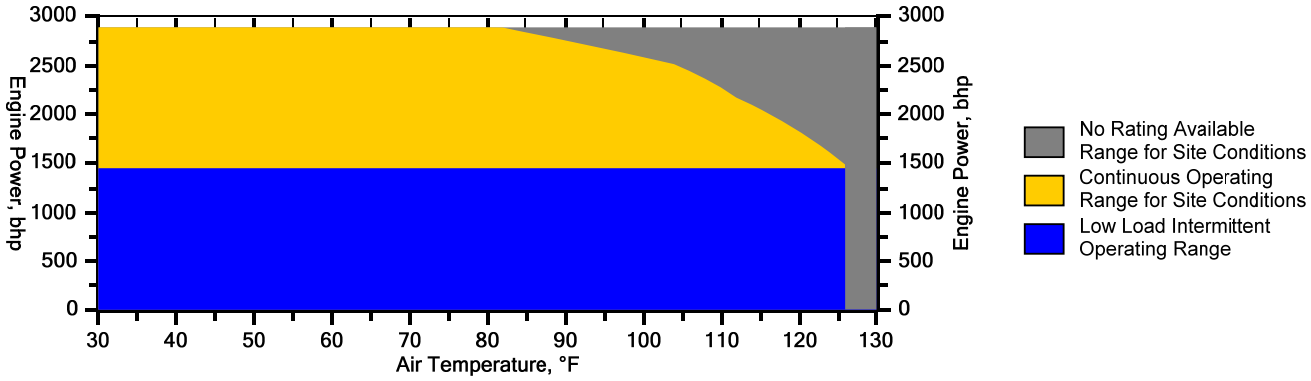
Engine Power vs. Inlet Air Temperature

Data represents temperature sweep at 600 ft and 1800 rpm



NOTES

1. Fuel pressure range specified is to the engine fuel control valve. Additional fuel train components should be considered in pressure and flow calculations.

2. Generator efficiencies, power factor, and voltage are based on specified generator. [Genset Power (ekW) is calculated as: Engine Power (bkW) x Generator Efficiency], [Genset Power (kVA) is calculated as: Engine Power (bkW) x Generator Efficiency / Power Factor]

3. Rating is with two engine driven water pumps. Tolerance is (+)3, (-)0% of full load.

4. Genset Effieciency published in accordance with ISO 3046/1.

5. Thermal Efficiency is calculated based on energy recovery from the jacket water, lube oil, 1st stage aftercooler, and exhaust to 248ºF with engine operation at ISO 3046/1 Genset Efficiency, and assumes unburned fuel is converted in an oxidation catalyst.

6. Total efficiency is calculated as: Genset Efficiency + Thermal Efficiency. Tolerance is ±10% of full load data.

7. ISO 3046/1 Genset fuel consumption tolerance is (+)5, (-)0% at the specified power factor. Nominal genset and engine fuel consumption tolerance is ± 2.5% of full load data at the specified power factor.

8. Air flow value is on a 'wet' basis. Flow is a nominal value with a tolerance of ± 5 %.

9. Inlet manifold pressure is a nominal value with a tolerance of ± 5 %.

10. Exhaust temperature is a nominal value with a tolerance of (+)63°F, (-)54°F.

11. Exhaust flow value is on a "wet" basis. Flow is a nominal value with a tolerance of ± 6 %.

12. 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.

13. Emissions data is at engine exhaust flange prior to any after treatment.

14. NOx tolerance's 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 the maximum values expected under steady state conditions. Fuel methane number cannot vary more than ± 3. THC, NMHC, and NMNEHC do not include aldehydes, adjusted to the specified NOx level at 100% load.

15. VOCs - Volatile organic compounds as defined in US EPA 40 CFR 60, subpart JJJJ

16. Exhaust Oxygen level is the result of adjusting the engine to operate at the specified NOx level. Tolerance is ± 0.5.

17. LHV rate tolerance is ± 2.5%.

18. 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, and ± 5% for aftercooler circuit.

19. Pump power includes engine driven jacket water and aftercooler water pumps. Engine brake power includes effects of pump power.

20. 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.

21. 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) and Oil Cooler (OC) 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

22. 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	92.2700	92.2700
Ethane	C2H6	2.5000	2.5000
Propane	C3H8	0.5000	0.5000
Isobutane	iso-C4H1O	0.0000	0.0000
Norbutane	nor-C4H1O	0.2000	0.2000
Isopentane	iso-C5H12	0.0000	0.0000
Norpentane	nor-C5H12	0.1000	0.1000
Hexane	C6H14	0.0500	0.0500
Heptane	C7H16	0.0000	0.0000
Nitrogen	N2	3.4800	3.4800
Carbon Dioxide	CO2	0.9000	0.9000
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:	Nat Gas
Unit of Measure:	English

Calculated Fuel Properties

Caterpillar Methane Number:	84.7
Lower Heating Value (Btu/scf):	905
Higher Heating Value (Btu/scf):	1004
WOBBE Index (Btu/scf):	1168
THC: Free Inert Ratio:	21.83
Total % Inerts (% N2, CO2, He):	4.38%
RPC (%) (To 905 Btu/scf Fuel):	100%
Compressibility Factor:	0.998
Stoich A/F Ratio (Vol/Vol):	9.45
Stoich A/F Ratio (Mass/Mass):	15.75
Specific Gravity (Relative to Air):	0.600
Fuel Specific Heat Ratio (K):	1.313

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 Gas Engine Rating Pro 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.