

Technical specification

avus 500plus BG | ct135-1



Design:

499 kW el.
400 V / 50 Hz
biogas (50% CH₄, 50% CO₂)
Hi = 4,98 kWh/Nm³
NO_x < 500 mg/Nm³
Exhaust cooling to 180 °C

1 Genset	3
1.1 Engine	3
1.2 Generator (utility planning data)	4
2 Mixture composition	4
2.1 Combustion air	4
2.2 Fuel	5
3 Integrated heat extraction	5
3.1 Heating circuit	5
3.2 Engine circuit	5
3.3 Mixture cooling water circuit - low temperature (LT)	5
4. Exhaust system	6
5 Ventilation	6
6 Operating fluids	6
7 Electronics and software	6
8 Interfaces	7
8.1 Dimensions and weights	7
8.2 Water / gas transfer points	8
8.3 Electrical connections / utility interface	8
8.4 Data interfaces	8
9 Technical boundary conditions	9

Subject to technical changes!

Note: Figure on cover page may differ

1 Genset

	50 %	75 %	91 %	Load
Electrical power	275	413	499	kW ⁽⁵⁾
Recoverable thermal output	311	439	499	kW ⁽²⁾
Energy input	709	1014	1193	kW ⁽¹⁾
Efficiencies electrical	38,8	40,7	41,8	% ⁽¹⁾
Efficiencies thermal	43,9	43,3	41,8	% ^{(1), (2)}
Efficiencies total (el. + th.)	82,6	84,0	83,6	% ^{(1), (2)}
CHP coefficient	0,88	0,94	1,00	^{(1), (2)}
	NOx	CO	HCHO	
Exhaust emissions without catalytic converter	< 500	< 1000	not specified	mg/Nm ³ ^{(4), (6)}
Exhaust emissions with catalytic converter *	< 500	< 300	< 40	mg/Nm ³ ^{(4), (6)}
Engine surface noise **			112,4	dB(A) ⁽⁷⁾
Engine surface noise with sound reducing encapsulation (optional) ***			70	dB(A) ⁽⁷⁾

1.1 Engine

Engine manufacturer	2G		
Engine type	agenitor 412 BG ct135		
Type	V engine		
No. of cylinders	12		
Operating method	4-stroke		
Combustion process	$\lambda > 1$		
Engine displacement	25007	ccm	
Bore	130	mm	
Stroke	157	mm	
RPM	1500	1/min	
ISO standard power (mech.)	569	kW	
compression ratio	14 : 1		
average effective pressure	18,2	bar	
average piston speed	7,9	m/s	
body of balance wheel	SAE 1		
Direction of rotation (based on balance wheel)	left		
tooth rim with number of teeth	137		
Engine dead weight	2150	kg	
Mixture cooling to	50	°C	

* With appropriate catalyst configuration! Reduction of HCHO to < 20 mg/Nm³ available (optional)

** Total sound power level at full engine load in accordance with DIN EN ISO 3746

*** Average sound pressure level under open area conditions at distance of 1 m in accordance with DIN 45635

An increased noise load must be taken into account with fresh air intake from the installation room.

1.2 Generator (utility planning data)

Manufacturer	Leroy Somer	
Type	LSA 49.3 L9 / 4p	
Generator type	Synchronous, directly coupled	
Voltage regulator (AVR)	D510C	
Rated speed	1500	1/min
Frequency	50	Hz
mechanical fuel shutoff	517	kW
Effective electrical power	499	kW
Apparent electrical power (cos φ 1.0 / cos φ 0.9)	499 / 554	kVA
Rated generator current (cos φ 1.0 / cos φ 0.9)	720 / 800	A
Rated generator voltage (\pm 10 %)	400	V
Subtransient reactance X"d	9,7	%
Short-circuit current I _k "3	10,26	kA
Power factor cos φ (inductive / capacitive)	0,9 / 0,9	
Generator circuit breaker	1000	A
Additional section switch (VDE-AR-N 4105)	1000	A
Efficiency (full load) at Cos φ = 1	96,6	%
Mass moment of inertia	10,58	kg · m ²
Ambient air temperature	40	°C
Stator circuit	star	
Protection class	IP 23	
Generator weight	1829	kg
Compensation	not available	
Engine startup	not available	

2 Mixture composition

2.1 Combustion air

Combustion air mass flow	2420	kg/h
Combustion air volume flow (25 °C, 1013 mbar)	2044	m ³ /h

2.2 Fuel

Fuel requirements in accordance with 'TA-004 Gas'

Reference methane number - minimum methane number	150 / 135	
Combustible mass flow	322,6	kg/h ⁽¹⁾
Combustible volume flow	239,4	Nm ³ /h ^{(6), (1)}
Gas pressure at rated load min. *	30	mbar
Gas flow pressure at rated load max. *	70	mbar
Gas regulation line safety pressure	500	mbar

* At the inlet to the gas regulation line

3 Integrated heat extraction

3.1 Heating circuit

Heating water requirements in accordance with 'TA-002 Heating circuit'

Heating water volume flow ($\Delta t = 20 \text{ K}$)	21,4	m ³ /h
Heating water return temperature (max)	70	°C
Heating water flow temperature (max) **	90	°C ⁽⁸⁾
Safety valve	6	bar
Operating pressure (min.)	1	bar
Internal pressure loss in heating circuit (approx.) *	400	mbar
Pressure reserve ca. *	500	mbar

3.2 Engine circuit

Coolant requirements in accordance with 'TA-001 Coolant'

Coolant heat	210	kW ⁽²⁾
Engine inflow temperature (min.)	80	°C
Engine exit temperature (max.)	88	°C
Balance inflow / exit (max.)	6	K
Recirculated coolant quantity (min.)	35,1	m ³ /h
Total cooling water circulation volume	62,6	m ³ /h
Operating pressure (max.)	2	bar
Operating pressure (min.)	1	bar
Safety valve	3,0	bar
Emergency cooling circuit Pressure reserve ca. (optional) *	250	mbar
Safety temperature limiter	110	°C
Mixture heat high temperature circuit (HT)	83	kW ⁽²⁾
Mixture coolant, inflow temperature high temperature circuit (max.)	82	°C
Mixture coolant recirculated quantity high temperature circuit (min.)	27,5	m ³ /h

3.3 Mixture cooling water circuit - low temperature (LT)

Coolant requirements in accordance with 'TA-001 Coolant'

Mixture heat low temperature circuit (LT)	39	kW ⁽²⁾
Mixture coolant, inflow temperature low temperature circuit	38	°C
Mixture cooling water outlet temperature LT	41	°C
Mixture coolant recirculated quantity low temperature circuit (min.)	13,1	m ³ /h
Safety valve	3	bar
Operating pressure (min.)	1	bar
Pressure reserve ca. *	500	mbar

* Up to / from module interface

** Heating water supply temperature max. in partial load operation < 90 °C

4. Exhaust system

Exhaust gas temperature downstream of turbine	421	°C ⁽³⁾
Exhaust temperature after exhaust heat exchanger	180	°C ⁽³⁾
Exhaust gas heat	206	kW ⁽²⁾
exhaust gas volume flow wet	2097	Nm ³ /h ⁽⁶⁾
exhaust gas volume flow dry	1871	Nm ³ /h ⁽⁶⁾
exhaust gas mass flow wet	2743	kg/h
exhaust gas mass flow dry	2550	kg/h
Exhaust back pressure downstream of turbine max.	50	mbar
Pressure reserve approx. (with catalytic converter) *	29 (24)	mbar
Exhaust outlet noise **	130	dB ⁽⁷⁾

5 Ventilation

radiant heat of module (approx.)	80	kW
Supply air volume flow min. (at $\Delta t = 15$ K)	18239	m ³ /h

6 Operating fluids

Lubricating oil approvals, see 'TA-003 Lubricating oil'

Lubrication oil consumption (max.)	0,20	g/kWh
Filling capacity lubricant (max.)	90	l
Lubricating oil filling tank fill capacity (optional)	190	l
Lubricating oil volume auxiliary tank (optional)	190	l
Motor circuit coolant fill quantity approx. (module)	172	l
Mixture cooling circuit LT coolant fill quantity approx. (module)	26	l

Coolant approvals, see 'TA-001 Coolant'

7 Electronics and software

Grid protection device	Deif GPC 2G	
Grid protection software status	> 13414	
Touchscreen display	10	"
Approval (depending on version)	BDEW / VDE-AR-N 4105	
Protection class Control cabinet	IP 54	
Protection class Power switch cabinet	IP 54	
Switch cabinet environmental temperature	0 - 35	°C
Switch cabinet relative air humidity (max.)	65	%

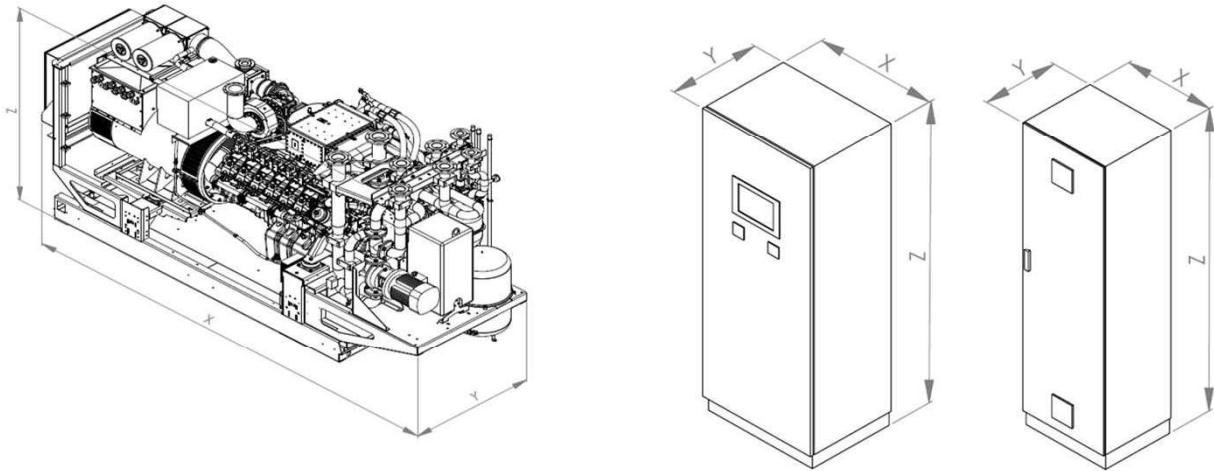
* From module interface (exhaust heat exchanger / catalytic converter in standard version and new condition)

** Total sound power level at full engine load in accordance with DIN 45635-11 Annex A

8 Interfaces

8.1 Dimensions and weights

(Figures may differ)



Length Module *	X	4545	mm
Width Module *	Y	1310	mm
Height Module *	Z	2200	mm
Weight Module (without operating fluids)		6150	kg
Weight Module with sound reducing encapsulation (optional)		7550	kg
Powder-coated CHP frame		RAL 6002	
Width Control cabinet	X	800	mm
Depth Control cabinet	Y	600	mm
Height Control cabinet	Z	2000	mm
Weight Control cabinet		200	kg
Control cabinet powder coated		RAL 7035	
Width Power switch cabinet	X	600	mm
Depth Power switch cabinet	Y	600	mm
Height Power switch cabinet	Z	2000	mm
Weight Power switch cabinet		150	kg
Power switch cabinet powder coated		RAL 7035	

*

8.2 Water / gas transfer points

Interfaces Gas	80 / 10	DN / PN
Interfaces Exhaust	125 / 10	DN / PN
Interfaces Heating circuit	80 / 16	DN / PN
Interfaces Emergency cooling circuit	80 / 16	DN / PN
Interfaces Mixture cooling circuit LT	50 / 16	DN / PN

8.3 Electrical connections / utility interface

Grid connection with pre-fuse (customer-provided)	400 V / 50 Hz	
Grid system	TN-S	
Short-circuit proof I _{cc} (max.)	50	kA

8.4 Data interfaces

Remote maintenance access (optional) *	DSL / UMTS (SIM)
Interfaces / Data interfaces (optional):	<ul style="list-style-type: none"> - Profibus DP - Profinet IO - Modbus RTU - Modbus TCP - Ethernet IP - Hardware signals
Access virtual power plant (optional)	Possible after technical clarification (bus or hardware signals)

* Access for remote maintenance must be provided by the customer

9 Technical boundary conditions

Unless otherwise specified, all data is based on full engine load with the respective indicated media temperatures and subject to technical improvements. The generator output measured at the generator terminals serves as the basis for the delivered electrical power. All power and efficiency specifications are gross specifications. The fuel gas quality must conform to the specifications of 'TA-004 Gas'. The operating fluids and plant system layout must conform to the 'Technical instructions' of 2G.

- (1) Performance conditions in accordance with DIN ISO 3046. Tolerance for specific fuel use amounts to + 5% of nominal performance. Efficiency specifications are based on an engine in new condition. An abatement in efficiency over the service life is reduced with observance of the maintenance requirements.
- (2) The tolerance for usable heat output is +/- 8 % under normal load.
- (3) Data according to new condition.
The tolerance for the exhaust temperature is +/- 8 %.
- (4) Corresponding to a residual oxygen concentration in the exhaust of 5 %
- (5) Electrical generator terminal power at $\cos \varphi = 1$.
- (6) Volume specifications for normal status:

Pressure	1013 mbar
Temperature	0 °C
- (7) Standard deviation of reproducibility 4 dB in accordance with DIN EN ISO 3746
- (8) The tolerance for the Heating water flow temperature is +/- 1 °C.

Power specifications in this document relate to standard reference conditions.

Standard reference conditions in accordance with DIN ISO 3046-1:

Air pressure	1000 mbar
Air temperature	25 °C
Relative air humidity	30 %

Power reduction

Power reduction due to installation at altitude > 300m a.s.l. and/or air suction temperature > 25°C shall be determined specifically for each project according "TI-049 Load reduction".