

Technical specification

g-box 50plus BG mager | asl135-1
techn. data prognosticated



Design:

50 kW el.
400 V / 50 Hz
biogas (50% CH₄, 50% CO₂)
Hi = 4,98 kWh/Nm³
NO_x 0,5 g/Nm³
Exhaust cooling to 180 °C

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Subject to technical changes!

Note: Figure on cover page may differ

1 Genset

1.1 General power data	50 %	75 %	100 %	Load
Electrical power	25	38	50	kW ⁽⁵⁾
Recoverable thermal output	53	68	78	kW ^{(2), (8)}
Energy input	92	117	144	kW ⁽¹⁾
Efficiencies electrical	27,1	32,1	34,8	% ⁽¹⁾
Efficiencies thermal	58,0	58,2	54,7	% ^{(1), (2), (8)}
Efficiencies total (el. + th.)	85,1	90,3	89,5	% ^{(1), (2)}
CHP coefficient	0,47	0,55	0,64	^{(1), (2)}

1.2 Emissions exhaust * gas & sound

	with catalytic converter	w/o exhaust aftertreatment	
NOx	< 0,5	< 0,50	g/Nm ³ ^{(4), (6)}
CO	< 0,50	< 1,0	g/Nm ³ ^{(4), (6)}
HCHO	< 5	< 60	mg/Nm ³ ^{(4), (6)}
THC (as total carbon)	< 1,30	k.A.	g/Nm ³ ^{(4), (6)}
Engine surface noise**		80	dB(A) ⁽⁷⁾
Exhaust outlet noise after primary muffler **		84	dB ⁽⁷⁾

1.3 Engine

Engine manufacturer	Liebherr	
Engine type	G 924 NA	
Type / No. of cylinders	row / 4	
Operating method	4-stroke	
Combustion process	$\lambda > 1$	
Engine displacement	6640	ccm
Bore / Stroke	122 / 142	mm
RPM	1500	1/min
ISO standard power (mech.)	60	kW
compression ratio	15 : 1	
average effective pressure	7,2	bar
average piston speed	7,1	m/s
body of balance wheel	SAE 2	
Direction of rotation (based on balance wheel)	left	
tooth rim with number of teeth	147	
Engine dead weight	640	kg
Mixture cooling to	Nicht vorhanden	
		°C

* With appropriate catalyst configuration!

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

1.4 Generator (utility planning data)

Manufacturer	Leroy Somer	
Type	LSAH 44.3 M6	
Generator type	Synchronous, directly coupled	
Voltage regulator (AVR)	D510	
Rated speed	1500	1/min
Frequency	50	Hz
mechanical fuel shutoff	52	kW
Effective electrical power	50,0	kW
Apparent electrical power (cos φ 1.0 / cos φ 0.9)	50 / 55,6	kVA
Rated generator current (cos φ 1.0 / cos φ 0.9)	72 / 80	A
Rated generator voltage (\pm 10 %)	400	V
Cooling water inlet/outlet temperature (max.)	70 / 75	$^{\circ}$ C
Short-circuit current $I_k^{(3)}$	1,15	kA
Power factor cos φ (inductive / capacitive)	0,9 / 0,9	
Generator circuit breaker	100	A
Efficiency (full load) at Cos φ = 1	96,9	%
Mass moment of inertia	1,098	kg \cdot m ²
Ambient air temperature	80	$^{\circ}$ C
Stator circuit	star	
Protection class	IP 44	
Generator weight	580	kg
Compensation	not available	
Engine startup	not available	

2 Mixture composition

2.1 Combustion air

Combustion air mass flow	237	kg/h
Combustion air volume flow (25 $^{\circ}$ C, 1013 mbar)	200	m ³ /h

2.2 Fuel

Fuel requirements in accordance with 'TA-004 Gas'

Reference methane number - minimum methane number	150 / 135	
Fuel mass flow	38,8	kg/h ⁽¹⁾
Fuel volume flow	28,8	Nm ³ /h ^{(6), (1)}
Min. gas pressure at nom. Output *	30	mbar
Max. gas pressure at nom. Output *	100	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 ($\Delta t = 20$ K)	3 - 10	m ³ /h
Heating water return temperature (max) *	70	°C
Heating water flow temperature (max) **	85	°C
Safety valve	6	bar
Operating pressure (min.)	1	bar
Generator heat / Exhaust gas heat	1,6 / 8,3	kW
Pressure reserve ca. *	500	mbar

3.2 Engine circuit

Coolant requirements in accordance with 'TA-001 Coolant'

Coolant heat (Engine & Exhaust)	69	kW ⁽²⁾
Engine inflow temperature (min.)	83	°C
Engine exit temperature (max.)	90	°C
Balance inflow / exit (max.)	5	K
Recirculated coolant quantity (min.)	13,7	m ³ /h
Total cooling water circulation volume	13,7	m ³ /h
Operating pressure (max.)	2	bar
Operating pressure (min.)	1	bar
Safety valve	2,5	bar

* Up to / from module interface

** depending on the design of the heating circuit pump group, information applies to design by 2G. Heating water supply temperature max., in partial load operation < 85 °C.

4. Exhaust system

Exhaust gas temperature downstream of engine	552	°C ⁽³⁾
Exhaust temperature upstream of / after exhaust heat exchanger	277 / 180	°C ⁽³⁾
Exhaust gas heat (exhaust heat exchanger)	8	kW ⁽²⁾
exhaust gas volume flow wet	210	Nm ³ /h ⁽⁶⁾
exhaust gas volume flow dry	183	Nm ³ /h ⁽⁶⁾
exhaust gas mass flow wet	276	kg/h
exhaust gas mass flow dry	252	kg/h
Exhaust back pressure downstream of engine	80	mbar
Pressure reserve approx. (with catalytic converter) *	15	mbar
Safety temperature limiter	100	°C

5 Sound reducing encapsulation

sound encapsulation temperature (max.)	50	°C
sound pressure level ***	75	dB(A)

6 Operating fluids

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

Lubrication oil consumption (Ø / max.)	0,15 / 0,3	g/kWh
Filling capacity lubricant (max.)	18,5	l
Lubricating oil filling tank fill capacity (optional)		
Lubricating oil volume auxiliary tank (optional)	100	l
Motor circuit coolant fill quantity approx. (module)	44	l

Coolant approvals, see 'TA-001 Coolant'

7 Electronics and software

Grid protection device	Bachmann GSP	
Grid protection software status	> C02_201746D_01	
Touchscreen display	7	"
Approval (depending on version)	VDE-AR-N 4105 / VDE-AR-N 4110	
Protection class Control cabinet	IP 54	
Protection class Power switch cabinet	/	
Switch cabinet environmental temperature	0 - 35	°C
Switch cabinet relative air humidity (max.)	65	%

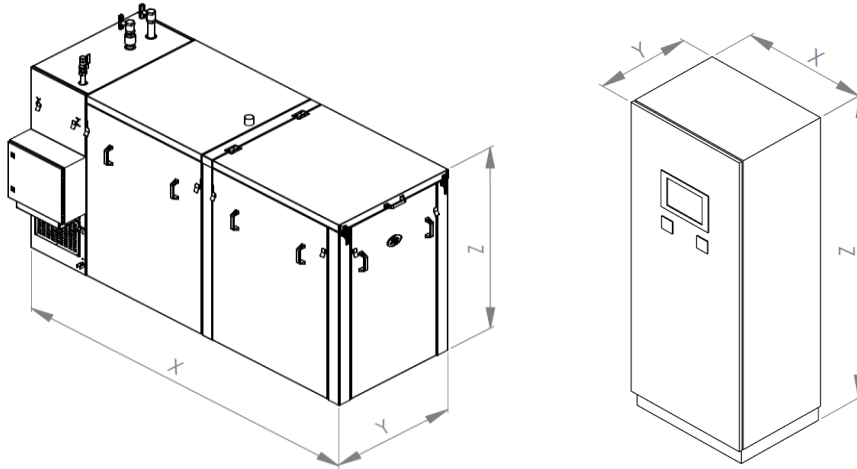
* From module interface (exhaust heat exchanger / catalytic converter in standard version and new condition)

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

8 Interfaces

8.1 Dimensions and weights

(Figures may differ)



Length Module *	X	2800	mm
Width Module *	Y	990	mm
Height Module *	Z	1600	mm
Weight Module (without operating fluids)		1740	kg
Weight Module with sound encapsulation		2370	kg
Powder-coated CHP frame		RAL 6002	
Width Control cabinet	X	800	mm
Depth Control cabinet	Y	500	mm
Height Control cabinet	Z	1910	mm
Weight Control cabinet		150	kg
Control cabinet powder coated		RAL 7035	

*

8.2 Water / gas transfer points

Interfaces Gas	1	"
Interfaces Exhaust	65 / 10	mm
Interfaces Heating circuit	1 1/2	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):	-	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. The specified efficiency is based on a heating circuit supply temperature of 90°C. The efficiency may vary for variants with higher heating circuit supply temperatures.
- (2) The tolerance for 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 ISO 3046-1:

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

Power reduction

Power reduction due to installation at altitude > 100 m a.s.l. and/or air suction temperature > 25 °C shall be determined specifically for each project according "TI-049 Load reduction".

(*) Operation with up to 40% hydrogen possible. Depending on the hydrogen content, a conversion may be necessary.