

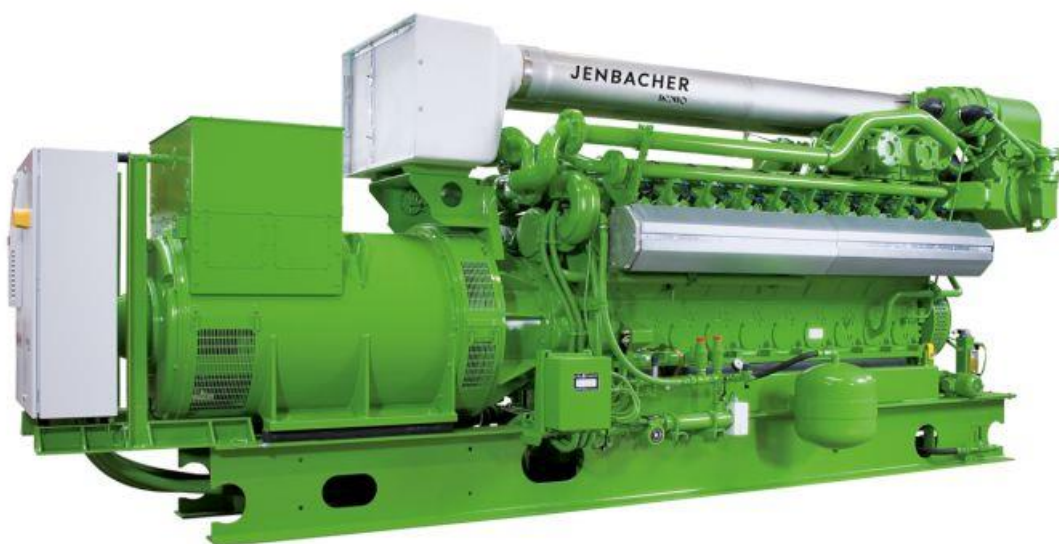
Technical Description

Genset

JGS 320 GS-B.L

no special Grid Code

BG 2021-1



Electrical output 1063 kW el.

Emission values

NO_x < 500 mg/Nm³ (5% O₂) | < 190 mg/Nm³ (15% O₂)

0.01 Technical Data (at genset)

			100%	75%	50%
Power input	[2]	kW	2,622	2,015	1,421
Gas volume	*)	Nm ³ /h	477	366	258
Mechanical output	[1]	kW	1,095	821	548
Electrical output	[4]	kW el.	1,063	796	529
Heat to be dissipated (calculated with Glykol 37%)					
~ Intercooler 1st stage (Engine jacket water cooling circuit)	[9]	kW	187	84	19
~ Intercooler 2nd stage (Low temperature circuit)		kW	81	54	32
~ Lube oil (Engine jacket water cooling circuit)		kW	126	99	86
~ Jacket water		kW	345	310	263
~ Surface heat	ca. [7]	kW	90	~	~
Spec. fuel consumption of engine electric	[2]	kWh/kWel. h	2.47	2.53	2.69
Spec. fuel consumption of engine	[2]	kWh/kWh	2.40	2.45	2.59
Lube oil consumption	ca. [3]	kg/h	0.33	~	~
Electrical efficiency			40.6%	39.5%	37.2%
Fuel gas LHV		kWh/Nm ³	5.5		

*) approximate value for pipework dimensioning

[] Explanations: see 0.10 - Technical parameters

All heat data is based on standard conditions according to attachment 0.10. Deviations from the standard conditions can result in a change of values within the heat balance and must be taken into consideration in the layout of the cooling circuit/equipment (intercooler; emergency cooling; ...). In the specifications in addition to the general tolerance of $\pm 8\%$ on the thermal output a further reserve of $+5\%$ is recommended for the dimensioning of the cooling requirements.

Main dimensions and weights (at genset)

Length	mm	~ 5,700
Width	mm	~ 1,700
Height	mm	~ 2,300
Weight empty	kg	~ 13,600
Weight filled	kg	~ 14,100

Connections

Jacket water inlet and outlet	DN/PN	80/10
Exhaust gas outlet [C]	DN/PN	250/10
Fuel Gas (at genset) [D]	DN/PN	80/16
Water drain ISO 228	G	½"
Condensate drain	mm	~
Safety valve - jacket water ISO 228 [G]	DN/PN	1½"/2,5
Lube oil replenishing (pipe) [I]	mm	28
Lube oil drain (pipe) [J]	mm	28
Jacket water - filling (flex pipe) [L]	mm	13
Intercooler water-Inlet/Outlet 1st stage	DN/PN	80/10
Intercooler water-Inlet/Outlet 2nd stage [M/N]	DN/PN	65/10

Output / fuel consumption

ISO standard fuel stop power ICFN	kW	1,095
Mean effe. press. at stand. power and nom. speed	bar	18.00
Fuel gas type		Biogas
Based on methane number Min. methane number	MZ	135 117 d)
Compression ratio	Epsilon	12.5
Min./Max. fuel gas pressure at inlet to gas train	mbar	80 - 200 c)
Max. rate of gas pressure fluctuation	mbar/sec	10
Maximum Intercooler 2nd stage inlet water temperature	°C	50
Spec. fuel consumption of engine	kWh/kWh	2.40
Specific lube oil consumption	g/kWh	0.30
Max. Oil temperature	°C	90
Jacket-water temperature max.	°C	95
Filling capacity lube oil (refill)	lit	~ 342

c) Lower gas pressures upon inquiry

d) based on methane number calculation software AVL 3.2

0.02 Technical data of engine

Manufacturer		JENBACHER
Engine type		J 320 GS-D25
Working principle		4-Stroke
Configuration		V 70°
No. of cylinders		20
Bore	mm	135
Stroke	mm	170
Piston displacement	lit	48.67
Nominal speed	rpm	1,500
Mean piston speed	m/s	8.50
Length	mm	3,320
Width	mm	1,358
Height	mm	2,065
Weight dry	kg	5,200
Weight filled	kg	5,700
Moment of inertia	kgm ²	8.61
Direction of rotation (from flywheel view)		left
Radio interference level to VDE 0875		N
Starter motor output	kW	7
Starter motor voltage	V	24

Thermal energy balance

Power input	kW	2,622
Intercooler	kW	268
Lube oil	kW	126
Jacket water	kW	345
Exhaust gas cooled to 180 °C	kW	506
Exhaust gas cooled to 100 °C	kW	642
Surface heat	kW	48

Exhaust gas data

Exhaust gas temperature at full load	[8]	°C	465
Exhaust gas temperature at bmep= 13.5 [bar]		°C	~ 494
Exhaust gas temperature at bmep= 9 [bar]		°C	~ 512
Exhaust gas mass flow rate, wet		kg/h	5,657
Exhaust gas mass flow rate, dry		kg/h	5,250
Exhaust gas volume, wet		Nm ³ /h	4,420
Exhaust gas volume, dry		Nm ³ /h	3,913
Max.admissible exhaust back pressure after engine		mbar	60

Combustion air data

Combustion air mass flow rate		kg/h	5,208
Combustion air volume		Nm ³ /h	4,030
Max. admissible pressure drop at air-intake filter		mbar	10

basis for exhaust gas data: natural gas: 100% CH₄; biogas 65% CH₄, 35% CO₂

Sound pressure level

Aggregate a)		dB(A) re 20 μ Pa	96
31,5	Hz	dB	78
63	Hz	dB	90
125	Hz	dB	92
250	Hz	dB	89
500	Hz	dB	92
1000	Hz	dB	90
2000	Hz	dB	89
4000	Hz	dB	87
8000	Hz	dB	90
Exhaust gas b)		dB(A) re 20 μ Pa	122
31,5	Hz	dB	97
63	Hz	dB	108
125	Hz	dB	118
250	Hz	dB	110
500	Hz	dB	113
1000	Hz	dB	114
2000	Hz	dB	117
4000	Hz	dB	115
8000	Hz	dB	114

Sound power level

Aggregate	dB(A) re 1pW	117
Measurement surface	m ²	120
Exhaust gas	dB(A) re 1pW	130
Measurement surface	m ²	6.28

a) average sound pressure level on measurement surface in a distance of 1m (converted to free field) according to DIN 45635, precision class 3.

b) average sound pressure level on measurement surface in a distance of 1m according to DIN 45635, precision class 2.

The spectra are valid for aggregates up to bmep=18 bar. (for higher bmep add safety margin of 1dB to all values per increase of 1 bar pressure).

Engine tolerance \pm 3 dB

0.03 Technical data of generator

Manufacturer		Leroy-Somer e)
Type		LSA 50.2 VL10 e)
Type rating	kVA	1,317
Driving power	kW	1,095
Ratings at p.f. = 1,0	kW	1,063
Ratings at p.f. = 0.8	kW	1,053
Rated output at p.f. = 0.8	kVA	1,316
Rated reactive power at p.f. = 0.8	kVar	790
Rated current at p.f. = 0.8	A	1,900
Frequency	Hz	50
Voltage	V	400
Speed	rpm	1,500
Permissible overspeed	rpm	1,800
Power factor (lagging - leading) (UN)		0,8 - 1,0
Efficiency at p.f. = 1,0		97.1%
Efficiency at p.f. = 0.8		96.2%
Moment of inertia	kgm ²	26.33
Mass	kg	3,300
Radio interference level to EN 55011 Class A (EN 61000-6-4)		N
Cable outlet		left
I _k " Initial symmetrical short-circuit current	kA	17.24
I _s Peak current	kA	43.88
Insulation class		H
Temperature (rise at driving power)		F
Maximum ambient temperature	°C	40

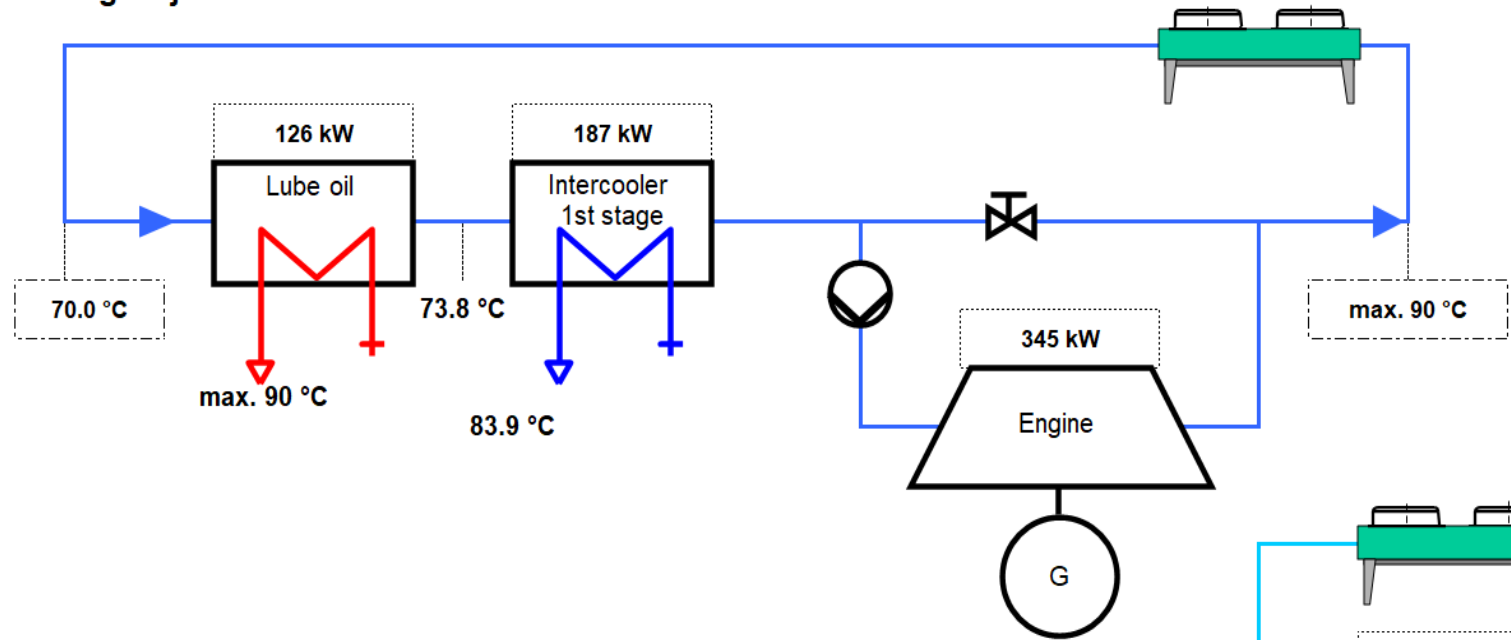
Reactance and time constants (saturated) at rated output

x _d direct axis synchronous reactance	p.u.	2.428
x _d ' direct axis transient reactance	p.u.	0.180
x _d " direct axis sub transient reactance	p.u.	0.109
x ₂ negative sequence reactance	p.u.	0.095
T _d " sub transient reactance time constant	ms	20
T _a Time constant direct-current	ms	30
T _{do} ' open circuit field time constant	s	4.06

e) JENBACHER reserves the right to change the generator supplier and the generator type. The contractual data of the generator may thereby change slightly. The contractual produced electrical power will not change.

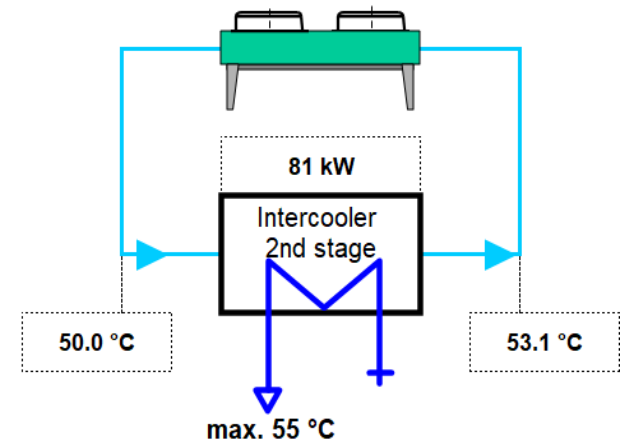
Engine jacket water cooling circuit (calculated with Glykol 37%)

Heat to be dissipated = 658 kW
 (±8 % tolerance +5 % reserve for cooling requirements)
 Engine jacket water flow rate = 31.7 m³/h



Low temperature circuit (calculated with Glykol 37%)

Heat to be dissipated = 81 kW
 (±8 % tolerance +5 % reserve for cooling requirements)
 Cooling water flow rate = 25.0 m³/h



0.05 Cooling water circuit

Oil - heat (Engine jacket water cooling circuit)

Nominal output	kW	126
Max. Oil temperature	°C	90
Loss of nominal pressure of engine jacket water	bar	0.20
Safety valve - max press. set point	bar	2.50

Engine jacket water - heat (Engine jacket water cooling circuit)

Nominal output	kW	345
Max. engine jacket water temperature (outlet engine)	°C	90
Engine jacket water flow rate	m³/h	31.7
Safety valve - max press. set point	bar	2.50

Mixture Intercooler (1st stage) (Engine jacket water cooling circuit)

Nominal output	kW	187
Max. inlet cooling water temp. (intercooler)	°C	73.8
Nominal pressure of cooling water / (max. operating pressure)	PN	10
Loss of nominal pressure of engine jacket water	bar	0.40
Safety valve - max press. set point	bar	2.50

Mixture Intercooler (2nd stage) (Low temperature circuit)

Nominal output	kW	81
Max. inlet cooling water temp. (intercooler)	°C	50
Aftercooler water flow rate	m³/h	25.0
Nominal pressure of cooling water / (max. operating pressure)	PN	10
Intercooler water pressure drop	bar	0.20
Safety valve - max press. set point	bar	2.50

The final pressure drop will be given after final order clarification and must be taken from the P&ID order documentation.

0.10 Technical parameters

All data in the technical specification are based on engine full load (unless stated otherwise) at specified temperatures and the methane number and subject to technical development and modifications.

All pressure indications are to be measured and read with pressure gauges (psi.g.).

[1] At nominal speed and standard reference conditions ICFN according to ISO 3046-1, respectively

[2] According to ISO 3046-1, respectively, with a tolerance of **+5 %**.

Efficiency performance is based on a new unit (immediately upon commissioning). Effects of degradation during normal operation can be mitigated through regular service and maintenance work.

reference value --> 65%CH4 / 35%CO2

[3] Average value between oil change intervals according to maintenance schedule, without oil change amount

[4] At p. f. = 1.0 according to VDE 0530 REM / IEC 34.1 with relative tolerances, all direct driven pumps are included

[5] Total output with a tolerance of $\pm 8 \%$

[6] According to above parameters [1] through [5]

[7] As a guiding value at p.f. 0.8 and only valid for (engine, generator, TCM). Other peripheral equipment is not considered.

[8] Exhaust temperature with a tolerance of $\pm 8 \%$

[9] Intercooler heat on:

* **standard conditions** - If the turbocharger design is done for air intake temperature $> 30^{\circ}\text{C}$ w/o de-rating, the intercooler heat of the 1st stage need to be increased by $2\%/^{\circ}\text{C}$ starting from 25°C .

Deviations between $25 - 30^{\circ}\text{C}$ will be covered with the standard tolerance.

* **Hot Country application (V1xx)** - If the turbocharger design is done for air intake temperature $> 40^{\circ}\text{C}$ w/o de-rating, the intercooler heat of the 1st stage need to be increased by $2\%/^{\circ}\text{C}$ starting from 35°C . Deviations between $35 - 40^{\circ}\text{C}$ will be covered with the standard tolerance.

Radio interference level

The ignition system of the gas engines complies the radio interference levels of CISPR 12 and EN 55011 class B, (30-75 MHz, 75-400 MHz, 400-1000 MHz) and (30-230 MHz, 230-1000 MHz), respectively.

Definition of output

- ISO-ICFN continuous rated power:

Net break power that the engine manufacturer declares an engine is capable of delivering continuously, at stated speed, between the normal maintenance intervals and overhauls as required by the manufacturer. Power determined under the operating conditions of the manufacturer's test bench and adjusted to the standard reference conditions.

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Standard reference conditions:

Barometric pressure: 1000 mbar (14.5 psi) or 100 m (328 ft) above sea level
Air temperature: 25°C (77°F) or 298 K
Relative humidity: 30 %

- Volume values at standard conditions (fuel gas, combustion air, exhaust gas)
Pressure: 1013 mbar (14.7 psi)
Temperature: 0°C (32°F) or 273 K

Loss of engine performance

a) Performance reduction due to gas quality

If the reference methane number is not reached and the knock control responds, the ignition timing at full performance is adjusted in conjunction with the engine management system; only then is performance reduced.

H₂ admixtures in the range of 3–5 Vol% into the natural gas network are generally regarded as non-critical. Prerequisites for this are rates of change according to TA 1000-0300, as well as the knock resistance (minimum methane number) of the natural gas-H₂ mixture according to the specification. For reliable compliance with required NO_x emissions, the JENBACHER LEANOX^{plus} control is recommended (measurement of NO_x emissions and correction of the LEANOX controller). Higher H₂ addition rates into the natural gas network must be assessed on a project-specific basis.

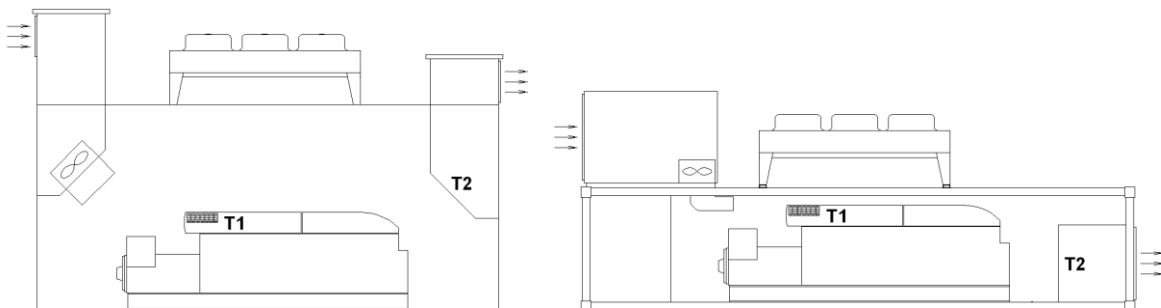
b) Performance reduction due to voltage and frequency limits

If the voltage and frequency limits for generators specified in IEC 60034-1 Zone A are exceeded, performance is reduced.

c) Performance reduction due to environmental conditions

Standard rating of the engines is for an installation at an altitude ≤ 500 m and combustion air temperature ≤ 30 °C (T₁)

Engine room outlet temperature: 50°C (T₂) -> engine stop



The minimum recommended air change ratio (C) must be observed to maintain the required air quality and prevent unwanted gas accumulations (refer to Section ⇒ Potentially explosive Atmospheres as per TA1100-0110). The calculation is based on TA 1100-0110 and is $C_{\min} = 50h^{-1}$ for JENBACHER modules.

Parameters for the operation of JENBACHER gas engines

The genset fulfils the limits for mechanical vibrations according to ISO 8528-9.

The following forms an integral part of a contract and must be strictly observed: **TA 1000-0004, TA 1100 0110, TA 1100-0111, and TA 1100-0112.**

Transport by rail should be avoided. See **TA 1000-0046** for further details

Failure to adhere to the requirements of the above-mentioned TA documents can lead to engine damage and may result in loss of warranty coverage.

Parameters for the operation of control unit and the electrical equipment

Relative humidity 50% by maximum temperature of 40°C.

Altitude up to 2000m above the sea level.

Parameters for using a gas compressor

The gas quantity indicated under the technical data refers to standard conditions with the given calorific value. The actual volume flow (under operating conditions) has to be considered for dimensioning the gas compressor and each gas feeding component – it will be affected by:

- Actual gas temperature (limiting temperature according to **TA 1000-0300**)
- Gas humidity (limiting value according to **TA 1000-0300**)
- Gas Pressure
- Calorific value variations (can be equated with methane (CH₄) variations in the case of biogas)
- The gas compressor is designed for a max. relative under pressure of 15 mbar(g) (0.22 psi) and a inlet temperature of 40°C (104°F) , if within scope of supply JENBACHER.