



11/2018

Technical Description

Genset

JGS 420 GS-S.L

no special Grid Code

PRJ-10



Electrical output 1411 kW el.

Emission values

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



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0.01 Technical Data (at genset)

			100%	75%	50%
Power input	[2]	kW	3.457	2.680	1.903
Gas volume	*)	Nm ³ /h	300	233	166
Mechanical output	[1]	kW	1.466	1.100	733
Electrical output	[4]	kW el.	1.411	1.054	692
Heat to be dissipated (calculated with Glykol 50%)					
~ Intercooler 1st stage (Engine jacket water cooling circuit)	[9]	kW	267	118	16
~ Intercooler 2nd stage (Low temperature circuit)		kW	95	73	53
~ Lube oil (Engine jacket water cooling circuit)		kW	233	205	168
~ Jacket water		kW	414	373	305
~ Surface heat	ca. [7]	kW	104	~	~
Spec. fuel consumption of engine electric	[2]	kWh/kWel.h	2,45	2,54	2,75
Spec. fuel consumption of engine	[2]	kWh/kWh	2,36	2,44	2,60
Lube oil consumption	ca. [3]	kg/h	0,29	~	~
Electrical efficiency			40,8%	39,3%	36,4%
Fuel gas LHV		kWh/Nm ³	11,5		

*) 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	~ 7.100
Width	mm	~ 1.900
Height	mm	~ 2.200
Weight empty	kg	~ 16.800
Weight filled	kg	~ 17.500

Connections

Jacket water inlet and outlet	DN/PN	80/10
Exhaust gas outlet [C]	DN/PN	300/10
Fuel Gas (at genset) [D]	DN/PN	125/16
Water drain ISO 228	G	½"
Condensate drain	mm	~
Safety valve - jacket water ISO 228 [G]	DN/PN	2x1½"/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	1.466
Mean effe. press. at stand. power and nom. speed	bar	16,00
Fuel gas type		Flare gas
Based on methane number Min. methane number	MZ	60 60 d)
Compression ratio	Epsilon	11,8
Min./Max. fuel gas pressure at inlet to gas train	mbar	120 - 200 c)
Max. rate of gas pressure fluctuation	mbar/sec	10
Maximum Intercooler 2nd stage inlet water temperature	°C	40
Spec. fuel consumption of engine	kWh/kWh	2,36
Specific lube oil consumption	g/kWh	0,20
Max. Oil temperature	°C	87
Jacket-water temperature max.	°C	95
Filling capacity lube oil (refill)	lit	~ 437

c) Lower gas pressures upon inquiry

d) based on methane number calculation software AVL 3.2 (calculated without N2 and CO2)



0.02 Technical data of engine

Manufacturer		GE Jenbacher
Engine type		J 420 GS-B91
Working principle		4-Stroke
Configuration		V 70°
No. of cylinders		20
Bore	mm	145
Stroke	mm	185
Piston displacement	lit	61,10
Nominal speed	rpm	1.800
Mean piston speed	m/s	11,10
Length	mm	3.750
Width	mm	1.580
Height	mm	2.033
Weight dry	kg	7.200
Weight filled	kg	7.900
Moment of inertia	kgm ²	11,64
Direction of rotation (from flywheel view)		left
Radio interference level to VDE 0875		N
Starter motor output	kW	13
Starter motor voltage	V	24

Thermal energy balance

Power input	kW	3.457
Intercooler	kW	362
Lube oil	kW	233
Jacket water	kW	414
Exhaust gas cooled to 180 °C	kW	617
Exhaust gas cooled to 100 °C	kW	801
Surface heat	kW	36

Exhaust gas data

Exhaust gas temperature at full load	[8] °C	437
Exhaust gas temperature at bmep= 12 [bar]	°C	~ 463
Exhaust gas temperature at bmep= 8 [bar]	°C	~ 490
Exhaust gas mass flow rate, wet	kg/h	7.710
Exhaust gas mass flow rate, dry	kg/h	7.207
Exhaust gas volume, wet	Nm ³ /h	6.089
Exhaust gas volume, dry	Nm ³ /h	5.464
Max.admissible exhaust back pressure after engine	mbar	60

Combustion air data

Combustion air mass flow rate	kg/h	7.465
Combustion air volume	Nm ³ /h	5.777
Max. admissible pressure drop at air-intake filter	mbar	10



Sound pressure level

Aggregate a)	dB(A) re 20μPa	100
31,5 Hz	dB	82
63 Hz	dB	90
125 Hz	dB	101
250 Hz	dB	98
500 Hz	dB	94
1000 Hz	dB	89
2000 Hz	dB	91
4000 Hz	dB	95
8000 Hz	dB	92
Exhaust gas b)	dB(A) re 20μPa	115
31,5 Hz	dB	95
63 Hz	dB	117
125 Hz	dB	115
250 Hz	dB	113
500 Hz	dB	108
1000 Hz	dB	105
2000 Hz	dB	108
4000 Hz	dB	109
8000 Hz	dB	107

Sound power level

Aggregate	dB(A) re 1pW	120
Measurement surface	m ²	110
Exhaust gas	dB(A) re 1pW	123
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=16 bar. (for higher bmep add safety margin of 1dB to all values per increase of 1 bar pressure).
Engine tolerance ± 3 dB



0.03 Technical data of generator

Manufacturer		AVK e)
Type		DIG 120 h/4 e)
Type rating	kVA	1.900
Driving power	kW	1.466
Ratings at p.f. = 1,0	kW	1.411
Ratings at p.f. = 0,8	kW	1.398
Rated output at p.f. = 0,8	kVA	1.747
Rated reactive power at p.f. = 0,8	kVar	1.048
Rated current at p.f. = 0,8	A	242
Frequency	Hz	60
Voltage	kV	4,16
Speed	rpm	1.800
Permissible overspeed	rpm	2.250
Power factor (lagging - leading)		0,8 - 1,0
Efficiency at p.f. = 1,0		96,3%
Efficiency at p.f. = 0,8		95,3%
Moment of inertia	kgm ²	48,00
Mass	kg	4.900
Radio interference level to EN 55011 Class A (EN 61000-6-4)		N
Cable outlet		left
I _k " Initial symmetrical short-circuit current	kA	1,33
I _s Peak current	kA	3,39
Insulation class		F
Temperature (rise at driving power)		F
Maximum ambient temperature	°C	40

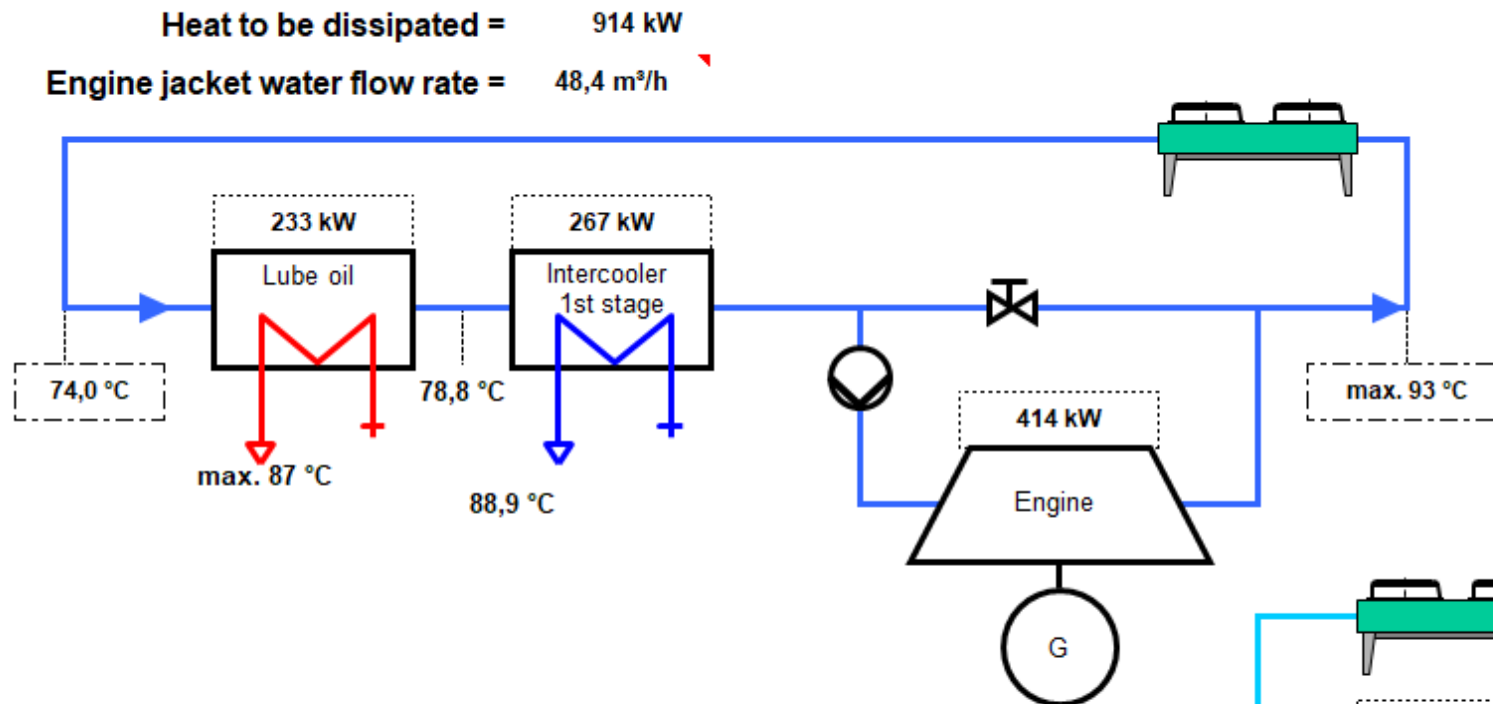
Reactance and time constants (saturated) at rated output

x _d direct axis synchronous reactance	p.u.	1,99
x _d ' direct axis transient reactance	p.u.	0,29
x _d " direct axis sub transient reactance	p.u.	0,18
x ₂ negative sequence reactance	p.u.	0,18
T _d " sub transient reactance time constant	ms	15
T _a Time constant direct-current	ms	50
T _{do} ' open circuit field time constant	s	2,90

e) GE 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.

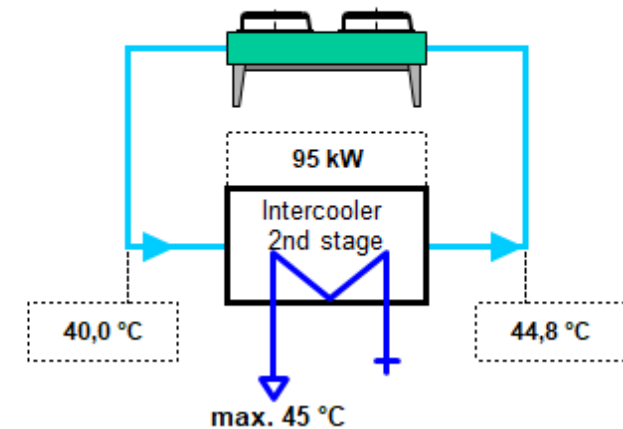
connection variant 1K
PRJ-10 J 420 GS-B91

Engine jacket water cooling circuit (calculated with Glykol 50%)



Low temperature circuit (calculated with Glykol 50%)

Heat to be dissipated = 95 kW
(±8 % tolerance +5 % reserve for cooling requirements)
Cooling water flow rate = 20,0 m³/h





0.05 Cooling water circuit

Oil - heat (Engine jacket water cooling circuit)

Nominal output	kW	233
Max. Oil temperature	°C	87
Loss of nominal pressure of engine jacket water	bar	0,50
Safety valve - max press. set point	bar	2,50

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

Nominal output	kW	414
Max. engine jacket water temperature (outlet engine)	°C	93
Engine jacket water flow rate	m³/h	48,4
Safety valve - max press. set point	bar	2,50

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

Nominal output	kW	267
Max. inlet cooling water temp. (intercooler)	°C	78,8
Nominal pressure of cooling water / (max. operating pressure)	PN	10
Loss of nominal pressure of engine jacket water	bar	0,30
Safety valve - max press. set point	bar	2,50

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

Nominal output	kW	95
Max. inlet cooling water temp. (intercooler)	°C	40
Aftercooler water flow rate	m³/h	20,0
Nominal pressure of cooling water / (max. operating pressure)	PN	10
Intercooler water pressure drop	bar	0,80
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 DIN-ISO 3046 and DIN 6271, respectively
- (2) According to DIN-ISO 3046 and DIN 6271, 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.
- (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) Only valid for engine and generator; module and peripheral equipment not considered (at p. f. = 0,8), (guiding value)
- (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.

- 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)

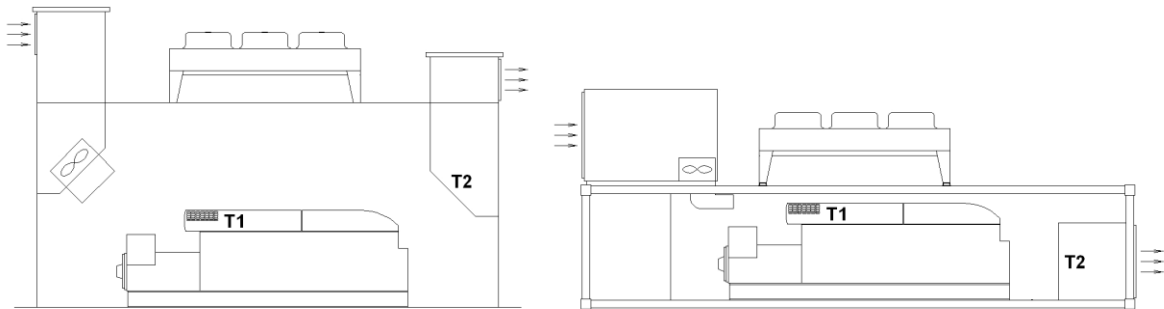
Pressure: 1013 mbar (14.7 psi)

Temperature: 0°C (32°F) or 273 K

Output adjustment for turbo charged engines

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



If the actual methane number is lower than the specified, the knock control responds. First the ignition timing is changed at full rated power. Secondly the rated power is reduced. These functions are carried out by the engine management system.

Exceedance of the voltage and frequency limits for generators according to IEC 60034-1 Zone A will lead to a derate in output.

Parameters for the operation of GE Jenbacher gas engines

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

The following "Technical Instruction of GE JENBACHER" 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.

0.20 Mode of Operation

Grid Parallel Mode

The genset is running in parallel to the utility. The unit load can be adjusted via its power control set point or designated option.

Procedure in the event of mains failure:

When the mains monitor relay (protective relay ANSI No. 27, 59, 81, 78- provided either by GE or the customer) is activated due to a mains failure, the engine is isolated from the mains by opening the generator breaker. The module is shut down without any cool-down run.



Island operation is not available in this case!

The module can be restarted following the restoration of mains power after a 5-minute mains stabilization period.