Technical Description

Cogeneration Unit-Container

JGMC 320 GS-B.L

MT ENEGIE - West Sussex

Electrical output	**1063 kW el.**
Thermal output	**603 kW**

Emission values

NOx < 500 mg/Nm³ (5% O2)

0.01 Technical Data (container)

Data at:				Full load	Part Load	
Fuel gas LHV		kWh/Nm³		5		
				100%	75%	50%
Energy input		kW	[2]	2.606	2.008	1.409
Gas volume		Nm³/h	*)	521	402	282
Mechanical output		kW	[1]	1.095	821	548
Electrical output		kW el.	[4]	1.063	796	528
Recoverable thermal output						
~ Intercooler 1st stage		kW		171	72	13
~ Lube oil		kW		122	93	81
~ Jacket water		kW		310	303	251
Total recoverable thermal output		kW	[5]	603	468	345
Total output generated		kW total		1.666	1.264	873
Heat to be dissipated						
~ Intercooler 2nd stage		kW		88	58	33
~ Surface heat	ca.	kW	[7]	85	61	43
~ Balance heat		kW		26	20	14
Spec. fuel consumption of engine		kWh/kWh	[2]	2,38	2,45	2,57
Lube oil consumption	ca.	kg/h	[3]	0,33	~	~
Electrical efficiency		%		40,8%	39,7%	37,5%
Thermal efficiency		%		23,1%	23,3%	24,5%
Total efficiency		%	[6]	63,9%	63,0%	62,0%
Hot water circuit:						
Forward temperature		°C		90,0	85,5	81,4
Return temperature		°C		70,0	70,0	70,0
Hot water flow rate		m³/h		26,0	26,0	26,0

*) 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 +/- 8% on the thermal output a further reserve of 10% is recommended for the dimensioning of the cooling requirements.

Main dimensions and weights (container)

Length	mm	~ 12.200
Width	mm	~ 2.500
Height	mm	~ 2.600
Weight empty	kg	~ 26.500
Weight filled	kg	~ 28.000

Connections

Jacket water inlet and outlet	DN/PN	80/10
Exhaust gas outlet	DN/PN	250/10
Fuel gas connection (container)	mm	150/16
Fresh oil connection	G	28x2"
Waste oil connection	G	28x2"
Cable outlet	mm	800x400
Condensate drain	mm	18

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	MZ d)	100
Compression ratio	Epsilon	12,50
Min./Max. fuel gas pressure at inlet to gas train	mbar	80 - 200 c)
Allowed Fluctuation of fuel gas pressure	%	± 10
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	2,38
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 3.1

0.02 Technical data of engine

Manufacturer		GE Jenbacher
Engine type		J 320 GS-C25
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	5.000
Weight filled	kg	5.500
Moment of inertia	kgm²	8,61
Direction of rotation (from flywheel view)		left
Flywheel connection		SAE 18"
Radio interference level to VDE 0875		N
Starter motor output	kW	7
Starter motor voltage	V	24

Thermal energy balance

Energy input	kW	2.606
Intercooler	kW	259
Lube oil	kW	122
Jacket water	kW	310
Exhaust gas total	kW	740
Exhaust gas cooled to 180 °C	kW	479
Exhaust gas cooled to 100 °C	kW	615
Surface heat	kW	53
Balance heat	kW	26

Exhaust gas data

Exhaust gas temperature at full load	°C [8]	450
Exhaust gas mass flow rate, wet	kg/h	5.642
Exhaust gas mass flow rate, dry	kg/h	5.221
Exhaust gas volume, wet	Nm³/h	4.387
Exhaust gas volume, dry	Nm³/h	3.881
Max.admissible exhaust back pressure after engine	mbar	60

Combustion air data

Combustion air mass flow rate	kg/h	5.176
Combustion air volume	Nm³/h	4.004
Max. admissible pressure drop in front of intake-air filter	mbar	10

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

Sound pressure level

Aggregate b)	dB(A) re 20µPa	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 a)	dB(A) re 20µPa	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	m²	109
Exhaust gas	dB(A) re 1pW	129
Measurement surface	m²	6,28

a) average sound pressure level on measurement surface in a distance of 1m according to DIN 45635, precision class 2.
b) average sound pressure level on measurement surface in a distance of 1m (converted to free field) according to DIN 45635, precision class 3.
Operation with 1200 rpm see upper values, operation with 1800 rpm add 3 dB to upper values.
Engine tolerance ± 3 dB

0.03 Technical data of generator

Manufacturer		STAMFORD e)
Type		PE 734 C2 e)
Type rating	kVA	1.550
Driving power	kW	1.095
Ratings at p.f. = 1,0	kW	1.063
Ratings at p.f. = 0,8	kW	1.052
Rated output at p.f. = 0,8	kVA	1.315
Rated current at p.f. = 0,8	A	1.830
Frequency	Hz	50
Voltage	V	415
Speed	rpm	1.500
Permissible overspeed	rpm	2.250
Power factor lagging		0,8 - 1,0
Efficiency at p.f. = 1,0	%	97,1%
Efficiency at p.f. = 0,8	%	96,1%
Moment of inertia	kgm^2	36,33
Mass	kg	2.967
Radio interference level to VDE 0875		N
Construction		B3/B14
Protection Class		IP 23
Insulation class		H
Temperature (rise at driving power)		F
Maximum ambient temperature	°C	40
Total harmonic distortion	%	1,5

Reactance and time constants

xd direct axis synchronous reactance	p.u.	2,33
xd' direct axis transient reactance	p.u.	0,14
xd'' direct axis sub transient reactance	p.u.	0,10
Td'' sub transient reactance time constant	ms	10
Ta Time constant direct-current	ms	20
Tdo' open circuit field time constant	s	2,23

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.

0.04 Technical data of heat recovery

General data - Hot water circuit

Total recoverable thermal output	kW	603
Return temperature	°C	70,0
Forward temperature	°C	90,0
Hot water flow rate	m³/h	26,0
Nominal pressure of hot water	bar	10
Pressure drop hot water circuit	bar	0,20
Maximum Variation in return temperature	°C	+0/-20
Max. rate of return temperature fluctuation	°C/min	10

Mixture Intercooler (1st stage)

Type		gilled pipes
Nominal pressure of hot water	bar	10
Pressure drop hot water circuit	bar	0,40
Hot water connection	DN/PN	80/10

Mixture Intercooler (2nd stage) (Intercooler separate)

Type		gilled pipes
Nominal pressure of hot water	bar	10
Pressure drop hot water circuit	bar	0,20
Hot water connection	DN/PN	65/10

Heat exchanger lube oil

Type		shell-and-tube
Nominal pressure of hot water	bar	10
Pressure drop hot water circuit	bar	0,20
Hot water connection	DN/PN	80/10

Heat exchanger engine jacket water

Type		plate heat exchanger
Nominal pressure of hot water	bar	10
Pressure drop hot water circuit	bar	0,20
Hot water connection	DN/PN	80/10

Decoupling heat exchanger

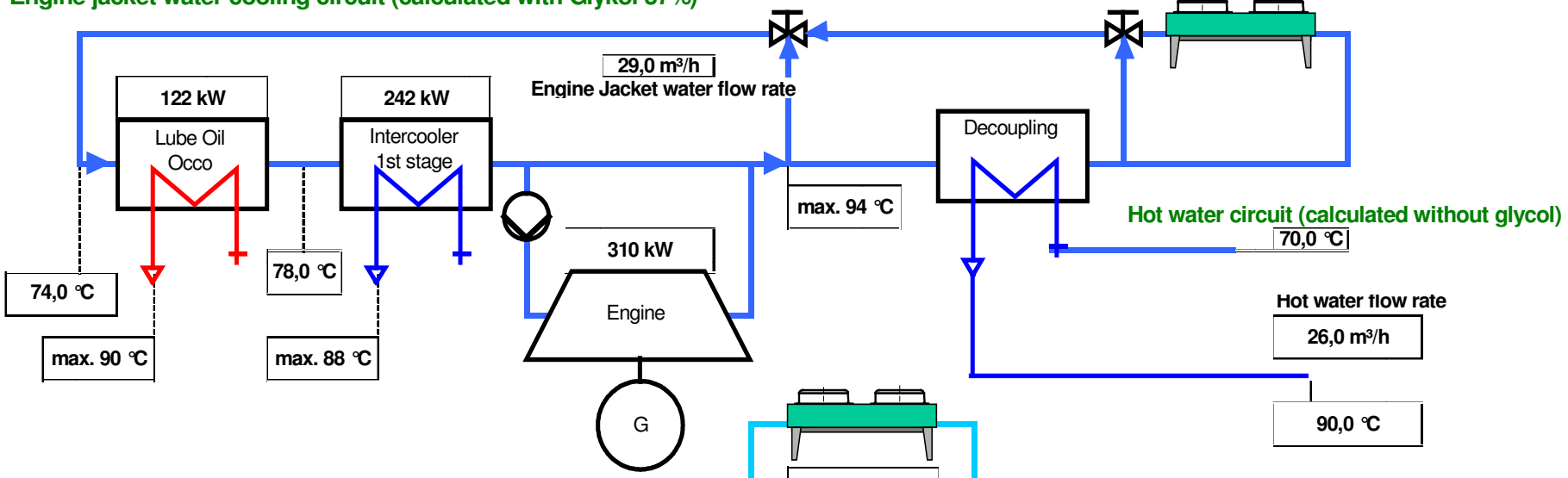
Type		plate heat exchanger
Nominal pressure of hot water	bar	10
Pressure drop hot water circuit	bar	0,20
Hot water connection	DN/PN	80/10

J 320 **J 320 GS-C25**

Total reoverable thermal output = 603 kW

(+8% tolerance +10% reserve for cooling requirement)

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



Low Temperature circuit (calculated with Glykol 37%)

Reoverable thermal output = 88 kW

(+8% tolerance +10% reserve for cooling requirement)

Cooling water flow rate = 25,0 m³/h

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 %; (basis: CH4=60 Vol.%; CO_2=40 Vol.%)
(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
(5) Total output with a tolerance of +/- 8 %
(6) According to above parameters (1) through (5)
(7) Only valid for engine and generator; module and peripheral equipment not considered
(8) Exhaust temperature with a tolerance of +/- 5 %

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 an air intake temperature ≤ **30 °C**.

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.

Parameters for the operation of GE Jenbacher gas engines

The genset fulfills 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: **TI 1100-0110, TI 1100-0111 and TI 1100-0112.**

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 TI 1000-0300)
- Gas humidity (limiting value according to TI 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 GE Jenbacher