

ANNEX II to Purchase Order No.54261R6_Zorg Biogas

Technical data

2300 kWel; 400 V, 50 Hz; Bio gas

Design conditions

Inlet air temperature / rel. Humidity:	[°C] / [%]	25 / 60
Altitude:	[m]	100
Exhaust temp. after heat exchanger:	[°C]	180
NO _x Emission (tolerance - 8%):	[mg/Nm ³ @5%O ₂]	500
Datasheet specification considers the grid codes EU 631/2016 (NC-RfG)		

Genset:

Engine / Configuration code:	TCG 3020 V20	X
Speed / Mean piston speed:	[1/min] / [m/s]	1500 / 9.8
Configuration / number of cylinders:	[-]	V / 20
Bore / Stroke / Displacement:	[mm]/[mm]/[dm ³]	170 / 195 / 89
Compression ratio:	[-]	14
Mean effective pressure:	[bar]	21,3
Mean lube oil consumption at full load:	[g/kWh]	0,15
Generator:	Marelli MJB 630 LB4	
Voltage / voltage range / cos Phi:	[V] / [%] / [-]	400 / 10 / 1
Speed / frequency:	[1/min] / [Hz]	1500 / 50

Fuel gas data: 2)

Methane number:	[-]	141
Lower calorific value:	[kWh/Nm ³]	5,48
Gas density:	[kg/Nm ³]	1,25
Standard gas:	Bio gas	
Analysis: CO ₂	[Vol%]	40,00
N ₂	[Vol%]	4,70
O ₂	[Vol%]	0,30
H ₂	[Vol%]	0,00
CO	[Vol%]	0,00
CH ₄	[Vol%]	55,00
C ₂ H ₄	[Vol%]	0,00
C ₂ H ₆	[Vol%]	0,00
C ₃ H ₆	[Vol%]	0,00
C ₃ H ₈	[Vol%]	0,00
C ₄ H ₈	[Vol%]	0,00
C ₄ H ₁₀	[Vol%]	0,00
C ₅ H ₁₂	[Vol%]	0,00
C _x H _y	[Vol%]	0,00
H ₂ S	[Vol%]	0,00
H ₂ O	[Vol%]	0

Energy balance

Load:	[%]	100	75	50
Electrical power COP acc. ISO 8528-1:	[kW]	2300	1725	1150
Engine jacket water heat:	[kW ±8%]	1246	947	673
Intercooler LT heat:	[kW ±8%]	150	113	69
Lube oil heat:	[kW ±8%]			
Exhaust heat with temp. after heat exchanger:	[kW ±8%]	919	771	614
Exhaust temperature:	[°C ±25°C]	431	458	499
Exhaust mass flow wet / dry:	[kg/h]	11872 / 10857	8926 / 8145	6154 / 5602
Combustion mass air flow:	[kg/h]	10669	7997	5495
Radiation heat engine / generator:	[kW ±8%]	74 / 62	71 / 53	68 / 47
Fuel consumption:	[kW+5%]	5287	4083	2899
Electrical / thermal efficiency:	[%]	43,5 / 40,9	42,3 / 42,1	39,7 / 44,4
Total efficiency:	[%]	84,4	84,4	84,1

System parameters 1)

Ventilation air flow (comb. air incl.) with ΔT = 15K	[kg/h]	55100
Combustion air temperature minimum / design:	[°C]	5 / 25
Exhaust back pressure from / to:	[mbar]	30 / 50
Exhaust volume flow wet / dry:	[Nm ³ /h]	9089 / 8029
Maximum pressure loss in front of air cleaner:	[mbar]	5
Zero-pressure gas control unit selectable from / to: 2)	[mbar]	20 ³⁾ / 200
Pre-pressure gas control unit selectable from / to: 2)	[bar]	0,5 / 10
Starter battery 24V, capacity required:	[Ah]	430
Starter motor:	[kWel.] / [VDC]	18 / 24
Lube oil content engine / base frame*:	[dm ³]	300 / 685*
Dry weight engine / genset:	[kg]	8170 / 21590

Cooling system

Glycol content engine jacket water / intercooler:	[% Vol.]	33 / 33
Water volume engine jacket / intercooler:	[dm ³]	210 / 22
KVS / Cv value engine jacket water / intercooler:	[m ³ /h]	47 / 58
Jacket water coolant temperature in / out:	[°C]	78 / 93
Intercooler coolant temperature in / out:	[°C]	45 / 48
Engine jacket water flow rate from / to:	[m ³ /h]	60 / 85
Water flow rate engine jacket water / intercooler:	[m ³ /h]	76 / 40
Water pressure loss engine jacket water / intercooler:	[bar]	2,6 / 0,5

1) See also "Layout of power plants":

2) See also Techn. Circular 0199-99-3017

3) Minimum pressure may be higher, depending on project conditions.

*) optional

Frequency band f [Hz]																				L _{WA} [dB(A)]	S [m ²]															
	25	31,5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k			2k	2.5k	3.15k	4k	5k	6.3k	8k	10k	12.5k	16k					
Air-borne noise 4)	94,8	96,1	97,4	101,0	103,7	107,3	112,7	118,9	115,5	115,3	112,7	110,8	112,1	111,5	108,8	108,6	109,3	108,5	108,2	108,8	106,4	104,8	103,8	102,9	106,1	116,7	104,3							121,0	117,3	
L _{W, Terz} [dB(lin)]																																			±4dB(A)	
Exhaust noise 5)	117,7	117,3	120,0	124,0	125,4	126,5	130,7	142,5	127,4	126,7	131,0	125,5	125,2	125,6	126,4	125,1	124,5	123,8	124,3	124,0	122,7	122,3	119,8	118,5	116,8	115,4	115,2	113,1	110,7					135,6	15,5 ⁶⁾	
L _{W, Terz} [dB(lin)]																																			±3dB(A)	

4) DIN EN ISO 9614-2 (s=±4 dB)

5) Measured in exhaust pipe (f ≤ 250Hz: ±5dB; f > 250Hz: ±3dB)

L_W: Sound power level

S: Area of measurement surface (S₀=1m²)

6) DIN 45635-11, Appendix A