

1. Operating characteristics and emissions of harmful substances

To run on	Biogas	
Methane number	MZ≥60	
Lower heating value	HU=6	kWh/Nm ³
Hot water temperature	90/70	°C
A unit with a synchronous generator to generate three-phase current	3 phases, 50Hz	

1.1. Operation power in parallel generation mode(100%)

Deviation of power consumption can be 5%, deviation of heat power production can be 8%, less or more in all possible modes. These are technical details in accordance with DIN ISO 3046-1. All data are valid for parallel network mode. Characteristics of other operation conditions can be sent on demand. Maximal total electric power output in kVA (rated current in accordance with generator rated kilowatt)

Type	LSA 44.3 L10	
Generator voltage	400	V
Electrical generator power (without overload)	100	kW(el)
Thermalpower (Cylinder bank/Lubrication oil/ Exhaustgas 120°C)	129	kW(th)
Energy consumption	262	kW
electrical efficiency	38,14	%
thermal efficiency	49,34	%
current index	0,773	

1.2. Operational power at partial load in parallel generation mode (75%)

Generator voltage	400	V
Electrical generator power (without overload)	75	kW(el)
Thermal power (Cylinder bank/Lubrication oil/Exhaust gas 120°C)	97	kW(th)
Energy consumption	197	kW

1.3. Operational power at partial load in parallel generation mode (50%)

Generator voltage	400	V
Electrical generator power (without overload)	50	kW(el)
Thermal power (Cylinder bank/Lubrication oil/Exhaust gas 120°C)	65	kW(th)
Energy consumption	131	kW

1.4. Self-driven system of emergency power supply

This option can be added on demand.

1.5. Emissions of Harmful Substances in the Environment

Amounts of emissions given for dry exhaust gas with 5% of O₂.

(Volumetric flow rate of exhaust gas - see section 3.4)

Nitrogen oxides without a catalyst according to MAN specification	< 500	mg/Nm ³
Carbon oxides without a catalyst according to MAN specification	< 600	mg/Nm ³
HCHO (Formaldehyd)	< 60	mg/Nm ³
NMHC	< 150	mg/Nm ³

Emission values based on dry exhaust gas 5% O₂ with catalyst (optional):

NOX	< 250	mg/Nm ³
CO	< 350	mg/Nm ³
HCHO (Formaldehyd)	< 20	mg/Nm ³

2. Construction / standard items

- Engine and generator shafts are connected to each other with a specially designed coupling
- Engine and Generator housing (SAE 1) are connected with each other via bell flanges torsional-resistant
- The module is built on a frame which is specially customized for vibration damping and protection against torsion.
- Cooling water and exhaust gas heat exchanger is built on the frame

2.1. Engine and equipment

Otto-Gas Engine	MAN E 0836 LE 202 (50°C)	
Lambda	1,4	
Cylinder configuration	in Row	
Number of cylinders	6	
Bore	108	mm
Stroke	125	mm
Volume	6,87	l
Direction of rotation (looking on the flywheel)	counter clockwise	
Engine speed	1500	1/min
Average piston speed	6,3	m/s
Compression ratio	11:1	
Mean effective pressure	12,81	bar
Standard power in accordance with ISO 3046	110	kW mech.
Lubrication oil consumption up to (without warranty,	0,125	kg/h
Engine width	740	mm
Engine length	1300	mm
Engine height	1030	mm
Engine weight	605	kg

Engine

- Base engine MAN E 0836
- Single cylinder heads for one cylinders with high alloy valve seat rings and valves
- Dry cylinder liners
- Flywheel housing SAE 1with gray cast iron spacer ring on SAE 1
- Suction pipe with mixture inflow on the side of the Flywheel
- Oil unit consisting of oil filter and oil cooler
- Oil sump, max 34 liters
- valve plunger made of hard metal
- Camshaft with pulser coil disc for electrical ignition system
- Cover plate for engine front cover
- Crankshaft without torsional vibration damper
- Water cooled exhaust gas pipe
- Crankcase ventilation
- Dipstick
- Special spark plugs for MAN industrial gas engines

Carburation

- Air absorption through dry air filter which is mounted on the unit
- Gas feeding through Venturi gas mixer

Turbo charger

- Yes

Lubrication oil system

- Lubrication oil pump mounted on the engine for pressure lubrication and piston cooling
- Lubrication oil heat exchanger mounted on the engine
- Replaceable lubrication oil filter mounted on the engine
- Oil level monitor attached to the unit
- Dipstick
- Crankcase ventilation via oil separator integrated in the mixture line

Dual circulation of an engine cooling system with:

- High-temperature circulation with integrated oil cooling and engine cooling system
- Compensators between the engine and the cooling circuit

Start device

- Electrical starter 4,0 kW, 24 V

Ignition system

- microprocessor controlled high-voltage ignition system with low voltage distributor, without any moving parts, wear-free
- Automatic adjustment of ignition energy
- Variable ignition timing
- Detectors on the flywheel and camshaft
- One spark coil for each cylinder
- Industry engine spark plugs

2.2. Generator

Self-regulating brushless pole synchronous generator with built-in exciter, voltage and Cos phi controller. Design according to VDE0530, radio interference level N, low harmonic design.

Generator voltage	400	V
Rated Power	137	kVA
Insulation class	H	
Temperature rise class	F	
Power factor (cos phi)*	1.0	
Frequency	50	Hz
Rotational speed	1500	1/min
Generator efficiency (at full load) at cos-phi 1	95,3	%
Max. ambient temperature	40	°C
Max. altitude above sea level	≤ 1000 m	m
Protection type	IP23	

2.3. Heat exchange system

Engine cooling water circuit (HT)

- Plate heat exchanger engine cooling / heating water
- Cooling water pump
- Self-adjusting mixing valve or ELCB controlled external pump for the cooling water circuit
- Expansion tank
- Pressure controlling cooling water
- Pressure relief valve

The cooling water information is based on a share of 30% antifreeze

Engine cooling (engine cylinder block with lubrication oil, 1. Stage Mixing Cooler)

Thermal power (8% tolerance)	73	kW
Min.temperature of cooling liquid at inlet	80	°C
Max.temperature of cooling liquid at outlet	88	°C
Max. difference between temperatures at inlet and outlet	6	K
Min. volume of cooling liquid to circulate	222	l/min
Pressure losses	0,78	bar
Max. allowable pressure	3	bar

Air-and-fuel mixture cooling (2. stage — low temperature)

Mixing NT	6	kW
Temperature of cooling liquid at inlet	40	°C
Minimum volume of cooling liquid to circulate	33	l/min
Pressure losses	0,7	bar
Max. Permissible pressure	2	bar

Plate heat exchanger in engine circulation

Thermal power (8% is permissible)	56	kW
Temperature of cooling liquid at inlet	86	°C
Temperature of cooling liquid at outlet	80	°C
Water temperature in heating system at inlet	70	°C
Water temperature in heating system at outlet	81	°C

2.4. Gas feeding

Adjusting gas paths are supplied not connected; the following key parts are included according to directive for gas components 90/356/EWG

Adjusting gas path

- Shutoff gas cock
- Gas filter
- Two magnetic valves
- Low pressure controller
- Flexible pipeline made from stainless steel

2.5. Unit control system

Control unit device

Control unit case IP 54 RAL 7032

Includes: control, operating units, service and protection elements, Network connection from below 3x 400V, N - neutral conductor, PE - protector, 50 Hz

Possible variant: separate power supply for own use (auxiliary drive)

Power section

- ✓ Integrated power protection with electronically switching system
- ✓ Short time delayed generator-short circuit protection with adjustable operating value
- ✓ Undelayed generator-short circuit protection with fixed operating value

Grid protection

Certified coupling (electromagnetic) switch controls voltage and frequency of electric network

Control functions

- Module plan of administration and control Siemens Simatic S7
- Color display 7"
- Engine monitoring (regulating of temperature, lambda)
- Generator control
- Network control
- rotational speed control/ power control
- Interface: Ethernet TCP / IP, Profinet; optional: Profibus IEC 60870-5-104-Slave

3. Operating supplies

Essential characteristics of adjustment of coolant, fuel, lubrication oil, exhaust gas condensate and heating liquid condensate are set in accordance with up-to-date instructions of MAN on operating/use materials

3.1. Capacitive information

Capacitive information for lubrication oil (the first fill-in min./max.)	24/34	litre
Capacitive information for lubrication oil (oil change)	24/34	litre
Engine coolant	16	litre

3.2. Heat production

Temperature of backflow in heating system	70	°C
Temperature of supply flow water in heating system	90	°C
Volumetric flow rate of water in the heating system	5,8	m ³ /h
Maximum permissible operating pressure (Plate HEX)	3,5	bar
Pressure losses at standard flow (between coupling flanges)	50	mbar

3.3. Combustion air/ Ventilation

Heat radiation of the engine max.	12	kW
Min. volumetric flow rate of intake air for Machine cooling (ventilation parameters of premises must be counted and adapted according to gas fuel requirements which are in force at the place of construction).	3396	m ³ /h
Volumetric flow rate of exhaust air	1400	m ³ /h
Air amount for combustion	470	kg/h
Min.temperature of incoming air (under different temperature conditions these parameters must be counted as agreed)	18	°C
Max.temperature difference between incoming and exhaust air	35	K
Max permissible intake low pressure before the air filter	15	mbar

3.4. Exhaust gas

Thermal power at 120 °C (tolerance 8%)	56	kW
Exhaust gas temperature (at the engine outlet)	480	°C
Exhaust gas mass flow rate, wet	525	kg/h
Exhaust gas flow rate, dry (0°C, 1013 mbar)	429	Nm ³ /h
Allowed backpressure after the engine	40	mbar

Separate pipelines for exhaust gases must be constructed at a mini-CHP unit. Under partial load operation exhaust temperature can reach 680 °C. If a catalyst is used temperature of exhaust gas can reach 700 °C due to exothermal reaction.

3.5. Noise level

Acoustic radiation from an engine surface without openings inlet and outlet paths

Total sound power	98,6	dB (A)
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Sound level at an exhaust pipe mouth without using a silencer according to DIN 45635-11

Total sound power	131,3	dB (A)
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Exhaust system 10m high, sound pressure level at the mouth measured in 90 °

Sound pressure level	81	dB (A)
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Sound pressure level in 10m distance

			OPTION	
Container	61	dB (A)	-	dB (A)
Dump Radiators	65	dB (A)	55	dB (A)
Ventilation / venting	63	dB (A)	52	dB (A)
Mixture cooler	65	dB (A)	55	dB (A)

3.6. Couplings

All coupling flanges must meet the demands of DIN 2501 if there are no other comments.

Nominal diameter and nominal pressure:

safety gas path*

Exhaust gas outlet (compensator)

Heating system water inlet / outlet

Input and output lubrication oil

Pipe coupling according to DIN 3861

Flange DN 50
Flange DN 65
Flange DN 125
Bayonet connection 1/2"

*) dimensions depend on gas pressure and gas quality

3.7. Dimensions and weight of a unit

Engine / generator incl. Noise reducing cover

Frame

Length	2300	mm
Width	1200	mm
Height	1800	mm
Unit (unladen weight)	2620	kg
Unit (operating weight)	2860	kg

Control Cabinet

Width	1000	mm
Depth	400	mm
Height	2000	mm

See design drawings for essential dimensions and weight can vary due to generator voltage. Other dimensions on demand.

The manufacturer can make changes and corrections in documents due to technical modifications of units