1. Operating characteristics and emissions of harmful substances

To run on	**Natural gas**	
Methane number	**MZ≥80**	
Lower heating value	**HU=10**	kWh/Nm³
Hot water temperature	**90/70**	°C
A unit with a synchronous generator to generate three-phase current	**3 phases, 60Hz**	

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 49.1 M6**	
Generator voltage	**480**	V
Electrical generator power (without overload)	**550**	kW(el)
Thermal power (Cylinder bank/Lubrication oil/Exhaust gas120°C)	**761**	kW(th)
Energy consumption	**1444**	kW

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

Generator voltage	**480**	V
Electrical generator power (without overload)	**412**	kW(el)
Thermal power (Cylinder bank/Lubrication oil/Exhaust gas 120°C)	**592**	kW(th)
Energy consumption	**1107**	kW

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

Generator voltage	**480**	V
Electrical generator power (without overload)	**280**	kW(el)
Thermal power (Cylinder bank/Lubrication oil/Exhaust gas 120°C)	**436**	kW(th)
Energy consumption	**790**	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/Nm³
Carbon oxides without a catalyst according to MAN specification	**<750**	mg/Nm³
Carbon oxides with a catalyst (optional, can be delivered on demand)	**<300**	mg/Nm³
NOX with catalyst (optional, can be delivered on demand)	**<250**	mg/Nm³

2. Construction / standard items

- Engine and generator shafts are connected to each other with a specially designed coupling
- Engine and Generator housing (SAE 2) 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 3262 LE 202**	
Lambda	**1.7**	
Cylinder configuration	**in V**	
Number of cylinders	**12**	
Bore	**132**	mm
Stroke	**157**	mm
Volume	**25,8**	l
Direction of rotation (looking on the flywheel)	**counter clockwise**	
Engine speed	**1800**	1/min
Average piston speed	**7,85**	m/s
Compression ratio	**12:1**	
Mean effective pressure	**17,1**	bar
Standard power in accordance with ISO 3046 (not overloaded)	**580**	kW mech.
Lubrication oil consumption up to (without warranty, at normal load and in 1000 operation hours)	**0,175**	kg/h
Engine width	**1240**	mm
Engine length	**1590**	mm
Engine height	**1234**	mm
Engine weight	**1520**	kg

Engine

- Base engine MAN E 3262
- Single cylinder heads for two cylinders with high alloy valve seat rings and valves
- Dry cylinder liners
- Flywheel housing SAE 1
- Flywheel 2.392 kg m² with a ring gear
- Suction pipe with mixture inflow on the side of the Flywheel
- Oil unit consisting of oil filter and oil cooler
- Oil sump, 90 liters
- valve plunger made of hard metal
- Camshaft with pulser coil disc for electrical ignition system
- Exhaust manifold dry, with heat insulation
- Crankshaft with counterweights
- without thermostat housing

- 2 x exhaust turbochargers with water cooled turbine housing and pressure oil lubricated bearing and water cooled bearing block
- Two-Stage mixture cooling
- Exhaust gas temperature sensor (NiCr- Ni, type K) 2x
- Cover plate for engine front cover
- Crankshaft without torsional vibration damper
- Crankcase ventilation with multi cyclone oil seperator
- 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

- Turbo charging with two exhaust gas turbocharges
- Two- stage mixture cooling (high and low temperature circuit)
- Throttle valve between mixture coolers and mixture distribution lines

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 6,4 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	**480**	V
Rated Power	**783**	kVA
Insulation class	**H**	
Temperature rise class	**H**	
Power factor (cos phi)*	**1**	
Frequency	**60**	Hz
Rotational speed	**1.800**	1/min
Generator efficiency (at full load) at cos-phi 1	**98,1**	%
Max. ambient temperature	**40**	°C
Max. altitude above sea level	**1000**	m
Protection type	**IP 23**	

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

Mixture cooling water circuit (2nd stage, LT)

- Pump for second stage mixture cooler
- Expansion tank (note max water volume) with pressure monitoring
- Pressure relief valve

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

Engine cooling (engine cylinder block with lubrication oil)		
Thermal power (8% tolerance)	**291**	kW
Min.temperature of cooling liquid at inlet	**76**	°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	**682**	l/min
Pressure losses	**0,78**	bar
Max. allowable pressure	**3**	bar

Air-and-fuel mixture cooling (2. stage — low temperature)		
Thermal power (8% is tolerance)	**95**	kW
Temperature of cooling liquid at inlet	**40**	°C
Minimum volume of cooling liquid to circulate	**251**	l/min
Pressure losses	**0,7**	bar
Max. Permissible pressure	**2**	bar

Plate heat exchanger in engine circulation		
Thermal power (8% is permissible)	**386**	kW
Temperature of cooling liquid at inlet	**80**	°C
Temperature of cooling liquid at outlet	**86**	°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 480V, N - neutral conductor, PE - protector, 60 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

Network protection

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

Control functions

- Module plan of administration and control Siemens Simatic S7
- Black-and-white display 5,7"
- 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.)	**102**	litre
Capacitive information for lubrication oil (oil change)	**100**	litre
Engine coolant	**27**	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	**32,7**	m³/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	**52**	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).	**8520**	m³/h
Volumetric flow rate of exhaust air	**6420**	m³/h
Air amount for combustion	**2699**	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%)	**335**	kW
Exhaust gas temperature (at the engine outlet)	**454**	°C
Exhaust gas mass flow rate, wet	**3172**	kg/h
Exhaust gas flow rate, dry (0°C, 1013 mbar)	**2530**	Nm³/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 550 °C. If a catalyst is used temperature of exhaust gas can reach 600 °C due to exothermal reaction.

3.5. Noise level

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

Frequency (Hz)	Noise power level	
63	67,8	dB (A)
125	71,9	dB (A)
250	96,4	dB (A)
500	94,3	dB (A)
1000	99,3	dB (A)
2000	97,4	dB (A)
4000	96,3	dB (A)
8000	95,0	dB (A)
Total sound power	**106,2**	**dB (A)**

Sound level at an exhaust pipe mouth without using a silencer according to DIN 45635-11

Frequency (Hz)	Noise power level	
63	93,4	dB (A)
125	103,1	dB (A)
250	103,8	dB (A)
500	109,4	dB (A)
1000	113,1	dB (A)
2000	115,7	dB (A)
4000	117,6	dB (A)
8000	114,4	dB (A)
Total sound power	**122,3**	**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*	Flange DN 65
Exhaust gas outlet (compensator)	Flange DN 200
Heating system water inlet / outlet	Flange DN 80
Input and output lubrication oil	Bayonet connection 1/2"
Pipe coupling according to DIN 3861	

*) dimensions depend on gas pressure and gas quality

3.7. Dimensions and weight of a unit

Engine / generator incl. Noise reducing cover

Frame

Length	**3700**	mm
Width	**1500**	mm
Height	**2100**	mm
Unit (unladen weight)	**4685**	kg
Unit (operating weight)	**4820**	kg

Control Cabinet

Width	**1200**	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