

Genset without heat recovery box

AoE 16V4000L62 (robust)

1 Ratings and Emissions

For operation on	NATURAL GAS MZ ≥ 80 Hu = 8,0-11,5 kWh/m³n 90 / 78 °C 3Ph, 50Hz 30 - 40 °C integrated 53 °C < 500	mg/m _n ³
Methane number		
Low heat value (LHV)		
Cooling water temperature		
Genset with synchronous generator for generating		
Intake air temperature		
Gas mixture cooler, intern (1 st stage HT)		
Gas mixture cooler, extern (2 nd stage LT)		
NO _x		

1.1 Continuous Operating Data in Grid Parallel Mode

8 % tolerance for thermal outputs and 5 % for total energy input listed. Performance data in accordance with ISO 3046. All data apply to grid parallel operation. Data for site operating conditions other than those mentioned, available on demand. Max. reactive power in kVA, resp. nominal current acc. to nominal output of the generator.

	GB1560N5	GB1560N5	GB1557N5	GB1554N5	GB1555N5	
Generator voltage	400	415	6300	10500	11000	V
Electrical output of generator (no overload capacity)	1560	1560	1557	1554	1555	kW _{el}
Thermal output (Engine cooling / lube oil / 1 st stage HT mixture cooler)			1007			kW _{th}
Thermal output (2 nd stage LT mixture cooling)			70			kW _{th}
Total energy input			3860			kW

1.2 Part Load Data in Grid Parallel Mode (75 %)

	400	415	6300	10500	11000	
Generator voltage	400	415	6300	10500	11000	V
Electrical output of generator	1170	1170	1166	1165	1165	kW _{el}
Thermal output (Engine cooling / lube oil / 1 st stage HT mixture cooler)			747			kW _{th}
Thermal output (2 nd stage LT mixture cooling)			52			kW _{th}
Total energy input			2967			kW

1.3 Part Load Data in Grid Parallel Mode (50 %)

	400	415	6300	10500	11000	
Generator voltage	400	415	6300	10500	11000	V
Electrical output of generator	777	776	774	773	773	kW _{el}
Thermal output (Engine cooling / lube oil / 1 st stage HT mixture cooler)			518			kW _{th}
Thermal output (2 nd stage LT mixture cooling)			36			kW _{th}
Total energy input			2082			kW

1.4 Continuous Operating Data in Isolated Mode

	400	415	6300	10500	11000	
Generator voltage	400	415	6300	10500	11000	V
Electrical output of generator	1420	1419	1416	1413	1414	kW _{el}

1.5 Pollutant Emissions

Emission values related to dry exhaust gas with 5 % O₂. (For exhaust gas volume flow see 3.5)

NO _x , stated as NO ₂	< 500	mg/m _n ³
CO, without catalyst	< 1000	mg/m _n ³
Formaldehyde, without catalyst	< 140	mg/m _n ³
CO, with catalyst (optional, delivered loose)	< 300	mg/m _n ³
Formaldehyde, with catalyst (optional, delivered loose)	< 60	mg/m _n ³

2 Design Principles / Scope of Supply

- ◆ Engine and flange-mounted alternator (SAE 00 housing) are connected via a torsionally resilient coupling and resiliently mounted to a rigid, welded steel base frame.
- ◆ Standby heater
- ◆ Lube oil pump for draining the oil sump (incl. two solenoid valves).
- ◆ The base frame is installed on vibration dampers

2.1 Engine plus Accessories

	MTU 16V4000L62	
Otto-Gas-Engine	V 16	
Cyl. arrangement, no. of cyl.	170 / 210	mm
Bore / stroke	76,27	Litre
Volume	1500	1/min
Speed	10,5	m/s
Mean piston speed	12,1:1	
Compression ratio	16,8	bar
Mean effective pressure		
Standard power acc. to ISO 3046, (no overload capacity)	1600	kW _{mech}
Specific full-load consumption (tolerance 5 %)	2,41	kWh/kWh _{mech}
Gas consumption (based on LHV = 10,03 kWh/m ³ n)	384,8	m ³ /h
Lube oil consumption (not guaranteed, at rated load and after 1000 Oh)	0,3	g/kWh _{mech}

Basic Engine

- ◆ Monobloc grey cast crankcase with inspection ports, flywheel housing SAE 00, flywheel 21" cast iron oil pan
- ◆ Forged crankshaft
- ◆ Forged connecting rods
- ◆ Four-valve, individual cylinder heads with central pre-chamber armoured valves with „Rotocap“ rotators
- ◆ Light-metal solid-skirt pistons with oil cooling duct, piston cooling via oil spray nozzles

Mixture Formation

- ◆ Air intake via dry-type engine-mounted air filters
- ◆ Venturi type air-gas mixer with gas supply via electronically controlled gas metering valve

Turbocharging

- ◆ Turbocharger for gas-air mixture compression
- ◆ Two-stage mixture cooling
- ◆ Throttles between mixture coolers and intake manifold

Exhaust System

- ◆ Dry-type, insulated exhaust manifolds in the engine Vee

Lube Oil System

- ◆ Lube oil circulation pump with safety valve for forced-feed lubrication and piston cooling
- ◆ Engine mounted heat exchanger
- ◆ Lube oil filters with replaceable filter elements
- ◆ Engine-mounted device for automatic oil level control
- ◆ Oil dipstick
- ◆ Closed crankcase venting system with oil separator connected to mixture piping before turbo charger
- ◆ Connections for oil refill and oil draining

Cooling System (2-circuit)

- ◆ High temperature circuit for lube oil cooling, 1st stage of mixture cooling and engine jacket
- ◆ Connections with counter-flanges for external cooling- or heat recovery system
- ◆ Integrated cooling preheating unit

Starting System

- ◆ Electric starter (2x 9 kW, 24 VDC)

Ignition System

- ◆ Microprocessor-controlled high-voltage spark-ignition system with low voltage distribution, no moving parts, no wear
- ◆ Automatic control for ignition energy adjustment
- ◆ Variable timing control
- ◆ Timing sensors at camshaft and crankshaft
- ◆ One ignition coil per cylinder
- ◆ Industrial spark plugs

2.2 Generator

Self-regulating, brushless revolving-field synchronous generator with built-in exciter, voltage and cos φ regulator, designed to VDE 0530, radio interference class N, low-harmonic design.

Generatorspannung	400	415	6300	10500	11000	V
Rating (F)	1935	1935	2148	2167	2270	kVA
Insulation class	H	H	F	F	F	
Temperature-rise rating	F	F	F	F	F	
Cos φ *	1,0 - 0,8	1,0 - 0,8	1,0 - 0,8	1,0 - 0,8	1,0 - 0,8	
Frequency			50			Hz
Speed			1500			1/min
Efficiency (100% load) at cos φ 1	97,5	97,5	97,3	97,1	97,2	%
Stator connection			Star			
Voltage tolerance			± 5			%
Frequency tolerance			± 5			%
Max. ambient temperature.			40			°C
Installation altitude max.			1000			m
Type of protection			IP 23			

*) Cos-phi must be over the whole power range in the defined range. Only inductive reactive power admissible (over-erected).

In case of nominal mains voltage variations by ± 2 %, an automatic voltage adjustment must be used.

2.3 Gas Supply

Gas regulation lines delivered loose, components approved per Directive for Gas Components 90/356/EWG

Gas Regulation Line

- ◆ Gas filter
- ◆ two solenoid valves (or double solenoid valve)
- ◆ Low pressure regulator
- ◆ valve leakage monitor
- ◆ flexible stainless steel hose

2.4 Controller of Genset

MMC

- ◆ Operation and visualization
- ◆ Control of auxiliary drives (cogeneration unit / extern)
- ◆ Connection / seperation of the generator to/from the grid
- ◆ Control of generator and grid protection functions, see separate description "Technical Description MMC 4000 control"

ECU7

- ◆ Speed governing
- ◆ Air / Fuel ratio control via engine characteristic map
- ◆ Engine start / stop sequence
- ◆ Emergency stop sequence
- ◆ Engine monitoring (temperatures, pressures, speed, etc.)

EMU7

- ◆ Single exhaust temperature monitoring (cylinderhead)

SAM

- ◆ Providing CANopen interface
- ◆ Lube oil make up
- ◆ Monitoring of minimum load

Ignition

- ◆ Electronic ignition system
- ◆ Ignition time setting
- ◆ Speed monitoring

Knocking monitoring AKR

- ◆ Acoustic knocking monitoring system
- ◆ Individual ignition timing adjustment per cylinder

3 Technical Data Design / Operation

3.1 Operating Media

The binding specifications for cooling water, fuel, lube oil, exhaust condensate and heating water are stipulated in the relevant MTU operating media regulations.

Values for cooling / heating water are based on water without antifrost and corrosions additives.
Admissible antifrost and corrosions additives see operating media. Values in brackets [] refer to 35 % Glycol.

3.2 Filling Quantities

Lube oil – quantity (first filling)	285	Liter
Lube oil – quantity (consecutive oil changes)	250	Liter
Engine cooling water, HT	270	Liter
Mixture cooling water, LT (without re cooler and pipes)	22	Liter

3.3 Heat Generation

Engine Cooling (engine block with lube oil and 1st stage HT mixture cooling)

Thermal output (8 % tolerance)	1007	kW
Cooling water temperature, in- / outlet	78 / 90	°C
Cooling water volume flow	77 [83]	m ³ /h
Pressure loss	2,7 [3,1]	bar
System pressure permitted max.	6,0	bar
Cooling water temperature, min.	40	°C

Mixture Cooling (2nd stage LT)

Thermal output (8 % tolerance)	70	kW
Mixture cooling water volume flow (8 % tolerance)	22	m ³ /h
Inlet temperature mixture cooling water max.	52	°C
Outlet temperature mixture cooling water max.	55	°C
Pressure loss	0,2	bar
System pressure permitted max.	6,0	bar
Note information pressure control valve.		

3.4 Combustion Air / Ventilation

Heat radiated from the genset (engine and generator without adjoining pipes) Engine room ventilation	100	kW
Minimum intake air volume flow for engine room cooling. (The engine room ventilation has to be calculated and adjusted according to the requirements for gaseous fuels valid at the installation site)	38433	m ³ /h
Outlet air volume flow	31367	m ³ /h
Combustion air volume flow	6483	m _n ³ /h
Intake air temperature min. (for other temperatures the limit values must be adapted after consultation)	30	°C
Temperature difference intake / ventilation max.	< 10	K
max. permissible intake negative pressure at inlet air filter	3	mbar

3.5 Exhaust Gas (Exhaust gas heat exchanger not included in scope of supply, optional)

Thermal output by 120 °C (8 % tolerance)	862	kW
Exhaust temperature (turbocharger outlet)	440	°C
Exhaust gas mass flow, dry	8059	kg/h
Exhaust gas mass flow, moist	8666	kg/h
Exhaust gas volume flow, dry (0 °C, 1013 mbar)	6116	m _n ³ /h
Exhaust gas volume flow, moist (0 °C, 1013 mbar)	6826	m _n ³ /h
Permissible back-pressure downstream of engine min. / max.	30 / 60	mbar

In multi-genset systems, separate exhaust piping for each genset is recommended.

If a common exhaust header system is installed, exhaust flow back into any non-operationing gensets must be avoided by use of a 100 % gas-tight exhaust shut-off flap.

In the range of partial load the exhaustive temperature rises up to 550 °C. In case of use of catalyzers, due to the exothermic reaction the exhaustive temperature may increase up to 600 °C.

3.6 Sound Levels

Engine surface noise emitted by the genset

(distance 1 m, free field measurement, Tolerance +5 dB for single 1/3-octave band, +2 db(A) for total A-weighted level)

Frequency (Hz)	Sound pressure levels (dB)	
12,5		
16		
20		
25		68,3
31,5		68,8
40		72,1
50		66,8
63		73,6
80		74,1
100		84,0
125		80,6
160		81,3
200		81,6
250		81,8
315		85,0
400		91,5
500		85,8
630		84,8
800		84,6
1000		83,5
1250		82,3
1600		81,0
2000		81,4
2500		82,2
3150		82,0
4000		82,8
5000		84,3
6300		94,8
8000		85,6
10k		82,5
Sum of sound pressure levels (dB)	Lin dB	dB (A)
Sound power levels dB (A)	99,3	98
		117,4

undampened Exhaust noise

(distance of 1 m from outlet, Tolerance +5 dB for single 1/3-octave band, +3 db(A) for total A-weighted level)

Frequency (Hz)	Sound pressure levels (dB)	
12,5		
16		
20		
25		90,8
31,5		85,9
40		98,3
50		89,7
63		107,2
80		116,4
100		117,2
125		110,5
160		107,1
200		105,2
250		103,6
315		102,2
400		100,7
500		96,9
630		94,7
800		93,0
1000		92,5
1250		91,9
1600		91,2
2000		91,3
2500		91,5
3150		89,2
4000		87,9
5000		79,7
6300		75,1
8000		67,9
10k		62,9
Sum of sound pressure levels (dB)	Lin dB	dB (A)
Sound power levels dB (A)	121,1	106,5
		118,7

3.7 Connections

Unless stated otherwise, the connecting flanges are to DIN 2501.

Nominal diameters and pressures are as follows:

Safety gas line *	DN80 / PN16	
Exhaust gas outlet (expansion joint)	DN300 / PN6	
Cooling water in- / outlet	DN100 / PN16	
Mixture cooling water in- / outlet	DN50 / PN16	
Lube oil flow and return: Tube connection to DIN 3861	d = 22	

*) Dimension depending on gas pressure and gas quality

3.8 Paints, Dimensions and

Engine and Generator	RAL 9006	
Frame	RAL 5002	
Length	5300	mm
Width	1850	mm
Height	2600	mm
Genset (dry weight) 400 V	13200	kg
Genset (dry weight), mean voltage	15000	kg
Genset (service weight)	13800	kg
Genset (service weight), mean voltage	15500	kg

For binding dimensions please refer to drawing.

Dimensions and weight may vary according to the alternator type (voltage rating)

Data are subject to change without notice in the interest of further development.

C 40 AoE 16V4000 L62 R Power

Containerized Natural Gas Genset

- Container with gas engine Genset AoE 16V4000L62 R (GB 1560 N5)
- Electrical Output 1560kW*
- Synchronous generator to generate alternating current at 400 V, 50 Hz

Design of Container

- Modified ISO 40' High Cube Container

Dimensions and Weight of the Container

Length	40'00"	12,192 mm
Width	8'00"	2,438 mm
Height	9'60"	2,896 mm
Weight (incl. lubricants and coolant)		ca. 32,200 kg

Container Design

- Engine and switchboard in main container room; Cooling radiator room separated
Installation of genset, exhaust system, cooling system, lube oil system, control panel and circuit breaker
Double-wing door at the front end; access door sideways
- Installation of module control panel, generator circuit breaker panel and auxiliary drive panel
- Container floor construction is designed as spill troughs for lubricant and coolant
- Container corners according to ISO 1161
- One long side with access door to the engine room. Noise attenuated door with panic lock
- Container outside/inside: RAL 7035
- Three-part roof construction for insertion and extraction of the genset or for service
- Container Lloyds CSC certified (Convention Safety Container) for easy transportation (Sea, Rail, Road)

Performance

- Specification of Genset is according to Technical Description TB 46216
- Modes of Operation: Grid Parallel and Island
- Sound emission: 82dB(A) in 3m
- The Containerized Genset is designed for ambient conditions of 0°C to 50°C temperature.
- Temperature De-Rating: 0,5% per °C above 40°C
- Altitude De-Rating specified on project specific basis.

* At standard conditions. Refer to Technical Description of Genset for detailed data