VITOBLOC 200

CHP unit – heat and power
from natural gas and LPG
High efficiency through combined heat and power
Overall efficiency 94.0 %
Primary energy savings 24.26 %

Technical description

VITOBLOC 200 Type EM-6/15

Part no. 7727268

Combined heat and power unit for natural gas and LPG operation
in accordance with the requirements of the EU Gas Appliance Regulation and EU Machine Directive
Electrical output 6.0 kW
Thermal output 14.9 kW
Fuel use 22.2 kW
Condensing technology with optimised emissions

6130125 GB 04/2019

Imprint

This equipment meets all basic requirements of the applicable standards and guidelines. Conformity has been verified. All associated documents and the original Declaration of Conformity are available from the manufacturer.

NOTE

The Vitobloc 200 CHP unit is not suitable for 60 Hz operation. It is therefore not available in certain markets, in particular America and Canada.

Important general application notes

Use this technical equipment only for its intended purpose and according to the installation, operating and service instructions. Maintenance and repairs may only be performed by authorised contractors.

Use this appliance only in those combinations and together with those accessories and spare parts indicated in the installation, operating and service instructions. Only use other combinations, accessories and wearing parts if they are designated explicitly for the intended application and they do not adversely affect performance characteristics or safety requirements.

Subject to technical modifications

This is part of the original operating instructions.

Constant development may lead to minor deviations in the illustrations, functional steps and specifications from those described/shown.

Depiction of notes

The notes in this documentation are important for safety and must be observed.

DANGER!

This symbol warns against the risk of injury.

PLEASE NOTE:

This symbol warns against the risk of material losses and environmental pollution.

NOTE

This symbol indicates information that will simplify work and ensure safe operation.

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1 General information

1.1 Purpose

The combined heat and power (CHP) unit is a complete, fully wired unit with an air cooled synchronous generator for generating 400 V, 50 Hz, three-phase power and domestic hot water with a return temperature level of 30 to 65 °C[1)] and a temperature spread of up to 20 K.

Standard equipment and product features	
- Mains parallel and mains substitution mode[2)] (in the event of power failure) as standard.	- Silencer hood and flexible connections for gas, exhaust and heating water to prevent structure-borne noise if siting the unit in areas where noise emissions are critical, such as in hospitals, schools and similar buildings.
- Meets the stringent technical connection conditions specified by power supply utilities (TAB) without inverters.	- Control system integrated into CHP unit for optimum space utilisation. No additional space required; no additional cabling.
- Flexible control – operation with heat bias or power bias possible In power bias mode, modulation 50 % - 100 %	- Certified according to the Power Supply Directive VDE-AR-N 4105
- Internal lubricating oil supply system dimensioned for a service interval of 6000 h.	- Data transfer via interface DDC for transferring the CHP parameters to the building management system as hardware module RS 232 with data protocol 3964 R (without RK512).
- Integral condensing technology for maximum overall efficiency. Due to the optimised design of the internal cooling circuit, no heating water return temperature raising facility is required.	- Telecontrol system with terminals for the transfer of operating and central fault messages via floating contacts to the on-site building management system.
- Reliable Gas-Otto-Engine, series product of the factory supplier.	- Fault history memory for recording complete fault chains to obtain specific fault analyses.
- Starter system with battery charger and maintenance-free, vibration-proof batteries.	- Integrated extract air fan for cooling the unit helps ensure longer service life of components.
- Synchronous three-phase generator with low harmonic content for optional mains substitution mode in island systems.	- Heat exchanger built and tested according to the Pressure Equipment Directive 2014/68/EU.
- Exhaust gas cleaning system, comprising a 3-way catalytic converter to comply with ½ TA-Luft 2002	- Factory test run with complete CHP unit (engine, generator, heat exchanger, control panel) according to DIN 6280, part 15.
- Gas train according to DVGW and DIN 6280 part 14, including thermal shut-off valve and gas ball valve.	- Technical documentation in the national language included as hard copy.
- Design in accordance with the EU Gas Appliance Regulation 2016/426 and EU Machine Directive with production in accordance with DIN ISO 9001.	

Tab. 1 Standard delivery, standard equipment level

1) In mains substitution mode, return temperature max. 60 °C
2) Prepared for mains substitution mode

1.2 Continuous output in mains parallel mode

Refer to Chapter 4 “Specification” for performances and efficiencies.

The outputs and efficiencies correspond to standard ISO 3046/1, at 25 °C air temperature,
1000 mbar air pressure (up to 100 m height above sea level), 30 % relative humidity and methane number 80, reactive factor cos phi = 1 and heating water inlet temperature into the unit of 30 °C. The tolerance for all efficiencies and heating outputs is 7 %. The tolerance for energy input is 5 %.

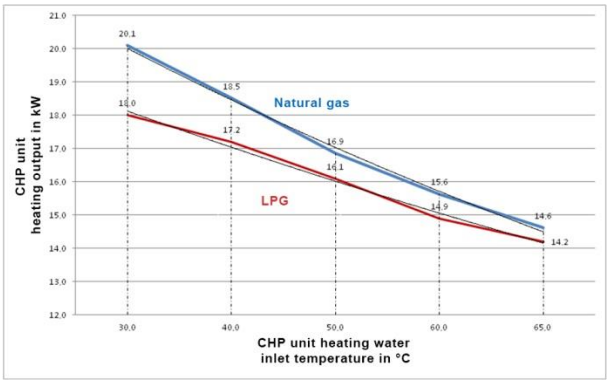


Fig. 1 Heating output of the CHP unit against the heating water inlet temperature in the CHP unit

All other CHP unit data applies to mains parallel mode. Details relating to the partial load range are provided for information only; these do, however, correspond to ISO (without guarantee).

Both natural gas according to DVGW Guideline, Code of Practice G260, gas category II and LPG (propane to DIN 51622) can be used as fuel. All the data required for other gas qualities and installation conditions is available on request.

Primary energy factor

In addition to the actual energy demand, the primary energy factor (fp) also includes all the upstream processes required to make the energy source available (obtaining, converting, distributing). As a CHP unit provides electricity, this displaces conventionally generated electricity.

This effect results in very low primary energy factors for the CHP unit as an individual system.

However, the overall system, consisting of CHP unit, additional energy generators and consumers must be assessed for each individual case.

Primary energy savings as per EU CHP Directive

The amount of primary energy saved is the percentage saving made in fuel due to combined heat and power generation within a CHP process compared with the fuel heat consumption in reference systems with non-combined heat and power generation.

The calculation formula is defined in Appendix III of EU Directive 2012/27/EU on the promotion of cogeneration based on a useful heat demand.

Every small and mini CHP system (<1 MW_{el}) that delivers a primary energy saving is considered highly efficient.
This means that all Vitobloc 200 CHP units used for cogeneration are highly efficient.

1.3 Mains substitution mode

Subject to the design of the on-site low voltage main distribution system (NSHV) as well as additional on-site equipment (central GS protection) and appliance-specific changes, CHP units may also be used as replacement power supply systems in mains substitution mode in the event of power failure.

In the case of mains failure with the CHP unit in standby mode, starting and automatic hook-up to the spare busbar of the first CHP unit is possible within 15 seconds.

The maximum output is reduced by 10 % to provide sufficient control reserves in mains substitution mode. Hook up the consumers which are entitled to receive emergency power in stages (e.g. 30 % – 30 % – 30 % with respect to the current).

The following applies for mains substitution systems: The heating water return temperature must not exceed 60 °C in mains substitution.

The mains substitution function does **not** apply in conjunction with the operation of an absorption cooling system.

1.4 Emissions

For emission values after emission control, refer to Chap. 4 “Specification”.

1.5 Energy statement

The energy statement graphically illustrates the energy flow of the CHP unit.

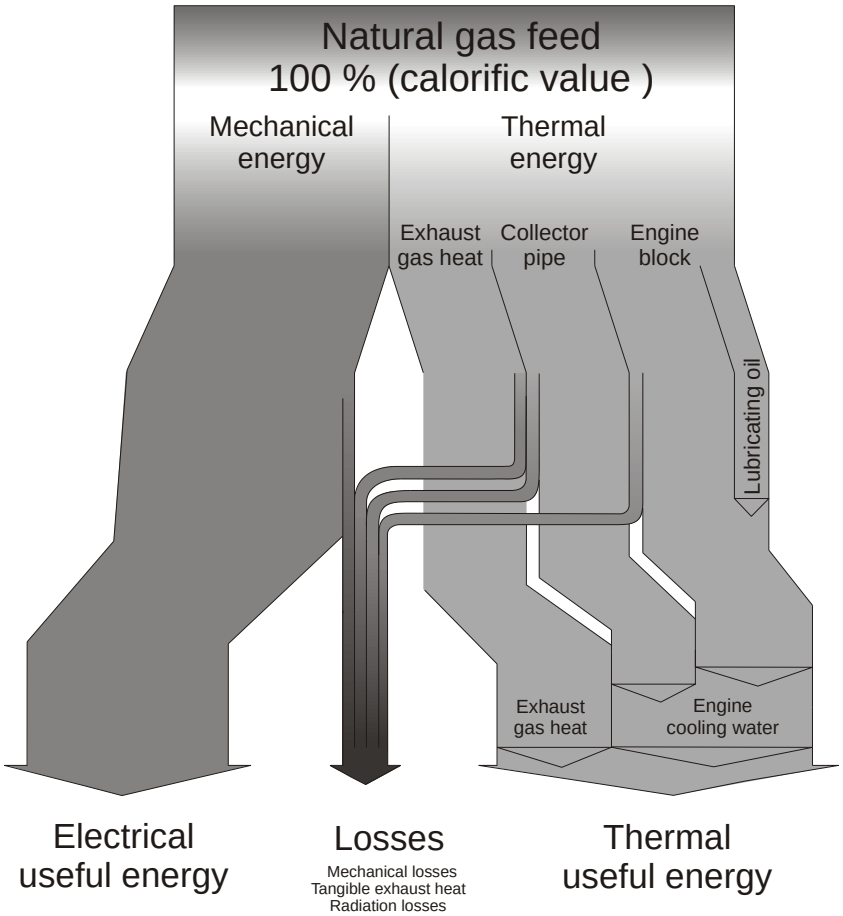
The energy statement illustrates the conversion of primary energy (natural gas or LPG, 100 %) into useful electrical and thermal energy. Losses incurred during this conversion are also illustrated.
The maximum internal electrical consumption is not illustrated; this may vary depending on the operating state.

The useable electrical energy is created by the combustion process within the gas engine, the rotational movement of which is converted into electricity via a synchronous generator.

The useable thermal energy is also created by the combustion process within the gas engine. It is divided between the exhaust gas heat, the header, the engine block and the engine lubricating oil and is used for heating purposes, e.g. for heating water.

The overall efficiency of the CHP unit is calculated by adding the useable electrical and thermal energy.

The efficiency according to [German] Energy Tax Implementation Ordinance (EnergieStV) is defined as the ratio of the total thermal and mechanical energy generated over the total energy and auxiliary energy consumed.



Natural gas	**27.0 %**	**6.0 %**	**67.0 %**
LPG	**27.3 %**	**9.1 %**	**63.6 %**

Fig. 2 Energy statement for the CHP unit in the case of optimum thermal connection

2 Product description

The CHP unit comprises various assemblies and components, which are explained in this chapter. The assemblies and components are part of the standard delivery of the CHP unit.

2.1 Gas engine with accessories

2.1.1 Gas engine

The gas engine is based on an industrial gas engine manufactured by Toyota. This gas engine is operated as an internal combustion engine (naturally aspirated engine) without a turbocharger and with an air ratio of Lambda = 1.

2.1.2 Engine lubricating oil system

The engine is lubricated by a forced-feed lubrication system.

Crankcase ventilation is connected to the combustion air intake via an oil separator.

2.1.3 Engine cooling system

The engine is cooled by means of a internal water circuit driven by a pump.

Due to the optimised hydraulic design of the internal cooling circuit, no heating water return temperature raising facility is required.

2.1.4 Battery starter system

Two maintenance-free batteries supply the engine starter and the ignition system with the electrical power for the engine starting procedure. The batteries also supply the electrical power for the monitoring and regulating devices.

2.1.5 Combustion air filter

The combustion air supplied to the gas engine is filtered by the combustion air filter.

2.2 Unit components

2.2.1 Gas supply and gas-air mixer

Gas is supplied to the CHP unit via an internal gas supply unit, with the following components approved according to DVGW:

- Gas filter
- Flexible stainless steel hose pipe (part of the standard delivery)
- Ball valve with thermally activated shut off equipment
- Gas pressure switch for minimum pressure
- Two solenoid valves designed as gas safety valves (normally closed)
- Zero governor for adjusting to zero pressure downstream of the gas train
- Linear actuator for fuel gas admixing
- Gas-air mixer, permanently set, with throttle

The gas flow pressure at the CHP/gas train transfer point must at least be 20 mbar and no more than 50 mbar.

2.2.2 Clutch

The clutch connects the gas engine to the synchronous three-phase generator.

2.2.3 Synchronous three-phase generator

Rotational movement by the synchronous three-phase generator generates electrical power.

The synchronous three-phase generator is equipped with an automatic cos-φ control unit.

2.2.4 Base frame

The base frame supports the CHP unit (gas engine, synchronous three-phase generator, coolant pump, coolant expansion vessel, heat exchanger, exhaust gas cleaning system, lubricating oil supply system and noise attenuating elements).

Detachable supports facilitate the lifting of larger components using lifting gear, cranes or similar for inspections.

The hydraulic interfaces for gas, exhaust, condensate, heating water and unit ventilation have been prepared ready to connect on-site on the "connection side". The other three sides are freely accessible for operation and maintenance. Anti-vibration elements for mounting the engine/generator unit are provided on the base frame. The base frame is mounted on four height-adjustable, anti-vibration feet without rigid anchors.

2.2.5 Pipework

The pipework is pre-assembled at the factory and connects the most important elements of the CHP unit (coolant heat exchanger, exhaust gas heat exchanger and engine). Coolant, heating and exhaust pipework between the elements is fully assembled and insulated where necessary.

For the purpose of vibration isolation, all pipe joints are provided with metal expansion joints or flexible hose connections and are designed as flanged or flat-gasket threaded connections. Pipes conveying water and exhaust gas are made of stainless steel.

2.2.6 Heat transfer system

The plate heat exchanger serves as a defined interface for heat transfer. It releases the heat from the "internal cooling circuit" to the secondary heating water.

2.2.7 Exhaust gas cleaning system

A regulated three-way catalytic converter reduces emissions of pollutants in the exhaust.

2.2.8 Lubricating oil supply system

Each CHP unit is equipped with a facility to monitor the lubricating oil level. The minimum value can be checked via an electronic level control with alarm contact (oil min.). The oil consumption is covered by an enlarged oil pan and an additional parallel tank, with a volume dimensioned for ≥ one service interval.

For safety reasons, the floor pan can hold the total contents of both engine oil pan and fresh oil reservoir in the event of a fault.

2.2.9 Noise attenuating elements and extract air fan

The casing of the CHP unit consists of noise attenuating elements for the engine/generator unit. Ventilation of the CHP unit is ensured by the extract air fan.

Supply air is drawn in via the floor pan.

The average frequency of the sound insulation of the hood is approx. 20 dB.

The CHP unit casing can easily be removed for installation work.

2.2.10 Materials provided as standard

The following material is provided with the CHP unit as standard:

- 1 exhaust gas expansion joint, nominal diameter DN 50
- 2 HP heating hoses E10, length 1000 mm, 3/4"
- 1 corrugated gas hose, DN25, length 1000 mm, 1”, including double nipple reduction R1" x R½"
- 1 corrugated extract air hose, DN 250, length 1000 mm
- Condensate drain expansion joint (silicone hose) with 2 ball joint clamps
- 4 anti-vibration adjustable feet (100 mm diameter)
- 1 gas filter

Delivery as parts provided loose for on-site installation.

The material is inside a box labelled "Material for commissioning Vitobloc 200 <10kW”.

2.2.11 General description of the monitoring equipment for the Vitobloc 200

Monitoring via transmitters for oil pressure, coolant temperature, exhaust gas temperature, heating water temperature and engine speed as well as transmitters for lubricating oil level and high limit safety cut-out, including wiring to the control panel.

CHP unit (standard delivery) | On-site services (recommendation)

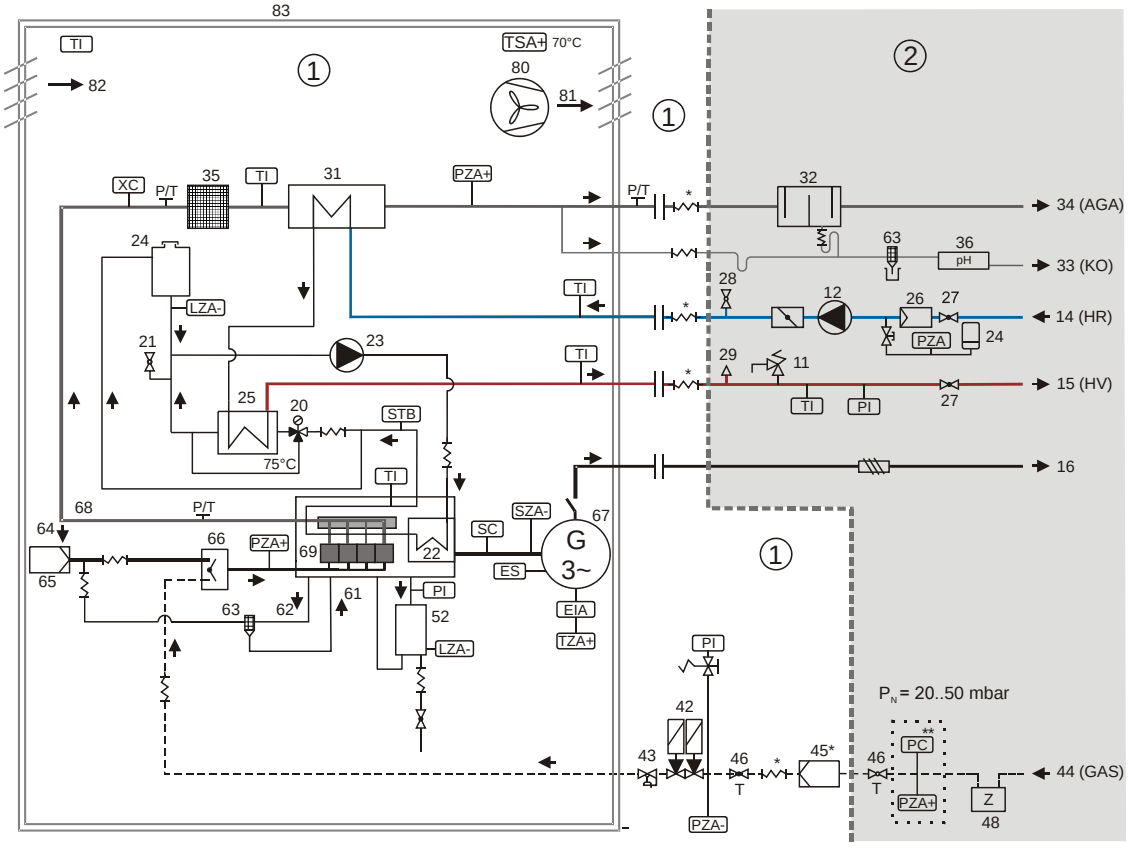


Fig. 3 Monitoring equipment

Overall key:

1 *CHP unit (standard delivery)*
2 *On-site services (recommendation)*
11 *Safety valve (heating water)*
12 *Heating water pump*
13 *Return temperature control*
14 *Heating water return (HR)*
15 *Heating water flow (HV)*
16 *Power current 400 V, 50 Hz*
17 *Coolant mixture flow*
18 *Coolant mixture return*
19 *Coolant mixture pump*
20 *3/2-way valve 75 ° C*
21 *Drain tap (engine cooling water)*
22 *Oil cooler*
23 *Coolant pump*
24 *Expansion tank*
25 *Coolant heat exchanger*
26 *Dirt trap*
27 *Shut-off valve*
28 *Fill and drain tap (hot water)*
29 *bleed valve*
31 *Exhaust gas heat exchanger*
32 *Silencer*
33 *Condensate outlet (KO) on the cleaning cover*
34 *Exhaust gas outlet (AGA)*
35 *3-way catalytic converter*
36 *Neutralization* ***42*** *Solenoid valve*
43 *Zero pressure regulator*
44 *Gas connection (GAS)*
45 *Gas filter, provided loose*
46 *Gas ball valve with thermally activated safety valve*
47 *Leak detector*
48 *Gas meter*
51 *Auxiliary lubricating oil tank (fresh oil)*
52 *Parallel tank with min. oil level monitoring*
61 *Lubricating oil return (from oil separator)*
62 *Crankcase vent*
63 *Oil separator*
64 *Combustion air*
65 *Air filter*
66 *Gas-air mixer with Lambda control valve*
67 *Generator*
68 *Exhaust gas header*
69 *Engine*
70 *Speed governor and throttle*
80 *Extract air fan*
81 *Extract air*
82 *Supply air*
83 *Silencer hood*

Test points:

EIA	*Generator monitoring indicator*
ES	*Generator output control*
LS	*Fill level control*
LZA	*Minimum level control*
P	*Pressure*
P_N	*Gas flow pressure*
PC	*Pressure control*
PI	*Pressure indicator*
PZA-	*Minimum pressure shutdown*
PZA+	*Maximum pressure shutdown*
SC	*Speed controller*
STB	*High limit safety cut-out*
SZA-	*Low speed*
T	*Temperature*
TA	*Extract air temperature before fan*
TC	*Temperature control*
TI	*Temperature indicator*
TS	*Silencer hood temperature*
TSA+	*Silencer hood overheating shutdown*
TZA+	*Generator winding temperature monitoring*
XC	*Lambda probe*

* *Provided loose for on-site installation*
** *Optional equipment*

NOTE

Only use type-tested parts for the safety equipment of the heating circuit connection.

2.2.12 Unit control panel with integral GS protection as per VDE-AR-N 4105

The control panel is mounted on the CHP unit as a supporting frame element. All the following components, including wiring, are located inside the CHP unit.

Brief description

Power unit:

- Feed-in circuit breaker, three-pole with thermomagnetic trip, manual actuation

GS protection as per VDE-AR-N 4105:

- Redundant mains protection with "single error safety"
- Mains voltage too high with 10 min averaging
- Mains voltage too high
- Mains voltage too low
- Mains frequency too high
- Mains frequency too low
- Island system detection
- 50.2 Hz control unit with output reduction
- Recording of last fault causes
- Password protection

Generator protection:

- Transformer set
- Generator voltage monitoring
- Generator current monitoring
- Generator load imbalance monitoring
- Generator temperature monitoring
- Fine synchronisation unit

Unit controller BBS 3000:

- Display (4.5") and programming unit
- Start-stop sequence controller for mains parallel and optional mains substitution mode
- Output control with warm start, fixed value and modulating modes
- Monitoring of relevant engine parameters
- Redundant, 2-channel, gas valve controller (2 processors)
- Operating and fault message memory
- Password-protected parameter level
- Data transfer for ignition, Lambda and speed control
- Optional data transfer to on-site BMS (K 3000 communication module)
- Optional data connection to external cylinder level controller SFR 3000
- Data transfer to Vitodata 100 with LON 3000 module
- Remote monitoring with Telecontrol LAN

Auxiliary drive unit:

- 24 V battery charger with V-I curve
- Emergency stop key switch
- Emergency stop safety contactor combination
- Starter controller
- Coolant pump controller
- Heating water pump controller
- Extract air fan controller
- Buffer discharge pump controller (option)
- Floating signalling contacts for operating and fault messages

Main wiring diagram of the electrical connection

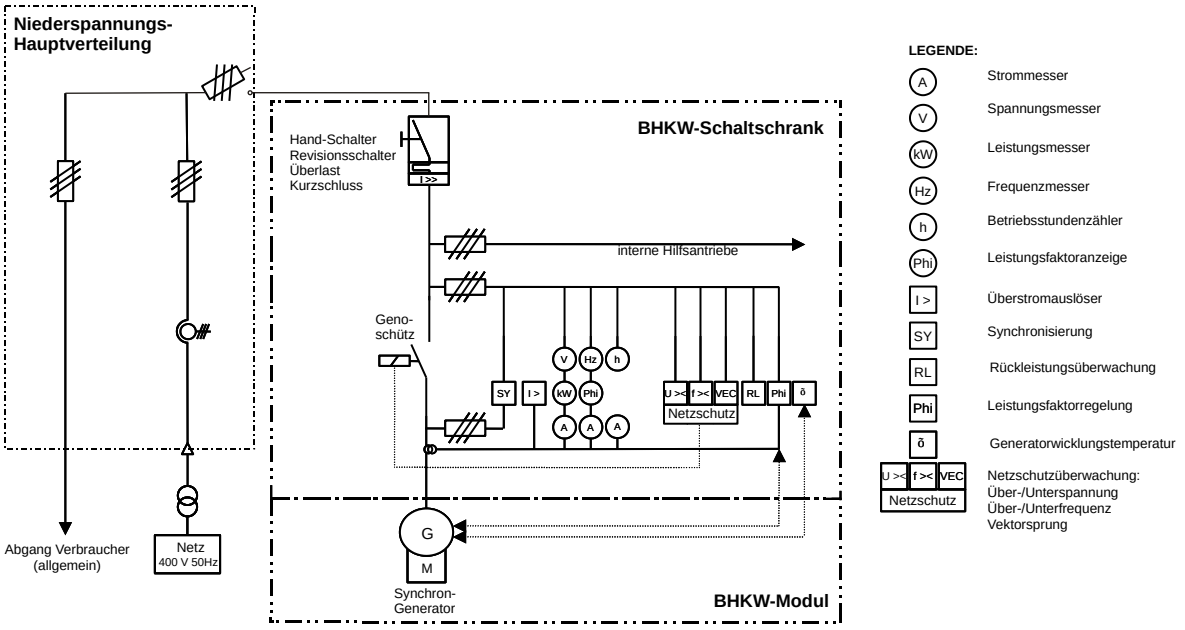


Fig. 4 Main wiring diagram of the electrical connection of a CHP unit in mains parallel mode

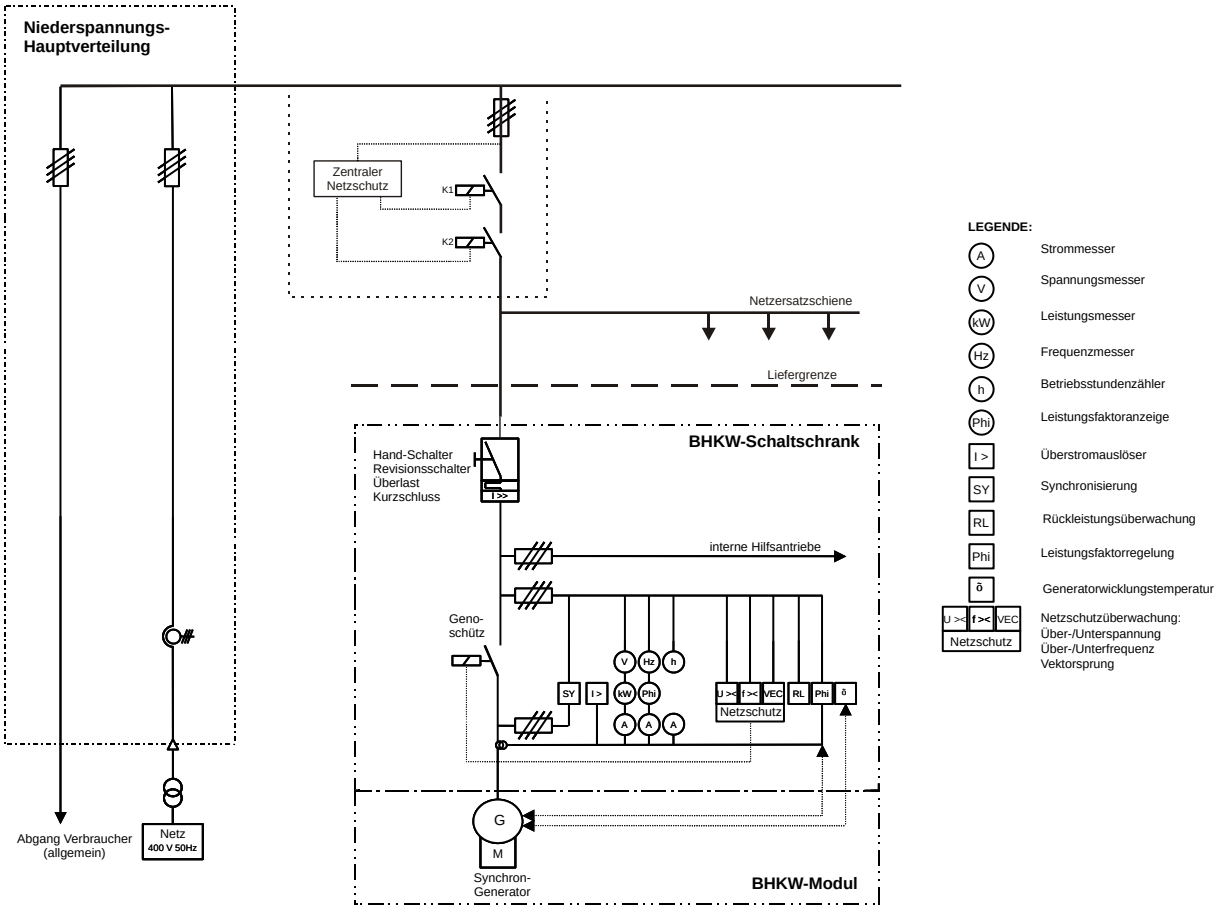


Fig. 5 Main wiring diagram of the electrical connection of a CHP unit in mains substitution mode

3 Service and maintenance

Consequential operating costs arise for the CHP unit, relating to inspection, servicing and corrective maintenance.

Due to its intended use, the CHP unit is exposed to various influences, such as wear, ageing, corrosion, and thermal and mechanical loads. This is described by DIN 31051 as wear. Components of the CHP unit are designed with a wear margin that ensures reliable operation of the CHP system in accordance with the operating conditions up to impairment of the functional capability. Once this point has been reached, these parts – differentiated into wearing parts and parts with a finite service life – must be replaced.

PLEASE NOTE:

Carry out a service at least once a year and no later than after 6,000 hours run.

PLEASE NOTE:

Proper servicing of the CHP unit may only be carried out by authorised personnel. Use only original spare parts and operating fluids (lubricating oil) approved by the CHP unit manufacturer. The operator is responsible for safeguarding and observing the regulations regarding operating fluids.

NOTE

The expected service life of the CHP unit is at least 10 years, provided that regular service and maintenance work is carried out.

4 Specification

All the following design and operating data relates to one CHP unit.

You will find detailed instructions for planning and implementation in the Expert Natural Gas Series for Combined Heat and Power Plants (Planning Instruction for Vitobloc 200).

4.1.1 Performances and efficiencies

Performances and efficiencies of CHP unit				Vitobloc 200	
Continuous output [1] in mains parallel mode				**EM-6/15 Natural gas**	**EM-6/15 LPG**
Electrical output [2]	cannot be overloaded	100% load	kW	6.0	6.0
		75% load	kW	4.5	4.5
		50% load	kW	3.0	3.0
Heating output	Tolerance 7 %	100% load	kW	14.9	14.0
		75% load	kW	12.4	11.5
		50% load	kW	9.7	9.5
Fuel use	Tolerance 5 %	100% load	kW	22.2	22.0
(at Hi [net cv] = 10.0 kWh/m³)		75% load	kW	18.9	17.7
		50% load	kW	14.8	13.9
Power index according to AGFW FW308 (electrical output / thermal output)				0.393	0.418
Primary energy factor fPE as per DIN V 18599-9 [3]				0.540	0.559
Primary energy savings PEE in accordance with directive 2012/27/EU (High Efficiency Certificate)			%	24.26	22.36
Efficiency as per EnergieStV [4]			%	96.9	93.7
Efficiency in mains parallel mode [1]					
Electrical efficiency		100% load	%	27.0	27.3
		75% load	%	23.8	25.4
		50% load	%	20.3	21.6
Heat efficiency		100% load	%	67.0	63.6
		75% load	%	65.6	65.0
		50% load	%	65.5	68.3
Overall efficiency		100% load	%	94.0	90.9
		75% load	%	89.4	90.4
		50% load	%	85.8	89.9

1) Output ratings in accordance with ISO 3046 part 1 (at air pressure 1000 mbar, air temperature 25 °C, relative humidity 30 %, 30 °C heating water inlet temperature in the unit and cos φ =1).
All further unit data applies to full load in mains parallel mode; partial load data is non-binding and for information purposes only; data for other installation conditions upon request.
2) The output indicated on the display is based on the generator reference arrow system and not the consumer reference arrow system, i.e. when outputting power (exporting), the output on the display is prefixed by a plus sign.
3) Calculated in accordance with DIN V 18599-9 with a primary energy factor for natural gas/LPG of 1.1 and for electricity of 2.8 (EnEV 2014). The CHP coverage fraction is included at 1.0.
4) The efficiency according to [German] Energy Tax Implementation Ordinance (EnergieStV) is defined as the ratio of the total thermal and mechanical energy generated over the total energy and auxiliary energy consumed

Tab. 2 CHP unit operating parameters - Performances and efficiencies

4.1.2 Operating parameters - energy

Operating parameters - energy				Vitobloc 200	
Heat generation (heating)				**EM-6/15 Natural gas**	**EM-6/15 LPG**
return temperature upstream of unit		min. / optimal / max.	°C	30 / 30 / 65 [1]	
standard temperature difference		return/forward flow	K	20	
flow temperature		max.	°C	50 / 50 / 85	
heating water volume flow		standard	m³/h	ca. 0.7	ca. 0.6
maximum acceptable operating pressure			bar	10	
pressure loss at standard flow rate in the unit		standard	mbar	50	
Electrical energy					
Voltage			V	400	
Current	rated current In at cos φ = 1		A	9	
Frequency			Hz	50	
Electrical output at	cos phi = 1 and Un		kW	6	
	cos phi = 0.95 and Un		kW	6	
	cos phi = 0.9 and Un		kW	6	
	cos phi = 1 and Un -10%		kW	6	
	cos phi = 0.95 and Un -10%		kW	6	
	cos phi = 0.9 and Un -10%		kW	6	
Own power consumption [2]	rated / max.		kW	0.15 / 0.4	

1) In mains substitution systems, return temperature max. 60 °C
2) Demand for coolant pump, fan, battery charger, power consumption is subject to the ambient temperature and the battery state of charge

Tab. 3 Operating parameters - energy

4.1.3 Operating fluids and capacities

Operating parameters - operating fluids and capacities			Vitobloc 200
Operating fluids and capacities valid for all variants			**EM-6/15**
Properties of fuel, lubricating oil, coolant and heating water			See latest operating regulations
Capacity	Lubricating oil	ltr	35
	Coolant	ltr	3
	Heating water	ltr	2.8
Gas flow pressure [1]		mbar	20 - 50

1) Gas connecting pressure is in accordance with DVGW-TRGI 1986/96 of the gas flowing pressure at the beginning of the module's gas regulating route

Tab. 4 Operating parameters - operating fluids and capacities

4.1.4 Emissions

Operating parameters - Emissions of CHP unit			Vitobloc 200
Pollutant emissions at 100% load [1)] valid for all variants			**EM-6/15**
NOx content (measured as NO_2)		mg/Nm³	< 250
CO content		mg/Nm³	< 250
Formaldehyde CH_2O		mg/Nm³	< 20
Sound emission Sound pressure level at 1 m distance in the open according to DIN 45635 (tolerance to the specified values 3 dB(A))			
exhaust gas [2)]	with 1 optional silencer	dB(A)	38
module		dB(A)	57

1) *Emission values as per the catalyst based on dry exhaust gas*
2) *We urgently recommend providing 2 consecutive exhaust gas sound absorbers when using the block-type thermal power station in residential areas to comply with the demands of spaces requiring special protection.*

Tab. 5 Operating parameters - Emissions of CHP unit

4.1.5 Ventilation and exhaust gas

Ventilation and exhaust gas			Vitobloc 200
Combustion air and ventilation valid for all variants			**EM-6/15**
module's radiating heat	without connecting line	kW	1.13
installation room ventilation	nominal supply air volume flow	m³/h	1,155
	nominal extract air volume flow	m³/h	1,125
residual pressure	at nominal extract air volume flow	Pa	70
supply air temperature	min./max.	°C	10 / 35 [1)]
Exhaust gas			
Exhaust gas mass flow rate, dry	0 % O_2 (0 °C; 1012 mbar)	kg/h	30
Max. permissible back pressure	Downstream of unit	mbar	15
Max. operating pressure		mbar	40
Exhaust gas temperature	max.	° C	100

1) *Ambient temperature no higher than 35°C and its average value over a period of 24 hours no higher than 30°C*

Tab. 6 General operating parameters - Ventilation and exhaust gas

4.1.6 Determining the energy efficiency class (ErP label)

Technical data for determining the energy efficiency class (ErP label) 10)				
			EM-6/15	
		Variants	Natural gas	LPG
Energy efficiency class			A++	
Electrical efficiency	$\eta_{el,CHP100+Sup0}$	%	27.0	27.3
Thermal efficiency	$\eta_{CHP100+Sup0}$	%	67.0	63.6
Minimum electrical consumption	el_{Min}	kW	0.120	
Maximum electrical consumption	el_{Max}	kW	0.192	
Stand-by electricity consumption	P_{SB}	kW	0.065	
Thermal performance	$P_{CHP100+Sup0}$	kW	14.9	14.0
Thermal stand-by losses	P_{stby}	kW	0.229	
Power required for ignition spark	P_{ign}	kW	0.02	

1) *The data required for the energy efficiency calculation for a package composed of different heat generators according to the basis for calculation in the Official Journal of the European Union 2014/C 207/02*

Tab. 7 Determining the energy efficiency class (ErP label)

4.2 Specification of a complete CHP unit in natural gas or LPG operation

CHP unit specification			Vitobloc 200 EM-6/15
Engine with accessories			
Gas engine	Manufacturer		Toyota
	Engine type		1KS
Operation			4-stroke
Number/arrangement of cylinders			3/in line
Bore/stroke		mm	72/78
Cubic capacity		l	1.0
Speed		rpm	1500
Compression ratio			12 : 1
Gas consumption, natural gas	at Hi [net cv] = 10.0 kWh/m³	Nm³/h	2.20
Gas consumption, LPG	at Hi [net cv] = 12.87 kWh/kg	kg/h	1.71
Lubricating oil pan capacity		l	15
Lubricating oil consumption	(average)	g/h	1.5
Engine weight	(approx.)	kg	70
Synchronous generator			
Generator type			LSA 40 VS2
Apparent power S_n	at cos phi = 0.8	kVA	11.5
Three-phase current	Voltage / frequency	V / Hz	400 / 50
Speed		rpm	1500
Efficiency at rated output of the unit and cos φ = 1[2)]		%	88.8
Rated current		A	16.6
Sub-transient short circuit current I''_k - initial - short alternating current according to DIN EN 60909-0 (VDE 0102)		A	204.9
Stator connection			Star
IP rating			IP 23

Cables to CHP terminal box (recommendation)		
Fuse rating NSHV (recommendation)	A	20
Minimum required version for proper connection of CHP system		
Power supply to NSHV, grid coupling section or transformer station	X1: L1, L2, L3, N, PE	H07 RNF 5 x 2.5 mm²
On-site remote selection **"Heating mode" 100 % output**	X1: Terminal 31 / 32	Ölflex 4 x 1.5 mm²
Unit feedback (floating contact) **"Ready"**	Terminal relay - direct connection -25K5 connections 11/12/14	
Unit feedback (floating contact) **"Mains parallel mode"**	Terminal relay - direct connection -25K6 connections 11/12/14	
Unit feedback (floating contact) **"Fault"**	Terminal relay - direct connection -25K10 connections 11/12/14	
Selection **heating water pump** [3] (floating contact)	X5: Terminal 9 / 10	
Heating water pump 230 V / 2 A[3]	X5: Terminal 1 / N / PE	Ölflex 3 x 1.5 mm²
Buffer cylinder discharge pump 230 V / 2 A	X5: Terminal 2 / N / PE	Ölflex 3 x 1.5 mm²
Heating water control valve (return temperature raising) 0..10 V (optional: variable speed heating water pump) [3]	X5: Terminal 3 / 4/ 5 / 6	Ölflex 4 x 0.75 mm²
Exhaust gas high limit safety cut-out (STB)	X1: Terminal 39 / 40	Connecting cable STB
Earth cable from unit to on-site equipotential busbar	Earth connection on the unit frame	Sizing according to on-site conditions

1) Output ratings according to ISO 3046 part 1
(at air pressure 1000 mbar, air temperature 25 °C, relative humidity 30 % and cos φ = 1)
All further unit data applies to mains parallel mode; data for other installation conditions upon request
2) cos φ display value in generator reference arrow system
3) The 230 V version of the heating water pump can be connected directly. With a 400 V pump the power unit must be installed on-site. The control selection, however, travels at zero volts from the unit controller.

Tab. 8 Complete CHP unit specification for natural gas operation

NOTE

This cable list contains the required minimum version for proper connection of a CHP system and serves merely as a guide. The relevant specialist electrical installation contractor is responsible for correct wiring of the system, which must be carried out in accordance with the local conditions and all current VDE and power supply utility regulations.

4.3 Dimensions, weights and colours

CHP unit dimensions			Frame size	incl. silencer hood and extract air fan
Length		mm	1,366	1,620
Width		mm	700	761
Height (without feet)		mm	1,334	1,413
CHP unit weight				
Dry weight	(approx.)	kg	490	
Operating weight	(approx.)	kg	540	
Colours				
Engine, generator			Light grey (RAL 7035)	
Frame			Anthracite grey (RAL 7016)	
Control panel			Vitosilver	
Silencer hood			Vitosilver	

Connections		Version	Standard	Size
AGA	Exhaust outlet	Pipe	EN 10255	DN 50
KO	Condensate drain	Pipe	EN 10217-7	ø 18 x 1.5 mm
GAS	Gas inlet	Gas ball valve	EN 10226	Rp ½" 1) internal thread
HV/HR	Heating flow/return	Pipe connector	EN 10226	Rp ¾" internal thread
AL	Extract air outlet	Plain flange	—	DN 250
Electrical connections and earthing (as per installation instructions)		Sizing as per local conditions and current VDE and power supply utility regulations (see Tab. 5 for a recommendation)		

1) Standard connection accessories: Gas hose 1", incl. double nipple reduction R1" x R1/2" as pressure buffer to balance gas pressure fluctuations

Tab. 9 Dimensions, weights, colours and connections

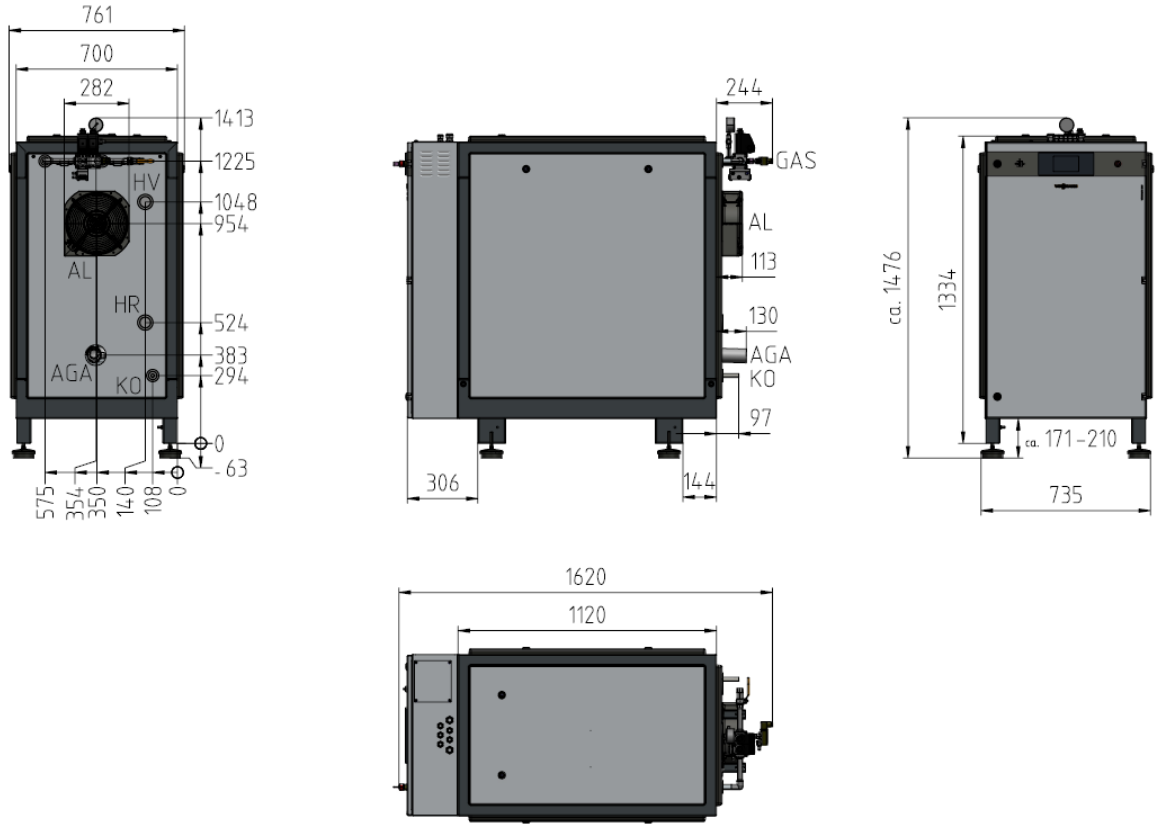


Fig. 6 Dimensions and connections for Vitobloc 200 EM-6/15 CHP unit (dimensions in mm)

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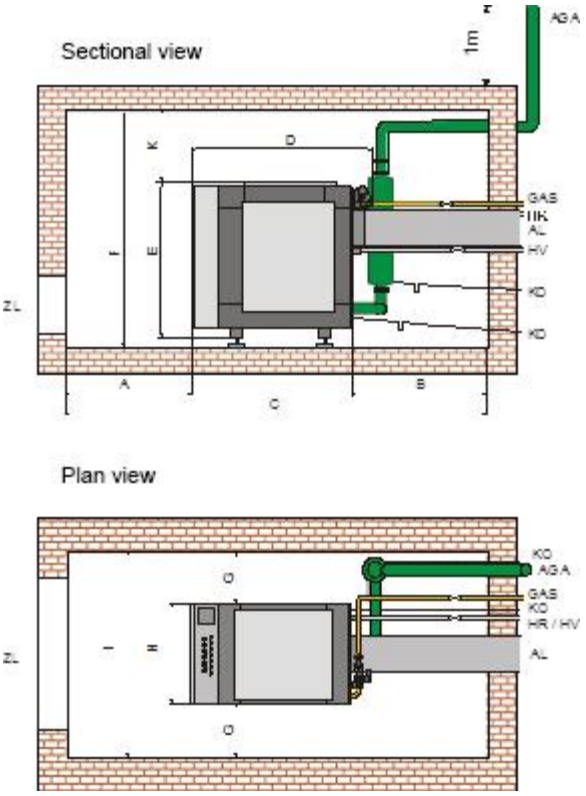
4.4 Siting information

You will find detailed instructions for planning and implementation in the Expert Natural Gas Series for Combined Heat and Power Plants (Planning Instruction for Vitobloc 200) and the corresponding "Installation instructions".

Observe the following points when siting the CHP unit:

- The room where it will be erected should be made pursuant to the applicable firing directive and applicable construction law ordinances/ regulations. We recommend integrating the CHP module into the fire protection strategy for safe operation.
- To increase workplace safety for the operator we recommend that you install a CO monitor in the installation room.
- For servicing and operating purposes, maintain a clearance as shown in installation diagram Fig. 7.
- For maintenance works, a filling and draining tap must be installed by the customer in close proximity to the CHP in the hot water inflow (e.g. a ½" KFE tap) and a vent valve must be installed in the hot water return (Fig. 3).
- We recommend that the gas supply pipe is designed with double the diameter approx. 5 m upstream of the CHP system in order to use this section as a buffer. This allows pressure fluctuations to be absorbed when boilers are switched on and off.
- We recommend using a calibrated gas meter, size G4, for natural gas operation. The gas meter should be provided on site.
- There is an option of equipping the BHKW module with a calibrated power meter with M-Bus-connection. The meter must also be ordered as an accessory.
- Condensate forms during operation of the CHP unit. A hydraulic seal (siphon flue) with an effective water column height of at least 250 mm WC must be provided in order to prevent the exhaust gas from escaping through the condensate drain pipe. Check the fill level of the hydraulic seal regularly.
- A reinforced installation base measuring 1200 x 800 x 150 mm (LxWxH), on which the CHP unit is positioned unrestricted on flexible elements, helps to increase the mass for improved insulation of structure-borne noise from the building structure. This is particularly important in residential buildings. Fully supporting the base on Sylomer mats is a practical solution for structure-borne noise attenuation.
- When using an exhaust gas manifold in multi-unit systems, the back flow of exhaust into idle CHP units must be reliably prevented by one 100 % gas-tight motorised shut-off damper per unit. Otherwise, provide a separate exhaust pipe for each CHP unit.
- Dispose of the exhaust condensate in accordance with local regulations.
- Since oil vapour in the exhaust gas can condense at low exhaust temperatures, provide an oil separator in the condensate line on site.

Siting in the plant room



Key:

AGA	*Exhaust*	*HR*	*Heating water return*
AL	*Extract air*	*HV*	*Heating water flow*
GAS	*Natural gas*	*KO*	*Condensate*
ZL	*Supply air*		

Fig. 7 Sample installation designs – depiction without fittings and safety assembly (dimensions in mm)

Fig. 7		Comment
A	1,000 mm	Uninstalled
B	700 mm	Recommendation
C	3,550 mm	
D	1,620 mm	without LSR 3000
E	1,440 mm	
F	2,220 mm	
G	800 mm	Uninstalled
H	770 mm	
I	2.360 mm	
K	700 mm	Uninstalled

Tab. 10 Installation dimensions

4.5 Start-stop ratio

The module should be at least 180 min in operation per start (approximately 3:1 ratio of the number of operating hours to the starts).
Early wear and tear in the starting equipment from shorter times are caused by operation and are not a defect.

5 General design and operating information

Observing the following points improves the operational reliability.

Faults and consequential losses resulting from prohibited operating conditions are not covered by the warranty or any service contract.

Sizing

- Avoid cyclical on-off operation and provide a buffer if necessary:
  $V_{buffer} = Q_{th} \times 43\ l/kW_{th}$ (minimum buffer size)

Installation room

- Install exhaust and extract air silencers in buildings where noise levels are critical; always factor in flexible connections (expansion joints).
- Ensure correct sizing and routing of the extract air and exhaust pipes (pressure drops, nominal diameters, flow noise).
- Use anti-vibration elements during installation to prevent structure-borne noise.

DANGER!

Do not assemble together with a boiler plant atmospheric burner or a NH_3refrigeration machine in a room/air ratio.

Heating

- Ensure a constant, adequate heating water flow rate.
- The combined heat and power (CHP) unit must be protected against silting from the existing heating system. It is recommended that you install a dirt catcher and a dirt separator in the return line to the CHP unit.
- Prevent fault shutdowns due to excessive heating water return temperatures. The heating water return temperature must not exceed the permissible value in either mains substitution mode or mains parallel mode.
- For hot water return temperatures lower than the minimum value as per the Technical specifications (Sec. 4.1.2), an increase in the return temperature is planned, which must be installed as close as possible to the CHP unit.
- The mains substitution function does not apply in conjunction with operation of an absorption cooling system.

Exhaust gas

- Size the exhaust cross-section adequately.
- In the case of prefabricated systems, the exhaust system must be type-approved, pressure-tight and **pulsation-proof up to 50 mbar**. At this test pressure, leakage must not exceed 0.006 l/m³s (corresponds to H1).
- For the condensate, provide an unrestricted drain with a fall of at least 3 %, which must be installed above the siphon (U-bend) at a height of min. 250 mm to prevent exhaust gas escaping through the condensate drain.
- Hydraulic seals must be executed, so that the water level can be checked and filled. The condensate line must be checked regularly blockages and sufficient water seal.
- Observe the exhaust system installation instructions for the Vitobloc 200.

Ventilation

- Ensure non-preheated and dust, sulphur & halogen-free cooling and combustion air.
- Ensure an adequate supply of fresh air and that extract air is discharged securely.
- In the case of air containing chlorine (e.g. in swimming pools), provide a separate supply air intake.

Fuel

- Ensure gas flow pressure of 20 mbar to 50 mbar.
- Recommendation: Oversize the gas supply pipe to create a pressure buffer with double the diameter approx. 5 m upstream of the CHP system.
- For operation with LPG, the "Technical rules for LPG 2012 - DVGW TRF 2012" must be observed.

Electrics

- The CHP unit generates 400 V of power. For safety reasons, it has sensitive electrical mains protection systems, which react to asynchronous network loads in the customer network according to the regulations. Safety shutdowns do not constitute a CHP unit fault.
- Incorrect sizing of the electrical loads in mains substitution mode can lead to fault shutdowns due to overload (inductive or capacitive start-up currents carry up to 20 times the rated current and lead to overloading of the CHP unit).
- Always avoid shutting down on full load, as this would subject the components to the highest mechanical loads.
- CHP units **must** be connected to the on-site equipotential busbar via an earth cable (for earth connection, see the installation instructions).

Service + operating fluids

- Regular servicing and maintenance by qualified personnel. We recommend a service contract.
- Elimination of drip leaks, proper disposal of old oil, regular checking of exhaust condensate lines for correct function.
- During longer idle periods, disconnect the batteries when decommissioning the unit and, in the case of shutdowns lasting longer than 12 weeks, perform a warranty preservation.
- Perform the warranty preservation no later than 24 weeks after delivery.

6 Declaration of conformity

EU-Konformitätserklärung

VIESSMANN

Vitobloc 200

Blockheizkraftwerk (BHKW) mit Schaltschrank für Erdgas- und Flüssiggasbetrieb

Vitobloc 200 folgende Typen:

EM-6/15
EM-9/20
EM-20/39

Wir, die Viessmann Werke GmbH & Co. KG, D-35107 Allendorf, erklären in alleiniger Verantwortung, dass die bezeichneten Produkte die Bestimmungen folgender Richtlinien und Verordnungen erfüllen:

EU 2016/426	Gasgeräteverordnung
2006/42/EG	Maschinenrichtlinie
2014/30/EU	EMV-Richtlinie
2014/35/EU	Niederspannungsrichtlinie
2010/30/EU	Richtlinie zur Energieverbrauchskennzeichnung
811/2013	EU-Verordnung „Energieeffizienzlabel“
813/2013	EU-Verordnung „Energieeffizienzanforderungen“

Angewandte Normen:

ISO 12100:2011	EN 61439-1:2012 (VDE 0660-600-1:2012)
ISO 13857:2008	EN 61439-2:2012 (VDE 0660-600-2:2012)
EN 437:2009-09	VDE 0100 Beiblatt 2:2001
EN 762-2:2011	VDE 0100 Teil 410:2007
EN 1443:2003	VDE 0100 Teil 420:2016
DIN 6280-14:1997	VDE 0100 Teil 430:2010
DIN 6280-15:1997	VDE 0100 Teil 450:1990
EN 55011: 2017	VDE 0100 Teil 460:2015
EN 61000-6-2:2006	VDE 0100 Teil 510:2014
EN 60204-1:2014	VDE 0100 Teil 520:2013
EN 60034-1:2011	VDE 0100 Teil 560:2013
EN 60034-5:2007	VDE 0100 Teil 600:2017
EN 60335-1:2012	

Gemäß den Bestimmungen der genannten Richtlinien wird dieses Produkt mit
CE - 0433 gekennzeichnet.

Allendorf, den 16. Mai 2018

Viessmann Werke GmbH & Co. KG

ppa. Reiner Jansen
Leiter Strategisches Qualitätsmanagement

4753493 DE 5/2018

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7 Certificate of Conformity of the Production Unit NA-Protection

primara
Test- und Zertifizier-GmbH

Konformitätsnachweis
Erzeugungseinheit, NA-Schutz

Antragsteller: **Viessmann Kraft-Wärme-Kopplung GmbH**
Emmy-Noether-Str. 3
86899 Landsberg am Lech
Deutschland

Produkt: **BHKW mit integriertem NA-Schutz**

Modell:	**Vitobloc 200 EM-6**	**Vitobloc 200 EM-9**
Leistung:	**6,0kW**	**8,5kW**
Bemessungsspannung:	**400V, 50Hz**	

Die oben bezeichneten Erzeugungseinheiten mit integriertem NA-Schutz erfüllen die Anforderungen der VDE-AR-N 4105 als bedingt regelbare Erzeugungseinheiten.

Der Konformitätsnachweis beinhaltet folgende Angaben:
- technische Daten der Erzeugungseinheit, der eingesetzten Hilfseinrichtungen und der verwendeten Softwareversion;
- den schematischen Aufbau der Erzeugungseinheit;
- zusammengefasste Angaben zu den Eigenschaften der Erzeugungseinheit

Netzanschlussregel:

VDE-AR-N 4105:2011-08
Erzeugungsanlagen am Niederspannungsnetz – Technische Mindestanforderungen für Anschluss und Parallelbetrieb von Erzeugungsanlagen am Niederspannungsnetz.

Mitgeltende Normen:

DIN VDE V 0124-100 (VDE V 0124-100):2012
Netzintegration von Erzeugungsanlagen – Niederspannung – Prüfanforderungen an Erzeugungseinheiten vorgesehen zum Anschluss und Parallelbetrieb am Niederspannungsnetz.

Ein repräsentatives Testmuster des oben genannten Erzeugnisses entspricht zum Zeitpunkt der Ausstellung dieser Bescheinigung der aufgeführten Netzanschlussregel.

Berichtsnummer: 12KFS062-01

Zertifikatsnummer: 15-190-02

Ausstelldatum: 2016-07-18

DAkkS
Deutsche Akkreditierungsstelle
D-ZE-12089-01-00

Andreas Aufmuth
Zertifizierstelle

CERTIFICATION primara Test- und Zertifizier-GmbH Grid Code Compliance VDE-AR-N 4105

Primara Test- und Zertifizier-GmbH | Gewerbestraße 28 | 87600 Kaufbeuren | Germany | www.primara.net

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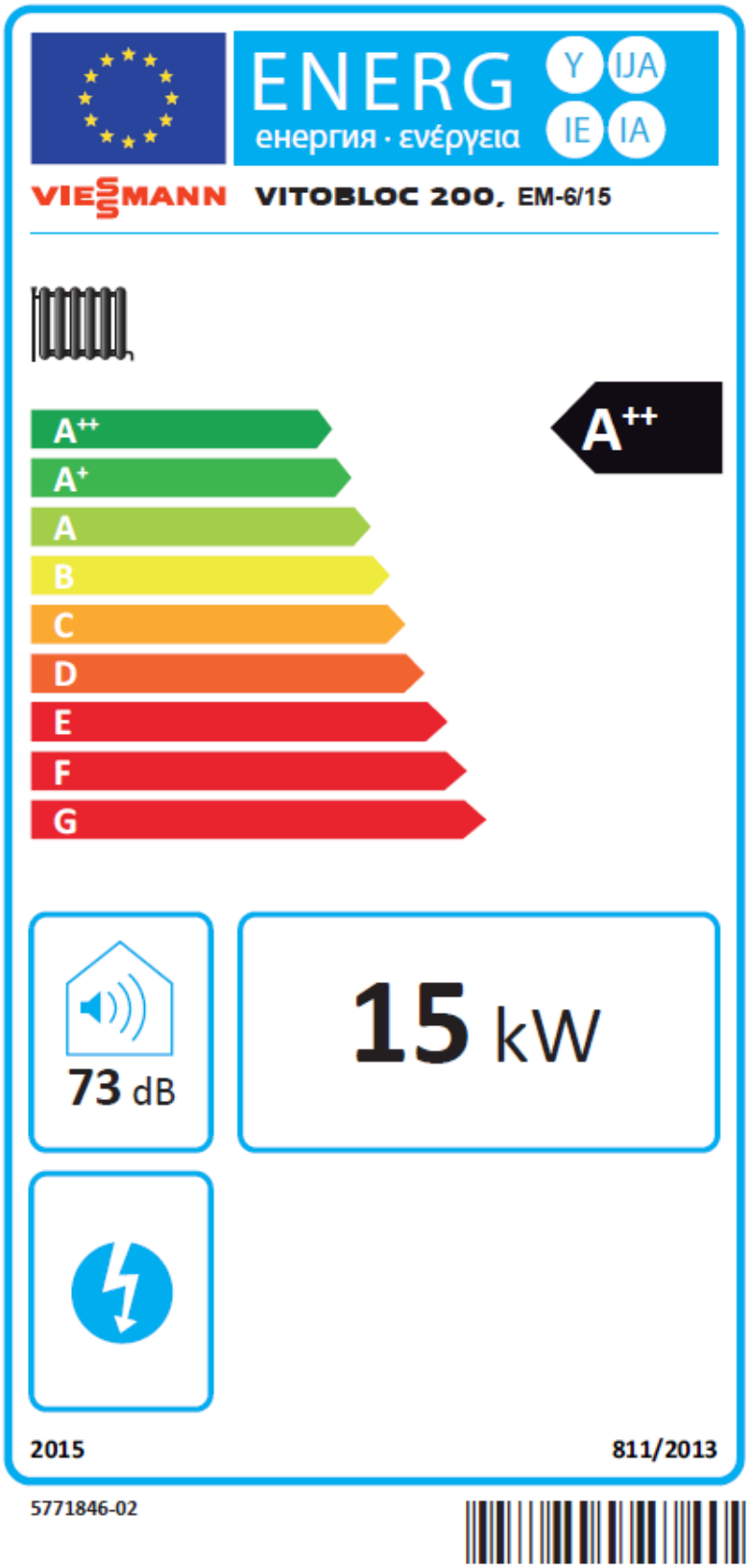
8 Energy Efficiency Label



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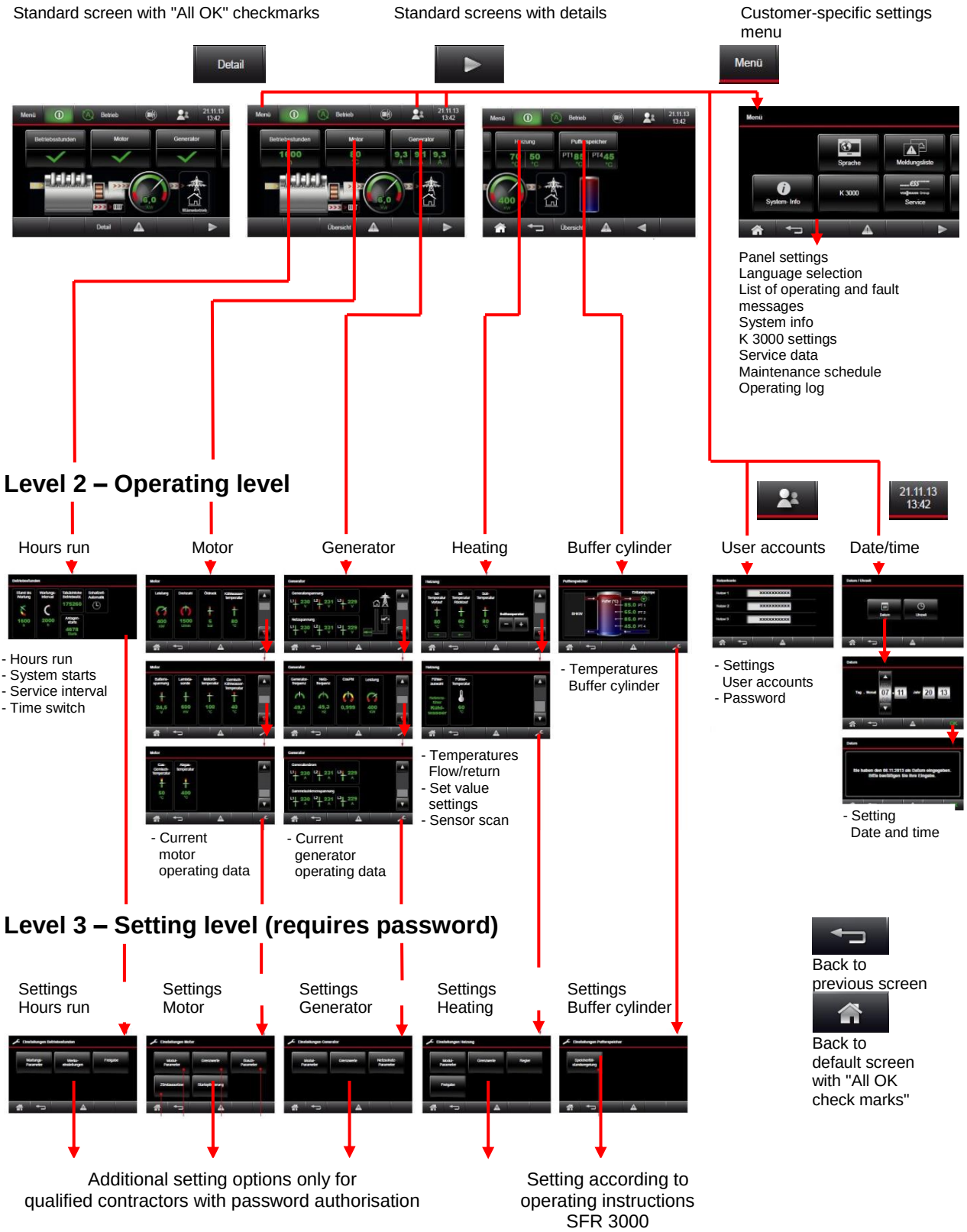
9 Getting started

Level 1 - Standard screens



Notes

Notes

Subject to change without notice!

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