



Product range 2010

Natural gas – Combined Heat and Power Unit

26 kW

to 400 kW

Electrical power

Compact modules with SCHMITT-ENERTEC gas engines





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FMB-65-GSK
FMB-88-GSK
FMB-120-GSK
FMB-155-GSK
FMB-190-GSK
FMB-215-GSMK
FMB-230-GSMK
FMB-255-GSMK
FMB-270-GSMK
FMB-275-GSMK
FMB-285-GSMK
FMB-320-GSMK
FMB-410-GSMK
FMB-430-GSMK
FMB-500-GSMK





1 SCHMITT ENERTEC natural gas CHP with SCHMITT ENERTEC gas engines

CHP-Type	Engine (Gas-Otto-engine) (naturally aspirated: Lambda = 1) (Leanburn; Turbocharged) Cyl. / Mode ¹⁾ / Manufacturer ²⁾	Electrical power ³⁾ /kW	Electrical efficiency ³⁾ /%	Thermal output ⁴⁾ /kW Abgastemp. 120°C	Fuel input ⁵⁾ /kW
FMB-31-GSK	3 / R - aspirated / SE-IV	26	32,0	46	81
FMB-65-GSK	4 / R – turbo / SE-IV	50	33,2	82	150
FMB-80-GSK	4 / R – turbo / SE-IV	75	33,6	127	223
FMB-120-GSK	6 / R - aspirated / SE-MB	100	34,4	161	291
FMB-155-GSK	6 / R - aspirated / SE-MB	122	35,1	196	348
FMB-190-GSK	8 / V 90 - aspirated / SE-MB	151	36,0	232	419
FMB-215-GSMK	6 / R - turbo int. 70°C / SE-MB	173	35,8	264	483
FMB-230-GSMK	6 / R - turbo ext. 50°C / SE-MB	185	36,5	239	507
FMB-255-GSMK	6 / R - turbo int. 45°C / SE-MB	205	37,5	268	547
FMB-270-GSMK	8 / V90 - turbo int. 70°C / SE-MB	220	37,3	307	590
FMB-275-GSMK	12 / V90 – aspirated / SE-MB	230	36,1	362	637
FMB-285-GSMK	8 / V90 - turbo ext. 50°C / SE-MB	233	37,7	283	618
FMB-320-GSMK	8 / V90 - turbo ext. 45°C / SE-MB	260	37,8	335	689
FMB-410-GSMK	12 / V90 - turbo int. 70°C / SE-MB	334	36,6	485	913
FMB-430-GSMK	12 / V90 - turbo ext. 50°C / SE-MB	350	38,1	413	919
FMB-500-GSMK	12 / V - turbo int / ext. / SE-MB	400	37,9	503	1.055

1)
R = Reihenmotor
V = V-engine 90°
int. = internal mixture cooling
ext. = external mixture cooling

2)
SE-IV = SCHMITT ENERTEC based on Iveco
SE-MB = SCHMITT ENERTEC based on Mercedes-Benz
3)
at pf=1, not over loadable
4)
+/- 8%; Methannumber 80
5)
+/- 5%; Methannumber 80



1.2 Equipment

1.2.1 Engine

Industrial engine for continuous operation, speed 1500 1/min.
Make: SCHMITT-ENERTEC based on Mercedes Benz.

Cylinder block:

- alloyed cast iron, with suspended main bearing caps, oil pan removal without lifting the engine
- bearing caps additionally side screwed

Cylinder liners:

- replaceable nitrited wear resistant wet cylinder liners of centrifugal cast iron

Pistoners:

- Aluminium alloy pistons with infused double- ring- carrier for the upper two rings, cooled via oil spray nozzles

Cylinder heads:

- single cylinder heads of special cast iron with shrink fitted, replaceable valve seat rings, replaceable valve guides

Power train:

- forged crankshaft with screwed control gear
- torsion vibration damper and fly wheel
- Main bearings: 6 Cylinder Line in engine: 5-fold
 8 Cylinder V-engine: 5-fold
 12 Cylinder V-engine: 7-fold
- screwed counter weights

Valves:

- each one inlet- and one outlet valve of Nimonic 80A per each cylinder, driven by camshaft push rods and rocker arms

Engine lubrication:

- internally fitted oil pump, gear pump, engine driven with safety valve
- main flow oil filter

Ignition:

- processor controlled condenser ignition system, contact- less with electronic controller, dead centre sensor, sensor for cylinder No. 1 and each one ignition coil and spark plug per cylinder

Starter:



- electric starter motor, 24V DC

1.2.2 Mixture formation:

Gas train:

- to DVGW, ready piped on the set, comprising counter flanges, gaskets, ball valve, double- solenoid valve, gas regulation valve (Lambda control valve), pressure gauge, gas filter, pressure switch, thermal shut- off device, deflagration filter, flexible connection hose

Intake air filter:

- dry air filter with clogging indicator

Gas mixer:

- Venturi gas- air- mixer

Throttle:

- throttle flap with actuator

Turbo charging / Mixture cooling (only for turbo-engines)

- Mixture-turbocharger
- Guascor V-engine: One turbocharger per cylinder bank
- Internal mixture cooling: Mixture cooling will dissipated in the engine cooling circuit (Return water entering mixture cooler: 80 °C)
- External mixture cooling: Mixture cooling will dissipated in an external LT cooler and to the ambient air. (Return water entering mixture cooler: 50 °C)

Emission control:

Catalyst:

- Naturally aspirated engine: Controlled 3-way catalytic converter in the exhaust stream
- Lean burn engine turbocharged: Oxidation catalyst in the exhaust stream

1.2.3 Hydraulic:



Transfer heat exchanger:

- for completion of the thermal heat of the CHP to an external heating water system
- soldered plate- type heat exchanger, stainless steel 1.4401
- primary circuit: approx. 95°C / 80°C
- secondary circuit: approx. 70°C / 90°C

Mixture cooler (only for turbo-engines)

- shell and tube heat exchangers
- Internal mixture cooling: Mixture cooling will dissipated in the engine cooling circuit (Return water entering mixture cooler: 80 °C)
- External mixture cooling: Mixture cooling will dissipated in an external LT cooler and to the ambient air. (Return water entering mixture cooler: 50 °C)

Oil cooler:

- Oil cooler integrated in the engine jacket water circuit

Engine cooling:

- high temperature circuit for engine jacket water, cylinder heads and exhaust gas manifold cooling

Exhaust gas heat exchanger:

- shell and tube type heat exchanger of stainless steel 1.4571
- primary (exhaust gas) approx. 470°C / 120°C (18 0°C)
- secondary circuit: approx. 89°C / 95°C

Cooling water pump:

- electric motor driven centrifugal pump set

Temperature control:

- electronically controlled three-way valve as flow divider to the transfer heat exchanger
- electronically controlled three- way mixing valve after emergency cooler (optional)

Emergency cooler (optional):

- table- type radiator cooler for dissipation of surplus heat not recovered and taken from the external heating system

LT cooler (only for Turbocharged engine with external mixture cooler):

- External cooler for dissipation of surplus LT-heat to the ambient air

Further components:



- diaphragm expansion tank
- safety valve
- pressure gauge
- temperature sensors
- compensators

Coolant:

- Glycol- water- mixture with 40% Glycol

1.2.4. Generator:

- Internal pole three- phase synchronous generator rigidly flanged to the flywheel housing of the engine
- brush- less
- with exciter machine
- voltage and cos phi regulator
- damper cage for parallel operation
- automatic voltage adaption during synchronizing
- three thermistors for winding temperature monitoring, built in accordance with VDE 0530
- Insulation class H
- Type of construction B2/B5

Flexible coupling of engine and generator:

- Flexible coupling to isolate the major sub harmonics of engine firing, access for radial change of the rubber element without moving engine or generator.

Base frame:

- Engine-/ generator unit flexibly mounted on torsion resistant common base frame, welded, of structural steel, receiving hot- water and jacket water circuits with jacket water heat exchanger, temperature regulation valve, jacket water expansion tank, pressure relief valves, electric motor driven pumps; heat exchangers pipe work, insulated. Drop oil pan under the engine. Damper elements for elastic mounting of the set (loose supply).

1.2.5. Control

The PLC based control unit of the set is integrated in the sheet steel switchboard elastically mounted on the base frame, ready wired.



Moreover supervision and control of the CHP the control unit can also provide the control for a boiler or the load sharing for two or more generators running in parallel mode (master, optional).

General functions:

- Start- program
- Stop- program
- Supervision of analog values
- Interpretation of digital signals
- Speed governing
- Synchronising control
- Heating water temperature control
- Lambda control
- Control of an external boiler
- Gas flare control fackelfreigabe bei Biogas- / Klärgasbetrieb
- Optional (control for isolated operation)

Start-program for gas engines:

- Start delay ON, 0-20 sec
- At starting speed: Ignition ON, after 2 seconds gas solenoid valves OPEN
- Ignition speed: Starter motor OFF, supervision ON
- After reaching the nominal operation values: Synchronizing and power control ON
- Two further attempts at starting failure

Stop-program for gas engines:

At stop demand:

- Power control DOWN, generator CB OPEN
- Stop delay ON (0-3 min)
- Gas solenoid valves SHUT
- Ignition OFF after approx. 20 sec.

At stop due failure:

- Generator CB OPEN
- Gas solenoid valves SHUT
- Ignition OFF after approx. 20 sec.

Supervision of analogous values:

Permanent supervision of all important operating values.

Deviations from the set point values or exceeding limit values will effect warnings or shut off of the set.

Failures are shown on the display with date and time of appearance



It is possible, to record the analog values during the operation.

Analogous values:

- Coolant temperature engine inlet and outlet
- Coolant pressure and level
- Heating water temperature inlet and outlet
- Lube oil pressure and level
- Lube oil temperature after oil cooler
- Exhaust gas temperature
- Combustion chamber temperature of reference cylinder
- Oxygen in exhaust gas (Lambda)
- Temperature noise protection housing
- Speed
- Frequency
- Effective power and apparent of generator power
- Phase voltage and current
- Turbopressure (only on turbocharged engines)

Digital signals:

- Warning or shut off at:
- Coolant temperature at engine outlet
- Coolant level min.
- Heating circuit over pressure (safety limiter)
- Heating circuit over temperature (safety limiter)
- Heating circuit flow sensor
- Lube oil level Min. and Max.
- Lube oil pressure Min.
- Housing ventilation flow sensor
- Generator winding temperature
- Control battery voltage
- Gas pressure Min.
- Level sensor leak oil pan

Speed governor/ power control:

- Electronic speed governor with electric controller actuating the mixture throttle Valve
- At parallel operation with the grid the load is regulated to a setpoint value in between 50 and 100 % of the nominal load.
- As an option the load can be automatically reduced when the hot water inlet temperature raises above an adjusted limit value.

Synchronizing control

The synchronizing control supervises the CHP switching to the utility grid.

The sharing of SCHMITT ENERTEC used synchronous generators requires a precise comparison between the network and the generator before it



connected to the network.

The synchronization and speed control are monitored and implemented.

Hot water temperature control(as an option)

- Continuous control of the hot water temperature by a control valve in the hot water circuit, at hot water inlet temperatures below 70 °C hot water outlet will be mixed to the inlet

Air/fuel ratio control

Option 1: Lambda control

- 3-point-stepper-motor-control to run the mixture control valve to operate the engine with constant stoichiometric combustion effecting in best conversion rates in the 3-way catalyst.

Option 2: Combustion room control (option on Lean burn engines)

- 3-point-stepper-motor-control to run the mixture control valve to operate the engine with constant combustion mixture regarding the engine load

**1.2.6 Execute with noise protection housing FMB-x...x-GSK / GSMK
Base frame, noise protection housing, auxiliary equipment**

Base frame:

- Engine-/ generator unit elastically mounted on common torsion resistant welded steel base frame, with fitted hydraulic components, auxiliaries and control-/ switchboard
- Leak oil pan under the engine to receive the total oil volume of the engine , with level sensor
- Elastic mounting pads under the base frame for erection of the set on site foundation or clean, plain and rigid surface

Noise protection housing:

- Housing fitted on the base frame
- Steel frame with sheet steel cladding panels, side cladding easily removable for easy maintenance, partially with windows
- Electric motor drive fan for housing ventilation
- Air intake from the bottom of the set, with filter
- Flow sensor for ventilation supervision

Exhaust gas silencer:

- Exhaust gas silencer fitted in the base frame
- Stainless steel 1.4571
- Noise pressure level at exhaust gas outlet: 75 dB(A)



Auxiliary equipment:

- Battery 24 V DC for starting and control power supply
- Battery charger 24 V DC
- Lube oil topping up tank fitted in the housing
- Topping up control by level sensors in the oil pan
- Tank capacity dimensioned for operating time in between the maintenance intervals
- Electric motor driven lube oil priming pump
- The priming pump can be used for draining the oil pan by switching over of the ball valve fitted in the lube oil pipe