Basic Characteristics

The GHP type units (GHP stands for "Gas-engine Heat Pump“ = a heat pump driven by the gas engine) are the energy sources that produce cold and the low-potential and high-potential heat by combusting the gas. This unit combines a gas engine, compressor, series of heat exchangers, and the control system to form one functional whole.

Advantages of GHP

Qualities of EKOSTAR GHP Unit

- maximum utilization of heat in the production of cold
- heat pump mode
- easy connection
- long service interval
- compactness
- internal / external version

Gas-engine Heat Pump is holder of the QMS and EMS Quality Management Certificates.

Basic Technical Data

maximum cooling power	160[3)]	kW
maximum heat power	259[4)]	kW
maximum power input in fuel	140.6[5)]	kW
electric input	1.7	kW
rated mechanical input	45	kW
COP of cooling	1.62	
COP of heating	2.58	
gas consumption at 100% power	15.4	m^3/hr
gas consumption at 75% power	11.6	m^3/hr
gas consumption at 50% power	7.7	m^3/hr

The Basic Technical Data are applicable for the standard conditions pursuant to the "GHP Technical Data Validity" document
Gas consumption is expressed under the invoicing conditions (15°C, 101.325 kPa)
1) max. engine circuit's outlet water temperature
2) max. condenser circuit's outlet water temperature
3) max. cooling power at the condensation temperature of 35°C and evaporation temperature of 5°C
4) max. heat power at the condensation temperature of 35°C and evaporation temperature of 5°C
5) max. input in fuel at the condensation temperature of 55°C

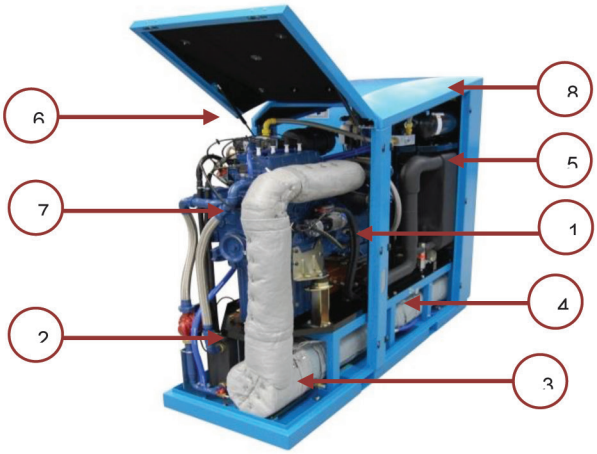
Observance of Emission Limits

emissions	CO	NOx
with 5% of O2 in exhaust gases	300 mg/Nm^3	250 mg/Nm^3

Reference Description of GHP

The unit is composed of the engine-compressor set, complete heating unit, including the power switchboard. All the elements are installed under the sound enclosure.

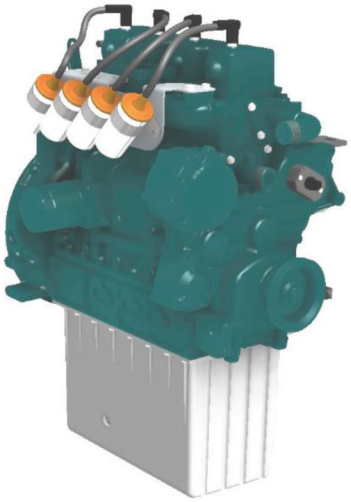
1) compressor
2) plate heat exchanger of P.C.
3) exhaust heat exchanger
4) silencer
5) evaporator
6) power switchboard
7) combustion engine
8) sound enclosure



Engine

The V3800 gas combustion engine, the product of EKOSTAR , is used to drive the unit. The engine has the basic parameters given in the table below:

number of cylinders	4
arrangement of cylinders	in line
bore × stroke	100 x 120 mm
displacement	3769 cm^3
compression ratio	13 : 1
speed	1280/1750 rpm
oil consumption, normal / max.	0.3/0.6 g/kWh
max. engine power	45 kW



Illustrative picture

Compressor

The source of cooling and low-potential heat is the piston compressor manufactured by BOCK, GEA Group, having the basic parameters according to the specified overview:

type	BOCK FX16/1751
Coolant 1 (the main coolant)	R407C
Coolant 2, 3 (alternative)	R134A,R507A
number of cylinders	6
volume of the drawn in fuel at (1450/1740 rpm)	152.2 / 182.6 m^3hr
oil charge	7.5 l
operating speed	700 - 1750 rpm
maximum permissible delivery pressure	28 bar

** The specified values are valid for the FX16-1751 compressor*

Illustrative picture

Thermal System (TOI and TOII)

In terms of the heat power, the GHP's thermal system is composed of two independent circuits, Heating Circuit I ("hot water") and Heating Circuit II ("warm water").The maximum heat power of the unit is a sum of the heat powers of both circuits when they are utilized to their full capacity.

Heating Circuit I

- In terms of extraction of the heat power (obtained by cooling the combustion engine and exhaust gases), it consists of the hydraulic circuit which is used to deliver the heat power into the heating system of the user. The GHP unit allows operation in various temperature modes. The circuit operates as standard with the return water temperatures from 40° to 70°C. Observance of the maximum temperature of 70°C is a prerequisite for the GHP unit to operate flawlessly.

Parameters of Heating Circuit I:

heat carrier	water + ethylene glycol
ethylene glycol's concentration	35%
heat power	66 kW
rated fluid temperature, input / output	70/90 °C
return fluid temperature, min / max	40/70 °C
rated flow rate	0.8 kg/s
max. working pressure	600 kPa
circuit's water volume in GHP	28l
pressure loss at the rated flow rate	35kPa
rated temperature drop	20 K

If the circuit's heat power cannot be removed in the marginal operation modes, this power or its part can be removed through the cooling unit for the emergency cooling that can be supplied individually.

Primary Circuit

-it represents inner enclosed pressure circuit that takes off the heat from the cooling jacket to pass it into the Heating Circuit I

Parameters of Primary Circuit:

heat carrier	water + ethylene glycol
concentration	35%
circuit's heat power	40 kW
max. working pressure	1.2 kPa
water volume in GHP unit circuit	9 l

Heating Circuit II

- it is the part of the compressor circuit of the inner GHP part and it represents the heat power circuit of the secondary part of the unit's condenser. The circuit operates with the return water temperatures from 25° to 50°C. Depending on these temperatures the efficiency is altered as stated in the "Basic Technical Data" table

Parameters of Heating Circuit II:

heat carrier	water + ethylene glycol
ethylene glycol's concentration	35%
heat power	158 kW
temperature drop	45/55°C
temperature range (output temperature)	31 – 56 °C
rated flow rate	3.7 kg/s[1)]
pressure loss at the rated flow rate	14 kPa
max. working pressure	600 kPa
circuit's water volume in GHP	30 dm^3

1) temperature difference 10 K

If this heat cannot be utilized, it must be wasted in convenient manner in the external cooling unit (water-air heat exchanger). This cooling unit can be supplied individually.
The heating water to charge the hydraulic circuits must be treated, its composition must correspond to the "Technical Instruction – GHP Water Circuits" document.

Cooling Circuit (COC)

The GHP's cooling circuit ("cold water") is a part of the compressor circuit of the inner unit's part. As far as the cooling power extraction is concerned the secondary part of the unit's evaporator is connected with the technological circuit where heat is transferred in the evaporator from the technological circuit's heat transfer fluid to the evaporator's coolant. The extracted heat is transferred in the evaporator and the cooled medium returns to the technological circuit.

Cooling Circuit Parameters:

heat carrier	water+ ethylene glycol
concentration	35%
cooling power	113 kW[1)]
rated water temperature, output	7°C
rated water temperature, input	12 °C
temperature range (output temperature)	-15°C - 15°C
max. working pressure	600 kPa
circuit's water volume in GHP	25 dm^3
pressure loss at the rated flow rate	15 kPa
rated flow rate	6.4 kg/s[2)]

1) *circuit's temperature drop 7/12°C*
2) *temperature difference of 5 K*

Fuel, Gas Inlet

Technical parameters given in this Specification are applicable for the natural gas of the properties stated below.

heat value	34 MJ/m^3
min. methane number	80
gas pressure	2 ÷ 10 kPa
max. pressure change under varying consumption	10 %
max. temperature	30 °C

The unit's gas route is constructed in conformity with TPG G 811 01 and it contains separate gas filter, a set of multi-functional gas valves that takes a role of a twin quick-acting electromagnetic valve to shut off the gas inlet when the unit is turned off, gas pressure governing convenient for mixing, flexible connection through a metal hose with the combustion engine's mixer.

Gas fixture of suitable size with adequate accumulation volume is required for the correct operation of the GHP unit to avoid gas pressure drop in the distribution system at the moment of incremental gas offtake. The gas fixture must be terminated with a manual gas stop and fitted with pressure gauge.

Combustion and Ventilation Air

Combustion air is sucked from the external space through the cold GHP area.
The unusable heat (radiated from the hot parts) is removed from GHP through the forced ventilation system. Ventilation air enters the GHP unit through the holes in the frame to exit in the rear part. The flow of ventilation air is ensured by the fan.

unused heat removed by the ventilation air	10 kW
amount of combustion air	144 Nm^3/hr
aspirated air temperature, min / max	-10 /45 °C

Exhaust Gas and Condensate Outlet

Combustion air is sucked from the external space through the cold GHP area.
Exhaust gases + condensate are removed from GHP unit through the piping (exhaust conduit) connected to the unit's flange. Exhaust conduit from the GHP unit's flange to the stack flue must be tight. Exhaust conduit must be inclined offward the unit. The alternatively formed condensate is evaporated under the unit's operation to be removed along with exhaust gases. The exhaust conduit material and its heat insulation in the machine room must resist to the temperatures of up to 200°C. The maximum pressure loss of the complete exhaust conduit from the CHP unit's flanges must not exceed 10 mbar.

amount of exhaust gases	150 Nm^3/hr
exhaust gas temperature - maximum	160 °C
max. back-pressure of exhaust gases downstream the GHP flange	10 mbar

Lubricant Charges

amount of lubrication oil in the engine	30l
replenishment oil tank volume	20 l

Noise Parameters

Noise parameters indicate the acoustic pressure level measured in a free acoustic field. Determination of the measuring points and evaluation method both comply with ČSN 09 0862.

acoustic cover of GHP at 1 m*	70dB(A)
exhaust gases outlet at 1m from the silencer flange	62dB(A)

Ambient Temperature

Ambient operating temperature	-10 to 45°C

Switchboard Version

Switchboard is a part of the sound enclosure, outlets are fitted in the switchboard's bottom part and they are intended to interconnect GHP with the external switchboards and peripherals.

The switchboard contains:

- central part of the control system and its extension modules
- protecting, controlling, and tripping elements
- elements intended for service purposes
- 12VDC (24VDC) power supply source
- terminal boxes for the connection of sensors, appliances, communication system, external peripherals ...
- customer's terminal boxes
- terminal boxes to connect the power supply unit
- main key-switch for the power feed line
- locking STOP button for quick unit's shutdown. The control system remains in operation
- external touch display for the unit's operation and servicing

Control System

The Amit control system with the control touch display on the switchboard's front side is used to control the GHP unit. This system assures fully automatic operation of GHP. It is a multi-processor modular system which consists of the central part, display unit, and extension modules of the analogue and binary inputs and outputs.

Display Unit

The Amit APT3221WT display unit with the touch display and IP65 protection class allows for a comfortable operation of GHP unit.

Features of the display unit:

- TFT display, 5.7“, (320 × 240) pixels
- operation by the touch panel
- internal temperature sensor
- RS232, Ethernet 10/100 Mbps
- optionally 2 × RS485 / RS232 / CAN
- slot for SD card (for utilization in future)

Operation Methods

Local:

- by using the control system's software or on the display unit

Remote (on request, without an active management):

- through voltage-free contact (register clock, mass remote control receiver, etc.)
- depending on the required power level or the building consumption level
- from the local or remote PC

Machine Set Operation Monitoring

From the local PC – connection possibilities:

- RS232
- RS485

From the remote PC – connection possibilities (on request):

- GSM modem
- Internet

Colour Version

engine, compressor	RAL 5000 (blue)
base frame	RAL 5012 (blue)
sound enclosure	RAL 5012 (blue)

GHP Dimensions and Weights

length	2300 mm
width	770 mm (+700 switchboard)
total height	2100 mm
service weight of the entire GHP unit	1650 kg

Linked Source Materials

- dimensional drawing: R 1208
- diagram: S 0548
- dimensional drawing of the silencer : R 1280
- generally binding documents according to the "List of Applicable Technical Documents"

Caution

Manufacturer reserves the right to alter this document and the linked source materials.

Scope of Delivery

Standard scope:

- complete GHP module

Beyond the standard scope:

- cooling unit to cool down the Heating Circuit I
- cooling unit to cool down the Heating Circuit II
- additional exhaust silencer
- condensate separator
- for the electrical retrofitting as required by customer see the "Operation Methods" Chapter
- Condensation exhaust heat exchanger

Connection Points