Heat pump

GEA RedGenium

Product Information (Translation from the original language)

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The product information makes the technical, product related and commercial information available to the customer in detail before the sale of the product.

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SYMBOLS USED

⚠ Danger

Stands for an immediate danger leading to severe physical injuries or death.

► Description for avoiding the danger.

⚠ Warning!

Stands for a potentially dangerous situation leading to severe physical injuries or death.

► Description for avoiding the dangerous situation.

⚠ Caution!

Stands for a potentially dangerous situation which could lead to minor physical injuries or damage to property.

► Description for avoiding the dangerous situation.

Notice

Stands for important information that must be observed for the intended use and function of the product.

► Description of the required action for the intended function of the product.

PREFACE

In addition to other products, the portfolio of GEA Refrigeration Germany GmbH includes complete chillers and heat pumps.

In light of the fact that the working principle is identical, GEA documentation differentiates between the terms chillers and heat pumps as follows:

A chiller is a system where the application focus lies on generating refrigeration (cooling a liquid secondary circuit), regardless of possible heat recovery options via a liquid-cooled condenser and/or oil cooler. GEA chillers include the series GEA BluAstrum, GEA BluGenium, GEA BluAir (duo), GEA BluX, GEA Grasso FX (duo) or MX (duo) which is a special series.

A heat pump is a system where the application focus lies on generating heat (heating a liquid heated medium). Here, the heat exchanger concept on the high pressure side is optimised with respect to this application. GEA heat pumps include the series GEA RedAstrum, GEA RedGenium, and GEA Grasso HX which is a special series.

The GEA Blu-Red Fusion product can be seen as a two-stage heat pump or also as a combined chiller-heat pump.

Many components and modes are used in the same way in different GEA chiller and heat pump product series. The descriptions of some components and operating principles are thus expressed in general terms in this document.

The figure on the front page shows the product in a project-specific version (project-related modifications possible).

LAYOUT INFORMATION

Bullet points and numbered list characters

Bullet points are used to separate logical contents within a section:

- Bullet point 1
  - Types of bullet point 1.
- Bullet point 2
  - Types of bullet point 2.

Numbered list characters are used to separate enumerations within a descriptive text:

Descriptive text with consecutive numbering:

- Numbered list point 1
- Numbered list point 2

Handling instructions

Handling instructions prompt you to do something. Several steps in sequence time form a handling sequence that should be completed in the prescribed order. The handling sequence can be divided into individual steps.

Handling sequence

1. Handling sequence step 1
   - step 1,
   - step 2,
   - step 3.
2. Handling sequence step 2

The subsequent handling sequence is the expected result:

→ Result of the handling sequence.

Individual handling steps

Individual handling steps are marked thus:

- Individual work steps

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1 Description

1.1 General information

Fig.1: GEA RedGenium

Parameter	Remark
Capacity range (application example pure heating mode, evaporator with ext. secondary refrigerant)	approx. 155 - 1475 / 190 - 1800 kW (cooling capacity / heating capacity) 27 °C / 22 °C (secondary refrigerant temperature) 50 °C / 70 °C (heat carrier temperature)
Capacity range (application example 2 as "add-on" heat pump with NH_3 cascade evaporator)	approx. 195 - 1835 / 235 - 2170 kW (cooling capacity / heating capacity) 30 °C (condensing temperature cooling system) 50 °C / 70 °C (heat carrier temperature)
Capacity range (application example 3 [1]as "add-on" heat pump at high temperature level with NH_3 cascade evaporator)	approx. 1125 - 2685 / 1345 - 3230 kW (cooling capacity / heating capacity) 48 °C (condensing temperature cooling system) 70 °C / 95 °C (heat carrier temperature)
Reciprocating compressor	GEA Grasso 35 HP- 65 HP series V_{th} = 101 ... 202 m³/h GEA Grasso V300 HP- V600 HP series V_{th} = 290 ... 580 m³/h GEA Grasso V350 XHP - V950 XHP series V_{th} = 376 ... 941 m³/h
Heat pump	GEA RedGenium
Evaporator type	Plate heat exchanger, fully welded, with integrated separator, with liquid secondary refrigerant applied (W) or as NH_3 cascade heat exchanger (K)

1 Only possible compressor of GEA Grasso V XHP series

Parameter	Remark
Working principle	flooded evaporation
Liquid separator	integrated
Condenser type	Fully welded plate heat exchanger
Transport	1 part [2]

2 The product can be transported in several parts for transport and/or installation purposes.

1.2 Technical specifications

Notice

The **GEA RedGenium** is manufactured and delivered according to technical specifications.

► Optional design variants based on the standard equipment can be considered.

Standard equipment	
Designation	**Design**
Design pressure:	38 bar(g) to 63 bar(g)
Intended environment:	Closed machine rooms
Ambient temperatures:	+15 ℃ to +40 ℃
Installation altitude:	≤ 1000 m above sea level
Cooling agent outlet temperature [3]:	-10 ℃ to +59 ℃
Evaporating temperature [4]:	+10 ℃ to +60 ℃
Heat carrier outlet temperature [5]:	+50 ℃ to +95 ℃
Electric motor:	standard scope of delivery
Refrigerant:	R717
Type of oil:	Hydrotreated mineral oil: PR-OLEO® C-MH100A-FG **Caution!** Deviating types of oil must be agreed with the manufacturer. ► Contact the Design or Technical Customer Service of GEA Refrigeration Germany GmbH.
Oil cooling:	standard scope of delivery (air cooled as standard)
Oil heater:	standard scope of delivery
Oil filter:	Single stage filter
Spare oil filter:	Oil pressure filter cartridge, delivered separately (included)
Oil level switch:	none
Pressure sensors:	on sensor block compressor
Safety pressure switch:	electronic
Overflow valve compressor:	standard scope of delivery
Overflow valve HP / LP:	standard scope of delivery
Safety valve LP:	Double safety valve with change-over valve
Flow monitor:	mechanically (paddle), for secondary refrigerant
Control:	GEA Omni
Communication:	EtherNet/IP, Modbus TCP
Power current and frequency inverter:	Standard scope of delivery, cable entry from below
Colour:	RAL 5014 (dove blue), switching cabinet RAL 7035
Soundproof housing:	none

3 Secondary refrigerant inlet temperature max. +60 °C and max. 10 K above the outlet temperature (standard). Small temperature differences up to 1 K can only be realised as long as the nozzle velocity at the evaporator does not exceed 7.5 m/s

4 In the design with NH_3 cascade evaporator

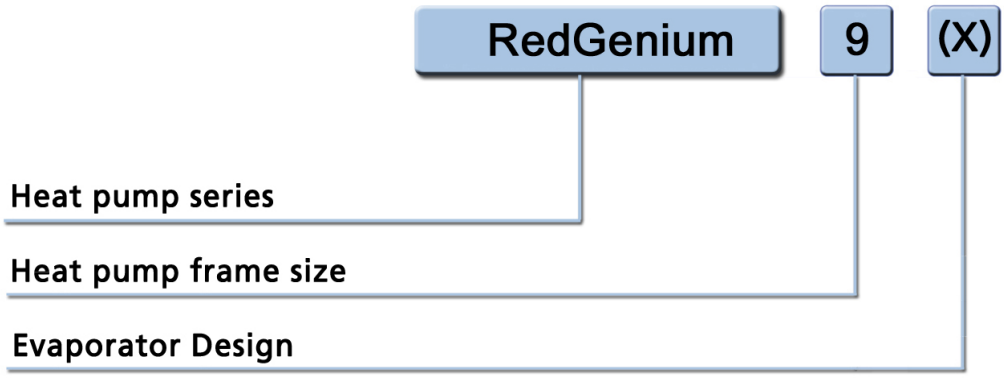
5 Temperature difference heat carrier maximum 50 K, higher outlet temperatures on request

Standard equipment	
Designation	**Design**
Vibration isolators:	without (standard)
Approval of pressure equipment:	CE-PED, Module H (piping)
Documentation:	electronic (provided on the server)

Optional equipment	
Designation	**Design**
Intended environment:	Outdoor installation on request
Installation altitude:	> 1000 m above sea level on request
Electric motor:	Provided by customer, customer specific design possible on request
Spare oil filter:	none
Overflow valve HP / LP:	Version as a double safety valve with change-over valve that blows into the surroundings
Flow monitor:	electronic, mechanically (paddle) or electronic also for heat carrier
Communication:	Profibus DP, ProfiNet
Control options:	intelligent sequence control, energy measurement
Vibration isolators:	can be delivered
Approval of pressure equipment:	CE-PED, module H1 (entire heat pump), 100 % weld test, French acceptance regulations, Russian acceptance regulations, Belarus acceptance regulations, DOSH acceptance for Malaysia (on request), MOM acceptance for Singapore (on request)
Documentation:	USB, paper

1.3 Product designation heat pumps with reciprocating compressors

GEA RedGenium series



Product code description

Code	Description
RedGenium	Heat pump series
9	Frame size (capacity) of the heat pump
(X)	Evaporator version

RedGenium = Heat pump series

9 = Frame size of the heat pump as a result of the compressor frame size

Compressor frame size	Frame size
35 HP	RedGenium 35
45 HP	RedGenium 45
55 HP	RedGenium 55
65 HP	RedGenium 65
V300 HP	RedGenium 300
V350 XHP	RedGenium 350
V450 HP	RedGenium 450
V550 XHP	RedGenium 550
V600 HP	RedGenium 600
V750 XHP	RedGenium 750
V950 XHP	RedGenium 950

(X) Evaporator version

Code	Description
(W)	Water-/liquid-cooled plate heat exchanger (completely welded) Heat pump for indoor installation
(K)	Evaporator as NH_3 cascade heat exchanger [6] Heat pump for indoor installation

Examples of designation

6 The version evaporator as NH_3 cascade heat exchanger (K) is also suitable for use in a two-stage chiller/ heat pump combination. There are application-related design differences.

Examples	Description
RedGenium 600 (W)	Heat pump with reciprocating compressor, evaporator with integrated separator **(RedGenium)** Frame size of the heat pump with V600 HP compressor **(600)** Water-/liquid-cooled evaporator designed as a completely welded plate heat exchanger, Heat pump for indoor installation **(W)**
RedGenium 300 (K)	Heat pump with reciprocating compressor, evaporator with integrated separator **(RedGenium)** Frame size of the heat pump with V300 HP compressor **(300)** NH_3 cascade evaporator designed as a completely welded plate heat exchanger, Heat pump for indoor installation **(K)**
RedGenium 750 (W)	Heat pump with reciprocating compressor, evaporator with integrated separator **(RedGenium)** Frame size of the heat pump with V750 XHP compressor **(750)** Water-/liquid-cooled evaporator designed as a completely welded plate heat exchanger, Heat pump for indoor installation **(W)**

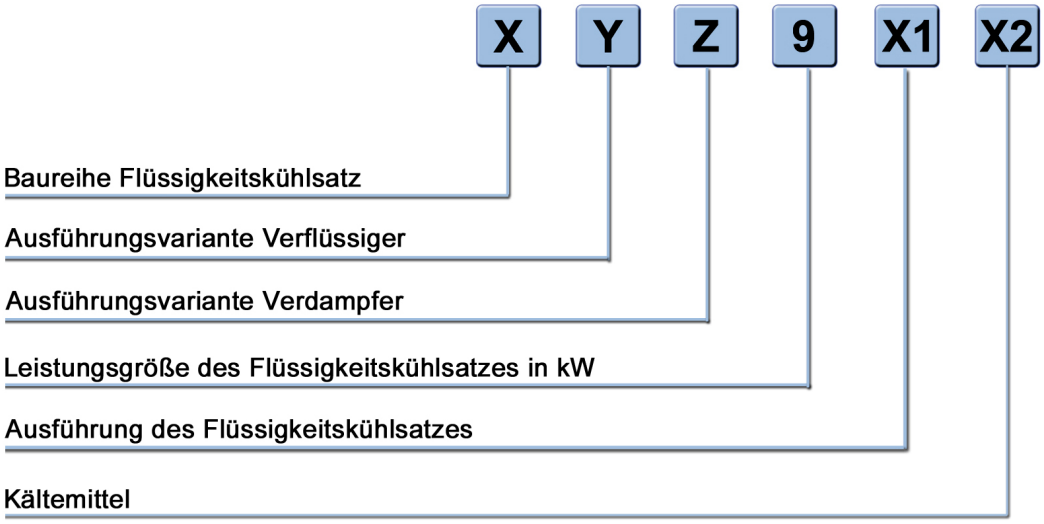
1.3.1 GEA Grasso HX GC series

Notice

Unless declared otherwise, this operating manual is also applicable for products which deviate from the standard depicted on the front page and may have different designations for in-house reasons.

► Information about the compressor model as well as the type of evaporation and condensation is provided on the basis of the following designation key.

► Please note that this is a generally applicable designation key which may also describe other products. Heat pumps with reciprocating compressor from the RedGenium standard always have the prefix HX GC.



Product code description

Code	Description
X	Chiller series
Y	Condenser version
Z	Evaporator version
9	Capacity of the chiller in kW pertaining to cold-water operations 12°C / 6°C
X1	Chiller version
X2	Refrigerant

X Chiller series

Code	Description
FX GCW	Chiller with flooded evaporator
MX GC	Chiller special design with flooded evaporator
HX GC	Heat pump special design [7] with flooded evaporator

Y Condenser version

7 Reciprocating compressor 5 HP, V HP, V XHP.

Code	Description
P	Plate heat exchanger (cassette welding)
S	Shell and plate condenser (completely welded)
R	Tube bundle condenser
L	Air cooled condenser [8]
V	Evaporating condenser

Z Evaporator version

Code	Description
P	Plate heat exchanger (cassette welding)
S	Plate heat exchanger (completely welded)
O	without evaporator (condensing unit)
X	Other version

9 Capacity [9]

Version with 1 compressor

Compressor frame size	Output in kW
35 HP	35
45 HP	45
55 HP	55
65 HP	65
V300	260
V300 HP	300
V350 XHP	350
V450	400
V450 HP	450
V550 XHP	550
V600	525
V600 HP	600
V700	600
V750 XHP	750
V950 XHP	950
V1100	900
V1400	1250
V1800	1500

Version with 2 compressor (parallel stage)

8 Not in the scope of delivery for GEA Refrigeration Germany.

9 Refrigerating capacity (value rounded) V300 and V600 related to cold water operation +12 / +6 °C at 1500 min^{-1}. Refrigerating capacity (value rounded) V700 – V1800 related to cold water operation +12 / +6 °C at 1200 min^{-1}. Refrigerating capacity (value rounded) V300 T – V600 T related to cold water operation -20 / -55 °C at 1500 min^{-1}. Refrigerating capacity (value rounded) V700 T – V1800 T related to cold water operation -20 / -25 °C at 1200 min^{-1}. HX heat pumps with high-pressure pistons 5 HP, V HP and V XHP series are listed on the basis of the compressor frame size.

Compressor frame size [10]	Output level in kW		Compressor frame size	Output level in kW
2x V300	520		2x 35 HP	2x35
V300 / V450	650		2x 45 HP	2x45
2x V450	800		2x 55 HP	2x55
V450 / V600	900		2x 65 HP	2x65
2x V600	1050		2x V300 HP	2x300
2x V700	1200		2x V350 XHP	2x350
V700 / V1100	1500		2x V450 HP	2x450
2x V1100	1800		2x V550 XHP	2x550
V1100 / V1400	2200		2x V600 HP	2x600
2x V1400	2500		2x V750 XHP	2x750
V1400 / V1800	2750		2x V950 XHP	2x950
2x V1800	3000			

Version with 2 compressor (two-stage) [11]

LP compressor Frame size	Output level in kW		HP compressor Frame size	Output level in kW
V300	260		35 HP	35
V450	400		45 HP	45
V600	525		55 HP	55
V700	600		65 HP	65
V1100	900		V300 HP	300
V1400	1250		V350 XHP	350
V1800	1500		V450 HP	450
V300 T	60		V550 XHP	550
V450 T	90		V600 HP	600
V600 T	120		V750 XHP	750
V700 T	140		V950 XHP	950
V1100 T	200			
V1400 T	280			
V1800 T	340			

X1 design of the chiller

Code	Description
(without)	Version with 1 reciprocating compressor
duo	Version with 2 reciprocating compressors (parallel stage)
T	Version with 2 reciprocating compressors (two-stage)

X2 refrigerant

10 The V HS series is not listed separately since there are no design-related differences to the V series.

11 The capacity is formed through LP compressor capacity (HP compressor capacity). Example: LP compressor frame size V1400 and HP compressor frame size V600 HP means capacity 1250(1100).

Code	Description
NH_3	Ammonia

Examples of designation

Example	Description
FX GC PP 900 duo NH_3	Chiller with reciprocating compressor **(FX GC)**, with plate heat exchanger as condenser **(P)**, with plate heat exchanger as evaporator**(P)**, capacity 900 kW **(900)**, 2 compressors parallel stage **(duo)**, for refrigerant ammonia **(NH_3)**
HX GC SS 900(550) T NH_3	Heat pump with reciprocating compressor **(HX GC)**, shell and plate condenser **(S)**, plate heat exchanger (completely welded) as evaporator **(S)**, Capacity LP compressor V1100 with HP compressor V550 XHP (900(550)), 2 compressors two-stage**(T)**, for refrigerant ammonia **(NH_3)**

2 Scope of delivery

The heat pump of the GEA RedGenium series consists of the following components:

- Reciprocating compressor,
- evaporator with integrated separator
- condenser,
- electric motor with coupling,
- oil supply system,
- oil cooler,
- subcooler (optional),
- oil filter,
- suction filter (integrated in the reciprocating compressor),
- motor valve on the compressor side,
- check valves on the compressor side,
- capacity control,
- monitoring and safety devices,
- frequency converter,
- low-voltage supply with control unit GEA Omni,

All components are fully mounted.

The low-voltage installation with frequency converter and control device GEA Omni are wired.

The oil is cooled by means of an oil cooler.

By default, a rigid installation on the foundation is intended. An installation with vibration isolators is available optionally.

All connections are closed tight on delivery.

Service fluids

The heat pumps of the GEA RedGenium series are delivered without refrigerants. They are filled with dry nitrogen (0.2 bar ... 0.5 bar overpressure).

When carrying out the function text or commissioning a start-up or a factory acceptance test (FAT) the refrigerator machine oil is included in the scope of delivery.

Insulation

The warm components (high pressure side) are insulated with mineral wool, including aluminium cladding.

The cold components (low pressure side) are insulated with PUR foam, including aluminium cladding or with Aramflex.

Painting

The painting is done with 2 component EP paint RAL 5014 with a coating thickness of 120 µm.

Approval

After approval, the heat pumps of the GEA RedGenium series are awarded a CE label in accordance with the Pressure Equipment Directive 2014/68/EU.

Documentation

Each heat pump of the GEA RedGenium series is delivered with user documentation. The user documentation contains:

- Drawings and part lists,
- Safety Instructions,
- Operating manual

  (with the description of the refrigerant and oil circuits, the instructions for installation, start-up and maintenance),
- Documentation of the main components (electrical motor, control),
- Maintenance manual,
- Acceptance certificate for components requiring acceptance

This transport instructions are also available from GEA Refrigeration Germany as a separate document if necessary.

3 Description of Design and Function

3.1 Design, applications

The heat pump GEA RedGenium program provides proven components as complete heat pump or secondary refrigerant systems for medium and large heating, refrigeration and/or air conditioning needs.

Main fields of application:

- (cold) and warm water for heat pump operation
- (cold) and warm saltwater for heat pump operation
- cold water for air conditioning
- cold brine for air conditioning with combined ice storage operation
- cold water for industrial processes
- cold brine for industrial processes

The heat pump GEA RedGenium can be equipped either with an external evaporator (W) with applied secondary refrigerant or with an NH_3 cascade evaporator (K) for use as an “add-on” heat pump or an existing liquid chiller.

In principle, these heating / refrigeration systems use ammonia as refrigerant which is characterized by a high refrigeration capacity, low energy consumption and a favourable price and are completely neutral towards the environment.

Equipped with the reciprocating compressor series, the program of the GEA RedGenium heat pumps covers a heating range 350 to 1100 kW with reference to the secondary refrigerant range.

The output ranges are defined by 3 sizes of the reciprocating compressor series.

The GEA RedGenium heat pumps work with flooded condenser systems in forced circulation mode and are designed with a cooling water (heat carrier)-operated condenser.

The heat pumps have a modular design and comprise the following main modules:

- Reciprocating compressor package in high pressure version
- Heat exchanger sub assembly with integrated liquid separator and de-oiling system
- Low-voltage installation with frequency converter and control device

The arrangement of the components ensures the compact design of the heat pump.

Only flat plate evaporators with integrated separator are used as evaporators.

Only plate condensers are used on the condenser side.

The GEA RedGenium heat pumps are supplied, as a standard, ready for connection, fully piped and wired.

The heat exchangers are designed according to the parameters of a project, taking into account a maximum energy efficiency on the evaporator and the condenser side.

The standard version of the heat pumps is equipped with a freely programmable control.

All operating and fault signals as well as the process variables can be read from a display.

The control device is operated via a Touch Panel.

The heat pump are delivered without refrigerant. They are filled with dry nitrogen (0.2 bar ... 0.5 bar overpressure).

Each heat pump is supplied with user documentation containing a description of the heating / refrigeration cycle, commissioning instructions, an operating manual and the maintenance manual.

Separate installation and maintenance manuals are provided for detailed information about the reciprocating compressors.

3.2 General mode of operation of chillers and heat pumps

Chillers and heat pumps are systems operating automatically in a cycle process in which a refrigerant absorbs heat at a low temperature level (source) and releases it at a high temperature level (sink).

The reciprocating compressor draws the refrigerant from the liquid separator and compresses it to condensation pressure.

The refrigerant condenses as it is cooled and releases the heat to a cooling medium or heat carrier. Before or after condensing, superheat or subcooling heat can be extracted from the refrigerant in an external desuperheater or subcooler. The liquid refrigerant is then expanded in the liquid separator.

In the liquid separator, the refrigerant vapour and liquid are separated.

The liquid is led through the evaporator by gravity circulation (thermosiphon principle). As result of liquid refrigerant absorbing heat (flooded evaporation) the refrigerant evaporates and the secondary refrigerant is cooled down. With a cascade version, an evaporator can be used which can be charged with compressed refrigerant from the low pressure stage instead of a secondary refrigerant fluid. The refrigerant from the process of the low pressure stage is condensed in the process.

During the operation of the reciprocating compressor, oil in the crankcase is used to lubricate moving parts. Since, as opposed to applications based on a screw compressor, the oil is not injected into the working chamber and does not mix with the refrigerant, no oil separation is required.

Despite this, tiny oil particles enter the refrigerant circuit and its low pressure side.

An automatic and maintenance-free oil return system, specifically developed for this purpose by GEA Refrigeration Germany GmbH, guides the oil out of the evaporator/liquid separator back into the reciprocating compressor.

This is a basic precondition for fault-free operation of the evaporator system.

The capacity of the reciprocating compressor is controlled by incrementally switching off the compressor or cylinder using internal controllers in the chiller as well as optionally by the FC control of the compressor drive motor (standard for the GEA BluGenium and GEA RedGenium series).

The refrigerating capacity can thus be adapted optimally to the effectively required refrigerating capacity.

During partial load operation, the cold water/brine and heat carrier volumetric flow rates may be reduced by a max. of 50% to guarantee the efficient transfer of heat to the heat exchanger systems.

3.3 Main components

3.3.1 Reciprocating compressor

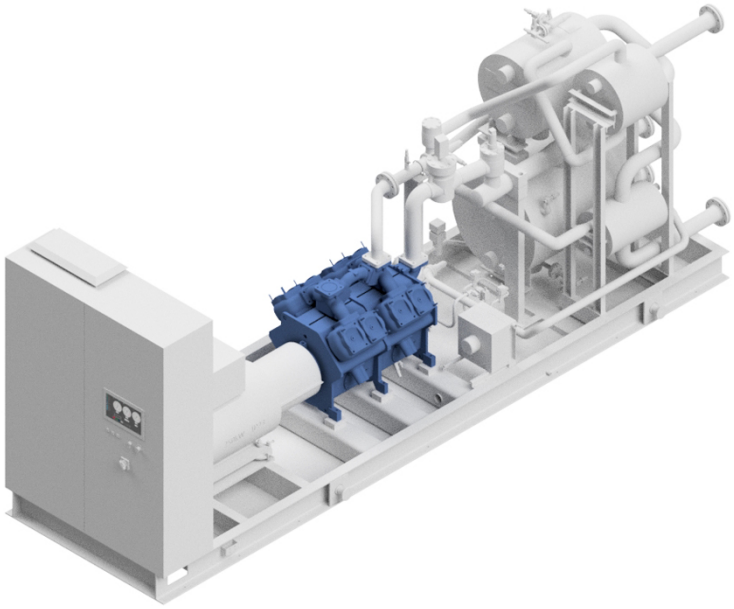


Fig.2: Position of the reciprocating compressor

The GEA RedGenium uses open, single-action, multi-cylinder reciprocating compressors for the refrigerant ammonia (R717).

The reciprocating compressors are characterised by compact design, high reliability, high quality components and ease of maintenance.

The compressors are operated with ammonia (NH_3) as the refrigerant.

With the compressor the suction of the ammonia vapour and its compression created in the evaporator takes place at condensing pressure.

The pressure and temperature transmitters installed on the compressor are used to monitor the operating values of the compressor. With the compressor the individual cylinders can be switched off either by bypass valves or suction valve relief devices.

The compressors have the following equipment features:

- Start-up load relief
- Capacity control by cylinders switch-off
- Monitoring oil difference pressure
- Oil heater
- Monitoring discharge pressure
- Monitoring suction pressure
- Monitoring crankcase pressure
- Monitoring discharge temperature
- Monitoring oil temperature
- Monitoring suction temperature

Safety equipment on the pressure generators is standard in compliance with EN 378 by current linkage valves combined with DBK safety pressure limiters.

The documentation of the reciprocating compressor (installation and maintenance instruction, part lists, drawings) is part of the product documentation.

3.3.2 Compressor drive motor

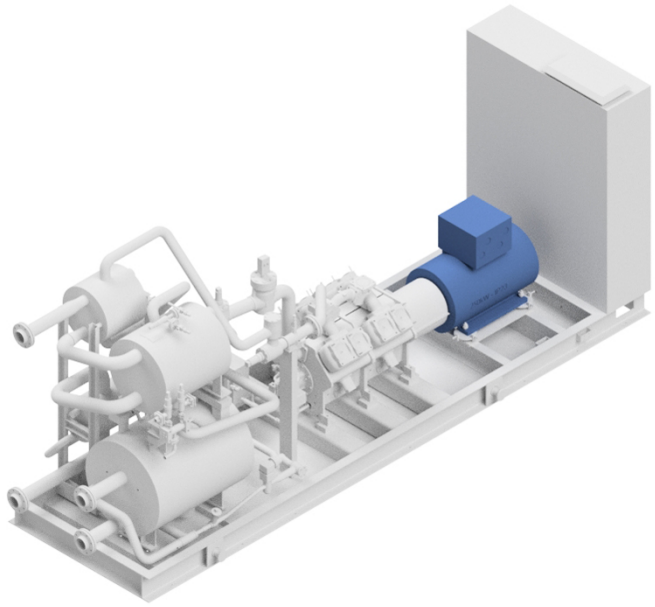


Fig.3: Arrangement of the compressor drive motor

Standard: The compressor is driven by an air-cooled 4-pole electric motor IP23 with an operating voltage of 400 V; 50 Hz using a coupling.

The motor speed is controlled using a frequency converter (optional equipment with chillers of the FX GC and FX GC duo series). The speed range is at 500 rpm ... 1500 rpm.

Option: Other manufacturers, operating voltages, frequencies, protection and efficiency classes, additional monitoring sensors and anti-condensation heaters, products without motor are available (to be supplied by the customer). Others on request.

The documentation for the electric motor (operating manual) is an integral part of the product documentation.

3.3.3 Coupling

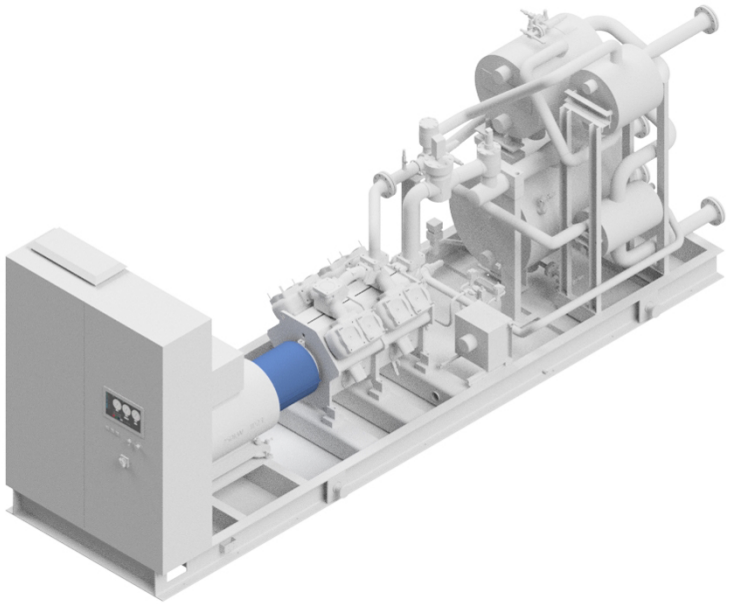


Fig.4: Arrangement of the coupling

The coupling helps in transmission of torque between compressor and compressor drive motor. The elastic design of the coupling brings about decoupling from otherwise disturbing influences such as axial or radial forces, vibrations or offset.

Speed fluctuations and speed shocks are damped and cushioned, while torsional vibrations are reduced.

The documentation of the coupling (operating manual) is a part of the product documentation.

3.3.4 Evaporator

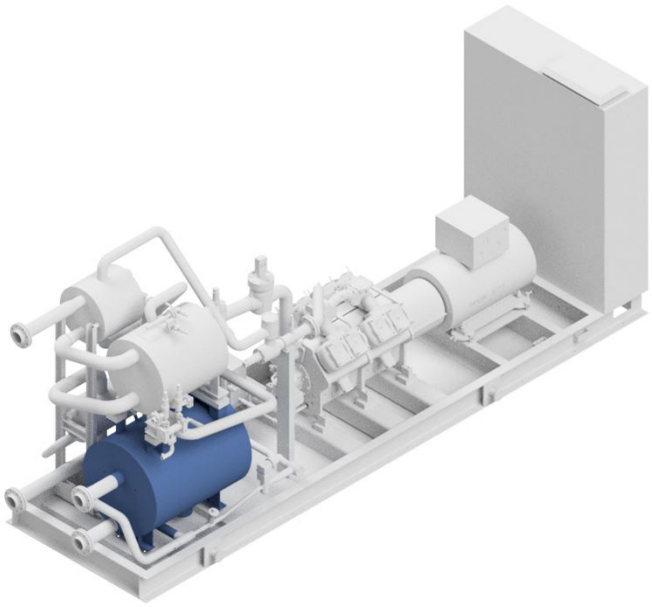


Fig.5: Arrangement of the evaporator

Variant (W) with evaporator charged with a secondary refrigerant:

In the evaporator heat is absorbed from the secondary refrigerant (which is thereby cooled) by way of evaporation of the refrigerant.

Variant (K) with NH_3 cascade evaporator:

As a result of the evaporation of the refrigerant, heat is absorbed in the evaporator from the condensation of the refrigerant in the chiller circuit.

Liquid drops are effectively separated in the liquid separator integrated into the evaporator.

Design, manufacture and acceptance of the evaporator with integrated liquid separator comply with the requirements of the Pressure Equipment Directive.

The documentation of the evaporator (operating and maintenance instructions, acceptance certificate) is a part of the product documentation.

3.3.5 Condenser

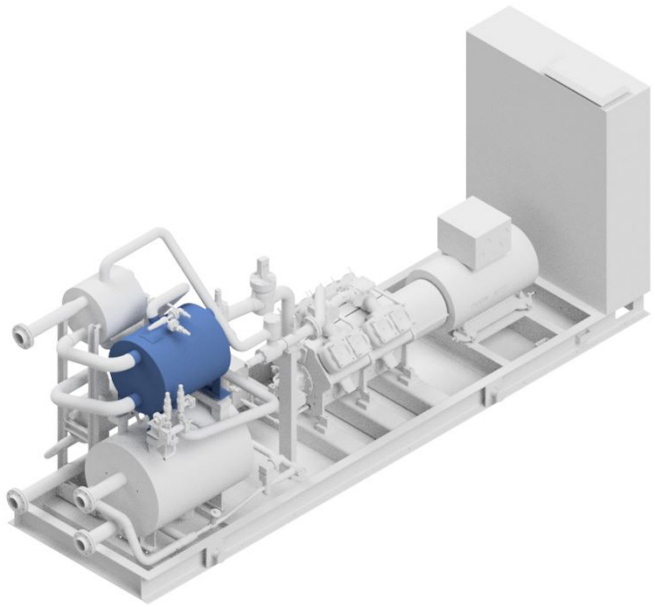


Fig.6: Position of the condenser

In the condenser the compressed refrigerant vapour is desuperheated and liquefied by dissipating the energy absorbed in the evaporator and compressor to the heat carrier (heating).

Design, manufacture and acceptance of the condenser comply with the requirements of the Pressure Equipment Directive.

Condenser designed as a plate heat exchanger (included in the scope of delivery)

The documentation of the condenser (operating and maintenance instructions, acceptance certificate) is a part of the product documentation.

3.3.6 Oil cooler

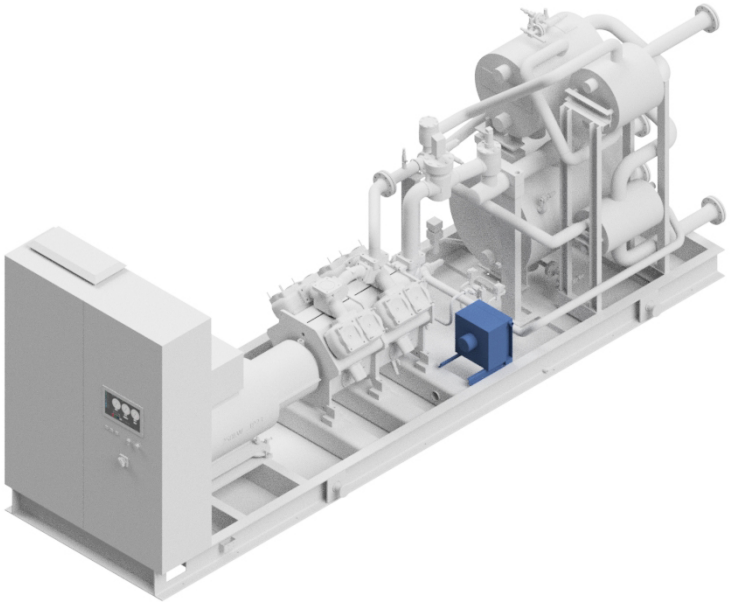


Fig.7: Arrangement of the oil cooler

The GEA RedGenium heat pumps are equipped with an air cooled oil cooler.

The oil cooler is used for cooling the oil heated in the compressor in order to ensure sufficient oil viscosity for supplying to the compressor.

The documentation of the oil cooler (acceptance certificate) is part of the product documentation.

3.3.7 Desuperheater (high pressure level with reciprocating compressor, optional)

Depending on the specific project conditions, the integration of a desuperheater can lead to some significant energy-related benefits and boost the efficiency of the heat pump because the subcooler output means additional heating or cooling output without additional drive power.

After it has been condensed, the refrigerant is heated by a certain temperature difference in the desuperheater (depending on the level of the heat carrier entry and exit temperature) and its heat is discharged to the heat carrier.

The documentation for the desuperheater (operating manual, acceptance certificate) is an integral part of the product documentation.

3.3.8 Subcooler (optional)

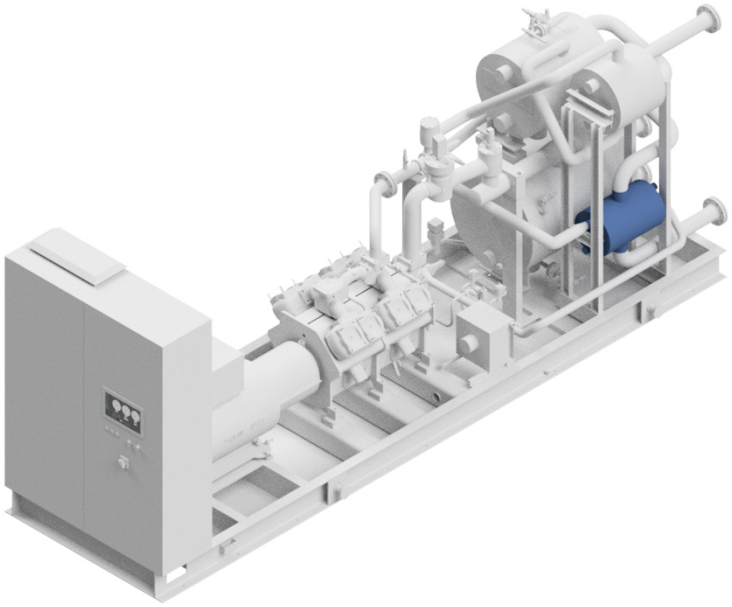


Fig.8: Position of the subcooler

Depending on the specific project conditions, incorporating a subcooler may have partly significant energy advantages and increase the efficiency of the heat pump, since the subcooler capacity adds to the heating and cooling capacity without requiring additional drive power.

After condensing, the refrigerant is supercooled in the subcooler by a certain temperature difference (depending on the level of the heat carrier inlet and outlet temperatures) and its heat is transferred to the heat carrier.

The documentation of the subcooler (operating manual, acceptance certificate) is part of the product documentation.

3.3.9 Control cabinet with control

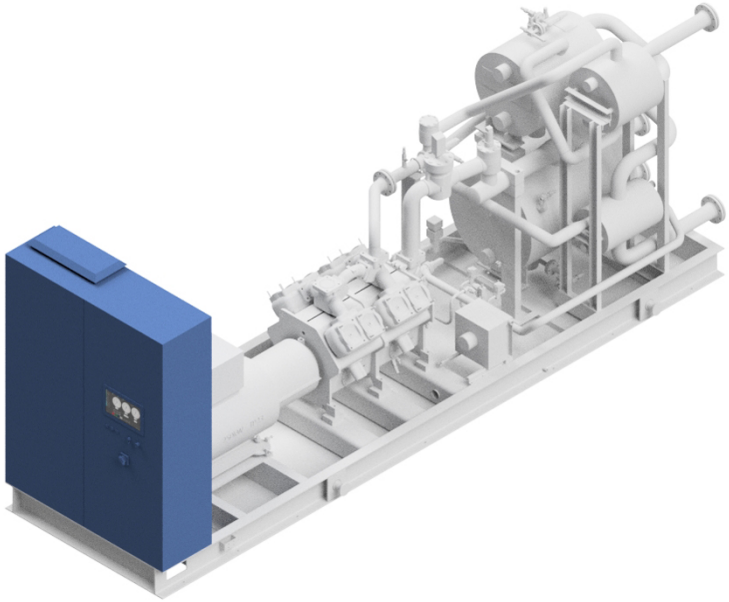


Fig.9: Position of the control cabinet

The product is equipped with a GEA Omni control as standard.

The switching cabinet and control device consists of the control with operating and display unit, indicator lights for “Operation”, “Warning” and “Fault”, EMERGENCY STOP button, coupling elements as well as the casing.

For motors with an output power of up to 450 kW, the control cabinet with the control is directly mounted on the product.

For certain product series, the control cabinet can be optionally removed from the scope of delivery. In this case, only the GEA Omni control is mounted in a control cabinet on the product.

If the product operates with variable speed (standard for the GEA Blu chiller and GEA Red heat pump series), the frequency converter is integrated in the control cabinet.

Notice

Depending on the motor size, the frequency converter (FC) must be installed in a separate cabinet. Depending on the application, the complete control cabinet is mounted in a different configuration than the one shown, or the FC cabinet is supplied separately.

In the standard, the control cabin is transported while connected to the frame.

For applications with piston compressors, the connecting screws must be undone on site and the control cabinet must be pulled a small distance away from the base frame.

► Details can be found in the project-specific specifications or the order drawings.

More details on the functional scope of the control can be found in the separate chapter concerning the GEA Omni.

The documentation for the control (operating manual, circuit diagram, parameter list, communication guideline) is an integral part of the product documentation.

Notice

The communication guideline offers detailed information about communication of the controller.

► The communication guideline can be made available before a planned installation.

3.3.10 Fittings

The term 'fittings' generally designates a control element of the product. Among other things, the term 'fittings' is also used for valves if they are used for the control and regulation of fluid flows in the pipes.

Furthermore, all kinds of installations in pipes, such as sight glasses, measurement apertures, filters and similar, are also designated as fittings. Therefore, fittings also include all kinds of valves, such as

- Stop valves
- Check valves
- Safety valves
- Throttle valves

Each fitting has its own field of use, according to the pressure or temperature in the pipe, the size of the pipe, the sealing requirements for the fitting, the reduction and direction of the flow of liquid, as well as the medium itself.

The safety fittings are used to limit the pressure in systems which are under pressure.

Each fitting is designed for the specific application. The fittings can be operated manually or by motor, e.g. by gear motors, or pneumatic or hydraulic cylinders. In reset fittings, the flow of fluid in the pipe causes automatic closing of the valve.

Depending on the model, different closing elements (e.g. valve discs, flaps, washers) close the pipe connected to the fitting.

The documentation of the fittings (acceptance certificate) forms part of the product documentation.

3.3.11 Safety devices

The product is equipped with a comprehensive software safety chain preventing excessive pressures, temperatures and the hazard of freezing.

A suction as well as condenser pressure control and a rated current limitation control will adjust the speed if the set limit values are exceeded.

Due to the applicable laws and regulations, various certifying bodies require a vast range of auxiliary equipment with independent safety devices.

The following safety equipment is included, if the chiller is delivered with CE label according to EN 378:

- Overflow valve (on the compressor) from discharge to suction side,

- Dual safety valve with blow-out connection, installed on the low pressure side of the product,

Notice

Correct installation of the blow-out connection.

► The contractors must guarantee that the pressure relief connection is safely operated to the outside.

- Safety pressure limiter via 2 switching positions with manual internal and external reset (one switching level may be enough for some applications)
- Pressure relief device for each closable container which can contain liquid refrigerant.

  This applies to all vessels in accordance with the requirements of the Pressure Equipment Directive.

The scope of delivery does not include the following safety devices in relation to escaping ammonia:

- Protective equipment (health and industrial safety)
- Gas warning device / gas warning sensors (included in the GEA BluAir and GEA BluAir duo series as standard)

In case of delivery according to EN 378 with CE label, all parts of the documentation mentioned in the regulation are also supplied in the national language.

All other approvals have to be agreed upon separately.

3.3.12 Safety devices for pressure limitation

The safety devices for pressure limitation of the product comply with EN 378-2.

The overflow valve for the protection of the compressor is designed according to EN 13136.

The blow-off pressure is set to the maximum permissible operating pressure of the system.

The blow-off pipe has been calculated according to EN 13136.

The electromechanical safety switching devices for pressure limitation comply with EN12263 and are type-tested. The settings correspond to the specifications of EN 378-2.

If electronic safety switching devices are used for pressure limitation, the setting may deviate from the standard specifications (see EN 378-2) due to the increased precision.

Notice

When using safety valves for pressure relief, the operator is responsible for:

► the calculation of the dimensioning of the blow-off pipes upstream of the safety valve,
► the safe discharge of refrigerant when the pressure relief device responds.

The safety equipment for pressure limitation according to EN 378-2 represents the minimum requirements. Therefore, before commissioning, the specifications from the national operational safety regulations must be compared with those of EN 378-2.

For the safe function of the safety devices for pressure limitation, the specified test intervals must be observed. These result from the respective industrial safety regulations.

3.3.13 Components installed by the client

⚠ Warning!

GEA Refrigeration Germany GmbH does not assume any liability for arising damages or for the violation of the safety regulations resulting from the use of unsuitable materials or a modification to the product that is not included in the original safety concept.

► The material properties of components and system parts provided by and monitored by the customer, in particular in the secondary refrigerant and heat carrier or coolant circuit as well as in the oil circuit, must be suitable for the fluids flowing there. Furthermore, in the event of modifications to the product by the customer, the effects upon the safety devices must be checked.

4 GEA Omni control

4.1 Product highlights

GEA stands for sophisticated precision solutions. The system provider once again demonstrates its technological leadership and innovation with the new GEA Omni control system.

Powerful and practical, sophisticated and intuitive, refined and simple. This is GEA Omni.

GEA Omni delivers what it promises: maximum efficiency and reliable system operation. The next generation control integrates all important components of a refrigeration and gas compression plant. This permits the system to be operated according to demand and in a particularly efficient manner.

GEA Omni advantages at a glance:

- System control with one device
  → Control of the refrigeration system with GEA Omni
- High-resolution display
  → 1366 x 768 pixel
- Multitouch display
  → Ergonomic and intuitive input
- Easy integration
  → Easy installation on site, ideal for retrofitting existing systems
- Configurable Modbus TCP communication
  → Data exchange with other systems without additional cabling required
- Hardware design
  → Standard industrial components with modular design
- Individual user profiles and management
  → Setup of individual user profiles and record user entries made
- Drawings, manuals and videos
  → Technical documentation including helpful videos can be accessed directly via the touch panel
- Intelligent service intervals
  → Timely modification of maintenance recommendations depending on the operation
- GEA OmniLink
  → Application for remote control of the GEA Omni via Ethernet with integrated data transmission
- GEA OmniHistorian
  → Application for detailed analysis of recorded operating data histories
- Global product with local sales and service
  → Product available worldwide in a uniform design

- Production in North America, Europe and Asia
  → available in over 25 languages
- Reliability with GEA
  → Developed, manufactured and supported by the market leader for control systems for refrigeration and gas compression systems

4.2 View

Fig.10: GEA Omni exterior view without indicator lights

Fig.11: GEA Omni exterior view with indicator lights

4.3 Standard function

The GEA Omni supports the following standard functions:

- Display of all important physical and technical parameters, e.g. pressure, temperature, motor current, capacity, number of run hours, operation mode and status signals,
  Different parameters and menus are hidden if they are not needed.
- Automatic start/stop of the product and capacity control depending on, for example:
  - Suction pressure
  - Discharge pressure
  - External setpoint value
  - External temperature
  - Network temperature
  - Inlet temperature (evaporator, secondary refrigerant)
  - Outlet temperature (evaporator, secondary refrigerant)
  - Inlet temperature (condenser, secondary refrigerant or heat carrier)
  - Outlet temperature (condenser, secondary refrigerant or heat carrier)
- Monitoring of all operating parameters.

- Limitation of the compressor capacity as soon as one of the defined limit values is reached or exceeded.
- Notification history (messages, warnings and faults) with date and time.
- Wire failure detection for all analogue input signals.
- Password protection to prevent unauthorised access to important parameters
- Saving of software, configuration and settings in non-volatile memory.
- Control via master controller via floating contacts.
- Programme saved on non-volatile CFast card.
- Possibility of communication with master controller via Modbus TCP, Ethernet/IP.
  (optionally via Profibus-DP and ProfiNet)
- Remote access (optional via Ethernet)

4.4 Components of GEA Omni

- Control cabinet (different sizes and mounting options, see - IEC standard IP54 / NEMA 4 minimum classification)
- Control cabinet with:
  - Industrial PC with multi-touch screen and HD display for operation
  - EMERGENCY-OFF switch - directly connected to the control outputs to be able to switch off all rotating components immediately.
  - USB interface - with IP54 cover for data exchange with the industrial PC
  - Optional indicator lights for:
    → “operation” – for status displays start, operation or stop of the compressor
    → “warning” – for the display that an operating condition has exceeded the limit value for a warning.
    → “fault” – for indicating that the compressor is switched off.
- Control cabinet interior view:
  - Power supply for the industrial PC, input and output circuits and sensor
  - Frequency converter (optional or standard depending on the product)
  - I/O system – as interface for all monitored digital and analogue inputs and regulated outputs
  - Connections – for incoming power supply and cabling connections
  - Fuses and circuit breakers - as short-circuit and overvoltage protection. Industrial PC and I/O logic are protected with a fuse. The power supplies of the control system and the sensors are protected by circuit breakers
  - Cable ducts - as a guide for internal cabling

Fig.12: GEA Omni control cabinet interior view (frequency converter installed in control cabinet)

4.5 Input and Output Signals

Low-voltage switchgear - GEA Omni			
from the low-voltage switchgear to the GEA Omni INPUTS		**from the GEA Omni to the low-voltage switchgear OUTPUTS**	
Not applicable if the scope of delivery contains a low-voltage switchgear.			
Input: 100 ... 240 V, 50/60 Hz			
digital	• Motor feedback • Motor protection compressor • Feedback external oil pump [12]	digital	• Run compressor • Run external oil pump [12] • Confirm malfunction
analogue (4-20 mA)	• Motor current compressor drive motor • Speed compressor drive motor [13]	analogue (4-20 mA)	• Compressor drive motor speed setpoint [13]

Remote controller or control system - GEA Omni			
from the remote controller (control system) to the GEA Omni INPUTS		**from the GEA Omni to the remote controller (control system) OUTPUTS**	
digital	• External ON/OFF • External "MORE" • External "LESS" • External run release • Confirm external fault • Switchover 2. Setpoint • Block compressor	digital	• Ready for external mode • Signal Compressor runs • Main failure • auxiliary output 1 (Default setting collective warning)
analogue (4-20 mA)	• Remote setpoint	analogue (4-20 mA)	• Swept volume

12 If fitted.
13 Only when operated with a frequency converter.

Chiller / heat pump - GEA Omni			
from the cooling system / heat pump to the GEA Omni INPUTS		**from the GEA Omni to the cooling system / heat pump OUTPUTS**	
digital	• external EMERGENCY-OFF (or EMERGENCY-STOP) • Separator level [14] • Eco-level [14] • Gas sensor • Discharge pressure safety switch • min. oil level [15] • max. oil level [15] • Level of refrigerant top / bottom [14]	digital:	• Solenoid valve capacity control max. [16] • Solenoid valve capacity control min.[16] • Solenoid valves capacity control [17] • Solenoid valve check valve suction side [14], [16] • Solenoid valves Vi-control [14], [16] • Solenoid valve economizer operation[14] • Solenoid valve start-up unloading [14] • Solenoid valves, oil return • Solenoid valve low pressure-high pressure relief [12] • Solenoid valve oil return from fine oil filter stage [12]
analogue (4-20 mA)	• Control / primary slide position[16] • Vi / control slide stop position [14], [16] • suction pressure • discharge pressure • Oil pressure • Pressure after oil filter[16] • Crankcase pressure [17] • Evaporating pressure [18] • Suction temperature • Discharge temperature • Oil temperature • Oil temperature oil separator sump [12] • Oil temperature compressor on / off [19] • Eco temperature[12] • Eco pressure[12] • Secondary refrigerant temperature on/off [20] • Inlet temp. refrigerant low pressure cooling system [21]	analogue (4-20 mA)	• Setpoint level control [14] • Setpoint IntelliSOC injection valve [14] • Setpoint motor valve suction line [12] • Setpoint motor valve remote condenser control[12] • Setpoint motor valve hot gas bypass start-up unloading[12]

14 The signals refer in part to optional features (not available for all products).
15 For screw compressor, optional.
16 Depends on compressor type.
17 For reciprocating compressor.
18 For heat pumps with motor valve on the suction side.
19 For heat pumps with reciprocating compressor.
20 For heat pumps with water/saltwater-based heat sources.
21 For heat pumps with a heat source of NH_3-condensation of the low pressure cooling system.

Chiller / heat pump - GEA Omni	
from the cooling system / heat pump to the GEA Omni INPUTS	**from the GEA Omni to the cooling system / heat pump OUTPUTS**
• Outlet temp. refrigerant low pressure cooling system [22] • Heat carrier / cooling medium temperatures [23]	

22 For heat pumps with a heat source of NH3-condensation of the low pressure cooling system (is substituted with the discharge temperature sensor of the low pressure level for products of the GEA Blu-Red Fusion series).

23 For heat pumps heat carrier temperature sensors on/off for every heat exchanger standard, for chillers optional, only 1x inlet/outlet respectively into / out of the product.

5 Technical data

5.1 Dimensions, weights, fill quantities and connections

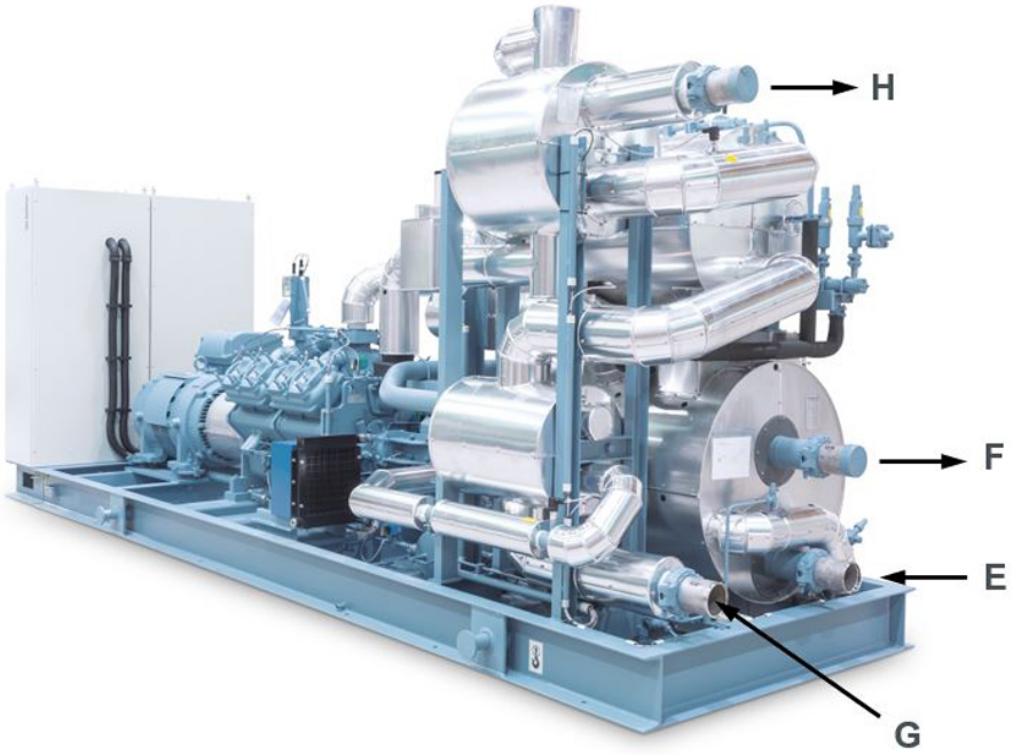


Fig.13: GEA RedGenium (variant (W) connections)

5.1.1 GEA RedGenium 35 (W) series ... GEA RedGenium 950 (W)

Notice

The data applies to the following conditions: (application example 1 pure heating mode, evaporator with ext. secondary refrigerator):

- ► Temperature of the coolant +27°C / +22°C
- ► Temperature of the heat carrier +50°C / +70°C

Data may differ in other conditions.

Characteristics						
Code	**Parameter**		**GEA RedGenium (W) heat pump with 5 HP**			
			35 [24]	**45**[24]	**55**[24]	**65**[24]
	Length [25]	mm	4500	4500	4700	4700
	Width	mm	1600	1600	1600	1600
	Height	mm	2250	2250	2250	2250
E	Cold water connection IN	DN	80	80	80	80
F	Cold water connection OUT	DN	80	80	80	80
G	Connection [26] Heat carrier ON	DN	80	80	80	80

24 Values subject to technical changes
25 Plus frame protrusion (< 200 mm)

Characteristics						
Code	**Parameter**		**GEA RedGenium (W) heat pump with 5 HP**			
			35 [24]	**45**[24]	**55**[24]	**65**[24]
H	Connection [26]Heat carrier OFF	DN	80	80	80	80
	Connection safety valve vent line	DN	25	25	25	25
	Weight without charging	kg	5000	5100	5300	5400
	Operating weight	kg	5050	5150	5355	5455
	Filling quantity (Oil)	l	16	16	18	18
	Filling quantity (refrigerant NH_3)	kg	27	28	30	32

Characteristics					
Code	**Parameter**		**GEA RedGenium (W) heat pump with V HP**		
			300 [24]	**450** [24]	**600** [24]
	Length [25]	mm	4900	5300	5700
	Width	mm	1600	1600	1600
	Height	mm	2250	2450	2450
E	Connection Cold water IN	DN	80	100	100
F	Connection Cold water OUT	DN	80	100	100
G	Connection[26] Heat carrier ON	DN	80	80	100
H	Connection [26] Heat carrier OFF	DN	80	80	100
	Connection of blow-off line to safety valve	DN	25	25	25
	Weight without charging	kg	5600	6600	7300
	Operating weight	kg	5655	6665	7380
	Filling quantity (Oil)	l	20	27	38
	Filling quantity (refrigerant NH_3)	kg	35	40	45

Characteristics						
Code	**Parameter**		**GEA RedGenium (W) heat pump with V XHP**			
			350 [24]	**550**[24]	**750**[24]	**950**[24]
	Length [25]	mm	5900	6100	6900	7200
	Width	mm	1600	1800	1800	1800
	Height	mm	2250	2450	2450	2450
E	Cold water connection IN	DN	100	100	125	125
F	Cold water connection OUT	DN	100	100	125	125
G	Connection [26]Heat carrier ON	DN	80	100	100	125
H	Connection [26]Heat carrier OFF	DN	80	100	100	125
	Connection safety valve vent line	DN	25	25	25	25

24 Values subject to technical changes
26 The position of the heat carrier inlet and outlet connections varies depending on how the heat exchangers are arranged (project-specific configuration)

Characteristics						
Code	**Parameter**		**GEA RedGenium (W) heat pump with V XHP**			
			350 [24]	**550[24]**	**750[24]**	**950[24]**
	Weight without charging	kg	6900	7200	7900	8900
	Operating weight	kg	6960	7280	8020	9070
	Filling quantity (Oil)	l	35	40	45	50
	Filling quantity (refrigerant NH_3)	kg	40	45	55	65

Notice

High temperatures are only possible with the GEA Grasso V XHP series piston compressor. The data applies to the following standard conditions: (application example 1 pure heating mode, evaporator with ext. secondary refrigerator):

► Temperature of the coolant +47°C / +42°C
► Temperature of the heat carrier +70°C / +95°C

Deviant data can be the result of other conditions.

Characteristics						
Code	**Parameter**		**GEA RedGenium (W) heat pump with V XHP**			
			350 [24]	**550[24]**	**750[24]**	**950[24]**
	Length [25]	mm	5900	6100	6900	7200
	Width	mm	1600	1800	1800	1800
	Height	mm	2250	2450	2450	2450
E	Cold water connection IN	DN	100	100	125	125
F	Cold water connection OUT	DN	100	100	125	125
G	Connection [26]Heat carrier ON	DN	80	100	100	125
H	Connection [26]Heat carrier OFF	DN	80	100	100	125
	Connection safety valve vent line	DN	25	25	25	25
	Weight without charging	kg	7700	8100	9500	11000
	Operating weight	kg	7790	8220	9670	13000
	Filling quantity (Oil)	l	40	45	50	55
	Filling quantity (refrigerant NH_3)	kg	44	49	59	69

5.1.2 GEA RedGenium 35 (K) series... GEA RedGenium 950 (K)

Notice

The data applies to the following conditions (application example 2 as “add-on” heat pump with NH_3 cascade evaporator):

► Condensation temperatures from the refrigeration system from +30 °C
► Temperature of the heat carrier +50°C / +70°C

Data may differ in other conditions.

Characteristics						
Code	**Parameter**		**GEA RedGenium (K) heat pump with 5 HP**			
			35 [27]	**45** [27]	**55** [27]	**65** [27]
	Length [28]	mm	4500	4500	4700	4700
	Width	mm	1600	1600	1600	1600
	Height	mm	2250	2250	2250	2250
E	Connection NH_3 OUT	DN	80	80	80	80
F	Connection NH_3 IN	DN	80	80	80	80
G	Connection[29] Heat carrier ON	DN	80	80	80	80
H	Connection [29] Heat carrier OFF	DN	80	80	80	80
	Connection of blow-off line to safety valve	DN	25	25	25	25
	Weight without charging	kg	5200	5300	5500	5650
	Operating weight	kg	5260	5365	5575	5735
	Filling quantity (Oil)	l	16	16	18	18
	Filling quantity (refrigerant NH_3)	kg	28	29	31	33

Characteristics					
Code	**Parameter**		**GEA RedGenium (K) heat pump with V HP**		
			300 [27]	**450** [27]	**600** [27]
	Length [28]	mm	5000	5300	5700
	Width	mm	1600	1600	1600
	Height	mm	2250	2300	2450
E	Connection NH_3 OUT	DN	80	100	100
F	Connection NH_3 IN	DN	80	100	100
G	Connection[29] Heat carrier ON	DN	80	80	100

27 Values subject to technical changes
28 Plus frame protrusion (< 200 mm)
29 The position of the heat carrier inlet and outlet connections varies depending on how the heat exchangers are arranged (project-specific configuration)

Characteristics					
Code	**Parameter**		**GEA RedGenium (K) heat pump with V HP**		
			300 [27]	**450** [27]	**600** [27]
H	Connection [29] Heat carrier OFF	DN	80	80	100
	Connection of blow-off line to safety valve	DN	25	25	25
	Weight without charging	kg	6500	8000	9800
	Operating weight	kg	6600	8125	9950
	Filling quantity (Oil)	l	20	27	38
	Filling quantity (refrigerant NH_3)	kg	37	42	48

Characteristics						
Code	**Parameter**		**GEA RedGenium (K) heat pump with V XHP**			
			350 [27]	**550** [27]	**750** [27]	**950** [27]
	Length [28]	mm	6100	6300	7100	7500
	Width	mm	1600	1800	1800	1800
	Height	mm	2250	2450	2450	2450
E	Connection NH_3 OUT	DN	100	100	125	125
F	Connection NH_3 IN	DN	100	100	125	125
G	Connection[29] Heat carrier ON	DN	80	100	100	125
H	Connection [29] Heat carrier OFF	DN	80	100	100	125
	Connection of blow-off line to safety valve	DN	25	25	25	25
	Weight without charging	kg	7200	7500	8250	9500
	Operating weight	kg	7300	7625	8400	9675
	Filling quantity (Oil)	l	35	40	45	50
	Filling quantity (refrigerant NH_3)	kg	37	42	52	60

Notice

High temperatures are only possible with the GEA Grasso V XHP series piston compressor. The data applies to the following standard conditions (application example 2 as “add-on” heat pump with NH_3 cascade evaporator):

► Condensation temperatures from the refrigeration system from +48 °C
► Temperature of the heat carrier +70°C / +95°C

Characteristics						
Code	**Parameter**		**GEA RedGenium (K) heat pump with V XHP**			
			350 [27]	**550** [27]	**750** [27]	**950** [27]
	Length [28]	mm	6100	6300	7100	7500
	Width	mm	1600	1800	1800	1800

Characteristics						
Code	**Parameter**		**GEA RedGenium (K) heat pump with V XHP**			
			350 [27]	**550** [27]	**750** [27]	**950** [27]
	Height	mm	2250	2450	2450	2450
E	Connection NH_3 OUT	DN	100	100	125	125
F	Connection NH_3 IN	DN	100	100	125	125
G	Connection[29] Heat carrier ON	DN	80	100	100	125
H	Connection [29] Heat carrier OFF	DN	80	100	100	125
	Connection of blow-off line to safety valve	DN	25	25	25	25
	Weight without charging	kg	8000	8400	10500	12000
	Operating weight	kg	8125	8550	10700	12250
	Filling quantity (Oil)	l	40	45	50	55
	Filling quantity (refrigerant NH_3)	kg	46	52	65	80

5.2 Operation limits

The heat pumps from the GEA RedGenium series can be operated within the specified operation limits according to the respective specifications under diverse work conditions. The operation limits listed below are based on the operational principle of the reciprocating compressor, thermodynamic relationships, the vessels and safety devices in use, and the practical operating conditions.

Permissible minimum and maximum values for heat pumps of the GEA RedGenium series						
Parameter				**GEA RedGenium (with 5 HP)**	**GEA RedGenium (with V HP)**	**GEA RedGenium (with V XHP)**
Speed	n	min^{-1}	min	500	500	500
			max	1500	1500	1500
Maximum permissible pressure, low pressure side [30]	PS	bar(g)	min	16	16	16
			max	25	25	25
Maximum permissible pressure, high pressure side	PS	bar(g)	min	40	38	40
			max	50	38	63
Suction pressure	p_{suc}	bar(g)	min	5.17	2.00	2.37
			max	17.00	13.13	26.16
Pressure ratio p / p_{suc} [31]	π	-	min	1.5	1.5	1.5
			max	6.0	6.0	6.0
Pressure difference p - p_{suc} [31]	Δp	bar(g)	min	2.59	1.00	1.00
			max	23.00	25.00	50.00
Secondary refrigerant inlet temperature [32]	t_{K1}	°C	min	+8.0	-9.0	-9.0
			max	+50.0	+50.0	+50.0
Outlet temperature of secondary refrigerant [32]	t_{K2}	°C	min	+7.0	-10.0	-10.0
			max	+44.0	+35.0	+49.0
Difference inlet / outlet temperature of secondary refrigerant [32]	Δt_K	K	min	1	1	1
			max	10	10	10
Evaporating temperature NH_3 cascade evaporator	t_0	°C	min	+10.0	+10.0	+10.0
			max	+43.0	+34.0	+50.0
NH_3 discharge temperature from the refrigeration plant with NH_3 cascade evaporator	t_{disK}	°C	max	+150.0	+150.0	+150.0
Heating agent inlet temperature in the heat pump	t_{W1}	°C	min	+15.0	+15.0	+15.0
			max	+75.0	+65.0	+90.0
Outlet temperature of the heat carrier from the heat pump [33]	t_{W2}	°C	min	+50.0	+50.0	+50.0
			max	+85.0	+70.0	+95.0

30 For the variant with cascade evaporator, the max. permissible pressure on the low pressure side is limited to 22 bar

31 The given pressure ratio and pressure difference ensure reliable compressor operation. Furthermore, allowance must be made for the pressure difference necessary for the control valves fitted in the refrigerating plant. Generalised maximum values for pressure ratio and difference cannot be specified due to their dependence on different parameters. Depending on the suction pressure level, the maximum possible discharge pressure may be below the value specified. The respective compressor usage diagrams apply. To comply with the minimum pressure difference, we recommend customer to provide a water-side 3-way valve.

32 Small secondary refrigerant inlet/outlet temperature differences of up to 1 K can only be implemented as long as the max. permitted speed at the heat exchanger nozzle (7.5 m/s) is not exceeded.

Permissible minimum and maximum values for heat pumps of the GEA RedGenium series						
Parameter				**GEA RedGenium (with 5 HP)**	**GEA RedGenium (with V HP)**	**GEA RedGenium (with V XHP)**
Difference inlet / outlet temperature of heat carrier	Δt_K	K	min	5	5	5
			max	50	50	50
Oil temperature	t_{oil}	°C	min	+45	+45	+45
			max	+70	+70	+70
Discharge temperature at compressor outlet [34]	t_{dis}	°C	max	143	+155	160
Ambient temperature	t_U	°C	min	+15	+15	+15
			max	+40	+40	+40
Installation altitude	h	m	max	3000	3000	3000
Relative ambient humidity [35]	*f*	%	max	95	95	95

Notes

1. When considering a specific application, all the conditions specified in the table must be taken into account and adhered to.
2. If the specified limits are exceeded for a specific application, GEA Refrigeration Germany GmbH must be consulted.
3. In addition to the operation limits given in the tables, consider the operating conditions which must be observed for the compressor (e.g. start-up regime, oil pressure, oil quantity, type of oil etc.).
4. The oil temperature at the compressor inlet must be at least +45 °C and below +70 °C.
5. The specified data refer to the operating conditions of a heat pump.

   During downtime or start-up, the limiting values may be exceeded or fallen short of for a short (never long-term) period of time.
6. The operating parameters of the order confirmation apply for an agreed field test.

33 Depending on the temperature level of the secondary refrigerant and the corresponding suction pressure, the maximum possible outlet temperature of the heat carrier may be below the value specified due to the maximum pressure ratios and pressure differences. The respective temperature operation limit diagrams of the compressor apply.

34 The minimum discharge temperature at the compressor outlet must be overheated by at least 1 K.

35 The max. permanent permissible ambient humidity depends on the drive motor and can be below 95% depending on the motor manufacturer and design. Binding values are detailed in the order specification.

5.3 Water quality requirements, parameters

All water bearing components from the manufacturer give an optimum performance and maximum protection from corrosion, if you meet all recommended limiting values of VDI 3803 issue 2010-02 (Tab. B3) for non-corrosive water and adequate water conditioning.

Notice

Disregarding the following rules for limiting values of non-corrosive water specified in VDI 3803, the manufacturer can not accept any warranty for water-contacting components.

► All components are designed for use with non-corrosive water. Water and glycol brine analysis is essential in protecting system components. Analyses prior to start up will prevent corrosion.

Following are shown required limiting values of VDI 3803, for use of carbon steel components in non corrosive water systems.

Water quality requirements, parameters			
Parameter		**Value**	**Unit**
Appearance		clear, without sediment	
Colour		colourless	
Odour		none	
pH-level at 20 °C		7.5 - 9.0	
Electrical conductivity	LF	< 220	mS/m
Soil alkali	Ca^{2+}, Mg^{2+}	< 0.5	mol/m³
General hardness, for stabilization	GH	< 20	°d
Carbonate hardness without hardness stabilizer	KH	< 4	°d
Chloride	Cl	< 150	g/m³
Sulphur	SO_4	< 325	g/m³
Active biological components	KBE	< 10 000	per ml
Thickness factor	EZ	2 - 4	

The use of carbon steel and cast iron required in the most of applications water conditioning with corrosion inhibitors.

The use of stainless steel requires very special monitoring of water in apply to Chloride contents (risk of stress crack and pitting corrosion).

Notice

Recommended with use of plate heat exchangers

► < 100 ppm Cl for the use of 1.4301 and max. 40 °C wall temperature in the plate heat exchanger

► < 200 ppm Cl for the use of 1.4401 and max. 100 °C wall temperature in the plate heat exchanger

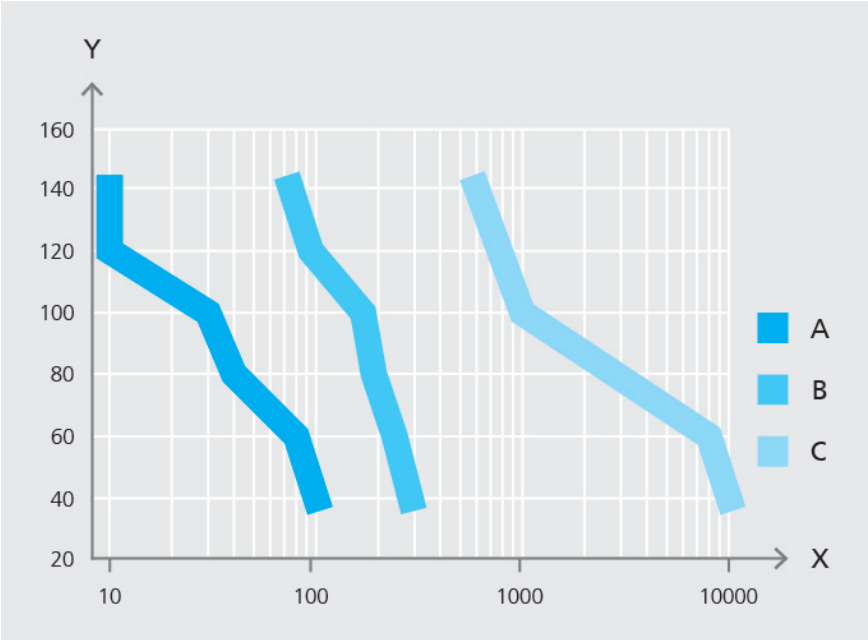


Fig.14: Corrosion resistance in presence of chlorides

X	Chloride ion concentration in ppm Cl^-
Y	Wall temperature heat exchanger in °C
A	AISI 304
B	AISI 316
C	SMO 254

Notice

Manufacturer recommendation: Use uncontaminated secondary refrigerants and cooling media, in particular in chillers and the use of plate heat exchangers.

► The media quality needs to be assured through an appropriate filter on the inlet to the heat exchanger. The mesh for such a filter needs to be ≤ 0.9 mm!

► Should the chiller need to remain in operation during filter cleaning, double filters need to be used. Pressure loss through the filter need to be taken into consideration on the building side when configuring the pump.

The manufacturer recommends enlisting the services of a reputable water conditioning company.

5.4 Performance characteristics

5.4.1 GEA RedGenium 35 (W) … GEA RedGenium 950 (W) series

Notice

The data is applicable to the following standard conditions

(application example 1 pure heating mode, evaporator with ext. secondary refrigerator):

► Q_0: Refrigeration capacity at cooling water inlet / outlet temperature = 27 / 22 °C

► P_e: Drive power online (at 1500 rpm)

► Q_H: Heating capacity at heat carrier inlet / outlet temperature = 50 / 70 °C

Performance characteristics			
Frame size	**Q_0 in kW**	**P_e:[36] in kW**	**Q_H in kW**
GEA RedGenium 35	155	40	190
GEA RedGenium 45	210	52	255
GEA RedGenium 55	265	66	320
GEA RedGenium 65	310	77	380
GEA RedGenium 300	455	109	555
GEA RedGenium 350	600	145	730
GEA RedGenium 450	685	164	835
GEA RedGenium 550	895	215	1090
GEA RedGenium 600	920	218	1120
GEA RedGenium 750	1175	286	1440
GEA RedGenium 950	1475	354	1800

36 Clamping output (including motor / frequency converter power losses)

5.4.2 GEA RedGenium 350 (W) … GEA RedGenium 950 (W) series

Notice

High temperatures are only possible with the GEA Grasso V XHP series piston compressor. The data is applicable to the following standard conditions

(application example 1 pure heating mode, evaporator with ext. secondary refrigerator):

► Q_0: Refrigeration capacity at cooling water inlet / outlet temperature = 47 / 42 °C
► P_e: Drive power online (at 1500 rpm)
► Q_H: Heating capacity at heat carrier inlet / outlet temperature = 70 / 95 °C

Performance characteristics			
Frame size	**Q_0 in kW**	**P_e:[37] in kW**	**Q_H in kW**
GEA RedGenium 350	975	237	1195
GEA RedGenium 550	1450	350	1775
GEA RedGenium 750	1950	467	2385
GEA RedGenium 950	2460	579	2995

37 Clamping output (including motor / frequency converter power losses)

5.4.3 GEA RedGenium 35 (K) series … GEA RedGenium 950 (K)

Notice

The data is applicable to the following standard conditions

(application example 2 as “add-on“ heat pump with NH_3 cascade evaporator):

► Q_0: Refrigeration capacity for condensation temperatures from the refrigeration system from +30 °C
► P_e: Drive power online (at 1500 rpm)
► Q_H: Heating capacity at heat carrier inlet / outlet temperature = 50 / 70 °C

Performance characteristics			
Frame size	**Q_0 in kW**	**P_e:[38] in kW**	**Q_H in kW**
GEA RedGenium 35	195	42	235
GEA RedGenium 45	265	55	315
GEA RedGenium 55	330	68	395
GEA RedGenium 65	390	82	465
GEA RedGenium 300	565	113	665
GEA RedGenium 350	735	150	875
GEA RedGenium 450	845	168	1000
GEA RedGenium 550	1100	222	1300
GEA RedGenium 600	1125	225	1330
GEA RedGenium 750	1470	296	1740
GEA RedGenium 950	1835	361	2170

38 Clamping output (including motor / frequency converter power losses)

5.4.4 GEA RedGenium 350 (K) series … GEA RedGenium 950 (K)

Notice

High temperatures are only possible with the GEA Grasso V XHP series piston compressor.

The data applies to the following standard conditions (application example 2 as “add-on” heat pump with NH_3 cascade evaporator):

► Q_0: Refrigeration capacity for condensation temperatures from the refrigeration system from +48 °C
► P_e: Drive power online (at 1500 rpm)
► Q_H: Heating capacity at heat carrier inlet / outlet temperature = 70 / 95 °C

Performance characteristics			
Frame size	**Q_0 in kW**	**P_e:[39] in kW**	**Q_H in kW**
GEA RedGenium 350	1125	240	1345
GEA RedGenium 550	1975	356	2000
GEA RedGenium 750	2195	474	2635
GEA RedGenium 950	2685	587	3230

39 Clamping output (including motor / frequency converter power losses)

6 Application form

GEA Refrigeration Germany GmbH supplies products of high quality and reliability. With regard to project requirements, every product is configured, constructed and manufactured individually.

Are you looking for the optimum solution for your application? Contact GEA sales and on request, we can provide you with an application form that you can also conveniently fill in and send away electronically.

You can find an overview of sales offices and contacts at:

www.gea.com

6.1 Manufacturer address

GEA Refrigeration Germany GmbH is a company of the GEA Group AG and provides its customers around the world with high-quality components and services for refrigeration and process technology applications.

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GEA Group is a global engineering company with multi-billion euro sales and operations in more than 50 countries. Founded in 1881, the company is one of the largest providers of innovative equipment and process technology. GEA Group is listed in the STOXX® Europe 600 Index.

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