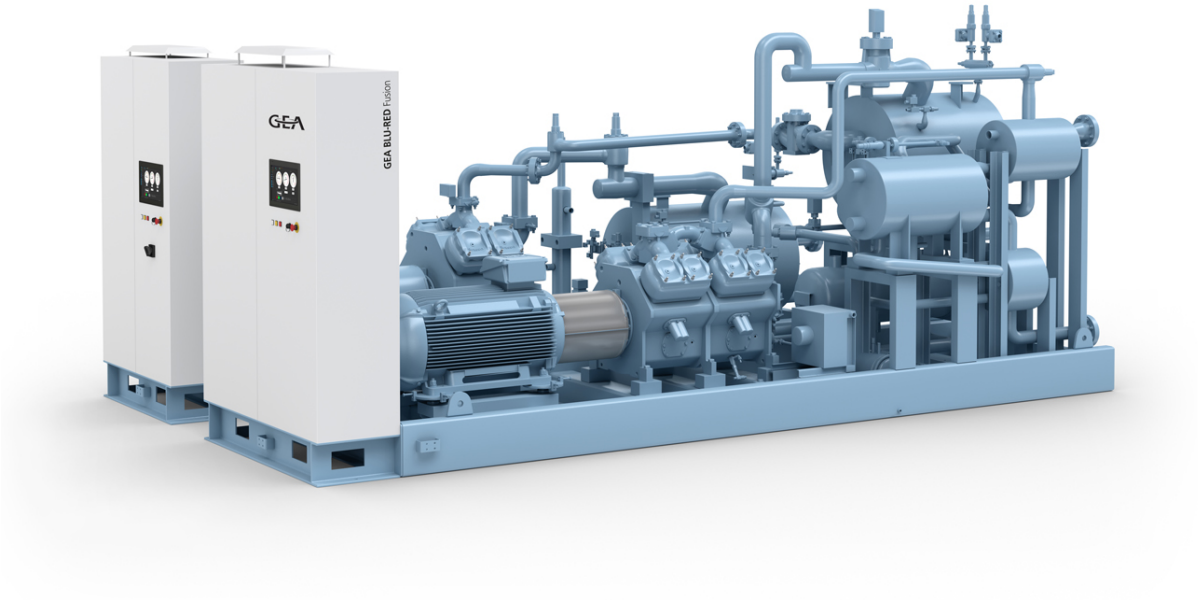
PRODUCT INFORMATION

Original document



GEA Blu-Red Fusion

Chiller / Heat pump

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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

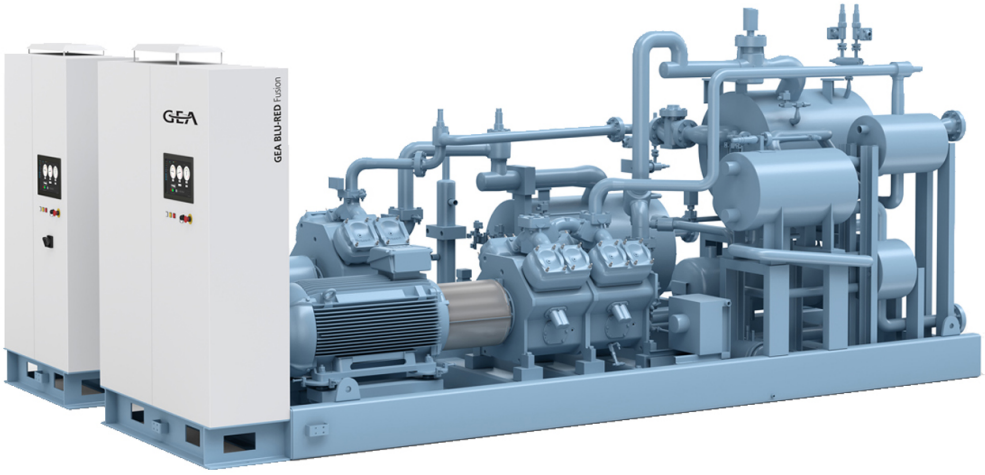


Fig.1: GEA Blu-Red Fusion (example version with reciprocating compressor), front view

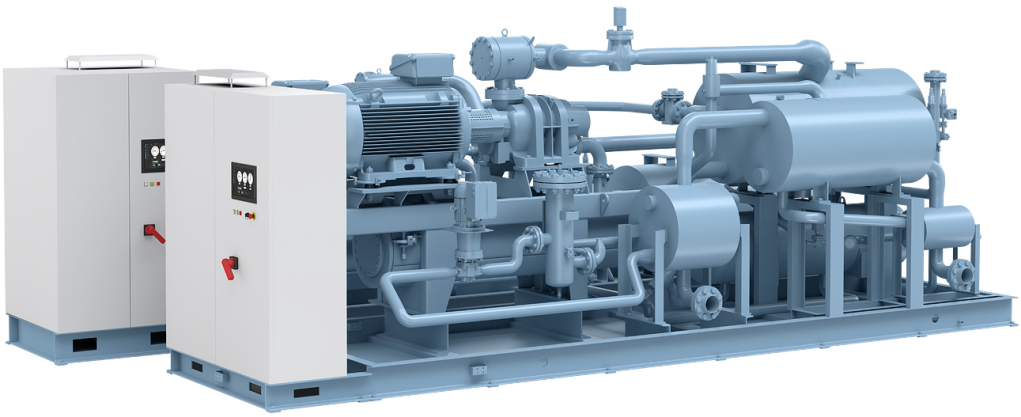


Fig.2: GEA Blu-Red Fusion (example version with screw compressor), front view

Parameter	Remark
Capacity range (Application example 1 temperature of the heat carrier 70°C	approx. 325 - 1730 / 425 - 2425 kW (cooling capacity / heating capacity) 12 °C / 6 °C (coolant temperature) 40 °C / 70 °C (heat carrier temperature)
Capacity range (Application example 2 temperature of the heat carrier 80°C	approx. 410 - 1605 / 625 - 2425 kW (cooling capacity / heating capacity) 12 °C / 6 °C (coolant temperature) 40 °C / 80 °C (heat carrier temperature)
Low pressure reciprocating compressor	Frame size GEA Grasso V300 - V1100 V_{th} = 290 … 1194 m³/h
High pressure reciprocating compressor	Frame size GEA Grasso V300 HP – V600 HP V_{th} = 290 … 580 m³/h
Low pressure screw compressor	Series GEA Grasso M, housing size D, G, H, L, M, N Frame size GEA Grasso LT, housing size R V_{th} = 390 ... 1040 m³/h (2940 min^{-1})
High pressure screw compressor	Series GEA Grasso M, housing size E, G, H, L, M, N Frame size GEA Grasso LT, housing size R V_{th} = 231 ... 1040 m³/h (2940 min^{-1})

Parameter	Remark
Screw compressor package	GEA Grasso M / GEA Grasso SP1 horizontal (high-pressure version in the high pressure level)
Chiller / heat pump	GEA Blu-Red Fusion
Evaporator type	Fully welded plate heat exchanger with integrated separator
Working principle	flooded evaporation
Liquid separator	integrated
Version low-pressure condenser	integrated in high-pressure evaporator / separator (common NH_3-NH_3 cascade heat exchanger)
Version high-pressure condenser	Fully welded plate heat exchanger
Transport	2 parts [1]

1.2 Technical specifications

Notice

The **GEA Blu-Red Fusion** 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 low pressure level:	22 or 25 bar(g)
Design pressure high pressure level:	38, 40 or 52 bar(g)
Intended environment:	Closed machine rooms
Ambient temperatures:	+15 ℃ to +40 ℃
Installation altitude:	≤ 1000 m above sea level
Cooling agent outlet temperature [2]:	-15 ℃ to +15 ℃
Heat carrier outlet temperature [3]:	+50 °C to +70 °C (with reciprocating compressor) +55 °C to +80 °C (with screw compressor)
Electric motor:	scope of delivery
Refrigerant:	R717
Type of oil:	Low and high pressure side acc. to specification **Caution!** Please contact the manufacturer in case of other types of oil. ► Contact the service or the design department of GEA Refrigeration Germany GmbH.
Oil cooling low pressure level:	scope of delivery air cooled for reciprocating compressor Secondary refrigerant injection for screw compressor

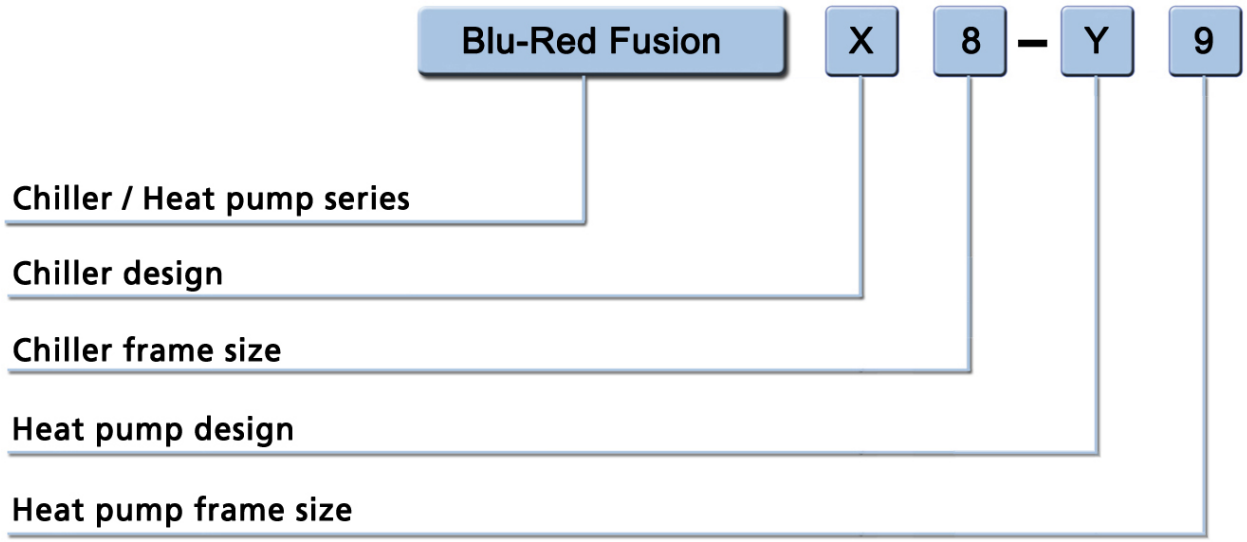
1 The product is supplied separately in a low pressure level (module Blue chiller) and high pressure level (module Red heat pump), plus connecting parts. Depending on the motor size, the power current panel must be transported separately.
2 Temperature difference secondary refrigerant maximum 10 K, higher values on request.
3 Temperature difference heat carrier maximum 50 K, higher values on request.

Standard equipment	
Designation	**Design**
Oil cooling high pressure level:	scope of delivery air cooled for reciprocating compressor liquid cooled for screw compressor
Oil heater:	scope of delivery
Oil filter:	Single stage filter
Spare oil filter:	scope of delivery
Oil level switch:	none
Pressure sensors:	on sensor block for reciprocating compressor with stop valve for screw compressor
Safety pressure switch:	electronic
Overflow valve compressor:	scope of delivery
Overflow valve HP/LP:	Standard delivery scope, each for low and high pressure level
Safety valve LP:	Double safety valve with change-over valve
Flow monitor:	mechanically (paddle), for secondary refrigerant
Control low pressure level:	GEA Omni™
Control high pressure level:	GEA Omni™ incl. GEA VTrac™
Communication:	EtherNet/IP, Modbus TCP
Power current and frequency inverter:	Standard delivery scope, cable opening at the bottom, each for low and high pressure level
Colour:	RAL 5014 (dove grey)
Soundproof housing:	not possible
Vibration isolators:	none
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
Oil level switch:	can be delivered
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
Control:	GEA Omni™ SIEMENS HMI
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 Chiller-heat pump combinations with reciprocating and screw compressors

Series GEA Blu-Red Fusion



Product code description

Code	Description
Blu-Red Fusion	Chiller / heat pump combination series
X	Chiller version variations
8	Chiller capacity (kW) related to cold water operation 12°C/ 6°C
Y	Heat pump version variations
9	Frame size or output of the heat pump

BluRed = series Chiller-heat pump combination series

X = Chiller version variation

Code	Description
BA	Chiller of the GEA BluAstrum series
BG	Chiller of the GEA BluGenium series

8= Capacity of the chiller in kW

relating to cold-water operations 12°C / 6°C at a corresponding speed

Compressor frame size	Capacity in kW	Speed in min^{-1}
V300	300	1500
D	400	4500
V450	450	1500
G	500	4500
V600	600	1500
V700	700	1500
H	800	4500
L	900	4500
M	1000	4500

Compressor frame size	Capacity in kW	Speed in min^{-1}
V1100	1200	1500
V1400	1400	1500
N	1500	4500
V1800	1800	1500
R	1800	4500

Y = Heat pump version variations

Code	Description
RA	Heat pump of the series GEA RedAstrum
RG	Heat pump of the GEA RedGenium series

9 = Frame size of the heat pump as a result of the housing size and rotor size of the screw compressor (GEA RedAstrum) or the frame size of the reciprocating piston compressor (GEA RedGenium)

GEA RedAstrum compressor type [4]	Frame size	Speed in min^{-1}
EMR-C	EC	3600
EMR-D	ED	3600
EMR-E	EE	3600
GMR-G	GG	3600
HMR-E	HE	3600
HMR-G	HG	3600
HMR-H	HH	3600
LMR-L	LL	3600
MMR-H	MH	3600
MMR-L	ML	3600
MMR-M	MM	3600
NMR-N	NN	3600
RR-M	RM	3300
RR-N	RN	3300
RR-R	RR	3300

GEA RedGenium compressor frame size	Frame size	Speed in min^{-1}
35 HP	35	1500
45 HP	45	1500
55 HP	55	1500
65 HP	65	1500
V300 HP	300	1500
V350 XHP	350	1500
V450 HP	450	1500

4 The version variant (normal with non-shortened rotors / heavy duty with shortened rotors) cannot be freely selected, but is the automatic result of various influencing variables from the project-specific conditions (suction pressure, discharge pressure, speed, compressor type). Most typical heat pump conditions require a heavy duty version with shortened rotors; in these cases, the non-shortened variants are not possible.

GEA RedGenium compressor frame size	Frame size	Speed in min^{-1}
V550 XHP	550	1500
V600 HP	600	1500
V750 XHP	750	1500
V950 XHP	950	1500

Examples of designation

Examples	Description
Blu-Red Fusion BG300-RG300	Chiller heat pump combination **(Blu-Red Fusion)** Chiller version GEA BluGenium **(BG)** Capacity of the chiller 300 kW **(300)** Heat pump version GEA RedGenium **(RG)** Compressor size of the heat pump 65 HP **(300)**
Blu-Red Fusion BG1200-RG750	Chiller heat pump combination **(Blu-Red Fusion)** Chiller versions GEA BluGenium **(BG)** Chiller performance 1200 kW **(1200)** Heat pump version GEA RedGenium **(RG)** Compressor size of the heat pump V750 XHP **(750)**
Blu-Red Fusion BA1800-RARR	Chiller heat pump combination **(Blu-Red Fusion)** Chiller versions GEA BluAstrum **(BA)** Chiller capacity 1800 kW **(1800)** Heat pump version GEA RedAstrum **(RA)** Frame size of the heat pump with compressor frame size R and rotor size-R **(RR)**

2 Scope of delivery

The products of the GEA Blu-Red Fusion series are a combination of low-pressure chillers similar to the GEA BluGenium and GEA BluAstrum series and a high pressure heat pump similar to the GEA RedGenium and GEA RedAstrum series.

The low and high-pressure level modules consist of the following components:

1. Low pressure chiller module with:
    - Reciprocating or screw compressor,
    - Evaporator with integrated separator
    - Condenser integrated into the evaporator of the high pressure heat pump module,
    - Electric motor with coupling
    - Oil supply system with oil separator (for screw compressor),
    - Oil cooler (not needed for certain reciprocating compressor models),
    - Oil filter,
    - Suction filter (integrated in the screw compressor depending on model),
    - Check valves on the suction and discharge sides (for screw compressor),
    - Capacity control,
    - Monitoring and safety devices,
    - Frequency converter
    - Low-voltage supply with control unit GEA Omni™,
    - Receiver (depending on operating/configuration type),

2. High pressure heat pump module with:
   - Reciprocating or screw compressor,
   - Evaporator with integrated separator
   - Condenser,
   - Desuperheater (optional for reciprocating compressor)
   - Electric motor with coupling
   - Oil supply system with oil separator (for screw compressor),
   - Oil cooler,
   - Subcooler (optional),
   - Oil filter,
   - Suction filter (integrated in the screw compressor depending on model)
   - Check valves on the suction and discharge sides (suction side only for screw compressor),
   - Capacity control,
   - Monitoring and safety devices,
   - Frequency converter
   - Low-voltage supply with control unit GEA Omni™.

All components are fully mounted; the low-voltage and high-voltage modules are transported separately.

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

The oil separator (for screw compressor) is arranged horizontally and mounted on the steel bearings bolted to the base frame.

In the chiller level with a screw compressor, the oil is cooled via liquid refrigerant injection; in the heat pump level with a screw compressor, the heat is discharged to the heat carrier via a liquid-cooled oil cooler.

In reciprocating compressor models, oil is cooled with an air-cooled oil cooler (some reciprocating compressor models of the low pressure level do not require oil cooling).

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

All connections are closed tight.

Service fluids

The GEA Blu-Red Fusion series is supplied without refrigerant. They are filled with dry nitrogen (0.2 bar ... 0.5 bar overpressure).

When commissioning a start-up or a factory acceptance test (FAT) the refrigerating machine oil is included in the scope of delivery.

Insulation

The warm components and the suction line section in front of the compressor outlet on the high pressure side are insulated with mineral wool or PUR foam, including aluminium cladding.

The cold components (low pressure side) are insulated with mineral wool or 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 products of the GEA Blu-Red Fusion series are awarded a CE label in accordance with the Pressure Equipment Directive 2014/68/EU.

Documentation

Each product of the GEA Blu-Red Fusion 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 (e.g. 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.

2.1 GEA Blu-Red Fusion with heat extraction

Depending on the requirement profile, the chiller / heat pump combination can also be configured for pure chiller operations (heat pump level switched off), or for operation with reduced heat output. In these cases, the excess heat of the chiller must be discharged from the low pressure level.

To this end, a separate external condensation device (for example an air cooled condenser or an evaporation condenser) must be designed and connected on site.

The products of the GEA Blu-Red Fusion series are equipped with a refrigerant collector, connections and control fittings for these kinds of applications; the external condenser for the heat extraction and the required pipes and connections are not part of the scope of delivery of the GEA Blu-Red Fusion.

3 Description of Design and Function

3.1 Design, applications

The chiller / heat pump combination GEA Blu-Red Fusion 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 two-level combination is a combination of a low-pressure level (module chiller of the GEA BluGenium and GEA BluAstrum series) and a high pressure level (module heat pump of the GEA RedGenium and GEA RedAstrum series). The two levels are connected via a common cascade heat exchanger; the condensation capacity of the low pressure level is therefore discharged directly and efficiently to the evaporator within the shared vessel.

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.

The low and high pressure level can be equipped with either reciprocating or screw compressors independently of one another. The chiller module of the low-pressure level is based on the GEA BluGenium and GEA BluAstrum series; the heat pump module is based on the GEA RedGenium and GEA RedAstrum series.

Based on the reciprocating compressor series, the GEA Blu-Red Fusion series program covers a refrigeration range of approx. 325 to 1275 kW for cold water and a heating range of approx. 425 kW to 1670 kW for the heat carrier.

The capacity ranges on the low pressure side are determined by 5 frame sizes of the screw compressor series GEA Grasso V on the low pressure side, and by 3 frame sizes of the reciprocating compressor series GEA Grasso V HP on the high pressure side.

Based on the screw compressor series, the GEA Blu-Red Fusion series program covers a refrigeration range of approx. 395 to 1730 kW for cold water and a heating range of approx. 570 kW to 2425 kW for the heat carrier.

The capacity ranges on the low and high pressure sides respectively are determined by 7 screw compressor frame sizes of the screw compressor series GEA Grasso M and LT.

The chiller / heat pump combinations GEA Blu-Red Fusion work with flooded condenser systems in forced circulation mode and operate with a cooling water (heat carrier)-operated condenser on the high-pressure side.

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

Low pressure chiller with:

- Standard compressor package with reciprocating compressor or screw compressor
- Evaporator subassembly with integrated liquid separator and de-oiling system
- Low-voltage installation with frequency converter and control device

High pressure heat pump with:

- Compressor package with reciprocating compressor or screw compressor in high-pressure version
- Heat exchanger subassembly with cascade heat exchanger with integrated liquid separator and de-oiling system
- Low-voltage installation with frequency converter and control device

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

Only plate condensers are used on the condenser side.

As standard, the GEA Blu-Red Fusion products are completely wired, assembled and ready to plug in, however the low-pressure and the high-pressure modules are transported separately.

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 chiller and heat pump modules 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 units are delivered without refrigerant. They are filled with dry nitrogen (0.2 bar ... 0.5 bar overpressure).

Each product 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 and maintenance instructions are provided for detailed information about the reciprocating and screw compressors.

3.2 General operating sequence of chillers and heat pumps

Chillers and heat pumps are automatic plants used in circuit processes in which a refrigerant absorbs low-temperature heat (source) and discharges it at a high temperature (sink).

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

The refrigerant liquefies as it is cooled and discharges its heat to a cooling medium or heat carrier. Before or after condensation, the overheating or undercooling heat can be removed from the refrigerant in an external desuperheater or subcooler. Then the liquid refrigerant is relaxed 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 cooling agent is cooled down.

In a two-stage system like the GEA Blu-Red Fusion series, the cycle process runs separately on the low and on the high pressure level respectively. During condensation on the low pressure level, the refrigerant absorbs heat from the secondary refrigerant and cools it. However, the condensation heat of the low pressure level (at a low temperature) is not discharged to an external carrier (cooling fluid or heat carrier), but is sent to a cascade heat exchanger of the evaporator of the high pressure level which then absorbs the heat from the low pressure circuit process and not from an external secondary refrigerant.

Optionally, the heating capacity can be controlled regardless of the cooling capacity, or the high pressure level can even be switched off completely for pure cooling mode. In these cases, the excess heat from the low-pressure circulation process can be discharged via a separate external condensation unit (provided by the customer). Products of the GEA Blu-Red Fusion series are equipped with connections and control fittings for cases like this.

The chiller and heat pump stage of the GEA Blu-Red Fusion can be equipped with either reciprocating or screw compressors independently of one another.

When the reciprocating compressor is operating, oil in the crank house lubricates the moving parts. Oil separation is not necessary here because, in contrast to applications that use screw compressors, the oil is not injected into the working chamber and is not mixed with the refrigerant. Despite this, minute oil particles enter the refrigerant circuit and its low pressure side.

During the operation of the screw compressor, oil is injected into the working chamber and then separated again from the refrigerant in the discharge side oil separator. The oil that has heated up in the compressor is cooled in an oil cooler to the inlet temperature. Despite the oil separation system, oil will reach the low pressure side of the circuit.

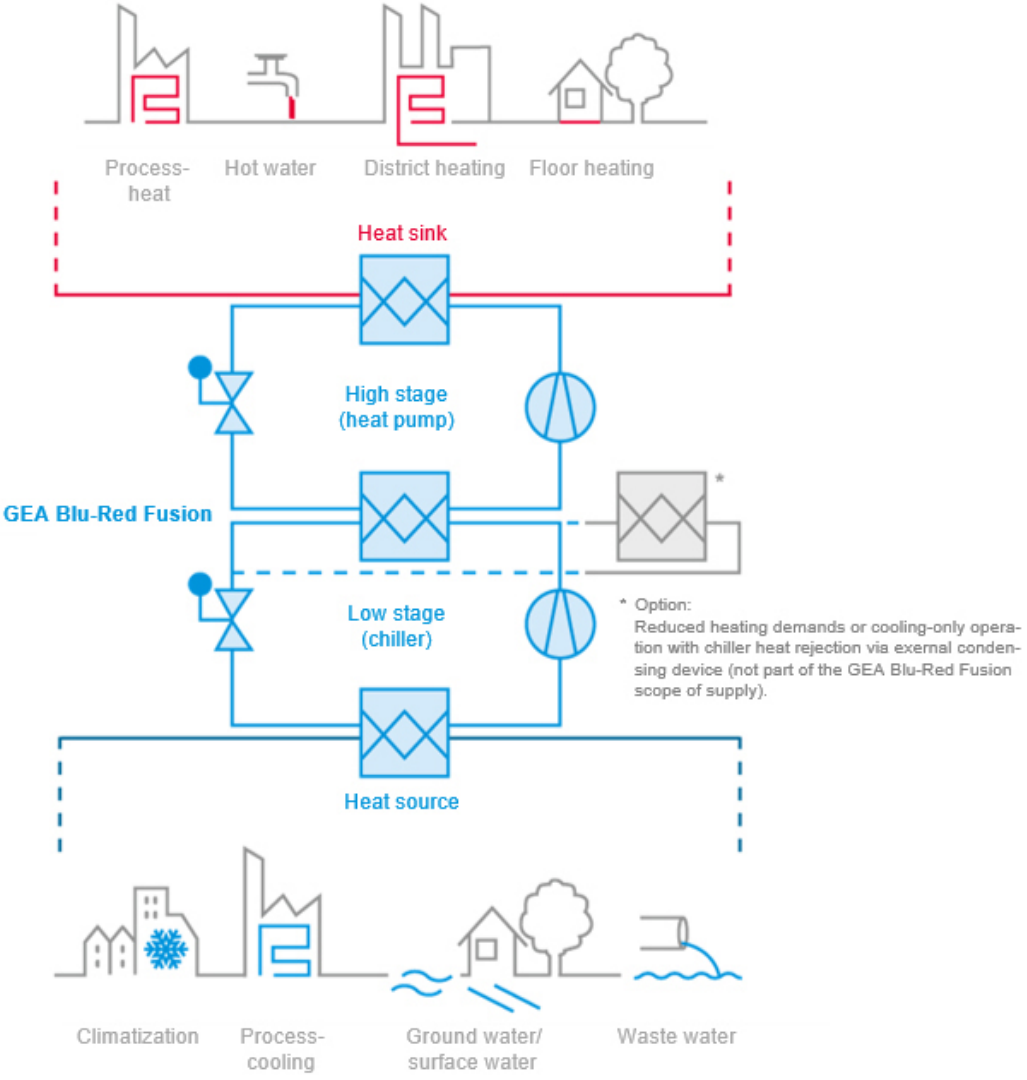


Fig.3: Circuit diagram of the GEA Blu-Red Fusion with application examples heat source and sink

A special automatic and maintenance-free oil returning system developed by GEA Refrigeration Germany GmbH returns the oil from the evaporator / liquid separator back to the reciprocating compressor.

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

The capacity control of the reciprocating compressor is controlled incrementally using the graduated compressor or cylinder shutdown by means of internal control units, and also by the frequency converter of the compressor drive motor.

The capacity control of the screw compressor is controlled infinitely using the control slide of the compressor and the frequency converter of the compressor drive motor. In this way, the cooling capacity can be adapted to the effectively required cooling capacity in the maximum range 0% to 100% (the minimum level is > 0 % depending on the application area).

The Vi capacity slide is hydraulically adjusted and activated using 2 solenoid valves. The position of the Vi control slide is displayed on the compressor control.

In this way, the cooling capacity can be adapted ideally to the effectively required cooling capacity.

In partial-load mode, the cold water / saltwater and heat carrier flows may be reduced by max. 50% to guarantee efficient transfer of the heat to the heat exchanger systems.

3.3 Main components

Notice

The products of the GEA Blu-Red Fusion series are a combination of low-pressure chillers similar to the GEA BluGenium and GEA BluAstrum series and a high pressure heat pump similar to the GEA RedGenium and GEA RedAstrum series. The modules of the low and high pressure level can be equipped with either reciprocating or screw compressors independently of one another.

► The following illustrations show example versions and the possible main components are described in a general manner. The project-specific scope of delivery of the main components is stated in the technical order specification.

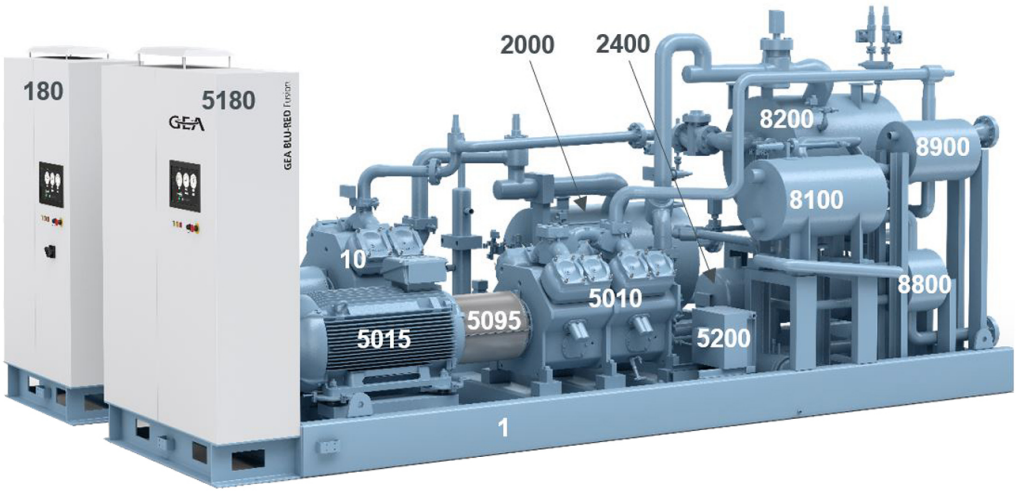


Fig.4: GEA Blu-Red Fusion example version with reciprocating compressor

Position number	Component
1	Separate base frame for: - Module chiller (low pressure level) - Module heat pump (high pressure level)
10	Reciprocating compressor (low pressure level)
180	Control cabinet with control and regulator (low pressure level)
2000	Evaporator (low pressure level)
2400	Liquid receiver
5010	Reciprocating compressor (high pressure level)
5015	Compressor drive motor (high pressure level, Pos. 15 concealed in low pressure level)
5095	Coupling (high pressure level, Pos. 95 largely concealed in low pressure level)
5180	Control cabinet with control and regulator (high pressure level)
5200	Air cooled oil cooler (high pressure level)
8100	Condenser (high pressure level)
8200	Cascade heat exchanger
8800	Subcooler (high pressure level)
8900	Desuperheater (high pressure level)

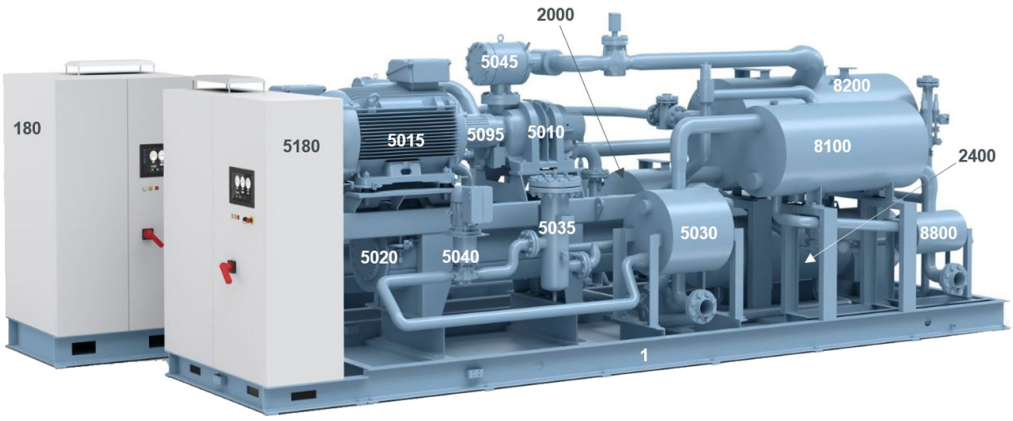


Fig.5: GEA Blu-Red Fusion example version with screw compressor

Position number	Component
1	Separate base frame for: - Module chiller (low pressure level) - Module heat pump (high pressure level)
180	Control cabinet with control and regulator (low pressure level)
2000	Condenser (low pressure level)
2400	Liquid collector
5010	Screw compressor (high pressure level, Pos. 10 concealed in low pressure level)
5015	Compressor drive motor (high pressure level, Pos. 15 concealed in low pressure level)
5020	Oil separator (high pressure level, Pos. 20 concealed in low pressure level)
5030	Oil cooler (high pressure level, Pos. 30 concealed in low pressure level)
5035	Oil filter (high pressure level, Pos. 35 concealed in low pressure level)
5040	Oil pump aggregate (high pressure level, Pos. 40 concealed in low pressure level)
5045	Suction filter combination (high pressure level, Pos. 45 concealed in low pressure level)
5095	Clutch (high pressure level, Pos. 95 largely concealed in low pressure level)
5180	Control cabinet with control and regulator (high pressure level)
8100	Condenser (high pressure level)
8200	Cascade heat exchanger
8800	Subcooler (high pressure level)

3.3.1 Reciprocating compressor

The product 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 switching off cylinders and through continuous speed adjustment (optional equipment for FX GC and FX GC duo series chillers)
- 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 Screw compressor

The screw compressor is characterised by a compact design, high reliability, high-quality components and ease of maintenance.

Screw compressors are dual rotor positive displacement machines that work according to the displacement principle and are operated by oil injection.

The screw compressor is operated with ammonia (NH_3) as the refrigerant.

Specific machine oils are recommended depending on application. These are stated in the specification or can be determined using a limited selection in the product configurator.

⚠ Caution!

Different types of oil that are not indicated in the specification must be agreed with the manufacturer.

► Contact the design or service department of GEA Refrigeration Germany GmbH.

Various series and frame sizes of screw compressors are available for different fields of application.

The screw compressor is driven directly by the motor via a coupling.

The documentation for the screw compressor (installation instructions, part lists, drawings) is an integral part of the product documentation.

3.3.3 Compressor drive motor

Standard: The compressor is driven by an air-cooled 2-pole electric motor IP23 with an operating voltage of 400 V; 50 Hz using a coupling.

4-pin motors are used for reciprocating compressors, and 2-pin motors are used for screw compressors.

The motors are speed-controlled via a frequency converter. The maximum speed range for 4-pin motors for reciprocating compressors is 500 rpm … 1500 rpm; the maximum speed range for 2-pin motors for screw compressors is 1000 rpm … 4500 rpm in the low pressure level and at 1500 rpm … 3600 rpm, screw compressors of frame size R are limited in the heat pump stage to 3300 rpm.

Depending on the application, foot motors as per design IM B3, flange motors as per design IM B5, or a combination (design IM B35) are used.

Optional: 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.

Notice

The use of an anti-condensation heater should be considered if there is a risk of condensation forming on the motor/product at the installation site, especially if high humidity levels above 60% and/or large temperature fluctuations are expected (especially motors that are at a standstill in humid environments).

► Whether this technical design is necessary must be decided by the customer/operator based on the actual system.

3.3.4 Coupling

The coupling helps in transmission of torque between compressor and compressor drive motor. The 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.

3.3.5 Evaporator

Evaporator low pressure level: In the evaporator of the chiller of the low-pressure level, heat is absorbed from the secondary refrigerant (which is thereby cooled) by way of evaporation of the refrigerant.

Evaporator high pressure level: In the evaporator of the heat pump of the high pressure level, the refrigerant is evaporated and the heat is absorbed 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.

3.3.6 Condenser

Condenser low pressure level: The condenser of the chiller of the low pressure level is part of the joint cascade heat exchanger.

In the condenser the compressed refrigerant vapour is condensed by dissipating the energy absorbed in the evaporator and compressor to the evaporating process of the high pressure level.

Condenser high pressure level: 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 implemented 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.

3.3.7 Oil separator

(only for products with a screw compressor)

The design of the oil separator is standardised and it is characterised by less oil carry-over.

The oil separator is installed horizontally as standard.

The documentation for the oil separator (operating and maintenance manuals, acceptance certificate) is an integral part of the product documentation.

Oil heater

Electric oil heaters are integrated in the oil separator to pre-heat the oil refrigerant mixture in the oil separator while the system is at standstill. The oil heater prevents refrigerant condensation from penetrating into the oil and, thus, any foaming of the oil during start-up.

The oil heater is switched on while the product is at standstill and is switched off automatically at start-up. A manual switch-off for long standstill periods is recommended.

The documentation for the oil heater (operating and maintenance manuals, acceptance certificate) is an integral part of the product documentation.

3.3.8 Oil cooler for reciprocating compressor

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.

Depending on the product / application various oil cooling systems are used. In the case of products with small reciprocating compressors, there is no significant oil cooling output due to the application type, which means that no oil cooler at all is required.

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

3.3.9 Oil cooler for screw compressor

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.

Depending on the product/application, the oil cooler is an optional component and is replaced with the injection of refrigerant into the compressor to cool the compression process.

For heat pumps and applications with heat recovery, a type of liquid cooling is used in which the oil cooler releases the oil's heat to a liquid medium (cooling medium/heat carrier).

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

3.3.10 Oil filter system with OMC-block (oil management centre) screw compressor

After cooling, the oil passes into the oil filter which holds back solid particles from the full oil flow.

Due to its large surface, the oil filter has a high absorbing capacity and thus a long operating lifetime. Depending on the application, the relative filter fineness is between 10 and 25 µm.

An additional coarse filter with a relative filter fineness between 40 and 80 µm may be installed upstream depending on the application.

The OMC block includes the oil distribution system of the oil circuit. Necessary control and shut-off fittings are integrated in the OMC block. Connections for temperature and pressure sensors as well as service ports are available. The OMC block is combined with a standardised filter system and oil pump units (if present) and forms the central control and regulation unit within the oil circuit.

Optionally, the OMC block can be equipped with a 3-way valve element (to ensure a minimum oil temperature when starting the compressor, not available as standard for all applications/products).

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

Notice

The OMC cannot be used under certain conditions (such as applications with high oil volume flows of more than 340 l/min and all products with a design pressure higher than 40 bar).

► In this case, all of the parts that are usually integrated in the OMC are installed separately in the oil circuit.

3.3.11 Oil pump

The oil pump is an essential component of the oil circuit. It is used for pumping and distributing refrigerator oil and ensures that the oil is distributed to the individual lubricating points (e.g. radial bearings, balance piston and the stuffing box of the compressor).

Under certain conditions, products based on the screw compressor of the GEA Grasso M series can or must be operated without a pump. In this case, the pressure difference between the suction and discharge sides of the compressor is used to ensure the oil supply.

High pressure reciprocating compressors are equipped with an oil pump that is flanged to the compressor as standard.

The documentation of the oil pump (operating manual, acceptance certificate) is a part of the product documentation.

3.3.12 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.

3.3.13 Subcooler (high pressure level, optional)

Depending on the specific project conditions, the integration of a subcooler 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 cooled down by a certain temperature difference in the subcooler (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 subcooler (operating manual, acceptance certificate) is an integral part of the product documentation.

3.3.14 Suction filter combination (screw compressor)

The suction filter combination contributes substantially to the high working reliability of the components and the overall product.

The suction filter combination prevents dirt particles carried by the suction flow from entering the screw compressor. The flow through the suction filter element is from the inside to the outside. It is designed such that monitoring is not required. The filter element can be cleaned.

The default integrated check valve prevents pressure compensation to the suction side after switching off. Depending on the design, it is closed with a spring or by a hot gas pulse when switched off.

The documentation of the suction filter combination (operating manual, acceptance certificate) is an integral part of the product documentation.

Compressor frame sizes C to N are equipped with a suction filter check valve integrated in the compressor as standard.

3.3.15 Refrigerant injection for chillers with screw compressor

Before it is returned to the compressor for use, the oil heated up in the compressor has to be cooled down to a temperature at which it has sufficient viscosity.

This can be guaranteed by refrigerant injection.

In case of refrigerant injection, the refrigerant is injected at a defined point on the compressor. The injection point is selected so that there is no loss of output on the compressor.

3.3.16 Control cabinet with control

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.

► 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.

3.3.17 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.

3.3.18 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.

3.3.19 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.

3.3.20 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.6: GEA Omni exterior view without indicator lights

Fig.7: 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.8: 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 [5]	digital	• Run compressor • Run external oil pump [5] • Confirm malfunction
analogue (4-20 mA)	• Motor current compressor drive motor • Speed compressor drive motor [6]	analogue (4-20 mA)	• Compressor drive motor speed setpoint [6]

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

5 If fitted.
6 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 [7] • Eco-level [7] • Gas sensor • Discharge pressure safety switch • min. oil level [8] • max. oil level [8] • Level of refrigerant top / bottom [7]	digital:	• Solenoid valve capacity control max. [9] • Solenoid valve capacity control min.[9] • Solenoid valves capacity control [10] • Solenoid valve check valve suction side [7], [9] • Solenoid valves Vi-control [7], [9] • Solenoid valve economizer operation[7] • Solenoid valve start-up unloading [7] • Solenoid valves, oil return • Solenoid valve low pressure-high pressure relief [5] • Solenoid valve oil return from fine oil filter stage [5]
analogue (4-20 mA)	• Control / primary slide position[9] • Vi / control slide stop position [7], [9] • suction pressure • discharge pressure • Oil pressure • Pressure after oil filter[9] • Crankcase pressure [10] • Evaporating pressure [11] • Suction temperature • Discharge temperature • Oil temperature • Oil temperature oil separator sump [5] • Oil temperature compressor on / off [12] • Eco temperature[5] • Eco pressure[5] • Secondary refrigerant temperature on/off [13] • Inlet temp. refrigerant low pressure cooling system [14]	analogue (4-20 mA)	• Setpoint level control [7] • Setpoint IntelliSOC injection valve [7] • Setpoint motor valve suction line [5] • Setpoint motor valve remote condenser control[5] • Setpoint motor valve hot gas bypass start-up unloading[5]

7 The signals refer in part to optional features (not available for all products).
8 For screw compressor, optional.
9 Depends on compressor type.
10 For reciprocating compressor.
11 For heat pumps with motor valve on the suction side.
12 For heat pumps with reciprocating compressor.
13 For heat pumps with water/saltwater-based heat sources.
14 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 [15] • Heat carrier / cooling medium temperatures [16]	

15 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).

16 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

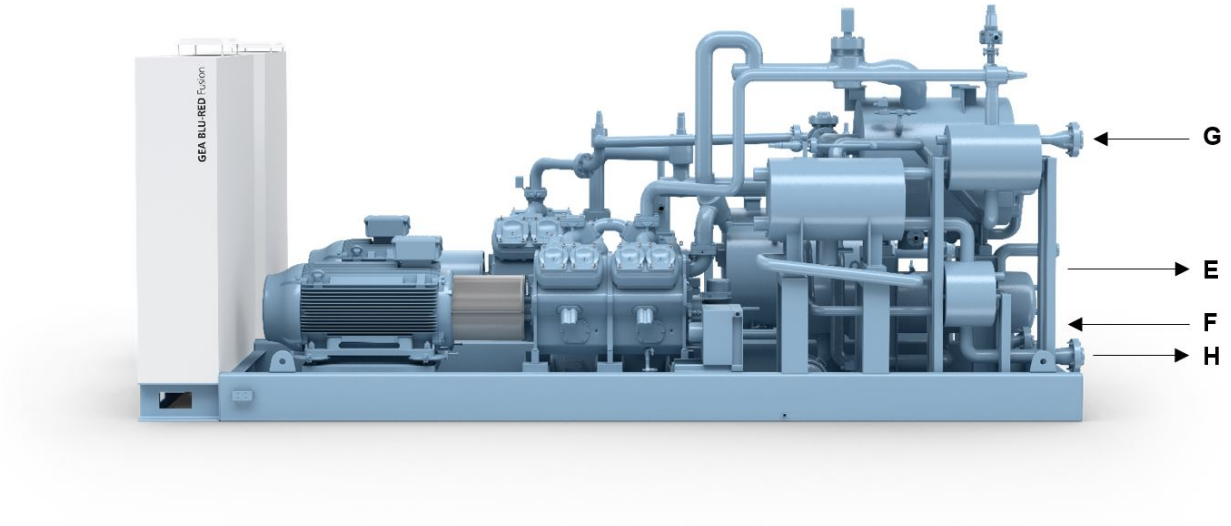


Fig.9: Connections GEA Blu-Red Fusion (with reciprocating compressor)

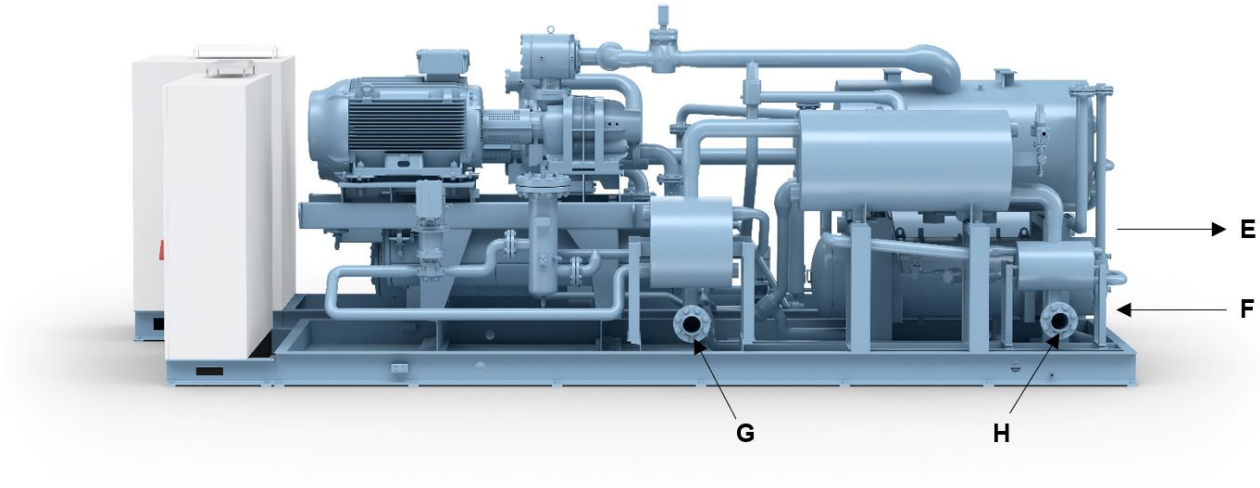


Fig.10: Connections GEA Blu-Red Fusion (with screw compressor)

5.1.1 GEA Blu-Red Fusion series for target temperatures of up to + +70 °C

Notice

Products of the GEA Blu-Red Fusion series can be equipped with reciprocating or screw compressor modules on the low or high pressure side which means that there are a lot of different combination options available. However, it should be noted that compressor technologies and types are restricted with respect to the kind of applications they are suitable for.

The following table shows a standard, efficiency-optimised overview of the series and data for the following conditions:

► Temperature of the coolant +12°C / +6°C
► Temperature of the heat carrier +40°C / +70°C

Data may differ in other conditions.

Characteristics							
Code	Parameter		GEA Blu-Red Fusion				
			BG300-RG500 [17]	BG450-RG500 [17]	BG600-RG800 [17]	BG900-RG800 [17]	BG1200-RG1100 [17]
	Length [18]	mm	5000	5300	5900	5900	6300
	Width	mm	3780	3780	3780	3780	3980
	Height	mm	2250	2250	2300	2300	2500
E	Connection[19] Cold water IN	DN	80	100	100	100	125
F	Connection[19] Cold water OUT	DN	80	100	100	100	125
G	Connection[20] Heat carrier ON	DN	80	100	100	100	100
H	Connection[20] Heat carrier OFF	DN	80	100	100	100	100
	Connection of blow-off line to safety valve	DN	25	25	25	25	25
	Weight without charging	kg	10100	10900	13600	13900	18500
	Operating weight	kg	10415	11355	14075	14385	19475
	Filling quantity (Oil)	l	40	45	55	60	100
	Charge (Refrigerant $NH_{3)}$	kg	70	75	105	110	180

17 Values subject to technical changes
18 Plus frame protrusion (< 200 mm)
19 In case of a high cooling capacity (secondary refrigerant volume flows), two inlet and outlet connections respectively can be planned for the specific project
20 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 Blu-Red Fusion**			
			BA1500-RAMH [17]	**BA1800-RAML [17]**	**BA1800-RARM [17]**	**BA1800-RARN [17]**
	Length [18]	mm	7500	7500	7500	7800
	Width	mm	3800	3800	3800	3800
	Height	mm	2400	2400	2450	2450
E	Connection[19] Cold water IN	DN	125	125	125	125
F	Connection[19] Cold water OUT	DN	125	125	125	125
G	Connection[20] Heat carrier ON	DN	125	125	125	125
H	Connection[20] Heat carrier OFF	DN	125	125	125	125
	Connection of blow-off line to safety valve	DN	25	25	25	25
	Weight without charging	kg	17200	19500	20200	21100
	Operating weight	kg	18325	20695	21500	22270
	Filling quantity (Oil)	l	385	410	425	430
	Charge (Refrigerant $NH_{3)}$	kg	205	225	235	240

5.1.2 GEA Blu-Red Fusion series for target temperatures of up to + 80 °C

Notice

Products of the GEA Blu-Red Fusion series can be equipped with reciprocating or screw compressor modules on the low or high pressure side which means that there are a lot of different combination options available. However, it should be noted that compressor technologies and types are restricted with respect to the kind of applications they are suitable for.

The following table shows a standard, efficiency-optimised overview of the series and data for the following conditions:

- ► Temperature of the coolant +12°C / +6°C
- ► Temperature of the heat carrier +70°C / +80°C

Data may differ in other conditions.

Characteristics						
Code	**Parameter**		**GEA Blu-Red Fusion**			
			BG450-RAEC[17]	**BG600-RAED[17]**	**BG900-RAHE[17]**	**BG1200-RAHG[17]**
	Length [18]	mm	6000	6000	6000	7100
	Width	mm	3780	3780	3780	3980
	Height	mm	2250	2250	2350	2500
E	Connection[19] Cold water IN	DN	100	100	100	100
F	Connection[19] Cold water OUT	DN	100	100	100	100
G	Connection[20] Heat carrier ON	DN	100	100	100	100
H	Connection[20] Heat carrier OFF	DN	100	100	100	100
	Connection of blow-off line to safety valve	DN	25	25	25	25
	Weight without charging	kg	12000	13900	14500	15800
	Operating weight	kg	12320	14380	15150	16515
	Filling quantity (Oil)	l	100	185	225	250
	Charge (Refrigerant $NH_{3)}$	kg	75	80	120	150

Characteristics						
Code	**Parameter**		**GEA Blu-Red Fusion**			
			BA1500-RAMH [17]	**BA1800-RAML [17]**	**BA1800-RARM [17]**	**BA1800-RARN [17]**
	Length [18]	mm	7300	7500	7500	7800
	Width	mm	4180	4000	4000	4000
	Height	mm	2500	2500	2450	2450
E	Connection[19] Cold water IN	DN	125	125	125	125
F	Connection[19] Cold water OUT	DN	125	125	125	125

Characteristics						
Code	**Parameter**		**GEA Blu-Red Fusion**			
			BA1500-RAMH [17]	**BA1800-RAML [17]**	**BA1800-RARM [17]**	**BA1800-RARN [17]**
G	Connection[20] Heat carrier ON	DN	100	125	125	125
H	Connection[20] Heat carrier OFF	DN	100	125	125	125
	Connection of blow-off line to safety valve	DN	25	25	25	25
	Weight without charging	kg	19900	21800	25300	25800
	Operating weight	kg	20930	23050	26765	27450
	Filling quantity (Oil)	l	385	410	415	420
	Charge (Refrigerant $NH_{3)}$	kg	190	210	225	235

5.2 Operation limits

The chiller / heat pump combinations from the GEA Blu-Red Fusion series can be operated within the specified operation limits according to the respective specifications under diverse work conditions. The operating limits listed below are based on the operating principle of the compressor, thermodynamic relations, vessels and safety devices used as well as practical operating conditions. The appropriate compressor model should be selected for the particular operating conditions.

Permissible minimum and maximum values for applications of the GEA Blu-Red Fusion series					
Parameters - GEA Blu-Red Fusion				**with reciprocating compressor**	**with screw compressor**
Speed low pressure side	n	min^{-1}	min	500	1000
			max	1500	4500
Speed high pressure side	n	min^{-1}	min	500	1500
			max	1500	3600 / 3300 [21]
Maximum permissible pressure, low pressure side chiller	PS	bar(g)	max	16	
Maximum permitted intermediate pressure [22] (maximum permissible pressure high pressure side chiller = low pressure side heat pump)	PS	bar(g)	min	22	
			max	25	
Maximum permissible pressure high pressure side heat pump	PS	bar(g)	min	38	40
			max	38	52
Inlet temperature of water as secondary refrigerant [23]	t_{K1}	°C	min	+3.5	
			max	+25.0	
Inlet temperature with frost-resistant secondary refrigerants [23]	t_{K1}	°C	min	-14.0	
			max	+25.0	
Outlet temperature of water as secondary refrigerant [23]	t_{K2}	°C	min	+2.5	
			max	+15.0	
Outlet temperature with frost-resistant secondary refrigerants [23]	t_{K2}	°C	min	-15.0	
			max	+15.0	
Difference inlet / outlet temperature of secondary refrigerant [23]	Δt_K	K	min	1.0	
			max	10.0	
Suction temperature compressor high pressure side	t_{02}	°C	min	+10.0	+10.0
			max	+34.0	+60.0
Heating agent inlet temperature in the heat pump	t_{W1}	°C	min	+15.0	+15.0
			max	+65.0	+70.0

21 Models based on compressor type R (housing size) are limited to 3300 rpm in this application^{-1} .

22 Depending on the design of the low pressure side, the max. permissible pressure in the intermediate stage is 22 bar with a GEA Grasso V HP reciprocating compressor-based heat pump module and 25 bar with a screw compressor-based heat pump module.

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

Permissible minimum and maximum values for applications of the GEA Blu-Red Fusion series					
Parameters - GEA Blu-Red Fusion				**with reciprocating compressor**	**with screw compressor**
Outlet temperature of the heat carrier from the heat pump [24]	t_{W2}	°C	min	+50.0	+55.0
			max	+70.0	+80.0
Difference inlet / outlet temperature of heat carrier	Δt_W	K	min	5.0	5.0
			max	50.0	50.0
Suction pressure low pressure side	p_{suc1}	bar	min	1.90	1.91 [25]
			max	7.00 / 8.50 [26]	7.29 [25]
Discharge pressure low pressure side	p_{dis1}	bar	min	n/a	7.30
			max	22.50	22.50
Suction pressure high pressure side [27]	p_{suc2}	bar	min	6.16	6.16
			max	13.13	26.16
Discharge pressure high pressure side [28]	p_{dis2}	bar	min	20.35 [29]	23.12 [29]
			max	35.00	46.10
Discharge temperature at low pressure compressor outlet	t_{dis1}	°C	min	n/a	+50.0
			max	+150.0	+100.0
Discharge temperature at high pressure compressor outlet	t_{dis2}	°C	min	+80.0	+80.0
			max	+150.0	+105.0
Pressure ratio p / p_{suc} [28]	π	-	min	1.5	1.5
			max	10.0 / 6.0 [30]	22.0
Pressure difference p - p_{suc}	Δp	bar	min	4.0	2.9 [31]
Pressure difference low pressure side p - p_{suc1} [28]	Δp	bar	max	19.0	20.59 [32]
Pressure difference high pressure side p - p_{suc2} [28]	Δp	bar	max	25.0	39.94 [32]
Oil temperature low pressure side	t_{Oil1}	°C	min	+30.0	+18
			max	+70.0	+75
Oil temperature high pressure side	t_{Oil2}	°C	min	+45.0	+60
			max	+70.0	+75

24 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. Higher outlet temperatures on request.
25 As a result of the minimum or maximum condensation temperatures due to the defined maximum values of the secondary refrigerant outlet temperatures.
26 GEA Grasso VL Models 7.0 bar, VM Models 8.5 bar.
27 As a result of the max. permissible high pressure compressor suction temperatures.
28 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.
29 As a result of the minimum heat carrier outlet temperatures
30 GEA Grasso V Series 10.0 bar, V HP Series 6.0 bar.
31 For screw compressor types from housing size R and in case of heavy-duty mode (shortened compressor rotors), the value may lie below 2.9 bar.
32 As a result of the permissible values of discharge pressure and suction pressure.

Parameters - GEA Blu-Red Fusion				with reciprocating compressor	with screw compressor
Ambient temperature	t_U	°C	min	+15	
			max	+40	
Relative humidity [33]	*f*	%	max	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 within the defined limits.
5. The specified data refer to the operating conditions of a chiller / heat pump combination.

   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 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

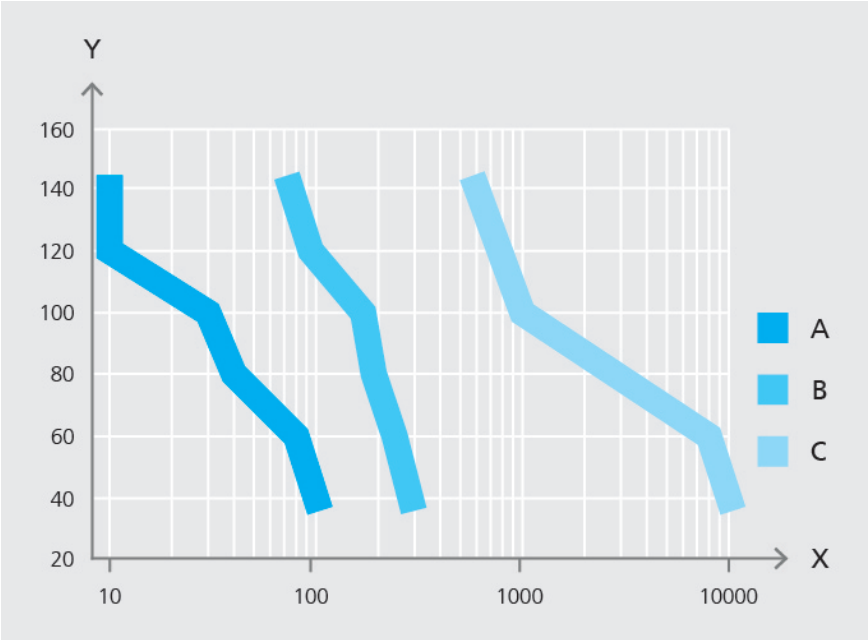


Fig.11: Corrosion resistance in presence of chlorides

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 Blu-Red Fusion series for target temperatures of up to + +70 °C

Notice

Products of the GEA Blu-Red Fusion series can be equipped with reciprocating or screw compressor modules on the low or high pressure side which means that there are a lot of different combination options available. However, it should be noted that compressor technologies and types are restricted with respect to the kind of applications they are suitable for.

The following table shows a standard, efficiency-optimised overview of the series and data:

- ► Q_0: refrigeration capacity [34]
- ► P_e: drive power low and high pressure level [35] on the grid
- ► Q_H: heating capacity [36]

Performance characteristics				
Frame size	**Q_0 in kW**	**P_e low pressure side in kW**	**P_e high pressure side in kW**	**Q_H in kW**
BG300-RG500	325	43	70	425
BG450-RG500	480	71	90	625
BG600-RG800	670	74	152	875
BG900-RG800	840	144	142	1100
BG1200-RG1100	1275	216	217	1670
BA1500-RAMH	1400	337	265	1950
BA1800-RAML	1610	389	310	2250
BA1800-RARM	1680	332	401	2350
BA1800-RARN	1730	266	493	2425

34 at cold water temperatures inlet / outlet +12 °C / +6 °C
35 Based on the configuration, the speeds lie slightly below the permissible maximum values as defined in the section Application limits.
36 at heat carrier temperatures inlet / outlet +40 °C / +70 °C

5.4.2 GEA Blu-Red Fusion series for target temperatures of up to + 80 °C

Notice

Products of the GEA Blu-Red Fusion series can be equipped with reciprocating or screw compressor modules on the low or high pressure side which means that there are a lot of different combination options available. However, it should be noted that compressor technologies and types are restricted with respect to the kind of applications they are suitable for.

The following table shows a standard, efficiency-optimised overview of the series and data:

- ► Q_0: refrigeration capacity [37]
- ► P_e: drive power low and high pressure level [38] on the grid
- ► Q_H: heating capacity [39]

Performance characteristics				
Frame size	**Q_0 in kW**	**P_e low pressure side in kW**	**P_e high pressure side in kW**	**Q_H in kW**
BG450-RAEC	410	92	143	625
BG600-RAED	560	117	191	840
BG900-RAHE	770	172	246	1150
BG1200-RAHG	1015	231	500	1500
BG1200-RAMH	1185	257	366	1755
BA1500-RAML	1365	363	385	2050
BA1800-RARM	1570	334	528	2360
BA1800-RARN	1605	338	552	2425

37 at cold water temperatures inlet / outlet +12 °C / +6 °C
38 Based on the configuration, the speeds lie slightly below the permissible maximum values as defined in the section Application limits.
39 at heat carrier temperatures inlet / outlet +70 °C / +80 °C

5.5 Information about noise emissions

The noise information provides approximate parameters and apply to the installation without any secondary noise protection measures.

The information has a tolerance of ±3 dB(A)

The precise data depend closely on the emission values for the motors, which are manufacturer dependent.

Should the local conditions require the adherence to noise limits, a calculation should be made in individual cases with specific motor data.

Wearing hearing protection with sufficient noise reduction is recommended in rooms with running heat pumps.

⚠ Caution!

According to EU Directive 2003/10/EC, the allowable exposure limit value regarding the daily noise exposure level is 80 db (A).

► In the event of noise levels above this limit value the system operator must provide the operator with information on exposure to noise and personal hearing protection and ensure that this is also worn (2003/10/EC Article 6).

Notice

Products of the GEA Blu-Red Fusion series can be equipped with reciprocating or screw compressor modules on the low or high pressure side which means that there are a lot of different combination options available. However, it should be noted that compressor technologies and types are restricted with respect to the kind of applications they are suitable for.

► The following information refers to a standard, efficiency-optimised overview of the series at the conditions stated in sections 5.1 and 5.4 for the dimensions, masses, filling quantities and performance parameters.
► Unfortunately, there was no sound data for applications with a high-pressure reciprocating compressor available at the time this product information went to print.

Enveloping surface sound pressure level Lp (A) @ 3 m (without soundproof housing)						
Motor size Low pressure level at 40 °C Pe in kW	Motor size High pressure level at 40 °C Pe in kW	Lp in dB (A) @ 3 m for mains operation 400 V / 50 Hz [40]				
		BG450-RAEC	BG600-RAED	BG900-RAHE	BG1200-RAHG	BG1200-RAMH
55	90	-	-	-	-	-
90	132	-	-	-	-	-
90	200	-	-	-	-	-
110	160	81.4	-	-	-	-
160	200	-	81.4	-	-	-
200	250	-	-	81.5	-	-
250	280	-	-	-	-	-

40 at a distance of 3m from the machine surface (A-close range sound level at open air conditions on reflecting surface)

Enveloping surface sound pressure level Lp (A) @ 3 m (without soundproof housing)						
Motor size Low pressure level at 40 °C Pe in kW	Motor size High pressure level at 40 °C Pe in kW	Lp in dB (A) @ 3 m for mains operation 400 V / 50 Hz [40]				
		BG450-RAEC	BG600-RAED	BG900-RAHE	BG1200-RAHG	BG1200-RAMH
280	400	-	-	-	-	84.4
315	315	-	-	-	81.8	-

Enveloping surface sound pressure level Lp (A) @ 3 m (without soundproof housing)						
Motor size Low pressure level at 40 °C Pe in kW	Motor size High pressure level at 40 °C Pe in kW	Lp in dB (A) @3 m for mains operation 400 V / 50 Hz [40]				
		BA1500-RAMH	BA1500-RAML	BA1800-RAML	BA1800-RARM	BA1800-RARN
315	315	-	-	-	-	-
315	560	-	-	-	-	-
355	280	86.2	-	-	-	86.5
355	450	-	-	-	87.6	-
355	630	-	-	-	87.6	87.5
400	315	-	-	88.2	-	-
400	400	-	88.0	-	-	-

The values in the table are verified and interpolated by actual measuring results. If no values are specified, these are not yet available or not applicable for the frame size of the heat pump.

40 at a distance of 3m from the machine surface (A-close range sound level at open air conditions on reflecting surface)

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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