

PRODUCT INFORMATION

Original document



GEA RedAstrum

HEAT PUMP

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- GEA Refrigeration Germany GmbH

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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. The GEA chillers include the standard GEA Blu series BluAstrum, BluGenium, BluAir (duo), BluX (duo) as well as the modular GEA Grasso FX series and the MX as 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 standard GEA Red series RedAstrum, RedGenium and the special series GEA Grasso HX.

The GEA Blu-Red Fusion product can be seen as a two-stage heat pump or also as a combined chiller-heat pump. Since the product is always (also) designed for a specific heating application, it is formally part of the GEA Red Standard series.

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 RedAstrum, front view

Parameter	Remark
Capacity range (Application example 1 pure heating mode, evaporator with ext. secondary refrigerant)	Approx. 620 - 2435 / 745 - 2910 kW (refrigerating/heating capacity) 40 °C / 35 °C (secondary refrigerant temperature) 40 °C / 70 °C (heat carrier temperature)
Capacity range (Application example 2 as "add-on" heat pump with NH ₃ cascade evaporator)	Approx. 615 - 2255 / 740 - 2720 kW (refrigerating/heating capacity) Approx. 32 °C ... 33 °C (evaporating temperature) 40 °C / 70 °C (heat carrier temperature)
Capacity range (Application example 3 combined cooling and heating mode, evaporator with ext. secondary refrigerant)	Approx. 365 - 1170 / 510 - 1585 kW (refrigerating/heating capacity) 12 °C / 6 °C (secondary refrigerant temperature) 40 °C / 65 °C (heat carrier temperature)
Screw compressor	GEA Grasso M series, housing size E, G, H, L, M, N, R $V_{th} = 231 \dots 1040 \text{ m}^3/\text{h}$ (2940 rpm)
Screw compressor package	GEA Grasso M / SP1 horizontal high-pressure version
Heat pump	GEA RedAstrum
Evaporator type	Plate heat exchanger, fully welded, with integrated separator, charged with liquid secondary refrigerant (W) or as NH ₃ cascade heat exchanger (K)
Working principle	flooded evaporation
Liquid separator	integrated
Condenser type	Fully welded plate heat exchanger
Transport	1 part ¹


¹ As standard up to motor size 450 kW

1.2 Scope of delivery

Notice

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

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

Standard equipment	
Designation	Design
Maximum permissible pressure:	40 bar(g) to 52 bar(g)
Intended environment:	Closed machine rooms
Ambient temperatures:	+15 °C to +40 °C
Installation altitude:	≤ 1000 m above sea level
Cooling agent outlet temperature ² :	-10 °C to +49 °C
Evaporating temperature ³ :	+10 °C to +45 °C
Heat carrier outlet temperature ⁴ :	+55 °C to +80 °C
Electric motor:	Standard scope of delivery
Refrigerant:	R717
Type of oil:	<p>According to order specification. Compare also the technical information on the lubricating oils for GEA packages, chillers and heat pumps.</p> <div style="background-color: yellow; padding: 5px;"> <p> Caution!</p> <p>Deviating types of oil must be agreed with the manufacturer.</p> <p>► Contact the Design or Technical Customer Service of GEA Refrigeration Germany GmbH.</p> </div>
Oil cooling:	Standard scope of delivery (liquid cooled)
Oil heater:	Standard scope of delivery
Oil filter:	Single stage filter
Spare oil filter:	Standard scope of delivery
Oil level switch:	none
Pressure sensors:	with stop valve
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 incl. GEA VTrac
Communication:	EtherNet/IP, Modbus TCP
Power current panel and frequency converter:	Standard scope of delivery, cable entry from below
Colour:	RAL 5014 (dove grey)

² Temperature difference of secondary refrigerant max. 10 K, higher values on request. The max. nozzle speed at the evaporator is 7.5 m/s (depending on the application, the max. outlet temperature of the refrigerant may be limited to values lower than +49 °C)

³ In the version with NH₃ cascade evaporator

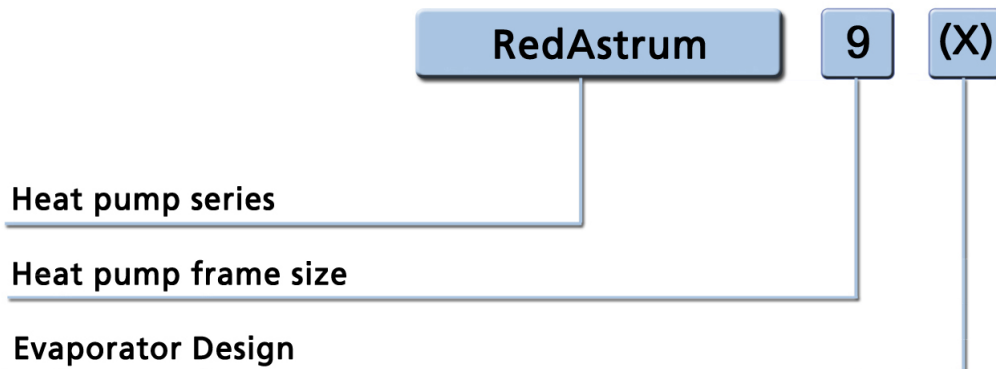
⁴ Temperature difference heat carrier maximum 50 K, higher values on request

Standard equipment	
Designation	Design
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:	available
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

Description

Product designation, heat pumps with screw compressors

1.3 Product designation, heat pumps with screw compressors**GEA RedAstrum series****Product code description**

Code	Description
RedAstrum	Heat pump series
9	Heat pump frame size (Housing and rotor size of the compressor)
(X)	Evaporator design type

RedAstrum = Heat pump series

9 = Heat pump frame size resulting from the compressor frame size (housing size) and the compressor's swept volume flow size (corresponds to the rotor size)

Compressor type ⁵	Frame size (frame size and swept volume flow size of the compressor) ⁵
EMR-C	EC
EMR-D	ED
EMR-E	EE
GMR-G	GG
HMR-E	HE
HMR-G	HG
HMR-H	HH
LMR-L	LL
MMR-H	MH
MMR-L	ML
MMR-M	MM
NMR-N	NN
RR-M	RM
RR-N	RN
RR-R	RR

(X) Evaporator design variant

⁵ The design type (normal with full rotors / heavy duty with shortened rotors) cannot be freely selected, this results automatically from the dependency of different influence factors of project-specific conditions (suction pressure, discharge pressure, speed, compressor type). Most typical heat pump conditions require a heavy-duty version with shortened rotors (non-shortened versions are not possible in these cases)

Code	Description
(W)	Water/liquid-cooled plate heat exchanger (fully welded) Heat pump for indoor installation
(K)	Evaporator as NH ₃ cascade heat exchanger ⁶ Heat pump for indoor installation

Examples of designation

Examples	Description
RedAstrum MH (W)	Heat pump with screw compressor, evaporator with integrated separator(RedAstrum) Frame size of the heat pump, M compressor frame size with H swept volume flow (MH) Version with water/liquid-cooled evaporator as fully welded plate heat exchanger Heat pump for indoor installation (W)
RedAstrum RR (K)	Heat pump with screw compressor, evaporator with integrated separator (RedAstrum) Frame size of the heat pump, R compressor frame size with R swept volume flow (RR) Version with NH ₃ cascade evaporator as fully welded plate heat exchanger Heat pump for indoor installation (K)

⁶ The evaporator design variant as NH₃ cascade heat exchanger (K) is also suitable for use in a two-stage chiller heat pump combination. This results in application-related design differences.

2 Components

The heat pumps of the GEA RedAstrum series comprise the following components:

- Screw compressor,
- Evaporator with integrated separator
- Condenser,
- electric motor with coupling,
- Oil supply system with oil separator,
- Oil cooler,
- Subcooler (optional),
- Oil filter,
- Suction filter,
- Check valves on the suction and discharge sides,
- 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 separator is arranged horizontally and mounted on the steel bearings bolted to the base frame.

The oil is cooled by means of a liquid cooled 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.

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 test 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 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 heat pumps of the GEA RedAstrum series are awarded a CE label in accordance with the Pressure Equipment Directive 2014/68/EU.

Documentation

Each heat pump of the GEA RedAstrum 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 RedAstrum programme 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 RedAstrum can be equipped either with an external evaporator (W) with applied secondary refrigerant or with an NH₃ 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 screw compressor series, the programme of the GEA RedAstrum heat pumps covers a heating range 750 kW to 2900 kW with reference to the secondary refrigerant range.

The capacity ranges are determined by 7 screw compressor sizes (housing size E, G, H, L, M, N, R).

The GEA RedAstrum 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:

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

The modular construction of the heat pumps is modelled on the construction of the screw compressor packages. The oil separator is installed horizontally. The arrangement of the components ensures the extremely compact design of the heat pumps.

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

Only plate condensers are used on the condenser side.

The GEA RedAstrum 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 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 screw compressor draws refrigerant gas 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 heating agent. 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 cascade variant, an evaporator can be used, which can also be charged with compressed refrigerant from the low-pressure stage instead of a refrigerant. The refrigerant from the process stage process is liquefied in the process.

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.

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 screw compressor.

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

The capacity control of the screw compressor is controlled continuously by the control slide of the compressor (not provided by default for the GEA BluAstrum and GEA BluAir series) and optionally by the FI control of the compressor drive motor (standard for the GEA BluAstrum, GEA BluAir and GEA RedAstrum series). 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 adjustment of the internal compression ratio to the current operating conditions is done steplessly by the compressor's Vi-slider. 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 partial-load mode, the cold water / saltwater and heating agent flows may be reduced by max. 50% to guarantee efficient transfer of the heat to the heat exchanger systems.

3.3 Main components

3.3.1 Screw compressor

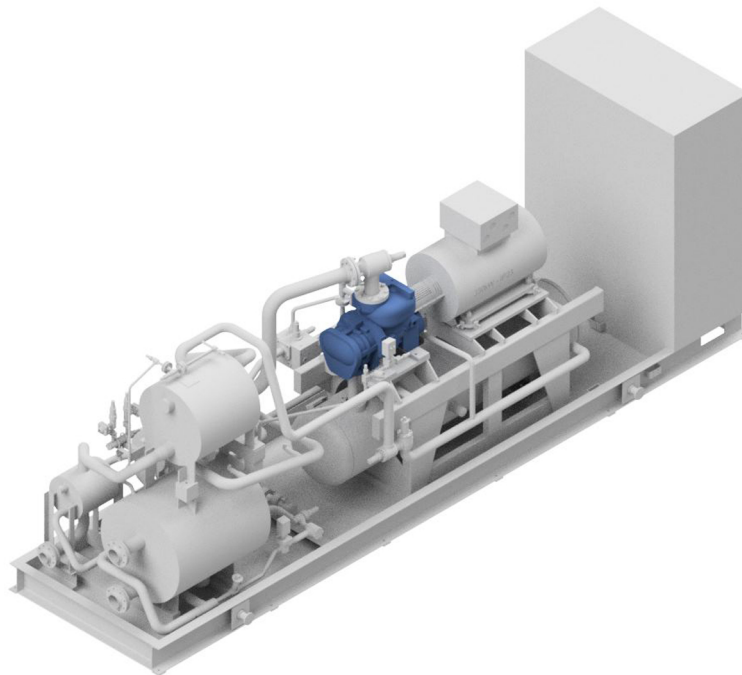


Fig.2: Arrangement of the compressor

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 can be found in the specifications 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.

3.3.2 Compressor drive motor

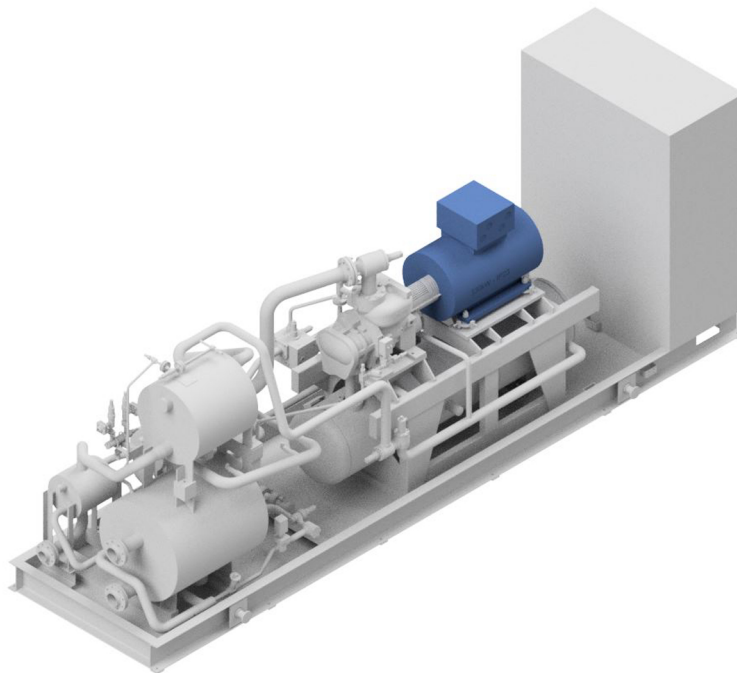


Fig.3: Position and arrangement of the motor:

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.

The motor speed is controlled using a frequency converter (optional equipment with chillers of the FX P and FX P duo series).

The maximum speed range is at 1000 rpm ... 4500 rpm, but is limited in both directions depending on the product and application.

The technical specifications provide information about the permissible speed range. 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.

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.

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.

3.3.3 Coupling

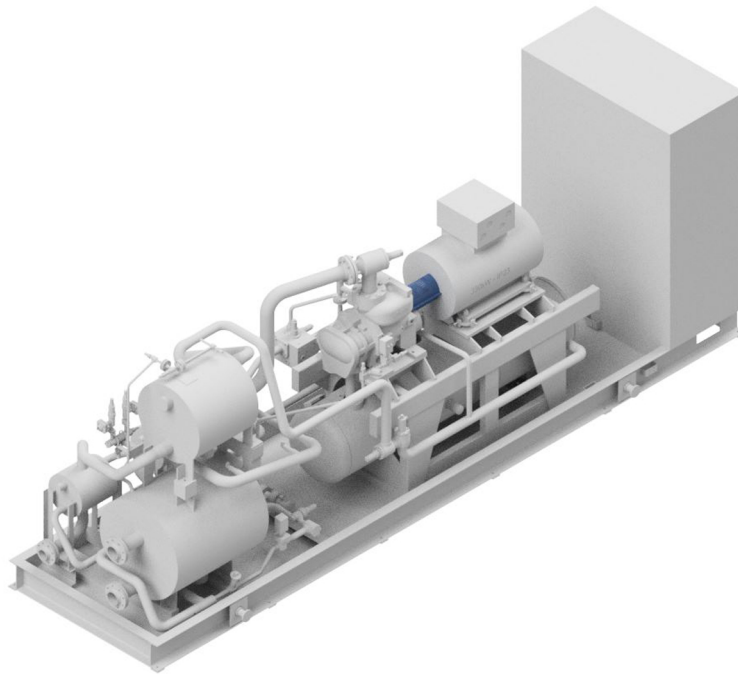


Fig.4: Arrangement of the coupling

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.

3.3.4 Evaporator

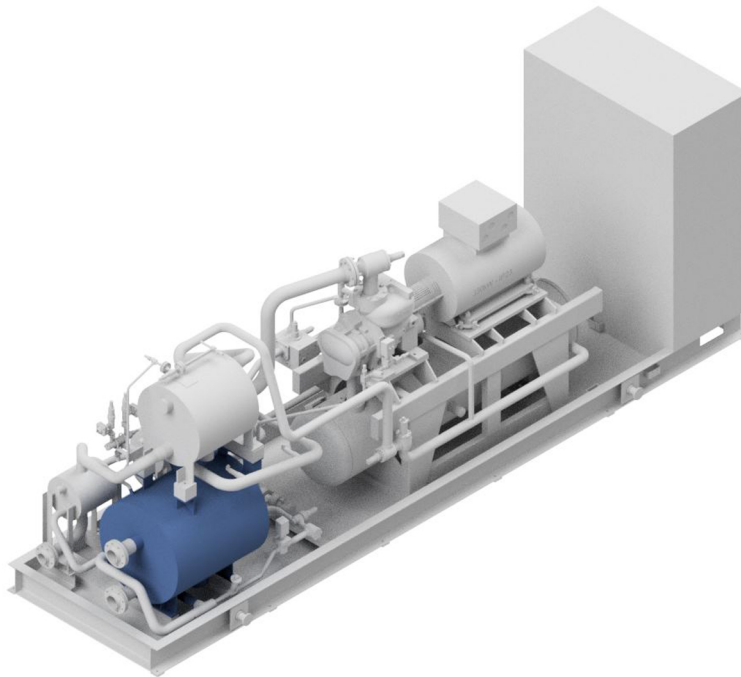


Fig.5: Arrangement of the evaporator

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 NH₃ 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

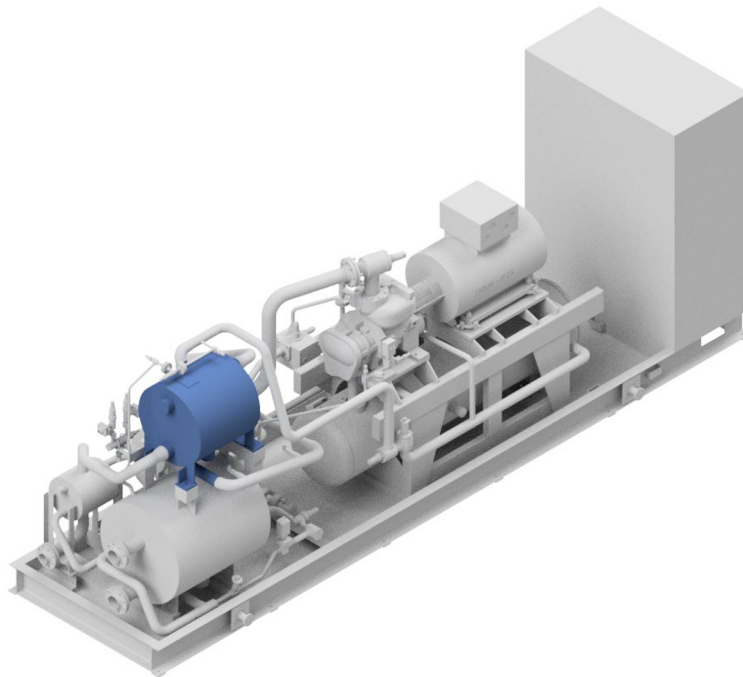


Fig.6: Position of the condenser

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 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.

3.3.6 Oil separator

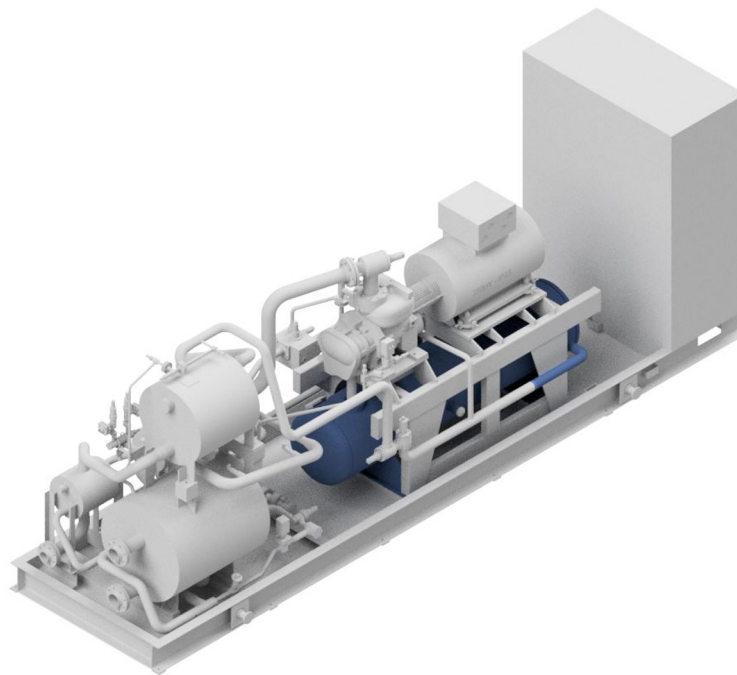


Fig.7: Configuration of the oil separator

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.

3.3.7 Oil cooler

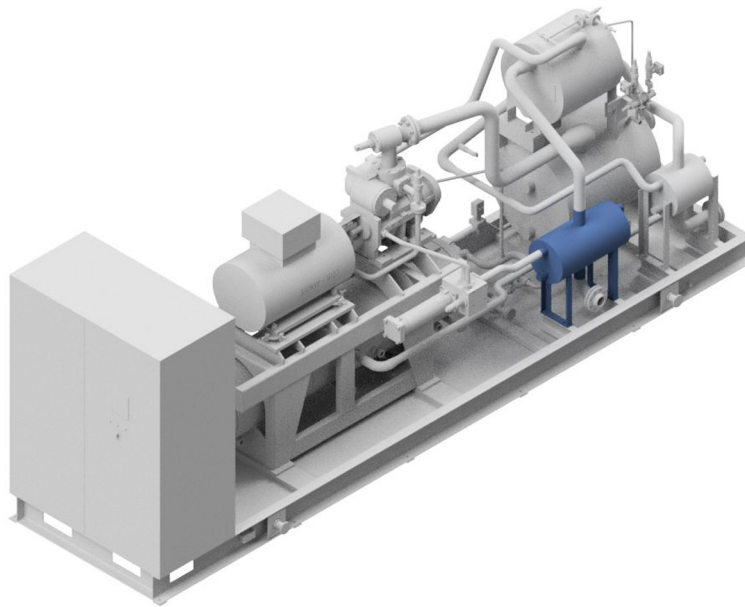


Fig.8: Arrangement of the oil cooler

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.

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.

3.3.8 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 maximum permissible 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.

3.3.9 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. bearings, balance piston and the shaft seal 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.

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

3.3.10 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.

3.3.11 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.

3.3.12 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.

3.3.13 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.

3.3.14 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.

3.3.15 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 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.

3.3.16 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.9: GEA Omni exterior view without indicator lights



Fig.10: 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.11: 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 <ul style="list-style-type: none"> • Motor feedback • Motor protection compressor • Feedback external oil pump ⁷ 	digital <ul style="list-style-type: none"> • Run compressor • Run external oil pump ⁷ • Confirm malfunction
analogue (4-20 mA) <ul style="list-style-type: none"> • Motor current compressor drive motor • Speed compressor drive motor ⁸ 	analogue (4-20 mA) <ul style="list-style-type: none"> • Compressor drive motor speed setpoint ⁸

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 <ul style="list-style-type: none"> • External ON/OFF • External "MORE" • External "LESS" • External run release • Confirm external fault • Switchover 2. Setpoint • Block compressor 	digital <ul style="list-style-type: none"> • Ready for external mode • Signal Compressor runs • Main failure • auxiliary output 1 (Default setting collective warning)
analogue (4-20 mA) <ul style="list-style-type: none"> • Remote setpoint 	analogue (4-20 mA) <ul style="list-style-type: none"> • Swept volume

⁷ If fitted.

⁸ 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
<p>digital</p> <ul style="list-style-type: none"> external EMERGENCY-OFF (or EMERGENCY-STOP) Separator level ⁹ Eco-level ⁹ Gas sensor Discharge pressure safety switch min. oil level ¹⁰ max. oil level ¹⁰ Level of refrigerant top / bottom ⁹ 	<p>digital:</p> <ul style="list-style-type: none"> Solenoid valve capacity control max. ¹¹ Solenoid valve capacity control min. ¹¹ Solenoid valves capacity control ¹² Solenoid valve check valve suction side ^{9, 11} Solenoid valves Vi-control ^{9, 11} Solenoid valve economizer operation⁹ Solenoid valve start-up unloading ⁹ Solenoid valves, oil return Solenoid valve low pressure-high pressure relief ⁷ Solenoid valve oil return from fine oil filter stage ⁷
<p>analogue (4-20 mA)</p> <ul style="list-style-type: none"> Control / primary slide position¹¹ Vi / control slide stop position ^{9, 11} suction pressure discharge pressure Oil pressure Pressure after oil filter¹¹ Crankcase pressure ¹² Evaporating pressure ¹³ Suction temperature Discharge temperature Oil temperature Oil temperature oil separator sump ⁷ Oil temperature compressor on / off ¹⁴ Eco temperature⁷ Eco pressure⁷ Secondary refrigerant temperature on/off ¹⁵ Inlet temp. refrigerant low pressure cooling system ¹⁶ 	<p>analogue (4-20 mA)</p> <ul style="list-style-type: none"> Setpoint level control ⁹ Setpoint IntelliSOC injection valve ⁹ Setpoint motor valve suction line ⁷ Setpoint motor valve remote condenser control⁷ Setpoint motor valve hot gas bypass start-up unloading⁷

⁹ The signals refer in part to optional features (not available for all products).

¹⁰ For screw compressor, optional.

¹¹ Depends on compressor type.

¹² For reciprocating compressor.

¹³ For heat pumps with motor valve on the suction side.

¹⁴ For heat pumps with reciprocating compressor.

¹⁵ For heat pumps with water/saltwater-based heat sources.

¹⁶ For heat pumps with a heat source of NH₃-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
<ul style="list-style-type: none"> • Outlet temp. refrigerant low pressure cooling system ¹⁷ • Heat carrier / cooling medium temperatures ¹⁸ 	

¹⁷ 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).

¹⁸ 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

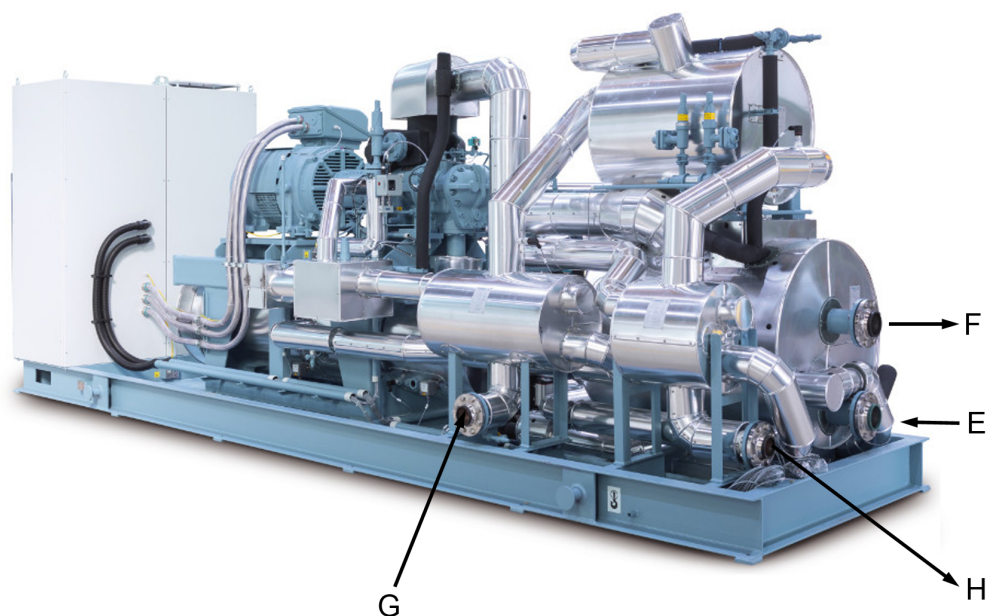


Fig. 12: GEA RedAstrum connections

5.1.1 GEA RedAstrum EC (W) ... series GEA RedAstrum RN (W)

Notice

The data is applicable to the following conditions

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

- Temperature of the coolant +40°C / +35°C
- Temperature of the heat carrier +40°C / +70°C

Data may differ in other conditions.

Characteristics						
Code	Parameter		GEA RedAstrum (W) heat pump			
			EC ¹⁹	ED ¹⁹	HE ¹⁹	HG ¹⁹
	Length ²⁰	mm	6000	7000	7000	7000
	Width	mm	1600	1800	1800	1800
	Height	mm	2350	2350	2450	2450
E	Connection ²¹ Cold water IN	DN	100	100	100	100
F	Connection ²¹ Cold water OUT	DN	100	100	100	100
G	Connection ²² Heat carrier ON	DN	100	100	100	100
H	Connection ²² 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	7200	7500	7700	8200
	Operating weight	kg	7420	7725	7945	8465
	Filling quantity (Oil)	l	180	185	200	220
	Charge (Refrigerant NH ₃)	kg	70	72	78	82

Characteristics						
Code	Parameter		GEA RedAstrum (W) heat pump			
			MH ¹⁹	ML ¹⁹	RM ¹⁹	RN ¹⁹
	Length	mm	7300	7600	7900	7900
	Width	mm	1800	1800	2000	2000
	Height	mm	2450	2450	2450	2450
E	Connection ²¹ Cold water IN	DN	125	125	125	125
F	Connection ²¹ Cold water OUT	DN	125	125	125	125

¹⁹ Values subject to technical changes

²⁰ Plus frame protrusion (< 200 mm)

²¹ In case of a high cooling capacity (secondary refrigerant volume flows), two inlet and outlet connections respectively can be planned for the specific project

²² 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 RedAstrum (W) heat pump			
			MH ¹⁹	ML ¹⁹	RM ¹⁹	RN ¹⁹
G	Connection ²² Heat carrier ON	DN	125	125	125	125
H	Connection ²² 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	8900	9900	11200	12500
	Operating weight	kg	9185	10205	11540	12860
	Filling quantity (Oil)	l	235	250	275	290
	Charge (Refrigerant NH ₃)	kg	90	100	110	120

5.1.2 GEA RedAstrum EC (K) ... series GEA RedAstrum RN (K)

Notice

The data is applicable to the following conditions

(application example 2 “add-on“ heat pump with NH₃ cascade evaporator):

- Evaporating temperatures approx. +32 °C ... +33 °C
- Temperature of the heat carrier +40°C / +70°C

Data may differ in other conditions.

Characteristics						
Code	Parameter		GEA RedAstrum (K) heat pump			
			EC ²³	ED ²³	HE ²³	HG ²³
	Length ²⁴	mm	6000	7000	7000	7000
	Width	mm	1600	1800	1800	1800
	Height	mm	2350	2350	2450	2450
E	Connection ²⁵ NH ₃ OUT	DN	100	100	100	100
F	Connection ²⁵ NH ₃ IN	DN	100	100	100	100
G	Connection ²⁶ Heat carrier ON	DN	100	100	100	100
H	Connection ²⁶ 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	7500	8400	8900	9600
	Operating weight	kg	7725	8630	9150	9870
	Filling quantity (Oil)	l	185	190	205	225
	Charge (Refrigerant NH ₃)	kg	72	74	80	84

Characteristics						
Code	Parameter		GEA RedAstrum (K) heat pump			
			MH ²³	ML ²³	RM ²³	RN ²³
	Length	mm	7300	7600	7900	7900
	Width	mm	1800	1800	2000	2000
	Height	mm	2450	2450	2450	2450
E	Connection ²⁵ NH ₃ OUT	DN	125	125	125	125

²³ Values subject to technical changes

²⁴ Plus frame protrusion (< 200 mm)

²⁵ For high refrigerating capacities (NH₃ volume flows), two inlet and two outlet connections can be provided for each project. The directions of the arrows shown in the figure must be interpreted in reverse here, one float at the NH₃ outlet of the cascade evaporator is included in the scope of delivery by default (it can be deselected from the scope of delivery), however not as shown in the figure (nominal widths and connection positions may vary depending on the application)

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 RedAstrum (K) heat pump			
			MH ²³	ML ²³	RM ²³	RN ²³
F	Connection ²⁵ NH ₃ IN	DN	125	125	125	125
G	Connection ²⁶ Heat carrier ON	DN	125	125	125	125
H	Connection ²⁶ 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	10200	11100	12200	13200
	Operating weight	kg	10490	11415	12550	13575
	Filling quantity (Oil)	l	240	255	285	300
	Charge (Refrigerant NH ₃)	kg	92	102	113	123

5.1.3 GEA RedAstrum EE (W) ... series GEA RedAstrum RR (W)

Notice

The data is applicable to the following conditions

(application example 3 combined cooling and heating mode, evaporator with ext. secondary refrigerant):

- Temperature of the coolant +12°C / +6°C
- Temperature of the heat carrier +40°C / +65°C

Data may differ in other conditions.

Characteristics						
Code	Parameter		GEA RedAstrum (W) heat pump			
			EE ²⁷	GG ²⁷	HH ²⁷	LL ²⁷
	Length ²⁸	mm	6000	6000	6000	6000
	Width	mm	1600	1600	1600	1600
	Height	mm	2350	2350	2450	2450
E	Connection ²⁹ Cold water IN	DN	100	100	100	100
F	Connection ²⁹ Cold water OUT	DN	100	100	100	100
G	Connection ³⁰ Heat carrier ON	DN	100	100	100	100
H	Connection ³⁰ 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	6800	7200	7500	7700
	Operating weight	kg	6995	7400	7705	7915
	Filling quantity (Oil)	l	160	165	170	175
	Charge (Refrigerant NH ₃)	kg	60	62	65	68

Characteristics					
Code	Parameter		GEA RedAstrum (W) heat pump		
			MM ²⁷	NN ²⁷	RR ²⁷
	Length	mm	7300	7300	7600
	Width	mm	1800	1800	2000
	Height	mm	2450	2450	2450
E	Connection ²⁹ Cold water IN	DN	100	125	125
F	Connection ²⁹ Cold water OUT	DN	100	125	125

²⁷ Values subject to technical changes

²⁸ Plus frame protrusion (< 200 mm)

²⁹ In case of a high cooling capacity (secondary refrigerant volume flows), two inlet and outlet connections respectively can be planned for the specific project

³⁰ 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 RedAstrum (W) heat pump		
			MM ²⁷	NN ²⁷	RR ²⁷
G	Connection ³⁰ Heat carrier ON	DN	100	100	125
H	Connection ³⁰ Heat carrier OFF	DN	100	100	125
	Connection of blow-off line to safety valve	DN	25	25	25
	Weight without charging	kg	8500	9700	11000
	Operating weight	kg	8725	9945	11260
	Filling quantity (Oil)	l	180	190	205
	Charge (Refrigerant NH ₃)	kg	75	85	92

5.2 Operation limits

The heat pumps from the GEA RedAstrum 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 screw compressor, thermodynamic relations, containers 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 heat pumps of the GEA RedAstrum series				
Parameter				Value
Speed ³¹	n	rpm	min	1500
			max	3600
Maximum permissible pressure, low pressure side	PS	bar(g)	min	16
			max	25
Maximum permissible pressure, high pressure side	PS	bar(g)	min	40
			max	52
Suction pressure	p _{suc}	bar(g)	min	2.58
			max	13.50
Discharge pressure ³²	p	bar(g)	min	23.12
			max	46.10
Pressure ratio p / p_{suc} ³²	π	-	min	1.5
Pressure difference $p - p_{suc}$ ³²	Δp	bar(g)	min	3.0
Inlet temperature of water as secondary refrigerant ³³	t _{k1}	°C	min	+3.5
			max	+50.0
Inlet temperature with frost-resistant secondary refrigerants ³³	t _{k1}	°C	min	-9.0
			max	+50.0
Outlet temperature of water as secondary refrigerant ³³	t _{k2}	°C	min	+2.5
			max	+49.0
Outlet temperature with frost-resistant secondary refrigerants ³³	t _{k2}	°C	min	-10.0
			max	+49.0
Difference inlet / outlet temperature of secondary refrigerant ³³	Δt_k	K	min	1.0
			max	10.0
Evaporating temperature NH ₃ cascade evaporator	t ₀	°C	min	+10.0
			max	+45.0

³¹ Models based on compressor type R (housing size) are limited to 3300 rpm in this application.

³² 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.

³³ Minor inlet/outlet temperature differences of up to 1 K of the secondary refrigerant may be implemented as long as the max. permissible speed (7.5 m/s) is not exceeded at the heat-exchanger nozzle.

Permissible minimum and maximum values for heat pumps of the GEA RedAstrum series				
Parameter				Value
Heating agent inlet temperature in the heat pump	t_{W1}	°C	min	+20.0
			max	+70.0
Heat carrier outlet temperature from heat pump ³⁴	t_{W2}	°C	min	+55.0
			max	+80.0
Difference inlet / outlet temperature of heat carrier	Δt_W	K	min	5.0
			max	50.0
Oil temperature	t_{oil}	°C	min	+60
			max	+75
Discharge temperature at compressor outlet	t_{dis}	°C	min	+80
			max	+105
Discharge temperature - Condensing temperature $t_{dis} - t_c$	Δt	K	min	10
Discharge temperature - Oil temperature $t_{dis} - t_{oil}$	Δt	K	min	4
Ambient temperature	t_U	°C	min	+5
			max	+40
Relative ambient humidity ³⁵	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 operating limits stated in the tables, the applicable operating conditions of the compressor must also be considered (e. g. start-up regime, oil pressure, oil quantity, oil type etc.).
4. The oil temperature at the compressor inlet must be at least 18 °C and below 80 °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.

³⁴ 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.

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 of the manufacturer provide optimum performance and maximum protection from corrosion, if all recommended limiting values of VDI 3803 issue 2010-02 (Tab. B3) for non-corrosive water and adequate water conditioning are met.

Notice

If the limits specified in VDI 3803 are not adhered to, the manufacturer cannot provide any warranty regarding the water-conducting parts of the delivered 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-value at 20 °C		7.5 - 9.0	
Electrical conductivity	LF	< 220	mS/m
Soil alkali	Ca ²⁺ , Mg ²⁺	< 0.5	mol/m ³
General hardness, for stabilization	GH	< 20	°d
Carbonate hardness without hardness stabilizer	KH	< 4	°d
Chloride (see also following information)	Cl	< 150	g/m ³
Sulphur	SO ₄	< 325	g/m ³
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

Recommend for use of plate heat exchangers

- < 100 ppm Cl for the use of 1.4301 (AISI 304) and maximum 40 °C wall temperature in the plate heat exchanger
- < 200 ppm Cl for the use of 1.4401 (AISI 316) and maximum 100 °C wall temperature in the plate heat exchanger

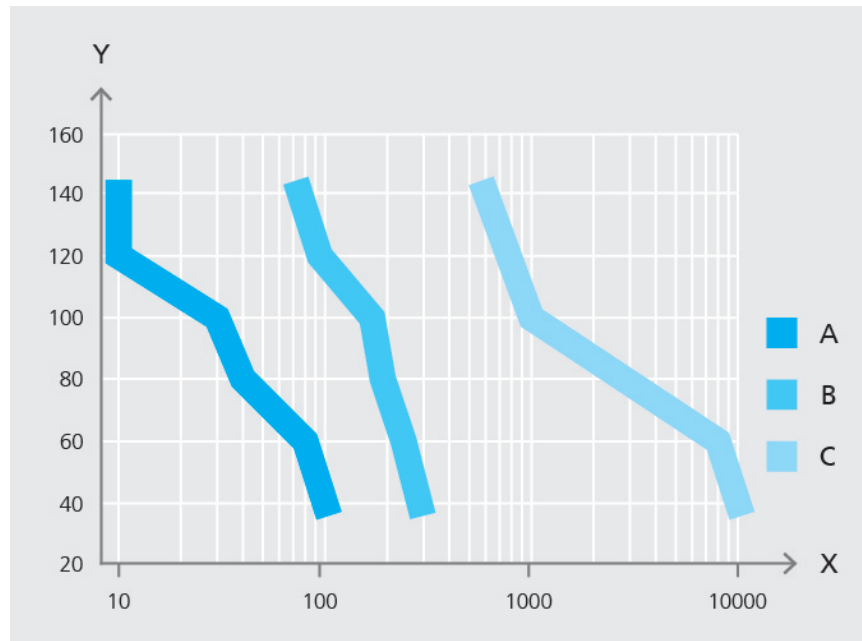


Fig.13: Corrosion resistance in presence of chlorides

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

Notice

Manufacturer recommendation: Use uncontaminated cooling agents and cooling media, in particular in chillers / heat pumps 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 these kinds of filters needs to be ≤ 0.9 mm!
- Should the system 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 will inform you on request about qualified specialist companies that can support you in the water analysis and the derived measures.

5.4 Performance characteristics

5.4.1 GEA RedAstrum EC (W) ... GEA RedAstrum RN (W) series

Notice

The data applies to the following standard conditions

(Application example 1 pure heating mode, evaporator charged with external secondary refrigerant):

► Q_0 : Refrigerating capacity at cooling water inlet/outlet temperatures = 40/35 °C

► P_e : Drive power (on mains (EC ... ML at 3600 rpm and RM/RN at 3300 rpm))

► Q_H : Heating capacity at heat carrier inlet/outlet temperatures = 40/70 °C

Performance characteristics			
Frame size	Q_0 in kW	P_e^{36} in kW	Q_H in kW
GEA RedAstrum EC	620	139	745
GEA RedAstrum ED	730	162	880
GEA RedAstrum HE	915	199	1095
GEA RedAstrum HG	1095	225	1300
GEA RedAstrum MH	1420	297	1690
GEA RedAstrum ML	1640	329	1940
GEA RedAstrum RM	1990	424	2380
GEA RedAstrum RN	2435	516	2910

5.4.2 GEA RedAstrum EC (K) ... GEA RedAstrum RN (K) series

Notice

The data applies to the following standard conditions

(Application example 2 as "add-on" heat pump with NH₃ cascade evaporator):

► Q_0 : Refrigerating capacity at evaporating temperatures of approx. 32 °C ... 33 °C

► P_e : Drive power on mains (EC ... ML at 3600 rpm and RM/RN at 3300 rpm)

► Q_H : Heating capacity at heat carrier inlet/outlet temperatures = 40/70 °C

Performance characteristics			
Frame size	Q_0 in kW	P_e^{36} in kW	Q_H in kW
GEA RedAstrum EC	615	140	740
GEA RedAstrum ED	725	162	870
GEA RedAstrum HE	910	199	1090

³⁶ Power consumption from mains (including power losses at motor and frequency converter approx. 7% of total full load)

Performance characteristics			
Frame size	Q_0 in kW	P_e^{36} in kW	Q_H in kW
GEA RedAstrum HG	1085	224	1290
GEA RedAstrum MH	1390	299	1660
GEA RedAstrum ML	1580	331	1885
GEA RedAstrum RM	1880	407	2255
GEA RedAstrum RN	2255	508	2720

5.4.3 GEA RedAstrum EE (W) ... GEA RedAstrum RR (W) series

Notice

The data applies to the following standard conditions

(application example 2 combined cooling and heating mode):

► Q_0 : Refrigerating capacity at cooling water inlet/outlet temperatures = 12/6 °C

► P_e : Drive power on mains (EC ... ML at 3600 rpm and RM/RN at 3300 rpm)

► Q_H : Heating capacity at heat carrier inlet/outlet temperatures = 40/65°C

Performance characteristics			
Frame size	Q_0 in kW	P_e^{36} in kW	Q_H in kW
GEA RedAstrum EE	365	160	510
GEA RedAstrum GG	425	178	590
GEA RedAstrum HH	550	229	760
GEA RedAstrum LL	635	263	875
GEA RedAstrum MM	765	310	1050
GEA RedAstrum NN	935	378	1280
GEA RedAstrum RR	1170	450	1585

5.5 Information on noise emissions

The noise information provides approximate parameters and applies 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 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 permitted exposure threshold regarding the level of daily noise exposure is 80 dB(A).

► Should noise levels rise above this threshold, 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).

Measuring-surface sound-pressure level L_p (A) @ 1 m (without soundproof housing)				
Motor size at 40 °C P_e in kW	Lp in dB(A) @ 1 m mains operation 400 V/ 50 Hz ³⁷			
	Heat pumps			
	GEA RedAstrum EC / ED / EE / GG	GEA RedAstrum HE / HG / HH / LL	GEA RedAstrum MH / ML / MM / NN	GEA RedAstrum RM / RN / RR
160	83	-	-	-
200	84	84	-	-
250	86	86	86	-
280	87	87	87	-
315	88	88	88	-
355	90	90	90	90
400	-	93	93	93
500	-	-	96	96
560	-	-	-	99

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

³⁷ at a distance of 1 m 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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