PRODUCT INFORMATION

Original document

GEA BluAstrum

Chiller

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LEGAL NOTICE

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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.

This product information serves as a support and technical advisory service for our partners and customers as well as for the marketing team. Apart from serving as the medium for transfer of product know-how, it also forms the basis for product demonstrations, the organisation and conduction of technical seminars as well as the technical support at trade fairs.

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In addition to this product information and the accident prevention regulations applicable for the respective country and area where the product is used, the accepted technical regulations for safe and professional work must also be observed.

GEA Refrigeration Germany GmbH reserves the right to make technical changes during the course of further development of the equipment covered by this product information.

Illustrations and drawings in this product information are simplified representations. As a result of the improvements and changes, it is possible that the illustrations do not exactly match the current development status. The technical data and dimensions are subject to change. No claims can be made on the basis of them.

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

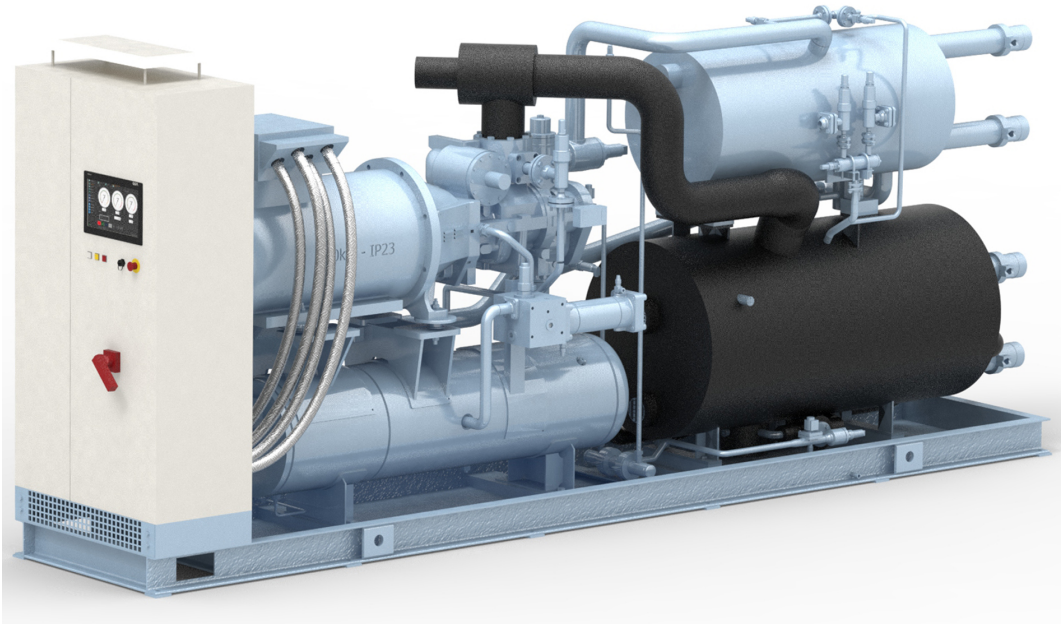


Fig.1: GEA BluAstrum, front view

Parameter	Remark
Output range	390 - 1730 kW 12 / 6 °C (secondary refrigerant temperature) 30 / 35 °C (temperature of the refrigerant)
Screw compressor	GEA Grasso M Series, types D, G, H, L, M, N Series GEA Grasso LT, series R V_{th} = 390 ... 1590 m³/h
Screw compressor package	GEA Grasso M, GEA Grasso SP1
Chiller	GEA BluAstrum
Evaporator type	Fully welded plate heat exchanger, with integrated separator
Working principle	flooded evaporation
Liquid separator	integrated
Condenser type	Fully welded plate heat exchanger
Condenser design type **(R)**	air cooled condenser or evaporative condenser (not included in scope of delivery)
Transport	1 part

1.2 Scope of delivery

Notice

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

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

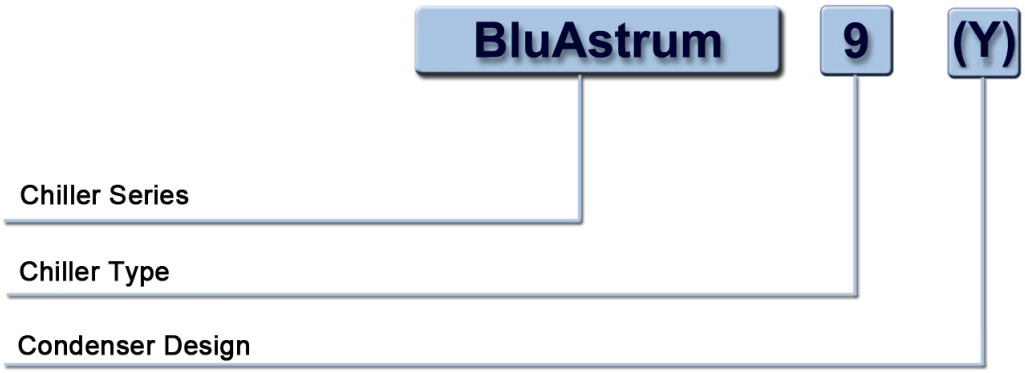
Standard equipment	
Designation	**Design**
Maximum permissible pressure:	Max. 28 bar
Intended environment:	Indoor installation
Ambient temperatures:	+5 ℃ to +40 ℃ (+5 °C to +32 °C with soundproof housing)
Installation altitude:	≤ 1000 m above sea level
Secondary refrigerant - outlet temperature [1]:	-15 °C/ 6 °C/ 18 °C
Electric motor:	Standard scope of delivery
Refrigerant:	R717
Type of oil:	According to order specification. Compare also the technical information on the lubricating oils for GEA packages, chillers and heat pumps. ⚠ **Caution** Deviating types of oil must be agreed with the manufacturer. ► Contact the Design or Technical Customer Service of GEA Refrigeration Germany GmbH.
Oil cooling:	Refrigerant injection
Oil heater:	Standard scope of delivery
Oil filter:	Single stage filter
Spare oil filter:	none
Oil level switch:	none
Pressure sensors:	directly in the pipe
separate push-button switch:	none
Overflow valve HP/LP:	Standard scope of delivery
Safety valve LP:	Double safety valve with change-over valve
Flow monitor:	electronic
Control:	GEA Omni
Communication:	Modbus TCP
Power current panel and frequency converter:	Standard scope of delivery, cable entry from below
Colour:	RAL 5014 (dove grey)
Soundproof housing:	none
Vibration isolators:	none
Approval of pressure equipment:	CE-PED, Module H (piping)
Documentation:	2x paper + 1 piece USB stick or electronic (provided on server)

1 Temperature difference secondary refrigerant maximum 10 K / standard 5 K

Optional equipment	
Designation	**Design**
Spare oil filter:	can be delivered
Soundproof housing:	can be delivered, colour: RAL 7035 (pebble grey)
Oil cooling:	Cooled with liquid or refrigerant
Communication:	Profibus DP ProfiNet
Electric motor:	customer specific design possible on request
Subcooler:	available
Flow monitor:	mechanically (paddle)
Vibration isolators:	available
Approval of pressure equipment:	CE-PED, Module H1 (complete chiller)

1.3 Product designation chillers with screw compressors

GEA BluAstrum series



Product code description

Code	Description
BluAstrum	Chiller series
9	Capacity of the chiller in kW related to cold-water operation 12 °C / 6 °C
Y	Condenser version

BluAstrum = Chiller series

9 Capacity of the chiller at 4500 min^{-1} in kW related to cold water operation 12 °C / 6 °C

Compressor frame size	Output in kW
D	400
G	500
H	800
L	900
M	1000
N	1500
R	1800

(Y) Condenser version

Code	Description
(W)	Water-/liquid-cooled plate heat exchanger (completely welded), chiller for indoor installation
(R)	Evaporating or air-cooled condenser [2] Chiller for indoor installation

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

Example of designation

Example	Description
BluAstrum 1000 (W)	Chiller with screw compressor, flooded evaporator with integrated separator **(BluAstrum)** Capacity of the chiller 1000 kW **(1000)** Design of evaporator and condenser as completely welded plate heat exchanger, chiller for indoor installation **(W)**

2 Components

The chillers of the series **GEA BluAstrum** comprise the following components:

- Screw compressor,
- Evaporator with integrated separator
- Condenser
  (design type (R): not included in scope of delivery),
- Electric motor with coupling and flange,
- Oil supply system with oil separator,
- Oil cooler (optional),
- Oil filter,
- Suction filter (only for GEA BluAstrum 1800),
- Check valves on the suction and discharge sides,
- Speed-dependent capacity control,
- Monitoring and safety devices,
- Frequency converter
- low-voltage supply with control unit GEA Omni,
- HP-receiver (for condenser design type (R) only).

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 default by refrigerant injection, optionally via a water cooled oil cooler or a refrigerant cooled oil cooler or heat recovery (for condenser design type (R)).

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 chillers of the series **GEA BluAstrum** are delivered without refrigerant and oil. 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

Standard insulation with soundproof housing for suction line and evaporator in 19 mm Armaflex.

Standard insulation without soundproof housing for cold system components in PUR/Alu.

The insulation is basically designed for an ambient temperature of 20 °C and a humidity of 70 %.

Painting

Coating system S 2.15 acc. to EN ISO 12944-5 for environmental conditions C2 acc. to EN ISO 12944-2.

Designed for room temperatures of 5 °C up to 40 °C.

Colour scheme chiller: RAL 5014 pigeon blue

Colour scheme control cabinet: RAL 7035

Colour scheme soundproof housing (optional): RAL 7035 light grey

Approval

The chillers of the series **GEA BluAstrum** are awarded a CE label in accordance with the Pressure Equipment Directive 2014/68/EC after approval.

Documentation

Every chiller of the series **GEA BluAstrum** includes 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.

2.1 Chillers in remote design

In addition to the chillers completely equipped ex works with a condenser, so called remote chillers are often also operated.

This means that the chiller delivered ex works does not contain a condenser but has only been designed for the requested condensation temperature.

The customer himself then selects a suitable condenser and connects this with the supplied remote chiller. The external (remote) condenser is either an air cooled condenser or an evaporative condenser.

3 Description of Design and Function

3.1 Design, applications

The **GEA BluAstrum** Chiller Programme provides proven components as complete refrigeration systems for medium and large refrigeration and/or air conditioning requirements.

Main fields of application:

- 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
- (cold) and warm water for heat pump operation

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

Equipped with the screw compressor series, the **GEA BluAstrum** chillers cover the refrigeration range of 400 to 1800 kW for cold water.

The output ranges are defined by 7 sizes of the screw compressor series.

The **GEA BluAstrum** chillers work with flooded evaporator systems and can be fitted with a variety of condenser types.

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

- Standard screw compressor package
- Heat exchanger subassembly with integrated liquid separator and de-oiling system
- Low-voltage installation with frequency inverter and control

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

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

On the condenser side, the following versions are used:

- Plate type condenser
- Evaporative condenser (R)
- air-cooled condenser (R)

The **GEA BluAstrum** chillers are supplied, as a standard, ready for connection, fully piped and wired.

The **GEA BluAstrum (R)** chillers are supplied in such a complete state that on site only the air cooled condenser or the evaporative condenser has to be integrated.

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.

Notice

The use of several GEA BluAstrum with only one common condenser is not permitted.

► When operating with an external condenser (type GEA BluAstrum (R)), a separate condenser must be available for each GEA BluAstrum!

The standard version of the chillers 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 chillers are delivered without refrigerant and refrigerating machine oil. They are filled with dry nitrogen (approx. 0.2 bar ... 0.5 bar overpressure).

After consultation with the customer, a refrigerator oil filling is possible after the factory acceptance test (FAT).

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

The separate installation and maintenance manual 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 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 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 continuously adjusted via the compressor's control slide (optional for the GEA BluAstrum and GEA BluAir product series) and through the frequency converter control of the compressor drive motor (standard equipment in the "Blu" and "Red" product families). 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 Compressor

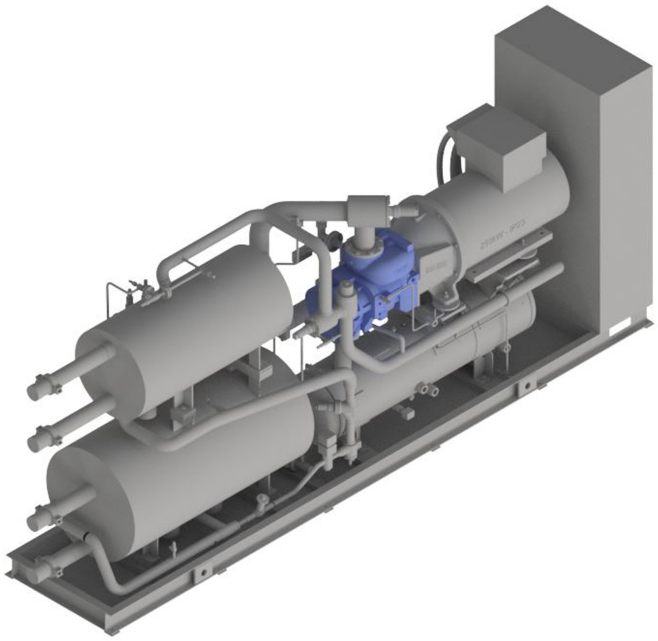


Fig.2: Arrangement of the compressor

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 Motor

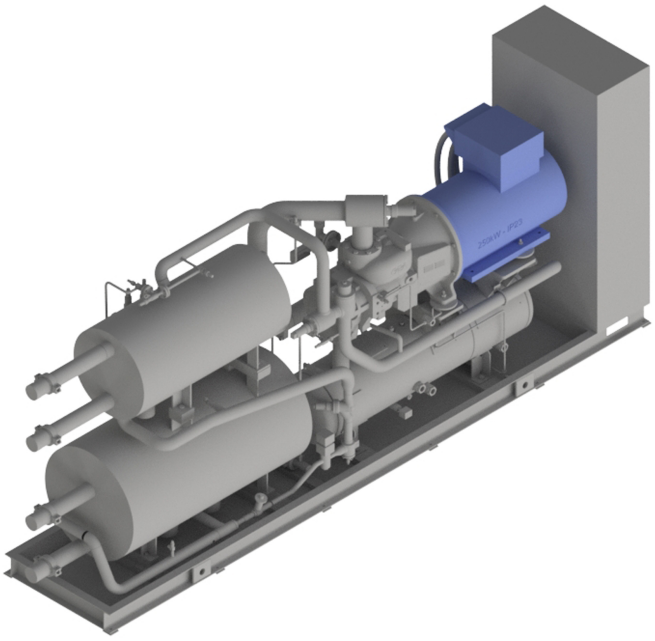


Fig.3: Position and arrangement of the motor:

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

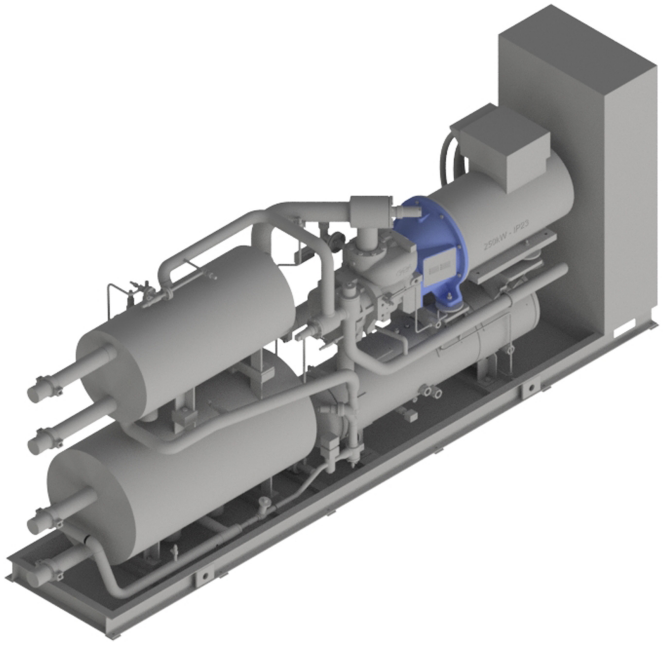


Fig.4: Arrangement of the coupling

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

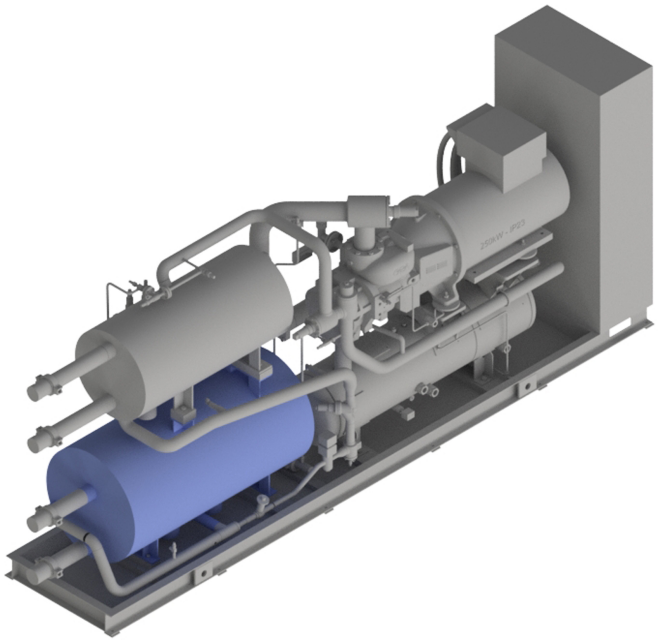


Fig.5: Arrangement of the evaporator

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

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

In the case of external condensing systems (design variant (R) of the condenser), a maximum level indicator is installed in the level sensor vessel to provide additional protection against overfilling. The suction pressure and secondary refrigerant outlet temperature are monitored to provide reliable protection against freezing.

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

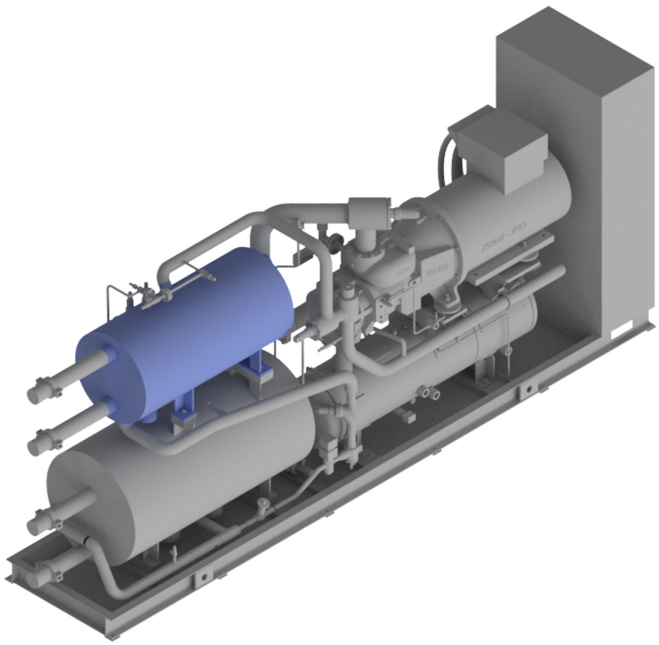


Fig.6: Position of the condenser

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

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

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

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

2. Condenser design type (R):

   Client-provided air-cooled condenser (not a part of scope of delivery)

   Client-provided evaporative condenser (not a part of scope of delivery)

Notice

The use of several GEA BluAstrum with only one common condenser is not permitted.

► When operating with an external condenser (type GEA BluAstrum (R)), a separate condenser must be available for each GEA BluAstrum!

3.3.6 Oil separator

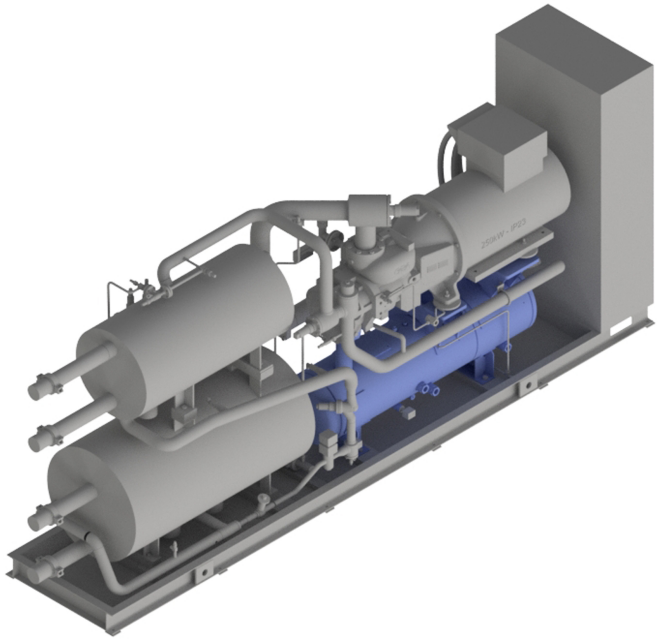


Fig.7: Arrangement of the oil separator

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

The oil separator is installed horizontally.

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 built into the oil separator to heat the oil-refrigerant mixture in the oil separator when the product is at a standstill. The oil heater prevents condensation of the refrigerant into the oil and, thus, any foaming of the oil during start-up.

To prevent overheating, the radiator is fitted with a correctly dimensioned overheating protection and a temperature control (in case of a fault, e.g. boil-dry protection, permanently set to 170 °C).

Notice

The oil heater may only be switched on when installed and used for heating the oil in the oil sump of the oil separator.

► For more information about handling the oil heater, please refer to the function description, commissioning, operation and control chapters.

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 (optional)

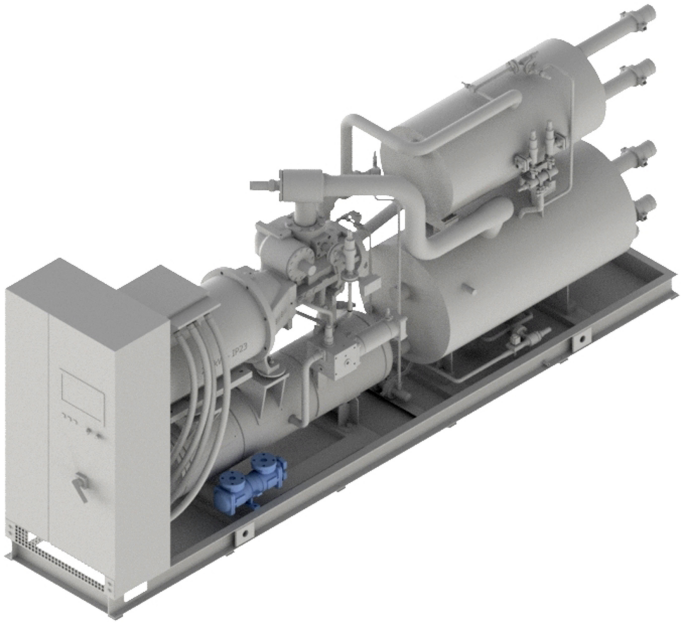


Fig.8: Arrangement of the oil cooler

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.

As standard, minimum oil temperature is maintained by oil temperature control using a 3-way valve. Unless otherwise specified, the oil cooler has all the pipelines on the coolant side.

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. 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.

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

3.3.10 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.

3.3.11 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.

3.3.12 Control cabinet with control

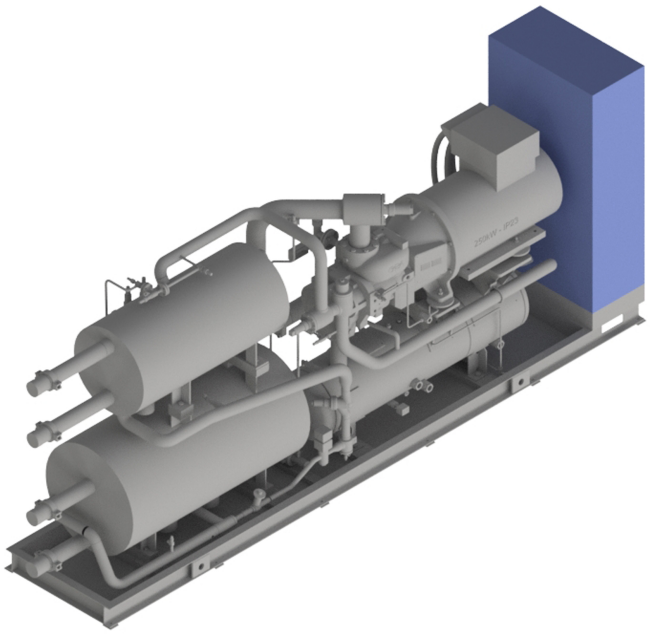


Fig.9: Position of the control cabinet

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

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

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

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

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

Notice

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

► 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 Soundproof housing

Fig.10: Soundproof housing, view

As an additional option, GEA Refrigeration Germany GmbH offers sound insulation for your machine room using a newly developed housing.

The double-walled and down-closed housing construction with insulating material reduces the sound pressure level measured outside by approx. 4 dB (A), thus achieving a significant reduction in noise.

In addition, the soundproof housing also serves as protection against physical contact.

An ventilation system keeps the temperatures in the interiors within limits and simultaneously prevents heat losses on the system.

Individual wall elements can be quickly and easily dismantled so that access for maintenance work is ensured. Alternatively, the entire soundproof housing can be removed completely by loosening a few screws in the base frame.

Last but not the least, the filigree design combines the functional requirements with modern, high-quality optics.

3.3.14 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.

3.3.15 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.

3.3.16 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 of the safety device is set to a pressure ≤ 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.

3.3.17 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.11: GEA Omni exterior view without indicator lights

Fig.12: 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.13: 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 [3]	digital	• Run compressor • Run external oil pump [3] • Confirm malfunction
analogue (4-20 mA)	• Motor current compressor drive motor • Speed compressor drive motor [4]	analogue (4-20 mA)	• Compressor drive motor speed setpoint [4]

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

3 If fitted.
4 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 [5] • Eco-level [5] • Gas sensor • Discharge pressure safety switch • min. oil level [6] • max. oil level [6] • Level of refrigerant top / bottom [5]	digital:	• Solenoid valve capacity control max. [7] • Solenoid valve capacity control min.[7] • Solenoid valves capacity control [8] • Solenoid valve check valve suction side [5], [7] • Solenoid valves Vi-control [5], [7] • Solenoid valve economizer operation[5] • Solenoid valve start-up unloading [5] • Solenoid valves, oil return • Solenoid valve low pressure-high pressure relief [3] • Solenoid valve oil return from fine oil filter stage [3]
analogue (4-20 mA)	• Control / primary slide position[7] • Vi / control slide stop position [5], [7] • suction pressure • discharge pressure • Oil pressure • Pressure after oil filter[7] • Crankcase pressure [8] • Evaporating pressure [9] • Suction temperature • Discharge temperature • Oil temperature • Oil temperature oil separator sump [3] • Oil temperature compressor on / off [10] • Eco temperature[3] • Eco pressure[3] • Secondary refrigerant temperature on/off [11] • Inlet temp. refrigerant low pressure cooling system [12]	analogue (4-20 mA)	• Setpoint level control [5] • Setpoint IntelliSOC injection valve [5] • Setpoint motor valve suction line [3] • Setpoint motor valve remote condenser control[3] • Setpoint motor valve hot gas bypass start-up unloading[3]

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

13 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).

14 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

Notice

The data is applicable to the following conditions:

- ► Temperature of the coolant +12°C / +6°C
- ► Temperature of the refrigerant +30 °C / +35 °C

Data may differ in other conditions.

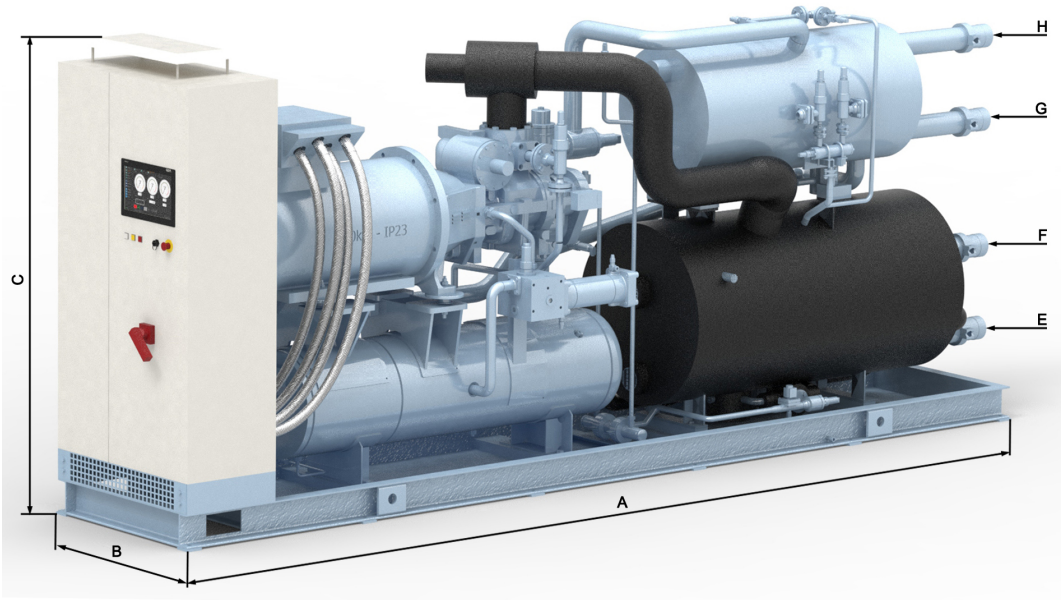


Fig.14: GEA BluAstrum 400 ... GEA BluAstrum 1800

Characteristics									
Code	**Parameter**		**GEA BluAstrum chiller**						
			400[15]	**500** [15]	**800**[15]	**900**[15]	**1000**[15]	**1500**[15]	**1800**[15]
A	Length	mm	4700	4700	5100[16]	5100[16]	5100[16]	6500[16]	6800[16]
B	Width	mm	1000	1000	1000	1000	1000	1200	1200
C	Height	mm	2100	2100	2100	2100	2100	2400	2400
E	Connection Cold water IN	DN	80	100	100	100	100	125	125
F	Connection Cold water OUT	DN	80	100	100	100	100	125	125
G	Connection Cooling water ON	DN	80	100	100	100	100	125	125
H	Connection Cooling water OFF	DN	80	100	100	100	100	125	125
	Connection of blow-off line to safety valve	DN	25	25	25	25	25	25	25

15 subject to technical changes
16 from p_e=355 kW A+700 mm

Characteristics									
Code	**Parameter**		**GEA BluAstrum chiller**						
			400[15]	**500** [15]	**800**[15]	**900**[15]	**1000**[15]	**1500**[15]	**1800**[15]
	Weight without charging	kg	5500	5500	6000	6500	7000	8000	8500
	Operating weight	kg	5820	5820	6370	6950	7450	8150	8800
	Filling quantity (Oil)	l	80	80	90	90	100	130	250
	Charge (Refrigerant $NH_{3)}$	kg	30	30	34	40	50	77	101

5.2 Application limits

The chillers of the series **GEA BluAstrum and GEA BluX** for flooded evaporation can be operated within the specified application limits according to the respective specifications under diverse work conditions. The application 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.

Application limits				
Parameter		Unit	Value	
Refrigerant				NH_3
Speed	n	min^{-1}	min	1000
			max	4500[17] 5200[18]
suction pressure	p_0	bar (a)	min max	1.9 7.3
Outlet temperature of water as secondary refrigerant	t_{WA}	°C	min max	+ 2.5 + 18
Outlet temperature with frost-resistant secondary refrigerants	t_{WA}	°C	min max	- 15 + 18
Maximum permissible pressure	PS	bar (a)	min max	7.3 22.5
Condenser inlet temperature of cooling medium	t_{Kwe}	°C	min max	12 45
Condensing temperature	t	°C	min max	15 54
Discharge temperature at compressor outlet	t_1	°C	min max	50 100
Pressure ratio p_c/p_0)	π	-	min	> 1.5
Pressure difference (p_c-p_0) [19]	Δp	bar	min	3 [20]

15 subject to technical changes
17 GEA BluAstrum
18 GEA BluX
19 The given pressure difference ensures reliable compressor operation. Furthermore, allowance must be made for the pressure difference necessary for the control valves fitted in the refrigerating plant.
20 To comply with the minimum pressure difference, we recommend customer to provide a water-side 3-way valve.

Notes

- When considering a specific application, all the conditions specified in the table must be taken into account and adhered to.
- If the specified limits are exceeded for a specific application, the manufacturer must be consulted.
- In addition to the application 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.).
- The oil temperature at the compressor inlet must be least 18 °C.
- The specified data refer to the operating conditions of a cooling or air-conditioning system.

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

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/m³
General hardness, for stabilization	GH	< 20	°d
Carbonate hardness without hardness stabilizer	KH	< 4	°d
Chloride (see also following information)	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

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

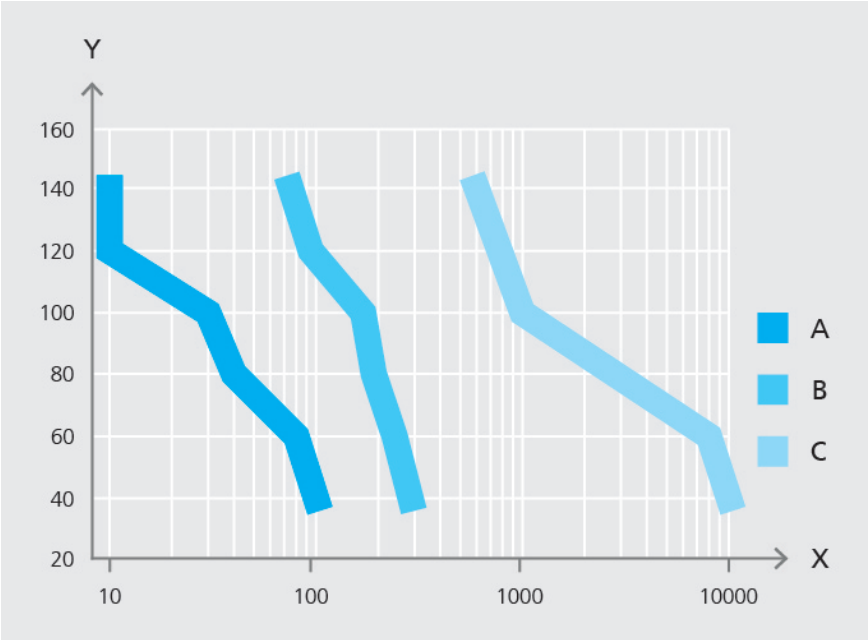


Fig.15: Corrosion resistance in presence of chlorides

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

Cold water inlet temperature = 12 °C

Cold water outlet temperature = 6 °C

Q_0: refrigerating capacity

P_e: driving power

Q_c: Condenser capacity at cooling water inlet / outlet temperatures = 30/35 °C

Performance characteristics			
Frame size	**Q_0 in kW**	**P_e[21] in kW**	**Q_c[22] in kW**
GEA BluAstrum 400	390	88	463
GEA BluAstrum 500	550	113	651
GEA BluAstrum 800	740	149	873
GEA BluAstrum 900	880	175	1037
GEA BluAstrum 1000	1100	213	1292
GEA BluAstrum 1500	1450	275	1697
GEA BluAstrum 1800	1730	322	2023

21 including motor/frequency inverter power losses
22 including oil cooling capacity

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.

For any person spending extended time in rooms with running chillers, the wearing of personal ear protection with sufficient sound insulation is recommended.

⚠ 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 Lp (A) @ 1 m (without soundproof housing)							
Motor size at 40 °C Pe in kW	**Lp in dB(A) @1 m mains operation 400 V/ 50 Hz [23] Chiller Type GEA BluAstrum ...**						
	400	**500**	**800**	**900**	**1000**	**1500**	**1800**
110	82	-	-	-	-	-	-
132	83	-	-	-	-	-	-
160	-	83	83	-	-	-	-
200	-	-	84	84	84	-	-
250	-	-	86	86	86	-	-
315	-	-	-	88	88	89	-
355	-	-	-	-	90	91	92
400	-	-	-	-	-	92	93
500	-	-	-	-	-	-	96

Notice

The values in the table are verified by actual measurement. If no values are specified, these are not yet available or not applicable for the chiller size.

► Noise emissions from external condensers are not taken into account.

► Reduce the measuring-surface sound-pressure level (1m) by 4 dB(A) for BluAstrum with sound insulation housing.

23 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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