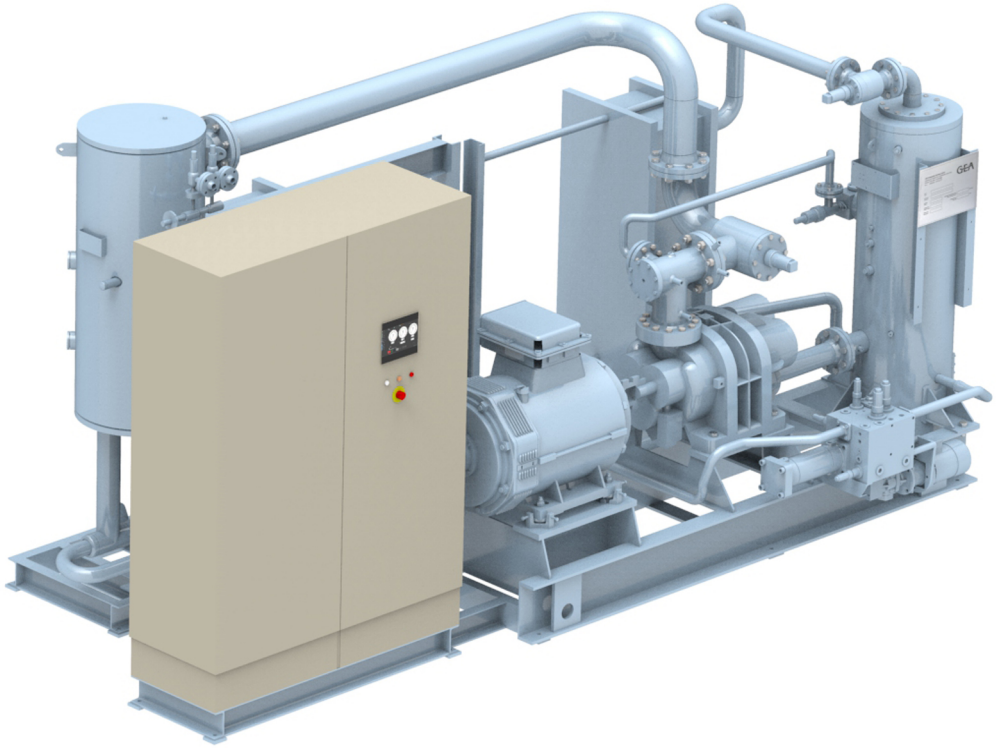

Chiller

GEA Grasso FX P

Product Information (Translation from the original language)

L_411011_10

engineering for a better world

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LEGAL NOTICE

This product information is a part of the documentation for the GEA Refrigeration Germany GmbH scope of delivery and serves as product presentation and customer advisory service. It contains important information and technical data regarding the product.

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.

This product information should be supplemented with the information about the industrial safety and health related regulations at the site of installation of the product. The regulations vary form place to place as a result of the statutory regulations applicable at the site of installation of the product and are therefore have not been considered in this product information.

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.

This product information has been written in good faith. However, GEA Refrigeration Germany GmbH cannot be held responsible for any errors that this document may contain or for their consequences.

GEA Refrigeration Germany GmbH reserves the right to make technical changes during the course of further development of the product 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. GEA chillers include the series GEA BluAstrum, GEA BluGenium, GEA BluAir (duo), GEA BluX, GEA Grasso FX (duo) or MX (duo) which is a special series.

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

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

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

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

LAYOUT INFORMATION

Bullet points and numbered list characters

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

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

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

Descriptive text with consecutive numbering:

- Numbered list point 1
- Numbered list point 2

Handling instructions

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

Handling sequence

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

The subsequent handling sequence is the expected result:

→ Result of the handling sequence.

Individual handling steps

Individual handling steps are marked thus:

- Individual work steps

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TABLE OF FIGURES

1 Description

1.1 General information

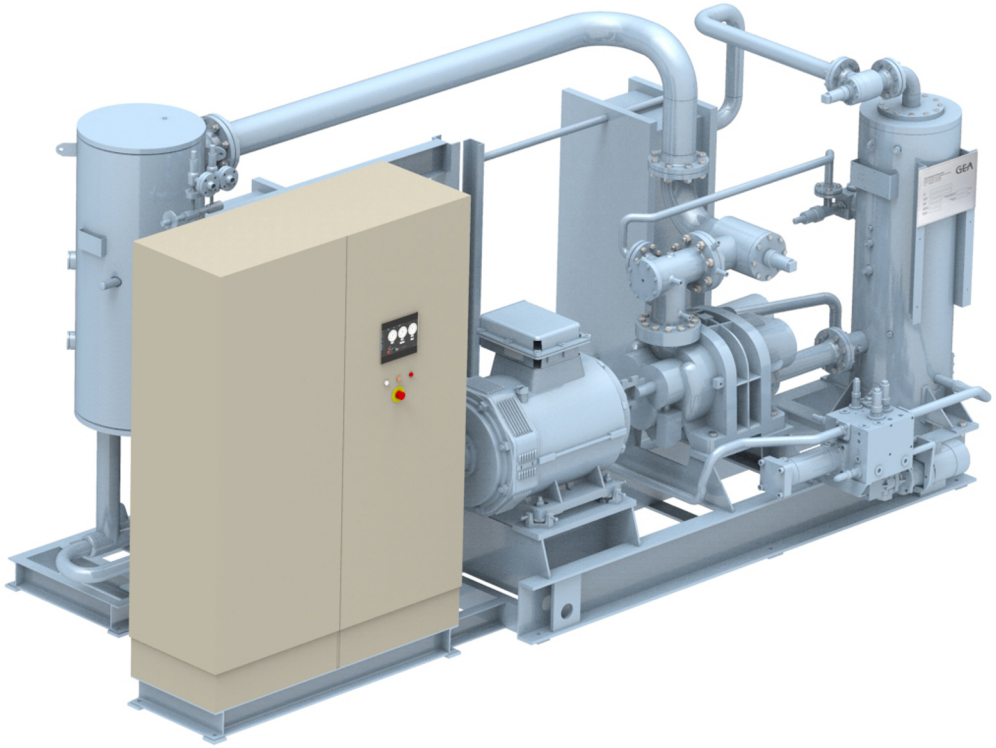


Fig.1: GEA Grasso FX P, front view

Parameter	Remark
Output range	200 - 8000 kW 12 / 6 °C (secondary refrigerant temperature) 27 / 32 °C (temperature of the refrigerant)
Screw compressor	GEA Grasso M series, frame size C, D, E, G, H, L, M, N GEA Grasso LT series, frame size P, R,S, T, V, W, Y, Z, XA, XB, XC, XD, XE, XF V_{th} = 231 ... 8560 m³/h
Screw Compressor Package	GEA Grasso M series, GEA Grasso SP1 series,
Chiller	GEA Grasso FX P
Design Evaporator	Plate heat exchanger, cassette welding Plate heat exchanger, completely welded
Working principle	flooded evaporation
Liquid separator	Performance-independent horizontal or vertical
Design Condenser	Plate heat exchanger, cassette welding Shell and plate condenser, completely welded Tubular condenser on request
Design type Condenser **(R)**	air cooled condenser or evaporative condenser (not included in scope of delivery)
Transport	Compressor GEA Grasso M series - 1 part Compressor GEA Grasso LT series - in several parts or modules

1.2 Technical specifications

Notice

The product is manufactured and delivered according to technical specifications.

► Optional design variants can be considered, on the basis of the standard equipment.

Standard equipment	
Designation	**Design**
Construction pressure:	Max. 28 bar
Intended environment:	Indoor installation
Ambient temperatures:	+5 ℃ to +40 ℃
Installation altitude:	≤ 1000 m above sea level
Electric motor:	standard scope of delivery
Refrigerant:	R717
Type of oil:	Hydrotreated mineral oil: PR-OLEO® C-MH68A; PR-OLEO® C-MH68A-FG Polyalphaolefin (PAO) oil: PR-OLEO® C-PAO68-FG ⚠ **Caution!** Deviating types of oil must be agreed with the manufacturer. ► Contact the Design or Technical Customer Service of GEA Refrigeration Germany GmbH.
Oil cooling:	cooled with water or refrigerant
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 panel	Standard scope of delivery, cable entry from below
Colour:	RAL 5014 (dove grey)
Vibration isolators:	none
Approval of pressure equipment:	CE-PED, Module H (piping)
Documentation:	2x paper form + 1 USB stick

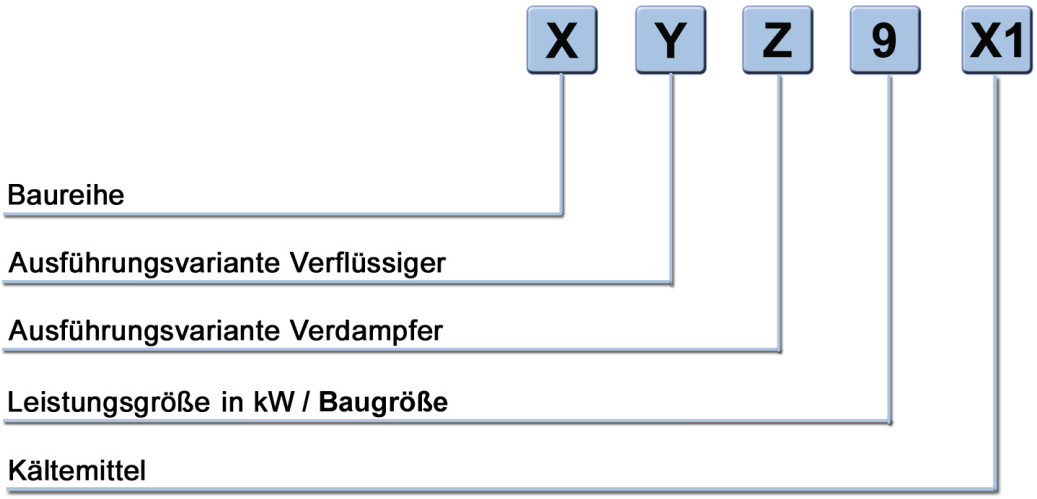
Optional equipment	
Designation	**Design**
Spare oil filter:	can be delivered
Communication:	Profibus DP ProfiNet

Optional equipment	
Designation	**Design**
frequency inverter:	can be delivered
Electric motor:	customer specific design possible on request
Flow monitor:	mechanically (paddle)
Vibration isolators:	can be delivered
Approval of pressure equipment:	CE-PED, Module H1 (complete chiller)

1.3 Product designation chillers and heat pumps with screw compressors

GEA Grasso FX, MX and HX series single stage with screw compressors GEA Grasso M,

GEA Grasso LT, GEA Grasso L XHP and GEA CompaX



Product code description

Code	Description
X	Chiller / heat pump series
Y	Condenser version
Z	Evaporator version
9	Chiller / heat pump capacity
X1	Refrigerant

X series

Code	Description
FX	Chiller with flooded evaporator
MX	Chiller special design with flooded evaporator
HX	Heat pump special design [1] with flooded evaporator

Y Condenser version

Code	Description
P	Plate heat exchanger (cassette welding)
S	Shell and plate condenser (completely welded)
R	Tube bundle condenser
L	Air cooled condenser [2]
V	Evaporating condenser [2]

1 NH_3, with screw compressor in 52/ 63 / 70 bar version.
2 Not in the scope of delivery for GEA Refrigeration Germany.

Z Evaporator version

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

9 Capacity / compressor frame size [3]

Compressor frame size [4]	Capacity in kW / frame size		Compressor frame size [4]	Capacity in kW / frame size
C	200		T	1500
D	250		V	1700
E	300		W	2000
CompaX 350	035		WH	H200
G	350		Y	2400
CompaX 400	040		YH	H240
H	450		Z	2800
L	550		ZH	H280
M	650		XA	3300
CompaX 700	070		XB	4200
N	900		XC	5000
CompaX 900	090		XD	5800
P	800		XE	7000
R	1100		XF	8000
S	1300			

X1 refrigerant

Code	Description
NH_3	Ammonia [5]

3 Relating to cold water operation +12 / +6 °C at 2940 min^{-1}, the compressor designation of heat pumps based on the new compressor series L XHP is the frame size.

4 Housing size (frame sizes XG / XH not permissible for chillers and heat pumps).

5 Other refrigerants on request.

Examples of designation

Example	Description
FX PP 650 NH_3	Chiller with screw compressor **(FX)**, Plate heat exchanger as condenser **(P)**, Plate heat exchanger (cassette welding) as evaporator **(P)**, Compressor frame size M / capacity 650 kW **(650)**, for refrigerant ammonia **(NH_3)**
HX SS 1700 NH_3	Heat pump with screw compressor **(HX)**, Shell and plate condenser **(S)**, Plate heat exchanger (completely welded) as evaporator **(S)**, Compressor frame size V / capacity 1700 kW **(1700)**, Refrigerant ammonia **(NH_3)**
HX SP H280 NH_3	Heat pump with screw compressor **(HX)**, Shell and plate condenser **(S)**, Plate heat exchanger (cassette welding) as evaporator **(P)**, Compressor frame size L XHP, frame size H2800 **(H280)**, Refrigerant ammonia **(NH_3)**

2 Scope of delivery

The chillers consist of the following components:

- 1 screw compressor from the FX P series,
- 2 screw compressors from the FX Pduo series,
- Evaporator,
- Condenser,
- 1 electric motor with coupling and flange from the FX P series,
- 2 electric motors with coupling and flange from the FX Pduo series,
- Oil separator,
- Oil cooler,
- Oil filter,
- Oil pump,
- Suction filter,
- Liquid separator,
- Expansion device,
- Oil return system,
- Low-voltage supply with control unit,

All of the standard fluids in refrigeration technology may be used along with water as a secondary refrigerant or cooling medium.

The evaporator is designed as a modular-welded or fully-welded plate heat exchanger as standard. Based on the chiller design, e.g. as a heat pump, solutions are also possible without evaporators.

Different design versions of the condenser are available.

Approval

After acceptance, the chillers get a CE label in accordance with the Pressure Equipment Directive 2014/68/EU.

Documentation

User documentation is delivered with each chiller package. The user documentation contains:

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

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

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 Grasso FX P** 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 Grasso FX P** chillers cover the refrigeration range of 200 kW to 8000 kW for cold water.

The output ranges are defined by 22 frame sizes of the screw compressor.

The **GEA Grasso FX P** 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
  - GEA Grasso M

    or
  - GEA Grasso SP1
- Heat exchanger module with low pressure separator and de-oiling system
- Low-voltage supply with control unit

The modular construction of the chillers is modelled on the construction of the screw compressor packages. The arrangement of the components ensures the compact design of the chillers.

Solely plate-type evaporators are used as evaporators.

On the condenser side, the following versions are used:

- Plate type heat exchanger PP
- Evaporative condenser VP
- Air-cooled condenser LP

The GEA Grasso M chiller series with screw compressor package are supplied, as a standard, ready for connection, fully piped and wired.

The modular design enables a divided delivery and assembly of the chiller with the screw compressor packages of the GEA Grasso SP1 series in different parts.

The modules will be re-assembled on site under consideration of certain special machine room conditions.

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 Grasso FX P with only one common condenser is not permitted.

► When operating with an external condenser (VP, LP), a separate condenser must be available for each chiller!

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 (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 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

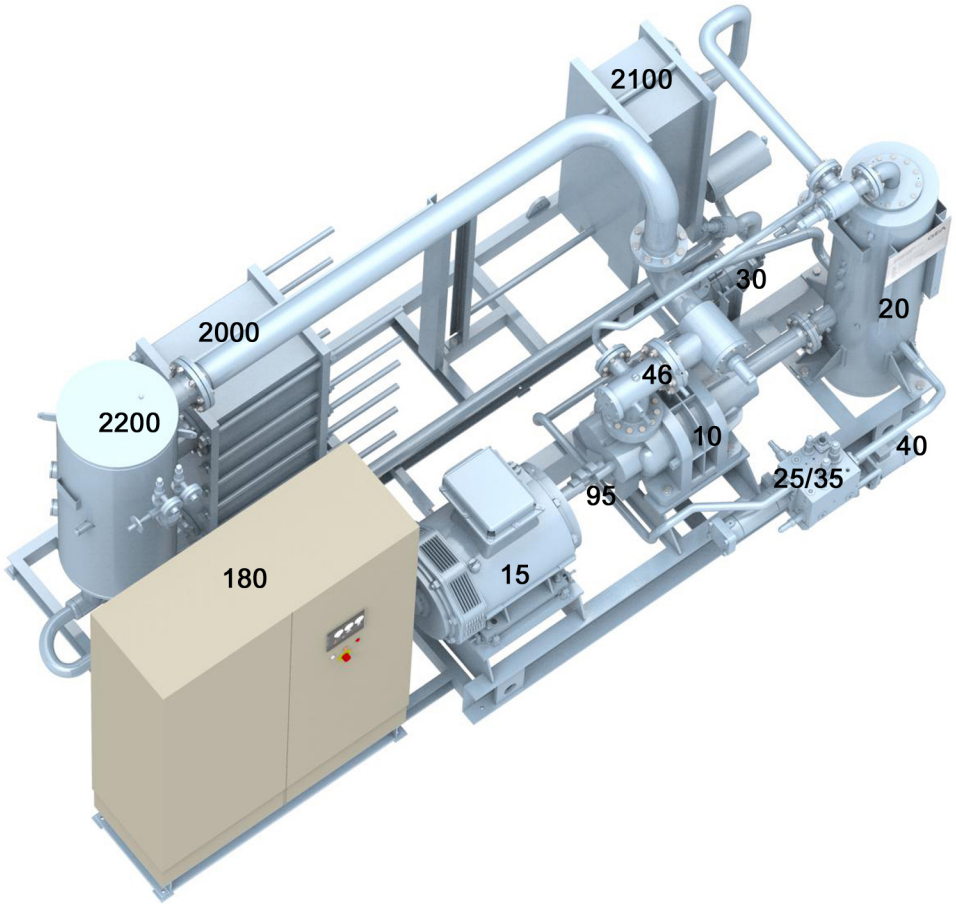


Fig.2: Standard Chiller GEA Grasso FX P main components

The chillers of the GEA Grasso FX P series consist of the following main assemblies and components:		
Position	**Main assemblies, component**	**Information**
10	Screw compressor	See installation and maintenance instructions for screw compressor
15	Compressor drive motor	See operating manual of the compressor drive motor
20	Oil separator	See component documentation
25/35	OMC block, oil filter	See component documentation
30 (200)	Water-cooled oil cooler (refrigerant-cooled oil cooler)	See component documentation
40	Oil pump with frequency inverter (for chillers with LT series compressors) [6]	See component documentation
45	Suction filter [7]	See component documentation See installation and maintenance instructions for screw compressor
55	Check valve - suction side [8],[7]	
60	Check valve - pressure side [9]	
95	Coupling in coupling housing [10]	See installation and maintenance instructions for screw compressor

6 An oil pump is used in certain applications for M series compressors.
7 In chillers with M series compressors, the component is part of the compressor. For chillers with LT series compressors, the component is used externally.
8 not marked in the figure
9 component is part of the oil separator.
10 Component is part of the compressor.

The chillers of the GEA Grasso FX P series consist of the following main assemblies and components:		
Position	**Main assemblies, component**	**Information**
175	Stop valve - compressor pressure side [8]	
180	Control/switching cabinet	See control documentation
260	Stop valve - pressure side [8]	
280	Stop valve - suction side [8]	
500	Solenoid valve - oil supply [8]	See component documentation
2000	Evaporator	See operating manual for the evaporator
2100	Condenser	See operating manual for the condenser
2200	Liquid separator	
2250 (2860)	High pressure float valve [8] (electronic expansion valve) [8]	See component documentation

Notice

The documentation for the main components is a part of the product documentation.

► See product description and operating manuals of suppliers, e.g. for the compressor drive motor, condenser and evaporator.

3.3.1 Screw compressor

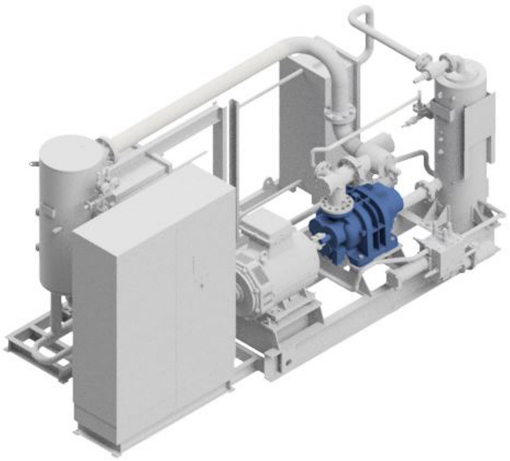


Fig.3: Arrangement of the evaporator

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

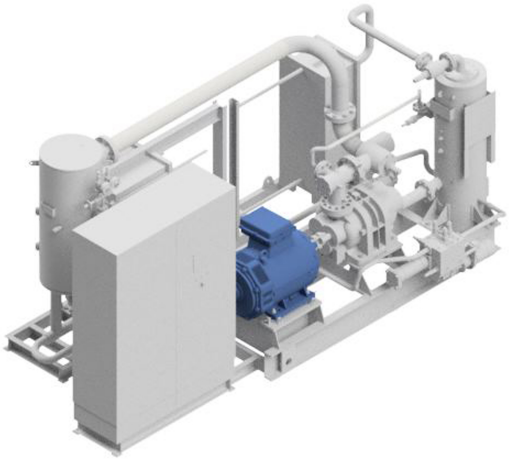


Fig.4: Arrangement of the compressor drive motor

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

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

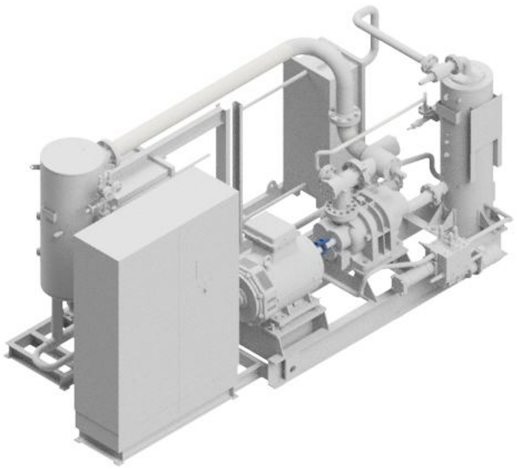


Fig.5: Arrangement of the coupling

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 and liquid separator

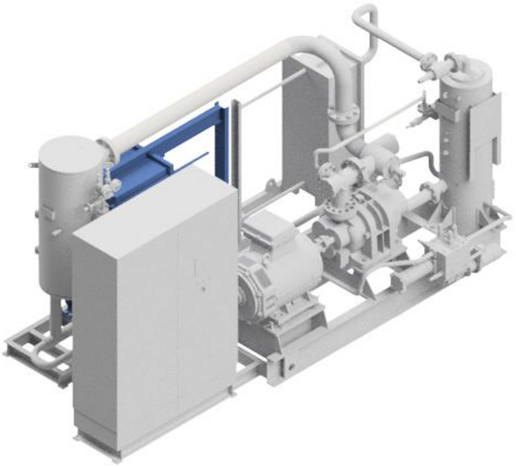


Fig.6: Arrangement of the evaporator

In the evaporator heat is absorbed from the secondary refrigerant (which is thereby cooled) by way of evaporation of the refrigerant. The evaporator works on the principle of flooded evaporation with external circulation.

The module-welded heat exchanger plates, made from AISI 304 stainless steel (other materials on request), are clamped together between the pressure plates using clamping bolts and attached to the upper carrying rod and the lower guide rail. The individual plate modules are sealed with elastomer ring seals on the refrigerant side and with elastomer field seals (free from adhesive) on the cooling medium side.

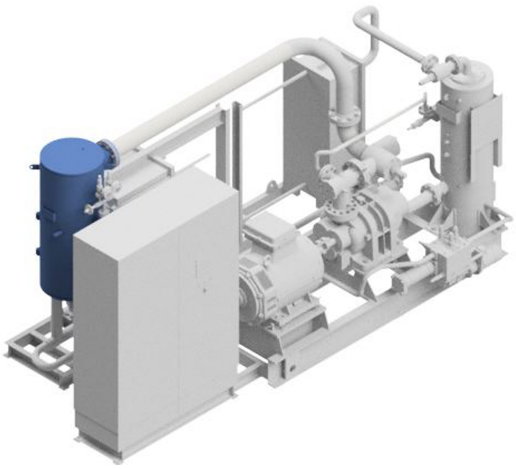


Fig.7: Position of the liquid separator

Liquids are effectively separated in the liquid separator.

The evaporator in the operating state is flooded with ammonia up to the height of the upper sight glass in the circulation line.

Non-soluble heavier oil is deposited in the oil dome and returns from there under automatic control to the compressor or compressors. For further details, refer to the section on the oil return system.

In the case of external condensing systems, a maximum level indicator is installed in the liquid separator to provide additional protection against overfilling.

The suction pressure and secondary refrigerant outlet temperature are monitored to provide reliable protection against freezing of the evaporator.

The liquid separator and suction line are supplied with water vapour diffusion-proof insulation.

Design, manufacture and acceptance comply with the requirements of the pressure appliances directive.

The documentation for the evaporator / liquid separator (operating manual, acceptance certificate) is an integral part of the product documentation.

Position of the suction line

For design type “O” of the evaporator (chiller as evaporator unit):

Prevent back condensation and liquid refrigerant in the suction line in front of the compressor by comply with the following requirements for installation!

The horizontal part of the suction line should be (slightly) tilted towards the liquid separator / evaporator (0° < α < 30°). Depending on the engine room and evaporation temperature, the suction line should be insulated as follows:

$t_{evaporation} > t_{machine\ room} + 10\ K \rightarrow$ suction line insulation (1.)

$t_{evaporation} > t_{machine\ room} + 15\ K \rightarrow$ suction line insulation (1.) and installation of a trace heating at the vertical part of the suction line in front of the compressor (2.)

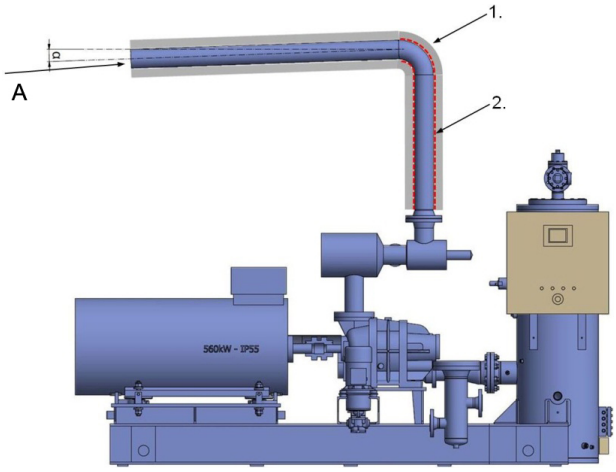


Fig.8: Position of the suction line

1	Suction line insulation
2	Trace heating
A	from liquid separator / evaporator

3.3.5 Condenser with expansion valve

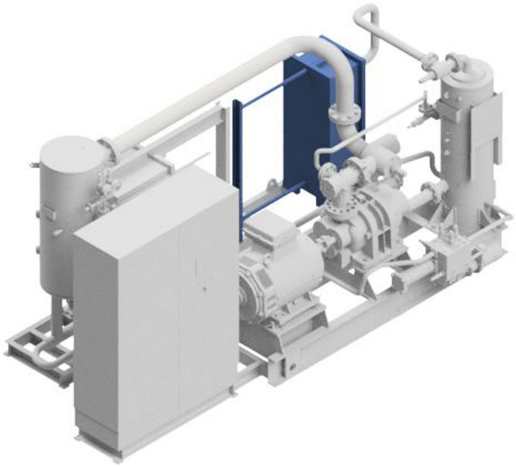


Fig.9: Position of the condenser

In the condenser, the compressed refrigerant vapour is heated, liquefied and possibly supercooled by dissipating the heat energy absorbed to the heating medium (heating).

The expansion valve relieves the condensed refrigerant of the condensation pressure on suction pressure.

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

3.3.6 Oil separator

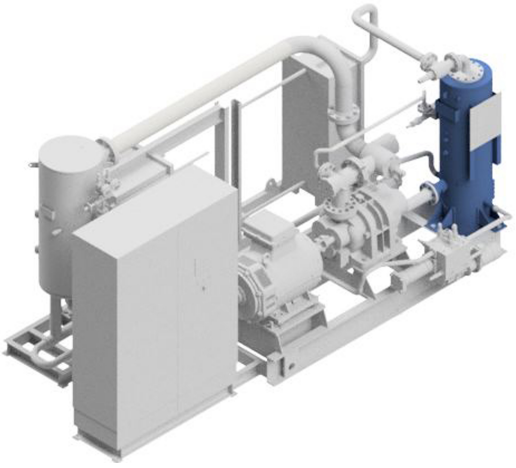


Fig.10: Arrangement of the oil separator

The design of the oil separators is standardised and features low oil carry-over and low oil consumption.

The oil separator is mounted horizontally in the chillers with the M-series compressors.

For chillers with LT series compressors, the oil separator is mounted vertically.

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

Oil heater

Electric oil heaters are built into the oil separator to pre-heat the oil refrigerant mixture in the oil separator during the standstill of the chiller. The oil heater prevents condensation of the refrigerant into the oil and, thus, any foaming of the oil during start-up.

Oil heaters are equipped with:

- **Temperature controller** to maintain a constant oil temperature in the oil separator

  (adjustable from 20 °C to 150 °C, pre-set at 60 °C)

- **Temperature limiter** in case of faults, e.g. protection against dry running

  (permanently set to 150 °C)

The oil heater is switched on when the chiller is stopped and is switched off automatically on starting. A manual switch-off for long standstill periods is recommended.

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

3.3.7 Oil cooler

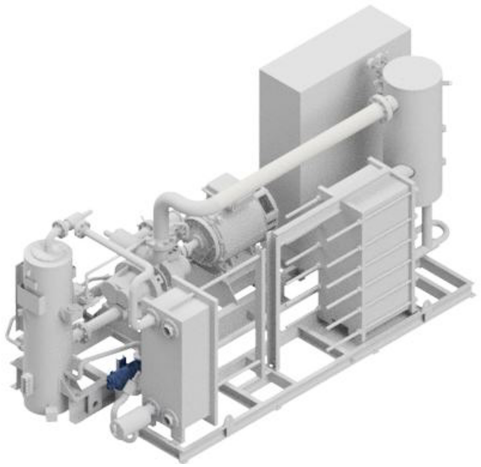


Fig.11: Arrangement of the oil cooler

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 design pressure higher than 40 bar).

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

3.3.9 Oil pump

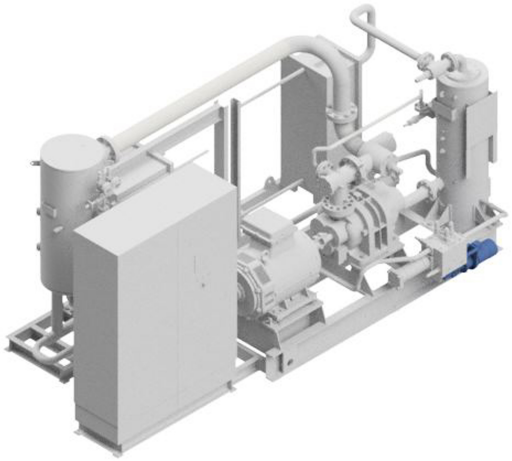


Fig.12: Arrangement of the oil pump

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 bearing, balance piston and packing gland 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 Control

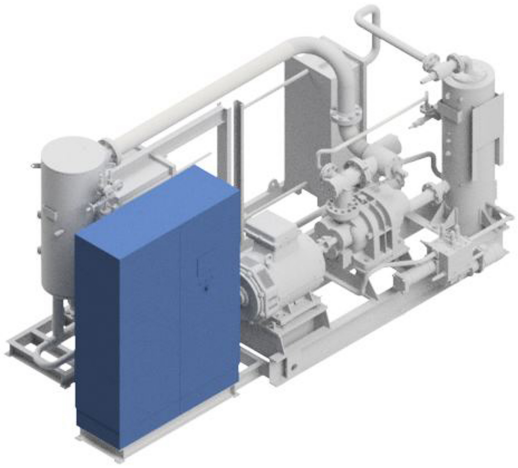


Fig.13: Position of the controller

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.

3.3.12 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.

3.3.13 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.

3.3.14 Safety devices for pressure limitation

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

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

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

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

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

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

Notice

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

► the calculation of the dimensioning of the blow-off pipes upstream of the safety valve,

► the safe discharge of refrigerant when the pressure relief device responds.

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

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

3.3.15 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.14: GEA Omni exterior view without indicator lights

Fig.15: 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.16: 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 [11]	digital	• Run compressor • Run external oil pump [11] • Confirm malfunction
analogue (4-20 mA)	• Motor current compressor drive motor • Speed compressor drive motor [12]	analogue (4-20 mA)	• Compressor drive motor speed setpoint [12]

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

11 If fitted.
12 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 [13] • Eco-level [13] • Gas sensor • Discharge pressure safety switch • min. oil level [14] • max. oil level [14] • Level of refrigerant top / bottom [13]	digital:	• Solenoid valve capacity control max. [15] • Solenoid valve capacity control min.[15] • Solenoid valves capacity control [16] • Solenoid valve check valve suction side [13], [15] • Solenoid valves Vi-control [13], [15] • Solenoid valve economizer operation[13] • Solenoid valve start-up unloading [13] • Solenoid valves, oil return • Solenoid valve low pressure-high pressure relief [11] • Solenoid valve oil return from fine oil filter stage [11]
analogue (4-20 mA)	• Control / primary slide position[15] • Vi / control slide stop position [13], [15] • suction pressure • discharge pressure • Oil pressure • Pressure after oil filter[15] • Crankcase pressure [16] • Evaporating pressure [17] • Suction temperature • Discharge temperature • Oil temperature • Oil temperature oil separator sump [11] • Oil temperature compressor on / off [18] • Eco temperature[11] • Eco pressure[11] • Secondary refrigerant temperature on/off [19] • Inlet temp. refrigerant low pressure cooling system [20]	analogue (4-20 mA)	• Setpoint level control [13] • Setpoint IntelliSOC injection valve [13] • Setpoint motor valve suction line [11] • Setpoint motor valve remote condenser control[11] • Setpoint motor valve hot gas bypass start-up unloading[11]

13 The signals refer in part to optional features (not available for all products).
14 For screw compressor, optional.
15 Depends on compressor type.
16 For reciprocating compressor.
17 For heat pumps with motor valve on the suction side.
18 For heat pumps with reciprocating compressor.
19 For heat pumps with water/saltwater-based heat sources.
20 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 [21] • Heat carrier / cooling medium temperatures [22]	

21 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).

22 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

All data are subject to change and only for the first overview.

► All of the figures and data are for the standard equipment of GEA Grasso products. (Special) options, such as Economizer vessels and oil separators, can have a corresponding affect on the charging quantities, dimensions and weights.
► GEA Refrigeration Germany GmbH reserves the right to make technical changes or change supplier during the course of further development of the products covered by this product information.
► Illustrations and drawings in this product information are simplified representations.
► The technical data and dimensions are subject to change. No claims can be made on the basis of them.
► More accurate details shall be provided by the respective technical proposal for one of the products listed.

5.1.1 GEA Grasso FX PP 200 ... series GEA Grasso FX PP 350

Notice

The data is applicable to the following conditions:

► **Temperature of the secondary refrigerant + 12°C / + 6°C**
► **Temperature of the refrigerant + °C / + 32°C**

Data may differ in other conditions.

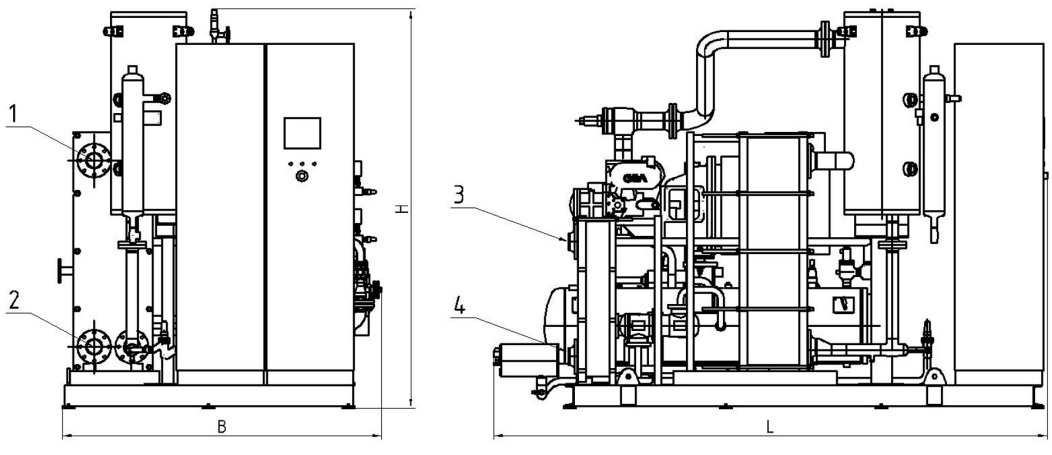


Fig.17: GEA Grasso FX PP 200 ... GEA Grasso FX PP 350

1	Secondary refrigerant outlet
2	Secondary refrigerant inlet
3	Cooling medium outlet
4	Cooling medium inlet

Characteristics					
Parameter		**GEA Grasso FX PP ... chillers with M series compressors**			
		200[23]	**250** [23]	**300**[23]	**350**[23]
Length	mm	2200	2200	2600	2600
Width	mm	1800	1800	2000	2000
Height	mm	2200	2200	2400	2400
Connection Cold water IN	DN	100	100	100	100
Connection Cold water OUT	DN	100	100	100	100
Connection Cooling water ON	DN	100	100	100	100
Connection Cooling water OFF	DN	100	100	100	100
Connection safety valve Blow-off line	DN	25	25	25	25
Connection oil cooler	Inch	1 1/2	1 1/2	1 1/2	1 1/2
Power supply	kW	55	55	75	75
Weight without charging	kg	3300	3400	3500	3600
Operating weight	kg	3450	3550	3650	3750
Filling quantity (Oil)	l	80	80	80	80
Charge (Refrigerant $NH_{3)}$	kg	29	30	31	32

23 subject to technical changes

5.1.2 GEA Grasso FX PP 450 ... series GEA Grasso FX PP 900

Notice

The data is applicable to the following conditions:

- ► **Temperature of the secondary refrigerant + 12°C / + 6°C**
- ► **Temperature of the refrigerant + °C / + 32°C**

Data may differ in other conditions.

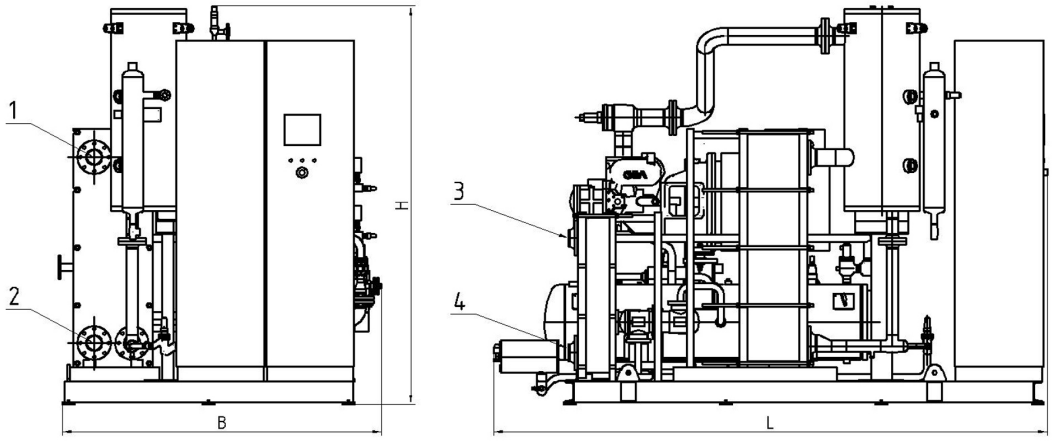


Fig.18: GEA Grasso FX PP 450 ... GEA Grasso FX PP 900

1	Secondary refrigerant outlet
2	Secondary refrigerant inlet
3	Cooling medium outlet
4	Cooling medium inlet

Characteristics					
Parameter		**GEA Grasso FX PP ... chillers with M series compressors**			
		450 [24]	**550** [24]	**650** [24]	**900** [24]
Length	mm	3900	4000	4200	4400
Width	mm	2200	2200	2300	2300
Height	mm	2450	2450	2650	2650
Connection Cold water IN	DN	100	100	100	100
Connection Cold water OUT	DN	100	100	150	150
Connection Cooling water ON	DN	100	100	100	100
Connection Cooling water OFF	DN	100	100	150	150
Connection safety valve Blow-off line	DN	25	25	25	25
Connection oil cooler	Inch	1 1/2	1 1/2	1 1/2	1 1/2
Power supply	kW	110	132	160	200

24 subject to technical changes

Characteristics					
Parameter		**GEA Grasso FX PP ... chillers with M series compressors**			
		450 [24]	**550** [24]	**650** [24]	**900** [24]
Weight without charging	kg	4700	5000	7100	7800
Operating weight	kg	4950	5300	7400	8150
Filling quantity (Oil)	l	90	90	120	120
Charge (Refrigerant $NH_{3)}$	kg	72	75	95	100

24 subject to technical changes

5.1.3 GEA Grasso FX PP 800 ... series GEA Grasso FX PP 2800

Notice

The data is applicable to the following conditions:

- ► **Temperature of the secondary refrigerant + 12°C / + 6°C**
- ► **Temperature of the refrigerant + °C / + 32°C**

Data may differ in other conditions.

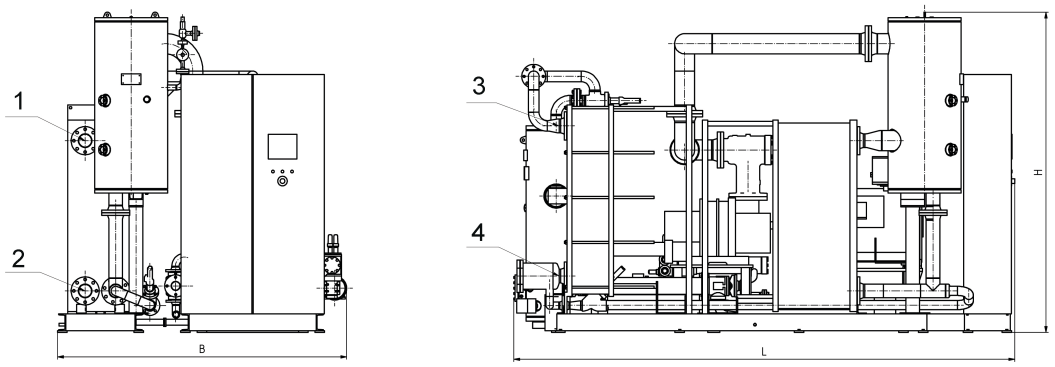


Fig.19: GEA Grasso FX PP 800 ... GEA Grasso FX PP 2800

1	Secondary refrigerant outlet
2	Secondary refrigerant inlet
3	Cooling medium outlet
4	Cooling medium inlet

Characteristics									
Parameter		**GEA Grasso FX PP ... chillers with LT series compressors**							
		800 [25]	**1100** [25]	**1300** [25]	**1500** [25]	**1700** [25]	**2000** [25]	**2400** [25]	**2800** [25]
Length	mm	4200	4500	4500	5000	5500	6000	6700	7000
Width	mm	2300	2450	2600	2600	2700	2900	3000	3000
Height	mm	2700	2700	2700	2700	3100	3500	3500	3500
Connection Cold water IN	DN	150	150	150	150	200	200	200	200
Connection Cold water OUT	DN	150	150	150	150	200	200	200	200
Connection Cooling water ON	DN	150	150	150	150	200	200	200	200
Connection Cooling water OFF	DN	150	150	150	150	200	200	200	200
Connection safety valve Blow-off line	DN	25	25	25	25	25	25	25	25
Connection oil cooler	Inch	1 1/2	1 1/2	1 1/2	1 1/2	2	2	2	2
Power supply	kW	200	250	315	315	355	400	450	560
Weight without charging	kg	8400	9000	9500	10000	12000	13000	15000	18000
Operating weight	kg	8750	9500	10100	10800	12900	14200	16400	19600

25 subject to technical changes

Characteristics									
Parameter		**GEA Grasso FX PP ... chillers with LT series compressors**							
		800 [25]	**1100** [25]	**1300** [25]	**1500** [25]	**1700** [25]	**2000** [25]	**2400** [25]	**2800** [25]
Filling quantity (Oil)	l	150	160	160	160	210	210	260	270
Charge (Refrigerant $NH_{3)}$	kg	83	130	150	190	240	300	370	450

25 subject to technical changes

5.1.4 GEA Grasso FX PP 3300 ... series GEA Grasso FX PP 8000

Notice

The data is applicable to the following conditions:

- ► **Temperature of the secondary refrigerant + 12°C / + 6°C**
- ► **Temperature of the refrigerant + °C / + 32°C**

Data may differ in other conditions.

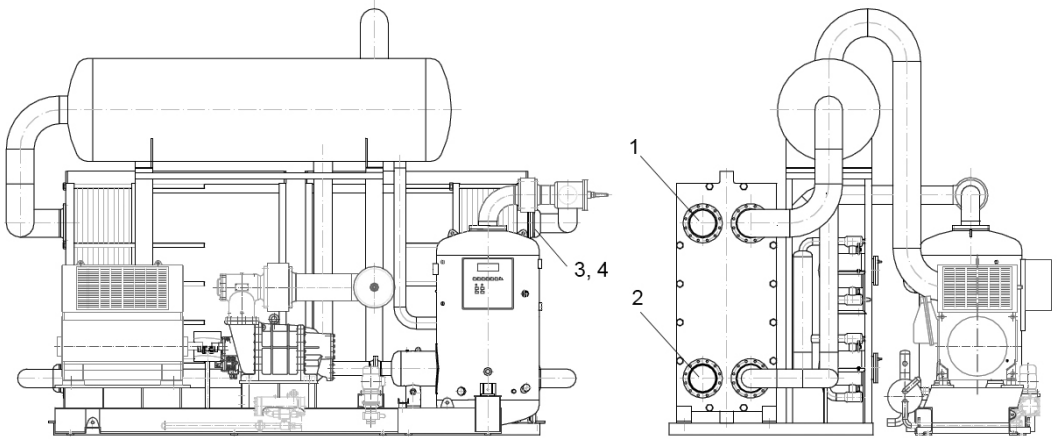


Fig.20: GEA Grasso FX PP 3300 ... GEA Grasso FX PP 8000

1	Secondary refrigerant outlet
2	Secondary refrigerant inlet
3	Cooling medium outlet
4	Cooling medium inlet (not shown in the picture)

Characteristics							
Parameter		**GEA Grasso FX PP ... chillers with LT series compressors**					
		3300 [26]	**4200** [26]	**5000** [26]	**5800** [26]	**7000**[26]	**8000** [26]
Length	mm	6800	7000	7500	8000	9000	9000
Width	mm	3300	4000	4500	4500	5000	5000
Height	mm	5000	5000	5000	5000	5500	5500
Connection Cold water IN	DN	200	200	300	300	300	300
Connection Cold water OUT	DN	200	200	300	300	300	300
Connection Cooling water ON	DN	200	200	300	300	200	200
Connection Cooling water OFF	DN	200	200	300	300	200	200
Connection safety valve Blow-off line	DN	50	50	50	50	65	65
Connection oil cooler	Inch	50	50	65	65	65	65
Power supply	kW	630	850	1000	1200	1400	1600
Weight without charging	kg	22000	25000	27500	30000	32000	34000
Operating weight	kg	24000	27000	29700	32500	34500	37000

26 subject to technical changes

Characteristics							
Parameter		**GEA Grasso FX PP ... chillers with LT series compressors**					
		3300 [26]	**4200** [26]	**5000** [26]	**5800** [26]	**7000**[26]	**8000** [26]
Filling quantity (Oil)	l	300	550	680	750	800	950
Charge (Refrigerant $NH_{3)}$	kg	450	450	750	800	800	850

26 subject to technical changes

5.1.5 GEA Grasso FX LP, VP 200 ... size GEA Grasso FX LP, VP 350

Notice

The data is applicable to the following conditions:

- ► **Temperature of the secondary refrigerant + 12°C / + 6°C**
- ► **Condensation temperatures from + 35 °C (VP) or + 45 °C (LP)**

Data may differ in other conditions.

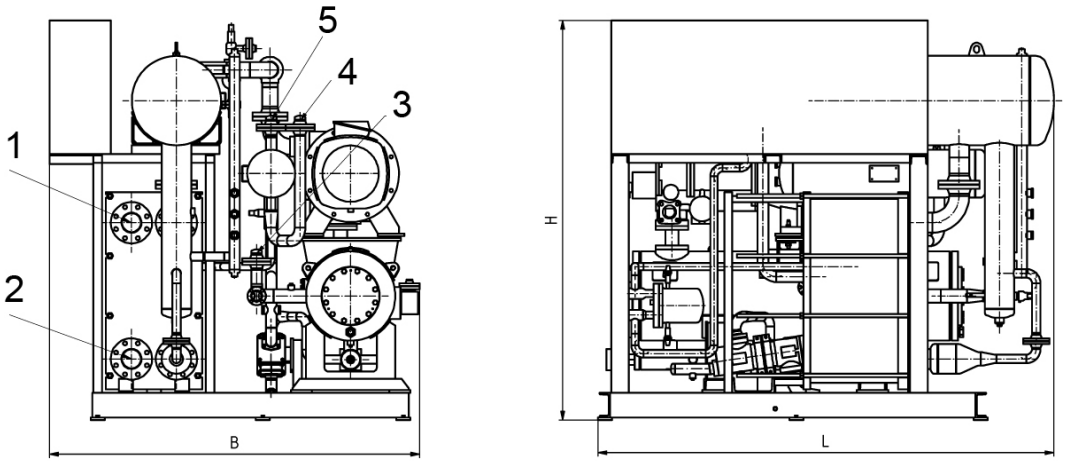


Fig.21: GEA Grasso FX LP, VP 200 ... GEA Grasso FX LP, VP 350

1	Secondary refrigerant outlet
2	Secondary refrigerant inlet
3	Hot gas outlet
4	Liquid inlet
5	Pressure compensation

Characteristics					
Parameter		**GEA Grasso FX LP, VP ... chillers with M series compressors**			
		200[27]	**250** [27]	**300**[27]	**350**[27]
Length	mm	2200	2200	2400	2400
Width	mm	2000	2000	2000	2000
Height	mm	2200	2200	2400	2400
Connection Cold water	DN	100	100	100	100
Connection Pressure line	DN	50	50	50	50
Connection Liquid line	DN	32	32	32	32
Connection Gas recirculation line	DN	25	25	25	25
Electrical connection (LP)	kW	75	75	90	90
Electrical connection (VP)	kW	55	55	75	90
Weight without charging	kg	2900	3000	3100	3200

27 subject to technical changes

Characteristics					
Parameter		**GEA Grasso FX LP, VP ... chillers with M series compressors**			
		200[27]	**250** [27]	**300**[27]	**350**[27]
Operating weight	kg	3100	3200	3300	3400
Filling quantity (Oil)	l	80	80	80	80
Charge (Refrigerant $NH_{3)}$	kg	40	41	42	43

27 subject to technical changes

5.1.6 GEA Grasso FX LP, VP 450 ... size GEA Grasso FX LP, VP 900

Notice

The data is applicable to the following conditions:

- ► **Temperature of the secondary refrigerant + 12°C / + 6°C**
- ► **Condensation temperatures from + 35 °C (VP) or + 45 °C (LP)**

Data may differ in other conditions.

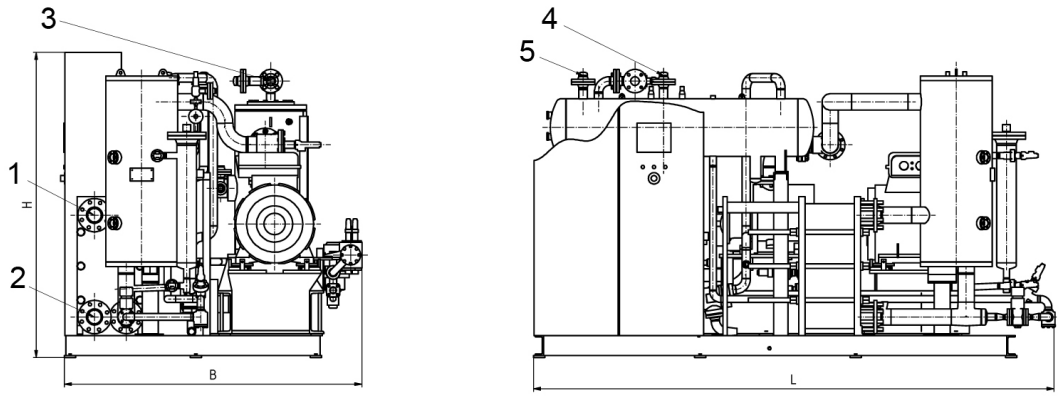


Fig.22: GEA Grasso FX LP, VP 450 ... GEA Grasso FX LP, VP 900

1	Secondary refrigerant outlet
2	Secondary refrigerant inlet
3	Hot gas outlet
4	Liquid inlet
5	Pressure compensation

Characteristics					
Parameter		**GEA Grasso FX LP, VP ... chillers with M series compressors**			
		450[28]	**550** [28]	**650** [28]	**900** [28]
Length	mm	3400	3400	3600	3800
Width	mm	2300	2300	2300	2300
Height	mm	2450	2450	2650	2650
Connection Cold water	DN	100	100	100/150	100/150
Connection Pressure line	DN	50	50	60	60
Connection Liquid line	DN	50	50	65	65
Connection Gas recirculation line	DN	50	50	50	50
Electrical connection (LP)	kW	132	160	200	250
Electrical connection (VP)	kW	110	132	160	200
Weight without charging	kg	4200	4500	5500	6500
Operating weight	kg	4450	4800	5770	6800

28 subject to technical changes

Characteristics					
Parameter		**GEA Grasso FX LP, VP ... chillers with M series compressors**			
		450[28]	**550** [28]	**650** [28]	**900** [28]
Filling quantity (Oil)	l	90	90	120	120
Charge (Refrigerant $NH_{3)}$	kg	95	98	103	110

28 subject to technical changes

5.1.7 GEA Grasso FX LP, VP 800 ... size GEA Grasso FX LP, VP 2800

Notice

The data is applicable to the following conditions:

- ► **Temperature of the secondary refrigerant + 12°C / + 6°C**
- ► **Condensation temperatures from + 35 °C (VP) or + 45 °C (LP)**

Data may differ in other conditions.

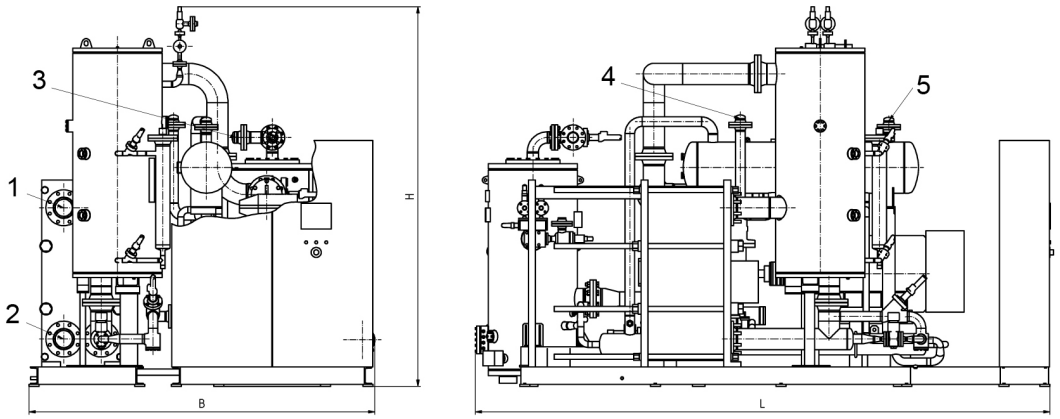


Fig.23: GEA Grasso FX LP, VP 800 ... GEA Grasso FX LP, VP 2800

1	Secondary refrigerant outlet
2	Secondary refrigerant inlet
3	Hot gas outlet
4	Liquid inlet
5	Pressure compensation

Characteristics									
Parameter		**GEA Grasso FX LP, VP ... chillers with LT series compressors**							
		800[29]	**1100** [29]	**1300** [29]	**1500** [29]	**1700** [29]	**2000** [29]	**2400** [29]	**2800** [29]
Length	mm	3800	4000	4200	4600	4500	5000	5400	6000
Width	mm	2300	2600	2600	2600	2700	2900	3000	3000
Height	mm	2900	2900	2900	2900	3500	3500	3500	3500
Connection Cold water	DN	150	150	150	150	200	200	200	200
Connection Pressure line	DN	65	80	80	80	100	100	125	150
Connection Liquid line	DN	50	65	80	80	100	100	100	100
Connection Gas recirculation line	DN	50	50	65	65	80	80	80	80
Electrical connection (LP)	kW	250	315	355	400	450	500	560	630
Electrical connection (VP)	kW	200	250	315	315	355	400	450	560
Weight without charging	kg	6100	6900	7600	8700	10000	11500	13000	15000
Operating weight	kg	6400	7350	8100	9300	10800	12500	15000	17300

29 subject to technical changes

Characteristics									
Parameter		**GEA Grasso FX LP, VP ... chillers with LT series compressors**							
		800[29]	**1100** [29]	**1300** [29]	**1500** [29]	**1700** [29]	**2000** [29]	**2400** [29]	**2800** [29]
Filling quantity (Oil)	l	150	160	160	160	210	210	260	270
Charge (Refrigerant $NH_{3)}$	kg	130	160	200	240	270	300	350	400

29 subject to technical changes

5.1.8 GEA Grasso FX LP, VP 3300 ... size GEA Grasso FX LP, VP 8000

Notice

The data is applicable to the following conditions:

- ► **Temperature of the secondary refrigerant + 12°C / + 6°C**
- ► **Condensation temperatures from + 35 °C (VP) or + 45 °C (LP)**

Data may differ in other conditions.

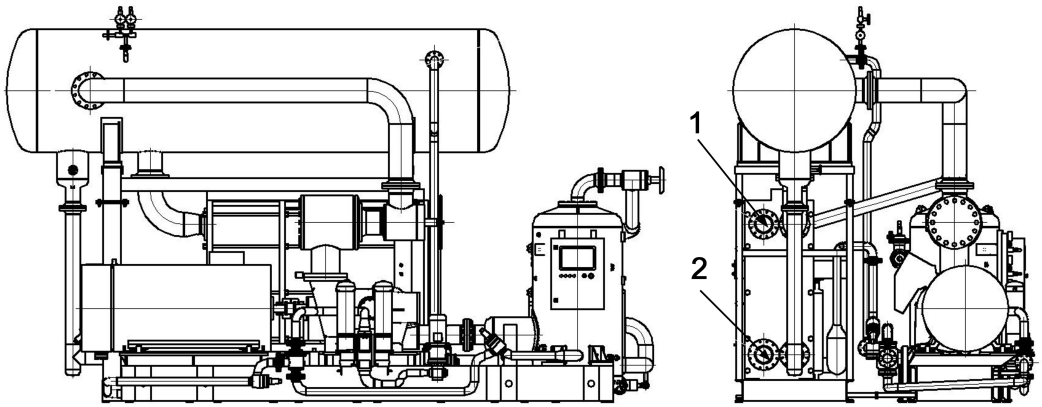


Fig.24: GEA Grasso FX LP, VP 3300 ... GEA Grasso FX LP, VP 8000

1	Secondary refrigerant outlet
2	Secondary refrigerant inlet

Characteristics					
Parameter		**GEA Grasso FX LP, VP ... chillers with LT series compressors**			
		3300 [30]	**4200** [30]	**5000** [30]	**5800** [30]
Length	mm	6200	6500	7000	7500
Width	mm	3500	4000	4500	4500
Height	mm	5000	5000	5000	5000
Connection Cold water	DN	200	200	300	300
Electrical connection (LP)	kW	710	1100	1300	1500
Electrical connection (VP)	kW	630	850	1000	1200
Weight without charging	kg	18000	23200	24300	24600
Operating weight	kg	21000	25200	26600	27100
Filling quantity (Oil)	l	500	550	680	750
Charge (Refrigerant $NH_{3)}$	kg	420	450	550	650

30 subject to technical changes

5.2 Operation limits

The **GEA Grasso FX P** series chillers for flooded evaporation can be operated within the specified operating 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.

Operation limits				
Parameter		Unit	Value	
Refrigerant				NH_3
Speed	n	rpm	min	1500
			max	4500
Suction pressure	p_0	bar (a)	min max	0.7 11.6
Outlet temperature of water as secondary refrigerant	t_{WA}	°C	min max	+ 1 +35
Outlet temperature with frost-resistant secondary refrigerants	t_{WA}	°C	min max	- 40 + 35
Discharge pressure	p	bar (a)	min max	8.0 20.3
Condenser inlet temperature of cooling medium	t_{Kwe}	°C	min max	10 48
Condensing temperature	t	°C	min max	18 45
Discharge temperature[31]	t_1	°C	min max	50 100
Pressure ratio (p_c/p_0) [32]	π	-	min	2
Pressure difference (p_c-p_0) [33]	Δp	bar	min	4

31 The minimum compressor discharge temperature t1 must be 25 K above condensing temperature t and in addition, 25 K above the oil temperature for supply to the bearings for compressors with journal bearings.
32 Gas vibration protection required for π ≥ 8 only.
33 The specified 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.

Notes

- When considering a specific application, all the conditions specified in the table must be taken into account.
- If the specified limits are exceeded for a specific application, the manufacturer must be consulted.
- 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.).
- The oil temperature at the compressor inlet must be least 18 °C.
- Ensure that the oil viscosity will be ≥ 7 cSt at n = 3000 rpm and ≥ 10 cSt at n = 1500 rpm for the oil supply to bearings. Take into account the drop in viscosity due to refrigerant dissolved in the oil!
- 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 field test.

5.3 Water quality requirements, parameters

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

Notice

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

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

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

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

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

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

Notice

Recommended with use of plate heat exchangers

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

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

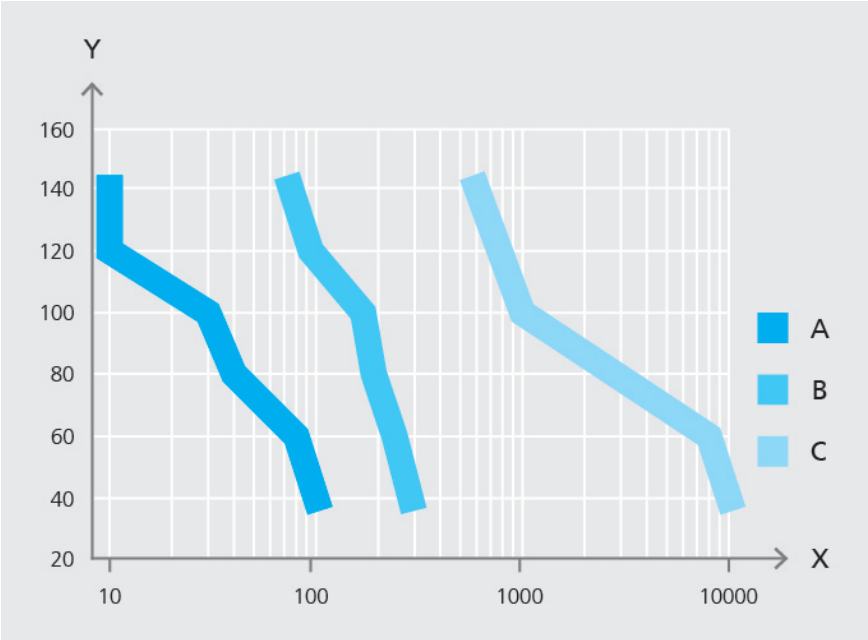


Fig.25: Corrosion resistance in presence of chlorides

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

Notice

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

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

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

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

5.4 Performance characteristics

Notice

The output of the chiller depends on different parameters, for example:

- the temperature regime,
- the efficiency of the heat exchanger used,
- the compressor speed,
- the condenser design.

► The contact person at GEA Refrieration Germany GmbH will be pleased to prepare a technical offer.

5.5 Sound pressure level

Measuring-surface sound pressure level

Distance to the machine surface: 1 m (A-sound level at free field conditions on reflecting surface) for Liquid Chillers (1 compressor and 1 drive motor)

Determining the measured values:

- Without secondary sound insulation.
- Reduce the above mentioned values by 25-30 dB in case of totally machine casing.

Notice

Measuring-surface sound-pressure level strongly depends on the type of the chiller and especially on the type of the drive motor (manufacturer, type, protection type).

► Because of this the values are guide values, which have to be confirmed by the technical specifications of the project.

Measuring-surface sound pressure level for chillers with compressor frame size C ... N								
Motor	**Compressor frame size ... / chiller frame size GEA Grasso FX P ...**							
at 40 °C P_e in kW	**C / 200**	**D / 250**	**E / 300**	**G / 350**	**H / 450**	**L / 550**	**M / 650**	**N / 900**
45	78	78	78	78	78	78		
55	78	78	78	78	78	78	78	
75	79	79	79	79	79	79	79	79
90		80	80	80	80	80	80	80
110			80	80	80	80	80	80
132				81	81	81	81	81
160					83	83	83	83
200						84	84	84
250							85	85

Measuring-surface sound pressure level for chillers with compressor frame size P ... Z								
Motor	**Compressor frame size ... / chiller frame size GEA Grasso FX P ...**							
at 40 °C P_e in kW	**P/ 800**	**R / 1100**	**S / 1300**	**T / 1500**	**V / 1700**	**W / 2000**	**Y / 2400**	**Z / 2800**
160	82							
200	83	83						
250	83	83	83					
315		84	84	84	84	84		
355			85	85	85	85	85	
400				85	85	85	85	85
450					85	85	85	85
500							86	86
560							86	86
630							87	87
700								87
710								87
800								87

Measuring-surface sound pressure level for chillers with compressor frame size XA ... XF				
Motor	**Compressor frame size ... / chiller frame size GEA Grasso FX P ...**			
at 40 °C P_e in kW	**XA / 3300**	**XB / 4200**	**XC / 4800**	**XD / 5800**
450	85			
500	86	86		
560	86	86	86	
630	87	87	87	
700	87	87	87	87
710	87	87	87	87
800	87	87	87	87
900	88	88	88	88
1100		89	89	89
1600			90	90

5.6 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.

Significant reduction in noise can be achieved through noise protection measures such as motor encapsulation or complete noise reducing housing for the chiller.

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).

Sound power level L_{WA}					
Compressor drive motor IP23 at 40 °C Pe in kW		**Chiller / theoretical swept volume in m^3/h at 2940 rpm L_{WA} in dB(A) mains operation 400 V/ 50 Hz**			
	GEA Grasso	**FX P 200 231**	**FX P 250 265**	**FX P 300 321**	**FX P 350 372**
22	Max	91	91	91	
	Min	84	84	84	
30	Max	92	92	92	92
	Min	85	85	85	85
37	Max	93	93	93	93
	Min	86	86	86	86
45	Max	94	94	94	94
	Min	87	87	87	87
55	Max	95	95	95	95
	Min	88	88	88	88
75	Max	96	96	96	96
	Min	89	89	89	89
90	Max	97	97	97	97
	Min	90	90	90	90
110	Max		98	98	98
	Min		91	91	91
132	Max			98	99
	Min			92	92

Sound power level L_{WA}					
Compressor drive motor IP23 at 40 °C Pe in kW		**Chiller / theoretical swept volume in m^3/h at 2940 rpm L_{WA} in dB(A) mains operation 400 V/ 50 Hz**			
	GEA Grasso	**FX P 450 471**	**FX P 550 544**	**FX P 650 690**	**FX P 800 805**
37	Max	93			
	Min	86			
45	Max	94	94		
	Min	87	87		
55	Max	95	95	95	95
	Min	88	88	88	88
75	Max	96	96	96	96
	Min	89	89	89	89
90	Max	97	97	97	97
	Min	90	90	90	90
110	Max	98	98	98	98
	Min	91	91	91	91
132	Max	99	99	99	99
	Min	92	92	92	92
160	Max	100	100	100	100
	Min	93	93	93	93
200	Max			101	101
	Min			94	94
250	Max				102
	Min				95

Sound power level L_{WA}					
Compressor drive motor IP23 at 40 °C Pe in kW		**Chiller / theoretical swept volume in m^3/h at 2940 rpm L_{WA} in dB(A) mains operation 400 V/ 50 Hz**			
	GEA Grasso	**FX P 900 860**	**FX P 1100 1040**	**FX P 1300 1290**	**FX P 1500 1465**
55	Max	95			
	Min	88			
75	Max	96	96		
	Min	89	89		
90	Max	97	97	97	
	Min	90	90	90	
110	Max	98	98	98	98
	Min	91	91	91	91
132	Max	99	99	99	99
	Min	92	92	92	92
160	Max	100	100	100	100
	Min	93	93	93	93
200	Max	101	101	101	101
	Min	94	94	94	94
250	Max	102	102	102	102
	Min	95	95	95	95
315	Max		103	103	103
	Min		96	96	96
400	Max		104	104	104
	Min		97	97	97
450	Max			104	104
	Min			98	98
500	Max				105
	Min				98
560	Max				105
	Min				99

Sound power level L_{WA}					
Compressor drive motor IP23 at 40 °C Pe in kW		**Chiller / theoretical swept volume in m^3/h at 2940 rpm L_{WA} in dB(A) mains operation 400 V/ 50 Hz**			
	GEA Grasso	**FX P 1700 1640**	**FX P 2000 1996**	**FX P 2400 2296**	**FX P 2800 2748**
110	Max	98			
	Min	91			
132	Max	99	99	99	
	Min	92	92	92	
160	Max	100	100	100	100
	Min	93	93	93	93
200	Max	101	101	101	101
	Min	94	94	94	94
250	Max	102	102	102	102
	Min	95	95	95	95
315	Max	103	103	103	103
	Min	96	96	96	96
400	Max	104	104	104	104
	Min	97	97	97	97
450	Max	104	104	104	104
	Min	98	98	98	98
500	Max	105	105	105	105
	Min	98	98	98	98
560	Max	105	105	105	105
	Min	99	99	99	99
630	Max		105	105	105
	Min		99	99	99
710	Max				105
	Min				99
800					106
					99

Sound power level L_{WA}					
Compressor drive motor IP23 at 40 °C Pe in kW		**Chiller / theoretical swept volume in m^3/h at 2940 rpm L_{WA} in dB(A) mains operation 400 V/ 50 Hz**			
	GEA Grasso	**FX P 3300 3250**	**FX P 4200 4150**	**FX P 5000 4900**	**FX P 5800 8560**
200	Max	101			
	Min	94			
250	Max	102	103		
	Min	95	100		
315	Max	103	104	104	105
	Min	96	100	100	101
400	Max	104	104	104	105
	Min	97	100	100	101
450	Max	104	104	104	105
	Min	98	100	100	101
500	Max	105	105	105	105
	Min	99	100	100	101
560	Max	105	105	105	105
	Min	100	100	100	101
630	Max	105	106	106	106
	Min	99	100	100	101
710	Max	106	106	106	106
	Min	99	100	100	101
800	Max	106	106	106	106
	Min	99	100	100	101
900	Max		107	107	107
	Min		100	100	101
1000	Max			107	107
	Min			100	101

Sound power level L_{WA}					
Compressor drive motor IP23 at 40 °C Pe in kW		**Chiller / theoretical swept volume in m^3/h at 2940 rpm L_{WA} in dB(A) mains operation 400 V/ 50 Hz**			
	GEA Grasso	**FX P 7000 7170**	**FX P 8000 8560**		
400	Max	105	105		
	Min	102	102		
450	Max	105	105		
	Min	102	102		
500	Max	105	105		
	Min	102	102		
560	Max	105	105		
	Min	102	102		
630	Max	106	106		
	Min	102	102		
710	Max	106	106		
	Min	102	102		
800	Max	106	106		
	Min	102	102		
900	Max	107	107		
	Min	102	102		
1000	Max	107	107		
	Min	102	102		

Notice

For chillers in the **GEA Grasso FX Pduo** design, the data from the above table must be added logarithmically for the respective compressor/motor combination.

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

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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