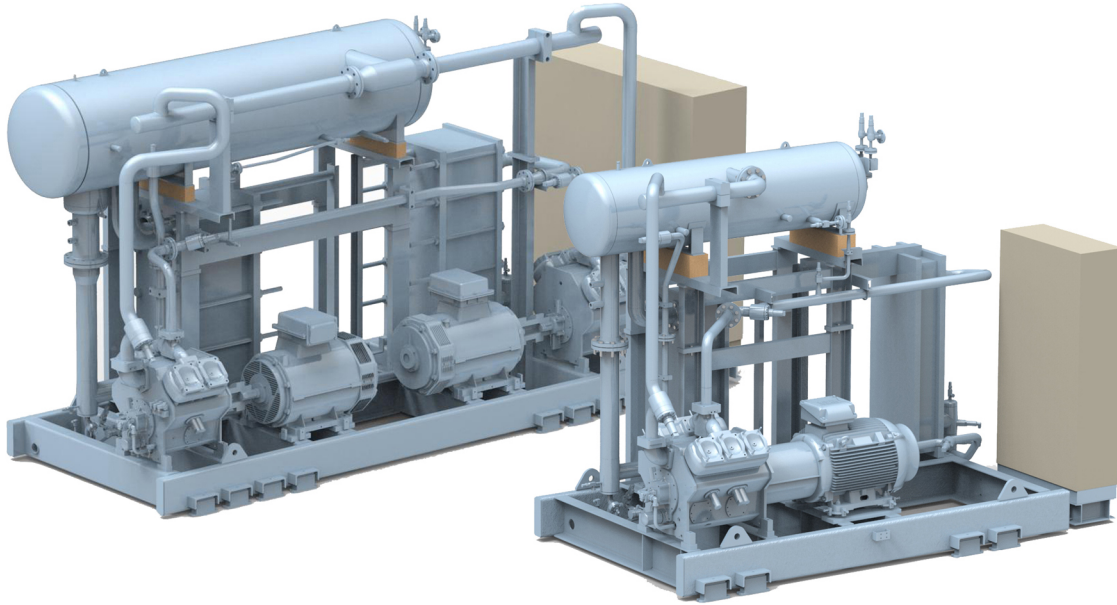


PRODUCT INFORMATION

Original document



GEA Grasso FX GC

Chiller

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- GEA Refrigeration Germany GmbH

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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.

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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

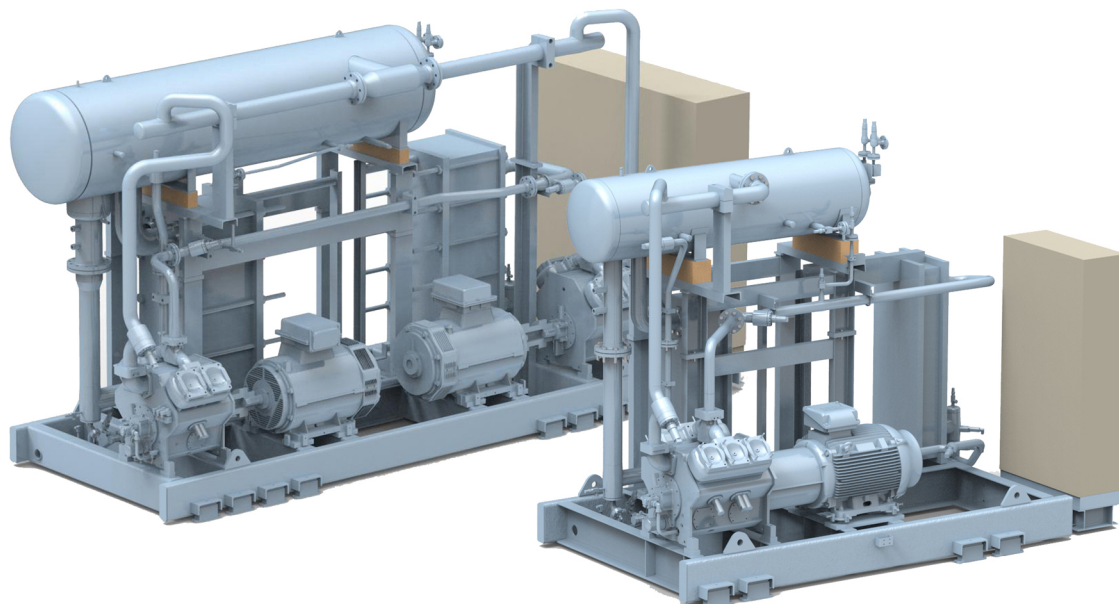


Fig.1: GEA Grasso FX GC PP duo and GEA Grasso FX GC PP chillers

Parameter	Remark
Output range	up to 3,000 kW 12 / 6 °C (secondary refrigerant temperature)
Reciprocating compressor	GEA Grasso V300 - V1800 frame size $V_{th} = 260 \dots 1500 \text{ m}^3/\text{h}$
Chiller	GEA Grasso FX GC PP / GEA Grasso FX GC PP duo
Evaporator type	Plate heat exchanger
Working principle	flooded evaporation
Liquid separator	arranged on the evaporator
Condenser type	Plate heat exchanger
Transport	1 piece or in individual parts or modules

1.2 Scope of delivery

Notice

The **Chiller** is manufactured and delivered according to technical specifications.

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

Description
Scope of delivery

Standard equipment for GEA Grasso FX GC and GEA Grasso FX GC duo	
Designation	Design
Maximum permissible pressure:	Max. 25 bar
Intended environment:	Indoor installation
Ambient temperatures:	+5 °C to +40 °C
Installation altitude:	≤ 1000 m above sea level
Cooling agent temperature ¹	-15 °C/ 6 °C/ 18 °C
Electric motor:	Default scope of delivery IP 23
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:	air-cooled (pipes fully installed)
Oil heater: (in compressor crankcase)	Standard scope of delivery
Oil filter:	Single stage filter
Spare oil filter:	Oil pressure filter cartridge, delivered separately (included)
Oil level switch:	GEA Grasso FX GC: without / GEA Grasso FX GC duo: with
Pressure sensors:	on sensor block compressor
separate push-button switch:	none
Overflow valve HD:	Standard scope of delivery
Safety valve LP:	Safety shuttle valve combination
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 blue), switching cabinet RAL 7035
Vibration isolators:	without (standard)
Approval of pressure equipment:	CE-PED, Module H (piping)
Documentation:	2x paper form + 1 USB stick

Optional equipment	
Designation	Design
Spare oil filter:	available
Communication:	Profibus DP ProfiNet
Electric motor:	IP 55
Flow monitor:	mechanically (paddle)

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

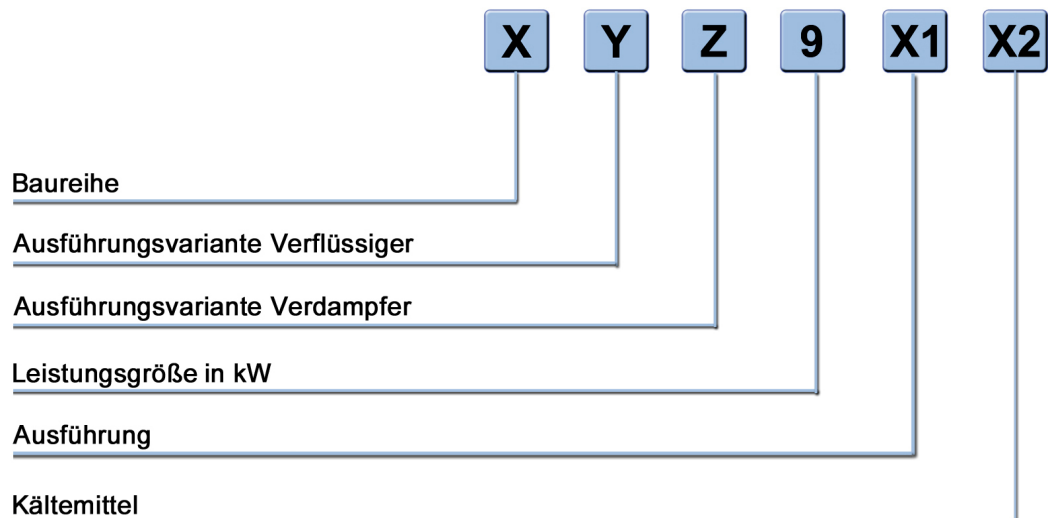
Optional equipment	
Vibration isolators:	available
Approval of pressure equipment:	CE-PED, Module H1 (complete chiller)

Description

Product designation chillers and heat pumps with reciprocating compressors

1.3 Product designation chillers and heat pumps with reciprocating compressors

GEA Grasso FX GC, MX GC and HX GC series



Product code description

Code	Description
X	Chiller / heat pump series
Y	Condenser version
Z	Evaporator version
9	Chiller / heat pump capacity related to cold-water operation 12 °C / 6 °C
X1	Chiller / heat pump version
X2	Refrigerant

X series

Code	Description
FX GCW	Chiller with flooded evaporator
MX GC	Chiller special design with flooded evaporator
HX GC	Heat pump special design ² 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 ³
V	Evaporating condenser ³
O	without condenser ("remote")
X	other design

² Reciprocating compressor 5 HP, V HP, V XHP.

³ 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 chiller)
X	other design

9 Capacity ⁴

Version with 1 compressor

Compressor frame size ⁵	Capacity in kW
35 HP	35
45 HP	45
55 HP	55
65 HP	65
V300	260
V300 T	60
V300 HP	300
V350 XHP	350
V450	400
V450 T	90
V450 HP	450
V550 XHP	550
V600	525
V600 T	120
V600 HP	600
V700	600
V700 T	140
V750 XHP	750
V950 XHP	950
V1100	900
V1100 T	200
V1400	1250
V1400 T	280
V1800	1500
V1800 T	340

- ⁴ Refrigerating capacity (value rounded) V300 and V600 related to cold water operation +12 / +6 °C at 1500 min⁻¹. Refrigerating capacity (value rounded) V700 – V1800 related to cold water operation +12 / +6 °C at 1200 min⁻¹. Refrigerating capacity (value rounded) V300 T – V600 T related to cold water operation -20 / -55 °C at 1500 min⁻¹. Refrigerating capacity (value rounded) V700 T – V1800 T related to cold water operation -20 / -25 °C at 1200 min⁻¹. HX heat pumps with high-pressure pistons 5 HP, V HP and V XHP series are listed on the basis of the compressor frame size.

Description

Product designation chillers and heat pumps with reciprocating compressors

Version with 2 compressor (parallel stage)

Compressor frame size ⁵	Capacity in kW / frame size		Compressor frame size ⁵	Capacity in kW / frame size
2x V300	520		2x 35 HP	2x35
V300 / V450	650		2x 45 HP	2x45
2x V450	800		2x 55 HP	2x55
V450 / V600	900		2x 65 HP	2x65
2x V600	1050		2x V300 HP	2x300
2x V700	1200		2x V350 XHP	2x350
V700 / V1100	1500		2x V450 HP	2x450
2x V1100	1800		2x V550 XHP	2x550
V1100 / V1400	2200		2x V600 HP	2x600
2x V1400	2500		2x V750 XHP	2x750
V1400 / V1800	2750		2x V950 XHP	2x950
2x V1800	3000			

Version with 2 compressor (two-stage) ⁶

LP compressor Frame size ⁵	Capacity in kW / frame size		HP compressor Frame size ⁵	Capacity in kW / frame size
V300	260		35 HP	35
V450	400		45 HP	45
V600	525		55 HP	55
V700	600		65 HP	65
V1100	900		V300 HP	300
V1400	1250		V350 XHP	350
V1800	1500		V450 HP	450
V300 T	60		V550 XHP	550
V450 T	90		V600 HP	600
V600 T	120		V750 XHP	750
V700 T	140		V950 XHP	950
V1100 T	200			
V1400 T	280			
V1800 T	340			

X1 design

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

⁵ The V HS series is not listed separately since there are no design-related differences to the V series.

⁶ The capacity is formed through LP compressor capacity (HP compressor capacity). Example: LP compressor frame size V1400 and HP compressor frame size V600 HP means capacity 1250(1100). HX heat pumps with high-pressure pistons 5 HP, V HP and V XHP series are listed on the basis of the compressor frame size.

X2 refrigerant

Code	Description
NH ₃	Ammonia

Examples of designation

Example	Description
FX GC PP 900 duo NH₃	Chiller with reciprocating compressor (FX GC), with plate heat exchanger as condenser (P), with plate heat exchanger as evaporator (P), capacity 900 kW (900), 2 compressors parallel stage (duo), for refrigerant ammonia (NH₃)
HX GC SS 900(550) T NH₃	Heat pump with reciprocating compressor (HX GC), shell and plate condenser (S), plate heat exchanger (completely welded) as evaporator (S), Capacity LP compressor V1100 with HP compressor V550 XHP (900(550)), 2 compressors two-stage (T), for refrigerant ammonia (NH₃)

2 Components

The following description of the main components and accessories relates to the standard version of the chiller. The actual delivery scope is subject to the "Order-dependent Technical Documentation".

GEA Grasso FX GC PP are chillers for interior operation in machine rooms or in housings for outdoor installation which are assembled and tested in the manufacturer's facilities.

All components are fully mounted. Low-voltage installation with frequency converter and control device are wired.

The chillers can be designed and completed with different types of condenser.

Designation	Design
GEA Grasso FX GC PP	Liquid chiller with water-cooled condenser and closed refrigerant circuit
GEA Grasso FX GC LP	Evaporator set for connection to a single air cooled condenser.
GEA Grasso FX GC VP	Evaporator set for connection to a single air cooled evaporative condenser.

Approval

The chillers are produced in accordance with the valid European regulations (EN, UVV, VDE) or in accordance with the regulations of the destination country.

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

Documentation

Every chiller 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

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 main task of the chillers is to chill liquid secondary refrigerants. They can be used for cooling purposes in a wide variety of applications, e.g.:

- Process engineering
- Air conditioning
- Cold storage and warehousing
- Waste heat usage (e.g. heat pump operation)
- Food and beverage industry
- Laboratories

Water and brines can be used as secondary refrigerants.

Notice

Use only appropriate materials in the secondary refrigerant circuit for the respective application (e.g. corrosion).

► Recommendation: Consultation with GEA Refrigeration Germany GmbH

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.

Distinctive features of the design are a stable supporting frame as well as easily accessible modules.

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

3.2 General mode of operation of chillers and heat pumps

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

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

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

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

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

The refrigerant from the process of the low pressure stage is condensed in the process.

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

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

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

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

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

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

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

3.3 Main components

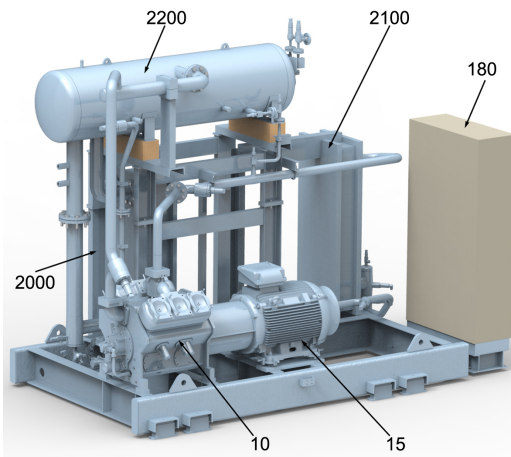


Fig.2: GEA Grasso FX GC PP chiller

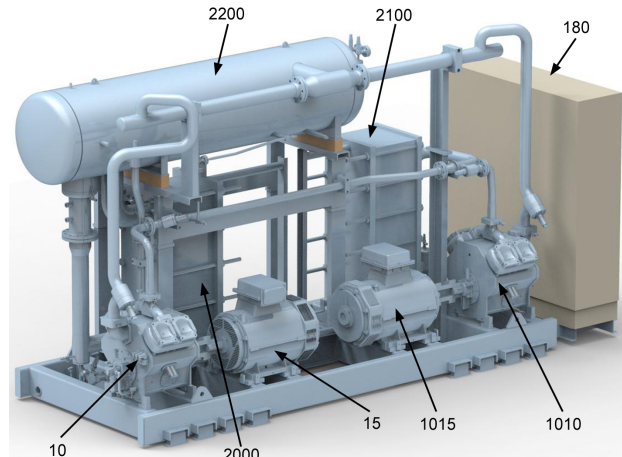


Fig.3: GEA Grasso FX GC PP duo chiller

The chiller packages of the GEA Grasso FX GC PP series are made up of the following main assemblies and components (standard scope of delivery, project-related deviations and optional equipment are possible):

Position	Main assembly, component	Information
10	Reciprocating compressor 1	see installation and maintenance instruction for reciprocating compressor
15	Compressor drive motor 1	See operating manual of the compressor drive motor
1010	Reciprocating compressor 2	see installation and maintenance instruction for reciprocating compressor
1015	Compressor drive motor 2	See operating manual of the compressor drive motor
180	Switching cabinet, control and direction of control	See control documentation
2000	Evaporator	See operating manual of the evaporator
2100	Water cooled condenser	See operating manual of the condenser
2200	Liquid separator	See component documentation

Notice

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

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

3.3.1 Reciprocating compressor

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

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

The compressors are operated with ammonia (NH₃) as the refrigerant.

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

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

The compressors have the following equipment features:

- Start-up load relief
- Capacity control by switching off cylinders and through continuous speed adjustment (optional equipment for FX GC and FX GC duo series chillers)
- Monitoring oil difference pressure
- Oil heater
- Monitoring discharge pressure
- Monitoring suction pressure
- Monitoring crankcase pressure
- Monitoring discharge temperature
- Monitoring oil temperature
- Monitoring suction temperature

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

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

3.3.2 Compressor drive motor

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

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

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

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

3.3.3 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 + liquid separator

Arrangement of the evaporator

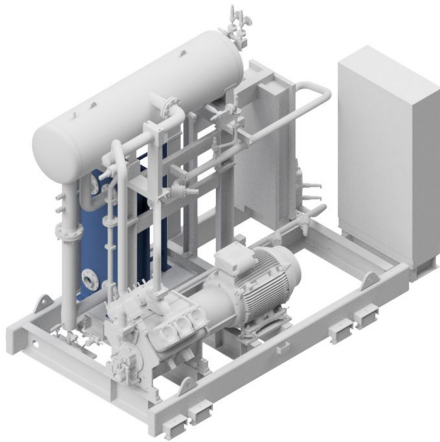


Fig.4: GEA Grasso FX GC PP - evaporator

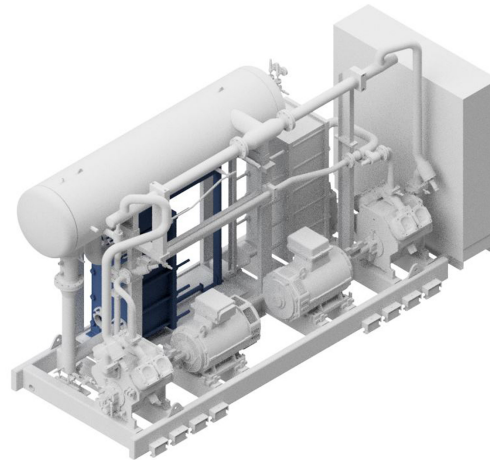


Fig.5: GEA Grasso FX GC PP duo - evaporator

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 / 316L (other materials on request), are clamped together between the stand plate and the pressure plate using clamping bolts and attached to the upper carrying rod and the lower guide rail. The individual plate modules are sealed with ring seals on the refrigerant side and with elastomer field seals, which are free from adhesive, on the secondary refrigerant and coolant sides.

Arrangement of the liquid separator

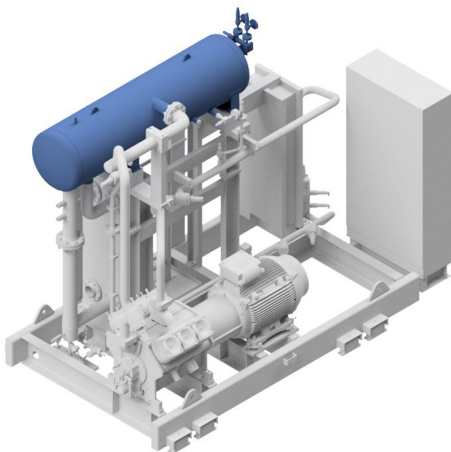


Fig.6: GEA Grasso FX GC PP - liquid separator

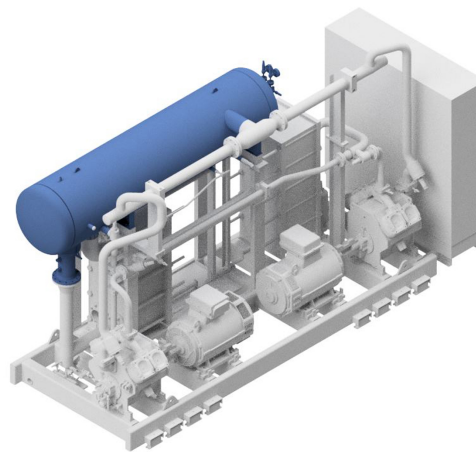


Fig.7: GEA Grasso FX GC PP duo - liquid separator

Liquid drops are effectively separated in the liquid separator which is arranged on the evaporator.

The evaporator in the operating state is flooded with ammonia up to the height of the upper sight glass in the circulation line (item 2555.2).

Non-soluble heavier oil is deposited in the oil sump 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.

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

The evaporator can be optionally provided with a detachable insulation box.

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

There is no evaporator when the chiller is designed as a condensing unit.

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

3.3.5 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).

The module-welded heat exchanger plates, made from AISI 316 stainless steel (other materials on request), are clamped together between the stand plate and the pressure plate using pulling bolts and attached to the upper carrying rod and the lower guiding rod.

If the chillers are designed as evaporator units, the water-cooled condenser is not installed. In this case, the refrigerant circuit is completed by the customer with other condenser types.

The cooling medium inlet is connected at the bottom, the outlet connector is located at the top.

Heat recovery (optional)

Depending on customer requirements, a pre-heater can be installed upstream of the condenser. The pre-heater can be designed as either a pure gas cooler or as a partial condenser. In order to achieve the maximum heat exchange surface in the condenser, the condensed ammonia arriving from the desuperheater (item 2900) should be discharged. From the specific separator/level tank, the liquid-free vapour can flow to the condenser where it is liquefied.

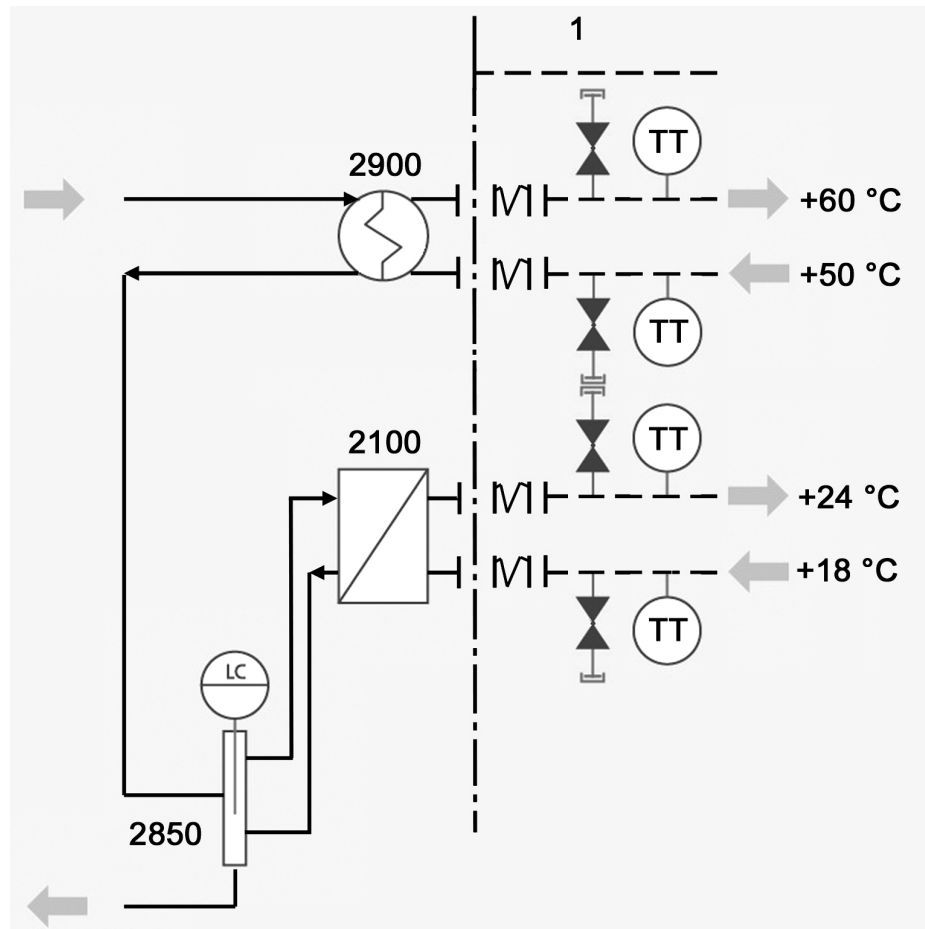


Fig.8: Heat recovery

1	Customer-side
2900	Desuperheater
2100	Condenser
2850	Level indicator

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

3.3.6 Control cabinet with control

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

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

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

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

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

Notice

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

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

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

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

Notice

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

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

3.3.7 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.

3.3.8 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.

3.3.9 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 $\leq$ 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.

3.3.10 Components installed by the client



Warning

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

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

4 GEA Omni control

4.1 Product highlights

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

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

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

GEA Omni advantages at a glance:

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

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

4.2 View



Fig.9: GEA Omni exterior view without indicator lights



Fig.10: GEA Omni exterior view with indicator lights

4.3 Standard function

The GEA Omni supports the following standard functions:

- Display of all important physical and technical parameters, e.g. pressure, temperature, motor current, capacity, number of run hours, operation mode and status signals,

Different parameters and menus are hidden if they are not needed.

- Automatic start/stop of the product and capacity control depending on, for example:
 - Suction pressure
 - Discharge pressure
 - External setpoint value
 - External temperature
 - Network temperature
 - Inlet temperature (evaporator, secondary refrigerant)
 - Outlet temperature (evaporator, secondary refrigerant)
 - Inlet temperature (condenser, secondary refrigerant or heat carrier)
 - Outlet temperature (condenser, secondary refrigerant or heat carrier)
- Monitoring of all operating parameters.

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

4.4 Components of GEA Omni

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



Fig.11: GEA Omni control cabinet interior view (frequency converter installed in control cabinet)

4.5 Input and Output Signals

Low-voltage switchgear - GEA Omni	
from the low-voltage switchgear to the GEA Omni INPUTS	from the GEA Omni to the low-voltage switchgear OUTPUTS
Not applicable if the scope of delivery contains a low-voltage switchgear.	
Input: 100 ... 240 V, 50/60 Hz	
digital - Motor feedback - Motor protection compressor - Feedback external oil pump ⁷	digital - Run compressor - Run external oil pump ⁷ - Confirm malfunction
analogue (4-20 mA) - Motor current compressor drive motor - Speed compressor drive motor ⁸	analogue (4-20 mA) Compressor drive motor speed setpoint ⁸

Remote controller or control system - GEA Omni	
from the remote controller (control system) to the GEA Omni INPUTS	from the GEA Omni to the remote controller (control system) OUTPUTS
digital - 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

⁷ If fitted.

⁸ Only when operated with a frequency converter.

Chiller / heat pump - GEA Omni	
from the cooling system / heat pump to the GEA Omni INPUTS	from the GEA Omni to the cooling system / heat pump OUTPUTS
digital - external EMERGENCY-OFF (or EMERGENCY-STOP) - Separator level ⁹ - Eco-level ⁹ - Gas sensor - Discharge pressure safety switch - min. oil level ¹⁰ - max. oil level ¹⁰ - Level of refrigerant top / bottom ⁹	digital: - Solenoid valve capacity control max. ¹¹ - Solenoid valve capacity control min. ¹¹ - Solenoid valves capacity control ¹² - Solenoid valve check valve suction side ^{9, 11} - Solenoid valves Vi-control ^{9, 11} - Solenoid valve economizer operation⁹ - Solenoid valve start-up unloading ⁹ - Solenoid valves, oil return - Solenoid valve low pressure-high pressure relief ⁷ - Solenoid valve oil return from fine oil filter stage ⁷
analogue (4-20 mA) - Control / primary slide position¹¹ - Vi / control slide stop position ^{9, 11} - suction pressure - discharge pressure - Oil pressure - Pressure after oil filter¹¹ - Crankcase pressure ¹² - Evaporating pressure ¹³ - Suction temperature - Discharge temperature - Oil temperature - Oil temperature oil separator sump ⁷ - Oil temperature compressor on / off ¹⁴ - Eco temperature⁷ - Eco pressure⁷ - Secondary refrigerant temperature on/off ¹⁵ - Inlet temp. refrigerant low pressure cooling system ¹⁶	analogue (4-20 mA) - Setpoint level control ⁹ - Setpoint IntelliSOC injection valve ⁹ - Setpoint motor valve suction line ⁷ - Setpoint motor valve remote condenser control⁷ - Setpoint motor valve hot gas bypass start-up unloading⁷

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

¹⁰ For screw compressor, optional.

¹¹ Depends on compressor type.

¹² For reciprocating compressor.

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

¹⁴ For heat pumps with reciprocating compressor.

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

¹⁶ For heat pumps with a heat source of NH₃-condensation of the low pressure cooling system.

Chiller / heat pump - GEA Omni	
from the cooling system / heat pump to the GEA Omni INPUTS	from the GEA Omni to the cooling system / heat pump OUTPUTS
• Outlet temp. refrigerant low pressure cooling system ¹⁷ • Heat carrier / cooling medium temperatures ¹⁸	

¹⁷ For heat pumps with a heat source of NH₃-condensation of the low pressure cooling system (is substituted with the discharge temperature sensor of the low pressure level for products of the GEA Blu-Red Fusion series).

¹⁸ For heat pumps heat carrier temperature sensors on/off for every heat exchanger standard, for chillers optional, only 1x inlet/outlet respectively into / out of the product.

5 Technical data

5.1 Dimensions, weights, fill quantities and connections

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 GC PP 260 to GEA Grasso FX GC PP 1250

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.

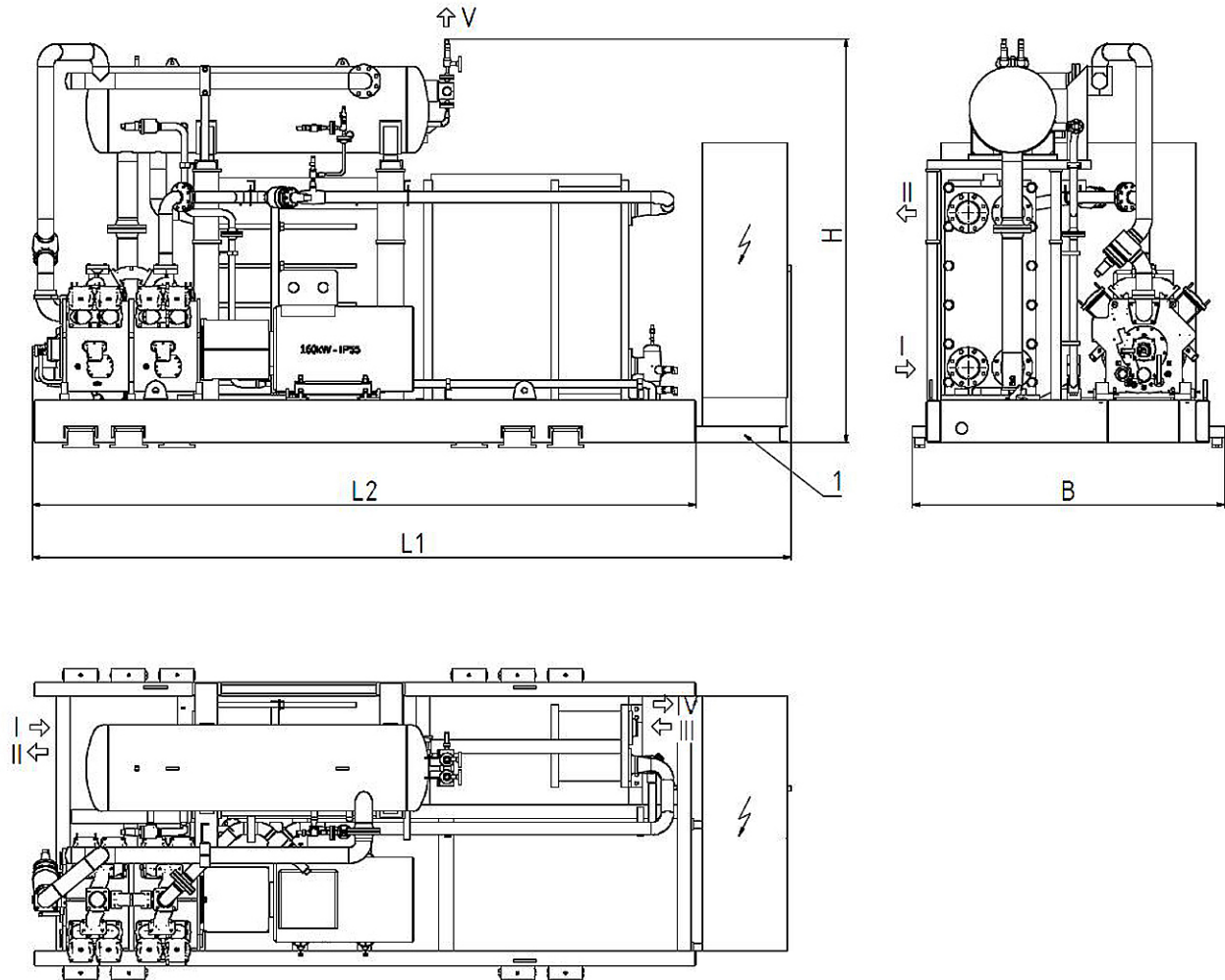


Fig.12: Set drawing GEA Grasso FX GC PP

I	Secondary refrigerant inlet of evaporator
II	Secondary refrigerant outlet of evaporator
III	Cooling medium inlet condenser
IV	Cooling medium outlet condenser
V	Blow-off line, safety valve
1	For installation on site, dismantle transport console and set electrical cabinet on foundation
	Feeding of power feed and control lines (on the customer side) from below

Technical data

Dimensions, weights, fill quantities and connections

Characteristics							
Parameter		GEA Grasso FX GC PP . chiller					
		260 ¹⁹	400 ¹⁹	525 ¹⁹	600 ¹⁹	900 ¹⁹	1250 ¹⁹
Length L1	mm	3750	4000	4300	5200	5450	5700
Length L2	mm	3000	3250	3600	4500	4750	5000
Width B	mm	2000	2000	2000	2300	2300	2300
Height H	mm	2700	2750	2850	3200	3300	3500
Cooling capacity Q ₀	kW	277	415	554	638	957	1276
Power consumption Compressor P _{eff}	kW	48.1	71.2	94.3	103.4	153.3	203.6
Weight without charging m _L	kg	4100	4600	5750	6300	8250	11500
Operating weight m _B	kg	4250	4750	6000	6550	8600	11900
Refrigerant charging quantity NH ₃	kg	38	42	48	61	83	135
Oil charging quantity V _{OIL}	l	17	23.9	34.6	22.4	31.9	55.1
Cooling agent volume	l	27	40	54	62	91	136
Cooling medium content	l	28	40	71	83	132	150
Secondary refrigerant connections ²⁰	DN	100	100	100	100	100	150
Cooling medium connections ²⁰	DN	100	100	150	150	150	250
GEA Grasso compressor	Type	V300	V450	V600	V700	V1100	V1400
LS power levels	%	25/50/75 /100	33/50/67 /83/100	25/37/50 /62/75 /87/100	25/50/75 /100	33/50/67 /83/100	25/37/50 /62/75 /87/100

Electrical data compressor motor - 1000-1500 min ⁻¹ , 400 V / 3 Ph / 50 Hz ²¹ , IP 23, air-cooled							
Parameter		GEA Grasso FX GC PP . chiller					
		260	400	525	600	900	1250
Nominal capacity ²² P _n	kW	55	90	110	132	200	250
Rated current at 400 V I _n	A	97.5	159	195	251	371	466
Relative starting current ²³ I _a /I _n		6.5	6.5	7.5	6.8	6.8	6
Switching cabinet for power supply		3 PEN / 400 V, internal control voltage: 230 V / 50 Hz / 24 VDC					
Supply line cross-section	mm ²	70	120	185	185	2x120	2x150
Primary fuse	A	160	250	315	315	400	500

¹⁹ subject to technical changes

²⁰ Connection flange for secondary refrigerant and cooling medium according to DIN 2633 (corresponds to ISO PN 16)

²¹ Euro voltage area ±10%, other voltages/frequencies on request

²² For water inlet/outlet 12/6°C; if conditions vary, motor output differs

²³ For Y - Δ start-up, the starting values are reduced to 30 %

5.1.2 GEA Grasso FX GC PP 520 duo to GEA Grasso FX GC PP 1800 duo

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.

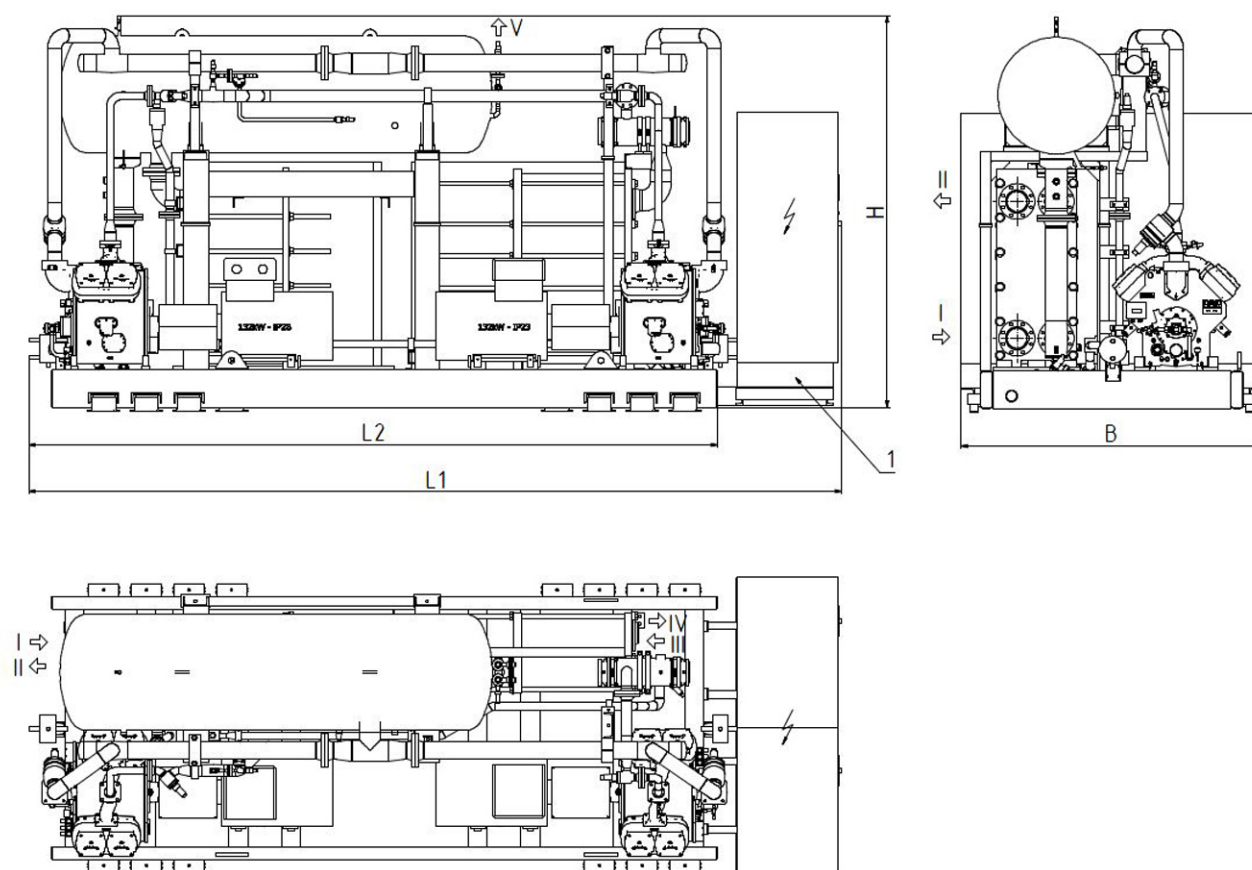


Fig.13: Set drawing GEA Grasso FX GC PP duo

I	Secondary refrigerant inlet of evaporator
II	Secondary refrigerant outlet of evaporator
III	Cooling medium inlet condenser
IV	Cooling medium outlet condenser
V	Blow-off line, safety valve

Technical data

Dimensions, weights, fill quantities and connections

Characteristics					
Parameter		GEA Grasso FX GC PP . duo chiller			
		520 ²⁴	650 ²⁴	800 ²⁴	900 ²⁴
Length L1	mm	4100	4400	4600	5100
Length L2	mm	3000	3250	3600	4500
Width B	mm	2000	2000	2200	2200
Height H	mm	2350	2450	2600	3150
Cooling capacity Q ₀	kW	554	690	830	969
Power consumption Compressor P _{eff}	kW	96.2	119.3	142.4	165.5
Weight without charging m _L	kg	5450	7200	8150	9100
Operating weight m _B	kg	5600	7450	8350	9400
Refrigerant charging quantity NH ₃	kg	53	73	90	106
Oil charging quantity V _{OIL}	l	34	40.9	47.8	58.5
Cooling agent volume	l	54	60	70	91
Cooling medium content	l	58	65	65	132
Secondary refrigerant connections ²⁵	DN	100	100	100	100
Cooling medium connections ²⁵	DN	100	100	100	150
GEA Grasso compressor	Type	V330+V300	V450+V300	V450+V450	V600+V450
LS power levels	%	25/38/50 /63/75/ 87/100	20/30/40 / 50/60 / 80/100	16/25/33 / 42/50/66 / 75/83/92 /100	14/28/43 / 50/57/71 /78/86/ 92/100

Electrical data compressor motor - 1000-1500 min ⁻¹ , 400 V / 3 Ph / 50 Hz ²⁶ , IP 23, air-cooled					
Parameter		GEA Grasso FX GC PP . duo chiller			
		520	650	800	900
Nominal capacity ²⁷ P _n	kW	55+55	90+55	90+90	110+90
Rated current at 400 V I _n	A	97.5+97.5	159+97.5	159+159	195+159
Relative starting current ²⁸ I _a /I _n		6.5/6.5	6.5/6.5	6.5/6.5	7.5/6.5
Switching cabinet for power supply		3 PEN / 400 V, internal control voltage: 230 V / 50 Hz / 24 VDC			
Supply line cross-section	mm ²	120	185	2x120	2x120
Primary fuse	A	250	315	400	400

²⁴ subject to technical changes

²⁵ Connection flange for secondary refrigerant and cooling medium according to DIN 2633 (corresponds to ISO PN 16)

²⁶ Euro voltage area ±10%, other voltages/frequencies on request

²⁷ For water inlet/outlet 12/6°C; if conditions vary, motor output differs

²⁸ For Y - Δ start-up, the starting values are reduced to 30 %

Characteristics					
Parameter		GEA Grasso FX GC PP . duo chiller			
		1050 ²⁴	1200 ²⁴	1500 ²⁴	1800 ²⁴
Length L1	mm	5500	6200	6700	7100
Length L2	mm	4750	5400	5900	6400
Width B	mm	2200	2300	2300	2300
Height H	mm	3150	3300	3700	3800
Cooling capacity Q ₀	kW	1108	1276	1595	1914
Power consumption Compressor P _{eff}	kW	188.6	206.8	256.7	407.2
Weight without charging m _L	kg	9500	12500	13600	14900
Operating weight m _B	kg	10000	13000	14100	15500
Refrigerant charging quantity NH ₃	kg	115	175	222	240
Oil charging quantity V _{OIL}	l	69.2	44.8	54.3	63.8
Cooling agent volume	l	105	136	178	234
Cooling medium content	l	157	149	190	230
Secondary refrigerant connections ²⁵	DN	100	150	150	150
Cooling medium connections ²⁵	DN	150	250	250	250
GEA Grasso compressor	Type	V600+V600	V700+V700	V1100+V700	V1100+V1100
LS power levels	%	18/25/43 /50/56/ 68/75/81 / 93/100	25/38/50 /63/75/ 87/100	20/30/40 / 50/60 / 80/100	16/25/33 / 42/50/66 / 75/83/92 /100

Electrical data compressor motor - 1000-1500 min ⁻¹ , 400 V / 3 Ph / 50 Hz ²⁶ , IP 23, air-cooled					
Parameter		GEA Grasso FX GC PP . duo chiller			
		1050	1200	1500	1800
Nominal capacity ²⁷ P _n	kW	110+110	132+132	200+132	200+200
Rated current at 400 V I _n	A	195+195	251+251	371+251	371+371
Relative starting current ²⁸ I _a /I _n		7.5/7.5	6.8/6.8	6.8/6.8	6.8/6.8
Switching cabinet for power supply		3 PEN / 400 V, internal control voltage: 230 V / 50 Hz / 24 VDC			
Supply line cross-section	mm ²	2x150	3x120	3x150	3x185
Primary fuse	A	500	630	800	800

5.2 Operation limits

The ammonia liquid chillers for flooded evaporation can be operated within the specified operation limits according to the respective specifications under diverse work conditions. The operation limits listed below are based on the operational principle of the reciprocating compressor, thermodynamic relationships, the vessels and safety devices in use, and the practical operating conditions.

Parameter		Unit	Value	
Suction pressure	p ₀	bar (a)	min	0.7
			max	7.0
Outlet temperature of water as secondary refrigerant	t _{KA}	°C	min	+3
			max	+15

Parameter		Unit	Value	
Outlet temperature with frost-resistant secondary refrigerants	t_{KA}	°C	min max	-15 +15
Condensing pressure	p_c	bar (a)	min max	10 23
Coolant inlet temperature	t_{WE}	°C	min max	+20 +45

The specified operation limits apply to operation at full load.

Partial load operation can lead to limitation of the operation limits and must be checked in the specific application.

Caution

Limitation of the secondary refrigerant - inlet temperature.

- During operation of the chiller, the increase of the secondary refrigerant inlet temperature must be limited to max. 3 K within 2 minutes. Non-adherence to these limits for a temporally approved temperature increase may lead to the chiller switching off!
- To comply with this load change speed, a suitable refrigerant accumulator must be installed on site.

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 type in question must also be considered (e.g. start-up regime, oil pressure, oil quantity, oil type, etc.).

The specified data refer to the operating conditions of a cooling or air-conditioning system. During periods of downtime or start-up, the limiting values may be exceeded or undercut for brief (never prolonged) periods of time.

5.3 Water quality requirements, parameters

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

Notice

If the limits specified in VDI 3803 are not adhered to, the manufacturer cannot provide any warranty regarding the water-conducting parts of the delivered components.

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

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

Water quality requirements, parameters			
Parameter		Value	Unit
Appearance		clear, without sediment	
Colour		colourless	
Odour		none	
pH-value at 20 °C		7.5 - 9.0	
Electrical conductivity	LF	< 220	mS/m
Soil alkali	Ca ²⁺ , Mg ²⁺	< 0.5	mol/m ³
General hardness, for stabilization	GH	< 20	°d
Carbonate hardness without hardness stabilizer	KH	< 4	°d
Chloride (see also following information)	Cl	< 150	g/m ³
Sulphur	SO ₄	< 325	g/m ³
Active biological components	KBE	< 10,000	per ml
Thickness factor	EZ	2 - 4	

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

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

Notice

Recommend for use of plate heat exchangers

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

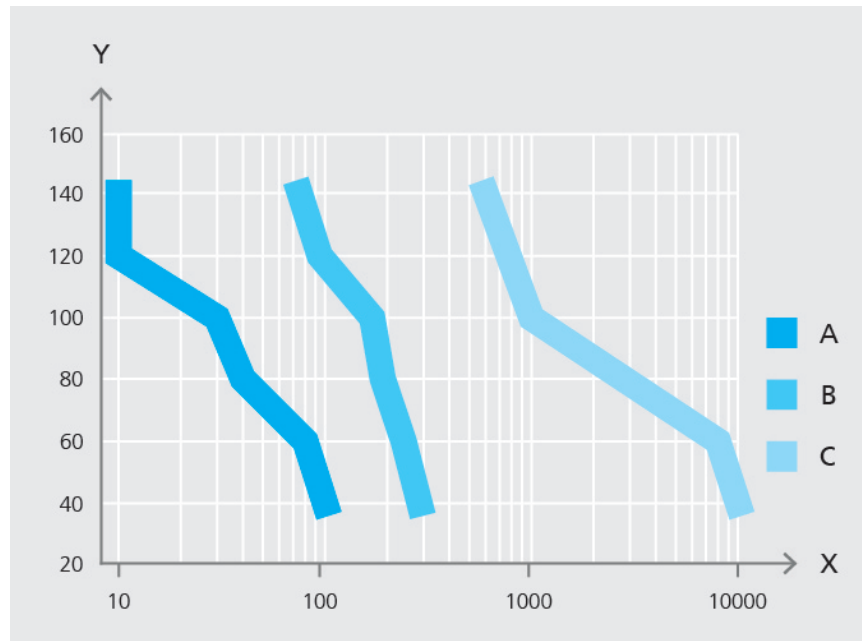


Fig.14: Corrosion resistance in presence of chlorides

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

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 Information on noise emissions

Determining the measured values:

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

Notice

The 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.

Frame size FX GC PP ...	Total acoustic pressure level ²⁹ LP [dB(A)]	Sound power LWA [dB(A)]	Octave sound pressure L _{POct} [dB]							
			Average sound frequency f _m [Hz]							
			63	125	250	500	1000	2000	4000	8000
260	75	90	81	89	92	90	87	85	83	77
400	78	92	91	89	85	92	91	87	85	79
525	80	96	83	95	94	97	93	84	83	82
600	83	101	87	98	101	97	98	93	88	86
900	83	101	88	99	101	99	98	94	88	86
1250	83	101	88	99	101	99	98	94	88	86
520 duo	79	93	84	92	95	93	90	88	86	80
650 duo	81	94	84	92	93	94	92	89	87	81
800 duo	81	95	84	92	88	95	94	90	88	82
900 duo	84	97	85	96	95	98	95	89	87	84
1050 duo	86	99	86	98	97	100	96	87	86	85
1200 duo	87	103	90	100	102	100	101	95	100	88
1500 duo	88	104	90	101	104	100	101	96	91	89
1800 duo	88	104	91	102	104	101	101	97	91	89

²⁹ Measurement distance 1 m; air-conditioning and heat pump range tolerances up to +3 dB

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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