

## **Bock Compressor HGZ7**

### Assembly instructions

HGZX7/1620-4 R404A/R507	HGZX7/1620-4 R410A
HGZX7/1860-4 R404A/R507	HGZX7/1860-4 R410A
HGZX7/2110-4 R404A/R507	HGZX7/2110-4 R410A

HGZ7/1620-4 R22  
HGZ7/1860-4 R22  
HGZ7/2110-4 R22

# About these instructions

Read these instructions before assembly and before using the compressor. This will avoid misunderstandings and prevent damage. Improper assembly and use of the compressor can result in serious or fatal injury.

Observe the safety instructions contained in these instructions.

These instructions must be passed onto the end customer along with the unit in which the compressor is installed.

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# 1| Safety

## 1.1 Identification of safety instructions:


	<b>DANGER!</b>	Indicates a dangerous situation which, if not avoided, will cause immediate fatal or serious injury.
	<b>WARNING!</b>	Indicates a dangerous situation which, if not avoided, may cause fatal or serious injury.
	<b>CAUTION!</b>	Indicates a dangerous situation which, if not avoided, may cause fairly severe or minor injury.
	<b>ATTENTION!</b>	Indicates a situation which, if not avoided, may cause property damage.
	<b>INFO!</b>	Important information or tips on simplifying work.

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## 1.2 Qualifications required of personnel

	<b>WARNING!</b>	<p>Inadequately qualified personnel poses the risk of accidents, the consequence being serious or fatal injury. Work on compressors must therefore only be performed by personnel with the qualifications listed below:</p> <ul style="list-style-type: none"><li>• For example, a refrigeration technician, refrigeration mechatronics engineer. As well as professions with comparable training, which enable personnel to assemble, install, maintain and repair refrigeration and air-conditioning systems. Personnel must be capable of assessing the work to be carried out and recognising any potential dangers.</li></ul>
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## 1.3 General safety instructions

	<b>WARNING!</b>	<ul style="list-style-type: none"><li>• Refrigerating compressors are pressurised machines and therefore require particular caution and care in handling.</li><li>• Risk of burns! Depending on the operating conditions, surface temperatures of over 60 °C on the pressure side or below 0 °C on the suction side can be reached.</li><li>• The maximum permissible overpressure must not be exceeded, even for testing purposes.</li></ul>
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# 1| Safety

## 1.4 Intended use

These assembly instructions describe the standard version of the HGZ7 manufactured by Bock. The compressor is intended for use in refrigeration systems in compliance with the limits of application. Only the refrigerant specified in these instructions may be used.

**Any other use of the compressor is prohibited!**



**WARNING! The compressor may not be used in potentially explosive environments!**

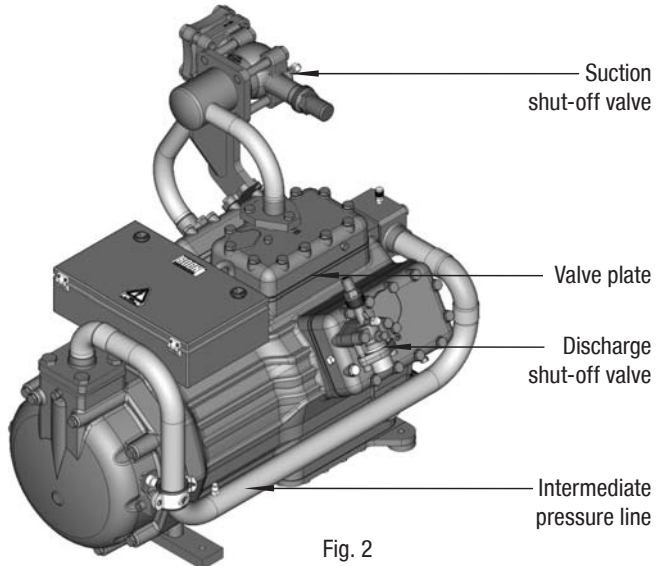
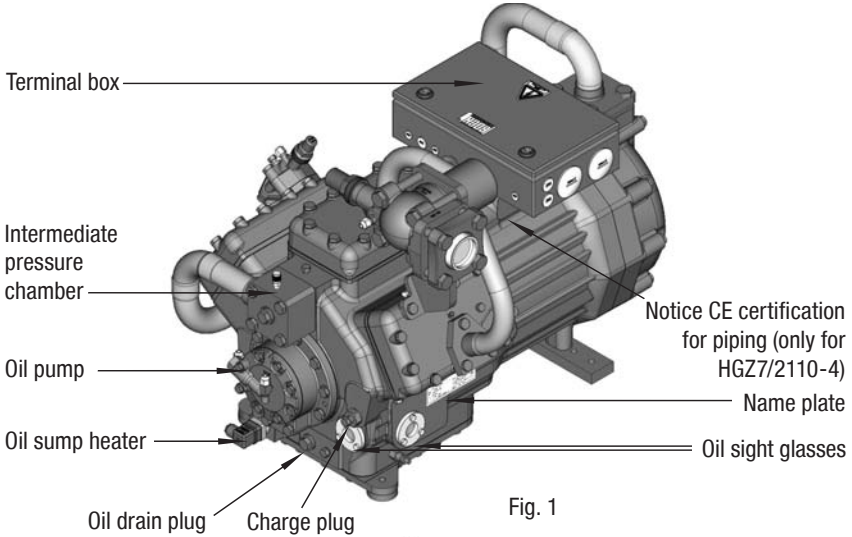
The Bock refrigerating compressor named in the title is intended for installing in a machine (within the EU according to the EU Directives 2006/42/EC Machinery Directive, 97/23/EC Pressure Equipment Directive and 2006/95/EC – Low Voltage Directive).

Commissioning is only permissible if the compressor has been installed in accordance with these assembly instructions and the entire system into which it is integrated has been inspected and approved in accordance with legal regulations.

# 2 | Product description

## 2.1 Short description standard version

- Semi-hermetic, two-stage, six cylinder reciprocating compressor with suction-gas-cooled drive motor.
- Stages divided into LP / HP at the ratio of 2 : 1
- Two-stage operation with liquid subcooler
- Expansion valve for subcooling adjusted for refrigerant and application range



Dimension and connection values can be found in Chapter 9

# 2 | Product description

## 2.2 Main and functional parts

1. **Standard version:** Compressor with intermediate-pressure line mounted and insulated.  
Fig. 3: Liquid subcooler, expansion valve, solenoid valve, filter drier and two sight glasses enclosed separately, for individual, external mounting.



Fig. 3

2. **Optional version:** Liquid subcooler, expansion valve, solenoid valve, filter drier and two sight glasses **mounted directly to the compressor**, piped and insulated.

## 2.3 Short description optional version

- Liquid subcooler, expansion valve, solenoid valve, filter drier and two sight glasses mounted directly to the compressor, piped and insulated.

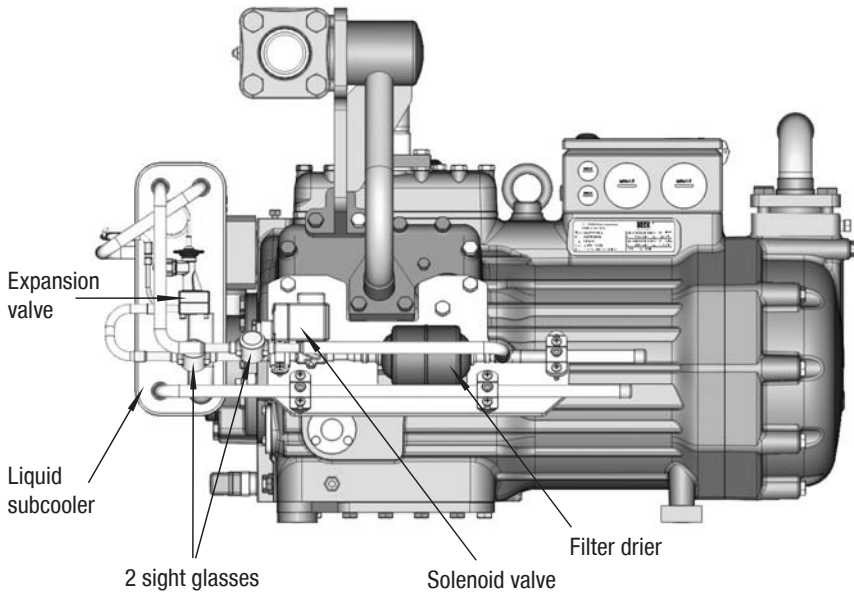


Fig. 4

Dimension and connection values can be found in Chapter 9

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# 2 | Product description

## 2.4 Name plate (example)

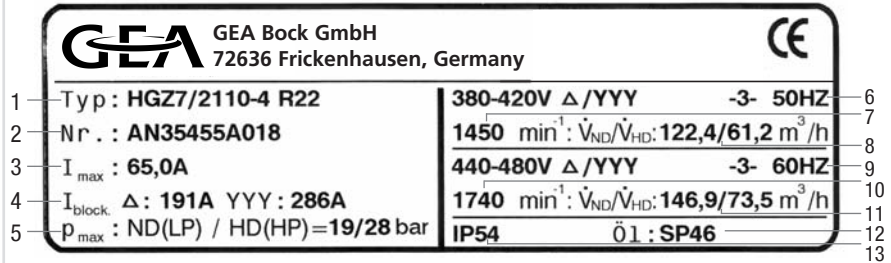


Fig. 5

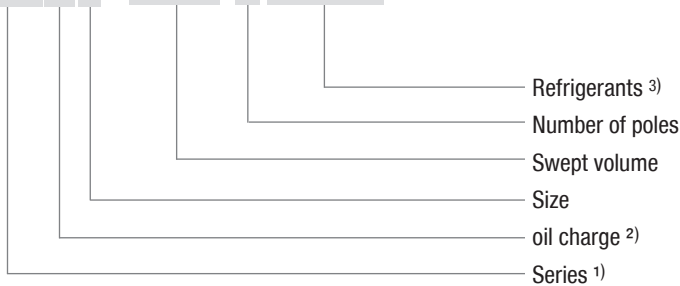
1 Type designation	6 Voltage, circuit, frequency
2 Machine number	7 Nominal rotation speed
3 maximum operating current	8 Displacement
4 Starting current (rotor blocked) Δ: Partial winding 1 YYY: Partial windings 1 and 2	$\dot{V}_{ND}$ = low pressure stage $\dot{V}_{HD}$ = High pressure stage
5 ND (LP): max. admissible operating pressure Low pressure side HD (HP): max. admissible operating pressure High pressure side	9 Voltage, circuit, frequency
	10 Nominal rotation speed
	11 Displacement
	$\dot{V}_{ND}$ = low pressure stage $\dot{V}_{HD}$ = High pressure stage
	12 Oil type filled at the factory
	13 Terminal box protection type

} 50 Hz (rows 8, 9, 10, 11)  
} 60 Hz (rows 11, 12, 13)

**i** Observe the limits of application diagrams!  
**i** Electrical accessories can change the IP protection class!

## 2.5 Type key (example)

**HGZ X7 / 2110-4 R404A**



- <sup>1)</sup> HGZ = Hermetic gas cooled (suction gas cooled), two-stage
- <sup>2)</sup> X = Ester oil filling (HFC refrigerant R404A/R507, R410A)
- <sup>3)</sup> Possible alternative refrigerants R404A/R507, R410A, R22



# 3 | Areas of application

## 3.1 Refrigerants

- HFC : R404A/R507, R410A
- (H)CFC: R22

## 3.2 Oil charge

- The compressors are filled at the factory with the following oil type:
  - for R404A/R507, R410A FUCHS Reniso Triton SE 55
  - for R22 FUCHS Reniso SP 46

Compressors with ester oil filling (FUCHS Reniso Triton SE 55) are marked with an **X** in the type designation (e.g. HGZX7/2110-4 R404A).



**INFO!** For refilling, we recommend the above oil types.  
Alternatives: see lubricants table, Chapter 8.5.



**ATTENTION!** The oil level must be in the visible part of the sight glass; damage to the compressor is possible if overfilled or underfilled!

max. oil level  
min. oil level

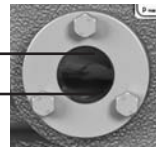


Fig. 6

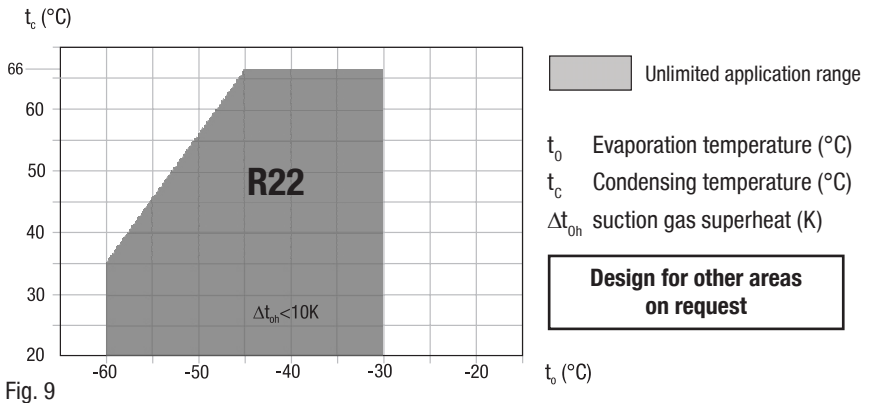
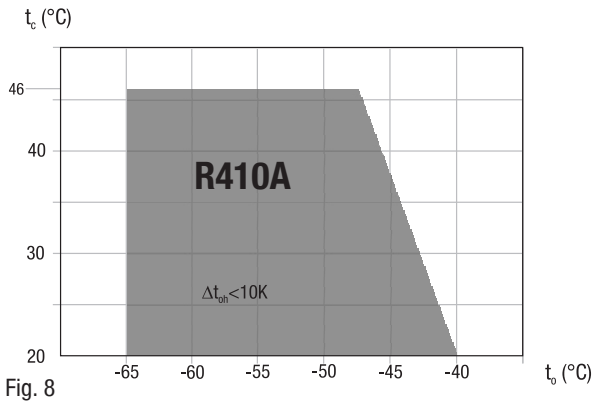
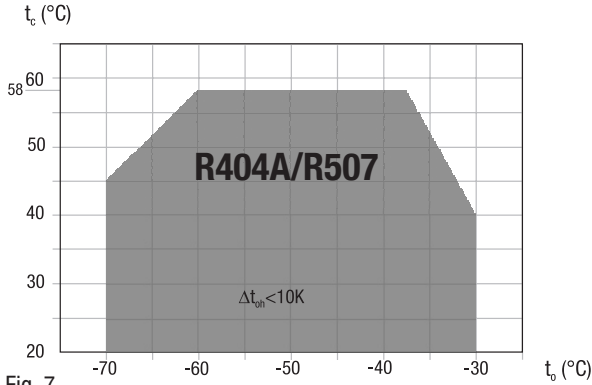
## 3.3 Limits of application



- ATTENTION!**
- Compressor operation is possible within the operating limits shown in the diagrams. Please note the significance of the shaded areas. Thresholds should not be selected as design or continuous operation points.
    - Max. permissible discharge end temperature 140 °C
    - Max. permissible switching frequency 12x /h.
    - A minimum running time of 3 min. steady-state condition (continuous operation) must be achieved.
  - For operation with supplementary cooling:
    - Use only oils with high thermal stability.
    - Avoid continuous operation near the threshold.
  - With enterprise with output regulator:
    - in the frontier sometimes reduction and/or individual attitude of the suction gas overheating necessarily.
  - For operation with frequency converter:
    - The maximum current and power consumption must not be exceeded. In the case of operation above the mains frequency, the application limit can therefore be limited.
  - When operating in the vacuum range, there is a danger of air entering on the suction side. This can cause chemical reactions, a pressure rise in the condenser and an elevated compressed-gas temperature. Prevent the ingress of air at all costs!

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# 3 | Areas of application



**Max. permissible operating pressure (LP/MP/HP)<sup>1)</sup>: 19/19/28 bar**

<sup>1)</sup> LP = low pressure MP = intermediate pressure HP = high pressure

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# 3 | Areas of application

## 3.4 Subcooling temperature

The design of the expansion valve on the compressor can be defined with the help of the diagram by approximately calculating the subcooling temperature arising in the relevant operating conditions ( $t_0/t_c$ ).

Diagrams for determining the subcooling temperature at the output of the liquid subcooler.

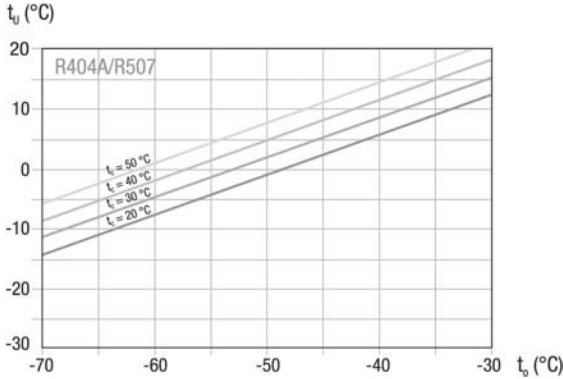


Fig. 10

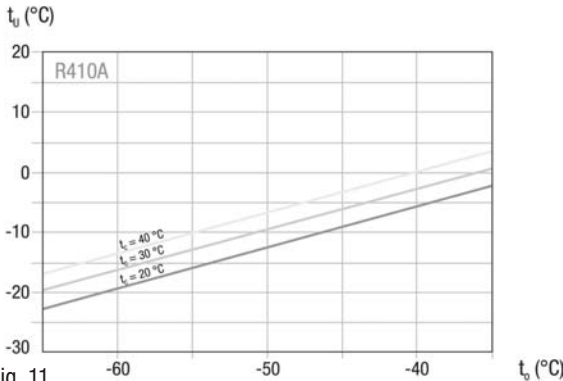


Fig. 11

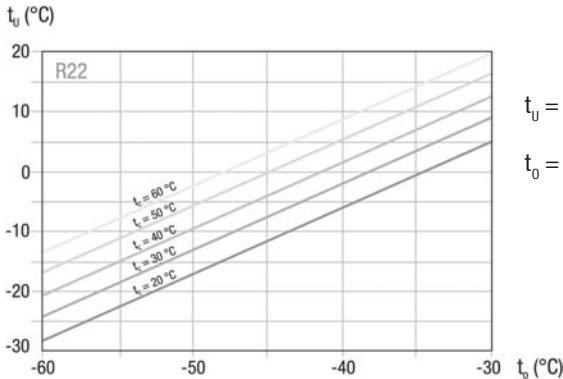


Fig. 12

$t_u$  = Subcooling temperature at the subcooler outlet (FUA)  
 $t_0$  = Evaporating temperature

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## 4| Description of functions

The refrigerant suctioned out of the evaporator (21) is compressed by the 4 cylinders of the LP stage (2) to intermediate pressure MP. After that, the superheated refrigerant flows through the intermediate pressure chamber (3), where it is cooled by the liquid subcooler system to reduce the discharge end temperature. The refrigerant then flows through the intermediate pressure line (4) to the electric motor of the compressor for to cool the motor. After this, the refrigerant is suctioned in by the two HP cylinders (5) and compressed to the final pressure.

### Liquid subcooler system

The liquid subcooler system consists of the components

- liquid subcooler (plate heat exchanger) (6)
- expansion valve (7)
- sight glasses (8, 9)
- solenoid valve (10)
- filter drier (11)

After the refrigerant receiver (16), the liquid line will be splitted into two lines:

**Line A** leads through the liquid subcooler (6) and the subcooled refrigerant flows to the evaporator (21). Through **Line B** refrigerant is expanding through the expansion valve (7) into the liquid subcooler (6) in order to subcool the refrigerant of line A and through the intermediate pressure line (MP) to cool the superheated refrigerant, which is compressed from low pressure to intermediate pressure chamber (3).

# 4| Description of functions

## 4.1 Two-stage refrigeration cycle with liquid subcooler

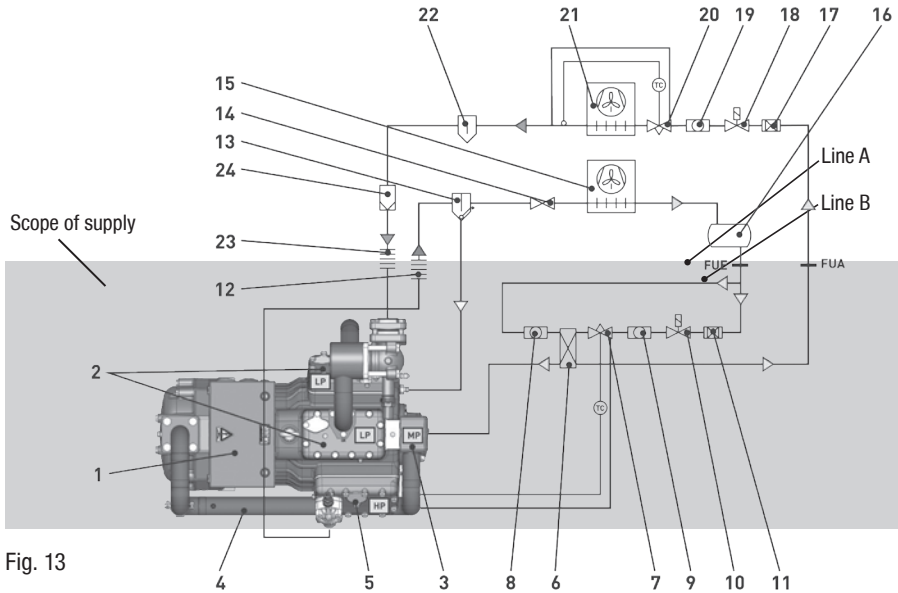


Fig. 13

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### Explanations

- |                                    |                                 |
|------------------------------------|---------------------------------|
| 1 Compressor                       | 16 Refrigerant receiver         |
| 2 Cylinder LP-stage                | 17 Filter drier                 |
| 3 Intermediate pressure chamber MP | 18 Solenoid valve               |
| 4 Intermediate pressure line MP    | 19 Sight glass                  |
| 5 Cylinder HP-stage                | 20 Expansion valve (evaporator) |
| 6 Liquid subcooler                 | 21 Evaporator                   |
| 7 Reinjection valve                | 22 Liquid separator             |
| 8 Sight glass                      | 23 Damper, suction line         |
| 9 Sight glass                      | 24 Filter suction line          |
| 10 Solenoid valve                  |                                 |
| 11 Filter drier                    | LP = Low pressure               |
| 12 Damper, pressure line           | MP = Intermediate pressure      |
| 13 Oil separator                   | HP = High pressure              |
| 14 Non-return valve                | FUE = Liquid subcooler, inlet   |
| 15 Condenser                       | FUA = Liquid subcooler, outlet  |

# 5| Compressor assembly



## INFO!

**New compressors are factory-filled with inert gas (3 bar nitrogen). Leave this service charge in the compressor for as long as possible and prevent the ingress of air. Check the compressor for transport damage before starting any work.**

## 5.1 Setting up



Fig. 14

- Use transport eyelet.
- Do not lift manually!
- Use lifting gear!

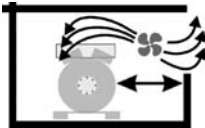


Fig. 15

- Provide adequate clearance for maintenance work.
- Ensure adequate compressor ventilation.



Fig. 16

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- Do not use in a corrosive, dusty, damp atmosphere or a combustible environment.

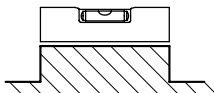


Fig. 17

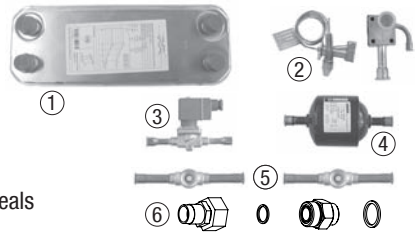
- Setup on an even surface or frame with sufficient load-bearing capacity.
- Compressor in principle rigidly install.

# 5 | Compressor assembly

## 5.2 Installation of the liquid subcooler system (standard version)

Separately enclosed components:

- ① Liquid subcooler
- ② Reinjection valve
- ③ Solenoid valve
- ④ Filter drier
- ⑤ 2 sight glasses
- ⑥ Screw-in sleeve, solder adapter and seals



Please check for completeness of parts before beginning installation.

Fig. 18



**INFO!** Observe manufacturer's instructions!



**ATTENTION!** To avoid vibration cracks in the subcooler system, the individual components must be mounted directly to the compressor or installed as a decoupled unit!

### Assembly:



**INFO!** The points listed here represent general guidelines and information on how to pipe and connect the subcooler unit. To perform this work technical knowledge and skill as well as proof of a hard-soldering test certificate in accordance with DIN EN 13133 is required.

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### Pipe connections:

For connections, see dimension diagram Chapter 10.

- System design, piping and necessary support points for the individual components must be carefully planned and carried out.
- Properly insulate liquid subcooler against condensation and heating and the related loss of performance.
- For rigidity reasons, the use of stainless steel pipes with a wall of 1 mm is preferred. The pipes must be free of tension during and after soldering to prevent possible breaks lateron.



**INFO!** Use only suitable hard solder and flux. Solder under an inert gas atmosphere when copper components are to be soldered! The accompanying expansion valve is designed and adjusted for the compressor and the listed refrigerant (sensor charge, nozzle). Only use expansion valves approved and supplied by Bock!



**INFO!** The intermediate pressure line and intermediate pressure chamber are fully insulated at the factory. To mount the expansion valve, cut the insulation as shown in the marked area in Fig. 17, page 16. Correct sensor placement is marked by an unpainted area on the pipe.

# 5 | Compressor assembly

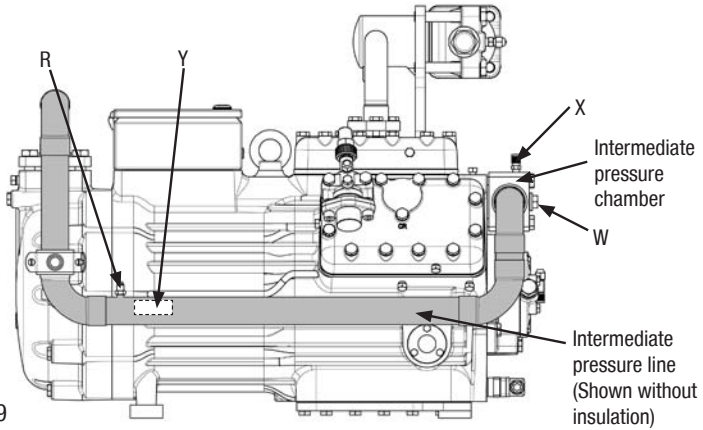


Fig. 19

R	Connection of pressure compensation line for expansion valve	$7/16"$ UNF
W	Refrigerant injection connection	M22 x 1,5
X	Schrader connection for intermedie-pressure gauge	$7/16"$ UNF
Y	Position of temperature sensor / unpainted	

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# 5 | Compressor assembly

## 5.3 Installation example, liquid subcooler with accessories

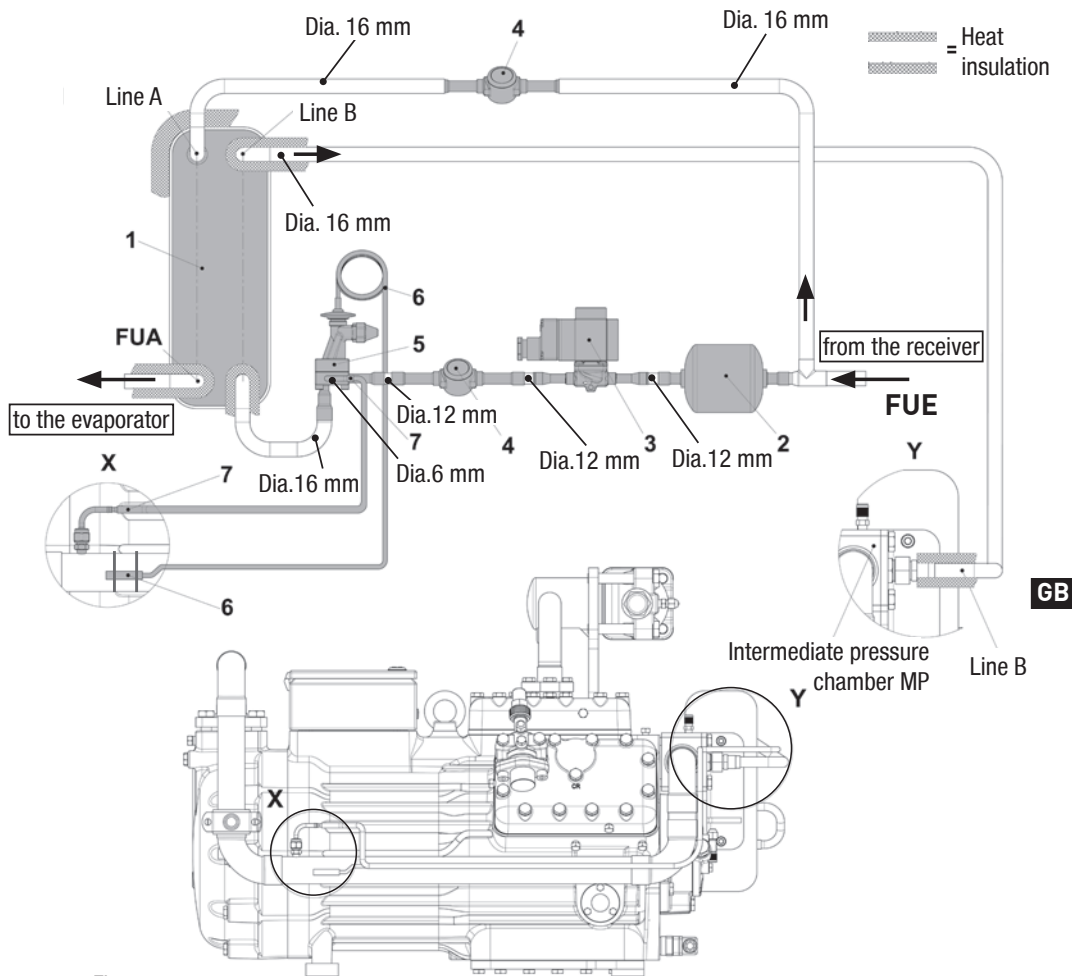


Fig. 20

- |                    |                                    |                              |
|--------------------|------------------------------------|------------------------------|
| 1 Liquid subcooler | 5 Expansion valve                  | FUA liquid subcooler, Outlet |
| 2 Filter drier     | 6 temp. sensor expansion valve     | FUE liquid subcooler, Inlet  |
| 3 Solenoid valve   | 7 Pressure compensation connection |                              |
| 4 sight glasses    |                                    |                              |



**INFO!**

**General notes:**

- Sensor lines, wires, etc. should not be attached with cable binders directly to pipes or frames; otherwise, the thin pipes may be worn through. It is better to run them through spiral protective tubes.
- If the compressor will be set up outside, UV-resistant materials should be used.

# 5 | Compressor assembly

## 5.4 Factory-installed liquid subcooler system (optional design)

Liquid subcooler, expansion valve, solenoid valve and two sight glasses are mounted directly at the compressor, piped and insulated.

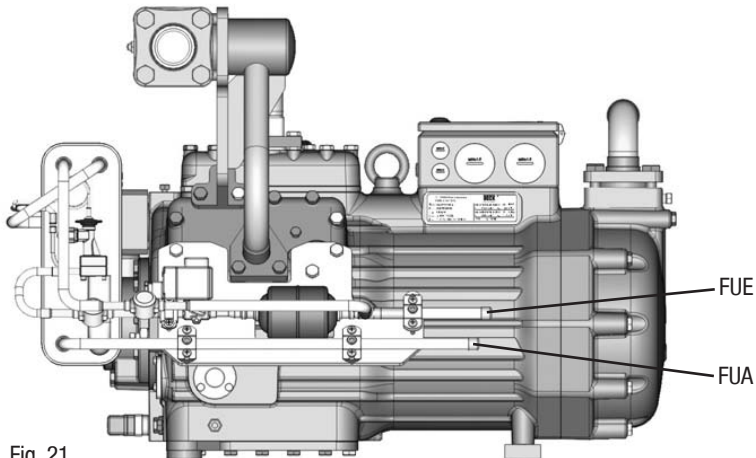


Fig. 21

FUE: Liquid subcooler inlet  
FUA: Liquid subcooler outlet

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## 5.5 Pipe connections



**ATTENTION!** Superheating can damage the valve.  
Remove the pipe supports therefore from the valve for soldering.  
Only solder using inert gas to inhibit oxidation products (scale).

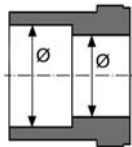


Fig. 22: graduated internal diameter

- The **pipe connections** have graduated inside diameters so that pipes with standart millimetre and inch dimensions can be used.
- The connection diameters of the shut-off valves are rated for maximum compressor output. **The actual required pipe cross section must be matched to the output. The same applies for non-return valves.**



**INFO!** A soldering suppot for tube diameter 54 mm is mounted to the suction shut-off valve of the compressor.  
A soldering support for tube diameter 2 1/8" accompanies the compressor.

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# 5 | Compressor assembly

## 5.6 Pipes

- Pipes and system components must be clean and dry inside and free of scale, swarf and layers of rust and phosphate. Only use air-tight parts.
- Lay pipes correctly. Suitable vibration compensators must be provided to prevent pipes being cracked and broken by severe vibrations.
- Ensure a proper oil return.
- Keep pressure losses to an absolute minimum.

## 5.7 Laying suction and pressure lines



**INFO!**

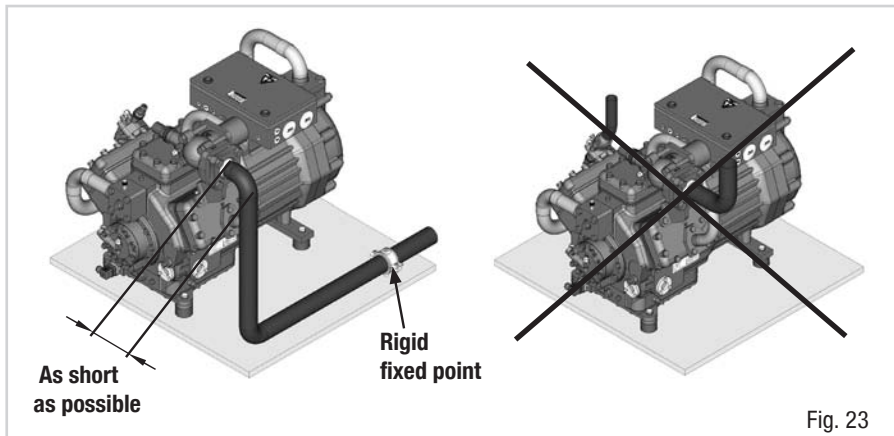
**Proper layout of the suction and pressure lines directly after the compressor is integral to the smooth running and vibration behaviour of the system.**



**ATTENTION! Improperly installed pipes can cause cracks and tears which can result in a loss of refrigerant,**

**A rule of thumb:**

Always lay the first pipe section starting from the shut-off valve **downwards and parallel to the drive shaft.**



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# 5 | Compressor assembly

## 5.8 Operating the shut-off valves

- Before opening or closing the shut-off valve, release the valve spindle seal by approx.  $\frac{1}{4}$  of a turn counter-clockwise.
- After activating the shut-off valve, re-tighten the adjustable valve spindle seal clockwise.

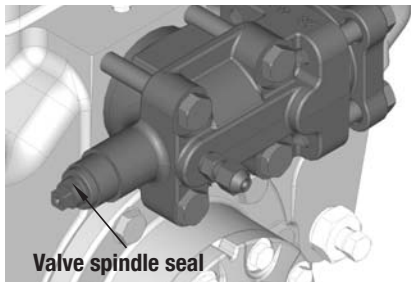


Fig. 24

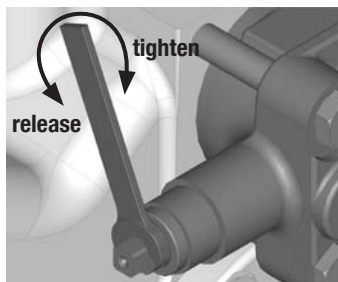


Fig. 25

## 5.9 Operating mode of the lockable service connections

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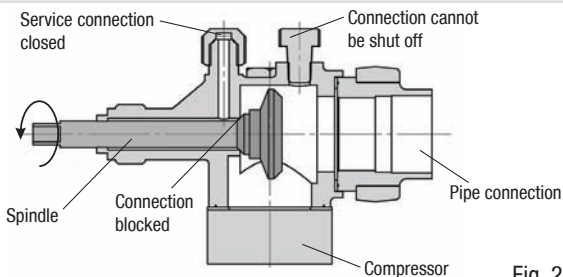


Fig. 26

### Opening the shut-off valve:

Spindle: turn to the left (counter-clockwise) as far as it will go.

—> Shut-off valve completely opened / service connection closed.

The connection which cannot be shut off is intended for safety devices.

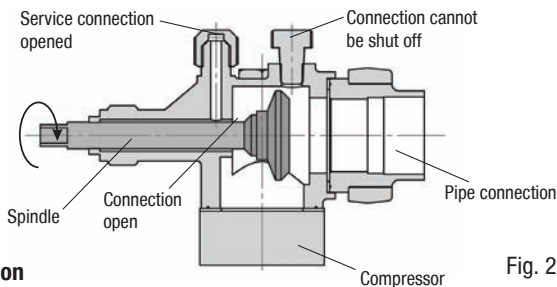


Fig. 27

### Opening the service connection

Spindle: Turn  $\frac{1}{2}$  - 1 turn to the right clockwise.

—> Service connection opened / shut-off valve opened.

The connection which cannot be shut off is intended for safety devices.

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# 6 | Electrical connection

## 6 Electrical connection



**DANGER!** High voltage! Risk of electric shock! Only carry out work when the electrical system is disconnected from the power supply!



**INFO!**

- Connect the compressor motor in accordance with the circuit diagram (see inside of terminal box).
- Use suitable cable entry point of the correct protection type (see name plate) for routing cables into the terminal box. Insert the strain reliefs and prevent chafe marks on the cables.
- Compare the voltage and frequency values with the data for the mains power supply.  
**Only connect the motor if these values are the same.**

### 6.1 Information for contactor and motor contactor selection

All protection equipment, switching and monitoring devices must comply with the local safety regulations and established specifications (e.g. VDE) and regulations as well as the manufacturer's specifications. **Motor protection switch is required!** Motor contactors, feed lines, fuses and motor protection switches must be rated according to the maximum operating current (see name plate).

Use the following overload protection device:

A current-dependent time-delayed overload protection device for monitoring of all three phases, not set higher than the rated current of the machine, which must respond at 1.2 times the set current within 2 hours and must not have responded at 1.05 times the set current within 2 hours, or another comparable device.

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## 6.2 Circuit diagram for part-winding start

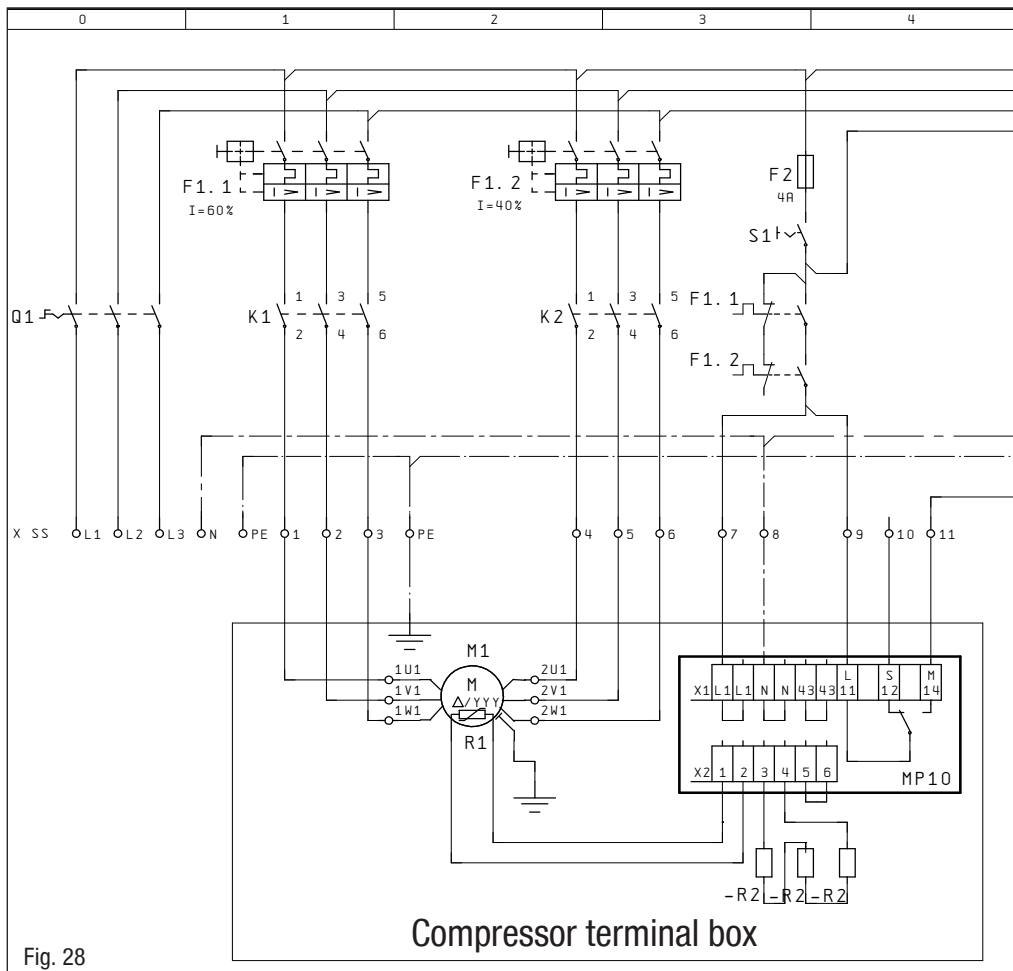
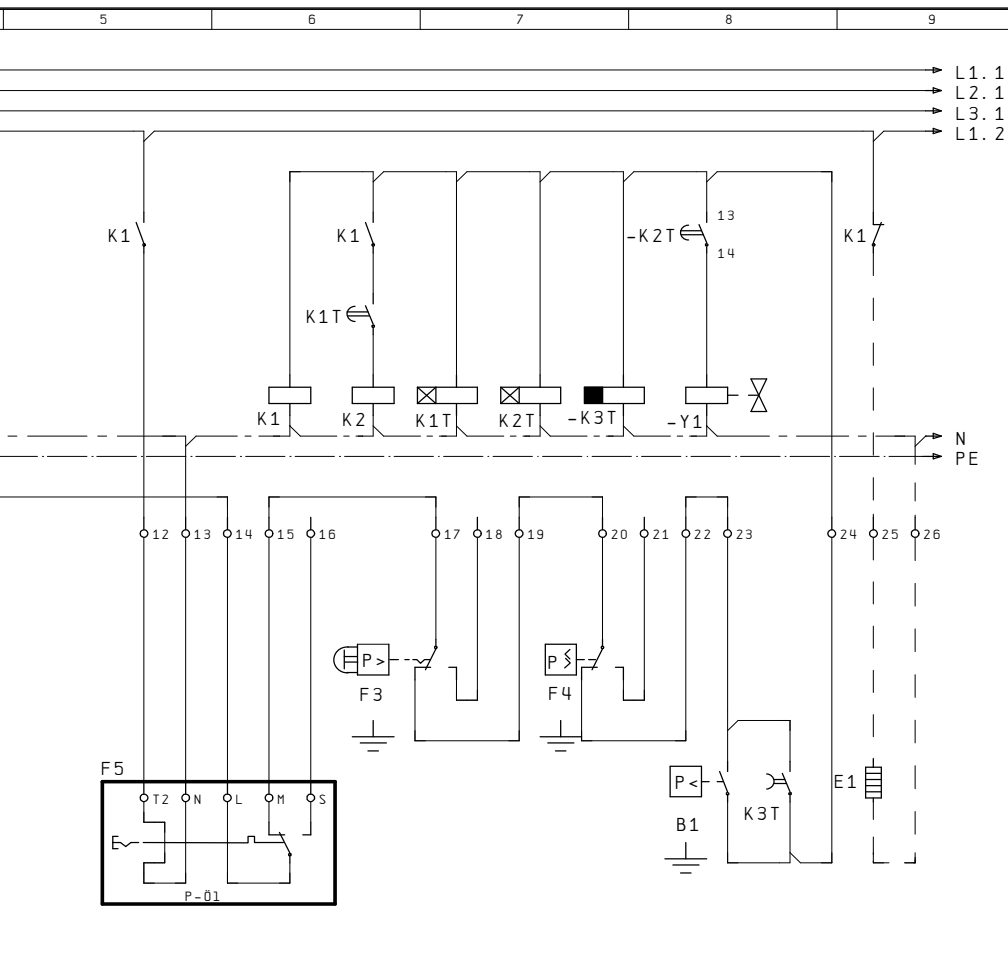


Fig. 28

Compressor terminal box

Q1	Main switch
F1.1	Motor protection switch part winding 1
F1.2	Motor protection switch part winding 2
F2	Fuse control current circuit
F3	High pressure safety monitor
F4	Safety chain (high/low pressure monitoring)
F5	Oil differential pressure monitor
S1	Control voltage switch
B1	Release switch (thermostat)
K1	Mains contactor part winding 1
K2	Mains contactor part winding 2




**GB**

K1T	Delay relay max. 1 s (slow release), part winding 2
K2T	Delay relay max. 20 s (slow release),
	Open solenoid Y1 (subcooler)
K3T	Delay relay max. 20 s (slow release),
	compressor switch-off (suction subcooler)
Y1	Solenoid valve intermediate cooler
M1	Compressor motor
R1	Cold conductor (PTC sensor)
R2	Thermal protection thermostat (PTC sensor)
R3	Oil temperature (NTC sensor)

# 6 | Electrical connection

## 6.3 Standard motor, design for direct or partial winding start

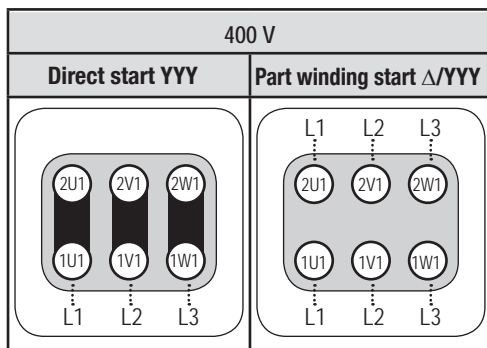
Designation on the name plate	Sticker on the terminal box
$\Delta / YYY$	

Compressors with this marking are suitable for direct or partial winding start. The motor winding is subdivided into two parts: Partial winding 1 = 60% and part winding 2 = 40%. This winding division reduces the start-up current needed for a part winding start to approx. 65% of that for a direct start.



**INFO!** A mechanical unloaded start with bypass solenoid valve is not required.

In the factory, the motor is switched for direct starting (YYY). For part winding start  $\Delta / YYY$ , remove the bridges and connect the motor feed cable according to the circuit diagram:



**INFO!** When testing the winding with resistance meter, please note that part winding 1 and part winding 2 are internally connected.



**ATTENTION!** Failure to do this results in opposed rotary fields and results in damage to the motor. After the motor starts up via partial winding 1, partial winding 2 must be switched on after a maximum delay of one second. Failure to comply can adversely affect the service life of the motor.



# 6 | Electrical connection

## 6.4 Electronic trigger unit MP 10

The compressor motor is fitted with cold conductor temperature sensors (PTC) connected to the electronic trigger unit MP 10 in the terminal box. Readiness to operate is signalled by the H3 LED (green) after the power supply is applied. In the case of excess temperature in the motor winding, the unit switches off the compressor and the H1 LED lights red.

The hot gas side of the compressor can also be protected against overtemperature using a thermal protection thermostat (accessory). The H2 LED (red) is provided for the protection function.

**The unit trips when an overload or inadmissible operating conditions occur. Find and remedy the cause.**



**INFO!** The device has a reclosure preventing feature. After eliminating the fault, the device is quit by interrupting the mains power with the external alarm reset switch S1 (see main-line wiring diagram, chapter 5.3). The reclosure preventing feature is unlocked and LEDs H1 or H2 go off again.

## 6.5 Connection of the trigger unit MP 10



**INFO!** Connect the trigger unit MP10 in accordance with the circuit diagram. Protect the trigger unit with a delayed-action fuse (F) of max. 4 A. In order to guarantee the protection function, install the trigger unit as the first element in the control power circuit.

**GB**

Temperature monitoring connections:

- Motor winding: Terminals 1 - 2
- Thermal protection thermostat: Terminals 3 - 4
- Restart prevention: Terminals 5 - 6



### ATTENTION!

Terminals 1 - 6 on the trigger unit MP 10 and terminals PTC 1 and PTC 2 on the compressor terminal board must not come into contact with mains voltage. This would destroy the trigger unit and PTC sensors. The supply voltage at L1-N (+/- for DC 24 V version) must be identical to the voltage at terminals 11, 12, 14 and 43.

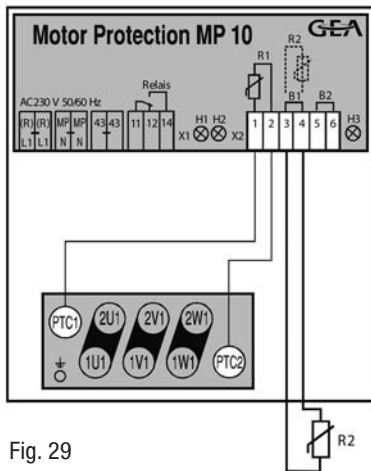


Fig. 29  
Terminal box

# 6 | Electrical connection

## 6.6 Function test of the trigger unit MP 10

Before start-up, troubleshooting or making changes to the control power circuit, check the functionality of the trigger unit:

Pos	Procedure	LED H1 red	LED H2 red	LED H3 green
1	<ul style="list-style-type: none"><li>• <b>Interrupt power supply (L1 or S1)</b></li><li>• Release the motor temperature sensor connection (1 or 2)</li><li>• Release the hot gas temperature sensor (if installed) (3 or 4)</li></ul>	OFF	OFF	OFF
2	<ul style="list-style-type: none"><li>• <b>Restore the power supply (L1 or S1)</b></li><li>• Function check of motor temperature sensor: operational</li><li>• Function check of hot gas temperature sensor: operational</li></ul>	ON	ON	ON
3	<ul style="list-style-type: none"><li>• <b>Interrupt power supply again (L1 or S1)</b></li><li>• Reconnect terminals 1 or 2 and/or 3 or 4</li></ul>	OFF	OFF	OFF
4	<ul style="list-style-type: none"><li>• <b>Restore the power supply (L1 or S1):</b></li><li>• MP 10 is operational again</li></ul>	OFF	OFF	ON

The compressor and the trigger unit MP10 are operational when the H3 LED (green) lights.

# 6 | Electrical connection

## 6.7 Oil sump heater (accessories)

When the compressor is at a standstill, refrigerant diffuses into the lubrication oil of the compressor housing, depending on pressure and ambient temperature. This reduces the lubrication capacity of the oil. When the compressor starts up, the refrigerant contained in the oil evaporates out through the reduction in pressure. The consequences can be foaming and migration of the oil, causing oil shocks under certain circumstances.

**Operation:** The oil sump heater operates when the compressor is at a standstill. When the compressor starts up, the oil sump heating switches off.

**Connection:** The oil sump heater must be connected via an auxiliary contact (or parallel wired auxiliary contact) of the compressor contactor to a separate electric circuit. Electrical data: 230 V - 1 - 50/60 Hz, 140 W.

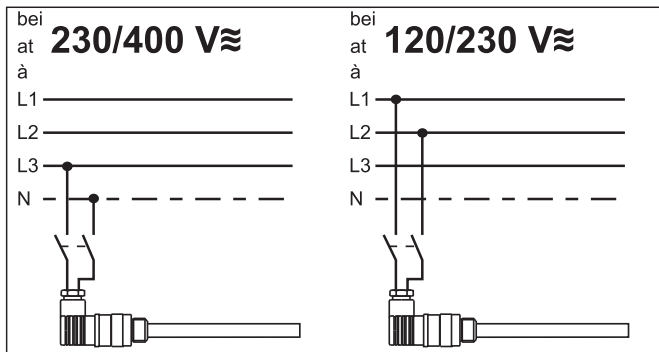


Fig. 30

GB



**ATTENTION!** The oil sump heater must not be connected to the electrical circuit of the safety control chain

# 7 | Commissioning

## 7.1 Preparations for start-up



### INFO!

**In order to protect the compressor against inadmissible operating conditions, high-pressure and low-pressure pressostats controls are mandatory on the installation side.**

The compressor has undergone trials in the factory and all functions have been tested. There are therefore no special running-in instructions.

**Check the compressor for transport damage!**

## 7.2 Pressure strength test



### DANGER!

**Bursting! The compressor must only be pressurised using nitrogen (N<sub>2</sub>). Never pressurise with oxygen or other gases! The maximum permissible overpressure of the compressor must not be exceeded at any time during the testing process (see name plate data)! Do not mix any refrigerant with the nitrogen as this could cause the ignition limit to shift into the critical range.**

The compressor has been factory-tested for pressure resistance. The following must be observed if the entire plant is subjected to an additional pressure strength test:

- Test the refrigeration circuit according to EN 378-2 or a corresponding safety standard.

## 7.3 Leak test



### DANGER!

**Bursting! Do not mix any refrigerant with the nitrogen (N<sub>2</sub>) as this could cause the ignition limit to shift into the critical range.**

- Carry out the leak test of the refrigerating system in accordance with EN 378-2 or a corresponding safety standard **without including the compressor.**

## 7.4 Evacuation



**ATTENTION! Do not start the compressor if it is under vacuum. Do not apply any voltage - even for test purposes (must only be operated with refrigerant).**

Under vacuum, the spark-over and creepage current distances of the terminal board connection bolts shorten; this can result in winding and terminal board damage.

- First evacuate the **system** and then include **the compressor in the evacuation process.**
- Relieve the compressor pressure.
- Open the suction and pressure line shut-off valves.
- Evacuate the suction and discharge pressure sides using the vacuum pump.
- At the end of the evacuation process, the vacuum should be < 1.5 mbar when the pump is switched off.
- Repeat this process as often as is required.

In addition to the suction or high pressure side, the intermediate pressure area of the compressor must also be evacuated (use connection X, see page 16, fig. 18). The solenoid valve of the subcooling system (page 17, fig. 19, item 3) must be opened.

# 7 | Commissioning

## 7.5 Refrigerant charge



**CAUTION!** Wear personal protective clothing such as goggles and protective gloves!

- Make sure that the suction and pressure line shut-off valves are open.
- With the compressor switched off, add the liquid refrigerant directly to the condenser or receiver, breaking the vacuum.
- **Pay attention to adequate refrigerant fill before starting up the compressor.**  
**During operation, refrigerant must be free of bubbles in sight glasses 1 and 2 of the liquid subcooler.**
- If the refrigerant needs topping up after starting the compressor, it can be topped up in vapour form on the suction side, or, taking suitable precautions, also in liquid form at the inlet to the evaporator.



- INFO!**
- **Avoid overfilling the system with refrigerant!**
  - **In order to prevent shifts in concentration, zeotropic refrigerant blends (e.g. R407C) must always only be added to the refrigerating system in liquid form.**
  - **Do not pour liquid refrigerant through the suction line shut-off valve on the compressor.**
  - **It is not permissible to mix additives with the oil and refrigerant.**

GB

## 7.6 Start-up



**WARNING!** Ensure that both shut-off valves are open before starting the compressor!

- Check that the safety and protection devices (pressure switch, motor protection, electrical contact protection measures, etc.) are functioning properly.
- Switch on the compressor and let it run for at least 10 minutes.
- Check the **oil level** : The oil must be visible in the sight glass.



**ATTENTION!** If larger quantities of oil have to be topped up, there is a risk of oil impact effects. If this is the case, check the oil return!

# 7 | Commissioning

## 7.7 Avoiding liquid sluggings



**ATTENTION!** Slugging can result in damage to the compressor and cause refrigerant to leak.

### To prevent slugging:

- The complete refrigeration plant must be properly designed.
- All components must be compatibly rated with each other with regard to output (particularly the evaporator and expansion valves).
- Suction gas superheating at the compressor input **should be min. 7 - 10 K** (check the setting of the expansion valve).
- The system must reach a state of equilibrium.
- When selecting the evaporator expansion valve, pay attention to correction factors for liquid subcooling. **Avoid transfer of refrigerant into the compressor when the system is at a standstill.**
- The use of a liquid separator is recommended.



**ATTENTION!** To avoid liquid shocks on the HP stage, the expansion valve may only be opened approx. 15-20 seconds after the compressor is switched on (full load operation).

**At compressor shut-down:**

**Close the solenoid valve approx. 15 - 20 seconds before the compressor is switched off.**

GB

# 8 | Maintenance

## 8.1 Preparation



- WARNING!** Before starting any work on the compressor:
- Switch off the compressor and secure it to prevent a restart.
  - Relieve compressor of system pressure.
  - Prevent air from infiltrating the system!
- After maintenance has been performed:
- Connect safety switch.
  - Evacuate compressor.
  - Release switch-on lock.

## 8.2 Work to be carried out

In order to guarantee optimum operational reliability and service life of the compressor, **we recommend** carrying out servicing and inspection work at regular intervals:

- **Oil change:**
  - not mandatory for factory-produced series systems.
  - for field installations or when operating near the application limit: for the first time after 100 to 200 operating hours, then approx. every 3 years or 10,000 - 12,000 operating hours. Dispose of used oil according to the regulations; observe national regulations.
- **Annual checks:** Oil level, leak tightness, running noises, pressures, temperatures, function of auxiliary devices such as oil sump heater, pressure switch.

GB

## 8.3 Spare part recommendation

HGZ7 / ...	1620-4	1860-4	2110-4
Designation	Ref. No.	Ref. No.	Ref. No.
Set of gaskets		80197	
Set of valve plate kit low pressure side LP		80193	
Set of valve plate kit high pressure side HP		80194	
Set oil pump kit		80116	
Set oil sump heater		08426	

**Only use genuine Bock spare parts!**

# 8 Maintenance

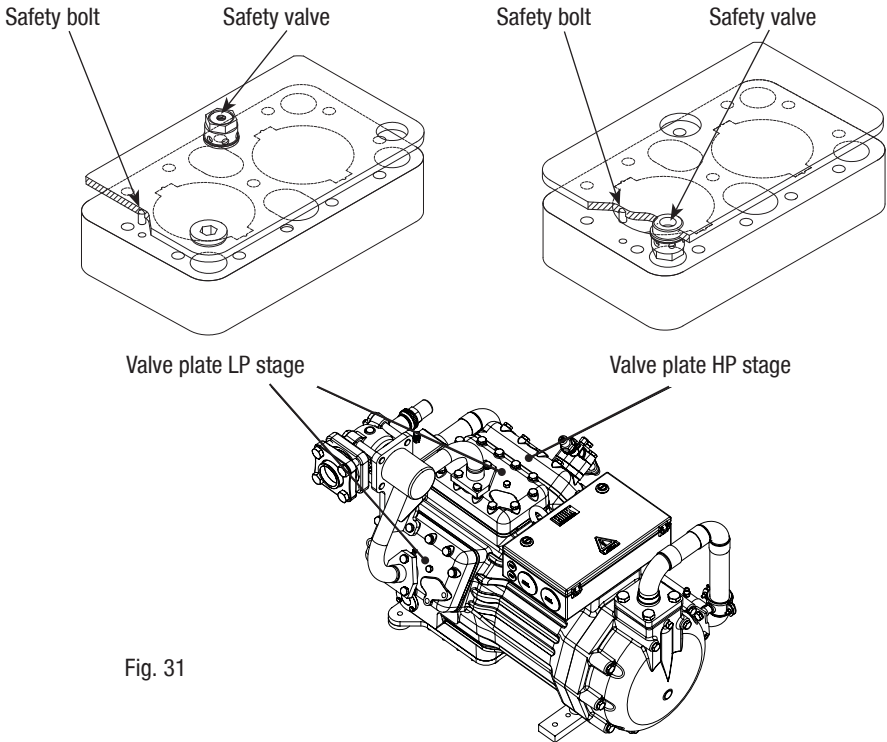
## 8.4 Replacing the valve plates

The compressors are divided into an LP and an HP compressor stage. Different valve plate designs are required because of the different ducts in the individual compressor stages.



The valve plates have been fitted with safety bolts to prevent any confusion. The safety bolts engage in the corresponding bores on the cylinder heads, **the safety bolts must not be removed!**

### Installation of the valve plates::



GB

Fig. 31



# 8 | Maintenance

## 8.5 Extract from the lubricants table

The oil type filled as standard in the factory is marked on the **name plate**. **This oil type should be used as a preference**. Alternatives are stated in the extract from our lubricants table below.

Refrigerants	Bock standard oil types	Recommended alternatives
<b>HFkw</b> (e.g. R134a, R404A, R407C)	<b>Fuchs Reniso Triton SE 55</b>	Fuchs Reniso Triton SEZ 32 Esso/Mobil EAL Arctic 46 Sunoco Suniso SL 46 Texaco Capella HFC 55
<b>HFCKW</b> (e.g. R22)	<b>Fuchs Reniso SP 46</b>	Fuchs Reniso SP 32 BP Energol LPT 46 Sunoco Suniso 3,5 GS Texaco Capella WF 46

## 8.6 Decommissioning

Close the shut-off valves on the compressor. Drain the refrigerant (it must not be discharged into the environment) and dispose of it according to the regulations. When the compressor is depressurised, undo the fastening screws of the shut-off valves. Remove the compressor using an appropriate hoist. Dispose of the oil inside in accordance with the applicable national regulations.

GB

## 8.7 Accessories

Available accessories can be found on the Internet at [www.bock.de](http://www.bock.de).

# 9 | Technical data

GB

Type	No. of cylinders	Hubvolumen		Elektrische Daten <sup>③</sup>			Anschlüsse <sup>1)</sup>		Oil charge		
		50 Hz (1450 rpm) LP HP	60 Hz (1740 rpm) LP HP	Voltage <sup>①</sup>	Max. Operating current <sup>②</sup>	Max. power consumption <sup>②</sup>	Starting current (rotor locked)	Weight <sup>2)</sup>		Discharge line DV	Suction line SV
		m <sup>3</sup> /h	m <sup>3</sup> /h		A	kW	A	kg	mm (inch)	mm (inch)	Ltr.
HGZ7/1620-4		93,7 / 46,9	112,5 / 56,2	④	*PW 1+2 50	27,0	*PW1/PW 1+2 185 / 278	294			
HGZ7/1860-4	6	107,6 / 53,8	129,1 / 64,6	④	55	30,0	185 / 278	291	35 (1 <sup>3</sup> / <sub>8</sub> )	54 (2 <sup>1</sup> / <sub>8</sub> )	4,5
HGZ7/2110-4		122,4 / 61,2	146,9 / 73,5	④	65	36,0	191 / 286	289			

\* PW = Part Winding, motors for part winding starting

1 = 1. part winding, 2 = 2. part winding

1) For solder connections <sup>2)</sup> in standard design

**LP** = Low pressure stage **HP** = High pressure stage

**Oil sump heater:** 230V -1- 50/60 Hz 140 W

① Tolerance (± 10%) relative to the mean value of the voltage range.

② Take account of the max. operating current / max. power consumption for design of fuses, supply lines and safety devices.

③ All specifications are based on the average of the voltage range

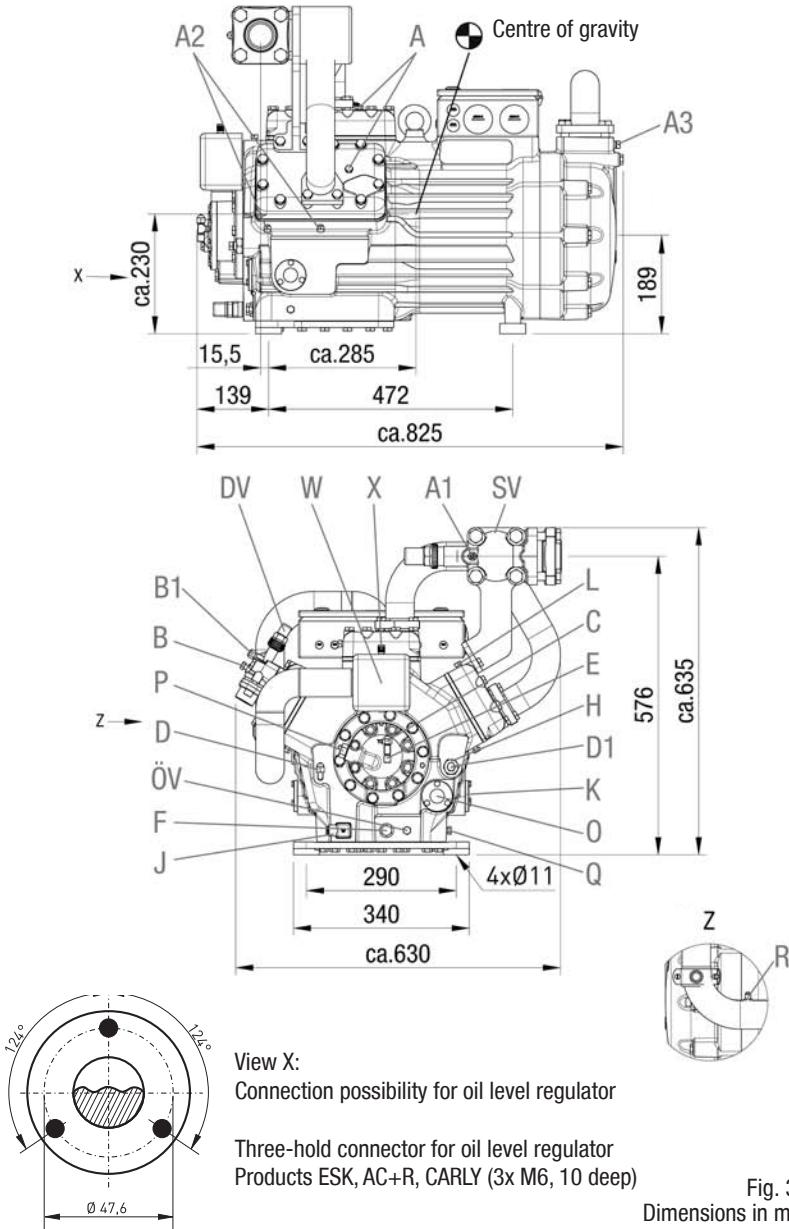
④ 380-420 V Δ/YYY -3- 50 Hz PW, 440-480 V Δ/YYY -3- 60 Hz PW

> Winding ratios: 60% / 40 %

# 10 | Dimensions and connections

## 10.1 Compressor in standard design

Intermediate pressure mixed line mounted and insulated.  
(Liquid subcooler with accessories as an extra item)



View X:  
Connection possibility for oil level regulator

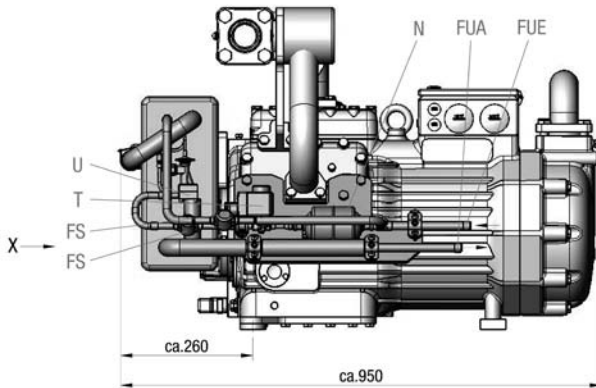
Three-hole connector for oil level regulator  
Products ESK, AC+R, CARLY (3x M6, 10 deep)

Fig. 32  
Dimensions in mm

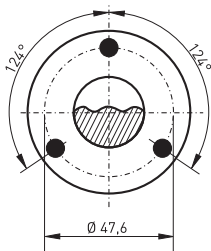
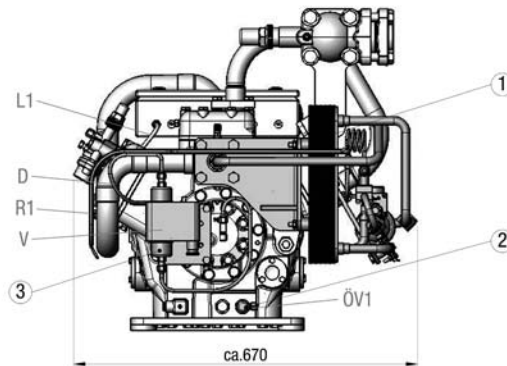
# 10|Dimensions and connections

## 10.2 Compressor in optional design

(Liquid subcooler with accessories attached directly to the compressor)



GB



View X:  
Connection possibility for oil level regulator

Three-hole connector for oil level regulator  
Products ESK, AC+R, CARLY (3x M6, 10 deep)

Fig. 33  
Dimensions in mm

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# 10|Dimensions and connections

<b>SV</b>	Suction line	see technical data, Chapter 9	
<b>DV</b>	Discharge line		
<b>FUE</b>	Liquid subcooler IN		Ø 16 mm - 5/8"
<b>FUA</b>	Liquid subcooler OUT		Ø 16 mm - 5/8"
<b>A</b>	Connection suction side, not lockable		1/8" NPTF
<b>A1</b>	Connection suction side, lockable		7/16" UNF
<b>A2</b>	Connection intermediate pressure, not lockable		1/8" NPTF
<b>A3</b>	Connection intermediate pressure, not lockable		1/4" NPTF
<b>B</b>	Connection discharge side, not lockable		1/8" NPTF
<b>B1</b>	Connection discharge side, lockable		7/16" UNF
<b>C</b>	Connection oil pressure safety switch OIL		7/16" UNF
<b>D</b>	Connection oil pressure safety switch LP		7/16" UNF
<b>D1</b>	Connection oil return from oil separator		1/4" NPTF
<b>E</b>	Connection oil pressure gauge		7/16" UNF
<b>F</b>	Oil drain		M22 x 1,5
<b>FS</b>	Sight glass liquid line		Ø 12 mm
<b>H</b>	Oil charge plug		M22 x 1,5
<b>J</b>	Oil sump heater (accessories)		M22 x 1,5
<b>K</b>	Sight glass		3 hole M6
<b>L</b>	Connection thermal protection thermostat		1/8" NPTF
<b>L1</b>	Thermal protection thermostat		1/8" NPTF
<b>N</b>	Filter drier		Ø 12 mm
<b>O</b>	Connection oil level regulator		see view X
<b>ÖV</b>	Connection oil service valve		1/4" NPTF
<b>ÖV1</b>	Oil service valve		7/16" UNF
<b>P</b>	Connection oil differential pressure sensor		M20 x 1,5
<b>Q</b>	Connection oil temperature sensor		1/8" NPTF
<b>R</b>	Connection of pressure compensation line for expansion valve		7/16" UNF
<b>R1</b>	Pressure compensation line for expansion valve		Ø 6 mm
<b>T</b>	Solenoid valve		Ø 12 mm
<b>U</b>	Expansion valve - refrigerant-dependent		Ø 12 mm
<b>V</b>	Oil pressure switch MP 54		-
<b>W</b>	Connection refrigerant injection		M22 x 1,5
<b>X</b>	Connection for Schrader valve for intermediate pressure manometer		7/16" UNF

**GB**

# 11| Declaration of conformity and installation

## DECLARATION OF CONFORMITY CE 01

for using the compressors within the European Union  
(in accordance with Low Voltage Directive 2006/95/EC)

We hereby declare that the following refrigerating compressors

Product designation: **HGZ7**

comply with the Low Voltage Directive 2006/95/EC.

Applied harmonised standard:

EN 60034-1:2010

EN 60204-1:2006

## DECLARATION OF INSTALLATION

for using the compressors within the European Union  
(in accordance with Machinery Directive 2006/42/EC)

The manufacturer: GEA Bock GmbH, Benzstraße 7  
72636 Frickenhausen, Tel.: 07022/9454-0

hereby declares that the refrigerating compressor **HGZ7** complies with the basic requirements of  
Appendix II 1B of the Machinery Directive 2006/42/EC.

Applied harmonised standard:

EN 12693:2008 and the corresponding standards referenced

A partly completed machine may only be put into operation when it has been established  
that the machine, into which the partly completed machine is to be installed, conforms to the  
regulations of the Machinery Directive (2006/42/EC).

The manufacturer undertakes to transmit electronically the special documentation required by  
individual states for partly completed machinery on request.

The special technical documentation required for partly completed machinery has been created  
in accordance with Appendix VII Part B.

Person responsible for documentation is: Wolfgang Sandkötter, Benzstraße 7, 72636 Frickenhausen.

Frickenhausen, 01.11.2011



ppa. Wolfgang Sandkötter,  
Chief Development Officer

# 11|Declaration of conformity

## **PED - CLASSIFICATION**

(as per EU Pressure Equipment Directive 97/23/EC)

## **DECLARATION OF CONFORMITY**

for use of the compressors within the European Union  
(as per EU Pressure Equipment Directive 97/23/EC)

We hereby declare that piping of the refrigerant compressors

HGZX7/2110-4 R404A, HGZX7/2110-4 R410A und HGZ7/2110-4 R22

agrees with the Pressure Equipment Directive 97/23/EG dated 29 May 1997.

## **Valid for Category I piping**

Evaluation procedure module A

The other parts of the piping fall under article 3§3 of the  
Guideline and correspond to good engineering practice

Frickenhausen, 01.11.2011



ppa. Wolfgang Sandkötter,  
Chief Development Officer

GB

# 11| Service

Dear customer,

Bock compressors are top-quality, reliable and service-friendly quality products.

If you have any questions about installation, operation and accessories, please contact our technical service or specialist wholesaler and/or our representative. The Bock service team can be contacted by phone with a **toll-free hotline 00 800 / 800 000 88** or via **e-mail: [bock@gea.com](mailto:bock@gea.com)**.

Yours faithfully

**GEA Bock GmbH**

**Benzstraße 7**

**72636 Frickenhausen**

**Germany**

We also provide information on the Internet at **[www.bock.de](http://www.bock.de)**.

For example, under the "Documentation" link you will find:

- Technical information
- Product information
- Product brochures
- and much more

**GB**







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GEA Group is a global engineering company with multi-billion euro sales and operations in more than 50 countries. Founded in 1881, the company is one of the largest providers of innovative equipment and process technology. GEA Group is listed in the STOXX® Europe 600 index.

## **GEA Refrigeration Technologies**

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