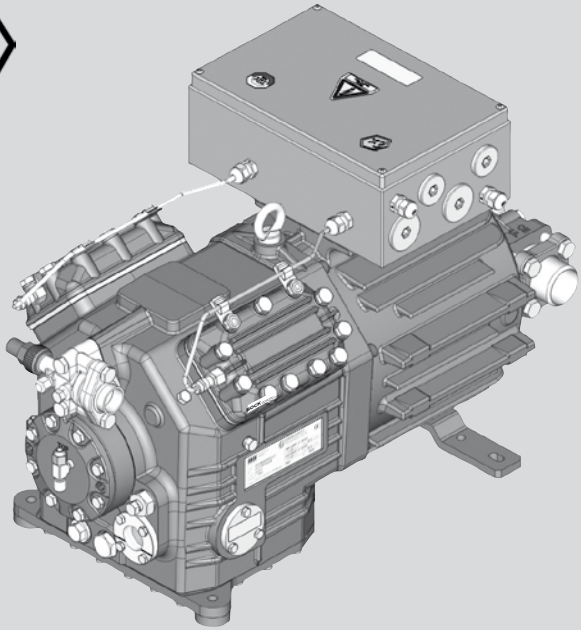
ENGINEERING
TOMORROW



BOCK® EX-HG4

Operating guide

Device category 2 G
acc. to directive 2014/34/EU

EX-HG4/465-4
EX-HG4/555-4
EX-HG4/650-4

EX-HG4/465-4 S
EX-HG4/555-4 S
EX-HG4/650-4 S

EX-HGX4/465-4
EX-HGX4/555-4
EX-HGX4/650-4

EX-HGX4/465-4 S
EX-HGX4/555-4 S
EX-HGX4/650-4 S

EX-HG4/465-4 HC
EX-HG4/555-4 HC
EX-HG4/650-4 HC

EX-HG4/465-4 S HC
EX-HG4/555-4 S HC
EX-HG4/650-4 S HC

Translation of the original instructions

AQ452742803709en-000201

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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1.1 Identification of safety instructions:

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

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1.2 Qualifications required of personnel

WARNING! **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 hereinafter qualifications and appropriate to additional qualification according to EN 60079-14.**

- For example, a refrigeration technician, refrigeration mechatronic engineer. As well as professions with comparable training, which enables 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.

1.3 Safety instructions

WARNING!

- **Refrigerating compressors are pressurised machines and therefore require particular caution and care in handling.**
- **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.**
- **The maximum permissible overpressure must not be exceeded, even for testing purposes.**
- **The compressor may be operated only if it is free of defects!**
- **No work may be performed when an explosive atmosphere is present!**
- **Smoking, fire and open flame are strictly prohibited! Mobile telephones must be switched off!**
- **Strongly charge-generating processes must be excluded within 2 meters. The contact of rapidly moving particles with the surface of the compressor must be avoided with certainty (e.g. pneumatically moved dust, flowing fluids, direct ventilation, belt drives, brushes, foils, etc.).**
- **Perform installation work only if no damage, leaks and/or appearances of corrosion can be recognized.**

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The Bock refrigerating compressors named in the title are intended for installation in machines that were set up in areas falling under the EU Explosion Protection Directive 2014/34/EU. In the European Union, electrical as well as mechanical devices operated in explosive atmospheres must fulfil what are known as **ATEX** (**AT**mospheres **EX**plosibles) conditions.

The compressors are specially designed for the category shown on the name plate in accordance with the ATEX directive and may only be used in conformity with the conditions specified and documented in the set-up area (explosion protection document). User safety is taken into account as a particular focus of design. But it is permissible to start up the compressor only if it was installed in accordance with these instructions and the entire system into which it is integrated has been inspected in accordance with legal regulations and approved.

The declarations and remarks by Bock can only refer to the product itself. We assume that the applicable regulations, standards and technical rules are followed in installation and during operation. The plant constructor/operator must evaluate the interactions with other devices and components of the system and with the environment, especially regarding potential ignition sources.

1.4 Intended use

These assembly instructions describe the standard version of the EX-HG4 manufactured by Bock. The compressor is intended for use in refrigeration systems inside explosion-endangered areas under the designation specified on the name plate in accordance with the European **ATEX Directives**. Use of the specified refrigerants as well as observance of the operating limits and listed standards must be ensured in any case. Likewise, all accessories available from, approved and specially marked by Bock are exclusively approved, according to their intended use, for attachment to and operation with Bock compressors of appliance category 2 in accordance with Directive 2014/34/EU.

WARNING! Any other use of the compressor and its approved accessories is prohibited! The ATEX permit is voided if the compressor is used outside the operating limits or undergoes inadmissible design changes!

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2 | Product description

2.1 Short description

- Semi-hermetic four-cylinder reciprocating compressor with oil pump lubrication.
- Suction-gas-cooled drive motor
- For use in explosion-endangered areas.

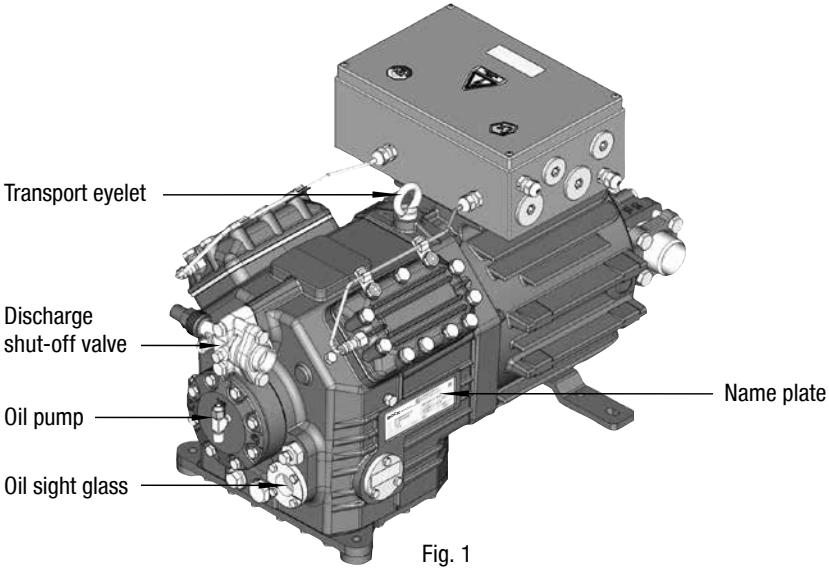

Fig. 1

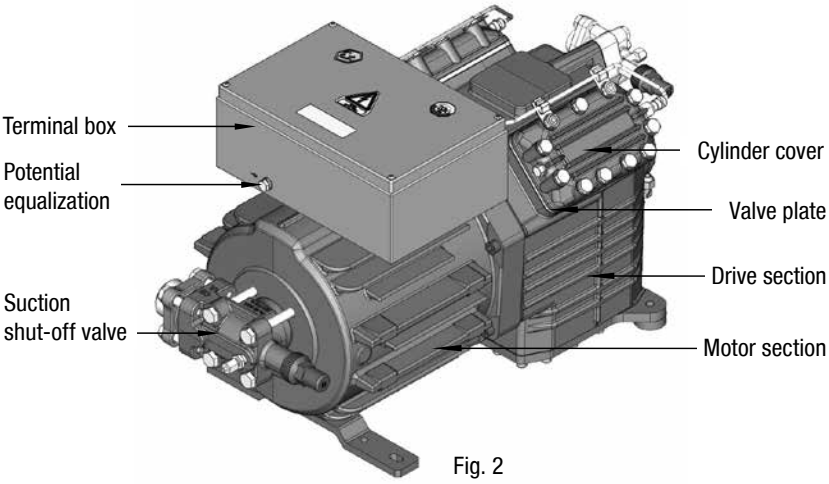

Fig. 2

Dimension and connection values can be found in Chapter 10

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2.2 Ignition protection concept

In accordance with Directive 2014/34/EU, Bock ATEX compressors are suitable for use in device category 2 for explosive gas atmospheres up to temperature class T3 and explosion hazard subgroup IIB/IIC.

For the compressor, essential characteristics of the protection type pressurization (Ex p) are applied. Fundamental part of this protection type is the exclusion of oxygen by using an inert gas, in this case refrigerant. By means of static pressurization (Ex p) the motor is completely surrounded by refrigerant and is thereby protected from explosive atmosphere. For protection against the loss of this static pressurization, safety pressure switches must be installed on the low pressure side of the compressor according to EN 60079-2 to shut-down the compressor before reaching the atmospheric pressure.

To prevent ignition risk caused by working materials also during system malfunctions, all used working materials have to meet the requirements for the temperature class of the compressor. The surface temperature of the compressor may not exceed 80% of the ignition temperature of the working material. For this reason all working materials need to have an auto-ignition temperature of > 250°C.

To protect against high temperatures that may occur during incorrect operation or faults at the compressor, the areas with the highest heat potential are controlled with temperature sensors (Ex b). The installation of the electronic control unit MP10 and the safety barrier, both included in the scope of supply, is therefore absolutely necessary.

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The connection areas for load circuits are designed according to the requirements of the appliance category in Ex e. The circuits for the temperature sensors of the used ignition source control Ex b have to be intrinsically safe to prevent inadmissibly high thermal or electric values. To ensure the intrinsic safety, the included safety barrier has to additionally be integrated in the electric circuit according to this assembly instruction. The terminal board is designed as an interface between Ex e and Ex p chamber in Ex d respectively Ex de. The whole electric connection area is protected by a housing that complies with the requirements for the protection type increased safety (Ex e).

Accessories

Heating elements for the compressors to protect against explosion risks are designed in the protection types increased safety (Ex e) for the make Thuba and pressure-proof housing (Ex d) for the make Elmess and have to have to be mounted stationary at the designated areas in the compressor housing. The heating elements can be operated without temperature- and oil level control since the thermal type testing by the manufacturer verified that the heating elements prevent the exceeding of the temperature class of the compressor. The electric connection of the heating elements has to be done in a protective housing that complies with the requirements of an approved protection type. The control has to be carried out in a way that the heating element can only be operated during shutdown of the compressor.

The magnetic coil of the capacity regulator is designed in the protection type encapsulation (Ex m) to protect against explsion risks. In addition, the connecting areas of the coil are placed in a housing that complies with the requirements of the protection type increased safety (Ex e).

2 | Product description

The oil pressure differential sensor INT250 from Kriwan is executed as a simple electrical operating device without a recognised ignition protection type. To ensure reliable operation, however, it must be equipped as an intrinsically safe electrical circuit with safety barriers. Please note that the plastic housing of the INT250 can be electrically charged by means of charge-generating processes (e.g. cleaning with a dry cloth, direct additional ventilation via fan etc.). Accordingly, the operator is required to take measures so that ignition hazards can be reliably ruled out.

2.3 Name plate (example)

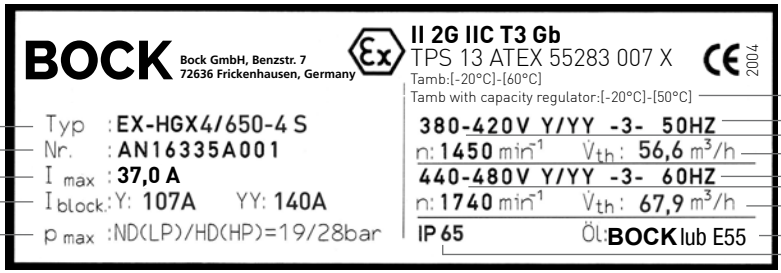

Fig. 3

1	Type designation	
2	Machine number	
3	Maximum operating current	
4	Start-up current (rotor blocked) Y: part winding 1 YY: part winding 1 + 2	
5	ND (LP): max. admissible over pressure suction side HD (HP): max. admissible over pressure high pressure side	
6	Voltage, switching, frequency	50 Hz
7	Nominal roatation speed	50 Hz
8	Swept volume	50 Hz
9	Voltage, switching, frequency	60 Hz
10	Nominal roatation speed	60 Hz
11	Swept volume	60 Hz
12	Oil filled at factory	
13	Protection type terminal box	
14	Permissible ambient temperature	

Observe the limits of application diagrams!

Electrical accessories can change the IP protection class!

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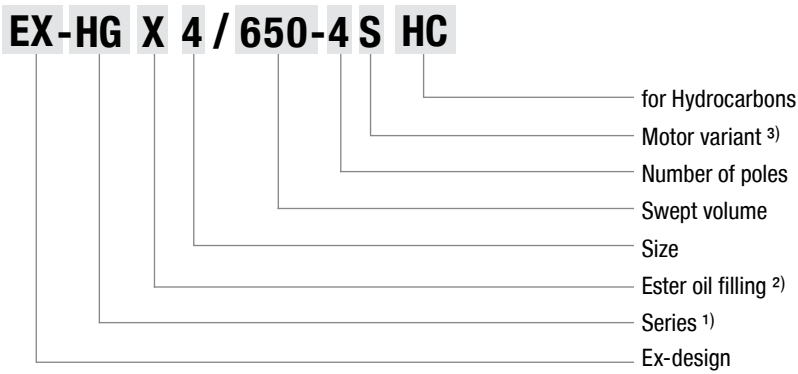
2.4 Type key (example)

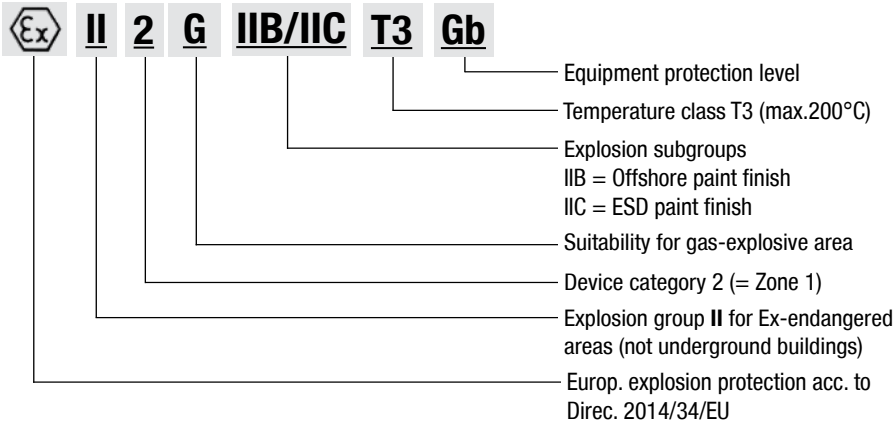


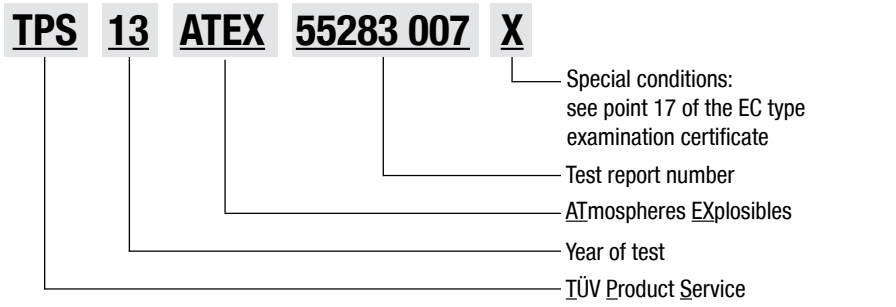
1) HG - Hermetic gas-cooled (suction gas-cooled)

2) X - Ester oil filling (HFC refrigerant, e.g. R134a, R404A, R507, R407C)

3) S - More powerful motor, e.g. air conditioning applications

2.5 ATEX identification





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3 | Areas of application

3.1 Approved refrigerant

- HFKW / HFC: R134a, R404A, R507, R407C
- (H)FCKW / (H)CFC: R22
- Hydrocarbons: R290, R1270

3.2 Important information on the use of hydrocarbons

Hydrocarbons (combustible refrigerants) may be used in the compressors named in the title only if all relevant and applicable regulations, standards and technical rules are followed. National safety regulations must be observed. In addition, we refer to the following applicable standards and regulations: EN 378, BGR500, TRBS 2152, EC Directives 1999/92/EC and 2014/34/EU.

The compressor and the refrigeration system must be permanently equipped with clear, identical labels/plates (ISO3864) that state that combustible refrigerants are used. This warning plate must be unremovably attached to the compressor.

A hazard analysis in accordance with the Operational Safety Ordinance must be performed for the set-up location. Use and handling of the refrigeration system and compressor are to be governed in the explosion protection document.

Installation, placement into operation, service and repair (as permitted by the manufacturer) may only be performed by personnel who have been specially trained on combustible refrigerants.

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If the compressor has to be removed from the system for inspection/maintenance/repair, the remaining refrigerant must be suctioned out and the compressor evacuated, filled with nitrogen (<0.5 bar) and closed gas-tight. The compressor must be equipped with a tag that clearly states that the compressor was operated with combustible refrigerant (name the refrigerant).

If the system contains combustible refrigerants or residues, extreme caution must be exercised when working on the compressor due to the danger of explosion. This applies especially for the use of fire, open flame or other ignition sources (e.g. electronic devices, mobile telephones, static charges, sparks, ...).

During maintenance and repair, it must be noted that hydrocarbon residues may remain dissolved in the oil. In addition used dryers contain bottoms of the inflammable refrigerants. Flush the dryer with nitrogen and supply it to the recycling.

It should be noted that the solubility of hydrocarbons in oil can be very high, especially at high suction pressures. A high-viscosity lubricant may be required, depending on the application and experience. The lubricant must be released for use by Bock. Depending on the application, a pump-down switch should also be added (e.g. when the refrigeration system is set up outside).

3.3 Oil charge

- The following refrigerants are approved for the compressor:

Refrigerant	Oil grade
R22	**BOCK** lub A46
R134a, R404A, R407C, R507	**BOCK** lub E55
R290, R1270	**BOCK** lub 68

Compressors with ester oil filling (**BOCK** lub E55) are marked with an **X** in the type designation (e.g. EX-HG**X**4/650-4).Compressors with oil filling **BOCK** lub 68 are marked with **HC** (eg. EX-HG4/650-4 **HC**).

- Operate compressors only with the approved refrigerants and the corresponding assigned and approved oils. Other combinations (e.g. R22 with ester oils) are not permitted!
  Conversion to another refrigerant/oil is not permitted!
- Oil level: The oil level from the factory reaches the upper edge of the sight glass. The oil level must be regulated in operation; if necessary to achieve a correct oil level (see Fig. 4), oil may have to be drained off or added.

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

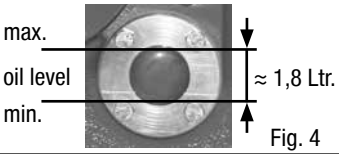

Fig. 4

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3.4 Limits of application

ATTENTION!

- **Compressor operation is possible within the operating limits. These can be found in Bock compressor selection tool (VAP) under vap.bock.de. Observe the information given there.**
  - **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.**
- **Suction gas overheating Δt_{oh}:**
  The correct setting of the suction gas overheating temperature Δt_{oh} t the compressor entrance is of decisive importance:
  too low Δt_{oh} => danger of liquid operation
  too high Δt_{oh} => danger of compressor overheating
  Δt_{oh} min = 7 - 10 K, individual adjustment required.
- **Permissible ambient temperature range -20°C bis +60°C**
- **Permissible ambient temperature range when using a capacity regulator: -20°C to +50°C**
- **Avoid continuous operation near the limits.**

3.4 Limits of application

- **For operation with capacity regulator:**
  - **Continuous operation, when the capacity regulator is activated, is not permissible and can cause damage to the compressor.**
  - **The suction gas superheat temperature may need to be reduced or set individually when operating near to the threshold.**
  - **When the capacity regulator is activated, the gas velocity in the system can not under certain circumstances ensure that sufficient oil is transported back to the compressor.**
- **For operation with frequency converter:**
  - **the maximum current and power consumption may not be exceeded. During operation above the mains frequency the application limit can be restricted. Variable frequency range: 25-70 Hz**
- **During operation in the vacuum range, there is a danger of air entering on the suction side. This can cause chemical reactions, pressure rise in the condenser and an excessive pressure gas temperature as well as shifting of the refrigerant ignition limit into the critical range. Avoid absolutely any entry of air! Two safety pressure switches on the low pressure side according to EN 60079-2 have to be provided.**

  The shut-off point has to be set at least 50 Pa higher than the prevailing ambient pressure! Safety devices detecting over pressures have to be installed and designed according to EX-directives and must comply with the requirements of the EN 60079-2!

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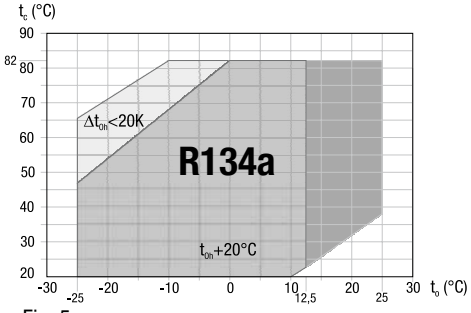

Fig. 5

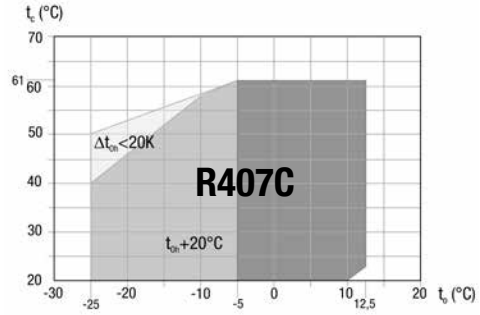

Fig. 6

Unlimited application range

Reduced suction gas temp.

Motor version S
(more powerful motor)

t_o Evaporation temperature (°C)

t_c Condensing temperature (°C)

Δt_{oh} Suction gas overheating (K)

t_{oh} Suction gas temperature (°C)

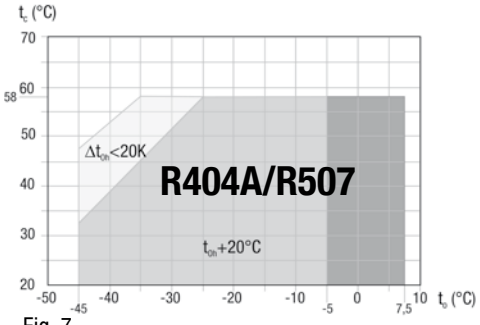

Fig. 7

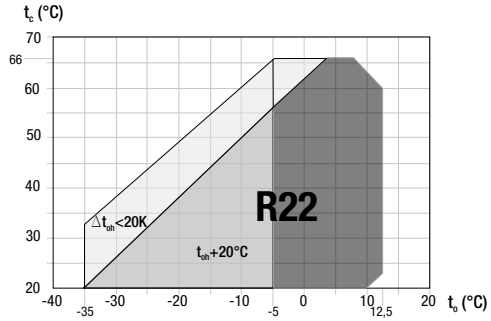

Fig. 8

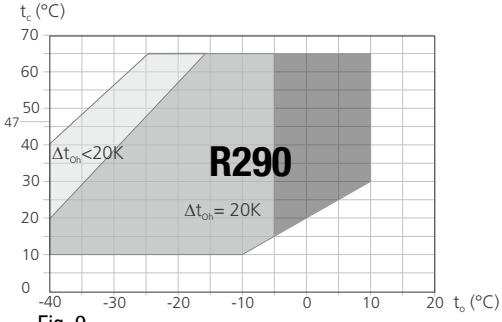

Fig. 9

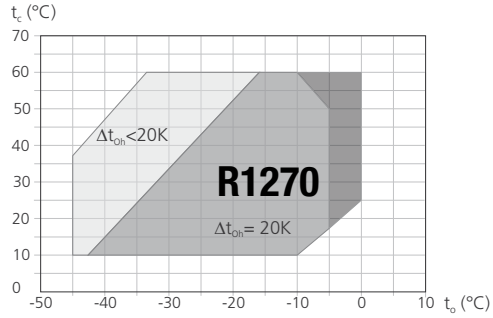

Fig. 10

Unlimited application range

Reduced suction gas temp.

Motor version S
(more powerful motor)

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t_o Evaporation temperature (°C)

t_c Condensing temperature (°C)

Δt_{oh} Suction gas overheating (K)

t_{oh} Suction gas temperature (°C)

Max. permissible operating pressure (LP/HP)[1]: 19/28 bar

[1] LP = Low pressure
HP = High pressure

Design for other areas on request

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.**
- **Before starting work, obtain written work release.**
- **Observe national regulations when setting up explosion-protected systems (within the EU: ATEX Directive 1999/92/EG, EN 60079-14, EN 60079-17 a.o.).**
- **Use only tools permitted for explosion-protected systems (within the EU, in accordance with EN 1127-1).**
- **Observe work safety rules (TRBS 2153, e.g. protective shoes, clothing etc.)!**

4.1 Pressurization of the compressor

The operation of the compressor below the atmospheric pressure is not permissible. To prevent the loss of this static pressurization e.g. because of leakages at seals, according to EN 60079-2 the compressor has to be equipped with two automatically working safety pressure switches at the not lockable connections of the low pressure side. The minimum over pressure with regard to the atmospheric pressure that is set at the safety pressure switches has to be at least 50 Pa.

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4.2 Ignition source control of the compressor

To protect against an exceeding of temperature the protection type ignition source control "b" is used at the compressor. Via sensors, the areas with the highest heat potential at every cylinder cover are controlled. Additionally, the temperature of the motor winding is controlled by the safety device MP10.

The permissible limit temperatures for normal operation of the compressor were set with 130°C for the motor and with 140°C for the hot gas side of the cylinder cover. If one of those values is exceeded, the compressor is shut down by the control device MP10. Besides the installation according to wiring diagram, the operator/installer does not have to regard other parameters for the correct functioning of the ignition protection system. A function check however has to be carried out before every startup of the compressor according to section 5.8 of this assembly instruction.

For a safe function of the ignition source control the MP10 has to be installed according to the wiring diagram fig. 29, the restart interlock (bridge B2) must not be removed in any case. Check the function of the ignition protection system according to section 5.9. Defective sensors or ignition protection systems have to be replaced before reconnection of the compressor.

Operation of the compressor without igintion source control is not permitted!
After shutdown by the MP10, precise error diagnostics and error correction is necessary.

4.3 Storage and transport

Fig. 11

- Storage at (-30°C) - (+70°C), maximum permissible relative humidity 10% - 95%, no condensation
- Do not store in a corrosive, dusty, vaporous atmosphere or in a combustible environment.

Fig. 12

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

4.4 Setting up

ATTENTION! Fittings (e.g. pipe holders, additional units, mounting parts etc.) on the compressor are not permissible!

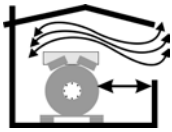

Fig. 13

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

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Fig. 14

- Do not operate in an aggressive and/or corrosive atmosphere.

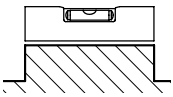


Fig. 15

- Setup on an even surface or frame with sufficient load-bearing capacity. Only set up on a slant after consulting with the manufacturer.
- Single compressor preferably on vibration damper.

Fig. 16

- Lightening protection: If the compressor is set up outdoors, a lightening protection concept has to be integrated.

Fig. 17

- Sun protection: If the compressor is set up outdoors, it has to be protected from direct sunlight.

4.5 Pipe connections

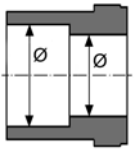


Fig.18: graduated internal diameter

- The **pressure and suction shut-off valves** have graduated inside diameters so that pipes in the common millimeter and inch dimensions can be used. The pipe will be inserted more or less deep, depending on the dimension.
- The connection diameters of the shut-off valves are designed for maximum compressor performance. **The actual required pipe cross section must be matched to the output. The same applies for non-return valves.**

ATTENTION!
- **An explosive atmosphere must not be present!**
- **Do not solder as long as the compressor is under pressure.**
- **Superheating can damage the valve. Remove the pipe supports therefore from the valve for soldering and accordingly cool the valve body during and after soldering.**
- **Only solder using inert gas to inhibit oxidation products (scale).**

4.6 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.

GB

4.7 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.**

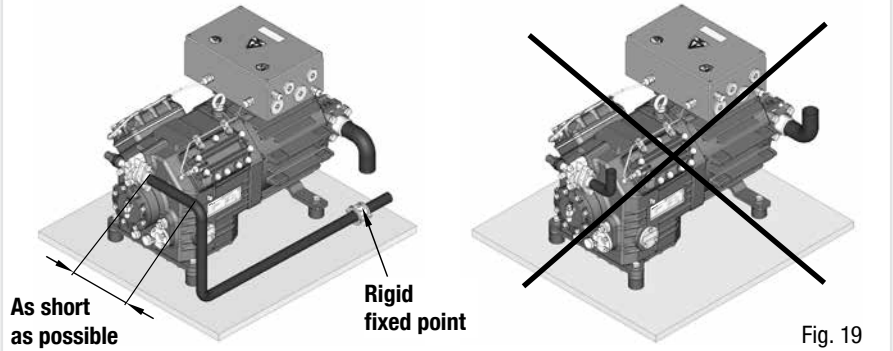


Fig. 19

4.8 Operating the shut-off valves

- Before opening or closing the shut-off valve, release the valve spindle seal by approx. ¼ of a turn counter-clockwise.
- After activating the shut-off valve, re-tighten the adjustable valve spindle seal clockwise.

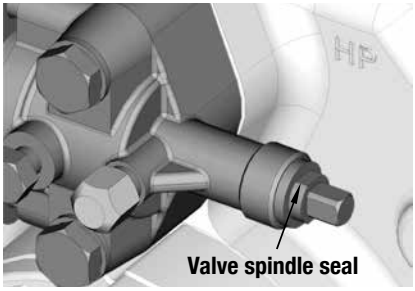


Fig. 20

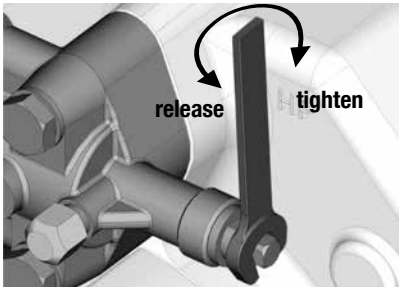


Fig. 21

4.9 Operating mode of the lockable service connections

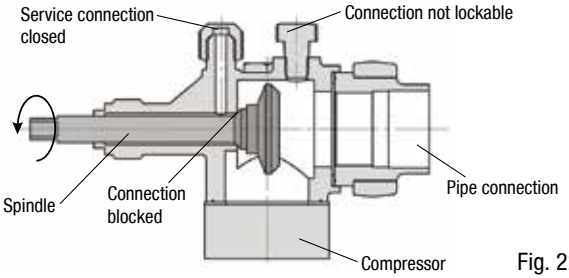


Fig. 22

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 is not lockable and is provided for safety devices.

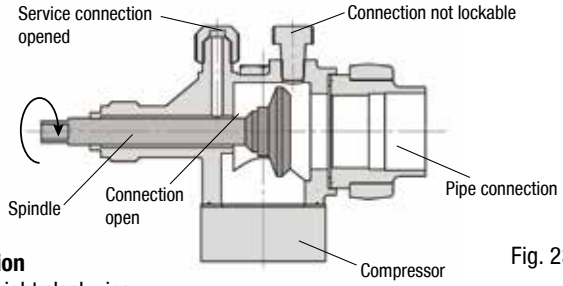


Fig. 23

Opening the service connection
Spindle: Turn ½ - 1 turn to the right clockwise.
—> Service connection opened / shut-off valve opened.
The connection is not lockable and is provided for safety devices.

After activating the spindle, generally fit the spindle protection cap again and tighten with 14-16 Nm. This serves as a second sealing feature during operation.

4.10 Suction pipe filter

For systems with long pipes and higher degree of contamination, a filter on the suction-side is recommended. The filter has to be be renewed depending on the degree of contamination (reduced pressure loss).

5 | Electrical connection

5 Electrical connection

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

ATTENTION! **When attaching accessories with an electrical cable, a minimum bending radius of 3 x the cable diameter must be maintained for laying the cable.**

INFO!

- Connect the compressor motor according to the circuit diagram (see Fig. 25-29 or inside the terminal box). Comply with local safety regulations for electrical work, safety standards (within the EU: EN 60204, EN 60335 among others) and regulations for setting up electrical systems in explosion-endangered areas (within the EU: EN 60079-14 among others).
- Avoid damage to cable fittings, since otherwise operational safety can be impaired. Lay the cable so that the fitting to the terminal box will not loosen itself. If necessary (e.g. installation that is not twist free), protection against loosening can be achieved through check nuts or appropriate adhesive. Avoid abrasion points on cables.
- For cable lead-through at the terminal box, use suitable Ex cable screw connections in the correct protective version (see name plate). Use strain relief. Avoid abrasion points on cables.
- Install all switching devices outside the explosion-endangered area. Motor contactors, feed lines and fuses are to be rated according to the maximum operating current (see name plate). Recommendations for contactor and motor protection selection are included in the table at the end of the „Electrical system“ chapter 5.2.
- Do not separate contacts 1 + 2 of the motor thermistors under voltage.
- Compare the details for voltage and frequency on the nameplate with the details for the electricity mains supply. The motor may only be connected if these details match.
- Use a motor protector switch. It should be set to the motor measurement current and checked.
- For the installation of phases L1, L2 and L3 to line-up terminals U1, V1 and W1, **no** solid wire may be used.
- **cross section for connection of line-up terminals L1, L2 and L3 = 6 - 35 mm².**
- **cross section for connection of line-up terminals 1, 2, 3 and 4 = max. 2,5 mm².**

GB

5.1 Potential equalization

Before start-up, the potential equalisation must be connected (see Fig. 24).

INFO! **Special attention must be paid to sufficient conductivity of all contact points. There must be a large seat (e.g. with ring cable lug). The installed voltage equalization must be secured against loosing and firmly connected to earth.**

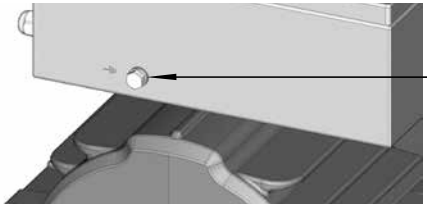


Fig. 24

5.2 Information for contactor and motor contactor selection

WARNING! **Always install all electrical peripheral devices in an external control cabinet outside the explosion-endangered area!**

GB

All protection devices and switching or monitoring units must be fitted in accordance with the local safety regulations and established specifications (e.g. VDE) as well as with the manufacturer's information. **Motor protection switches are required!** Motor contactors, feed lines, fuses and motor protection switches must be rated on the basis of the maximum working current (see name plate). For motor protection use a current-dependent and time-delayed overload protection device for monitoring all three phases. Set the overload protection device so that it must be actuated within 2 hours, if there is 1.2 times the max. working current.

5.3 Terminal cross section for leads

To limit the heating of conducting parts, the minimum terminal cross sections, indicated in the table have to be followed.

Compressor type	Minimum terminal cross section	
	direct start	part winding start
EX-HG(X)4/465-4 (HC)	3 x 10 mm²	6 x 6 mm²
EX-HG(X)4/465-4 S (HC)	3 x 16 mm²	6 x 10 mm²
EX-HG(X)4/555-4 (HC)	3 x 16 mm²	6 x 10 mm²
EX-HG(X)4/555-4 S (HC)	3 x 16 mm²	6 x 16 mm²
EX-HG(X)4/650-4 (HC)	3 x 16 mm²	6 x 16 mm²
EX-HG(X)4/650-4 S (HC)	3 x 16 mm²	6 x 16 mm²

- At ambient temperatures > 40°C, supply lines and cable/line bushings with a temperature resistance of at least 90°C must be used.
- The interpretation of the minimum terminal cross sections refer to the voltage range of 400 V, 50 Hz at 30° C ambient temperature.

5.4 Connection of the drive motor

INFO! **The compressor is equipped with a motor in Part-Winding design**

Designation on the name plate	Designation on the terminal box
Y/YY	

Compressors marked in this way are suitable for direct or part winding start. The motor winding is divided into two parts: part winding 1 = 66% and part winding 2 = 33%. This winding division reduces the start-up current during a part winding start to approx. 65% of the value for a direct start.

Mechanical start unloader with bypass solenoid is not required.

In the factory, the motor is connected for direct starting (YY). For part winding start (Y/YY) remove the bridges and connect the motor feed cable according to the circuit diagram.

ACHTUNG! **Failure to comply results in reversed fields of rotation and can cause motor damage. After the motor has started up with part winding 1, part winding 2 must be switched on after max. 1 second delay. Failure to comply can be detrimental to the service life of the motor.**

GB

Example: PW-start-up, without bridges

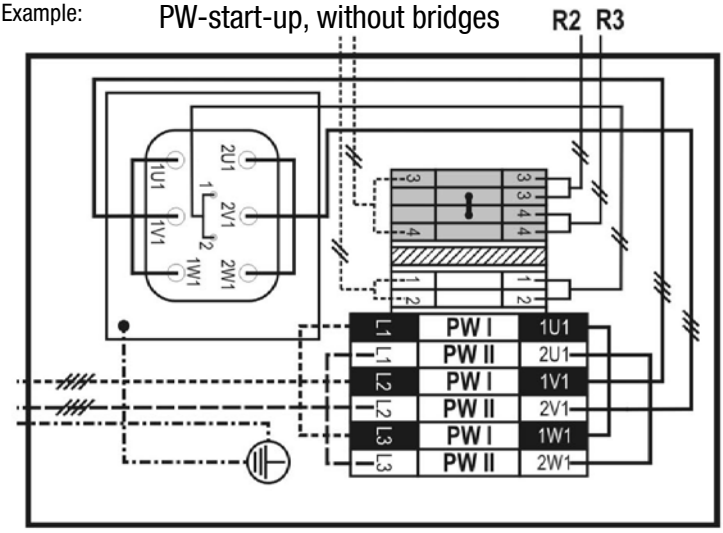


Fig. 25

= intrinsically safe electrical circuit
= protective conductor
= installed in factory
= installation by operator
= PE, installed in factory / by operator

ATTENTION! **Terminal boxes and cable screw connections must be properly closed. Protective class IP 65 must be ensured. Ex cable screw fittings must be used (pay attention to correct assignment of the cable and fitting diameter).**
Icing/condensate formation in the terminal box of the compressor must be avoided due to the danger of short circuits (e.g. through appropriate suction gas overheating). Carefully set suction gas overheating temperature! Check regularly for icing!

Example:

Direct start, with bridges

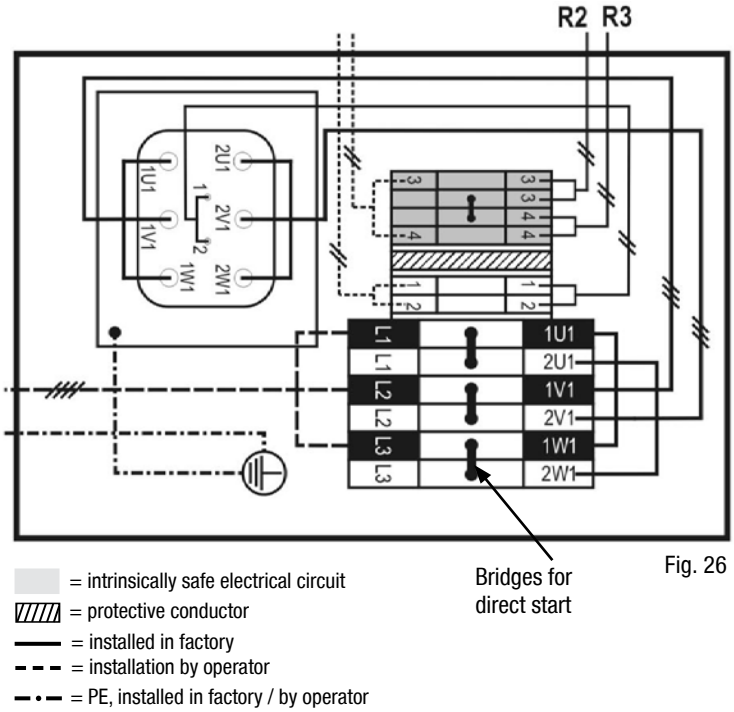


Fig. 26

For the safety guards at the compressor (terminal 1 - 4) only use twisted or screened cables

GB

Legend for circuit diagram YY (direct start)

Power section

QA1	Main switch
QA2	Motor contactor
FC1.1	Motor safety switch
EC1	Compressor motor
BT1	PTC-sensor motor winding
BT2	Heat protection thermostat
UC1	Terminal box compressor
X KK	Terminal strip in terminal box compressor
X SS	Terminal strip in external switch cabinet

Legend for circuit diagram Y/YY (part-winding start)

Power section

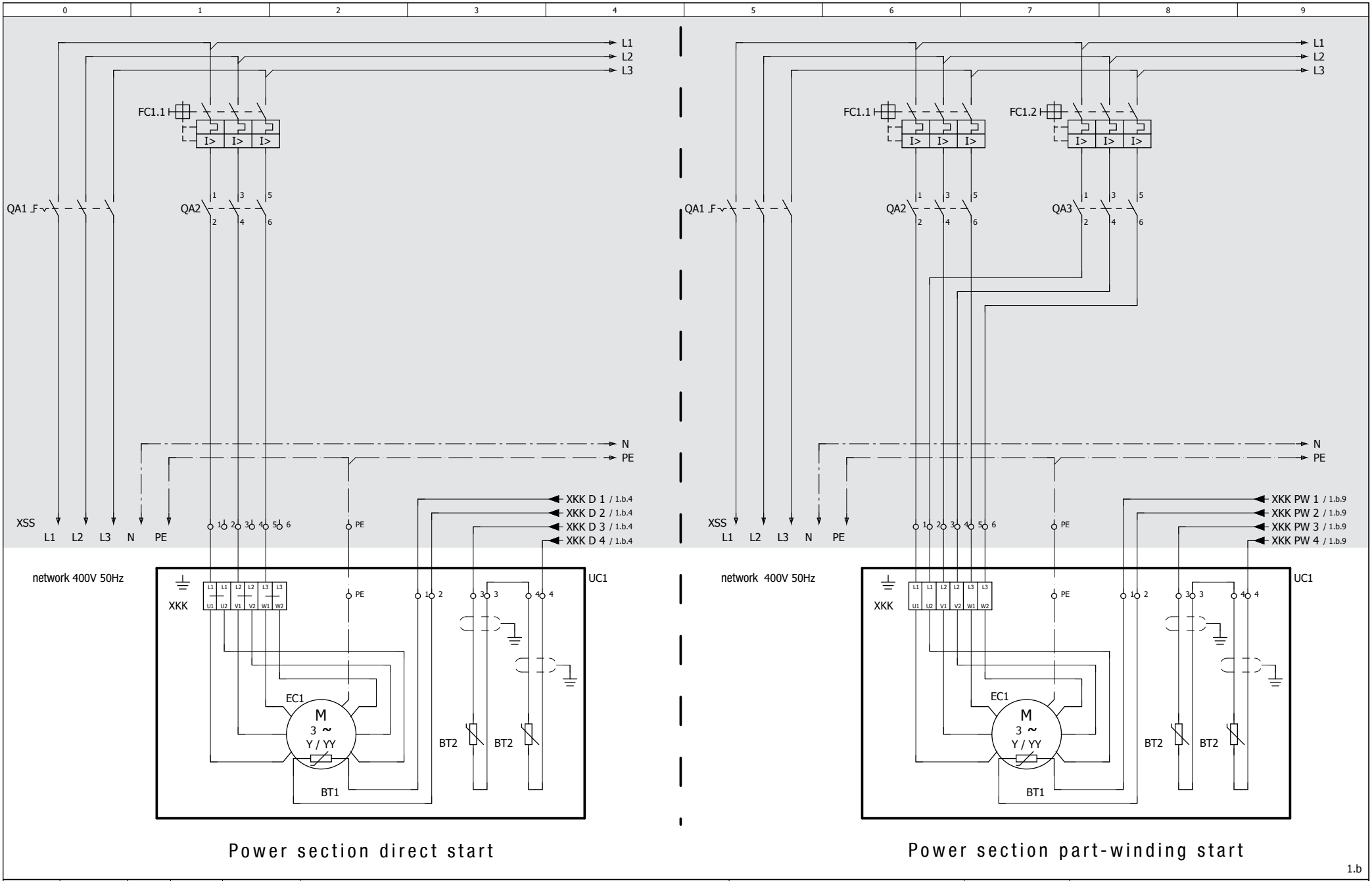
QA1	Main switch
QA2/3	Motor contactor
FC1.1	Motor safety switch
FC1.2	Motor safety switch
EC1	Compressor motor
BT1	PTC-sensor motor winding
BT2	Heat protection thermostat
UC1	Terminal box compressor
X KK	Terminal strip in terminal box compressor
X SS	Terminal strip in external switch cabinet

GB

WARNING! With the installation of control and adjust parts the valid regulations for the explosion protection have to be observed!

ATTENTION! Ensure that power is supplied via K1 to winding 1 (66 %) (1U1 / 1V1 / 1W1) and via K2 to winding 2 (33 %) (2U1 / 2V1 / 2W1). The motor contactors (K1 / K2) are each to be rated for approx. 70% of the max. operating current.

= Installation outside of the explosion endangered area!



Power section direct start

Power section part-winding start

1.b

Fig. 27

Legend for circuit diagram YY (direct start)

FB1	Fault protection switch (release current 30 mA)
FC2.1	Fuse control
FC2.2	Fuse control LR / Oil sump heater
SF1	Control voltage O/I
QA2	Performance contactor direct start
KF3	Collective malfunction alarm contactor
KF4[2]	Trigger unit MP10
FA1	AC-double barrier (Compression temperature)
BT1[1]	Pump down- pressostat/ thermostat or external enabling switch
BP1/BP2[1]	Type-examination tested safety pressure switch low pressure (PZLL)
BP3[1]	Type-examination tested safety pressure switch high pressure (PZHH)
BP4[1]	Type-examination tested pressure switch high pressure (PZH)
X SS	Terminal strip in the external switch cabinet
X KK	Terminal strip in the supplemental terminal box with recognised protection type

Optional

KF1	Time delay relay (on delay) max. 90 sec. (bypass time at start)
KF2	Time delay relay (drop-off delay) max. 90 sec. (function begins when the oil pressure / monitoring is reached during operation)
FA2	AC Switching Repeater (Oil pressure control)
BP5*	Oil differential pressure sensor (Kriwan)
EB1	Oil sump heater (ATEX design)
LR[2]	Capacity controller (ATEX design)

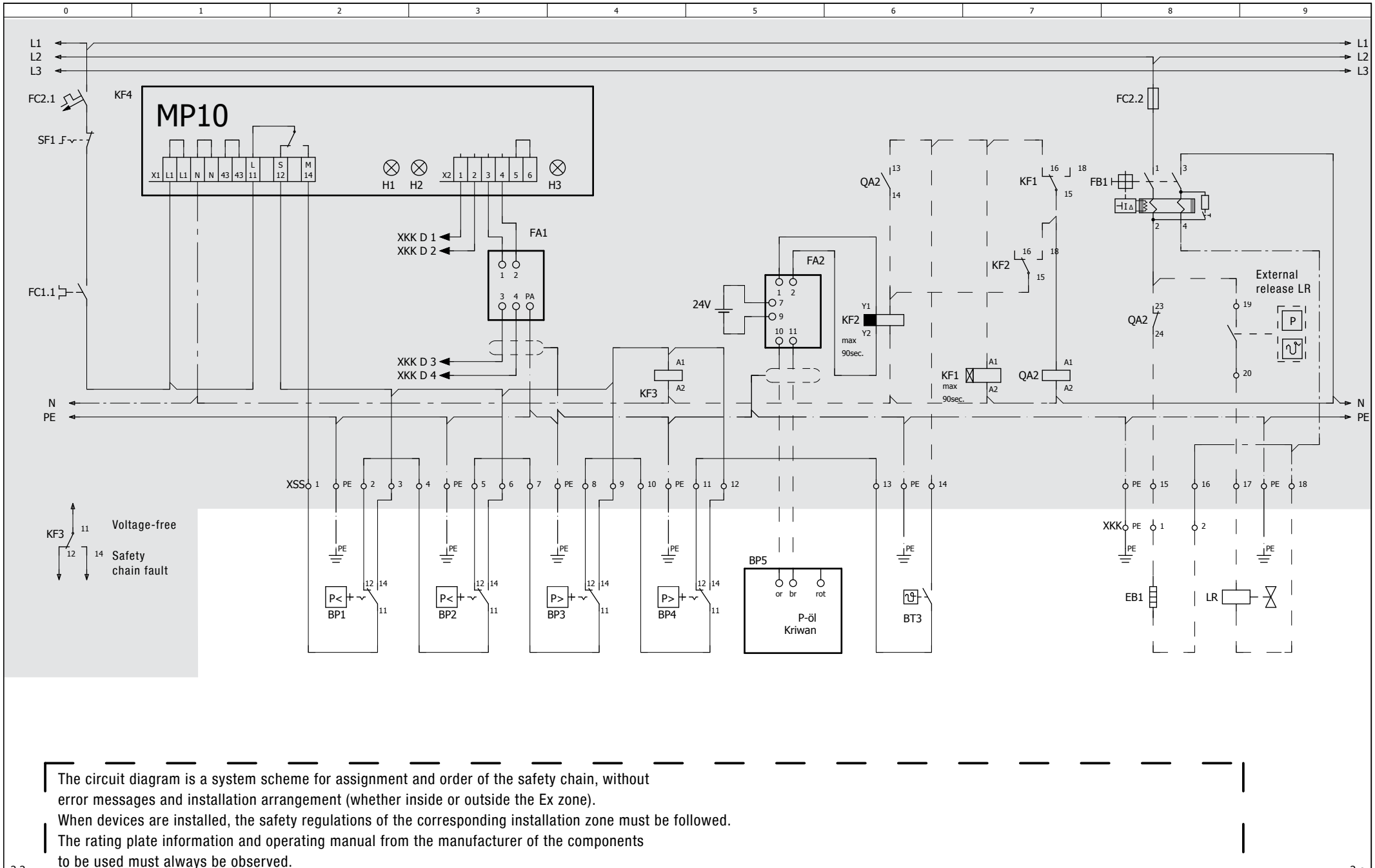
GB

[1]) Operate these components with the appropriate type of protection only

[2]) Regard deviating connection voltage!
When using 24V DC the installation of a safety isolating transformer is mandatory.

WARNING! With the installation of control and adjust parts the valid regulations for the explosion protection have to be observed!

= Installation outside of the explosion endangered area



The circuit diagram is a system scheme for assignment and order of the safety chain, without error messages and installation arrangement (whether inside or outside the Ex zone).
When devices are installed, the safety regulations of the corresponding installation zone must be followed.
The rating plate information and operating manual from the manufacturer of the components to be used must always be observed.

2.2 2.c

Fig. 28

Legend for circuit diagram Y / YY (part-winding-start)

FB1	Fault protection switch (release current 30 mA)
FC2.1	Fuse control
FC2.2	Fuse control LR / Oil sump heater
SF1	Control voltage O/I
QA2	Performance contactor part winding I
QA3	Performance contactor part winding II
KF3	Collective malfunction alarm contactor
KF5	Time relay for time delayed connect of the second part winding
KF4[2]	Trigger unit MP10
FA1	AC-double barrier (Compression temperature)
BT1[1]	Pump down- pressostat/ thermostat or external enabling switch
BP1/BP2[1]	Type-examination tested safety pressure switch low pressure (PZLL)
BP3[1]	Type-examination tested safety pressure switch high pressure (PZHH)
BP4[1]	Type-examination tested pressure switch high pressure (PZH)
X SS	Terminal strip in the external switch cabinet
X KK	Terminal strip in the supplemental terminal box with recognised protection type

GB

Optional

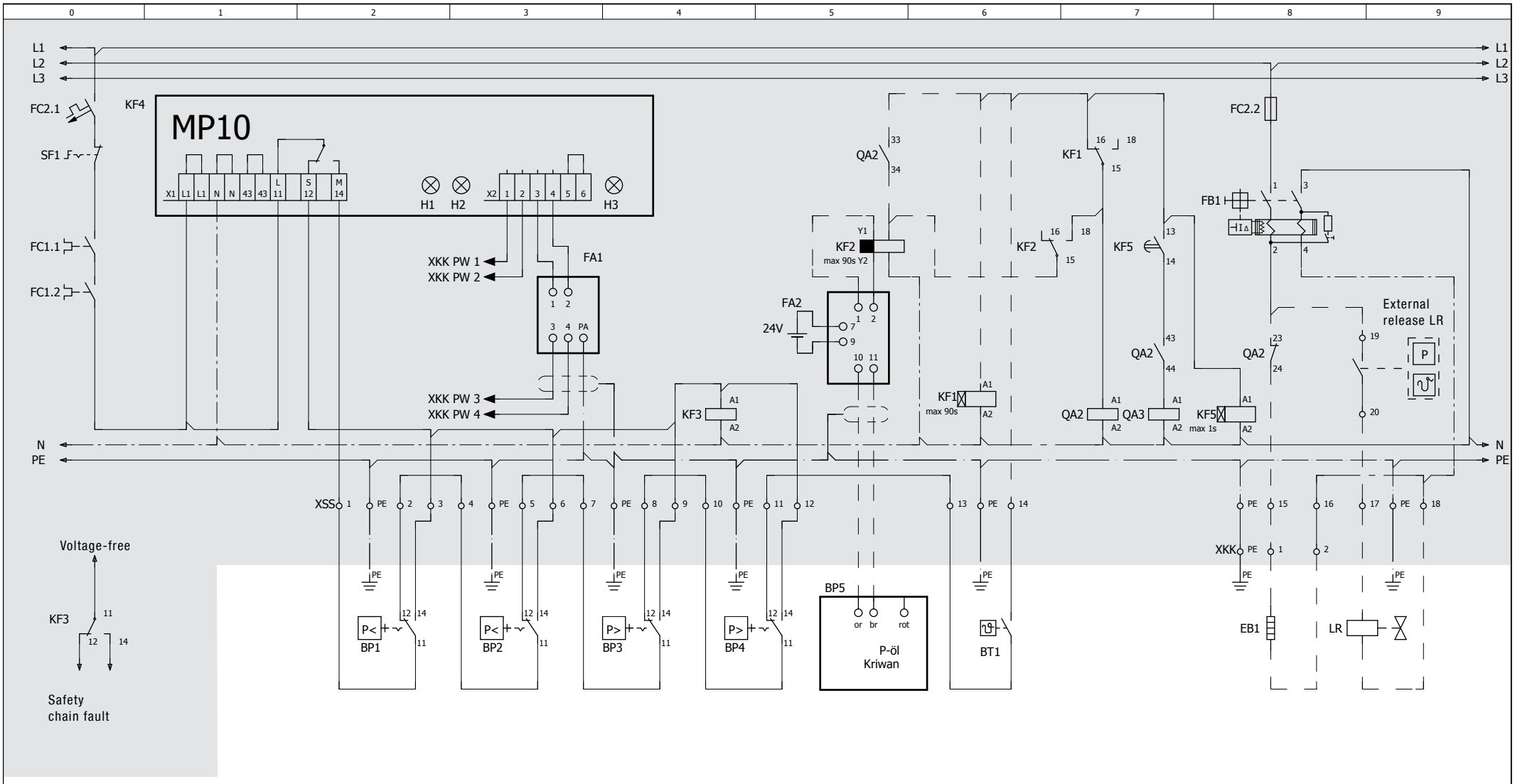
KF1	Time delay relay (on delay) max. 90 sec. (bypass time at start)
KF2	Time delay relay (drop-off delay) max. 90 sec. (function begins when the oil pressure / monitoring is reached during operation)
FA2	AC Switching Repeater (Oil pressure control)
BP5[1]	Oil differential pressure sensor (Kriwan)
EB1	Oil sump heater (ATEX design)
LR[2]	Output regulator (ATEX design)

[1]) Operate these components with the appropriate type of protection only!
[2]) Regard deviating connection voltage!
When using 24V DC the installation of a safety isolating transformer is mandatory.

WARNING! With the installation of control and adjust parts the valid regulations for the explosion protection have to be observed!

ATTENTION! Ensure that power is supplied via K1 to winding 1 (66 %) (1U1 / 1V1 / 1W1) and via K2 to winding 2 (33 %) (2U1 / 2V1 / 2W1). The motor contactors (K1 / K2) are each to be rated for approx. 70% of the max. operating current.

= Installation outside of the explosion endangered area



The circuit diagram is a system scheme for assignment and order of the safety chain, without error messages and installation arrangement (whether inside or outside the Ex zone).
When devices are installed, the safety regulations of the corresponding installation zone must be followed.
The rating plate information and operating manual from the manufacturer of the components to be used must always be observed.

2.e 3.2

Fig. 29

5.8 Electronic release unit MP10

ATTENTION! Install MP10 outside the explosion-endangered area
The MP10 trip unit must be installed according to the wiring diagram (Fig. 28/29).

- The accompanying MP10 release unit must be installed corrosion-free in the external switch cabinet outside the explosion-endangered area. Wire the release unit as the first member in the control power circuit and protect it with a fuse that is rated no larger than the smallest maximum permissible current of the installed component. **The MP10 does not have an ATEX identification.**
- When installing control and regulating parts, the respectively valid national regulations for Ex protection must be observed!
- When using the 24 V DC control voltage version of the Motor Protection Unit MP10, a protection class 3 (SELV or PELV) safety transformer must be installed in series. The safety transformer must conform to EN 60950-1
- Pay attention to safety rules during service or repair work! Consider applicable laws, standards, directives and possible new regulations before placing back into operation.
- Use only new original parts when replacing old ones (e.g. cable screw connections)
- Operate the electrical system only in an undamaged and clean condition; have it checked and serviced at regular intervals by trained personnel.

GB

- Carefully make conductor connections so that individual wires are not damaged. Properly prepare conductor ends of multiple-wire or fine-wire cables. Crimp wire end sockets only with suitable compression tools to achieve uniform quality. Ensure a secure connection of all terminal locations! **Check installation before start-up.**

- **Connection and testing PTC-sensor**

  Wire the PTC temperature sensor of the compressor motor, heat protection thermostats of the cylinder head, pressure and temperature monitoring of the system according to the wiring diagram (see Fig.27-29). In connecting the PTC sensor, pay attention to:
  - motor winding at terminals 1 and 2
  - hot gas side at terminals 3 and 4

  Terminals 1 - 6 on the trigger unit MP10 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.

  Connections between terminals in the terminal box to which heat protection thermostats (terminals 3 + 4) are connected and the electronic release unit MP10 must be designed as intrinsically safe sensor circuits and clearly marked in accordance with EN 60079-14. Appropriate measures (e.g. barrier) must be taken.
  Make the connecting lines intrinsically safe. Do not exceed the maximum resistance of 50 Ω! Take into account the resistance values of the heat protection thermostats:
  - Motor sensor as triple PTC resistor: 50 - 450 Ω (R_{cold} at + 25 °C) not intrinsically safe.
  - Hot gas sensor: Cold resistance ≤100 Ω (R_{cold} at + 25 °C per heat protection thermostat)

  The sensor outputs of the MP10 itself are not intrinsically safe. A barrier including plug-in base, is included.

- Device is ready for operation after the mains voltage is applied: LED H3: green.
- If the motor overheats: Compressor shuts off. LED H1: red.
- If the discharge-gas side overheats: Compressor shuts off. LED H2: red.
- Release (reset) required to switch back on after the device is triggered.

INFO! **When the device is triggered, an overload or impermissible operating conditions are present. Determine the cause and repair it.**

The device has a reclosure prevention device. After the malfunction is rectified, acknowledgement is made through interruption of the mains voltage or by means of an external alarm reset switch S1 (see principle circuit diagram for power section). This unlocks the reclosure prevention device and the LEDs H1 or H2 go out. **The locking device (B2) must not be removed.**

Verification of the intrinsic safety of the PTC hot gas sensor

The following values must be taken as the basis for verifying the intrinsic safety of the hot gas sensor:

Thermal protection thermostat (Art. No.** 097B50159) Conditions for intrinsic safety						
U_0	≤	U_{i1}	15,8	≤	30	[V]
U_0	≤	U_{i2}	15,8	≤	30	[V]
I_0	≤	I_{i1}	200	≤	300	[mA]
I_0	≤	I_{i2}	200	≤	300	[mA]
P_0	≤	P_{i1}	395	≤	9000	[mW]
P_0	≤	P_{i2}	395	≤	9000	[mW]
L_0	≥	$\Sigma L_{i1+} L_{i2+} L_c$*	0,5	≥	0,25*	[mH]
C_0	≥	$\Sigma C_{i1+} C_{i2+} C_c$*	478	≥	50*	[nF]

*) Values for L_c / C_c represent example values for the total output length, and they must be updated by the system builder in accordance with your design.
$L_{i1+} L_{i2}$: 0 mH $C_{i1+} C_{i2}$: 0 nF

**) Please note that the legacy BOCK codes are without 097B

GB

MP10 connection circuit diagram

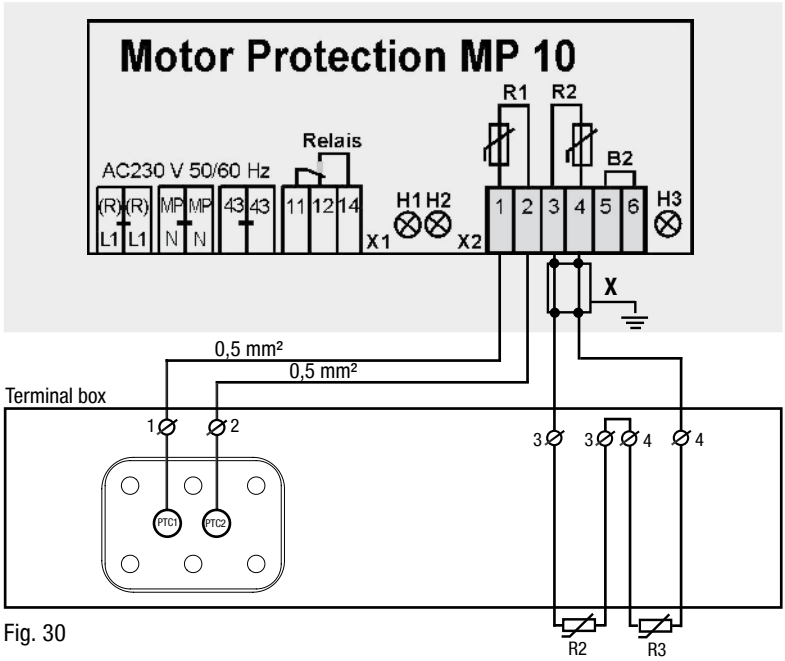


Fig. 30

= External control cabinet outside the Ex zone!

GB

5.9 Function test of the trigger unit MP10

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

Meaning of the LEDs: **red** = system not operational
green = system operational

Pos	Procedure	LED H1 red	LED H2 red	LED H3 green
1	• **Interrupt power supply (L1 or S1)** • Release the motor temperature sensor connection (1 or 2) • Release the hot gas temperature sensor (if installed) (3 or 4)	**OFF**	**OFF**	**OFF**
2	• **Restore the power supply (L1 or S1)** • Function check of motor temperature sensor: not operational • Function check of hot gas temperature sensor: not operational	**ON**	**ON**	**ON**
3	• **Interrupt power supply again (L1 or S1)** • Reconnect terminals 1 or 2 and/or 3 or 4	**OFF**	**OFF**	**OFF**
4	• **Restore the power supply (L1 or S1):** • MP10 is operational again	**OFF**	**OFF**	**ON**

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

GB

ATTENTION! All of the following work must be performed only by qualified personnel (see p. 4) and with exclusion of an explosive atmosphere.

6.1 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!

6.2 Pressure strength test

The compressor has been tested in the factory for pressure integrity. If however the entire system is to be subjected to a pressure integrity test, this should be carried out in accordance with EN 378-2 or a corresponding safety standard **without the inclusion of the compressor.**

6.3 Leak test

GB

DANGER! Risk of bursting!
The compressor must only be pressurised using nitrogen (N_2). 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.

- Carry out the leak test on the refrigerating plant in accordance with EN 378-2 or a corresponding safety standard, while always observing the maximum permissible overpressure for the compressor.

6.4 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.

6.5 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.
- 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.**

6.6 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!

6.7 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.
- Particularly in critical systems (e.g. several evaporator points), measures such as the use of liquid traps, solenoid valve in the liquid line, etc. are recommended.
  There should be no movement of refrigerant whatsoever while the compressor is at a standstill.

GB

6 | Commissioning

6.8 Preventing icing on the compressor

Check compressor regularly for icing!

Icing/condensate formation in the terminal box of the compressor must be prevented through suitable measures (e.g. suction gas overheating)

7 | Maintenance

7.1 Preparation

WARNING! **All work must be performed only by:**
- **qualified personnel (see page 4)**
- **with exclusion of any danger of explosion**

Before starting any work on the compressor:
- **Obtain written work release.**
- **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.**

GB

7.2 Work to be carried out

To avoid impermissible operating conditions for the compressor, the following service and maintenance work must be performed:

- **Tightness test**: regularly, at least once per year
- **Pressures, current consumption, temperatures, oil level:** annually
- **Pressure switches, motor protection switches and connection terminals:** annually
- **MP10 release unit, functional test:** bi-annual
- **Temperature sensors:** annually
- **Visible check, noises while running**: monthly
- **Avoid damage, dirt and dust deposits > 5 mm.**
  Clean compressor regularly with a damp cloth
- **Oil change:**
  - Not mandatory in factory-produced series systems.
  - In 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 old oil according to the regulations; observe national regulations.
- **Change of seal terminal box > compressor housing:** Seal has to be renewed every 5 years.

7.3 Spare part recommendation/accessories

Verfügbare Ersatzteile und passendes Zubehör finden Sie in unserem Verdichterauswahlprogramm unter **vap.bock.de** sowie auf **bockshop.bock.de.**

Verwenden Sie nur Original Bock Ersatzteile!

INFO! **If system function must be guaranteed with certainty, we recommend a standby compressor.**

7.4 Screw connections

The following torques must be used when re-assembling the compressor.

Cylinder head/bearing cover	M10	75 Nm
Oil filler plug, Oil drain screw, Oil sump heater	M22x1,5	100 Nm
Flange connect., soldering supports for shut-off valves	$^{7}/_{16}$" M10 M12	13 Nm 60 Nm 90 Nm
Plug	$^{1}/_{8}$" NPTF	25 Nm
Rotor	M12	65 Nm
Valve body LR 87		60 Nm
Screw-in part INT 250	M20x1,5	55 Nm

INFO! **Cylinder head / valve plate: starting from the middle, tighten screws crosswise in at least two steps (torque 50/100 %).**

7.5 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

8.1 Capacity regulation (retrofit kit Art.No. 097B81150)

according to EC Type Examination Certificate, TPS 13 ATEX 55283 007 X

INFO! **Using the Norgren magnetic coil, ID no. 4280/4281 (Bock part no.* 097B70123, 097B70124, 097B70125) effectively reduces the permissible ambient temperature of the compressor to (-20°C)–(50°C). Observe the type plate on the magnetic coil.**

The compressor output can be reduced to 50% by capacity regulation. The capacity regulation works on a cylinder bank. It is necessary to replace a cylinder cover (included in the kit) for retrofitting.

INFO!

- **The gas velocities and pressure conditions of the refrigerating plant change in operation with capacity regulation: Adapt the suction line run and dimensioning correspondingly, do not set control intervals too closely (steady state condition of the refrigeration plant must be reached), continuous operation in the control stage is not recommended (uneconomical).**
- **Electrical control of the solenoid valve: Opened de-energized (corresponds to 100% compressor output).**

GB

The explosion-protected magnetic coil for LR 87 is available in the Ex e mb design (encapsulation, increased safety). The electrical wiring within the explosion risk area has to be carried out via a separate terminal box that is designed in an approved ignition protection type M20x1,5 (e.g. Ex e).
For the installation, use heat-resistant lines with a temperature resistance of at least 140°C.
Wiring of the magnetic coil has to be static and mechanically protected.
During assembly and installation, the requirements of EN 60079-14 and the EN 60079-17 have to be observed. In addition, national laws, instructions (BetrSichV) or regulations have to be observed.
Additional installation instructions and installation/deinstallation instructions can be obtained from the accompanying kit documentation.
Terminal cross-section of magnetic coil: 3 x 1,5 - 4 mm^2
Clamping range cable screw connections (metal): 5 - 8 mm
Clamping range cable screw connections (plastic): 6 - 12 mm

ATTENTION! **The device may be used only within the data specified on the type plate. Changes to the device are not permitted.**

A fuse (max. $3xI_B$ in accordance with IEC 60127-2-1) corresponding to the rated current must be placed in front of every valve-actuating magnet as short-circuit protection. The rated voltage of the fuse must be equal to or greater than the rated voltage of the valve actuation magnets. The ability of the fuses to switch off must be greater than or equal to the maximum assumable short-circuit current at the installation location.

The EC type examination certifications must be observed!

*Please note that the legacy BOCK codes are without 097B

8.2 Capacity regulation (only for spare parts requirement Art.No.* 097B80495)

according to EC Type Examination Certificate, TPS 06 ATEX 1230 X

The compressor output can be reduced to 50% by capacity regulation. The capacity regulation works on a cylinder bank. It is necessary to replace a cylinder cover (included in the kit) for retrofitting.

INFO!

- **The gas velocities and pressure conditions of the refrigerating plant change in operation with capacity regulation: Adapt the suction line run and dimensioning correspondingly, do not set control intervals too closely (steady state condition of the refrigeration plant must be reached), continuous operation in the control stage is not recommended (uneconomical).**
- **Electrical control of the solenoid valve: Opened de-energized (corresponds to 100% compressor output).**

The explosion-protected magnetic coil for LR 87 is available in the EEx me design (encapsulation, increased safety). The electrical wiring within the explosion risk area has to be carried out via a separate terminal box that is designed in an approved ignition protection type M16x1,5 (e.g. EEx e II).
For the installation, use heat-resistant lines with a temperature resistance of at least 140°C.
Wiring of the magnetic coil has to be static and mechanically protected.
During assembly and installation, the requirements of EN 60079-14 and the EN 60079-17 have to be observed. In addition, national laws, instructions (BetrSichV) or regulations have to be observed.
Additional installation instructions and installation/deinstallation instructions can be obtained from the accompanying kit documentation.
Conductor cross-section of the supply line: 3 x 1,5 mm^2
Outside diameter of the supply line: 8,5 mm.

GB

ATTENTION! **The device may be used only within the data specified on the type plate. Changes to the device are not permitted.**

A fuse (max. $3xI_B$ in accordance with IEC 60127-2-1) corresponding to the rated current must be placed in front of every valve-actuating magnet as short-circuit protection. The rated voltage of the fuse must be equal to or greater than the rated voltage of the valve actuation magnets. The ability of the fuses to switch off must be greater than or equal to the maximum assumable short-circuit current at the installation location.

The EC type examination certifications must be observed!

*Please note that the legacy BOCK codes are without 097B

8.3 Oil sump heater (retrofit kit Art. No.** 097B80496)

The explosion-protected heating element of Thuba Co., type HEXL 12C, is supplied with an electrical supply line of 3 metres. As protection from damage during transport, the heating element is shipped packaged separately from the compressor and must be installed at the compressor's set-up location.
Electrical wiring within the potentially explosive area must be through a separate connecting box designed with a recognised protection type (e.g. EEx E II).
The connection line for the heating element must be laid permanently and mechanically protected.
During assembly and installation of the heating element, the requirements of EN 60079-14 and the BetrSichV operational safety regulations must be complied with. In addition, nationally valid laws, regulations (in Germany VDE 0100) or stipulations must be observed.
Additional installation instructions and installation/deinstallation instructions can be obtained from the accompanying kit documentation.

Conductor cross-section of the supply line: 3 x 1.5 mm^2
Outside diameter of the supply line: 8.3 mm.

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

ATTENTION! To limit the heat resulting from abnormal earth-connection and earth-conducting current, the following protective equipment must be installed in addition to excess-current protection:

- **In a TT- or TN system, a residual current protection device (RCD) must be used with a rated triggering current not exceeding 100 mA. Residual current protective equipment with a rated triggering current of 30 mA is preferable. The maximum switch-off time of the equipment for must not exceed 5 seconds for rated triggering current and 0.15 seconds in case of five-times the rated triggering current.**
- **In an IT system, an insulation monitoring device must be used to check whether the feed is switched off as soon as the insulation resistance drops to 50 Ω per volt of rated voltage.**

The EC type examination certifications must be observed!

GB

** Please note that the legacy BOCK codes are without 097B

8.4 Oil pressure differential sensor INT250 (retrofit kit Art. No.** 097B80516)

The oil pressure differential sensor kit INT 250 consists of INT 250 screw-in parts and switching parts, switching repeater and two timers. The INT 250 switching part is supplied with a 3-meter electrical supply line.

Electrical wiring within the potentially explosive area must be through a separate terminal box executed with a recognised protection type (e.g. Ex e). Within the zone classification, the electrical circuit must be executed intrinsically safe, a switching repeater is included with the kit.

The timers contained in the kit must be integrated in accordance with the basic circuit diagram of these instructions for assembly. They enable the rise/fall delay of the INT 250 oil pressure differential sensor. The timers are already set and sealed at the factory for a rise/fall delay of 90 seconds. The switching repeater and the central control unit must be installed outside the explosive area in the switch cabinet. The connection line for the INT 250 connecting part must be laid permanently and mechanically protected.

During assembly and installation of the oil pressure differential sensor INT 250, the requirements of EN 60079-14 and the BetrSichV operational safety regulations must be met. In addition, nationally valid laws, regulations (in Germany VDE 0100) or provisions must be observed.
Additional installation instructions and installation/deinstallation instructions can be obtained from the accompanying kit documentation.

GB

The following values must be taken as a basis for verifying intrinsic safety:

Oil pressure differential sensor INT250 (Art. No. 60018) Conditions for intrinsic safety						
U_o	≤	U_i	9,6 V	≤	9,6 V
I_o	≤	I_i	10 mA	≤	10 mA
P_o	≤	P_i	24 mW	≤	24 mW
L_o	≥	$\Sigma L_{i1+} L_{i2+} L_c$*	350 mH	≥	50*
C_o	≥	$\Sigma C_{i1+} C_{i2+} C_c$*	3,6 µF	≥	0,25*

*) Values for L_c /C_c represent example values for the total output length, and they must be updated by the system builder in accordance with your design.
$L_{i1+} L_{i2}$: 0 mH $C_{i1+} C_{i2}$: 0 nF

**) Please note that the legacy BOCK codes are without 097B

ATTENTION! **Installation must be in accordance with EN 60079-14 as an intrinsically safe electrical circuit and protected by the barrier already contained in the kit.** The EC type examination certifications must be observed.

Risk of static charge from the plastic housing of the INT 250. Avoid strong charge-generating processes in the proximity of the compressor (see Chapter 1.3). Carry out the cleaning work using only a damp cloth and away from potentially-explosive atmospheres.

Type	No. of cylinders	Displacement 50 / 60 Hz (1450 / 1740 1/rpm)	Electrical data ③				Weight	Connections ④		Oil charge
			Voltage ①	Max. Operating current ② PW 1 + 2	Max. power consumption ②	Starting current (rotor locked) PW1/PW1+2		Discharge line DV	Suction line SV	
		m^3/h		A	kW	A	kg	mm (inch)	mm (inch)	Ltr.
EX-HG4../465 - 4..	4	40,5 / 48,6	380-420 V Y/YY - 3 - 50 Hz PW 440-480 V Y/YY - 3 - 60 Hz PW PW = Part Winding Winding ratios: 66% / 33%	20	11,8	57 / 75	151	28 (1 1/8")	35 (1 3/8")	2,7
EX-HG4../465 - 4 S..		40,5 / 48,6		25	14,2	82 / 107	154			
EX-HG4../555 - 4..		48,2 / 57,8		24	14,1	82 / 107	153			
EX-HG4../555 - 4 S..		48,2 / 57,8		30	16,9	107 / 140	156			
EX-HG4../650 - 4..		56,6 / 67,9		29	16,8	82 / 107	155		42 (1 5/8")	
EX-HG4../650 - 4 S..		56,6 / 67,9		37	20,9	107 / 140	158			

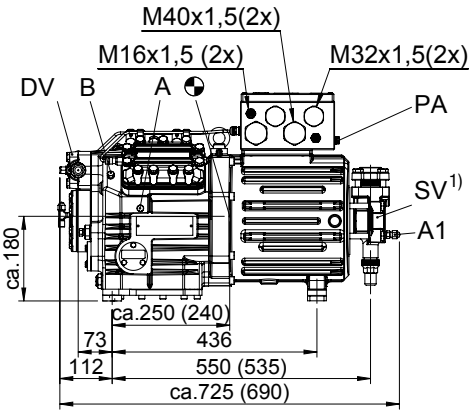
① Tolerance (± 10%) relative to the mean value of the voltage range.

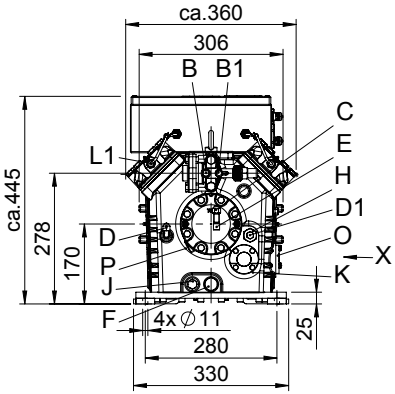
② - The specifications for max. power consumption apply for 50Hz operation. For 60Hz operation, the specifications have to be multiplied by the factor 1.2. The max. working current remains unchanged.
- Take account of the max. operating current / max. power consumption for design of fuses, supply lines and safety devices. Fuse: Consumption category AC3

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

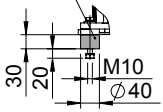
④ For solder connections

EX-HG4

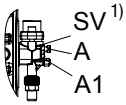




Vibration damper



View EX-HG(X)4/465+555-4 (S) +HC



GB

[1] SV 90° rotatable

Dimensions in () = EX-HG4/465+555-4 (S) +HC

Centre of gravity

View X: Possibility to connect to oil level regulator

○ Three-hole connection for TRAXOIL (3xM6x10)

● Three-hole connection for ESK, AC+R, CARLY (3xM6x10)

Dimensions in mm

Fig. 31

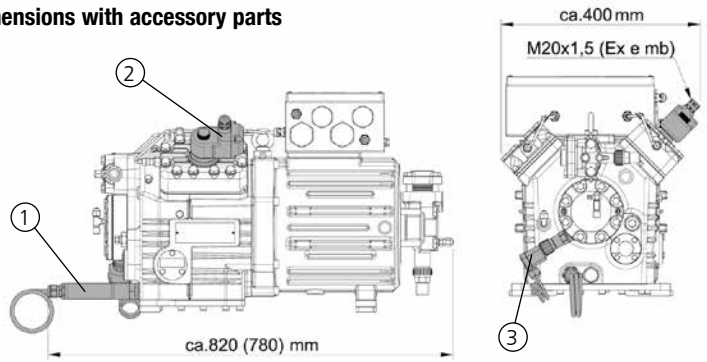
SV **DV**	Suction line Discharge line see technical data, Chapter 9	
A	Connection suction side, not lockable	1/8“ NPTF
A1	Connection suction side, lockable	7/16“ UNF
B	Connection discharge side, not lockable	1/8“ NPTF
B1	Connection discharge side, lockable	7/16“ UNF
C*	Connection oil pressure safety switch OIL	7/16“ UNF
D*	Connection oil pressure safety switch LP	7/16“ UNF
D1	Connection oil return from oil separator	1/4“ NPTF
E	Connection oil pressure gauge	7/16“ UNF
F	Oil drain	M 22 x 1,5
H	Oil charge plug	M 22 x 1,5
J*	Connection oil sump heater	M 22 x 1,5
K	Sight glass	4 x M 6
L1	Thermal protection thermostat	1/8“ NPTF
O*	Connection oil level regulator	3 x M 6
P*	Connection oil pressure differential sensor	M 20 x 1,5
PA	Potential equalisation connection	M 8

*) Operate these components with the appropriate type of protection only!

Dimensions MP10 for switch cabinet installation

Length: 100 mm Width: 60 mm Height: 52 mm

Dimensions with accessory parts



Dimensions in () = EX-HG4/650-4, EX-HG4/650-4 S

(1) Oil sump heater (2) Capacity regulator (3) Oil pressure differential sensor Fig. 32

(1) # EC – Type examination certificate

Product Service

(2) Equipment and protective systems intended for use in potentially explosive atmospheres – **Directive 94/9/EC**

(3) EC-Type examination certificate number

TPS 13 ATEX 55283 007 X

(4) Equipment: Compressor series EX-HG(X)4; EX-HG(X)5; EX-HG(X)6

(5) Manufacturer: GEA Bock GmbH

(6) Address: Benzstraße 7
D-72636 Frickenhausen / Germany

(7) The design of this equipment as well as any acceptable variation are specified in the annex to this type examination certificate.

(8) TÜV SÜD Product Service GmbH, notified body number 0123 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.
The test results are recorded in the confidential test report 71385686.

(9) The Essential Health and Safety requirements are met by compliance with:

EN 1127-1:2011 **EN 13463-1:2009** **EN 60079-0:2009**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the annex to this certificate.

(11) This EC-Type examination certificate relates only to the design and construction of the specified equipment in accordance with Directive 94/9/EC. Further requirements of the Directive apply to the manufacture and placing on the market of this equipment.

(12) The marking of the equipment shall include the following:

Compressor with conductive coating: **II 2G IIC T3 Gb**

Compressor with insulating coating: **II 2G IIB T3 Gb**

Certification Body for Explosion Protection

Andreas Pfeil

Stuttgart, January 27th, 2014

612030

TÜV SÜD Product Service GmbH · Zertifizierstelle · Ridlerstraße 65 · 80339 München · Germany

TÜV®

(13) **Annex**

(14) **EC-Type examination certificate TPS 13 ATEX 55283 007 X**

(15) Description of equipment:

The compressor is part of a refrigerant circuit and is used to compress the refrigerant while heating. As the drive motor is housed in the compressor, it is an integral part of the equipment. Thus, the equipment is considered as an electrical equipment.

Technical & electrical data:

Compressor EX-HG(X)4, EX-HG(X)5, EX-G(X)6	Characteristics
Operating voltage	400 V – 690 V
Frequency range	10 Hz – 90 Hz (restricted frequency range according to the manufacturer's documentation)
Maximum operating current	76 A (reduced values according to the manufacturer's documentation)
Maximum power consumption	51 kW (reduced values according to the manufacturer's documentation)
Protection class terminal box	IP65
Design compressor	Semi-hermetic
Compressor with insulating coating < 2 mm	Range of use – gas group IIB
Compressor with conductive coating < 2 mm	Range of use – gas group IIC

(16) Test report: 71385686

(17) Special conditions:

- The ambient temperature range is different from the standard temperature range and extends from -20°C up to +60°C.
- When operating the compressor with capacity regulator, the ambient temperature range will be restricted from -20°C ≤ Tamb up to ≤ +50°C.
- Use of flammable refrigerants: only types of refrigerants are permitted with an auto-ignition temperature "TS_{ign}" (TS ignition) > 250°C.
- There are only lubricants permitted with an auto-ignition temperature "TS_{ign}" (TS ignition) > 250°C.
- The electrical connection and equipotential bonding must be carried out according to EN 60079-14.
- The maximum operating current according to the specifications on the type plate shall not be exceeded even in the frequency-controlled area.

Product Service

- The notes in the operating / assembly instructions and the manufacturer's safety concept have to be observed.
- The ignition protection measures described in the manufacturer's operating / assembly instructions must be observed.
- Compressors with insulating coating < 2 mm may be used only in the gas groups IIB or IIA.
- Additionally, by means of an external motor protection switch, the plant manufacturer shall further protect the compressor motor against overload / short circuit.
- If the pressure drops, the compressor must be stopped. For this purpose, a low-pressure limiting shall be provided by the plant manufacturer.

(18) Essential Health and Safety Requirements:

are covered by the specified standards and the manufacturer's existing safety concept.

Certification Body for Explosion Protection

Stuttgart, January 27th, 2014

Andreas Pfeil

GB

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