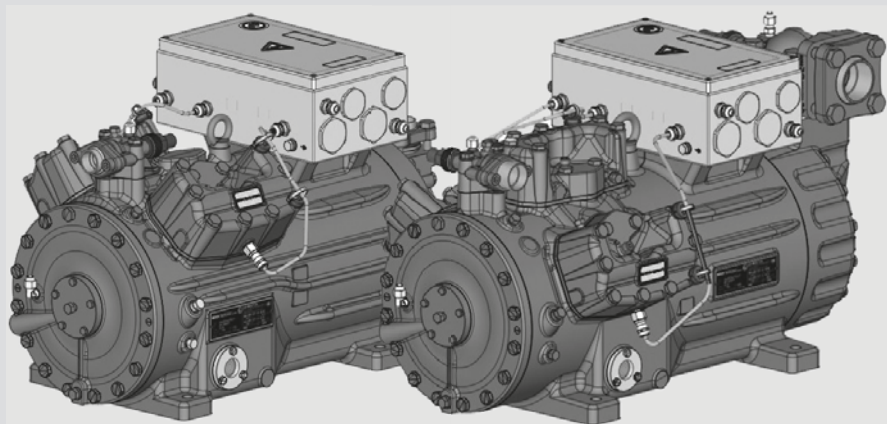




BOCK EX-HG44e/EX-HG56e

Assembly instructions

96389-07.2023-Gb

Translation of the original instructions

Device category 2 G

- acc. to directive 2014/34/EU

- acc. to UKSI 2016 No. 1107

EX-HG(X)44e/475-4 (S)

EX-HG(X)44e/565-4 (S)

EX-HG(X)44e/665-4 (S)

EX-HG(X)44e/770-4 (S)

EX-HG(X)56e/850-4 (S)

EX-HG(X)56e/995-4 (S)

EX-HG(X)56e/1155-4 (S)

EX-HG(X)44e/475-4 (S) HC

EX-HG(X)44e/565-4 (S) HC

EX-HG(X)44e/665-4 (S) HC

EX-HG(X)44e/770-4 (S) HC

EX-HG(X)56e/850-4 (S) HC

EX-HG(X)56e/995-4 (S) HC

EX-HG(X)56e/1155-4 (S) HC

BOCK®

colour the world
of tomorrow

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:



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.

GB

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 | Safety

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.

GB

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 1999/92/EC (operator directive). 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 | Safety

1.4 Intended use

These assembly instructions describe the compressors named in the title 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 and/or UK SI 2016 No. 1107.



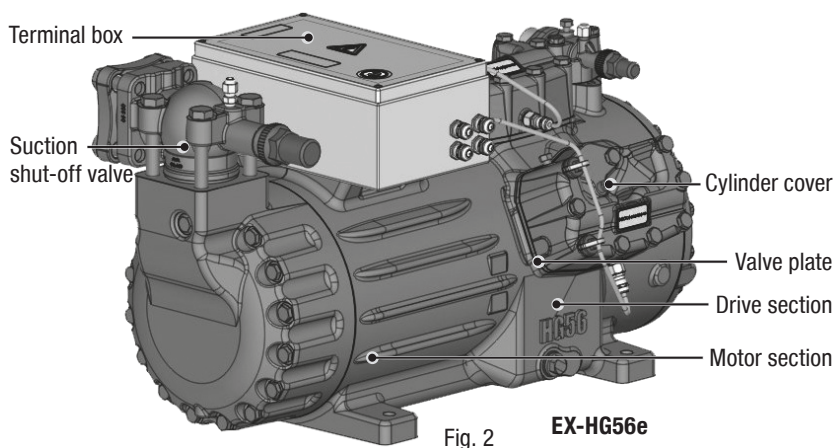
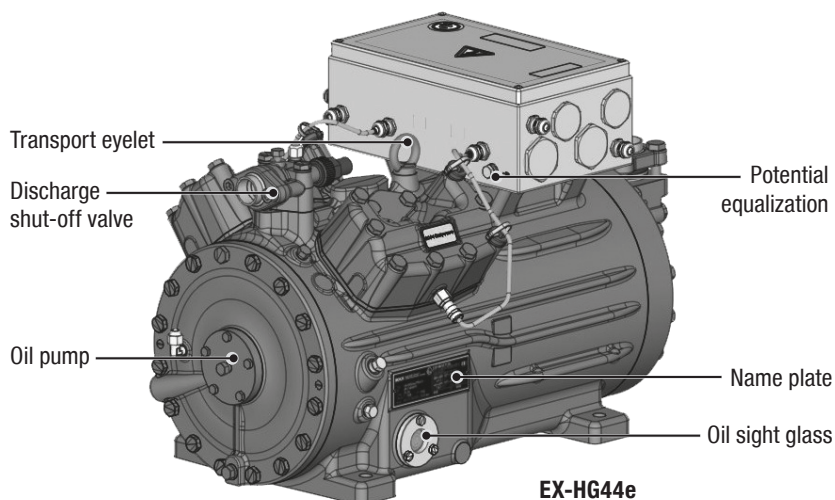
WARNING

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!

2 | Product description

2.1 Short description

- **EX-HG44e:** Semi-hermetic four-cylinder reciprocating compressor with oil pump lubrication.
- **EX-HG56e:** Semi-hermetic six-cylinder reciprocating compressor with oil pump lubrication.
- For use in explosion-endangered areas.



Dimension and connection values can be found in Chapter 10

2 | Product description

2.2 Ignition protection concept

In accordance with Directive 2014/34/EU and/or UK SI 2016 No. 1107, 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.

The entire compressor, including motor, is perceived as technically tight and therefore does not need an ignition protection.

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 h). The installation of the electronic control unit INT69 EX2 and the safety barrier, both included in the scope of supply, is therefore absolutely necessary.

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 h 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 for the protection type 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).

The scope of delivery of the standard compressor comprises a conductive paint finish, that is suitable for the use in explosion group IIC. If the compressor is delivered with the accessory "Offshore Paint Finish", the application is restricted to explosion group IIB.

2 | Product description

Accessories

Heating elements for the compressors to protect against explosion risks are designed in the protection types increased safety (Ex d) and 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 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 explosion 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).

The oil differential pressure sensor INT250 Ex 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 switching repeater. Please note that the plastic housing of the INT250 Ex 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.

Equipment	Type of ignition protection	EPL ¹⁾
Terminal box	Ex e	b
Terminal board	Ex d+e	b
Through terminals in the terminal box	Ex e	b
Cable entrances	Ex e /	b
plug	Ex d	b
Line entrances	Ex d	b
Magnetic coil	Ex e m	b
Oil sump heater	Ex d	b
Oil differential pressure sensor INT250 Ex	Ex i	a
Hot gas PTC sensor	Ex i	a

¹⁾ Equipment Protection Level

GB

2 | Product description

2.3 Name plate (example)

1

2

3

4

5

Typ : EX-HGX44e/770-4 S

Nr. : AX12345A001

I_{max} : 35,0 A

I_{block}:Y: 133A YY: 171A

p_{max} :ND(LP)/HD(HP)= 19/28 bar

BOCK

Bock GmbH, Benzstr. 7
72636 Frickenhausen, Germany

UK
CA 2503

II 2G Ex db eb ia mb IIC T3 Gb / EPS 17 ATEX 1002 X/CML 21UKEX1800X
Ex db eb ia mb IIC T3 Gb / IECEx EPS 17.0001 X

Tamb: [-20°C] - [60°C]

380-420V Y/YY -3- 50 HZ

n: 1450 min⁻¹ V_{th}: 67,0 m³/h

440-480V Y/YY -3- 60 HZ

n: 1740 min⁻¹ V_{th}: 80,4 m³/h

IP66

Öl: BOCKlub E55

CE 2004

Fig. 3

1

Type designation

2

Machine number

3

maximum operating current

4

Starting current (rotor blocked)
Y: Part winding 1
YY: Part windings 1 and 2

5

ND (LP): max. admissible operating
pressure (g) Low pressure side
HD (HP): max. admissible operating
pressure (g) High pressure side

6

Voltage, circuit, frequency

7

Nominal rotation speed

8

Displacement

9

Voltage, circuit, frequency

10

Nominal rotation speed

11

Displacement

12

Oil type filled at the factory

13

Terminal box protection type

14

Permissible ambient temperature

i

Observe the limits of
application diagrams!

i

Electrical accessories can change
the IP protection class!

2.4 Type key (example)

EX-HG X 4 4 e / 770-4 S HC

for hydrocarbons

Motor variant ³⁾

Number of poles

Swept volume

e-series

Number of cylinders

Size

Ester oil filling ²⁾

Series ¹⁾

Ex-design

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

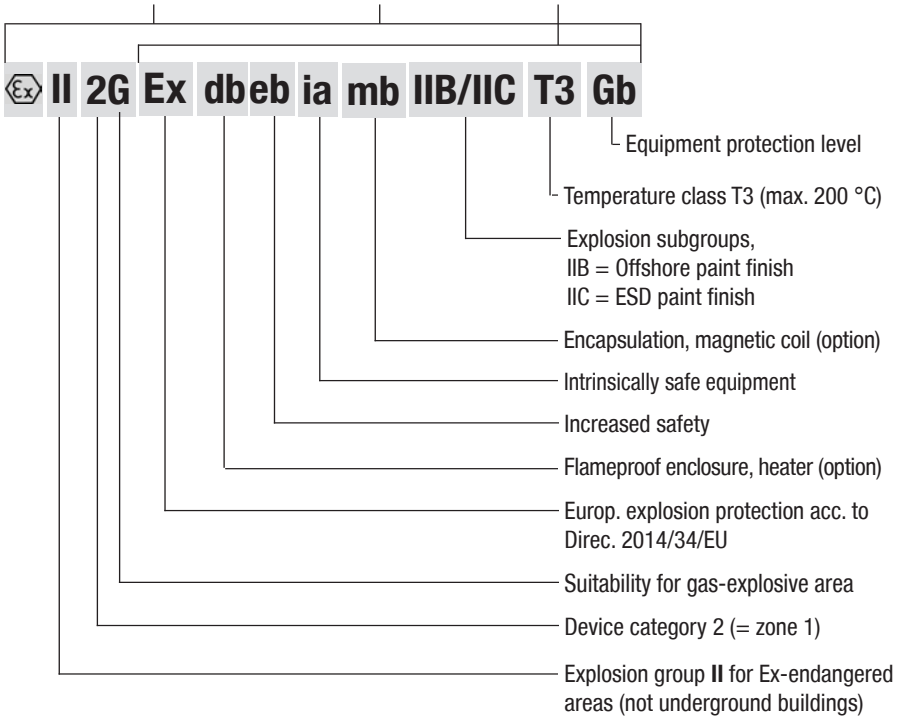
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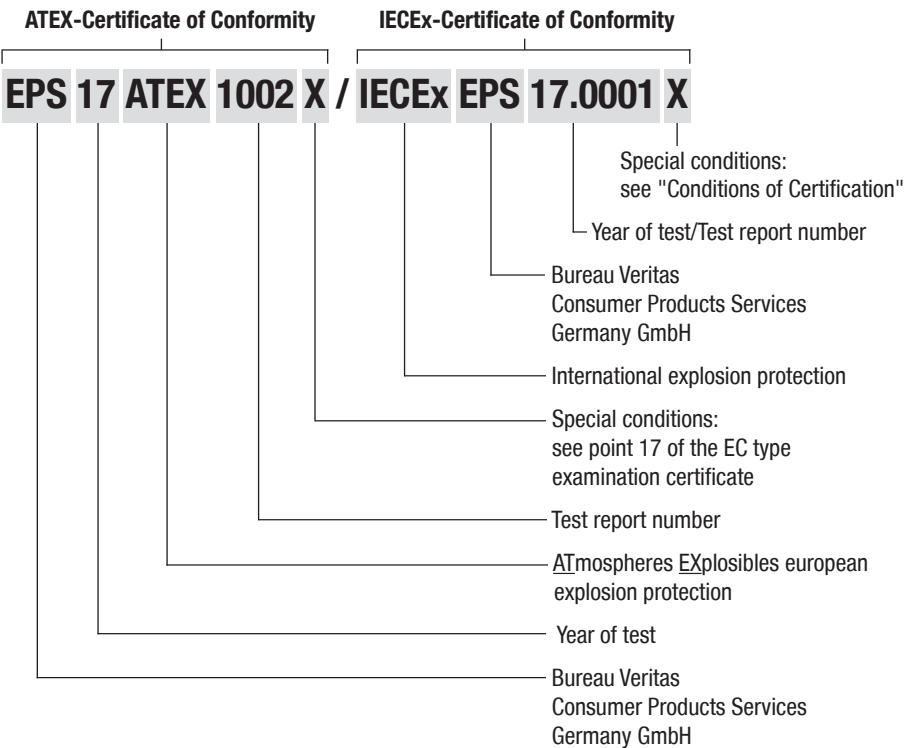
2 | Product description

2.5 ATEX identification / UKEX identification / IECEx identification



GB

3 | Areas of application



3 | Areas of application

3.1 Approved refrigerant

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



INFO

Used refrigerants have to have a self-ignition temperature of > 250 °C.

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 and/or UK SI 2016 No. 1107.

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.

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).

GB

3 | Areas of application

3.3 Oil charge

- The following oil grades are approved for the compressor:

Refrigerant	Oil grade
R22	BOCK lub A46
R134a, R404A, R507, R407C	BOCK lub E55
R290, R1270	BOCK lub G68



INFO

Used refrigerant oils have to have a self-ignition temperature of > 250 °C.

Compressors with ester oil filling (**BOCK** lub E55) are marked with an X in the type designation (e.g. EX-HG**X**44e/770-4). Compressors with oil filling **BOCK**lub G68 are marked with HC (e.g. EX-HG44e/770-4 **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 under-filled!

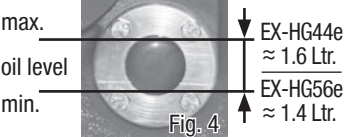


Fig. 4

3 | Areas of application

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 12 x / 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} at the compressor entrance is of decisive importance:

Too low Δt_{oh} => danger of liquid operation

Too high Δt_{oh} => danger of compressor overheating

$\Delta t_{oh} \text{ min} = 7 - 10 \text{ K}$, individual adjustment required.

Permissible ambient temperature range -20 °C to +60 °C.

Avoid continuous operation near the limits.

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.

(For more information on frequency converters, see Chapter 5.13, P. 33).

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 operation in the vacuum range!

4 | Compressor assembly



INFO

- New compressors are factory-filled with inert gas. 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 (TRGS 727, e.g. protective shoes, clothing etc.)!

4.1 Ignition source control of the compressor

To protect against an exceeding of temperature the protection type ignition source control "h" 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 INT69 EX2.

GB

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 INT69 EX2. 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 5.10 of this assembly instruction.

For a safe function of the ignition source control the INT69 EX2 has to be installed according to the wiring diagram fig. 21. Check the function of the ignition protection system according to section 5.10. Defective sensors or ignition protection systems have to be replaced before reconnection of the compressor.

Operation of the compressor without igitnion source control is not permitted!

After shutdown by the INT69 EX2, precise error diagnostics and error correction is necessary. The INT69 EX2 has a restart interlock that can only be interrupted by means of voltage interruption.

4 | Compressor assembly

4.2 Storage and transport



Fig. 5



Fig. 6

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

4.3 Setting up



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

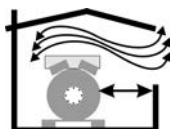


Fig. 7

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



Fig. 8

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

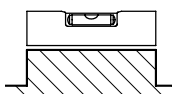


Fig. 9

- 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. 10

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



Fig. 11

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

GB

4 | Compressor assembly

4.4 Pipe connections

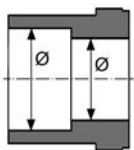


Fig.12: graduated internal diameter

- 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).

4.5 Pipes

GB

- 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.

4 | Compressor assembly

4.6 Laying suction and pressure lines

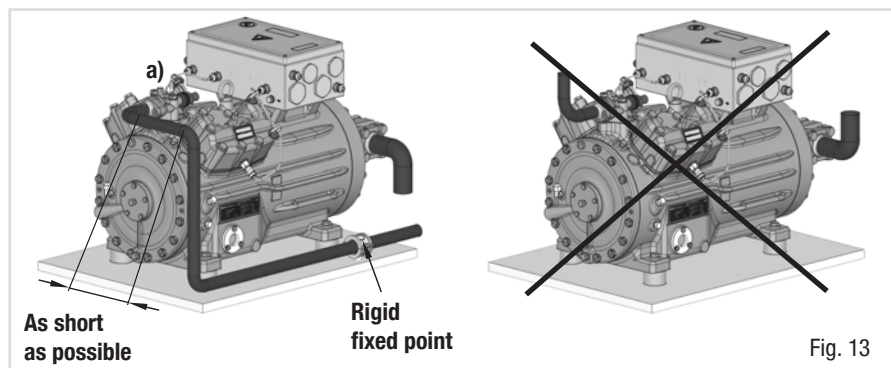


ATTENTION Improperly installed pipes can cause cracks and tears which can result in a loss of refrigerant



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.

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



GB

- a) For EX-HG44e an intermediate flange (height 27 mm) is optional available, Art-Nr. 81194.
With this intermediate flange it is possible to lay the pressure line directly from the valve to the left or right.



4.7 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.

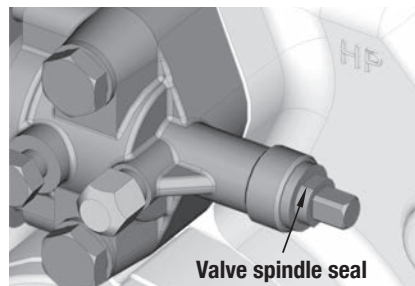


Fig. 14

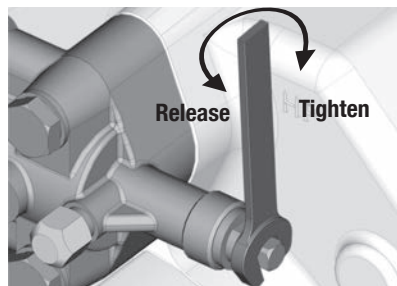


Fig. 15

4 | Compressor assembly

4.8 Operating mode of the lockable service connections

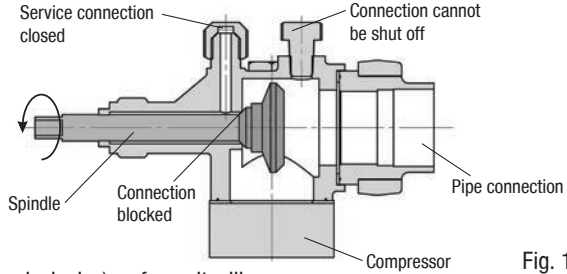


Fig. 16

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.

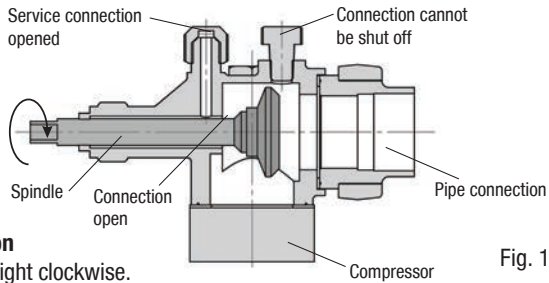


Fig. 17

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.

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.

4.9 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 renewed depending on the degree of contamination (reduced pressure loss).

5 | Electrical connection

5 Electrical connection



DANGER

Risk of electric shock! High voltage!

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.

5 | Electrical connection



INFO

- Connect the compressor motor according to the circuit diagram (s. fig. 19-21 or sticker 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: IEC/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 rated motor 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

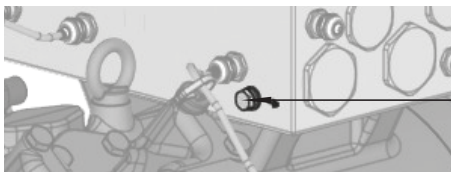
5.1 Potential equalization

Before start-up, the potential equalisation must be connected (see Fig. 18).



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 loosening and firmly connected to earth



Potential equalization connection

Fig. 18

5 | Electrical connection

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!

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)44e/475-4 (HC)	3 x 10 mm ²	6 x 6 mm ²
EX-HG(X)44e/475-4 S (HC)	3 x 16 mm ²	6 x 10 mm ²
EX-HG(X)44e/565-4 (HC)	3 x 16 mm ²	6 x 10 mm ²
EX-HG(X)44e/565-4 S (HC)	3 x 16 mm ²	6 x 16 mm ²
EX-HG(X)44e/665-4 (HC)	3 x 16 mm ²	6 x 16 mm ²
EX-HG(X)44e/665-4 S (HC)	3 x 16 mm ²	6 x 16 mm ²
EX-HG(X)44e/770-4 (HC)	3 x 16 mm ²	6 x 16 mm ²
EX-HG(X)44e/770-4 S (HC)	3 x 16 mm ²	6 x 16 mm ²
EX-HG(X)56e/850-4 (HC)	3 x 25 mm ²	6 x 16 mm ²
EX-HG(X)56e/850-4 S (HC)	3 x 25 mm ²	6 x 25 mm ²
EX-HG(X)56e/995-4 (HC)	3 x 25 mm ²	6 x 16 mm ²
EX-HG(X)56e/995-4 S (HC)	3 x 25 mm ²	6 x 25 mm ²
EX-HG(X)56e/1155-4 (HC)	3 x 25 mm ²	6 x 16 mm ²
EX-HG(X)56e/1155-4 S (HC)	3 x 25 mm ²	6 x 25 mm ²

- 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 | Electrical connection

5.4 Connection of the drive motor



INFO

The compressor is equipped with a motor in Part-Winding design.

Designation on the name plate
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 = 50 % and part winding 2 = 50 %. This winding division reduces the start-up current during a part winding start to approx. 50 % 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.



ATTENTION

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



ATTENTION

Terminal boxes and cable screw connections must be properly closed, in order to achieve the protective class IP 66. Use Ex cable screw fittings (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!

Legend for circuit diagram YY (direct start)

Power section

QA1	Main switch
QA2	Performance contactor direct start
FC1.1	Motor safety switch
EC1	Compressor motor
BT1	PTC-sensor motor winding
BT2	Thermal 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	Performance contactor part-winding I
QA3	Performance contactor part-winding II
FC1.1	Motor safety switch
FC1.2	Motor safety switch
EC1	Compressor motor
BT1	PTC-sensor motor winding
BT2	Thermal protection thermostat
UC1	Terminal box compressor
X KK	Terminal strip in terminal box compressor
X SS	Terminal strip in external switch cabinet



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 QA2 to winding 1 (50 %) (1U1 / 1V1 / 1W1) and via QA3 to winding 2 (50 %) (2U1 / 2V1 / 2W1). The motor contactors (QA2 / QA3) are each to be rated for approx. 50% of the max. operating current.



= Installation outside of the explosion endangered area

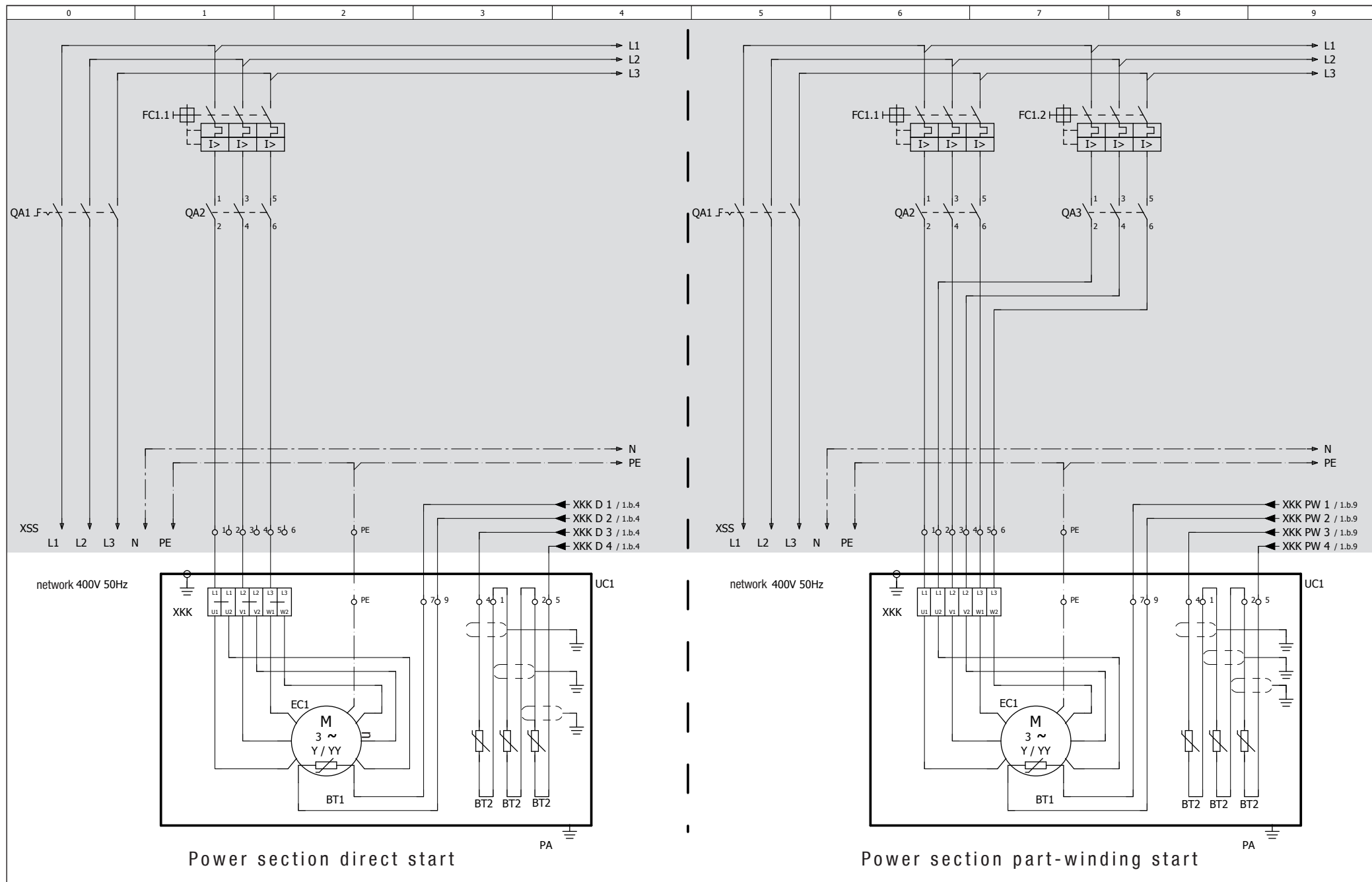


Fig. 19

Legend for circuit diagram YY (direct start)

FC1.1	Motor safety switch
FC2.1	Control fuse
FC2.2	Control fuse LR / oil sump heater
SF1	Control voltage O/I
QA2	Performance contactor direct start
KF3	Collective malfunction alarm contactor
KF4 ²	Electronic trigger unit INT69 EX2
FA1	AC-double barrier (compression temperature)
BT3 ¹	Pump down- pressostat/ thermostat or external enabling switch
BP1/BP2 ¹	High/low pressure monitoring in accordance with the relevant national regulations
X SS	Terminal strip in the external switch cabinet
X KK	Terminal strip in terminal box compressor

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)
BP5	Oil differential pressure sensor (Kriwan)
EB1	Oil sump heater (ATEX design)
FA2	Switching repeater (oil pressure control)
FB1	Fault protection switch (release current 30 mA)
LR	Capacity regulator (ATEX design)

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

²⁾ Regard deviating connection voltage!

When using 24 V DC the installation of a safety isolating transformer is mandatory.

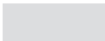


WARNING

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



INFO

 = Installation outside of the explosion endangered area!

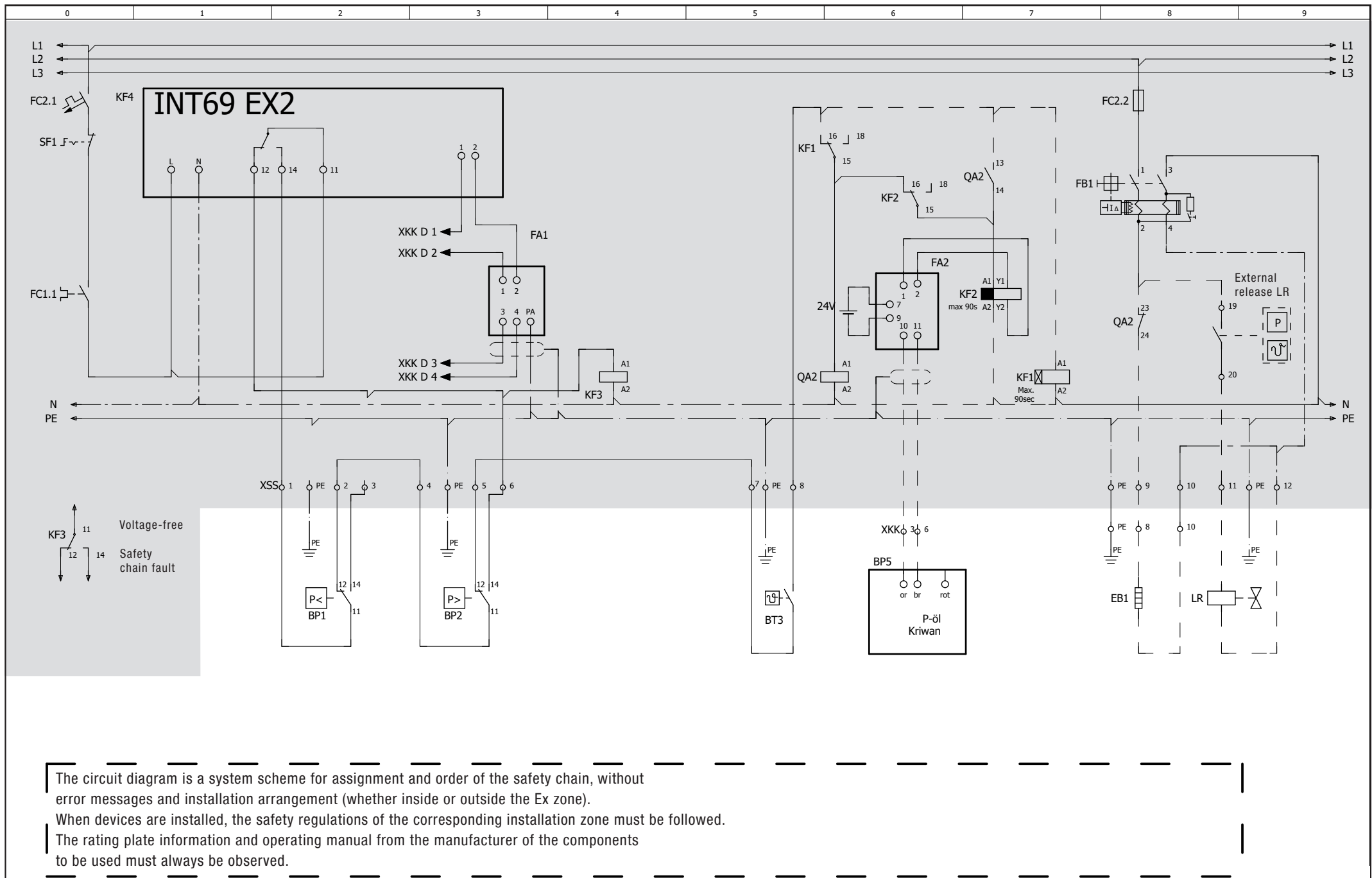


Fig. 20

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

FC1.1	Motor safety switch
FC1.2	Motor safety switch
FC2.1	Control fuse
FC2.2	Control fuse 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
KF4 ²	Electronic trigger unit INT69 EX2
KF5	Time relay for time delayed connect of the second part winding
FA1	AC-double barrier (compression temperature)
BT3 ¹	Pump down- pressostat/ thermostat or external enabling switch
BP1/BP2 ¹	High/low pressure monitoring in accordance with the relevant national regulations
X SS	Terminal strip in the external switch cabinet
X KK	Terminal strip in terminal box compressor

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)
BP5 ¹	Oil differential pressure sensor (Kriwan)
EB1	Oil sump heater (ATEX design)
FA2	Switching repeater (oil pressure control)
FB1	Fault protection switch (release current 30 mA)
OLR	Capacity regulator (ATEX design)

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

²⁾ Regard deviating connection voltage!

When using 24 V 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 QA2 to winding 1 (50 %) (1U1 / 1V1 / 1W1) and via QA3 to winding 2 (50 %) (2U1/ 2V1 / 2W1). The motor contactors (QA2 / QA3) are each to be rated for approx. 50 % of the max. operating current.



= Installation outside of the explosion endangered area

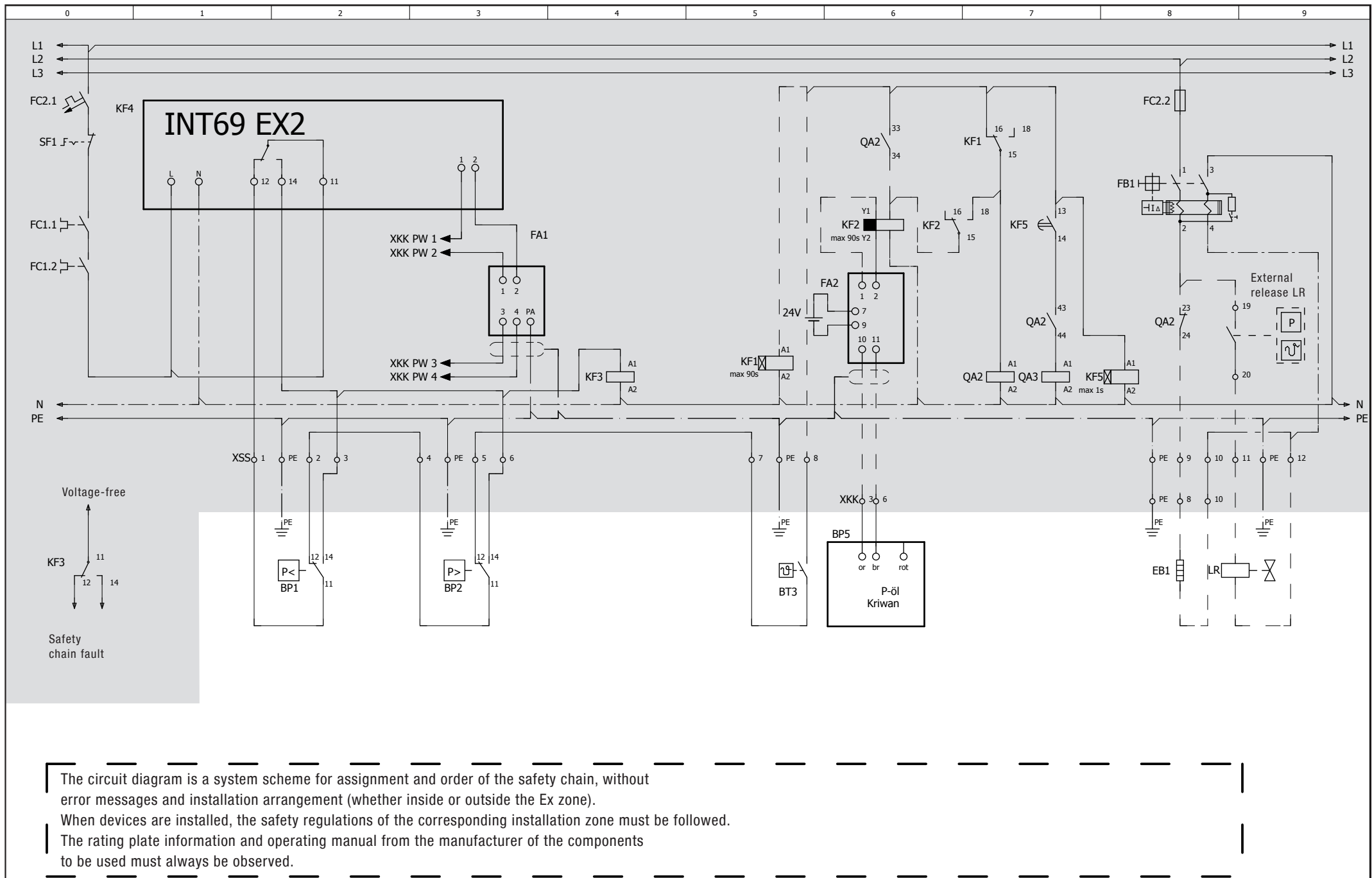


Fig. 21

5 | Electrical connection

5.8 Electronic trigger unit INT69 EX2



ATTENTION Install INT69 EX2 outside the explosion-endangered area.
The INT69 EX2 trigger unit must be installed according to the wiring diagram.

The hot gas sensors of the cylinder cover and the temperature sensors of the motor are observed by the electronic trigger unit INT69 EX2. In case of excess temperature in the motor winding and/or in the hot gas, the INT69 EX2 deactivates the motor contactor. Once cooled, it can be restarted only if the electronic lock of the output relay (terminals 1+2) is released by a mains reset > 5 sec.

The INT69 EX2 fulfills the requirements of the Ignition protection system "b1" as prescribed in the EN 80079-37.

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



INFO The relay switching output is executed as a floating changeover contact. This electrical circuit operates according to the quiescent current principle, i.e. the relay drops into a the idle position and deactivates the motor contactor even in case of a sensor break or open circuit.

GB

- The accompanying INT69 EX2 release unit must be installed corrosion-free in the external switch cabinet outside the explosion-endangered area. Max. sensor cable length 30 m. 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.
- 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 INT69 EX2, a protection class 3 (SELV or PELV) safety transformer must be installed in series. The safety transformer must conform to EN 62368-1.



WARNING With the 24 V DC version of the INT69 EX2 triggering unit there is no galvanic separation between small voltages and current supply. For this reason, appropriate measures against electrical shock must be provided, also for the current supply unit and further components that are connected directly with the power supply if users can have access to them.

- 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.
- 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.**

5 | Electrical connection

5.9 Connection of the trigger unit INT69 EX2

Wire the PTC temperature sensor of the compressor motor, thermal protection thermostats of the cylinder cover, pressure and temperature monitoring of the system according to the wiring diagram (fig. 20+21). Pay attention for connecting the PTC sensor.

Terminals 1 + 2 on the trigger unit INT69 EX2 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 and 14.

Connections between terminals in the terminal box to which thermal protection thermostats are connected and the electronic trigger unit INT69 EX2 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 thermal 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 thermal protection thermostat)

The sensor outputs of the INT69 EX2 itself are not intrinsically safe. A barrier including plug-in base, is included.



INFO

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

GB

5.10 Function test of the trigger unit INT69 EX2

Before commissioning, after troubleshooting or making changes to the control power circuit, check the functionality of the trigger unit. Perform this check using a continuity tester or gauge.

Gauge state	Relay position
Deactivated state	11-12
INT69 EX2 switch-on	11-14
Disconnect hot gas sensor one-sided in the compressor terminal box	11-12
Connect hot gas sensor one-sided in the compressor terminal box	11-12
Reset after mains on	11-14

Relay position INT69 EX2

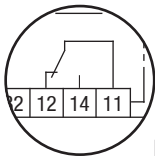


Fig. 22



INFO

In case of malfunction, the system has to be checked and defective components must be replaced!

5 | Electrical connection

5.11 To verify the intrinsic safety of the PTC hot gas sensor

To verify the intrinsic safety of the hot gas sensor, the following values must be rated:

Thermal protection thermostat (Art. No. 50159)				
Conditions for intrinsic safety				
$U_0 \leq U_{i1}$	15.8	$\leq$	30	[V]
$U_0 \leq U_{i2}$	15.8	$\leq$	30	[V]
$I_0 \leq I_{i1}$	200	$\leq$	300	[mA]
$I_0 \leq I_{i2}$	200	$\leq$	300	[mA]
$P_0 \leq P_{i1}$	395	$\leq$	9000	[mW]
$P_0 \leq P_{i2}$	395	$\leq$	9000	[mW]
$L_0 \geq \sum L_{i1} + L_{i2} + L_c^*$	0.5	$\geq$	0.25*	[mH]
$C_0 \geq \sum C_{i1} + C_{i2} + C_c^*$	478	$\geq$	50*	[nF]

*) Values for L_c / C_c represent example values for the total output length of 250 m, and they must be updated by the system builder in accordance with your design.
 $L_{i1} + L_{i2} : 0 \text{ mH} \quad C_{i1} + C_{i2} : 0 \text{ nF}$

5.12 Oil sump heater on HC compressors

As the solubility of hydrocarbons in oil can be very high, especially at high suction pressures, the compressor must be equipped with an oil sump heater. For this reason, a pump-down circuit is recommended during standstill to reduce the suction-side standstill pressures.

Electrical data: 230 V - 1 - 50/60 Hz, 180 W.



ATTENTION The oil sump heater must generally be connected and operated!
National standards and regulations must be observed.
For further information, see Chapter 8.2, Page 39.

5 | Electrical connection

5.13 Selection and operation of compressors with frequency converters

For safe operation of the compressor, the frequency converter must be able to apply an overload of at least 140% of the compressor's maximum current (I-max.) for at least 3 seconds.

When using frequency converters, the following things must also be observed:

1. The maximum permissible operating current of the compressor (I-max) (see type plate or technical data) must not be exceeded.
2. If abnormal vibrations occur in the system, the affected frequency ranges in the frequency converter must be blanked out accordingly.
3. The maximum output current of the frequency converter must be greater than the maximum current of the compressor (I-max).
4. After each compressor start, run for at least 1 minute at a minimum frequency of 50 Hz.
5. Carry out all designs and installations in accordance with the local safety regulations and common rules (e.g. VDE) and regulations as well as in accordance with the specifications of the frequency converter manufacturer

The permissible frequency range can be found in the technical data chapter 9, p. 41/42.

Rotational speed range	0 - f-min	f-min - f-max
Start-up time	< 1 s	ca. 4 s
Switch-off time	immediately	

f-min/f-max see chapter 9: Technical data: permissible frequency range

GB

6 | Commissioning



WARNING 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 prohibited operating conditions, high- and low-pressure monitors are necessary in accordance with the relevant national regulations!

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 | Commissioning

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



DANGER

Risk of bursting!

The compressor must only be pressurised using nitrogen (N₂).

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.

6 | Commissioning



- ATTENTION**
- 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 1 minute at a frequency of at least 50 Hz. Only then may the speed of the compressor be reduced.
- 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!

GB

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 stand-still.

The use of a check valve is strongly recommended, especially in heat pump applications. Otherwise there is a risk of subsequent condensation which can damage the compressor.

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:

- **Leak test:** regularly, at least once per year
 - **Pressures, current consumption, temperatures, oil level:** annually
 - **Pressure switches, motor protection switches and connection terminals:** annually
 - **Trigger unit INT69 EX2, 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.

7 | Maintenance

7.3 Spare part recommendation/accessories

Available spare parts and accessories can be found on our compressor selection tool under **vap.bock.de** as well as at **bockshop.bock.de**.

Only use genuine Bock spare parts!



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 cover/bearing cover	M10	75 Nm
Oil filler plug/oil drain plug/oil sump heater	M22 x 1.5	100 Nm
Flange connection, soldering supports for shut-off valves	7/16"	13 Nm
	M10	60 Nm
	M12	90 Nm
Plug	1/8" NPTF	25 Nm
Rotor	M12	65 Nm
Valve body LR 14	M10	75 Nm
Screw-in part INT250 Ex	M20 x 1.5	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.

8|Accessories

8.1 Capacity regulation (retrofit kit item no. 81570)

The compressor output can be reduced for EX-HG44e to 50 % and for EX-HG56e to 66 %. 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 LP connection on the cylinder cover must not be used for the low-pressure switch in capacity-controlled operation.

The explosion-protected magnetic coil for LR 14 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 M16 x 1.5 (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 - 2.5 mm²

Mountable cable diameter: 7 - 9 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. 3 x I_B accordance with IEC 6 0127-2-1) 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 shortcircuit current at the installation location.

The EC type examination certifications must be observed.



ATTENTION Valve magnets are only operational, if they are mounted on the valve belonging to them.

8|Accessories

8.2 Oil sump heater (retrofit kit item no. 81401)

The explosion-protected heating element is supplied as PTC heating element in a flameproof enclosure (Ex d) and is supplied with an electrical supply line of approx. 3.2 metres.

Electrical wiring within the potentially explosive area could be through the terminal box compressor. The connection line for the heating element must be laid permanently and mechanically protected. During assembly and installation, the requirements of EN 60079-14 and EN 60079-17 must be observed. In addition, nationally applicable laws, safety regulations (BetrSichV) or provisions must be observed.



ATTENTION The supply line length of 3.2 m must not be shortened under any circumstances during installation (integrity of protection against arcing or flame penetration within the cable insulation).

Additional installation instructions as well as the assembly/disassembly manual can be referred to in the enclosed documentation of the kit.

Conductor cross-section of the supply line: 3 x 1.5 mm²

Outside diameter of the supply line: 8.1 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 switchoff 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.

GB

8 | Accessories

8.3 Oil differential pressure sensor INT250 Ex (retrofit kit item no. 81575)

The oil differential pressure sensor kit INT250 Ex consists of screw-in parts INT250 Ex and switching parts, switching repeater and two timers. The switching part INT250 Ex is supplied with a 3-meter electrical supply line.

Electrical wiring within the potentially explosive area could be through the terminal box compressor. 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 oil differential pressure sensor INT250 Ex. Enable the time relay on a on delay of 90 sec. (KF1) res. on a drop-off delay of 90 sec. (KF2). The switching repeater and the central control unit must be installed outside the explosive area in the switch cabinet. The connection line for the connecting part INT250 Ex must be laid permanently and mechanically protected.

During assembly and installation of the oil differential pressure sensor INT250 Ex, 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 differential pressure sensor INT250 Ex (Art. No. 60018)					
Conditions for intrinsic safety					
U_o	$\leq$	U_i	9.6 V	$\leq$	9.6 V
I_o	$\leq$	I_i	10 mA	$\leq$	10 mA
P_o	$\leq$	P_i	24 mW	$\leq$	24 mW
L_o	$\geq$	$\Sigma L_i + L_c^*$	350 mH	$\geq$	0.25 mH*
C_o	$\geq$	$\Sigma C_i + C_c^*$	90 nF	$\geq$	52.42 nF*

*) Values for L_c / C_c represent example values for the total output length of 250 m, and they must be updated by the system builder in accordance with your design.
 L_i : 0 mH C_i : 2.42 nF



ATTENTION Installation must be in accordance with EN 60079-14 as an intrinsically safe electrical circuit and protected by the switching repeater already contained in the kit.

Risk of static charge from the plastic housing of the INT250 Ex. 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.

9 | Technical data

Type	No. of cylinders		Displacement (1450 / 1740 rpm)		Voltage		Max. operating current ②		Max. power consumption ②		Starting current (rotor locked)		Permissible fre- quency range		Weight		Connections ④		Oil charge (ex works)	Oil charge (sight glass centre)					
			50 / 60 Hz m³/h	① V	PW1+2 A	② kW	PW1 / PW1+2 A	Hz	kg	mm (inch)	mm (inch)	litr	litr												
EX-HG44e/475 - 4..			41.3 / 49.6	380-420 V Y/YY - 3 - 50 Hz PW 440-480 V Y/YY - 3 - 60 Hz PW PW = Part Winding Winding ratios: 50 % / 50 %	19	11.0	65 / 109	25 - 70												164	35 (1 3⁄8)	28 (1 1⁄8)	42 (1 5⁄8)	2.7	2.3
EX-HG44e/475 - 4 S..			41.3 / 49.6		23	13.1	87 / 149	168																	
EX-HG44e/565 - 4..			49.2 / 59.0		22	13.2	65 / 109	165																	
EX-HG44e/565 - 4 S..			49.2 / 59.0		26	15.6	101 / 174	170																	
EX-HG44e/665 - 4..			57.7 / 69.2		26	15.4	87 / 149	171																	
EX-HG44e/665 - 4 S..			57.7 / 69.2		30	18.3	101 / 174	168																	
EX-HG44e/770 - 4..			67.0 / 80.4		30	17.8	101 / 174	168																	
EX-HG44e/770 - 4 S..			67.0 / 80.4		35	21.4	101 / 174	168																	

- ① Tolerance ($\pm 10\%$) relative to the mean value of the voltage range.
- ② - The specifications for max. power consumption apply for 50 Hz operation. For 60 Hz 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

9|Technical data

GB

Oil charge (sight glass centre)		litr	2.7					
Oil charge (ex works)		litr	3.2					
Connections ④	Suction line SV	mm (inch)	54 (2 1/8)					
	Discharge line DV	mm (inch)	35 (1 3/8)					
Weight		kg	204	219	216	218	219	228
Electrical data ③	Permissible fre- quency range	Hz	25 - 70					
	Starting current (rotor locked)	PW1 / PW1+2 A	101 / 174	125 / 209	125 / 209	149 / 246	149 / 246	196 / 335
	Max. power consumption	② kW	19.7	23.5	23.2	27.7	28.0	33.3
	Max. operating current ②	PW1+2 A	33	39	39	46	47	58
	Voltage ①	V	380-420 V Y/YY - 3 - 50 Hz PW 440-480 V Y/YY - 3 - 60 Hz PW PW = Part Winding Winding ratios: 50 % / 50 %					
Displacement (1450 / 1740 rpm)	50 / 60 Hz m³/h	73.8 / 88.6	73.8 / 88.6	86.6 / 103.9	86.6 / 103.9	100.4 / 120.5	100.4 / 120.5	
No. of cylinders		6						
Type	EX-HG56e/850 - 4.. EX-HG56e/850 - 4 S.. EX-HG56e/995 - 4.. EX-HG56e/995 - 4 S.. EX-HG56e/1155 - 4.. EX-HG56e/1155 - 4 S..							

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

② - The specifications for max. power consumption apply for 50 Hz operation. For 60 Hz 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

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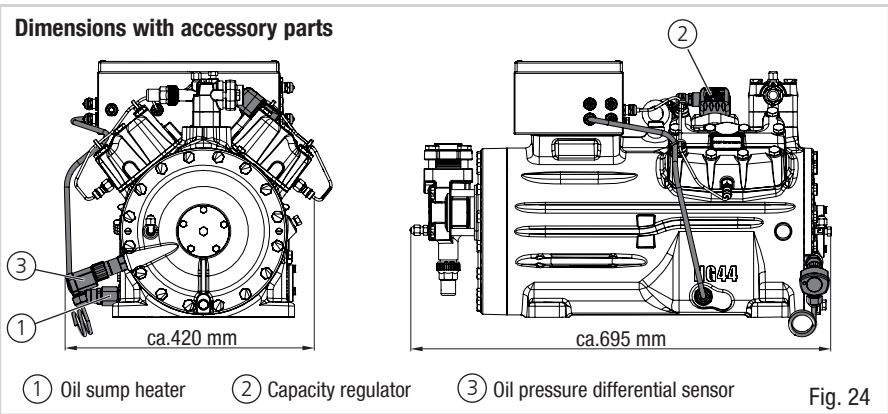
10|Dimensions and connections

EX-HG44e		
SV	Suction line	see technical data, Chapter 9
DV	Discharge line	
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 switch OIL	1/8" NPTF
D*	Connection oil pressure safety switch LP	7/16" UNF
D1	Connection oil return from oil separator	1/4" NPTF
F	Oil drain	M12x1.5
H	Oil charge plug	1/4" NPTF
J*	Connection oil sump heater	M22x1.5
K	Sight glass	3 x M6
L1	Thermal protection thermostat	1/8" NPTF
M	Oil strainer	M12x1.5
O*	Connection oil level regulator	3 x M6
PA	Potential equalisation connection	M8

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

Dimensions INT69 EX2 for switch cabinet installation

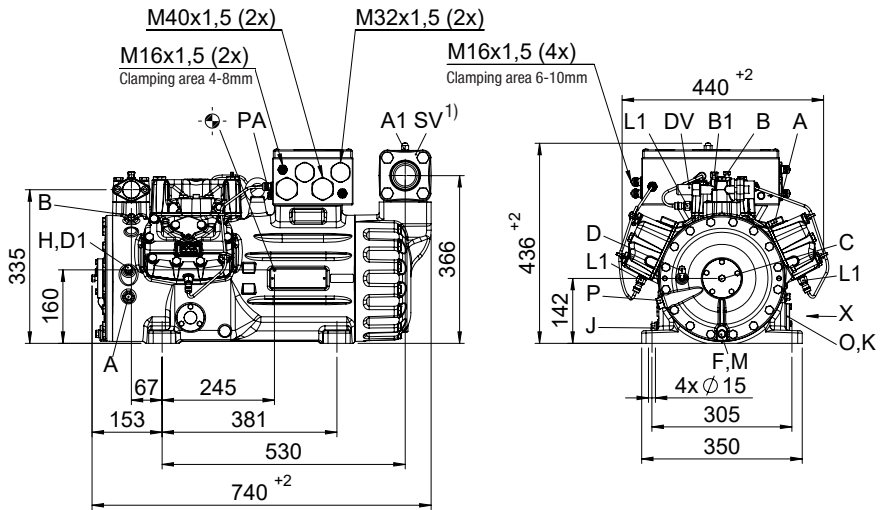
Length: 68 mm Width: 33 mm Height: 53 mm



GB

10|Dimensions and connections

EX-HG56e

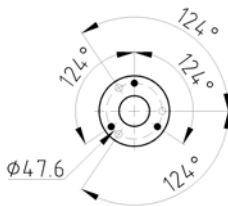


¹⁾ SV 90° rotatable

● Centre of gravity

GB

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. 25

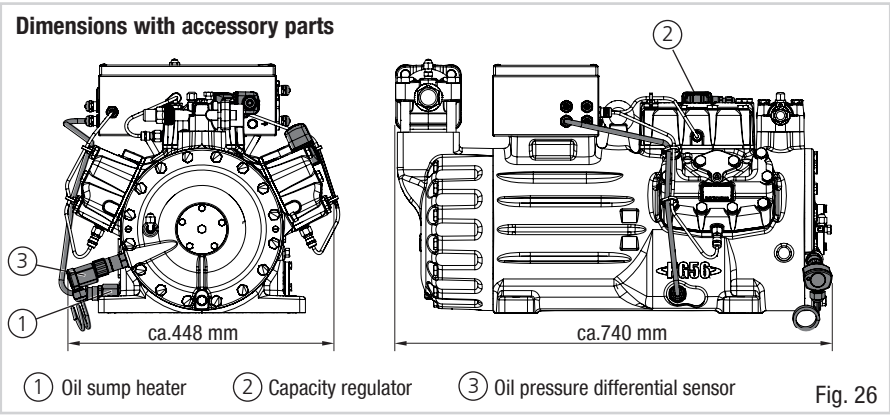
10|Dimensions and connections

EX-HG56e		
SV	Suction line	see technical data, Chapter 9
DV	Discharge line	
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 switch OIL	1/8" NPTF
D*	Connection oil pressure safety switch LP	7/16" UNF
D1	Connection oil return from oil separator	1/4" NPTF
F	Oil drain	M12x1.5
H	Oil charge plug	1/4" NPTF
J*	Connection oil sump heater	M22x1.5
K	Sight glass	3 x M6
L1	Thermal protection thermostat	1/8" NPTF
M	Oil strainer	M12x1.5
O*	Connection oil level regulator	3 x M6
PA	Potential equalisation connection	M8

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

Dimensions INT69 EX2 for switch cabinet installation

Length: 68 mm Width: 33 mm Height: 53 mm



EU - Type Examination Certificate

- (1)
- (2) Equipment and protective systems intended for use in potentially explosive atmospheres – Directive 2014/34/EU
- (3) EU - Type Examination Certificate Number

EPS 17 ATEX 1 002 X

Revision 2

- (4) Equipment: Semi-hermetic compressor type EX-HG(X)44e, EX-HG(X)56e and EX-HG(X)66e
- (5) Manufacturer: Bock GmbH
- (6) Address: Benzstraße 7
72636 Frickenhausen
Germany
- (7) This equipment and any acceptable variation thereto are specified in the annex to this certificate and the documentation therein referred to.
- (8) Bureau Veritas Consumer Products Services Germany GmbH, notified body No. 2004 in accordance with Article 21 given in the Directive 2014/34/EU of the European Parliament and of the Council of 26 February 2014, certifies that 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 of the Directive. The examination and test results are recorded in the confidential documentation under the reference number 15TH0260.
- (9) Compliance with the essential health and safety requirements has been assured by compliance with:

EN IEC 60079-0:2018

EN 60079-1:2014

EN 60079-7:2015/A1:2018

EN 60079-11:2012

EN 60079-18:2015/A1:2017

- (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 EU - Type Examination Certificate relates only to the design and construction of the specified equipment in accordance with Directive 2014/34/EU. Further requirements of this Directive apply to the manufacture of this equipment and its placing on the market. Those requirements are not covered by this certificate.
- (12) The marking of the equipment shall include the following:

 II 2G Ex db eb Ia mb IIC/IIB T3 Gb



Hamburg, 2021-01-25

Page 1 of 3

Certificates without signature and seal are void. This certificate is allowed to be distributed only if not modified. Extracts or modifications must be authorized by Bureau Veritas Consumer Products Services Germany GmbH. EPS 17 ATEX 1 002 X, Revision 2.



**BUREAU
VERITAS**



(13)

Annex

(14) **EU - Type Examination Certificate EPS 17 ATEX 1 002 X**

Revision 2

(15) Description of equipment:

The semi-hermetic refrigerating compressor is a central equipment of the refrigeration cycle. By the compression of the refrigerant gas from the low to the high-pressure side of the compressor, it is heated. The drive motor is integrated in the semi-hermetic design into the compressor. The entire refrigerant circuit including the motor is viewed as hermetically sealed and thus it does not require a standardized ignition protection. The entire electrical connection area is protected by the use of the ignition protection Ex "eb" and/or Ex "db".

Technical & electrical data:

Characteristics	EX-HG(X)44e	EX-HG(X)56e	EX-HG(X)66e
Rated voltage	400 – 690 V	400 – 690 V	400 – 690 V
Frequency range	10Hz – 90 Hz (restricted frequency range according to manufacturer documents)	10Hz – 90 Hz (restricted frequency range according to manufacturer documents)	10Hz – 90 Hz (restricted frequency range according to manufacturer documents)
Max. current	42 A (reduced values according to manufacturer documents)	70 A (reduced values according to manufacturer documents)	103 A (reduced values according to manufacturer documents)
Protection terminal box	IP66	IP66	IP66
Design compressor	Semi-hermetic	Semi-hermetic	Semi-hermetic
Compressor with an insulating coating < 2 mm	Range of use – gas group IIB	Range of use – gas group IIB	Range of use – gas group IIB
Compressor with dissipative coating < 2 mm	Range of use – gas group IIC	Range of use – gas group IIC	Range of use – gas group IIC

(16) Reference number: 15TH0260



EU - Type Examination Certificate EPS 17 ATEX 1 002 X

Revision 2

(17) Special conditions for safe use:

Rated ambient temperature range: $-20\text{ °C} \leq T_a \leq +60\text{ °C}$

Limitation EX-HG(X)66e: For compressor operation with capacity regulator, the ambient temperature range is reduced to: $-20\text{ °C} \leq T_a \leq +50\text{ °C}$

Use of flammable refrigerants and oils: There are only refrigerants and/or oils permissible with a spontaneous ignition temperature of $T_{\text{ign}} > 250\text{ °C}$.

Compressors with an insulating coating $< 2\text{ mm}$ shall be used only in the gas group IIB or IIA.

(18) Essential health and safety requirements:

Met by compliance with standards.



Hamburg, 2021-01-25



IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION IEC Certification System for Explosive Atmospheres

for rules and details of the IECEx Scheme visit www.iecex.com

Certificate No.: **IECEx EPS 17.0001X**

Page 1 of 4

Certificate history:

Status: **Current**

Issue No: 2

Issue 1 (2019-01-25)

Issue 0 (2017-04-04)

Date of Issue: 2021-01-25

Applicant: **Bock GmbH**
Benzstraße 7
72636 Frickenhausen
Germany

Equipment: **Supply-, control- and heating-unit type: EX-HG(X)44e, EX-HG(X)56e and EX-HG(X)66e**

Optional accessory:

Type of Protection: **flame proof enclosure "d", increased safety "e", intrinsic safety "i", encapsulation "m"**

Marking: **Ex db eb ia mb IIC/IIB T3 Gb**

Approved for issue on behalf of the IECEx
Certification Body:

Position:

Signature:
(for printed version)

Date:



1. This certificate and schedule may only be reproduced in full.
2. This certificate is not transferable and remains the property of the issuing body.
3. The Status and authenticity of this certificate may be verified by visiting www.iecex.com or use of this QR Code.



Certificate issued by:

Bureau Veritas Consumer Products Services Germany GmbH
Businesspark A96
86842 Türkheim
Germany





IECEx Certificate of Conformity

Certificate No.: **IECEx EPS 17.0001X**

Page 2 of 4

Date of issue: 2021-01-25

Issue No: 2

Manufacturer: **Bock GmbH**
Benzstraße 7
72636 Frickenhausen
Germany

Additional
manufacturing
locations:

This certificate is issued as verification that a sample(s), representative of production, was assessed and tested and found to comply with the IEC Standard list below and that the manufacturer's quality system, relating to the Ex products covered by this certificate, was assessed and found to comply with the IECEx Quality system requirements. This certificate is granted subject to the conditions as set out in IECEx Scheme Rules, IECEx 02 and Operational Documents as amended

STANDARDS :

The equipment and any acceptable variations to it specified in the schedule of this certificate and the identified documents, was found to comply with the following standards

IEC 60079-0:2017 Explosive atmospheres - Part 0: Equipment - General requirements
Edition:7.0

IEC 60079-1:2014-06 Explosive atmospheres - Part 1: Equipment protection by flameproof enclosures "d"
Edition:7.0

IEC 60079-11:2011 Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i"
Edition:6.0

IEC 60079-18:2017 Explosive atmospheres - Part 18: Protection by encapsulation "m"
Edition:4.1

IEC 60079-7:2017 Explosive atmospheres - Part 7: Equipment protection by increased safety "e"
Edition:5.1

This Certificate **does not** indicate compliance with safety and performance requirements other than those expressly included in the Standards listed above.

TEST & ASSESSMENT REPORTS:

A sample(s) of the equipment listed has successfully met the examination and test requirements as recorded in:

Test Report:

DE/EPS/ExTR17.0001/03

Quality Assessment Report:

DE/EPS/QAR15.0005/05



IECEx Certificate of Conformity

Certificate No.: **IECEx EPS 17.0001X**

Page 3 of 4

Date of issue: **2021-01-25**

Issue No: 2

EQUIPMENT:

Equipment and systems covered by this Certificate are as follows:

The scope of testing and certification is a supply-, control-, feedthrough- and heating-unit for hermetically sealed cooling compressores. The entire electrical connection area is protected by the use of the ignition protection Ex "eb" and/or Ex "db". The control-unit is protected by the use of the ignition protection Ex "eb", "ia" and "mb", the heating-unit is protected by kind of protection Ex "db".

Technical & electrical data:

Unit type	EX-HG(X)44	EX-HG(X)56	EX-HG(X)66e
Rated voltage	400 V - 690 V	400 V - 690 V	400 V - 690 V
Frequency Range	10 Hz - 90 Hz (restricted frequency range according to manufacturer documents)	10 Hz - 90 Hz (restricted frequency range according to manufacturer documents)	10 Hz - 90 Hz (restricted frequency range according to manufacturer documents)
Max. supply current	42 A (reduced values according to manufacturer documents)	70 A (reduced values according to manufacturer documents)	103 A (reduced values according to manufacturer documents)
Protection terminal box	IP66	IP66	IP66

SPECIFIC CONDITIONS OF USE: YES as shown below:

Rated ambient temperature range: $-20^{\circ}\text{C} \leq T_a \leq +60^{\circ}\text{C}$

Limitation EX-HG(X)66e: For compressor operation with capacity regulator, the ambient temperature range is reduced to: $-20^{\circ}\text{C} \leq T_a \leq +50^{\circ}\text{C}$



IECEx Certificate of Conformity

Certificate No.: **IECEx EPS 17.0001X**

Page 4 of 4

Date of issue: **2021-01-25**

Issue No: 2

DETAILS OF CERTIFICATE CHANGES (for issues 1 and above)

Company name change, standard update.

UK Type Examination Certificate CML 21UKEX1800X Issue 0

United Kingdom Conformity Assessment

- 1 Product or Protective System Intended for use in Potentially Explosive Atmospheres UKSI 2016:1107 (as amended) – Schedule 3A, Part 1
- 2 Equipment **Semi-hermetic compressor type EX-HG(X)44e, EX-HG(X)56e and EX-HG(X)66e**
- 3 Manufacturer **Bock GmbH**
- 4 Address **Benzstraße 7
72636 Frickenhausen
Germany**
- 5 The equipment is specified in the description of this certificate and the documents to which it refers.
- 6 Eurofins E&E CML Limited, Newport Business Park, New Port Road, Ellesmere Port, CH65 4LZ, United Kingdom, Approved Body Number 2503, in accordance with Regulation 43 of the Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016, UKSI 2016:1107 (as amended), certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment intended for use in potentially explosive atmospheres given in Schedule 1 of the Regulations.

The examination and test results are recorded in the confidential reports listed in Section 12.

- 7 If an 'X' suffix appears after the certificate number, it indicates that the equipment is subject to specific conditions of use (affecting correct installation or safe use). These are specified in Section 14.
- 8 This UK Type Examination certificate relates only to the design and construction of the specified equipment. Further requirements of the Regulations apply to the manufacturing process and supply of the product. These are not covered by this certificate.
- 9 Compliance with the Essential Health and Safety Requirements, with the exception of those listed in the confidential report, has been demonstrated through compliance with the following documents:

EN IEC 60079-0:2018	EN 60079-1:2014	EN 60079-7:2015/A1:2018
EN 60079-11:2012	EN 60079-18:2015/A1:2017	
- 10 The equipment shall be marked with the following:



Refer to attached certificate EPS 17 ATEX 1 002 X Issue 2 for specific marking of explosion protection symbols.

Refer to attached certificate EPS 17 ATEX 1 002 X Issue 2 for marked code and ambient temperature range.



Ben Trafford
Certification Officer



CML 21UKEX1800X
Issue 0

11 Description

For product description refer to attached certificate EPS 17 ATEX 1 002 X Issue 2

12 Certificate history and evaluation reports

Issue	Date	Associated report	Notes
0	18 Oct 2021	R14369B/00	Issue of the prime certificate. EPS 17 ATEX 1 002 X Issue 2 is attached and shall be referred to in conjunction with this certificate.

Note: Drawings that describe the equipment are listed in the Annex.

13. Conditions of Manufacture

For conditions of manufacture, refer to attached certificate EPS 17 ATEX 1 002 X Issue 2

Any routine tests/verifications required by the ATEX certification shall be conducted.

14. Specific Conditions of Use

For specific conditions of use, refer to attached certificate EPS 17 ATEX 1 002 X Issue 2

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96389-07.2023-DGbFEIRu

Certificate Annex

Certificate Number CML 21UKEX1800X
Equipment Semi-hermetic compressor type EX-HG(X)44e, EX-HG(X)56e and EX-HG(X)66e
Manufacturer Bock GmbH



The following documents describe the equipment defined in this certificate:

For drawings describing the equipment, refer to attached certificate EPS 17 ATEX 1 002 X. In addition to the drawings listed on EPS 17 ATEX 1 002 X, the following drawings include the additional marking required for this UK Type Examination certification:

Drawing No	Equipment Name/ Model Number	Sheets	Rev	Approved date	Title
FR-RD-MI-002	Ex-HG(X)44e/... Ex-HG(X)56e/... Ex-HG(X)66e/...	1 to 5	0A	18 Oct 2021	Ex-Labeling name plate

GB

Service

Dear customer,

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, **+49 (0)7022 9454-0** or via **service@bock.de**

Yours faithfully Bock GmbH

GB



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