

BOCK® EX-HG88e

Operating guide

Device category 3 G

- acc. to directive 2014/34/EU

- acc. to UKSI 2016 No. 1107

EX-HG88e/2400-4 3G
EX-HG88e/2735-4 3G
EX-HG88e/3235-4 3G

EX-HGX88e/2400-4 3G
EX-HGX88e/2735-4 3G
EX-HGX88e/3235-4 3G

EX-HG88e/2400-4 3G HC
EX-HG88e/2735-4 3G HC
EX-HG88e/3235-4 3G HC

EX-HG88e/2400-4 S 3G
EX-HG88e/2735-4 S 3G
EX-HG88e/3235-4 S 3G

EX-HGX88e/2400-4 S 3G
EX-HGX88e/2735-4 S 3G
EX-HGX88e/3235-4 S 3G

EX-HG88e/2400-4 S 3G HC
EX-HG88e/2735-4 S 3G HC
EX-HG88e/3235-4 S 3G HC

Translation of the original instructions

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.

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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 | 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.

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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 (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 3 in accordance with Directive 2014/34/EU and/or UK SI 2016 No. 1107.



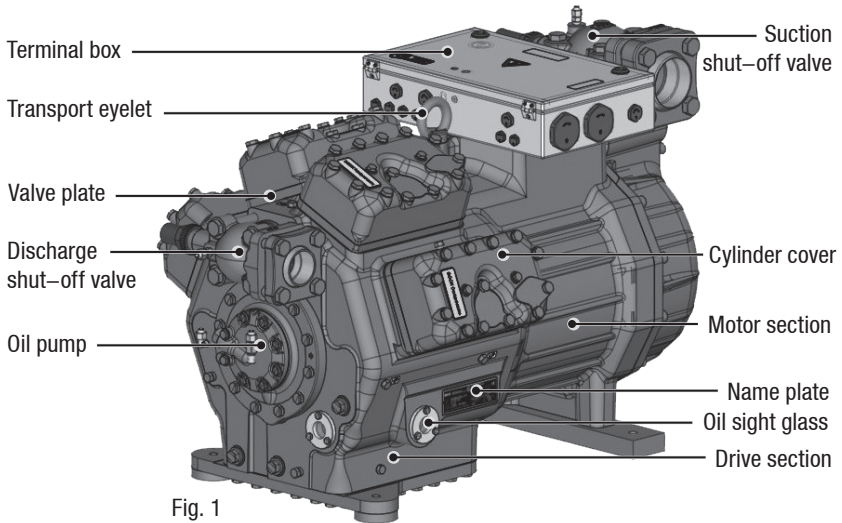
WARNING

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

- Semi-hermetic eight-cylinder reciprocating compressor with suction-gas cooled drive motor.
- The stream of refrigerant sucked out of the evaporator flows over the motor and cools it intensively. In this way, the motor can be kept at a relatively low temperature level, particularly under high loads.



Dimension and connection values can be found in Chapter 10.

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2 | Product description

2.2 Ignition protection concept

The compressor described in these instructions for assembly is suitable for use in device category 3 for explosive gas atmospheres up to temperature class T3 and explosion hazard subgroup IIB/IIC in accordance with Directive 2014/34/EU and/or UK SI 2016 No. 1107.

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.

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. 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 (Offshore)	Ex e	b
Terminal box (Onshore)	Ex nA	c
Terminal board	Ex nA	c
Through terminals in the terminal box	Ex e	b
Cable/line entrances in the terminal box (accessories)	Ex e	b
Magnetic coil LR	Ex e mb	b
Oil sump heater	Ex d	b
Oil differential pressure sensor INT250 Ex	Ex nC	c
Hot gas PTC sensor	Ex nA	c

¹⁾ Equipment Protection Level

2 | Product description

2.3 Name plate (example)

BOCK II 3G Ex db eb mb nA nC IIC T3 Gc / EPS 16 ATEX 1042 X / CML 21UKEX1799X
 Ex db eb mb nA nC IIC T3 Gc / IECEx EPS 16.0018X

Bock GmbH, Benzstr. 7
72636 Frickenhausen, Germany

Tamb: / Tamb with capacity regulator:
[-20°C]-[60°C] / [-20°C]-[50°C]

1	Typ : EX-HGX88e/3235-4 3G	7	380-420V Y/YY -3- 50 HZ	15
2	Nr. : AY09529A040	8	n: 1450 min ⁻¹ V _{th} : 281,0 m ³ /h	7
3	I _{max} : 131,0 A	9	440-480V Y/YY -3- 60 HZ	8
4	I _{block} : Y: 475A YY: 551A	10	n: 1740 min ⁻¹ V _{th} : 337,0 m ³ /h	9
5	ρ _{max} : ND(LP)/HD(HP)= 19/28 bar	11	IP65	10
		12	Öl: BOCKlub E55	11
		13		12
		14		13
		15		14

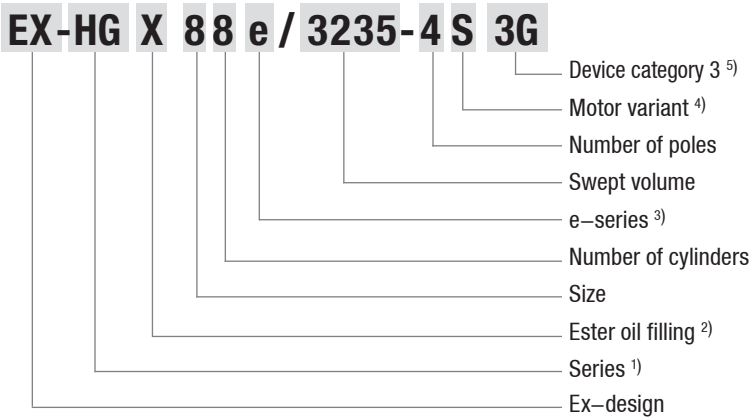
Fig. 2

1	Type designation	7	Voltage, circuit, frequency
2	Machine number	8	Nominal rotation speed
3	Type code	9	Displacement
4	Maximum operating current	10	Voltage, circuit, frequency
5	Starting current (rotor blocked)	11	Nominal rotation speed
	Y: Part winding 1	12	Displacement
	YY: Part winding 1 and 2	13	Oil type filled at the factory
6	ND (LP): max. admissible over pressure	14	Terminal box protection type
	Low pressure side	15	Permissible ambient temperature
	HD (HP): max. admissible over pressure		
	High pressure side		

i Electrical accessories can change the IP protection class!

i Observe the limits of application diagrams!

2.4 Type key (example)

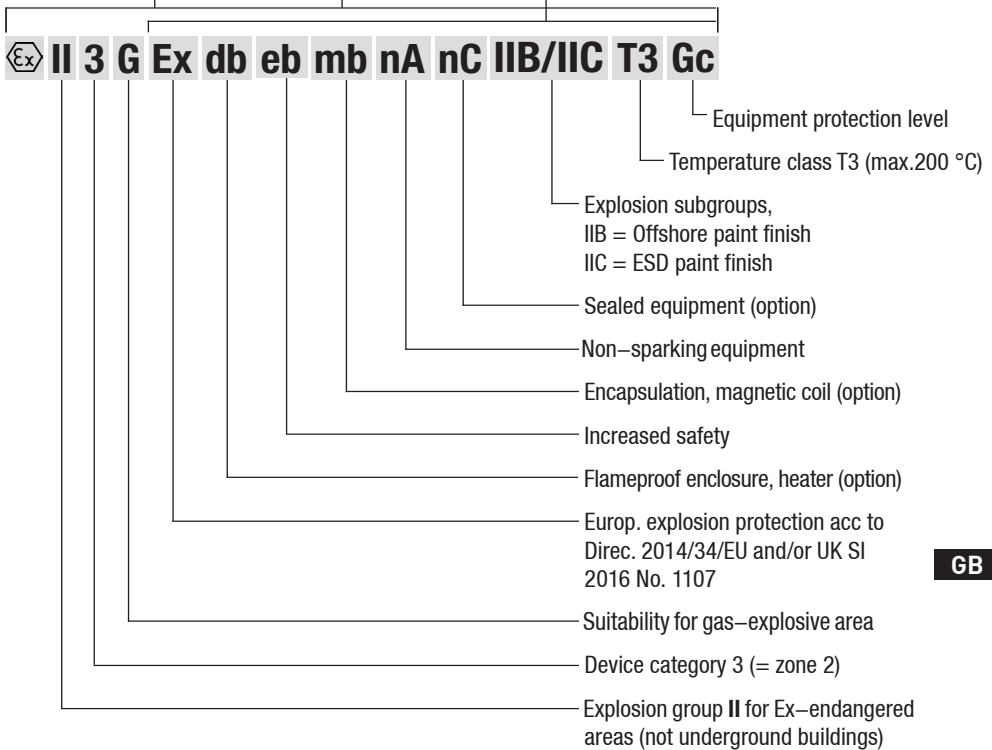


- ¹⁾ HG –Hermetic Gas–Cooled (suction gas–cooled)
- ²⁾ X – Ester oil filling (HFKW refrigerant, e.g. R134a, R404A, R507, R407C)
- ³⁾ e – Additional declaration for e–Serie compressors
- ⁴⁾ S – More powerful motor, e.g. air conditioning applications
- ⁵⁾ for explosion–endangered atmospheres caused by gases, vapours or mists

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2 | Product description

2.5 ATEX identification / UKEX identification / IECEx identification

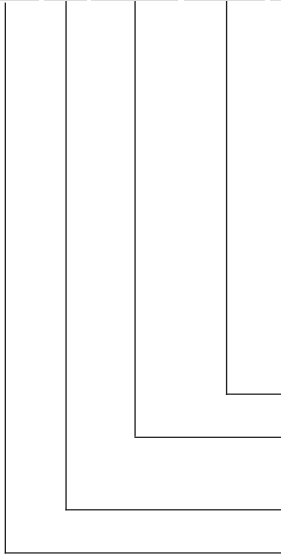


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2 | Product description

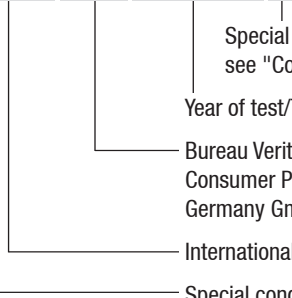
ATEX-Certificate of Conformity

EPS 16 ATEX 1042 X



IECEx-Certificate of Conformity

IECEx EPS 16.0018 X



Special conditions:
see "Conditions of Certification"

Year of test/Test report number

Bureau Veritas
Consumer Products Services
Germany GmbH

International explosion protection

Special conditions:
see point 17 of the EC type
examination certificate

Test report number

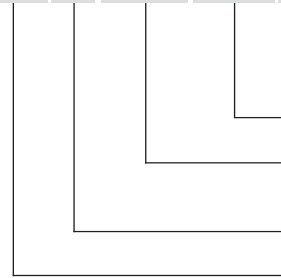
ATmospheres EXplosibles
european explosion protection

Year of test

Bureau Veritas
Consumer Products Services
Germany GmbH

UKEX-Certificate of Conformity

CML 21 UKEX 1799 X



Special conditions:
see "Conditions of Certification"

Test report number

UK Type Examination
certificate

Year of test

Approved body

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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



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 (ISO 3864) 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).

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3 | Areas of application

3.3 Oil charge

- The following refrigerants 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-HGX88e/3235-4 3G). Compressors with oil filling **BOCK**lub G68 are marked with HC (e.g. EX-HG88e/3235-4 3G **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!

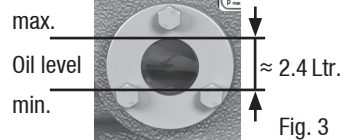


Fig. 3

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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

Δt_{oh} min = 7 - 10 K, individual adjustment required.

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

Permissible ambient temperature range when using a capacity regulator: -20 °C bis +50 °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 5.11, P. 32).

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!

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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 Storage and transport



Fig. 4

- 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. 5

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

4 | Compressor assembly

4.2 Setting up



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

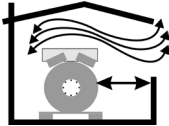


Fig. 6

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



Fig. 7

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

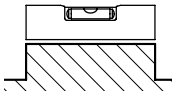


Fig. 8

- 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.

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Fig. 9

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



Fig. 10

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

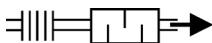


Fig. 11

- Installation of pipe vibration mufflers is recommended!

4 | Compressor assembly

4.3 Pipe connections

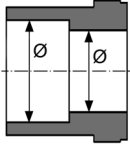


Fig.12: graduated internal diameter

- 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).**

4.4 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.

4.5 Start unloader (external)

A internal start unloader ex factory is not available. Alternatively a start unloader can be installed in the plant. Monitoring, including the parts used, must comply with Directive 2014/34/EU and/or UK SI 2016 No. 1107.

Operation:

When the compressor is started, a solenoid valve receives power via a time switch and opens a by-pass between the discharge- and suction line. At the same time, a non-return valve in the discharge line closes and prevents a backflow of refrigerant from the condenser (Fig. 13).

The compressor is now short-circuited and delivers from the outflow directly into the intake. The pressure differential consequently decreases substantially. As a result, the torque on the drive shaft of the compressor is considerably diminished. The drive motor can now start with a low level of starting torque. As soon as the motor and the compressor reach their rated speed, the solenoid valve closes and the non-return valve opens (Fig. 14). The compressor now works under normal load.

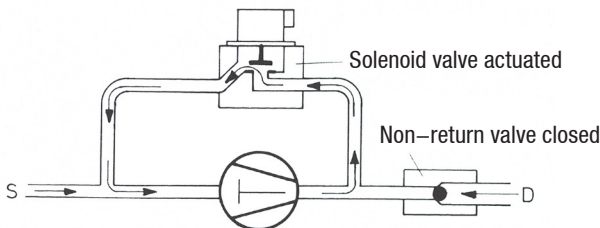


Fig. 13

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4 | Compressor assembly

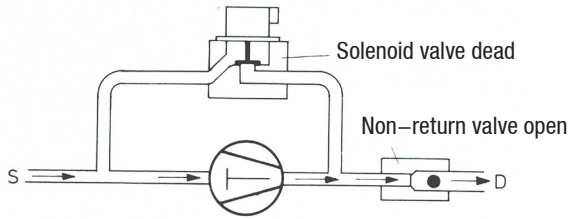


Fig. 14

Important:

- Start unloader may only be employed during the starting phase.
- Check the solenoid valve and the non-return valve regularly for tightness.
- In addition, we recommend to use a heat protection thermostat on the discharge side of the compressor. This protects the compressor against thermal overloading. Connect the heat protection thermostat in series on the safety chain of the control circuit, to switch off the compressor if necessary.
- Follow these instructions to avoid thermal overloading.

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**.

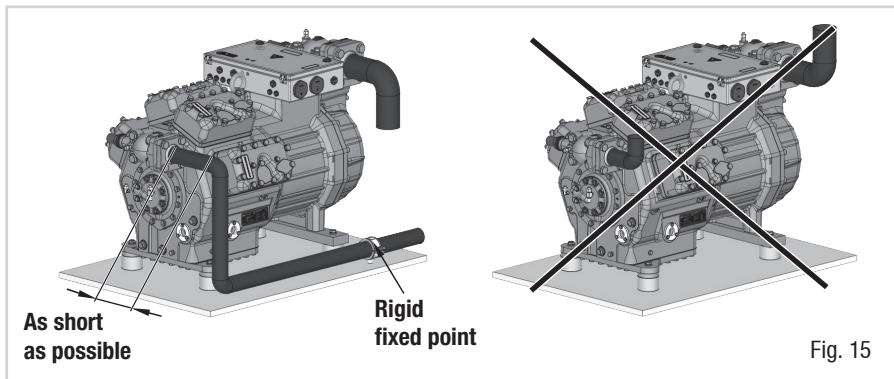


Fig. 15

4 | Compressor assembly

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.

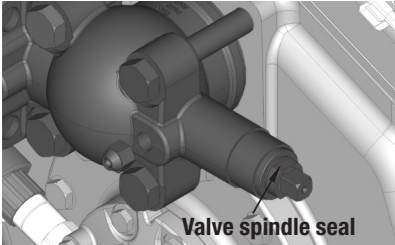


Fig. 16

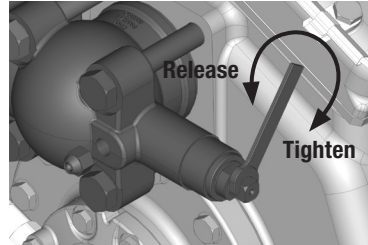


Fig. 17

4.8 Operating mode of the lockable service connections

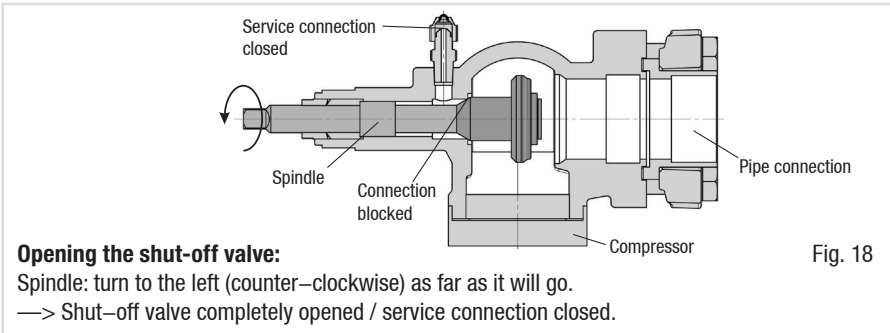


Fig. 18

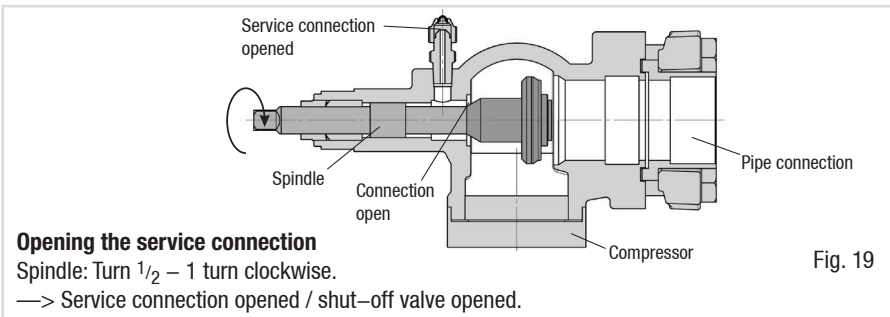


Fig. 19

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.



INFO

- Connect the compressor motor according to the circuit diagram (s. fig. 20–22 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 5.1.
- 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.
- Only line and cable inserts approved for the corresponding device category may be used for passage of cables into the terminal box.
- Appropriately protect cable screw connections/plug screws made of plastic if there is an increased risk of mechanical hazard.

GB

5 | Electrical connection

5.1 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.

5.2 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	Onshore		Offshore	
	Minimum terminal cross section 400V / 50 Hz			
	Direct start	Part winding start	Direct start	Part winding start
EX-HG88e/2400-4 3G (HC)	6 x 35 mm ²		6 x 35 mm ² *)	
EX-HG88e/2400-4S3G(HC)	6 x 35 mm ²		6 x 35 mm ² *)	
EX-HG88e/2735-4 3G (HC)	6 x 35 mm ²		6 x 35 mm ² *)	
EX-HG88e/2735-4S3G(HC)	6 x 35 mm ²		6 x 35 mm ² *)	
EX-HG88e/3235-4 3G (HC)	6 x 35 mm ²		6 x 35 mm ² *)	
EX-HG88e/3235-4S3G(HC)	6 x 35 mm ²		6 x 35 mm ² *)	

– Where ambient temperatures are > 35 °C, supply lines and cable/line bushings with a temperature resistance of at least 95 °C must be used.

*) If supply line cross-sections of 6 x 50 mm² are used, these can be of standard grade.



INFO

- The insulation plate used on the terminal board serves to guarantee the air and creepage paths. It is therefore essential that it remains on the terminal board.
- Use tubular cable lugs for the electrical connection to the terminal board.

5 | Electrical connection

5.3 Connection of the drive motor

Designation on the name plate

Y/YY

Compressors marked in this way are suitable for direct or part winding start.

motor winding is divided into two parts:

Part winding 1 = 50 % and part winding 2 = 50 %.

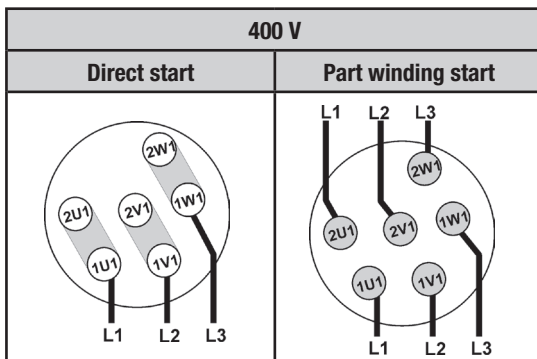
This winding division reduces the start-up current during a part winding start to approx. 50 % of the value for a direct start.



INFO

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.



ATTENTION Terminal boxes and cable screw connections must be properly closed, in order to achieve the IP protective class. 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	Motor contactor
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
QA2/3	Motor contactor
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



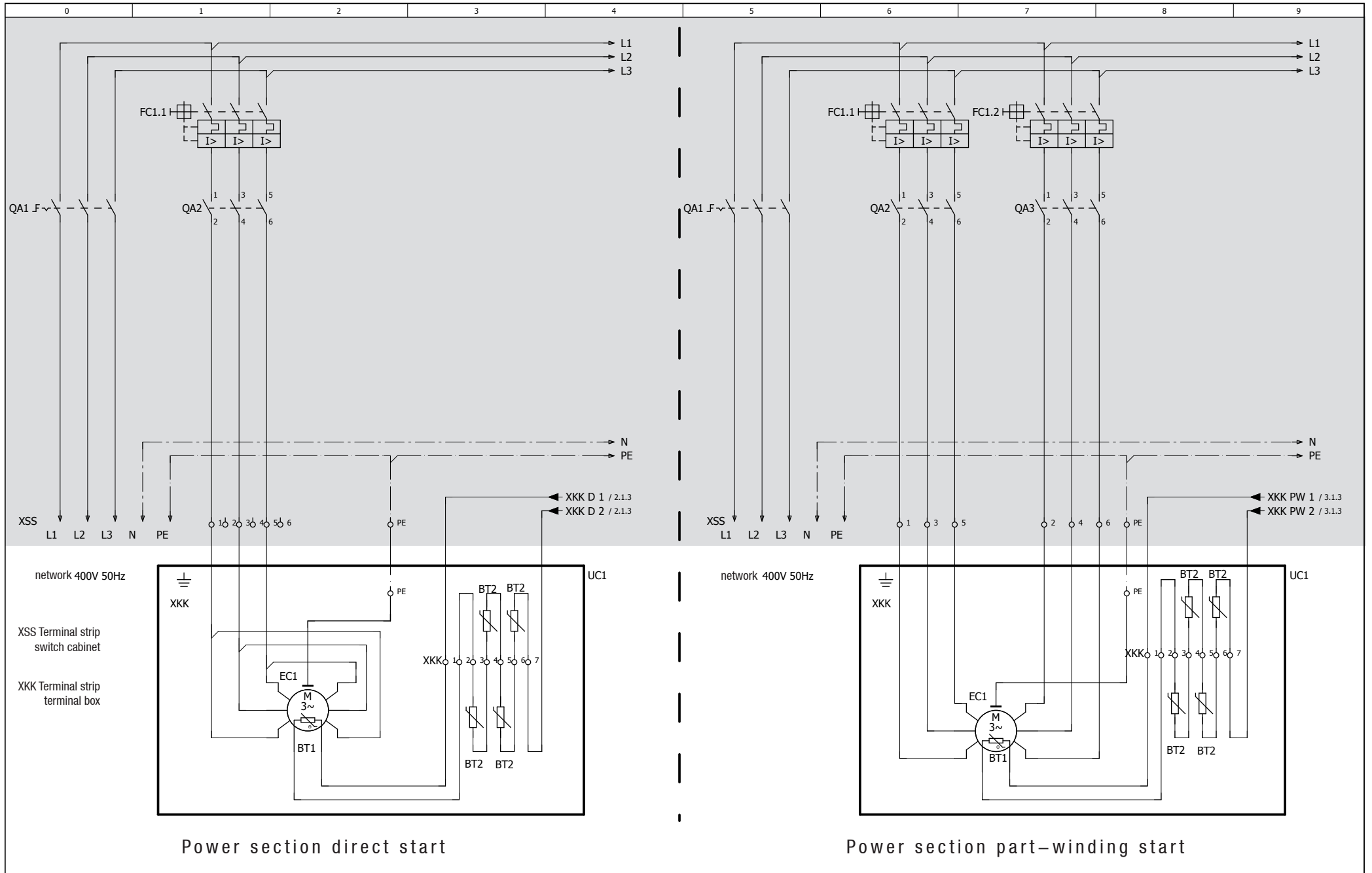
WARNING With the installation of control and adjust parts the valid regulations for the explosion protection have to be observed!



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



Legend for circuit diagram YY (direct start)

FB1	Fault protection switch (release current 30 mA)
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
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. (on begins when the oil pressure / monitoring is reached during operation)
BP3	Oil differential pressure sensor INT250 Ex (Kriwan)
EB1	Oil sump heater (ATEX design)
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.

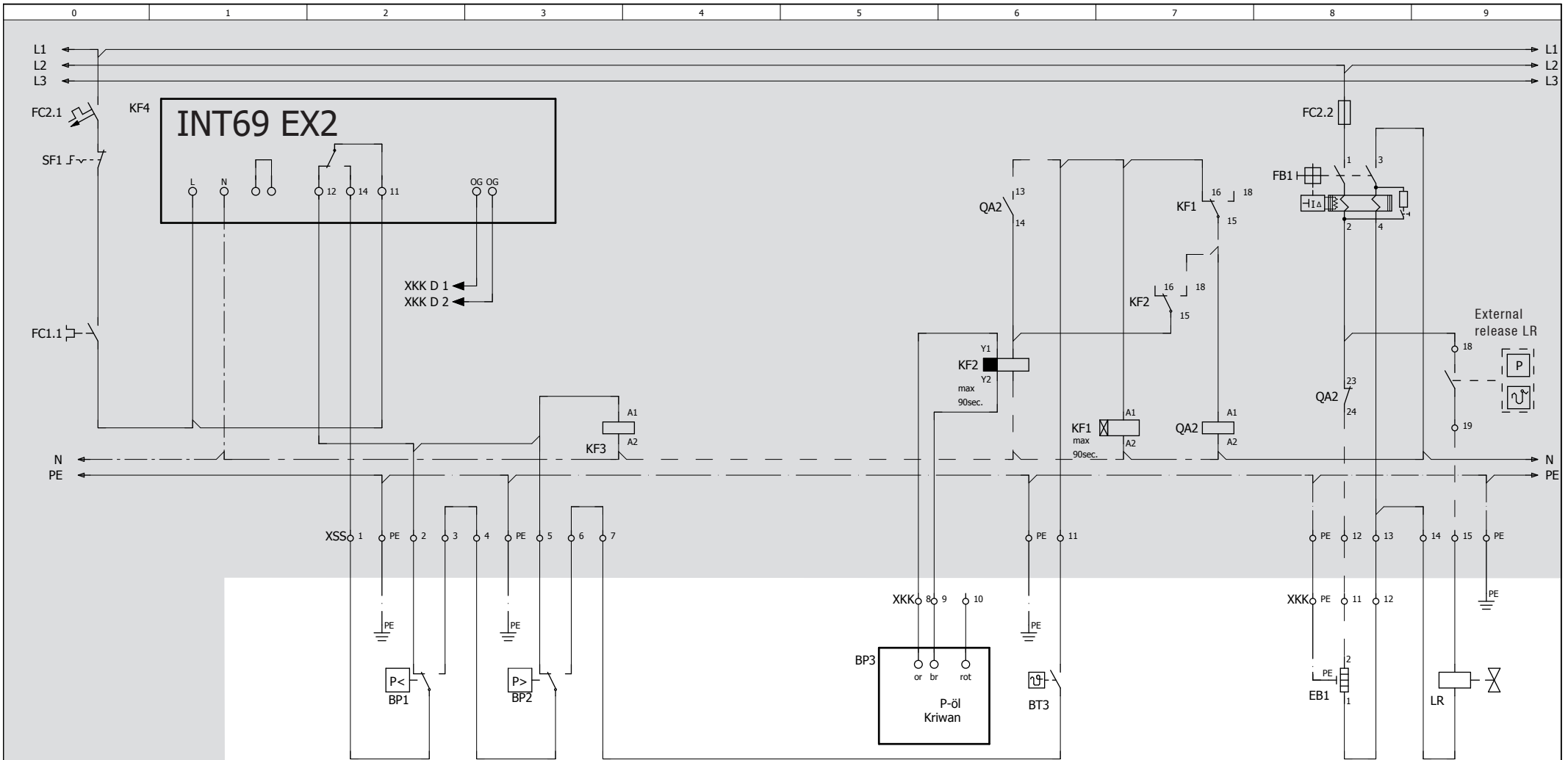


WARNING With the installation of control and adjust parts the valid regulations for the explosion protection have to be observed!



INFO

 = Installation outside of the explosion endangered area!



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.

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

FB1	Fault protection switch (release current 30 mA)
FC2.1	Control fuse
FC2.2	Control fuse LR / oil sump heater
SF1	Control voltage 0/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
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)
BP3	Oil differential pressure sensor INT250 (Kriwan)
EB1	Oil sump heater (ATEX design)
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.



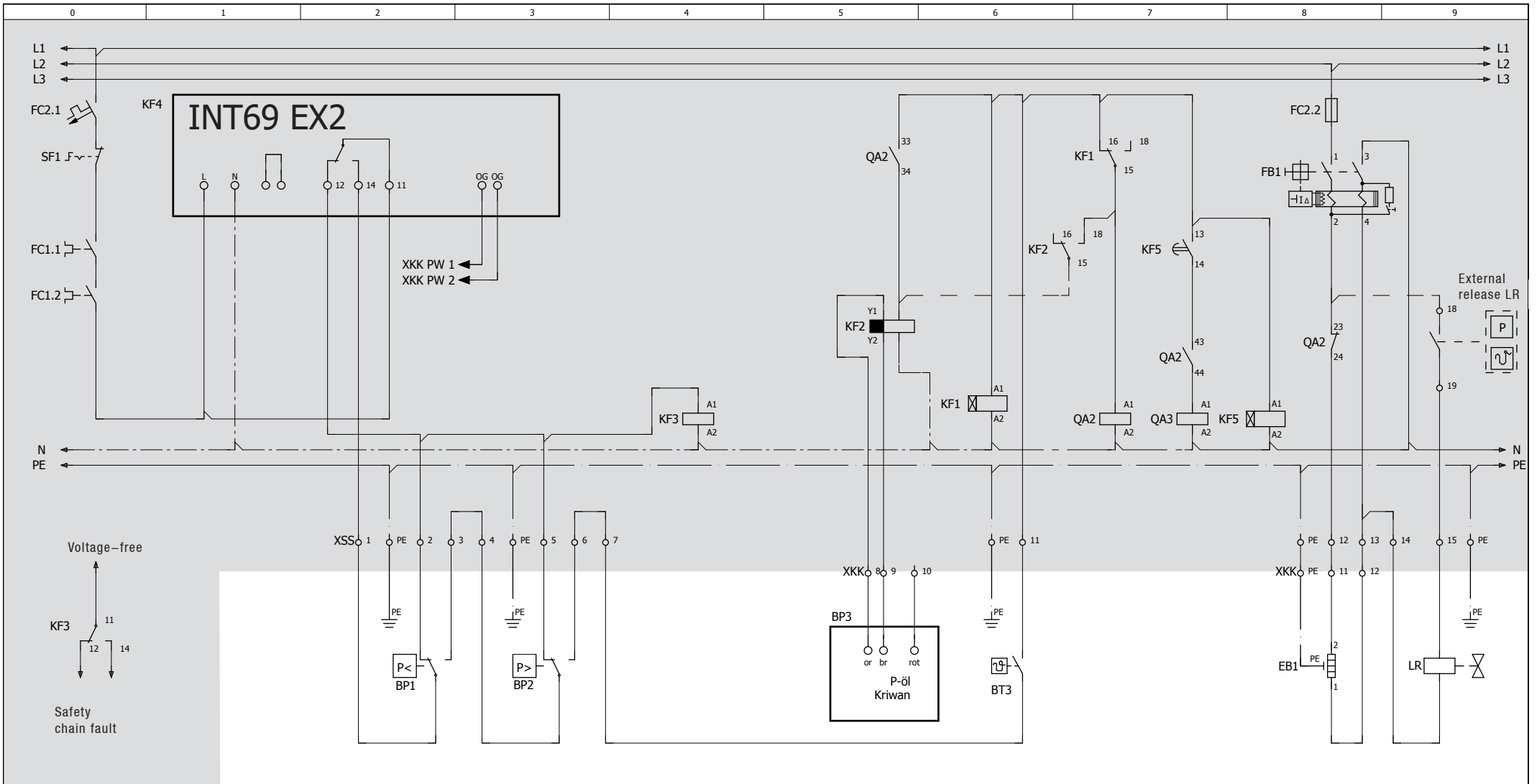
WARNING With the installation of control and adjust parts the valid regulations for the explosion protection have to be observed!



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



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.

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 and has a corresponding Ex marking.

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 60950–1.



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. 21+22). 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 $\leq 100 \Omega$ (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

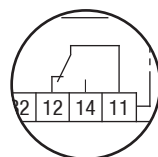


Fig. 23



INFO

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

5 | Electrical connection

5.10 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 stand still to reduce the suction–side stand still pressures.

Electrical data: 230 V–1–50/60 Hz, 240 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.

5.11 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.

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.

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!

6.2 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.**

GB

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 | Commissioning

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.



- 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 | Commissioning

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!

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 for heat pump applications. Otherwise there is a risk of back condensation, which can result in compressor damage.

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.

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!

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 12		60 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 %).

GB

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



INFO

Using the Norgren magnetic coil, ID no. 4280/4281 (Bock part no. 097B70123*, 097B70124*, 097B70125*, 097B70149*) effectively reduces the permissible ambient temperature of the compressor to (–20 °C)–(+50 °C). Observe the type plate on the magnetic coil.

By a capacity regulation, the compressor capacity can be reduced by switching off up to three cylinder banks by 25 % each (in relation to maximum power). It is necessary to replace the respective cylinder cover (included in the kit) for retrofitting.

Retrofit kits:

EX-HG88e / ...	2400–4 (S) 3G	2735–4 (S) 3G	3235–4(S) 3G
Designation	Item No.	Item No.	Item No.
Kit Capacity regulator with cylinder cover 230 V AC	097B81648*	097B81646*	097B81644*
Kit Capacity regulator with cylinder cover HC 230 V AC	097B81801*	097B81802*	097B81803*



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 12 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 M22 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 (BetSichV) 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 mm².

Clamping range cable screw connections (metal): 5 – 8 mm.

Clamping range cable screw connections (plastic): 6 – 12 mm.

* Please note that the legacy BOCK code numbers are without 097B

8 | Accessories



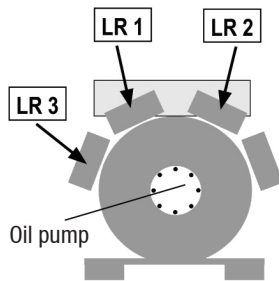
ATTENTION The device may be used only within the data specified on the type plate. Changes to the device are not permitted.

A fuse (max. $3 \times I_b$ 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 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.



The compressor can be equipped with three capacity regulators.

GB

Fig. 24



WARNING Several capacity controllers cannot switch at the same time during compressor operation! Otherwise the sudden change in load can damage the compressor! Comply with the switching interval of 60 s.

- Comply with the switching sequence:
Switching on LR1 — 60s → LR2 — 60s → LR3
Switching off LR3 — 60s → LR2 — 60s → LR1

8 | Accessories

8.2 Oil sump heater (retrofit kit item no. 097B81193*)

The explosion-protected heating element in self-limited design, including immersion sleeve and approved cable fitting (Es d), is supplied with an electrical supply line of approx. 3.2 metres. Installation in the terminal box of the compressor is already prepared.

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 mm.

Operation: The oil sump heater must be operated as a standstill heater, the appropriate control must be performed by the equipment manufacturer / installer.



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.

* Please note that the legacy BOCK code numbers are without 097B

GB

8 | Accessories

8.3 Oil differential pressure sensor INT250 Ex (retrofit kit item no. 097B81196*)



ATTENTION Installation must be in accordance with EN 60079-14.

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.

The oil differential pressure sensor kit INT250 Ex consists of screw-in parts INT250 Ex, switching parts and two timers. The switching part INT250 Ex is supplied with a 3-meter electrical supply line. The installation in the terminal box of the compressor is already prepared.

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 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.

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8.4 Oil separator



ATTENTION Oil slugging can result in damage to the compressor.

To prevent oil slugging:

- The oil return from the oil separator must be guided back at the intended connection (D1) on the compressor housing.
- A direct oil return into the suction line from the oil separator is not permissible.
- Ensure that the oil separator is properly dimensioned.

* Please note that the legacy BOCK code numbers are without 097B

9 | Technical data

Type	No. of cylinders		Displacement (1450 / 1740 rpm)		Electrical data			Permissible frequency range	Weight	Connections ^④		Oil charge (sight glass centre)	Oil charge (ex works)	Sound pressure level
	HG88e/				Voltage	Max. operating current ^②	Max. power consumption ^②			Starting current (rotor locked) ^③	Discharge line DV			
2400-4 3G			209.1 / 250.9	50 / 60 Hz	101	59.5	PW 1 / PW 1+2	298 / 438	450			80 / 80 / 80.5		
2400-4 S 3G			209.1 / 250.9		120	69.8		447 / 657	470			81.5 / 81 / 81		
2735-4 3G		8	237.9 / 285.5		116	67.1		386 / 567	457			81 / 81 / 80		
2735-4 S 3G			237.9 / 285.5		136	80.0		447 / 657	466	54 (2 1/8)	76 (3 1/8)	82 / 81 / 81		
3235-4 3G			281.3 / 337.6		135	79.2		447 / 657	460			82.5 / 81 / 81		
3235-4 S 3G			281.3 / 337.6		162	93.9		538 / 791	468			83 / 82 / 82		

^① Tolerance ($\pm 10\%$) relative to the mean value of the voltage range.
Other voltages and types of current on request.

^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

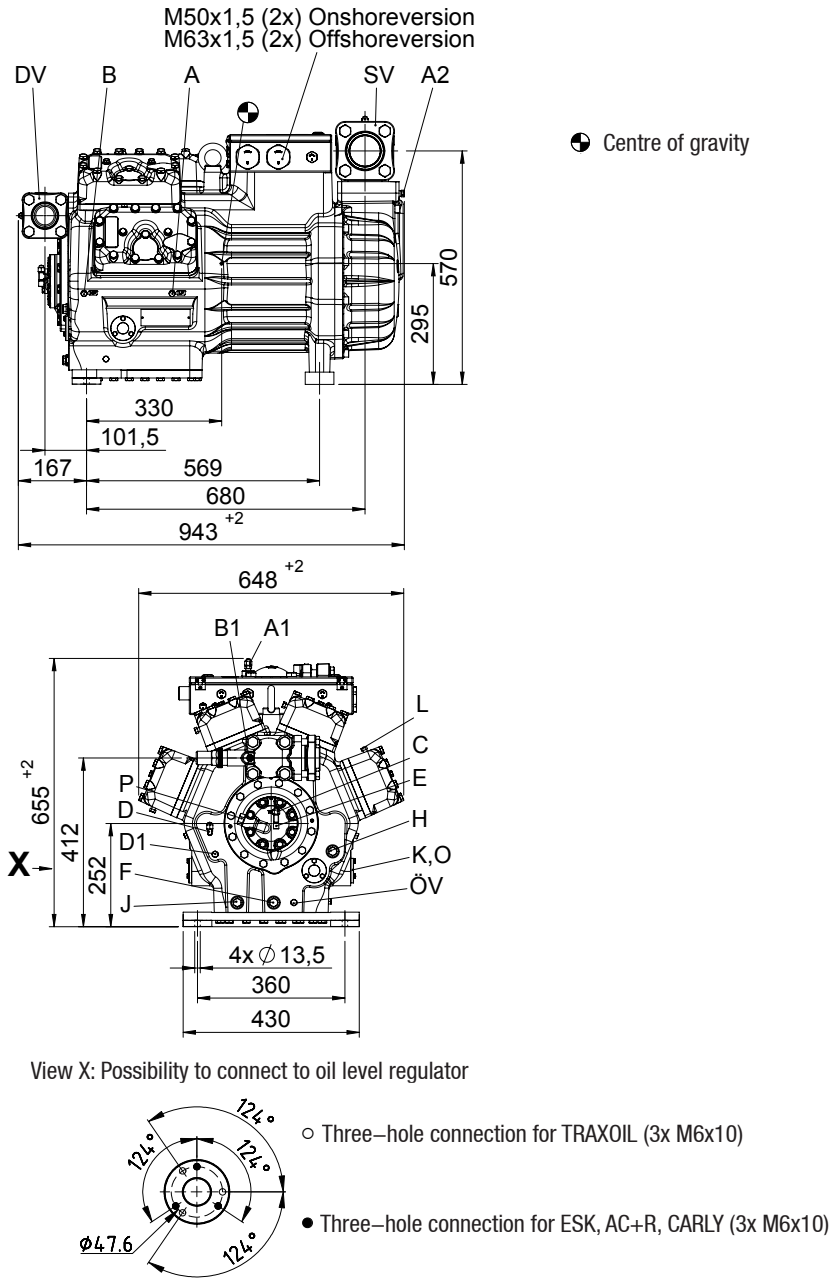
^③ All specifications are based on the average of the voltage range

^④ For solder connections

^⑤ L = low temperature (35 / 40 °C), M = normal cooling (10 / 45 °C), H = air conditioning (5 / 50 °C) sound pressure level measured in low reflection measuring area, measuring distance 1m.
Compressor operation at 50 Hz (1450 rpm), refrigerant R404A.
Values stated are average values, tolerance ± 2 dB(A).

10|Dimensions and connections

EX-HG88e



Dimensions in mm

Fig. 25

GB

10 | Dimensions and connections

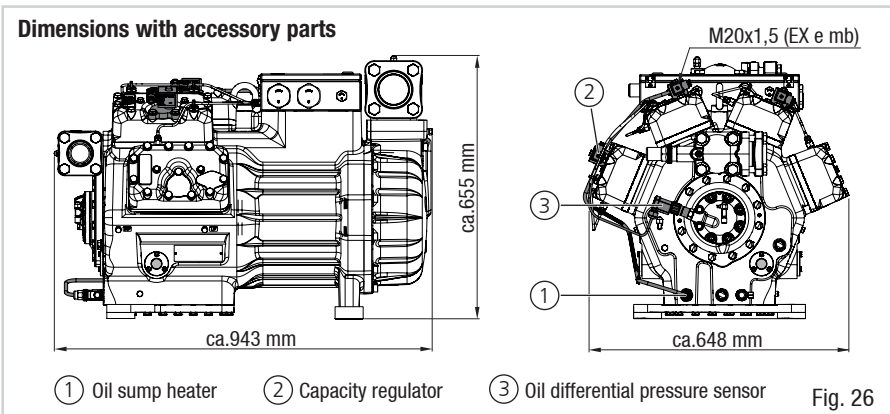
SV	Suction line	see technical data, Chapter 9	
DV	Discharge line		
A	Connection suction side, not lockable		1/8" NPTF
A1	Connection suction side, lockable		7/16" UNF
A2	Connection suction side, not lockable		1/4" NPTF
B	Connection discharge side, not lockable		1/8" NPTF
B1	Connection discharge side, 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		M22 x 1.5
H	Oil charge plug		M22 x 1.5
J	Connection oil sump heater		M22 x 1.5
K	Sight glass		3 x M6
L	Thermal protection thermostat		1/8" NPTF
O*	Connection oil level regulator		3 x M6
P*	Connection oil level regulator		M20 x 1.5
ÖV	Connection oil level regulator		1/4" NPTF

GB

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

Dimensions INT69 EX2 for use in switching cabinets

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





Certificate of Conformity

- (1)
- (2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres – Directive 2014/34/EU
- (3) Certificate Number: **EPS 16 ATEX 1 042 X** Revision 1
- (4) Equipment: Semi-hermetic compressor type EX-HG(X)7 and EX-HG(X)88e
- (5) Manufacturer: Bock GmbH
- (6) Address: Benzstraße 7
72636 Frickenhausen
Germany
- (7) This equipment and any acceptable variation thereto are specified in the schedule to this Certificate of Conformity and the documents therein referred to.
- (8) Bureau Veritas Consumer Products Services Germany GmbH certifies based on a voluntary assessment 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 2014/34/EU. The examination and test results are recorded in the confidential documentation under the reference number 16TH0088.
- (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 60079-15:2010

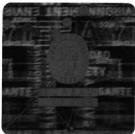
EN 60079-18:2015/A1:2017

- (10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subjected to special conditions for safe use specified in the annex to this certificate.
- (11) This Certificate of Conformity relates only to the design and the construction of the specified equipment in accordance with Directive 2014/34/EU. Further requirements of this Directive apply to the manufacture and supply of this equipment.
- (12) The marking of the equipment shall include the following:

 II 3G Ex db eb mb nA nC IIC/IIB T3 Gc

Certification department of explosion protection

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 16 ATEX 1 042 X, Revision 1.



Annex

(13)

(14) **Certificate of Conformity EPS 16 ATEX 1 042 X**

Revision 1

(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 "e" and/or Ex "n").

Technical & electrical data:

Characteristics	EX-HG(X)7	EX-HG(X)88e
Rated voltage	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)
Max. current	145 A (reduced values according to manufacturer documents)	215 A (reduced values according to manufacturer documents)
Protection terminal box	IP65 (IIC); IP66 (IIB)	IP65 (IIC); IP66 (IIB)
Design compressor	Semi-hermetic	Semi-hermetic
Compressor with an insulating coating < 2 mm	Range of use – gas group IIB	Range of use – gas group IIB
Compressor with an dissipative coating < 2 mm	Range of use – gas group IIC	Range of use – gas group IIC

(16) Reference number: 16TH0088

Page 2 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 16 ATEX 1 042 X, Revision 1.



Certificate of Conformity EPS 16 ATEX 1 042 X

Revision 1

(17) Special conditions for safe use:

Rated ambient temperature range: $-20\text{ °C} \leq T_a \leq +60\text{ °C}$ or
 $-20\text{ °C} \leq T_a \leq +50\text{ °C}$ (in combination with capacity regulator)

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

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.

Certification department of explosion protection

Hamburg, 2021-01-25



GB



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 16.0018X	Page 1 of 4	Certificate history: Issue 0 (2016-05-13)
Status:	Current	Issue No: 1	
Date of Issue:	2021-01-25		
Applicant:	Bock GmbH Benzstraße 7 72636 Frickenhausen Germany		
Equipment:	Supply-, control- and heating-unit type EX-HG(X)7 and EX-HG(X)88e of semi-hermetic compressors		
Optional accessory:			
Type of Protection:	flameproof enclosure "d", increased safety "e", encapsulation "m", non sparking "n"		
Marking:	Ex db eb mb nA nC IIC/IIB T3 Gc		

GB

Approved for issue on behalf of the IECEX
Certification Body:

Position:

Signature:
(for printed version)

Date:

Holger Schaffer

Manager Certification

2021-01-25



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 16.0018X**

Page 2 of 4

Date of issue: 2021-01-25

Issue No: 1

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 60079-15:2010 Explosive atmospheres - Part 15: Equipment protection by type of protection "n"
Edition:4

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/ExTR16.0018/01

Quality Assessment Report:

DE/EPS/QAR15.0005/05

GB



IECEx Certificate of Conformity

Certificate No.: **IECEx EPS 16.0018X**

Page 3 of 4

Date of issue: 2021-01-25

Issue No: 1

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 compressors. The entire electrical connection area is protected by the use of the ignition protection Ex "eb" and/or Ex "nC". The control-unit is protected by the use of the ignition protection Ex "eb", "mb" and "nA", the heating-unit is protected by kind of protection Ex "db".

Technical & electrical data:

Unit type	EX-HG(X)7	EX-HG(X)88e
Rated voltage	400 - 690 V	400 - 690 V
Frequency range	10 - 90 Hz (restricted frequency range according to manufacturer documents)	10 - 90 Hz (restricted frequency range according to manufacturer documents)
Max. supply current	145 A (reduced values according to manufacturers documents)	215 A (reduced values according to manufacturers documents)
Protection terminal box	IP65 (IIC); IP66 (IIB)	IP65 (IIC); IP66 (IIB)

SPECIFIC CONDITIONS OF USE: YES as shown below:

Rated ambient temperature range:	-20°C ≤ T _a ≤ +60°C or
	-20°C ≤ T _a ≤ +50°C (in combination with capacity regulator)

GB



IECEX Certificate of Conformity

Certificate No.: **IECEX EPS 16.0018X**

Page 4 of 4

Date of issue: 2021-01-25

Issue No: 1

DETAILS OF CERTIFICATE CHANGES (for issues 1 and above)

Company name change, standard update, deletion of type EX-HG(X)76e and addition of type Ex-HG(X)7.

GB

Type Examination Certificate CML 21UKEX1799X 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)7 and EX-HG(X)88e**
- 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 60079-15:2010 EN 60079-18:2015/A1:2017

- 10 The equipment shall be marked with the following:



Refer to attached certificate EPS 16 ATEX 1 042 X Issue 1 for specific marking of explosion protection symbols.

Refer to attached certificate EPS 16 ATEX 1 042 X Issue 1 for marked code and ambient temperature range.



Ben Trafford
Certification Officer



CML 21UKEX1799X
Issue 0

11 Description

For product description refer to attached certificate EPS 16 ATEX 1 042 X Issue 1

12 Certificate history and evaluation reports

Issue	Date	Associated report	Notes
0	18 Oct 2021	R14369A-00	Issue of the prime certificate. EPS 16 ATEX 1 042 X Issue 1 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 16 ATEX 1 042 X Issue 1

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 16 ATEX 1 042 X Issue 1

GB

Certificate Annex

Certificate Number CML 21UKEX1799X
Equipment Semi-hermetic compressor type EX-HG(X)7 and EX-HG(X)88e
Manufacturer Bock GmbH



The following documents describe the equipment defined in this certificate:

For drawings describing the equipment, refer to attached certificate EPS 16 ATEX 1 042 X. In addition to the drawings listed on EPS 16 ATEX 1 042 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)7/... Ex-HG(X)88e/...	1 to 5	0A	18 Oct 2021	Ex-Labeling name plate

GB

This certificate shall only be copied in its entirety and without change
www.CMLEx.com

1 of 1

Version: 4.0 Approval: Approved



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