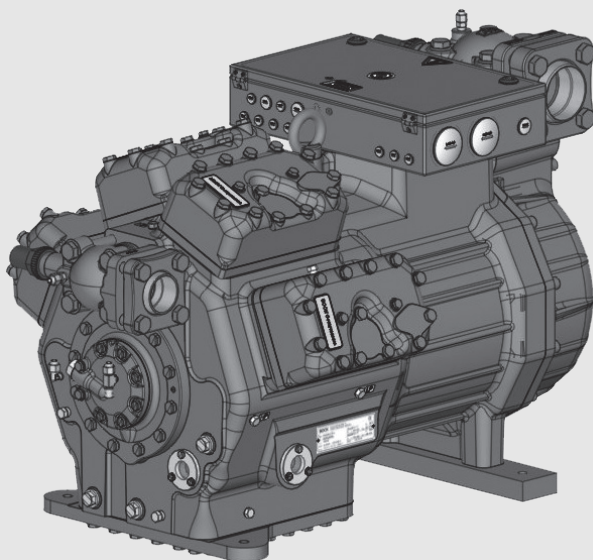




Reciprocating Compressor

BOCK® UL-HGX88e

UL-HGX88e/2400 ML 60
UL-HGX88e/2735 ML 70
UL-HGX88e/3235 ML 80

UL-HGX88e/2400 S 70
UL-HGX88e/2735 S 80
UL-HGX88e/3235 S 95

Foreword

▲DANGER

Risk of accidents.

Refrigerating compressors are pressurized machines and as such call for heightened caution and care in handling.

Improper assembly and use of the compressor can result in serious or fatal injury!

- **To avoid serious injury or death, observe all safety instructions contained in these instructions before assembly and before using the compressor! This will avoid misunderstandings and prevent serious or fatal injury and damage!**
- **Never use the product improperly but only as recommended by this manual!**
- **Observe all product safety labels!**
- **Refer to local building codes for installation requirements!**

Unauthorized changes and modifications to the product not covered by this manual are prohibited and will void the warranty!

This instruction manual is a mandatory part of the product. It must be available to the personnel who operate and maintain this product. It must be passed onto the end customer along with the unit in which the compressor is installed.

This document is subject to the copyright of BOCK GmbH, Germany. The information provided in this manual is subject to change and improvements without notice.

Manufacturer and contact

Bock GmbH
Benzstr. 7
72636 Frickenhausen
Germany
Phone +49 7022 9454-0
Fax +49 7022 9454-137
bock.danfoss.com
bock.info@danfoss.com

Contents

Page

1	Safety	4
1.1	Identification of safety instructions	4
1.2	General safety instructions	4
1.3	Intended use	5
1.4	Qualifications required of personnel.....	5
2	Product description.....	6
2.1	Short description	6
2.2	Name plate (example)	7
2.3	Type key (example)	7
3	Areas of application	8
3.1	Refrigerants.....	8
3.2	Oil charge	8
3.3	Limits of application.....	8

4	Compressor assembly.....	9
4.1	Storage and transport.....	9
4.2	Setting up.....	9
4.3	Pipe connections.....	10
4.4	Pipes.....	10
4.5	Starting unloader (external)	10
4.6	Laying suction and pressure lines.....	11
4.7	Operating the shut-off valves.....	12
4.8	Operating mode of the lockable service connections	12
4.9	Suction pipe filter and filter drier.....	13
5	Electrical connection	13
5.1	General safety.....	13
5.2	Information for contactor and motor contactor selection.....	13
5.3	Standard motor, design for direct or partial winding start.....	14
5.4	Basic circuit diagram for part winding start with standard motor.....	16
5.5	Special motor: design for direct or star-delta start.....	18
5.6	Circuit diagram for star-delta start 230 V Δ / 400 V Y.....	20
5.7	Electronic trigger unit INT69 G.....	22
5.8	Connection of the trigger unit INT69 G.....	22
5.9	Function test of the trigger unit INT69 G	23
5.10	Oil sump heater (accessories)	23
5.11	Capacity regulator (accessories)	24
5.12	Selection and operation of compressors with frequency converters.....	24
6	Commissioning	24
6.1	Preparations for start-up.....	25
6.2	Pressure integrity test.....	25
6.3	Leak test.....	25
6.4	Evacuation	25
6.5	Refrigerant charge	26
6.6	Start-up	26
6.7	Avoiding slugging.....	26
7	Maintenance	27
7.1	Preparation	27
7.2	Work to be carried out	27
7.3	Spare parts recommendation/accessories	27
7.4	Lubricants / oils	27
7.5	Decommissioning	27
8	Accessories.....	28
8.1	Capacity regulator.....	28
8.2	Oil separator	29
8.3	Oil level regulator	30
9	Technical data.....	31
10	Dimensions and connections	32
11	Declaration of incorporation.....	34
12	UL-Certificate of Compliance.....	36
13	Service	37

1| Safety

1.1 Identification of safety instructions



Indicates a dangerous situation which, if not avoided, will cause immediate fatal or serious injury.



Indicates a dangerous situation which, if not avoided, may cause fatal or serious injury.



Indicates a dangerous situation which, if not avoided, may cause fairly severe or minor injury.



Indicates a situation which, if not avoided, may cause property damage.



Important information or tips on simplifying work.

US

1.2 General safety instructions



Risk of accidents.

Refrigerating compressors are pressurized machines and as such call for heightened caution and care in handling.

The maximum permissible overpressure must not be exceeded, even for testing purposes!

Risk of burns!

- Depending on the operating conditions, surface temperatures of over 140 °F (60 °C) on the discharge side or below 32 °F (0 °C) on the suction side can be reached.

- Contact with refrigerant must be avoided.

Contact with refrigerant can cause severe burns and skin damage.

1 | Safety

1.3 Intended use

⚠ WARNING

The compressor may not be used in potentially explosive environments!

- These assembly instructions describe the standard version of the compressor named in the title manufactured by Bock. Bock refrigerating compressors are intended for installation in a machine (within the EU according to the EU Directives 2006/42/EC Machinery Directive, 2014/68/EU Pressure Equipment Directive, outside the EU according to the respective national regulations and guidelines).

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

The compressors are intended for use in refrigeration systems in compliance with the limits of application.

Only the refrigerant specified in these instructions may be used.

Any other use of the compressor is prohibited!

US

1.4 Qualifications required of personnel

⚠ WARNING

Inadequately qualified personnel poses the risk of accidents, the consequence being serious or fatal injury. Work on compressors is therefore reserved for personnel who are qualified to work on pressurized refrigerant systems:

- For example, a refrigeration technician, refrigeration mechatronic engineer. As well as professions with comparable training that 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 recognizing any potential dangers.

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.

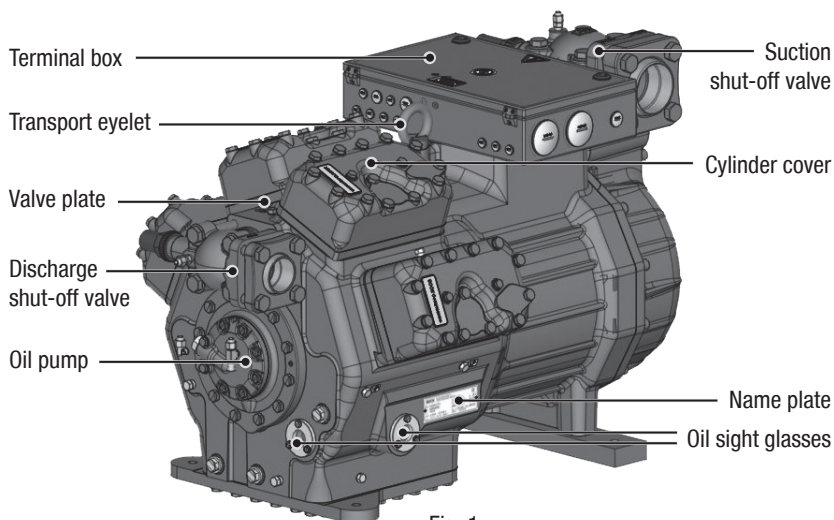


Fig. 1

Dimension and connection values can be found in Chapter 10.

3 | Areas of application

3.1 Refrigerants

R404A, R407A, R410A, R407C, R407F, R134a, R448A, R449A, R450A, R513A, R452A

More informations about approved refrigerants on Bock compressor selection tool VAP (vap.bock.de).

3.2 Oil charge

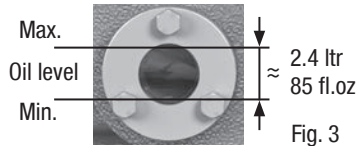
- The compressors are filled at the factory with the following oil type: **BOCK**lub E55



For refilling, we recommend the above oil types.
See also section 7.4.

NOTICE

The oil level must be in the visible part of the sight glass; damage to the compressor is possible if overfilled or under-filled!



3.3 Limits of application

NOTICE

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.

- Permissible ambient temperature: -4°F ... 140°F (-20 °C ...+60 °C).
- Max. permissible discharge end temperature 284°F (140 °C).
- Max. permissible switching frequency 12x / h.
- A minimum running time of 3 min. steady-state condition (continuous operation) must be achieved.

For operation with supplementary cooling:

- Use only oils with high thermal stability.
- Avoid continuous operation near the threshold.
- Additional fans (accessories) can be used for additional cooling.

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 must not be exceeded. In the case of operation above the mains frequency, the application limit can therefore be limited. Max. 60 Hz.

(For more on the frequency converter, see chapter 5.12, p. 24).

When operating in the vacuum range, there is a danger of air entering on the suction side. This can cause chemical reactions, a pressure rise in the condenser and an elevated compressed-gas temperature. Prevent the ingress of air at all costs!

3 | Areas of application

Maximum admissible frequency: 60 Hz

Maximum admissible operating pressure (LP/HP)¹⁾:
19/28 barg (276/406 psig)

¹⁾ LP = Low pressure
HP = High pressure

4 | Compressor assembly



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.

4.1 Storage and transport



- Storage at -22°F...+158°F, (-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.



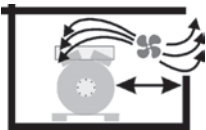
- Use transport eyelet.
- Do not lift manually!
- Use lifting gear!

US

4.2 Setting up

NOTICE

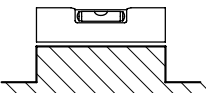
Attachments (e.g. pipe holders, additional units, fastening parts, etc.) directly to the compressor are not permissible!



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



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



- Setup on an even surface or frame with sufficient load-bearing capacity.
- Single compressor preferably on vibration damper.
- Duplex and parallel circuits always rigid.
- On shell and tube condensers, install only with rubber-metal shock mountings.



- Installation of pipe vibration mufflers is recommended!

4 | Compressor assembly

4.3 Pipe connections

NOTICE

Damage possible.

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).

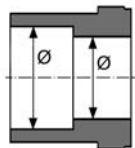


Fig. 4: graduated internal diameter

- Pipe connections on the compressor are available for soldering or welding (accessories). The **discharge and suction line valves** have graduated inside diameters so that pipes with standard millimetre and inch dimensions can be used. The pipe will be immersed more or less deeply according to dimension.
- The connection diameters of the shut-off valves are rated for maximum compressor output. **The actual required pipe cross section must be matched to the output. The same applies for non-return valves.**

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.
- When using drawing oils in the inner pipe, the oils must then be completely removed by degreasing.
- 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 Starting unloader (external)

An internal start unloader ex factory is not available. Alternatively a starting unloader can be installed in the plant.

Operation:

When the compressor is started, a solenoid valve receives power via a time switch and opens a bypass 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. 5).

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. 6). The compressor now works under normal load.

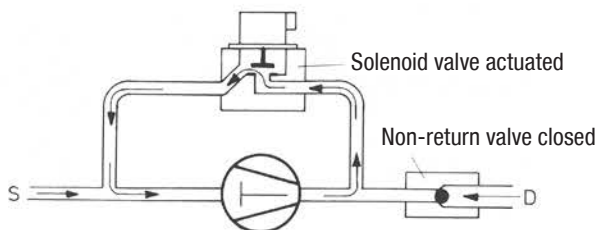


Fig. 5

4 | Compressor assembly

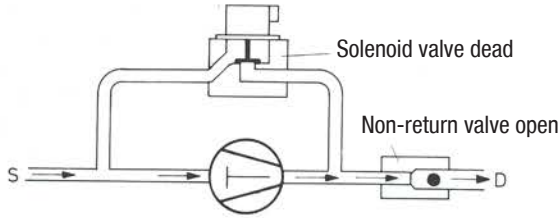


Fig. 6

Important:

- Starting 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 using 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

NOTICE

Improperly installed pipes can cause cracks and tears, the result being a loss of refrigerant.



Proper layout of the suction and discharge lines directly after the compressor is integral to the system's smooth running and vibration behavior.

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

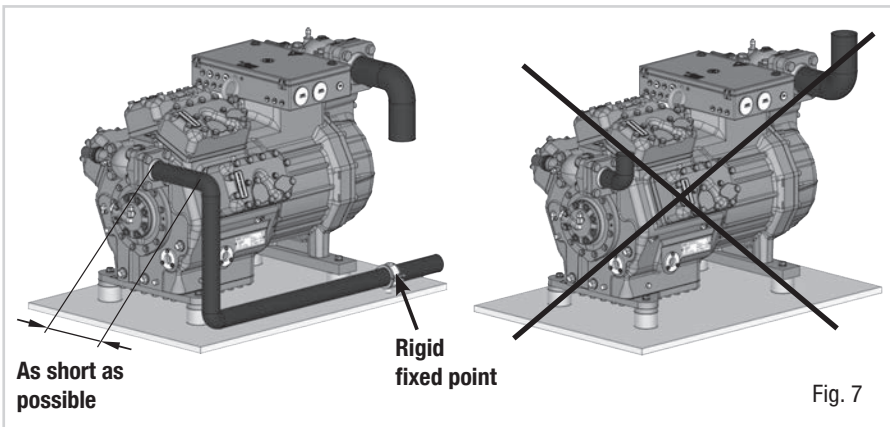


Fig. 7

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.

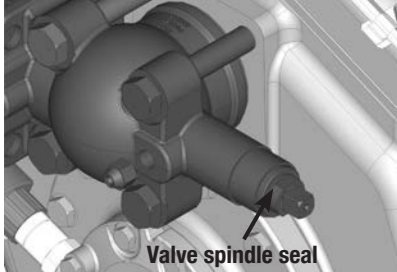


Fig. 8

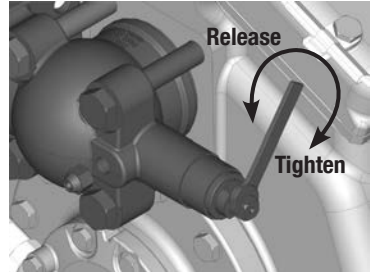


Fig. 9

4.8 Operating mode of the lockable service connections

US

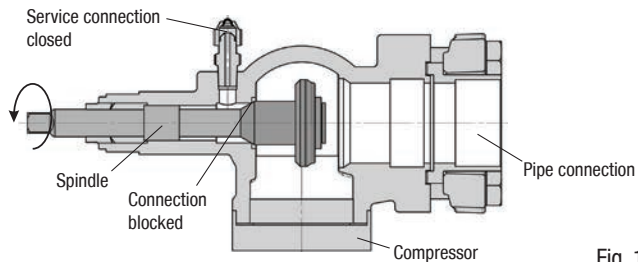


Fig. 10

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.

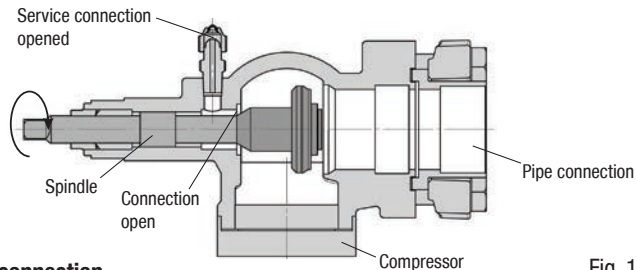


Fig. 11

Opening the service connection

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

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

After activating the spindle, generally fit the spindle protection cap again and tighten with 14-16 Nm (10-12 lb-ft). This serves as a second sealing feature during operation.

4 | Compressor assembly

4.9 Suction pipe filter and filter drier

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).

Moisture in the refrigeration circuit can lead to crystal and hydrate formation. For this reason, we recommend using a filter drier and a sight glass with a moisture indicator.

5 | Electrical connection

5.1 General safety

DANGER

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

NOTICE

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



Connect the compressor motor in accordance with the circuit diagram (see inside of terminal box).

- Use suitable cable entry point of the correct protection type (see name plate) for routing cables into the terminal box. Insert the strain relieves and prevent chafe marks on the cables.
- Compare the voltage and frequency values with the data for the mains power supply.

Only connect the motor if these values are the same.

5.2 Information for contactor and motor contactor selection

All protection devices and switching or monitoring units must be fitted in accordance with the local safety regulations and established specifications (e.g. OSHA, UL/CSA) 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 | Electrical connection

5.3 Standard motor, design for direct or partial winding start

Designation on the name plate
Y/YY

Compressors with this marking are suitable for direct or partial winding start. The motor winding is subdivided into two parts:

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

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



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

5 | Electrical connection

The motor is wired for direct start (YY) at the factory. For part winding start Y/YY the bridges must be removed and the motor feed line connected according to the circuit diagram:

Rated voltage	
Direct start YY	Part winding start Y/YY

US



The supplied insulators must be mounted according to the illustrations as shown.

The connection examples shown refer to the standard version. In the case of special voltages, the instructions affixed to the terminal box apply.

NOTICE

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

5.4 Circuit diagram for part winding start

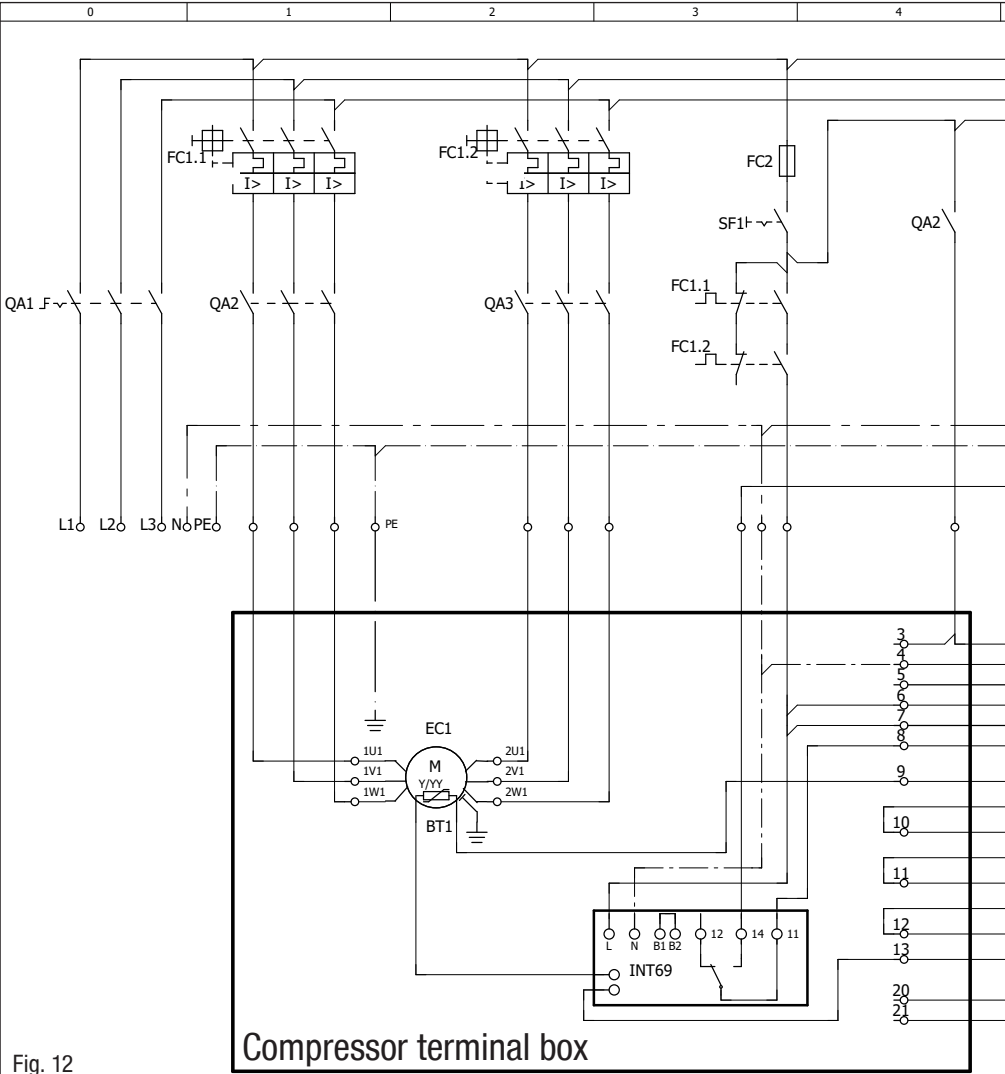
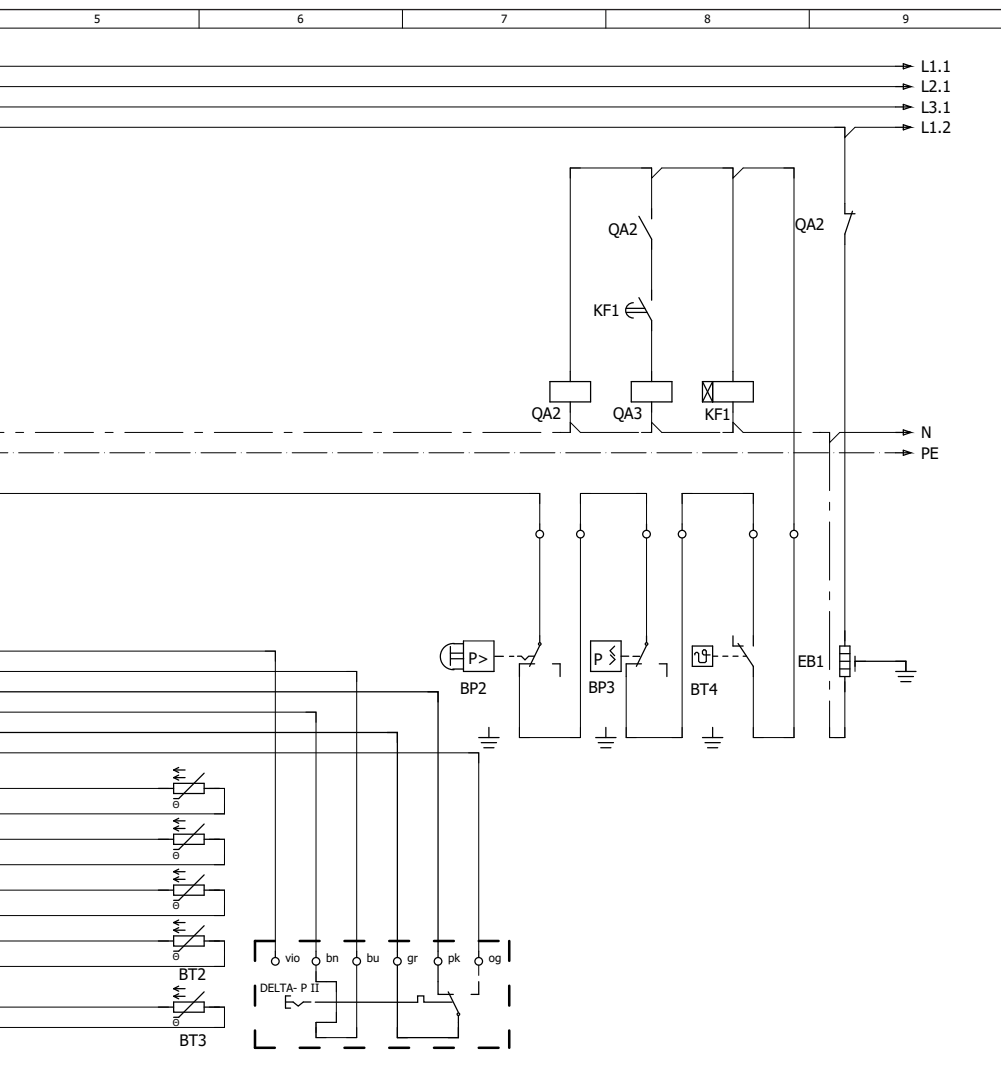


Fig. 12

Compressor terminal box

BP2	High pressure safety monitor
BP3	Safety chain (high/low pressure monitoring)
BT1	Cold conductor (PTC sensor) motor winding
BT2	Thermal protection thermostat
BT3	Oil temperature sensor (PTC sensor)
BT4	Release switch (thermostat)
DELTA-P II	Oil differential pressure sensor DELTA-P II (accessories)
EB1	Oil sump heater
EC1	Compressor motor



US

FC1.1/1.2	Motor protection switch
FC2	Control power circuit fuse
INT69 G	Electronic trigger unit INT69 G
KF1	Delay relay for contactor switch over
QA1	Main switch
QA2	Mains contactor (part winding 1)
QA3	Mains contactor (part winding 2)
SF1	Control voltage switch

5 | Electrical connection

5.5 Special motor: design for direct or star-delta start

A mechanical unloaded start with bypass solenoid valve (accessories) is required for the star-delta start.

Designation on the name plate
Δ / Y

US

5 | Electrical connection

Star-delta start-up is only possible for Δ power supply. Example:

Lower voltage Δ		Higher voltage Y
Direct start	Star-delta-start	Direct start only

In the factory the motor is wired for direct starting at high voltage.
The brides are to be removed for star delta starting at low voltage.



The supplied insulators must be mounted according to the illustrations as shown.

The connection examples shown refer to the standard version. In the case of special voltages, the instructions affixed to the terminal box apply.

US

5.6 Circuit diagram for star-delta start

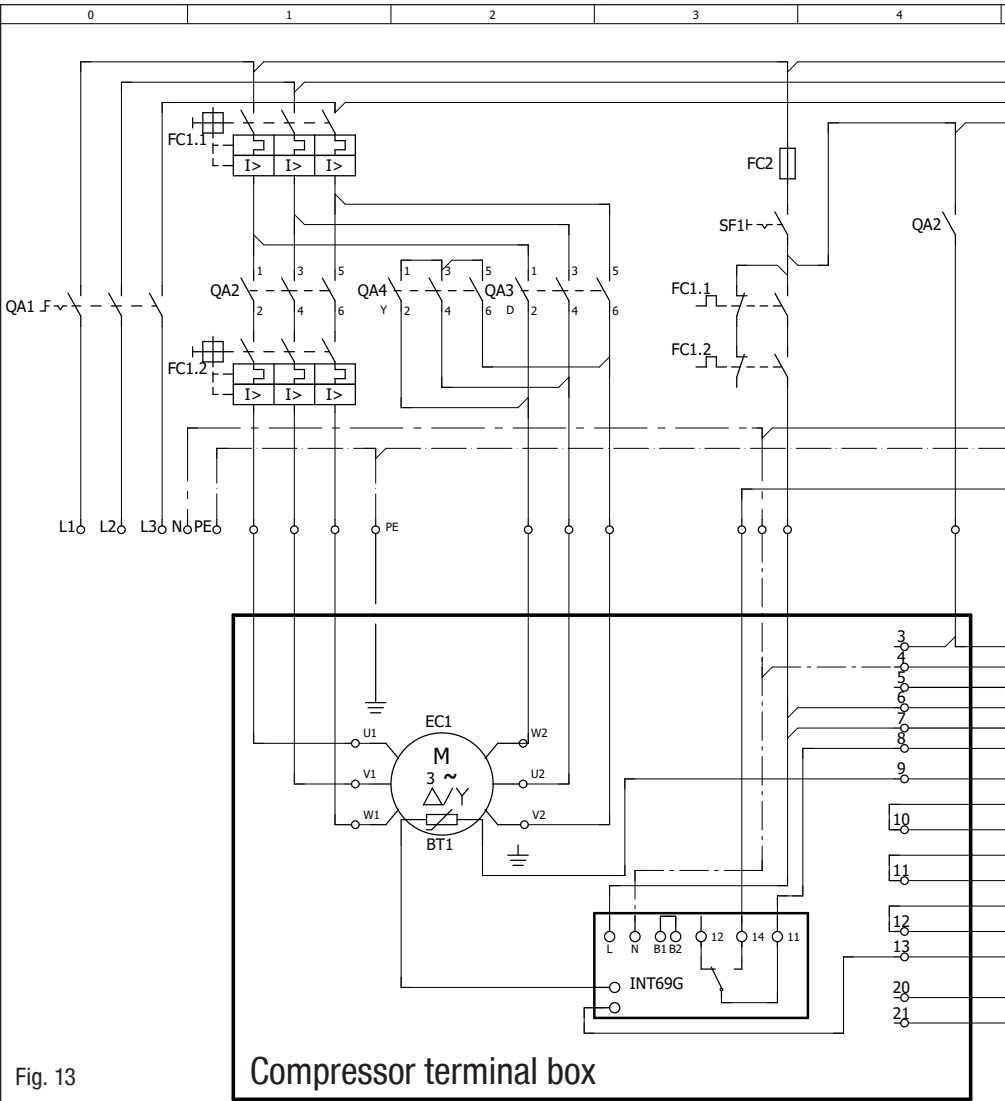
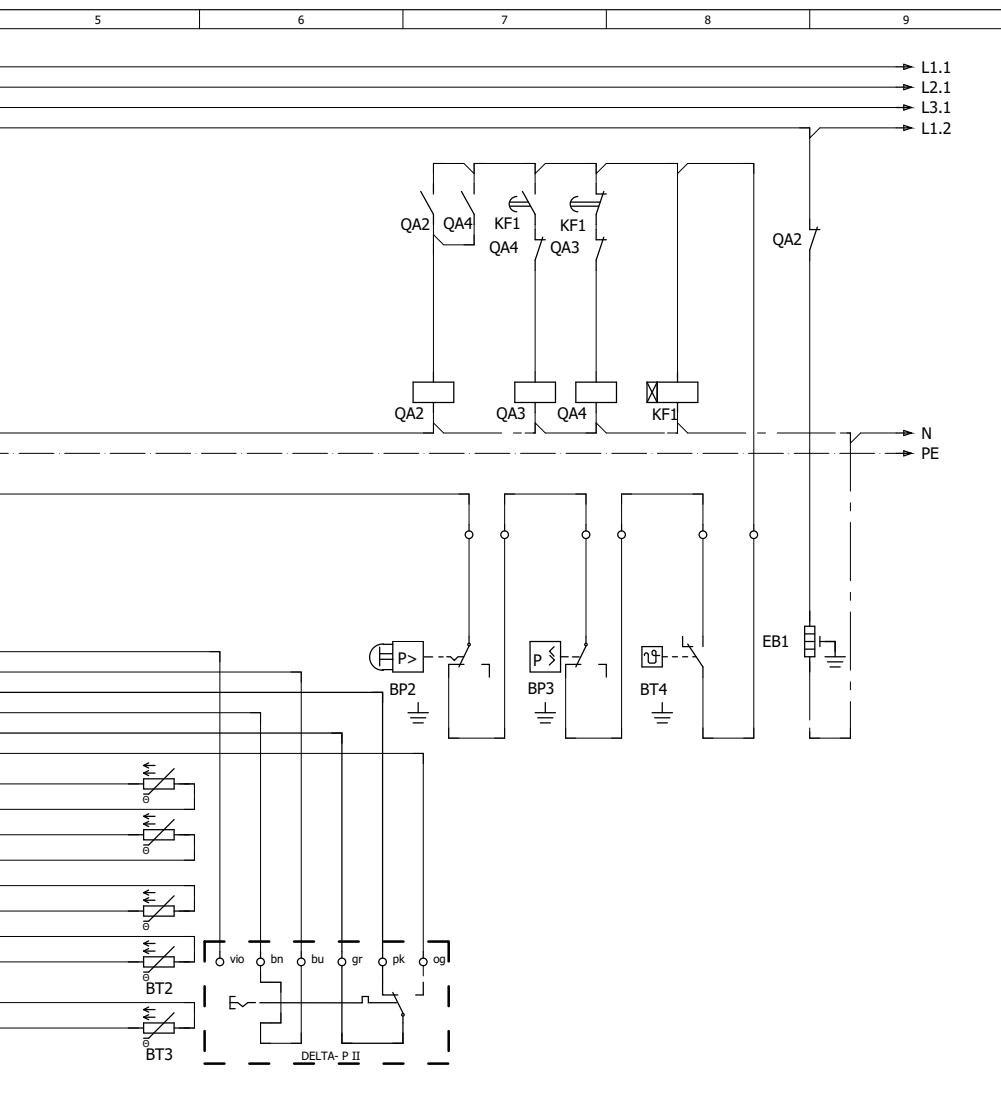


Fig. 13

Compressor terminal box

BP2	High pressure safety monitor
BP3	Safety chain (high/low pressure monitoring)
BT1	Cold conductor (PTC sensor) motor winding
BT2	Thermal protection thermostat
BT3	Oil temperature sensor (PTC sensor)
BT4	Release switch (thermostat)
DELTA-P II	Oil differential pressure sensor DELTA-P II (accessories)
EB1	Oil sump heater
EC1	Compressor motor



US

FC1.1/1.2	Motor protection switch
FC2	Control power circuit fuse
INT69 G	Electronic trigger unit INT69 G
KF1	Delay relay for contactor switch over
QA1	Main switch
QA2	Mains contactor
QA3	Δ-contactor
QA4	Y-contactor
SF1	Control voltage switch

5 | Electrical connection

5.7 Electronic trigger unit INT69 G

The compressor motor is fitted with cold conductor temperature sensors (PTC) connected to the electronic trigger unit INT69 G in the terminal box. In case of excess temperature in the motor winding, the INT 69 G deactivates the motor contactor. Once cooled, it can be restarted only if the electronic lock of the output relay (terminals B1 + B2) is released by interrupting the supply voltage.

The hot gas side of the compressor can also be protected against overtemperature using thermal protection thermostats (accessory).

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



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.

5.8 Connection of the trigger unit INT69 G



Connect the trigger unit INT69 G in accordance with the circuit diagram. Protect the trigger unit with a delayed-action fuse (FC2) of max. 4 A. In order to guarantee the protection function, install the trigger unit as the first element in the control power circuit.

NOTICE

Measure circuit BT1 and BT2 (PTC sensor) must not come into contact with external voltage. This would destroy the trigger unit INT69 G and PTC sensors.

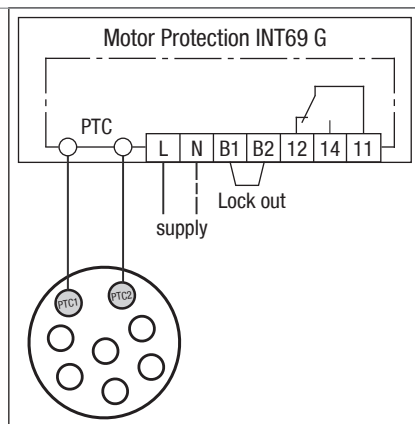


Abb. 14
Terminal box

5 | Electrical connection

5.9 Function test of the trigger unit INT69 G

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 G switch-on	11-14
Remove PTC connector	11-12
Insert PTC connector	11-12
Reset after mains on	11-14

Relay position INT69 G

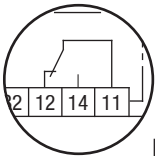


Fig. 15

5.10 Oil sump heater (accessories)

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

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

Connection: The oil sump heater must be connected via an auxiliary contact (or parallel wired auxiliary contact) of the compressor contactor to a separate electric circuit.

El. data: 230 V AC - 1 - 60 Hz, 200 W.

NOTICE

Connection to the current path of the safety control chain is not permitted.

5 | Electrical connection

5.11 Capacity regulator (accessories)

NOTICE

A fuse (max. 3xIB in accordance with IEC 60127-2-1) corresponding to the rated current must be placed in front of every magnetic coil of the capacity regulator as short-circuit protection. The rated voltage of the fuse must be equal to or greater than the rated voltage of the magnetic coil. The ability of the fuses to switch off must be greater than or equal to the maximum assumable short-circuit current at the installation location.

5.12 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 frequency of at least 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. 31.

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

6 | Commissioning

6.1 Preparations for start-up



To protect the compressor against inadmissible operating conditions, high pressure and low pressure pressostats are mandatory on the installation side.

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

Check the compressor for transport damage!

6.2 Pressure integrity 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 UL 207 or a corresponding safety standard **without the inclusion of the compressor**.

6.3 Leak test

⚠ DANGER

Risk of bursting!

The compressor must only be pressurized using nitrogen (N₂). Never pressurize 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.

US

- Carry out the leak test on the refrigerating plant in accordance with UL 207 or a corresponding safety standard, while always observing the maximum permissible overpressure for the compressor.

6.4 Evacuation

NOTICE

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 < 0.02 psig (1.5 mbar) when the pump is switched off.
- Repeat this process as often as is required.

6 | Commissioning

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 vapor form on the suction side, or, taking suitable precautions, also in liquid form at the inlet to the evaporator.

NOTICE

- **Avoid overfilling the system with refrigerant!**
- **To avoid shifts in concentration, zeotropic refrigerant blends must always only be filled into the refrigerating plant in liquid form.**
- **Do not pour liquid refrigerant through the suction line 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 all 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 by:** The oil must be visible in the sight glass.

NOTICE

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

6.7 Avoiding slugging

NOTICE

Slugging can damage the compressor and cause refrigerant to leak.

To prevent slugging:

- The complete refrigeration system 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 superheat 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 are recommended such as replacement of liquid traps, solenoid valve in the liquid line, etc.

There should be no movement of refrigerant whatsoever while the compressor is at a standstill.

The use of a check valve is strongly recommended, especially for heat pump applications. Otherwise there is a risk of back condensation, which can cause compressor damage.

7 | Maintenance

7.1 Preparation

⚠ WARNING

Before starting any work on the compressor:

- Switch off the compressor and secure it to prevent a restart.
- Relieve compressor of system pressure.
- Prevent air from infiltrating the system!

After maintenance has been performed:

- Connect safety switch.
- Evacuate compressor.
- Release switch lock.

7.2 Work to be carried out

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

• Oil change:

- not mandatory for factory-produced series systems.
- for field installations or when operating near the application limit: for the first time after 100 to 200 operating hours, then approx. every 3 years or 10,000 - 12,000 operating hours. Dispose of used oil according to the regulations; observe national regulations.

- **Annual checks:** Oil level, leak tightness, running noises, pressures, temperatures, function of auxiliary devices such as oil sump heater, pressure switch.

US

7.3 Spare parts 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 Lubricants / oil

The oil type filled as standard in the factory is marked on the **name plate**, and this should always be used, even in the case of maintenance units. **Alternative oil types** can vary significantly in quality due to additives or inferior raw materials by the manufacturer. Validation within the compressors entire operating limits can not be guaranteed, if such alternative oil types are used. It is for this reason, that we only recommend the use of oil from Bock! Bock assumes no liability for any damage arising from alternative oil types.

Bock standard oil type: BOCKlub E55

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 regulator

NOTICE

If the capacity regulator is installed at the factory, the control component (pilot valve) is subsequently installed and connected by the customer.

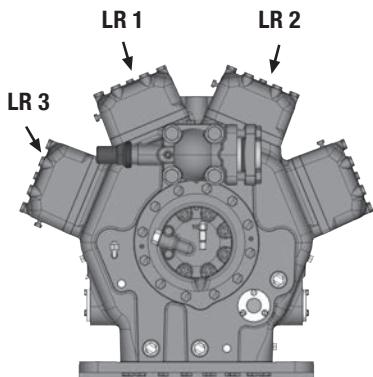
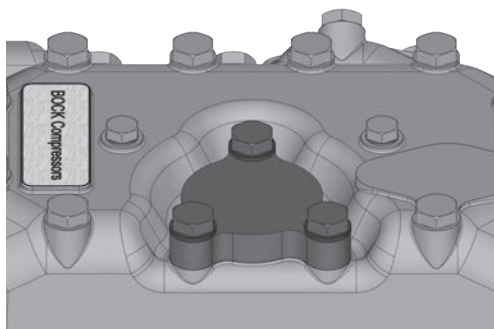


Fig. 16



Delivery condition 1 (from the factory):
Cylinder cover prepared for capacity regulator.

Fig. 17

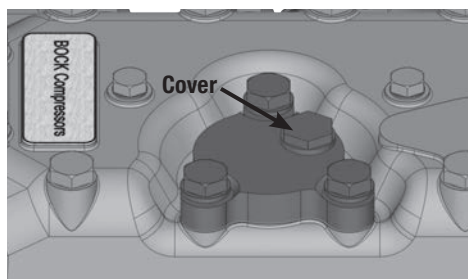


Fig. 18 Delivery condition 2 (from the factory):
Capacity regulator installed with cover
(transport protection).

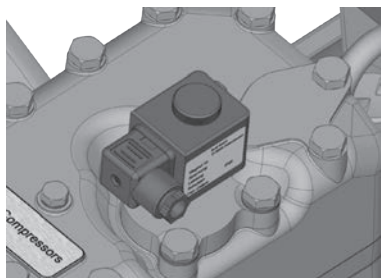


Fig. 19

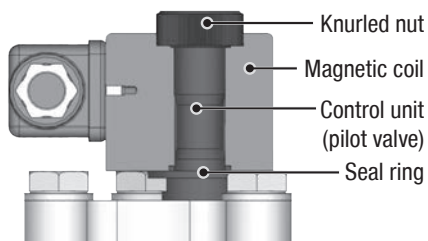


Fig. 20

Before start-up, remove the cover at the capacity regulator and replace it with the enclosed control unit (pilot valve).

Attention! Compressor is under pressure! Depressurize the compressor first.

Screw in control unit (pilot valve) with seal ring and tighten with 15 Nm. Wet thread sides with ester oil. Insert magnetic coil, fasten it with knurled nut and connect it.

⚠ WARNING

Several capacity regulators 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

NOTICE

- **Capacity-regulated operation alters the gas speeds and pressure ratios of the refrigerating plant: Adjust the suction line routing and dimensioning accordingly, do not set the control intervals too close and do not let the system switch more than 12 times per hour (refrigerating plant must have reached a state of equilibrium). Continuous operation in the control stage is not recommended as the gas velocity in the plant system under certain circumstances does not guarantee sufficient oil return to the compressor with activated capacity regulator.**

We recommend switching to unregulated operation (100 % capacity) for at least 5 minutes per capacity-regulated operating hour. An assured oil return can also be realised by a 100 % capacity requirement after each compressor restart.

NOTICE

- **Electrical actuation of the solenoid valve: Normally open, (corresponds to 100 % compressor capacity).**
- **The LP connection on the cylinder cover must not be used for the low-pressure switch in power-controlled operation.**

Special accessories are only premounted in the factory if ordered specially by customer. Retrofitting is possible in full compliance with the safety instructions and repair instructions enclosed with the kits. Information about the use, operation, maintenance and servicing of the components is available in the printed literature or on the internet under vap.bock.de.

8.2 Oil separator

NOTICE

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.

8 | Accessories

8.3 Oil level regulator

Oil level regulation systems have proven themselves with parallel circuits of several compressors. The connection "O" is provided for installing an oil level regulator (see dimensions drawing). All common mechanical oil level regulators from AC&R, ESK, Carly as well as the electronic oil level regulation system from AC&R, Teklab, OM3 TraxOil from Alco and ESK (only long version) can be connected directly without adapters (see fig.21). A sight glass on the oil level regulator is not required. The assembly is made at the original position of the standard sight glass.

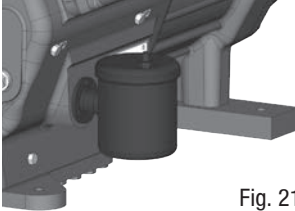
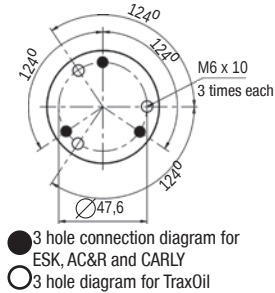


Fig. 21

Mechanical oil level regulator
at the "O" connection



9 | Technical data

Oil charge (sight glass centre)		ltr (fl.oz)	9.0 317)					
Oil charge (ex works)		ltr (fl.oz)	9.6 (338)					
Connections ④	Suction line SV	mm (inch)	76 (3 1⁄8)					
	Discharge line DV	mm (inch)	54 (2 1⁄8)					
Weight		lb	996	996	1003	1023	1012	1030
Electrical data ③	Adjustable frequency range	Hz	25 - 60					
	Starting current (rotor locked)	PW 1 / PW 1+2 A	319 / 449	466 / 657	433 / 610	466 / 657	466 / 657	466 / 657
	Max. power consumption ②	kW (HP)	71,8 (97,6)	84,2 (114,5)	81,0 (110,1)	96,5 (131,2)	95,6 (130,0)	113,3 (154,1)
	Max. operating current ②	PW 1+2 A	101	120	116	136	135	162
	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 ratio : 50 % / 50 %					
Displacement (1450 / 1740 rpm)		50 / 60 Hz cfh	7384 / 8861	7384 / 8861	8401 / 10081	8401 / 10081	9936 / 11923	9936 / 11923
No. of cylinders			8					
Type	UL-HGX88e/		2400 ML 60	2400 S 70	2735 ML 70	2735 S 80	3235 ML 80	3235 S 95

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 60 Hz operation.

- 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

US

10 | Dimensions and connections

UL-HGX88e

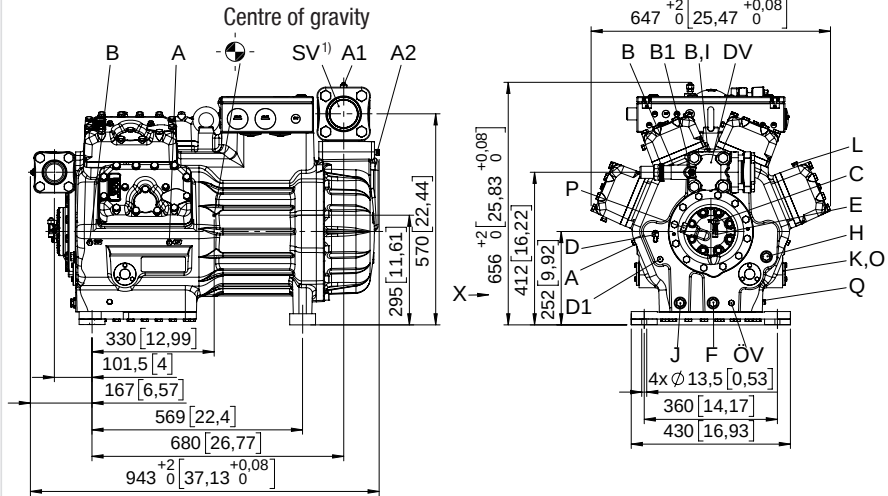


Fig. 22

¹⁾Suction cover 90° rotatable
Dimensions in mm [inch]

Suction connection on the side left or right 90°

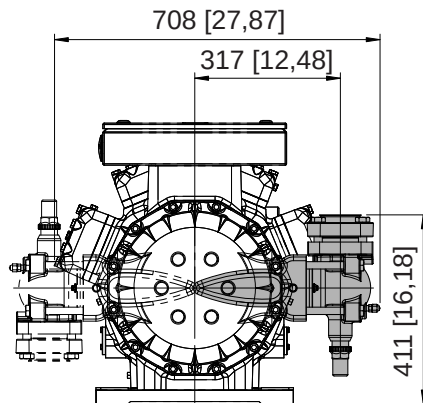


Fig. 23

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		M22x1,5
H	Oil charge plug		M22x1,5
I	Connection hot gas temperature sensor		1/8" NPTF
J	Connection oil sump heater		M22x1,5
K	Sight glass		3 x M6
L	Connection thermal protection thermostat		1/8" NPTF
O	Connection oil level regulator		3 x M6
ÖV	Connection oil service valve		1/4" NPTF
P	Connection oil pressure differential sensor		M20x1,5
Q	Connection oil temperature sensor		1/8" NPTF

US

11 | Declaration of incorporation

**Declaration of incorporation for incomplete machinery
in accordance with EC Machinery Directive 2006/42/EC, Annex II 1. B**

Manufacturer: Bock GmbH
Benzstraße 7
72636 Frickenhausen, Germany

We, as manufacturer, declare in sole responsibility that the incomplete machinery

Name: Semi-hermetic compressor
Types: HG(X)12P/60-4 S (HC) HG(X)88e/3235-4(S) (HC)
UL-HGX12P/60 S 0,7 UL-HGX88e/3235 S 95
HG(X)12P/60 S 0,7 LG HG(X)88e/3235 (ML/S) 95 LG
HG(X)22(P)(e)/125-4 A HG(X)34(P)(e)/380-4 (S) A
HG(X)34(P)(e)/255-2 (A) HG(X)34(P)(e)/380-2 (A)(K)
HA(X)12P/60-4 HA(X)6/1410-4
HAX22e/125 LT 2 LG HAX44e/665 LT 14 LG
HG(X)12e/20-4 S CO₂ HG(X)44e/565-4 S CO₂
UL-HGX12e/20 S 0,7 CO₂ UL-HGX44e/565 S 31 CO₂
HG(X)12(e)/20-4 (ML/S/SH) CO₂ (L)T HG(X)56(e)/680-4 (ML/S/SH) CO₂ (L)T
UL-HGX12(e)/20 (ML/S/SH) 2 CO₂ (L)T UL-HGX56(e)/680 (ML/S/SH) 116 CO₂ (L)T
HGZ(X)7/1620-4 HGZ(X)7/2110-4
HGZ(X)66e/1340 LT 22 HGZ(X)66e/2070 LT 35
HRX40-2 CO₂ T H HRX60-2 CO₂ T H

Name: Open type compressor
Types: F(X)2 F(X)88/3235 (NH3)
FK(X)20/120 (K/N/TK) FK(X)50/980 (K/N/TK)

US

Serial number until 11/2025: BC00000A001 – BN999999Z999
Serial number starting 12/2025: 2549(DE/CZ/CN/IN/MX)000001 – 9953(DE/CZ/CN/IN/MX)999999

complies with the following provisions of the above-mentioned Directive:

According to Annex I, points 1.1.2, 1.1.3, 1.1.5, 1.3.2, 1.3.3, 1.3.7, 1.5.1, 1.5.2, 1.5.13 and 1.7.1 to 1.7.4 (excepted 1.7.4 f) are fulfilled.

Applied harmonised standards, in particular:

EN ISO 12100 :2010	Safety of machinery; General principles for design, risk assessment and risk reduction
EN 12693 :2008	Refrigerating systems and heat pumps; Safety and environmental requirements — Positive displacement refrigerant compressors

Remarks: We also declare that the special technical documentation for this incomplete machine has been created in accordance with Annex VII, Part B and we obligate to provide these upon reasoned request from the individual national authorities by data transfer.

Commissioning is prohibited until it has been confirmed that the machinery into which the incomplete machine above is to be incorporated complies with the EC Machinery Directive and an EC Declaration of Conformity, Annex II. 1. A exists.

Authorized person for compiling and handing over technical documentation: Bock GmbH
Alexander Layh
Benzstraße 7
72636 Frickenhausen, Germany

Frickenhausen, 1st of December 2025 

i. A. Alexander Layh, Global Head of R&D

11| Declaration of incorporation

Manufacturer: Bock GmbH
Benzstraße 7
72636 Frickenhausen, Germany



We, as manufacturer, declare in sole responsibility that the partly completed machinery

Name: Semi-hermetic compressor
Types: HG(X)12P/60-4 S (HC) HG(X)88e/3235-4(S) (HC)
UL-HGX12P/60 S 0,7 UL-HGX88e/3235 S 95
HGX12P/60 S 0,7 LG HGX88e/3235 (ML/S) 95 LG
HG(X)22(P)(e)/125-4 A HG(X)34(P)(e)/380-4 (S) A
HGX34(P)(e)/255-2 (A) HGX34(P)(e)/380-2 (A)(K)
HA(X)22e/125-4 HA(X)6/1410-4
HAX22e/125 LT 2 LG HAX44e/665 LT 14 LG
HGX12e/20-4 S CO₂ HGX44e/565-4 S CO₂
UL-HGX12e/20 S 0,7 CO₂ UL-HGX44e/565 S 31 CO₂
HGX12(e)/20-4 (ML/S/SH) CO₂ (L)T HGX56(e)/680-4 (ML/S/SH) CO₂ (L)T
UL-HGX12(e)/20 (ML/S/SH) 2 CO₂ (L)T UL-HGX56(e)/680 (ML/S/SH) 116 CO₂ (L)T
HGZ(X)7/1620-4 HGZ(X)7/2110-4
HGZ(X)66e/1340 LT 22 HGZ(X)66e/2070 LT 35
HRX40-2 CO₂ T H HRX60-2 CO₂ T H

Name: Open type compressor
Types: F(X)2 F(X)88/3235 (NH3)
FK(X)20/120 (K/N/TK)..... FK(X)50/980 (K/N/TK)

Serial number until 11/2025: BC00000A001 – BN99999Z999
Serial number starting 12/2025: 2549(DE/CZ/CN/IN/MX)000001 – 9953(DE/CZ/CN/IN/MX)999999

complies with the following provisions of the above-mentioned Statutory instrument:

According to Schedule 2, part1, points 1.1.2, 1.1.3, 1.1.5, 1.3.2, 1.3.3, 1.3.7, 1.5.1, 1.5.2, 1.5.13 and 1.7.1 to 1.7.4 (excepted 1.7.4 f) are fulfilled.

Designated standards: EN ISO 12100 :2010 Safety of machinery — General principles for design — Risk assessment and risk reduction
EN 12693 :2008 Refrigerating systems and heat pumps — Safety and environmental requirements — Positive displacement refrigerant compressors

Remarks: We also declare that the special technical documentation for this partly completed machine has been created in accordance with Annex II, 1. B and we obligate to provide these upon reasoned request from the individual national authorities by data transfer.

Commissioning is prohibited until it has been confirmed that the machinery into which the partly completed machine above is to be incorporated complies with the UK Statutory Instrument Supply machinery (Safety) regulations 2008 and an EC Declaration of Conformity, Annex II, 1. A exists.

Authorized representative for compiling and handing over technical documentation:

Danfoss LTD., 22 Wycombe End,
HP9 1NB, GB

Frickenhausen, 1st of December 2025

i. A. Alexander Layh, Global Head of R&D

US

12| UL-Certificate of Compliance

Dear customer,

the Certificate of Compliance can be downloaded by the following QR-Code:



<https://vap.bock.de/stationaryapplication/Data/DocumentationFiles/UL-Certificateofconformity.pdf>

13 | 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 **bock.info@danfoss.com**.

Yours faithfully Bock GmbH

US

Explore our solutions
danfoss.com



Danfoss can accept no responsibility for possible errors in catalogues, brochures and other printed material. Danfoss reserves the right to alter its products without notice. This also applies to products already on order provided that such alterations can be made without subsequential changes being necessary in specifications already agreed.

All trademarks in this material are property of the respective companies. Danfoss and the Danfoss logotype are trademarks of Danfoss A/S.

All rights reserved.

BOCK®

Bock GmbH
Benzstraße 7
72636 Frickenhausen
Germany
Phone +49 7022 9454-0
Fax +49 7022 9454-137
bock.danfoss.com

© Bock GmbH