




Danfoss UL-HGX12e CO2 LT Reciprocating Compressor User Guide

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Danfoss UL-HGX12e CO2 LT Reciprocating Compressor



Product Information

The product is a reciprocating compressor designed for CO₂ applications. It is available in different models: UL-HGX12e/20 ML 0,7 CO₂ LT, UL-HGX12e/30 ML 1 CO₂ LT, UL-HGX12e/40 ML 2 CO₂ LT, UL-HGX12e/20 S 1 CO₂ LT, UL-HGX12e/30 S 2 CO₂ LT, and UL-HGX12e/40 S 3 CO₂ LT. The compressor is manufactured by Bock GmbH in Germany.

Product Usage Instructions

Safety:

Follow the safety instructions provided in the manual to prevent injuries and property damage.

Electrical Connection:

- Refer to section 5 for information on electrical connection.
- Follow the instructions for contactor and motor contactor selection.
- Connect the driving motor as described in the section

If using a direct start circuit diagram, follow the instructions in the section For electronic trigger unit INT69 G, refer to the section for information on the connection.

Functional Test:

Perform a functional test of the electronic trigger unit INT69 G as described in section

Oil Sump Heater:

If required, follow the instructions in section 5.7 for installing and operating the oil sump heater.

Frequency Converters:

Refer to section 5.8 for the selection and operation of frequency converters.

Technical Data:

Refer to section 8 for detailed technical data on the compressor.

Dimensions and Connections:

For information on dimensions and connections refer to the section

Declaration of Incorporation:

Read the declaration of incorporation provided in the section

UL-Certificate of Compliance:

Review the UL-Certificate of Compliance in section

Note: Unauthorized changes or modifications to the product not covered by the manual are prohibited and will void the warranty. Ensure that the manual is available to personnel operating and maintaining the product, and pass it on to the end customer when installing the compressor.

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!

CO₂ applications require a completely new kind of system and control. They are not a general solution for the substitution of F-gases. Therefore, we expressly point out that all information in these assembly instructions has been provided according to our current level of knowledge and may change due to further development. Legal claims based on the correctness of the information cannot be made at any time and are hereby expressly excluded. 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.

Safety**Identification of safety instructions:**

DANGER	Indicates a dangerous situation that, 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 immediately cause fairly severe or minor injury.
NOTICE	Indicates a situation which, if not avoided, may cause property damage
INFO	Important information or tips on simplifying work

General safety instructions

DANGER: Risk of accident.

Refrigerating compressors are pressurized machines and therefore require particular caution and care in handling.

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

DANGER: Danger of suffocation!

CO₂ is a nonflammable, acidic, colorless, and odorless gas and is heavier than air.

Never release significant volumes of CO₂ or the entire contents of the system into closed rooms!

Safety installations are designed or adjusted by EN 378-2 or appropriate national safety standards.

WARNING: Risk of burns!

- Depending on the operating conditions, surface temperatures of over 140°F (60°C) on the pressure side or below 32°F (0°C) on the suction side can be reached.
- Avoid contact with refrigerant under any circumstances. Contact with refrigerants can lead to severe burns and skin irritations.

Intended use

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

These assembly instructions describe the standard version of the compressors 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 and 2014/68/EU Pressure Equipment Directive, outside the EU according to the respective national regulations and guidelines). Commissioning is only permissible if the compressors have been installed by these assembly instructions and the entire system into which they are integrated has been inspected and approved by legal regulations. The compressors are intended for use with CO₂ in transcritical and/or subcritical 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!

Qualifications required of personnel

WARNING: Inadequately qualified personnel pose the risk of accidents, the consequence being serious or fatal

injury. Work on compressors must therefore only be performed by personnel with the qualifications listed below:

- e.g., a refrigeration technician or refrigeration mechatronics engineer.
- As well as professions with comparable training, which enable personnel to assemble, install, maintain, and repair refrigeration and air-conditioning systems.
- Personnel must be capable of assessing the work to be carried out and recognizing any potential dangers.

Product Description

Short description

- Semi-hermetic two-cylinder reciprocating compressor with suction gas-cooled driving motor.
- The flow of refrigerant sucked in from the evaporator is led over the engine and provides for particularly intensive cooling. Thus the engine can be kept on a relatively low temperature level, especially during high load.
- Oil pump independent of the direction of rotation for reliable and safe oil supply.
- One decompression valve each on the low and high-pressure side, which vents into the atmosphere when inadmissibly high-pressure levels are reached.

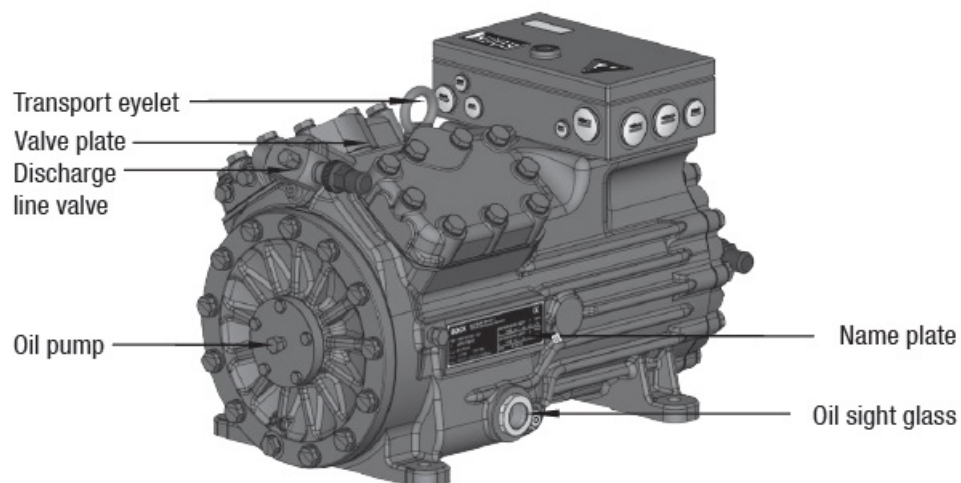


Fig. 1

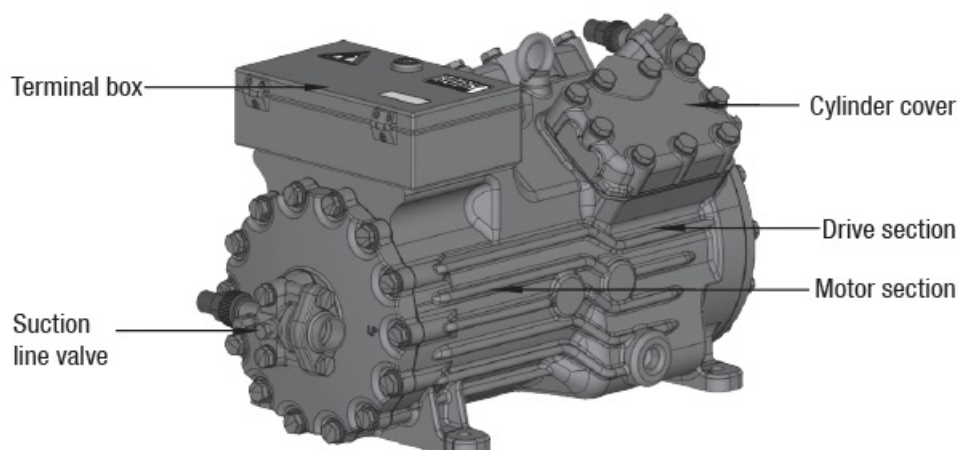


Fig. 2

Dimension and connection values can be found in Chapter 9

Product Description

Nameplate (example)

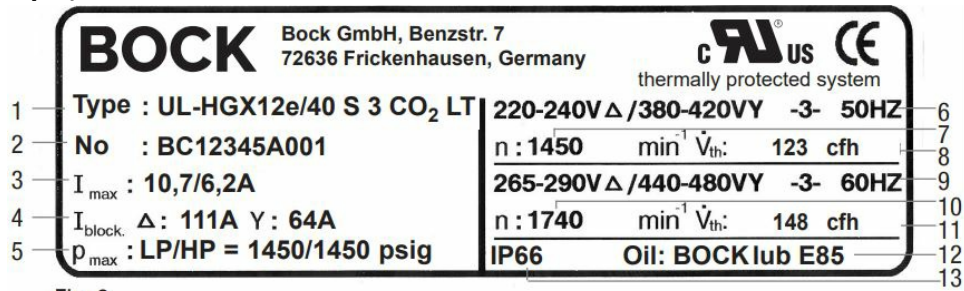


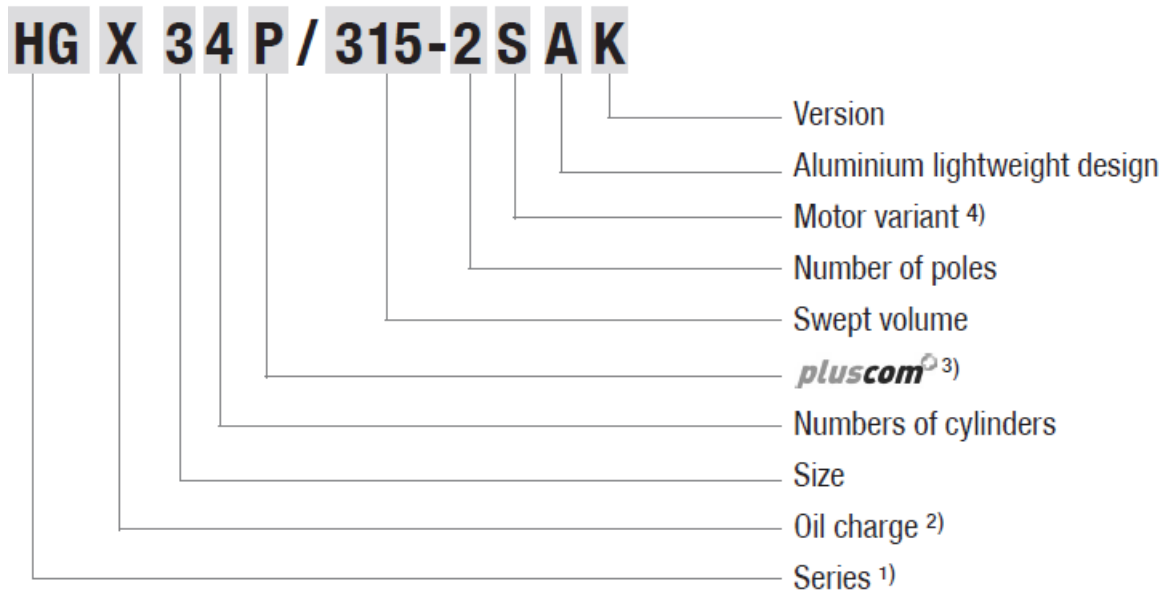
Fig. 3

1	Type designation	6	Voltage, circuit, frequency	} 50 Hz
2	Machine number	7	Nominal rotation speed	
3	maximum operating current	8	Displacement	} 60 Hz
4	Starting current (rotor blocked)	9	Voltage, circuit, frequency	
5	LP: max. admissible operating pressure (g) Low pressure side	10	Nominal rotation speed	
	HP: max. admissible operating pressure (g) High pressure side	11	Displacement	
		12	Oil type filled at the factory	
		13	Terminal box protection type	

Observe the limits of application diagrams!

Electrical accessories can change the IP protection class!

Type key (example)



- ¹⁾ **HG**: Hermetic Gas-Cooled (suction gas-cooled)
- ²⁾ **X**: Ester oil charge
- ³⁾ **ML**: Deep freezing at low and medium evaporation temperatures
- **S**: For frequency regulation and extended limits of application

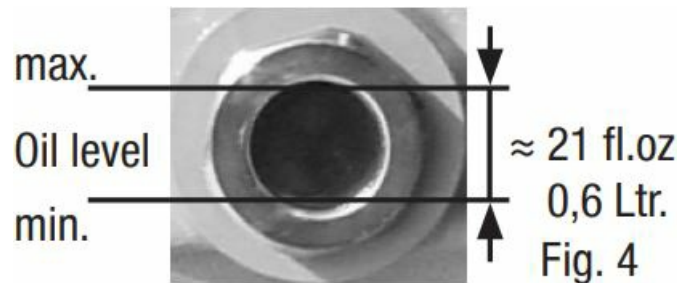
Areas of application

Refrigerants

- **R744:** CO₂ (required CO₂ quality 4.5 (< 5 ppm H₂O))

Oil charge The compressors are factory-filled with the following oil type: BOCK lub E85

NOTICE: Property damage is possible. The oil level must be in the visible part of the sight glass; damage to the compressor is possible if overfilled or underfilled!



Limits of application

ATTENTION Compressor operation is possible within the operating limits. These can be found in the 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 320°F (160 °C).
- Min. discharge end temperature $\geq 122^{\circ}\text{F}$ (50 °C).
- Min. oil temperature $\geq 86^{\circ}\text{F}$ (30 °C).
- Max. permissible switching frequency 12x /h.
- A minimum running time of 3 min. steady-state condition (continuous operation) must be achieved.

Avoid continuous operation in a limited range.

Max. permissible operating pressure (LP/HP)¹⁾: 1450/1450 psig, 100/100 bar

- **1) LP** = Low pressure
- **HP** = High pressure

For operation with frequency converter:

- The control range of the compressor is 15 – 50 Hz (K Design 15 – 60 Hz).
- 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
- Use a heat protection thermostat.
- Oil return at low frequency must be supplied. When operating in the vacuum range, there is a danger of air entering 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!

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.

Storage and transportation

- Storage at $(-30^{\circ}\text{C}) - (+70^{\circ}\text{C})$, maximum permissible relative humidity 10% – 95%, no condensation
- Do not store in a corrosive, dusty, vaporous atmosphere or a combustible environment.



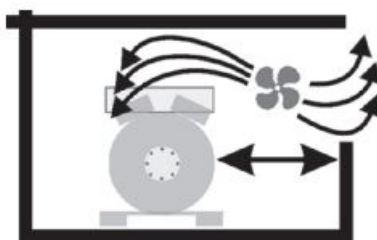
- Use transport eyelet.
- Do not lift manually!
- Use lifting gear!



Setting up

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

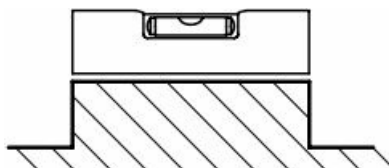
- Provide adequate clearance for maintenance work.
- Ensure adequate compressor ventilation.



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



- Setup on an even surface or frame bearing capacity.
- Single compressor preferably on vibration damper.
- Duplex and parallel circuits are always rigid.



Compressor assembly

Pipe connections

NOTICE: Damage possible. 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).

- Material soldering/welding connection: S235JR
- The pipe connections have graduated inside diameters so that pipes with standard dimensions can be used.
- The connection diameters of the shut-off valves are rated for maximum compressor output. The actual required pipe cross section must be graduated and matched to the output. The same applies to non-return valves.

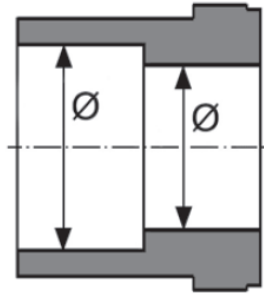


Fig. 11: graduated internal diameter

Pipes

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

Flange shut-off valves (HP/LP)

CAUTION: Risk of injury. The compressor must be depressurized through connections A1 and B1 before commencing any work and before connecting to the refrigerant system.

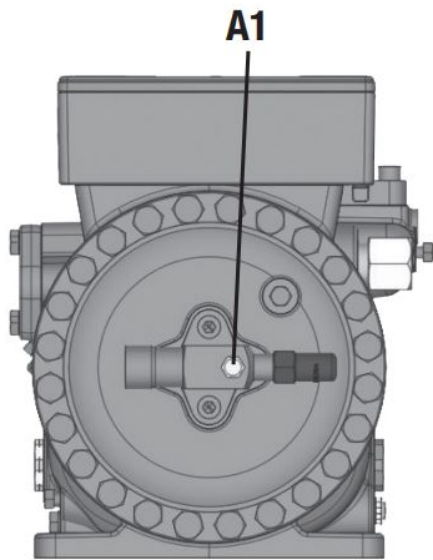


Fig. 6

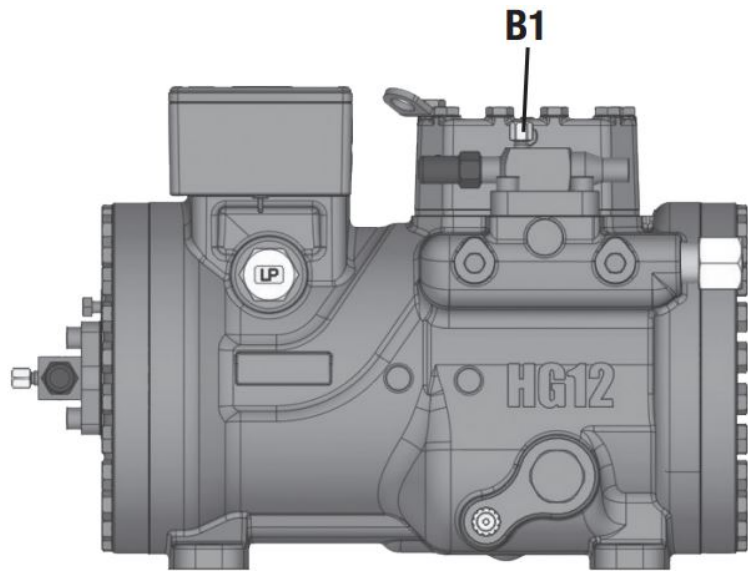


Fig. 7

Laying suction and pressure lines

NOTICE:

- Property damage is possible. Improperly installed pipes can cause cracks and tears, which can result in a loss of refrigerant.
- Proper layout of the suction and pressure lines directly after the compressor is integral to the smooth running and vibration behavior 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.

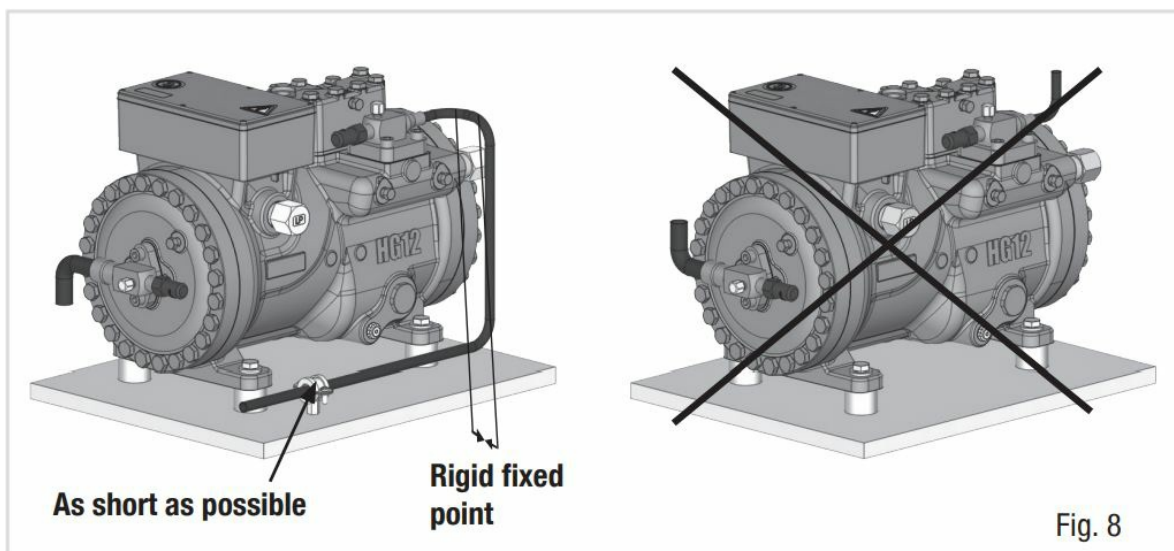


Fig. 8

Operating the shut-off valves

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

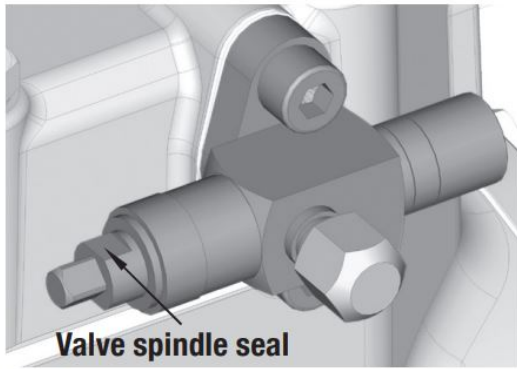


Fig. 9

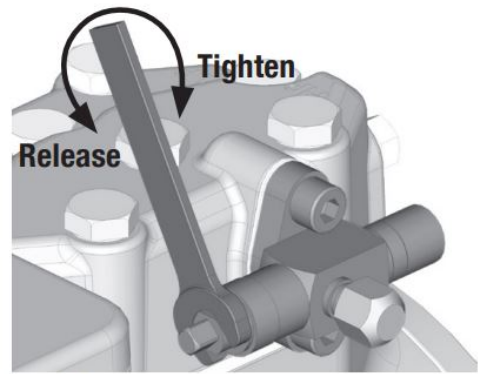


Fig. 10

Operating mode of the lockable service connections (example)

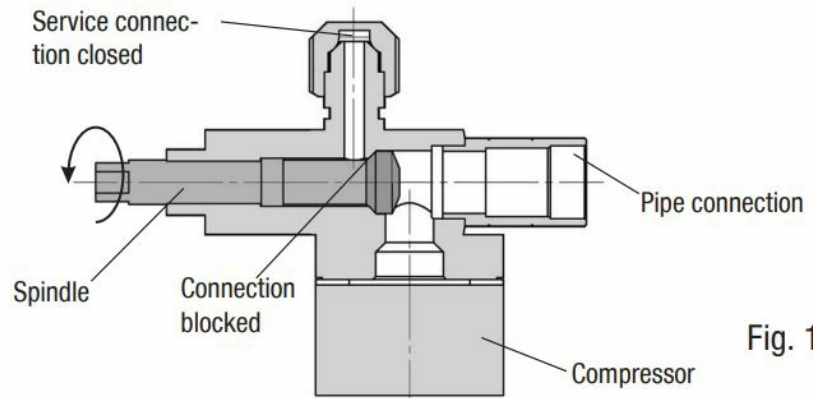


Fig. 11

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.

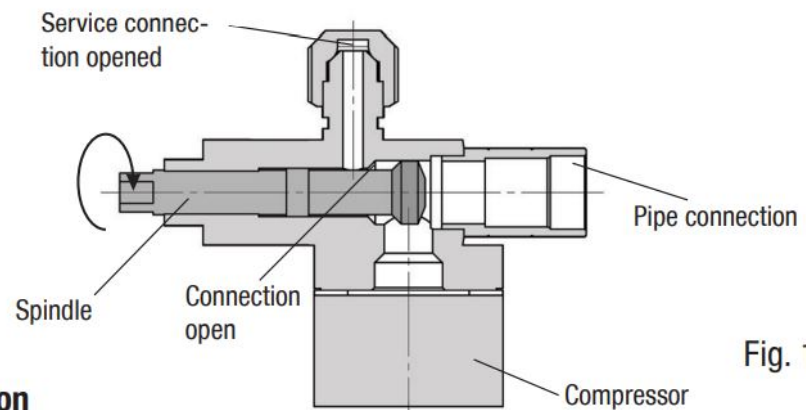


Fig. 12

Opening the service connection

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

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

After activating the spindle, generally fit the spindle protection cap again and tighten with 40 – 50 Nm. This serves as a second sealing feature during operation.

Oil return

To ensure the oil return function will work reliably no matter what kind of system configuration you are using, Bock recommends incorporating oil separators or oil-level monitoring equipment. The "O" connection is already available from the factory to install the additional oil level monitoring component. Oil should be returned from the oil separator to the compressor via the "D1" connection provided for this purpose on the compressor.

Suction pipe filter

For systems with long pipes and a 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).

Electrical connection

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.

INFO: Connect the compressor motor by the circuit diagram (see inside of terminal box).

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

Only connect the motor if these values are the same.

Information for contactor and motor contactor selection

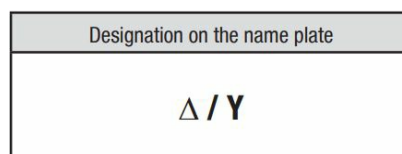
All protection devices and switching or monitoring units must be fitted by the local safety regulations and established specifications (e.g. VDE) as well as with the manufacturer's information.

Motor protection switches are required!

Motor contactors, feed lines, fuses, and motor protection switches must be rated based on the maximum working current (see nameplate). 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.

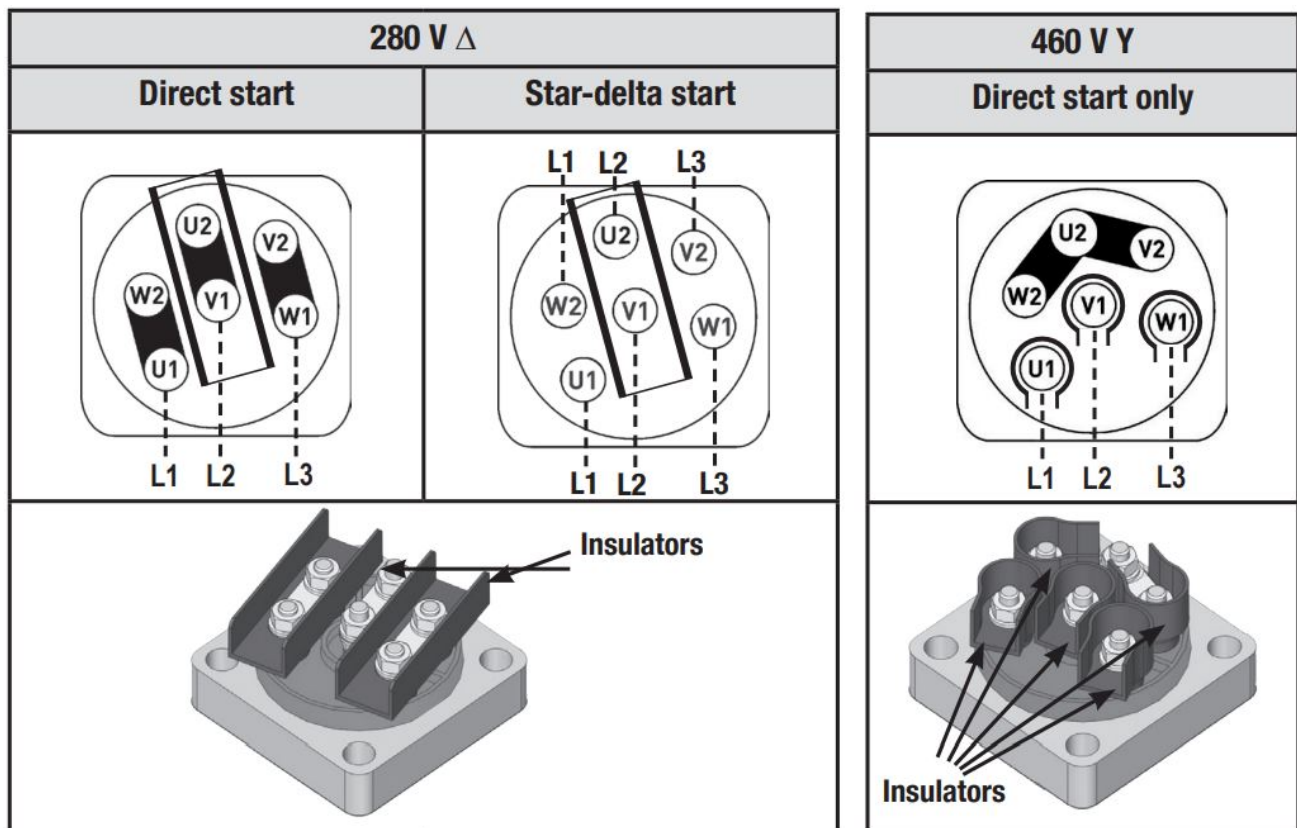
Connection of the driving motor

The compressor is designed with a motor for star-delta circuits.



Star-delta start-up is only possible on a 280 V voltage supply.

Example:



INFO

- 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.

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

Circuit diagramm for direct start 280 V Δ / 460 V Y

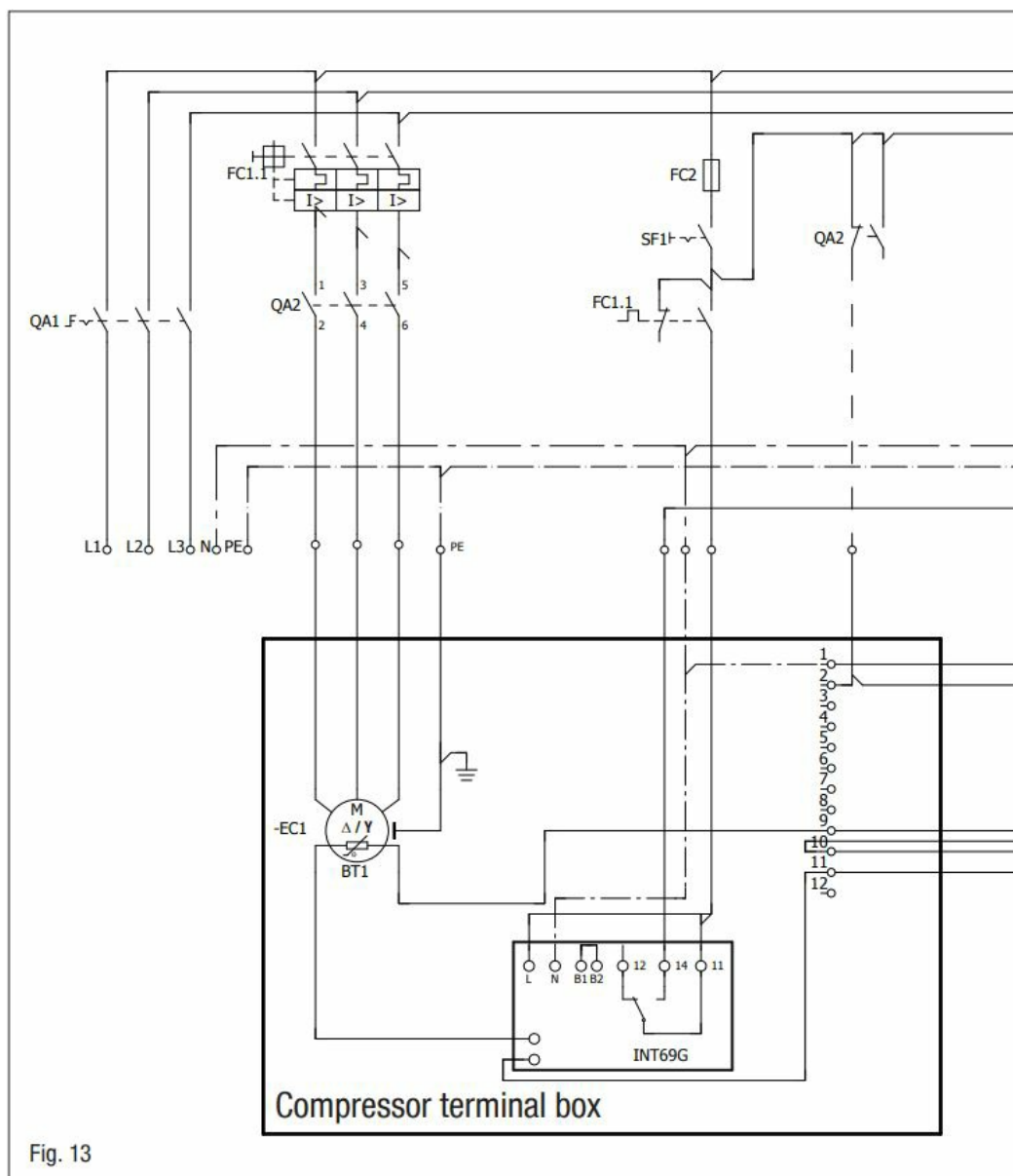
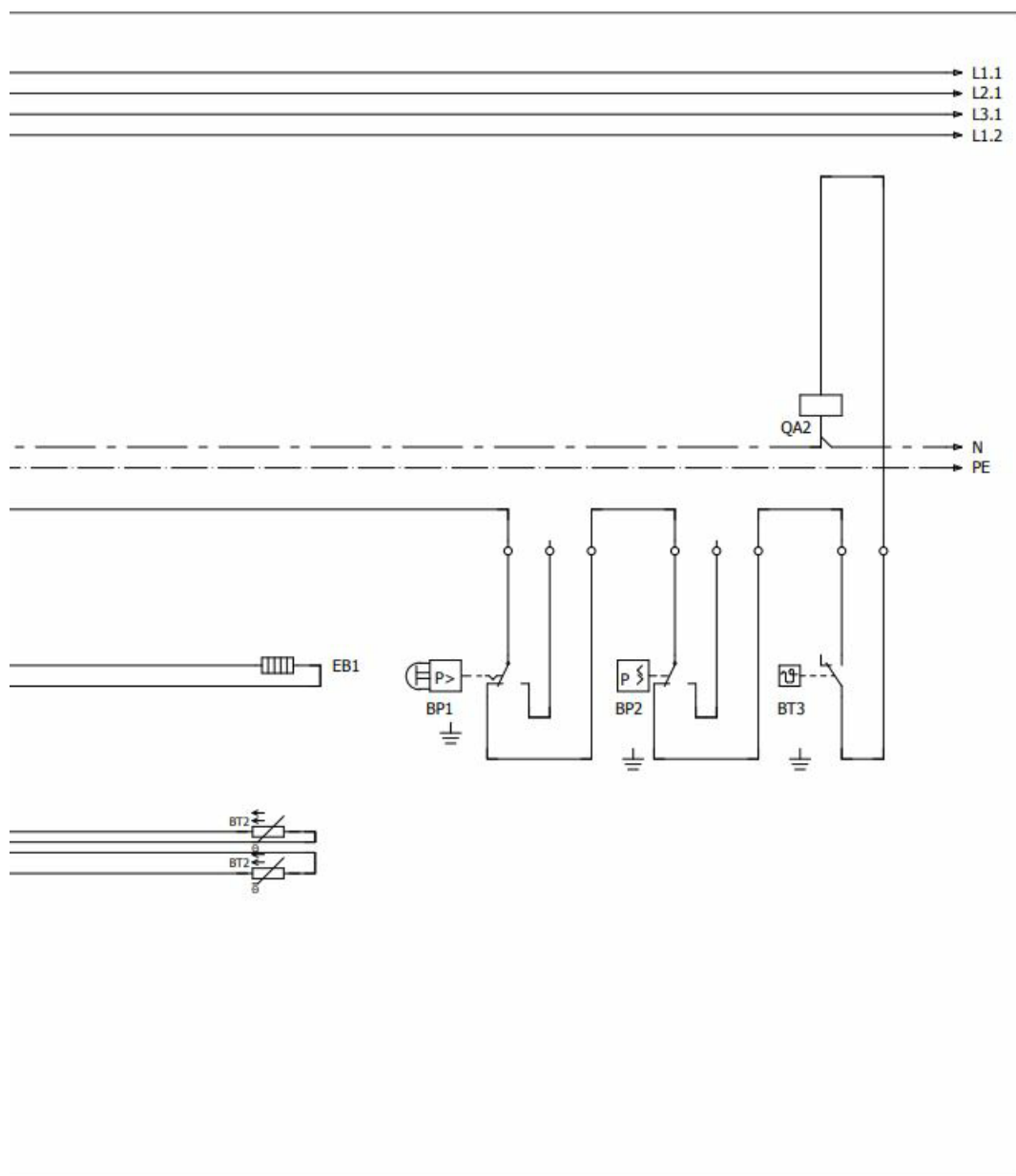


Fig. 13

BP1	High-pressure safety monitor
BP2	Safety chain (high/low-pressure monitoring)
BT1	Cold conductor (PTC sensor) motor winding
BT2	Thermal protection thermostat (PTC sensor)
BT3	Release switch (thermostat)
EB1	Oil sump heater
EC1	Compressor motor



FC1.1	Motor protection switch
FC2	Control power circuit fuse
INT69 G	Electronic trigger unit INT69 G
QA1	Main switch
QA2	Net switch
SF1	Control voltage switch

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 INT69 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.

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 an idle position and deactivates the motor contactor even in case of a sensor break or open circuit.

Connection of the trigger unit INT69 G INFO

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

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

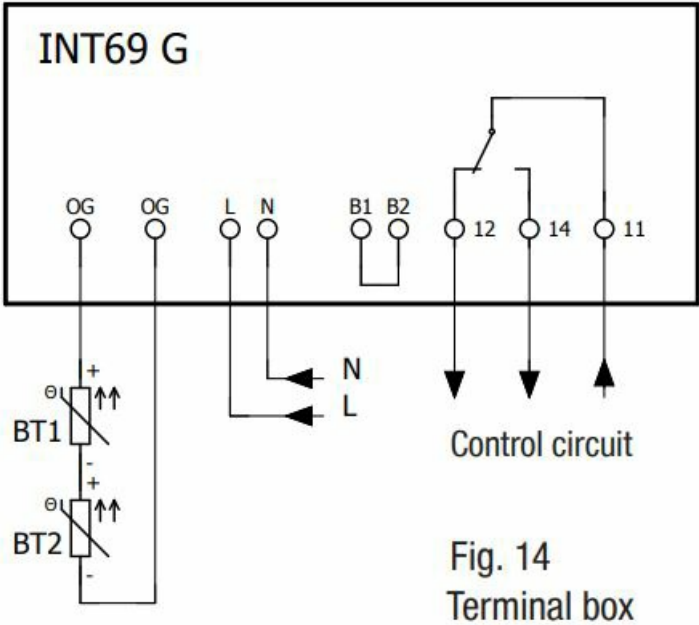


Fig. 14
Terminal box

External connection 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
1.	Deactivated state	11-12
2.	INT69 G switch-on	11-14
3.	Remove PTC connector	11-12
4.	Insert PTC connector	11-12
5.	Reset after mains on	11-14

Relay position INT69 G

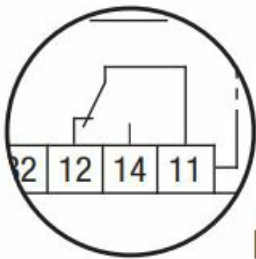


Fig. 15

Oil sump heater

To avoid damage to the compressor, the compressor has to be equipped with an oil sump heater.

NOTICE: The oil sump heater must generally be connected and operated!

- **Operation:** The oil sump heater operates when the compressor is at a standstill. When the compressor starts up, the oil sump heating switches off.
- **Connection:** The oil sump heater must be connected via an auxiliary contact (or parallel wired auxiliary contact) of the compressor contactor to a separate electric circuit.
- **Electrical data:** 115 V – 1 – 60 Hz, 80 W.

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 160% 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 starts, run for at least 1 minute at a frequency of at least 50 Hz.
5. Carry out all designs and installations according to the local safety regulations and common rules (e.g. VDE) and regulations as well as by the specifications of the frequency converter manufacturer

The permissible frequency range can be found in the technical data.

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: Technical data: permissible frequency range

Commissioning

Preparations for start-up

INFO: To protect the compressor against inadmissible operating conditions, high-pressure and low-pressure pressostat controls are mandatory on the installation side.

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

Check the compressor for transport damage!

WARNING: When the compressor is not running, depending on ambient temperature and amount of refrigerant charge, the pressure may rise and exceed permitted levels for the compressor. Adequate precautions must be taken to prevent this from happening (e.g. using a cold

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 by UL-/CSA- Standards or a corresponding safety standard without the inclusion of the compressor.

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 nameplate 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 by UL-/CSA standards or a corresponding safety standard, while always observing the maximum permissible overpressure for the compressor. Only dry test gases may be used for the leak test, e.g. nitrogen N₂ min. 4.6 (= purity 99.996 % or higher).

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.
- Turn on the oil sump heater.
- Evacuate the suction and discharge pressure sides using the vacuum pump.
- The vacuum has to be broken with nitrogen several times between the evacuations.
- 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.

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.

INFO: Depending upon the design of the CO₂ refrigerant filling bottle (with/without tubing) CO₂ can be filled in liquid after weight or gaseously. Use only high-dried CO₂ quality (see chapter 3.1)!

- Filling the liquid refrigerant: It is recommended that the system first be filled at a standstill with gas on the high-pressure side up to a system pressure of at least 75 psig (5.2 bar) (if it is filled below 75 psig (5.2 bar) with liquid, there is a risk of dry ice formation). Further filling according to the system.
- To eliminate the possibility of dry ice formation when the system is operating (during and after the filling process), the shut-off point of the low-pressure switch should be set to a value of at least 75 psig (5.2 bar).

WARNING: Never exceed the max. permissible pressures while charging. Precautions must be taken in time.

- A refrigerant supplement, which may become necessary after start-up, can be topped up in vapor form on the suction side.

NOTICE:

- Avoid overfilling the machine with refrigerant!
- Do not charge liquid refrigerant into the suction side of the compressor.
- Do not mix additives with the oil and refrigerant.

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.
- The machine should reach a state of equilibrium.
- Check the oil level: The oil level must be visible in the sight glass.
- After a compressor is replaced, the oil level must be checked again. If the level is too high, oil must be drained off (danger of oil liquid shocks; reduced capacity of the refrigerating system).

NOTICE: 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!

Pressure switch

Suitably adjusted pressure switches according to UL 207 / EN 378 or national standards that switch off the compressor before reaching the maximum permissible operating pressure must be installed in the system. The pressure reduction for the pressure switches can occur either at the suction and pressure lines between the shut-off valve and compressor or at the non-lockable connections for the shut-off valves (connections A and B, see Chapter 9).

Pressure relief valves

NOTICE: The compressor is fitted with two pressure relief valves. One valve each on the suction and discharge side. If excessive pressures are reached, the valves open and prevent further pressure increase. Thereby CO₂ is blown off to the ambient! If a pressure relief valve activates repeatedly, check the valve and replace it if necessary as during blow-off extreme conditions can occur, which may result in a permanent leak. Always check the system for refrigerant loss after activation of the pressure relief valve! The pressure relief valves do not replace any pressure switches and the additional safety valves in the system. Pressure switches must always be installed in

the system and designed or adjusted by EN 378-2 or appropriate safety standards. Failure to observe can result in a risk of injury from CO₂ streaming out of the two pressure relief valves!

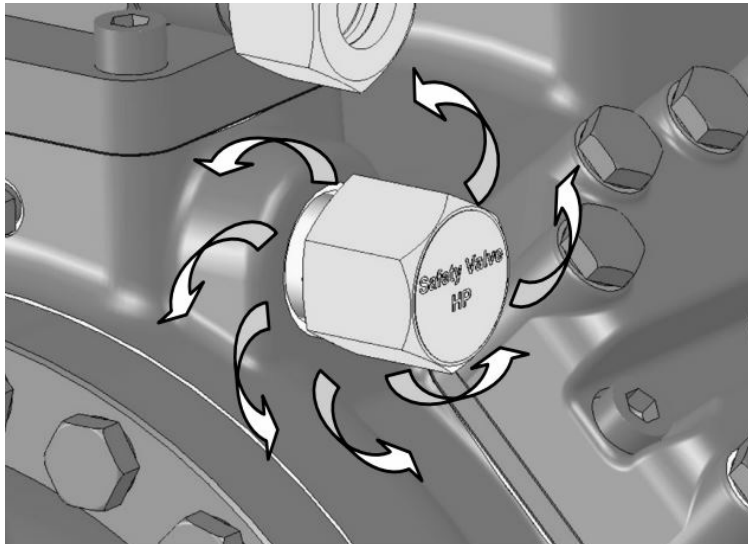


Fig. 16

Avoiding slugging

NOTICE: 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 about output (particularly the evaporator and expansion valves).
- Suction gas superheating at the compressor input should be $> 15\text{ K}$ (check the setting of the expansion valve).
- Regarding oil temperature and pressure gas temperature. (The pressure gas temperature has to be high enough min. 122°F ($50\text{ }^{\circ}\text{C}$), so the oil temperature is $> 86^{\circ}\text{F}$ ($30\text{ }^{\circ}\text{C}$)).
- 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 valves in the liquid line, etc. are recommended.
- There should be no movement of refrigerant in the compressor while the system is at a standstill.

Filter dryer

Gaseous CO₂ has a significantly lower solubility in water than other refrigerants. At low temperatures, it can therefore cause blocking of valves and filters due to ice or hydrate. For this reason, we recommend the use of an adequately sized filter drier and a sight glass with a moisture indicator.

Maintenance

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 the safety switch.
- Evacuate compressor.
- Release the switch-on lock.

WARNING: The decompression has to be carried out in a way that no dry ice solid CO₂ is produced which blocks the outlet and could hinder the streaming out of CO₂. Otherwise, there is the danger that pressure can be built up again.

Work to be carried out

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.

Spare part recommendation

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!

Lubricants

For operation with CO₂, the following oil types are necessary: compressor version ML and S: BOCKlub E85

Decommissioning

Close the shut-off valves on the compressor. CO₂ does not need to be recycled and can therefore be blown off into the environment. It is essential to ensure good ventilation or conduct the CO₂ into the outdoors to avoid the danger of suffocation. When releasing CO₂, avoid a fast drop in pressure to prevent oil from exiting with it. If the compressor is unpressurized, remove the piping on the pressure- and suction-side (e.g. dismantling of the shut-off valve, etc.) and remove the compressor using an appropriate hoist. Dispose of the oil inside by the applicable national regulations.

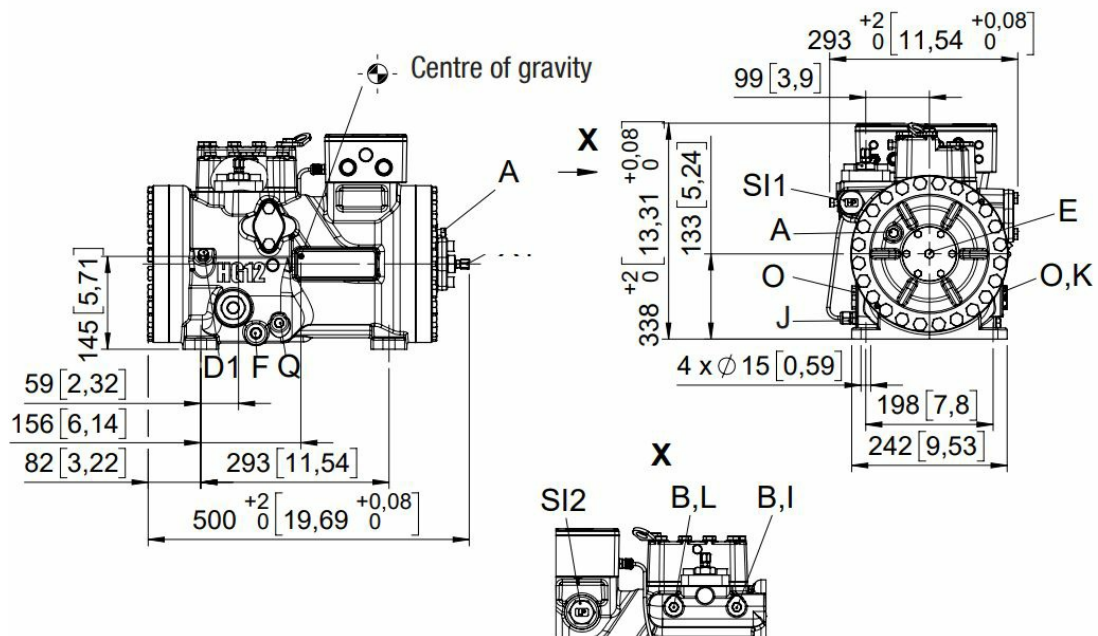
When decommissioning the compressor (eg. for service or replacement of the compressor) larger amounts of CO₂ in the oil can be set free. If the decompression of the compressor is not sufficient enough, closed shut-off valves may lead to intolerable excessive pressure. For this reason, the suction side (LP) and the high-pressure side (HP) of the compressor have to be secured by decompression valves.

Technical data

Oil charge (sight glass center)		Ltr. (fl.oz)	1,1 (39)						
Oil charge (ex works)		Ltr. (fl.oz)	1,3 (46)						
Connections	Suction line SV ⑤	mm (inch)	16 (5/8)						
	Discharge line DV ④	mm (inch)	12,8 (1½)						
Weight		lb	190	190	209	209	209	209	
Electrical data ③	permissible frequency range		Hz	30 - 70					
	Starting current (rotor locked) ②	Δ / Y	A	32 / 19	32 / 19	111 / 64	111 / 64	111 / 64	111 / 64
	Max. power consumption ②		kW (HP)	1.6 (2.2)	2.0 (2.7)	2.6 (3.5)	3.1 (4.2)	3.1 (4.2)	3.7 (5)
	Max. operating current ②	Δ / Y	A	4,2 / 2,4	4,9 / 2,8	9,0 / 5,2	9,9 / 5,7	9,7 / 5,6	10,7 / 6,2
	Voltage ①		V	265-290 V Δ / 440-480 V Y - 3 - 60 Hz					
Displacement (1450 / 1740 rpm)		50 / 60 Hz	cfh	61 / 73		100 / 120		124 / 148	
No. of cylinders			2						
Type	UL-HGX12e/		20 ML 0,7 CO2 LT	20 S 1 CO2 LT	30 ML 1 CO2 LT	30 S 2 CO2 LT	40 ML 2 CO2 LT	40 S 3 CO2 LT	

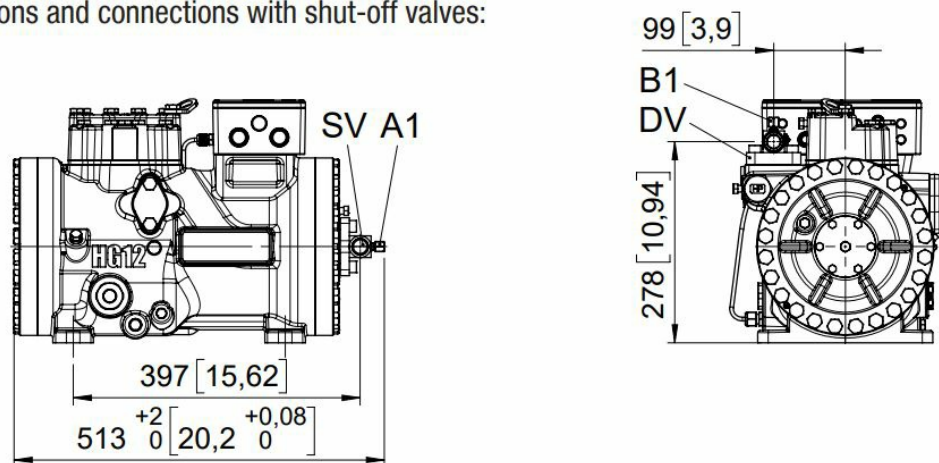
1. Tolerance (± 10 %) relative to the mean value of the voltage range. Other voltages and types of current on request.
2. The specifications for max. power consumption applies for 60 Hz operation.
 - Take account of the max. operating current / max. power consumption for the design of fuses, supply lines, and safety devices.
 - **Fuse:** Consumption category AC3
3. All specifications are based on the average of the voltage range
4. Cutting ring connector for steel tubes
5. For solder connections

Dimensions and connections



Dimensions and connections with shut-off valves:

Dimensions and connections with shut-off valves:



SV DV	For the suction line see technical data, chapter 8 Discharge line	
A	Connection suction side, not lockable	1/8" NPTF
A1	Connection suction side, lockable	7/16" UNF
B	Connection discharge side, not lockable	1/8" NPTF
B1	Connection discharge side, lockable	7/16" UNF
D1	Connection oil return from oil separator	1/4" NPTF
E	Connection oil pressure gauge	1/8" NPTF
F	Oil drain	M12x1.5
I	Connection hot gas temperature sensor	1/8" NPTF
J	Connection Oil sump heater	3/8" NPTF
K	Sight glass	1 1/8" – 18 UNF
L	Connection thermal protection thermostat	1/8" NPTF
O	Connection oil level regulator	2 x 1 1/8" – 18 UNEF
Q	Connection oil temperature sensor	1/8" NPTF
SI1	Decompression valve HP	M22x1.5
SI2	Decompression valve LP	M22x1.5

Declaration of incorporation

Declaration of incorporation for incomplete machinery by 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-HGX66e/2070 S 60
- 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)12P/60-4..... HA(X)6/1410-4
- HAX22e/125 LT 2 LG..... HAX44e/665 LT 14 LG
- HGX12e/20-4 (ML/S) CO2 (LT) HGX44e/565-4 S CO2
- UL-HGX12e/20 (S/ML) 0,7 CO2 (LT)... UL-HGX44e/565 S 31 CO2
- HGX12/20-4 (ML/S/SH) CO2T..... HGX46/440-4 (ML/S/SH) CO2 T
- UL-HGX12/20 ML(P) 2 CO2T..... UL-HGX46/440 ML(P) 53 CO2T

- 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)1..... FK(X)3
- FK(X)20/120 (K/N/TK)..... FK(X)50/980 (K/N/TK)

Serial number:

BC00000A001 – BN999999Z999 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 harmonized 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 by 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,  i. A. Alexander Layh, Global Head of R&D

Germany Frickenhausen, 04th of January 2021

Declaration of incorporation

Declaration of incorporation for incomplete machinery by 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-HGX66e/2070 S 60
- 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)12P/60-4..... HA(X)6/1410-4
- HAX22e/125 LT 2 LG..... HAX44e/665 LT 14 LG
- HGX12e/20-4 (ML/S) CO2 (LT) HGX44e/565-4 S CO2
- UL-HGX12e/20 (S/ML) 0,7 CO2 (LT)... UL-HGX44e/565 S 31 CO2
- HGX12/20-4 (ML/S/SH) CO2T..... HGX46/440-4 (ML/S/SH) CO2 T
- UL-HGX12/20 ML(P) 2 CO2T..... UL-HGX46/440 ML(P) 53 CO2T
- 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)1..... FK(X)3
- FK(X)20/120 (K/N/TK)..... FK(X)50/980 (K/N/TK)


Serial number: BC00000A001 – BN99999Z999 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.

Remarks: We also declare that the special technical documentation for this partly completed machine has been created by Annex II, 1. B and we are obligated to provide these upon a 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 person for compiling and handing over technical documentation:

Bock GmbH Alexander Layh Benzstraße 7 72636 Frickenhausen, Germany  i. A. Alexander Layh, Global Head of R&D

Frickenhausen, 14th of October 2022

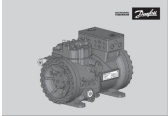
UL-Certificate of Compliance

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




<https://vap.bock.de/stationaryapplication/Data/DocumentationFiles/COCCO2trans.pdf>



Documents / Resources

 <p>BOCK® UL-HGX12e CO₂ LT User guide</p>	<p>Danfoss UL-HGX12e CO2 LT Reciprocating Compressor [pdf] User Guide UL-HGX12e CO2 LT Reciprocating Compressor, UL-HGX12e CO2 LT, Reciprocating Compressor, Compressor</p>
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References

-  bockshop.bock.de
-  vap.bock.de
-  [Home | BOCK](#)

Manuals+.