

Bock Compressor FK30

Assembly instructions

FK30/235 N	FK30/275 N	FK30/325 N
FK30/235 K	FK30/275 K	FK30/325 K
FK30/235 TK	FK30/275 TK	FK30/325 TK

FKX30/235 N	FKX30/275 N	FKX30/325 N
FKX30/235 K	FKX30/275 K	FKX30/325 K
FKX30/235 TK	FKX30/275 TK	FKX30/325 TK

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 lead to 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 is therefore reserved for personnel with the qualifications listed below: <ul style="list-style-type: none">• 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.
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1.3 General safety instructions

	DANGER! <ul style="list-style-type: none">• Refrigerating compressors are pressurised machines and as such call for heightened caution and care in handling. The maximum permissible overpressure must not be exceeded, even for testing purposes.
	WARNING! <ul style="list-style-type: none">• Risk of burns! Depending on the operating conditions, surface temperatures of over 60 °C on the discharge side or below 0 °C on the suction side can be reached.

1| Safety

1.4 Intended use

These assembly instructions describe the standard version of the FK30 manufactured by Bock. The compressor is 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!

The Bock refrigerating compressor named in the title is intended for installation in a machine (within the EU according to the EU Directives 2006/42/EC Machinery Directive, 97/23/EC Pressure Equipment Directive).

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.

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2 | Product description

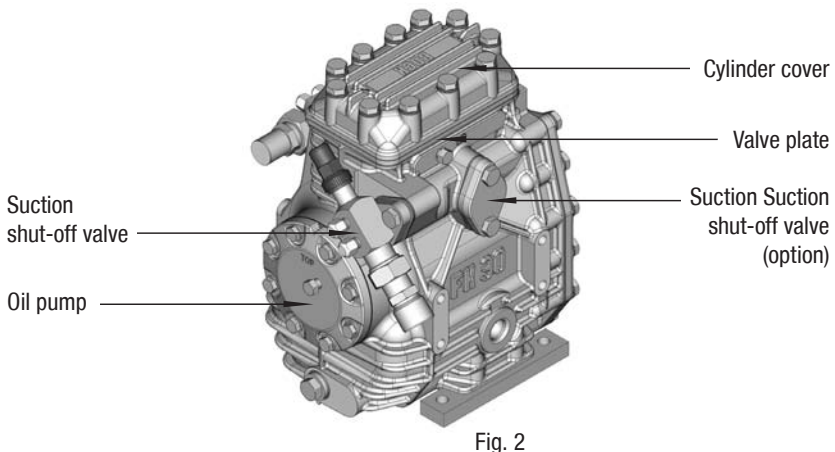
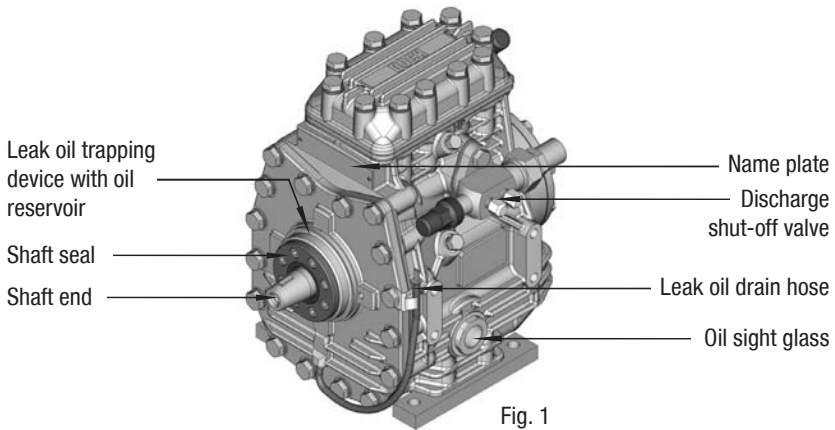
2.1 Brief description

Three different designs are available for various ranges of application:

- > for air-conditioning **the K Design**
- > for air-conditioning or normal cooling **the N Design**
- > for deep freezing **the TK Design**

The differences lie mainly in the valve plate tooling which is adapted to each application range where operational safety and efficiency are concerned.

- Compact two-cylinder compressor in single row.
- Three capacity ranges.
- Lightweight aluminum design.
- Lubricating oil pump with oil pressure relief valve independent of rotational direction.
- Variable connection and fixing options.



Dimension and connection values can be found in Chapter 9

2 | Product description

2.2 Name plate (example)

Fig. 3

1	Type designation	4	Machine number
2	Displacement at 1450 rpm	5	Factory-filled oil type
3	ND (LP): max. permissible operating pressure Low pressure side HD (HP): max. permissible operating pressure High pressure side	Observe the limits of application diagrams!	

2.3 Type key (example)

FK X 30 / 325 N

- Designs ¹⁾
- Swept volume
- Size
- Ester oil charging ²⁾
- Series

¹⁾ K - specially for air-conditioning
 N - specially for air-conditioning or normal cooling
 TK - specially for deep freezing
²⁾ X - Ester oil charging (HFC refrigerant, e.g. R134a, R407C)

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3 | Areas of application

3.1 Refrigerants

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

3.2 Oil charge

- The compressors are factory-filled with the following oil type:
 - for R134a, R404A/R507, R407C FUCHS Reniso Triton SE 55
 - for R22 FUCHS Reniso SP 46

Compressors with ester oil charge (FUCHS Reniso Triton SE 55) are marked with an X in the type designation (e.g. FKX30/325 N).



INFO!

For recharging, we recommend the above oil types. Alternatives are: see lubricants table , Chapter 6.5.

3.3 Limits of application



ATTENTION! • Compressor operation is possible within the limits of application shown in the diagrams. Please note the significance of the shaded areas. The limits of application must be observed. Thresholds should not be selected as design or continuous operating points.

- Max. permissible discharge end temperature: 140°C
- Max. permissible ambient temperature: 100°C
- Max. permissible switching frequency: 12 x /h
- A minimum running time of 2 min. at equilibrium (continuous operation) must be achieved.

- Avoid continuous operation near the threshold. Should the compressor happen to be used near the thresholds, we recommend the use of a thermal protection thermostat (Accessories, Chap. 7).
- 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

3.4 N and K versions

Models available:

- FXK30/235 N • FXK30/275 N • FXK30/325 N
- FXK30/235 K • FXK30/275 K • FXK30/325 K

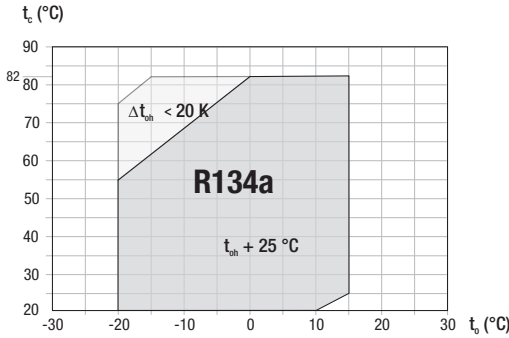
3.4.1 Limits of application R134a (N and K versions)

Permissible rotation speeds:

N-Design: 500 - 3000 1/rpm (max rotation speed 3500 rpm)

K-Design: 500 - 3500 1/rpm

Max. permissible operating pressure high-pressure side (HP): 28 bar



- Unrestricted application range
- Reduced suction gas temperature

t_o Evaporation temperature (°C)

t_c Condensing temperature (°C)

Δt_{oh} Suction gas superheat (K)

t_{oh} Suction gas temperature (°C)

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Fig. 4

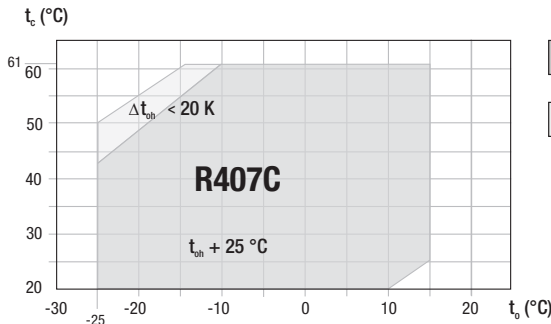
3.4.2 Limits of application R407C (N and K versions)

Permissible rotation speeds:

N-Design: 500 - 2600 1/rpm

K-Design: 500 - 3500 1/rpm

Max. permissible operating pressure high-pressure side (HP): 28 bar



- Unrestricted application range
- Reduced suction gas temperature

t_o Evaporation temperature (°C)

t_c Condensing temperature (°C)

Δt_{oh} Suction gas superheat (K)

t_{oh} Suction gas temperature (°C)

Fig. 5

Design for other ranges on request

3 | Areas of application

3.5 TK version

Models available:

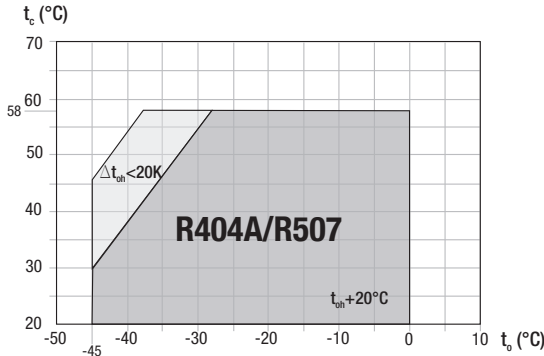
- FK30/235 TK • FK30/275 TK • FK30/325 TK
- FKX30/235 TK • FKX30/275 TK • FKX30/325 TK

3.5.1 Limits of application R404A/R507 (TK version)

Permissible rotation speeds:

TK design: 500 – 2600 1/rpm

Max. permissible operating pressure (g) high-pressure side (HP): 28 bar



Unrestricted application range

Reduced suction gas temperature

t_o Evaporation temperature (°C)

t_c Condensing temperature (°C)

Δt_{oh} Suction gas superheat (K)

t_{oh} Suction gas temperature (°C)

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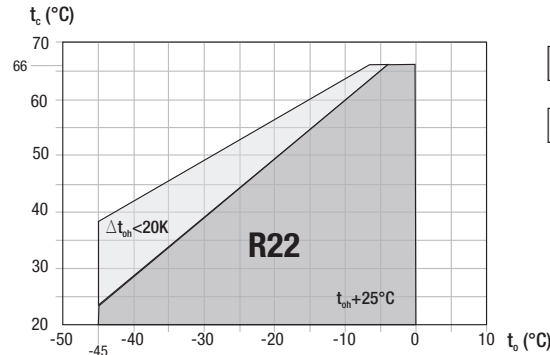
Fig. 6

3.5.2 Limits of application R22 (TK version)

Permissible rotation speeds:

TK design: 500 – 2600 1/rpm

Max. permissible operating pressure (g) high-pressure side (HP): 28 bar



Unrestricted application range

Reduced suction gas temperature

t_o Evaporation temperature (°C)

t_c Condensing temperature (°C)

Δt_{oh} Suction gas superheat (K)

t_{oh} Suction gas temperature (°C)

Fig. 7

Design for other ranges on request

4 | Compressor assembly



INFO! New compressors are factory-filled with inert gas (3 bar nitrogen). Leave this service charge in the compressor for as long as possible and prevent the ingress of air. Check the compressor for transport damage before starting any work.

4.1 Setting up

- Fittings (e.g. pipe holders, additional units etc.) on the compressor are permissible only following consultation with Bock.
- Setup on an even surface or frame with sufficient load-bearing capacity. Use all 4 fastening points.
- Correct setup of the compressor and mounting of the belt drive are decisive for running comfort, operating safety and the service life of the compressor.
- In the condition on delivery the compressor is provided with installation feet (see Fig. 8). Alternatively the compressor can also be bolted directly, without installation feet, on the substructure.

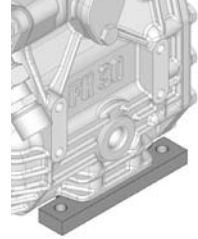


Fig. 8

4.2 Maximum permissible inclination



ATTENTION! Poor lubrication can damage the compressor. Respect the stated values.

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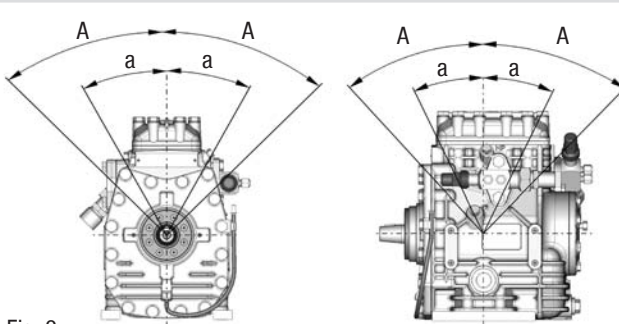


Fig. 9

A	max. 30°, max. 2 minutes
a	max. 15°, continuous operation

4 | Compressor assembly

4.3 V-belt drive



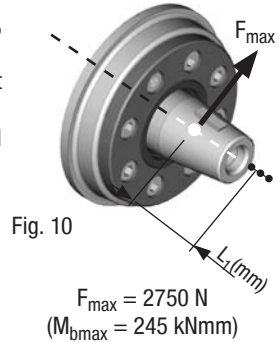
ATTENTION! Inappropriately designed belt drives, especially belt knocking or excessive tensioning forces can cause compressor damage! Make sure that the drive belt is designed correctly, e.g. by using tensioners and selecting the belt profile and the belt length.

4.4 Main bearing load

To prevent the belt drive overloading the compressor main bearing, ensure that:

- The force applied at the force engagement force by the belt tension (see Fig. 10) must not exceed $F_{\max} = 2750 \text{ N}$.
- If the force engagement point shifts forwards (see Fig.10, small point), the force F_{\max} reduces as per the following formula:

$$F_{\max \text{ zul.}} = \frac{245 \text{ kNm}}{(90 \text{ mm} + L_1 [\text{mm}])}$$

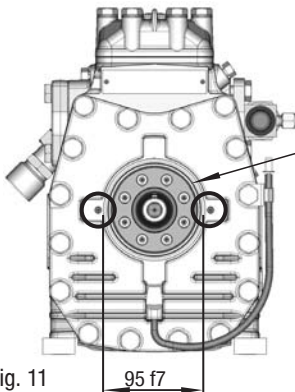


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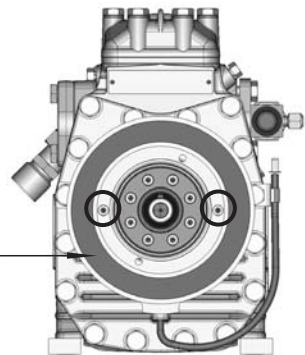
4.5 Installation of electromagnetic clutch assembly

The following description applies for an electromagnetic clutch secured to a shaft.

- To absorb the magnetic field of the electromagnetic clutch, the front bearing flange has a snug fit $\varnothing 95 \text{ f7}$ (see Fig. 11).
- For the installation push the magnetic field on snugly and fasten with 2 cheese head screws M6 x 16 (see Fig. 12). Screw tightening torque = 15 Nm.
- Further assembly of the electromagnetic clutch according to the clutch manufacturer.



Bearing flange, front



Magnetic field

4 | Compressor assembly

4.6 Pipe connections

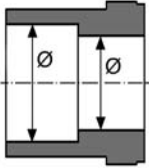


Fig.13: Stepped internal diameters

- The **discharge and suction line valves** have stepped internal diameters, enabling the use of pipes with standard millimetre and inch dimensions. The depth of pipe insertion will depend on the dimension.
- The connection diameters of the shut-off valves are designed for maximum compressor output. **The required pipe cross-section must be matched to the capacity. The same applies for non-return valves.**



ATTENTION! Overheating can damage the valve. Therefore, remove the pipe supports from the valve before soldering. Solder only using inert gas to inhibit oxidation products.

- The required tightening torque for the flange connection is 80 Nm.

4.7 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.

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4.8 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.

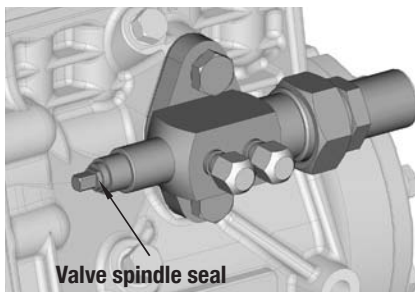


Fig. 14

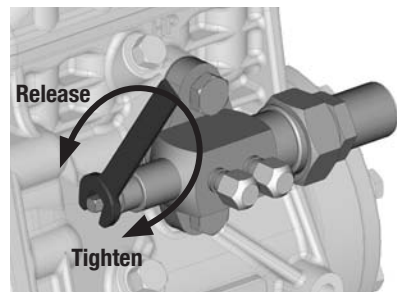


Fig. 15

4 | Compressor assembly

4.9 Operating mode of the lockable service connections

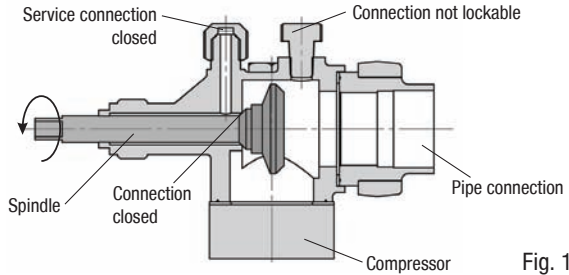


Fig. 16

Opening the shut-off valve:

Spindle: turn to the left (counter-clockwise) as far as it will go.

—> Shut-off valve fully opened / service connection closed.

The connection is not lockable and is provided for safety devices.

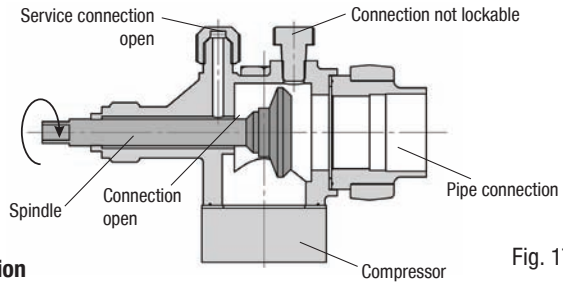


Fig. 17

Opening the service connection

Spindle: Turn 1/2 -1 rotation to the right.

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

The connection is not lockable and is provided for safety devices.

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5 | Commissioning

5.1 Preparations for start-up



INFO!

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!

5.2 Pressure strength test



DANGER!

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.

The compressor has been factory-tested for pressure resistance. The following must be observed if the entire plant is subjected to an additional pressure strength test:

- Test the refrigeration circuit according to EN 378-2 or a corresponding safety standard.

5.3 Leak test



DANGER!

Bursting!

Do not mix any refrigerant with the nitrogen (N₂) as this could cause the ignition limit to shift into the critical range.

- Carry out the leak test of the refrigerating system in accordance with EN 378-2 or a corresponding safety standard **without including the compressor.**

5.4 Evacuation

- First evacuate the **system** and then include **the compressor in the evacuation process.**
- Relieve the compressor pressure.
- Open the suction and discharge line 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 the process as often as is required.

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5 | Commissioning

5.5 Refrigerant charge



CAUTION! Wear personal protective clothing such as goggles and protective gloves!



ATTENTION! • Avoid overfilling the system with refrigerant!

- To avoid shifts in concentration, zeotropic refrigerant blends (e.g. R407C) must always be added to 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.

- Make sure that the suction and discharge line 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.

5.6 Oil level check

After starting, check the compressor's oil level.

- Drive motor in operating condition "High idle".
- Compressor run time min. 10 minutes.
- The system should have reached operating points.
- Check oil level. The oil level must be visible in the sightglass.



ATTENTION! After a compressor is replaced, the oil level must be checked again. If the level is too high, oil must be drained off (risk of oil impact, reduced performance of the air-conditioning system).

5.7 Shaft seal



ATTENTION! Failure to observe the following instructions can cause loss of refrigerant and damage to the shaft seal!



INFO!

- The shaft seal seals and lubricates with oil. An oil leakage of 0.05 ml per operating hour is therefore normal. This applies particularly during the run-in phase (200 - 300 h).
- To trap and collect leaked oil, the FK30 is fitted with an integrated leak oil trapping device with oil reservoir (p.6, Fig. 1).

5 | Commissioning

The compressor shaft is sealed to outside using a shaft seal. The sealing element rotates with the shaft.

The following is especially important to ensuring fault-free operation:

- The complete refrigerant circuit must be correctly executed and clean inside.
- Heavy shocks and vibrations to the shaft as well as continuous cyclic operation are to be avoided.
- The sealing surfaces can stick together during prolonged downtimes (e.g. winter). Therefore, run the system every 4 weeks for 10 minutes.

5.8 Shaft seal, emptying the oil reservoir

As changing the shaft seal involves opening the refrigerant circuit, this is recommended only if the seal is losing refrigerant. Replacing the shaft seal is described in the spare part kit concerned.

Emptying the oil reservoir: The oil reservoir can be emptied very simple without having to dismantle the coupling and/or belt drive. It is recommended that this is done at the same time as the air-conditioning maintenance and motor service. To proceed, detach the oil hose from the bracket, remove the sealing plug and drain the oil into a collecting vessel.

After emptying, reseal the oil hose and clamp it into the bracket. **Dispose of the used oil in accordance with national regulations.**

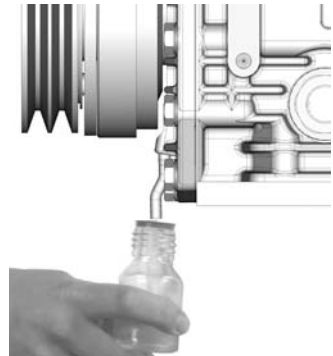


Fig. 18

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5.9 Avoiding liquid shocks



ATTENTION! Slugging can damage the compressor and cause refrigerant to leak.

To avoid liquid shocks, the following points should be observed:

- The complete refrigeration plant must be correctly designed and executed.
- The capacities of all components must be compatible (particularly evaporator and expansion valve).
- Suction gas superheating at the evaporator output should be at least 7 – 10 K (check setting of the expansion valve).
- The system must reach a state of equilibrium.
- Particularly in critical systems (e.g. several evaporator points), suitable measures, e.g. use of liquid traps, solenoid valve in the liquid line, etc. are recommended.

6| Maintenance

6.1 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.

6.2 Work to be carried out

- **Oil change:** In principle, an oil change is not mandatory if the system is correctly manufactured and operated. However, based on decades of experience we recommend that the following oil change/service work is carried out:
 - First oil change during the first maintenance of the vehicle.
 - Then after every 5,000 operating hours, though no more than 3 years, clean the oil strainer at the same time. If necessary, also empty the oil reservoir at the shaft seal.
- **Annual checks:** Oil level, tightness of the compressor, running noise, pressures, temperatures, function of the auxiliary equipment check.

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6.3 Recommended spare parts

FK30 / ...	235 N 235 TK	275 N 275 TK	325 N 325 TK	235 K 275 K 325 K
Designation	Art.-No.	Art.-No.	Art.-No.	Art.-No.
Set of gaskets	80232			80126
Valve plate kit	80240	80242	80241	80010
Set of shaft seals	80123			
Oil collector ring	80127			
Oil SP 46, 1 Ltr.	02279			
Oil SE 55, 1 Ltr.	02282			

Only use genuine Bock spare parts!

6.4 Integrated decompression valve (only FK30/275 + 325)

The valve is maintenance free.

However, constant leakage can occur after blowing off due to abnormal operating conditions. This leads to reduced performance and increases the compressed gas temperature. In this case check the valve and replace as necessary.

6| Maintenance

6.5 Extract from the lubricants table

The oil type charged as standard in the factory is marked on the **name plate**. **This oil type should be used as a preference**. Alternatives are stated in the extract from our lubricants table below.

Refrigerant	Bock standard oil grade	Recommended alternatives
HFC (e.g. R134a, R407, R 404A)	Fuchs Reniso Triton SE 55 (see also chap. 6.3)	Fuchs SEZ 32/68/80 Esso/Mobil EAL Arctic 46
HCFC (e.g. R22)	Fuchs Reniso SP 46 (see also chap. 6.3)	BP Energol LPT 46 Sunoco Suniso 3.5GS Texaco Capella WF 46

6.6 Decommissioning

Close the shut-off valve on the compressor. Drain the refrigerant (it must not be discharged directly 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 valid national regulations.

7 | Accessories

7.1 Thermal protection thermostat (Art.-No. 07595)

A screw-in option is provided for the sensor element on the hot gas side of the compressor housing (see Chap. 9). Connect the thermal protection thermostat in series with the control line.

Technical Data:

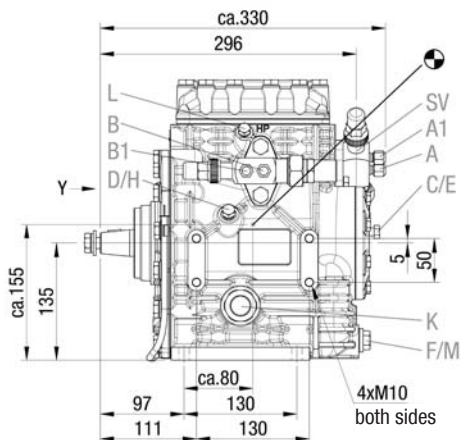
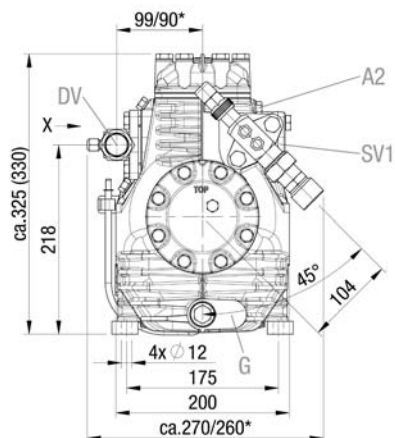
Switching voltage max. :	24 V DC
Switching current max. :	2.5 A at 24 V DC
Switch-off temperature :	145 °C ± 5 K
Switch-on temperature :	approx. 115 °C

8 | Technical data

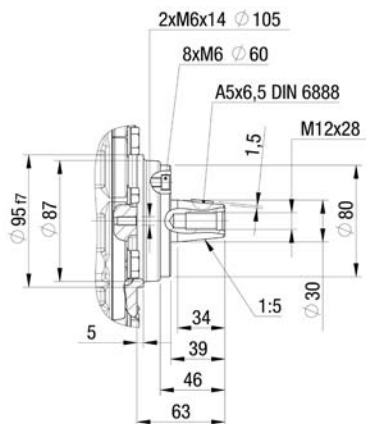
Type	Nu. of Cylinders	Displacement cm ³	Swept volume (1450 rpm) m ³ /h	Weight kg	Connections		Oil charge Ltr.	Inertia moment of the driving unit [kgm ²]	Lubrication	Oil pump
					Discharge line DV mm / inch	Suction line SV mm / inch				
FK30/235	2	233	20,3	25,0	16 / ⁵ / ₈	22 / ⁷ / ₈	2,0	0,0028	Forced lubrication	Rotation-independent
		277	24,1		22 / ⁷ / ₈	28 / 1 ¹ / ₈				
		325	28,3		22 / ⁷ / ₈	28 / 1 ¹ / ₈				

The technical data for the different designs K, N and TK are identical.
The compressor type data therefore do not mention these additions.

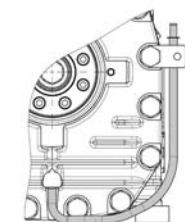
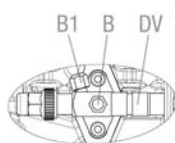
9 | Dimensions and connections



Shaft end



only FK30/235



Leak oil drain hose



Centre of gravity

Dimensions in mm

Dimensions in Ø = K - Design

* = FK30/235

Fig. 19

9 | Dimensions and connections

SV	Suction line	see technical data, Chapter 8
DV	Discharge line	
A	Connection suction side, not lockable	7/16" UNF
A1	Connection suction side, lockable	7/16" UNF
A2	Connection suction side, not lockable	1/8" NPTF
B	Connection discharge side, not lockable	7/16" UNF
B1	Connection discharge side, lockable	7/16" UNF
C	Connection oil pressure safety switch OIL	1/8" NPTF
D	Connection oil pressure safety switch LP	1/4" NPTF
E	Connection oil pressure gauge	1/8" NPTF
F	Oil drain	M22 x 1,5
G	Opt. connection for oil sump heating ¹⁾	M22 x 1,5
H	Oil charge plug	1/4" NPTF
K	Sightglass	1 1/8" - 18 UNEF
L	Connection thermal protection thermostat	1/8" NPTF
M	Oil strainer	M22 x 1,5
SV1	Opt. connection for suction line valve	--

¹⁾ = Only possible ex factory

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10 | Installation certificate

INSTALLATION CERTIFICATE

for using the compressors within the European Union
(in accordance with Machinery Directive 2006/42/EC)

The manufacturer: GEA Bock GmbH, Benzstraße 7
D-72636 Frickenhausen, Tel.: 07022/9454-0

hereby declares that the refrigerating compressor **FK30** conforms to the essential requirements
of Annex II 1B of the Machinery Directive 2006/42/EC.

Applied harmonised standard:

EN 12693:2008 and the corresponding standards referenced

A partly completed machine may only be put into operation when it has been established
that the machine, into which the partly completed machine is to be installed, conforms to the
regulations of the Machinery Directive (2006/42/EC).

The manufacturer undertakes to transmit electronically the special documentation required
by individual states for partly completed machinery upon request.

The special technical documentation required for partly completed machinery has been created
in accordance with Annex VII Part B.

Person responsible for documentation is:
Wolfgang Sandkötter, Benzstraße 7, 72636 Frickenhausen.



ppa. Wolfgang Sandkötter,
Chief Development Officer

Frickenhausen, 01.11.2011

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11| Service

Dear customer,

Bock compressors are top-quality, reliable and service-friendly quality products.

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 with a **toll-free hotline 00 800 / 800 000 88** or via **e-mail: bock@gea.com**.

Yours faithfully

GEA Bock GmbH

Benzstraße 7

72636 Frickenhausen

Germany

We also provide information on the Internet at **www.bock.de**.

For example, under the "Documentation" link you will find:

- Technical information
- Product information
- Product brochures
- and much more

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GEA Group is a global engineering company with multi-billion euro sales and operations in more than 50 countries. Founded in 1881, the company is one of the largest providers of innovative equipment and process technology. GEA Group is listed in the STOXX® Europe 600 index.

GEA Refrigeration Technologies

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