

BOCK FK

BOCK Frickenhausen, Frank Alisch Trainer
Training Department 13.und 15.04.21

Service and Maintenance FK Webinar
Marc EN und Frank DE

BOCK

colour the world
of tomorrow

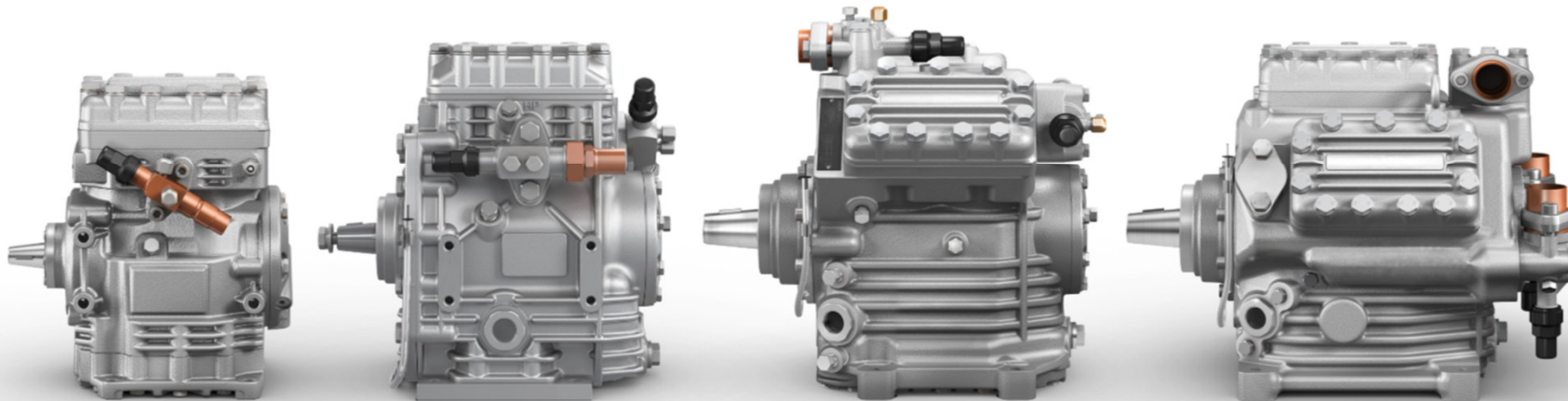
Agenda BOCK FK-Service Webinar

1. Influence of the A / C system to the compressor FK
2. Service - Shaft Seal
3. Troubleshooting, Root Cause
4. Maintenance and preventive maintenance



BOCK Mobile Compressor FK

- Four sizes - FK 20-50 with 14 displacement stages : FK 40 up to 755 ccm - FK 50 up to 980 ccm
- Individual customization / many accessories selectable - capacity regulator, clutch, valves
- customized valve plates for special needs in mobile applications:
 - K-Plate for Bus and TK-plate for transport
- Strong and robust - maintenance-friendly



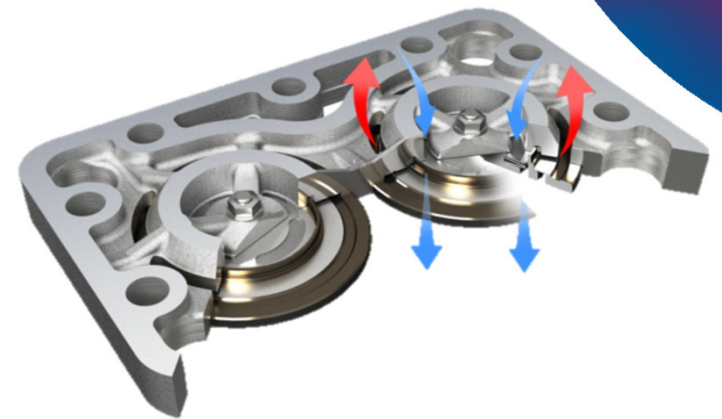
BOCK Compressor (FK)

- Special Construction
 - Strong crankshaft and hardened surfaces
 - Roller bearings on both sides, designed for maximum forces
 - Balanced crankshaft and dynamic mass compensation
 - for smooth operation and less vibrations
 - Forged connecting rods
 - Aluminum pistons with two piston-ring design



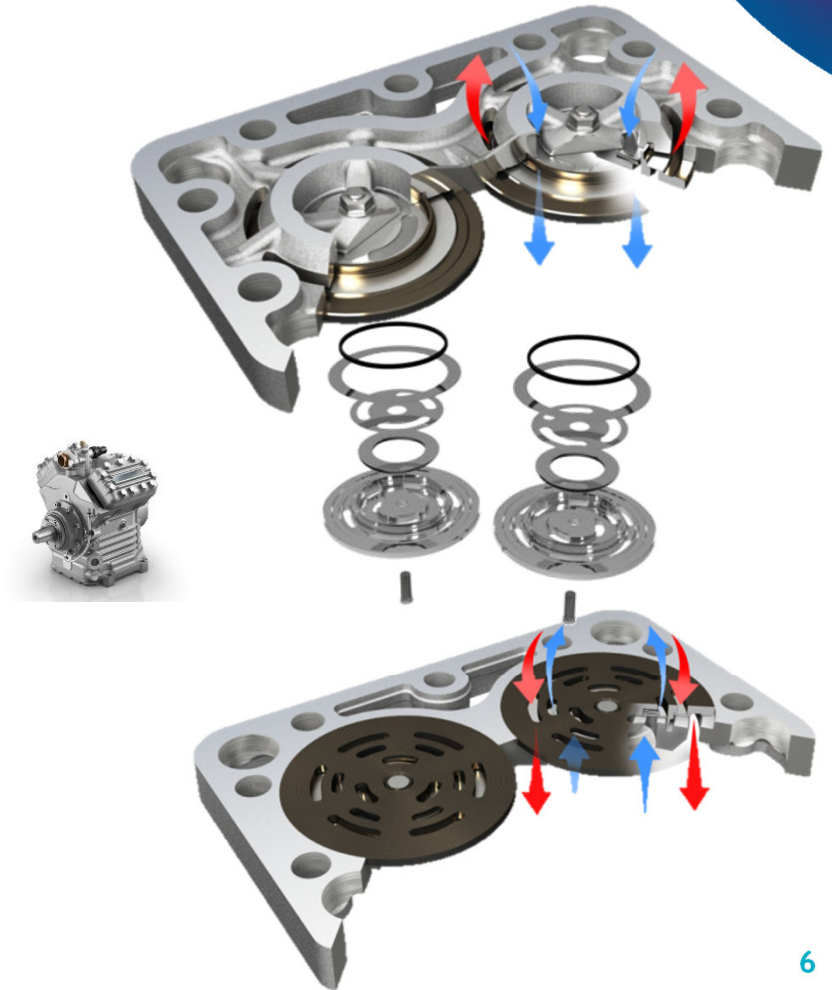
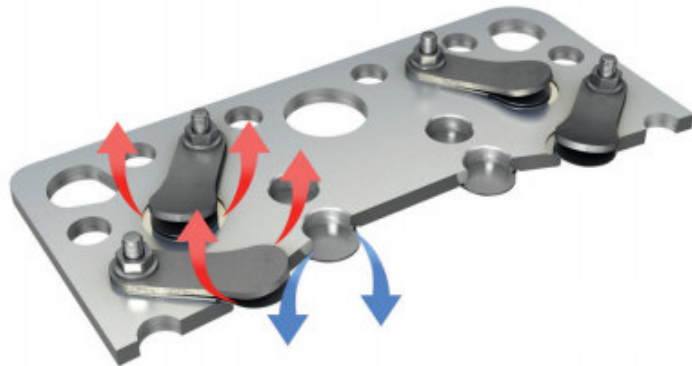
BOCK Compressor (FK)

- The K-Plate - a Bock Innovation
 - Unique valve plate system for for the highest demands
 - Designed for Bus and Coaches
 - Ring valves made of high-quality, impact-resistant spring steel
 - Extremely robust and reliable
 - Insensitive to permanent speed and pressure fluctuations
 - Extremely robust to liquid refrigerant



BOCK Compressor (FK)

- Special features K-Plate
- The valves are designed as a ring lamella package:
 - Free fixation without bending and torsion force
 - No parts can fall into the cylinder area
- Aluminum base plate for less weight
- The N-Plate for A/C, standard and freezing application



BOCK Compressor (FK) Oil supply

- Special features - Safe oil supply for FK



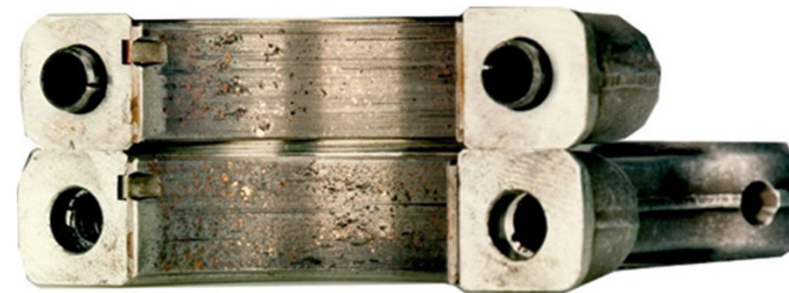
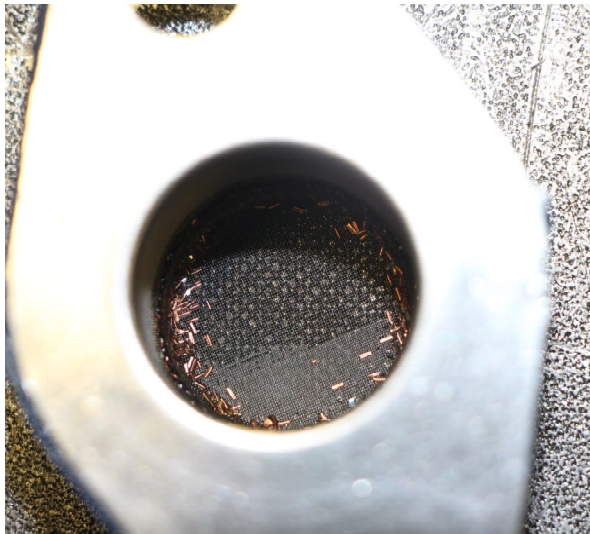
- Reliable, **direction-independent** oil pump
- Large oil sump
- FK40/50 with two oil sight glasses
- FK30 with one sight glass
- Low oil throw



Influence of the A/C system to the compressor

Contaminants from the system

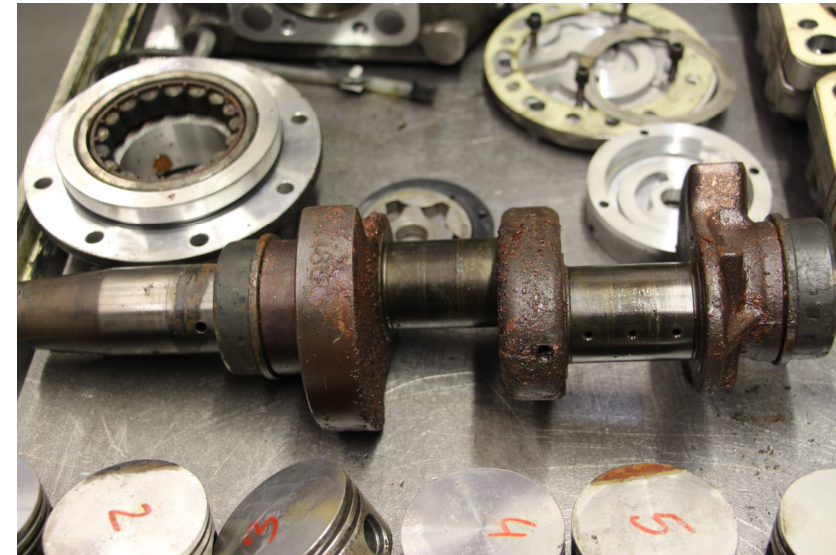
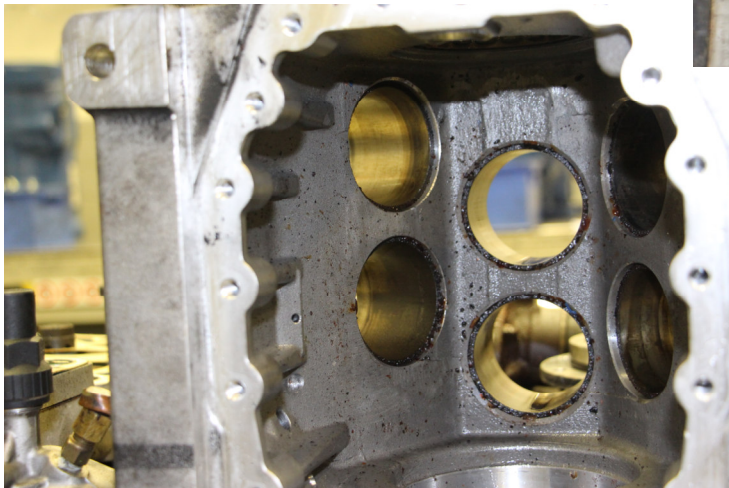
- Chips
- Scale oxide
- Dust
- Production contamination



Influence of the A/C system to the compressor

Moisture and foreign gases in the system

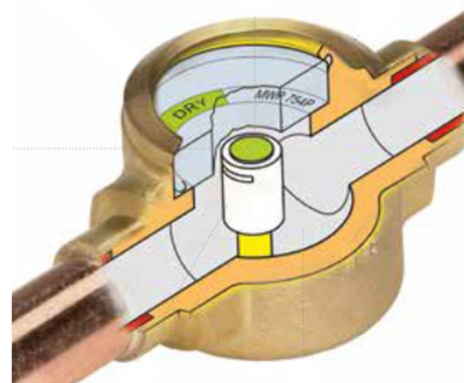
- Inadequate evacuation
- Leakage
- Saturated filter drier
- Contaminated refrigerant



Influence of the A/C system to the compressor

Preventive measures with every maintenance

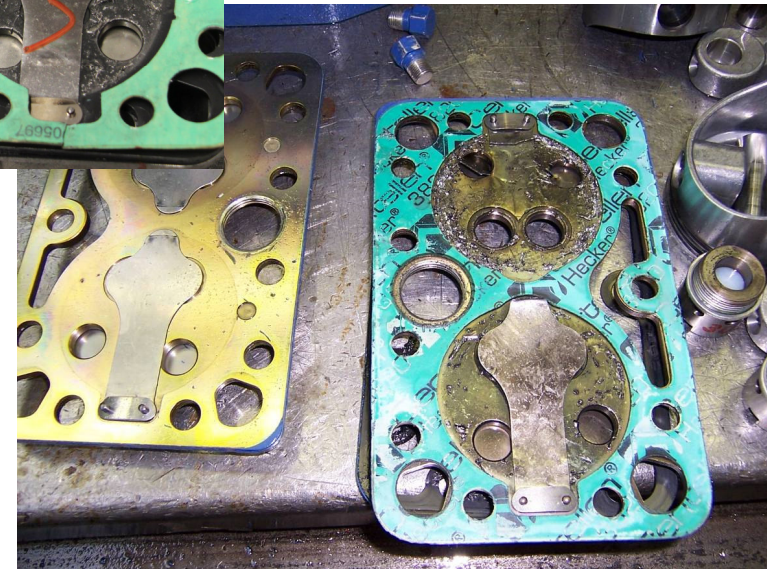
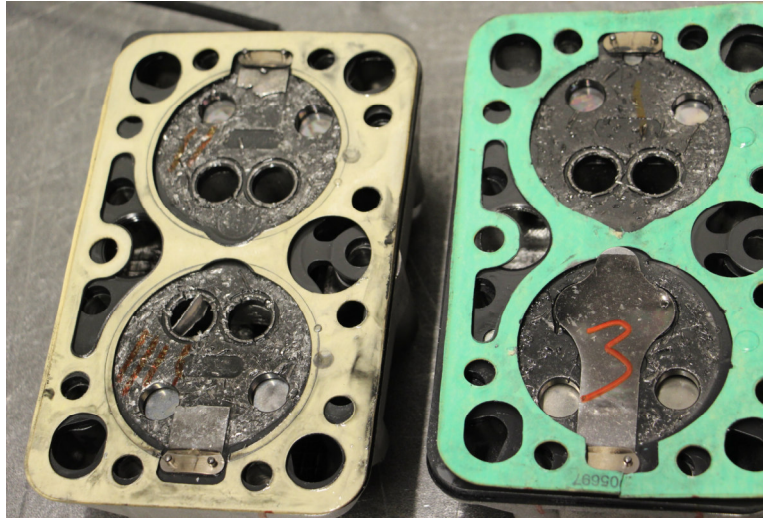
- Check moisture indicator
- After opening the system:
 - sufficient evacuation
 - Change filter drier
 - Check the oil condition and change if necessary
- Dispose of contaminated refrigerant
- Use high-quality refrigerant
- Never leave the oil open
 - Use only fresh, sealed oil
 - Do not store open cans
- If necessary, take an oil sample and do a Laboratory analysis



Influence of the A/C system to the compressor

Liquid Slugging

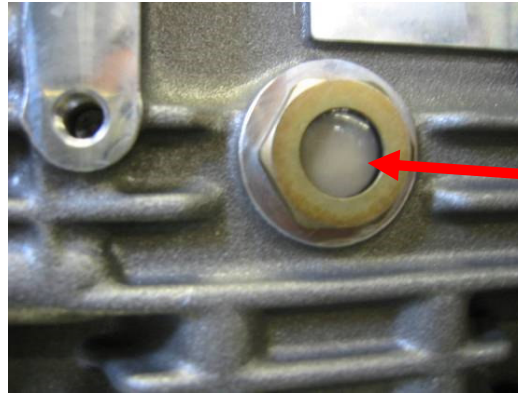
- Iced heat exchangers
- Clogged air filters
- Defective fan
- Defective expansion valve
- Defective liquid solenoid valve
- Refrigerant overfill
- Insufficient oil return
- Refrigerant shift
- Filling the system
- Suction gas superheating too small



Influence of the A/C system to the compressor

Suction gas superheat too small

- Target: min. 10K
- Measure suction gas superheat
- Check TXV settings
- Attention - lack of lubrication



No visible oil level at the sight glass

Liquid refrigerant has dissolved in the oil and diluting it.

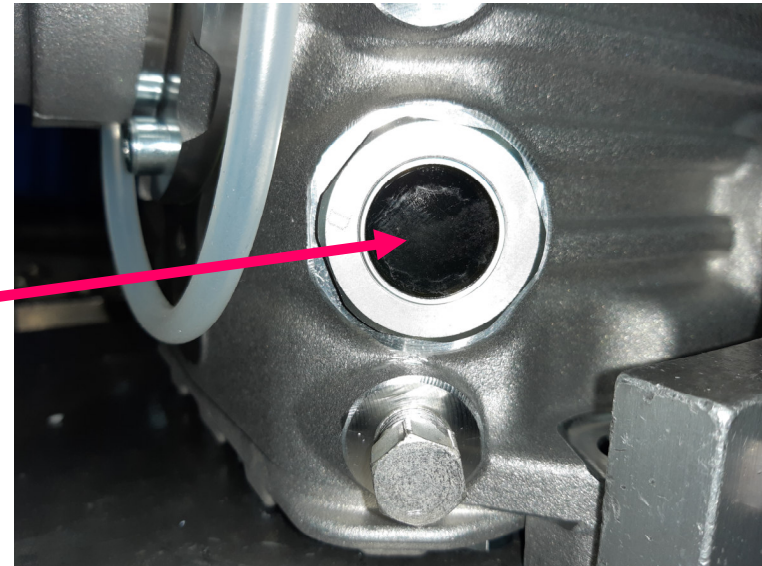


Influence of the A/C system to the compressor

Preventive measures with every maintenance

- Measure the suction gas superheat
 - >10K
- Check the check valve
- Check the solenoid valve for leaks and function
- Check oil return
 - Be careful when adding oil
- Clean air filter
- Check frost protection device

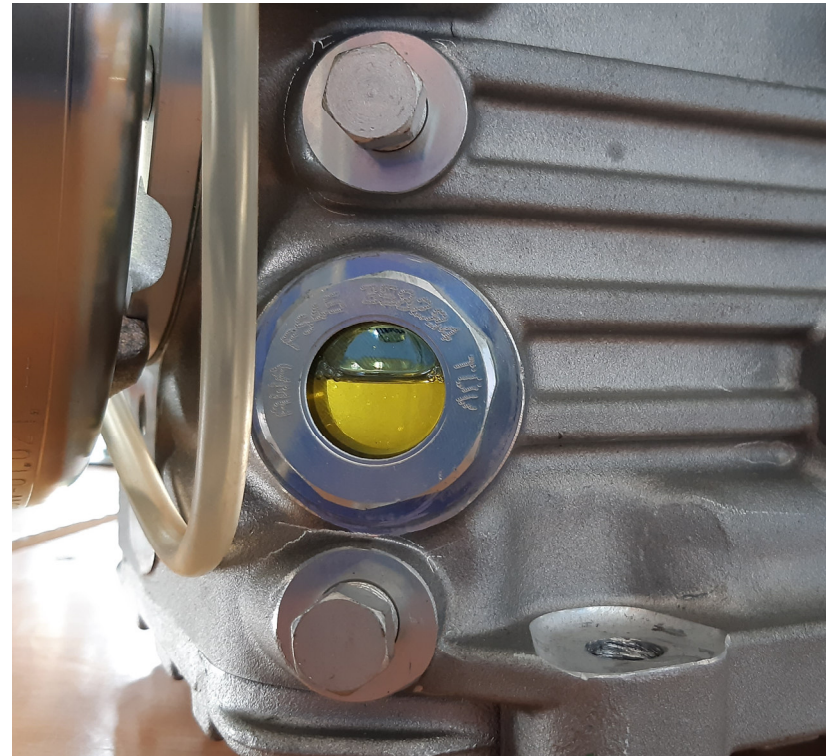
Clear sight glass



Influence of the A/C system to the compressor

Preventive measures with every maintenance

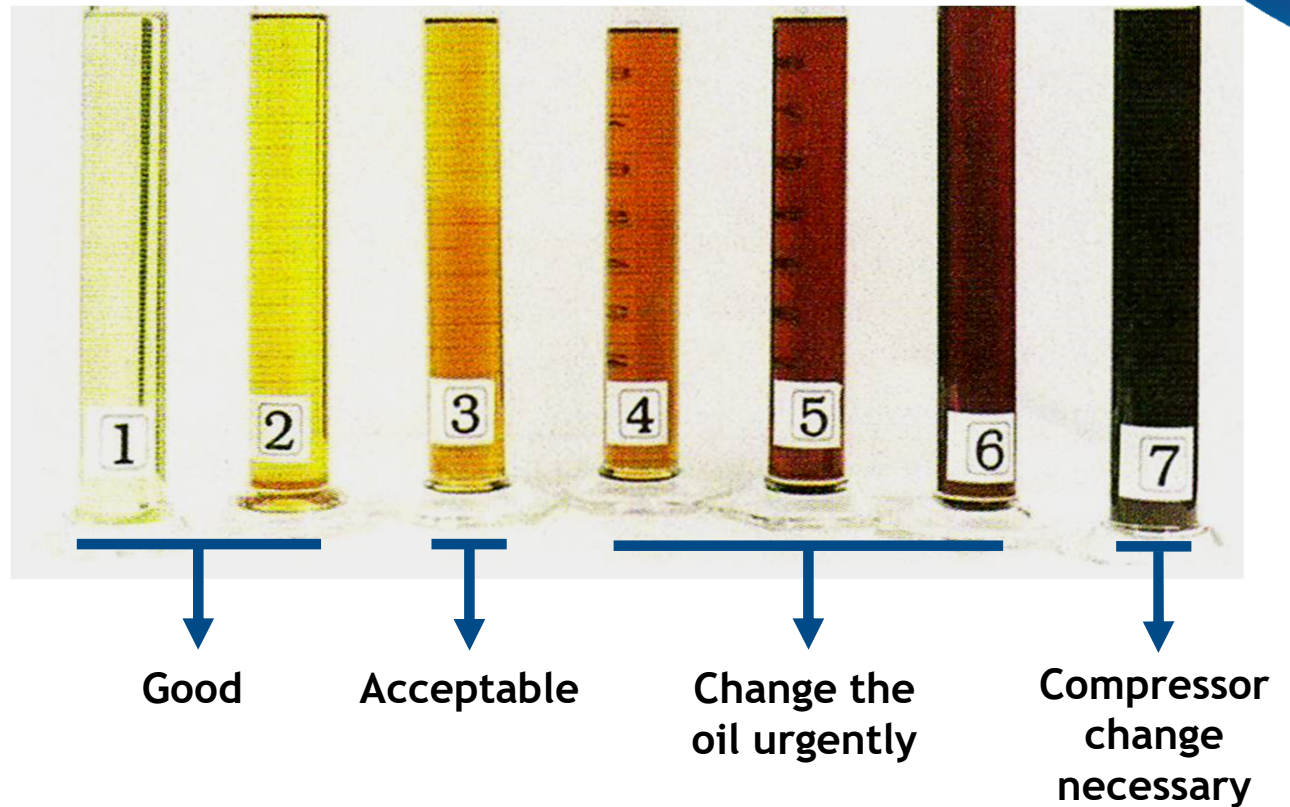
- Check the oil level
 - If the oil level is too low, find the cause - don't just fill it up
- Check the oil quality
 - If necessary, change the oil
 - If the oil is dark and smell bad also change the filter drier and the refrigerant.



Influence of the A/C system to the compressor

Oil Quality

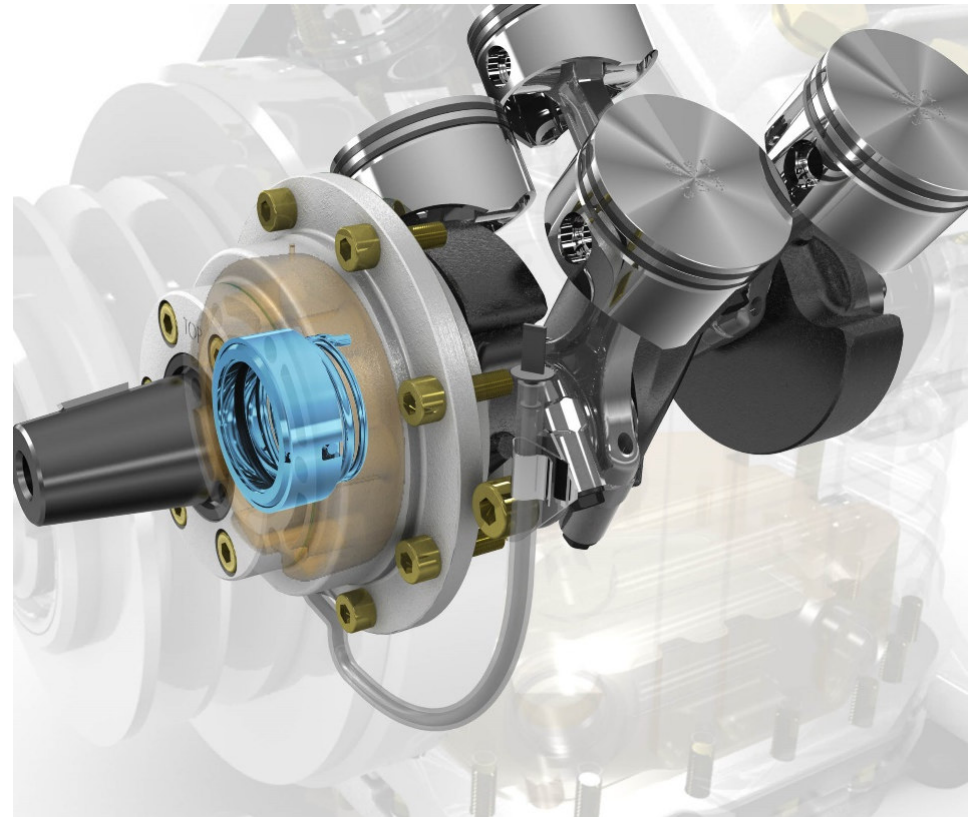
- Humidity
- Discharge end temperature
- Ambient temperature
- Foreign gas
- Oil aging
- Oil mixture
- Fluorescence additives



Influence of the A/C system to the compressor

Wear Part - Shaft Seal

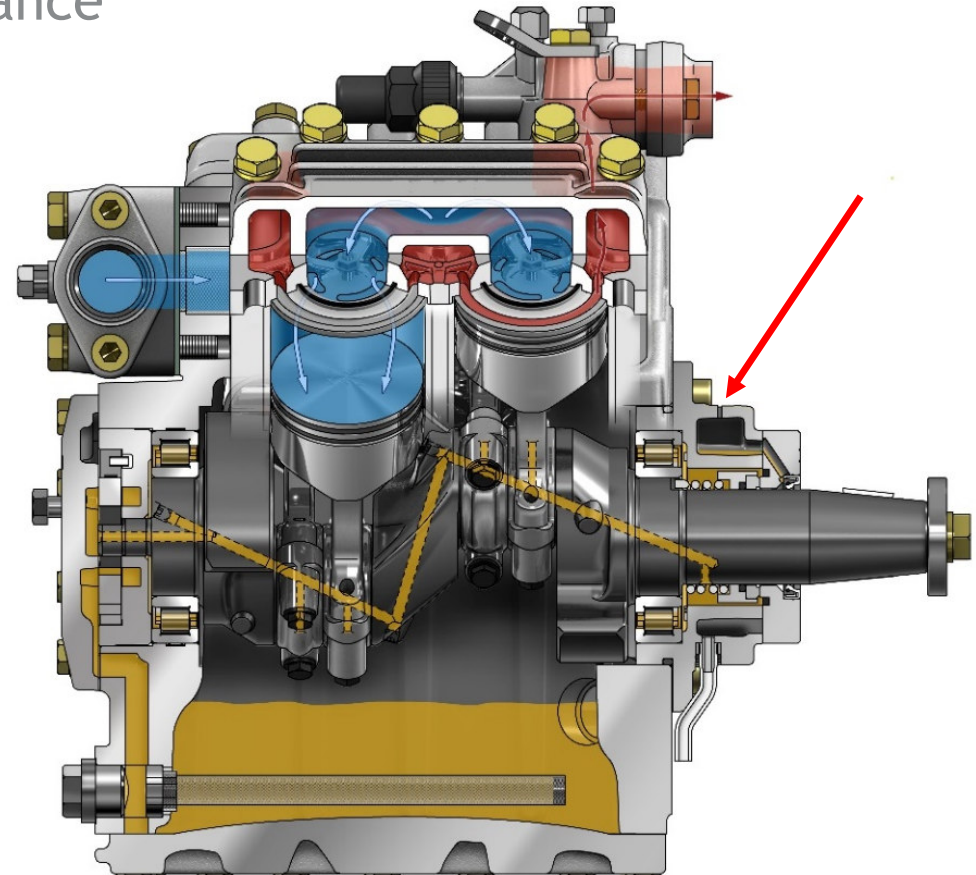
- Technically mandatory oil leak
- Is gas tight - not oil tight
- Higher wear due to:
 - Incorrect belt tension (belt slapping)
 - High ambient temperature
 - Overheating
 - Operating conditions
 - Worn out oil
 - Humidity in system
 - Liquid slugging
 - Many start - stop operations
 - Contaminated system (particles)
 - Lack of lubrication



Influence of the A/C system to the compressor

Preventive measures with every maintenance

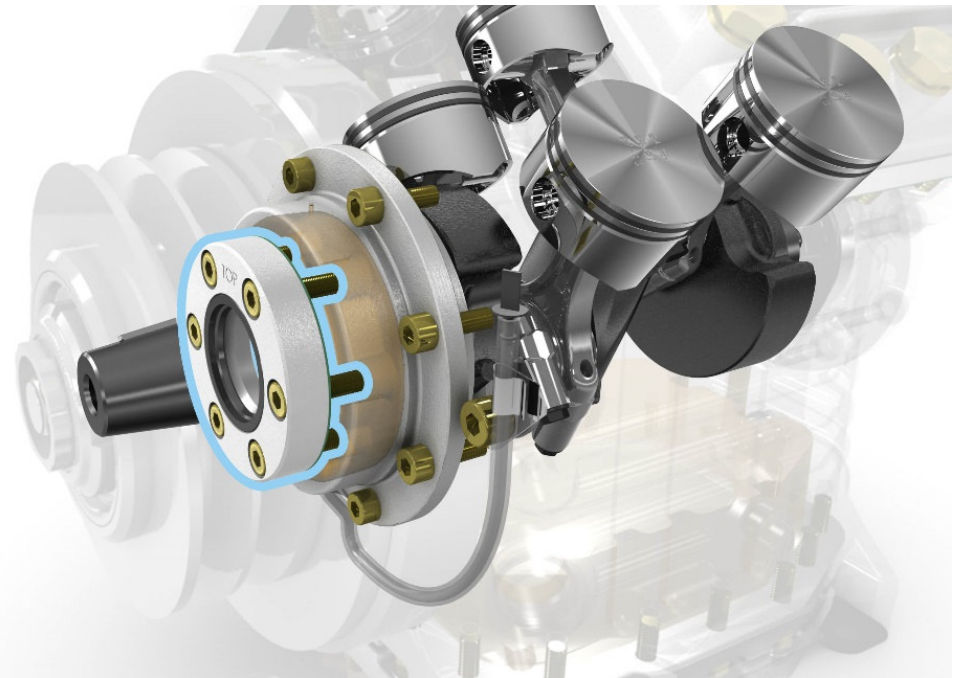
- Empty the oil collecting system with every service or maintenance
- After 1400 operating hours at the latest
 - Drain completely
- If the collecting system has overflowed:
 - Drain oil collecting system
 - Clean the compressor (e.g. brake cleaner)
 - It is not necessary to replace the shaft seal



Things to know about the FK shaft seal

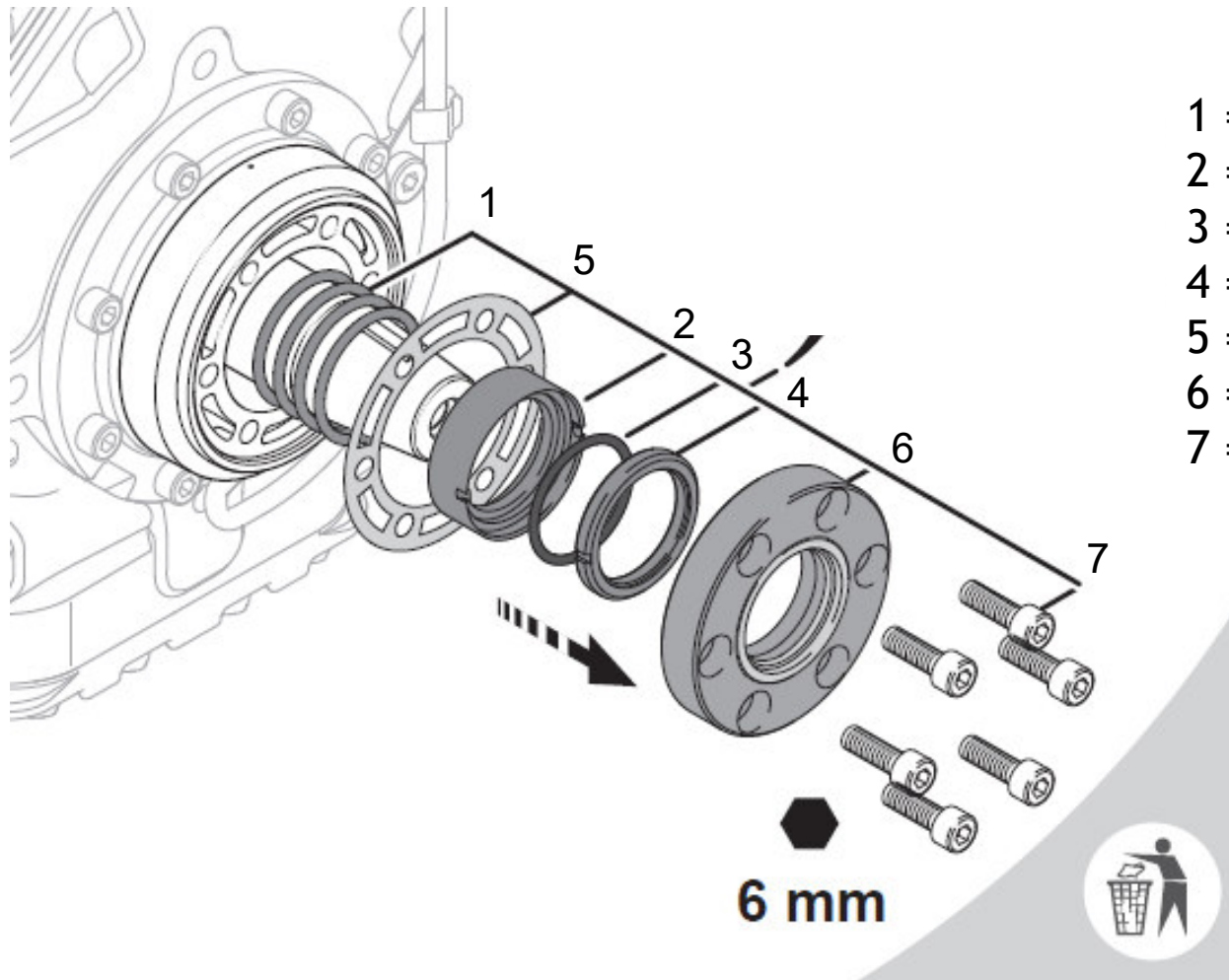
Technical data shaft seal

- Oil collecting system: **max. 70 ml**
- Average oil leakage: **0,05 ml/h**
- Run in time: **200h - 300h**
 - The leak rate can be increased during the running-in phase.
- The oil collecting system should (on average) be emptied after 1,000 - 1,400 operating hours in order to avoid oil leaks.



Things to know about the FK shaft seal

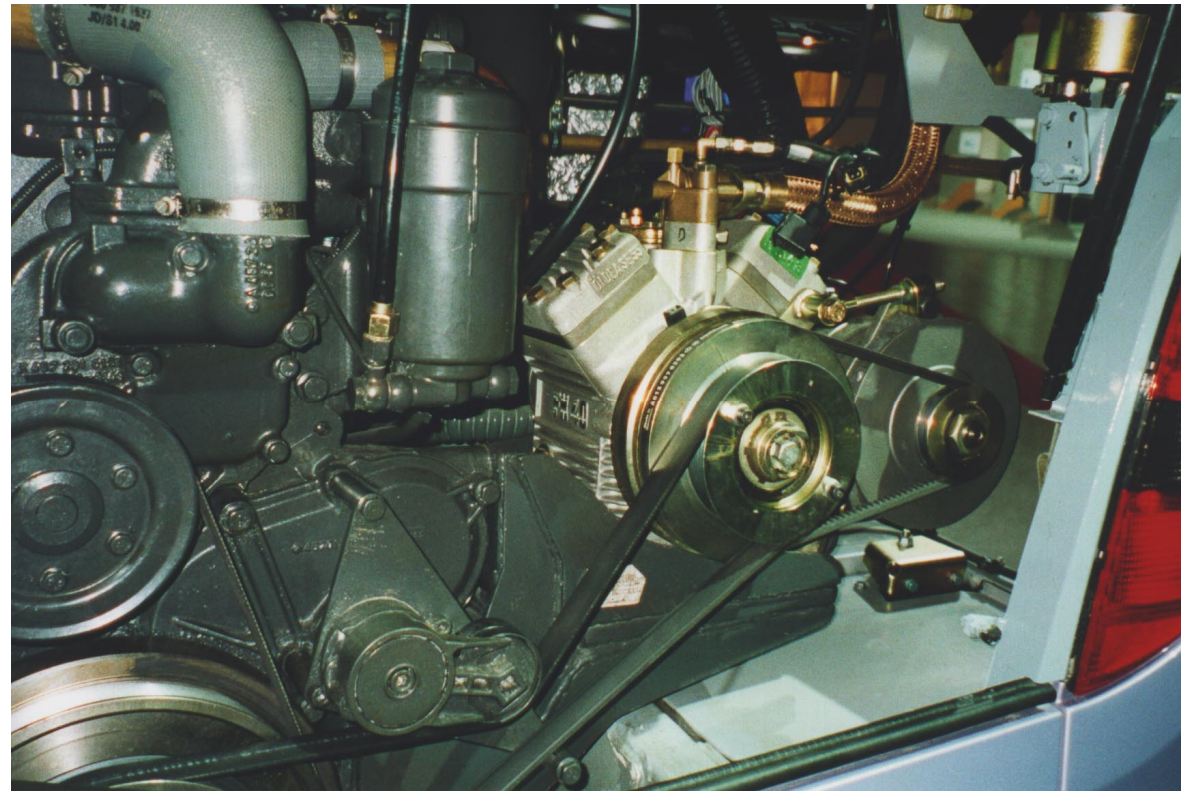
Structure of the Bock shaft seal



Influence of the A/C system to the compressor

Preventive measures with every maintenance

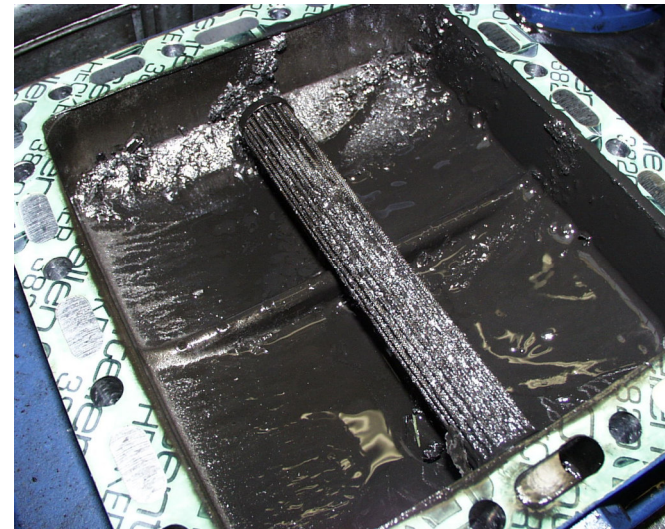
- Belt tension:
 - Regular checking of the belt tension
 - Belt slamming must be avoided
- Regular replacement of the belt
 - Replace immediately if worn
 - Readjust the belt tension
- Clean the compressor if necessary



Root cause FK Compressor

Cause - system contamination

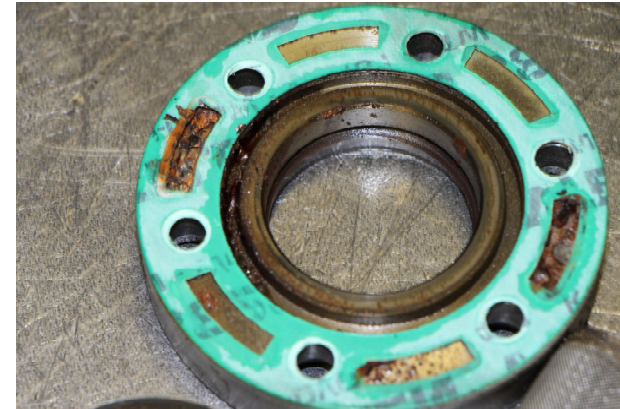
- Due to contamination of the A / C system through the suction strainer, foreign particles appear in the sealing area of the shaft seal.
 - Particles <0.41 mm can be sieved.
 - Abrasion due to insufficient lubrication and liquid hammer. Chips, particles and scale from the pipeline system are also possible.
 - Oil color dark / gray / cloudy
- **Suggested solution:**
 - Replace filter drier.
 - Carry out an oil change (original Bock oil).
 - Replace the mechanical seal completely.
 - Flush the system if necessary.
 - Take an oil sample and determine the oil quality.



Root cause FK Compressor

Cause - humidity

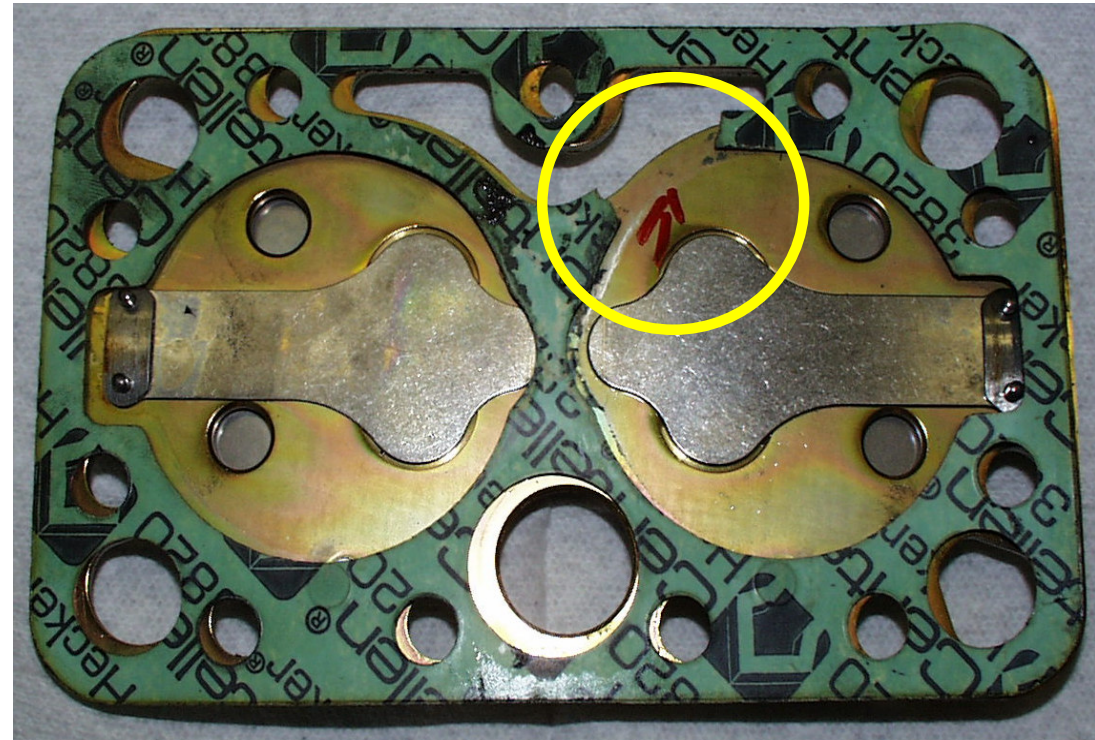
- Moisture in the circuit causes chemical decomposition of the refrigerator oil. The hydrolysis produces carboxylic acids and a wide variety of polyvalent alcohols.
 - Moisture due to insufficient evacuation of the system.
 - Moisture from "contaminated" service devices.
 - Moisture through leaks (evaporator, pipeline) and operation in a vacuum.
 - Reuse of refrigerant that has already been used.
- **Suggested solution:**
 - Replace the filter dryer - if there is acid in the system, use a special filter dryer.
 - Carry out an oil change - if necessary several times within a few weeks. (Original Bock oil).
 - Replace the mechanical seal completely.
 - **Sufficient evacuation** - use Torr meter, evacuate at least 1 hour, this is also necessary for the initial assembly.



Various incidents

Broken gasket

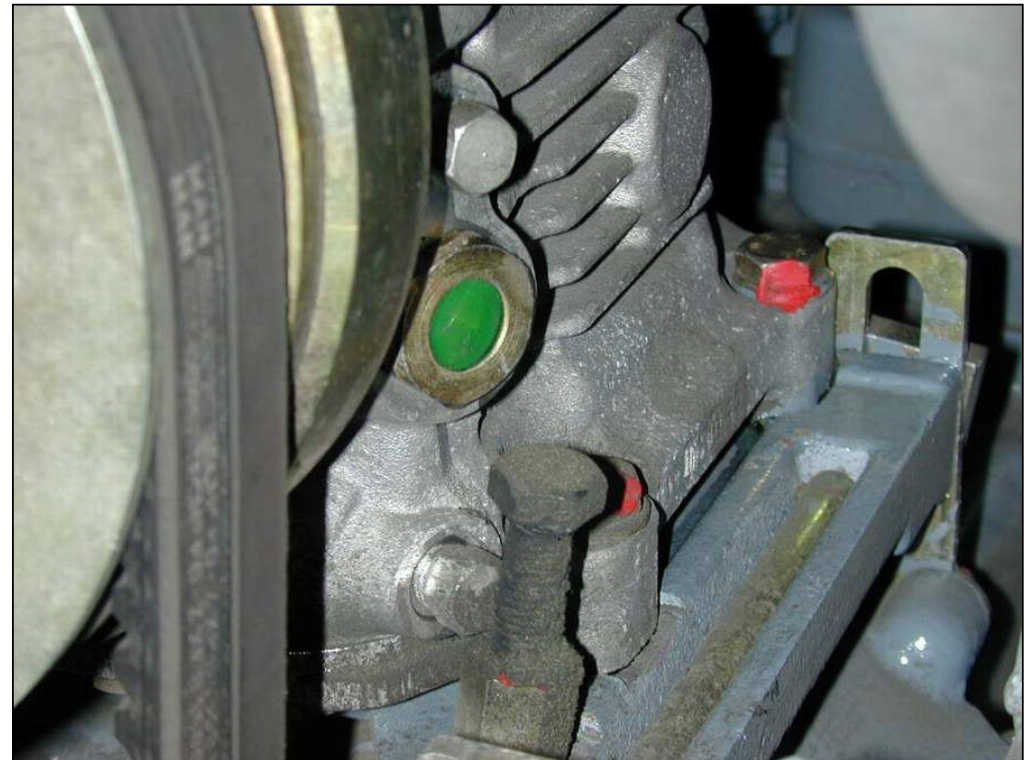
- Shortcut between HP and LP
 - Not enough cooling capacity
 - Compressor will overheat
 - Compressor will break down due to lack of lubrication



Various incidents

Fluorescence additives

- Changes the properties of the oil
- Change the viscosity
- Changes the chemical stability



Various incidents

Electromagnetic Clutch

- Burned Solenoid
 - Under- or over voltage
 - Clutch slips (Clutch is overloaded)
- **Suggested solution:**
 - Check the plugs
 - Check the relay and controller
 - Check the compressor
- Transmissible Torque (e.g. LA16):
 - after 10 operating cycles: = 420 Nm
 - new: = 140 Nm



Various incidents

Electromagnetic Clutch

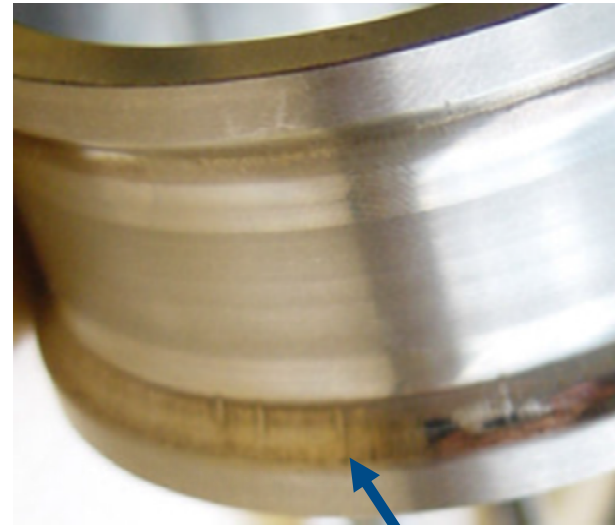
- Fretting corrosion
 - Corrosion between clutch and compressor cone
 - Clutch was incorrectly mounted
- Suggested solution:
 - Pay attention to a suitable assembly
 - Especially Woodruff key
 - Do not use any grease
 - If the assembly is done well, it won't corrode



Various incidents

Electromagnetic Clutch

- Bearing damage
 - Pitting of the bearing
 - Bearing ring damaged
- Non stop operation of the clutch
 - Use microlocking or switch the clutch off for a moment (every 30 minutes)
 - Kendrion Linnig recommend the IQ16 modul



BOCK colour the world
of tomorrow