

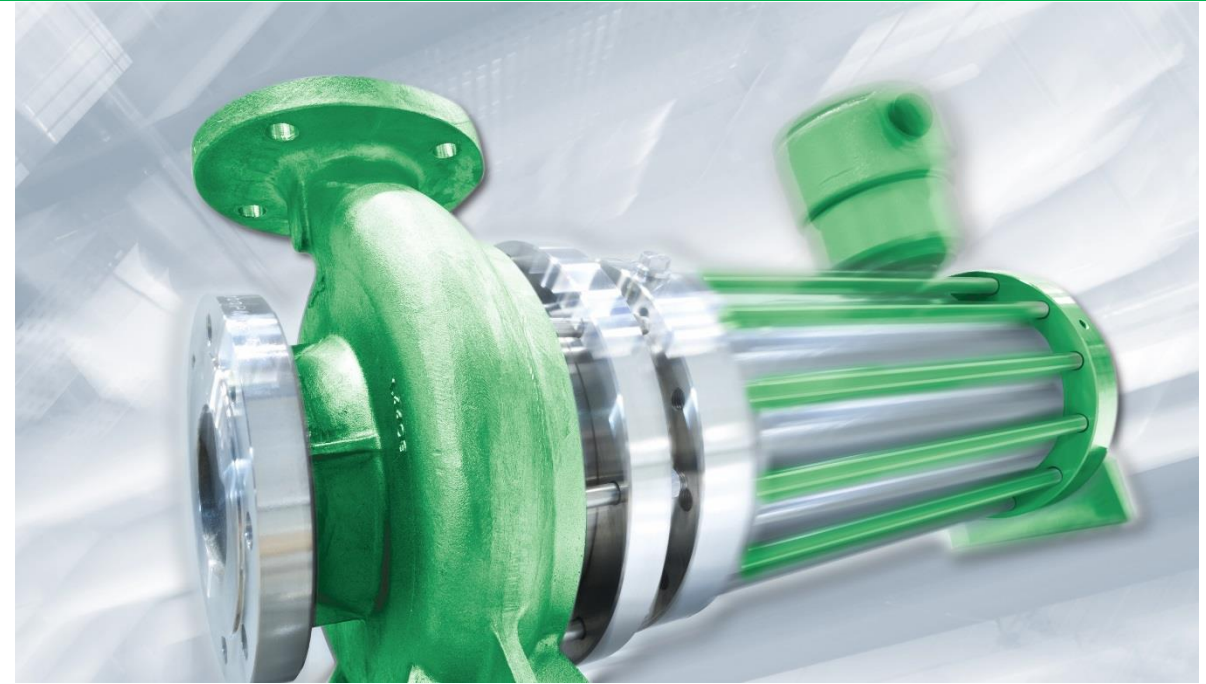
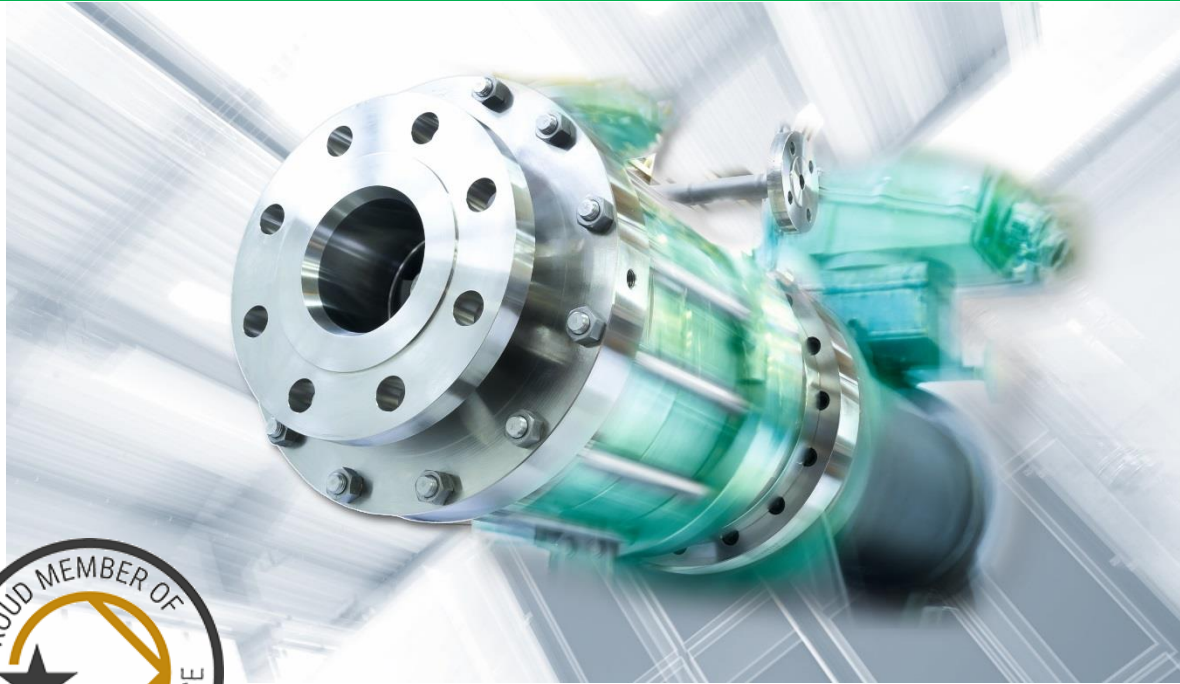
CONNECTING
EXPERTS.

CHILLVENTA eSPECIAL

Refrigeration | AC & Ventilation | Heat Pumps

13.–15.10.2020

NÜRNBERG MESSE

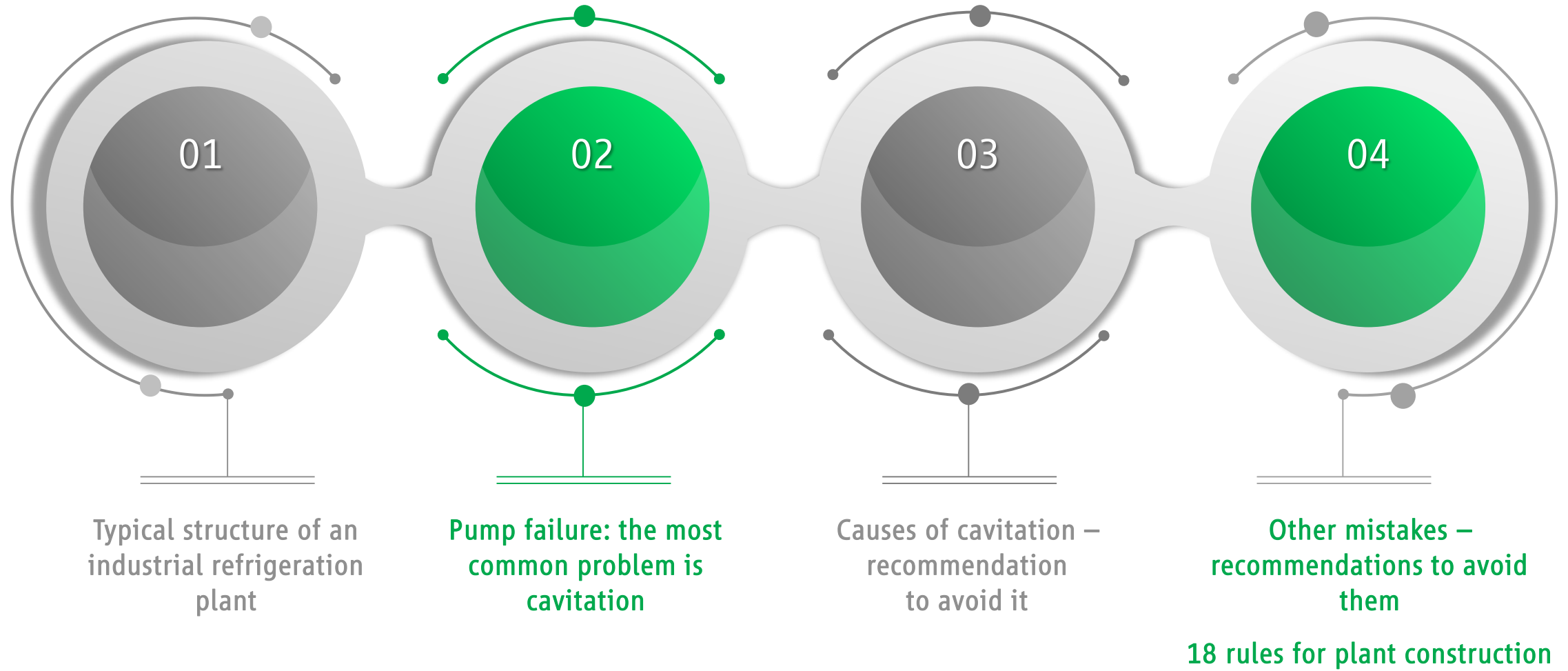


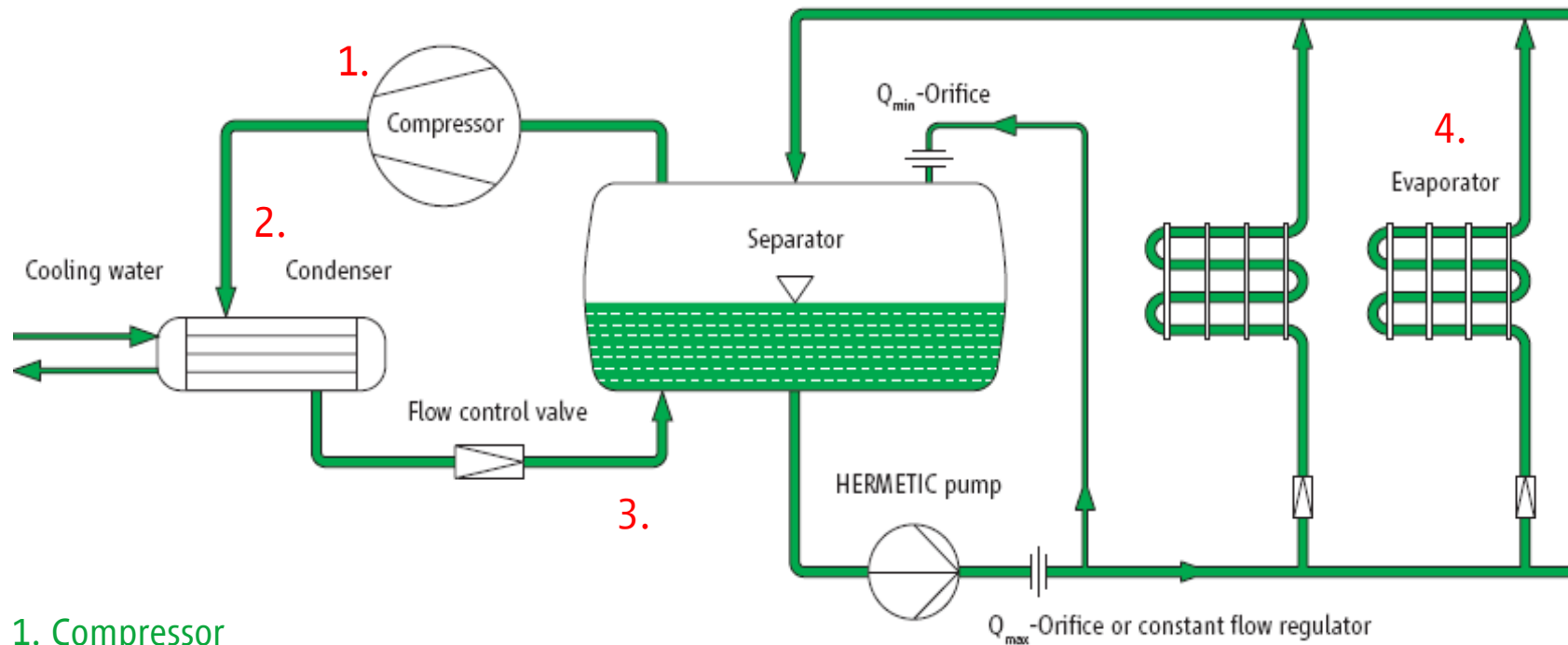
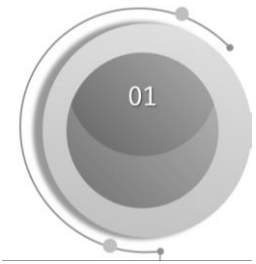
HERMETIC-Pumpen GmbH

Typical mistakes in pump planning and installation –
and how to avoid them



Sealless Technology
Unlimited





1. Compressor

- Screw or piston compressor

2. Condenser (e.g. plate)

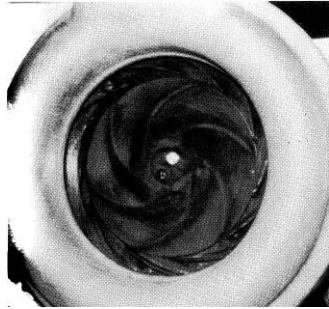
- Liquid-cooled
- Air-cooled
- Cooled by evaporation

3. Expansion valve

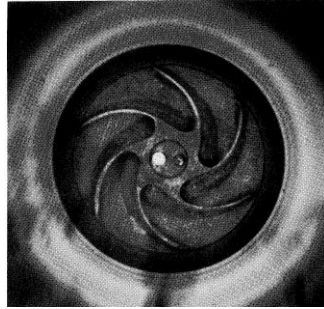
- Thermodynamic expansion valve
- Pressure controlled expansion valve
- Electronic expansion valve

4. Evaporator

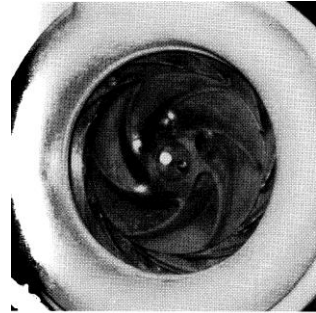
- Tube evaporator
- Plate evaporator



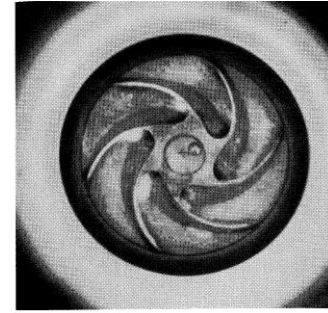
1. Absolute flow picture



Relative flow picture



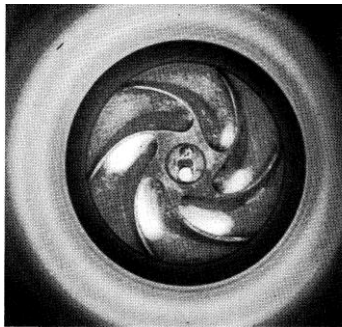
2. Absolute flow picture



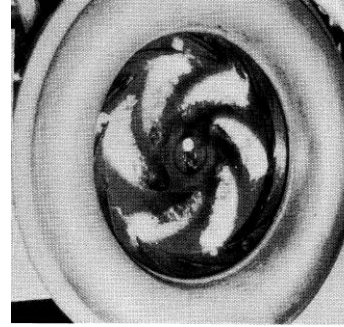
Relative flow picture



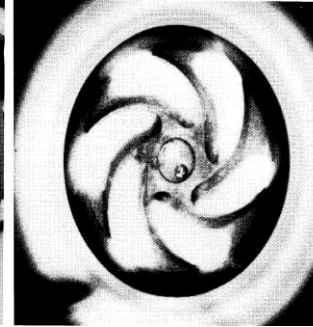
3. Absolute flow picture



Relative flow picture



4. Absolute flow picture



Relative flow picture



Pressure peaks of imploding bubbles lead to material erosion



Kavitationserosion am Diffusor einer mehrstufigen Kreiselpumpe.

Picture 1: Cavitation-free operation

Picture 2: Cavitation begins, the first vapor bubbles form. No change can be seen in the Q-H diagram

Picture 3: Cavitation expands. The Q-H properties begin to decline

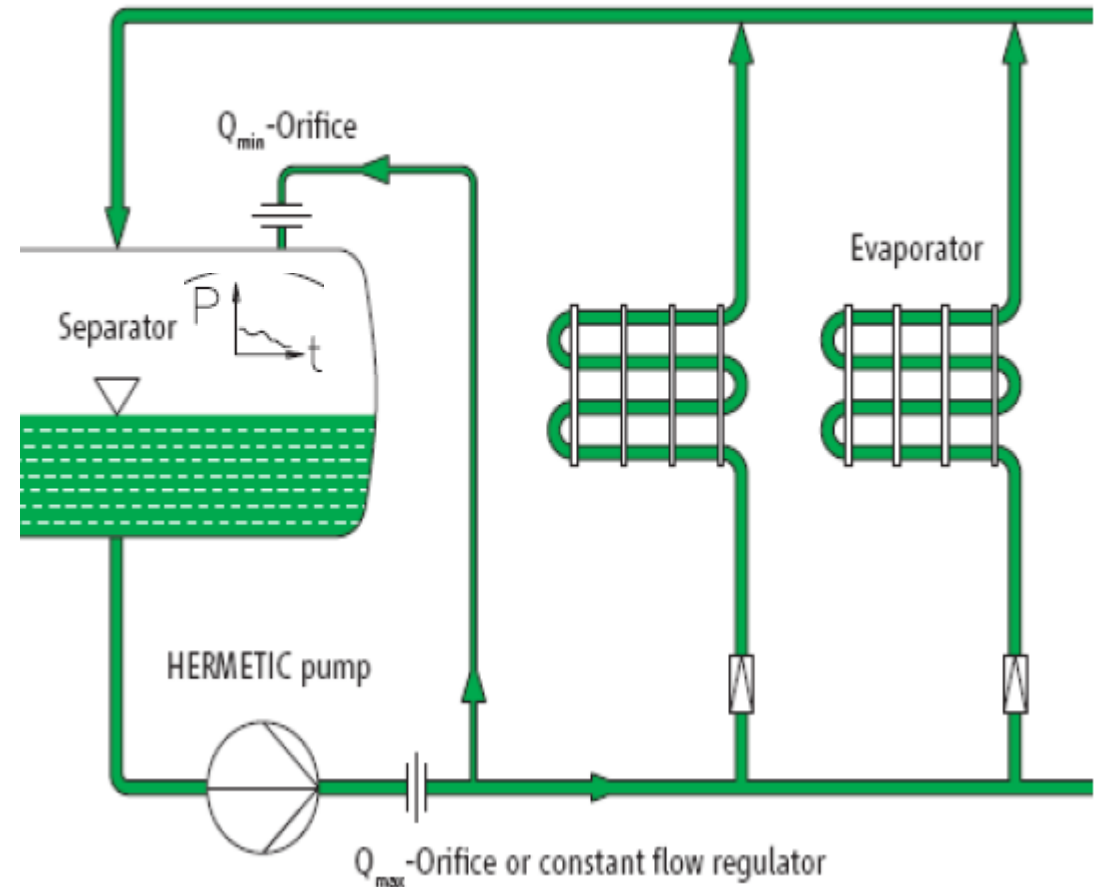
Picture 4: Full cavitation, the characteristic drops steeply, vapor bubbles enter the guide, the process completely collapses.



- **Increased noise** from the pump (crackling or popping gas implosions)
- **Increased vibration** on the pump and pressure line
- **Drop in delivery head** and **volume flow** until complete termination
- **Axial thrust in the direction of the suction side** of the pump, which can be read on the axial thrust monitor (if installed)
- **Increased power consumption** if axial start-up and thus mechanical wear has already occurred. This may involve internal gasification of the product and thus **dry running of the plain bearing**
- **Temperature increases** in the liquid



1. $NPSHA < NPSHR$
2. Pipe diameter too small
3. Conveying speed in the suction pipe too low or too high
4. No Q_{min} orifice / poor degassing
5. Pressure reduction speed too high
6. Filter in suction line
7. Incorrect installation at separator

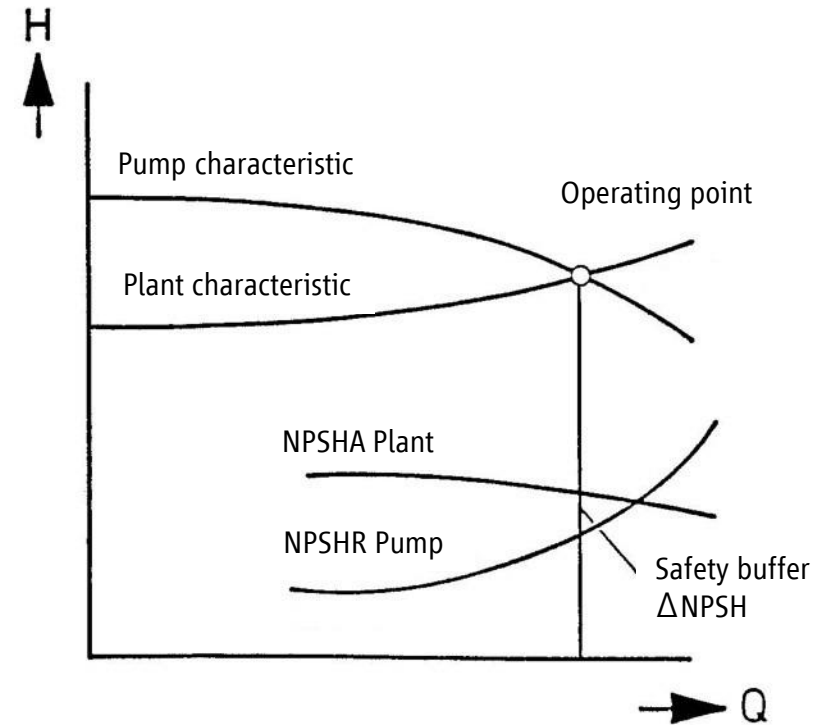


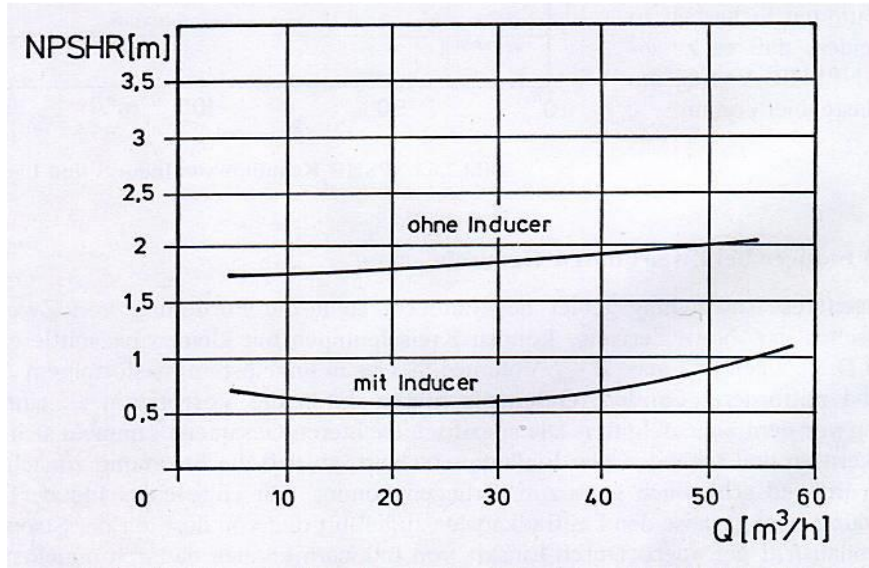


NPSHA > NPSHR

Important:

- Minimum: $\text{NPSHA} \geq \text{NPSHR} + 0,5 \text{ m}$
- Check the operating point → Avoid shifts





- Lower NPSHR by up to 50%
- Dissolve undissolved gas by 12 – 15 % (versus 2 – 3 %)

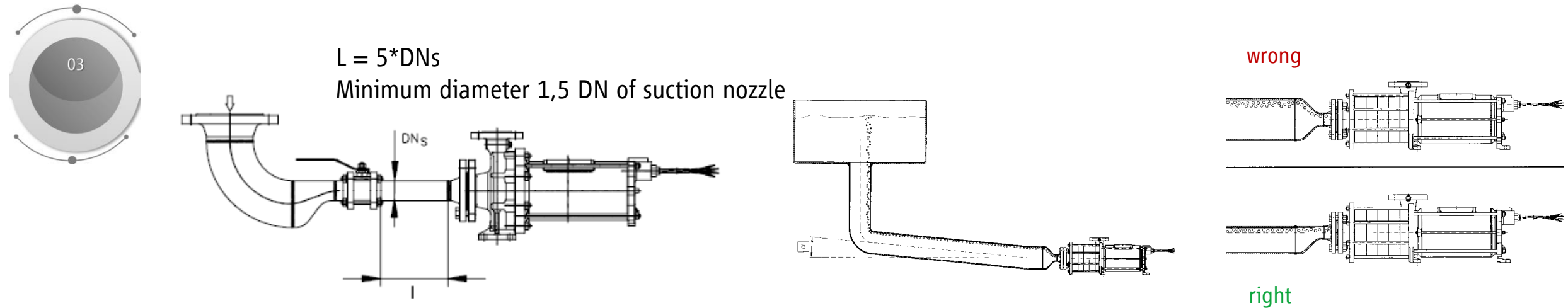


Without Inducer:

- At low to medium speeds and with an increased proportion of gas in the fluid, the gas components are deposited in the inlet cross-section
- Increased NPSHA necessary

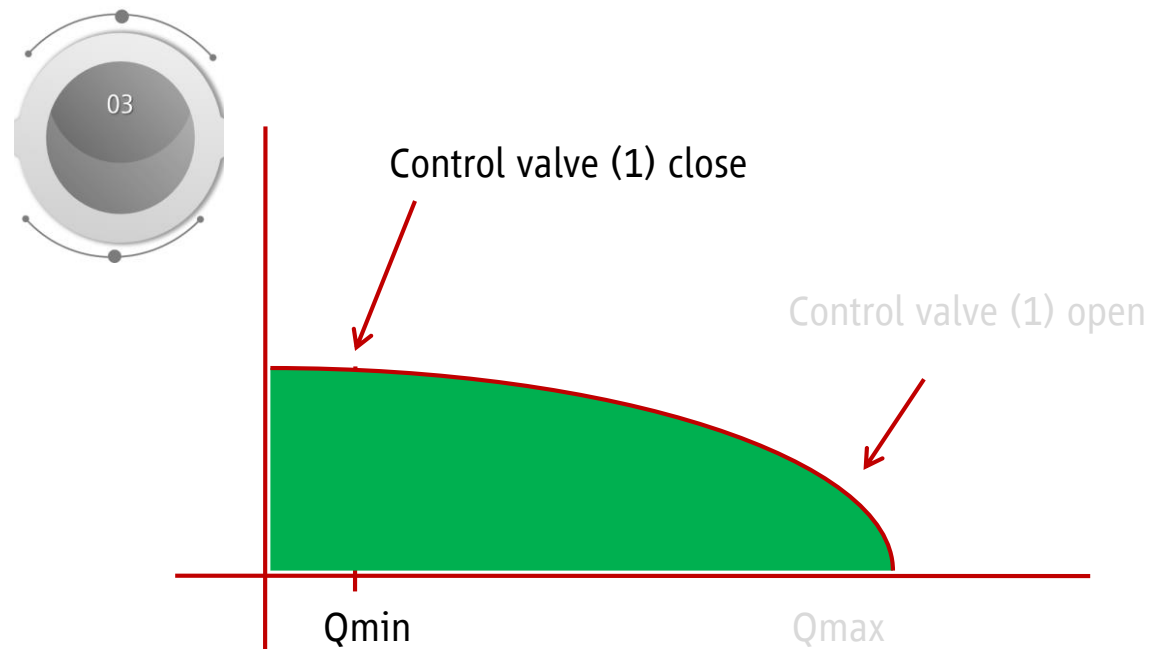
With Inducer:

- Fluid with up to 12 – 15 % gas content can be pumped without problems



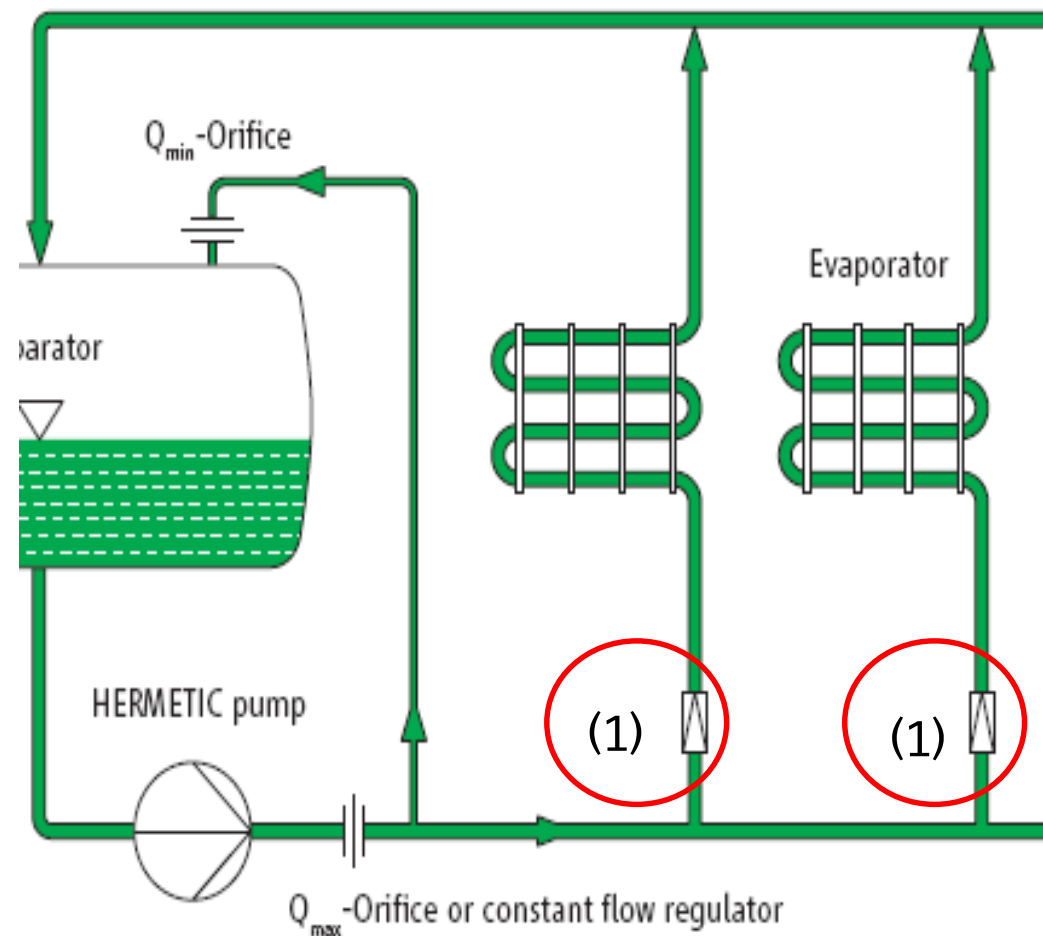
The dimensioning and design of the suction line is very important

- Each pump must have a separate suction line
- If two pumps are operated in parallel, one suction line is sufficient
 - Condition: one pump is a standby-pump
- The suction line should be short, well insulated and stable with a lowering towards the pump
- Recommended flow rate in the suction line: max. 0,3 - 0,5 m / s.



Advantages of Qmin / Bypass line:

1. Continuous operation
2. Degasing





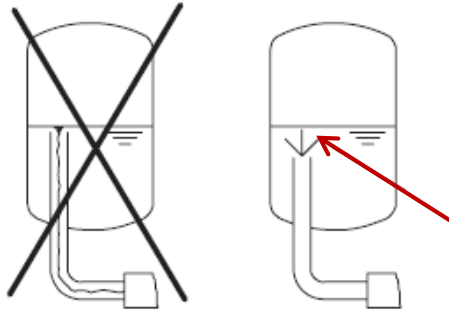
- Filter in suction line just during installation
- Mesh < 0,8mm
- Must be removed as soon as possible or must be monitored with differential pressure instrument

If necessary, only install during the start-up phase a filter
In the suction line

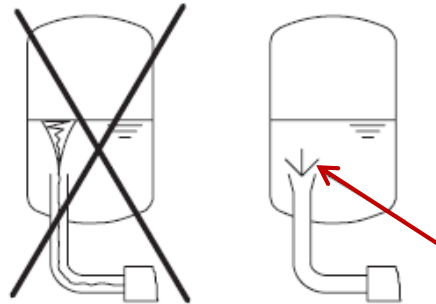




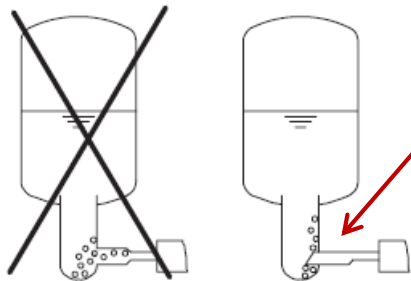
Installation separator



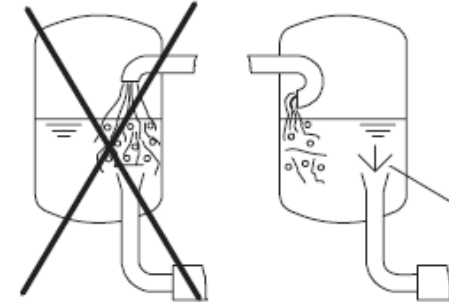
Minimum height
to suction line



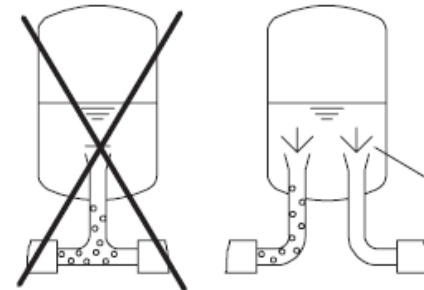
Convex
suction line



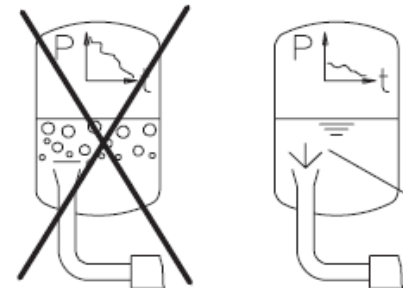
Adjusted across
the top for
suction line



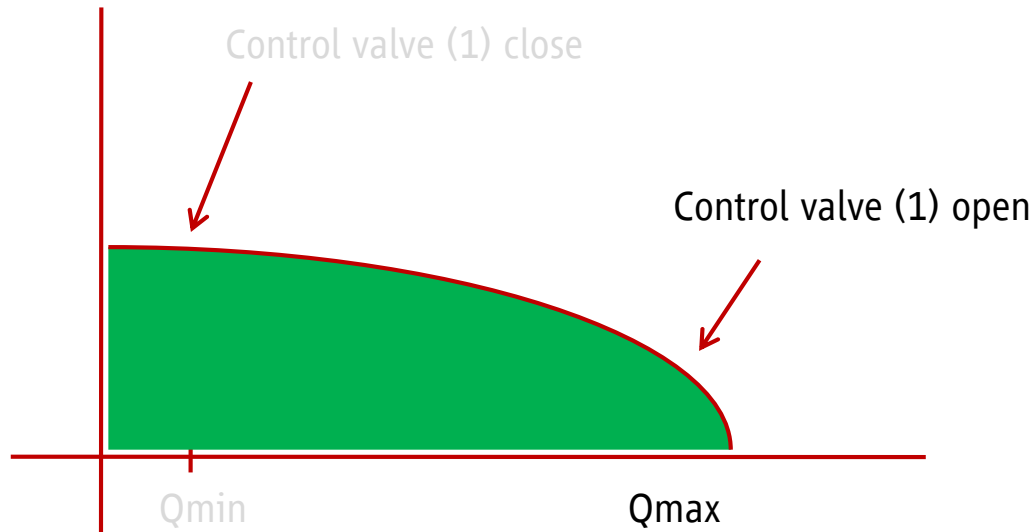
Courved pipes
into separator



Two separate
suction lines

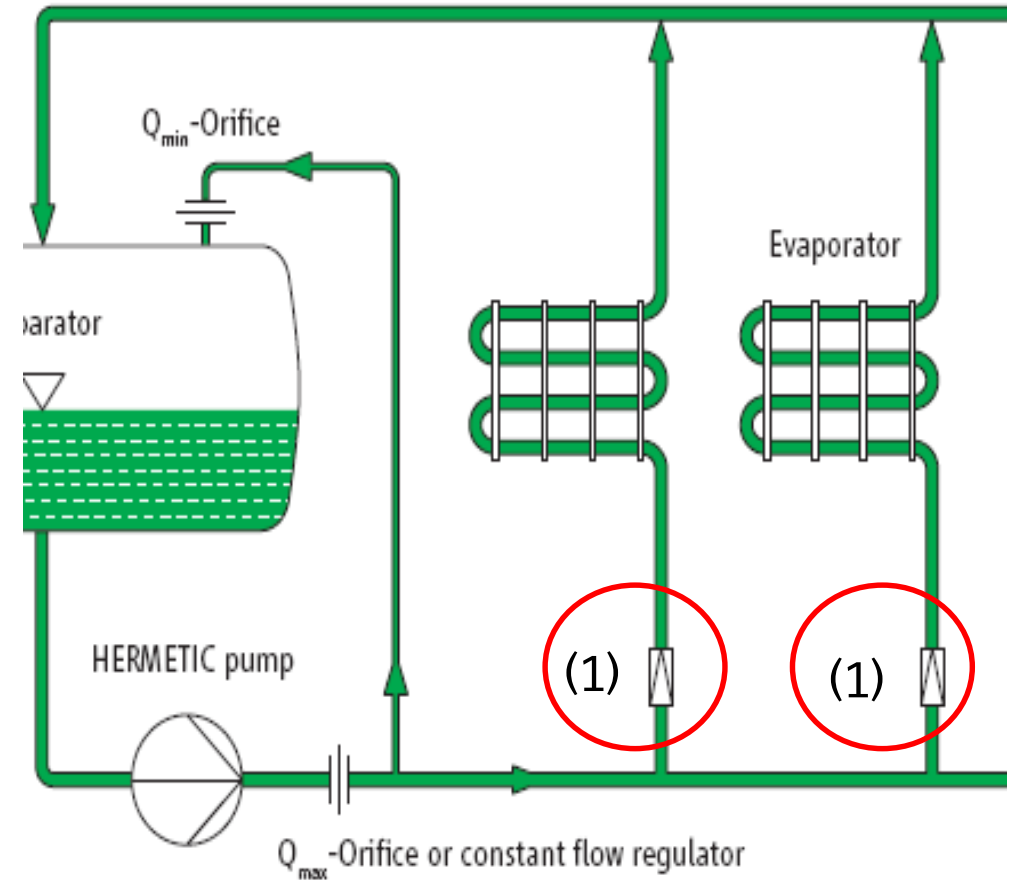


Avoid gas in
the separator



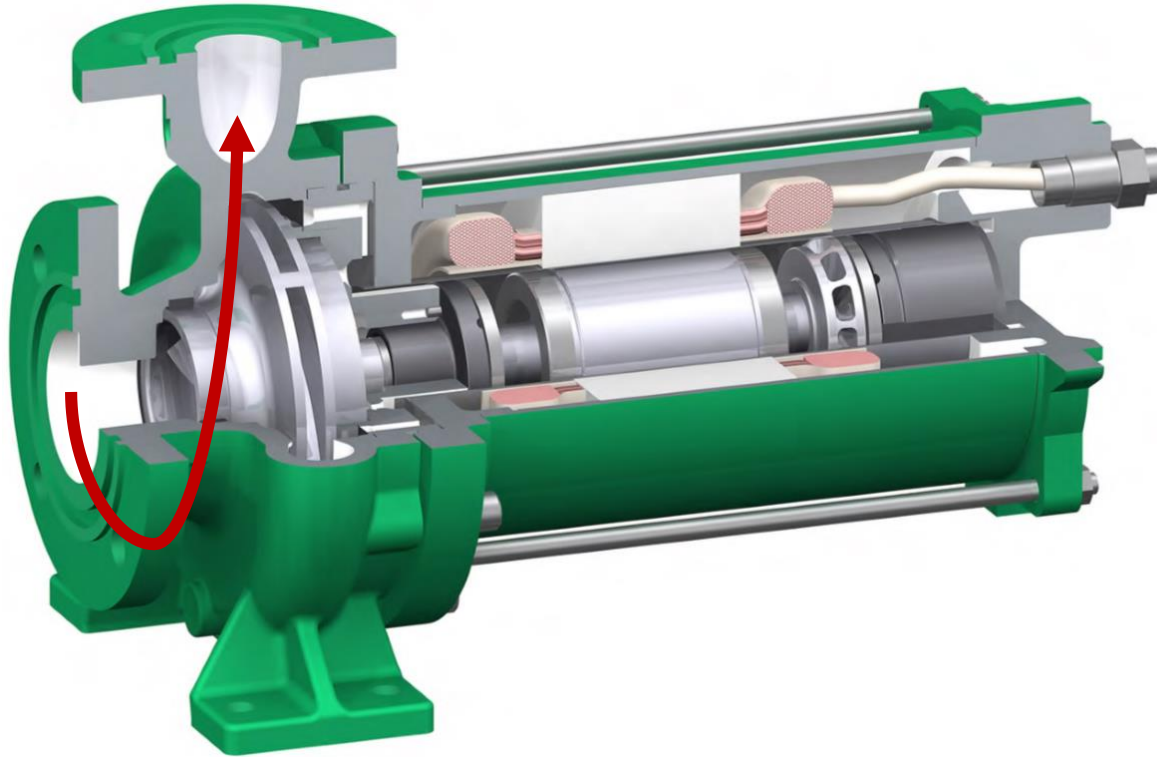
Advantages Qmax orifice / Flow control valve:

1. Continuous resistance pressure
2. Protection against flooding



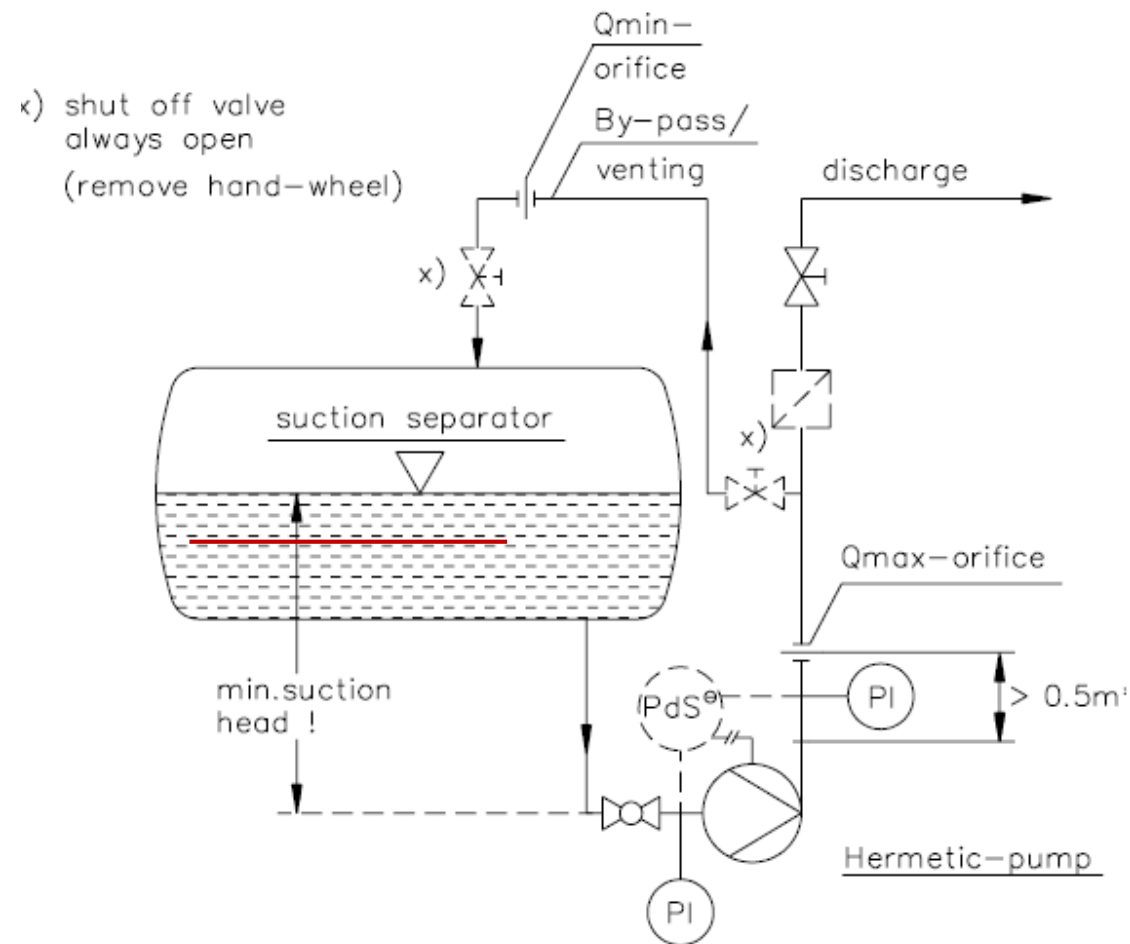


Check the rotational direction of the pump



04

- At standstill: bypass line is used as a vent line
- When restarting or starting-up for the first time, wait until all pump parts have cooled down to operating temperature
- Caution when opening check valves at the pump outlet: Bypass line must be installed before the check valve to enable automatic venting.
- Important: a check valve must not be used in the bypass line





1. The suction line should be as short as possible, in line with the pump
2. No rising suction line allowed
3. Separate suction line for each pump
4. Remove the start-up filter immediately after cleaning the pipes
5. Speed of the liquid in the suction line should be max. 0.3 – 0.5 m/s
6. Install bypass line after Qmax orifice
7. Install bypass line before the shut-off / non-return valve to completely degas the system
8. Return the bypass line to the gas phase of the separator
9. Install the Qmin orifice above the liquid level
10. Provide parallel running pumps with separate bypass lines and separate Qmin orifice



11. Install the Qmax orifice 0.5 m from the pump
12. After stopping operation, let the motor cool down before restarting the pump (5-10 minutes) to enable degassing.
13. After a fast pressure drop in the separator, cavitation can take place in the pump.
14. Check the direction of rotation by reversing the phase. The circuit with the higher differential pressure is the right one
15. Use thermistor for winding protection
16. Install differential pressure measurement with shutdown 10-15 sec. delayed before Qmax orifice
17. Avoid excessive forces and moments in the suction and discharge lines
18. Flush the lines before commissioning

Webinar series during the Chillventa 2020

- Please have a look to our roundtables for other webinars to technical basic knowledge and our pump selection tool
- There will also webinars in other languages available soon – Russian, French, Spanish and Dutch are planned

Thank you

Your Trainer: Adrian Schaefer
Product- and Application Manager
HERMETIC-Pumpen GmbH
Schaefer.adrian@hermetic-pumpen.com

Follow us on 

**Thank you for your
attention.**

**CONNECTING
EXPERTS.**

