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Chillventa Specialist Forums 2022
Chillventa Fachforen 2022

CONNECTING EXPERTS.

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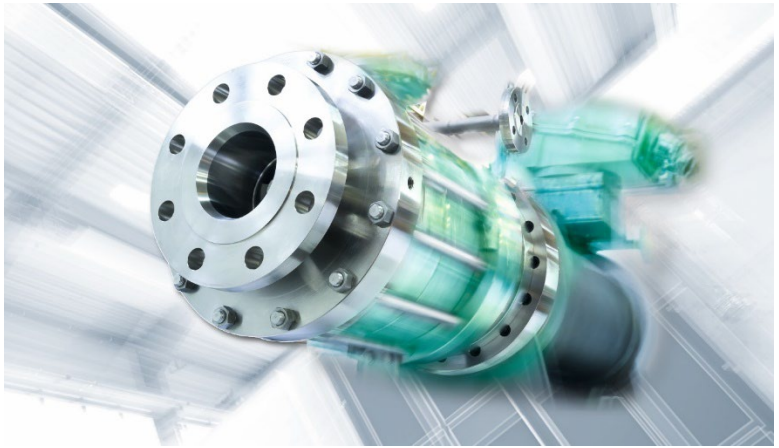

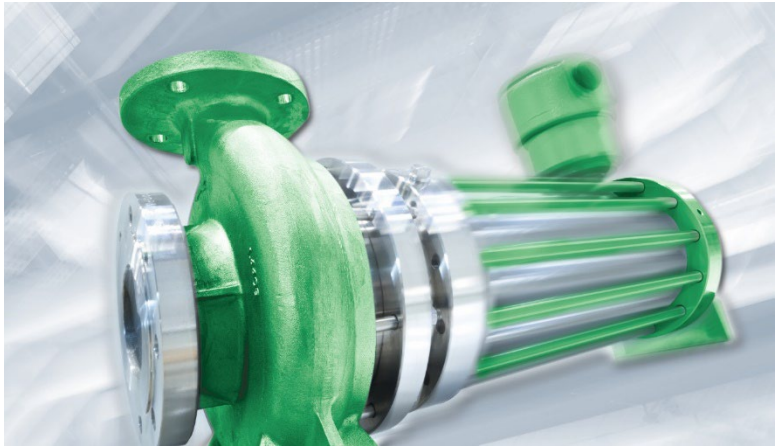

HERMETIC-Pumpen GmbH

Canned Motor Pumps for natural refrigerants

Sealless Technology Unlimited

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Agenda

- Natural Refrigerants – Properties and Specific considerations
  - Natural Refrigerants
  - Properties and specific considerations
  - Applications
- Why Canned Motor Pumps?
  - CMP, MDP, Pumps with single and double mechanical seals
  - Benefits of CMP
- Cavitation
  - What is cavitation?
  - Most common mistakes and how to avoid it
  - Selection Software

Market Outlook – Expectations for different refrigerants

	Ammonia	CO2	HFCs	Other
2017	9	4	2,5	2,5
2018	9,5	4,5	2,5	2,5
2024	12,5	6,5	2,5	2,5

Largest growth for CO2 (appr. 7%/per year until 2024)

Main refrigerant still NH3 (appr. 5% per year until 2024)

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Properties NH3:

- R717
- Global Warming Potential (GWP) = 0
- Density (0°C) = 638.6 kg/m3
- Spec. Heat (0°C) = 4.616 kJ/kgK
- Vapor pressure (0°C) = 0.429 Mpa / 60 pisa

Advantages	Disadvantages
+ Efficient, good heat transfer	- Toxic / intense smell
+ Boiling Point (-33,3°C)	- Flammable
+ Low overall pressure design of the installation	- Chemical reaction with cooper and CU-alloys
+ low cost	- High installation cost based on mandatory required safety instrumentation

CO2 – as natural refrigerant

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Properties CO2:

- R744
- Global Warming Potential (GWP) = 1
- Density (0°C) = 927.4 kg/m3
- Spec. heat(0°C) = 2.542 kJ/kgK
- Vapor pressure (0°C) = 3.485 Mpa / 500 psia

Advantages	Disadvantages
+ Low gobal warming potential	- High pressure installations
+ Not hazardeous to product in case of contact	- Expensive installation
+ Low pressure/compression ratio	- Operating conditions can be close to critical (triple) point
+ Low cost	

Typical installations

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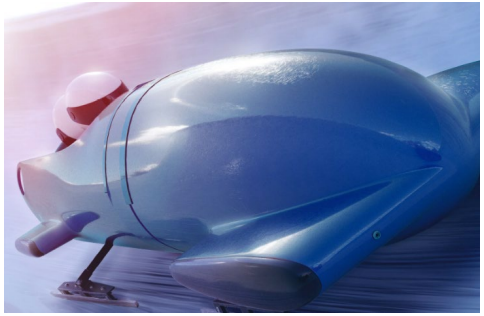


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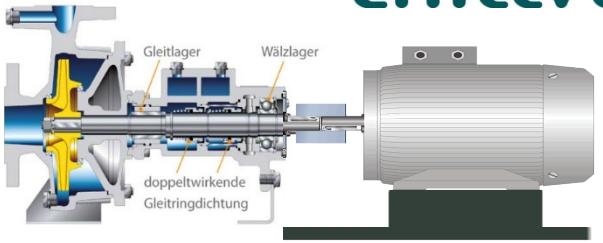
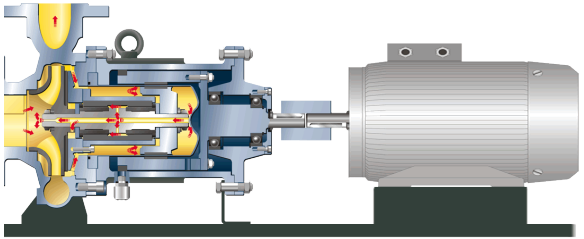
Types of centrifugal pumps

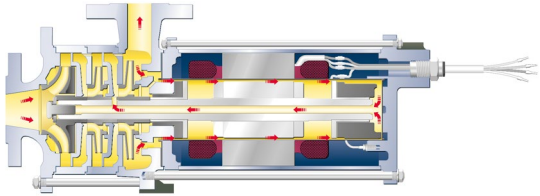
- Centrifugal Pumps with double mechanical seal



- Magnetic coupled pumps

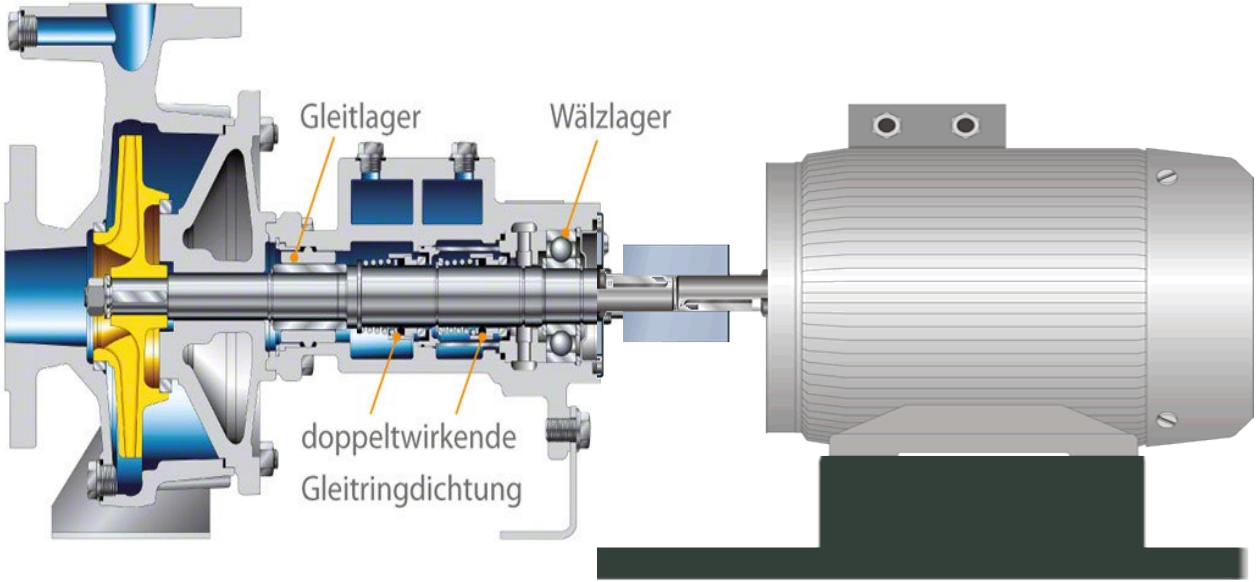


- Canned Motor Pumps



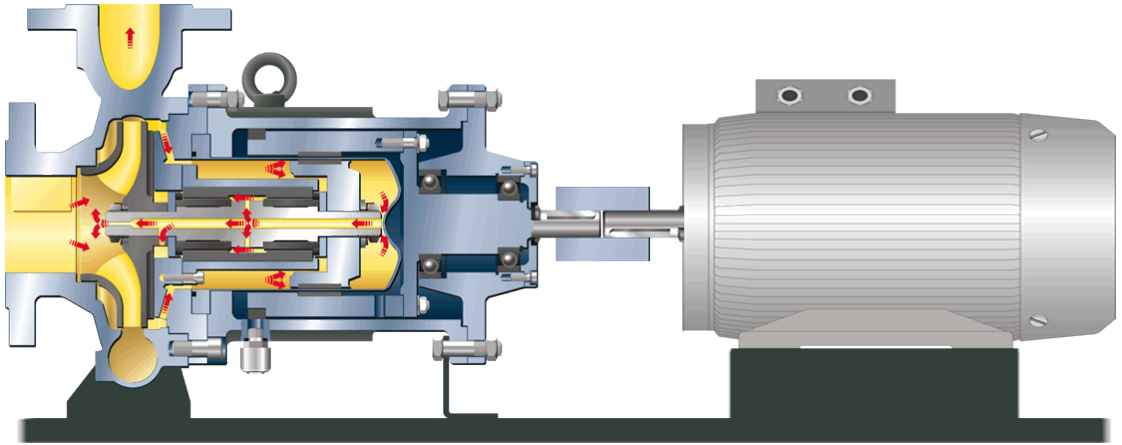
Types of centrifugal pumps

- Centrifugal Pumps with double mechanical seal



Types of centrifugal pumps

- Magnetic coupled pumps



Types of centrifugal pumps

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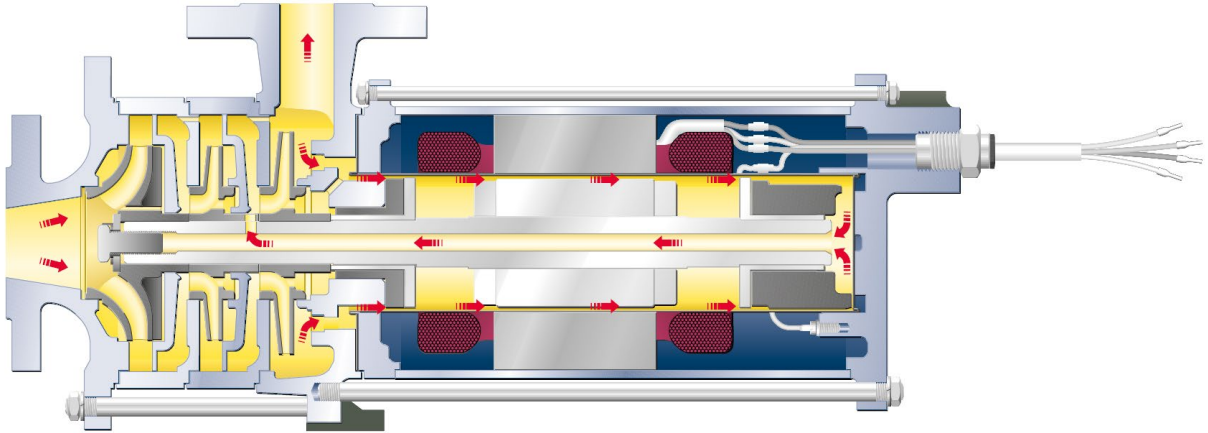
- Canned Motor Pumps



Comparison of pump types – for natural refrigerants

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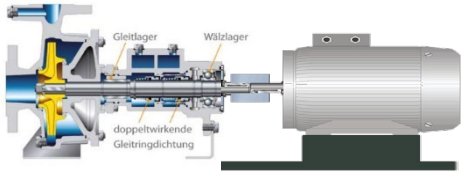
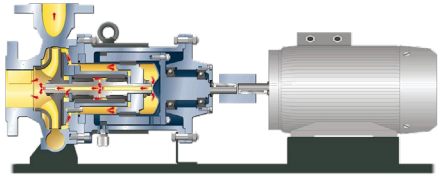
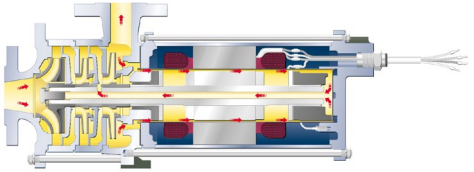






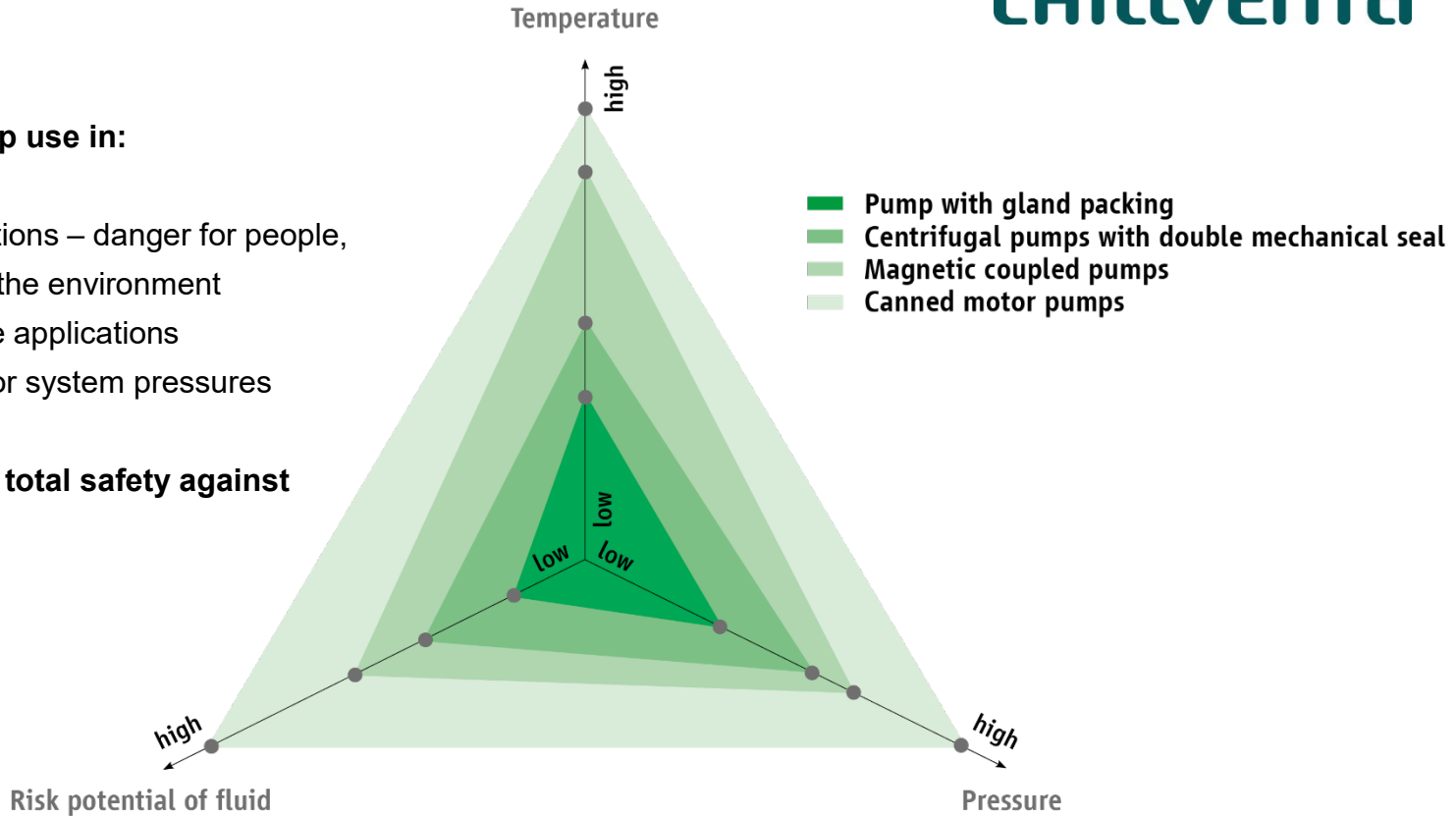
	Pump with double mechanical seal	Magnetic coupled pump	Canned motor pump
Benefits	+ Initial cost low (without installation) + Cheap wet end, big selection + Lowest heat input to liquid (no motor cooling)	+ External motor is cheap + Cheap change of motor unit + Increased safety	+ Maximum safety (secondary containment) + Lowest LCC + Compactness + Easiest installation + Resource-saving
Disadvantages	- Highest risk pump for leaks - Highest maintenance cost and efforts - High maintenance cycles - Largest footprint - High installation cost and efforts	- Initial cost and lifecycle costs are between seal and canned motor pumps - Maintenance intervall range between seal and CMP as well - Performance drop through many interfaces - Liquid cooling adds heat to the process	- Highest cost for pump - Losses through can - Liquid cooling adds heat to the process

Safety – Environmental safety

Canned motor pump use in:

- High risk applications – danger for people, installations and the environment
- High temperature applications
- High differential or system pressures

2nd containment for total safety against medium leakage



MTBF Drive Total cost of ownership

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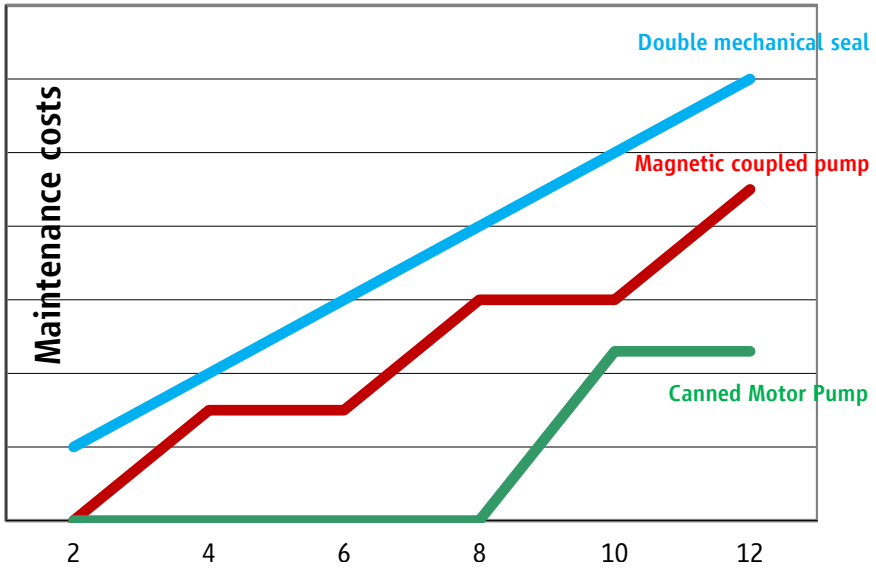
Small companies and large corporations have experienced now for 60+ years that CMP Technology and MTBF are lowering operation cost and reduce material resources.

Sealing system	MTBF	Costs
Double mechancial seal	2-3 years	Appr. 1000 EUR
Magnetic coupled pumps	4 years	Appr. 1500 EUR
Canned motor pumps	8 – 12 years	Appr. 2300 EUR



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Benefits of hermetic CMP

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+ Proven Technology with 50+ years experience
+ Easy and fast to select
+ Short delivery times
+ Emergency stock and service team
+ Large pump portfolio (Standard + ETO)
+ Suitable for ALL refrigerants
+ Best in price and performance
+ Global support and service network

+ Secondary containment, leakfree
+ Low Life Cycle Costs
+ Small footprint
+ Long lasting
+ Low maintenance
+ Resource-saving

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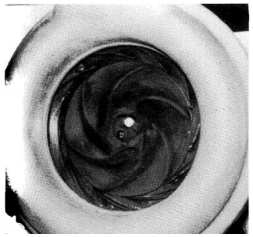
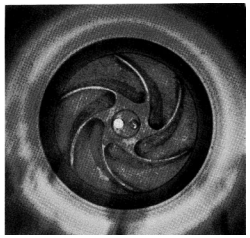
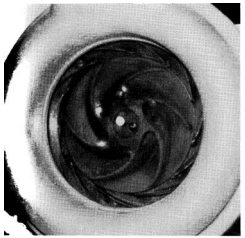
Cavitation - Process



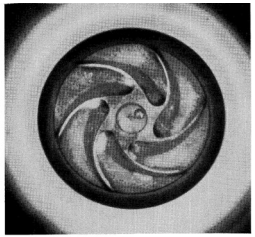
1. Absolute flow picture



Relative flow picture



2. Absolute flow picture



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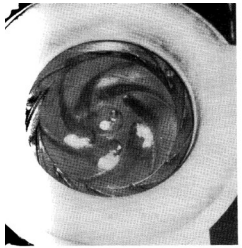

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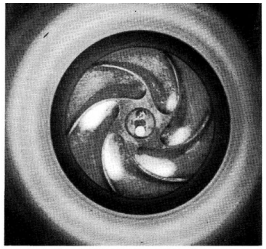

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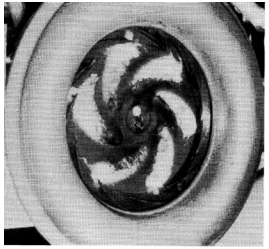

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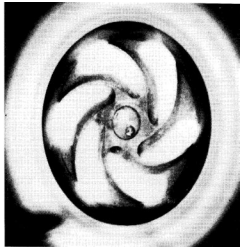

Relative flow picture

Pressure peaks of imploding bubbles lead to material erosion

Cavitation erosion on the diffuser of a multistage centrifugal pump

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.

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- **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

Pump failure through suction-side causes

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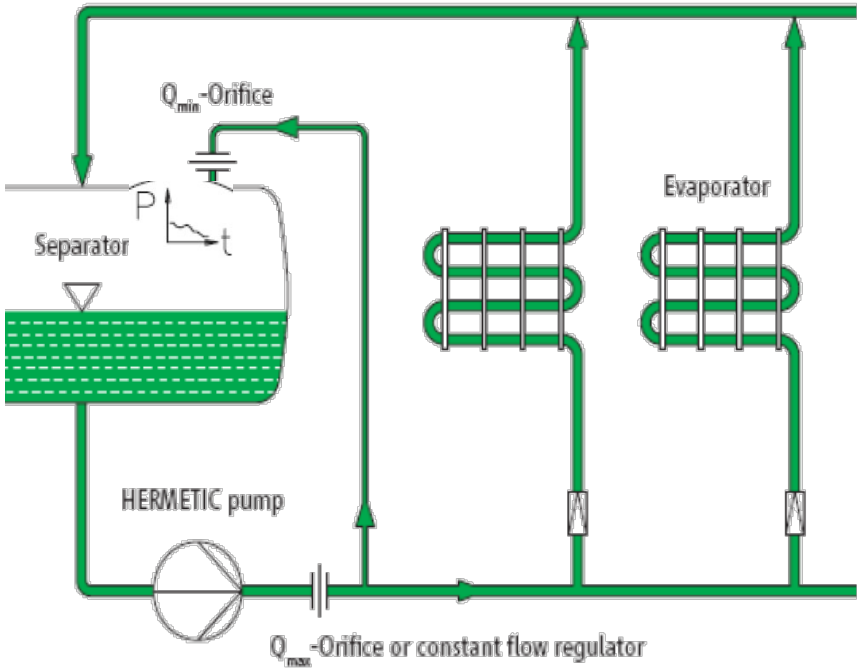
1. NPSHA < NPSHR
2. Pipe diameter too small
3. Conveying speed in the suction pipe too low or too high
4. Poor degassing
5. Pressure reduction speed too high
6. Filter in suction line
7. Incorrect installation at separator



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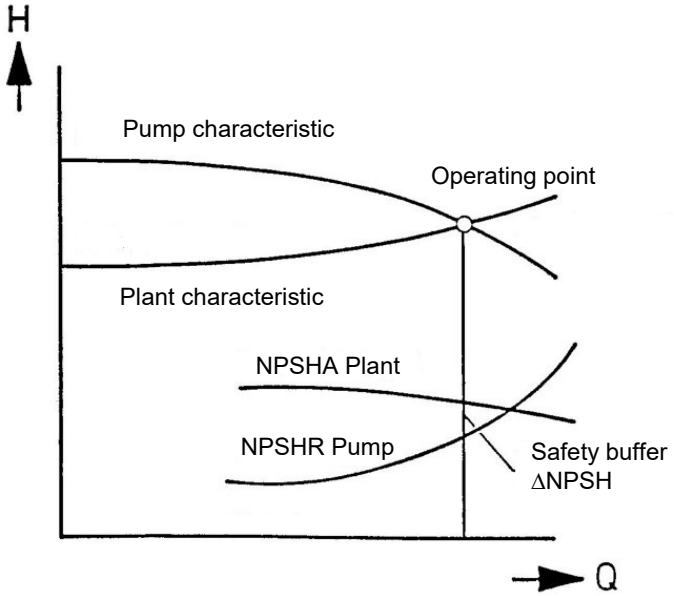
NPSHA > NPSHR

Important:

- Minimum: NPSHA >= NPSHR + 0,5 m
- Check the operating point → Avoid shifts



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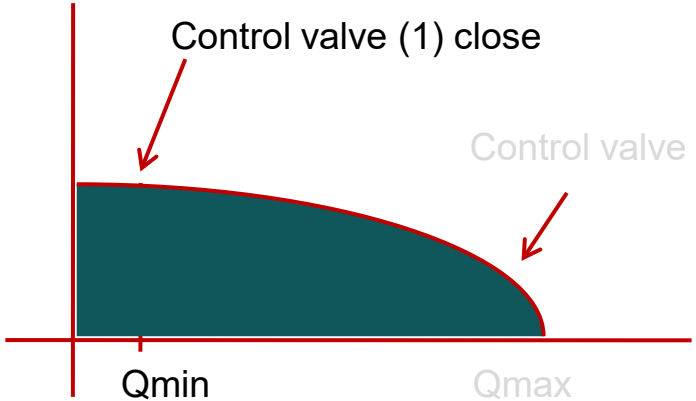
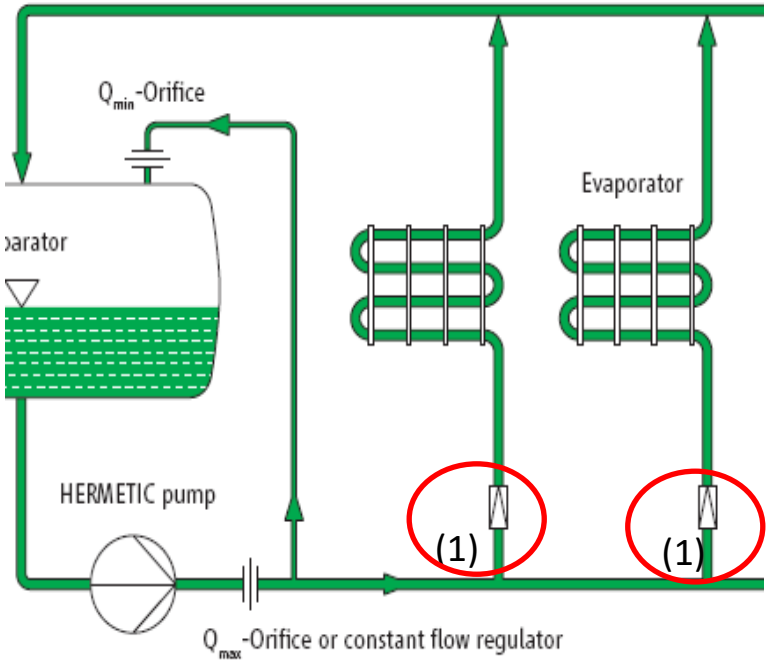
Qmin - Limitation





Advantages of Qmin / Bypass line:

1. Continuous operation
2. Degasing

Installation separator

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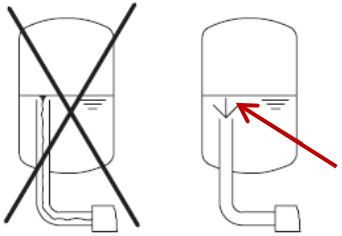
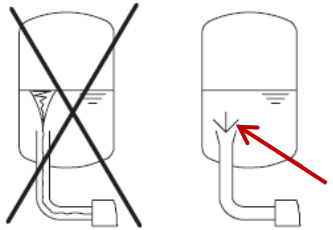
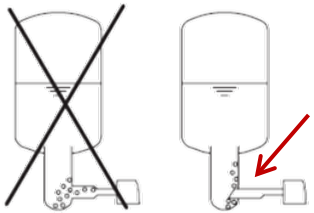


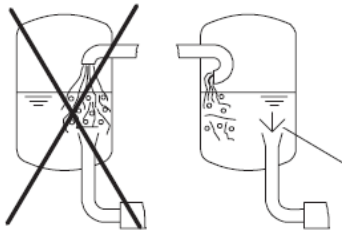
Minimum height to suction line



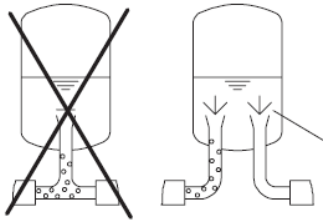
Convex suction line



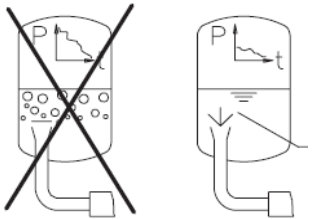
Adjusted across the top for suction line



Courved pipes into separator



Two separate suction lines



Avoid gas in the separator

Pump selection – the easy Hermetic way

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+ Fast selection in a couple of minutes

+ Free selection of refrigeration

+ Online and no software to install

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Thank you very much!

If you have any questions please contact me:

Schaefer.adrian@hermetic-pumpen.com

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