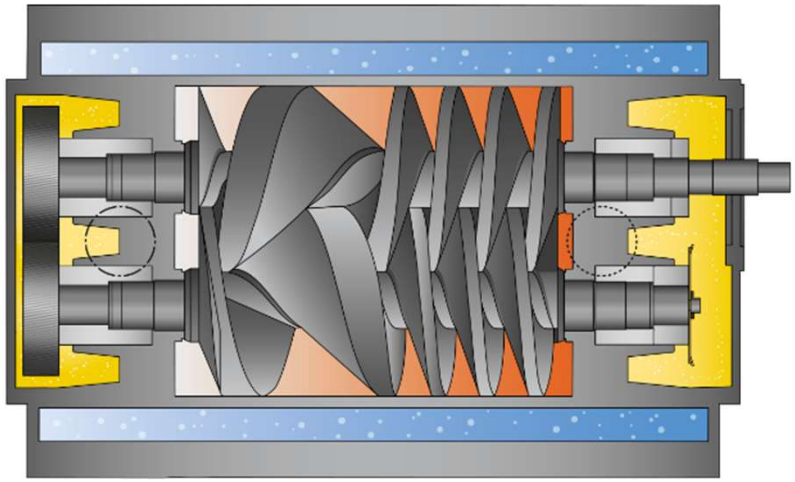
4 COMMON DRY SCREW VACUUM PUMP MISTAKES AND HOW TO AVOID THEM

4 Common Dry Screw Vacuum Pump Mistakes

Inside dry screw vacuum pumps, two screw rotors rotate in opposite directions. The pumped medium is trapped between the cylinder and the screw chambers. There, it is compressed, and transported to the outlet. During this process, the screw rotors do not get in contact with each other or the cylinder.



4 Common Dry Screw Vacuum Pump Mistakes

1. LOW PUMPING SPEED
2. ISSUES ON START-UP
3. CORROSION
4. OVERHEATING

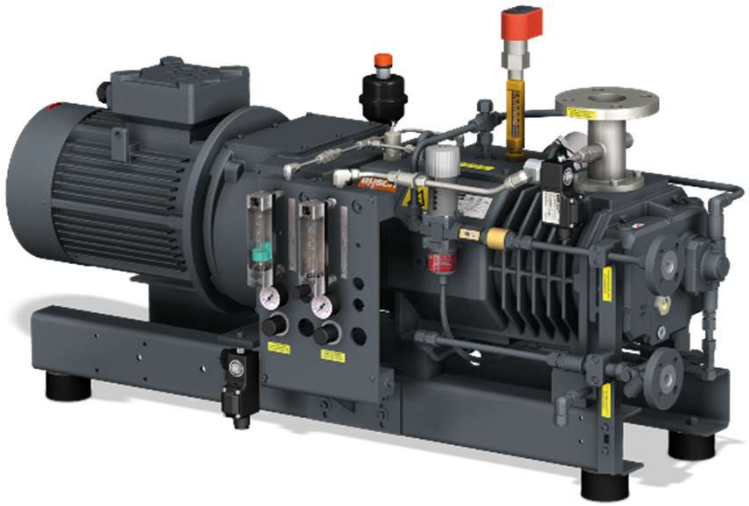
1. LOW PUMPING SPEED

1. Low Pumping Speed

Incorrect Pumping Speed → Reasons

Incorrect pumping speed often results from:

- Restriction on inlet piping
- Leak in the installation
- Faulty pump

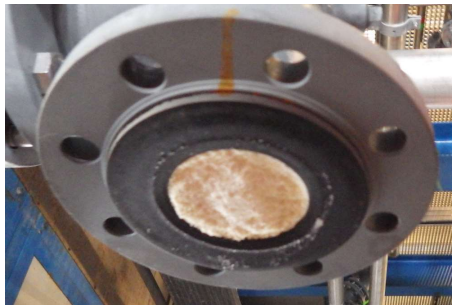


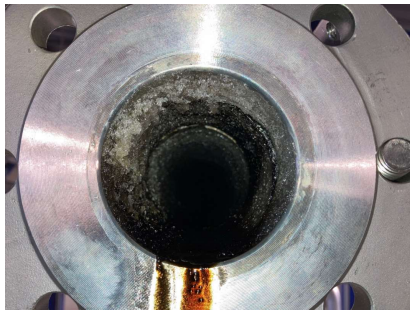
1. Low Pumping Speed

Incorrect Pumping Speed → Restrictions

Restrictions can be due to:

- Blocked flame arrestors (inlet)
- Valve stuck and not fully open
- Chocked filter
- Pipes too small





Finding the restriction:

Process of elimination – Start furthest away and work back to the pump

1. Low Pumping Speed

Incorrect Pumping Speed → Leak

Several elements can lead to leaks:

- Leak on pipework
- Filter drain valve left open
- Faulty seal
- Restricted valve – compressed air supply closed

Process of elimination:

- Start furthest away and work back to the pump

1. Low Pumping Speed

Incorrect Pumping Speed → Faulty Pump

Pump can also be faulty:

- Corrosion
- Coating peeled off
- Seal failure
- … …

Check the power consumption of the vacuum pump at ultimate pressure.

At the same time do a pressure rise test in the installation.

2. ISSUES ON START-UP

2. Issues on Start-Up
Pump Blocked on Start-Up - Reasons

Apart from the obvious (no power, safety button off…), usually due to solid deposit inside the pump resulting of:

- Insufficient protection from contamination during process
- Insufficient cleaning procedure before shut-down
- Backflow during standstill

2. Issues on Start-Up

Pump Blocked on Start-Up – Quick Fix

Among the possible solutions:

- Turn the rotors by hand.
- Soak the pump in a suitable solvent, drain before trying again by hand.
- If the deposit can be melted (e.g. fat), try to lower the pressure steam.

2. Issues on Start-Up

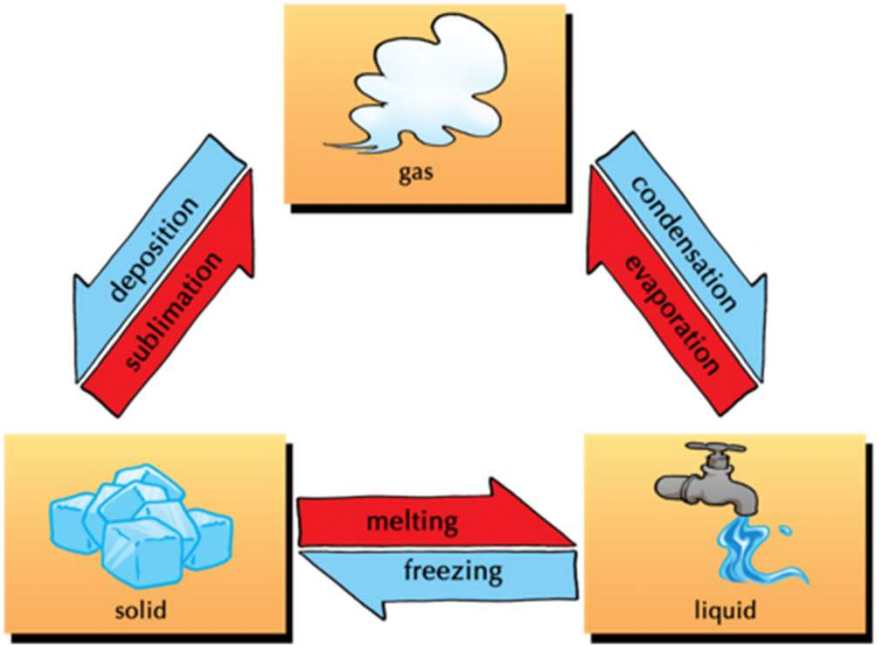
Pump Blocked on Start-Up – Pump Protection

Solution Principle:

Prevent the damaging stuff from reaching the pump.

Damaging stuff can come in 3 different phases:

- Solid → Filtration
- Liquid → Knock-out pot / demister
- Gas → Condense / Trap (if possible)



2. Issues on Start-Up
Against Solids → Filters

Principle: Protects vacuum equipment from ingestion of solid materials.

Action: Remove particles from gas stream to avoid unwanted accumulation/reactions in the pump.

Remarks:

- Types: single/double stage, reverse pulse
- Need to have the right pore size.
- Cleaning / discharging need to be planned.
- Material of construction, pressure drop measurement

2. Issues on Start-Up

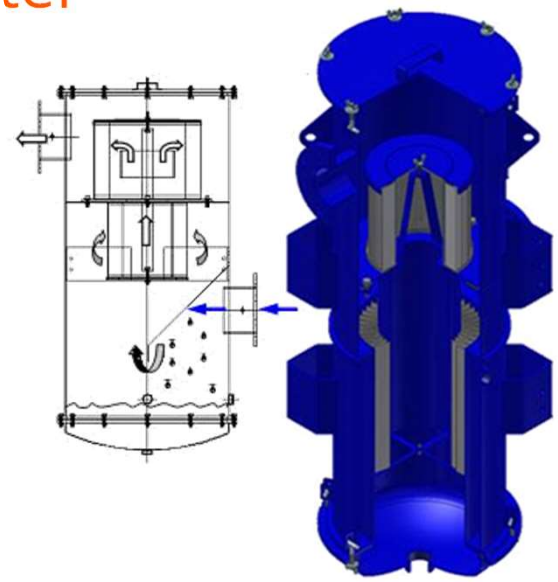
Against Liquids → Knock-out pot / Demister

Principle: Remove liquid carry over form stream by physical action (remove velocity, coalescence).

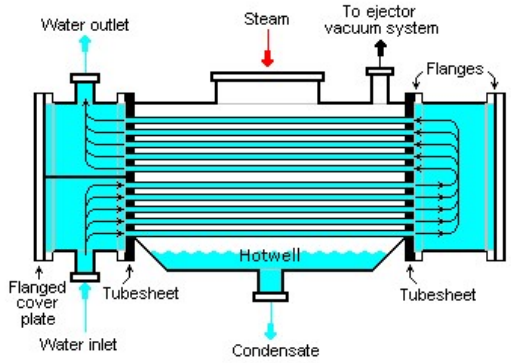
Action: Remove liquids from gas stream to avoid unwanted accumulation/reactions in the pump.

Remarks:

- Can be coupled or integrated with a cooler / condenser unit.
- Cleaning / discharging needs to be planned.
- Material of construction needs to be adapted.



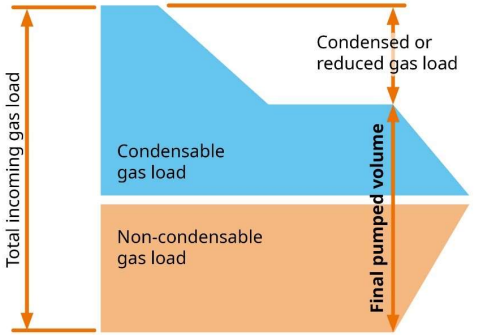
2. Issues on Start-Up
Against Gases → Condensers



Principle: Remove condensibles by liquifying them

Actions:

- Remove condensibles from gas stream
- Avoid unwanted accumulation/reactions in the pump
- Reduce required pumping speed



Remarks:

- Can be installed before and after the pumping unit or between stages.
- Cleaning needs to be planned (avoid fouling).
- No condenser is 100% efficient (85% at best).
- Consider pressure drop (recommended <10% operating pressure).

2. Issues on Start-Up

Pump Blocked on Start-Up → Flushing

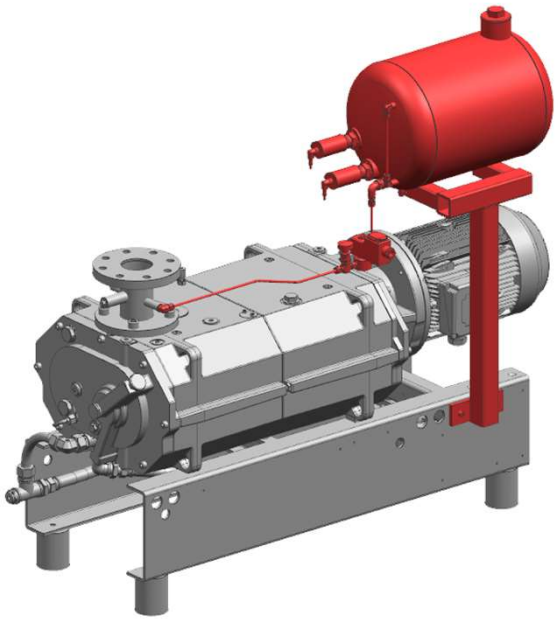
Solution Principle: Injection of liquid at pump inlet

Action:

- Remove liquids and particles by washing away residue.
- Clean the pump to avoid blocking during standstill especially at the end of a campaign.

Operation:

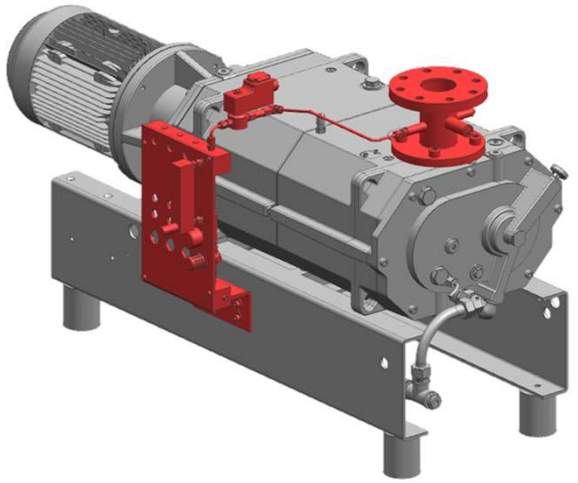
- During the batch: every 5 minutes for 3 seconds
- After the batch: During the shutdown sequence if possible, running at 10 Hz, 0.5 l/min.
- Need a purge afterwards!!



2. Issues on Start-Up

Pump Blocked on Start-Up → Purge

Principle: Injection of nitrogen at pump inlet



Action:

- Dry and inertize the pump before the batches.
- Remove residual liquids before shut-down.

Operation:

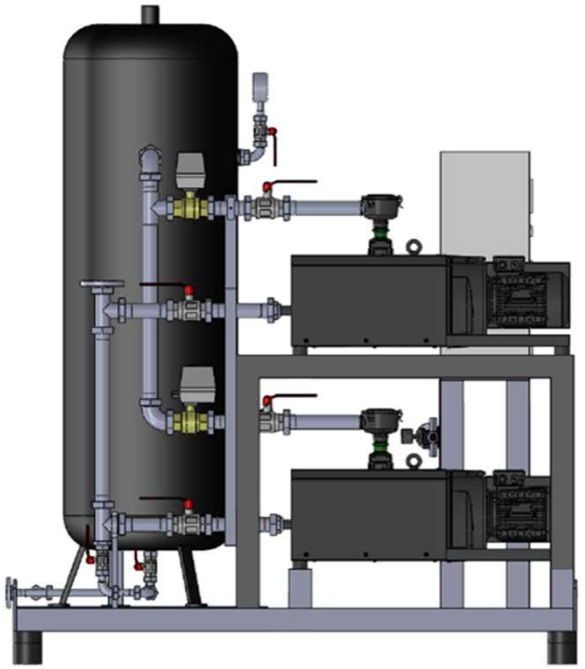
- Run the pump with a closed inlet flange and the purge gas open for 15-30 min.

2. Issues on Start-Up

Pump Blocked on Start-Up → Liquid Back Flow

Reasons:

- Other pumps on the same exhaust header.
- No isolation valve at the exhaust. Check valve is good only for short term protection.
- Pressure equalization through exhaust, allowing back flow of liquid to pump internals. → purge before stop
- Incorrect exhaust discharge pipework arrangement, vertical pipework without catch-pot on exhaust allowing condensate to flow back into pump.
- Liquid accumulation in silencer → remove it or drain it.



3. CORROSION

3. Corrosion

Corrosion – Definition

Corrosion is the transformation of a material to its more stable oxide.
Usually it is observed for metals.

An example of corrosion is rust. Another is the protective layer you get on aluminium.

It happens when unprotected metal is exposed to an oxidant (mostly oxygen) for a long time.

Some chemicals facilitates the corrosion of the pump material (HCl, HBr, moisture).

For dry and oil-lubricated pumps, corrosion starts with condensation inside the pump.

3. Corrosion
Tips & Tricks

The main idea is to keep the dry pumps free of condensates. This can be achieved by:

- Protect the pump during process: Efficient condensation system
- Prevent condensation:
  → Warm pump (Warm-up, right operating temperature)
  → Using dilution gas
- Clean the pump:
  → Flush during batch if condensation cannot be avoided and/or long batch
  → Liquid flush after the batch
- Protect the pump during standstill
  → Isolate the pump by closed inlet and exhaust valves

Keep in mind that pipes can be very efficient condensers:

→ Install a catch pot before going up at pump exhaust

3. Corrosion
Pump Position

A liquid ring pump should be kept with its liquid inside (about half full):

→ Installed at the lowest point of the system to allow all liquids to flow in by gravity, the excess being removed through the separator.

A dry pump should be kept dry

→ To be installed at the highest pump of the system to allow the natural flow of liquid out of the pump.

When replacing a liquid ring pump by another technology:

→ To be installed on the top position of a system to facilitate drain and to avoid sucking of condensates.

4. OVERHEATING

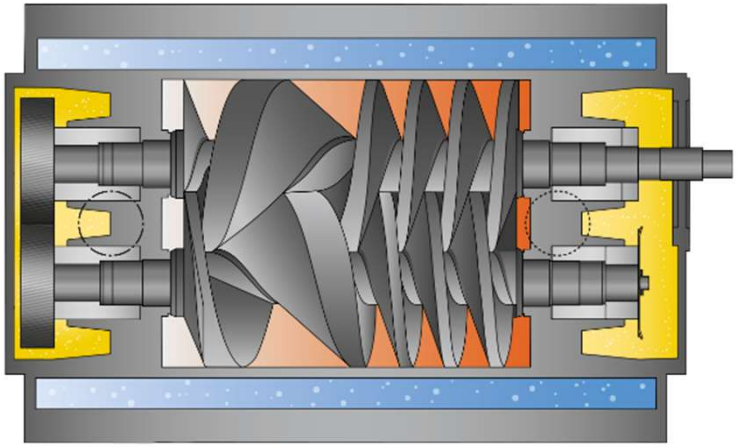
4. Overheating

Overheating → Reasons

Overheating often results from:

- Cooling issues
- Back pressure
- Wrong temperature control setting
- Incoming gases temperature

  →Follow the instruction manual



4. Overheating

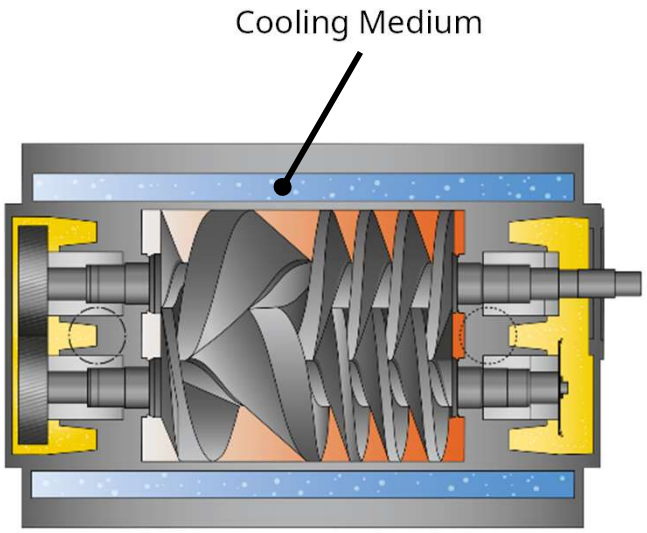
Overheating → Cooling

Main cooling issues:

- Insufficient Cooling Supply:
  → Blocked/restrained cooling circuit by deposit
  → Cooling liquid pressure and/or flow too low

- Cooling liquid too warm

- Incorrect cooling liquid (100% glycol is less efficient than 50/50 mix of Water & Glycol)

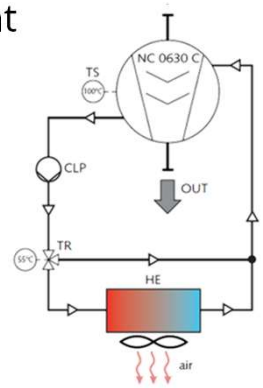


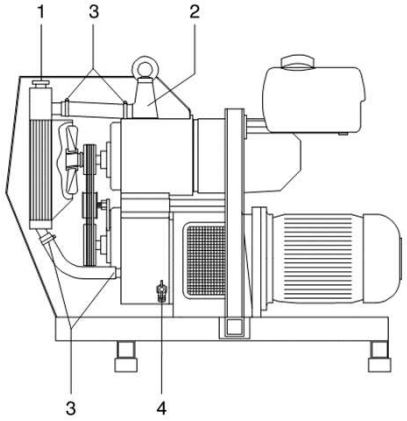
4. Overheating
Radiator Cooling

Advantage: No expensive cooling water required

But:

- Heats up the environment (attention with closed rooms!)
- Pump temperature depends on ambient temperature



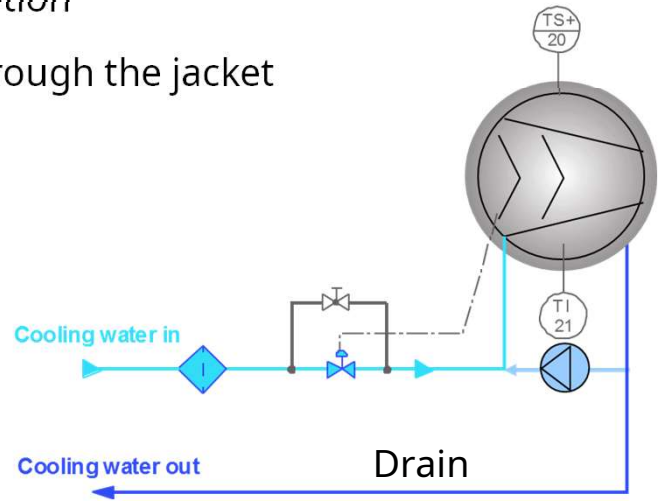


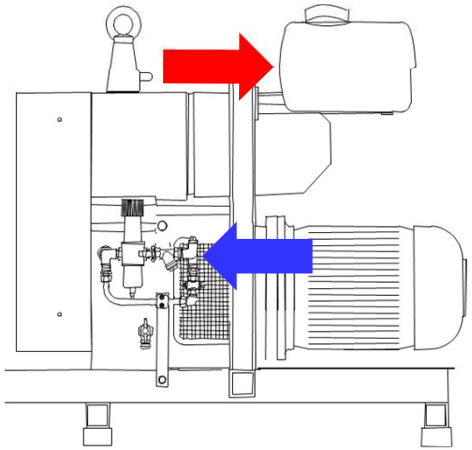
4. Overheating
Direct Cooling

Advantage: No heat up of the environment

But:

- Cooling water consumption
- Cooling water going through the jacket





4. Overheating
Glycol Circuit with Heat Exchanger

Advantages:

- No heat up of the environment
- Only glycol going through the jackets

But: Cooling water consumption

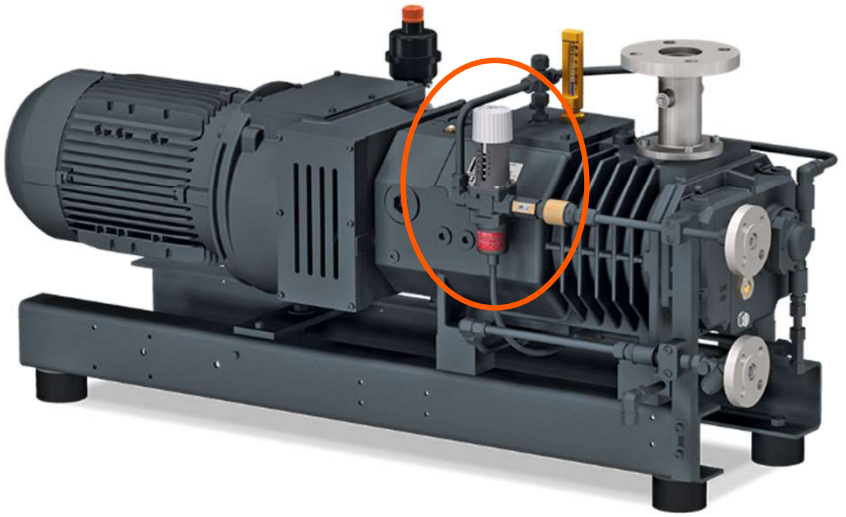
Note: Only available on COBRA

4. Overheating
Back Pressure Reasons

- Blocked flame arrester (outlet)
- Outlet check valve stuck or not fully open
- Liquid accumulation in silencer
- Liquid accumulation into upgoing pipes at exhaust

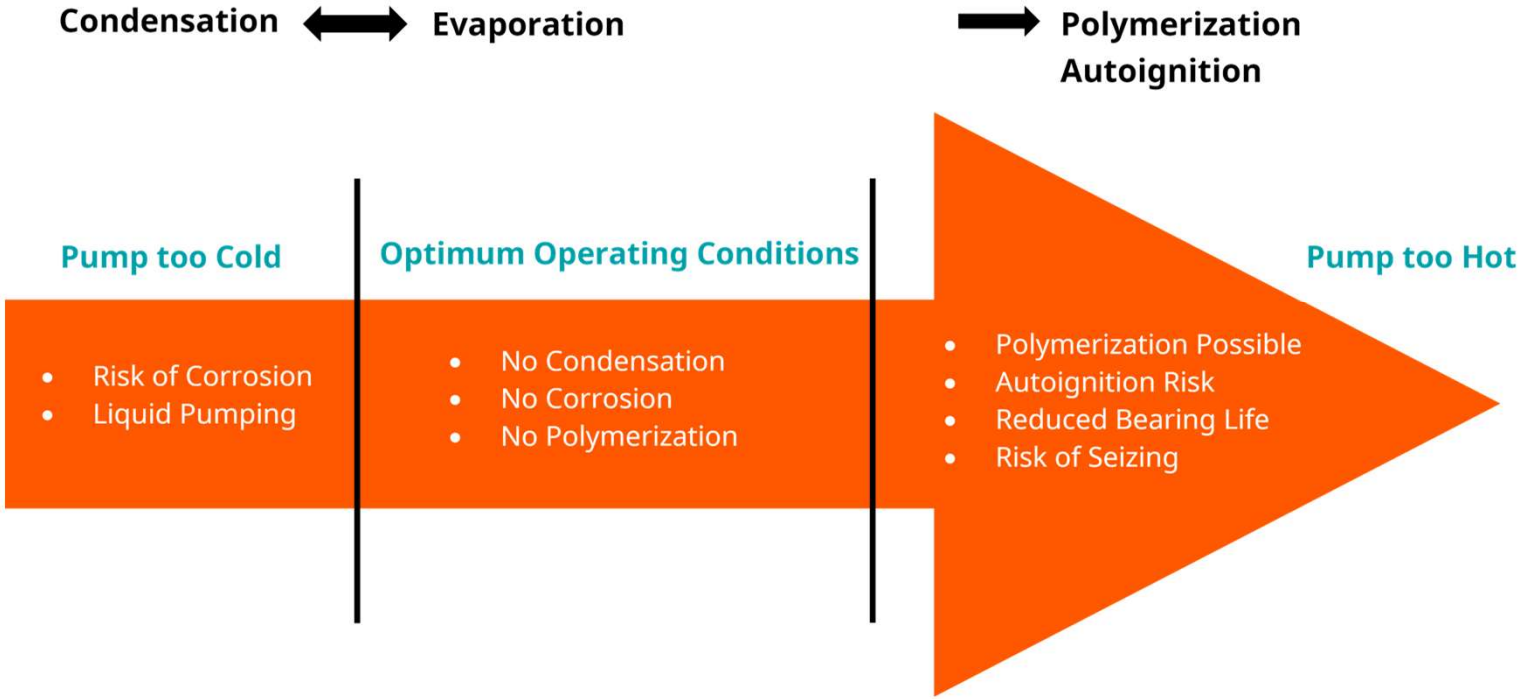
4. Overheating
Temperature Control Settings

COBRA Danfoss valve to be set between 1 and 5 according to process conditions



4. Overheating

Operate in the Right Conditions



CONCLUSION

Conclusion
Goals achieved?

- ➔ In order to have your pump running smoothly it is important to tailor the design and service liquid to your specific process.
- ➔ If you find yourself still having problems we would be happy to send our experienced experts to find the right solution for you.

THE RIGHT PARTNER FOR YOU

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- Busch is known for its efficient vacuum and overpressure technology in all industries.
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