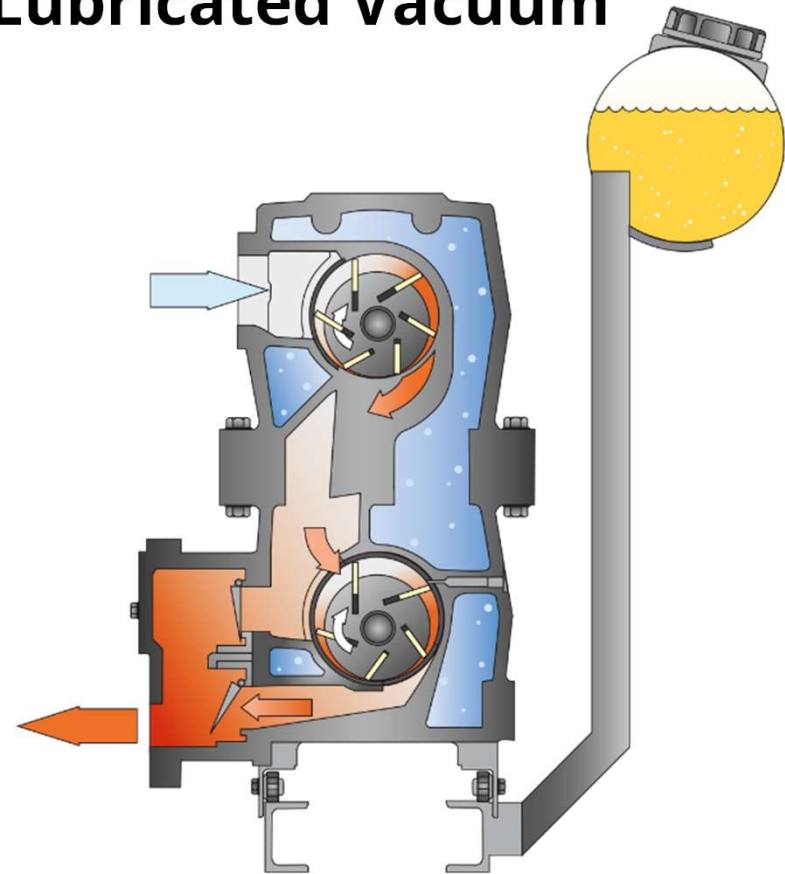




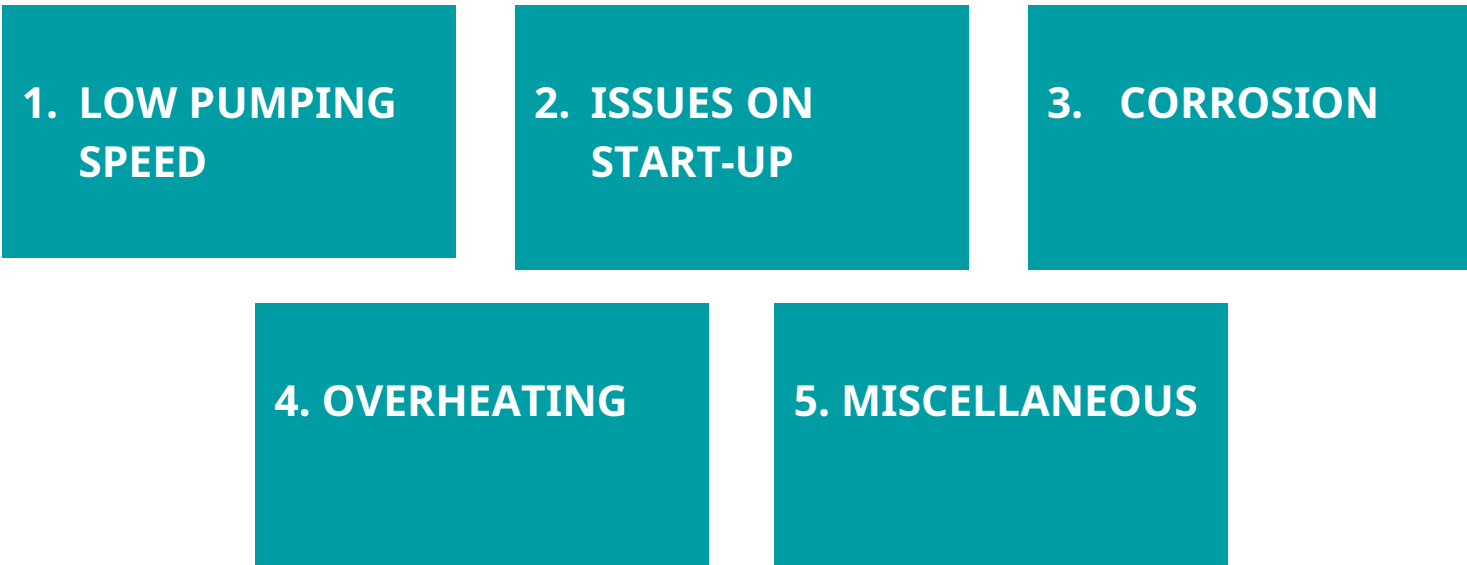
5 COMMON ONCE-THROUGH OIL-LUBRICATED VACUUM PUMP MISTAKES AND HOW TO AVOID THEM

5 Common Once-Through Oil-Lubricated Vacuum Pump Mistakes

Once-through oil-lubricated rotary vane vacuum pumps have a one- or two-stage design. Both stages contain an eccentrically mounted rotor. Due to centrifugal force, each vane slides out and forms a chamber between the vane and the housing. The pumped medium is trapped inside these sickle-shaped chambers. During rotation, the volume of the chamber is constantly reduced. The pumped medium is compressed and transported to the high-pressure second stage, which operates on the same principle.



5 Common Once-Through Oil-Lubricated Vacuum Pump Mistakes



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

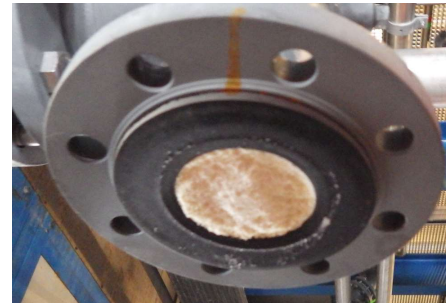


1. Low Pumping Speed

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 due to:

- Corrosion
- Broken vanes
- 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
- Wrong or insufficient lubricant



2. Issues on Start-Up

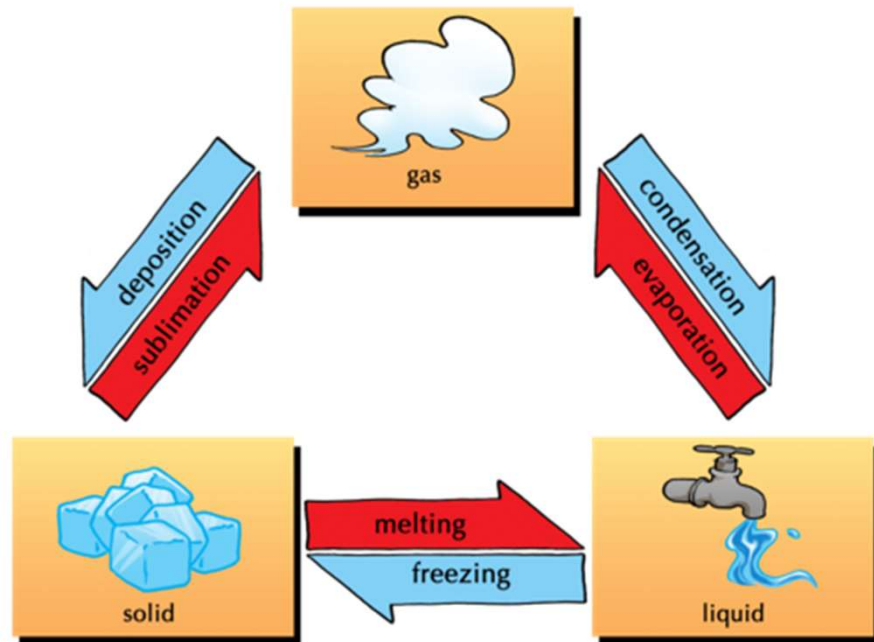
Pump Blocked on Start-Up – Pump Protection

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

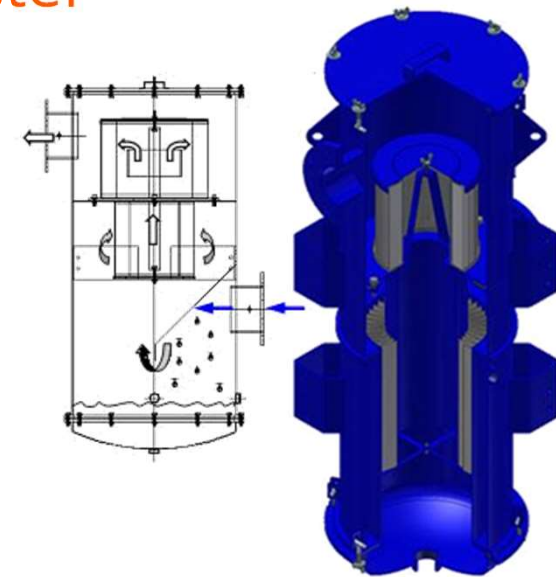
Against Liquids → Knock-out pot / Demister

Principle: Remove liquid carry over from 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

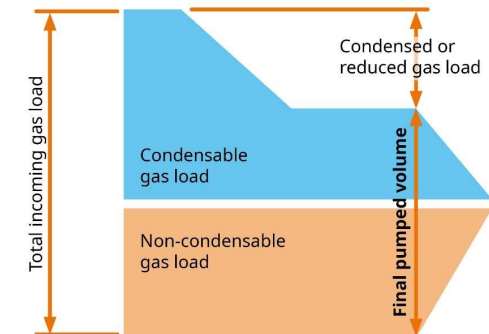
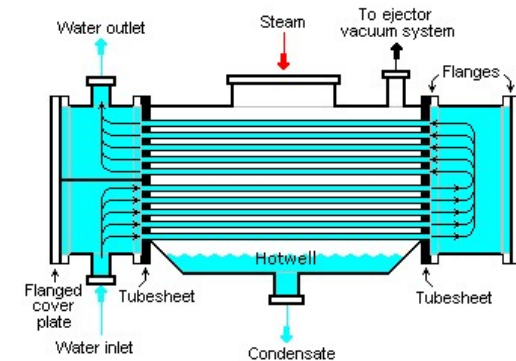
Principle: Remove condensibles by liquifying them

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

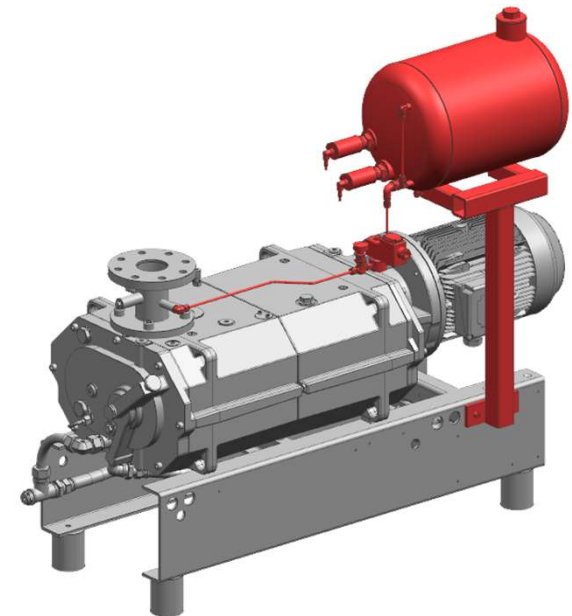
Solution Principle: Injection of liquid at pump inlet

Action:

- Remove liquids and particles by washing away residue
- Cleans 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!!
- On HUCKEPACK: mix 1/3 solvent, 2/3 lubricant to be used

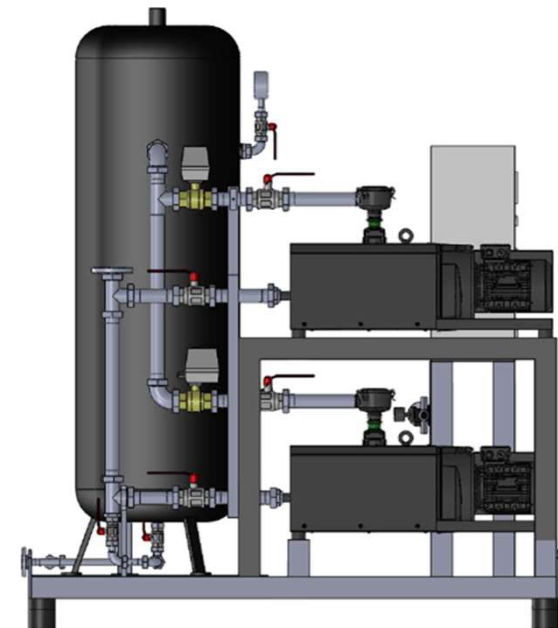


2. Issues on Start-Up

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.



2. Issues on Start-Up

Pump Blocked on Start-Up → Pump Lubrication

Once-through oil-lubricated vacuum pumps have a fresh lubricant system without recirculation.

It needs constant feed of fresh lubricant:

- ~ 0.3 L/h (50 Hz) for HO 0429-0433 F
- ~ 0.5 L/h (50 Hz) for HO 0437-0441 F

Main reasons for failure:

- Oil tank empty → Level sensors!
- Blocked piping
- Faulty oil pump → Oil pump rotation monitoring!
- Wrong settings on oil pump



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 pumps, corrosion starts with condensation inside the pump.



3. Corrosion

Tips & Tricks

The main idea is to keep the oil 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 + gas purge 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.



An oil 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.

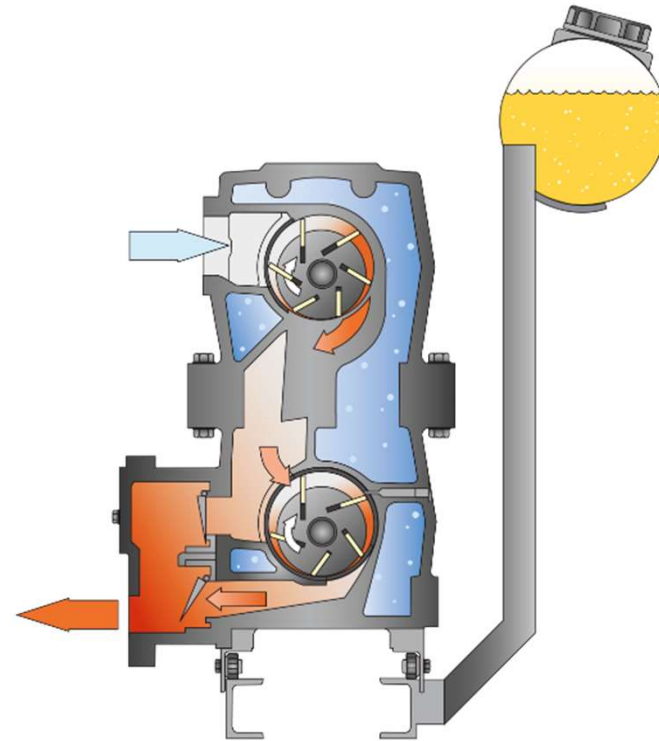
4. OVERHEATING

4. Overheating

Overheating → Reasons

Overheating often results from:

- Cooling issues
- Back pressure
- Wrong temperature control setting
- Incoming gases temperature
→ Follow the instruction manual

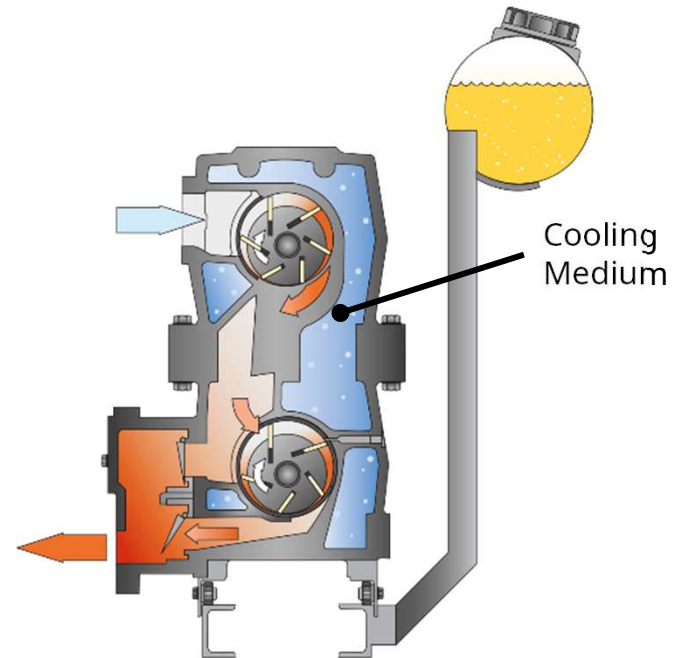


4. Overheating

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

Back Pressure Reasons

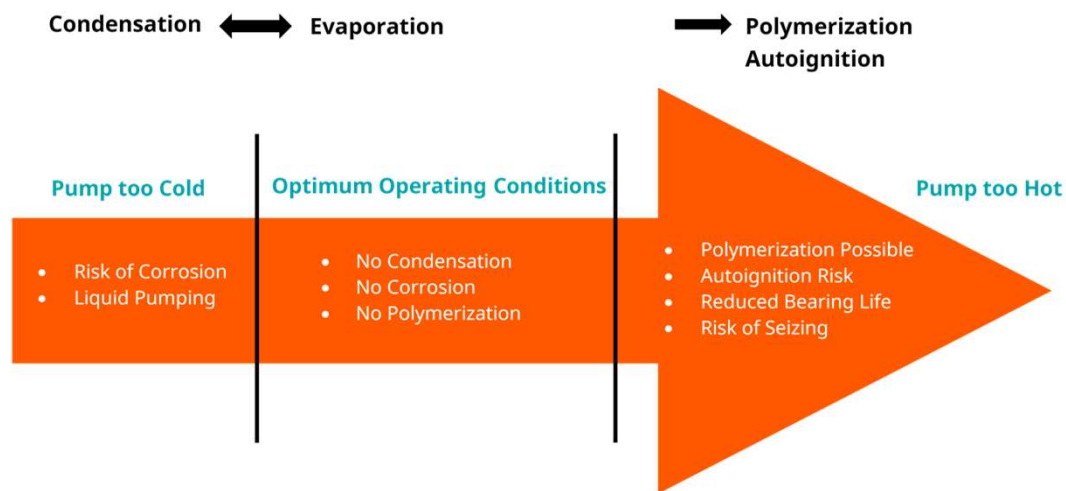
- Blocked flame arrester (outlet)
- Outlet check valve stuck or not fully open
- Liquid accumulation in silencer
- Liquid accumulation into upgoing pipes at exhaust



4. Overheating

Temperature Control Settings

- Once-through oil-lubricated pump jacket temperature between 60°C and 90°C



5. MISCELLANEOUS

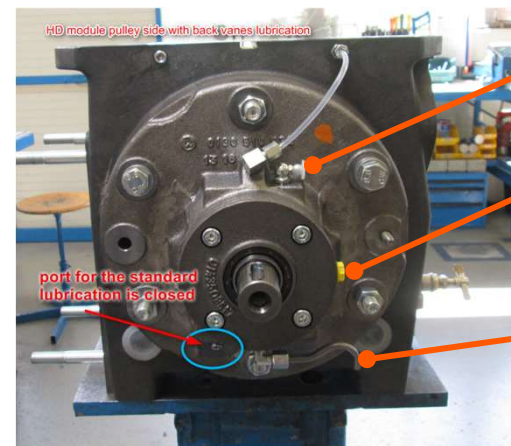
5. Miscellaneous

Tell Tail Pipe – Overuse of Grease

Tell Tail pipe → seal failure indication

During greasing, open the grease overflow cap.

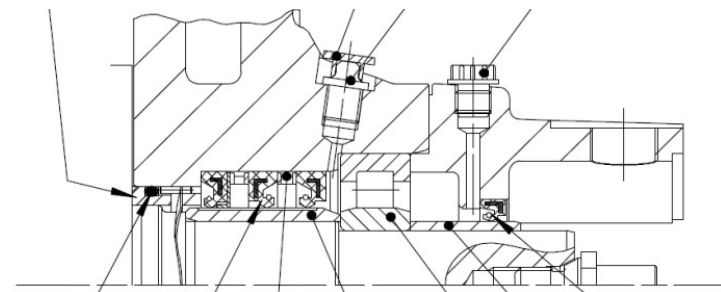
Using tell tail pipe as indication grease overflow leads to seal failure.



Lubricator connection

Grease overflow port
(open it!)

Tell Tail Pipe
(Indicate seal failure)

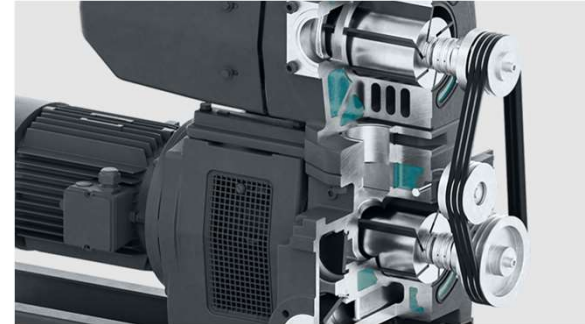


5. Miscellaneous

Broken vanes

Reasons:

- Vane material incompatible with process
→ check selection
- Upper stage: liquid ingestion
→ Demister
- Lower stage: too much condensation
→ Open the gas-ballast valve



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.

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