3 COMMON LIQUID RING VACUUM PUMP MISTAKES AND HOW TO AVOID THEM

3 Common Liquid Ring Vacuum Pump Mistakes

An eccentrically mounted impeller rotates in a housing partially filled with operating fluid. The impeller blades dip into the fluid, and the centrifugal force exerted by their rotation forms a so-called liquid ring. The pumped medium is transported in the spaces between the blades and the liquid ring. The eccentric rotation of the impeller alters the volume of these spaces. Thereby, the gas is drawn in, compressed and expelled. Operation as a compressor is possible.

3 Common Liquid Ring Vacuum Pump Mistakes

1. LOW PUMPING SPEED
2. ISSUES ON START-UP
3. CAVITATION

1. LOW PUMPING SPEED

1. Low Pumping Speed
Introduction

A common issue manufacturers face is finding that their liquid ring vacuum pump (LRVP) is not reaching full capacity. Incorrect pumping speed often stems from:

- **Installation issues**:
  - Restriction on inlet piping
  - Restriction on discharge piping
  - Leak in the installation

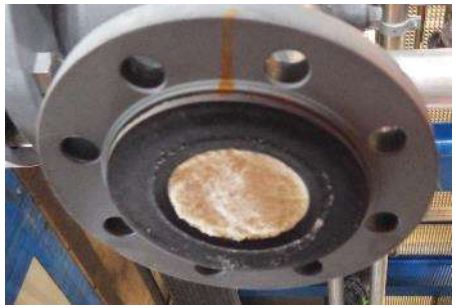
- **Issues from the pump**:
  - Service liquid too hot
  - Wrong or contaminated service liquid
  - Service liquid flow rate (too low or too high)

1. Low Pumping Speed

Incorrect Pumping Speed → Restrictions

Decreased pumping speed can be due to restrictions such as:

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



Finding the restriction:

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

1. Low Pumping Speed
Incorrect Pumping Speed → Leak

Leaks in the vacuum system are another possible culprit.

Check for:

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

Process of elimination:

- Start furthest away and work back to the pump

1. Low Pumping Speed

Incorrect Pumping Speed → Service Liquid

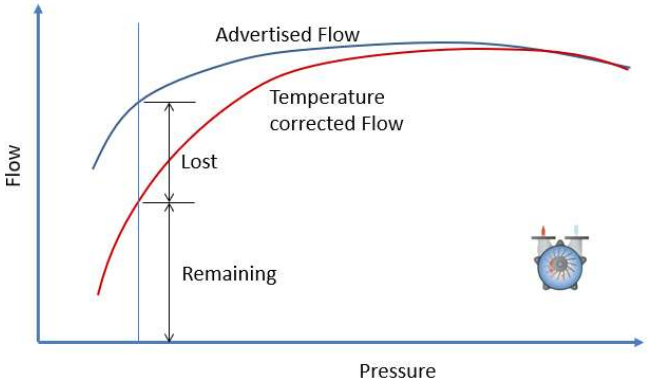
Liquid ring vacuum pumps are dependant on the vapor pressure of the service liquid.

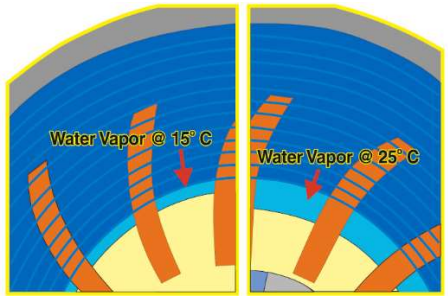
The vapor pressure is linked to:

- The temperature of the service liquid
- The nature and composition of the service liquid

Increase in vapor pressure leads to lower performance.

Most pumping speed curves are based on 15 °C seal water.





1. Low Pumping Speed

Incorrect Pumping Speed → Service Liquid

Main reasons leading to too hot service liquid:

- Not enough recirculation flow:
  - → Recirculation pump needed
  - → Restriction in the circuit (dirty heat exchanger…)
- Insufficient cooling supply (flow, temperature)
- Higher condensation rate (faulty pre-condenser, process upset)
- Increased back pressure:
  - → Check the piping

1. Low Pumping Speed

Incorrect Pumping Speed → Service Liquid

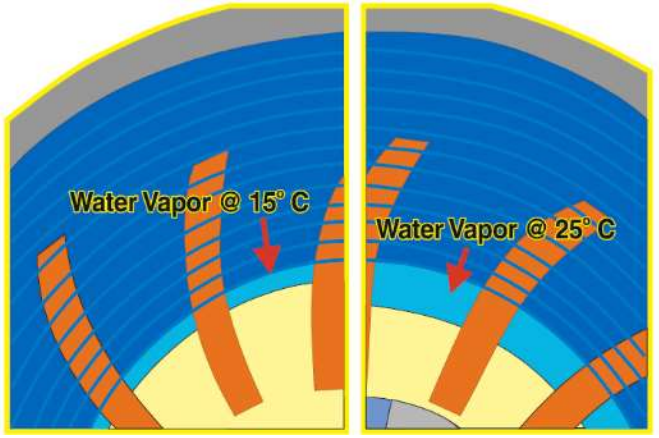
Using the wrong service liquid can greatly effect the pumping speed.

The main reasons for using the wrong service liquid are:

- Wrong selection at the design stage
- Operator mistake
- Contamination by process

The **solution** is to drain and fill the pump with the right service liquid.

For contamination, the purge rate can be adjusted.



2. ISSUES ON START-UP

2. Issues on Start-Up

Pump Blocked on Start-Up – Main issues

Many times, there will be issues at start-up.

Apart from the obvious (no power, safety button off…), issues can include:

- Pump stuck due to corrosion
- Pump stuck due to solid deposit
- Pump flooded
- Noise due to piece of metal broken during shut down turning in the cylinder
- Frozen service liquid or too viscous

2. Issues on Start-Up

Pump Blocked on Start-Up – Corrosion

Corrosion results from a wrong association of:

- Pump construction material
- Service liquid composition
- Process stream

All of the above can be part of the solution.

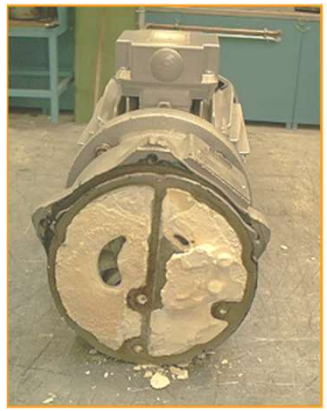
Preservation during standstill is also to be considered.

2. Issues on Start-Up

Pump Blocked on Start-Up – Solid deposit

Solid deposit can come from:

- Particles in the process stream
- Service liquid (lime in water)
- Reaction between service liquid and process
- Polymerisation of process



There are many possible solutions that are dependant on the specific process stream.

2. Issues on Start-Up

Protection 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
- Material of construction, pressure drop measurement
- Cleaning / discharging need to be planned
- Material of construction to be adapted

2. Issues on Start-Up
Pump Blocked on Start-Up – Flooding

- Too much liquid can be damaging.
  (liquids are not compressible)
- Flooding can create noise & vibrations going up to bending and breaking.

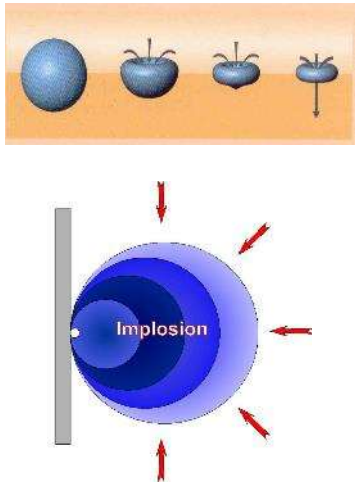
- Ensure the liquid level before start-up is at about the middle of the shaft.
- The overflow outlet of the separator should also be on this level.

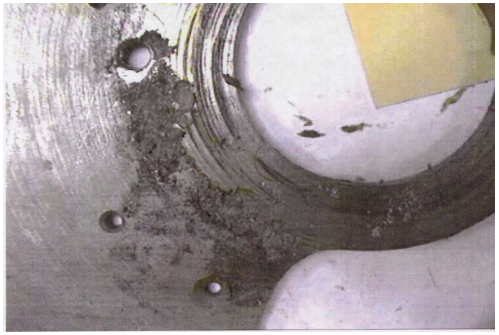
3. CAVITATION

3. Cavitation
Introduction

Cavitation occurs when parts of the pumped fluid is flashing into a vapor and there is a resulting formation of bubbles.

A forceful implosion of the bubbles occurs when the fluid stream reaches a region of higher pressure.





3. Cavitation
Solution - Protection

Rules of thumb:

- The limit of pumping pressure should be 2 times the saturation vapor pressure (safe assumption):
  - → Cool down or change the service liquid

- The mass flow of non-condensibles should not be lower than the listed total mass flow at ultimate pressure under standard conditions:
  - → Vacuum regulation through controlled leak
  - → Anti-cavitation line
  - → Air injection in the recirculation circuit
  - → Gas/air ejector
  - → If the pump is oversized, a frequency drive will help and save energy.

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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