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RATS - ROTATING & TURBOMACHINERY SOCIETY

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MAINTENANCE
RELIABILITY
OPERATIONS

TECHNICAL CONFERENCE & WORKSHOPS

12 ways to kill your pump

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DOW Centennial Centre - Fort Saskatchewan

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RATS is a non-profit organization, run by a volunteer board of directors. The founding premise of RATS is in the social networking and community building of people within the rotating equipment and turbomachinery industries.

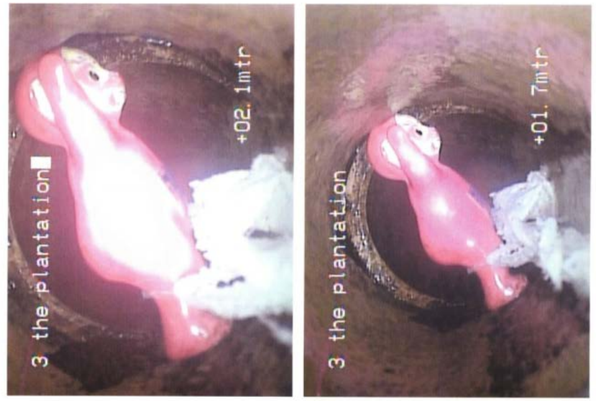
12 ways to kill your pump

1. Solids
2. Dirty Suction
3. NPSH
4. Oversized
5. Parallel gone wrong
6. Material
7. Alignment
8. Pipe Strain
9. Discharge
10. Mechanical seals
11. Incomplete failure analysis
12. Let’s hear from you

Solids

- Large solid items that enter the pump not designed to handle, will destroy the pump
- Water with some dissolved solids is not the same as completely clean water
- Should use appropriate suction strains
- Items found in waste water treatment plants

A Teletubby



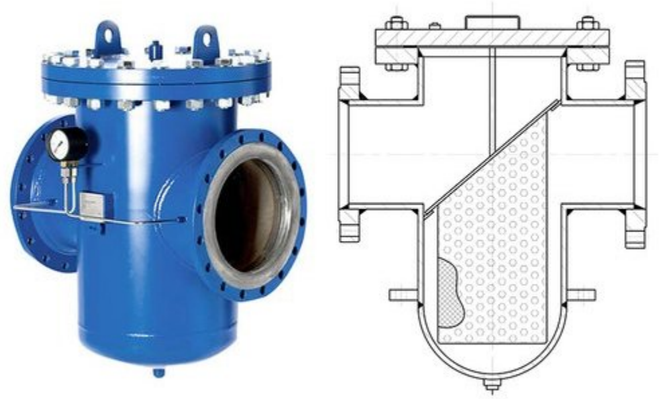
Dirty suction strains

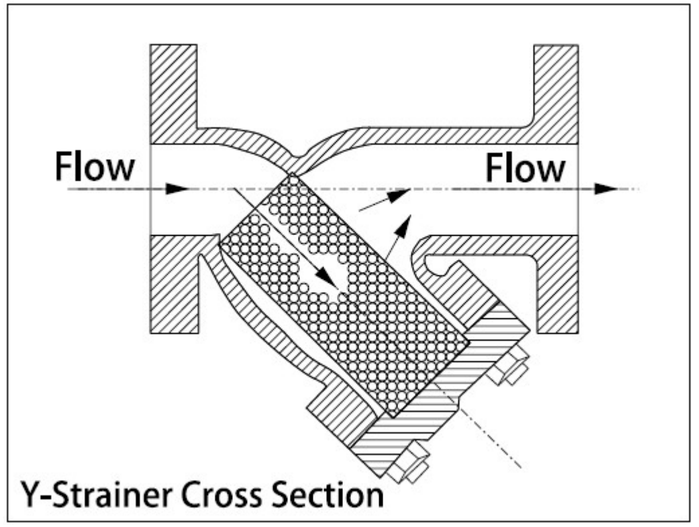
- Dirty and clogged suction strains are a common reason for pump failures.

- Clogged strains cause pump inlet flow to decrease, causing cavitation

- Suction strains should be periodically inspected and cleaned

Most centrifugal pumps are designed to handle some amount and size of solids
CV is that it is equal to the number of gallons per minute that can flow through the strainer with less than or equal to a 1psi drop.





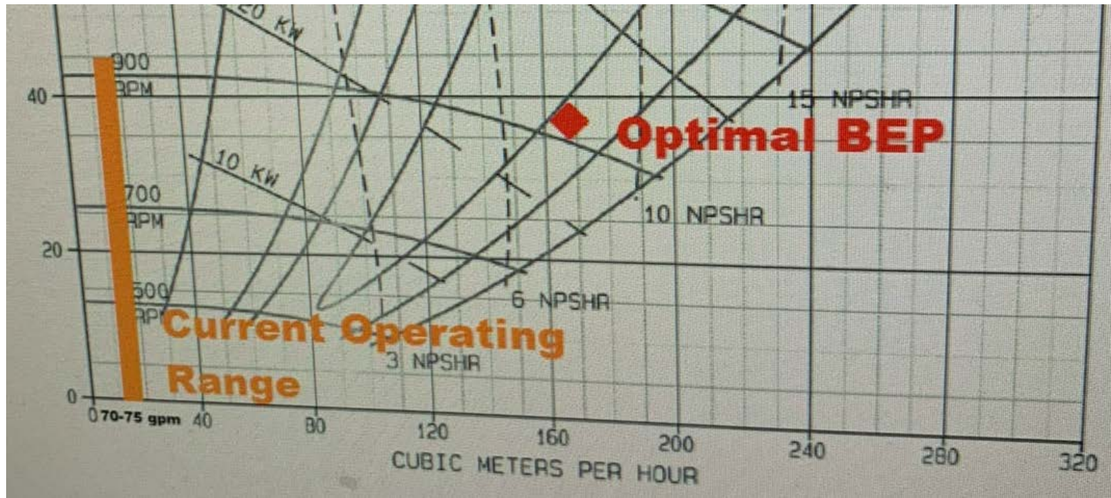
NPSHr < NPSHa = Cavitation

- NPSHa ≥ NPSHr + margin
- Cavitation occurs in a pump when the temperature and pressure of the liquid at the suction of the impeller equals the vapor pressure
- At what temp will water boil on mount Everest?
- Clogged Suction strains, piping, closed inlet valves, low water levels can all lead to cavitation

- Things that will affect NPSH
- **Vapor Pressure ,** As the temperature of the liquid increases, the vapor pressure increases, decreasing the amount of $NPSH_A$
- **Increased Fluid Velocity**
- **Poor Suction Piping Design**

Bigger is not always better

- Try to avoid oversizing a pump
- Pump is considered oversized when it’s not operated within 20% of it’s Best Efficiency Point(BEP)
- Pump may be oversized to account for future growth in the system i.e a municipality planning population growth, or another kiln added to the plant
- Lack of design details at the time of purchasing



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Dissimilar Parallel Operation

Using dissimilar pumps in parallel

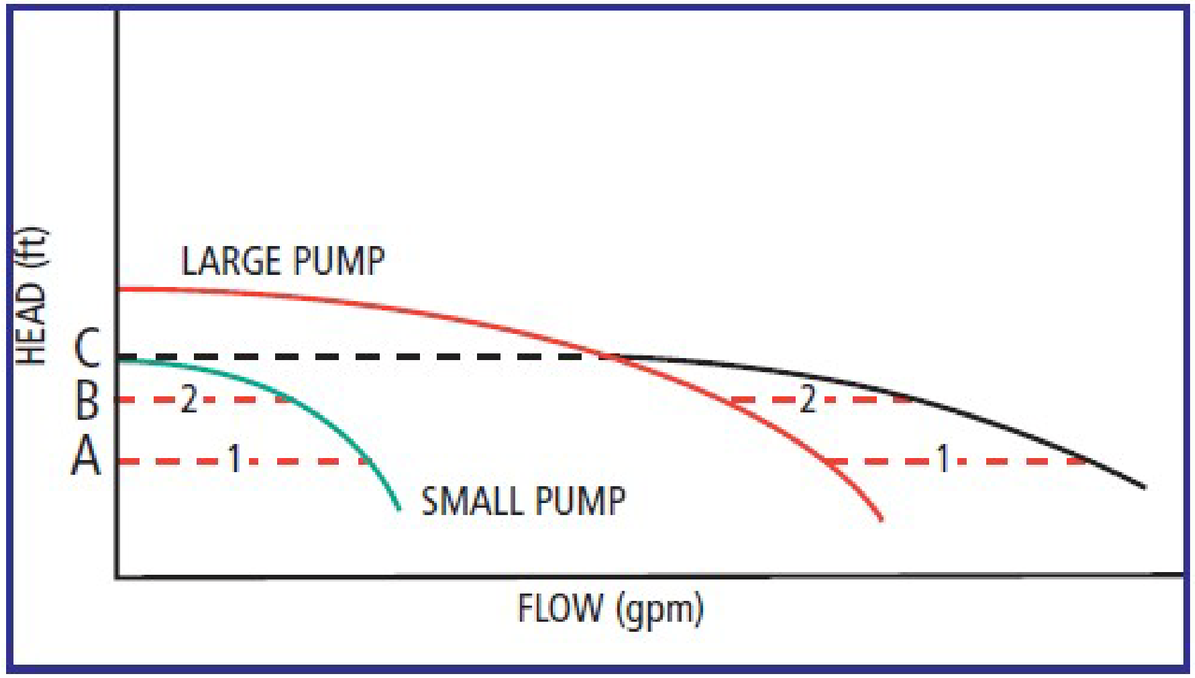
- **At “B” feet,**

the smaller pump adds Flow “2” to that of the larger pump

- **Above “C “ feet :**

the larger pump will provide more head Than the smaller pump shut off head closing the smaller pump’s check valve

Prolonged operation at this point will result in severe damage to the pump



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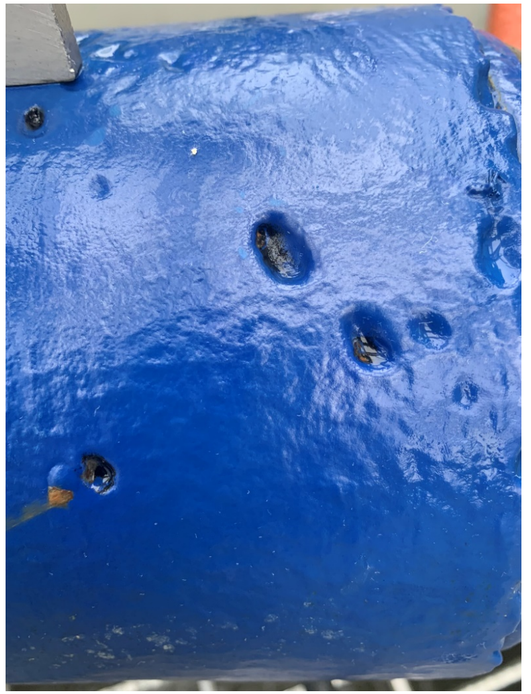
Wrong material selection

Material selection

- Engineering company who prepared the RFQ did not specify materials.

Cast Iron or Stainless steel?

- Expected corrosion rate
- Select an appropriate grade of stainless steel
  - The 304 grade contains 18% chromium and 8-10% nickel.
  - The 316 grade also includes 2% molybdenum and has greater resistance to acids and to localized corrosion.
- nickel-based “superalloys” have a higher resistance to corrosion than stainless steel.
- Chemical capability chart or consult a professional



Alignment

- Thermal growth

Thermal growth is not considered, no hot alignment

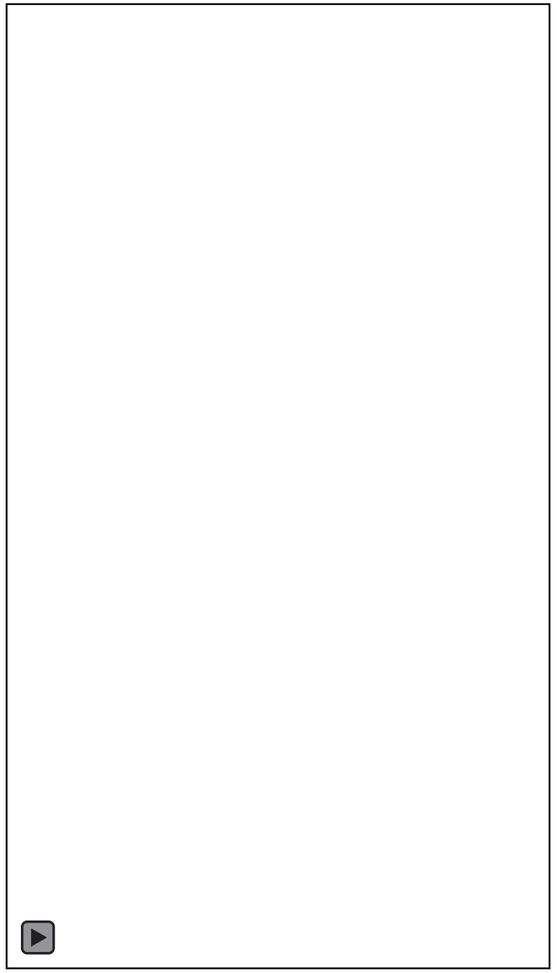
- Motor mag centres

Running a motor uncoupled will pull the motor rotor into a magnetic center. The shaft maintains a distinct axial position when running which could be different from the position of the shaft at rest.

Quality of the foundation

- Re-purposed or damaged base plate and foundation.

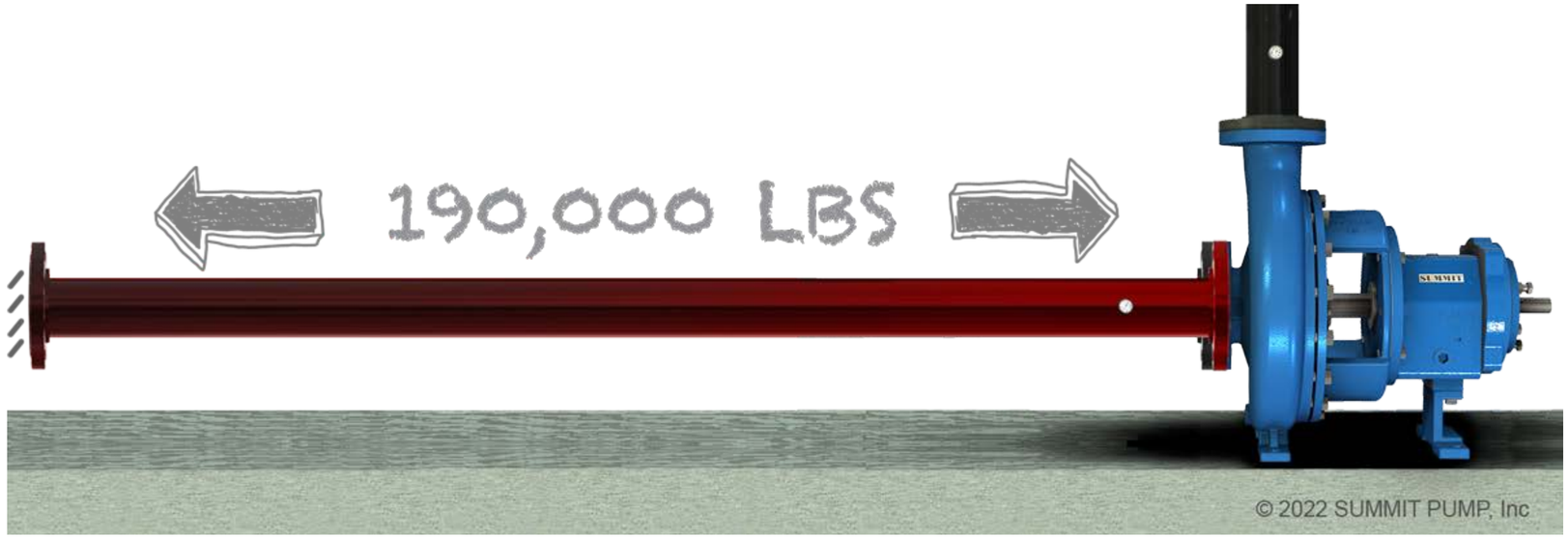
- Too many shims



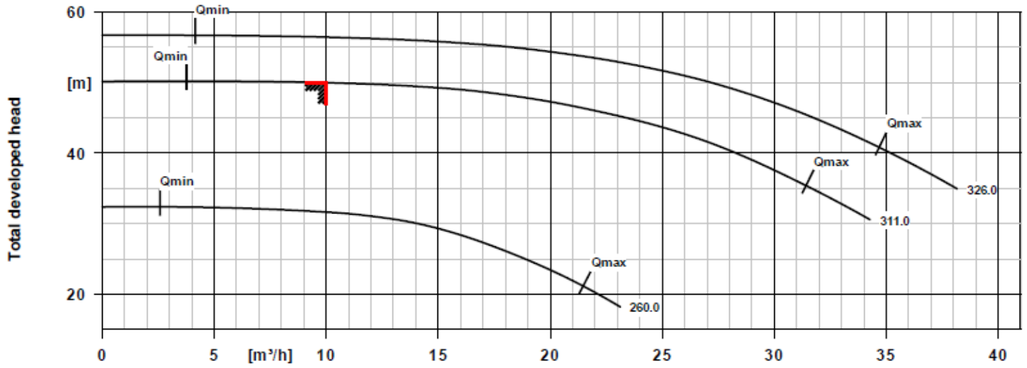
Pipe Strain

Pump internals cannot handle

The forces of pipe strain



Discharge issues



- Closed or partially closed discharge valves

Closed discharge valve will cause the pump to run at shut-off , recirculating the fluid will cause it to heat up which causes pump damage.

Throttling the discharge valves can cause the pump to run close to shut-off shortening it’s life

- Process demands

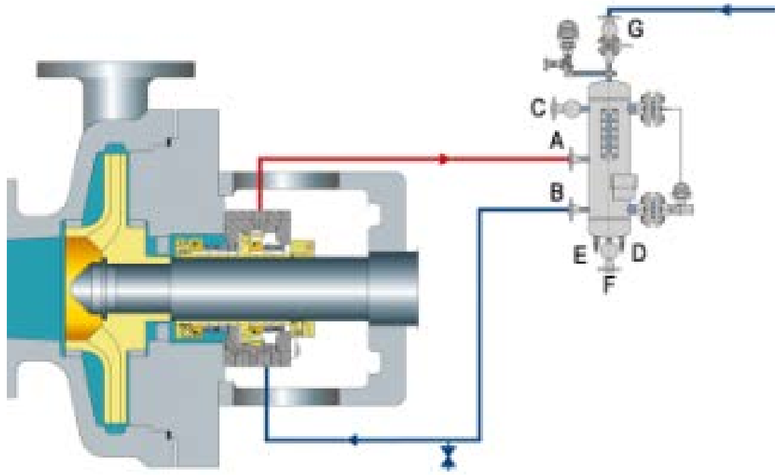
Change in process demands can either cause the pump to run close to Qmax or Qmin.

Boiler water washing process

- Use a min flow valve

Mechanical seals

- Improper installation
- Fluid incompatibility
- Lack of lubrication and cooling
  - Cooling water air locks
- Inadequate piping plan
- Shaft movement due to bearing wear
- Worn shaft or shaft sleeves
- Address Issues Promptly
- Also Cavitation, excess heat , dry running and solid ingress



plan 53a

Incomplete failure analysis

- Insanity is doing the same thing and expecting different results
- What has changed in the process since operation was last satisfactory? i.e. pressure, temperature, fluid viscosity etc.
- When was the pump last serviced?
- What was the appearance and condition of the pump internal components?
- How long did the pump operate before the problem?
- Any changes in pump noise or vibration?
- Blindly saying a bigger pump is required for the application

What do you see in the field?