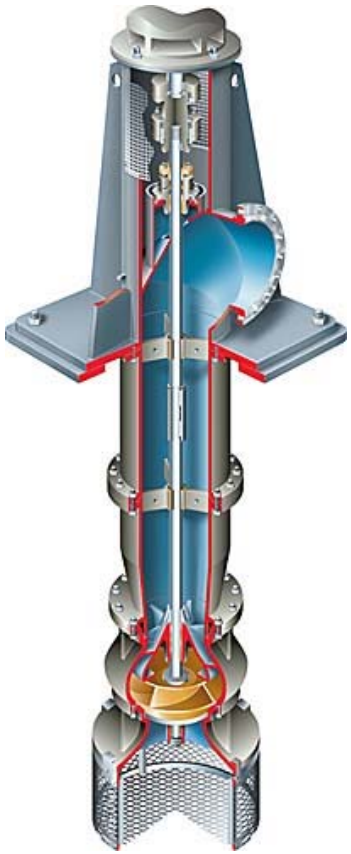
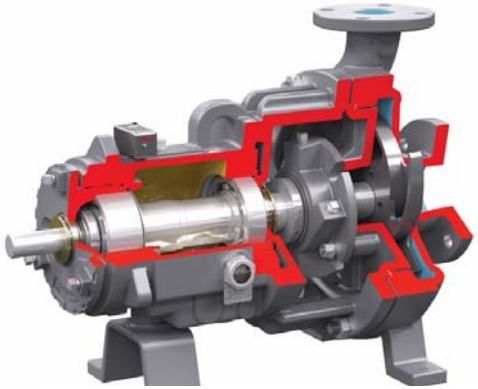
SANSOM EQUIPMENT LIMITED

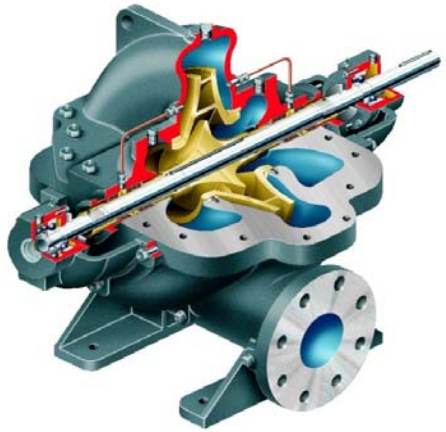
10 WAYS TO MURDER YOUR PUMP

PRESENTER: BOBBY EVANS, P.ENG.

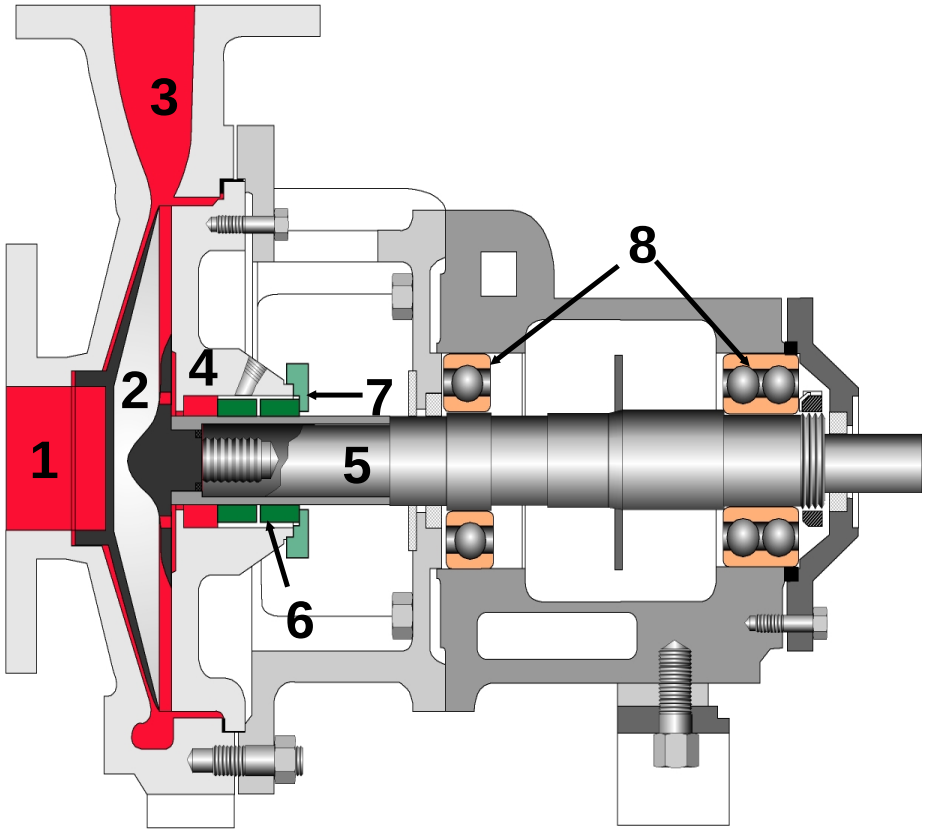
VICTIM: CENTRIFUGAL PUMPS





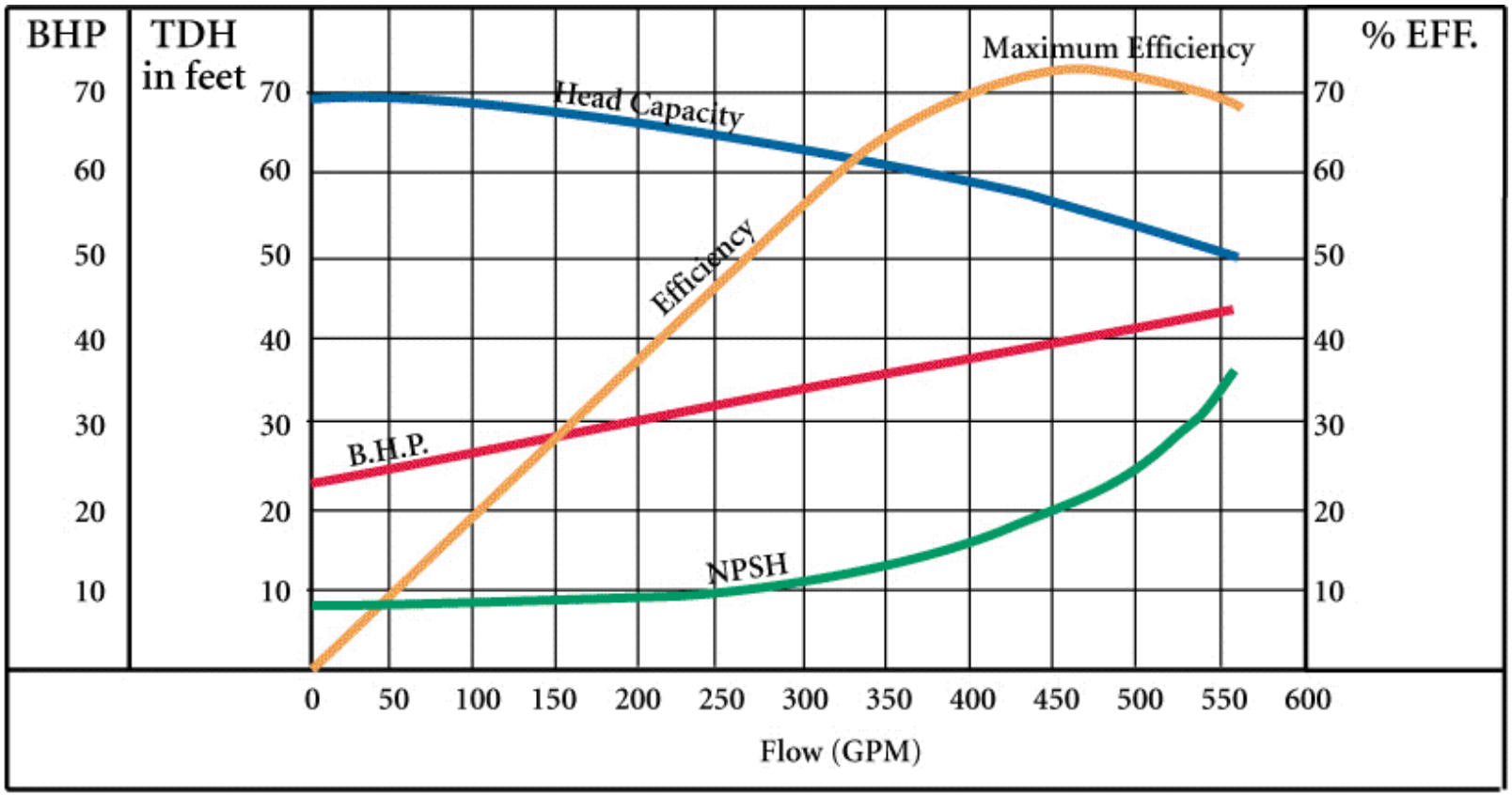


TYPICAL CENTRIFUGAL PUMP

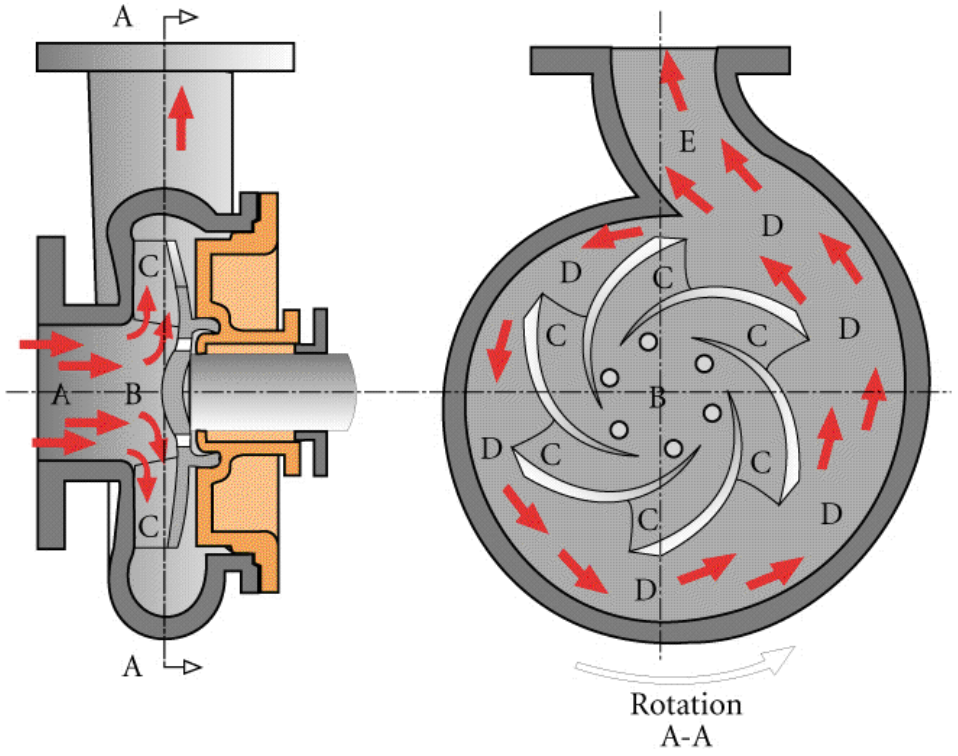


1. Suction (Suction Pressure)
2. Impeller
3. Discharge (Discharge Pressure)
4. Stationary Casing & Rear Cover
5. Rotating Shaft
6. Packing / Mechanical Seal in Stuffing Box (Stuffing Box Pressure)
7. Gland
8. Radial & Thrust Bearings to Support the Shaft

CRIME SCENE INVESTIGATION PERFORMANCE CURVE



TYPICAL CENTRIFUGAL PUMP HYDRAULIC BALANCE



A - Suction (low P, low V)

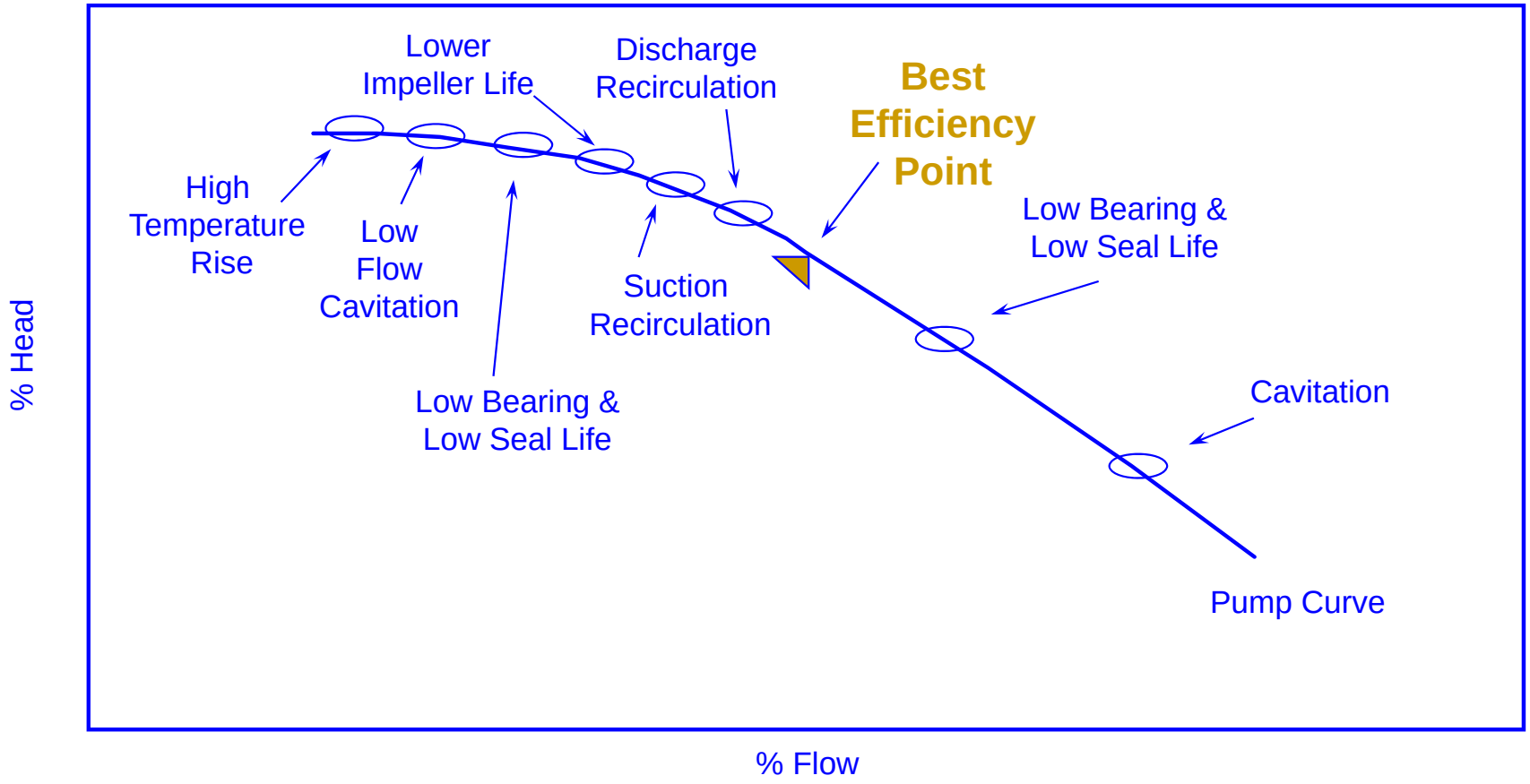
B - Eye of Impeller (low P, low V)

C - Vanes of Impeller (increasing P, high V)

D - Volute (high P, low V)

E - Discharge (high P, low V)

PUMP RELIABILITY – BEST PRACTICE



EVIDENCE: DISCHARGE CAVITATION

- **Pitting on vane tips.**
- **Fluid vaporizes due to low pressure condition.**
- **Vapour condenses on the surface of the impeller like a mini implosion.**
- **Recirculation, operating near shut-off.**

EVIDENCE: SUCTION CAVITATION

- **Pitting on impeller vane – suction side.**
- **Fluid vaporizes due to low suction pressure.**
- **Vapour condenses on the surface of the impeller like a mini implosion.**
- **Low suctions pressure, operating near run-out.**

EVIDENCE: SHAFT BREAKAGE

Radial Fatigue Break

- Total Dynamic Head Too High
- Dead Head
- Air Entrainment (Hydraulic Imbalance)
- Mechanical Imbalance

Torsional Break (twisting)

- Pump Lock-up
- Reverse Rotation
- Short Cycling

#1 - STARVED TO DEATH

Insufficient NPSHA

- Restricting the suction line
- Lowing the fluid level in the supply source

Run Dry operation

- Mechanical seal thermal shock
- Poor cooling of rotating components - Thermal expansion

Lack of seal flush

Lack of lubricant

Indicators

- Audible cavitation – collapse of vapour causing erosion on the impeller & cut water
- Low suction gauge pressure

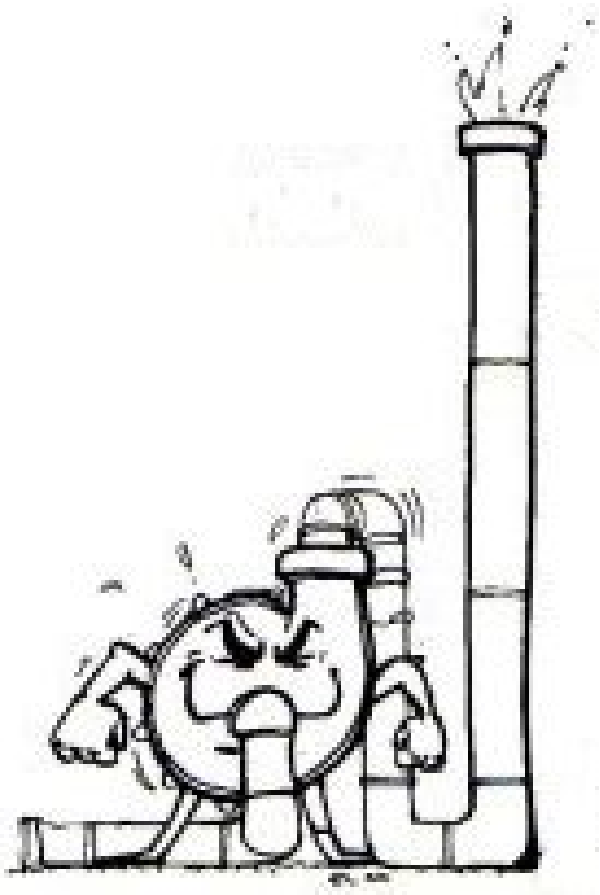
#2 - WORK IT TO DEATH

Operating outside the allowable operating range

- Hydraulic imbalance at runout
- Cavitation
- Vibration

Running into the motor service factor

Frequent start/stop cycles



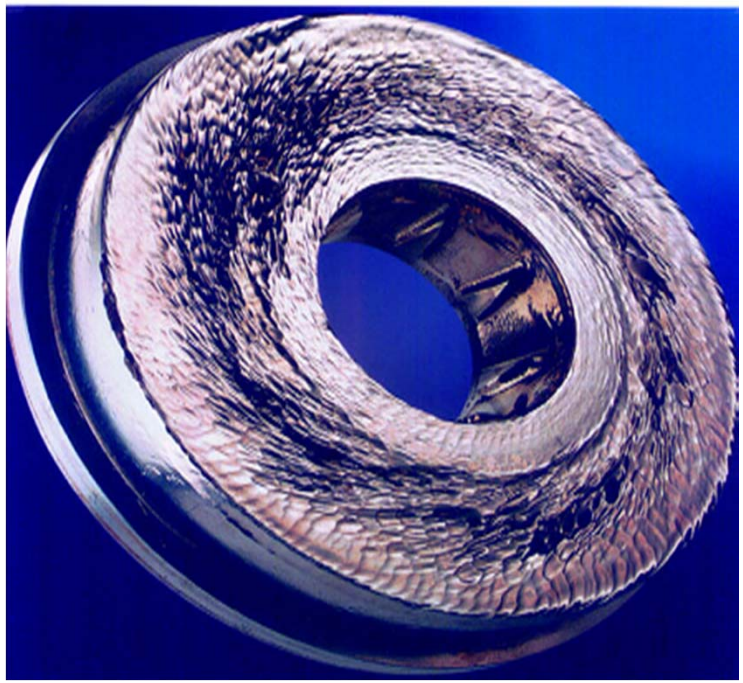
#3 - BEAT TO DEATH

Abrasives, Grit, Solids

- Clog or even break the pump
- Shorten life of casing, impeller, seal, wear plate/rings.
- Impeller imbalance
- Efficiency reduction

Match materials for the process fluid

- Hardened metal or rubberlined materials for abrasives



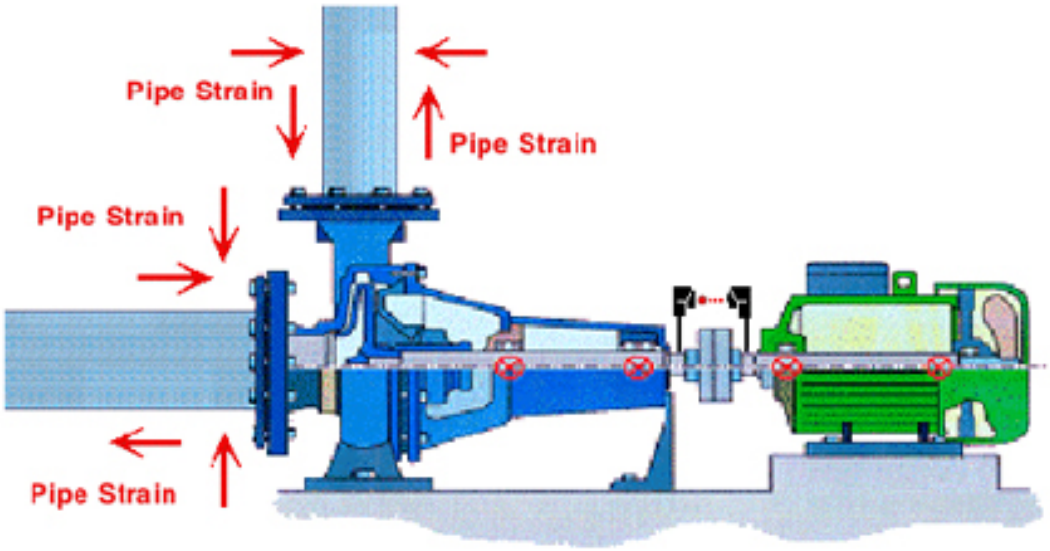
#4 - TOO MUCH STRESS

Pump casing deflection

- Pipe strain to pump nozzles
- Pumps do NOT support pipes/valves
- Soft foot
- Thermal expansion

Common Corrective Action

- Expansion joints
- Precision alignment



#5 - MARRIAGE

It’s all about compatibility

- Efficient hydraulic selection
- Incorrect style of pump
- Chemically compatible
- Proper sizing of the suction and discharge pipe
- Piping configuration

#6 - DROWNING

Water in the oil

- Small amount of water in the bearing oil can drastically reduce bearing life.
- Promote oil seal leaks

Seal Flush Water Management

- Direct leakage away from the pump
- Adjust packing leakage to a minimum (1 drop/sec)

#7 - BOILED TO DEATH

Operating at or near shutoff.

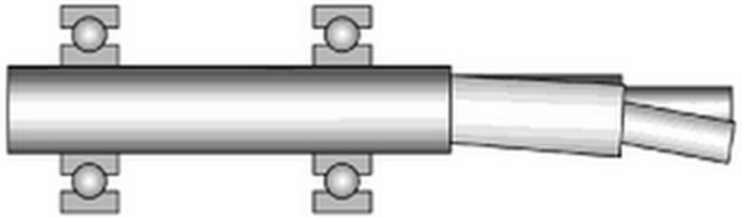
- Excessive recirculation
- Increase internal temperature & pressure
- Radial loads – shaft deflection, reduced bearing life.
- Vibration, cavitation
- High seal temperature

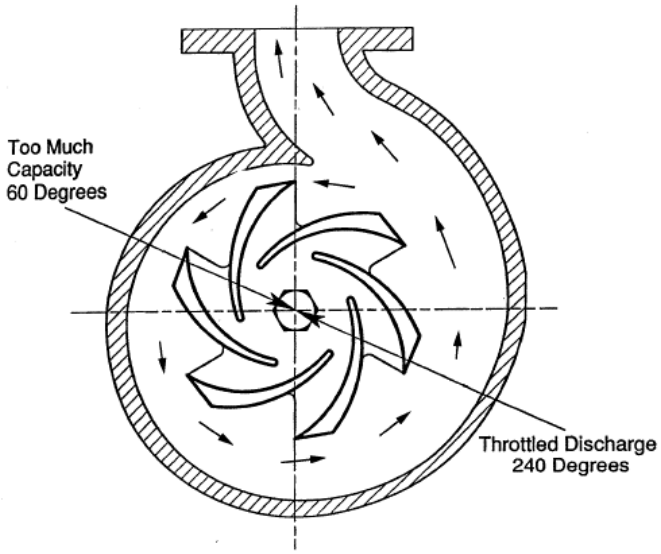
Potential Sources

- Partially closed valve
- Clogged discharge line
- Upset system upstream

Pump Protection

- Heat detection and shutdown protection
- Discharge pressure monitoring & protection.
- Pressure relief device





#8 - POISONED

Fluid Compatibility

- Pumps are designed to handle specific fluid properties.
- Fluid property changes can have a negative impact on the pump. Temperature, chemistry, density, viscosity.

Corrosive Environments

- Chlorine rich environments, salt water environment, submersible pumps
- Heavy corrosion on pump casing & mating surfaces
- Corrosion fatigue

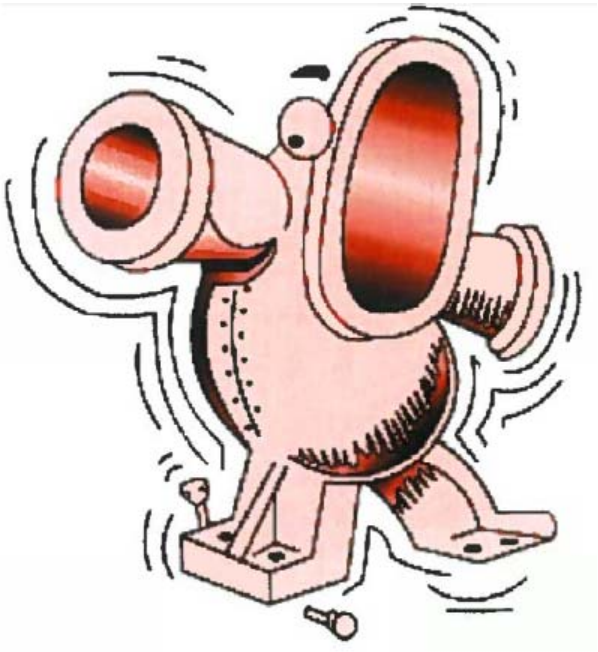
#9 - SHAKE TO DEATH

Sources of Vibration

- Pump hydraulic selection
- Machine imbalance
- Resonance with natural frequency of the pipework

Mitigating Vibration

- Operate pump near BEP
- Proper installation – soft foot, alignment
- Anchoring & grouting to a solid foundation
- Piping support



#10 - NEGLECT

Follow O&M Manual maintenance inspections

Get to know your pump

Record anomalies and corrective actions

Monitor gauge readings, amp draw.

Keep the lubricates clean and at proper levels