kishor pumps

Designed for processes, Made for people.

Welcome

Enhancing energy efficiency & site maintainability of Pumps

Webinar Series 2020

30 April 2020

Agenda

- Types of pumps used in STPs
- Enhancing energy efficiency of pumping systems
- Approaches for enhancing site maintainability
- Other points & summary

Company History & Profile

Founder Chairman, Late Mr. Narayan N. Desai

- Founded as Kishor Industries in 1963 in Mumbai
- Incorporated as Kishor Pumps Pvt. Ltd. in 1965
- Developed India's first indigenous vertical pumps (VS4 type) for domestic fertiliser and acid industry
- Brought in collaborations to further indigenise single stage pumps in end suction horizontal and vertical sump pumps, and submersible pumps
- Introduced India's first domestically manufactured submersible pump in 1985 with German collaboration

Company History & Profile

- Headquartered in Pune, India
- ISO 9001 certified
- Over 87,000 pumps working globally
- More than 50,000 sewage / solid handling pumps working
- Widest spectrum of metallurgy
- President of India award for import substitution
- Tailor-made application specific pumps for critical duty
- VFD Testing upto 12,000 m^3/hr & 500 kW as per ISO 9906
- In-house submersible motor manufacturing upto 450 kW
- Maintenance & user friendly design focus
- Only Indian company approved in Government ministries in Middle East & South East Asia

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Pumps in STPs – Approaches for enhancing energy efficiency & site maintainability

- Pumps are one of most maintenance & energy intensive equipments used in a sewage treatment plant
- Pumps are the starting point of treatment to ensure uninterrupted flow to the rest of equipments & basins
- India possesses unique challenges, especially for pumps, in terms of continuous operation

Types of Pumps Used in STPs (Centrifugal Type Only):

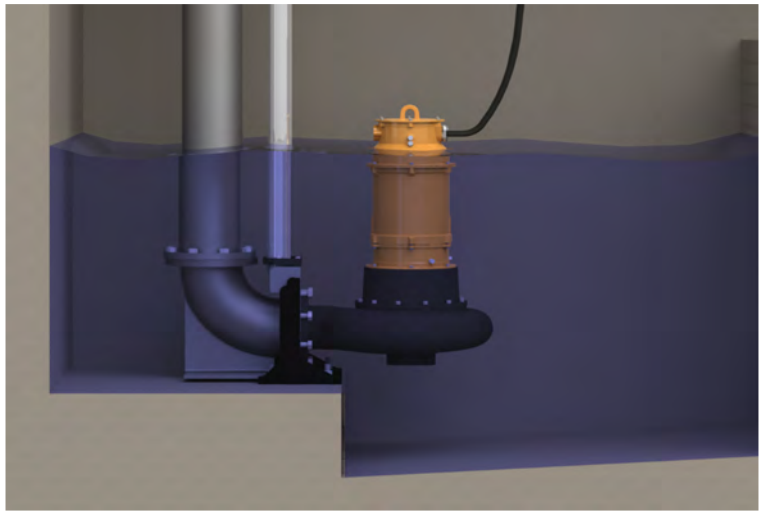
Submersible
(Wet Well and / or Dry Pit)

Vertical Non Clog Dry Pit

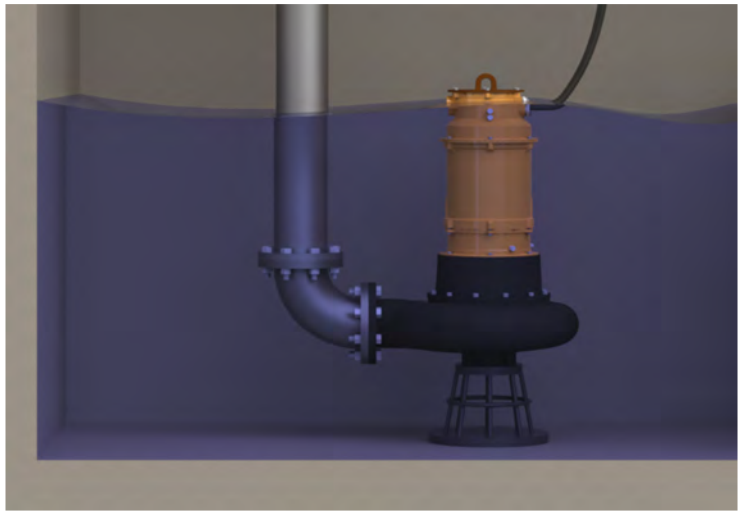
Horizontal
Non Clog

Horizontal
Clear Liquid

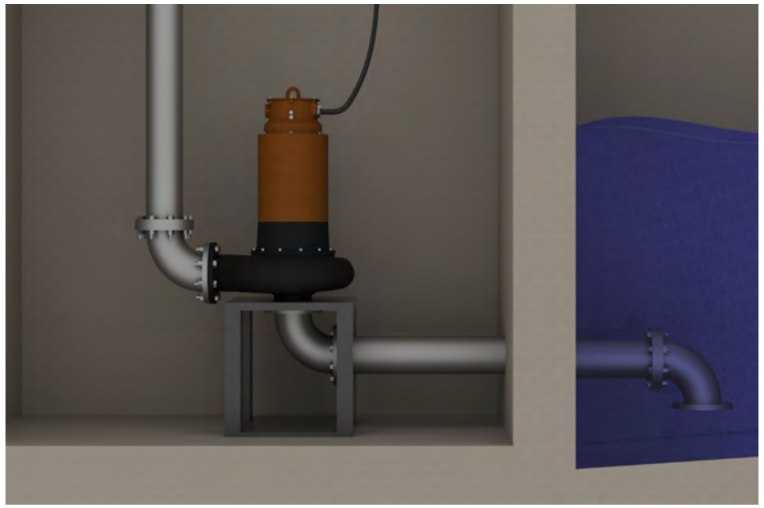
Pumps in STPs – Approaches for enhancing energy efficiency & site maintainability



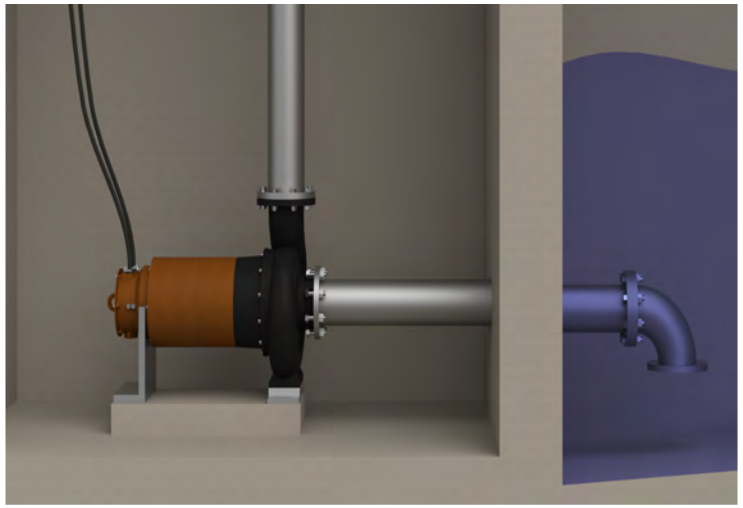
Wet Pit



Wet Pit with stand



Vertical Dry Pit



Horizontal Dry Pit

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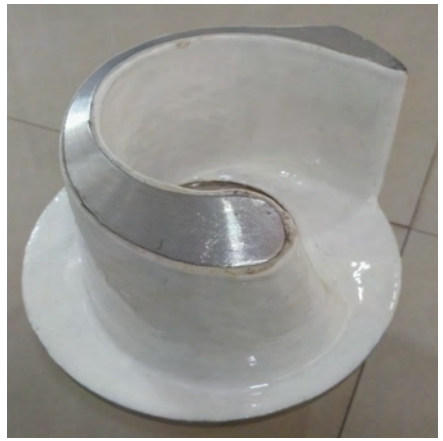
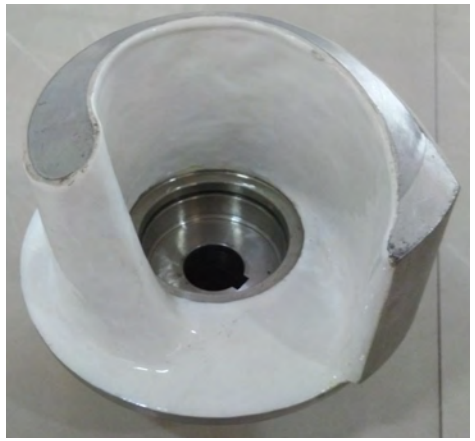
Opportunities for enhancing energy efficiency

- At plant level: Plant design factors affecting energy consumption in wastewater pumping & treatment:
  - Piping & piping system characteristics in which the pump operates
    - Roughness & length of piping
    - Bends, joints, valves in the pipeline
    - Selecting the pump on its best efficiency point corresponding to the system curve
    - Use of speed control for achieving different flow rates from the same pump & maximising efficiency
  - Characteristics of the liquid being pumped
    - Suspended solids content & nature of such solids
    - Solids consistency
    - Corrosion potential





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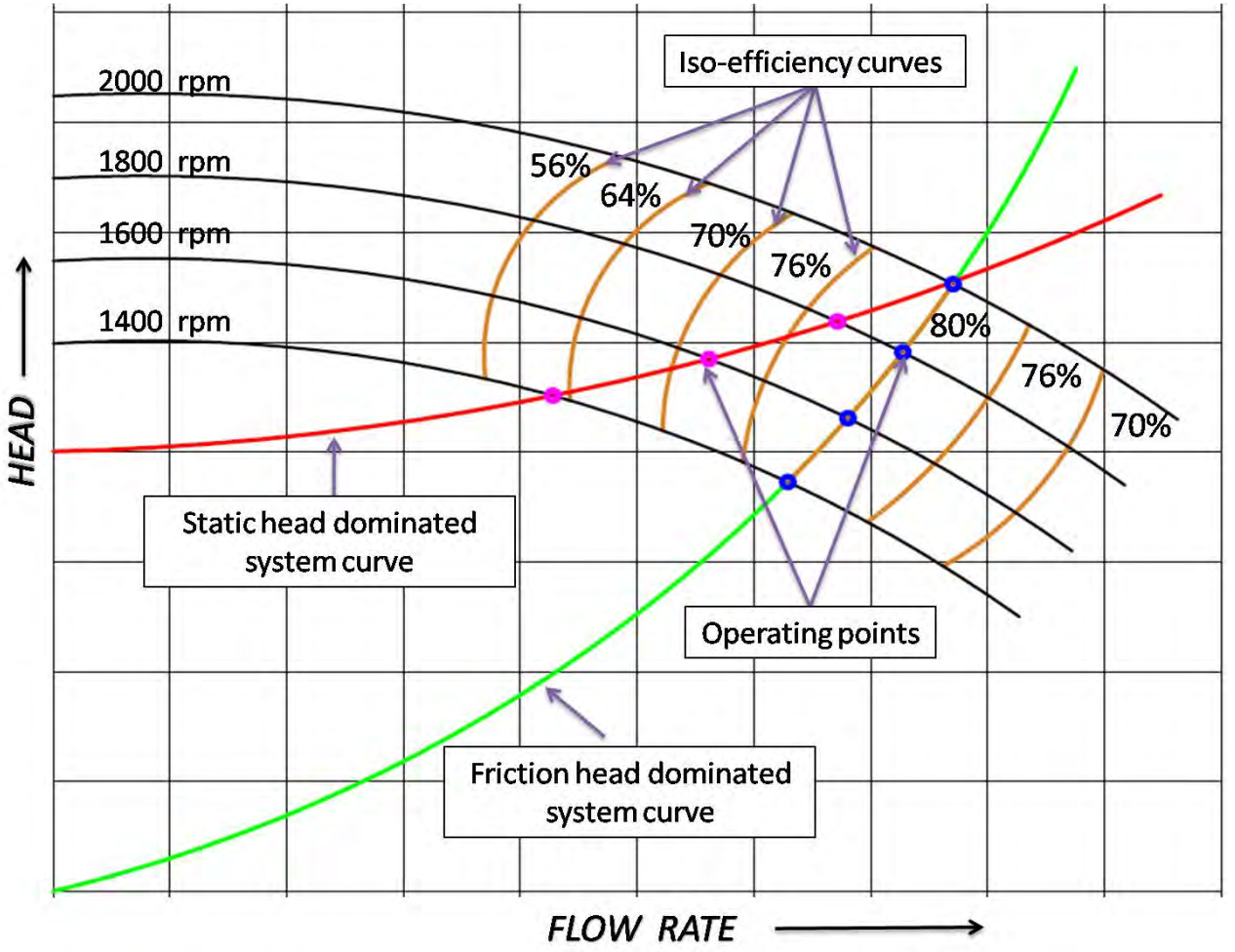
    - Solids consistency
    - Corrosion potential
- At pump level: can adjust wear plate to restore efficiency over time

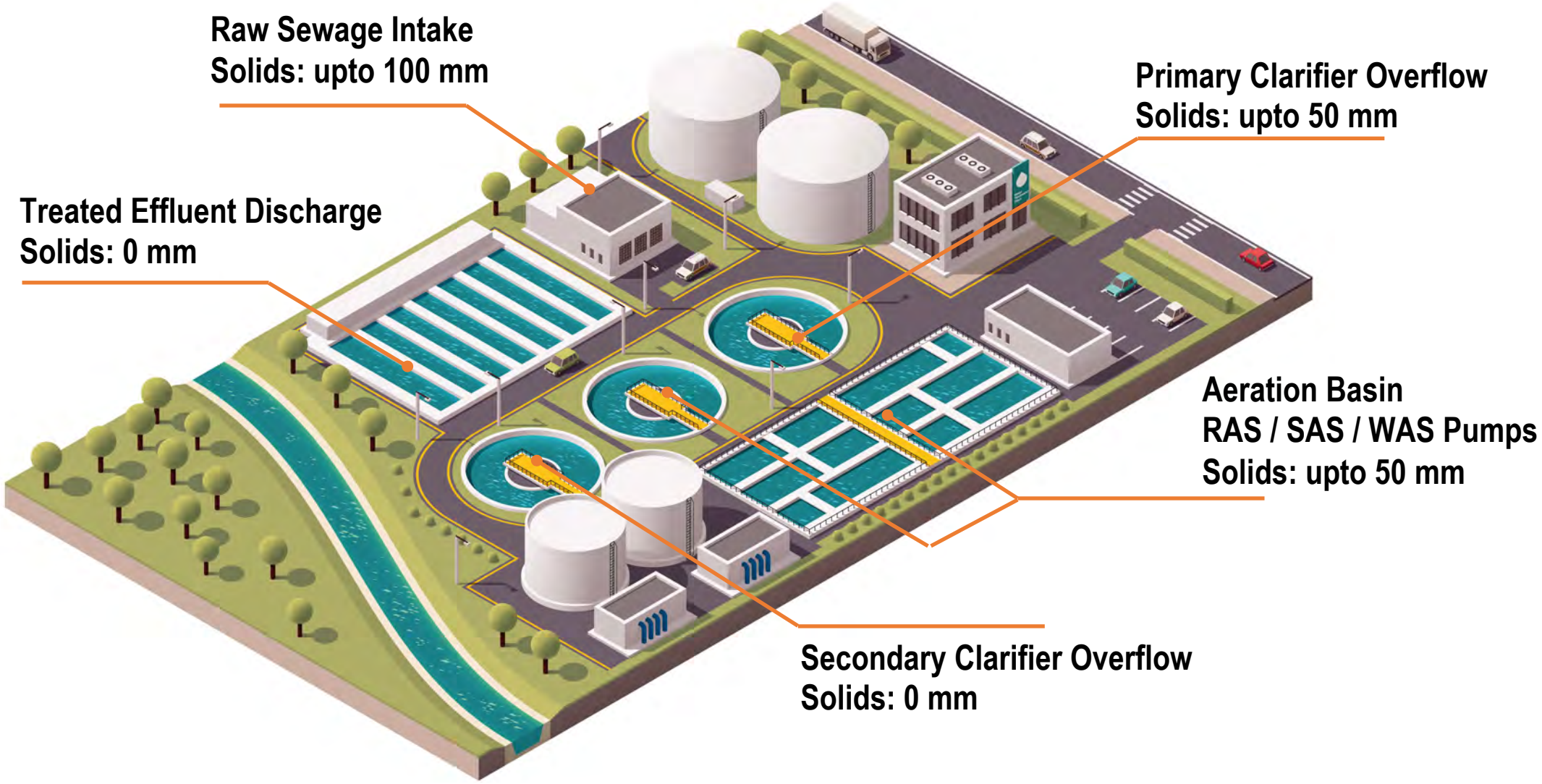
Opportunities for enhancing energy efficiency - VFDs

- **Use of speed control for achieving different flow rates from the same pump & maximising efficiency**

  - VFDs offer good opportunity for enhancing the efficiency of existing / new pumping systems
  - VFD systems are most effective in friction head dominated systems
  - Ensure motor is capable of operation on VFD
  - If VFD is used parallel pumping, ensure frequency of all VFDs are equal
  - Energy saving through elimination of throttling valves which consume energy



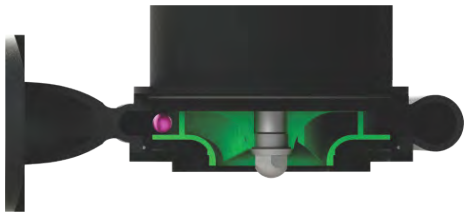
Opportunities for enhancing energy efficiency – Solids Characteristics



Opportunities for enhancing energy efficiency – Solids Characteristics

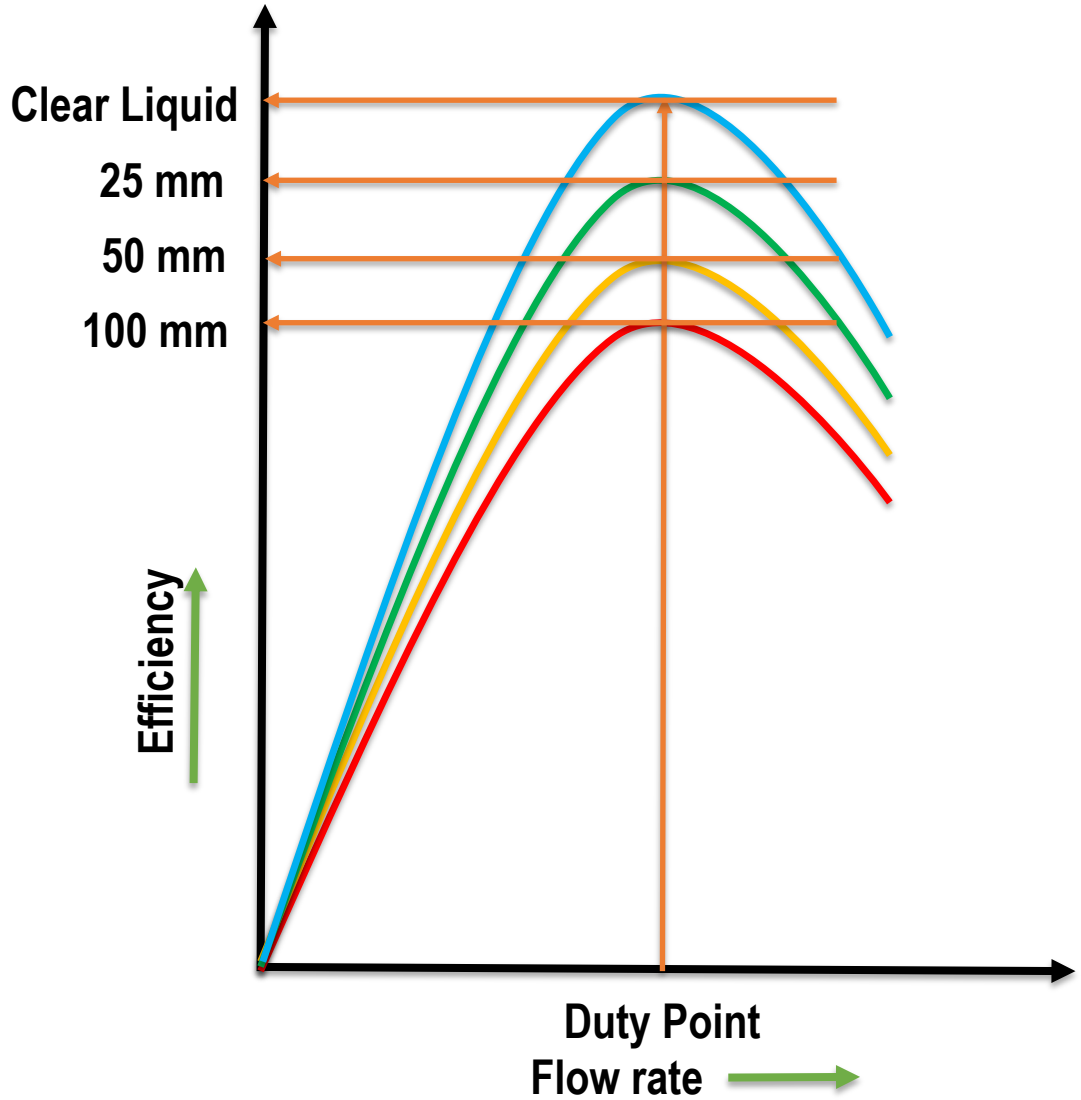
100 mm solids passage

50 mm solids passage



25 mm solids passage

No Solids / Clear Liquid



Opportunities for enhancing energy efficiency – Solids Characteristics

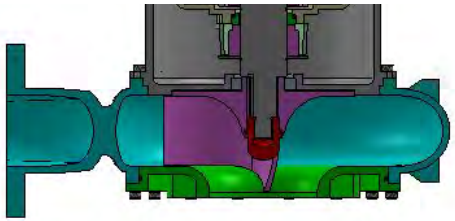
Raw Sewage Pumping Station Pit

High solid handling, low efficiency

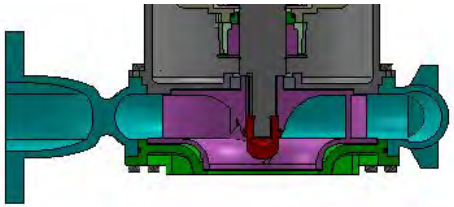
Secondary Treated Sewage Clarifier Pit

Low to nil solid handling, high efficiency

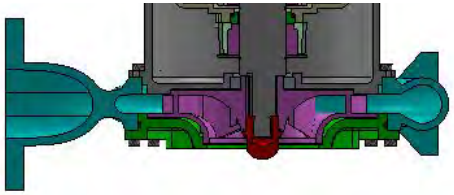
Opportunities for enhancing energy efficiency – Solids Characteristics



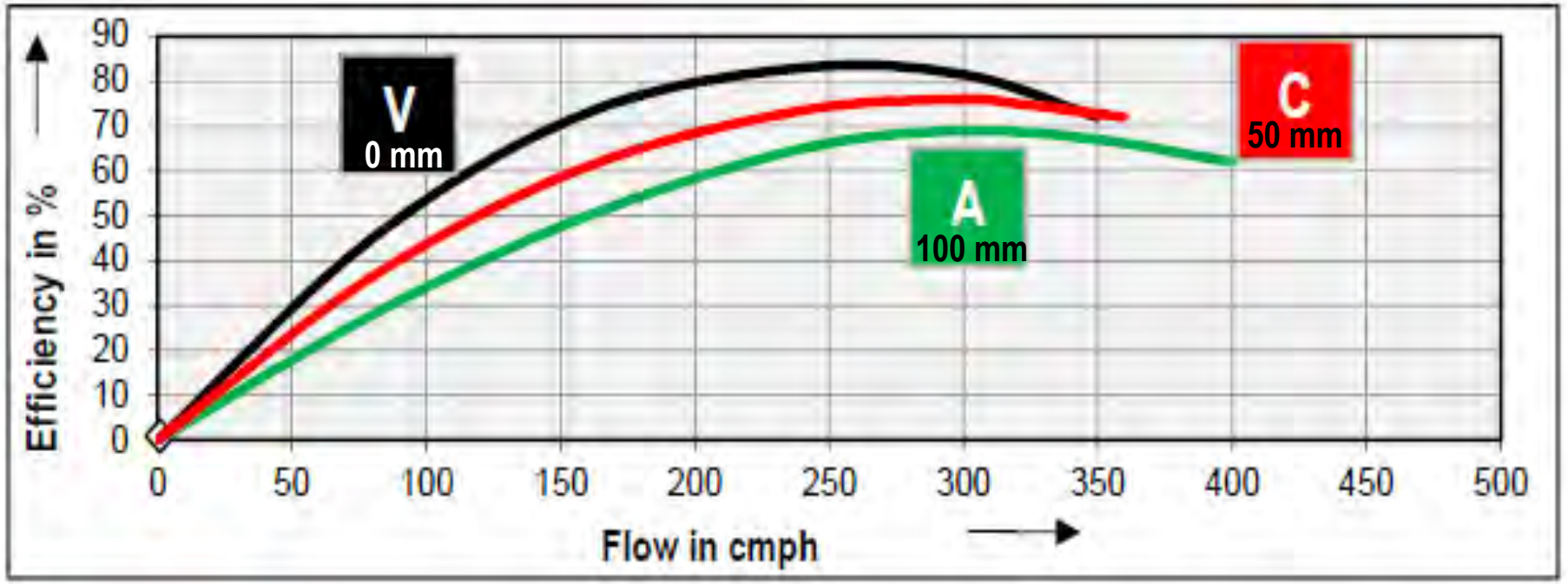
A Series
100 mm solid passage
300 m^3/hr @ 26 mlc
Efficiency @ Duty Point: 70%



C Series
50 mm solid passage
300 m^3/hr @ 26 mlc
Efficiency @ Duty Point: 76%



V Series
0 mm solid passage
300 m^3/hr @ 26 mlc
Efficiency @ Duty Point: 82%



Opportunities for enhancing energy efficiency – Solids Characteristics

Impact of solids passage consideration on pumps & pumping efficiency:

- For solids to pass, impeller design must be modified. Higher solids passage design lowers efficiency
- Solid passage restrains speed of rotation also forcing to operate the pump at lower rpm making the pump bigger (and expensive) for the same duty point
- More wear & tear over time for pumps requiring to pass solids which results in efficiency degradation

Possible avenues at plant design level for optimisation of pumping energy consumption in STPs:

- Pump manufacturers & plant designers can work together from design phase of the plant to ensure solid passage requirements of the pumps are optimised based on the application in the STP (and avoid energy losses)
- Plant operators MUST ensure screening of incoming raw sewage is properly done and maintained at all times
- Improving sludge consistency in aeration basins can improve homogeneity of the liquid being pumped, thereby improving efficiency

Opportunities for enhancing energy efficiency – Pump Selection

Impact of pumps selection efficiency:

- Selection of pump with high efficiency alongwith non-loading power curve (i.e.) in case system head changes or flow fluctuates the variance in power drawn by the pump should be small.
- For municipal STPs, since there is requirement for solid handling, appropriate solid passage size of pump for the given process must be selected. Solid passing size has a high effect on efficiency. Higher the solid passage allowance, lower the efficiency for the same pump.
- Pumps which are selected for VFD operation, need to be fitted with motors designed and manufactured specifically for VFD use.

Opportunities for enhancing energy efficiency – Pump Installation & Operation

Impact of pumps installation & operation efficiency:

- Correct installation of pumps is extremely critical for reliability & efficiency.
- Suction piping (wherever needed) must have sufficient length before the pump suction to avoid cavitation.
- For submersible pumps, bolting of pedestal coupling on ground needs to be reviewed to avoid vibration. Loosening of foundations over time, increases vibrations and deteriorates efficiency. Also, delivery pipe must be perpendicular to ground.
- Placement of NRV & sluice valves must be according to the manufacturers' recommendations.

Opportunities for enhancing energy efficiency – Pump Maintenance & Retrofitting

Impact of pump maintenance & retrofitting on efficiency:

- Establish regular pump system audits to assess energy consumption.
- Review and modification of pipelines if needed to reduce system head to match pump design conditions, if originally designed conditions & operation conditions do not match.
- In case of old pumps, check whether changing of motors to high efficiency motors alongwith with VFD operation will reduce the energy consumption.
- Annual Maintenance Contracts (AMC) with pump manufacturers or with their authorised service centers to maintain the pumps with proper preventive maintenance. Use of original & genuine spare parts to get the desired parameters like head / flow / efficiency.
- Leakages in distribution network (especially in water supply schemes)

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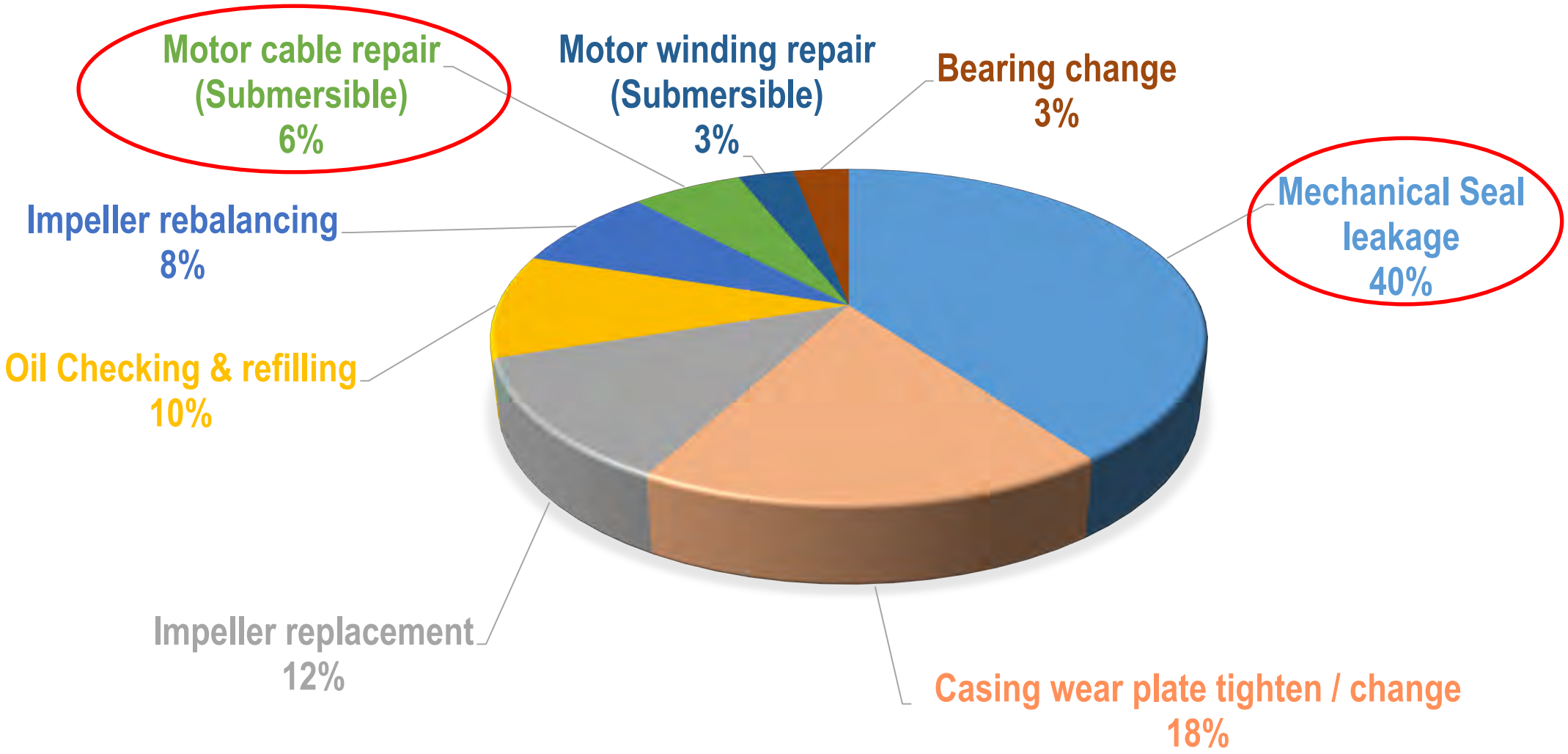
- Other points & summary

Opportunities for enhancing site maintainability of pumps

Typical repair areas in centrifugal pumps at STPs



Opportunities for enhancing site maintainability of pumps

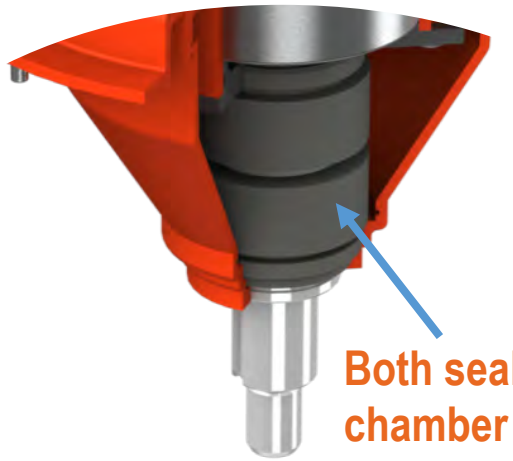
Mechanical Seal Leakages

Causes apart from normal wear & tear based in Indian conditions:

- In India, stormwater drains & sewerage systems are often the same. This leads to ingress of sand & hard particles in the system and affect pump seals
- Many STPs have inlet from open "Nullah" which brings along sediments, sand and other hard objects into the pumping station.
- Presence of cow dung in sewerage systems also has an impact on the mechanical seal life

Possible prevention & solution to reduce downtime:

- Designs are available (in submersible pumps), which prevent exposure of seals to liquid



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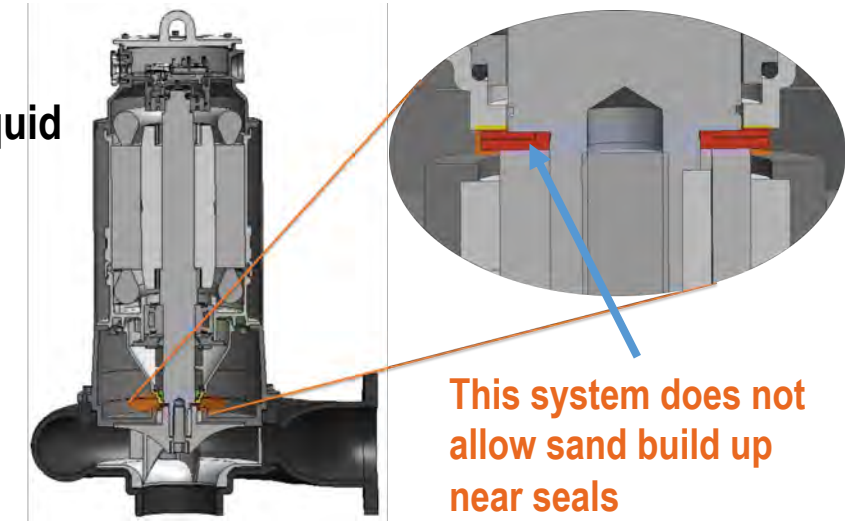
- Installation of enhanced protection for seals from heavy but small particles like sand



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- Installation of enhanced protection for seals from heavy but small particles like sand
- Manufacturers should ensure no special tooling required for seals replacement
- Plant design modifications, if any, for removal of fine & heavy solids (sand)

Opportunities for enhancing site maintainability of pumps

Submersible motor cable repair

Causes apart from normal wear & tear based in Indian conditions:

- Cables are high value items and STPs often experience pilferage / damage wherein the cables get cut allowing moisture entry
- Older plants lack the appropriate cable management systems often damaging the insulation on cables
- Improper and unscientific pump / cable handling during installation often leads to cable damage due to excessive twisting
- Lack of tooling at site and sealing requirement during repair of cable, means pumps need to be transported to a service / repair facility entailing cost and downtime.

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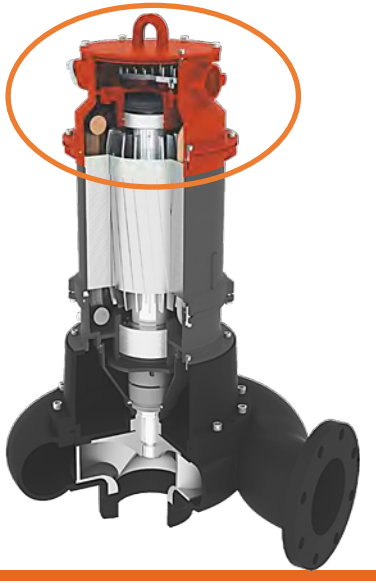

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- Scientifically designed systems for cable exits from the pumping pit

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Other points and summary for enhancing efficiency & site maintainability of pumps

Enhancing energy efficiency:

- Ensuring good piping practices and minimising bends / valves / joints
- Thorough discussion with manufacturer at design stage about whether use of VFDs will achieve better operational efficiency
- Selecting the pump as per the minimum required solids passage size depending on where the pump is used in the STP / SPS
- Selecting the pump with best efficiency at the needed duty point & adjust wear plate (suction side) after specified hours of usage
- Understand whether corrosion is going to be a factor and selection of material accordingly

Enhancing site maintainability:

- Discussion with manufacturer about any special tooling needed for routine maintenance & repairs
- Understanding liquid conditions in terms of hard / abrasive solids coming inside the pump & impact on mech. seal accordingly
- For submersible pumps, optimising cable length & selecting pumps with site replaceable cables
- For submersible pumps, check with manufacturer if mechanical reverse rotation prevention devices are available
- Ensure electronic pump controllers supplied by the manufacturers are installed at commissioning and not disconnected ever

Thank you for your time & attention

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