Optimizing Lift Station Preventative Maintenance

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- Date: 6/17/2025

What is a Sewer Lift Station?

- - A lift station is used to pump wastewater from a lower elevation to a higher elevation.
- - Vital in areas where gravity flow is not feasible.
- - Consists of pumps, valves, control systems, wet well, and power supply.

Importance of PM

- - Prevents costly emergency repairs
- - Minimizes downtime and environmental impact
- - Extends equipment lifespan
- - Ensures compliance with regulations

Safety Considerations

- - Use proper PPE
- - Confined space procedures
- - Lockout/tagout protocols
- - Electrical safety training
- - Gas monitoring (H_2S, methane)

What Needs Regular Maintenance?

- - Pumps and Motors
- - Float switches and level sensors
- - Electrical panels and controls
- - Backup Diesel Pumps or power systems (generators)
- - Wet well structure and debris levels
- - Check valves and discharge piping

Order of Maintenance Schedule

Routine Inspections

- - Visual inspection of site for leaks or alarms
- - Listen for abnormal pump noises
- - Check SCADA or control system data
- - Remove trash and debris from wet well grates
- - Test communication systems and alarms

Monthly Tasks

- - Clean float switches
- - Exercise pumps (alternate use if duplex)
- - Inspect and test backup pumps or generators
- - Calibrate level sensors
- - Check ventilation and odor control systems

In-Depth Maintenance

- - Pull and inspect pumps for wear
- - Inspect and clean check valves
- - Clean wet well (vacuum or pressure wash)
- - Electrical system testing
- - Record insulation resistance (megger testing)

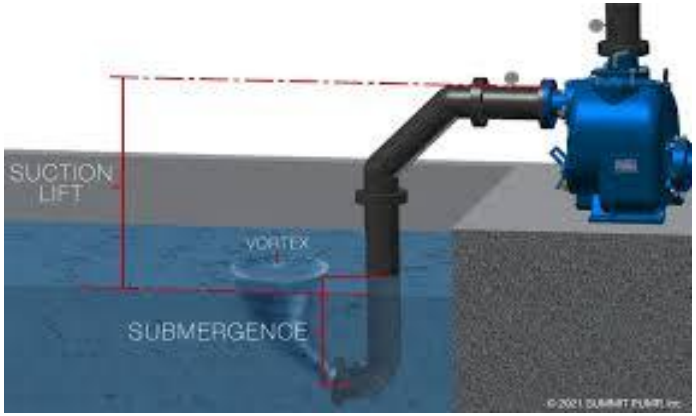
Annual Service Activities

- - Full system inspection and report
- - Replace worn seals or bearings
- - Backup pump or generator load testing and service
- - Update operation manuals and logs
- - Train operators and review safety protocols

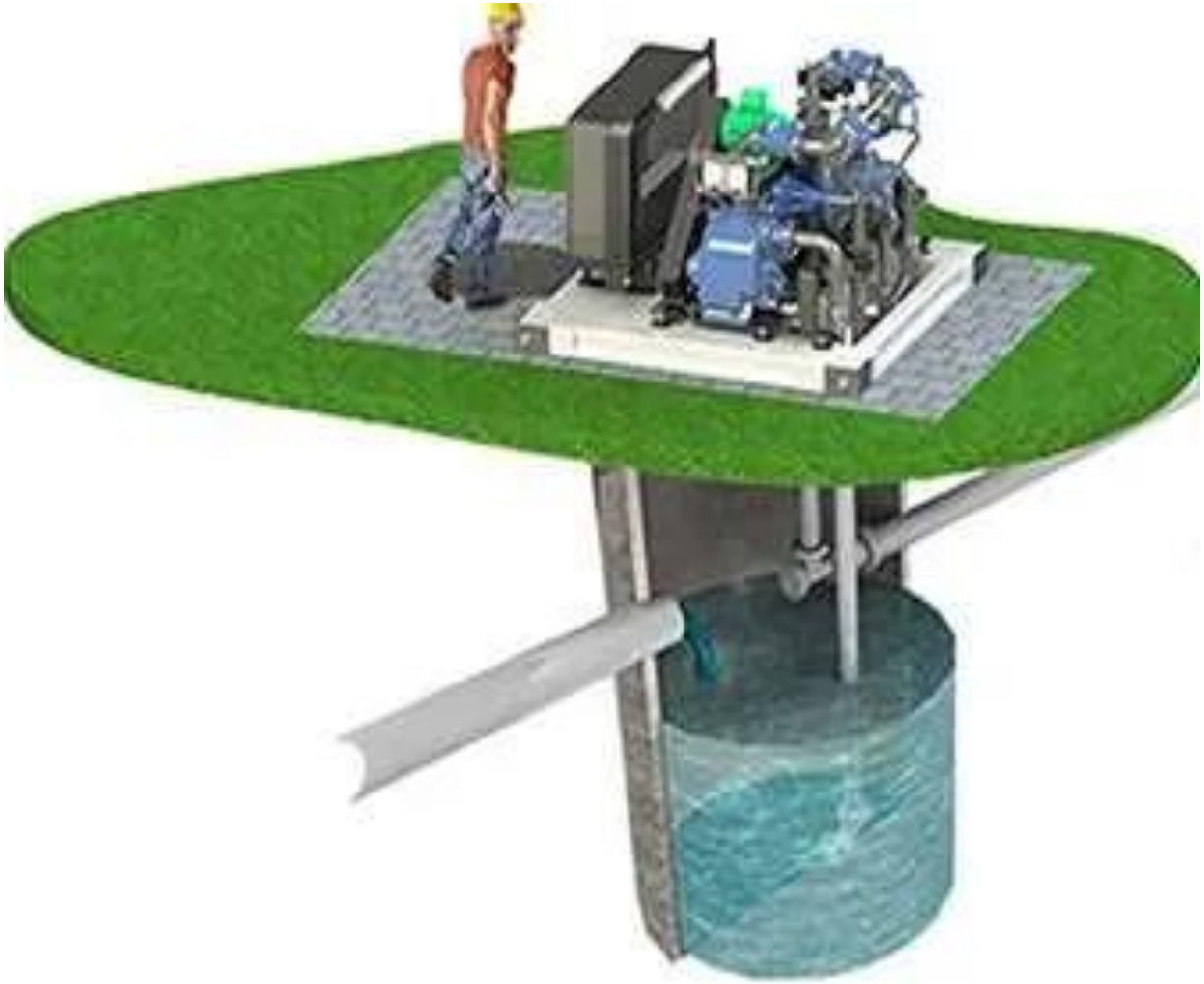
Types of Pumps in Pumping Stations
2 main types

- Submersible centrifugal

- Suction Lift



Suction Lift Self Priming



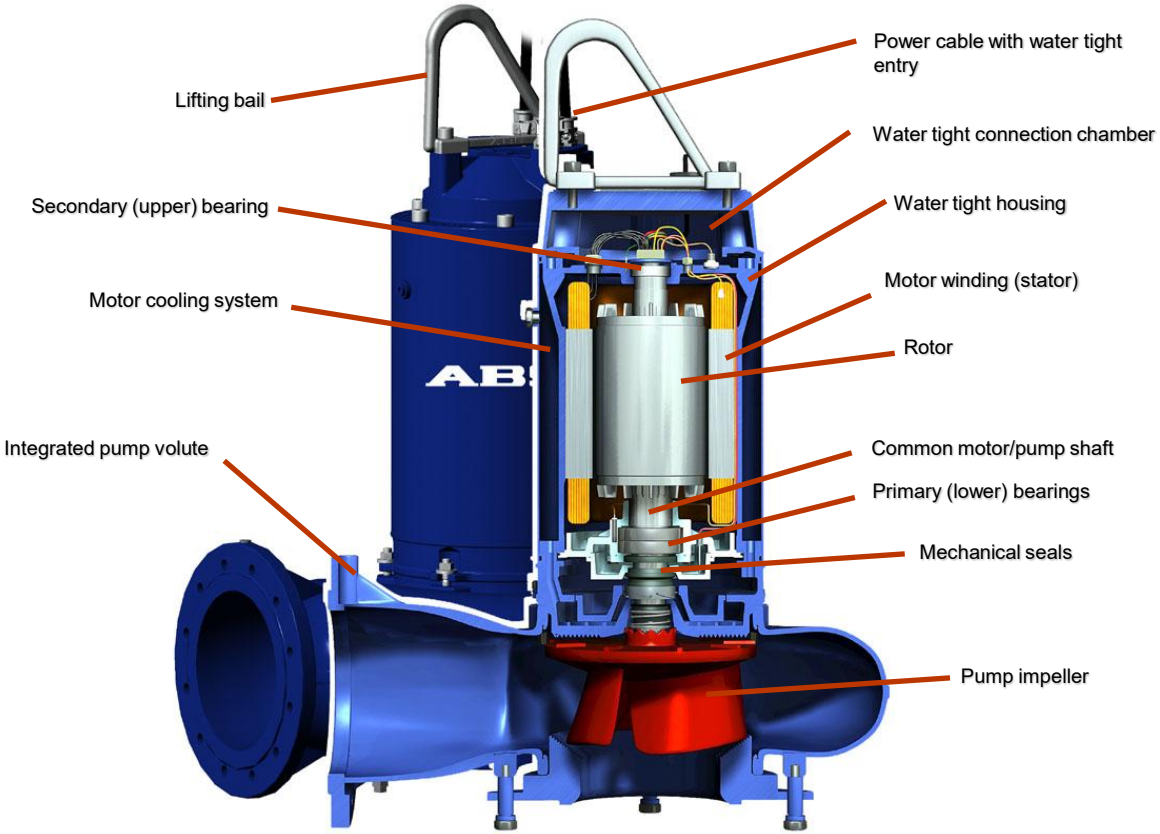
Suction Lift PM Checks

- Check seal sight glass for oil level or if water is present
- Check for debris in pump
- Check for wear on impeller and wear plate
- Check for vacuum leaks in suction piping (particularly if you notice priming loss or long priming times)
- Inspect coupling and/or belts

Suction Lift Pump

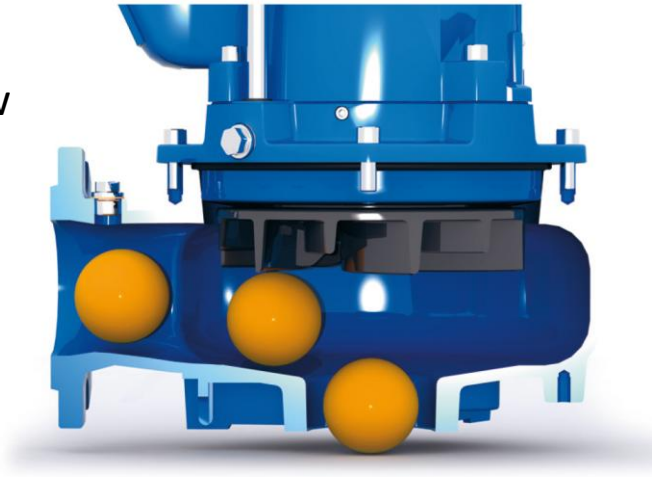
Submersible Lift Station

Design of the Submersible Pump



Vortex impellers

- Suitable for pumping gaseous medium or fluids with a high amount of sand
- Dry solids content up to 8%
- Free solids passage of 50 - 100 mm
- Rag handling capability and less sensitive to wear
- Suitable for "high head - low flow" pumping with low vibration levels even on left side of curve
- Castellation ring protecting mechanical seal



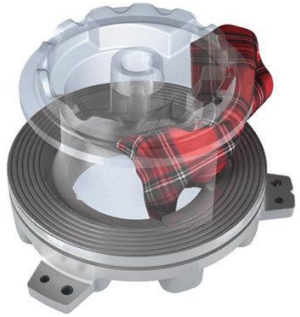
Channel impellers

- Large pumps have large solids passage and allow channel impellers to be used in wastewater transport
- High efficiency and smooth running
- Free solids passage of 80 mm to 200 mm x 125 mm
- Dry solid content <2%
- Wear rings are needed and must be maintained

* NOTE! The suitability of closed type impellers for wastewater depends on the amount of fibrous material and the flow velocity, especially with VFD

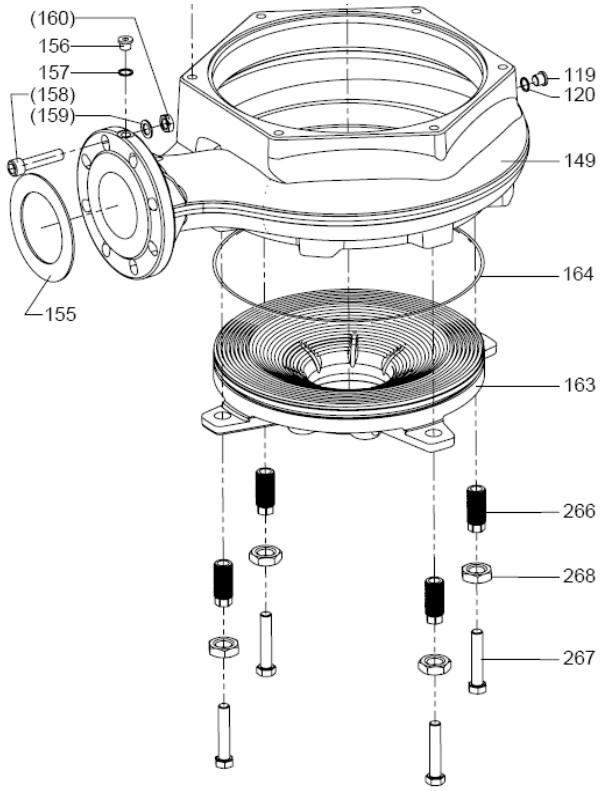
Single-vane Contrablock Plus impellers

- High suction effect with spiral blade
- Without cutting action, reducing the abrasion effect
- Large solids free passage (minimum 75 mm*)
- Improved hydraulic efficiency – up to 76%
- Adjustable bottom plate restores pump efficiency and rag handling
- Avoid accumulation of solids with leading edge profile and impeller hub
- Castellation ring protecting the mechanical seal



* Special high head hydraulics with 2-pole motors may have smaller solids passages

XFP Contra Bloc® Wear Plate Adjustment Large Pumps



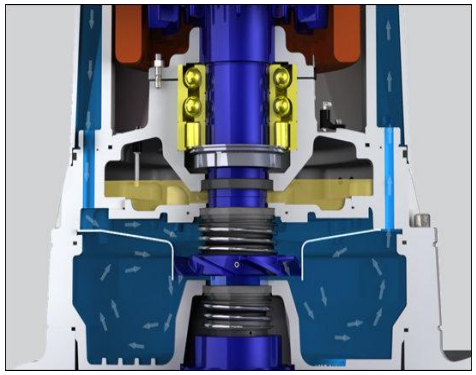
- **Remove screws (267) to release wear plate from volute.**
- **Loosen adjusting grub screws (266).**
- **Insert the wear plate into the volute until it makes contact with the impeller.**
- **Tighten adjusting grub screws (266) until they lightly touch the fixing lugs.**
- **Tighten the adjusting grub screws (266) an additional ¼ turn.**
- **Tighten the securing screws (267).**
- **A light rub is acceptable as long as the impeller is able to be rotated by hand.**
- **For optimum performance the maximum allowable gap between impeller and wear plate is 0.2mm.**

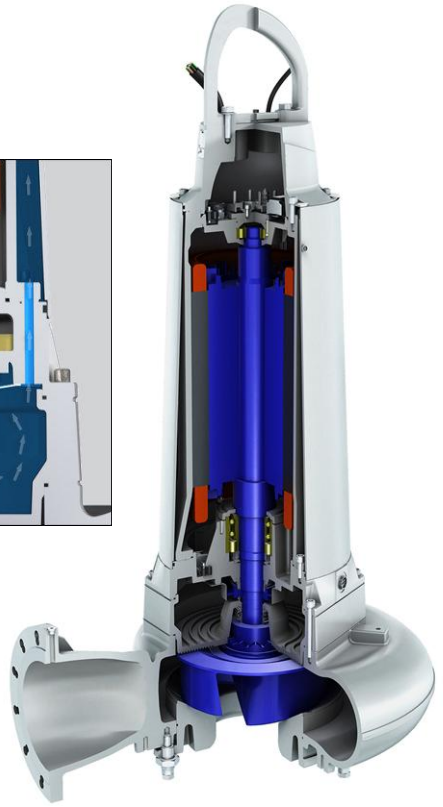
Cooling systems (Dry Pit)

- Oil cooled motor (PE1 and PE2)
- Continuous operation in dry installation

- Closed loop water cooling system* (PE3 to PE6)
- Continuous operation in wet well installation with un-submerged motor
- Continuous operation in dry installation

- Open loop cooling system (PE7)
- Continuous operation in wet well installation with un-submerged motor
- Continuous operation in dry installation





General Overall Inspection

- **Be sure to inspect the unit for any signs of damage to the following:**
  - **Power Cable (Secured Properly, Nicks, Cuts, Abrasions, Swelling & Stress Fractures)**
  - **Impeller (Clogged, Worn, Pitting, Chunks Missing, Impeller Bolt Tight)**
  - **Wear Plate to Impeller Clearance not greater than 0.2mm**
  - **Make sure cables are free of strain, well supported and in conduit where possible.**
  - **Keep power cables away from control wiring, especially 4-20mA circuits. The higher voltage in power cables creates a magnetic field around themselves which could interfere with the sensitive 4-20mA circuit.**
  - **Make sure cables are not hanging from a sharp bend, damage to the insulation could occur.**
  - **Make sure the transition gasket is securely in place on the slide rail adapter if so equipped.**

Wet Well PM

- Scoop floating debris
- Clean out or break-up grease
- Remove rags and grease from pump and level control components
- Pressure wash if needed
- Utilize Vac truck for removing sand and settled material in the bottom of wet well as needed

Wet Well Inspection

Slight Grease Problem

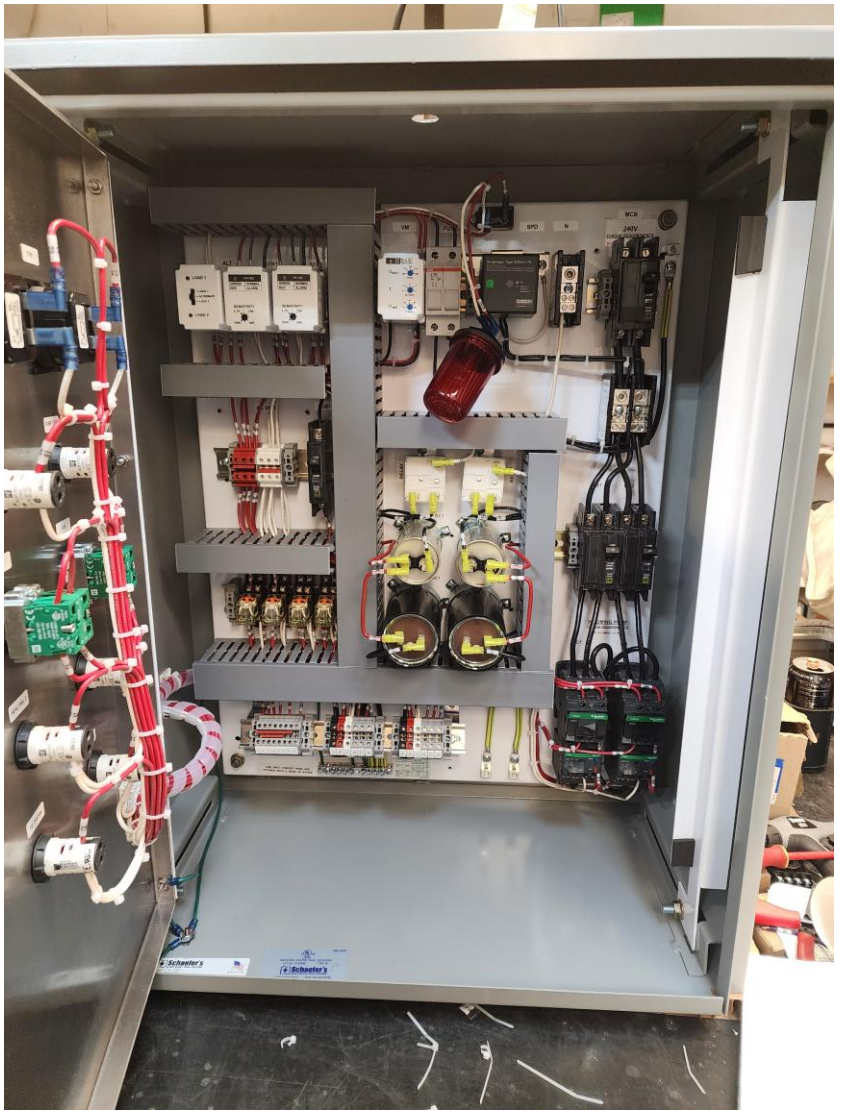
A lil More Grease

Slight Debris

Controls: SAFETY – PPE in Panels

- Lock Out Tag Out at all times
- Check, Check and Check Again.
- Pay Attention!!!!
- Distractions will get you killed or seriously hurt.

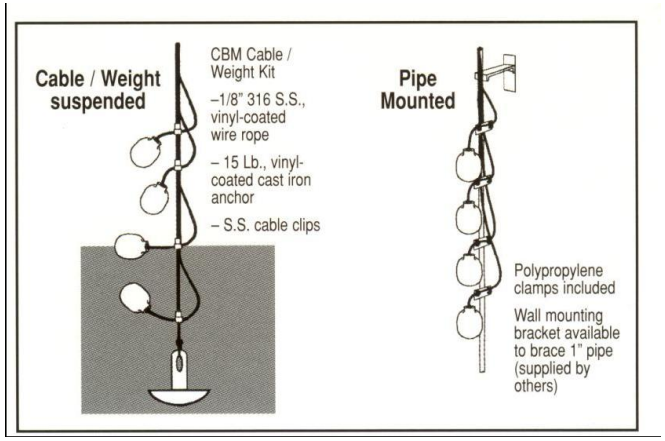
Basic Control Panel



Control Panel PM

- Look for loose wire
- Look for corrosion on wire or electric components
- Check incoming power (meter or disconnect)
- Make sure free from wildlife/insects

Electrical Components – Level Control System



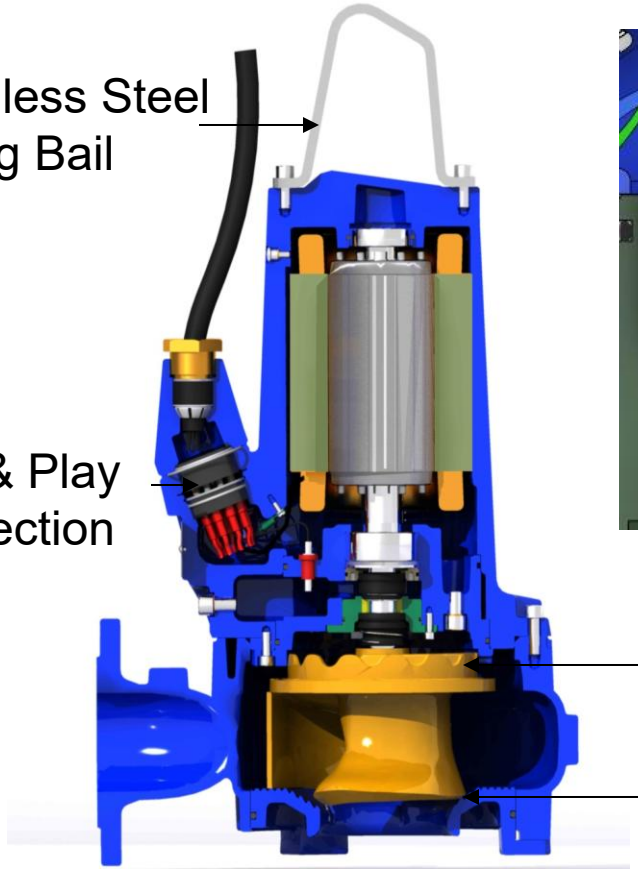
- **Consider running your level control system through a brief test on a monthly basis**
- **Make sure pumps come on and turn off at correct level**
- **Make sure alternation works**

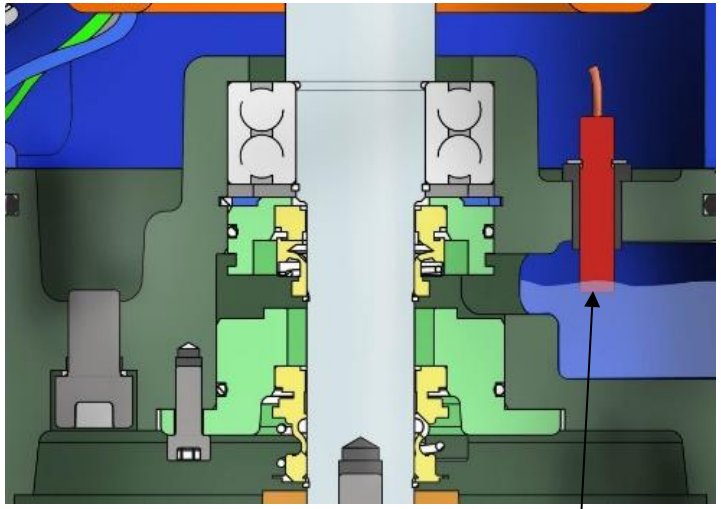
Electrical Components – Level Control System

- **Check calibration on all elements producing varying (analog or 4-20 mA) signals like flow meters—especially if used for billing purposes**

- **Level Sensor test**
  - **Measure resistance across discrete sensors (floats)—should approach infinity if normally open**
  - **Measure amperage for any varying (analog) sensors like level transducers while in operation (break circuit and put meter in series with instrument)**

Seal Probe


Stainless Steel
Lifting Bail
Plug & Play
Connection
Seal Guard System
Contra Bloc® Impeller
With adjustable Wear Plate


Moisture Detection
Probe

Electrical Components – Monthly Checks

- **Perform and record the motor insulation test ("megging" the motor – 500 VDC for 230V Motors, 1000VDC for 460V motors).**
- **New factory value is 20 MΩ or higher. Field value for us is 10 MΩ or higher.**
- **If value is between 500,000 and 10 M Ω, consider having motor sent to shop for drying and then re-test.**

The Startup

Pre-Startup Checks

- Check for missing or loose components
- Check for obvious signs of damage
- Check to make sure that the schematic is correct
- Make sure that all wire connections are tight
- All cable entries should maintain the integrity of the enclosure
- Enclosure should open and close without binding or excessive force
- Check for moisture in the enclosure
- Clean out all debris

“Wild Leg” or “Stinger Leg”

- 240 three phase four wire service from a Delta connected transformer
- One leg of power (phase to ground) is the “wild leg”
- 210VAC is common as opposed to 120VAC
- Care should be taken to insure that no control or 120VAC devices are powered from the “wild leg”

Startup Procedure

- All breakers should be in the off position
- Check voltage on the line side of the main or on the terminal block
- Check the Phase Monitor if applicable
- If voltage is correct, the main can be switched on
- Check voltage for the additional breakers on the line side. If voltage is correct switch them on, one at a time.

Check Pump Protection Devices

- Check to make sure that seal fail and thermal protection devices are connected properly and are receiving the correct signal from the pump.
- Check that the seal fail and thermal protection devices are operating correctly by disconnecting one thermal lead and the seal probe lead from the control.
- Be sure to isolate the disconnected leads from arcing out against the control enclosure!!

Checking pump operation

- Turn each HOA to hand position to check that the pump runs in manual and is rotating correctly.

- Amperage readings can be taken with the pump fully submerged and motor breaker in the on position. If amperage is excessive on any leg of power, care must be taken to balance the feed.

Testing Automatic Operation

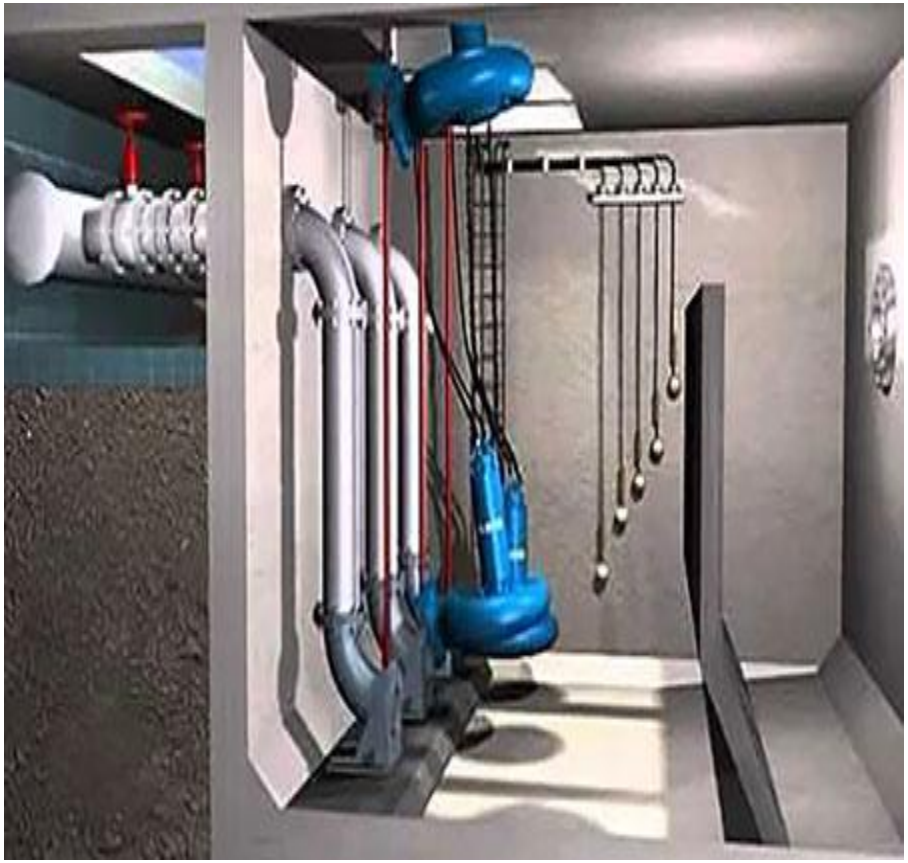
- Real testing is watching actual cycles.
- Simulation testing can be utilized when sufficient water is not available.

Backup Pump/Generator PM

Inspect and Replace

- Oil
- All Filters
- Coolant level on liquid cooled engines
- Make sure any/all gauges are working
- Run monthly or at least quarterly operational test and load testing
- Pre-set weekly auto engine cycle testing (if capable)
- *Note*Backup Pumps allow for PM of primary pumps

Valve PM



Valve PM

- Exercise gate valves monthly
- Inspect lever on swing check valve
- Clean out check valve if debris suspected
- Check bypass valve (NEEDED!!!) in most situations

How SCADA is used for PM

- SCADA (Supervisory Control and Data Acquisition) Hydra Link
- Allows for remote monitoring of pumps or other equipment at the pump station
- Can give indications to problems or potential problems before they happen
- Logs the info and can be retrieved or plotted to show a complete picture of the pump stations life cycle

Performing Lift Station Drawdown test

- Gives pump wear indications
- Identifies system problems (clogs, change in system conditions)
- Insures pump performance in relation to the incoming flow
- Gives you the ability to know if the station can handle future growth and development in the area

Draw Down Test: Determine Characteristics of Lift Station

- Diameter of Wet Well
- Determines Gallons per Inch
- Refer to hand out for round and square/rectangle basins
- All tests must be done with wet well level below the inverts

Active Station? Calculate In-Flow

- Pump station level to well below the invert
- Take a measurement from water level to top slab
  - It is important to always use the same reference point
- Allow inflow without pumps running for 60 seconds
- Take another measurement from water level to top of slab
- Subtract start elevation from finish elevation
- Multiply the difference (In-Flow) by the gallons per inch determined from the size of the well

City Lift Station #3			
Wet Well Dia	48	Inches	
Gal/Inch	7.83		
Water coming in			
Start	150		Inches
Finish	133		Inches
In Flow	17		Inches
Time	60		Seconds
Flow Rate	133.1		GPM

Station Draw Down – Calculate Pump Flow

- Pump station level to below invert
- Take a measurement from water level to top slab
  - It is important to always use the same reference point
- Run one pump for 60 seconds
- Take another measurement from water level to top of slab
- Subtract start elevation from finish elevation
- Multiply the difference (Draw Down) by the gallons per inch determined from the size of the well
- If station is active, add in-flow to pumped gallons per minute

Water coming out			
	Pump#1	Pump#2	
Start	120	124	Inches
Finish	148	156	Inches
Draw Down	28	32	Inches
Time	60	60	Seconds
In-Flow Rate	133.1	133.1	GPM
Flow Rate	352.3	383.7	GPM

In Closing: Keeping Accurate Logs

- - Maintenance logs by date and personnel
- - Inspection reports with photos
- - Repair and replacement history
- - Alarm and failure logs
- - Compliance records (for audits and permits)
  SCADA is a great channel for these records

What to Watch Out For

- Pump clogging | Screen cleaning, debris checks
- Float switch failure | Monthly cleaning and testing
- Odor complaints | Maintain odor control equipment
- Alarm failure | Regular testing of control panel

Key Takeaways

- - Routine PM prevents failures and extends equipment life
- - Daily to annual tasks are essential
- - Keep thorough records
- - Safety and training are critical components

Any Questions?