Submersible Pumps & Motors
Preventative Maintenance

June 7, 2012
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Water & Wastewater
Submersible Pump Applications

- Submersible Pumps Can Operate Submerged In A Wet Well Or Permanently Mounted In A Dry Well
- Pump Preventative Maintenance Should Include The Pump Environment & Equipment, The Pump Itself And The Controls
- Proper Preventative Maintenance Of The Well Will Increase The Longevity Of The Pumps
- Regular Control Panel Checks Can Give Forewarning Of Potential Problems
- Annual Pump Inspections Can Increase The Life Of The Pump And Prevent Catastrophic Failures
Maintenance & Troubleshooting Safety

- Follow All Safety Guidelines When Working Around Lift Stations And With Mechanical & Electrical Equipment
- Check For Any Hazards Including Trip, Fall, Chemical And Dangerous Gases
- Use Proper Safety Gear Including Proper Safety Shoes, Hard Hats, Harnesses, Gas Monitors And Gloves
- Only Qualified Service Personnel Should Perform Work And Should Never Work Alone
- Do Not Ignore Health Hazards. Observe Strict Cleanliness
- A First-aid Kit Must Be Handy
- Use Lock-out Tag-out Procedures On Electrical Equipment
Wet Well Preventative Maintenance

- Properly Ventilate Well And Check For Gases Before Observing Wet Well
- Remove Debris From Top Of Wet Well Water Level
- Check Condition Of Power Cables
- Check Guide Rails
Wet Well Preventative Maintenance

- **Clean Level Sensors (Floats, Transducers) And Check For Proper Operation**
  - Clean Floats And Check By Tilting
  - Check Transducers By Using Known Water Height and Verify In Controls

- **Check Pump Connection For Proper Sealing**
  - If Water Swirls Or Sprays Around Discharge Connection, This Could Indicate Improper Sealing or Sludge Build Up Around Pump
Wet Well Preventative Maintenance

- Pump Lift Station Down And Clean Side Walls Off
  - Flygt Pumps Can Be Operated Until The Pumps “Snore” To Help Remove Debris And Decrease Build Up. (Check Other Manufactures If Pumps Can Be Operated Continuously This Low.)
  - Use Two Pumps To Pump Down Station To Increase Velocity In The Discharge Piping And Reduce Chance Of Clogging.
Submersible Dry Pit Preventative Maintenance

- Follow The Same Guidelines For The Wet Well
- Check Ventilation Equipment
- Properly Ventilate Dry Well And Check For Gases Before Entering
- Follow Safety Codes Before Entering The Dry Well And Before Opening The Wet Well
Submersible Dry Pit Preventative Maintenance

- The Dry Well Needs To Be Checked For Cracks And For Water Leaks In The Walls
- Sump Pump Needs To Be Checked For Operation
- Fittings Need To Be Checked For Tightness
- Gate & Plug Valves Need To Be Operated To Prevent Seizing And Allow Full Closure When Needed
Submersible Pumps & Motor

- Submersible Pumps And Motors Are One Unit (No Couplings, Impeller Is Directly Attach To The Motor Shaft)
- Mechanical Seals Isolate Motor From Pumped Media
- Most Submersible Pumps Use Upper & Lower Mechanical Seals That Provide A Seal Chamber For Lubricating & Cooling The Seals
- Mechanical Seal Failure Can Be Cause By Erosion, Vibration Or Thermal Shock
- Water Intrusion Into The Motor Chamber Causes Motor Failure, Leak Sensors Notify The Onset Of A Leak
- Motor Failure Can Also Be Caused By Electrical Malfunction
Typical Submersible Pump

- Junction Chamber
- Motor Compartment
- Seal Oil Chamber
- Hydraulic Wet End
Typical Small Submersible Pump

- JUNCTION CHAMBER
- MOTOR COMPARTMENT
- SEAL OIL CHAMBER
- HYDRAULIC WET END
Flygt N-technology

Working together for higher efficiency

- N-impeller
- Insert ring
- Guide pin
- Relief groove
- Pump housing
“Compact Mixers/Pumps” 4600 - Series

Water & Wastewater
“Horizontal Axial Flow Pumps” PP4600 - Series
Pump Preventative Maintenance (Annually)

- Run Pump And Listen For Any Unusual Noise In Upper & Lower Bearings
- Remove Pumps And Clean Off Build Up
- Check For Build Up Around Power And Lifting Cables/Chain
- Check Impeller Clearance
- Check For Clogging
PUMP DRAWS HIGH AMPS – MAY BE CLOGGED
Beaver
Pump Preventative Maintenance (Annually)

- Remove Pump From Volute To Remove Any Stringy Material From Around Impellers And Any Lodged Or Debris Build Up

- Check Oil Chamber For Oil Condition And Level Plus Change Oil (Properly Dispose Of Old Oil & Replace O-Rings)

- Meggering The Power Leads
  - Insulation Check
  - Water Intrusion Check
  - Cable Damage Check
Checking A Pump With Multimeter

- Check Each Power Lead To Pump
  Ground Lead
  - Open – Winding Is Not Grounded
  - Resistance – Winding Is Grounded

- Check Between Power Leads To
  Determine
  - Resistance Values Shows What Voltage
    Pump Is Wired For
  - Open Circuit Could Be Open Windings
    Or Cut Cable
Checking A Pump With Megger

- Disconnect Pump Power And Ground Leads
- Check With A Cool Motor
- Check Power Lead To Pump Ground Lead
  - High Megohm – Good Motor
  - Medium Megohm – Used Motor, Hot Motor or Slightly Wet
  - Low Megohm – Deteriorated Motor Insulation, Bad Cable, Wet Windings
  - Low-No Megohm – Burnt Motor, Grounded Leads, Soaked Cable or Motor
- Do NOT Megger Pump If It Has Internal Contactors Or Capacitors (Single Phase)
Check Pump Sensor Leads

- Check Manufacture’s Ratings For Sensor Leads And To Determine Proper Test Procedure And Function

- Usually Sensor Leads Are Checked by Resistance (1200 – 1550 normal)

- Open Resistance Will Show Fault, Possible Open Thermals (~)

- Resistance Values On Leak Sensors Can Determine If A Leakage Has Occurred (300)
MOISTURE IN PUMP
Control Panel Preventative Maintenance

- Check In-Coming Power
- Check Run Time Meters And Compare Previous Run Times
- Check Operating Amps For Each Pump And Compare To Previous Readings & Full Load Ratings
- Check All Electrical Components And All Connections Including Surge Arrestors, Alternators, Relays And Pump Sensors
Control Panel Preventative Maintenance

- Check Alarm Light & Horn Operation
- De-energize Panel, Check And Tighten All Connections
- Check Conduit For Tightness And Sealing (Replace Sealing When Floats Or Pumps are Pulled Through)
- Use A Mild Protective Spray On The Door Gasket To Ensure Watertight Integrity
Pump Troubleshooting

- Pump is operating but not pumping
  - Air Locked (Pump will pull lower than usual amps)
  - Pump Is Not Sitting On The Discharge Connection Properly
  - Valves stuck or closed (Pump will pull lower than usual amps)
  - Debris in front of inlet pipe (Can possibly hear cavitation or rattling in pump)
  - Wear Ring is worn out or Impeller clearance needs adjusted
  - Pump is turning backwards (Three Phase Only) (Pump may vibrate more)
  - Loose or Broken Impeller (Pump will pull lower than usual amps)
  - Verify check valve on opposite side is closed (Will see return flow around pump)
Pump Troubleshooting

- Pump will not operate
  - Check phase monitor is tripped
  - Check for thermal/leak sensor is tripped
  - Check Starter overloads
  - Check for “Low Level Shut” off

- Pump will operate but motor protection trips
  - Check the impeller
  - Check incoming power (out of phase)
  - Megger the pump for wet or burnt motor
OVERHEATED MOTOR

05/26/2005
Types of Electrical Motor Failures

- **Winding Single-Phased**
  A single-phased winding failure is the result of an open in one phase of the power supply to the motor. The open is usually caused by a blown fuse, an open contactor, a broken power line or bad connections.

- **Phase Damage Due to Unbalanced Voltage**
  Thermal deterioration of insulation in one phase of the stator winding can result from unequal voltage between phases. Unequal voltages usually are caused by unbalanced loads on the power source, a poor connection at the motor terminal, or a high resistance contact (weak spring).

  **Note:** A one-percent voltage unbalance may result in a six- to ten-percent current unbalance.
Types of Electrical Motor Failures

- **Winding Damaged Due to Overload**
  Thermal deterioration of the insulation in all phases of the stator winding typically is caused by load demands exceeding the rating of the motor.
  **Note:** Under-voltage and over-voltage (exceeding NEMA standards) will result in the same type of insulation deterioration.

- **Damage Caused by Locked Rotor**
  Severe thermal deterioration of the insulation in all phases of the motor normally is caused by very high currents in the stator winding due to a locked rotor condition. It may also occur as a result of excessive starts or reversals.
Types of Electrical Motor Failures

- This type of insulation failures is typically caused by contaminants, abrasion, vibration or voltage surges.

- Winding Grounded at Edge of Slot
- Winding Grounded in the Slot
- Winding Shorted Phase-to Phase
- Shorted Connection
- Winding with Shorted Coil

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February 19, 2009

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Questions

- Any Questions?