Submersible Pump Troubleshooting

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Baker & Associates

Troubleshooting Opportunities

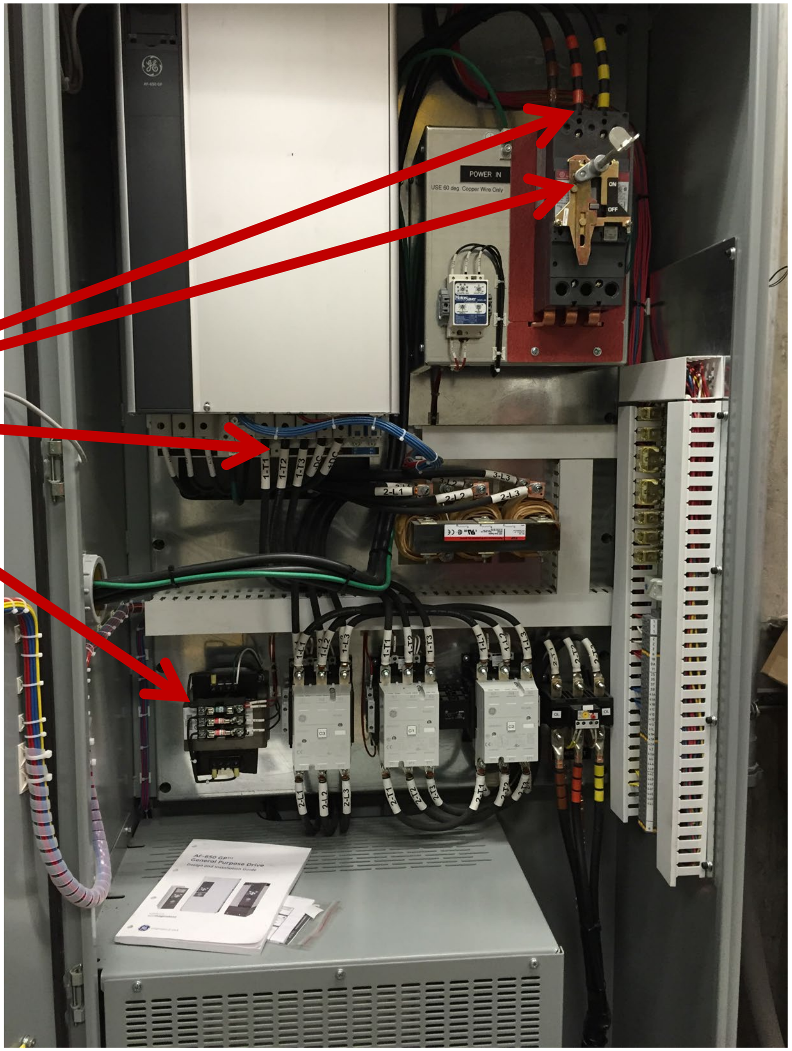
- Pump is on site and running
- Pump is on site, not running
- Pump is in shop, assembled
- Pump is in shop, disassembled

Pump In the Wetwell, Not Running

Pump In the Wetwell, Not Running

Control Panel

- Is there power to the panel?
- Is there correct voltage?
- Are the electrical connections tight?

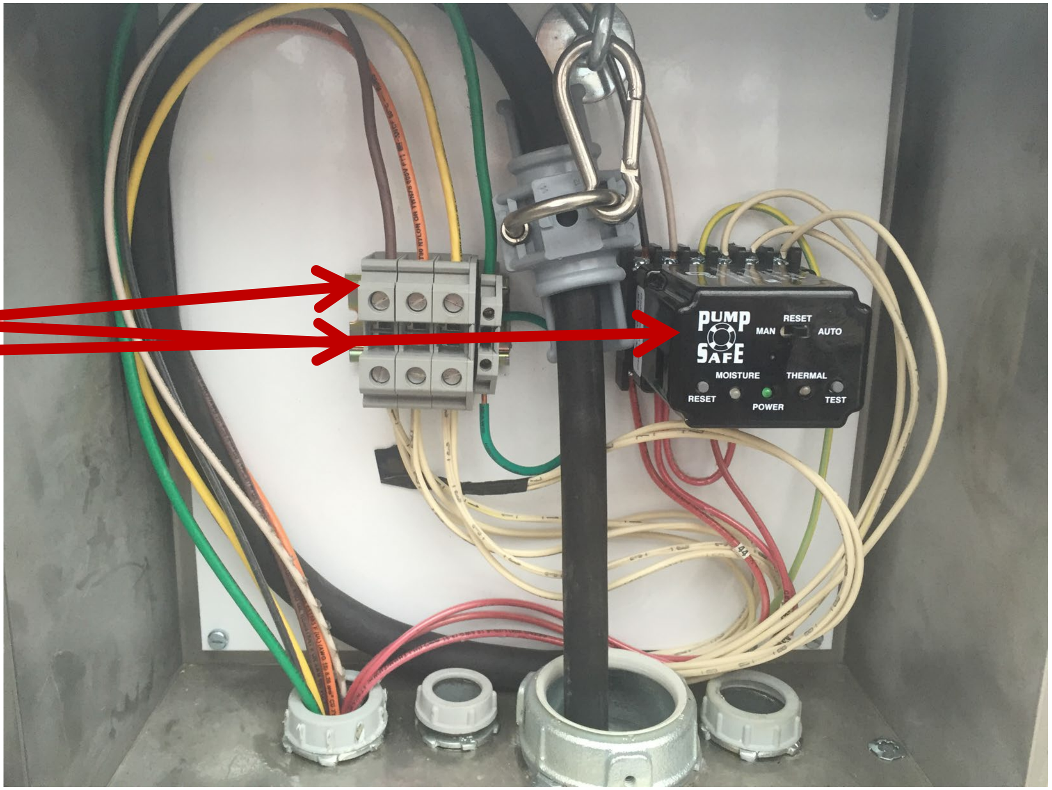


Pump In the Wetwell, Not Running

Junction Box

- Are the electrical connections tight?
- Is there proper voltage?

tripped/functioning?



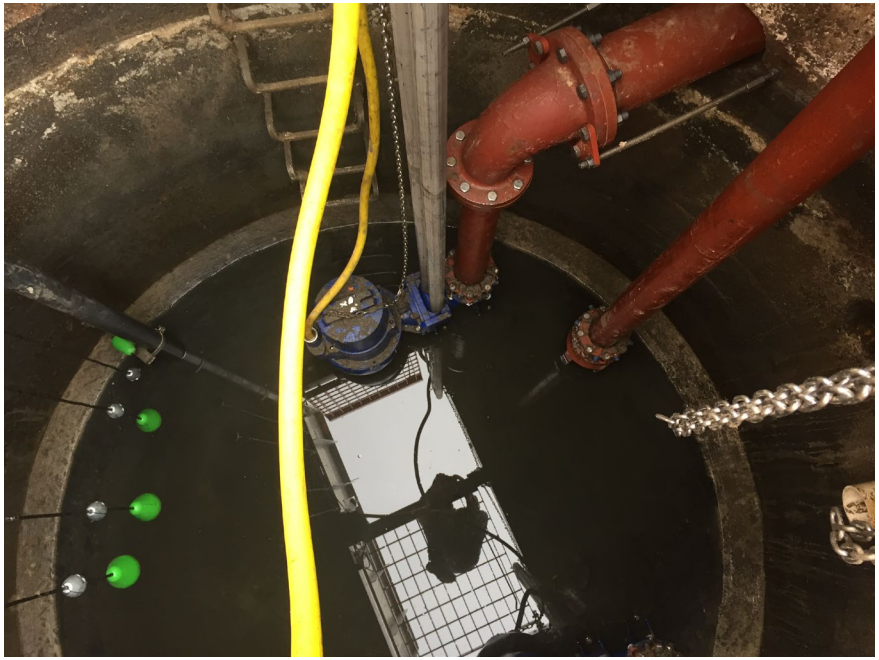
Pump is On Site, Not Running

- Check to ensure the impeller spins freely.
- Inspect for clogging

Pump In the Wetwell and Running

Pump In the Wetwell and Running

- Is the level going down?
- Is there any abnormal noise?
  - Can you "pin point" the source?
- Is there excessive vibration?
  - Perception or instrumentation
- Is the check valve opening?



Pump In the Wetwell and Running

- Is pump properly seated on the discharge?

Pump In the Wetwell and Running

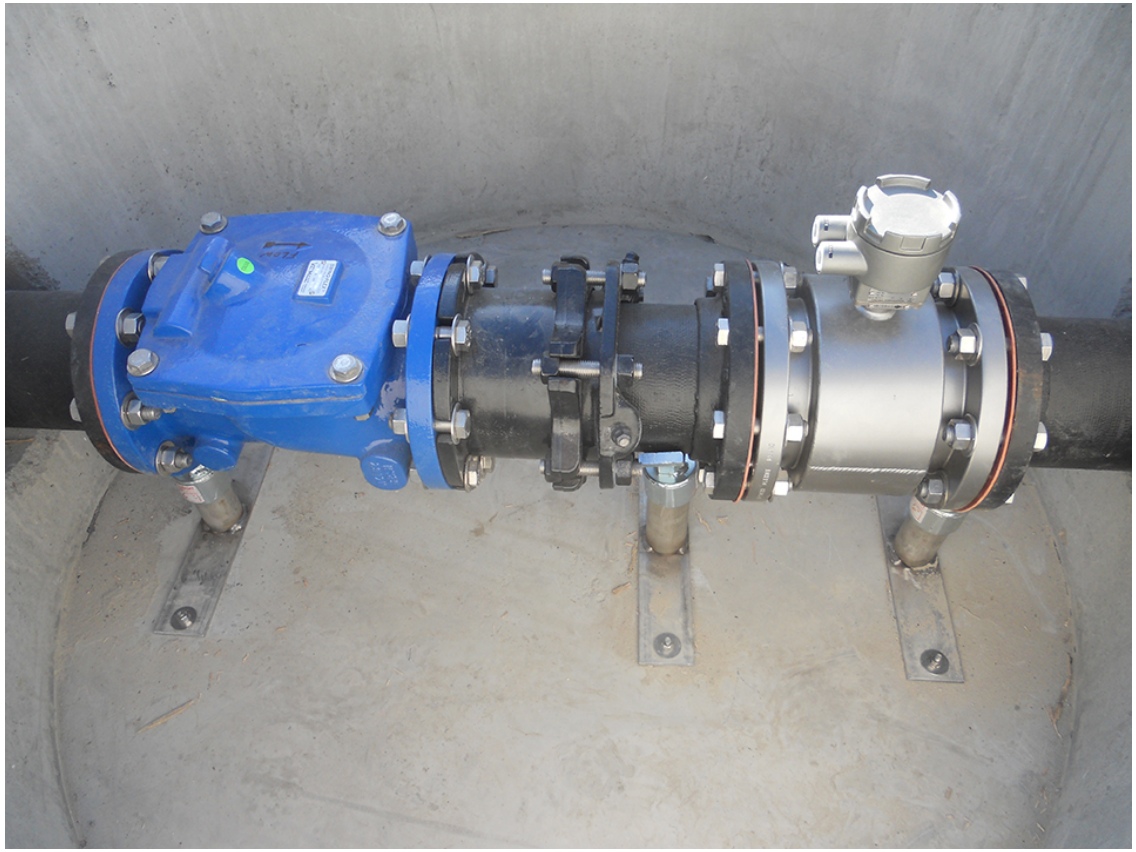
Instrumentation Checks

- What is the head pressure?

Pump In the Wetwell and Running

Instrumentation Checks

- Is there a flow meter available?



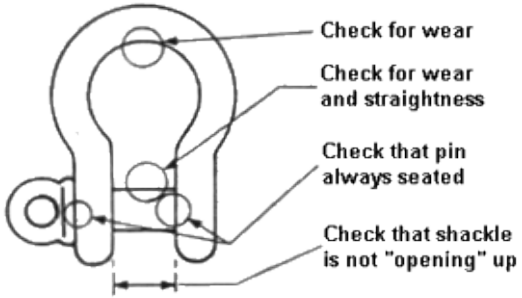
Pump In the Wetwell and Running

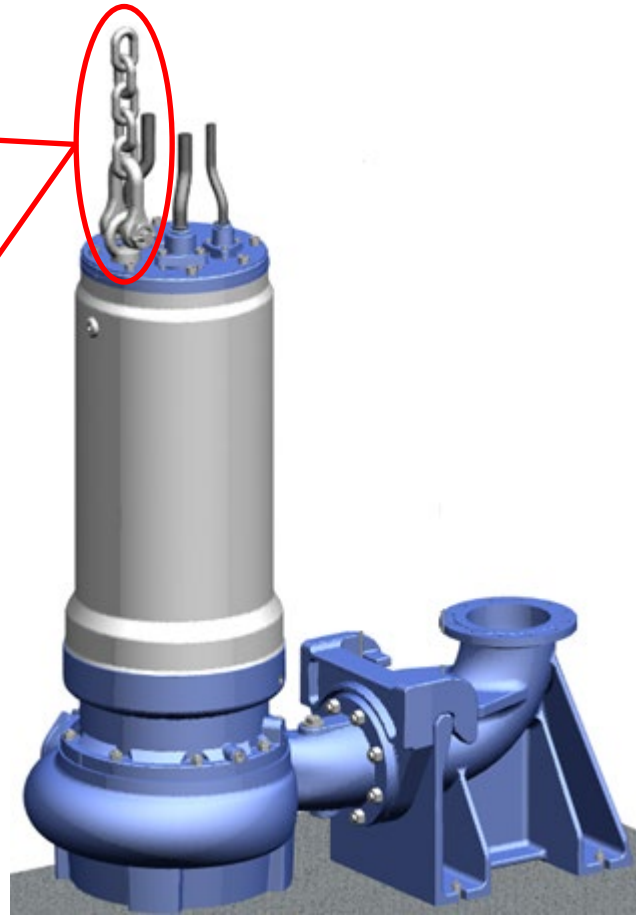
Instrumentation Checks

- What is the current draw?
- Measure the pump monitoring sensors.

Pump is in shop, assembled

Inspect Lifting Chain





Pump is in shop, assembled

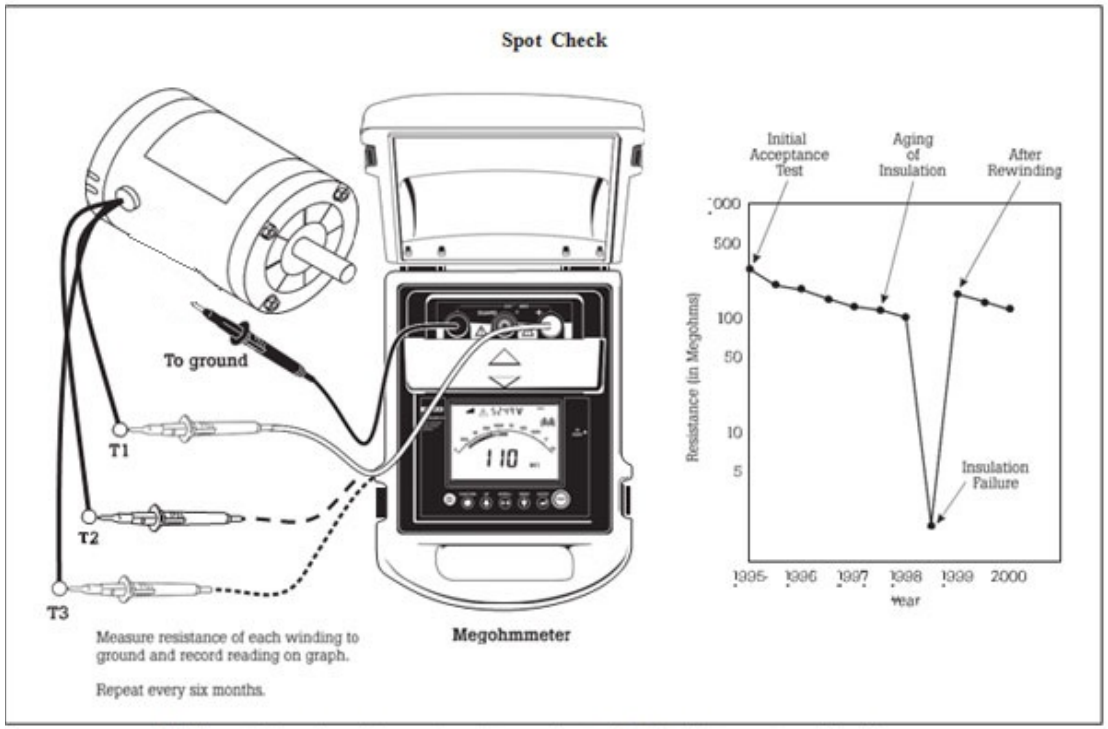
- Visually inspect pump cables for tears or cuts

Pump is in shop, assembled

- Inspect for signs of wear
- Check wear ring tolerances.

Pump is in shop, assembled

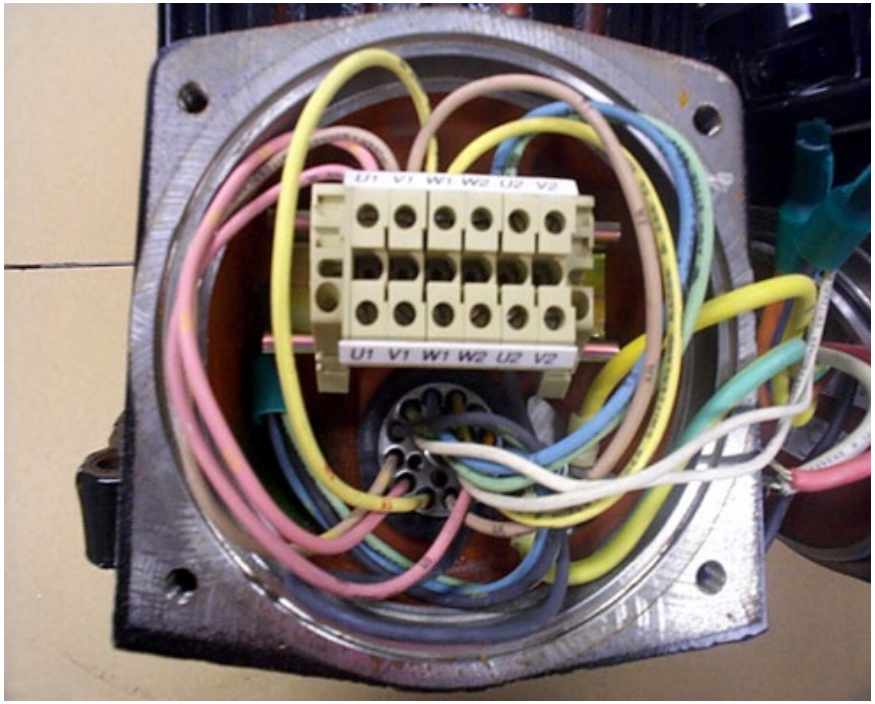
- Check Winding Resistance



Periodic spot check can be used for preventive maintenance, but must be adjusted for temperature and humidity.

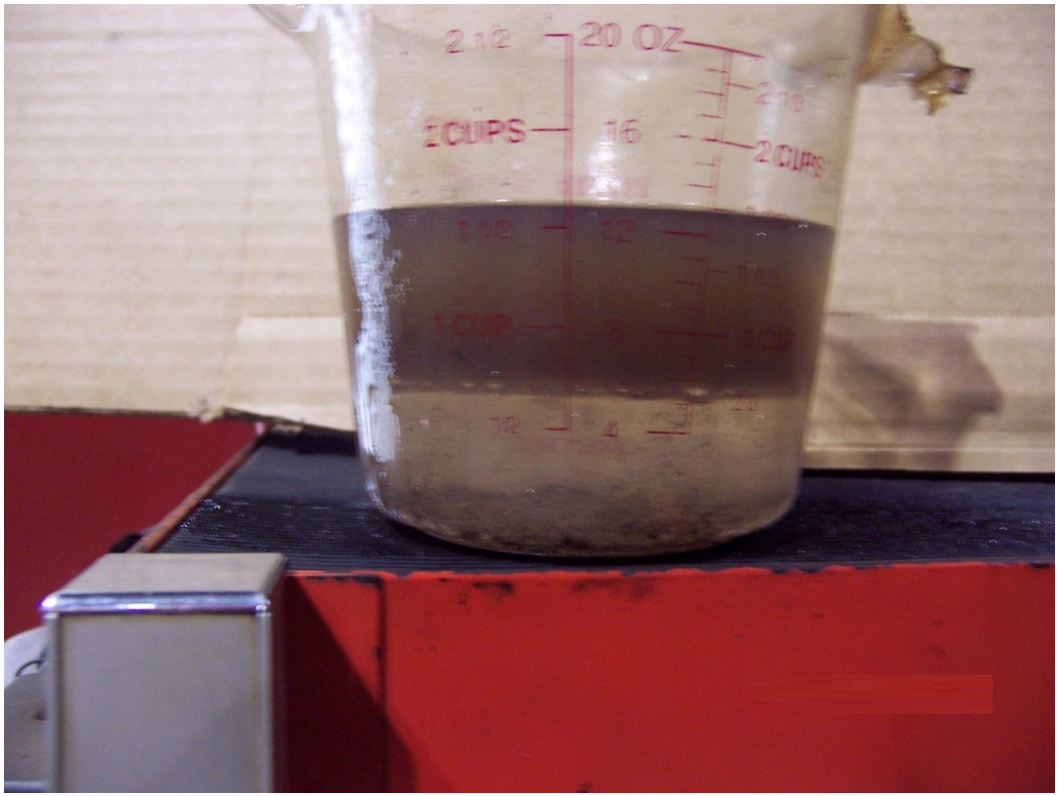
Pump is in shop, assembled

- Check for proper wiring of the terminal board.



Pump is in shop, assembled

- Evaluate the seal oil.



Pump is in shop, assembled

- Check for restricted movement of rotating parts.
- Check for loose hardware.

Pump is in shop, assembled

- Check mechanical seal installation.
- Check mechanical seal condition.

Pump is in shop, disassembled

Pump is in shop, disassembled

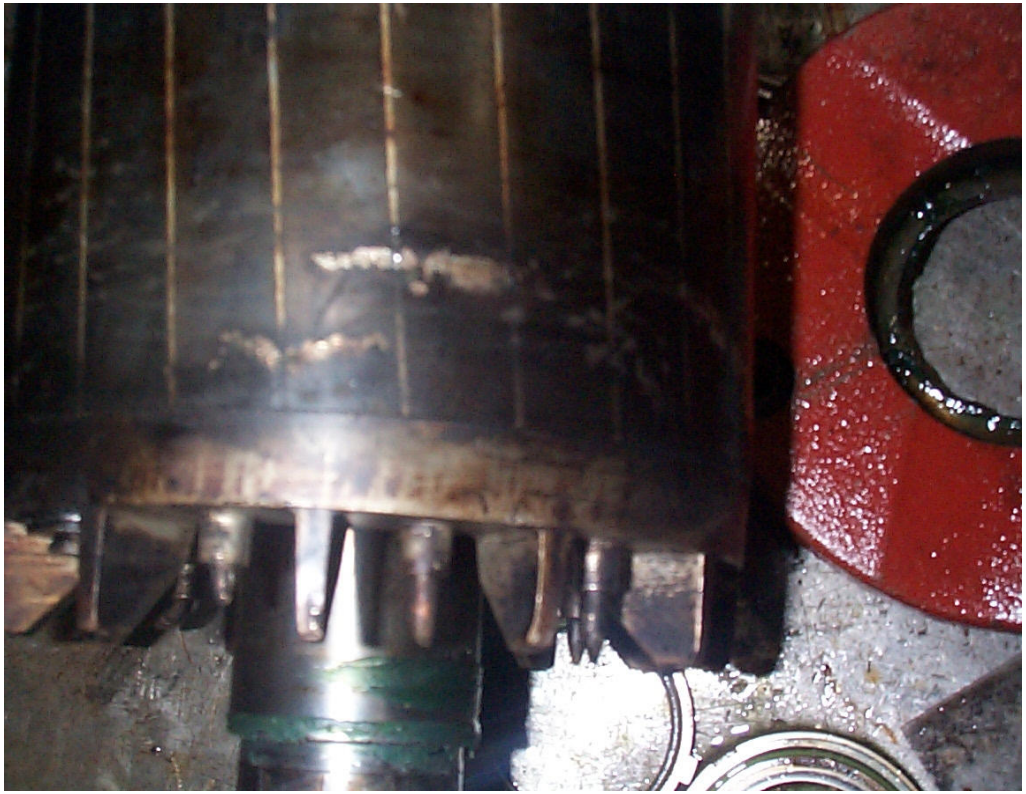
- Check for wear, rubbing, or discoloration of pump components.
  - Housings
  - Shafts
  - Rotor
  - Impeller
  - Seals

Pump is in shop, disassembled

- Overheated Motor

Pump is in shop, disassembled

- Rotor Damage



Pump is in shop, disassembled

- Inspect the Wet End
- Impeller Wear Ring
- Casing Wear Ring
- Impeller Damage/Wear
- Cavitation

Pump is in shop, disassembled

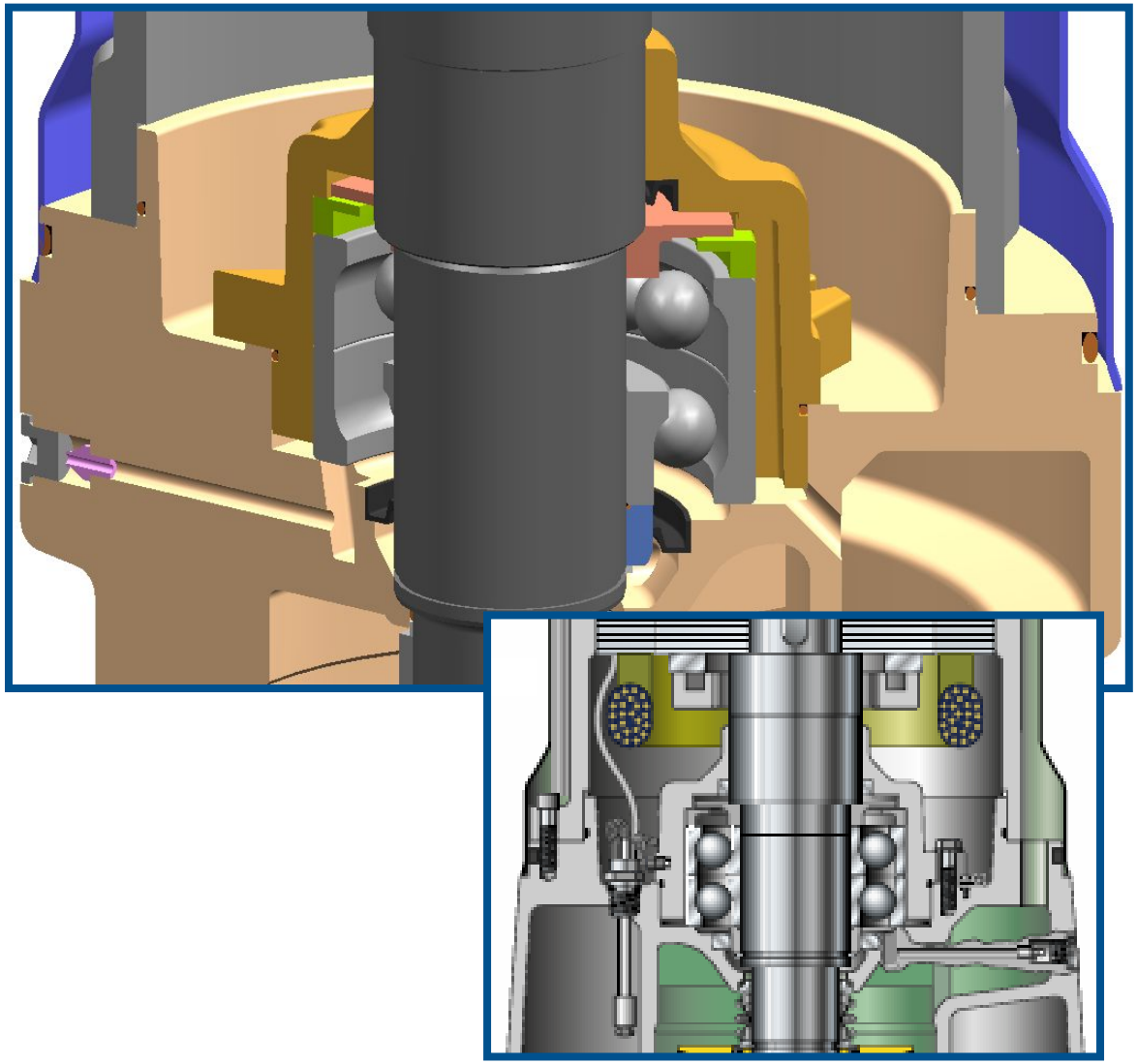
- Seal Failure

Pump is in shop, disassembled

- Can you see evidence of corrosion?
- Are there any parts missing?
- Are there any signs of misuse?
- Inspect the O-rings

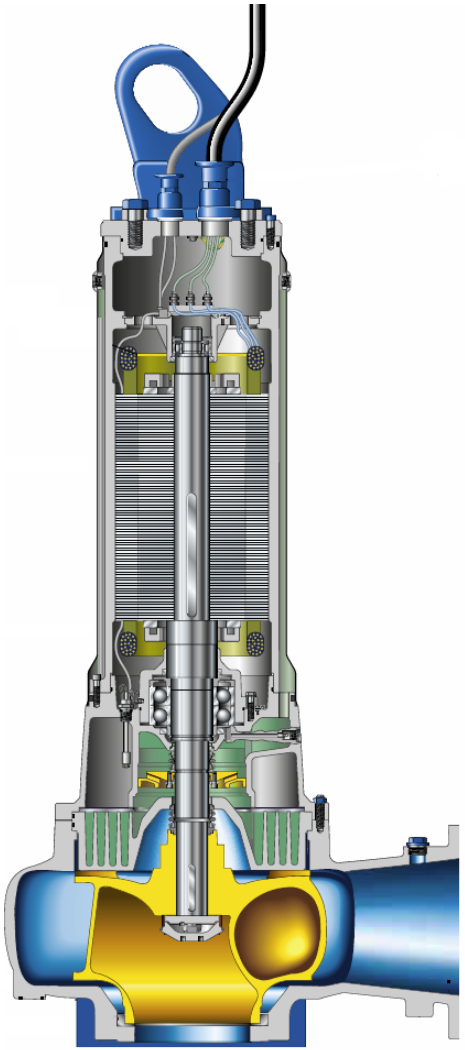
Pump is in shop, disassembled

- Bearings
- Lack of Lubrication
- Signs of Wear



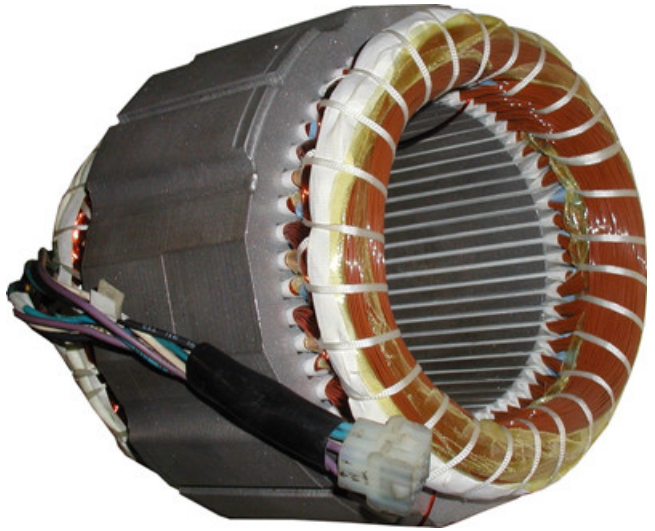
Failure Determination

- Electrical
- Mechanical
- Seal



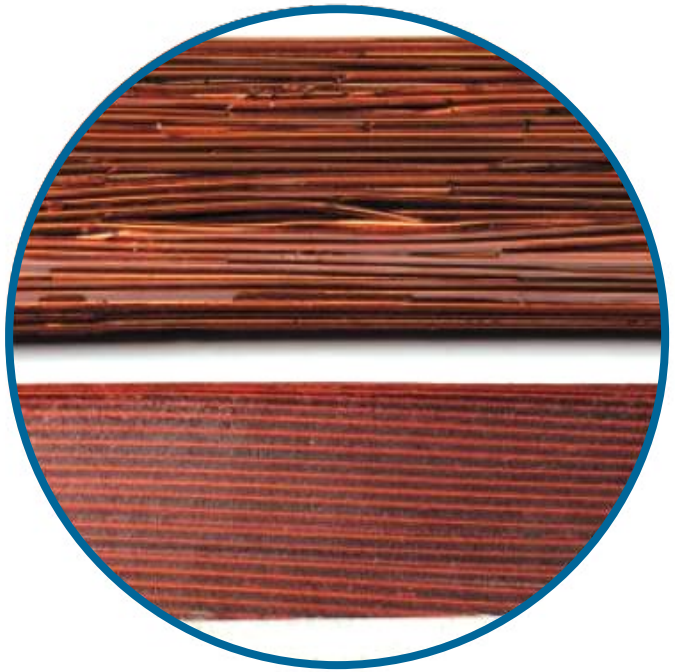
Electrical Failure

- Most Common by Insulation Breakdown
- Insulation in the Motor Fails
- Windings Short
  - To Ground
  - To Adjacent Winding



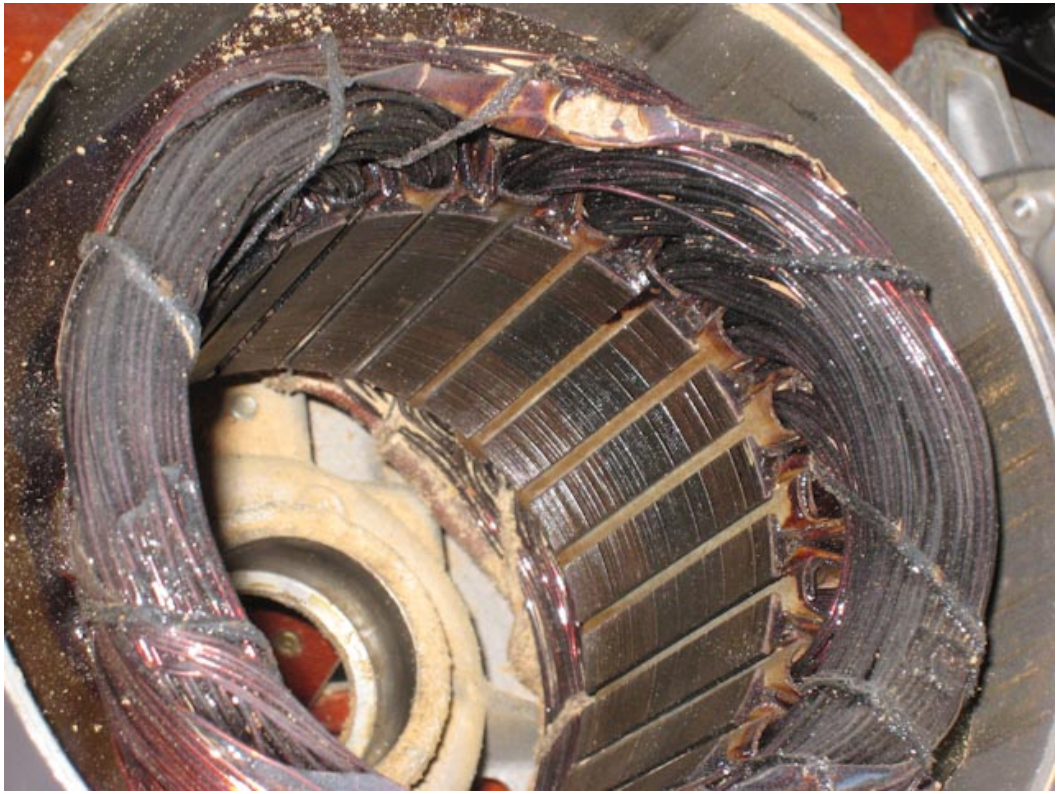
Electrical Failure

- The motor insulation is broken down by heat.
- In the long term this is normal wear and tear.
- In the short term this is a failure.
- Excessive heat can be caused by:
  - Overloading
  - Under voltage -10% of rated voltage
  - Voltage unbalance -1%
  - Cooling system failure
  - Starting pump too frequently



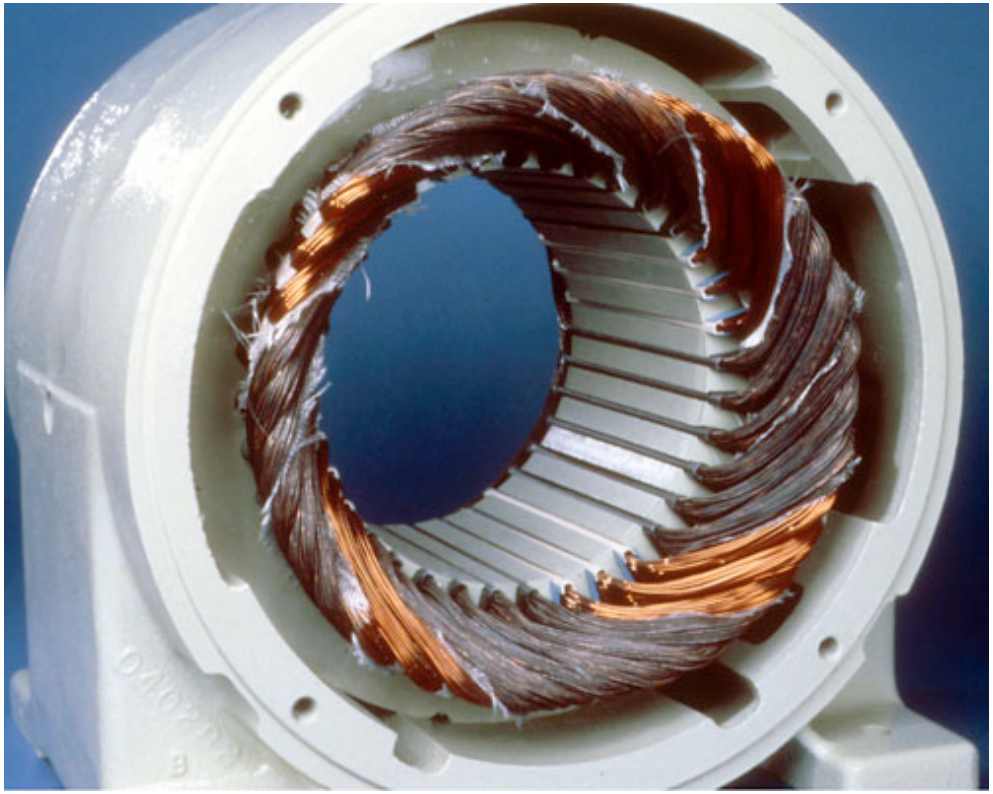
Electrical Failure

- Overload / Under voltage



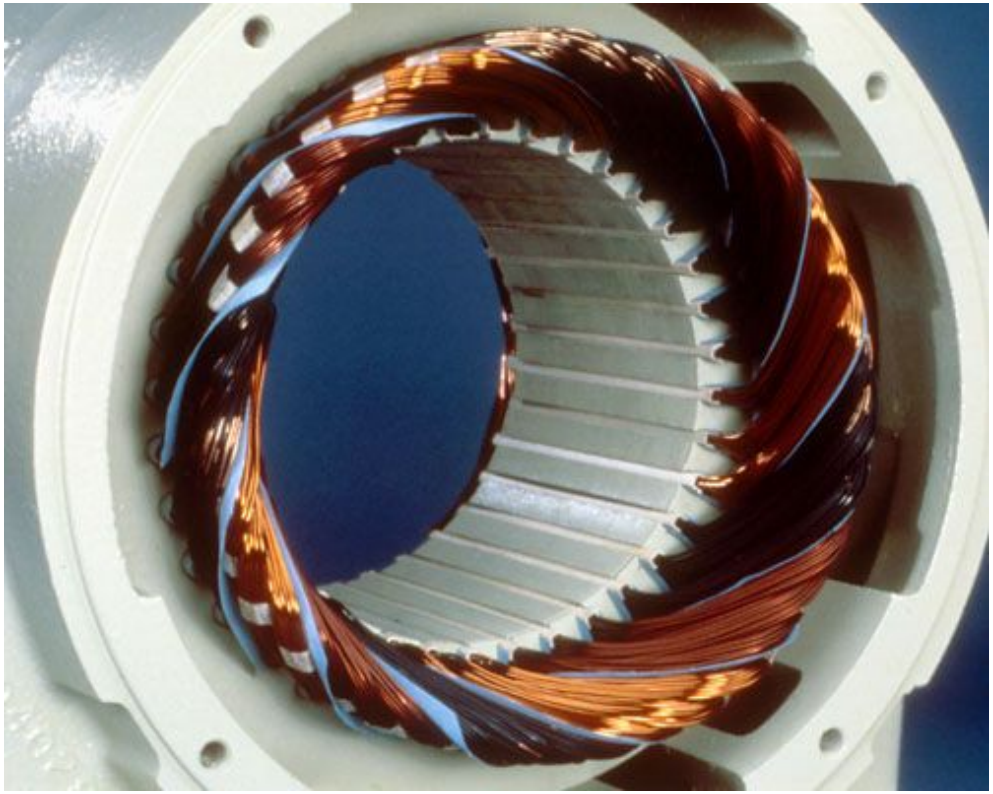
Electrical Failure

- Single Phasing



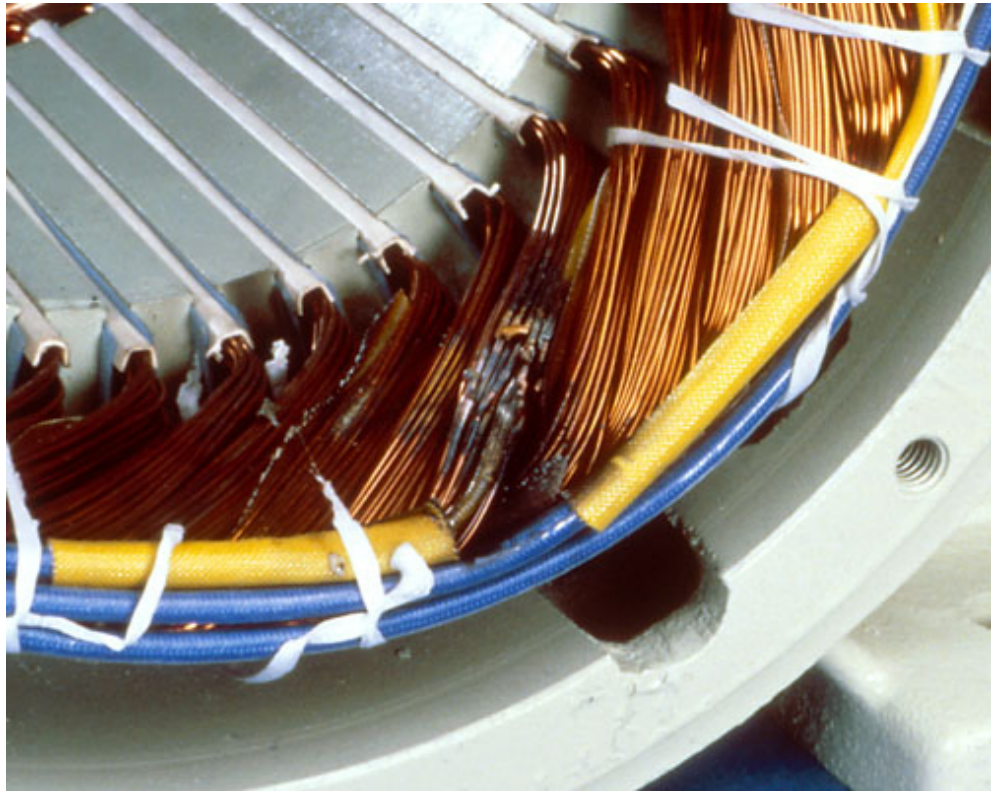
Electrical Failure

- Unbalanced Voltage



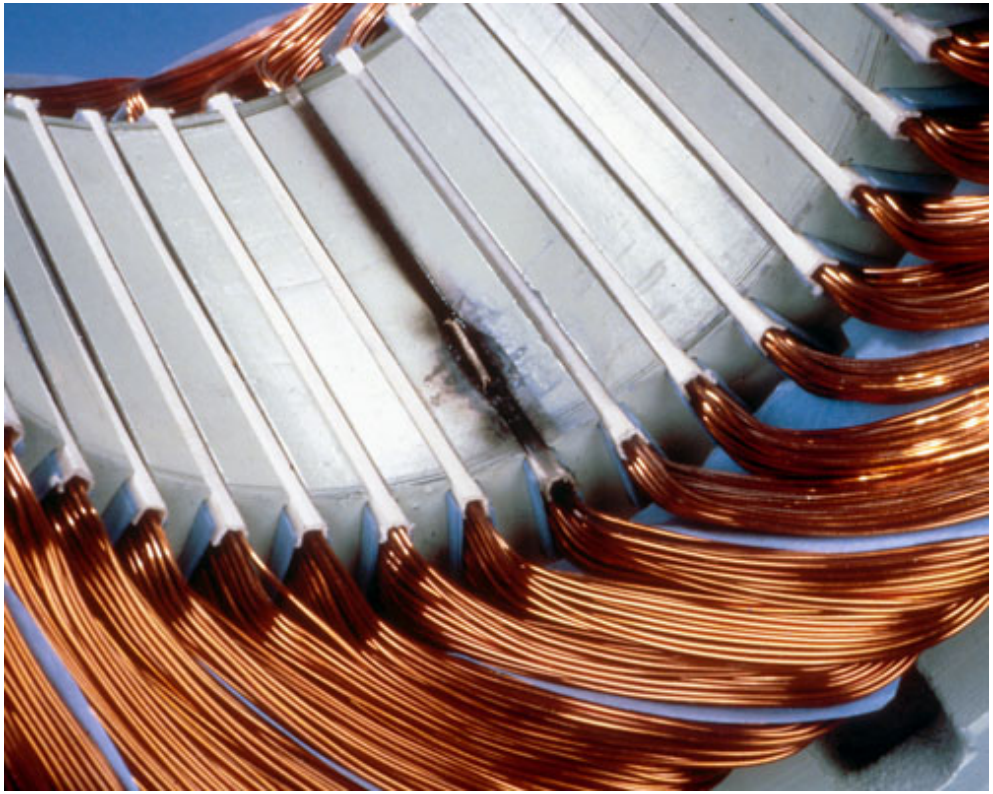
Electrical Failure

- Voltage Surge



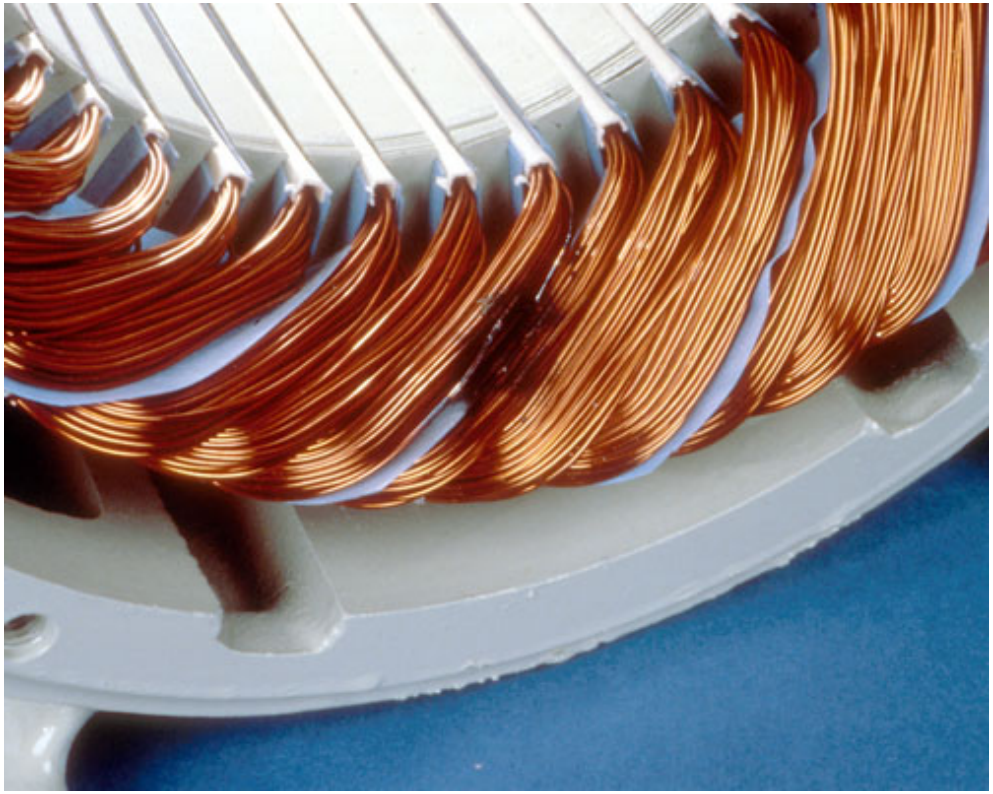
Electrical Failure

- Grounded Windings
- Typically caused by vibration or voltage surge



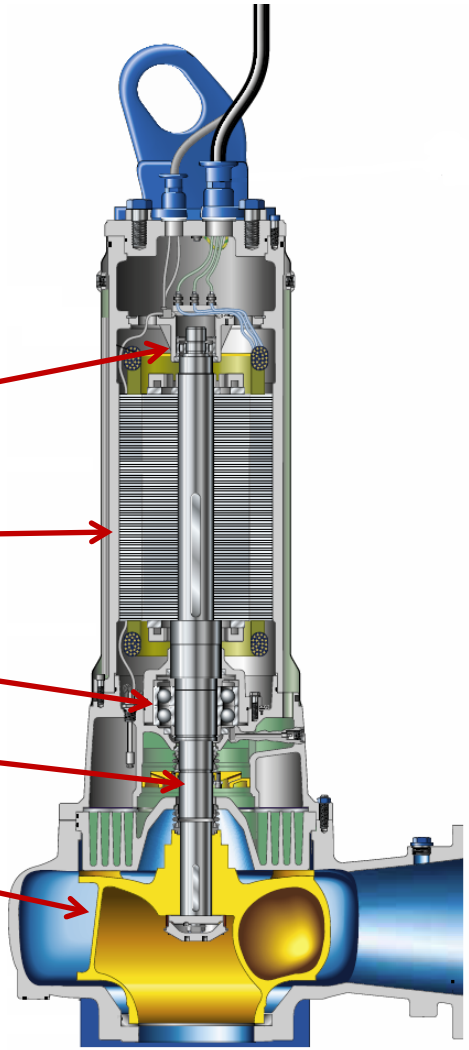
Electrical Failure

- Shorted Phase to Phase



Mechanical Failure

- Support bearing
- Rotor
- Main bearing
- shaft
- Impeller



Mechanical Failure

There will be evidence of this contact

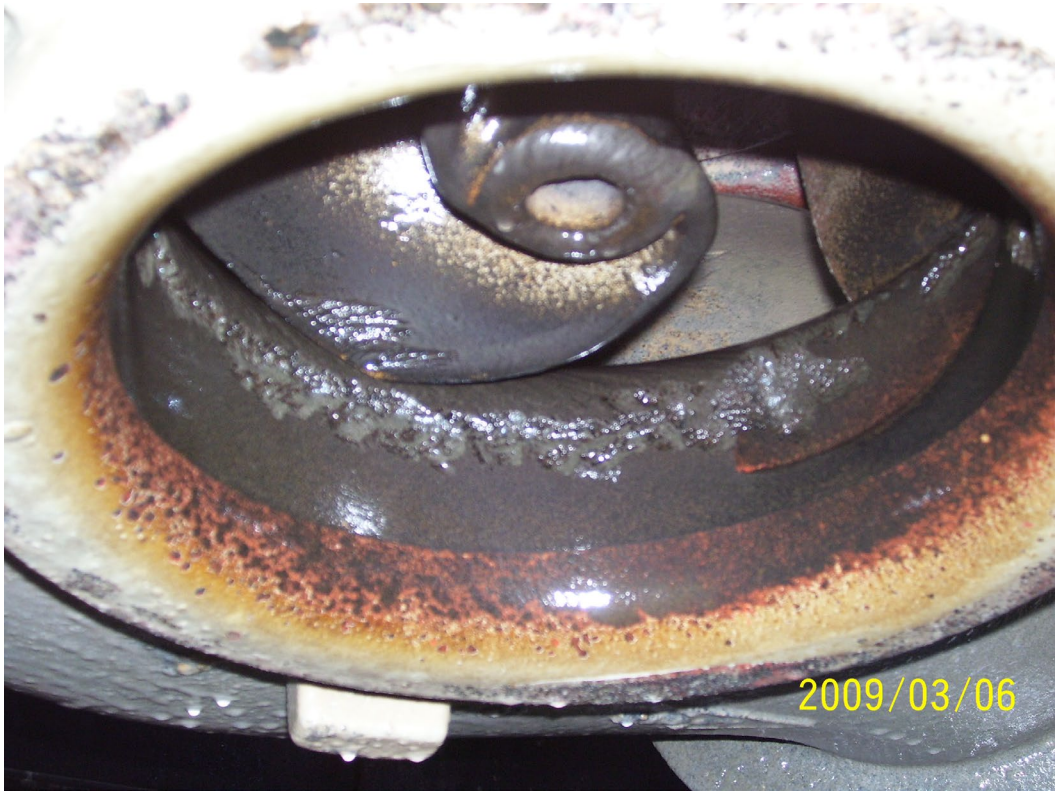
- rubbing
- wear
- discoloration
- damage to one or both of the components.

Mechanical Failure

- Corrosion

Mechanical Failure

- Impeller Wear



Mechanical Failure

Bearing Failure

- rubbing
- wear
- inadequate lubrication
- excessive runtime

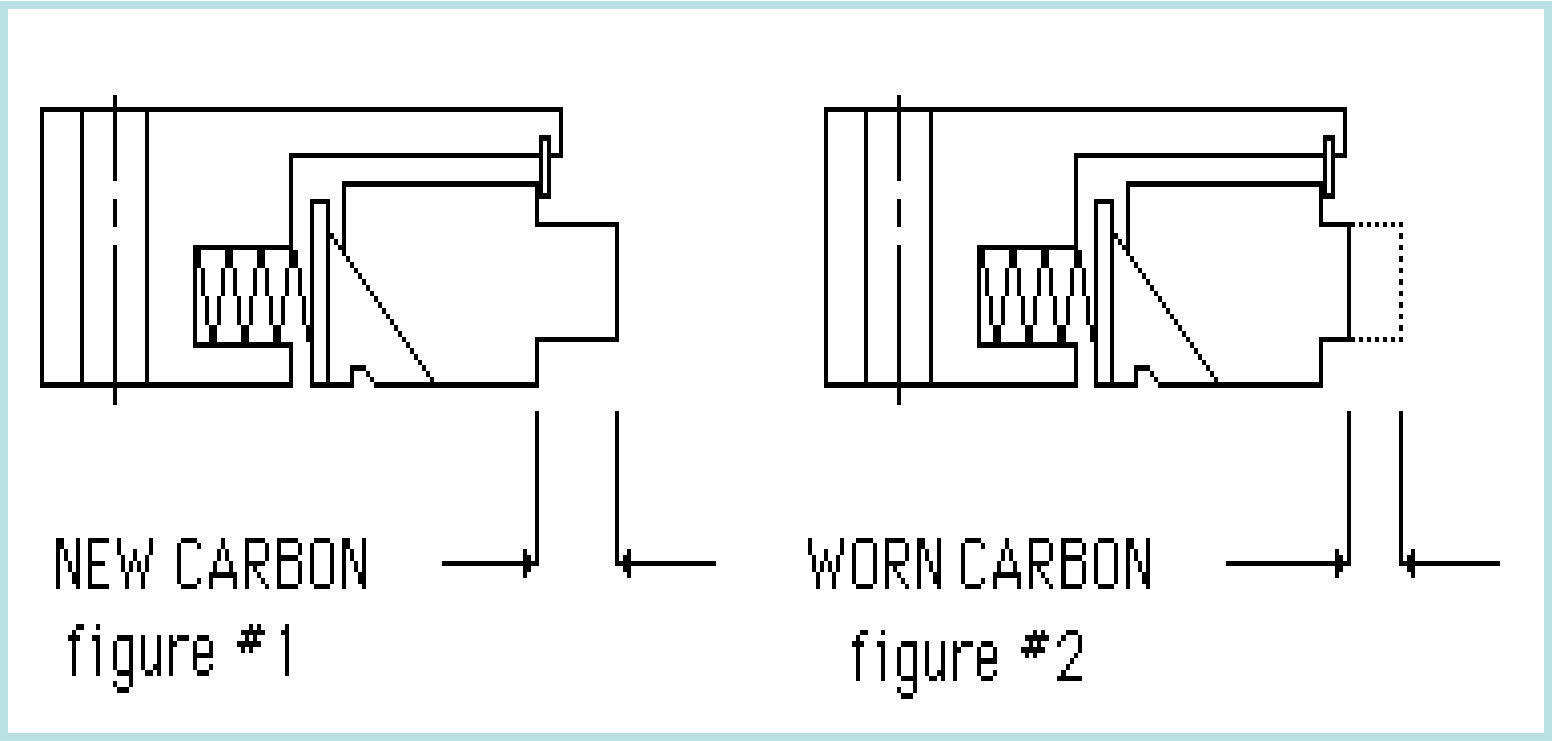
Mechanical Failure

Seal Failure

- Seal Worn
- Seal Failed

Mechanical Failure

- New & Worn Seal



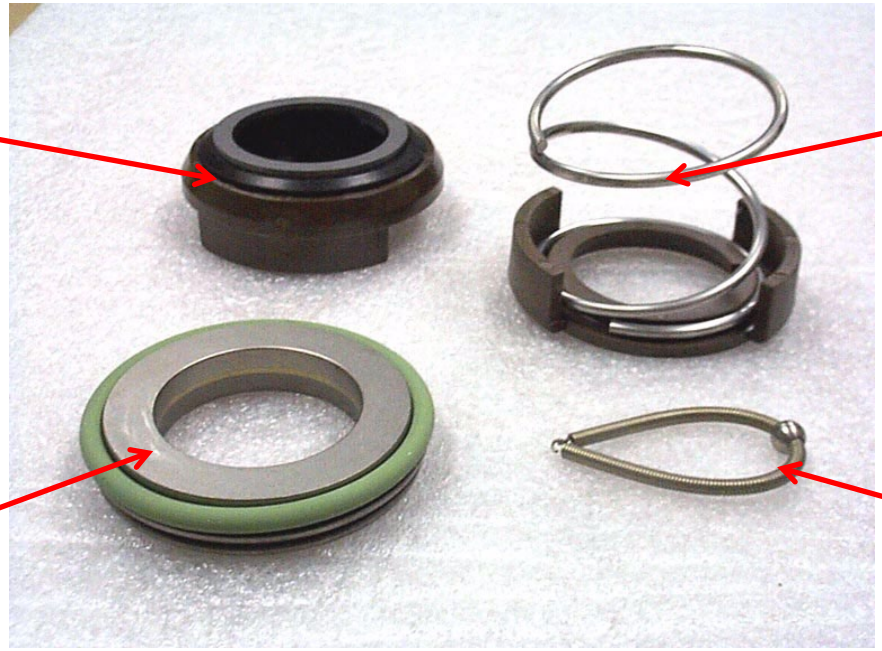
Mechanical Failure

Seal Failure can be separated in two broad categories:

- Components damaged
    - By Heat
    - Clogging/Abrasives
    - Corrosion
- Seal faces separate

Mechanical Failure

- Basic Mechanical Seal Components



Most mechanical seals are constructed of three materials: Metal or plastic parts, A face combination , Rubber o-rings

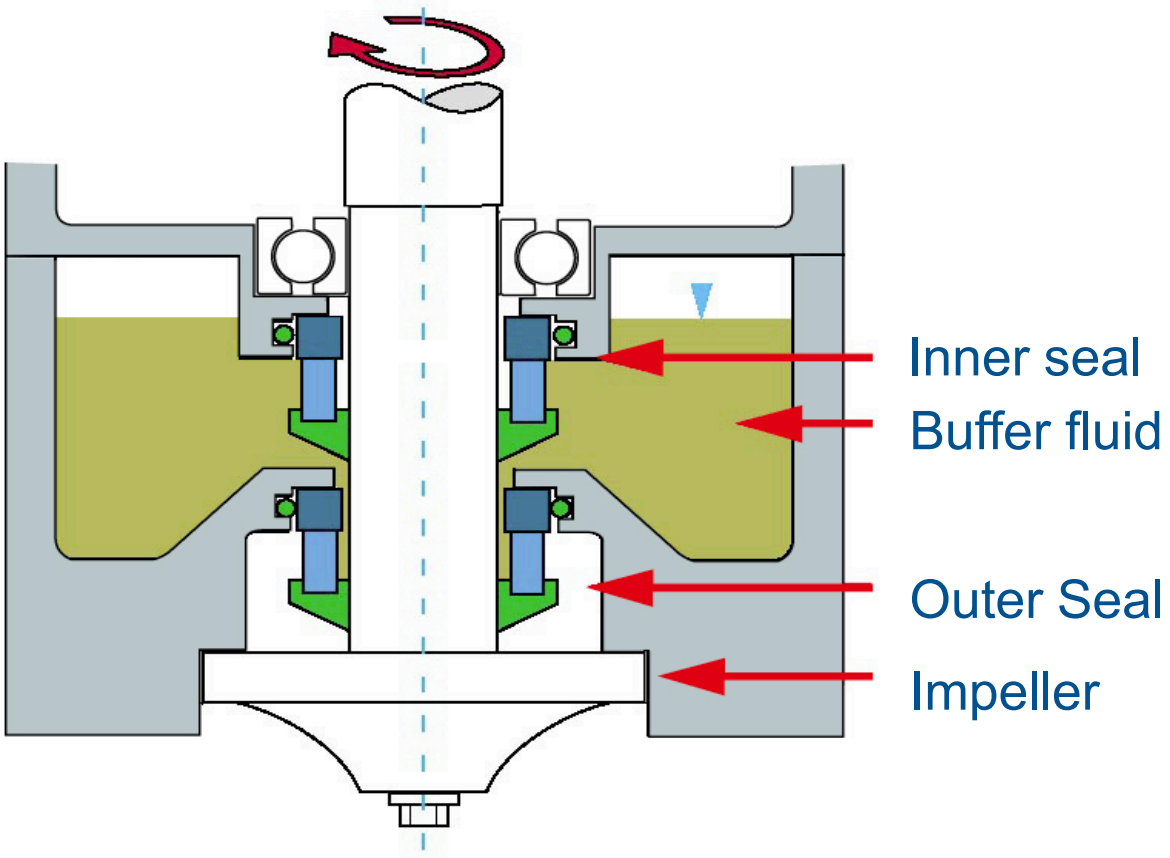
Mechanical Failure

What to Look For:

- Evidence of rubbing
- Evidence of corrosion
- Discoloration of one of the seal component materials
- Sticking or coating on the face causing face separation.

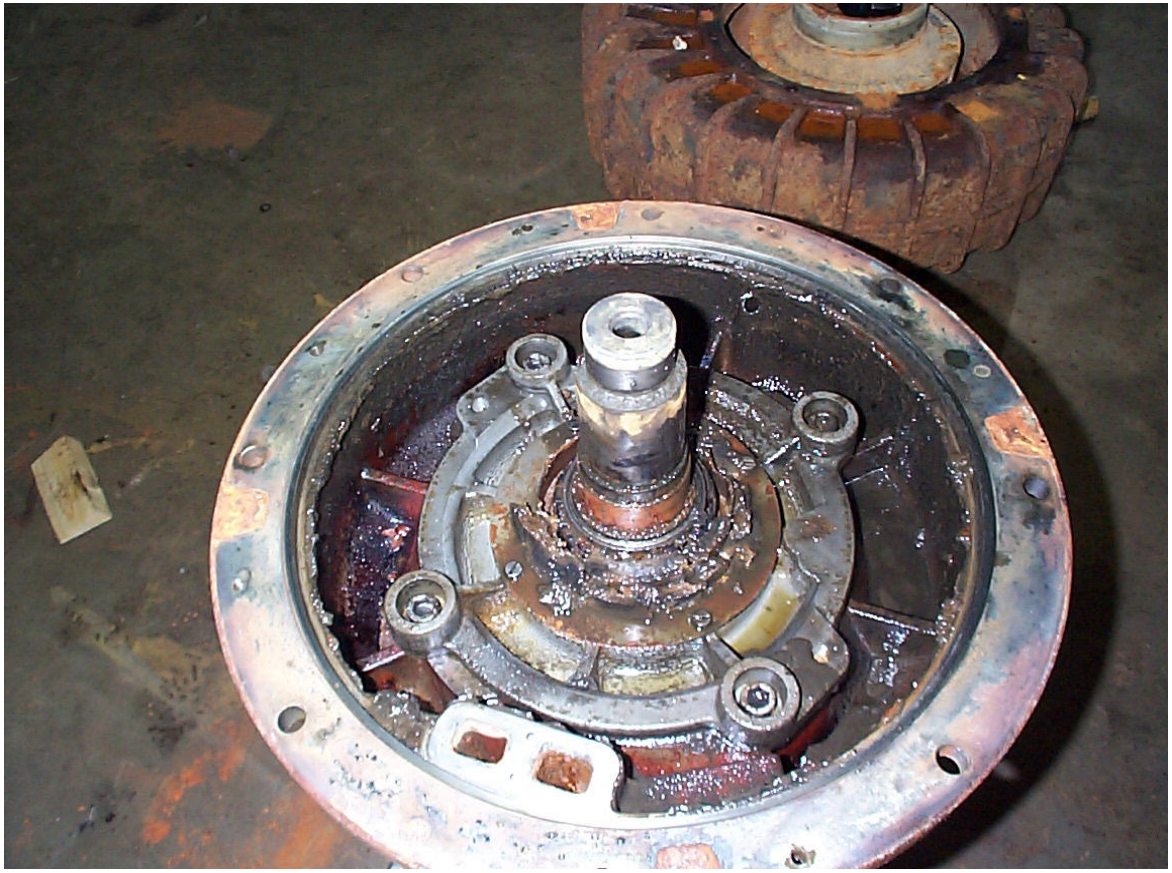
Mechanical Failure

Oil Housing



Mechanical Failure

Oil Housing Contamination

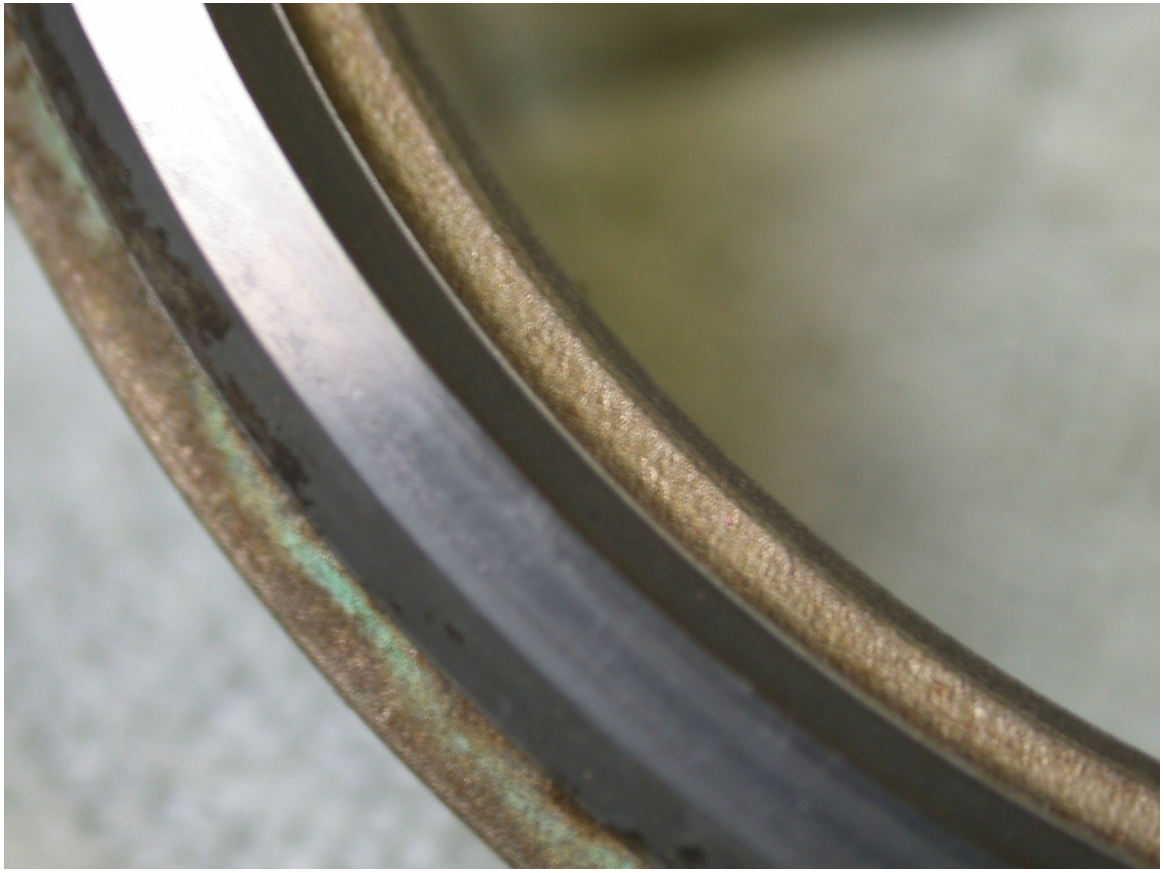


Mechanical Failure

Rubbing

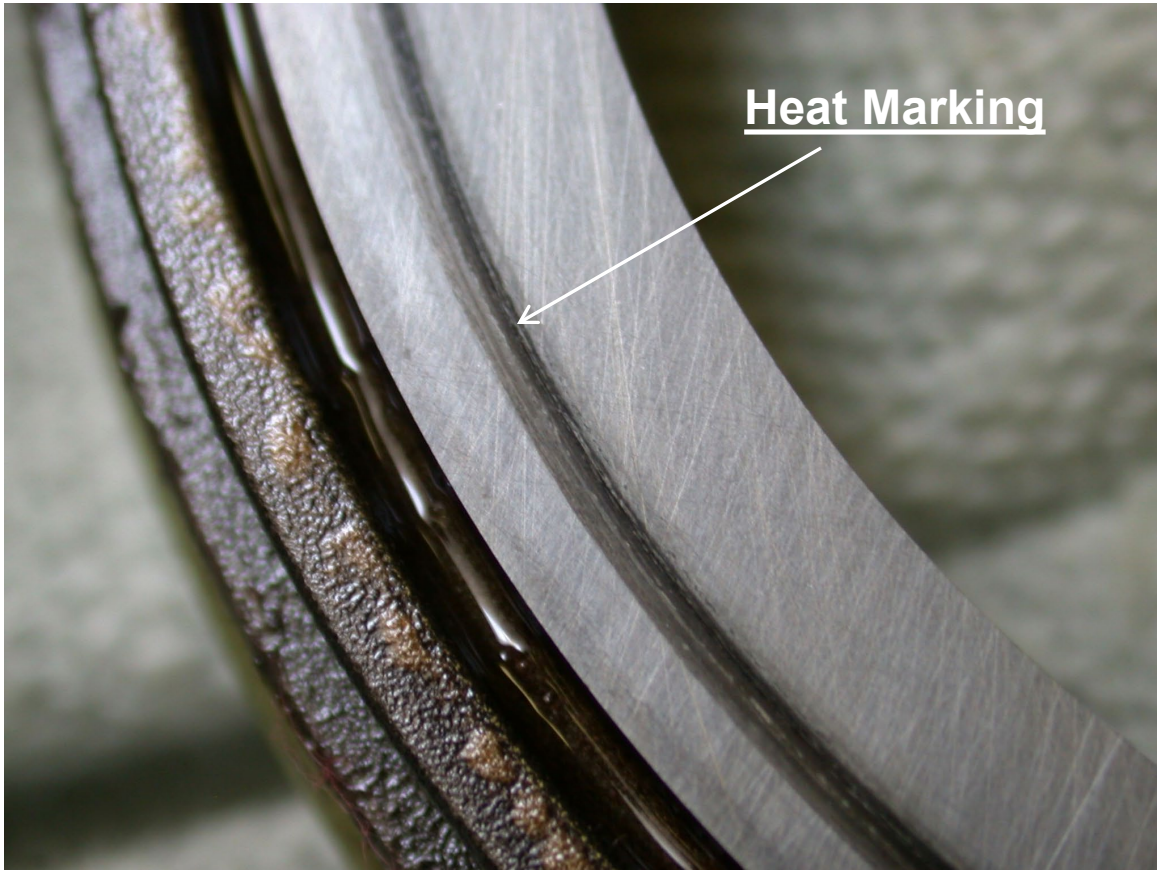
Mechanical Failure

Discoloration



Mechanical Failure

Heat Marking



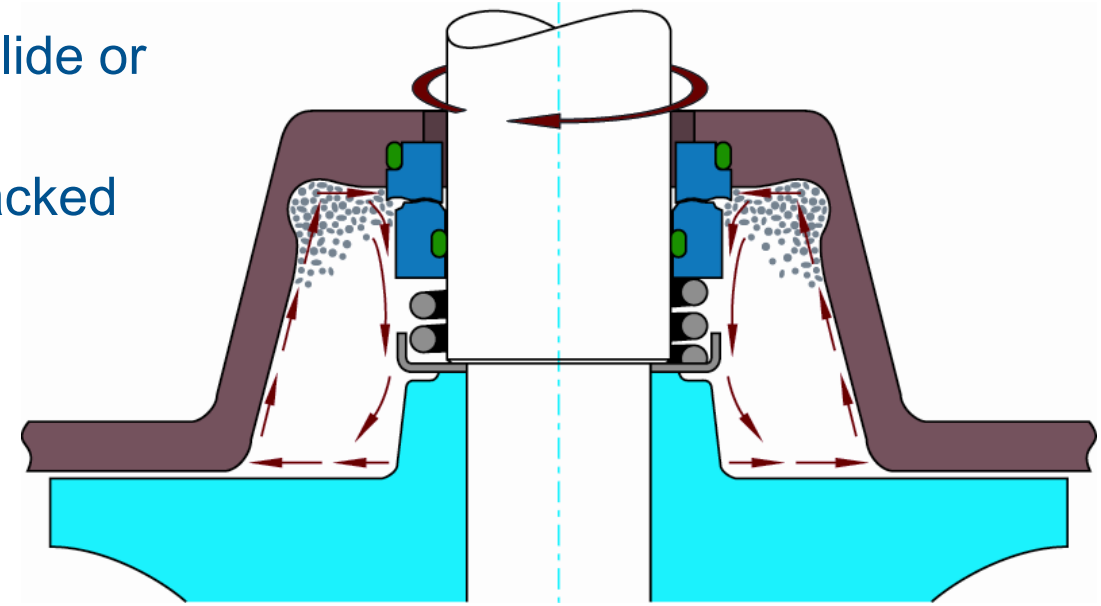
Mechanical Failure

Corrosion

Mechanical Failure

Seal Face Separation:

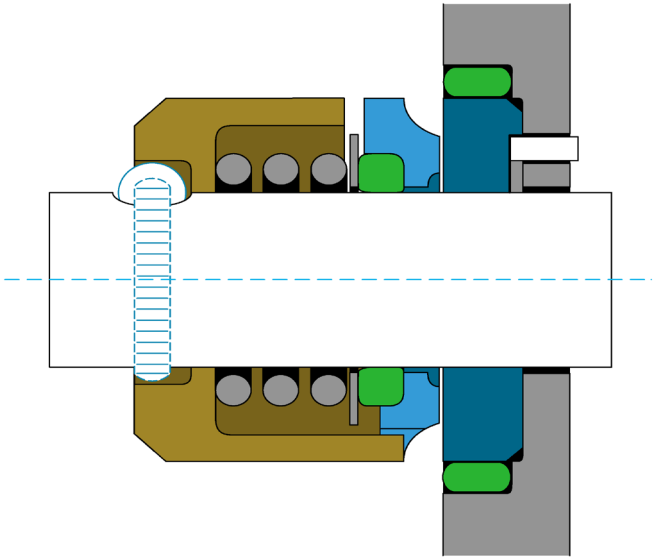
- The seal is not free to slide or move on the shaft
- The spring becomes packed with material



Failure Determination

Seal Face Separation

- The seal face is being distorted by either temperature or pressure.
- Vibration
- Pump is operating outside of the allowable limits of the pump curve.



Submersible Pump Troubleshooting

- **Pumps Fail**
- **Mechanical failures leave evidence:**
  - Wear marks, broken pieces or impact damage
- **Electrical failures also leave evidence:**
  - Burnt stators, Tripped breakers
- **Seal failures leave evidence also:**
  - Washed out bearings and media in pumps
  - Wear marks, broken pieces, burnt stators, tripped breakers,

Submersible Pump Troubleshooting

Thank You!