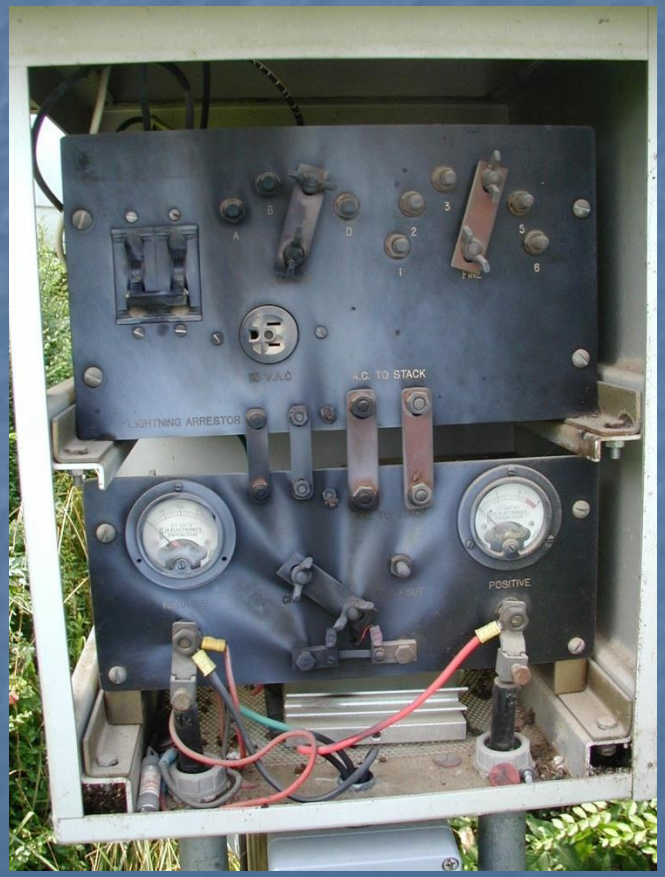
Corrosion Control in M&R Stations

Safety

- We must Be alert at all times for hazardous conditions
- Some hazards are obvious. Signs may be used to call our attention to them
- Others are not so obvious and require us to constantly monitor our surroundings for hidden hazards

Safety



Safety

Corrosion Control in M&R Stations

3 main corrosion concerns:

1. Adequate Cathodic Protection
2. Atmospheric Corrosion
3. Internal Corrosion

Corrosion Control in M&R Stations

Most CP problems at M&R stations involve a direct short of the structure that is intended to be cathodically protected to some type of grounding system.

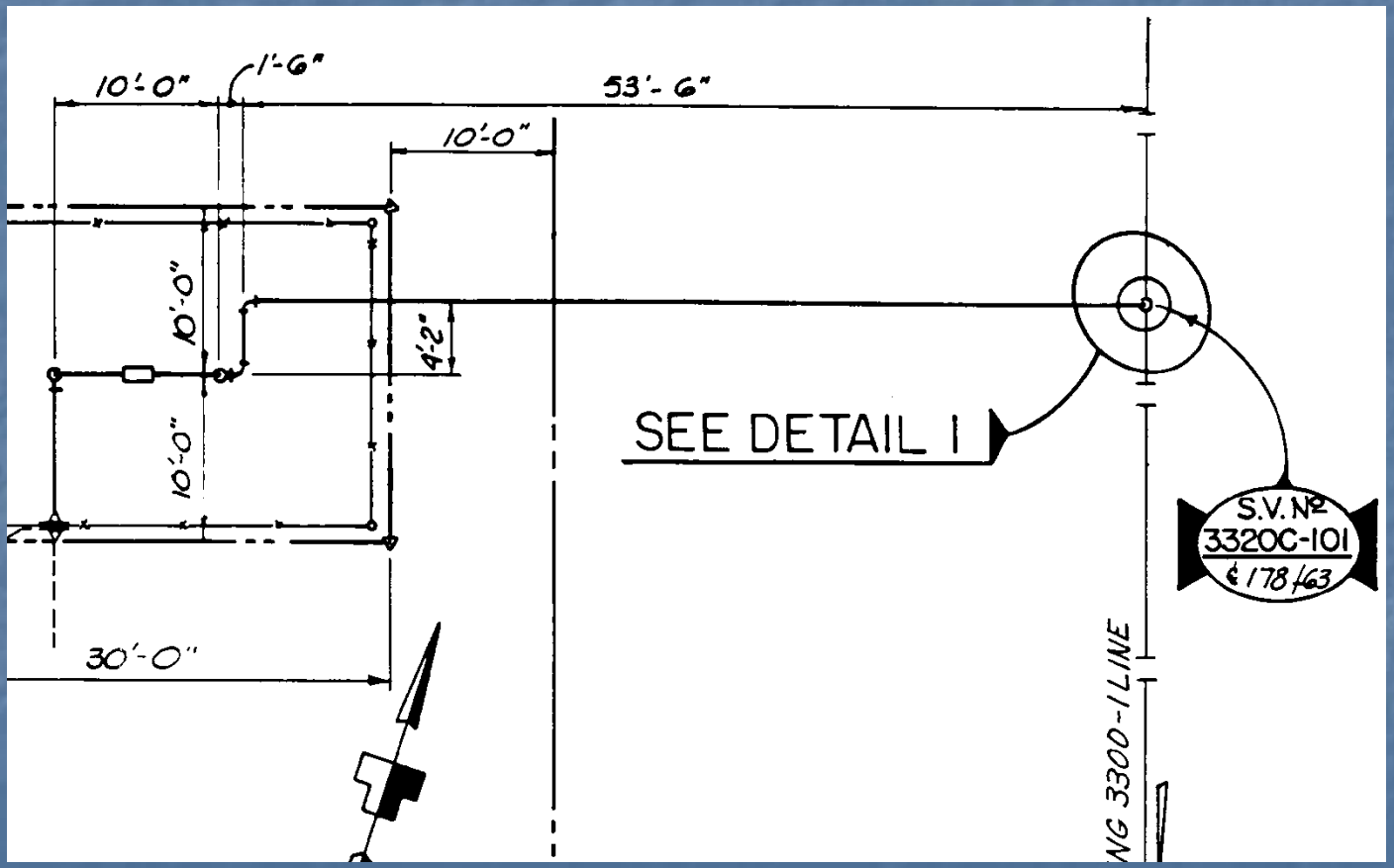
Corrosion Control in M&R Stations

This effectively increases the surface area of the pipeline (cathode) as the grounding system is now electrically connected to the pipeline. Potentials fall below protection levels since our CP system is now trying to protect the pipeline and whatever other structure is involved.

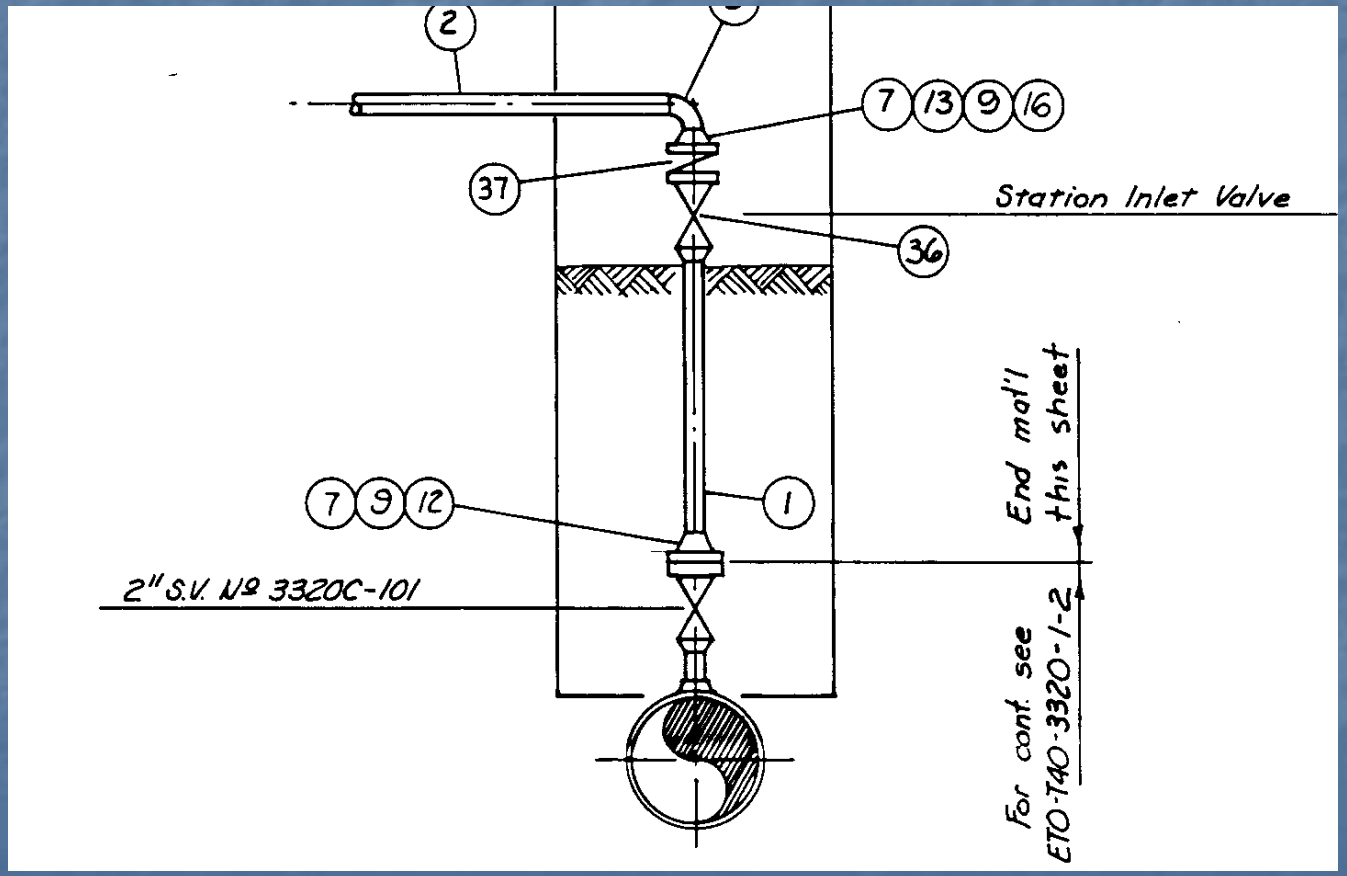
Typical M&R Layout

- Tap Valve
- Insulator (may or may not be present)
- Continuity Bond (may or may not be present)
- Interconnecting Pipe
- M&R inlet (may or may not contain an insulator)
- Meter & Regulating runs (may or may not be insulated)
- Transducers
- Outlet Piping
- Outlet Insulator

Typical M&R Layout



Hot Tap Detail



M&R Cathodic Protection Options

Mainline CP Option

- Insulated fittings (with test leads on both sides) should be installed at the tap valve. If the M&R is to be protected with mainline CP current then a continuity bond should be installed in the test station.

M&R Cathodic Protection Options

M&R Cathodic Protection Options

Mainline CP Option

- This arrangement is easiest to install
- It adds a very small load to mainline CP system
- It simplifies collecting ON/OFF potential readings
- Allows problems in the M&R to affect mainline potentials

M&R Cathodic Protection Options

Dedicated Sacrificial System

- If the M&R is to be protected with a dedicated sacrificial system, the anodes should be connected to the piping through a test station with color coded wires. An appropriate over voltage device should be connected across the insulating flange to prevent lightning damage.

M&R Cathodic Protection Options

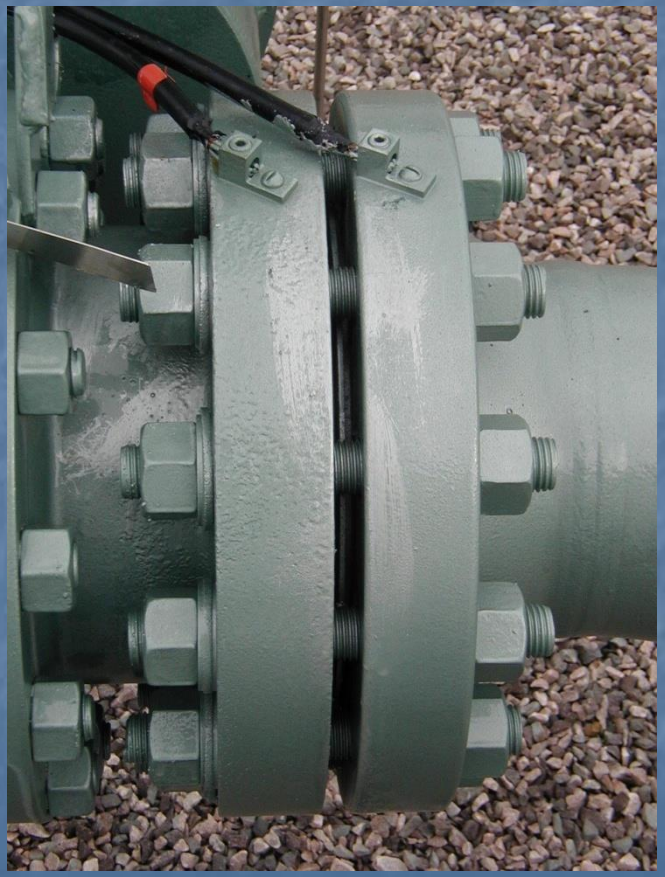
Dedicated Sacrificial System

- This arrangement places no additional load on the mainline CP system
- Has a moderate cost associated with installation
- Prohibits use of solid state interruption devices
- Prevents M&R problems from affecting mainline potentials

Flange Insulating Kits

- Buy Good Ones
- Phenolic disc with nitryl seal and phenolic washers on **both** sides of the flange with Mylar bolt sleeves.
- Stay away from 1 piece washer & sleeve combinations – they will compress and leak over time when buried.

Flange Insulation Kits



Flange Insulation Kits

Over Voltage Protection Devices

- Used to prevent lightning from destroying flange insulation kits. Normally these devices are seen as an open circuit to CP systems, then short circuit under surge conditions.
  - Zinc grounding cell – connected to each side of an insulated flange and buried much the same way as a large sacrificial anode. Disadvantage is the size and weight.
  - Solid state device – connected to each side of an insulated flange and pole mounted.

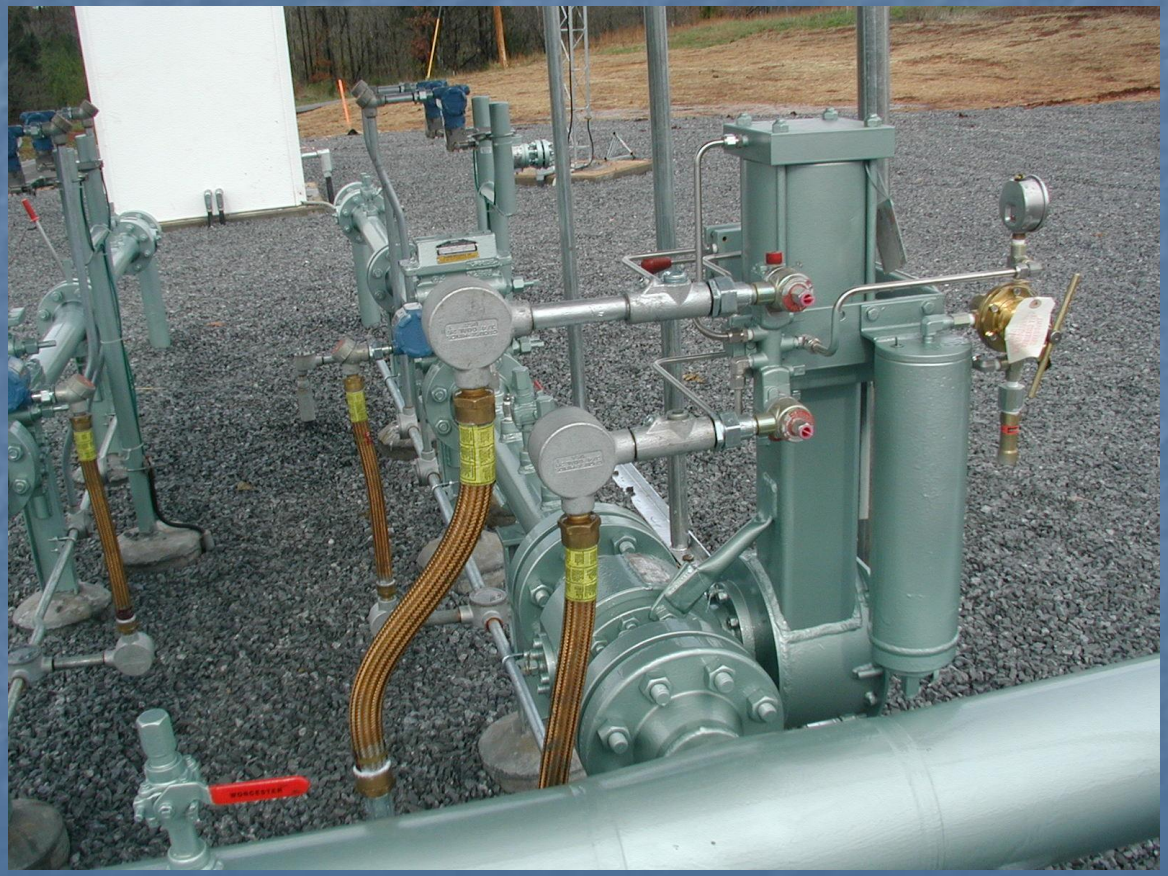
Over Voltage Protection Devices

Over Voltage Protection Devices

Inlet, M&R Runs and Transducers

- Telemetry equipment is sensitive to transient spikes (lightning). To minimize damage transducers should be isolated from cathodically protected piping and connected to a grounding grid of some kind.
- Transducers and solenoids (including ones that control automatic valve operators) connected to an RTU via metallic conduit ultimate provide to the electric utility's grounding system, unless properly isolated.
- Isolation is accomplished by:
  - Installing insulating fittings at each transducer
  - Insulating meter runs from inlet and outlet piping

Inlet, M&R Runs and Transducers



Outlet Piping and Insulator

- When meter runs are insulated from inlet and outlet piping care must be taken to insure that outlet piping is cathodically protected.
- This can be done by:
  - Installing a bonding wire directly from the inlet side of the station to the outlet side.
  - Intentionally leaving a path for current to flow through M&R Piping
  - Using sacrificial anodes to protect the outlet piping.

Outlet Piping and Insulator

Troubleshooting – The Mechanism

- Most M&R low potential problems are caused by lightning or measurement technicians (improper maintenance):
  - Lightning turns insulating devices into conductors, allowing CP current to take other than desired paths.
  - Improper maintenance involves insulators being left out or being put in where they shouldn't be.

Troubleshooting

Troubleshooting - Goal

- The Goal is to find the shorted insulating device and correct the problem. CP levels will return to normal

Troubleshooting

- Equipment Needed:
  - Multimeter & reference cell
  - Clamp on D/C ammeter with 0.1A resolution
  - Gas Electronics Model 601 insulation checker – uses an RF signal that can single out one shorted insulator when 2 or more are in parallel.
  - Portable current source and electrodes – no car batteries

Troubleshooting

- The Process – By looking at potentials on piping, tubing and conduit and tracing current flow we can find where current is leaving the M&R piping and correct the problem.
  - If an M&R is protected through a continuity bond, monitor potentials on the pipeline side of the insulator and remove the bond. If pipeline potentials increase substantially, this confirms that the M&R is having an adverse effect on the pipeline.
  - Install a shunt across the insulator to measure current flow to the M&R station.
  - Re-install the bond and proceed to the M&R.

Troubleshooting

- Higher than normal potentials on conduit or ground rods in the M&R are the tell-tale sign of a short
- In the M&R use the clamp on ammeter to check tubing and conduit for current flow.
- When measurable current flow is found, trace it back to the source which will usually be a damaged or missing insulating fitting.
- Use insulation checker to pinpoint which fitting is shorted, and tag the offending fitting with brightly colored ribbon.
- Call measurement tech and advise him that you need his assistance.

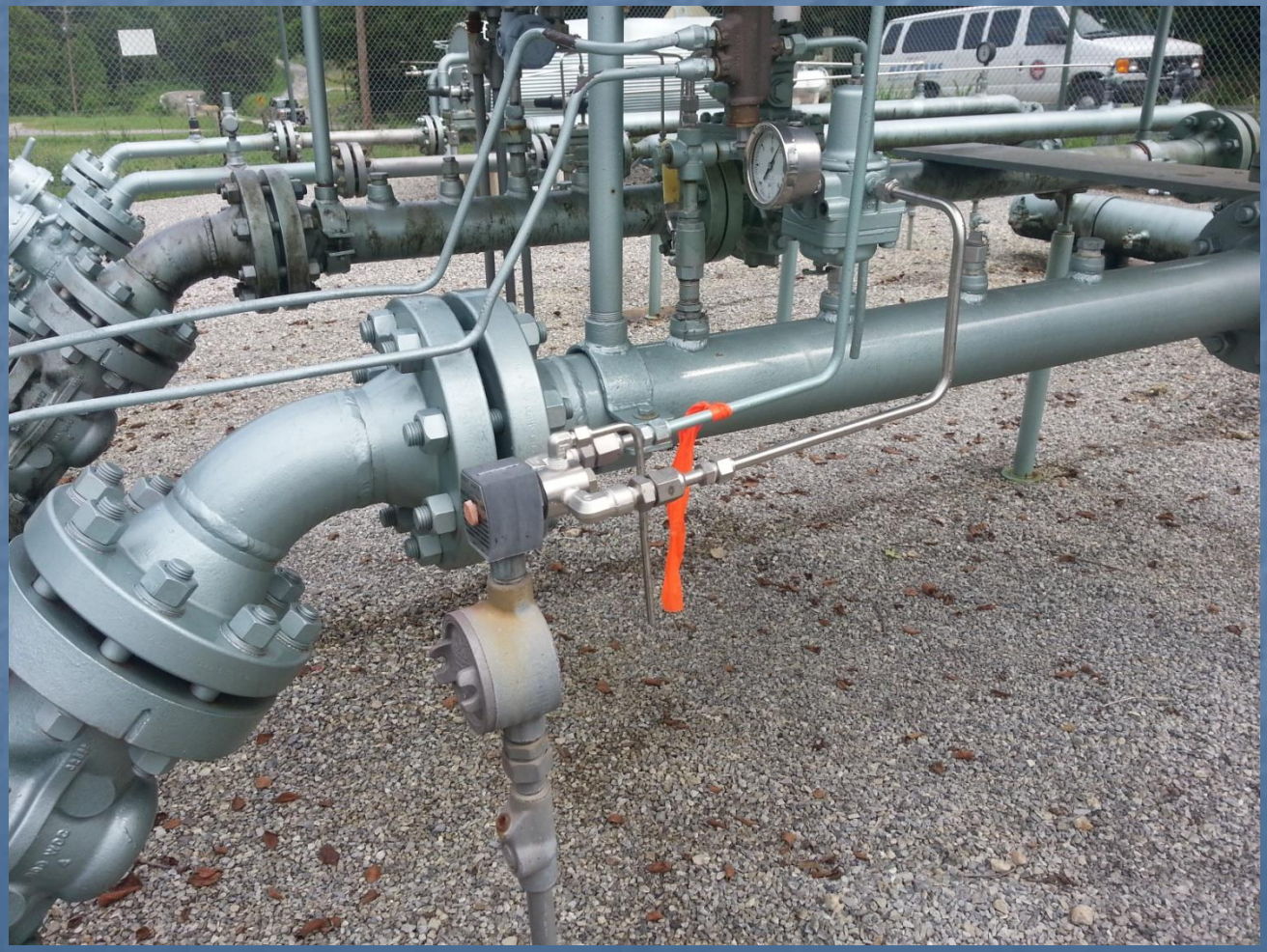
Troubleshooting – Buried Flanges

- Identifying the problem: Potential on both sides of the insulating flange are nearly identical.

Troubleshooting – Buried Flanges

- Using a portable current source and groundpins, create a temporary groundbed and apply current to one side of the insulator.
- Monitor potentials on both sides of the insulator.
- If the insulator is good potential on the side of the insulator with current being applied to it should increase, the "insulated" side should either decrease or remain the same.
- If potentials increase on both sides of the insulator by the same amount, the insulator is probably shorted.

Atmospheric Corrosion



Atmospheric Corrosion

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Internal Corrosion

Internal Corrosion

LIQUIDS SAMPLING:

1. Collect Sample
2. Analyze for Water – If no water present stop here.
3. Record pH
4. Perform serial dilution Bacterial Test.

Internal Corrosion

SOLIDS SAMPLING:

1. Collect Sample
2. Analyze for Water – perform bacterial test if water indicated
3. Record pH
4. Field Test for sulfides
5. Field Test for carbonates
6. Send to lab for further analysis
7. Document Results

Heaters