Treating Ground Loop Fluid for long term reliability

Presented by Eric Grant
WHAT FERNOX DOES

Established in 1964, Fernox has pioneered the development and acceptance of the important role of water treatment in maintaining and improving the efficiency of heating and cooling systems through best-in-class chemicals, system filters and test kits.
Fernox Sales Team

- Michelle Hulett
  - Sales Director
  - Americas
- Jason Seifert
  - Regional Sales Manager
  - Midwest
- Eric Grant
  - Regional Sales Manager
  - East Coast & Canada
- Paul Smith
  - Customer Service
  - Americas
Fernox - Who We Are

• What We Do
  • Established in 1964, Fernox has pioneered the development and acceptance of the important role of water treatment in maintaining and improving the efficiency of hydronic heating and cooling systems

• Our Core Technologies
  • Inhibitors
  • Cleaners
  • System Filters

• Key Markets
  • Renewable heating systems
  • Residential HVAC
  • Commercial HVAC
Fernox – Problems We Solve

• **Clean** systems of dirt and sludge to improve system efficiency
• **Protect** against corrosion, debris, and scale build up that can damage vulnerable components such as heat exchangers and pumps
• **Guard** against future system failure and premature breakdown as well as inefficiencies caused by poor fluid quality
Corrosion Inhibitors in Geothermal Loops

Are they needed?

- Cold System
- PEX (rubber) piping
- Non-corrosive antifreeze used
- Local water isn’t corrosive
- Components aren’t susceptible to corrosion
Ground Source Heat Pumps

• Materials
  • Cast iron pumps (volutes)
  • Brass fittings
  • Steel evaporators
  • PEX and Polyethylene (PE) piping

• Operating Temperature
  • Maximum temperature of 60-70°F (source side)

• Other operating conditions
  • Flow rate – too high?
What Happens without Corrosion Inhibitor?

- Corrosion debris
- Limescale debris (hard water only)
- Component/system failure
- Blockages in piping
- Loss of efficiency
- Increased noise of appliance
- Mechanical erosion from debris
- Dissolved metals plating onto other metals
Two week old System Fluid without Inhibitor

• Dirt and sludge have already formed in the system fluid
• Corrosion begins almost immediately
  • What does your system fluid look like on day 366 when your pump warranty just expired?
Chemical Cleaning

80% More debris removed with a cleaner than just water

- Disposal Considerations
- Non-Toxic
- Aggressive or Non-Aggressive

Water – 3 hours  Cleaner – 3 hours
Fernox F1 At Work – Three Inhibitors

• Organic Inhibitors
  • Bind to the metal within the hydronic system

• Anodic inhibitors
  • React with metal ions on the anode and create an insoluble protective film e.g. nitrates, molybdates

• Cathodic inhibitor
  • Particles combine with hard water salts to form an insoluble layer
Other Types of Corrosion Inhibitors

• Food grade
  • Phosphate based
  • Normally unstable with hard water
  • Normally used with MPG

• ‘Organic’
  • Tannins
  • ‘Organic acid technology’ - Uses neutral versions of organic acids

• Mixed inhibitors
  • Uses organic and inorganic
  • Normally combines organic and anodic mechanisms
  • Can be non-hazardous
  • Can be hazardous (containing boron, nitrites etc...)

\[
\text{HO}^{-}\text{P}^{-}\text{O}^{-}\text{O}^{-}\text{K}^{+}
\]
Factors to Consider with Corrosion Inhibitors

• Need to use with demineralized water
  • Additional cost and availability
  • Hard water instability

• Nitrites/Nitrates
  • Environmental impact
  • Underdosing
  • Hazardous warning

• Phosphates
  • Environmental impact
  • Wastewater treatment issues
Factors to Consider with Corrosion Inhibitors

- Borates
- Reproductive toxicity
- Biocides
- Water quality
  - Ammonia
  - Chlorides
  - pH buffering
  - Glycol stabilizers
  - Adding inhibitor separately
Fernox Global Certifications & Approvals

- NSF®
- NSF® Nonfood Compounds Program Listed
- NSF CIAS
- BELGAQUA
- kiwa
- FDA
- GRAS APPROVED
- IGSHPA
Types of Antifreeze

Organics - Polyols
- Monopropylene glycol
- Monoethylene glycol
- Glycerine/ glycerol
- Other polyols

Organics - Alcohols
- Methanol
- Ethanol

Brines
- Acetates
- Formates
- Calcium chloride
# Types of Antifreeze - Summary

**Table Y: Typical Properties of Common Commercial Aqueous Heat Transfer Fluids**

<table>
<thead>
<tr>
<th>Property</th>
<th>Water</th>
<th>Ethylene Glycol</th>
<th>Propylene Glycol</th>
<th>Methanol</th>
<th>Ethanol</th>
<th>Acetates, Formates</th>
<th>Glycerin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency</td>
<td>Very good</td>
<td>Very good</td>
<td>Average</td>
<td>Very Good</td>
<td>Good</td>
<td>Very Good</td>
<td>Good</td>
</tr>
<tr>
<td>Corrosion protection</td>
<td>None</td>
<td>Very good</td>
<td>Very good</td>
<td>Fair</td>
<td>Fair</td>
<td>Poor</td>
<td>Very good</td>
</tr>
<tr>
<td>Freeze Protection</td>
<td>None</td>
<td>Very good</td>
<td>Very good</td>
<td>Very good</td>
<td>Very good</td>
<td>Very good</td>
<td>Very good</td>
</tr>
<tr>
<td>BOD/COD</td>
<td>None</td>
<td>Low</td>
<td>Medium</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Flammable</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>Toxic</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Proposed table for revised CSA C448 (2023)
Test Options - Onsite using Refractometer

Refractometers identify frost protection level by measuring the way light is refracted.
Ease of Using Dip Test Strips

• Test strips can be used to confirm the presence of corrosion inhibitors/water treatment.
Thank you for listening! Any questions?

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