TREAT Sodium Loop: Status Update

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Clint Baker
Outline

• Document Recovery
• History
• Mk-III Loop
• Key Sodium Loop Technologies
• 3D Modeling
• The Future
Document Recovery

- Mk-II and especially Mk-III loops
  - Drawings
  - System Design Descriptions (SDD)
  - Operating and Maintenance Manuals (OMM)
  - Fabrication specifications
  - Design requirements documents
  - Final design disclosure documents
  - Memorandums
  - Safety Analysis Reports (SAR)
  - Experiment final reports
  - External reports (conferences etc.)
History (Mk-I onward)

- **Mk-I loop**
  - One 4”x4” grid position in TREAT core
  - Annular flow path for molten sodium
  - Faraday-type conduction pump

- **Mk-II loop**
  - Two grid positions (4”x8”) in TREAT core
  - Flow path for molten sodium was through vertical parallel legs
  - Single annular linear induction pump (ALIP)
  - More instrumentation, a larger test section, higher operating temperature and pressure, better remote handling capabilities
  - Several Mk-II model designations, ending with Mk-IIICB, whose changes were for improvements in fabricability, inspectability, and attachment of loop outfitting
History (Mk-I onward)

• Mk-III loop was a lengthened version of the Mk-IIICB loop
  – ~37 inches longer
  – Usually two ALIPs

• Two experiment sponsors
  – ANL Reactor Analysis and Safety (RAS) Division
  – Hanford Engineering Development Laboratory (HEDL)
Mk-III Loop

• Three Mk-III model designations
  
• Mk-IIIA, Mk-IIIB, Mk-IIIC
  
  • Differed only in the capacity and/or dimensional size of their test sections
  
  • The bulk of the Mk III loop structure was common to all three loops
# Mk-III Design Features & Characteristics

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>Design pressure at temperature</td>
<td>34.5 MPa at 538°C (5000 psi at 1000°F)</td>
</tr>
<tr>
<td>Initial pressure proof test</td>
<td>43.1 MPa at 538°C (6250 psi at 1000°F)</td>
</tr>
<tr>
<td>Static pressure (pre-transient)</td>
<td>≤ 710 kPa (103 psi) abs, at temperature</td>
</tr>
<tr>
<td>Test section inlet temperature (pre-transient)</td>
<td>≤ 400°C (752°F)</td>
</tr>
<tr>
<td>Volume of sodium</td>
<td>≈ 2 liters</td>
</tr>
<tr>
<td>Mass of sodium</td>
<td>≈ 1.25 kg</td>
</tr>
<tr>
<td>Sodium flow velocity</td>
<td>≤ 7 m/s (23 ft/s)</td>
</tr>
<tr>
<td>Sodium flow rate</td>
<td>≤ 1.2 liter/s (19.4 gal/min)</td>
</tr>
<tr>
<td>Burst disc design pressure (P)</td>
<td>30% ≤ P ≤ 90% of loop rated pressure (± 5%) (1500 ≤ P ≤ 4500 psi)</td>
</tr>
<tr>
<td>Mass of loop</td>
<td>115 kg (253 lb)</td>
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Mk-III Loop Instrumentation
Mk-III Loop Instrumentation
Key Sodium Loop Technologies

- Annular Linear Induction Pump (ALIP)
- Pressure Transducer
- Permanent Magnet Flowmeter
3D Modeling (Mk-III A Loop)
The Future

• Design of Mk-IV loop should be based upon the Mk-III loop
• Room for advancement – materials, fabrication techniques, instrumentation
• Maintain compatibility with legacy equipment and the TREAT core
• More demanding design requirements are likely – increased temperature, flow rate, length, etc.
• Disposition pathway for sodium should be considered during the design phase
Questions and Answers (Open Forum)