The Importance of & Complexities Associated with Selecting the Right Thermowell Material
Outline

• Origin Story

• Scenarios
  – Project impact
  – Material Degradation
  – Accurate Selection, Uninformed Decision
  – Misconception

• Takeaways
Origin Story

• Root cause analysis

• Review previous project

• Patterns
Brief Introduction

• Thermowell

“Thermowell, n. – a closed-end reentrant tube designed for insertion of a temperature-sensing element, and provided with means for a pressure-tight attachment to a vessel. (See also protecting tube).”
• Types of Thermowells connections
  – Threaded
• Types of Thermowells connections
  – Flanged
• Types of Thermowells connections
  – Socket-Weld (Weld-in)
• Materials
  – General Considerations
  • Process Fluid
  • Fluid velocity
  • Pressure
  • Temperature
  • Weldability
  • Application
Scenarios

• Project Impact
– Welded Thermowell
- API STD 1104 (Compliance)
- Qualification of Welding Procedure Specification (WPS)
- Welder Qualification Requirements

<table>
<thead>
<tr>
<th>Activities for Welding certification on Job Site</th>
<th>Day 1*</th>
<th>Day 2*</th>
<th>Day 3*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify Welding Procedure Specification (WPS)</td>
<td>1 hr</td>
<td></td>
<td></td>
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<tr>
<td>Collect test coupon &amp; Consumables</td>
<td></td>
<td>4 hrs</td>
<td></td>
</tr>
<tr>
<td>Perform test weld (minimum 3 welds)</td>
<td></td>
<td>6 hrs</td>
<td></td>
</tr>
<tr>
<td>Weld testing (NDT)</td>
<td></td>
<td></td>
<td>4 hrs</td>
</tr>
<tr>
<td>Certification (Record)</td>
<td></td>
<td></td>
<td>1 hr</td>
</tr>
</tbody>
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* Assuming 8-hrs work shift
NDT = Non-destructive testing
Proper Early Analysis

*Alternative: Carbon Steel*
• Material Degradation
  – Galling
– Mitigation techniques
  • Wrench Speed
  • Installation Torque
  • Lubrication

– Root Cause analysis
• Accurate Selection, Uninformed Decision
  - Chloride Stress Corrosion Cracking (CLSCC)
• Chloride Stress Corrosion Cracking (CLSCC)
EARLY IDENTIFICATION COULD PREVENT DISASTER
• Misconception
  - Galvanic Corrosion
Galvanic Corrosion

“occurs when two different metals are in contact in a corrosive environment”
Cathode = More noble metal, e.g. Stainless Steel
Anode = Less noble metal, e.g. Carbon Steel
Takeaways

• Never assume default selection, take each situation as unique
• Strong interdisciplinary collaboration during design phase
• Early identification = better mitigation options / no mitigation needed
• Incorrect selection can seem innocuous at first but usually has greater impact
Q&A
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Manages the I&C engineering and design team. Performs final QA/QC for instrumentation and materials work products. He also directs all efforts related to the commissioning and startup of pipeline systems and facilities.

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Primarily responsible for performing technical evaluations of field instruments to assure desired reliability, maintainability, integration, and cost. He provides onsite construction support, and performs root-cause analysis.

- BSc in Electrical Engineering Cum Laude from Texas A&M University
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