Thinking about the Weld Defects – Defining Acceptance Criteria beyond the Standard

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• Replace
• Retire
• Repair
• Rerate
• Revisit

FFS
API 579 / BS7910
Criticality and Time left for defect
Flaw acceptance criteria in welding standards are typically based on normally achievable workmanship criteria and are conservative.

Defect Size?

Porosity with 20% WT
Exposed to Fatigue loading
Endurance threshold 140 MPa
(Grey color < 140 MPa)
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- Conventional NDT is not good for finding the exact location of flaw
- Challenge of quantitative analysis of multiple flaws.

15 pores + 1 LOF detected
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If you can precisely determine:

- Size,
- Shape,
- Orientation,
- & Location

of your flaw in your structure, FFS standards allow you for case-specific decision on acceptability or rejection.
ASSESSMENT OF RETROFIT OPTIONS
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Wonky welds keep West Coast submarines stuck in port
Assessment of Defect Criticality
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Assessment Beyond Standard

Full Scale Model

Three Welded Connections

Top Connection

Mid Connection

Btm Connection
Assessment Beyond Standard

Top Connection

Mid Connection

Btm Connection

Design Load on each Connection
**Assessment Beyond Standard**

- **Top Connection**
  - Local Axial Stress: 65 MPa
  - Max Axial Tension: 90 MPa
  - Local Shear Stress: 9 MPa

- **Mid Connection**
  - Local Axial Stress: 58 MPa
  - Max Axial Tension: 10 MPa
  - Local Shear Stress: 12 MPa

- **Btm Connection**
  - Local Axial Stress: 65 MPa
  - Max Axial Tension: 90 MPa
  - Local Shear Stress: 9 MPa
Different defect scenario embedded into this location

<table>
<thead>
<tr>
<th>Location of defect</th>
<th>Largest acceptable defect (mm)</th>
<th>Linear (width x length)</th>
<th>Volumetric (diameter)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weld Root, Wall Bevel to Flange</td>
<td></td>
<td>1x5 or 2x4</td>
<td>2</td>
</tr>
<tr>
<td>Weld Root, Radially Oriented, Reinforcement Fillet</td>
<td></td>
<td>1x5 or 2x4</td>
<td>2</td>
</tr>
<tr>
<td>Weld Root, Axially Oriented, Reinforcement Fillet</td>
<td></td>
<td>1x7 or 2x5</td>
<td>2</td>
</tr>
<tr>
<td>Weld Root, Longitudinal Weld</td>
<td></td>
<td>1x3</td>
<td>1</td>
</tr>
</tbody>
</table>
Wrap-up

Definitely, standards are the most practical and key references and guides to use.

But if you have a defendable reason for an alternative option beyond the standard, this shall not be interpreted as an act against the standard and existing practice.

Alternative option beyond the standard is a standard (FFS)
Wrap-up

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Thank-you