Technical (and other) challenges associated with welding and inspection of CRA pipelines

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Welding in the industry
Welding in our industry

AWS D1.1

DNV

ASME
Welding of CRA HP/HT Pipelines

DNV-OS-F101 + DNV JIP + Company specification
NDT of CRA Pipelines

Carbon Steel Pipelines: same/similar material for pipe & weld
NDT of CRA Pipelines

CRA pipelines: dissimilar materials for pipe & weld & CRA layer

• High anisotropy (grain orientation)
• Scatter of ultrasound
• Varying speed of sound transmission
• Specific calibration block & qualification program
• Training of operators
Specify an achievable & consistent flaw acceptance criteria

Planned buckles over ZRBs / DIs

Unplanned buckles
CRA Linepipe Procurement
Qualifications & Testing

1: WPS & Welders qualification

2: Inherent welding flaws

3: NDT procedure qualification
Welding Preparation

B = 5° ± 2°
R = 2.4 mm
L = 1.3 ± 0.2 mm
T = 1.4 ± 0.2 mm
F = 1.4 ± 0.2 mm
D = 0°
H = 0 to 0.5 mm
WT = 21 ± 3 mm
Main Line Welding Process
Welding Qualifications

1: Automatic welding (GMAW) for main line

2: Manual welding (GTAW) for repairs & tie-ins
Welding & Purge Monitoring

Strict control on welding parameters
CRA Root Pass Inspection
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AUT Qualification

Comprehensive program to demonstrate sizing/detection capability of the AUT system:

- Significant number of defects (minimum of 122 flaws seeded across the weld volume)
- All flaws need to be representative of production inherent flaws and actual ECA criteria
AUT Qualification

Comprehensive program to demonstrate sizing/detection capability of the AUT system:

• Comparing AUT predicted flaw sizes with actual flaw sizes (oversizing and undersizing)
Qualified Personnel

- Welding Engineer - Operator and Contractor
- NDT Level 3 in RT & UT (PA & TOFD) - Operator and Contractor
- Experienced QC Welding & NDT Inspectors (surveillance)
- Trained and familiarised welder and operators (training school and pipe cycling)

CONTINUITY is the key! The same people involved at qualification will follow on offshore pipeline production
The Lucky Country

Engineers – 8 on / 4 off
Welders – 13 on / 3 off

WA & NT – 3 on / 3 off
Bass Strait – 2 on / 2 off

Changes are needed to ensure consistent pipeline production
Less Offshore Welding

Most of the pipeline production removed from critical path and performed outside Australia (South East Asia, etc.)
EPCI Contracting

- EPCI procure his pipes according to the agreed project specification therefore they have to weld it together
- Only 3 pipe mills in the world (Japan & Germany)
- SMEs and Company reps to work as an integrated team with the installation contractors
- It’s done this way for complex SURF projects overseas
- “You’re building my house but not living in it later on” so managing risks can’t be left to Contractor only who doesn’t share the same risks as the Operator
In-house expertise

Installation contractors and specialised subcontractors have their own welding center of excellence with permanent R&D projects to improve the productivity and quality of pipeline welding and inspection.
Conventional Dip
Surface Tension Transfer (STT)
Controlled Dip – Wire Retraction

CMT
Recent welding technology
Previous NDT technology

“Old School” Radiography Technology, everybody can “see”
Recent NDT technology

Ultrasonic Technology, not everybody can “see” and interpret
Recent NDT technology

More NDT companies = competition drives to innovation
The next frontier in WA?
The “Terrace”

- Talking and knowledge sharing

- We have laid more CRA flowlines in WA in the last 5 years than any other country so by now we should know how do to get it right

- But there is no silver bullet, every project is different and when technical issues arise we work together to solve it and sometimes learn to give up on specs or design!!