Challenges with Field Girth Welding

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Recent Girth Weld Incidents
Interactive Girth Weld Threat

Girth Welds with Low Tensile Strain Capacity + High Axial Tensile Strain
Girth Welds with Low Tensile Strain Capacity

• Recent incidents:
  - High weld misalignment
  - Poor weld quality
  - Pre-existing hydrogen-assisted WM/HAZ cracks
  - Evidence of little or no plastic deformation

• Codes have no requirement for girth weld tensile strain capacity
PHMSA Advisory Bulletin

- ADB-10-03 (Mar 24, 2010) Girth weld quality issues due to improper transitioning, misalignment, and welding practices of large diameter linepipe

http://www.phmsa.dot.gov/pipeline/regs/advisory-bulletin
In-service Failure

- Below in-service failure of 42” X70 gas transmission pipeline at 1200 psi (65% SMYS)
Misalignment
Misalignment at Segmented Bend
Avoid segmenting bends (order the exact bend angle or use cold field bends when possible)

When cutting bends, use segmentable bends with tighter body tolerances, confirm acceptable end dimensions, and use transition pipe pups
Shop fabricated bend assembly

- “Difficult welds” (thickness transitions and backwelding) to pipe pups are made in a fabrication shop/yard
- “Easy welds” (straight pipe of the same wall thickness) are made in the field
- Ensure adequate pup length and support
Improper Weld Transitions

ASME B31.8 Fig. I-5

37°
Backweld Quality

- Difficult to weld
- Difficult to inspect
- Highly stressed
- Bead shape is critical to minimize stress concentration
Welding Segmented Induction Bends

- Joint Industry Project (JIP) on Welding of Segmented Induction Bends
  - DNV Columbus, P-PIC, 9 pipeline operators
  - Develop guidance for field construction practices and purchase specification of segmentable bends
Hydrogen Assisted Cracking (HAC)
HAC: One cellulosic weld pass

Low Hydrogen

Mechanized GMAW

9010

9018-M

Repair

6:00
HAC: Weld Repair

Mechanized GMAW

9010

9018-M

6010

Repair
HAC: Flux-cored Weld

81T8 (FCAW-S) Fill & Cap

9018-M Hot
6010 Root

6010 Backweld
Proper Weld Preheat is Critical

- Heat **entire** circumference, especially the **top** and **bottom** of the pipe.
Avoid Dry Cellulosic Electrodes

Increases Mn, Si

Up to 24% Increase in Yield Strength with E8010-G

http://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=144
Lowering In Stress

- Maximum weld stress occurs during lowering in
- Most weld failures at top & bottom of pipe
Low Strength Fittings

Hydrotest failure at 80% of test pressure
Low Strength Fittings

Coating cracks from expansion of fitting during hydrotest
Thank you

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