Room Temperature Creep Behavior of Low Frequency ERW Pipe Seams and Implications on Managing Pressure Reversals in Hydrostatic Tests

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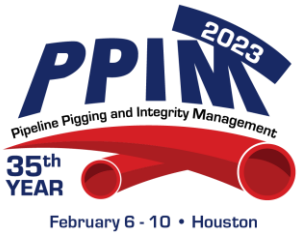

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Abstract

Seam weld defects (e.g., lack of fusion, stitching, and hook cracks) in low frequency (LF) ERW pipes can reduce the pressure-carrying capacity of a line pipe. When these defects are subjected to a hydrostatic test, there is a possibility that these defects could lead to failures at a lower pressure upon re-pressurization than the pressure achieved prior to re-pressurization. This type of failure, which occurs at a pressure less than the previous test pressure without time dependent degradation from fatigue or corrosion, is commonly referred to as a pressure reversal.

LF ERW seam can fail when held at a constant load below the straight-off to failure load. This is because ductile materials can exhibit creep behavior even at room temperature. Evidence of time dependent behavior is failures that occur during the maximum pressure hold period of a hydrostatic test.

This paper covers:
1) A testing methodology that can measure the creep behavior of vintage LF ERW bondline flaws from small-scale test samples at elevated stress levels and stress reversals which is equivalent to pressure reversal in a pressure testing.
2) Tests used to measure the growth of actual bondline flaws of vintage LF ERW seams at elevated stress levels.

The testing methodology is successful in showing the time-dependent creep behavior of the bondline flaws at elevated loads, as well as establishing that after reducing the pressure down to zero and back to load, the creep behavior could be re-activated.

Keywords: vintage pipeline, low frequency ERW, cold weld, hook crack, pressure reversal, creep