Wang, Y.-Y., Kotian, K., Effects of High-Low Misalignment on Girth Weld Integrity, Proceedings of the 10th International Pipeline Conference, 2014, Calgary, Alberta, Canada, Paper no. IPC2014-33464

Abstract

High levels of high-low misalignment in pipeline girth welds have been identified as one of the possible contributing factors to some of the recent pre-service hydrostatic test failures or subsequent service failures. However, pipeline service experience indicates that nominally defect-free girth welds with high levels of misalignment and proper weld profiles can provide satisfactory long-term service. In this paper, recent analytical and experimental work aimed at understanding the impact of high-low misalignment in girth welds is described. In nominally defect-free welds, the performance of the welds is found to be predominantly determined by the misalignment ratio, weld strength mismatch ratio, and the weld profile. Iso-load-capacity relations are developed through finite element analysis (FEA) to capture the interdependence of those key parameters. The analysis procedure is validated by cross-weld tensile testing of girth welds with various levels of misalignment and weld strength mismatch. The effects of the circumferential extent of misalignment, alternatively termed local misalignment, are also analyzed. The effects of misalignment in girth weld with planar flaws are examined in the context of the tensile strain capacity.

The analytical and experimental evidence indicate that the absolute level of misalignment is not a sole indicator of girth weld performance. Weld transition profile, pipe wall thickness, and weld strength mismatch all play an important role. With proper weld profiles, minimal or small reduction of load capacity is observed even at very high levels of misalignment. Work is continuing to further examine the effects of high-low misalignment with a goal of making practical recommendations to be included in codes and standards.

Keywords

Girth weld, High-low misalignment, Load capacity, Strain capacity, Weld strength mismatch