

Wang, Y.-Y., Rapp, S., Horsley, D., Warman, D., and Gianetto, J., 2018, Attributes of Modern Linepipes and Their Implications on Girth Weld Strain Capacity, Proceedings of the 12th International Pipeline Conference, Paper No. IPC2018-78809, September 24-28, 2018, Calgary, AB, Canada.

Abstract

There has been a number of unexpected girth weld failures in newly constructed pipelines. Girth weld failures have also been observed in pre-service hydrostatic testing. Post-incident investigations indicated that the pipes met the requirements of industry standards, such as API 5L. The welds were qualified per accepted industry standards, such as API 1104. The field girth welding was performed, inspected, and accepted per industry standards, such as API 1104. Some of the traditional causes of girth weld failures, such as hydrogen cracks and high-low misalignment, were not a factor in these incidents.

This paper starts with a review of the recent girth weld incidents. A few key features of a failed weld and their implications are examined. The characteristics of the recent failures is summarized, and the major contributing factors known to date are given.

Some of the options to prevent future failures include (1) changes to the tensile properties of the pipes and enhanced hardenability, (2) welding options aimed at increasing the weld strength and minimizing heat-affected zone (HAZ) softening, and (3) reduction of stresses on girth welds. This paper focuses on the first two options.

The trends of chemical composition and tensile properties of linepipe are reviewed. The potential contribution of these trends to the girth weld incidents is examined. Possible changes to the linepipe properties and necessary updates in the testing and qualification requirements of the linepipes are provided.

Welding options beneficial to enhanced girth weld strain capacity are discussed. Possible revisions to welding procedure qualification requirements, aimed at achieving a minimum level of strain tolerance/capacity, are proposed. The application of previously developed tools in estimating the propensity of HAZ softening is reviewed.

Keywords

Linepipe, Modern microalloyed steels, Strain hardening, Hardenability, HAZ softening, Girth weld failures, Strain capacity