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Abstract

At least 10 girth weld incidents in newly constructed pipelines are known to have occurred in North America. More than 30 girth weld incidents in newly constructed pipes have been identified worldwide. A review of the North American incidents identified a few main contributing factors: (1) weld strength undermatching, (2) heat-affected zone (HAZ) softening, and (3) elevated stresses/strains from normal settlement and other loads. Weld bevel geometries of manual welding processes that favor plastic straining along the softened HAZ and low strength root passes were also compounding contributing factors.

Prior publications focused on the industry practices that led to the formation of those contributing factors. This paper covers the improved linepipe specifications and welding practice that aim to reduce the risk of similar girth weld incidents, thus leading to more resilient pipelines.

The improved linepipe specifications include interim recommendations that aim to limit the upper-bound longitudinal strength for a given pipe grade and reduce the linepipe steels' susceptibility to HAZ softening. The implementation of the interim recommendations is assisted by allowing alternative hoop tensile tests.

The improved welding practice includes (1) the selection of welding procedures, including consumables, that minimizes the likelihood of weld strength undermatching and reduces the propensity for HAZ softening, and (2) welding procedure qualification tests and requirements for the production of strain-resistant girth welds.

The recommendations covered in this paper principally target new pipeline construction projects, but are also applicable to pipe replacement projects. It is expected that pipeline operators would incorporate the recommendations in their internal procedures and work with welding contractors to execute the recommendations. The improved linepipe specifications and welding practice are expected to increase the resilience of pipelines subjected to realistic construction and in-service loads. The implementation of the recommendations requires changes to some long-standing industry practices and can only occur with collaborative efforts from all stakeholders.

Keywords

Girth weld incident, strain capacity, linepipe specifications, HAZ softening, girth welding, welding procedure qualification