Wang, Y.-Y., Jia, D., Wang. J., Dekhane, A., Quintana, M., Application of Essential Welding Variable Methodology in Addressing Low Girth Weld Strain Capacity Issues and Path to Standard Revision, Paper No. 3, 22nd Joint Technical Meeting of APGA-EPRG-PRCI, Brisbane, Australia, April 29 – May 3, 2019.

Abstract

The consistency of mechanical properties of welds is maintained through the use of essential welding variables (EWVs). The lists of EWVs in current codes and standards came from experience. They remain largely unchanged despite advances in steel making and welding processes.

A new approach to welding procedure qualification and assurance of weld quality, termed essential welding variable methodology (EWVM), has been under development for over a decade. EWVM is rooted in the fundamentals of weld properties, i.e., the weld performance is controlled by its microstructure, which, in turn, is controlled by the interaction between the chemical composition and the welding process. This methodology has been applied to linepipe grades from X70 to X100.

The key features of EWVM are briefly reviewed first. The girth weld thermal analysis tool (GWTAT), which forms a key part of EWVM, is covered in its currently published format for mechanized GMAW processes. The extension of this tool to FCAW-S processes and the expected new features are described. The focus is then turned to the possible application of EWVM in addressing the low strain capacity issues of some newly fabricated girth welds from modern microalloyed TMCP steels. Updates to girth welding standards, such as API 1104, are proposed. The possible updates include an alternative way to manage essential variables in welding procedure qualification and instrumented cross-weld tensile tests intended to ensure that girth welds have sufficient strain capacity to survive commonly encountered real-world loadings. Finally, systematic improvements to welding procedure qualifications are highlighted.

Keywords

Girth welding procedure qualification, Essential variables, Girth weld strain capacity, HAZ softening, Standard revision