

Funderburk, S., Spielbauer, P., **Chen Y.**, and Quintana, M., The Essential Welding Variable Methodology and Its Application in Welding Procedure Development for Mechanized Girth Welds of X100 Line Pipes, Proceedings of the 10th International Pipeline Conference, Calgary, Alberta, Canada, 2014, Paper no. IPC2014-33379

Abstract

The mechanical properties of X100 pipeline girth welds are quite sensitive to welding parameters and the design range for a viable welding procedure is narrower compared to pipeline steels of lower grades. The use of a high-productivity welding process, such as dual-torch gas metal arc welding (GMAW), further compounds the dependency of weld properties on welding parameters. Consequently, for X100 pipe welding procedure development, the path to achieve the required weld performance can be a time-consuming and costly process.

Developed in a recently completed project, the essential welding variable methodology provides an effective approach to optimize the development process for X100 pipe welding, with the benefits of reducing development time and saving cost. The present paper presents a practical case study of the methodology for girth welds.

The present paper focuses on the information needed and the analyses performed in the application of the methodology to the process of welding procedure development for a dual-torch pulsed GMAW(GMAW-P) procedure.

Using an analysis tool that can predict the thermal cycles from welding parameters and the available knowledge of microstructure and mechanical responses of both pipe materials and weld metals to welding thermal cycles (cooling rate), several candidates of dual-torch pulsed GMAW procedures were evaluated first for cooling times to help the determination of the final welding procedures. The finalized welding procedures used for the production of the qualification welds were evaluated to estimate the mechanical properties of the girth welds. The estimated weld properties will be compared to those from the test results when they become available.

Keywords

X100, welding, Pipeline, Essential welding variables, Welding procedure development