Failure Analysis of 4" Elbow Pipe Weld Crack

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Abstract

A four inch elbow pipe was failed during services. Visual examination of the failed surface showed a crack propagated along the borderline of HAZ and weld metal. The crack along the weld joint direction with the crack length is approximately 248 mm and the widest crack is about 1.9 mm. The marking at the elbow showed material specification should conform to A 234 Gr WPB. Metallographic examination at the HAZ region of the elbow showed a martensite phase. Chemical analysis of the elbow base metal revealed a higher carbon content. (CE at the elbow was 0.7) The weld crack associated with the martensite phase at HAZ known as Hydrogen Induced Cracking or cold crack. The failure was occurred due to unconformity of elbow material specification which resulting improper welding process.

Keyword: Elbow, Cold Cracking, Martensite, improper welding