

EFFECT OF REELING ON WELDED UMBILICAL TUBING FATIGUE

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ABSTRACT

One key component of umbilicals is the steel tubing carrying the pressurized fluids. During manufacturing and deployment of the umbilical, the tubing is subjected to a series of reeling and unreeling operations, resulting in a cumulative amount of plastic strain. For conventional design, this plastic strain is thought to limit the fatigue performance of the tubing, thereby limiting the number of such operations.

This paper discusses an experimental program aimed at assessing the effect of the cumulative reeling strain on the fatigue life of girth-welded, super duplex steel tubing. In particular, the reeling simulation and fatigue testing equipment used are described and the experimental procedures are presented. Interpretation of fatigue tests indicate that (1) reeling degrades the fatigue performance of the welded tubing, (2) 75% of the B design curve may represent the 97.5% survival bound for tubing reeled up to 12% cumulative reeling strain, and (3) the fraction of the B design curve reduces to 40% for the same bound when the data from the 20% reeling strain tests are included. However, given the uncertainties involved, project-specific applications will require a fatigue qualification program for the specific tubing size, reeling history, and welding procedure at hand.

KEYWORDS: Reeling, umbilical, tubing, girth weld, fatigue data.

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