Fatigue TN Curves for Chain, Wire, and Polyester Mooring Lines (Including Corrections for High-tension Ranges)

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1 Introduction

This report summarizes the derivation of high-load range, low-cycle corrections to API 2SK, Third Edition studlink and studless chain fatigue curves, and in this respect supplements the derivation of standard fatigue curves reported in API TR 2FC-1, First Edition. In addition, low-cycle, high-load range corrections to API 2SK's independent wire rope core (IWRC) and spiral strand (SS) wire rope fatigue curves are proposed, and polyester rope fatigue data are reviewed and compared with the recommendations presently contained in API 2SM, API 2SK, and ISO 19901-7. The proposed corrections to API's TN curves and the chain and polyester fatigue test data are shown in Figure 1. The lower part of the piecewise linear TN curves (in the log-log space) are the same as in API 2SK, while the upper part is the correction or change proposed.

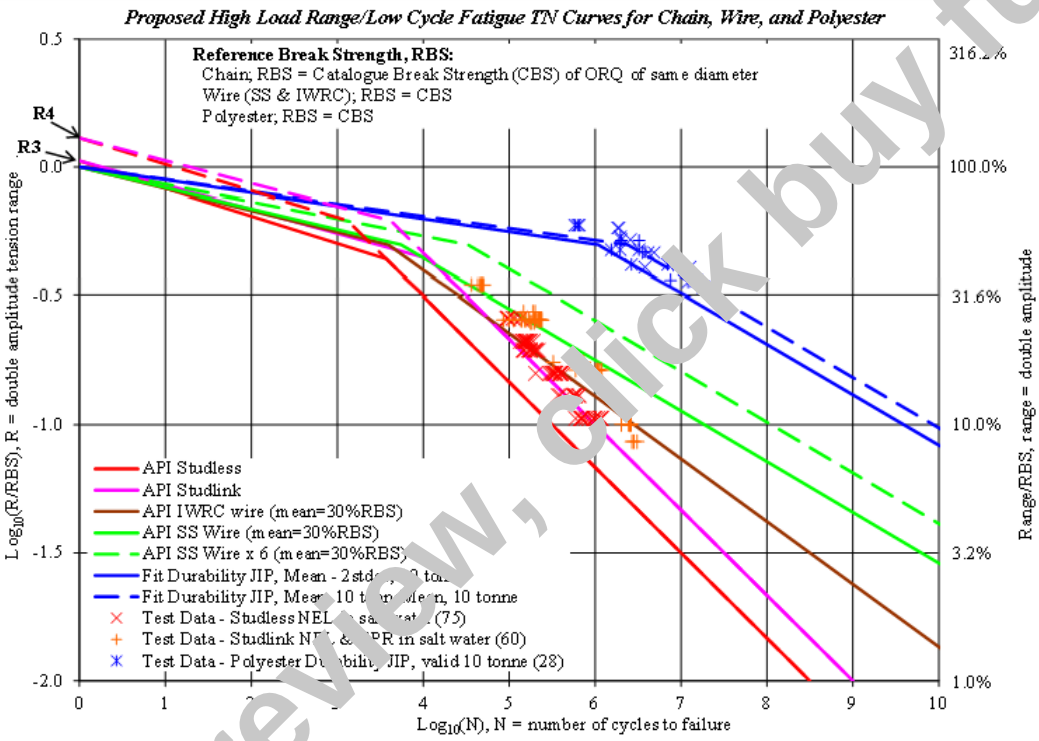

Figure 1—Proposed High-load Range/Low-cycle Corrections to API's TN Curves for Chain and Wire Rope, and Polyester TN Curves including Spiral Strand × 6

Large tension ranges resulting from vortex induced motions of a Gulf of Mexico spar first led to the identification of the need to add a correction for high-tension range, low-cycle fatigue damage to the existing fatigue curves contained in API 2SK, Appendix H. More recently, a "Cyclic Integrity Test (20-hurricane test)" consisting of 20,000 cycles between 15 % and 45 % of the ropes break strength has been proposed for polyester ropes. Consequently, it seems appropriate at this time to review existing fatigue curves and test data, and propose corrections for low-cycle, high-tension range fatigue damage.

2 Chain TN Fatigue Curves

Equation (1) expresses API 2SK's TN curves for chain mooring lines in tension as:

$$\log_{10}(N) = m\log_{10}(T) + \log_{10}(a) \tag{1}$$