



SEAL-LOCK XD TUBING
Product Line Validation
Connection Brief
Industry Standard Connection Qualification
Testing and Evaluation
API RP 5C5:2017 4th ed.

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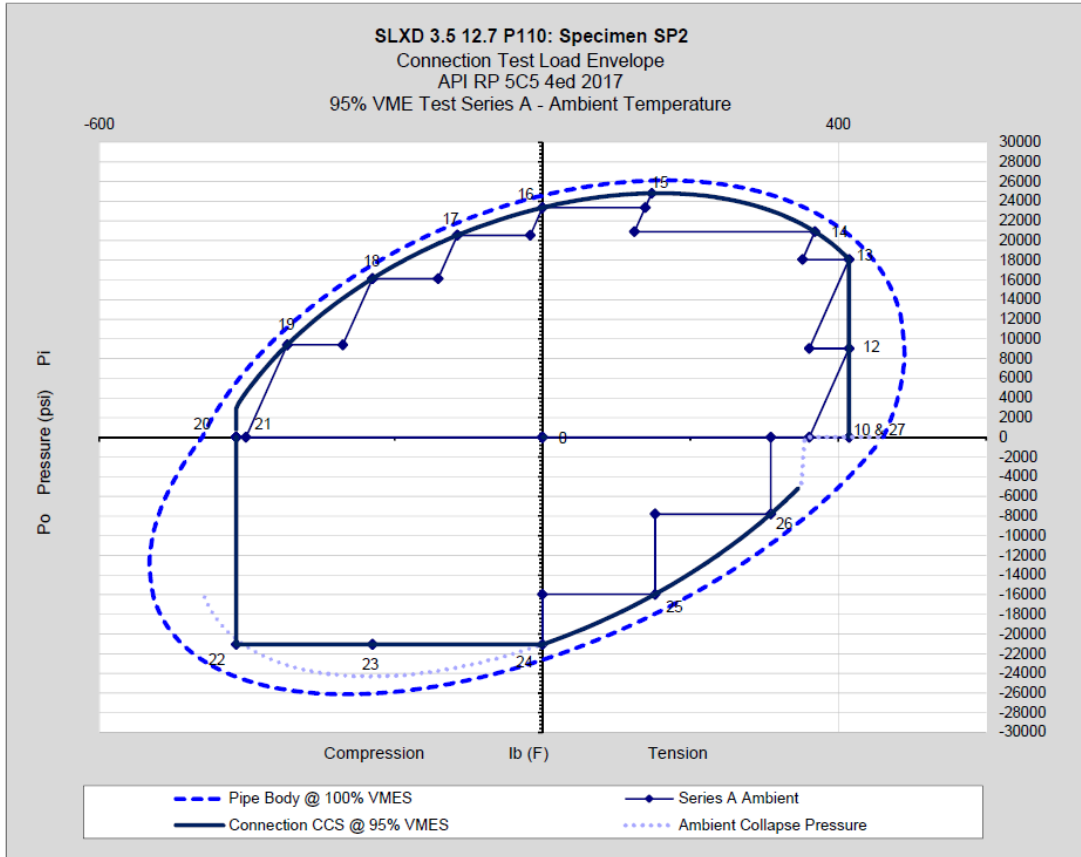
The evaluation of connection performance is a vital part of a reliable tubing well design for the oil and natural gas industry. Tubing connections are subject to loads that include internal pressure, external pressure, axial tension, axial compression, bending, torsion, transverse forces, and temperature change. The magnitude and combination of these loads will result in various pipe body and connection failure modes.

SEAL-LOCK XD is a threaded and coupled premium connection designed to provide internal and external pressure integrity under extreme loads. SLXD utilizes a negative load-flank thread form, advanced connection geometry, and a metal-to-metal seal to provide performance ratings that equal or exceed pipe body ratings in tension, compression, internal and external pressure. SLXD is designed and tested for HPHT wells and critical service applications.

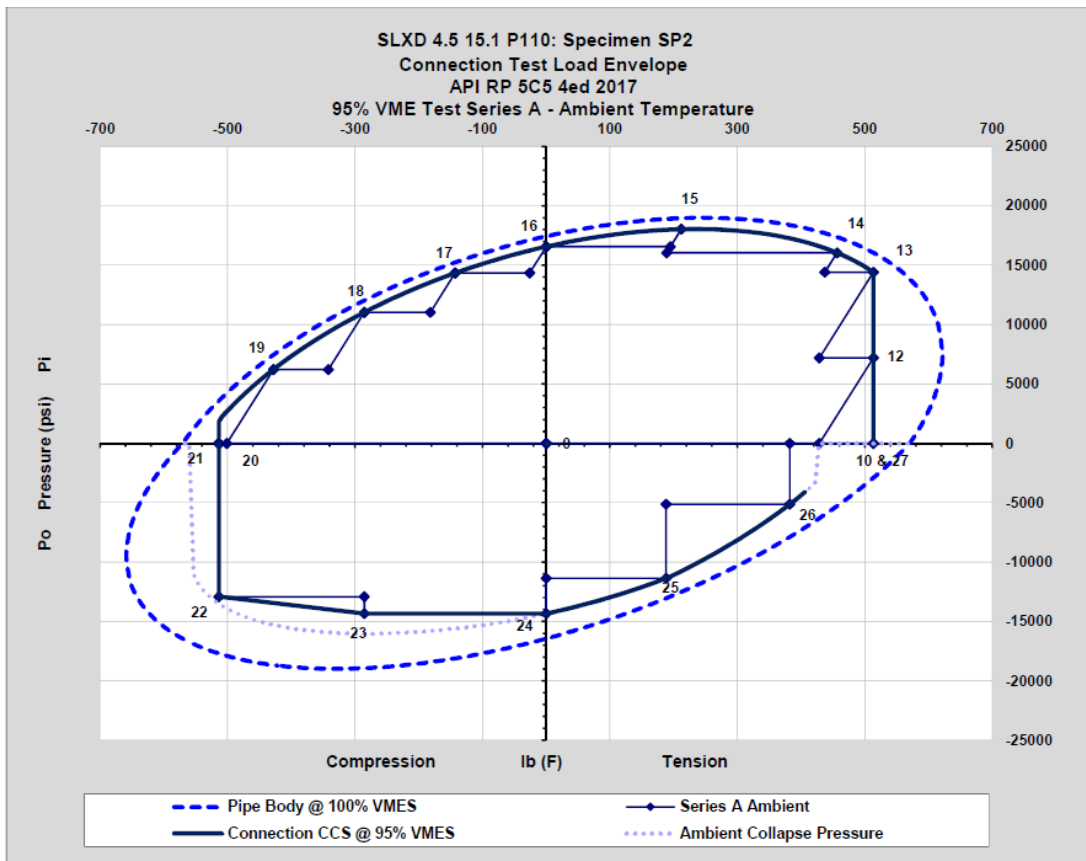
Experimental testing and analytical evaluation of these loads are essential to validating a connection performance envelope. Hunting Energy Service Connection Technology Division has standardized on API RP 5C5 Fourth Edition, January 2017 for the experimental testing and validation of tubing connection performance.

As experimental testing in accordance with API RP 5C5 is costly and time consuming, product line validation and extrapolation/interpolation of connection designs fully tested have significant benefits. API recognizes that full-scale physical testing on every diameter, mass, and grade within a product line is not practical and not necessary to define connection performance. Hunting Energy Service Connection Technology Division has established guidelines for product line validation through the interpolation and extrapolation of completed full scale physical connection testing compliant with API RP 5C5 Annex F. Refer to the HES “Premium Connection Product Line Validation and Extrapolation Connection Brief” for an example of these guidelines.

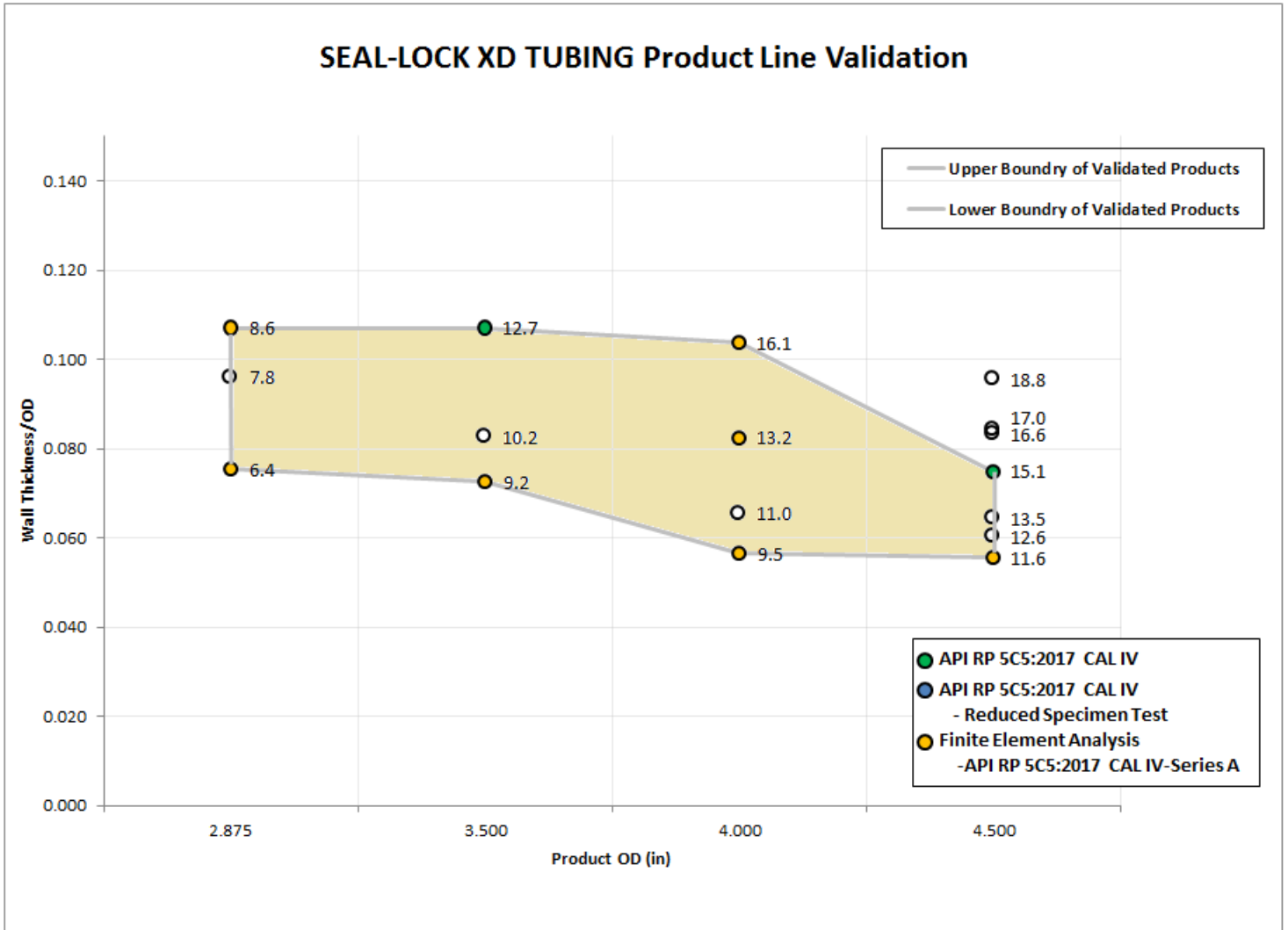
The foundation for the SEAL-LOCK XD product line validation is centered on the full scale API RP 5C5 4ed: 2017 CAL IV Qualification testing of 3.500 12.70 P110 and 4.500 15.10 P110 connections. Information regarding the qualification testing can be found in the HES “3.500 12.70 lb/ft (.375 wt) P110 SEAL-LOCK XD” and the “4.500” 15.10 lb/ft (.337 wt) P110 SEAL-LOCK XD” Connection Briefs. Refer to the Qualified Connection Performance envelopes depicted below. Additional Finite Element Analysis was completed on the Extrapolated sizes and subsequent interchangeable weights to confirm that the galling tendency, sealing performance and structural integrity of were similar to the full-scale tested connections.



3.500 12.70 (.375) SEAL-LOCK XD Performance Envelope



4.500 15.10 (.337) SEAL-LOCK XD Performance Envelope



SEAL-LOCK XD Product Line Validation

For the XD Tubing Product Line, full-scale CAL IV testing was completed on the 3.500 12.70 ppf (t/D = .107) and the 4.500 15.10 ppf (t/D = .0749) API P110 Grade connections. The Product Line Validation from Interpolation includes 3.500 12.70 ppf down to 9.20 ppf and across to 4.500 15.10 ppf down to 11.60 ppf when the Finite Element Analysis on the lighter weight connections were completed. Product Line Validation from Extrapolation of the 3.500 12.70 ppf CAL IV testing includes 2.875 8.60 ppf (t/D = .107) and 4.000 16.10 ppf (t/D = .104). Extrapolation includes through the interchangeable weights of 2.875 6.40 ppf (t/D = .0755) and 4.000 9.50 ppf (t/D = .0565). Combining the Interpolated and Extrapolated sizes produces the final Product Line Validated CAL IV Testing Results for P110 material and below.