



9.625" OD 40.00 lb/ft (.395 wt) L80

Seal-Lock XD

Connection Brief

Industry Standard Connection Qualification Testing

ISO 13679 2011 FDIS CAL IV

ISO/PAS 12835:2013 (TWCCEP)

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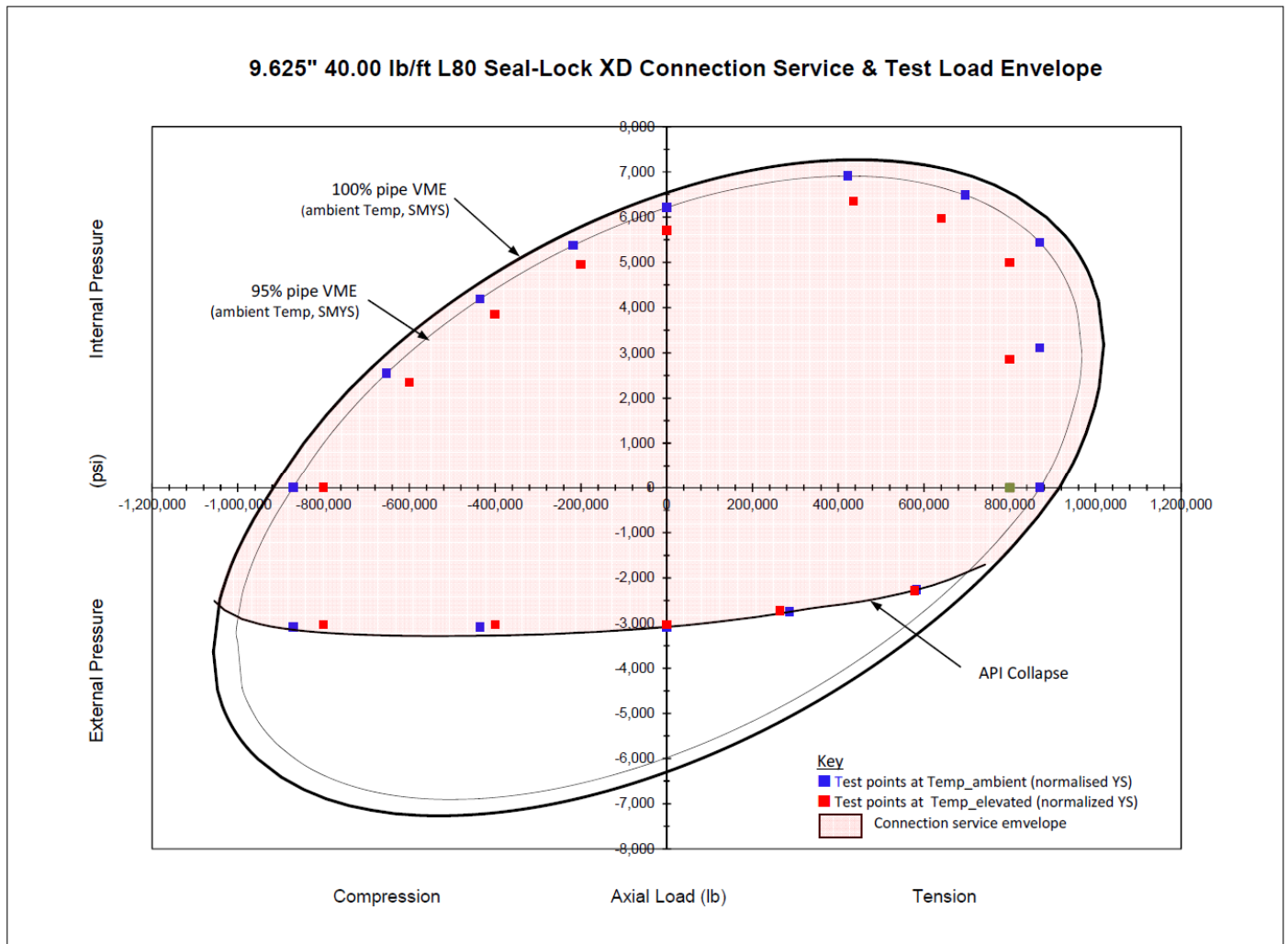


Hunting Connection Technology division performed ISO 13679 FDIS 2011 CAL IV and ISO/PAS 12835:2013 (TWCCEP) testing on the 9.625" OD 40.00 lb/ft (.395 wt) L80 SLXD to evaluate the sealing and structural integrity of the Seal-Lock XD casing connection. The 9.625" OD 40.00 lb/ft (.395 wt) L80 SLXD connection ratings are:

Tension Efficiency: 100% Pipe Body Yield Strength
 Compression Efficiency: 100% Pipe Body Yield Strength
 Internal Pressure: 100% Minimum API Internal Yield Pressure
 External Pressure: 100% API Collapse Pressure

The Maximum total axial loads and pressures attained during the 5 specimen CAL IV sealing and structural testing were:

Tension Efficiency: 954,283 lbf (104% of Specified PBYS)
 Compression Efficiency: 954,283 lbf (104% of Specified PBYS)
 Internal Pressure: 7,393 psi (129% of API MIYP)
 External Pressure: 3,090 psi (100% of API Collapse Pressure)



Normalized Connection Test Load and Service Envelope

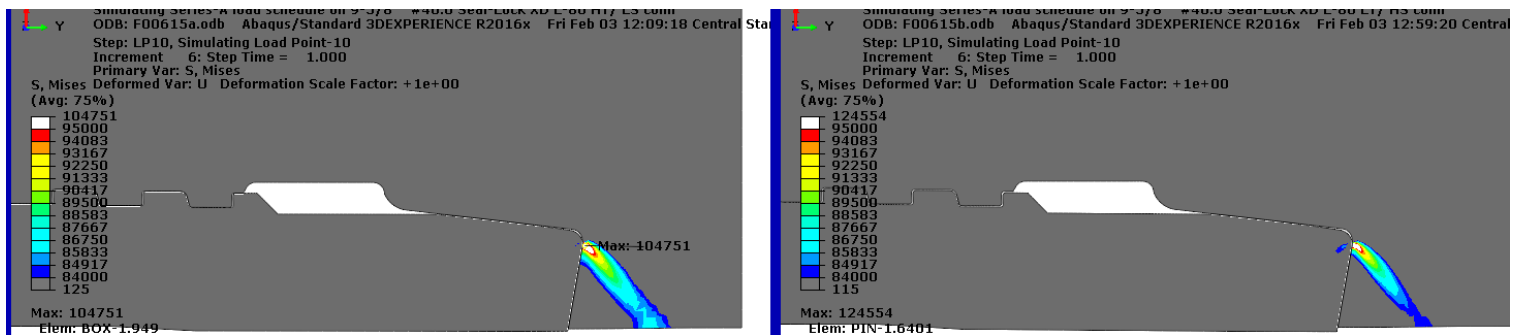
All of 9.625" OD 40.00 lb/ft (.395 wt) L80 SLXD specimens successfully completed the ISO 13679 FDIS 2011 CAL IV requirements.

The ISO/PAS 12835 (TWCCEP) testing is intended for the assessment of casing connections in which the well application generates significant axial loading on the casing connection from constrained thermal expansion. The testing protocol assesses the connection's galling resistance, structural integrity, and sealability under loads typical for assembly and thermal well service. Often, the strain based loading exceeds the casing connections yield limits and the ISO/PAS 12835 protocol is considered complimentary to the ISO 13679 protocol for connection testing in elastic design applications.

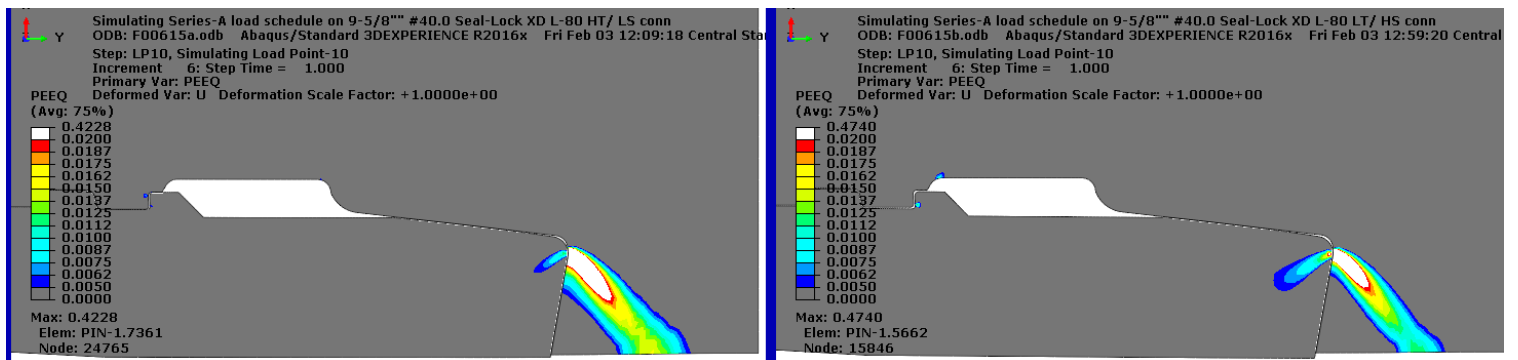
In accordance with the TWCCEP Application Severity Level-290, 4 specimens of 9.625" OD 40.00 lb/ft (.395 wt) L80 SLXD successfully completed 10 thermal cycles alternating between 290°C (550°F) and approximately 20°C (68°F), while maintaining 1065 psi of gas pressure. In addition to the thermal cyclic testing, 2 specimens were progressively strained in tension. Failure of both specimens exceeded the TWCCEP limit of 3% global strain, failing at 3.8% and 3.9%.

9.625" OD 40.00 lb/ft (.395 wt) L80 SLXD with 8.750" Special Drift

Finite Element Analysis has been performed to extrapolate the performance of the standard drift (8.679") connection to the special drift (8.750") connection. The changes to the connection result in approximately 10% difference in the connections shoulder area. The focus of the FEA was therefore centered on the plasticity and stress of the shoulder under high compressive loads and seal contact energy at various combined load points as compared to the original product.



VME Stress plot at 870 kips Compression (left: SPCL Drift, right STD Drift)

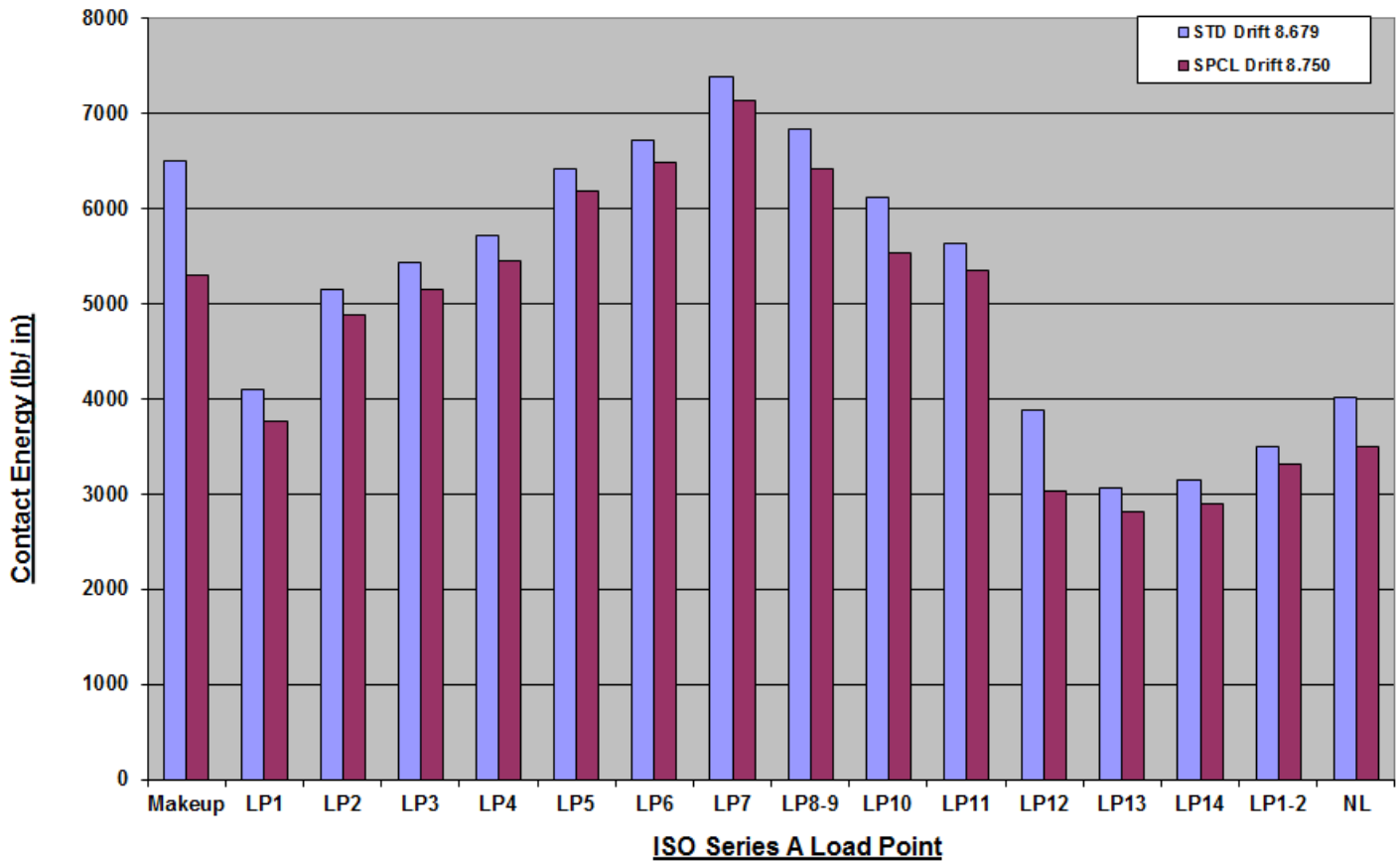


PEEQ plot at 870 kips Compression (left: SPCL Drift, right STD Drift)

As is illustrated in the above plots the, the VME stress and the Von Mises Equivalent Plastic Strain show only a slight increase for the 8.750" special drift connection as compared to the standard drift at 95% compressive loading. The VME stress in the shoulder increased on average 11% with local increases at 12.8% above the standard drift product.

Even with the increase in shoulder stress, the indication of combined load sealability is typically illustrated by the associated contact energy between the pin and box sealing surfaces.

**Contact Energy at Internal Seal
9.625 40.00 SLXD Special Drift Comparison**



On average, there was only an 8% decrease in the contact energy across all of the ISO Series A load points. Of which, a majority of the decrease can be accounted for on the make-up and unload load steps.

The resulting contact energy and only a slight increase in the shoulder stress gives clear indication that the 9.625" OD 40.00 lb/ft (.395 wt) L80 SLXD with an 8.750" Special Drift with respect to the pipe will have matching performance when compared to the standard product.