3.10.2. Grooves for hydraulic expanding

The current edition of the TEMA Standards requires grooves for hydraulic expanding to be 6.35 mm wide. Although this width is suitable for most materials, use Eq. 2 to optimize the groove width.

\[ W = 1.56 \sqrt{Rt} \]  

(2)

In this equation, \( W \) is the optimal width, \( R \) is the mean tube radius, and \( t \) is the tube wall thickness.

4. CONCLUSIONS

The following conclusions are drawn from the foregoing discussions of expanding theory and the difficulty of making methods adequate to predict deduction of percent wall reduction.

(1) For thin-walled Titanium tubes, correlating shear loads (pullout loads) with torque provides a superior way to achieve consistent results.

(2) Designers should be aware that rolled joints with thin-walled Titanium tube may require annular groove configurations different from TEMA standard grooves. They should be aware that grooves for hydraulic expanding should be at least 6.35 mm wide.

(3) Two-stage expanding is desirable because of the stiffening effect of the first stage on the tubesheet.

(4) Hybrid expanding takes advantage of fixing the tubes firmly in place and stiffening the tubesheet in the hydraulic expanding stage, and strain hardening the inner shells of the tube end sufficiently to overcome spring back. This results in tube-to-tubesheet joints less prone to fatigue failures and with adequate strength for the service.

5. ACKNOWLEDGEMENTS

The author wishes to acknowledge the information that HydroPro, Inc. of San Jose, California provided about their hydroexpanding equipment.