An Experimental Study of the thread compound Sealing Capacity for threaded connection

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Abstract

Oil & gas exploration at greater depth and development of technically ever more challenging reservoirs has led to advanced well designs requiring casings and tubings with increased pressure and temperature ratings. More demanding well loads have also increased the demand on threaded connections.
Wells are typically designed with a two-barrier-philosophy. Production tubing and casing constitute the primary and secondary barrier to reservoir loads. The production casing also acts as the primary barrier to the lift gas injection load and the intermediate casing. Threaded connection leads mean loss or degradation of well barriers. To re-instate well barriers, tubing change-outs and tie-backs are required which are costly, especially in an offshore environment. Connection leak repairs by pumping sealants into wells are successful only if engineered and executed correctly. Even then, the tubular pressure rating may not be fully restored and the seal may be only last for a certain period of time.
An experimental study was carried out to investigate the effect of five different thread compounds on leak resistance and the performance of threaded connections subjected to a pressure differential. The improved “grooved-plate method” was applied.
The tests have shown a large variation of sealing capacity for different thread compounds. The results were compared with published results and good compatibility was found. It was found that the leak resistance is time dependent and that the higher the pressure differential the shorter the time to establish a leak will be. Furthermore, our tests have shown that leak is more likely to occur after 90 minutes for the best case and in less than 30 min in the worst case scenario.

Introduction

The fixture proposed by project PRAC 88-51 offers the advantage of comparing only the threaded compounds, by neglecting the makeup and tolerance-induced errors. This is why it has been considered the use of the same experimental setup as the one described by Wood et al. (1990).
The grooved-plate setup has been chosen for thread-compound analysis because it allows testing of thread compounds independent from thread tolerances and stress/strain state. Later, full-scale specimens with controlled geometry have been used for reference.
The test was performed according to the following procedure: the grooved plate was completely filled with the dope to be tested, and then the grooved plate was assembled over the sealing plate and placed into the hydraulic press. The center of the grooved plate was connected to the high-pressure pump. Mineral-hydraulic oil has been used as the pressurizing medium. The pressure was slowly increased, and the moment at which the dope was expelled was recorded.
To build the groove plates, we calculated the groove size according to the real dimensions of a 5½-in. API Buttress thread. The testing setup and the specimens (grooved and seal plates) are shown in Figs. 1.
The experimental results of 5 thread compounds are shown in figure 2.

Conclusions

The Buttress leak resistance has an asymptotic behavior. At contact pressures higher than 100 MPa, the leak resistance is constant.
Additional long term tests have shown that after 90 minutes a Buttress Connection will leak even at low value of internal pressure.

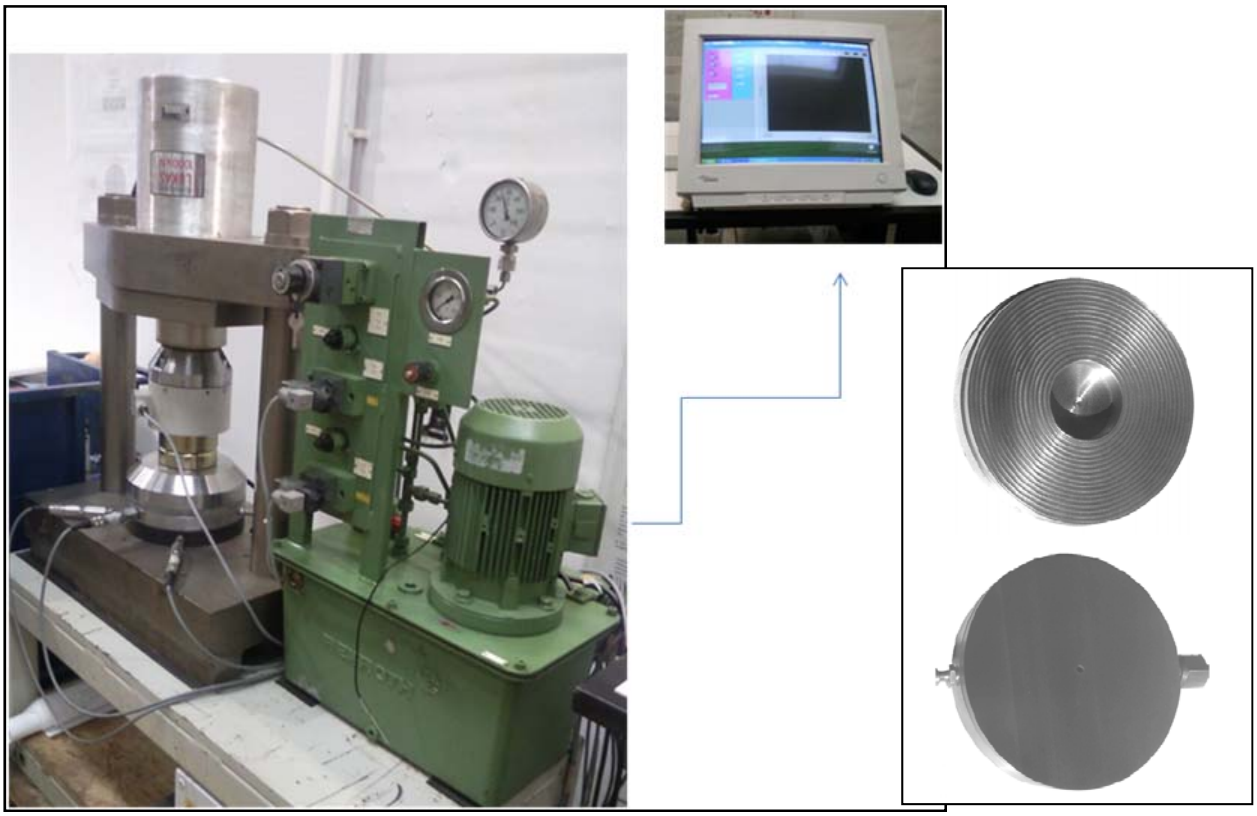

Figure. 1. The experimental setup of grooved plate method

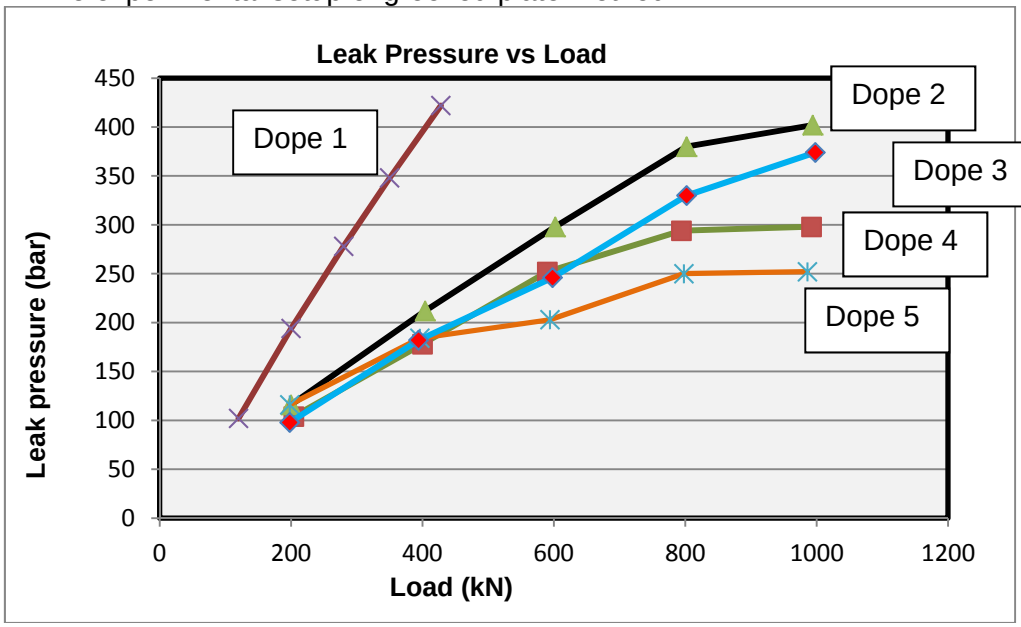

Figure 2. Leak pressure of selected thread compounds