ADVANCED INTERMITTENT GAS LIFT UTILIZING A PILOT VALVE

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A field trial was completed to test the effects of utilizing gas lift with a Pilot Valve to obtain low instantaneous FBHP's in a low fluid rate, low reservoir pressure horizontal well. The operations of the system were focused on intermittent gas injection into the flow string at the depth just above the perforations, and the gas injection was used to physically displace a liquid column. The liquid column is allowed to accumulate above the standing valve during the non-injecting cycle of the system.

The Pilot Valve was designed and built to take the function of the intermittent cycles from surface and bring the gas control down-hole. In conventional intermittent gas lift systems, the injection (on) and non-injection (off) cycles are controlled by a valve on the injection line at surface and near the wellhead. The idea of the Pilot Valve, allowed Flowco to transfer the control of the injection (on) and non-injection (off) cycles down-hole. Moving the control of the injection cycles down-hole, improves the response and timing of each injection cycle. ***Figure 1*** illustrates each injection cycle over a 24-hour period. For unconventional horizontal wells, the wellbore conditions, production rates, and reservoir pressures are dynamic and constantly changing. The Pilot Valve allows for simple retrieval for inspection and repair, and also for adjustments to be made without the need of a work-over rig. As fluid production declines and reservoir pressure changes, the set pressures, and required gas volumes of the Pilot Valve can be adjusted accordingly. This process can be adjusted and have the well back online in less than 24 hours, as optimization is required.

The Pilot Valve system can be an alternative use for a positive displacement pump application. Alternative uses are suited for deviated and horizontal wellbores, deep wells and those that make too much formation gas for efficient positive displacement pumping. The Pilot Valve surface requirements are very flexible and can range from high-pressure gas supply lines to single site compressors. The Pilot Valve is well suited for single site compression, in remote or isolated well sites. The single sites yield themselves well to Pilot Valve operations, due to the low injection pressure and volume requirements on a daily basis. The expected fluid rates that can be achieved on Pilot Valve operations are dependent on the depth, reservoir pressure, and tubing size of the selected wells. Maximum fluid rates occur at about 75 to 150 BFPD in 2-3/8" tubing, 125 to 300 BFPD in 2-7/8" tubing, and 200 to 400 BFPD in 3.5" tubing.

Operational fixes and improvements will be discussed and shown, as a means to improve efficiency and reduce % loss during intermittent cycles. The benefit over conventional intermittent gas lift systems, where gas is cycled at the surface, will be discussed. Production results from Pilot Valve tests will be indicated, along with predicted FBHP's, to illustrate the change in FBHP's as a result in drawdown from low reservoir pressure wells. The test well for the Pilot Valve is a horizontal granite wash targeted well. The perforation depth is at 10,764' TVD with 2-7/8" tubing set at 10,696' TVD. ***Figure 2*** illustrates the change in production, as the artificial lift methods were switched.

Matt Young is the Technical Sales Manager for Flowco Production Solutions. After graduating from Texas A&M, he started his career with BJ Services as a field engineer in the cementing division in Hobbs, New Mexico. After leaving BJ Services, he joined International Lift Systems (ILS) as a Field Service Technician for the gas lift and plunger lift product line. In 2009 ILS was acquired by Lufkin Industries. During the Lufkin/ILS acquisition, he moved into the Mid-Continent Operations manager position, handling gas lift and plunger lift technical support, and installation in Oklahoma City, OK. He was promoted into the North American Operations and Sales Manager position with Lufkin and continued in that position through the GE Oil & Gas acquisition in 2013. After a year with GE, Matt left to join Flowco in 2014. Matt has worked on gas lift and plunger lift installs and optimization projects throughout oil and gas fields in Texas, New Mexico, Oklahoma, Colorado, and Louisiana. He also has experience from working a brief stint in Canada and MENA with various technical and sales positions.

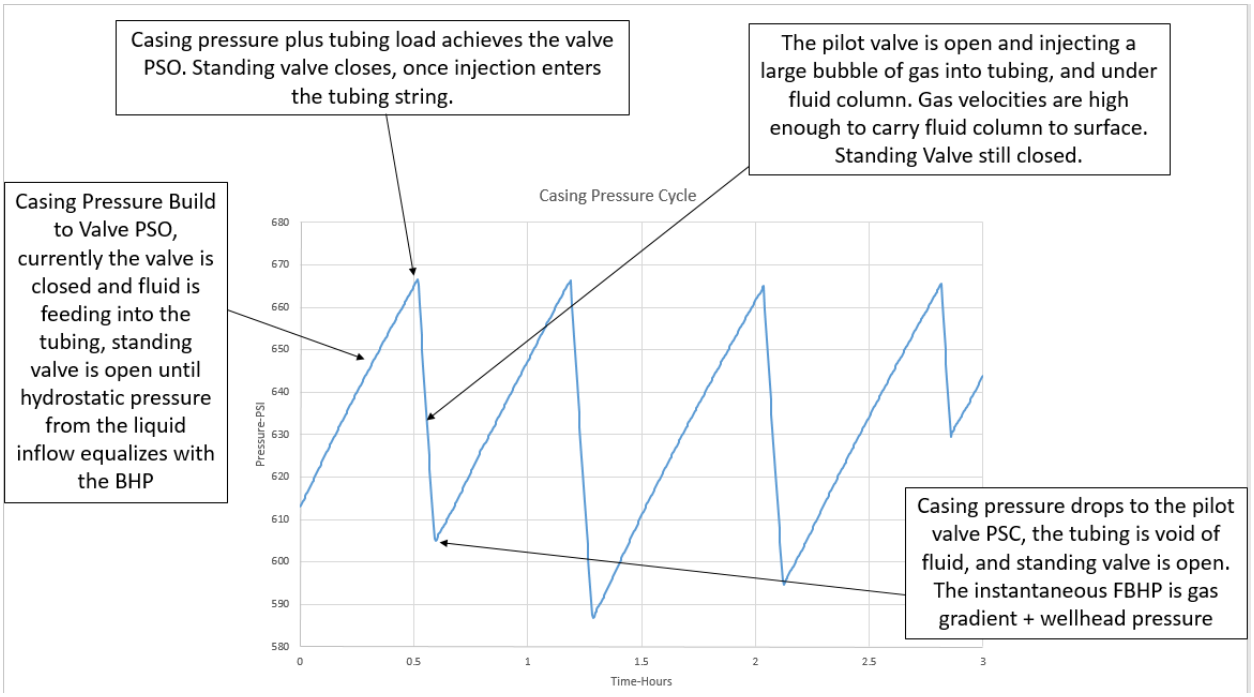

Figure 1

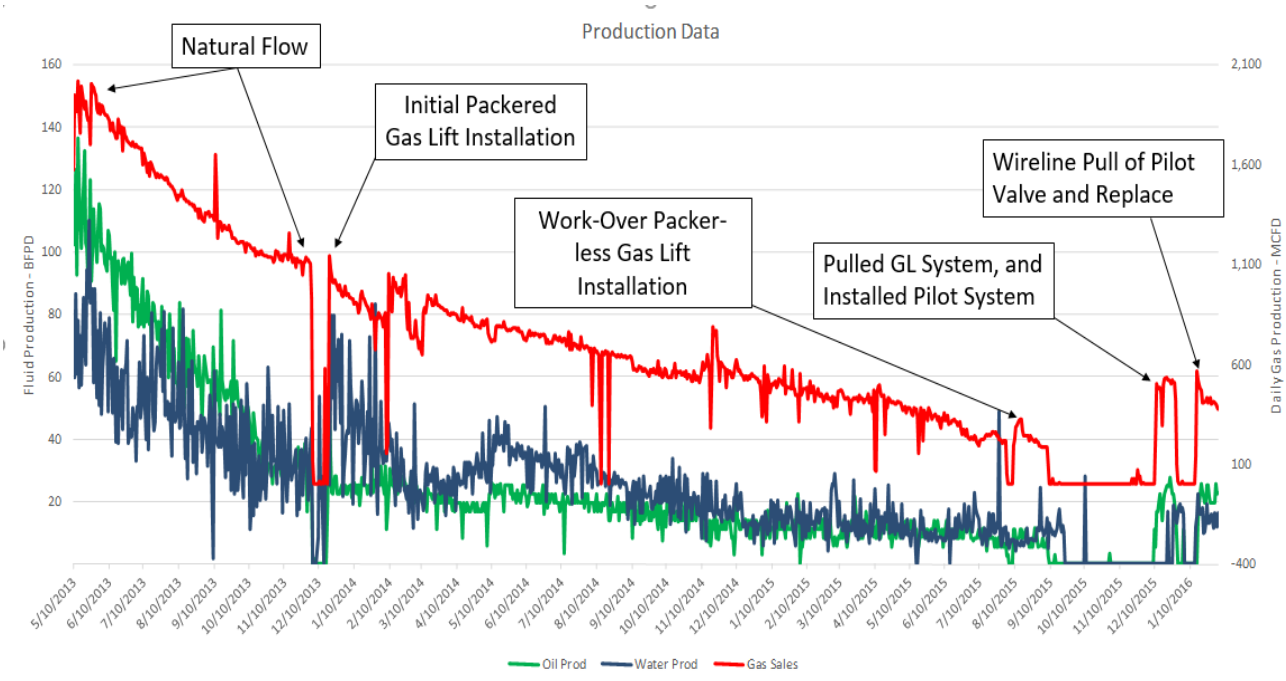

Figure 2