Optimising Production through Novel PCP Life Enhancement Technologies

Hugo Flores[1]

[1]WellDog, Denver, CO, USA

Abstract

Production of coal seam gas requires that the hydrostatic pressure on the coals be reduced to below the critical desorption pressure of gas stored in a sorbed state within the coal matrix. Production wells are therefore equipped with some form of downhole pump to dewater the coal cleat structure. The produced water can contain significant coal fines and mineral solids from interbedded sandstones and shales. These solids, together with the chemical potential of solubilized gases and associated dissociation products in the produced water to degrade progressive cavity pump elastomers and water's lack of lubricity, pose a significant challenge in achieving acceptable pump run life. Two conditions in particular, fluid pump-off and produced solids settling on top of the pump during well shutdown periods, can greatly affect mean-time-to-failure.

The frequency of pump failures due to these challenging production conditions is greatly impacting coal seam gas economics, with well workovers resulting in deferring gas production and increasing life-cycle well maintenance costs. To address the imperative for reducing workover frequency, a number of innovative and complementary technology platforms have been developed aimed at enhancing pump run life. These are at various stages of commercialisation and uptake, with performance impact on well economics quantified through evaluation of case histories. The aim of this presentation is to showcase these novel pump life enhancement techniques and reveal how they also improve dewatering of coal seam gas wells.

Progressive Cavity Pumps

The Jurassic sub-bituminous Walloon coal measures of the Surat basin and Late Permian sub-bituminous Bandanna coal measures of the Bowen basin comprise a number of subgroups. Net coal is around 10% of gross interval, with individual coal layers ranging in thickness from less than one meter to several meters. The coals are mostly thinly interlaminated with carbonaceous mudstone, mudstone, siltstone, and sandstone, with both slotted liner and cased hole completion designs employed to access multiple seams in each CSG production well. Dewatering these coal measures can result in significant production of interlaminated siltstone and sandstone solids. Progressive Cavity Pumps (PCP) are therefore favoured over Electrical Submersible Pumps (ESP) to extract water due to their greater tolerance of entrained solids.

Progressive Cavity Pump Life Enhancements

While PCPs can tolerate solids production better than other rotary pumping technologies, they can nonetheless be rendered inoperable due to excessive settling of solids on top of the pump during planned or unplanned shutdowns. Furthermore, continuous inflow of water from the coals can be interrupted if the wellbore fluid level is pulled too low, resulting in a lack of lubrication of the Stator elastomer. This so-called

pump off condition can cause the elastomer to burn, which will cause the pump to either seize or lose the ability to surface fluid. These failure modes have resulted in average PCP run lives being drastically reduced in CSG production wells.

PCPDefender™

PCPDefender™ has been specifically developed to mitigate these failure modes in rod-driven progressing cavity pumps. It provides both solids and mechanical pump off control and has shown great success in improving PCP run-life.

How it Works

PCPDefender™ increases the run lifetime of progressing cavity pumps by diverting settling solids into the annulus during shutdown. In the idle condition, or when the pump is discharging fluid, a shuttle valve floating on a polished rod isolates the tubing from the annulus. In a no flow condition (with pump on or off), the shuttle valve open ports to allow fluid and any entrained solids in the tubing above the pump to be flushed into the annulus.

Features and Benefits

- Prevent buildup of solids
- Eliminate pump off condition
- Reduce rod backspin
- Deployed during well completion
- Enables flush-by without removal
- Increases PCP run life
- High success rate

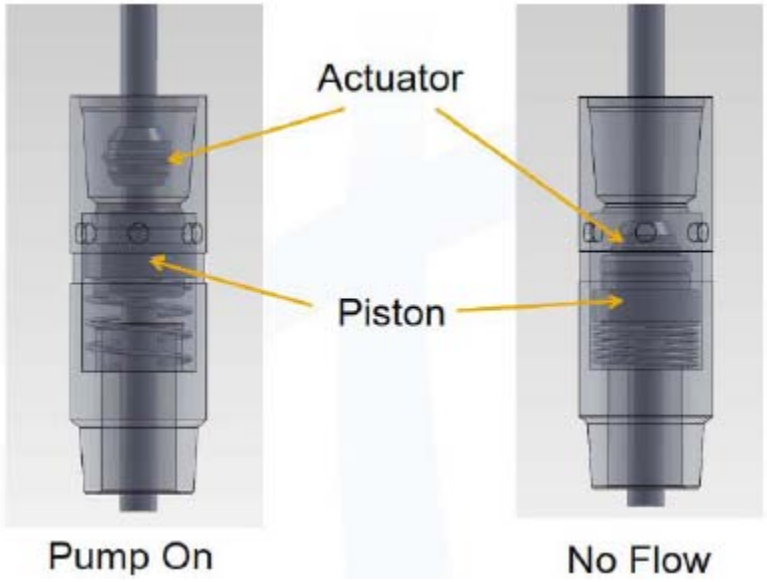

Figure 1. Operating Principle.

Fluid Level Monitoring

One objective of CSG operations is to accelerate onset of gas production by optimising dewatering rates. It is also vital that uninterrupted PCP operations be sustained throughout the dewatering phase, as unlike a conventional gas well, shut-in of CSG wells can result in significant loss of gas producing potential. This is due to water encroachment and pressure recharge of the drainage area, as well as inefficiencies associated with relative permeability effects. Optimising dewatering rates essentially involves pulling wellbore fluid level as low as possible, while sustaining PCP operations means having to avoid the pump off condition, which can also drastically reduce PCP run lives. Equally important is the manner in which the well is pumped down after any well shutdown. Pumping the well down creates a pressure drop in the near wellbore region. The gas saturation in this region can be high. If flowing bottom hole pressure is lowered too quickly, formation shock and surging of gas and water into the wellbore will cause co-production of damaging solids that can lead to plugging of slotted liners