

Title: Design and Optimization of PAGL and GAPL

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The combined usage of plunger and gas lift offers production increase and cost-cutting opportunities. Compared to continuous gas lift operation, the plunger lift mechanistic models and software packages are not commonly available. Implementing analytics improves the plunger-assisted gas lift (PAGL) and gas-assisted plunger lift (GAPL) operation at the design stage and optimization.

Plunger creates a sealing between gas and liquid phase to reduce hydrostatic pressure losses and cut injection rates for gas lifted wells. The intermittent gas lift is compared to the GAPL, and continuous gas injection is compared with the PAGL to demonstrate the efficiency of the plunger sealing. The fall and upstroke mechanics of both PAGL and GAPL are explained with experimental videos. The liquid unloading mechanism, plunger types, and characteristics of both plunger lift methods are described. Examples from literature are provided to show the successful applications starting from the pre-liquid loading stage to the later life of the well.

The analytics required for artificial lift selection and when to deploy a plunger in a gas-lifted well are discussed. The effect of bottomhole assembly location on cycle times and hydrostatic pressure removal is explained with the inclination angle limitations. The shut-in and afterflow time setting influence the hydrodynamics of both fall and upstroke stages. The increasing number of plunger cycles per day can cause reduced production-on time due to frequent shut-in stages. Higher afterflow times are shown to be increasing the liquid loading between each plunger cycle hence rising cycle duration.

The study presents design parameters and optimization opportunities for PAGL and GAPL operations. The value of plunger lift application for gas lifted wells is demonstrated by videos, literature, and the outflow performance curve. Surface compression combined with a plunger and gas lift was found to reduce flowing bottomhole pressure and extend PAGL operational range.