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IMPROVED EQUATIONS TO CALCULATE THE MINIMUM STEM TRAVEL IN GAS LIFT VALVES

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ABSTRACT

The minimum stem travel required to fully open an unbalanced, single-element Gas Lift Valve (GLV) is an important parameter in GLV performance calculations. The value of this parameter dictates whether the valve is fully or partially opened, thus determining the amount of gas passage through the GLV. The geometries of the ball and the seat are the main factors affecting this parameter.

There exists only one equation in literature to readily calculate this minimum stem travel required for a fully open GLV. However, the derivation of this equation is based on only one position of the ball which might not be the case for different ball and seat geometries. Also, this equation allows to calculate the minimum stem travel for sharp-edge seats only. Recently, detailed theoretical calculations were made and experiments were run based on modified seat designs (beveled seats) (Elldakli, Soliman, Shahri, Winkler, & Gamadi, 2014) which showed a significant performance improvement compared to sharp-edge seats. As minimum stem travel depends on seat geometries, the existing equation cannot be applied for the beveled seats.

In this paper, a set of new equations have been presented to calculate minimum stem travel for fully open GLV for any ball positions, and ball and seat geometry. In addition to the equation for sharp-edge seats, another equation has been derived for beveled seat based on average port area. This set of new equations is expected to make the relevant calculations more precise and correct.

KEYWORDS: Stem Travel, Single-Element Gas Lift Valve (GLV), GLV Performance