

ABSTRAK

ANALISIS TURPIN UNTUK OPTIMASI *ELECTRICAL SUBMERSIBLE PUMP* PADA SUMUR FFF LAPANGAN ZYH

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Sumur FFF pada Lapangan ZYH menggunakan *Electrical Submersible Pump* (ESP) sebagai metode pengangkatan buatan (*artificial lift*) untuk mengalirkan fluida reservoir ke permukaan. Nilai *Gas Oil Ratio* (GOR) yang sangat tinggi sebesar 9.103,84 scf/STB menyebabkan gas bebas pada *intake* pompa berpotensi menimbulkan *gas interference*, penurunan efisiensi, hingga risiko *gas locking*, sehingga operasi ESP menjadi tidak stabil dan produksi tidak optimal. Oleh karena itu, diperlukan evaluasi kinerja dan optimasi sistem ESP.

Kemampuan produksi dievaluasi menggunakan kurva IPR metode *Vogel Generalized*, dipilih karena terjadi aliran dua fasa parsial akibat tekanan reservoir yang berada di atas *bubble point* sementara tekanan alir dasar sumur berada di bawahnya. Evaluasi kinerja ESP menggunakan korelasi Turpin untuk menentukan batas stabilitas operasi secara kuantitatif berdasarkan hubungan antara *pump intake pressure* (PIP) dan rasio gas-liquid pada *intake* pompa. Optimasi dilakukan dalam dua skenario yang meliputi penyesuaian frekuensi *Variable Speed Drive* (VSD) berdasarkan *affinity law*, penentuan *Pump Setting Depth* (PSD) optimum, serta pemasangan *Rotary Gas Separator* (RGS) dan *Advance Gas Handler* (AGH) dengan asumsi efisiensi pemisahan masing-masing 90%.

Hasil kurva IPR menunjukkan laju alir maksimum 145,025 BPD. Nilai Turpin awal sebesar 20,267 mengindikasikan ESP beroperasi tidak stabil akibat tingginya kandungan gas bebas. Pada Skenario 1 (VSD 39 Hz, PSD 5.205,05 ft), produksi mencapai 122,85 blpd; setelah pemasangan RGS dan AGH, nilai Turpin turun menjadi 0,097 dengan *Total Dynamic Head* (TDH) 4.732,90 ft. Pada Skenario 2 (VSD 41,43 Hz, PSD 5.205,05 ft), produksi mencapai 130,522 blpd dengan nilai Turpin 0,291 dan TDH 4.902,51 ft. PSD optimum pada kedalaman 5.205,05 ft dipilih karena menghasilkan nilai Turpin terendah dan kondisi operasi pompa paling stabil pada kedua skenario.

Kata kunci: *Electrical Submersible Pump*, Turpin, *gas interference*, *rotary gas separator*, *advance gas handler*

ABSTRACT

TURPIN ANALYSIS FOR ELECTRICAL SUBMERSIBLE PUMP OPTIMIZATION IN FFF WELL, ZYH FIELD

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Well FFF in Field ZYH uses an Electrical Submersible Pump (ESP) as the artificial lift method to bring reservoir fluid to surface. The very high Gas Oil Ratio (GOR) of 9,103.84 scf/STB causes free gas at the pump intake to generate gas interference, reducing pump efficiency and risking gas locking, resulting in unstable ESP operation and suboptimal production. This necessitates ESP performance evaluation and system optimization.

Well productivity was evaluated using the Vogel Generalized IPR method, selected due to partial two-phase flow conditions caused by reservoir pressure being above the bubble point while bottomhole flowing pressure falls below it. ESP performance was assessed using the Turpin correlation, which quantitatively defines stability limits through the relationship between pump intake pressure (PIP) and the gas-liquid ratio at the pump intake. Optimization covered two scenarios involving Variable Speed Drive (VSD) frequency adjustment based on affinity law, determination of optimum Pump Setting Depth (PSD), and installation of a Rotary Gas Separator (RGS) and Advance Gas Handler (AGH), each assumed to operate at a separation efficiency of 90%.

IPR analysis yielded a maximum flow rate of 145.025 BPD. The initial Turpin value of 20.267 indicated unstable ESP operation due to high free gas content at the pump intake. In Scenario 1 (VSD 39 Hz, PSD 5,205.05 ft), production reached 122.85 blpd; after RGS and AGH installation, the Turpin value dropped to 0.097 with a Total Dynamic Head (TDH) of 4,732.90 ft. In Scenario 2 (VSD 41.43 Hz, PSD 5,205.05 ft), production reached 130.522 blpd with a Turpin value of 0.291 and TDH of 4,902.51 ft. The optimum PSD of 5,205.05 ft was selected for both scenarios as it yielded the lowest Turpin value and most stable pump operating conditions.

Keywords: Electrical Submersible Pump, Turpin, gas interference, rotary gas separator, advance gas handler