

# Gas Release System Bypass (GRSB): An Advanced Gas-Handling Technology to Enhance ESP Performance in High-GLR Wells

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## **ABSTRACT**

This paper presents the Gas Release System Bypass (GRSB), the latest advancement in gas regulation and separation technologies for Electric Submersible Pump systems operating in high-GLR and gas-slugging environments. The GRSB enhances conventional gas-handling methods by integrating the principles of gas regulation, pressurization, centrifugal dispersion, and controlled gas venting through a dedicated bypass system. This design ensures that fluids delivered to the pump intake are properly conditioned, enabling stable ESP performance, improved drawdown, and reduced motor temperature, while mitigating shutdowns associated with gas interference. The system serves as a high-efficiency solution for wells nearing the limits of ESP operability and as an intermediate step before transitioning to alternative artificial lift systems.

The GRSB integrates four major components, a Triple Seal Packer, Pressurization Chamber, Centrifugal Regulator, and Gas Release Bypass section, working sequentially to homogenize fluid and efficiently vent free gas. Large gas slugs are first dispersed into smaller bubbles, then reabsorbed through pressure increases generated within an oversized chamber. Centrifugal forces further break remaining bubbles, and any unrecombined gas is vented through a one-way valve above the ESP discharge. The result is a stable, homogenized liquid stream that promotes efficient motor cooling and consistent pump operation.

Four field applications in the Midland Basin demonstrate the impact of the system. Sensor parameters recorded before and after installation will be compared to assess the tool and overall, ESP performance. The analysis will focus on pump intake pressure (PIP), motor current, frequency, and motor temperature. Additionally, the data will be evaluated to determine whether the new technology extended pump operation and prevented shutdown events.

Overall, the Gas Release System Bypass provides a robust and innovative approach to transforming slug flow into a manageable, homogenized stream, optimizing ESP performance in challenging gas-prone wells. Its ability to regulate, separate, and release

gas before reaching the pump intake establishes the GRSB as a transformative technology for modern artificial lift operations.

## **INTRODUCTION**

Electric submersible pumps are widely used in artificial lift applications due to their ability to produce high fluid volumes efficiently. However, their performance can be significantly affected in wells with elevated Gas–Liquid Ratios, particularly under unstable multiphase flow conditions. The presence of free gas at the pump intake reduces effective pump head, decreases volumetric efficiency, and increases the risk of gas interference and gas lock. In high-GLR wells, declining reservoir pressure promotes gas liberation, and intermittent slug flow can introduce large gas pockets into the intake. These conditions often result in fluctuating pump intake pressure, unstable amperage, elevated motor temperatures, and frequent shutdown events, ultimately limiting drawdown capability and shortening ESP run life. While conventional gas separators provide partial mitigation, their effectiveness may be reduced in severe slugging environments or small casing sizes. For wells operating near the gas-handling limits of ESP systems, additional flow conditioning strategies are required to stabilize intake conditions and extend operational performance.

The Gas Release System Bypass was developed to address these challenges in high-GLR wells by conditioning multiphase flow prior to entering the ESP intake, improving stability and extending the operability of ESP systems under gas-prone conditions.

## **PROBLEM DESCRIPTION**

As a well ages, production naturally declines as reservoir pressure drops and more free gas reaches the pump intake. Early in the well life, an ESP can handle the gas liquid ratio if flow remains steady. Over time, depletion causes gas to break out in the lateral, forming slugs that reach the pump in cycles. This leads to unstable operation, fluctuating amperage, and reduced efficiency.

Gas interference becomes evident when the pump no longer delivers the expected head from its performance curve. As gas volume increases, liquid production decreases and efficiency drops. Trends in gas oil ratio also reflect these changes, with increasing values indicating gas liberation and reservoir depletion, and more erratic behavior signaling unstable inflow conditions.

Inside the pump, gas separates from the liquid due to density differences. The liquid is pushed through the impellers while gas accumulates in low-pressure regions, disrupting flow. As gas builds up, the pump may surge and eventually become gas locked, stopping fluid movement. Without fluid flow, the motor loses cooling, temperature rises quickly, and amperage drops. If not corrected, the ESP will shut down, and repeated events can lead to failure (Figure 1).

To manage these issues, operators commonly use gas separators and/or gas handlers to reduce the amount of free gas entering the pump. Variable speed drives help adjust pump speed to changing conditions and avoid gas locking. Modern control systems can respond to load and temperature changes by slowing or cycling the pump. Despite these options available, gas continues to pose issues for ESPs and additional measures must be taken to operate them in gassy wells.



Figure 1. ESP operating under gassy conditions.

## **GAS RELEASE SYSTEM BYPASS**

The Gas Release System Bypass (GRSB) is the new technology used on ESPs to enable its efficient and smooth operation in gassy wells and maximize the wells' productivity by drawing down the fluid level to a limit beyond the conventional ESP applications. The system is installed below the sensor and combines gas handling and separation for ESP systems. This technology aims to homogenize the flow to disperse the free gas into the liquid phase (gas handler) and takes the innovation a step further by adding a Gas Release Bypass system to separate the remaining continuous gas phase (slug gas separator) using a capillary tube that goes from the tool's body to the production tubing above the ESP head of discharge (Figure 2). The expected efficiency is designed based on the well conditions and the components were built with premium materials to increase reusability.

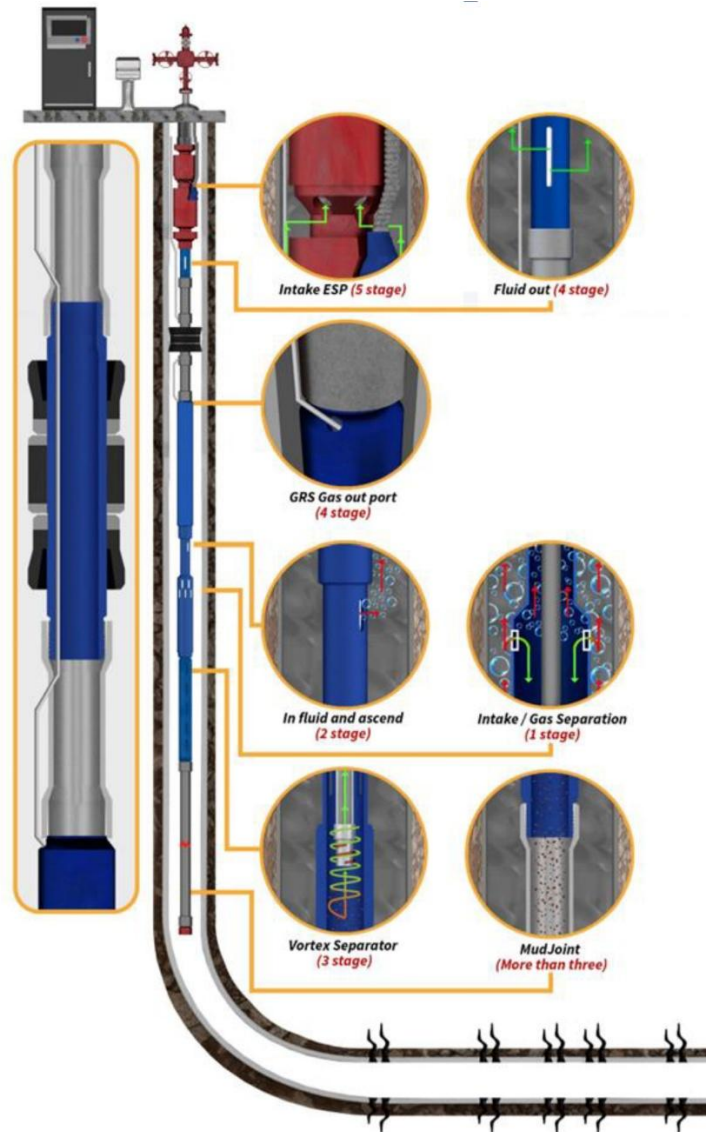


Figure 2. Gas Release System Bypass.

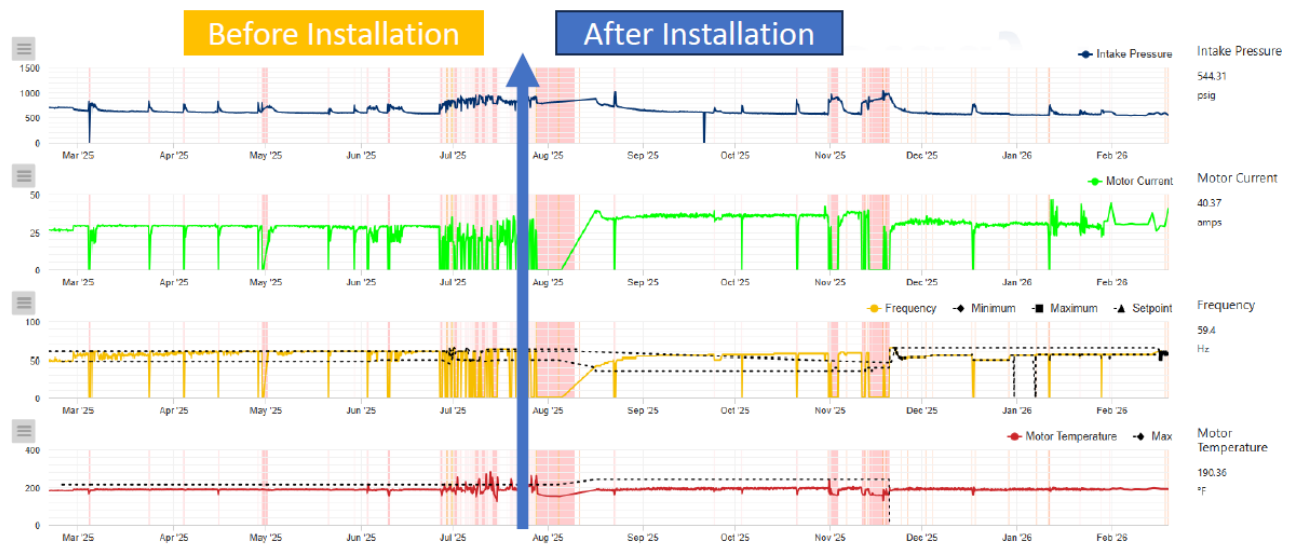
The function of the GRSB is based on five sequential steps as shown in Figure 2. In the first step, Initial Gas Regulation, the triple-seal packer initiates the process by mixing gas slugs with the carried fluid, breaking large gas pockets into smaller gas bubbles. In the second step, the mixture of bubbles and liquid enters the pressurization chamber, where fluid velocity decreases due to the chamber's larger cross-sectional area. According to Bernoulli's principle, this reduction in velocity results in an increase in pressure, which helps disperse smaller gas bubbles in the liquid phase (continuous phase in the chamber). In the third step, Centrifugal Regulation, a centrifugal regulator applies rotational forces to further disperse the gas into a fine bubble flow. The conditioned fluid then moves into the dip tube, leading to the Gas Release System. During the fourth step,

Gas Separation, the system acts as a separator by venting any remaining free gas. The gas passes through a one-way valve and is vented above the discharge of the ESP. Finally, in the fifth step, Fluid Homogenization and Motor Cooling, the homogenized fluid moves into a second dip tube and exits above the packer. This configuration ensures efficient motor cooling, preventing shutdowns and supporting reliable ESP operation.

## **CASE STUDIES:**

### **Case Study #1:**

The first case analyzes the impact of the GRSB system in the well's behavior. Before the installation of the GRSB tool, the system showed high instability, with more than 30 shutdowns in 4 months that affected the ESP run time and caused production variability, reducing effective operating time. During this period, average production was 634.44 BPD, and the GLR was 1756.45 SCF/STB, reflecting unstable operating conditions. After installation, shutdowns decreased to approximately 6 events in 7 months, representing an 80% reduction. Despite natural reservoir pressure decline, total liquids increased and became more stable, reaching an average of approximately 765.90 BPD, while GLR was maintained at 1298.98 SCF/STB.



*Figure 3. Case Study 1 – Sensor Data.*

Figure 3 shows that the motor temperature remains stable and consistently below 200°F, with no significant peaks even as the pump intake pressure declines below 500 psi. The motor now operates at a lower frequency than before the installation which, when compared to the fluid output, indicates that the overall system is operating more efficiently (Figure 4).

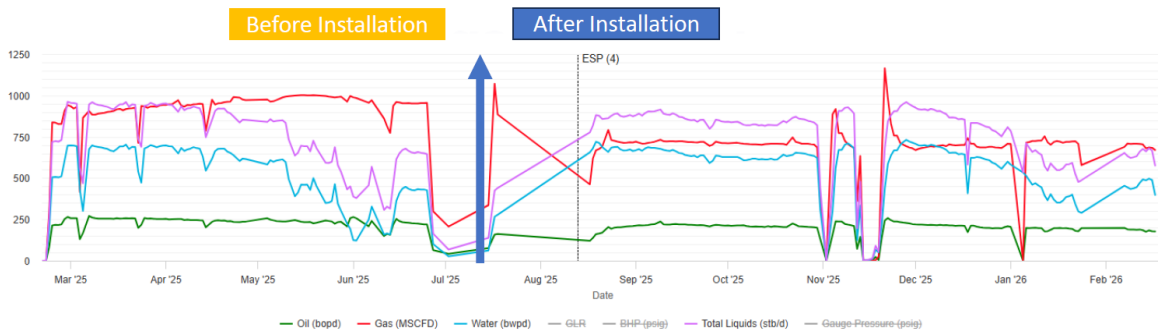


Figure 4. Case Study 1 – Fluid production trend.

**Case Study #2:**

The second case analyzes the impact of the GRSB system in the pump’s behavior. Before installation, the well showed high instability, with intake pressure averaging 900–1000 psi and significant noise in motor current and frequency (around 45 Hz). Intake temperature exceeded 150°F with peaks near 190°F, indicating poor cooling. During this period, average production was 368.19 BPD and GLR averaged 976.31 SCF/STB. After installation, intake pressure stabilized between 550–630 psi, motor current normalized below 40 amps, and frequency stabilized at 40 Hz. Intake temperature stabilized around 145°F (Figure 5). Average production increased by approximately 273% (from 368.19 to 1374.54 BPD), while GLR decreased by about 23% (from 976.31 to 752.74 SCF/STB), demonstrating a significant improvement in operational stability and well performance.

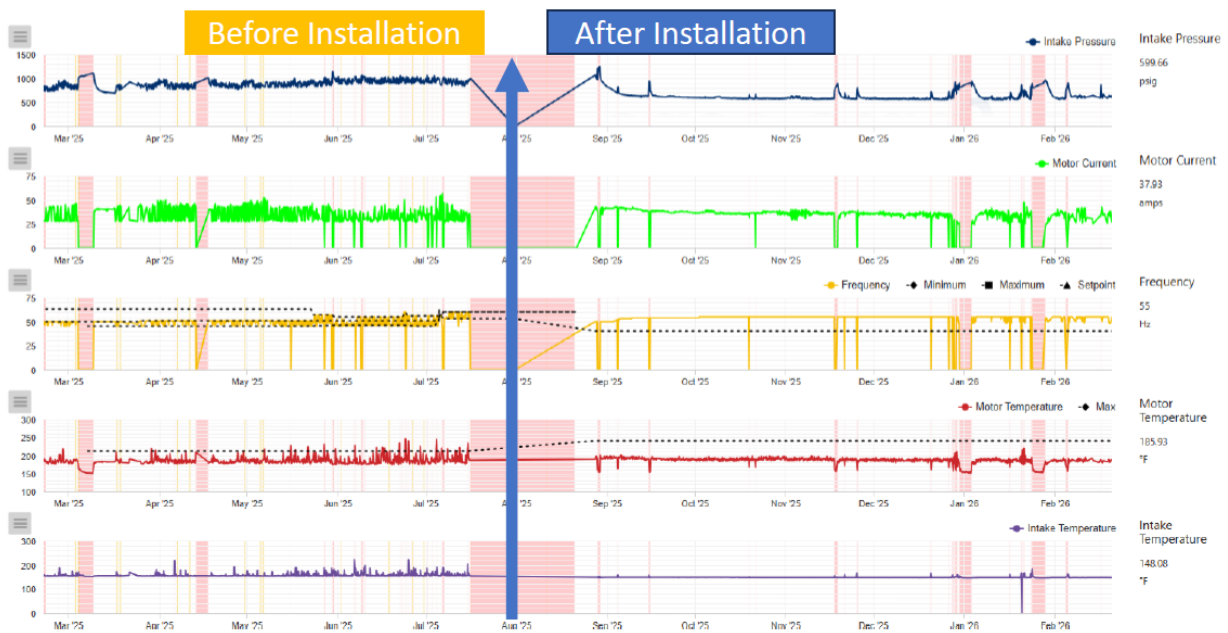


Figure 5. Case Study 2 – Sensor Data.

Additionally, frequency is being maintained lower compared to before (45 Hz to 40 Hz), reducing dynamic stress on the ESP and a higher overall efficiency is indicated by the higher fluid production rate (Figure 6).

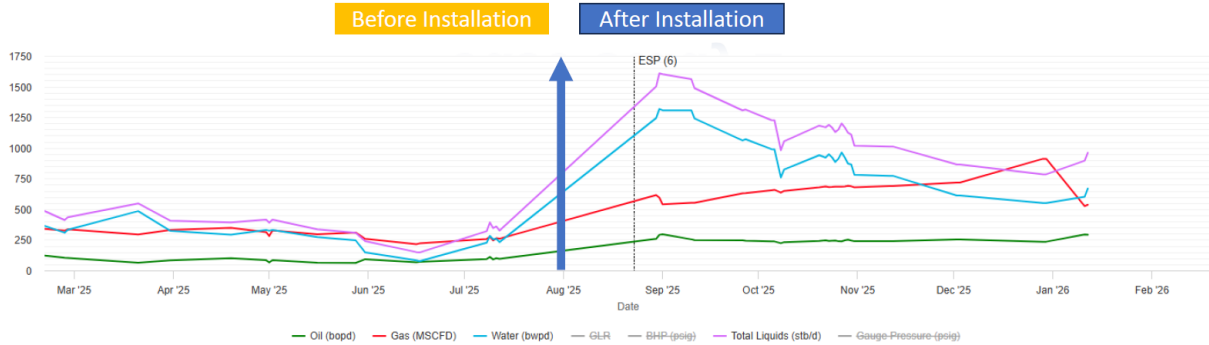


Figure 6. Case Study 2 – Fluid production trend

**Case Study #3:**

In this well, after the installation of the GRSB tool, the system shows improved operational stability. Intake pressure, which previously had peaks near 700 psi and then declined to 350–400 psi, stabilizes below 400 psi after the intervention and is trending down. Motor current and frequency remain stable, with no significant overloads or fluctuations, indicating a more balanced operating regime.



Figure 7. Case Study 3 – Sensor Data.

In terms of average production, the well increased from 1441.82 BPD to 1807.05 BPD, representing approximately a 25% increase with a stable GLR behavior in the well (Figure 8).

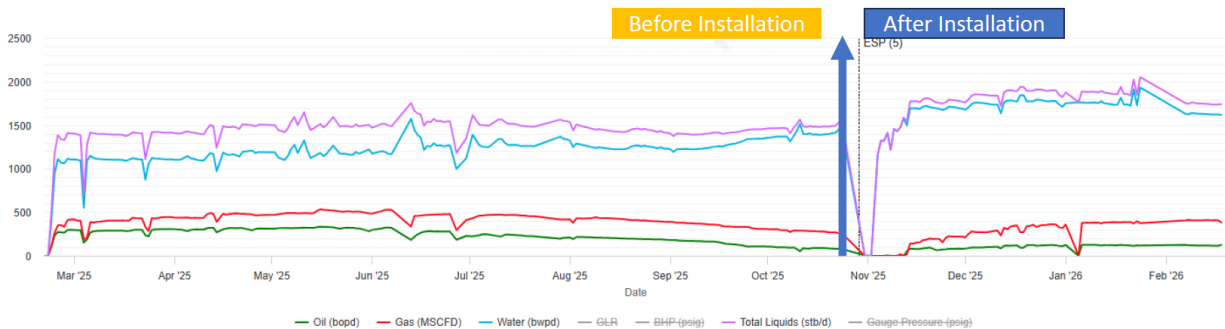


Figure 8. Case Study 3 – Fluid production trend

**Case Study #4:**

Before the GRSB installation, intake pressure was around 730 psi with peaks up to 900 psi and noticeable noise. After installation, a short initial pressure spike was observed, followed by stabilization below 700 psi with a much cleaner and more controlled trend. Motor current previously showed multiple fluctuations; after installation, it stabilized around 27 amps, representing a deviation of only 1 amp to the most recent data point. Frequency also has remained steady, indicating a more efficient operating regime (Figure 9).

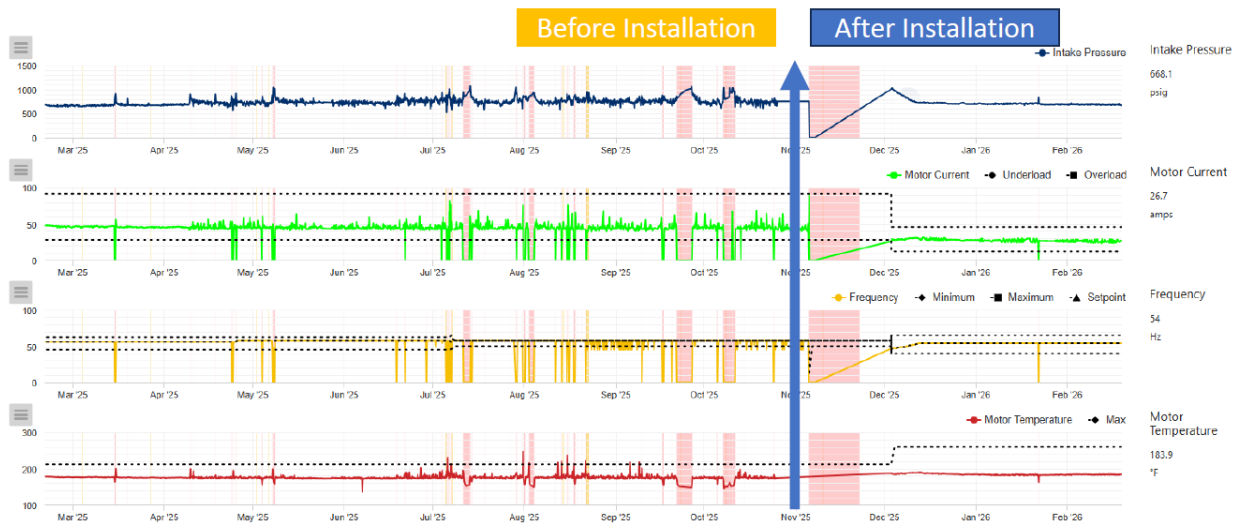


Figure 9. Case Study 4 – Sensor Data.

In terms of production, average output increased from 581.67 BPD to 957.35 BPD, equivalent to an increase of about 65%. Additionally, GLR has been historically above 1,400 GLR which indicates high gas handling efficiency in the overall system (Figure 10).

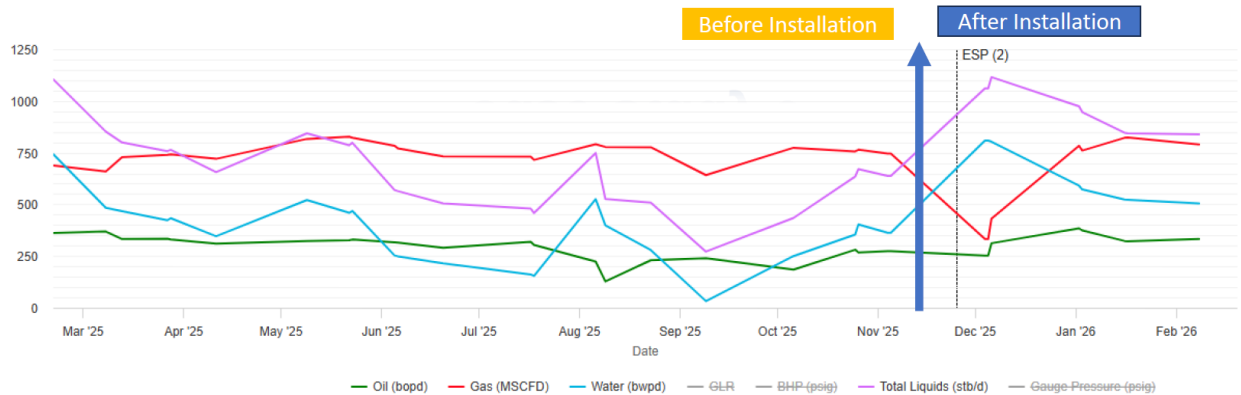


Figure 10. Case Study 4 – Fluid production trend

## CONCLUSIONS

The implementation of the Gas Release System Bypass as an advanced gas separation and flow-conditioning method has demonstrated measurable improvements in well behavior. Based on the analysis of operational parameter trends observed in the production and system performance plots, the installation of the GRSB resulted in improved stability and efficiency of ESP systems operating in high-GLR environments. The evaluation of the data indicates consistent improvements in key operational parameters such as intake pressure declination, motor current behavior, motor current stability, production rates, and gas handling capability. The main conclusions derived from the analyzed field data are summarized as follows:

- The GRSB system effectively conditions multiphase flow before entering the ESP intake. The field results demonstrate improved gas handling and stability in high-GLR wells.
- Installation of the GRSB significantly reduces shutdown events and electrical instability; this contributed to deeper drawdown and increased production rates.
- The GRSB provides a practical solution for improving ESP performance before transitioning to alternative artificial lift methods.
- In the analyzed case studies, fluid production increased in a range that goes from 21% to 273%.

- The comparison between expected production performance and actual well production indicated an incremental production potential ranging between 3% and 17%, highlighting the opportunity for improved performance through enhanced downhole gas management and flow-conditioning strategies.

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