SONAR Flow Meter for ESP Lifted Wells

Electric Submersible Pumps (ESP) commissioning and performance optimization

Summary

Expro has deployed its clamp-on Sonar*Test*™ surveillance service on several hundred ESP lifted wells to measure the production of the well and the lift efficiency of the ESP. Production surveillance on ESP lifted wells can help optimize ESPs installation and help extend the ESP run-life.

Background

Approximately 120,000 of the world's oil wells are equipped with electrical submersible pumps (ESPs). Field operators have made significant investments in ESP systems. Maximizing the lift efficiency of these systems and extending their run life is of imperative to the return on these investments.

Measurement challenges

Most oil wells are not equipped with flow metering. Installing traditional multiphase flow meters on each well is, in most cases, cost prohibitive. Because there is typically no individual wellhead production data, ESP wells are monitored using pump parameters and theoretical pump performance curves typically provided by the ESP supplier. Although useful, theoretical pump curves make certain assumptions with regard to pump efficiency, mechanical integrity of the pump and reservoir deliverability. The most useful tool to measure, analyze and ultimately improve the performance of an ESP system is to measure the actual pump flow rate from the well.

Key deliverables

- Non-intrusive design
- Real time measurement
- No process shut down
- Installation and data collection while the well is in production
- No modification of the surface lines
- Cost effective surveillance
- Accurate

Technology Used

- PassiveSONAR™ flow meter
- Sonar*Test*™

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Many failures of ESP systems occur at start-up, for a variety of reasons. Production surveillance at the wellhead during ESP commissioning can help confirm:

- Successful installation and commissioning of the ESP
- Volumetric flow rates and the Production Index (PI)
- The ESP is not oversized for the reservoir, resulting in pump-off
- The ESP is not under size for the well and is achieving maximum production
- Confirm ESP operation is efficient on the lift curve, achieving maximum production with minimum electrical power

Expro's solution

Expro Meters Sonar*Test*™ non-intrusive production testing package is used to measure flow rates from the well before and after commissioning of the ESP, and periodically thereafter to monitor production from the well and efficiency of the ESP. The SonarTest™ solution consists of Expro's PassiveSONAR™ flow meter, which is clamped onto the wellhead production pipework. The PassiveSONAR™ flow meter output is integrated with a PVT and multiphase flow engine to calculate the properties of the produced fluids, and the individual phase flow rates.

The SONAR flow meter provides a direct measurement of the mixture flow velocity within the flow line. The mixture flow velocity is then interpreted in terms of actual gas and liquid flow rates by the PVT engine, which calculates the gas and liquid properties of the produced fluids at the line pressure and temperature conditions where the Sonar flow meter is clamped-on. Once the gas and liquid flow rates are determined at actual conditions, the oil, water, and gas flow rates are converted to and reported at standard conditions.

The PassiveSONAR™ meter can be installed either upstream or downstream of the choke manifold, allowing flexibility in terms of field installation. Wells are tested at fixed flowing conditions or at multiple choke settings and ESP drive frequencies.

The Sonar*Test*™ approach requires about 60 minutes for installation and commissioning, which allows multi-rate testing of wells in one day. The package is deployed by one or two Expro Field Technicians and is lightweight and portable, allowing for transportation to the well site by small vehicle or offshore via a single man lift package.

In many cases, clients step through several ESP drive frequencies during SONAR testing to evaluate the production rate at various set points. Clients use the data provided by Expro to ensure correct installation of ESPs, to monitor and diagnose performance of their ESPs, to optimize drive frequency and choke settings, and to detect the onset of mechanical failure. This information enables intelligent decision making, which maximizes oil production rates, influences work over strategies and extends the run-life of ESPs.