

Case study

Zenith ground fault immune ESP gauge maintained data transmission in multiple wells, eliminated workovers

The pioneering Zenith™ ground fault immune (GFI) ESP monitoring system is the first electrical submersible pump (ESP) gauge to deliver unshakable surveillance despite ground fault conditions, providing operators with continuous reliable pump and well condition data necessary to enable better decision making, optimized production, and efficient well operation.

With 130 gauges sold and 70 tracked installations to date on a wide range of variable speed drive (VSD) systems, switchboard drives, and pump manufacturers, the GFI gauge is successfully gathering high-quality, high-speed data across the globe.

Effective system design

The field-proven, award-winning system has demonstrated value in fault conditions. Ongoing installations continue to illustrate the benefits of the GFI system's groundbreaking technology to operators who are able to maintain optimized production despite fault conditions.

Faults encountered to date include:

- Four instances of dead shorts on the ESP power system during install
- Five instances of poor insulation during install
- One case where the well site power supply experienced a cable fault—the system measured this correctly

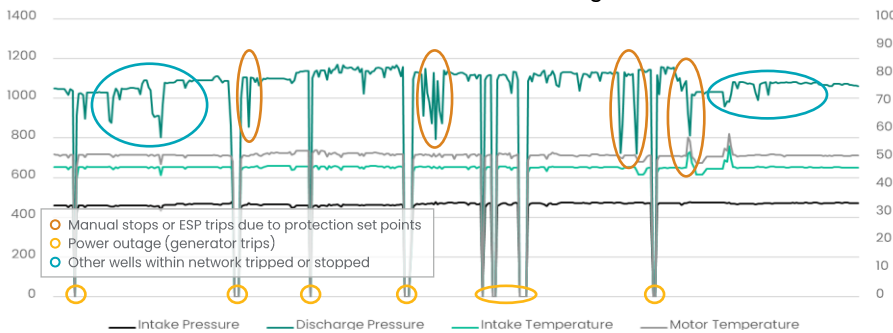
The GFI gauge continued to record data throughout all these events.

Challenges

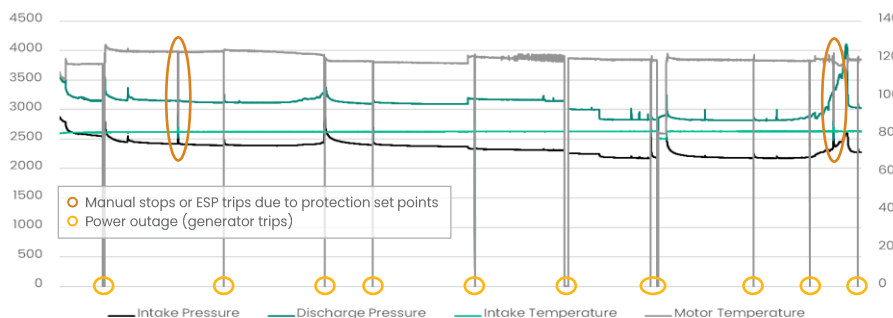
- Prevent loss of downhole monitoring system data due to ground fault, dead short, and cable short
- Avoid workover operations or requirement to run motors at lower rates to ensure safe ESP operation when producing without access to reliable pump and well measurements

Results

- Maintained real-time, high-speed data delivery despite presence of ground faults enabling ongoing optimized production
- Delivered accurate data at a higher sampling rate than currently available sensors
- Improved reservoir data quality during startup and shutdown by providing updated intake pressure readings per second
- Prolonged ESP runlife and assisted root cause analysis of ESP electrical failure using diagnostic trail and continuous monitoring of ESP cable health
- Improved workover and cable inventory management using fault location measurement system



Pressure and temperature data from a GFI gauge over a 12-month period



Pressure and temperature data from a GFI gauge over a 6-month period

Operators have shared their enthusiasm for a gauge system capable of continued, reliable operation despite common electrical faults during lift system installation and production operations. By detecting faults and delivering diagnostics on the source, the Zenith GFI ESP monitoring system is positively impacting ESP operations.

Case studies

Enabling decisions despite cable fault in live production operations

Despite a cable fault in a live producing well, the Zenith GFI continued to operate and deliver reliable data. The gauge demonstrated its value in this critical situation where the well was not only suffering a faulty cable but also a blocked pump. Informed operational decisions were made based on the maintained real-time data the GFI gauge provided regardless of the ground fault. This ESP completion would have been pulled at significant cost or ran blindly and unoptimized if a non-GFI sensor had been installed.

Detecting, measuring, and operating through a dead short

The GFI gauge successfully detected, measured, and continued to operate through an instance in Thailand with a dead short on the ESP power cable during installation. The system developed a hard wire fault during install, and the team was able to detect this occurring during run-in-hole and continue to recover data from the gauge.

Locating cable fault

A fault developed in a packer feedthrough during run-in-hole in Saudi Arabia causing a loss of insulation on the cable. The GFI system continued to record data, showing a 3kohm fault at 7,000 ft (2133 m). This measurement proved accurate to <60 ft (18 m) of the exact location of the feedthrough.

GFI gauge delivered valuable insights despite electrical faults

An operator in South East Asia had a number of ESP systems developing in-well ground faults, preventing delivery of readings from the downhole gauge. In one field, 40% of gauges lost data due to faults.

Knowledge from reliable, continuous monitoring of downhole well and pump conditions was critical to the efficiency of the production operations. Operators can see up to 25% loss of production without live downhole data.

The Zenith GFI ESP gauge was installed successfully, and the operator has since installed 30 GFI ESP gauges across the region, improving the operator's overall ESP field management.

Challenges

- Repeated electrical faults resulting in loss of downhole data from ESP wells
- Lack of critical insight into ESP operations leading to significant production loss and potential equipment damage

Results

- Uninterrupted transmission of downhole measurements and cable condition data
- Sustained optimized production based on accurate, real-time, high-speed data
- Detection of phase-to-phase ground short circuit in real time