Gas Lock Ride Thru Software

Advanced Algorithm to Manage ESP Performance in High Gas Production Using Axiom®II Variable Speed Drive

Applications

- ESP wells producing higher volumes of free and associated gas

Benefits

- Increased ESP uptime and production through a reduction in the number of system shutdowns due to gas lock conditions

Features

- Detection of downhole ESP conditions typical of high gas volume fractions at the intake

- Pre-programmed, controlled adjustment of ESP speed

- Multiple ESP speed settings available in a single cycle

- Pre-programmed number of cycle attempts

- Condition alarming (gas lock alarm) to notify operator

- Controlled shut down and alarm (gas lock fault) to protect downhole equipment in the event gas lock condition is not overcome

Increasing volumes of free gas in produced fluids have long been the enemy of electric submersible pumps (ESPs). The ESP is considered gas locked when gas volume has sufficiently replaced fluid and the pump has ceased to lift fluids to surface. If downhole conditions are not modified, damage to the ESP is possible.

Modern variable speed drives (VSDs) incorporate various algorithms that when utilized, modify ESP operation in response to the conditions detected at the drive when a gas lock condition is detected. However, most surface controlled "gas lock" algorithms are pre-programmed and require an advanced knowledge or expectation of the type of gas lock condition a pump will experience.

The Borets Axiom II VSD incorporates an enhanced Gas Lock Ride Thru algorithm that permits the drive to detect gas lock conditions and adjust ESP speed accordingly. It can adjust motor speed faster to help overcome smaller gas bubble events and is able to reduce motor speed as required to help the ESP manage longer duration gas slugs.

Configured by the surface drive operator, the Gas Lock Ride Thru algorithm is pre-programmed with input for:

- *Gas lock detection threshold* – the output current underload level at which the drive considers the conditions that may exist for gas lock.

- *Gas lock detection time* – the time duration over which the drive output current remains at or below the preset gas lock detection threshold before the drive accelerates/decelerates to the gas lock speed.

- *Gas lock speed* – the frequency (speed) to which the drive sets when gas lock conditions are detected.

- *Gas lock dwell time* – the duration (in seconds) over which the adjusted gas lock speed is maintained until the drive re-evaluates conditions. The speed does not return to the original value if the gas lock condition persists.

These inputs define one cycle or attempt at Gas Lock Ride Thru. The algorithm incorporates a user-definable number of cycles the drive will attempt to overcome gas lock conditions, up to a maximum five before returning an alert condition.

The Gas Lock Ride Thru algorithm was recently installed in a Borets Axiom II VSD on an ESP well in the Permian Basin. Prior to installing this new software, gas volumes were increasing which resulted in numerous ESP shutdowns typical of unconventional well production.

After installation, set up of the algorithm inputs, and well restart, the frequent shutdowns attributable to gas lock conditions were prevented. Comparative monitoring of motor frequency, motor current, and motor temperature before and after implementation of the Gas Lock Ride Thru algorithm clearly show the algorithm helped manage ESP operation through gas lock conditions, increasing uptime and total well production.

Gas Lock Ride Thru Algorithm Installation Benefits
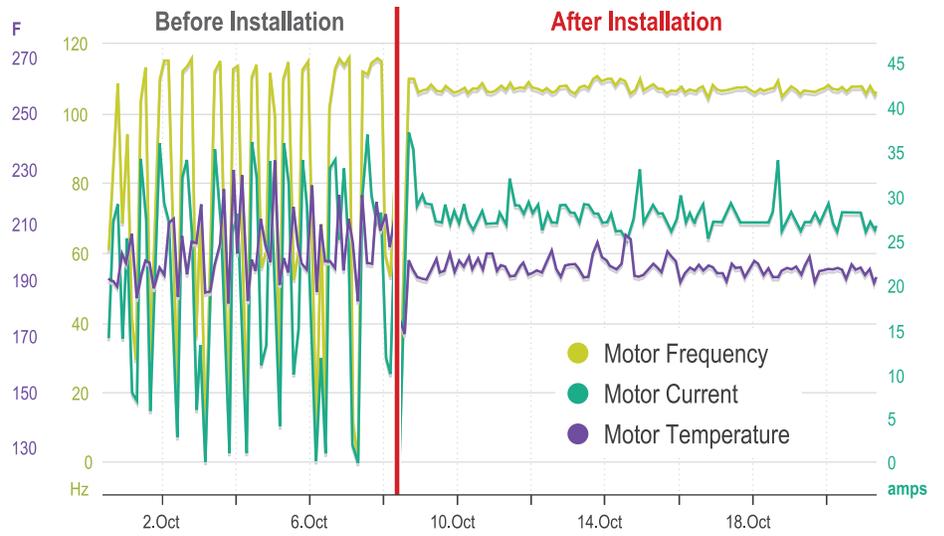
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