PRODUCING COAL GAS WELLS IN THE SAN JUAN BASIN WITH THE PROGRESSING CAVITY PUMP

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Abstract

Within the last few years the progressing cavity pump has been successfully utilized as a method of deliquifying coal gas wells in the San Juan Basin. The progressing cavity pump has many advantages over other types of artificial lift. Ideally for the San Juan Basin progressing cavity pumps are capable of producing abrasive fluids at high volumes. The low profile is less obtrusive than other types of artificial lift, facilitating acceptance in the national forests. Through research, the initial problems experienced running progressing cavity pumps in the mid 1980's have been dealt with and solved therefore opening the door to an economical and effective method of producing coal gas wells in the San Juan Basin.

Introduction

The progressing cavity pump has become a practical alternative for wells utilizing artificial lift in the San Juan Basin. The versatility of the progressing cavity pump lends itself well to the necessity of varying pumping rates, ability to pump coal fines, and gaseous fluids. The progressing cavity pump also offers the advantages of lower capital expenditure, pump longevity, and high operating efficiency. Applications in the San Juan Basin may vary from 5 BWPD to 100 BWPD around 1200 feet in the southern part of the Basin up to 200 BWPD to 500 BWPD around 3,300 feet in the northern part of the basin. A multiple well study of progressing cavity pumps run in 1990 indicates an average elastomer life span of three (3) plus years, after an initial period of severe abrasive characteristics in most applications diminishes during the first few months. Some of these pumps were replaced within six to nine months after the initial installation but have not been replaced since, while others were replaced after about a three year period, and still others are continuing to be functional since originally installed in the mid 1990.

Applications & Design

Numerous factors are involved in the design of a progressing cavity pump installation. There are a few basic considerations such as productivity, depth, temperature, type of fluid and or oil gravity. However in coal gas wells CO_2 concentration and coal fine characteristics play a very important role. When the elastomer is exposed to CO_2 swelling occurs due to aromatics. This swelling may be compensated for by rotor sizing and using an elastomer with good aromatic resistance. The coal fine characteristics of coal gas wells may be accommodated by rotor sizing. Normally undersized rotors will create less torque.

On the surface a drive head capable of handling the rod string and hydraulic load at high rotational speeds, upward to 600 RPM, is a must. Another drive head feature lending itself well to the coal gas applications is the hollow shaft design. While pumping fluid with high concentrations of solids, in this case coal fines, the solids suspended in the tubing will settle on top of the pump during periods when the well is shut in or down, causing the rotor to stick. If the problem becomes severe enough it may require more torque for a restart than the rod string is capable of transferring. In this case a pole truck can simply lift the rod string by the polish rod extending through the hollow shaft drive head allowing the solids to be washed back through the pump.

A wide selection of prime movers may be used on progressing cavity pump applications. A large portion of the wells in the San Juan Basin are remotely located where electrification is not a consideration. Therefore natural gas is the most attractive alternative. The most widely used prime mover in the San Juan Basin is a hydraulic system powered by an industrial natural gas engine. This system utilizes well head gas for fuel and offers the versatility of hydraulic control. With the hydraulic system torque on the rod string can be monitored constantly through a relationship with hydraulic pressure including during restarts. This system can be set to maintain a high torque setting or shut down on high or low torque. The hydraulic system also allows a complete range of rotational speed control from 0 RPM to 600+ RPM. Adjusting rotation speed is normally done with a simple hand lever, although it can be automated.

Problems & Solutions

The most common problem experienced in running progressing cavity pumps in coal gas wells in the San Juan Basin is elastomer swell. Elastomer swell creates a tight fit with standard rotors causing high torques. A combination of CO_2 impregnation and temperature contribute to this condition of the elastomers presently available for this type application. There is research being done to try to solve this problem such as no swell additives in the elastomer and elastomers with different component make up. For now a simple solution for anticipated elastomer swell in San Juan Basin coal gas wells is to undersize the rotor. Taking into consideration the size of the pump, CO_2 concentration, and temperature, swell can be predicted thus the rotor can be properly sized so after swell a standard fit will be simulated.

When the stator is pulled, after being exposed to high concentrations of CO_2 it will experience an explosive decompression reaction as the CO_2 begins working its way out of the elastomer. Explosive decompression causes severe blistering and swelling of the elastomer making it impossible, in most cases, to use the stator again after exposing it to atmosphere. There is a procedure now to reduce or eliminate explosive decompression although the best approach has not been resolved.

Coal fines have the capability of causing high torques. Depending on the quantity or concentration of coal fines determines the severity of high torqueing. Great quantities of coal fines passing through the pump without the presence of a lubricating fluid may cause higher torques, however due to the physical characteristics of the progressing cavity pump this is seldom a problem. As mentioned in Applications & Design the most common problem caused by great quantities of coal fines is that the fines suspended in the tubing will settle on top of the pump during down time causing high torques during restart. Again this problem has been addressed by utilizing the hollow shaft drive head.

Problems created by coal fines are usually temporary. Initially loose fines are carried through the pump with fluid in greater quantities then gradually decrease to a minimal influx as the formation cleans up.

Conclusion

The mechanically simple design, tolerance of solids, low initial cost, and low operating expense along with determination to utilize an effective tool to enhance economics of deliquifying coal gas wells has made the progressing cavity pump a successful method of artificial lift in the San Juan Basin.

References

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