

Oil & gas

Seal-less pumps work in polymer injection

A US specialist in enhanced oil recovery systems required pumps for a polymer injection facility in a Wyoming oilfield. Seal-less diaphragm pumps were selected for the 24 hour facility. Their ongoing long-service performance and gentle handling of the polymers led to additional pumps being installed to extend the facility.

Low-shear pumping action, responsive control and reliability were critical considerations for enhanced oil recovery (EOR) systems specialist Nalco FabTech when designing and installing a 21 pump polymer injection facility for a Wyoming oilfield. Looking beyond the established plunger-type pumps in general use for polymer injection, the company turned to an alternative, seal-less Hydra-Cell G25 diaphragm pump manufactured by Wanner Engineering. Six years later, the pumps are still running 24 hours a day and additional Hydra-Cell pumps have been installed to extend the facility. Each pump is individually controlled to match varying conditions within its own well.

Based in Casper, Wyoming, USA, FabTech operates worldwide as designer, fabricator and installer of purpose-built process equipment for oil and gas production. Development of customised injection plants is a key activity.

Handling polymers

Polymer injection plays an important role in enhanced oil recovery. EOR is usually the tertiary stage of an oil field and occurs after primary production and water flooding. Polymers are used to improve the viscosity and distribution of the injection water by contacting previously bypassed oil and improving field recovery. However, the same chemical properties which make the polymer viscous, also make the polymer difficult to dissolve and pump. Proper handling of the polymer solution



Figure 1. Polymer injection plant designed and built by FabTech, incorporating 21 seal-less Hydra-Cell H25 pumps.

is imperative. Preventing degradation due to shear, through pumps and pipes, as well as degradation due to chemical incompatibility with brines, is of paramount concern. The sensitivity of the polymer solution imposes limits on the type of pumps that can be used. Even some typical designs like centrifugal, gear, and screw pumps are not suitable for this type of chemical EOR.

Prior to 2004, almost all polymer injection plants built by FabTech incorporated triplex plunger pumps. The Wyoming contract, in which liquid volumes and pressure rating were within the range of

the Hydra-Cell H25, allowed the company to give serious consideration to an attractive alternative. The H25 can operate anywhere in the range up to 70 bar, varying flow as required between 1 l/min and 69 l/min.

A distinctive feature of the Hydra-Cell is that there are no dynamic seals or close-tolerance moving surfaces in the design. Smooth, low-pulse pumping action is achieved by the sequential flexing of multiple hydraulically balanced diaphragms within a single compact head – while the diaphragms totally isolate pumped fluid



Figure 2. Each pump serves a separate oil well. Pump flow and pressure are regulated via VFD speed control in response to conditions in the well.

from the drive parts of the pump, which operate submerged in lubricant. Moreover the design minimises internal friction, reducing heat input into the system and further ensuring that the injected liquid reaches its target in effective condition.

Seal-less design has implications for the service life of the pump and life cycle costs, by removing the most common cause of premature wear and consequent loss of performance. But equally significant for FabTech on the injection application is the

low-shear pumping action of the Hydra-Cell, protecting the polymer from degradation.

FabTech executive Rick Binks admits that his company did not take pump performance claims on trust. "We had to design for pumping a viscous solution containing 800 ppm of high molecular polymers and up to 350 ppm of soda ash (Na₂CO₃). Not until we had run shear degradation tests with the Hydra-Cell pump in the lab did we move to the next stage."

Controlling pump flow and pressure was not complicated. Output of the Hydra-Cell pump is directly related to its speed, and virtually independent of system pressure. So a relatively simple system using VFD to vary motor speed gives accurate flow control with fast response.

Following the success of the Wyoming plant, FabTech has installed injection plants with Hydra-Cell pumps in Canada and Oklahoma, while additional pumps incorporated in the Wyoming plant include a larger Hydra-Cell model, the H35.

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