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Swellable Packers

AER Experience

- * More than 2500 Swelling Packer Installations to Date
- * Related US Patents Awarded
- * Related Industry Publications

SPE/PS-CIM/CHOA 97928-PP
PS2005-XXX

Innovative Completion Technology Enhances Production Assurance in Alaskan North Slope Viscous Oil Developments

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Abstract

In the challenging North Slope operating environment, use of innovative production equipment has provided solutions to several completion and packer integrity problems in viscous oil reservoirs. Operators have employed new seal and technology using expendable rubber elements to manage annular fluid flow, control subsurface production, and achieve zonal isolation in wells where high costs, shallow depths, and long access times create unique completion challenges. The new technology is allowing new bypassed zones to be added to existing developments, and making future developments more economically viable.

The new design approach involves installing swelling rubber packer (SRP) technology as part of the completion. The technology is based on specially designed swelling properties of rubber in crude or natural oil-based fluid (MCSO) to expand and seal the annulus.

The paper describes one operator's use of so many as 17 devices in a 12-in. horizontal wellbore to manage annular flow and enhance subsurface production. The successful application of this technology has allowed shale interbedding to be effectively sealed behind blind pigs, thus allowing an additional zone to be added to the existing development. To date, the technology has been applied to eleven wells, improving production assurance.

Another major operator on the North Slope has used the technology to isolate potentially conductive fluid crossings along the bore and maintain zonal crossings while fishing out from the perforations. Multiple packers have been run in



single bore to achieve the desired zonal isolation without reasonable offset on liner running time. More closely spaced SRPs show significantly more isolation than previously envisioned, increasing the ability to manage annular flow.

Development and application of the SRP technology is detailed in the paper, including discussion of improved efficiency as a result of its use. The paper will also discuss field operations, installation, and unique considerations associated with design and installation in viscous oil environments.

Introduction

On the North Slope of Alaska, there are billions of barrels of unappreciated viscous oil reserves. It has been estimated that the North Slope contains a 33-35 billion barrels of OILIP (API 30-50) (Figure 1). To date, development of the oil reserves has been limited. For the western, less viscous oil fields below, the reserve base consists of highly viscous oil due to the low reservoir temperatures caused by the current northern climate, the presence of 1,200 feet of permafrost, and its relatively shallow burial depth.

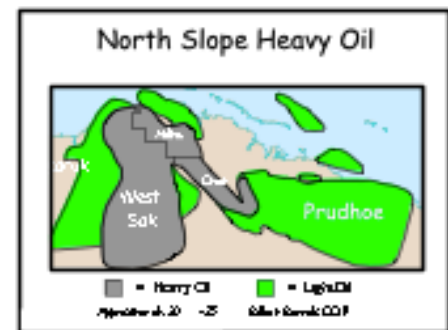


Figure 1 North Slope Heavy Oil Reserves

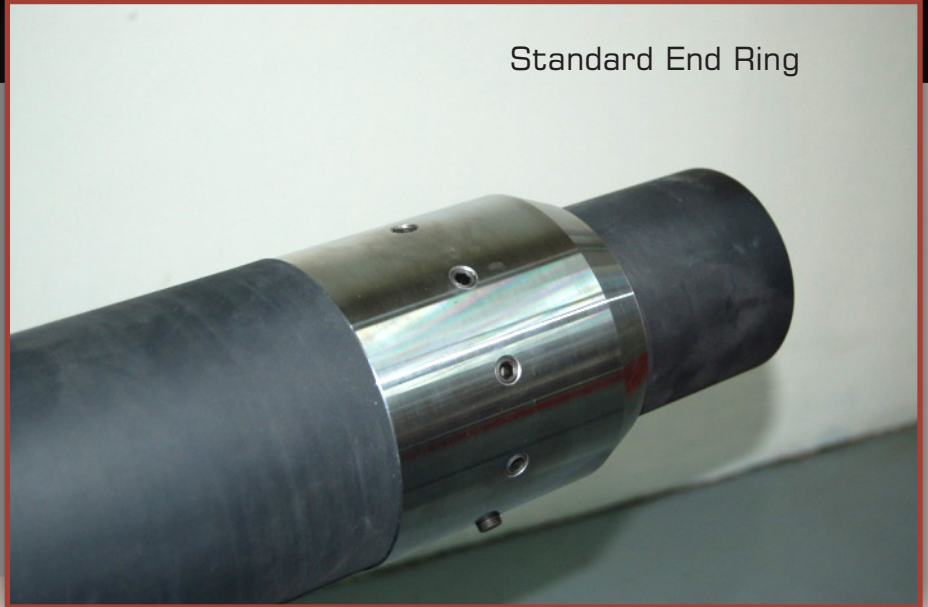


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Robust End Ring Design

- * Substantial end ring design provides protection to the rubber element during run in.
- * Rubber element is vulcanized to the base pipe using pressure, heat and chemical reaction to establish one effective annular seal.
- * Prevents extrusion during the sealing and production operations.

Standard End Ring



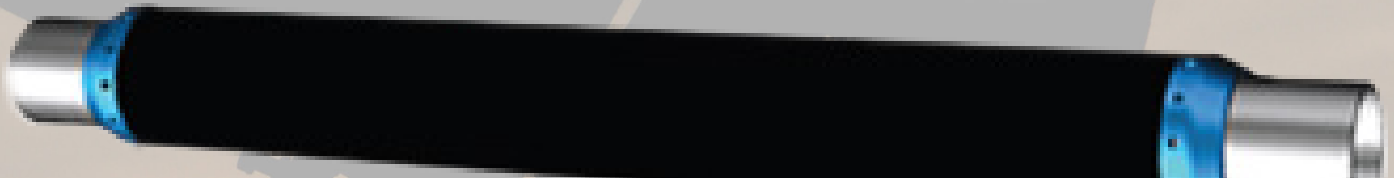
Enhanced AER End Ring



Why Use WEPS Packers?

Getting Packer to TD is tougher & tougher...

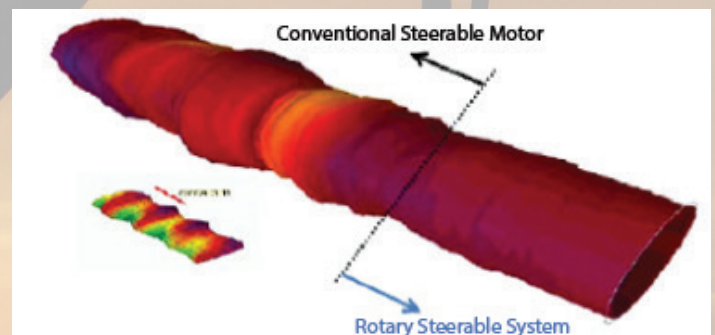
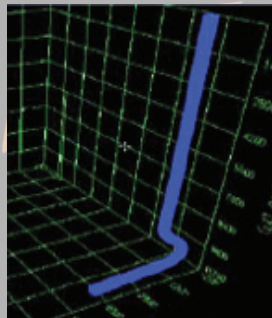
We have the technology to make that happen...



- ⚡ AER has 98% success with getting packers to TD with use of our technology and reamer tools
- ⚡ AER Understands the interconnected relationship of borehole quality, T&D, Directional Drilling and Swell Packer Design
- ⚡ Several Swellable Packer Patents & Technology - WEPS Patented End Ring Design
- ⚡ Superior bonded element, not slip-on
- ⚡ Testing with research capabilities - engineering support and manpower assets
- ⚡ AER provides service and support throughout the purchasing process that ensures performance success
- ⚡ AER employees have hands on experience relating to providing reamers and packers on hundreds of wells

Swellable Packers

Fast Acting ♦ Powerful
Quick Into Position



With AER introduction of a new reaming tool for ream-while-drilling (RWD) in the Williston Basin we have had 100% successful installations of swellable packer in over 100 wells and over 5 million feet reamed.

Testing and Qualification



Scaled Testing

- * Swell Oil and Water Testing
- * Pressure Testing
- * Scaled Length Testing
- * Full Scale Testing
- * Different Fluids
- * Temperatures
- * Diameters



Full Scale Testing

What is the cost of liner not getting to TD or being off depth?

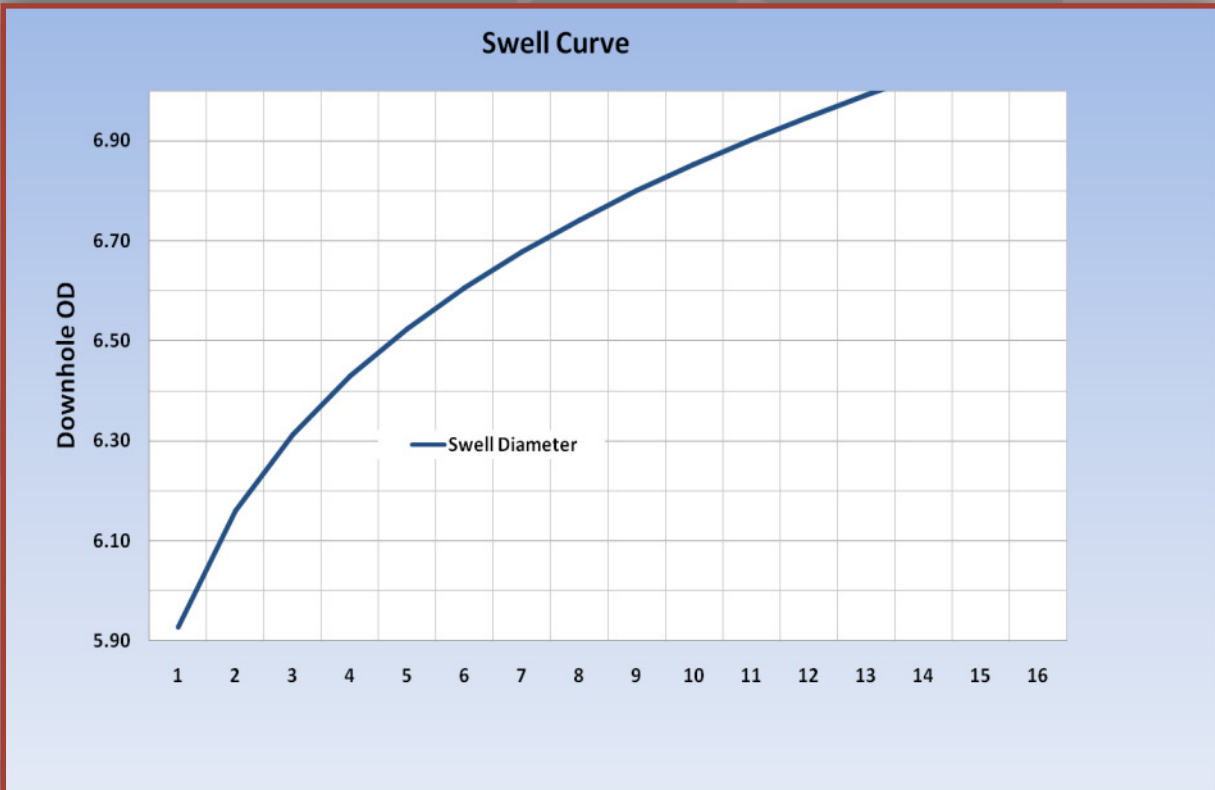


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We estimate 10-20% liners not going to TD today - note end rings



Quality Rubber Elements



- * Both the rubber and packers are manufactured in the same facility.
- * Traceability of each batch or rubber to the rubber and the date the element was manufactured.
- * Consistent quality control through the entire process.



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