

Advanced Sealed-Bearing Assembly for Positive Displacement Motors Used in Micro-Borehole Drilling

DE-FG02-05ER84206

Goal

The goal of this research project is the development of an advanced sealed-bearing assembly for positive displacement motors (PDMs) suitable for microhole drilling.

Performer

Kalsi Engineering, Inc.
Sugarland, TX

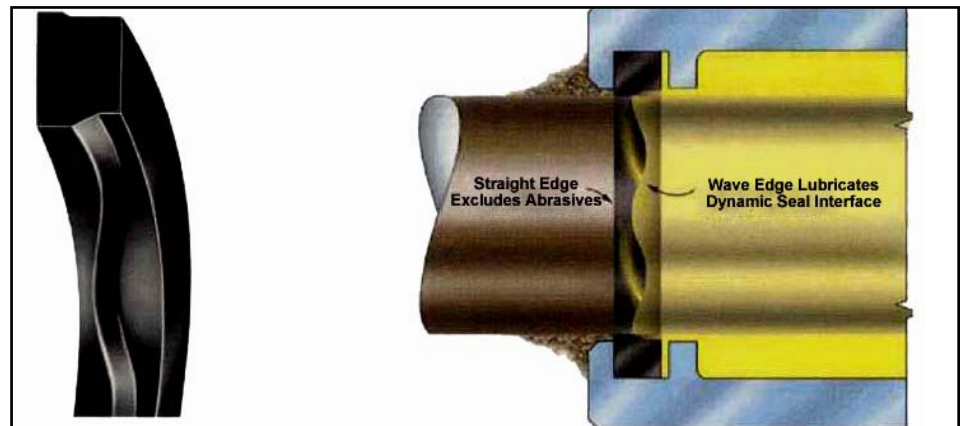
Results

Expected outcome of the project is the development of advanced hydrodynamic rotary seal and thrust bearing designs, as well as the sealed-bearing assembly, in an effort to meet the challenges posed by technical issues related to scaling down components for microhole drilling.

Field tests performed over the last two years with the newly developed, hydrodynamically lubricated, load-responsive, hydrodynamic thrust bearings in 4³/₄-inch PDMs used in coiled tubing drilling applications have demonstrated that they are very durable and are able to provide long life and reliable performance under the severe loads imposed by high vibrations without any damage, whereas the conventional rolling-element bearings had routinely experienced premature failures. The new bearing technology will be critical in these coiled tubing microdrilling applications, which are expected to impose higher levels of shock and vibrations.

Benefits

DOE has identified the development of PDMs as a critical technology need for its microhole drilling program. This research will lead to an advanced sealed-bearing assembly for PDMs that is very durable, has long life, and can perform reliably with low operating cost under the higher differential pressures required for efficiently drilling microholes. The advanced technology will be available as a modular, self-contained unit that readily mates with the power section of various PDMs being developed by industry. This intensive, parallel development effort will accelerate commercialization of the other critical



Basic geometry and principle of operation of the hydrodynamic rotary seal.

technologies being developed for the microhole program.

This technology will be a key contributor to the microhole program goal of faster, cheaper, and safer oil and gas drilling, with DOE projecting savings of 30-50% in drilling costs and 90% in equipment cost. This also will contribute towards the U.S. goal of maintaining global technical leadership.

Background

DOE has undertaken a new research and development initiative to develop microhole technologies that use portable drilling rigs with a smaller footprint and lower environmental impact. It identified PDMs as one of five critical technology development initiatives needed to support the microhole initiative. Another critical technology area identified is the development of integrated rotary-percussion motors (IRPMs). The detailed analysis of the requirements for the drilling-fluid circulation system for microhole drilling (performed by Los Alamos National Laboratory) showed that 1) larger pressure drops will be required across the PDMs as compared with current design, and 2) the motors will need sealed bearings that are cooled by the flow through the motor as opposed to flow through a bearing assembly that bypasses the bit to provide the maximum pressure drop across the bit. The higher pressure drop at the bit nozzles will be converted to jet drilling power, hole-

cleaning, or some combination of both to optimize the penetration rate.

Summary

Kalsi Engineering, Inc. will apply its background, field experience, and technical insights to extend this high-pressure, rotary seal-and-bearing technology to the sealed-bearing assembly for the 2-inch and smaller-diameter microhole PDMs targeted under this program. These advances will be accomplished through a systematic and rigorous development program, including detailed analyses, design, and testing to address scaling issues, higher pressures, more-severe vibrations, and proportionately larger radial deflections caused by bit side loads.

The research is aimed at developing the sealed-bearing assembly technology for microhole drilling with PDMs. The technology also can potentially benefit IRPMs for microdrilling.

Current Status (January 2006)

Kalsi Engineering has worked with Novatek and Dresser-Rand to develop two different technologies for rotary percussive drilling to meet sealing requirements. The more recent technology, patented by Dresser-Rand, requires rotary seals capable of performing under higher pressures. These technologies also will need scaled-down versions of the advanced, high-pressure rotary seals for the microhole drilling program.

Project Start / End: 6-27-05 / 3-26-06

DOE / Performer Cost: \$99,739 / \$0

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