Technology for Geothermal Drilling
While Every Drilling Application is Unique, Every Geothermal Application is a Challenge

Drilling for alternate energy sources like geothermal energy derived from the earth’s crust most often encounters bottom hole temperatures that can exceed 450 degrees Fahrenheit (232°C). Hard abrasive and sometimes difficult to drill formations are also the norm in geothermal drilling.

To address this application, Halliburton incorporates many of the innovative, reliable features common in roller cone bits for oilfield drilling. These features have a long proven history of excellent performance in challenging drilling applications.

**FEATURES**

- **Higher Energy Bearings** significantly increase bit load carrying capacity, making more robust bits that can meet the physical demands of geothermal drilling by reducing heat and friction
- **Innovative Mechanical Pressure Compensation System** withstands heat degradation to perform better, longer, increasing bearing/seal system reliability and delivering consistent pressure compensation and relief
- **Premium Sealing System** materials have higher thermal properties and greater wear resistance for long life in hot, high pressure conditions
- **Improved Bearing Lubricants** withstand degradation under extreme conditions, extending bearing system life to increase footage drilled
- **Advanced Cutting Structures** and Energy Balanced® bit process design platform optimizes ROP performance in hard-to-drill geothermal formations
- **Enhanced Gauge and Shirttail Protection** includes diamond enhanced compacts and patented hardfacing that increase wear resistance and help optimize bit life

**ENHANCED BEARING SYSTEMS, GREASE, AND SEALS**

**Improved Bearings, Increased Performance**
To get the most from our advanced cutting structure design you need a bearing system that delivers similar reliability. Improved bearings have significantly increased the load carrying capacity for QuadPack® Plus bits 12-1/4” and smaller, with bearings in larger size Jumbo/XL bits similarly optimized to maximize load capacity. The larger bearing creates a more stable body design accommodating higher energy levels (weight on bit, higher RPM) common to geothermal drilling, minimizing vibration and enhancing performance and bit life.

**Mechanical Pressure Compensation (MPC) System**
The key to prolonging roller cone bit life is protecting bearings from damage or premature wear. In high temperature, high pressure environments of geothermal wells, where extreme temperatures can substantially degrade seal materials, the risk of contamination is great. To protect the seal integrity and eliminate any negative effects of fluctuations in internal or external pressure, Halliburton has introduced an innovative Mechanical Pressure Compensation (MPC) system that addresses these issues. The MPC design replaces the elastomer valve of a diaphragm system with an energized mechanical spring to manage internal pressure. The MPC demonstrates improved performance when compared to the integrated diaphragm, delivering consistent, repeatable and reliable pressure relief at a much lower pressure. As a result, bearing reliability is also improved.

**New Seal Design and Lubricant Formulation**
Seal reliability is improved as a result of higher thermal properties and greater wear resistance in the seal materials. To ensure maximum seal reliability, new bearing lubricants have been developed that better withstand degradation under the extreme conditions of geothermal drilling. The entire bearing system has been redesigned to ensure drilling mud is excluded and bearing contact points are lubricated.

**Optimized Cutting Structure and Gauge Enhancements**

**Optimized Cutting Structure**
From Diamond TECH2000™ hardfacing to diamond enhanced carbide inserts, our patented technology provides a wide variety of cutting elements to create optimum cutting structures for geothermal wells. The patented Energy Balanced bit process provides a means of managing the distribution of forces acting on the cutting structure. This engineered process manipulates the forces to increase cutting efficiency, yielding more aggressive bit designs with tougher, more durable cutting structures that can significantly extend bit service life.

**Premium Wear Resistant Protection Options**
Maintaining full gauge hole is critical when drilling geothermal applications. The bit gauge area is in constant contact with the hole wall and constantly wearing. Costly reaming time, difficulty tripping or running casing and damage to the subsequent bit are all detrimental effects caused by undergauge hole. Premium gauge protection is a necessity for insert bits in geothermal applications.
Materials, compact shapes and positions can be optimized for the application. In addition, diamond enhanced compacts can also be incorporated to minimize wear and extend bit life. The shirttail area of a roller cone bit is also critical to the protection and integrity of the seal and bearing. Various options can be incorporated into the shirttail design for added protection.

**Designed to Drill, Built to Last**

Only Halliburton employs a unique design process that incorporates first hand customer input into the bit design function, following a continuous improvement loop to ensure you benefit fully from the latest developments in bit technology.

Design at the Customer Interface (DatCI℠) process uses a global network of Application Design and Evaluation (ADE℠) service specialists who work directly with the customer to define application-specific bit solutions. These ADE service specialists analyze formation properties and precisely define the application, then match design to application using powerful 3-D IBitS™ software to optimize the design. During drilling, the software models the specific downhole environment to determine optimum drilling parameters and bit usage, while post-well analysis provides direction for further refinements.

As a result, Halliburton combines just the right bit design features required to meet application-specific challenges of geothermal drilling, then builds them to last, so you get the best bit performance in your well.