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IMPROVEMENTS IN DRILLING BIT TYPES

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At the very bottom of the hole, and at the very end of the drillstring, is the bit, one of the most important parts of the entire drilling process. As with all the other tools used in drilling, bits have undergone a steady evolution over the years. Basically, the job of the bits is to advance the hole by breaking up and dislodging the formation so that the drilling fluid can remove the cuttings. There are literally dozens of types of bits. Each is designed to fit a particular need dictated by the type of soil and rock encountered. When shallow wells are drilled through soft soils and formations, one bit may be used for the entire job. When drilling deep wells through many different types of rock and soil, bits may have to be changed many times, either as they wear out or as soil conditions change.

The decision to change bits is not made easily, because of the time and money involved in tripping out, breaking out, and then reassembling and tripping back in what well may be thousands of feet or drillpipe. However, the alternative may be greatly reduced drilling effectiveness because of a worn-out bit.

Bits are classified by the International Association of Drilling Contractors (IADC). There are literally dozens of varieties - each designed for a specific application. Among the many factors affecting bit selection are: the type of formation to be encountered; the use of mud motor, turbine, percussion, or directional drilling; the anticipation of abnormal temperatures; and whether or not cores are desired.

The IADC lists six categories of formations that affect bit selection. These include extremely hard, hard, medium-to-hard, soft-to-medium, soft, and soft sticky. Each formation may have its own classification of bits. These include:

Steel Tooth Rotary Bits. There are at least nine sub-types of these, each differing in shape, bearings, use, etc.

Insert Bits have tungsten carbide inserts implanted in them.

Poly crystalline Diamond Compact Bits (PDC) have inserts of that material attached to the tungsten carbide inserts mentioned above.

Diamond Bits are implanted with industrial diamonds for use in extremely hard formations.

In addition, there are hybrid bits which combine the features of several of these types; also, variations of each of these types are manufactured as core bits to obtain core samples.

And, there are yet other special-use bits such as thermally stable synthetic diamond bits (TSD) which are used in geothermal applications.

Diamond bits are 40 to 50 times harder than the strongest steel and this makes it possible to run them longer between changes. As might be expected, they are correspondingly more expensive than a steel bit.

Some situations call for the use of down hole drilling motors at the bottom of the string. As the name implies, these are powered motors that drive the bit. Power may come from drilling fluids such as high-pressure natural gas, compressed air, mud, or from electricity.

Included among the many specific designs of bits available are tri-cone roller bits, button bits, tapered bits, fishtail bits, and mill bits. The tri-cones have three inwardly-facing toothed rotating cones mounted on axles with lubricated bearings. As the drillstring turns, so do the rollers, which in so doing, grind their way through the rock.

Roller cone bits used in soft formations will have longer "teeth" set in them, and the cones will be skewed to an angle that will allow a scraping instead of a true rolling action. Medium-hard formations require bits with more and shorter teeth and larger bearings. In very hard formations, bits with still shorter teeth or tungsten carbide inserts are used. Openings in the bit direct the flow of the drilling fluid either through the cones, or directly down against the bottom of the hole. Fishtail bits are used to enlarge the hole behind the bit, and mill bits are used to mill or grind away metal debris in the hole such as stuck pipe.

Pound for pound, bits are some of the most expensive items that must be taken into account when designing the drilling program. Not only are they costly to purchase and use, their relatively small size in relation to other rig components and high value makes them easy targets for thieves.

In deep-water hard formation drilling environments, extreme stresses are placed on down hole tools which mean higher risks for failure. Down hole shock and vibration can reduce drilling penetration rates, reduce borehole quality, and damage down hole tools, all leading to expensive non-productive time (NPT).

Drilling optimization services can be used to overcome the challenges associated with drilling in harsh environments. Measuring, modeling and optimizing drillstring integrity, vibration and hydraulics during the drilling process can mitigate the harmful effects of deepwater stresses on drilling equipment.

Halliburton offers a variety of drilling optimization services dedicated to providing improvements in drilling performance and achieving well construction objectives. Experienced personnel deliver analysis and solutions to optimize drilling rates, improve operational efficiency, and minimize the impact of unplanned events.

Halliburton’s proven processes have increased drilling operation efficiencies in Brazil. When high vibration created considerable NPT for wells in a Brazilian field, the operator decided to utilize Halliburton’s drilling optimization services. The result was a reduction in damaging vibration, increase in tool reliability, and optimization of the operator’s rate of penetration (ROP). The next well was drilled 50 days faster, saving $7.5 million.

Another way to optimize drilling practices is to closely examine drill bit performance. At Halliburton, specialists offer customized bit design for deepwater applications, assuring the right bit is designed for a certain environment. In Brazil’s hard post-salt deepwater environments, the bits are successfully being utilized. Worldwide, Halliburton bits have increased ROP.