Weathering difficult conditions

As the most accessible parts of the planet have largely been explored, demand for drill rigs tailored to function in more extreme environments is increasing. Signe Hansen looks at some of the challenges facing companies supplying and applying equipment for mineral exploration and water-well drilling in some of the world's harshest environments

Main image: a Dando Mintec rig drilling using reverse circulation in the desert of Saudi Arabia is built to withstand severe sandstorms that can occur

Top left inset: dust storms are a frequent problem in the arid areas of Burkina Faso. Here a usually orange-coloured Dando Watertec 9000 continues to drill through the dust

Bottom left inset: Meridian Drilling operates in the Danakil Depression in Ethiopia. In the area, which is one of the hottest and driest places on earth, salt is a significant threat to the functionality of drill rigs

As companies are forced to venture further into remote, hostile and climatically extreme regions, the challenges they face are becoming greater. In scorching deserts, sand, dust and salt endanger engines and compressors, while the humidity and torrential rain of tropical climates cause obvious risks to electrical control systems.

Luckily, the technology, flexibility and durability of today's equipment provide a fair match for these demands. But, as the challenges are often greatest in remote and inaccessible areas, it is also essential to find the simplest solution possible, explains Jeremy Moore, managing director at Meridian Drilling, which has, for the last five years, operated in the Danakil Depression in Ethiopia, one of the hottest places on earth.

"Many of the major drill-rig manufacturers will now tailor-build their machines to accommodate these harsher environments. The challenge is getting the balance right of sufficient technology to aid in the harsh environments against the logistical challenges of 'fixing' the technology should something go wrong. If parts are not readily available to resolve any technological problems, it can be a challenge getting these to often remote areas quickly to avoid significant downtime," he says.

Dando Drilling International, which has been building rigs for a variety of conditions for over 140 years, supports this. "Fundamentally, we aim to manufacture rigs that perform, but which are strong and easy to maintain. This is important in parts of the world where access to tools, services and a skilled workforce is not always easy. As a result, we have learnt to keep rigs as simple and functional as possible," says sales director Quentin Dulake.

WHEN THE ENEMY IS SALT

Remote and arid, the Danakil Depression in Ethiopia is not only one of the hottest places on the planet but also one of the lowest and driest. Combined with large saltpans and the lack of roads, this environment presents huge challenges for drilling contractors.

Having explored potash for various clients, such as Allana Potash and G&B African Resources, the people at Meridian Drilling know exactly how pertinent special measures are to overcome the challenges.

"Together with the harsh climate and temperatures, the salt on both the ground and in the air can cause significant damage to drill rigs and equipment should adequate control measures not be in place," explains Moore.

The measures implemented by Meridian Drilling in Ethiopia include applying anti-corrosive paint to protect against not only corrosion from the harsh and salty environment but also the salt-based drilling fluids used in the drilling process. Furthermore, hydraulic pipes are protected with a tape resistant to salts and impermeable to liquids and gases. Essentially, the special measures aim at ensuring that everything is sealed tight and that electrics are protected against saline intrusion.

Moore also warns: "If the correct control measures are not implemented, the drill rigs and machines can quickly deteriorate. Machines without an appropriate base may sink into the saltpan as deep as two feet. Salt corrosion will degrade the equipment very quickly, resulting in damage, rust and mechanical problems, leading to downtime and loss of revenue, not to mention unhappy clients and reputation damage. Should excess salt enter the electrics, then the machines may shut down completely."

DRILLING IN THE DUST

Engines, compressors and other ancillaries that draw in air, dust and sand cause a similar threat to equipment. Not only can they clog filters, contaminate lubricants and erode moving parts, they can also be extremely abrasive and cause damage to bearings, bushes, gears and other high-wear components. And, while dust is common in drilling environments, rigs working in parts of Africa and the Middle East often have to cope with extremes in the form of dust and sand storms. Consequently, drilling for water is the greatest challenge in the regions that need it the most.

One such area is the desert of Algeria, where Dando Drilling International recently provided a contractor with a Watertec 40 to drill 12in (305mm) boreholes to 250m for irrigation to a number of farm projects. For this project, the manufacturer tailored a number of site-specific add-on features to ward off the sand.

Mark Brown, engineer team leader, explains: "One of our strengths at Dando is that we are ready to adapt rigs to a customer's specific situation, including rigs that are used in harsh environments. [In Algeria] the sand was a real issue, especially with the cooling systems, so we designed and built a special canopy to protect the cooling and compressor intakes during sand storms. The canopy design had a dual purpose: to keep sand out and to allow air to flow unimpeded through the radiators."

He adds: "When customers look at purchasing a new rig, they often look at rotary head specs, engine size and so on, but there are many other features that make a rig suited to an environment, and that's one area I think we do very well in."

KEEPING THE WATER AT BAY

Another big problem for drilling rigs, caused by climatic factors, is water. Torrential rain, high humidity and surface water (as well as mud and pressurised water exiting the borehole) can all spell trouble for a rig's electrical parts.

Drilling for minerals in the tropics can be particularly problematic as rigs may be immersed for long periods of time; consequently, water exposure must be accounted for from the outset of design work to create a robust drilling rig for this kind of environment. Dando's Dulake explains: "When it comes to water resistance, this means avoiding electronics and electrical systems as much as possible and using top-quality hydraulic systems and controls as standard."

The challenges of drilling in the tropics are often accompanied by environmental concerns. Where it was once acceptable to cut down trees to build roads into forested areas, there is now a demand for drill rigs that can navigate through such environments with much less disruption to flora.

Consequently, Dando Drilling International is receiving an increasing number of orders for rigs that include climatically robust features and can function in forests with closely spaced trees, uneven or loose terrain, and slippery or sticky ground conditions.

To meet all of these challenges, Dando has developed a high-specification Multitec 4000 model. The rig is only 1.4m wide when tracking, small enough to navigate between trees and along narrow jungle paths, but has the drilling capabilities of much larger equipment and a water-resistant control system.

"Where electronic systems are essential, such as the radio remote-control units for tracking rigs safely over uneven terrain, we ensure the highest-rated water-resistant units are selected. We currently use Scanreco remote-control units, which are sealed and among the most robust electric-over-hydraulic systems available on the market," says Dulake.

The standard for dust and water-ingress resistant enclosures is IP-65, but all Dando electrical systems have enclosures rated at IP-68. This means the unit could be immersed in water over a metre deep without water ingress.

It all shows that when it comes to climatic challenges, the solutions are as manifold as the problems, and, as a consequence, more and more extreme environments are becoming accessible for drill rigs.

Bottom right inset: a jungle-exploration rig being used for nickel exploration in central Sulawesi, Indonesia. Single-bar grousers and radio remote control allow the rig to track safely through the muddy, sloping and extremely wet conditions

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