2\(\frac{1}{8}\)-in Neyrfor TTT

Thru-Tubing Turbodrill

Schlumberger
In 1956, the first Neyrfor turbodrill was developed. Today, Neyrfor turbodrilling systems have become more advanced and power-efficient than ever before.

Based on the proven performance of turbodrills in hard rock drilling, Schlumberger has developed a turbodrill that improves well intervention operations in slimhole milling applications, even in high-temperature and harsh-fluid environments.

The 2½-in-OD Neyrfor TTT* thru-tubing turbodrill efficiently converts hydraulic energy into mechanical energy, accommodating the most demanding thru-tubing applications while delivering higher speed and ROP, lower torque, enhanced hole cleaning, and efficient cuttings removal.
Efficient milling and hole cleaning
The Neyrfor TTT turbodrill ensures a balanced and consistent milling profile capable of efficiently clearing cement and scale from tubing or liners. Its high speed and efficient blade design produces small, uniform cuttings for enhanced hole cleaning.

Reliability in harsh conditions
With an all-metallic design, the Neyrfor TTT turbodrill enables reliable operation in high-temperature, pressure-sensitive, and harsh-fluid environments where conventional motor life is shortened and elastomer stators may be unusable. This helps eliminate frequent tripouts to change motors and saves rig time and associated costs. It also works efficiently with dual-phase drilling fluids.

Protection from long-term torsional affects
Built with robust blade stages and a thrust-bearing, concentric design, the Neyrfor TTT turbodrill produces less reactive torque compared with conventional positive-displacement motors. Its concentric design ensures significantly less destructive vibration and helps protect downhole tools and coiled tubing from extended torsional stress.
Applications

- Slimhole coiled tubing, milling, and acidizing operations
- Milling operations in scale, cement, barium, and sand
- Underbalanced milling in N₂, CO₂, and air environments
- Acidizing and harsh-environment operations

Benefits

- Improves ROP and footage due to efficient blade design
- Extends operating life in harsh environments by adapting to downhole fluctuation and stalls without accruing tool damage
- Enhances hole cleaning with more efficient cuttings removal

Features

- All-metallic design delivers consistently high-speed, low-torque power output
- Lower reactive milling torque and vibrations
- Durable design withstands acids and temperatures up to 500 degF (260 degC)
- Facilitation of multiple runs
- Capable of working with two-phase fluids
An operator in the Mobile Bay, Gulf of Mexico needed to mill through calcium carbonate and an unknown obstruction under extreme conditions below 22,000 ft with temperatures exceeding 400 degF and an inclination of more than 30°. This is the first time the operator attempted to clean out an HPHT well in the area. The operator previously used a high-temperature positive displacement motor, impact tool, and jet assembly, but none of them were able to deliver satisfactory results.
Clean out scale, acidize well, and restore production

Schlumberger recommended using the 2½-in Neyfor TTT thru-tubing turbodrill to clean out the scale while performing an acidifying job in the HPHT well. The turbodrill has an all-metallic construction that can withstand temperatures up to 500 degF and be used with exotic fluids and acids. In addition, the turbodrill’s high speed produces small cuttings that are easy to get out of hole. Its highly reliable turbine system enables it to facilitate multiple runs.

Achieved objectives in 59 operating hours

The Neyfor TTT turbodrill milled approximately 137 ft at 2 ft/min to expose perforations. In 59 operating hours, including the acidifying job, the turbodrill was pulled out of hole in excellent condition.
Improve production efficiency in challenging environment

Conventional workovers or sidetracks in depleted wells are not often economically viable. In addition, killing a heavily depleted well can cause formation damage and decrease productivity. Coiled tubing drilling techniques can significantly lower costs providing the ability to work in a live well, which can make drilling in depleted wells economically attractive.

Using ACTive services and the Neyrfor TTT thru-tubing turbodrill (blue), the operator achieved 3 times higher ROP compared with using PDM drilling (gray).
Real-time CT with turbodrill enabled improved drilling operation

The 2½-in Neyrfor TTT turbodrill was run to increase drilling efficiency. Other Schlumberger tools run on the BHA included the ACTive PTC* live CT pressure, temperature, and casing collar locator tool; ACTive TC* live CT tension and compression tool; and a 2.28-in Kinetic* diamond-impregnated bit.

The thru-tubing turbodrill provides an efficient drilling capability with greater durability to avoid additional trips out of hole. The turbodrill drills a smooth borehole with less weight on the bit, which ultimately increases drilling length before the CT buckles. Real-time downhole weight and torque monitoring was also key to optimizing drilling performance.

Enhanced cost efficiency and production, increased ROP

The BHA enabled a 300% increase in ROP when compared with previous CT drilling operations using positive displacement motors, and gas production increased by 50%. This technique reduced drilling time and costs, increased versatility towards drilling fluids, and ultimately provided improved reservoir knowledge postdrilling.
Neyrfor TTT Turbodrill vs. Mud Motor

The specially designed turbodrill blades generate the highest downhole horsepower of any other tool its size.
## Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. OD, in [mm]</td>
<td>2.125 [54]</td>
</tr>
<tr>
<td>Overall length, ft [m]</td>
<td>12.12 [3.69]</td>
</tr>
<tr>
<td>Max. downhole temperature, degF [degC]</td>
<td>500 [260]</td>
</tr>
<tr>
<td>Flow rate, galUS/min [m^3/min]</td>
<td>40–65 [0.15–0.25]</td>
</tr>
<tr>
<td>Stall torque, ft.lbf [N.m]</td>
<td>107 [145]</td>
</tr>
<tr>
<td>Operating speed, rpm</td>
<td>2,880–4,680</td>
</tr>
<tr>
<td>Runaway speed (water), rpm</td>
<td>5,660–8,910</td>
</tr>
<tr>
<td>Speed per flow rate, rpm/galUS</td>
<td>72</td>
</tr>
<tr>
<td>Overpull capacity, † lbf [N]</td>
<td>41,200 [183,267]</td>
</tr>
<tr>
<td>Shipping weight, lbm [kg]</td>
<td>233 [106]</td>
</tr>
<tr>
<td>Connections</td>
<td></td>
</tr>
<tr>
<td>Top</td>
<td>1½ Reg box</td>
</tr>
<tr>
<td>Bottom</td>
<td>1½ Reg pin</td>
</tr>
<tr>
<td>Max. mud weight, lbm/galUS [kg/m^3]</td>
<td>10 [1,198]</td>
</tr>
</tbody>
</table>

†Subsequent service in shop recommended for excess of 30,000 lbf applied to string.
Related Services

Thru-Tubing Intervention Tools
Reliable solutions for thru-tubing operations
slb.com/ThruTubing

CoilTOOLS Coiled Tubing Intervention Tools and Solutions
One-stop CT solutions for all downhole equipment requirements
slb.com/CoilTOOLS

2½-in Neyrfor TTT
Thru-Tubing Turbodrill