Welcome to productive drilling

Directional Casing While Drilling

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Directional Casing While Drilling With RSS

1st Schlumberger Directional Casing while Drilling with RSS Job in 2004

We have used Directional Casing while Drilling with RSS on the following wells:

1 in Norway (Offshore) with exhaustive testing in CTF prior to job
3 in Qatar (Offshore)
1 in Indonesia (Offshore)
1 in Germany (Offshore)

3 in South Texas (Land)
5 in Colorado (Land)
1 in Wyoming (Land)

On the above listed wells we drilled multiple Hole Sections with Directional Casing while Drilling with RSS.
Directional Casing While Drilling With RSS

Casing Sizes and Footage Drilled with Schlumberger RSS

10¾” -- 4,618 feet
9 5/8” – 8,091 feet
7 5/8” – 8,178 feet
7” -- 43,517 feet

Total of 66,404’ Drilled using RSS
92 % of above footage was Drilled Directionally
Directional Casing While Drilling With RSS

RSS Tools Used
Power Drive X-5 – Push the Bit System
Power Drive Xceed - Point the Bit System.

We have used both systems depending on local conditions and accepted practices in the region where the work is located.

We have drilled hole sizes ranging from 17 ½” x 12 ¼” down to 8 7/8 “x 6 ½” in Directional Casing while Drilling with RSS applications. We utilized RSS Technology with TESCO Underreamers and Casing while Drilling tools.
Directional Casing While Drilling With RSS

The next step in Directional Casing while Drilling with RSS Technology is to go to a smaller casing size. We have seen a overwhelming acceptance of Directional Casing while Drilling with RSS in the smaller hole sizes. For 7” Casing we have seen 500% more footage drilled than with the larger sizes of casing.

We propose to use our Ultra Slim Hole Crossbow RSS to drill with 5 ½” Casing.
Crossbow RSS Results From Operator and Service Provider Collaboration

- Shell, Statoil and BP offered funding
- Based on the 4¾-in. Power Drive X5 success
- Specifications set by above Operators

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Target Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hole size</td>
<td>Not less than 3.875 in.</td>
</tr>
<tr>
<td>Dogleg capability</td>
<td>&gt; 10 deg/100 ft but &lt; 15 deg/100 ft</td>
</tr>
<tr>
<td>Temperature</td>
<td>Up to 150°C</td>
</tr>
<tr>
<td>Pressure</td>
<td>Up to 15,000 psi</td>
</tr>
<tr>
<td>Flow rate</td>
<td>&gt; 80 gpm but &lt; 140 gpm</td>
</tr>
<tr>
<td>Surface RPM</td>
<td>&gt; 20 rpm but &lt; 80 rpm</td>
</tr>
</tbody>
</table>

Shell, Statoil and BP offered funding based on the 4¾-in. Power Drive X5 success. Specifications set by above Operators.
PowerDrive Crossbow Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal OD</td>
<td>3 1/4”</td>
</tr>
<tr>
<td>Bit Size</td>
<td>3 7/8”</td>
</tr>
<tr>
<td>Hole opening</td>
<td>Up to 4 ½”</td>
</tr>
<tr>
<td>Flow rate*</td>
<td>300 – 530 l/min (80-140 GPM)</td>
</tr>
<tr>
<td>Maximum RPM</td>
<td>6.7 Hz (400 RPM)</td>
</tr>
<tr>
<td>Maximum Temperature</td>
<td>150°C (302°F)</td>
</tr>
<tr>
<td>Operating Pressure</td>
<td>1,400 Bar (20,000 psi)</td>
</tr>
<tr>
<td>Dogleg capability</td>
<td>15°/30m (100 ft)</td>
</tr>
<tr>
<td>Pass thru (3 7/8” hole)</td>
<td>25°/30m (100 ft) rotating</td>
</tr>
<tr>
<td></td>
<td>50°/30m (100 ft) sliding</td>
</tr>
<tr>
<td>Maximum weight on bit</td>
<td>2.2 tonnes (5000lbs)</td>
</tr>
</tbody>
</table>

For more information see SPE Paper # 96329

Using 2 flow kits: 80-120 and 100-140 GPM
Directional Casing while Drilling with RSS

To Perform Directional Casing while Drilling with Slim hole RSS
A Downhole Latch Assembly (DLA) was required
TESCO has developed a series of DLA;s which are Wire line Retrievable
Drill Pipe Retrievable and a Pump Down Reverse Out system for larger sizes

TESCO has now developed a DLA for 5 ½” Casing to meet the requirements in smaller casing sizes
Directional Casing While Drilling With RSS
Directional Casing while Drilling with RSS

In combination with TESCO who provides the Latching Tools and Equipment, utilizing Crossbow Ultra Slim Hole RSS we are working to provide a solution to Directional Casing while Drilling with RSS available for Smaller sizes of Casing than Previously Attempted.

We intend to combine Tested and Accepted technology in a measured Step by Step Collaboration effort to Advance the Directional Casing while Drilling with RSS Services.
Questions?

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