

Successful Offshore Caspian Sea Liner Hanger Installation

Dual-plug design and rotation while cementing critical to achieve pay zone annular isolation

Background

LUKOIL subsidiary, LUKOIL-Nizhnevolzhskneft, is carrying out an exploration drilling campaign at the Khazri area in the Caspian Sea. The pioneer well has entered the formations of Tithonian age (upper epoch of Jurassic period), and the client confirmed the presence of oil pay zone in this formation. The client has decided to expand drilling to the Middle Jurassic formation located at 16,500 ft. Another pay zone was found at this depth; however, it was challenging to carry out a proper well test due to casing design limitations. A 7-in. liner was run through 9 $\frac{5}{8}$ -in. casing to complete the well. To achieve good pay zone annular isolation, it was critical to set up a good quality cement well-bonded both to the casing and to the formation. The main factor determining the cement bond quality is the high efficiency of drilling mud displacement from the annular space, which can be increased by cementing-related technologies and completion-related technologies, especially by the high-technology liner hanger system.

Solution

The NOV Completion Tools team completed a second job for an offshore Russian well. This was the first offshore Russian job to include a dual-plug design and rotation while cementing. Performed on a jack-up rig, rotating the liner hanger system helped the customer achieve good cement quality with minimum time spent cementing. A liner hanger system equipped with four cement plugs (two for drill pipe and two for liner) combined with a thrust bearing that provides the ability to rotate the liner after the hanger is set was used in this well.



Case study facts

Location: Caspian Sea

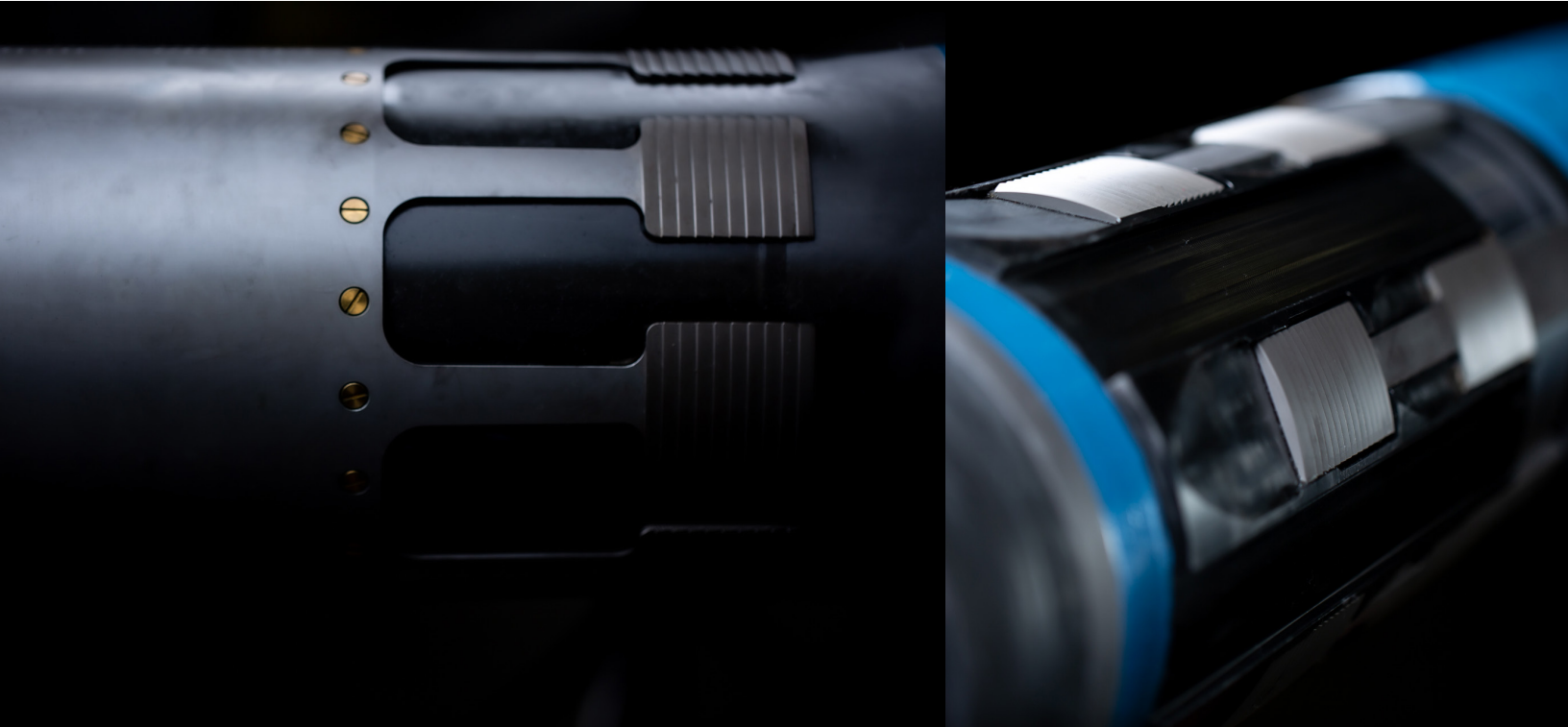
Customer: LUKOIL-Nizhnevolzhskneft

Products

- 7-in. PBR, 10 ft, L80 material
- 7 x 9.625-in. VXP liner top packer, 10,000-psi pressure rating, L80 material, V0 rated
- 7 x 9.625-in. GSP hydraulic liner hanger, L80
- Dual-plug system and a landing collar for 7-in. liner

General well information

- Previous casing: 9.625 in. 53.5#
- Liner: 7 in. 26#
- Liner top MD: 8,497 ft (2,590 m)
- Liner shoe MD: 13,058 ft (3,980 m)
- Mud weight: 10.7 ppg (1.29 SG)
- Cement density: 16 ppg (1.92 SG)



This dual-plug system provided a complete separation of all the pills pumped into the well during the cementing process, including mud, buffers, cement, and displacement fluid. This process was secured from the formation of mixing zones that would decrease the cement quality drastically. It is especially important when the fluids have different specific gravity and rheological characteristics. In the case of this well, the mud was 1.29 SG, the buffer was 1.65 SG, the cement was 1.92 SG, and the displacement was done by mud. During the whole cementing process, the liner was rotated at 10 rpm. This helped further increase the quality of mud displacement in the annular space.

Results

- The entire job was flawlessly executed with no NPT, including the following steps: activating the liner hanger, releasing the running tool, completing the cement job while rotating the liner, and setting the packer. Cement plug bump indication was clearly observed along with observation of double-shear for complete set of liner top packer.
- After the cement was set, the liner was pressure tested at 5,200 psi and filled with 1.29-SG mud for 30 minutes, thereby confirming well integrity.
- The new liner hanger system proved its reliability and pressure capabilities in a deep vertical well application with a harsh wellbore environment.