

South Arabic Gulf

VersaFlex[®] and XtremeGrip[®] expandable liner hanger systems combined in challenging sour environment

UAE offshore exploratory well successfully completed with four different cemented liner sizes

CHALLENGES

- Complex wellbore design
- Sour environment

SOLUTIONS

- Field-proven reliable equipment
- High-efficiency ratings

RESULTS

- All hole-section challenges overcome
- No HSE or service quality issues
- On-time completion

Overview

An offshore well was drilled to a depth of more than 20,000 ft to allow the operator to explore several zones of interest from a single wellbore. During the design and execution phases, multiple liner hanger systems were deployed to reach the required depth without jeopardy to the overarching design. Because of the challenging sour environment and complex design, the VersaFlex[®] expandable liner hanger (ELH) and XtremeGrip[®] ELH systems were selected for the job.

Challenges

The final design required four sections to be isolated with cemented liners. Each section presented potential operational issues that required ELHs with unique capabilities.

Section 1: 16-in. liner x 20-in. parent casing

A salt formation with movable sands was encountered during the drilling phase. Movable sands are known to pose operational issues related to well control, kicks, and tight spots.

Section 2: 13 5/8-in. liner x 16-in. parent casing

After the 16-in. shoe was initially drilled through, the hole section exhibited balloon effects, which were quickly controlled. The remainder of the hole section was drilled without issue. While no notable liner-deployment challenges were discerned, standard ELH protocol required pre-job planning and risk mitigation.



Each hole section progressed without any HSE or service quality issues, which saved time and maximized OPEX.



Section 3: 11 3/4-in. liner x 13 5/8-in. parent casing

This section was defined as the most challenging because of the depleted Wasia formation, which needed to be drilled through, then requiring an intermediate liner be installed to isolate the wellbore and prevent compromise of the following sections. Depleted zones are known for operational issues related to differential sticking, excessive fluid loss, and potential well control.

Section 4: 9 5/8-in. liner x 13 5/8-in. parent casing

This hole section involved drilling through the Nahr Umr, Thamama, and Salld/Rayda formations. Hard rock was encountered at 16,939 ft, where the hole size was reduced, switching from a 12 1/4-in. reamer to a 10 5/8-in. bit. Like Section 2, no notable liner deployment challenges were identified, therefore standard ELH protocol required that pre-job planning and risk mitigation be utilized.

Solutions

The following overviews each hole section and outlines the ELH system installation highlights and solution provided.

Section 1: A 16- x 20-in. VersaFlex® Big Bore ELH system was deployed into the well and required washing, reaming, and slack off weight to pass 75 tight spots along 5,830 ft (1777 m) of openhole section. Auto-fill float equipment was deployed to minimize surge/swab effects attributed to a narrow frac margin. Liner cement procedures went as planned, and the liner hanger was set and tested with a run tool before successful release and retrieval.

Section 2: A 13 5/8- x 16-in. VersaFlex Big Bore ELH system with a 20-ft upper tieback receptacle (TBR) was deployed into the well without issue. Auto-fill float equipment was also used to help minimize surge/swab effects. Liner cement procedures went as planned with 10% excess placed above the top of liner (TOL). The liner hanger was set and tested, and the run tool was released; however, it required additional time, multiple attempts, and excessive slack-off weight (SOW) before successful retrieval.



VersaFlex® Big Bore ELH system

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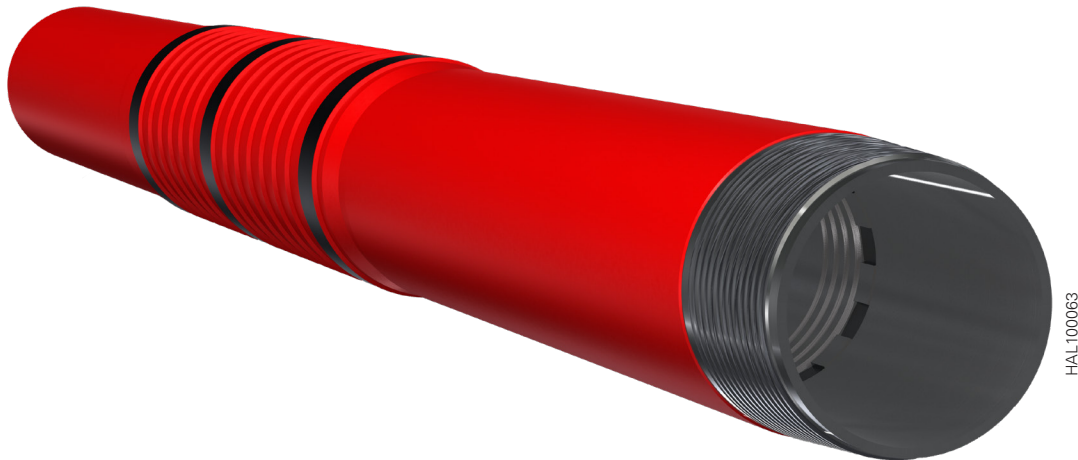
CASE STUDY

Section 3: An 11 3/4- × 13 5/8-in. XtremeGrip® ELH system was deployed into the well. The last 377 ft (115 m) required hard reaming to reach the required depth. Reference to previous drilling experience helped determine that a casing reamer shoe should be used in this hole section to reach the desired depth. Auto-fill float equipment was also used to help minimize surge/swab effects in the tight-clearance application. The liner cement design was modified to align with the static thickening time of the slurry and additional time was allowed for circulation. The application went as planned and the liner hanger was set and tested. A run tool was released after additional slack-off force was applied and successfully retrieved.

Section 4: A 9 5/8- × 13 5/8-in. XtremeGrip ELH system with a 20-ft lower polished bore receptacle (PBR) at an overall length of 90 ft (27.7 m) was transported to and

deployed into the well without issue. A casing reamer shoe was deployed but not used. Auto-fill float equipment was used to help minimize surge/swab effects in this tight-clearance application. Lessons learned from previous sections were considered and the cement design was implemented as planned. The liner hanger was set and tested, and the run tool was successfully released and retrieved at the surface.

Because of the challenging sour environment and complex wellbore design, the VersaFlex® and XtremeGrip® ELH systems were selected as proven technology with high reliability recognized globally.



XtremeGrip® ELH system

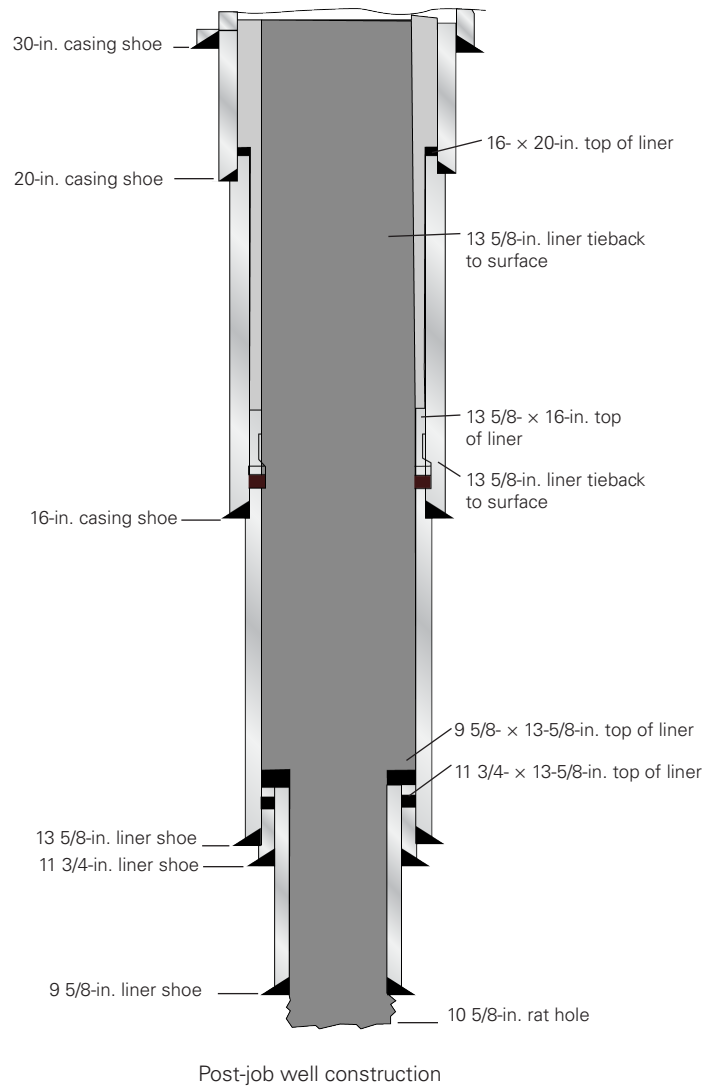
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Results

Both the VersaFlex® and XtremeGrip® ELH systems allowed the operator to reach the required depth, cement, and successfully set the liner hangers, despite the complex well profile. Design characteristics of both ELH systems confirmed the following advantages:

- Capability of high reaming, flow, and torque rates with no risk of premature release or set. Multiple challenges were overcome in several hole sections.
- Reaming confirmed the potential of the VersaFlex and XtremeGrip ELH systems (max. torque = 24K ft-lb, RPM = 20, max. SOW = full liner weight).
- Providing a smooth radial flow path for an improved ECD profile during cement operations, outperforming a conventional liner hanger system, and aiding cement above the TOL.
- Incorporating lessons learned from multiple service functions into the job design helped achieve the desired results and ensure risk mitigation.

The VersaFlex and XtremeGrip ELH systems helped overcome a variety of issues (over multiple hole sections with significantly distinctive characteristics) without the risk of presetting or pre-releasing. The technology and services provided a sealed liner top that followed a preplanned design, which was adjusted as lessons were learned to help mitigate potential risks. No HSE or service quality incidents were encountered, and each hole section was completed efficiently and on time.



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