Raising the bar for liner hangers

Heavier parent casing in increasingly deep waters has posed challenges for conventional expandable liner hangers. Jennifer Pallanich reports on a new metal-to-metal sealing system designed for such extreme conditions.

The deepwater and ultra-deepwater application of heavier parent casing weight liners creates a two-fold challenge. The first is dealing with the heavier parent weight, and the second is setting hangers at elevated temperatures. The combined challenge was more than standard liner hangers, which typically rely on all-elastomer seals, could handle. This forced reliance on a modified standard liner hanger system that required the cement job to provide overall sealing capability.

Halliburton created the VersaFlex XtremeGrip liner hanger to provide a reliable liner-top seal in these instances, says James Williford, Halliburton’s global product champion for liner hangers. A multi-piston tool design provides the additional force needed to set the hanger in heavier weight parent casings. “We have gone from an all-elastomer seal holding all the hang weight to a metal-to-metal seal with the hanger body holding the hang weight and the elastomer forming the secondary seal,” Williford says. A metal-to-metal seal in the form of an extrusion ring

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James Williford, Halliburton
contacts the parent casing to form the seal and anchor the liner hanger to the parent casing. A minimal elastomer provides a secondary seal in case of damage to the parent casing.

Williford says the hanger body’s extrusion rings expanding into the parent casing do not damage the casing.

“The angle of design and the way that it’s manufactured” prevent the extrusion rings from penetrating the parent casing wall. “We plastically deform the hanger body so we can form the seal to the parent casing and contact with enough force to anchor the liner” so it can handle the hang load.

As the industry went to higher temperatures and heavier weight parent casings, the elastomers in the standard designs were “squeezing off” the hanger body.

“This limits the amount of deflection or amount of plasticity in the parent casing. It causes the rubber to want to squeeze off instead of compress. That’s why we had to go to a different design and came up with the engineered rings to work in the heavier parent weight casing,” he says.

“We initially took our standard VersaFlex design and went through the process of looking at it without any elastomer. We performed some testing but it would not hold the pressures that we needed satisfactorily,”

The design team then engineered an extrusion ring solution to maintain anchor load and sealing capability.

A client collaborated with the service company in the design process, which took place in Halliburton’s office in Carrollton, Texas, near Dallas. Some of the suggestions from the collaboration resulted in minor changes to the overall design. One change was the optimisation of the mandrels on the running tool to increase the tensile load, says Nathan Wyatt, Halliburton’s Gulf of Mexico liner hangers account representative.

The company carried out most of the testing in its deep well simulator in Carrollton, where the new liner hangers are being manufactured.

“It’s a heavy-duty piece of equipment in a clean-form design with no moving components,” Williford says.

“I don’t think there’s anything out there on the market that can compete with the VersaFlex XtremeGrip system.”

Williford says Halliburton views the XtremeGrip as an “uplift” technology. It can hang liner and seal off in temperatures up to 400° Fahrenheit tested to ISO 14310 V0 qualification for oil and gas wells, and it has been tested up to 575° Fahrenheit to ISO 14310 V3 qualifications with no elastomers for geothermal applications. He says the company has begun design work on the system that “will take us to 20K,” or pressures to 20,000 psi, which could reach the market as early as the third quarter of 2016.

The existing tool is available in a range of sizes for parent casings of seven inches to 20 inches. Williford says the team is working to round out the portfolio of sizes.

“We’re not trying to replace the current VersaFlex systems with this technology,” he says.
“We’re trying to capture the whole operating envelope to address our customers’ needs.”

The first installation of the VersaFlex XtremeGrip tool was in the third quarter of 2013. Since then, it has been deployed globally.

In November 2014, Halliburton deployed the tool in 4570 feet water depth in the Gulf of Mexico. Wyatt says using the tool reduced non-productive time for the client during expandable liner hanger installation.

“99% of the liner bore was expanded,” he says. The well design called for a 7 ½ inch production liner at the bottom of the well. At 10 1/8 inch OD, 0.8 inches wall thickness, and 81 pounds per foot, the parent casing was “an oddball size. It was so oddball, so thick, that we didn’t have a hanger that was set up for that,” Wyatt says. “It’s pretty thick pipe. The customer refers to it as the gun barrel pipe.”

Halliburton designed the tool for the job, which Wyatt says performed “perfectly” during the operation. The hydraulic hanger expanded at “a pressure very close to what our engineers predicted it would expand at,” he says.

The top of the liner was at 23,900 feet below sea level and the bottom was at 27,964 feet. “Hydrostatic pressures are high at that depth,” Wyatt observes.

The well was “extremely deviated”, he adds. The company ran just over 4000 feet of casing to the bottom of the well, which reached a maximum deviation of 59 degrees, then performed the cement job, isolated the formation, and set the hanger. After the hanger was set, the crew verified the set by tug testing on it with the drill pipe before releasing the running tool from the hanger and coming out of hole.

The deployment took 60 hours from make-up to casing set, and another 12 hours to come out of hole.

The customer has since placed orders for the VersaFlex XtremeGrip system in multiple sizes, Wyatt says, and has scheduled a second run of the tool in the Gulf of Mexico in August. “They’re definitely adopting this technology,” he says. [1]

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