Case study: Gulf of Mexico, North America

Extreme DST combination valve left clean perforations, reduced fluid loss, and provided accurate shut in data

An offshore shelf operator in the Gulf of Mexico drilled a deviated well to a total depth (TD) of 10,500 ft (3200 m) and a total vertical depth of 5,900 ft (1800 m). The perforating plan called for creating 500-psi (34.48-bar) underbalance while perforating each of the bottom three target production zones to establish clean perforation tunnels. They also expected to encounter some fluid loss based on previous experience with other wells in the area, and needed to collect pressure build-up data in a shut-in operation.

The operator chose to partner with Baker Hughes and use its **Extreme drillstem test combination valve (xDCV)** because of its reliability and flexibility. The xDCV combines a debris-tolerant ball-type sealing valve with a metal-to-metal, elastomeric hybrid circulating valve in a single unit. In addition to providing underbalance during perforation operations, the annulus-operated xDCV can also be used to spot fluid-loss pills and conduct shut-in pressure tests.

The Baker Hughes xDCV was made up to a nitrogen chamber and annular reference trap system (ARTS) at the surface. The assembly was then run to depth and the tubing-conveyed perforating (TCP) guns were spaced out across the lowest production zone at 10,500 ft.

The xDCV was utilized to run part of the workstring dry and create a 500 psi underbalance. After firing the TCP system, fluid from the formation rushed into the wellbore through the perforations, removing loose debris in the perforations and increasing communication with the reservoir.

After the initial perforating operation, the well was losing fluid at the unacceptable rate of 3 bbl per minute, which drives up costs and can damage the formation. The Baker Hughes team used the xDCV to spot a fluid-loss pill across the lower production zone, reducing fluid loss to a manageable 12 bbl per hour. The BHA was tripped out of hole and redressed to perform the next perforating run. This process was repeated for the middle and upper production zones, leaving clean perforations and helping to manage fluid loss and formation damage across all three zones.

The xDCV was also utilized to reverse circulate to remove all hydrocarbons from the production string and then shut in to record pressure build-up data for use in production modelling. This was accomplished by applying pressure cycles from the surface to close the ball valve and leave the circulating valve open.

Taking only two days per perforating zone, the Baker Hughes team performed the operation flawlessly and without incident. The ARTS reduced safety risks for personnel associated with high-pressure nitrogen charging at the surface, and the operator was left with clean perforations, reduced fluid loss, and accurate shut-in data for the well.

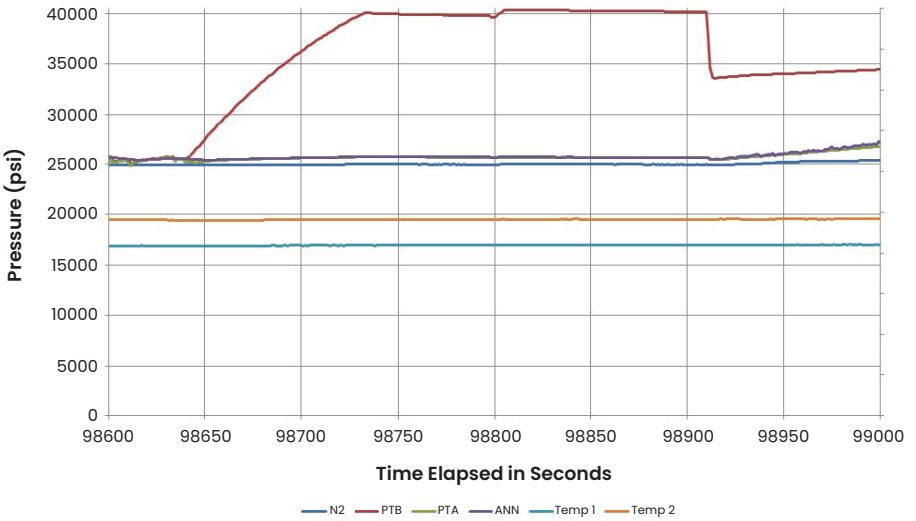
The Baker Hughes team has conducted extensive testing on the xDCV to ensure it is capable of handling the most demanding conditions.

Challenges

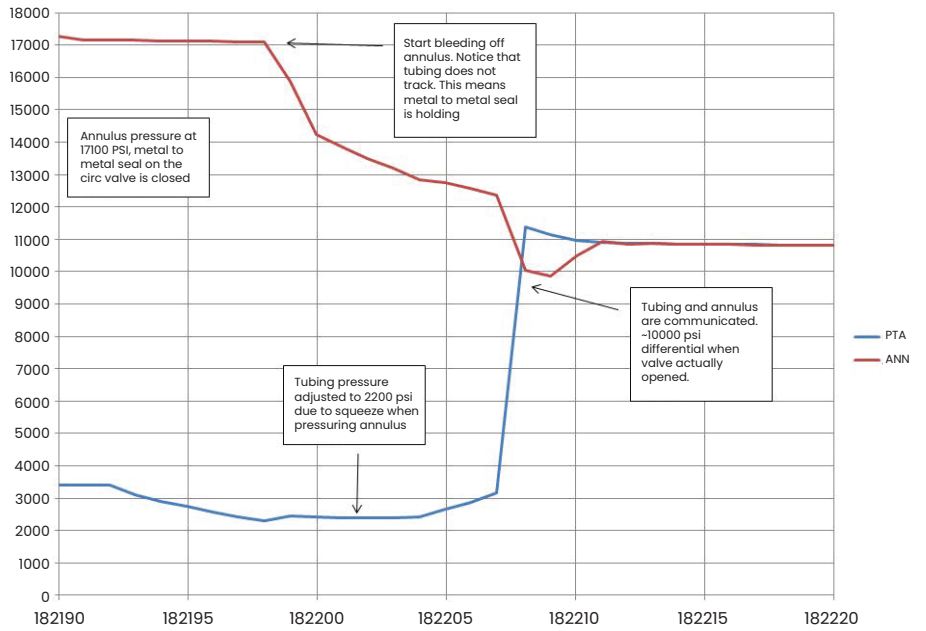
- Offshore deviated well with a TD of 10,500-ft
- High permeability well requiring 500-psi underbalance
- Perforating plan called for underbalance on three production zones followed by a fluid loss control pill

Results

- Ran the xDCV to create underbalance, spot fluid-loss control pills, and provide shut-in data
- Used ARTS to reduce required nitrogen pre-charge pressure at surface
- Improved production potential by leaving clean perforations using underbalance
- Reduced fluid loss and formation damage by spotting a fluid-loss control pill
- Provided accurate shut-in data



The xDCV will stand up to 40,000 psi (2758.6 bar) below the ball and 25,000 psi (1724.1 bar) above the ball at temperatures near 400°F (204°C).



The hybrid elastomeric-and-metal-to-metal seal of the circulating valve is designed to withstand 10,000-psi (689.6-bar) differential pressure while cycling a minimum of 25 times at temperatures near 400°F.

Baker Hughes