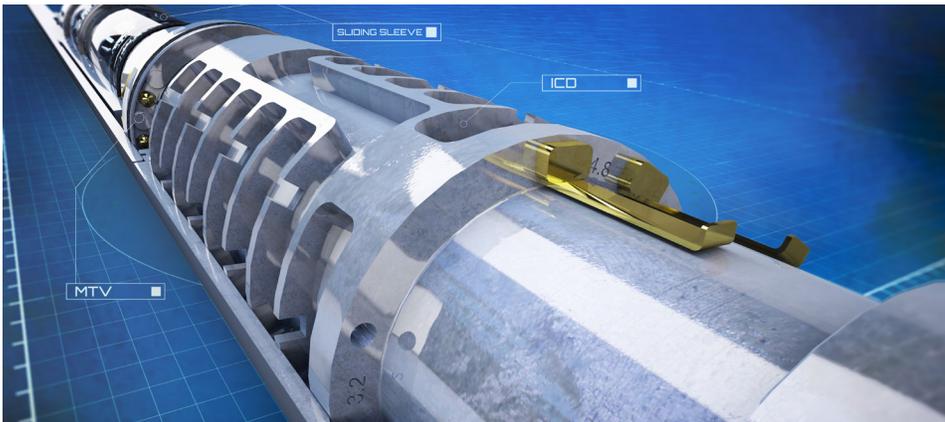


LOCATION: MIDDLE EAST



EQUALIZER SELECT AICDs restricted water, maximized oil drainage in carbonate well



As fluid flows through the EQUALIZER SELECT AICD's series of staggered flow chambers, pressure is gradually reduced based on the fluid's momentum and properties, creating a dynamic choking effect that minimizes the production of higher density fluids such as water.

After several years of production, which had already been interrupted once to perform an operation to isolate watered out zones, a well in a carbonate field in the Middle East was taken offline due to extremely high water cut. With recoverable reserves still in place, the customer planned to revive production by drilling a lateral wellbore off of the existing vertical producer to access additional oil.

Looking for a way to better control flow and to minimize water production, the customer worked closely with Baker Hughes, a GE company (BHGE) completion engineers to identify the best solution, and ultimately agreed

on **EQUALIZER SELECT autonomous inflow control devices (AICDs)** outfitted with sliding sleeves and **multitasking valves (MTVs)**. The EQUALIZER SELECT AICD features a unique tortuous path geometry that equalizes flow across lateral wells to restrict unwanted fluids and to enhance production—with no interaction from surface. The sleeves would allow the customer to shut off zones at a later date if needed, and the MTVs, which create a temporary closed system, would help to accelerate installation operations.

To create a truly reservoir-optimized completion design, the fluid resistance rating (FRR), or restriction level, of each EQUALIZER

Results

- Equalized flow across the lateral to enable more effective reservoir drainage
- Restricted water production
- Enabled production rates of 6,000 BOPD with no detectable water production
- Minimized costs associated with water handling and water-related interventions
- Cut tool deployment time in half
- Gave the customer the ability to selectively control zones
- Delivered flow performance that closely matched pre-job simulations

Challenges

- Optimizing oil production from existing carbonate well with varying permeability and a high risk of water breakthrough
- Minimizing water production

BHGE solution

- Installed 16 EQUALIZER SELECT AICDs to restrict water and maximize oil production
- Used MPas mechanical packers and REPACKER reactive-element packers to isolate AICDs into compartments
- Incorporated MTVs and sliding sleeves into EQUALIZER SELECT AICDs to accelerate deployment and to enable selective zonal control

SELECT AICD was determined based on the flow profile in the area of the well in which it would be installed. With six available ratings, the AICD offers an increased level of design flexibility to help improve well productivity.

Because the AICDs included MTVs that temporarily prevented flow between the tubing and the annulus during run-in, the customer was able to quickly circulate the assembly to bottom in half the time of a standard installation using an inner string and a washpipe. Once at depth, a total of 17 packers were set to isolate sections of the well. **MPas™ mechanical packers** were used to divide the well into four major compartments and **REPacker™ reactive-element packers** were used to isolate the AICDs into smaller individual compartments within the major compartments. The well was put on production and flowed at a consistent 6,000 BOPD with no detectable water.

After one year of production, the customer elected to run specialized fiber-optic coiled tubing to learn more about the flow performance of the AICDs and to test the closing ability of the sliding sleeves. The production logging results showed uniform flow from the AICDs with no dominating zone. Each AICD compartment was contributing to total production at different rates, and the flow profile clearly indicated that all packers were sealing properly.

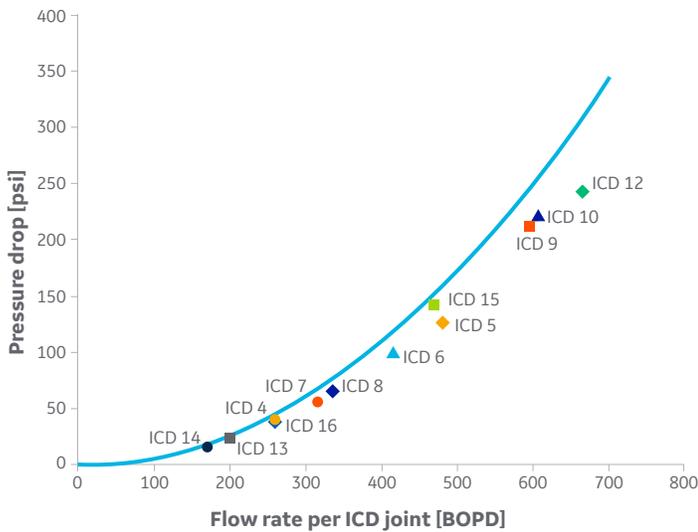
The customer also used the permeability profile obtained from the production log to simulate the production profile of the openhole well if it had been completed without any flow control devices. The simulation revealed extremely inefficient drainage, further confirming the value of the EQUALIZER SELECT AICDs.

Using a hydraulically-actuated shifting tool deployed on the coiled tubing, the customer

then closed and re-opened each sliding sleeve. A downhole tension/compression sensor installed on the shifting tool bottomhole assembly provided downhole pressure and weight data that confirmed all sleeves were successfully shifted closed and then re-opened. The production logs corroborated these results. Actual production performance also very closely matched the simulations generated during the completion design phase, verifying the effectiveness of the process.

In addition to delaying water breakthrough and minimizing water-related costs, the EQUALIZER SELECT AICDs also gave preferential flow to oil, helping to enhance production. Pleased with the results, the customer plans to install EQUALIZER SELECT AICDs in more of its carbonate wells to maximize ROI and minimize costs.

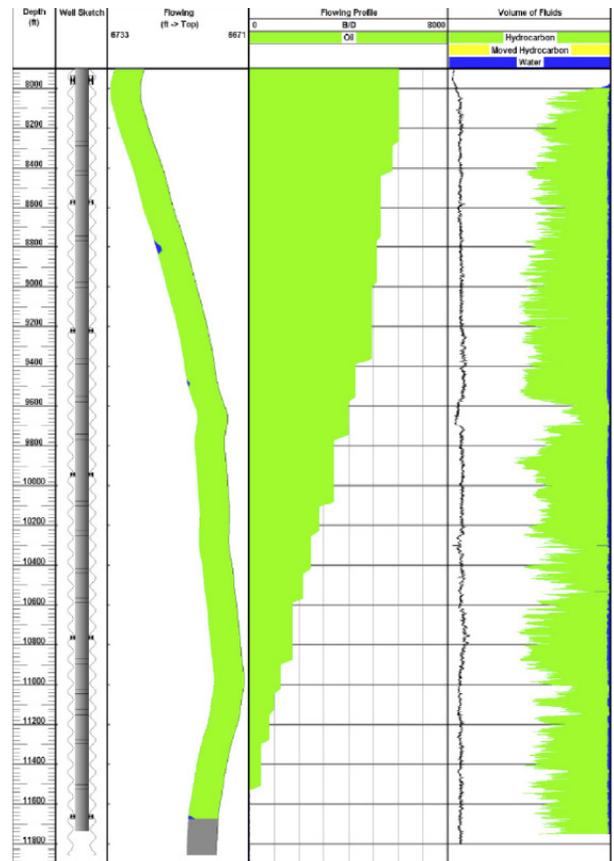
Production Performance Curve



The predicted production performance curve for the EQUALIZER SELECT AICDs very closely matched the actual performance derived from the production logs, confirming the effectiveness of the reservoir-optimized completion design process.

The well's flow profile confirmed that all EQUALIZER SELECT AICD compartments were contributing to production.

Well Flow Profile



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