

Case Study
i-Frac CEM™

80-Sleeve i-Frac CEM Cemented Completion

Integrated expertise from installation to production



i-Frac CEM™ - 80-Sleeve Cemented Completion

Background

Our customer was in search of a way to add fracture initiation points to their cemented horizontal well and to reduce the time required to stimulate multiple stages along the lateral section of the wellbore. Once all stimulation operations were completed, the customer would need to remove any obstructions in the wellbore to optimize production.

We proposed the installation of an 80-sleeve system using proprietary i-Frac CEM technology. i-Frac CEM is a cost-effective, cemented, ball-drop activated, multistage frac sleeve solution with a unique design that would allow the operator to place multiple fractures along the length of the well using an engineered limited entry design.



Our proprietary i-Frac CEM sleeve is a cost-effective, cemented, ball-drop activated, multistage frac solution with a unique design that would ensure multiple fractures along the length of the well with up to five initiation points per stage.

Solution

The 80-sleeve i-Frac CEM system, with internal ball seat diameters ranging from 55.83 to 89.15 mm (2.2 – 3.5 in.), was installed and cemented into place. A wiper dart specifically designed for the i-Frac CEM system was pumped by our cementing services and bumped near the calculated volume.

The completion consisted of 2 BPS (Burst Port System)™ toe initiation sleeves and 17 ball-drop fracture stages. Each ball-drop fracture stage was made up of 3, 4 or 5 sleeves, with a total of 17 fixed sleeves and 63 flex sleeves installed. The nozzle configuration was designed to allow for limited entry to ensure fracture propagation from all initiation points, and dissolvable balls were used to open the sleeves and isolate each stage of the stimulation.

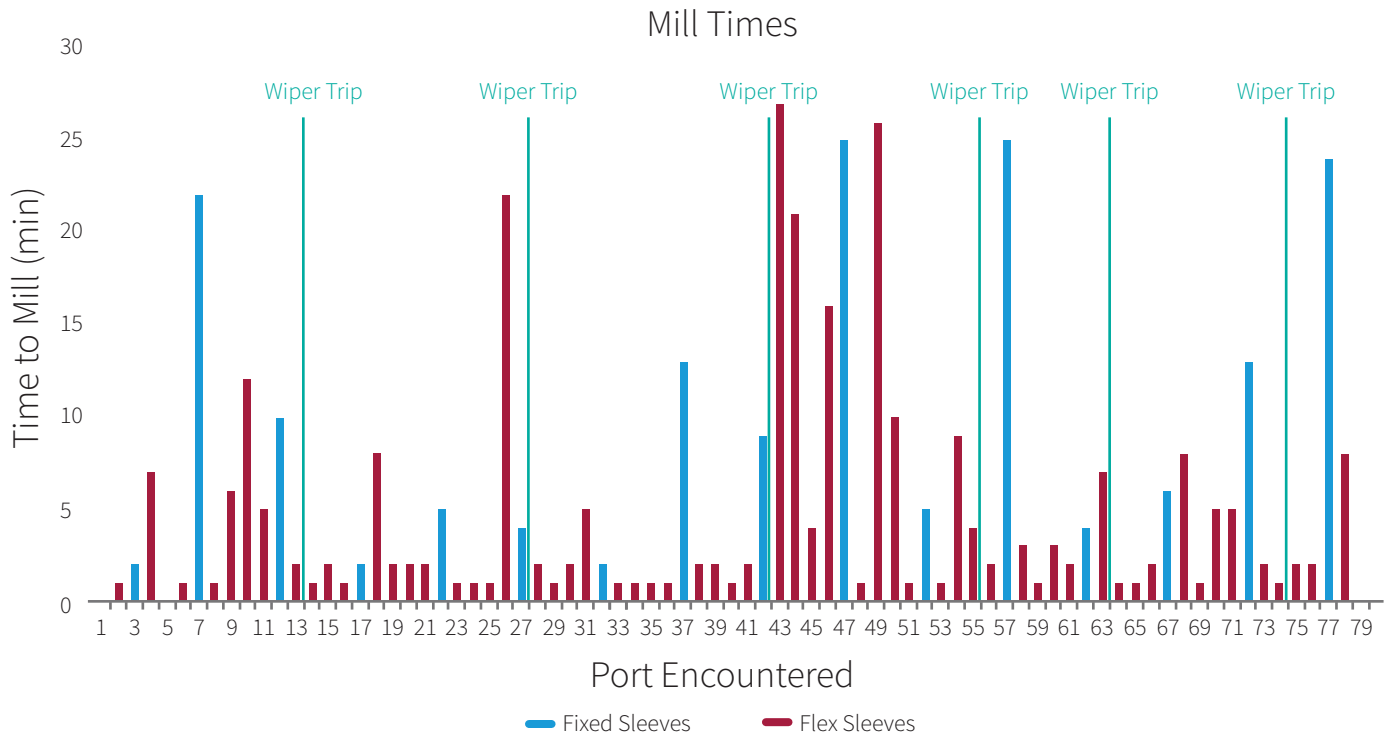
After the stimulation treatment was completed, coiled tubing services and well intervention tools services used 60.3 mm (2.37 in.) coiled tubing and a milling bottomhole assembly (BHA) to mill out the ball seats. The milling BHA included proprietary mill and a positive displacement motor. A friction reduction tool was run above the motor to overcome friction between the coiled tubing and 114.3 mm (4.5 in.) casing, and to help ensure adequate load on the mill face throughout the length of the wellbore.

Results

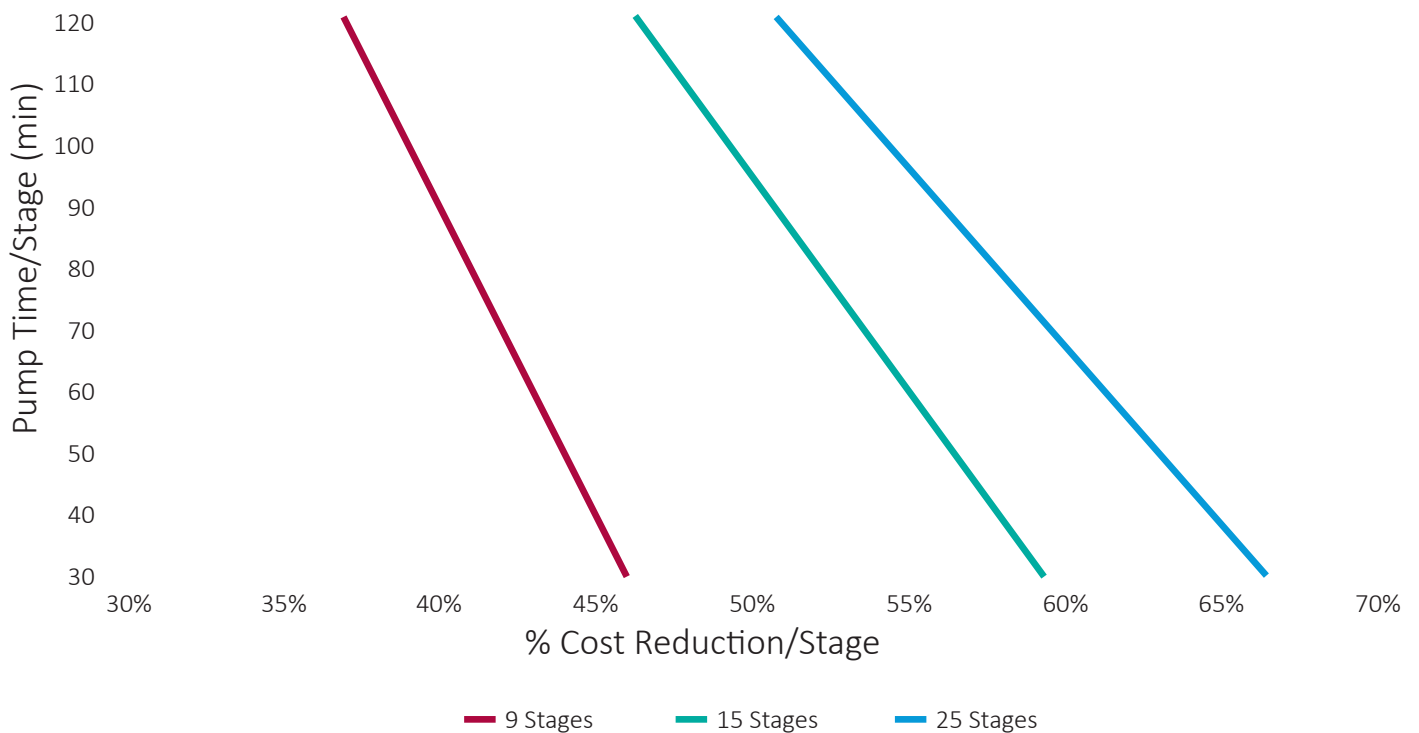
Using our reliable ball-drop technology, we successfully met our customer's objectives, resulting in the largest number of 114.3 mm (4.5 in.) i-Frac CEM sleeves installed in a single wellbore. Additionally, a total of 78 ball seats were milled in one run, providing a significant cost savings to our customer. While coiled tubing friction and lockup prevented the last 2 ball seats at the toe of the well from being milled, the dissolvable balls dropped during the stimulation treatment allowed production through the last 2 sleeves, even with the ball seats still in place.

Our proprietary mill performed exceptionally well during the milling operation. The average mill time was 5.7 minutes/seat, with flex seats averaging 4.4 minutes/seat and fixed seats averaging 10.7 minutes/seat. The average stage-to-stage time was 25 minutes, with up to 15 seats milled between wiper trips.

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Average Cost Savings – Ball-Drop vs. Plug-and-Perf



A representation of our complete service line cost for plug-and-perf versus i-Frac for fracture treatment designs with various numbers of stages and stage sizes (measured by pump times).

Case Study Snapshot

Date: 2015

Project Area: Montney Formation, B.C. Canada

Challenges:

- Add fracture initiation points to the customer's cemented horizontal well
- Reduce the time required to stimulate multiple stages along the lateral section of the wellbore while still using cement for zonal isolation between stages
- Remove any obstructions in the wellbore to optimize production

Solution:

- Installation of an 80-sleeve i-Frac CEM ball-drop activated system
- Stimulation of the well would be followed by milling out the ball seats using NOV coiled tubing and well intervention tool services

Results:

- We successfully completed the largest number of 114.3 mm (4.5 in.) i-Frac CEM ball-drop frac sleeves cemented in a single wellbore worldwide and the most number of i-Frac CEM seats milled in one run
- 78 of the i-Frac CEM ball seats were milled in one run, resulting in a significant cost savings for our customer
- Dissolvable balls dropped during the stimulation treatment allowed production through the last 2 sleeves, even with the ball seats still in place
- Our proprietary mill performed exceptionally well. The average mill time was 5.7 minutes/seat, with mill times through the flex seats averaging 4.4 minutes/seat and fixed seats averaging at 10.7 minutes/seat

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