HALLIBURTON

STIMULATION | ACID TREATMENT DIVERSION

AccessAcid® stimulation service

Improved reservoir access through effective acid stimulation treatment diversion

BENEFITS

- Diverts acid stimulation treatments from high permeability and naturally fractured zones to low-permeability zones to maximize reservoir contact
- Provides diversion fluid properties for optimum coverage when targeting long intervals, independently of the pumping rate
- Self-degradable particulates are providing leak-off control properties by bridging against the formation or fracture face
- Customized particle blends provide near-wellbore and/or far-field diversion, including granulated and fiber particles
- No mechanical isolation required. It can be bullheaded or placed through a coiled tubing (CT) unit
- Particulates in the diversion system will self-degrade completely at a predicted time based on bottomhole temperature
- Easily mixed (batch-mixed or pumped on-the-fly)
- No need for breaker or cleanup stage
- Excellent regained permeability to hydrocarbons

Overview

AccessAcid® stimulation service helps improve acid coverage in sandstone and carbonate reservoirs beyond the capabilities of conventional diversion systems during acid stimulation treatments. AccessAcid integrated service delivers ideal acid placement through self-degradable particulates with proprietary multi-modal, customized particle blends to optimize acid placement, including granulated and fiber particles. This is critical for enhancing hydrocarbon recovery from the reservoir. The diversion agent is placed in alternating stages with the acid service throughout the treatment. Once the acid stimulation treatment is completed, the particulates in the diversion agent will self-degrade based on reservoir temperature, eliminating the need for a cleanup or removal treatment.

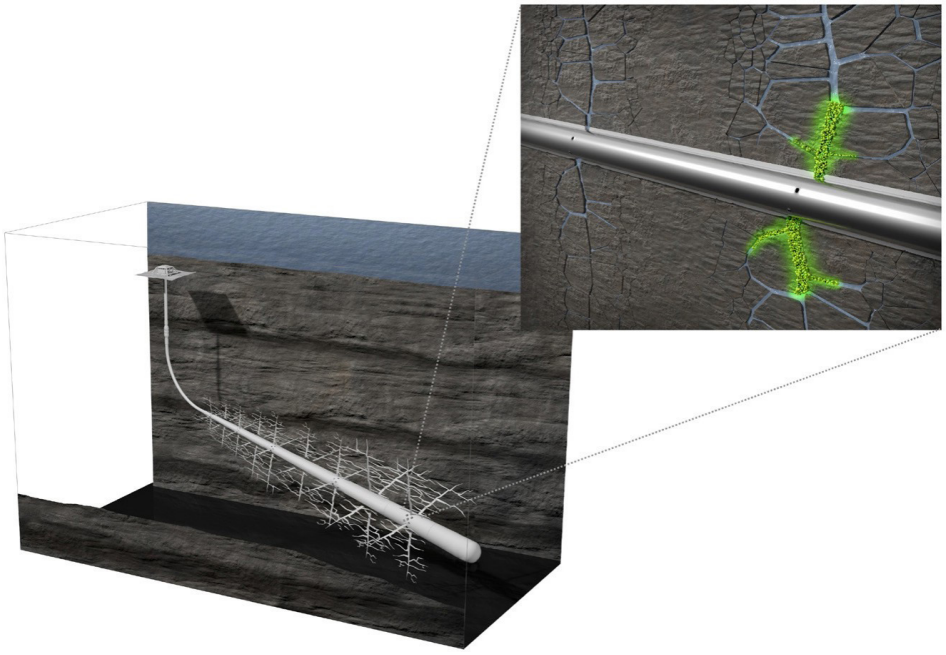


Figure 1: AccessAcid® stimulation service helps improve acid coverage in sandstone and carbonate reservoirs beyond the capabilities of conventional diversion systems during acid stimulation treatments.

Features

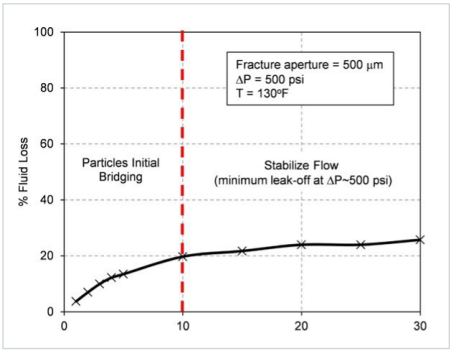
- Offers a wide temperature range of application, ranging from 120°F (49°C) to 300°F (149°C)
- Applicable to sandstone, carbonate, and shale reservoirs. Compatible with most common acid stimulation treatments, including Halliburton's Carbonate 20/20™ and Sandstone 2000™ acidizing services
- When combined with SPECTRUM Diagnostic service it provides real-time injection and diversion monitoring
- Suited for new completions and re-stimulation treatments in mature, deepwater, and unconventional assets. Applicable to matrix acidizing and/or acid frac treatments

Real-time monitoring and evaluation

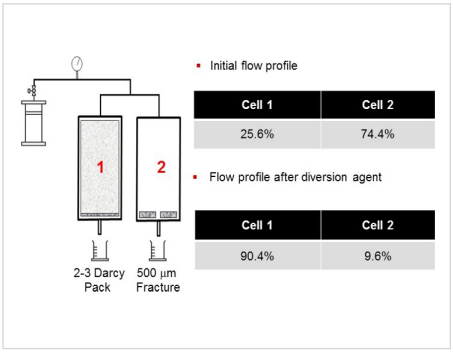
Employing historical data-driven machine learning models to aid in operational risk mitigation has a critical impact on optimum job execution. Integrated into VIDA, the Barrier Advisor model has access to constantly growing data from thousands of historical jobs across the globe. Every design decision has a corresponding Cement Dependability Index (CDI) response, which is used to calculate a score for any given set of design parameters for a specific job. The model identifies similar jobs (i.e., nearest neighbors) using a clustering approach based on similar well conditions. Additionally, the model computes and displays each job's score. Evaluating these scores allows an engineer to visualize the critical CDI responses from nearest neighbors and modify the current job design decisions to improve the job score and, ultimately, its execution. The nearest neighbors are identified by clustering historical jobs based on geometry, placement conditions, fluid properties, job objectives and job type parameters. This ability to optimize job designs based on a database comprised of thousands of best practices and design decisions mitigates operational risks to deliver a tailored barrier with an increased probability of operational success and therefore minimum effort required for barrier validation.



a.



b.



c.

Figure 2: AccessAcid® stimulation service – Optimizing acid diversion in challenging reservoirs conditions: (a) it uses self-degradable particulate with proprietary multi-modal, customized particle blends to optimize acid placement for near-wellbore and far-field diversion (b) Fluid loss test shows AccessAcid stimulation service ability to provide bridging and leak-off control properties, even in fractured environments (500 µm fracture aperture, ΔP~500 psi, testing temperature = 130°F), and (c) Core flow test in parallel shows optimum diversion properties, effectively changing the fluid distribution profile away from naturally fractured zones to lower permeability zones.

Field Proven – Case History

A land well in Latin America was completed in a mature, oil-producing, naturally fractured carbonate reservoir. This well had a cased-hole and perforated completion with eight different perforated intervals (gross interval ~1368 ft, net perforations ~650 ft). After multiple acidizing treatments (5), it was impossible to positively impact the decline curve in this well, mainly due to high reservoir heterogeneity and a thief zone identified at the bottom zone.

Halliburton successfully implemented AccessAcid® stimulation service to distribute the acidizing treatment across the eight intervals effectively. The well intervention was enhanced with SPECTRUM® Diagnostic service (real-time coiled tubing service) to optimize fluid distribution. The real-time fiber optic integrated service allowed adjusting the diverter design in real time to obtain optimum acid coverage as illustrated by Figure 3. Our experts performed four alternating stages of acid and AccessAcid stimulation service.

After the treatment, AccessAcid stimulation service provided a steady hydrocarbon production uplift of 82 percent, increasing oil production from 920 to 1680 BOPD, under the same choke conditions. Figure 4 shows the final acid fluid distribution across the eight different intervals. AccessAcid stimulation service effectively optimized acid diversion and reservoir access during this wellbore intervention.

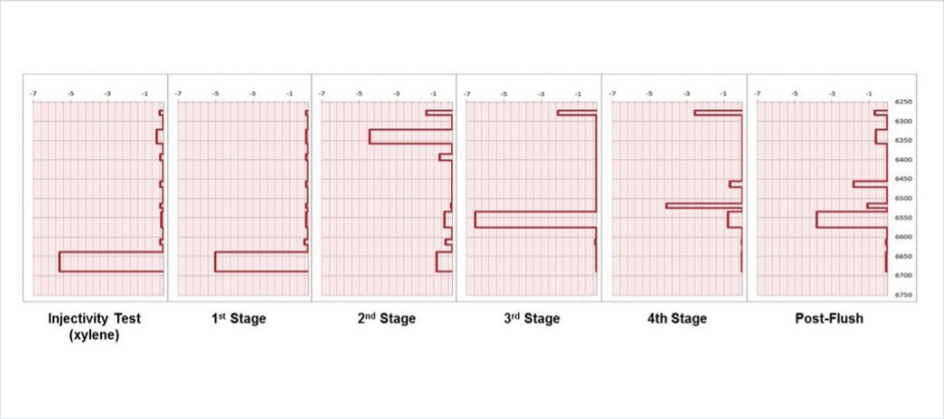


Figure 3: Acid stimulation treatment was optimized with AccessAcid® stimulation service using four diversion stages. The above charts show the acid fluid distribution monitored in real-time with SPECTRUM® Diagnostic service. For Stage 1, diverter concentration was adjusted on the fly from 1 to 5 ppg to effectively divert acid away from the thief zone to the upper, less permeable intervals.

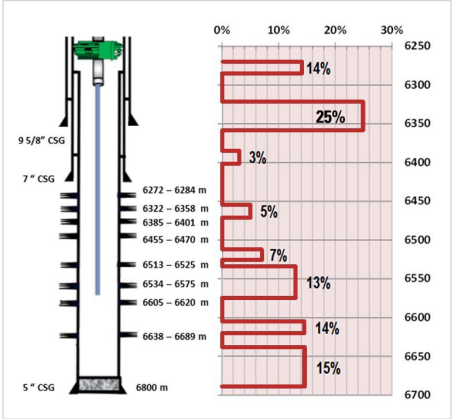


Figure 4: AccessAcid stimulation service for Well A – (a) wellbore schematic (gross interval ~1368 ft, net perforations ~650 ft), (b) Optimized acid fluid distribution after four diversion stages with AccessAcid stimulation service.

For more information, contact your local Halliburton representative or visit us on the web at www.halliburton.com

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