Halliburton’s PermStim™ fluid fracturing system is a better, cleaner, more cost-effective system than guar-based alternatives

Less residue, less damage, more production

The PermStim fluid system relies on a derivatized polysaccharide, which leaves little to no residue upon breaking. The crosslinked fluid viscosity can be controllably reduced to provide excellent regained conductivity and proppant pack cleanup. Many of the current gelling agents (guar and xanthan) used in the industry contain insoluble residues ranging from 8% to 15%. These residues can cause production to be lower than the reservoirs’ capabilities, decreasing flow rate and reserve recovery factors.

Excellent proppant suspension and transport capabilities

PermStim fluid has excellent proppant transport and suspension to effectively achieve correct and efficient placement of the proppant in the fracture. A low temperature version of the PermStim fluid provides these properties in applications from 120 to 160°F while the standard PermStim formulation enables higher temperature applications.

Now increasing production and revenue for operators across North America

PermStim fluid is being used throughout the United States and in Canada and Mexico, and is helping operators in several basins improve the efficiency of their fracturing treatments. By February 2013, PermStim fluid had been used by 29 different operators in 200 wells and over 2,500 stages. Production increases average 27% with a high of 60% production increase compared to offset wells treated with conventional guar-based fluid systems.

Real benefits make PermStim service more effective and more efficient

- Clean fluid system provides high regained proppant pack permeability
- Contains virtually none of the residue typical of guar-based fluid systems
- Instant and delayed crosslinking systems available
- Provides excellent proppant transport
- Applicable across a wide temperature range, from a low of 100°F (38°C) to providing a 30 minute pumping time at 275°F (135°C). Higher temperatures are possible when cool-down effects are considered.
- Well cleanup is improved resulting in greater effective frac length
- Sustained productivity is enhanced
- Higher regained permeability helps maximize fracture treatment cost effectiveness
- Salt tolerant – up to 7% KCl or NaCl

PermStim™ fracturing fluid system helps Magnum Hunter Resources increase production in the Eagle Ford Shale

New, non-guar, near-residue-free PermStim™ fracturing fluid reduced gel damage to the proppant pack and formation and led to a more efficient fracture system.

Overview

Sustained economic and effective post-fracture production in the South Texas Eagle Ford Shale is a process dependent on a multitude of variables. To achieve optimal well productivity there, the efficient functioning of fracture mechanics, proppant selection, and frac fluid characteristics is vital. The crucial variable of effective fracture conductivity is often negatively impacted by residual frac fluid damage.

Magnum Hunter Resources worked with Halliburton on a campaign to enhance production by utilizing Halliburton’s new low-damaging PermStim™ fluid to deliver a fracture system that would be more efficient than the conventional fracture systems in the immediate offsetting acreage. Results were dramatic. The volume of frac fluid flow back not only increased, it also came back to the surface cleaner. More importantly, Magnum Hunter experienced increased production of 14,000 BOE in the first 140 days.

Challenges and risks?

- They make sense economically given the operational challenges and risks?

Solutions

- Halliburton’s non-guar-based fluid
  - Halliburton’s PermStim™ fracturing fluid with its more robust well clean-up capabilities made it a more attractive alternative to guar-based fluid systems from both an efficiency and effectiveness perspective.

- More effective lateral treatment
  - After a fracturing treatment, broken frac fluid and hydrocarbons flow through the proppant pack back to the wellbore. The ability to regain maximum proppant pack conductivity following a treatment is necessary to obtain maximum hydrocarbon recovery.

- Optimizing completions
  - The operator had successfully optimized completions to a level where results were predictable and repeatable at 1800 BOE per day average with 20-frac stages. Rock properties, drilling, and frac parameters were all consistent. The only way to improve the process would be to change the fluid being used.

- Halliburton’s non-guar, near-residue-free system
  - Halliburton’s PermStim™ fluid provided improved protection from gel damage plus over 90% regained permeability within the fracture network. Both fluid performance and the stimulated reservoir volume (SRV) response exceeded the operator’s expectations in a short amount of time.
A CASE STUDY: Stimulating reservoir performance using new fracturing fluid technology

PermStim™
SERVICE
Fracturing with the non-guar near-residue-free fracturing fluid system.

OVER 2500
fracturing stages have been completed within the Bakken, Niobrara, Cline, Wolfberry, and Eagle Ford reservoirs in the United States, Canada, and Mexico.

3500 to 11,500 feet deep
That's the depth range PermStim fluid has been successfully utilized with bottom hole static temperatures up to 330°F.

14,000 BOE
incremental production in the 1st 140 days for Magnum Hunter in the Eagle Ford.

Tests showed broken cross-linked gels of PermStim fluid contained virtually 0% residue compared to 8 to 15% insoluble solids for broken guar-based fluid.

Halliburton’s non-guar-based PermStim™ fracturing fluid produces outstanding results for Magnum Hunter Resources in the Eagle Ford Shale

Superior performance in head-to-head competition
In collaboration with Magnum Hunter, Halliburton introduced its non-guar, near-residue-free fracturing fluid—PermStim™—into two wells. The wells soon began to outperform other wells in the area peer group as Halliburton’s more efficient fracture system lead to accelerated production.

A commonly used operation gets an uncommon infusion
The wells involved were stimulated using zipper frac operations, a methodology of an alternating fracture sequence between each well to increase stimulated reservoir volume. PermStim fluid replaced the guar-based borate system typically run for these wells. The stimulation design for each stage consisted of pumping 210,000 gallons of PermStim fluid, at a rate of 50 barrels per minute (bpm) and 30/50 and 20/40 premium white sand. SandWedge conductivity enhancer was also utilized to coat the sand. In total, more than 2.5 million lb of 30/50 and 1.75 million lb of 20/40 sand were pumped for an average of 175,000 lb of sand placed per interval and 655,000 lb of sand placed per 1,000 ft of lateral.

Early signs of positive results
The first noticeable change following the use of this fluid system was the change in frac fluid flow back volume and physical color. The PermStim fluid came back to surface as a clear brine. The conventional fluid system used in the area is a highly popular guar borate fluid system, and its flow back was recorded at a lower rate and volume. Plus the conventional fluid tended to have a “tea like” color.

Not just a cleaner system, a more valuable one too
The production slope showed that the PermStim fluid system added value to the operator’s wells. When compared to the typical type curve, the additional value delivered was ~14,000 BOE increased production in the first 140 days, and it is accelerating in value creation with time.