



MVP FRAC™ SAME PROPPANT, GREATER DISTRIBUTION

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Efforts to improve proppant transportation have always focused on modifying the fluid system. Trican has turned this on its head and looked at modifying the proppant itself.

In tight oil and gas formations, it is common to use low-viscosity water-based fluid and proppant combinations pumped at a high rate. These slick water treatments are effective, but do present some challenges. The lack of viscosity can result in poor proppant transportation, leading to increased settling or duning, and less effective proppant placement. Modifying the design of a traditional slick water treatment by adding a novel chemical to the proppant and 5%-20% nitrogen, the limitations of this type of stimulation fluid can be reduced.

The MVP Frac™ (Maximum Volume Placement) process consists of a non-energized component (Trican's FlowRider® additive) and an energized component. MVP Frac transmits a hydrophobic coating onto the proppant surface, creating an attraction to gaseous phases present in the fluid, making proppant more buoyant without increasing fluid viscosity. This easily fluidized proppant has enhanced transportation characteristics, allowing for greater propped fracture height and length, and greater overall conductivity.

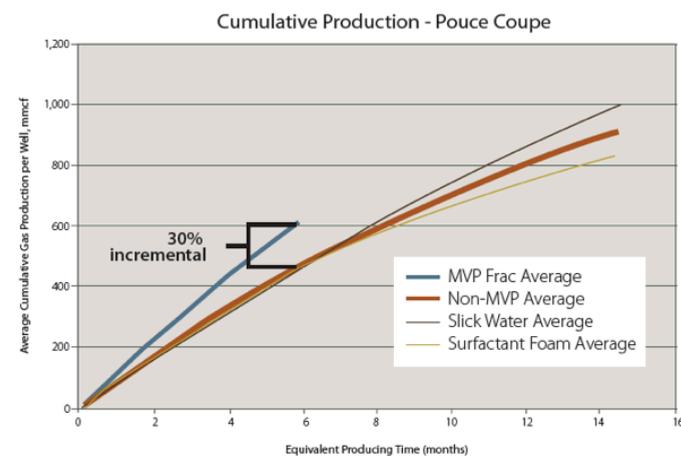
Both components help to dramatically reduce the settling of proppant that occurs during slick water fracture treatments, without affecting the viscosity of the fluid. MVP Frac also enables the customer to reduce the volume of water required to pump the treatment - by pumping higher sand concentrations made possible with enhanced proppant transportation.

Improving the performance of the slick water treatment is achieved by modifying the proppant's surface properties. A novel surfactant preferentially coats the surface of the proppant (including ceramics and resin coated proppants), causing the surface to be hydrophobically modified. The enhanced surface properties of the proppant creates an attraction between the proppant surface and nitrogen gas, in effect, surrounding the particle with a thin layer of gas and thus increasing the buoyancy of the proppant in water. These enhanced properties allow for improved proppant distribution, deeper proppant penetration within the complex fracture network, increased proppant pack volume, and increased maximum proppant concentration that can be placed. Improving proppant placement and increasing the volume that the proppant occupies within the fracture enhances the fracture network conductivity, improving the productivity of the well.

By way of example, Trican used MVP Frac in the Montney formation in Canada. Production data was collected from an operator's wells completed during 2012 and 2013, making use of three different fluid systems: nitrogen foamed surfactant water, slick water, and MVP Frac. In 2012, slick water replaced foamed surfactant as the preferred fluid system due to logistical constraints handling large volumes of nitrogen gas, and a desire to create a longer, more complex fracture network. The lack of viscosity in the slick water design is thought to have yielded less propped fracture height. In 2013, MVP Frac was incorporated to address this issue. This created a long, complex fracture network with greater propped fracture height. All of the operator's wells were equipped with comparable multistage, ball actuated liners with open hole packer isolation. A total of 33 wells were evaluated using publically available completion and production data.

Of the 33 wells, 11 were stimulated with nitrified foamed water, 10 completed with slick water, and 12 using slick water with MVP Frac.

	MVP Frac	Slick Water	Surfactant Foam	Slick Water and Surfactant Foam Combined Average
Number of wells	12	10	11	21
Average number of stages	14.3	14.9	13.6	14.2
Average total proppant pumped tonne (lb)	1,036 (2,287,000)	1,083 (2,387,600)	913 (2,013,000)	994 (2,191,000)
Average rate m ³ /min (bpm)	5.7 (36)	5.1 (32)	4.0 (25)	4.5 (28)
Average surface treating pressure MPa (psi)	41.0 (5,946)	39.5 (5,729)	46.6 (6,759)	43.2 (6,266)
N ₂ volume 1000 scm (mscf)	146 (5,165)	45 (1,598)	893 (31,541)	489 (17,282)
Average water volume pumped m ³ (gallons)	6,547 (1,729,500)	7,117 (1,880,100)	1,270 (335,500)	4,054 (1,070,900)



The wells stimulated with nitrified foam and slick water include more than a full year of production data. The MVP wells, completed more recently, include six months of data. Production has been averaged based on fluid system used and compared on time scales with all down time eliminated. After six months, the average gas production shows a 30% increase when using MVP Frac.

MVP Frac continues to be a success for Trican and its customers. In 2014 so far, MVP Frac has helped 19 Canadian customers achieve greater proppant placement in their slick water fracture treatments. Representing more than 3000 stages over 170 wellbores, MVP Frac has proven effective in creating a more conductive pathway from the reservoir into the wellbore by distributing the proppant more evenly and deeper into the fracture network. Jeff Boyer, Technical Specialist – Fracturing with Trican says, “MVP Frac has significantly improved fracture placement success while reducing water requirements. Customers are reporting enhanced production in both oil and gas formations.”

The figures below show lab samples of conventional slick water (left) and MVP Frac slick water (right). The MVP proppant pack clearly displays an increased volume compared to the densely packed sand of the conventional slick water.



settled slick water 2.5 ppg 40/70 sand



settled MVP Frac 2.5 ppg 40/70 sand

For more information about Trican's MVP Frac, contact Jeff Boyer, Technical Specialist Fracturing, jboyer@trican.ca.