

Solving HPHT completion challenges in the Duvernay

[Canada, Duvernay](#)
[Titanium XV System](#)

Background

The Duvernay is the latest emerging liquids-rich shale play in Alberta and covers a surface area of approximately 100,000 km². Best known as the source rock for the Devonian-aged Leduc Reef, Keg River and Slave Point formations, development in the Duvernay is currently in its infancy. It has drawn many comparisons to the Eagle Ford Shale in the United States due to its high liquids content.

The formation is composed of interbedded bituminous shales, calcareous shales and dense argillaceous limestones. The thickness of the formation varies, ranging from 10 m to 70 m depending on the location. Approximate depths range from 2,500 m to 4,000 m. Formation characteristics of the Duvernay are very limited; however, estimates in the Kaybob region have indicated a porosity range of 3 to 12% and permeability up to 0.01 mD. Sweet spots in the formation are yet to be determined, but will be exposed as more wells are drilled in the area. The Duvernay was once thought to be uneconomical to produce and, consequently, was largely ignored until the advent of horizontal drilling and multi-stage fracturing began unlocking resource plays.



Challenge

As operators continue to drill and complete deeper and increasingly challenging wells in emerging plays, they are relying on advances in completion technology, which can accommodate high pressure and high temperature (HPHT) ratings to perform the desired stimulation. Formations with high fracture gradients result in higher breakdown pressures, and thus the need to achieve higher treating pressures in order to effectively stimulate wells. Formation heterogeneity along the lateral can also lead to greater than expected differential pressures where each isolated zone has a different breakdown pressure to initiate a fracture. Downhole tools with higher pressure capabilities mitigate the risk of burst and collapse scenarios often encountered in zones where these conditions exist.

Solution

The Packers Plus StackFRAC® Titanium® XV system addresses the need for completion systems in wells where differential pressures above 69 MPa (10,000 psi) could be encountered. Titanium XV HPHT tools are capable of withstanding differential pressures of 103 MPa (15,000 psi) and extreme bottom hole temperatures. This was achieved through the use of an innovative metallurgical composition and premium seal technology. Higher pressure

capabilities also allow operators to increase pumping rates, lateral lengths and the number of stages to be fractured.

The Titanium XV system was developed with the same function and design as the Packers Plus StackFRAC system, which uses a continuous pumping operation to effectively stimulate isolated zones along the entire length of the wellbore. Mechanical isolation is achieved with the Titanium XV RockSEAL® II packer. A Titanium XV FracPORT™ sleeve is run in between two packers to allow specific zones of the wellbore to be selectively fractured.

In addition, HPHT tools have also been developed for the QuickFRAC® batch fracturing system to allow for limited entry stimulation in open hole completions. All Packers Plus systems are modular, allowing combination StackFRAC and QuickFRAC Titanium XV HPHT systems to be run together. This method maximizes the number of stages available while maintaining the largest ball seat size possible for coiled tubing intervention.



Results

An operator targeting the Duvernay shale in the Kaybob region completed a 25-stage well with a combination StackFRAC and QuickFRAC Titanium XV HPHT system. The system was run into a wellbore with a lateral length of 1,735 m, true vertical depth of 3,392 m and measured depth of 5,160 m. Bottom hole pressure in the wellbore was 47 MPa and bottom hole temperature was 115°C.

During the slickwater fracture treatment, the surface treating pressure and pump rate reached 69 MPa and 16.5 m³/min, respectively. Pump rates ranged from 8.2 m³/min to 16 m³/min during stimulation operations. An average of 98 tonnes of proppant and 1,000 m³ of slickwater were used per stage to fracture the well for a total of 2,440 tonnes of proppant and 25,030 m³ of slickwater.

The Titanium XV system allows the installation and stimulation of challenging wells in areas that could previously not be completed. StackFRAC Titanium XV systems have been run in shale and tight sandstone reservoirs in Canada including the Montney and Duvernay. Packers Plus is the innovator of open hole multi-stage fracture stimulation systems and is an industry leader in designing and manufacturing technology-based solutions for a variety of completion challenges.