

# Multistage Stimulation Completions



**NOV** Completion &  
Production Solutions

# Completion Tools

No matter the challenge or preferred technique, our comprehensive completion tools portfolio has the multistage fracturing technologies you need. We offer state-of-the-art solutions for openhole, cemented, sand control, plug-and-perf, and toe-prep applications.



## Who we are

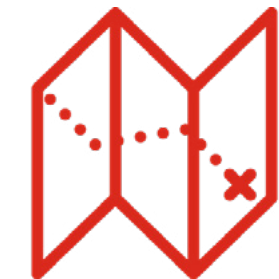
We are an innovative, reliable completion tools company focused on building successful products and long-lasting customer relationships. Our team of professionals offers the highest levels of technical and operational support to the industry—our people and products have helped us grow and adapt to the new oil and gas market. By challenging conventional wisdom and offering various solutions, we're working to outperform our competitors in the completion tools space.



## Focusing on partnerships

We're invested in our customers' success and provide high-quality service, technical solutions, customer service, and innovative technology throughout the completions market. We strive to be the first call for our customers and offer them fully integrated solutions, so they don't have to go elsewhere to find the solutions they need.

Many customers have moved to a model that deploys various completions tools providers on their wells. We offer our customers the ability to use one service company to ensure everything is compatible, and they get the best price and service quality on every well they drill.



## Forging new paths

One of our core values is purposeful innovation, and we apply this approach daily, as we develop new products and find better ways to help our customers. Whether it's our best-in-class dissolvable technologies or groundbreaking sand control systems, we're committed to bringing real change to the global market.

The driver for our innovation has always started with the customer. We listen to our customers and work through their challenges with them, which helps us get at the core of their problems. Our engineering team uses a balance of creativity and experience to challenge the status quo, developing new solutions and techniques to bring to the completions market.



## Value of time

Our highly technical sales teams are always looking to add value for their customers, and our talented personnel consistently deliver critical cost-savings solutions. We have demonstrated our ability to save our customers time and money on their projects. Whether it's a novel use for our current products or a willingness to test our products in new applications, we save our customers rig time, reduce their pumping hours, and get their wells on production faster.

**Our brochure is interactive!** For more information on any of our products, simply click on the product name throughout.

# Cemented Multistage Completions

We have designed our cemented multistage completion systems to reduce the operational time spent during hydraulic fracturing or stimulation operations. The systems yield operator cost savings while being able to establish limited entry and pinpoint fracture initiation for very efficient and reliable operations.

## i-Valve CEM system



The i-Valve™ sleeve system is a multipurpose injection, cementing, production, and stimulation valve suitable for even the most demanding high-pressure, high-temperature (HPHT) environments. It is ISO 14998/API 19AC V0 qualified up to 15,000 psi. The i-Valve CEM system is delivered with easily configurable carbide nozzles that can be installed on location before running in the hole for optimum flow control and activated through our reliable i-Shift™ shifting tool.

## i-Valve re-frac success

We have successfully deployed the i-Valve system in the North Sea since 2009. In one example, a customer restimulated a well that had been producing for seven years with the help of the i-Valve closable frac sleeve. The restimulation was only possible because the wellbore could be fully closed and isolated.

For more information see: [i-Valve 500 AkerBP case study »](#)

## Bulldog frac system



The Bulldog™ frac sleeve system is a versatile, robust means of conducting an annular stimulation. This system eliminates wellbore restrictions, allowing operators to push the limits of each treatment in unlimited stage counts to maximize productivity and recovery. The Bulldog frac sleeve is activated using our proprietary Bulldog frac BHA, which allows operators to locate, shift open, isolate, and stimulate each stage with the help of a multisets packer.

## Bulldog MOC sleeve

The Bulldog frac system has helped many operators in both single-open and multi-open/close (MOC) configurations. The Bulldog MOC sleeve was recently deployed in Russia in a packerless BHA configuration. The operation's success relied heavily on our patented MOC seal design, which allowed stage isolation to be maintained.

Through high-quality service and innovative design, we were able to complete the wells without the need for an isolation packer, thereby improving our coiled tubing reach and limiting any additional friction.

## i-Frac CEM system



The i-Frac™ CEM sleeve system is a ball-drop-activated design for cemented, openhole, multiple open/close horizontal completions. Multiple stages can be installed in a wellbore, with each stage containing one to twenty sliding sleeves to optimize completion design and maximize efficiency without intervention. Our reliable i-Frac system has the highest industry records in cemented completions and has been rigorously tested to the latest ISO 14998 /API 19AC V0 standards with options up to 15,000 psi.

For more information see: [80 i-Frac CEM sleeves record case study »](#)

## i-Frac CEM limited entry

The i-Frac CEM product line includes our fixed- and flex-seat technologies. By utilizing multiple flex sleeves, we can perform limited entry-style completions, allowing operators to fully replace their plug and perf limited-entry completions.

Perforations are known to erode throughout the stimulation, which can cause sand diversion issues that result in a poorly stimulated reservoir and a higher probability of frac hits. Our i-Frac CEM technology uses hardened nozzles that maintain their shape much better than perforations, resulting in more consistent stimulation and better sand placement.

# Openhole Multistage Completions

Our expertise in openhole (OH) solutions helps us drive value for our customers. From our best-in-industry testing to our world-class engineering and operations support, we bring high performance and value to every operation.

## Maximizing ball stages

Through rigorous testing and qualification, we can offer large stage count systems up to 92 stages. Our testing allowed us to challenge the conventional wisdom around seat geometry and ball sizing, and our research and development team is continuously evaluating new ball technology.

## Ball options include:

- Maximum stage count
- High dissolvability
- Fresh-water dissolvability
- Easy drillout
- Acid-compatible coatings

## Voyager frac sleeve



Our Voyager™ frac sleeve provides a reliable OH stimulation port without introducing any weak points to the well. We accomplished this by ensuring the burst, collapse, tensile, and torque ratings exceeded API 5CT specifications for casing. Designed to perform, our Voyager frac sleeves maintain well integrity and isolation throughout the completion operation.

For more information see: [Hybrid system reduces frac time case study »](#)

## Voyager 15XT openhole packer



When we developed the Voyager 15XT OH packer, we designed it for maximum isolation and performance. This premium, dual-element packer is tested to 15,000 psi (1034 bar) and 350°F (177°C), far exceeding API 19OH V1 requirements. In addition, high temperatures and extreme cycling cases have been conducted to exceed industry expectations.

For more information see: [First NOV Voyager 15XT case study »](#)

## Flow Lock Sub



With available high-flow rate, high-pressure, and high-temperature options, the Flow Lock Sub™ activation tool can be used to close off the annulus of the well so hydraulically activated tools can be set.

## GripR openhole anchor



Our high-capacity hydraulically activated GripR™ OH anchor is designed to ensure the forces experienced don't exceed the casing limitations during stimulation. The anchor does not restrict the wellbore, so multiple anchors can be run throughout the liner, if required.

# Advancing Frac Plugs

Our composite and dissolvable frac plugs provide the most advanced technology and robust designs for our customers, while consistently outperforming the competition through purposeful innovation.

## VapR frac plug



The VapR™ dissolvable frac plug provides reliable temporary isolation for multistage fracturing operations. A complete redesign of conventional frac plugs was key to the success of the VapR technology—the product uses 60% fewer parts while still ensuring good fluid contact is available for dissolution.

For more information see: [VapR frac plug Appalachian success case study »](#)

## VapR dissolving materials

Conventional dissolving frac plugs are based on older composite plug designs that utilize a solid mandrel, which makes poor fluid contact and does not easily dissolve. The VapR plug's unique design allows it to hold pressure throughout the stimulation while enhancing the dissolution process. The proprietary dissolvable material can be tailored to any plug-and-perf application, and our team of experts can determine the right material for your application.



## Setter frac plug

The Setter™ fully composite frac plug is our leading-edge solution for the composite frac plug market's needs. The slips and element system allow for maximum differential pressures to be reached without skidding the plug during stimulation. The slips are not made of cast iron, which improves overall milling performance, and the plug can be deployed as a standard frac plug or with the ball in place for additional fluid savings.

For more information see: [Permian Basin Setter frac plug case study »](#)

## Setting the pace

A major operator in Canada uses the Setter frac plug on all of their plug-and-perf completions. Their commitment to our product is due to the significant per-well savings they see from the faster pump-down operations. Due to its reliable design, the Setter frac plug can be pumped downhole much faster than competitors' products.

## VapR XR frac plug



The VapR XR frac plug is an extended-reach dissolvable plug that's suitable for applications where wellbore restrictions prevent the use of standard-diameter plugs. Using the VapR design as the starting point, we can supply slimmer plugs that quickly dissolve while maintaining strength during stimulation.

# Tailor Your Toe Selection

Our toe-initiation sleeves are designed for reliability and are available in any size, thread, or material. Each highly configurable sleeve is up for the challenge from even the harshest completion environments.

## Burst Port System



Due to the industry-leading atmospheric chamber technology it helped pioneer, our Burst Port System (BPS™) is one of the most successful toe-initiation tools on the market. Each BPS features multiple individual burst ports, giving it inherent redundancy and ensuring activation every time. The BPS is available in all sizes and can be installed with discs that activate up to 21,000 psi (1448 bar).

In addition to our BPS Maxx high-flow option, the BPS-iS integrated seat can be deployed in wellbores requiring full pressure-testing capabilities. Finally, we offer a fully integrated closable sleeve in the BPS MOC system.

For more information see: [Anadarko Basin BPS Maxx case study »](#)

## Multiply the injection of your toe section

One operator was having difficulty establishing enough injection to perform their first stage frac. After a successful conversion to our BPS Maxx system, which has three times the flow of our standard BPS ports, the operator was able to increase their injectivity to 96 bpm (15 m<sup>3</sup>/min).

## Defender toe valve



In areas where a high flow area and closable technology is needed, the Defender™ toe valve is the perfect fit. The Defender system uses highly configurable burst discs to activate and subsequently provides access to the formation through full-flow area slots.

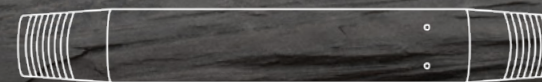
After the stimulation, a closing sleeve can be activated with our i-Shift™ shifting tools if the sleeve needs to be closed. This allows operators to close off the toe if it produces water or if an area requires waterflood operations.

## Wet-shoe sub



Sometimes, the simplest solutions work the best. Our wet-shoe sub is a combination landing collar and toe-initiation tool that allows you to bump plugs and apply additional pressure to open the toe once the cement is set. The wet-shoe sub eliminates the need for extra downhole equipment and simplifies the toe design of the wellbore.

## i-Opener TD system



Our i-Opener™ time-delay (TD) system was designed to ensure full pressure testing of the casing is possible before stimulation. The i-Opener TD system is the only ISO14998 V0 toe sleeve on the market, and our design can be run with one or two pressure-cycling stages, allowing multiple tests to be performed in each cycle.

The i-Opener single-open system is available in areas that don't require the full pressure-cycling time-delay features.

For more information see: [North Sea i-Opener TD case study »](#)

## Strong success in the North Sea

Our customer has deployed the i-Opener TD system 30 times to date, achieving 100% success with installations and pressure-cycling operations. The system's performance has led to significant cost savings for the customer over course of the drilling campaign. Additionally, the i-Opener TD system is being used as part of the well barrier, improving safety, efficiency, and reliability in their wellbore.

# Redefining Sand Control

In tight reservoirs where stimulation is needed and sand control is required, our Bullmastiff™ technology reduces the number of well interventions required and helps maintain the completion's integrity to maximize well life production. The Bullmastiff system redefines conventional sand control and inflow control devices.

For more information see: [Russian Bullmastiff frac system case study](#) »

## Allowing the formation to heal

When production flowback is initiated too soon in a well, the effects can create many issues in the formation. A stimulation treatment causes pressure to build up in the fractured parts of the reservoir, which can pull formation debris and proppant out of the reservoir when flowing back the well. Using the “open-frac-close” methodology, the formation pressure is allowed to dissipate, and the closure stresses help to lock in the proppant and debris, preventing them from migrating into the casing during production flowback.

## Bullmastiff frac sleeves



The fully ball-drop closable Bullmastiff frac sleeve uses our proprietary flex seats, meaning we can ball-drop close sleeves without losing additional ball stages.

## Bullmastiff screen



Bullmastiff screens are installed throughout the completion and remain closed during stimulation. After the well has been stimulated, an innovative and patented mill-open feature allows the screen to open during well cleanouts or shifting tool intervention, allowing the well to flow through the sand screens and preventing proppant and debris to flowback.

## Innovative new screen concept

The Bullmastiff screen sub is available with a variety of customizable screen options. It allows the control of any proppant, formation fines, or debris that may cause operational issues. The modular nature of the screens makes it easy to scale, and unlike conventional screens, the system is closed when running in, allowing full liner circulation during installation.

## Bullmastiff Maxx sleeve



The ball-drop closable Bullmastiff Maxx toe sleeve uses our industry-leading BPS™ Maxx burst ports. High-flow-area Maxx burst discs allow for improved pumping efficiency while maintaining the most reliable performance in the industry. The Maxx toe sleeve is closed after stimulation, allowing all production to be redirected to the screen subs in the first stage.

## Advancing inflow control

Our Bullmastiff screen sleeves can be installed with inflow control devices (ICD) to further enhance wellbore production, and we can deploy autonomous ICDs (ACIDs) with this innovative system. The inner sleeve protects the ICD/AICD mechanisms, allowing the well to be stimulated and converted into production mode without ever exposing the ICD/AICD to potentially harmful fluids and pressures.

# Unlimited Single-Trip Multistage Frac System

Our focus in research and development is to innovate new technologies that help operators maximize efficiency and minimize operational risk. Performing a single-trip multistage frac while in drilling mode, along with the need for a system to isolate the reservoir after fracturing allowing the formation to heal, has been an industry challenge. Our Ragnarok™ unlimited multistage single-trip frac system is here to eliminate those challenges.

## Ragnarok Bottom Hole Assembly

The Ragnarok service BHA has no packer elements, slips, or rotating components, reducing the risks of a stuck work string. It is designed with robust shifting mechanisms that are debris resistant and with a large flow area for higher stimulation rates.



## Ragnarok Frac Sleeve

The Ragnarok frac sleeve is a multi-open-close sleeve that is deployed as part of the production liner in both cemented and open-hole applications. Each sleeve functions by deploying the Ragnarok service BHA on drill pipe or coiled tubing. The sleeve is initially opened and after stimulating, closed, with only upward movement of the work string. This allows the sleeves to be reliably opened and closed in a single trip for all stages, even in long horizontal wells. The Ragnarok frac sleeve incorporates the patented i-Valve™ sealing system that is ISO 14998 V0 qualified to provide barrier-qualified isolation of the reservoir while installing the upper completion. A large inner diameter through the sleeve allows full access for future wellbore intervention operations.





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