Cemented Multistage Completion Solutions
Improve efficiency and maximize reservoir access
Traditional plug-and-perf completions are the method of choice for most unconventional operators...

but the extended lengths and complex geometries of today's wells are pushing the limits of conventional techniques.

Using composite plugs to create stage isolation for hydraulic fracturing was the first widely adopted method for stimulating shale wells. It also paved the way for the economic development of unconventional reservoirs.

In today's cemented multistage completion wells, operators need to efficiently access as much of their reservoirs as possible to keep costs low and to boost production. For many years, plug-and-perf completions using composite plugs have remained the method of choice among unconventional operators, and they account for the majority of new well completions in North America today.

Traditional plug-and-perf completions offer stage placement flexibility, provide fullbore access after plug drillout, and enable the treatment of stages as far as wireline and coiled tubing (CT) can reach.

Efficient operations and maximum reservoir contact are critical for keeping costs low and improving production.

Despite their reliable track record, plug-and-perf operations using composite plugs can be operationally complex and time consuming—especially when coordinating services from multiple providers. And the reach of intervention tools can limit plug depths.

But, with the right mix of integrated technology and field-proven expertise, you can improve efficiency and maximize reservoir access with minimal downtime, regardless of well design, reach, or preferred completion method—and with refrac in mind.
Our FracPoint™ multistage fracturing system reduces overall pumping time with quick, continuous hydraulic fracturing using ball-activated frac sleeves. After the system has been installed, cement is pumped down the annulus to isolate stages. The sleeves are then activated, using various-sized frac balls dropped from the surface as the stimulation treatment is pumped, thus eliminating the need to rig up and rig down between stages. After fracturing is complete, production can begin immediately, and our IN-Tallic™ frac balls disintegrate in the well to ensure a clear flow path without through-tubing intervention.

Stimulation of stages with composite plugs requires the rigging-up and rigging-down of wireline and pressure pumping equipment between each stage—and the addition of post-frac intervention can quickly lead to long completion times.

To accelerate the time from completion installation to production, Baker Hughes offers a comprehensive portfolio of efficient and interventionless single- and multiple-entry fracturing systems to effectively access your reservoir.

Cut frac cycle times from weeks to days with ball-activated systems

Each stage contains a predetermined number of retracting ball seats and one hard seat. When the frac ball engages each ball seat, hydraulic pressure opens the sleeve and the ball seat subsides, allowing the ball to pass through to the next seat. Once the ball lands on the hard seat and increased pressure opens the lowermost sleeve, the frac treatment is delivered through all the opened sleeves for maximum contact and enhanced reservoir drainage.

Achieve precise placement with FracPoint single-entry sleeves

FracPoint single-entry sleeves enable precision placement of fracture treatments along the wellbore. Successively sized ball seats correspond to different-sized IN-Tallic frac balls, enabling the sequential treatment of individual stages. As each stage is fractured, the ball for the next stage is dropped. Once the ball lands on seat, a set amount of pressure opens the sleeve and allows the next stage to be fractured.

Create cluster perforations with FracPoint multi-point sleeves

FracPoint multi-point (MP) sleeves mimic the cluster perforations of a plug-and-perf completion, but require 50% less fracturing time. The MP sleeves use graduated balls and ball seats to open up to five sleeves per stage with a single frac ball for increased efficiency.

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The OptiPort system features pressure-balanced frac sleeves that are hydraulically opened with a customized CT bottomhole assembly (BHA). A casing collar locator positions the BHA across each sleeve, and a CT packer provides isolation from the previous stage. The OptiFrac system uses the EasyCut™ sand jet perforating tool to create abrasive perforations, and isolation is achieved using either sand plugs or a packer.

Integrated into the OptiPort and OptiFrac BHAs, the EasyCut sand jet perforator doubles as a circulation port, providing a secondary flow path down the CT to enable real-time bottomhole pressure monitoring. Data gathered during fracturing operations allows operators to optimize frac treatments on the fly and to reduce the risk of screenouts. And if a screenout does occur, operators can recover quickly by circulating through the CT.

The total volume of fluid is minimized with OptiPort and OptiFrac systems, because pumping is shut down between stages. And, for added operational efficiency, the systems provide fullbore access without the need for post-frac intervention.

Real-time data monitoring and analysis enables more aggressive frac treatments while reducing the risk of screenouts.

Maximize pumping efficiency and reduce downtime with coiled-tubing-activated systems

OptiPort™ and OptiFrac™ CT-activated multistage fracturing systems enhance reservoir contact through an extended number of stages while maximizing operational efficiency. Precisely placed single-entry fracs enable targeted fracturing and give operators better control over fracture growth while using less fluid and less horsepower than standard completion methods.

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Eliminate post-frac milling operations with interventionless plugs

The SHADOW™ series frac plug is a permanent millable plug designed to be left down hole during production, completely eliminating the plug drillout phase of plug-and-perf completions. The plug features a large flow-through inside diameter (ID) and uses IN-Tallic disintegrating frac balls so production can flow with the plugs in place, shaving days off of completion times, and eliminating the cost and risk associated with CT intervention.

Historically, intervention has been unavoidable in plug-and-perf completions. Last year alone, operators set over an estimated 325,000* frac plugs in North American wells and spent more than 42,000** days milling them out before production could begin.

SHADOW frac plugs are run in hole on wireline and are set along the lateral section of the wellbore to isolate stages for treatment, just like composite plugs. And the initial reservoir entry point is created using our pressure-activated Alpha™ sleeve rather than a perforating gun run in on a CT assembly. After all stages have been perforated and fractured, the plugs stay in the well and production can be turned on—without intervention and with no reduction in production volume.

When traditional composite plugs are run in the well, they can only be set as far as CT-conveyed milling tools can reliably operate, which is typically only 6,000 ft (1829 m). Because SHADOW plugs stay in the well, they can be set in horizontal sections deeper than the reach of CT, allowing you to access more of your reservoir. And, you can extend your plug-and-perf operations to more remote developments that previously would have been limited by the accessibility of intervention equipment.

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Access longer laterals and more of your reservoir without sacrificing efficiency

In unconventional wells, increasing reservoir contact in productive formations improves initial production and enhances ultimate recovery. For this reason, drilling extended horizontal wellbores has become commonplace, but traditional systems are limited in their lateral reach and treatment flexibility. They also lack the efficiency required to keep completion costs down when fracturing a large number of stages.

**MULTIPLE ENTRY**
As a stand-alone system, cemented FracPoint MP sleeves can create multiple entry points along the length of an average wellbore. But if you want more access using cluster perforations, we have several hybrid solutions that can increase reservoir connectivity:
- Installing cemented FracPoint MP sleeves at the toe of the lateral and using SHADOW frac plugs at the top, for a solution that does not require post-frac intervention
- Setting QUIK Drill™ composite plugs above cemented FracPoint MP sleeves or SHADOW frac plugs to eliminate CT requirements at the farthest depths

**SINGLE ENTRY**
If you prefer the precision of single-entry fracs, you can treat an extended number of stages in one operation with OptiPort sleeves, or you can run OptiPort sleeves with other isolation solutions to access even longer laterals.

OptiPort sleeves can be run above ball-activated FracPoint single-entry sleeves, or above SHADOW plugs with a single set of perforations, for controlled entry in long horizontals.

With Baker Hughes cemented completion solutions, you can maximize reservoir access, and our optimized systems allow you to maintain or improve efficiency during fracturing, even in extended-reach applications.

Design the optimal completion and stimulation program. Streamline operations.

When you have a reservoir-driven completion and stimulation design, you can maximize initial production rates. And when you work with an experienced service provider that has a comprehensive portfolio of solutions ranging from virgin reservoir analysis to refrac planning and execution, you can ensure efficient operations—and improve recovery factors.

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**StageWatch™ fracture analysis services** help retrieve and assess well data to build more effective wells. Using cost-effective sensors during the fracturing process provides vital data about your well, the formation, the reservoir, and the extended field. This enables proper planning for future wells, effective re-fracturing strategies, and data-driven completion designs that increase production and ultimate recovery, all while lowering operational costs.

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