MaxForce® Flow Ultra-Kleen Gun System delivers unsurpassed flow area with lowest gun debris in the Gulf of Mexico

Gun system meets client’s expectations at extreme downhole pressure greater than 21,000 psi (1,448 bar)

Location: Gulf of Mexico

**Overview**

A Gulf of Mexico operator with a challenging deepwater, high-pressure well needed a perforating system that could perforate bottomhole pressure greater than 21,000 psi (1,448 bar) at a depth of more than 30,000 ft (9,144 m) TVD. Because of the extreme well conditions, a standard gun system was not an option. The operator was concerned about the dynamic transient load that a gun system might exert on their completion string during the perforating event; thus, the selected gun system could not exceed the pressure limitations of other downhole tools and equipment, nor compromise the ability to perform a successful frac-pack operation. Through close collaboration with Halliburton, the operator selected the innovative 6¾-in. 18-SPF Big Hole MaxForce® Flow Ultra-Kleen Gun System, designed with Dynamic Transient Control, because of its maximum flow area and limited debris. The gun system performed as designed, preventing shock loading from dynamic transient forces and safeguarding the completion and tubing-conveyed perforating string for future frac-pack operations. Debris was kept to a minimum, and the entire operation was completed with no nonproductive time (NPT) or safety issues, meeting the customer’s expectations.

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<td>With its bottomhole pressure greater than 21,000 psi (1,448 bar) and perforation depth at more than 30,000 ft (9,144 m) TVD, the operator was concerned about exceeding pressure limitations and the dynamic loading of other tools and equipment downhole during perforation event.</td>
<td>The 25,000 psi (1,724 bar) 6¾-in 18-SPF Big Hole MaxForce Flow Ultra-Kleen Gun System was utilized. This system was developed for optimum performance in deepwater and high-pressure wells, and designed with Dynamic Transient Control to address dynamic loading concerns.</td>
<td>The gun system performed as designed to prevent shock loading from dynamic transient forces during perforation event, safeguarding the completion and tubing-conveyed perforating string.</td>
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<td>Operator required a gun system that would produce maximum flow area and, at the same time, be debris free to enhance and ensure the frac-pack operation could be completed without NPT.</td>
<td>The MaxForce Flow Ultra-Kleen Gun System was selected for its delivery of the maximum flow area and lowest debris in the industry, ensuring the best environment for frac-pack completions.</td>
<td>Confirmation of the bottomhole assembly (BHA) was done upon retrieval from the wellbore. No incidents (i.e., sticking, bending, etc.) occurred. No debris was spotted on the shakers. The entire job was completed successfully as designed with no NPT or safety issues.</td>
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Extreme conditions no match for the MaxForce® Flow Ultra-Kleen System

A Gulf of Mexico operator, facing a deepwater high-pressure well challenge, needed a perforating solution to perforate at bottomhole pressure greater than 21,000 psi (1,448 bar) at a depth of more than 30,000 ft (9,144 m) total vertical depth (TVD). Under these extreme downhole conditions, standard perforating solutions were not an option. The operator was concerned about the dynamic transient load that a gun system could exert on its completion string during the perforating event. The perforating system could not exceed the pressure limitations of other downhole tools and equipment. The operator also needed a gun system that produced maximum flow area and limited debris that could cause operational issues during the frac-pack operation.

The operator approached Halliburton for a solution. The Halliburton Global Engineering and Technology team designed and modeled a unique solution to meet these challenges. Halliburton’s innovative 6¾-in. 18-SPF Big Hole MaxForce® Flow Ultra-Kleen Gun System, designed with Dynamic Transient Control, was the solution. The gun system is rated to 25,000 psi (1,724 bar) and 425°F (218°C). It was designed for optimum performance in deepwater and high-pressure wells, allowing Halliburton to perforate the well within the limits of operator’s requirements. With a confirmed official API 19B Section 1 and 5 Test, the MaxForce Flow Ultra-Kleen Gun System leads the industry both in hole size and lowest debris. It delivers a high-flow area of 13.04 sq. in./ft, in a 9 7/8-in 62.8 lb/ft Q-125 casing test, and lowest debris of 16 g/ft, which allows for the best frac-pack completion. The gun’s system design prevents shock loading from dynamic transient forces during the perforation event, which protects the completion and tubing-conveyed perforating string.

The perforated interval was from 30,710 ft (9,360 m) to 30,815 ft (9,392 m) MD, and had a temperature of 245°F (118°C) and pressure of 21,174 psi (1,460 bar). The MaxForce Flow Ultra-Kleen Gun System fired and functioned successfully. After the guns fired, the well was monitored and reversed out. No debris was spotted on the shakers. The sump packer was retagged at the exact original tag mark on the pipe. With no indication of movement and fill, the gun was pulled out of the hole. The completion and tubing-conveyed perforating string were retrieved to surface with no incidents (i.e., sticking, bending, etc.), with physical confirmation of all shots fired and minimum lost debris as designed. The entire job was also completed with no nonproductive time (NPT) or safety issues.

Through effective communication and planning with the operator, the job was successfully executed as proposed. The MaxForce Flow Ultra-Kleen Gun System successfully perforated the well under these extreme conditions, while meeting all the client’s expectations and addressing all their concerns.