DATA SHEET

HALLIBURTON

PERFORATING SOLUTIONS

G-Force® inclined perforating system

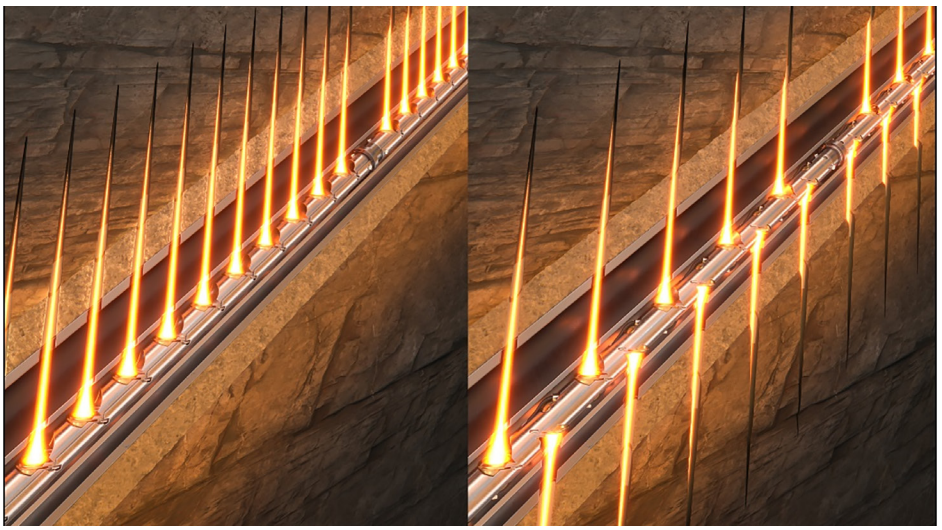
Unique solution to orient perforations in true vertical position in deviated wellbores

FEATURES

- Customized gun design directs shaped charges, positions shaped charges at an angle relative to gun body to align the perforations in the true vertical direction, even in a deviated wellbores
- Uses industry leading G-Force® system platform with unmatched run history
- Orienting mechanism contained within the gun carrier, unaffected by potential restrictions in the completion string or wellbore debris
- Can be run through tubing to orient in casing
- Does not require fin tandems, eccentric tandems, or swivel subs
- Gun assemblies can be centralized in the casing
- No external weight bars required, which eliminates gaps between loaded sections and lost shots
- Gun orientation can be verified after gun retrieval

BENEFITS

- Unique capability to orient perforations in the true vertical plane in deviated wells (~45 or ~60°)
- Incorporates all the benefits of the G-Force® system for internally orientated guns:
- Increased orientation accuracy range of ± 5°
- Can be deployed on coiled tubing, wireline, slickline, or jointed pipe



0° and 0 to 180° G-Force® inclined gun systems at a 45° well deviation

Overview

Typical orientated perforating systems are designed for use in horizontal wellbores. The shaped charges exit the gun perpendicular to the gun body and therefore the wellbore. This aligns with the plan of maximum stress and reduces sand production. To achieve true vertical perforating in deviated wellbores (opposed to horizontal), an alternative perforating solution that allows charges to exit the gun at an inclined angle is necessary.

Halliburton addressed this challenge with the G-Force® inclined gun system. Using the industry leading orientated G-Force® perforating system platform as the design basis, the G-Force® inclined system incorporates a unique charge tube and charge securing design to angle the perforations into the true vertical direction for both 45° and 60° deviation wellbores. Two shot phasing options are available — 0° and 0° to 180°— dependent on the perforating objectives and deployment type.

The G-Force inclined system incorporates all the design benefits of the traditional G-Force system, to include an orientation accuracy of ±5°, reduced dead-space between guns, and an orienting mechanism unaffected by potential restrictions in the completion string and wellbore conditions.

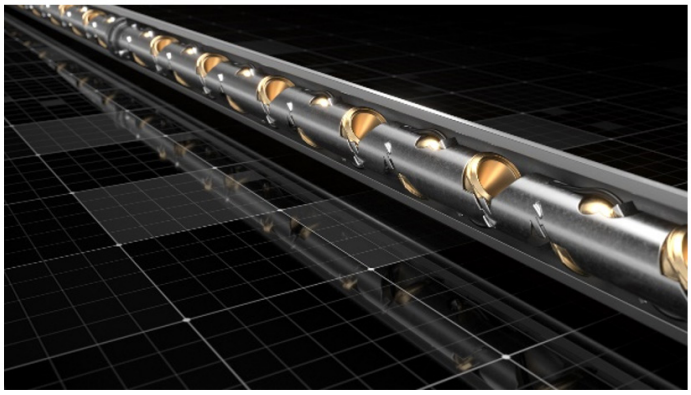
Challenge

North Sea

A North Sea operator wanted to reduce risk in offshore well completion using an optimized oriented perforating technique to minimize sand production and eliminate the need for costly sand-control completion equipment. The depleted reservoir conditions increased the likelihood of sand production, which could result in the operator reducing the production rate later in well life, and thus erode value. The 59° well deviation proved to be a challenge because traditional orientated perforating techniques would not perforate in the true vertical direction (plan of maximum stress); so, a new approach was required.

Halliburton used a 3 1/8-in., 0° phased G-Force® inclined gun system, designed to operate at this specific well deviation. The gun system was deployed on drill pipe in a tubing-conveyed perforation (TCP) shoot-and-pull operation. Quick torque connectors (QTCs) were used to avoid personnel in the red zone, reduce operational risk, and increase efficiency.

The custom G-Force inclined gun system worked as designed, and successfully perforated the well. Initial results validated the theory that true vertical perforating could be achieved to reduce sand production. No significant shock hazard occurred during perforation. The well now produces as expected at a continued production rate with zero sand production.



G-Force® inclined gun system specifications

GUN OD (IN.)	SPF	PHASING (°)	WELL INCLINATION (°)	CHARGE TYPE	POST SHOT WELL OD (IN.)	PRESSURE RATING (IN.)	TENSILE RATING (LB)	NOMINAL LENGTHS (FT)
3 1/8	4	0	45	175 MaxForce HMX 175 MaxForce HMX RD 175 RockJet HMX 175 Millennium-II HNS	3.34 (air)	19,000	148,000	7.8, 15, 22
			60					
		0 to 180	45		3.40 (air)			
			60					

For more information, contact your local Halliburton representative or visit us on the web at www.halliburton.com