210 MaxForce®-FRAC

Perforating charges traditionally have been designed for natural completions, which focus on depth of penetration with little regard to hole size and consistency. Oil and gas reservoirs, including unconventionals, that require stimulation to be productive, benefit from consistent hole size to improve fracture placement.

Halliburton's MaxForce-FRAC is an engineered charge that addresses perforating for stimulation. The charge is designed to maximize hole size performance while maintaining entry hole consistency in the casing regardless of the gun's azimuth orientation and standoff.

Benefits

- Provides hole size consistency without centralization
- Ensures even distribution of fracture pumping pressure
- Highly suited for ball seal applications
- Designed for stimulation or injection wells
- Improves injection rates
- Reduces treating pressures
- Increases flow efficiency

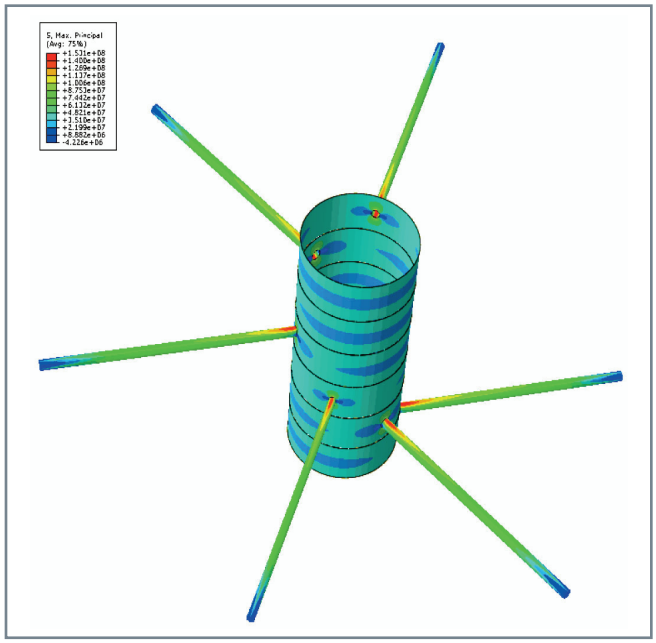
Features

- Compatible with industry-standard perforating guns
- High-pressure systems available up to 25,000 psi (172.4 MPa)

Modeling

Advanced fracture simulations using finite element analysis support the performance improvements demonstrated by consistent hole sizes and observed during extensive field testing.

Results show that if the variation of the entrance hole diameter of the neighboring perforation tunnels is too large, then the fracture can initiate at the edge of the larger holes, leaving the smaller hole diameter perforations less effective during stimulation. Halliburton's MaxForce-FRAC charge provides less variance of the entrance hole diameters compared to conventional deep penetrating (DP) and good hole (GH) charges, thus improving pressure distribution, even treatment of perforations, and stimulation efficiency.



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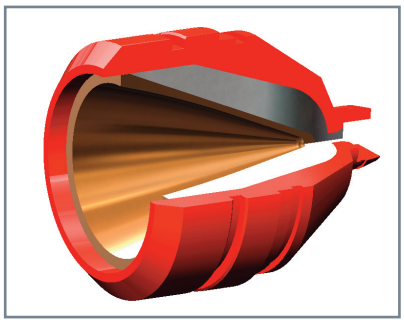
Sample results from FEA model. Ideally, the average hole size that is published would be the result at every phase of the gun, but in the real world it varies significantly. The local maximum principal stress is always on the surface of the perforation tunnel near the entrance, so the entrance hole diameter is the dominant parameter in fracture initiation, not the tunnel length.



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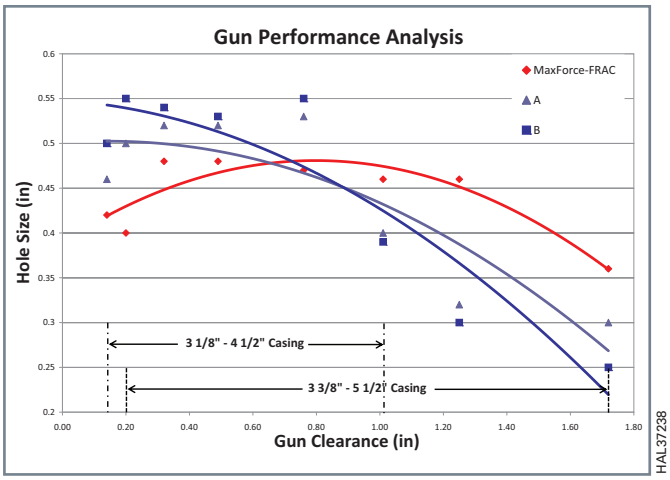
MaxForce®-FRAC

Hole Size Consistency (% Standard Deviation)*		
Charge	3-1/8 in. System	3-3/8 in. System
MaxForce-FRAC	10.9	25.6
A	24.7	57.1
B	28.8	75.0

*(Maximum – Minimum /Average Hole Size) x 100



Hole Size vs Gun Clearance of MaxForce-FRAC compared to competitor charges A and B

Case Histories

Martin County, Texas, USA

Using the new 210 MaxForce-FRAC charge in a 3-3/8 in. 6 spf 60° gun system, an operator increased injectivity by 20% during a stimulation treatment compared to the same cluster, hole density, phasing, and GH charge used previously.

Reagan County, Texas, USA

The new 210 MaxForce-FRAC charge was thoroughly and independently evaluated over 15 separate frac stages to comparable offset wells perforated with an industry-available GH shaped-charge perforating system. The MaxForce-FRAC charge consistently demonstrated lower treating pressures at the same pump rate, or 8-10 percent higher pump rate at the same treating pressure.

Charge Specifications

210 MaxForce-FRAC								
Gun Size (in.)	**Explosive Type**	**JRC P/N**	**Gun Type**	**Maxium Shot Density (per ft)**	**Explosive Mass (gram)**	**Casing Size Tested (in.)**	**Average Exit Hole Diameter (in.)**	**Hole Size Variation (percent)**
3-1/8	RDX	102045430	HSC	6	21.0	4-1/2	0.46	10.9
3-3/8	RDX	102045430	HSC	6	21.0	5-1/2	0.43	25.6
3-1/8	HMX	102127122	HSC	6	21.0	4-1/2	0.49	8.2
3-3/8	HMX	102127122	HSC	6	21.0	5-1/2	0.45	33.3

For more case histories or additional information, please contact your local Halliburton Business Development Representative.

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