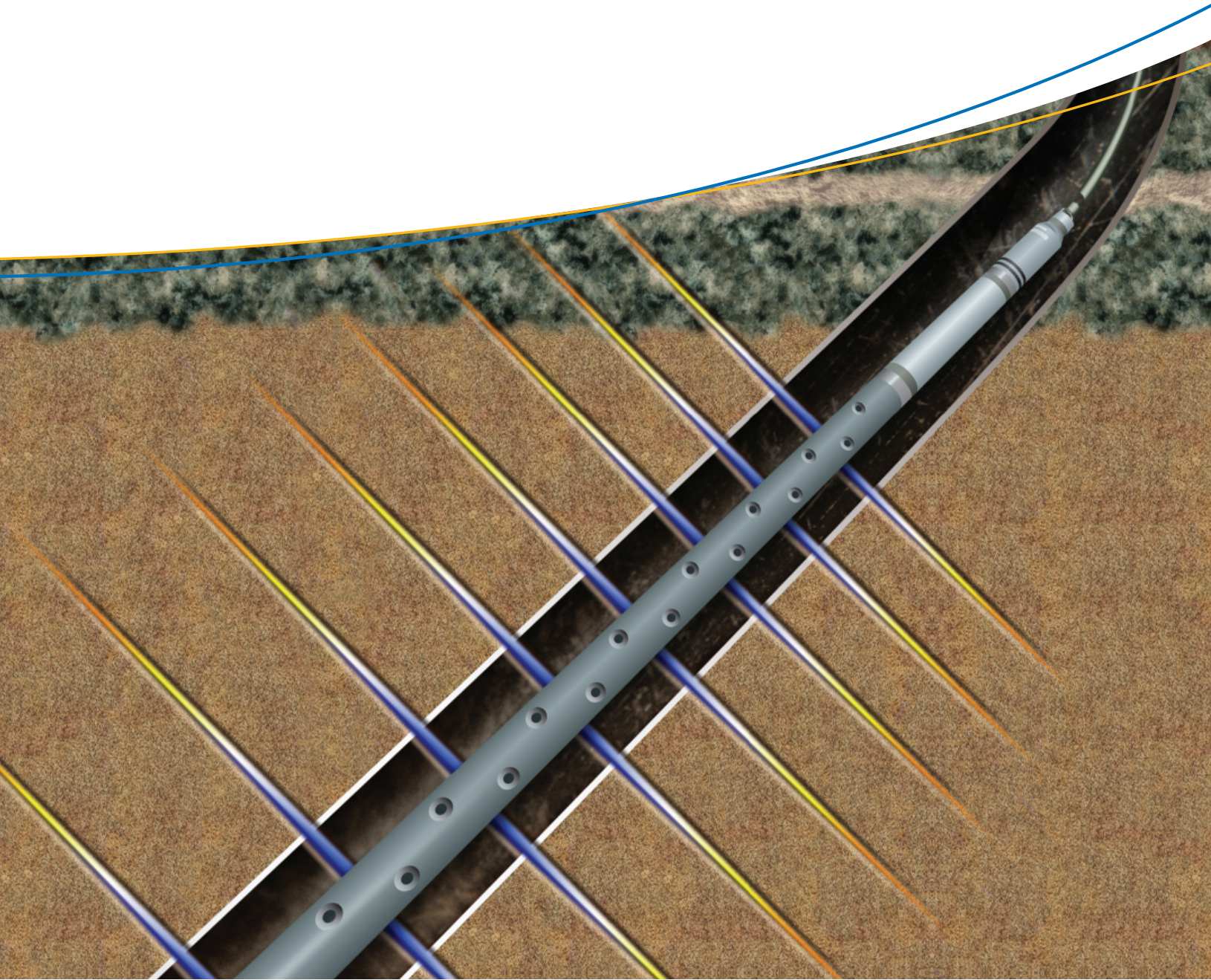


Predator XS Perforating Charges

Engineered Perforations for Natural Completions
and Stimulation Success



Advancing Reservoir Performance

Predator XS Perforating Charges

Predator XS Charges – Engineered for Natural Completions and Stimulation Successes

A properly designed and executed stimulation job can often make the difference between a marginal well and a successful commercial producer. The Baker Hughes Predator XS™ shaped charges provide the optimum perforating results for successful stimulation jobs. These new charges also serve as excellent premium perforators for wells with minimal near-wellbore damage.

Engineered Stimulated Completions

Completion objectives including perforating techniques should be determined early in the planning phase. Underbalanced or overbalanced perforating, shot density, perforation lengths, and entry-hole sizes all play a critical role in the success of a stimulation job. An ideal entry-hole diameter, in combination with perforation length, are key elements when designing and executing a stimulation. Too small of a perforation leads to excessive pumping friction and shear, thus increasing horsepower needed to break down and treat the formation. Predator XS charges meet the required perforation criteria to fit most design requirements for successful stimulation results.

The correct concentration of properly sized proppant is crucial when trying to establish optimum production in a given zone. Figure 1 shows that stimulation treatments involve selecting entry-hole diameters to match the desired proppant sizes and concentrations. Predator XS charges were engineered by our scientists to give an optimum hole size and perforation depth to best facilitate stimulation operations.

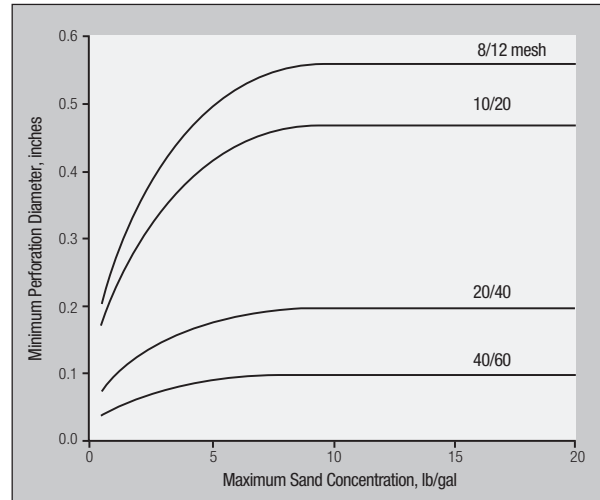


Figure 1 – Minimum perforation diameter vs. proppant size and concentrations. (Gruesbeck, C. and Collins, R.E., in Particle Transport through Perforations, in SPEJ (Dec 1982) 857-65).

Predator XS perforating charges were developed to generate larger diameter perforations than shaped charges optimized for maximum formation penetration, yet still provide substantial penetration to bypass near wellbore damage.

- Large perforation and formation tunnel diameters reduce pumping friction and shear, which effectively maximizes the horsepower available for perforation break-down.
- Engineered “right-sized” perforation diameters reduce the risk of proppant bridging.
- Increased penetration over traditional “big hole” perforating charges bypasses near-wellbore damage from drilling and cementing operations.

The list below denotes the entry-hole sizes and perforation lengths of four Predator XS systems:

- 3 3/8-in. Predator XS charge 6spf, 60° phasing EHD avg. = 0.53 in. TTP avg. = 22.7 in.
- 3 1/8-in. Predator XS charge 6spf, 60° phasing EHD avg. = 0.42 in. TTP avg. = 25.9 in.
- 2 7/8-in. Predator XS charge 6spf, 60° phasing EHD avg. = 0.37 in. TTP avg. = 21.1 in.
- 2-in. Predator XS LS charge 6spf, 60° phasing EHD avg. = 0.34 in. TTP avg. = 10.5 in.



Natural Completions Using Predator XS Charges

When minimal wellbore damage is present, the performance of the Predator XS charges is sufficient for natural completions. Well Evaluation Module modeling (Figure 2) illustrates the performance of the Predator XS charges compared to other similar or greater hole size gun systems registered with the API. The engineered perforation geometry of Predator XS charges reduces the restrictions through the perforations – enabling higher production rates. This enhanced flow area, in combination with Predator XS perforation lengths, make it a good choice for wells with minimal damage.

Bypass Near Wellbore Damage in Natural Completions

Figure 3 – This scaled diagram illustrates the performance level of Predator XS perforating charges (middle) compared to the Predator XP (top) and Predator FP perforating charges (bottom) available for a given gun size. The Predator XS offers “right-sized” perforation diameters needed for successful stimulation, while still providing substantial penetration to bypass any near-wellbore damage.

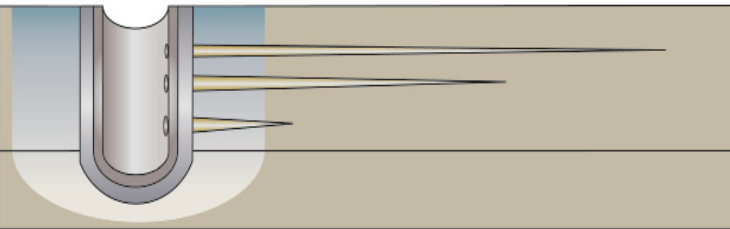


Figure 3 – Different performance systems offered by Baker Hughes

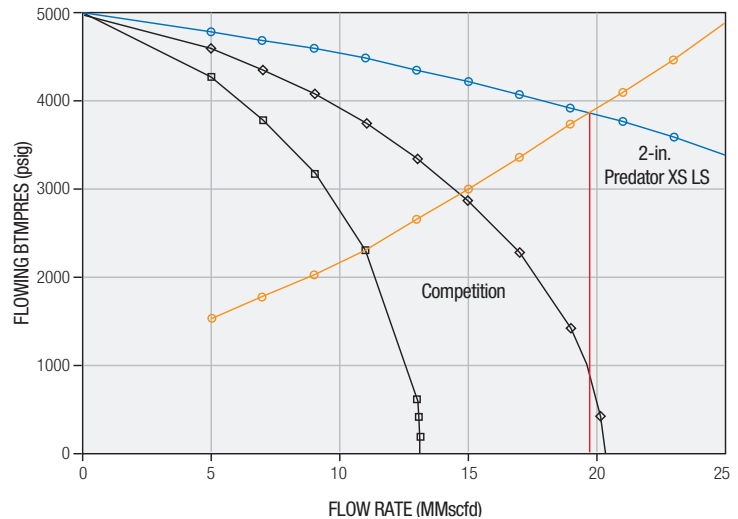
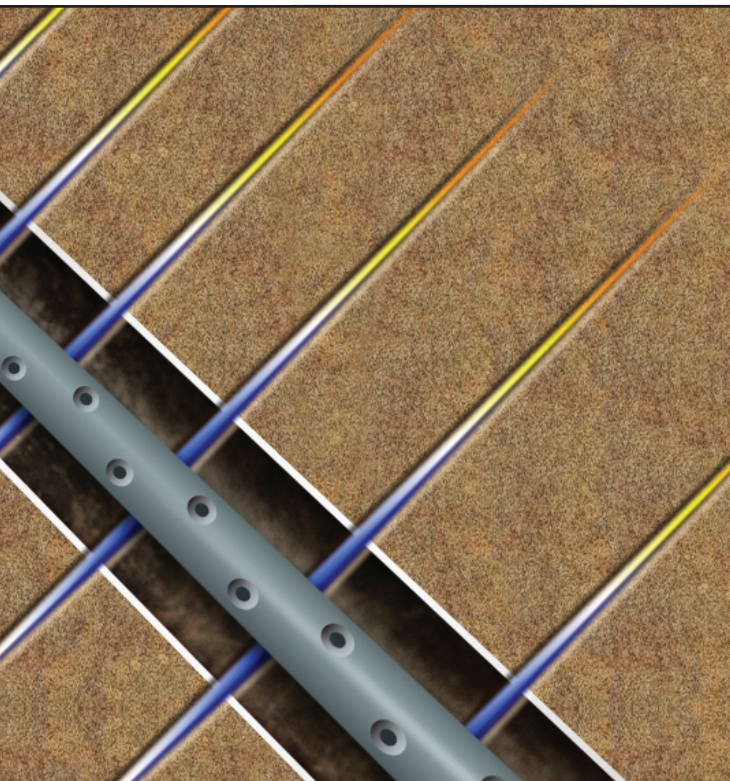


Figure 2 – WEM, Well Evaluation Module by P.E. Moseley and Associates predicts well performance using the 2-in. Predator XS LS charge, compared to competitor charges.

Predator XS charges are engineered and manufactured to exacting specifications and are in conformance with the Baker Hughes ISO 9001 Certification. Predator XS perforating charge performance is verified through witnessed testing and certification in accordance with the rigid requirements of API RP-19B, “Recommended Practices for Evaluating Well Performers.”



Applications

- Mixed loading with Predator XP charges to support natural completion followed by frac completions
- Used in wireline, tubing-conveyed, coiled-tubing, and slickline perforating operations
- Compatible with advanced perforating solutions and advanced deployment systems including:
 - DUO™ – Dynamic Underbalance Optimization
 - StimGun® Propellant-Assisted Perforating
 - HOPS™ – Horizontal-Oriented Perforating System
 - SGS™ – Stackable/Retrievable Gun Deployment System
 - J-Gun™ – J-Gun Brake for management of gun shock and long-interval wireline deployments



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