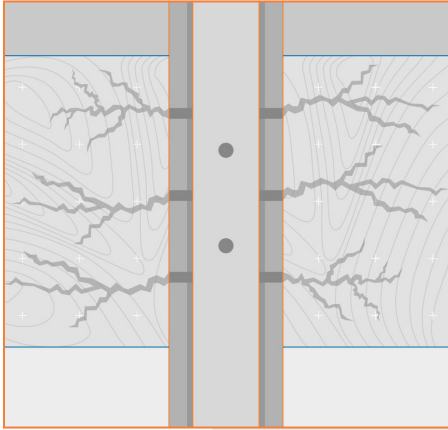


# CASE STUDY



## California Operator Improves Frac Performance and Reduces Cost with Kraken Technology



### Pre-frac treatment

- Lowers completion cost and improves frac performance
- Breaks down formation, reduces treating pressure
- Creates fractures in the preferred plane

### Project Challenge

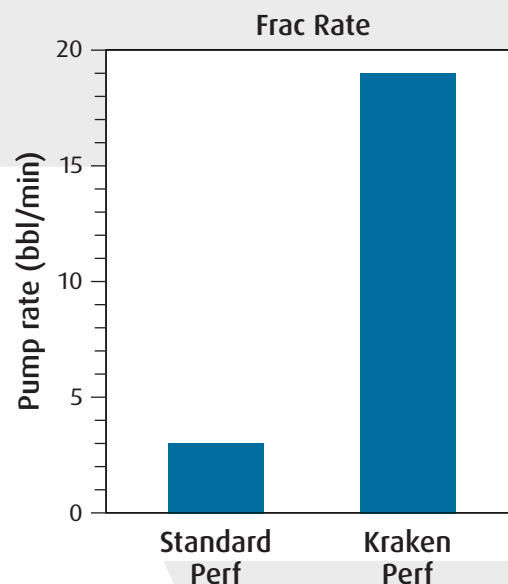
An operator in California routinely fracs their vertical diatomite injection and production wells due to the reservoir's extremely low permeability. The wells are all completed with 5½-in. intermediate casing and 7-in. production casing. They have a lot of difficulty initiating the fracs because they are not able to get good communication to the reservoir via standard perforating through two strings of casing. The operator said, "The typical response in the past would be very high pressures and very low rates, 3 to 5 barrels per minute, too low to run an X-link system. We had to reperfurate 75% of the time, which added time and cost to our treatments."

### Kraken® Frac Solution

The operator used Enhanced Energetics' Kraken propellant-boosted perforating, and the frac was pumped at much higher rates (15 to 19 bbl/min).

The operator commented, "Many are familiar with the Kraken guns we are using in the injectors. They create a hole and then blast behind it to clean out the perforations. We explained to the Halliburton frac engineers on location that this was a huge improvement over past work. As in previous uses of the Kraken gun, as soon as the proppant touched the perforations the pressure fell and the stage was completed without issues."

"This methodology will be incorporated into a Kaizen, and the future improvement will be to use the Kraken gun and a Select Fire™ system." —Operator



### Application

Pre-frac (production well)

### Interval

712–998 ft

### Formation

Diatomite

### Location

Kern County, CA

### Porosity

25%

### Permeability

0.01–2 mD

### Skin

Unknown

### Gun design

3⅛-in. Kraken perforating gun

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# Better Treatments with Kraken Perforating Guns



The Kraken® propellant-enhanced perforating gun is designed to overcome the reservoir damaging effects of conventional perforating gun systems. The propellant boosters inside the Kraken gun are based on the same progressively burning propellant technology used in our GasGun® stimulation tools. Progressively burning propellants have been proven by independent research to be many times more effective in creating fractures than competitor solutions.

## Benefits

- Perforates and stimulates the reservoir in one trip
- Creates multiple radial fractures extending 1 to 5 ft past the perforation tunnels.
- Removes skin and cleans up the wellbore damaged by perforators, drilling fines, cement, mudcake, etc.
- Prepares the well for hydraulic fracturing by breaking down the formation first with the Kraken gun. Treating pressures are often dramatically reduced, flow rates improved, and the effects of tortuosity minimized.
- Improves the effectiveness of acidizing by fracturing first with the Kraken gun.

## Features

- Compatible with shaped charges that create a 0.42-in. or larger entrance hole.
- 4-spf standard shot density; can be customized from 1 to 4 spf.
- 60-degree standard shot phasing; can be customized upon request.
- Compatible with simultaneous or select fire systems.
- Conveyed via wireline, pumpdown, TCP, coiled tubing and tractor



Nominal OD	3.125 in. [79 mm]
Maximum shot density	4 spf [13 spm]
Maximum pressure	20,000 psi [138 MPa]
1-hr temperature rating*	280°F [138°C]
10-hr temperature rating*	260°F [127°C]
Recommended detonating cord	80 grains/ft
Typical gun swell	3.48 in. [88 mm]

\*Exceeding maximum temperature ratings can result in unintentional detonation.

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