

**B E S T
I N C L A S S**

Introducing a New Team of High-Performance, Water-Based Frac Fluids



The best fluids for every formation and regulatory environment



Baker Oil Tools

The Best Team of Frac Fluids for Increasing Production or Water Injection Rates, Decreasing Drawdown, and Eliminating Sand Control Problems

A Highly Experienced Team with Exciting New Players and Unique Capabilities

In global production operations, the rules of the game are changing. Environmental regulations continue to raise the bar for combining performance with benign environmental effects. It's easy to engineer high-performance frac fluids if you can disregard environmental consequences. The far greater challenge is to engineer frac fluids that exceed both the performance and environmental demands made by today's global production operations and the regulations that govern them.

Baker Oil Tools has done this several times with an unsurpassed team of fluids customized for a wide range of performance and regulatory requirements. For example, game-changing B⁹ Emerald FRAQ™ fluid maintains superior stimulation performance meeting drilling fluid toxicity standards and the oil and grease discharge standards of < 29 mg/l Hexane Extractable Material (HEM) as established by 40 CFR (Code of Federal Regulations), Part 435 for Oil and Gas Extraction Point Source Category, for offshore operations.

The SurFRAQ™ and Diamond FRAQ™ Visco-Elastic Surfactant (VES) fluids are two more examples of Baker Oil Tools frac fluids with unique performance properties. Both systems are non-ionic, which is a critical factor in sandstone or carbonate reservoirs. This minimizes the risk of altering the formation's water-wetness and degrading production rates, which can only be repaired by costly remedial chemical treatment.

This team of fluids gives you the ability to bypass wellbore damage and overcome high permeability, low fluid efficiency formations that restrict the building of proppant packed-width. These fluids create the geometry and width for proppant placement past the damaged zone. Our team's record speaks for itself. It's the result of having the right players for every situation in the game.

The Baker Oil Tools' Frac Fluids Team

B⁹ Emerald FRAQ™

Baker Oil Tools B⁹ Emerald FRAQ fluid sets a new environmental standard for the industry while providing the required fracturing stimulation fluid performance characteristics.

The B⁹ Emerald FRAQ fluid is an advanced, second-generation frac-pack and fracturing stimulation fluid designed to have a low, benign environmental impact. Three benchmarks were set for the fluid to meet: oil and grease content < 29 mg/l HEM, low toxicity, and biodegradability. The fluid formulation meets the same applicable oil and grease standard of 40 CFR, Part 435 of < 29 mg/l HEM, tested by EPA 1664, Revision A, as the Emerald FRAQ™ fluid for well treatment, completion, and workover fluids. Plus the B⁹ Emerald FRAQ fluid meets the 40 CFR, Part 435 for water-based drilling fluids and associated drill cuttings toxicity standard, and the Organization for Economic Co-operation and Development (OECD) guidelines for biodegradability at the point of manufacture.

The 40 CFR for facilities located beyond three miles from shore, does not specify a toxicity standard for well treatment, completion, and workover fluids, but it does for water-based drilling fluids. In keeping with the spirit of the regulations, the B⁹ Emerald FRAQ fluid was developed to meet the toxicity standard for water-based drilling fluids. This standard requires a minimum 96 hours LC₅₀ of the Suspended Particulate Phase (SPP) toxicity test to be 3% by volume. This test was modified to test the frac fluid, and the B⁹ Emerald FRAQ fluid met the standard with the test results presented below.

The 40 CFR does not specify a biodegradability standard for well treatment, completion, and workover fluids. Therefore, the biodegradability tests were conducted according to OECD guidelines which require < 60% in 28 days which the fluid met.

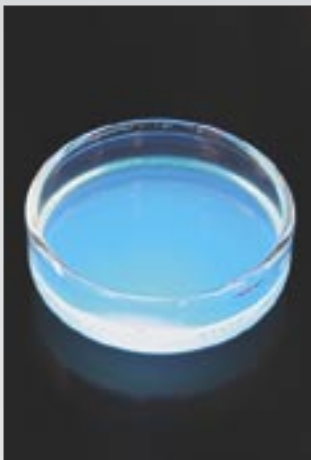
The B⁹ Emerald FRAQ system consists of a low-residue guar polymer crosslinked with borate ions specifically designed for offshore frac-pack treatments. The polymer can be used in concentrations from 25 to 50 lb/1,000 gallons (3 to 6 kg/m³) depending on formation temperature, permeability, and pump time. Lower polymer loadings along with the low-residue polymer minimize damage to the formation and proppant bed. Crosslink times can vary from instant to as much as ten minutes depending on well-treatment requirements.



B⁹ Emerald FRAQ™
offshore frac fluid



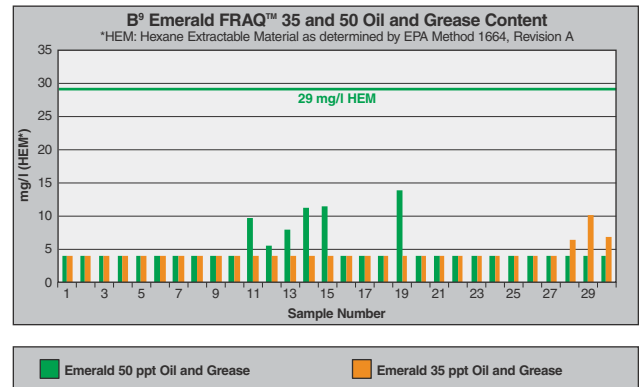
B⁹ Emerald FRAQ™,
no fluorescence



Oil fluorescence

B⁹ Emerald FRAQ™ Fluid Benefits

- May be discharged according to permit.
- Helps to reduce the environmental impact of offshore frac-pack operations.
- High fluid efficiency allows fracture geometry to be achieved in high kH intervals.
- Easy and economical to mix.
- Compatible with normal additive packages.
- Viscosity in 100's of cps at bottomhole static temperatures.
- Predictable fluid performance characteristics.
- Incorporates BreakBAQ™ breaker technology—a new generation of fracturing fluid breaker systems developed by Baker Oil Tools to help minimize gel damage and maximize conductivity. BreakBAQ breakers provide the same or better retained permeability for borate crosslinked guar polymer fluids and meet oil and grease, low-toxicity, and biodegradability standards.
- Low pumping friction properties can be achieved by optimizing crosslink time.
- Relatively low damage to reservoir matrix permeability—ranges from 25% to 50%. Damage to proppant is 30% to 50%.
- B⁹ Emerald FRAQ fluid achieves very large fracture widths, allowing placement of high proppant concentrations to maximize fracture conductivity.



Mysid and Minnow Test Results			
Test Sample	96 Hours LC ₅₀	95% Confidence Level	Control Survival
Mysid Shrimp (Mysidopsis Bahia)*	214,110 ppm	205,717 to 222,845 ppm	100%
Silverside Minnow (Menidia Beryllina)**	1431.4 mg/l	1337.2 to 1532.2 mg/l	
*Mysid Shrimp (Mysidopsis Bahia) test per 40 CFR, Part 136, Method 1007.0			
**Silverside Minnow (Menidia Beryllina), test method from 40 CFR, Part 136, Method 1006.0			

Emerald FRAQ™

The Emerald FRAQ™ fluid is our first-generation Emerald class fluid. The fluid system is designed with a low oil and grease content to help operators meet the increasingly stringent environmental discharge requirements. The fluid is formulated to have < 29 mg/l HEM (oil and grease HEM determined by EPA 1664, Revision A) at the point of manufacture and exceeds the standard established by 40 CFR, Part 435 for well treatment, completion, and workover fluids. The fluid system components, including the polymer slurry and other components, are specially formulated and selected to have low oil and grease content. The Emerald FRAQ fluid uses a low-residue guar polymer crosslinked with borate ions. The polymer is used in concentrations from 25 to 50 lb/1,000 gallons depending on formation temperature, permeability, and pump time. Lowering the polymer loading along with the low-residue polymer minimizes damage to the formation and proppant bed. Crosslink time can vary from instant to as much as ten minutes depending on well-treatment requirements.

Emerald FRAQ™ Fluid Benefits

- High fluid efficiency allows fracture geometry to be achieved in high kH intervals.
- Easy and economical to mix.
- Viscosity in 100's of cps at bottomhole static temperatures.

Frac Fluids— What's the Difference?

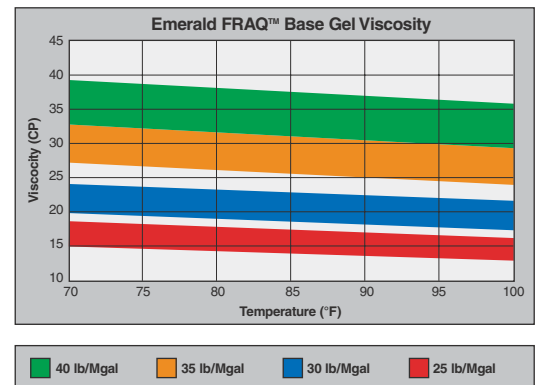
Because frac fluids from all manufacturers share a few common ingredients, it may appear that these fluids are all alike. This is certainly not the case. Although a handful of basic building blocks are shared, Baker Oil Tools' frac fluids chemical compositions, performance envelope, and applications know-how, are unique, significant, and unsurpassed in the industry.

Numerous patents awarded to Baker Oil Tools for frac fluid technology illustrate this difference. The innovations represented by these patents have steadily expanded the applications and performance envelope of our fluids. For example, our latest frac fluid innovation, B⁹ Emerald FRAQ, is a game-changing, environmentally benign fluid created as a direct result of our "out-of-the-box" thinking about frac fluid composition.

BreakBAQ breaker chemistry is another breakthrough technology found only in Baker Oil Tools frac fluids. Until now, successfully combining high performance with benign environmental effects has been restrained by conventional breaker technology. Baker Oil Tools scientists and engineers bypassed suppliers of typical oilfield chemicals and examined a wide range of chemicals used in a variety of completely unrelated areas. And they made a remarkable discovery. The BreakBAQ breakers derive their performance and environmental friendliness from readily available chemicals found in our everyday agriculture, cosmetics, and food industries.

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- Predictable performance characteristics.
- Controlled break time allows optimization of pump time, well cleanup, and minimizes damage to the formation and proppant permeability.
- Compatible with normal additive packages.
- Low pumping friction properties can be achieved by optimizing crosslink time. This reduces hydraulic horsepower requirements, reduces wellhead pressures, and allows treatments at higher rates while reducing the cost of treatment and minimizing the shear history on the crosslinked fracturing fluid.



- Relatively low damage to reservoir matrix permeability—ranges from 20% to 50%. Damage to the proppant is 30% to 50%.
- Achieves very large fracture widths, which allows placement of high proppant concentrations to maximize the closed fracture width and fracture conductivity.
- Uses internal and encapsulated breakers to achieve a controlled break for treatment placement and fluid cleanup.
- Incorporates BreakBAQ breaker technology—a new generation of fracturing fluid breaker systems developed by Baker Oil Tools to help minimize environmental impact.

Fluid Type	Emerald FRAQ™ 25	Emerald FRAQ™ 30	Emerald FRAQ™ 35
Temperature (°F)	150	175	200
GBW324 (lb/Mgal)	0.125	0	0
DBW-1 (lb/Mgal)	2.0	2.0	0.5
Shut-In (hrs)	13	33	34
Kair (mD)	1,000	800	800
Ki (mD)	856	79	106
Kf (mD)	495	62	55
% Damage	42	23	48

Diamond FRAQ™

Baker Oil Tools specifically developed the VES concentrate and the internal breaker system for sandstone frac-pack applications where high-retained permeability of the proppant in the perforation tunnels and casing/screen annulus is required. The Diamond FRAQ fluid is a water-based, non-ionic VES fluid with internal breakers. The fluid is designed for treating oil and gas sandstone reservoirs where a controlled break of the fluid is desired and may be used for hydraulic fracture stimulation, frack packs, gravel packs, and DIRECT PAK™ system treatments.

Diamond FRAQ's fluid VES is broken with internal breakers or external breakers. The internal breaker system uses Baker Oil Tools' unique and proprietary BreakBAQ chemistry to break the VES viscosity. The concentrations of these breaker additives are adjusted according to reservoir conditions and treatment requirements to degrade the VES with time and concentration across its temperature range.

Diamond FRAQ™ Fluid Benefits

- Diamond FRAQ incorporates unique internal BreakBAQ chemistry to break the VES viscosity.
- The internal breakers work in all reservoirs including dry gas, condensate, and oil reservoirs.
- Diamond FRAQ can be broken by internal and external breaker systems assuring post-treatment cleanup. The fluid does not degrade with time except with the use of internal breakers and upon contact with hydrocarbon fluids.
- The fluid provides excellent sand/proppant transport characteristics. Concentrations of 1.5% to 3% by volume are capable of carrying up to 14 ppa (pounds proppant added) sand to pack the fracture.
- Leak-off characteristic facilitates packing of the casing/screen annulus for the gravel pack operation.
- Broken Diamond FRAQ fluid will not reform, minimizing post-treatment cleanup problems.
- Diamond FRAQ flows back with low differential pressure to recover treating fluid.
- The non-ionic Diamond FRAQ surfactant is insensitive to emulsion formation in most crude oils.
- Diamond FRAQ has demonstrated superior shale stabilizing characteristics for treating reservoirs with high shale content.
- Wide temperature range, 80°F to 250°F (26°C to 121°C), to treat most formations.
- Compatible with heavy brines for hydrate inhibition applications and maintaining well control.
- The Diamond FRAQ fluid has < 29 mg/l HEM as tested by EPA 1664, Revision A.

SurFRAQ™

The SurFRAQ fluid system is a water-based, polymer-free VES fluid specifically developed for Baker Oil Tools frac-pack and gravel-pack applications. The SurFRAQ surfactant is non-ionic and compatible with sandstone reservoirs. It can viscosify seawater and brines made with sodium chloride, potassium chloride, calcium chloride, and brines to 14.5 ppg. SurFRAQ is suited for use in a variety of frac-pack, gravel-pack, and DIRECT PAK system applications up to 250°F (121°C).

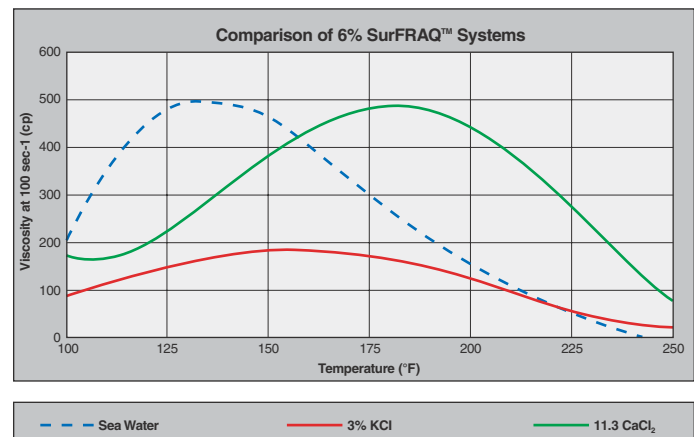
The SurFRAQ concentrate is a single additive concentrate that forms a non-ionic micelle viscous solution when added to aqueous fluids such as completion brines or seawater. The concentrate is custom-manufactured for Baker Oil Tools to avoid many of the shortcomings of other visco-elastic products. With slight agitation, the concentrate forms a highly viscous solution with the base brine without the need for any co-additives or surfactants.



Proppant settling: 3% KCL with 6% VES and 8 PPA

SurFRAQ™ Fluid Benefits

- Provides excellent sand/proppant transport characteristics. Very low concentrations (1.5% to 3% by volume) are capable of carrying up to 14 ppa (pounds proppant added) sand to pack the fracture.
- SurFRAQ fluid does not form a filter cake, which enhances productivity by not plugging the formation face with polymer solids.
- Leak-off characteristic facilitates packing of the casing/screen annulus for gravel pack operations.
- Viscosity controlled by concentration of the SurFRAQ concentrate and base brine.
- Viscosity control permits controlling fracture fluid efficiency for various applications.



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Frac Fluids— What's the Difference?

Applications know-how is also a critical difference. This can have a direct effect on the success or failure of a stimulation operation. Baker Oil Tools' expertise is unsurpassed, and our experience spans nearly the entire history of the petroleum industry. Our resources include not only the Baker Oil Tools frac fluids team of engineers, scientists, and field personnel, but also other resources like Baker Hughes INTEQ, the industry leader in formation evaluation.

Baker Oil Tools' job planning and execution tools also make a big difference. From software to steel, each of these tools provides unique advantages.

What's the difference in frac fluids? There are many, and the best place to see them is in your bottom line.

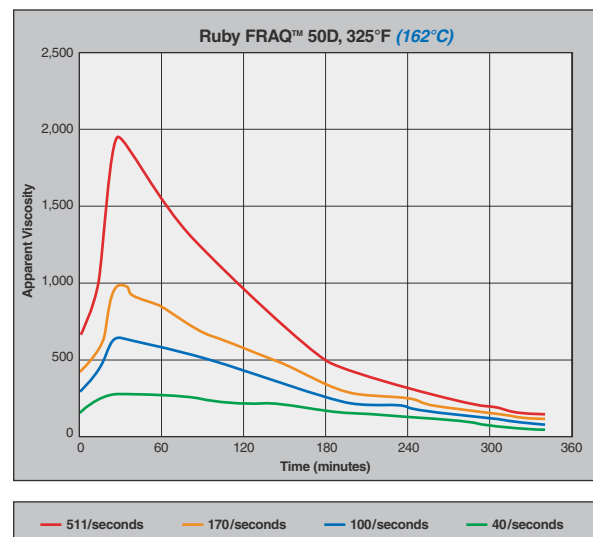
- The SurFRAQ fluid has outstanding friction reduction properties, varying from 35% to 70% less friction loss compared to base brine.
- Single concentrate additive provides easy, on-the-fly mixing of fluid system.
- Non-ionic surfactant charge is ideal for treating sandstone or carbonate reservoirs.
- Fluid broken by external break mechanisms to assure post-treatment cleanup.
- Broken SurFRAQ will not reform, minimizing post-treatment cleanup problems.
- The SurFRAQ fluid system flows back with low differential pressure to recover treating fluid.
- The VES system demonstrates shale stabilizing characteristics for treating reservoirs with high shale content.
- Wide temperature range, 80°F to 250°F (26°C to 121°C), to treat most formations.
- Best applied to formation permeabilities of 1 to 300 md.
- The SurFRAQ fluid has < 29 mg/l HEM as tested by EPA 1664, Revision A.

Ruby FRAQ™

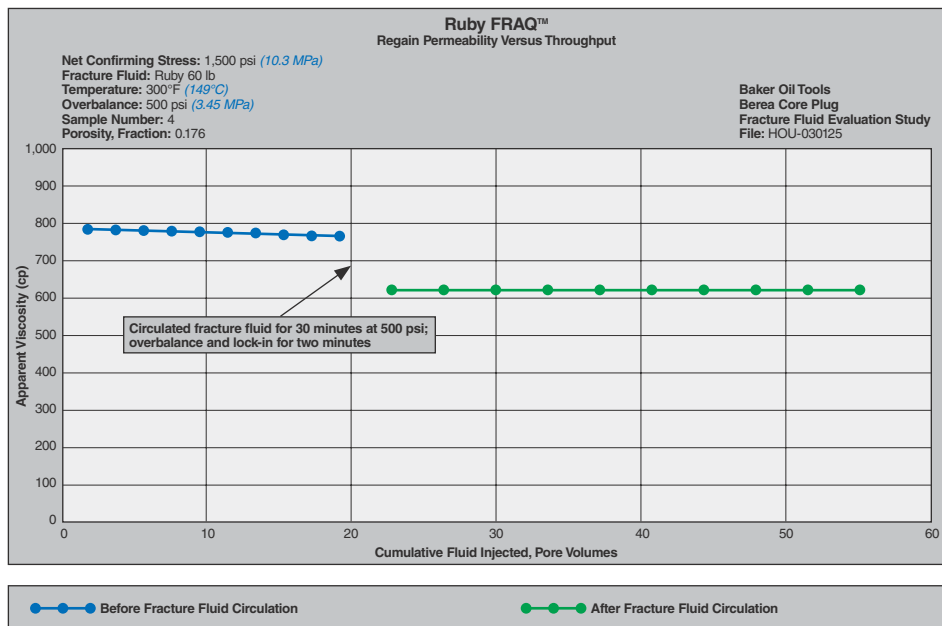
The Ruby FRAQ™ fluid is a high-temperature, high-pH fluid that uses a low-residue, derivatized hydroxypropyl guar (HPG) polymer crosslinked with zirconate ions. The fluid is designed for higher temperature fracture stimulation applications of 250°F to 350°F (120°C to 180°C). The polymer is used in concentrations from 30 to 60 lb/1,000 gallons depending on formation temperature, permeability, and pump time. Crosslink time can vary from instant to greater than ten minutes depending on well-treatment requirements. The chemicals used to formulate the Ruby FRAQ fluid are oil and grease free, with < 29mg/l HEM, and do not sheen or contain any priority pollutants.

Ruby FRAQ™ Fluid Benefits

- High-temperature viscosity stability.
- Good to excellent fluid efficiency—allows fracture geometry to be achieved in high kH intervals.
- Easy and economical to mix.
- Viscosity in 100's of cps at high bottomhole static temperatures.
- Predictable performance characteristics.
- Controlled break time allows optimization of pump time, well cleanup, and minimizes damage to formation and proppant permeability.
- Compatible with normal additive packages.
- Low pumping friction properties can be achieved by optimizing crosslink time. This reduces hydraulic horsepower requirements, surface treating pressures, and allows treatments at higher rates while reducing the cost of the treatment and minimizing the shear history on the crosslinked fracturing fluid.



- Relatively low damage to reservoir matrix permeability—ranges from 10% to 50%. Retained permeability to the proppant pack is 30% to 50%.
- Temperature stability achieves very long fracture lengths, which allows placement of proppant to maximize closed fracture length and fracture conductivity.
- Uses internal breakers to achieve controlled break to break the polymer for cleanup.
- Incorporates BreakBAQ breakers—a new generation of fracturing fluid breaker systems developed by Baker Oil Tools to help reduce the environmental impact of fracturing fluids.



Fluid	Description	Applications	Temperature Range
B³ Emerald FRAQ™	Guar-based borate crosslinked fluid exceeding standards of < 29 mg/l HEM oil and grease, with low toxicity and biodegradability of < 60% in 28 days.	Specifically designed for frac-pack operations.	< 300°F (144°C)
Emerald FRAQ™	Guar-based borate crosslinked fluid. Meets oil and grease discharge regulations.	Specifically designed for frac-pack operations.	< 300°F (144°C)
Diamond FRAQ™	Non-ionic, clear VES (polymer-free). Additional additive breaker package for controlled break of fluid. Meets oil and grease discharge regulations.	Applications requiring a fast controlled break. Treatment of low to moderate permeability formations or when limited height growth is desired. Ideal for sandstone and carbonate formations. Recommended for DIRECT PAK™ systems.	< 250°F (121°C)
SurFRAQ™	Non-ionic, clear VES (polymer-free). Meets oil and grease discharge regulations.	Provides for increased retained permeability of the proppant in perforation tunnels and casing/screen annulus over borate crosslinked guar systems. Treatment of low to moderate permeability formations or when limited height growth is desired. Ideal for sandstone or carbonate formations. Recommended for DIRECT PAK systems.	< 250°F (120°C)
RubyFRAQ™	Hydroxypropyl guar-based zirconate crosslinked fluid. Meets oil and grease discharge regulations.	High-temperature fracture stimulation fluid.	250°F to 350°F (120° to 180°C)

The Best Frac Fluid Technology Comes with the Best Delivery Systems

Industry-leading, high-performance frac fluids are only one component of Baker Oil Tools' Best-in-Class completion technology. Our pumping capability includes a wide range of skid-mounted pumping equipment for platform or inland barge-based stimulation treatments. For offshore use, the *RC Baker* and *HR Hughes* are two of the most capable and up-to-date motor vessels at work today.



RC Baker

RC Baker

The *RC Baker* pioneered 24 x 7 satellite communications for frac-pack operations and set a new standard for offshore fracturing vessel communications. It carries 250,000 lb of proppant on deck, with 8,000 hydraulic horsepower, and has an onboard lab. The *RC Baker* is able to treat the majority of frac-pack completions in the Gulf of Mexico.



HR Hughes

HR Hughes

With one-million pound proppant capacity above deck, 12,500 hydraulic horsepower, and twin flexible steel treating hoses, the *HR Hughes* set a new benchmark for frac-pack vessels in the Gulf of Mexico. Numerous enhancements such as DP-1 dynamic positioning, 24 x 7 satellite communications, and an onboard laboratory make it easier for operators to execute the most complex stimulation operations.

Contact Baker Oil Tools for more information about these highly capable vessels.

THE Completion Company™

www.bakerhughes.com/bot/