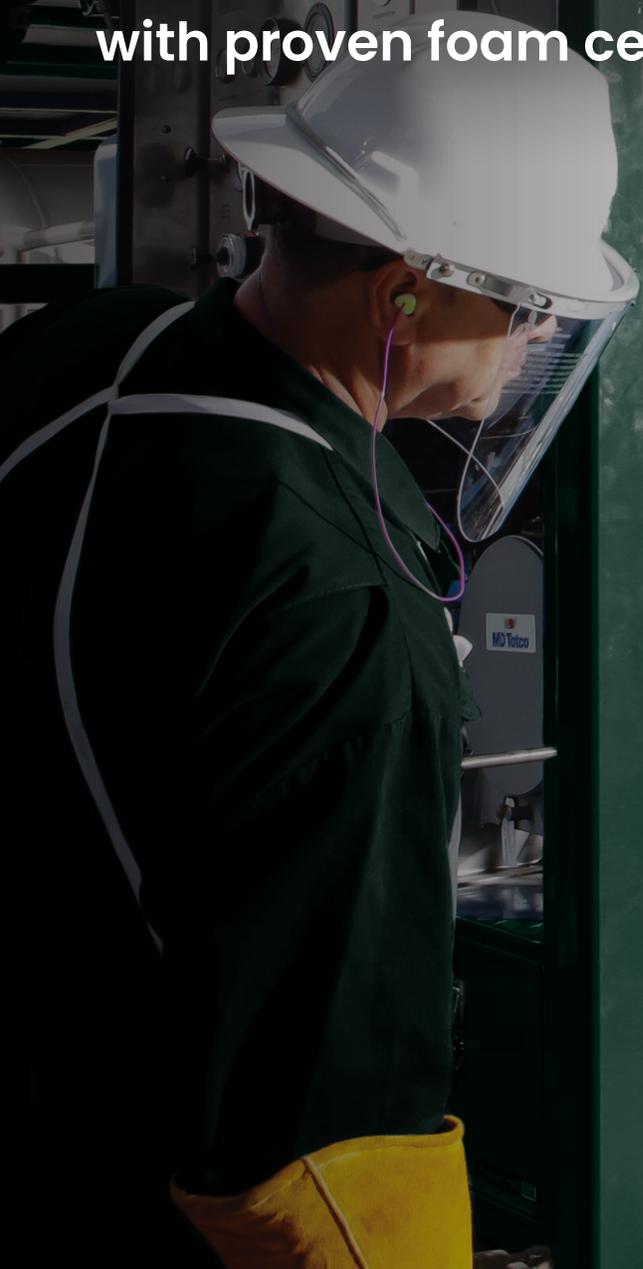


FoamSet system

Achieve reliable zonal isolation
with proven foam cementing services





Choose the industry's most comprehensive and effective foam cementing solution

Foam cementing can provide wellbore integrity, ensure proper zonal isolation, and protect the environment while offering significant benefits over traditional cement applications. Its unique properties:

- Permit flexible job designs
- Provide superior hole cleaning and coverage in non-gauge wellbores
- Offer improved thermal insulation
- Deliver superior mechanical properties at lower densities

Foam cementing is an ideal solution for shutting off shallow water or gas flows and in applications with narrow pore pressure windows. And, because a small foam slurry can effectively expand to cement a larger section of the wellbore without compromising set cement properties, the volume of bulk cement and additives required for a job is minimized—significantly improving economics in large-volume applications.

A well-designed, well-executed foam cement job is often your best solution for long-term wellbore integrity and reliable zonal isolation. It simply requires:

- A precisely engineered cement design
- The right cementing system and technology
- A well-trained, experienced foam-cementing crew.

The Baker Hughes **FoamSet™ system** is delivered as part of an integrated foam cementing solution incorporating detailed planning and flawless execution to minimize risk while improving both cementing efficiency and performance.

Achieve improved cleanup and displacement

CONVENTIONAL CEMENT

FOAMSET CEMENT

CHALLENGE

Insufficient contact time or contamination can result in poor mud removal by a spacer system.

CHALLENGE

Mud debris or an oil-wet surface can prevent a good bond when the cement forms, compromising zonal isolation.

FOAMSET ADVANTAGE

The highly viscous FoamSet slurry provides additional cleaning and debris removal as it expands over the desired zone—helping overcome a compromised spacer application, if necessary.

FOAMSET ADVANTAGE

The properly conditioned wellbore permits a reliable cementing operation for superior zonal isolation—minimizing the risk of annular gas or water migration and eliminating the need for costly remediation and squeeze-cement operations.

With any cement job, spacer design and application are crucial. Even thin layers of synthetic or oil-base drilling fluid on the casing or formation can prevent a slurry from forming a good bond to these surfaces. Without that bond, it is difficult to achieve effective zonal isolation and often results in costly remediation.

With FoamSet and other cementing systems, Baker Hughes carefully selects and deploys the most effective spacer system based on specific downhole conditions and compatibility with the drilling fluid and cement. However, if spacer performance is compromised by downhole temperatures, contamination, or insufficient contact time, FoamSet slurries and spacers provide a more viscous fluid to scour and remove any immobile mud from the annulus.

Minimize losses in weaker formations

Whether it results from a weak, unstable formation, a low fracture gradient, or a fault or another type of thief zone, it is very difficult to properly seal an irregular wellbore or one prone to losses. With conventional cement systems, the slurries tend to follow the path of least resistance. This can result in voids and gaps in the cement and also poor zonal isolation.

However, unlike conventional cement systems, the FoamSet slurries can be engineered to deliver superior set properties at relatively low densities. This minimizes the risk of an induced fracture or formation breakdown that could lead to losses. Additionally, because the FoamSet system is energized, it can expand to fill fissures, cracks, voids, and washouts, and to ensure the proper isolation between zones.

In short, because the FoamSet system offers reduced hydrostatic pressure, it lowers the risk of formation breakdown. Then, the foam expands to ensure complete cement coverage across the desired zone.

CONVENTIONAL CEMENT



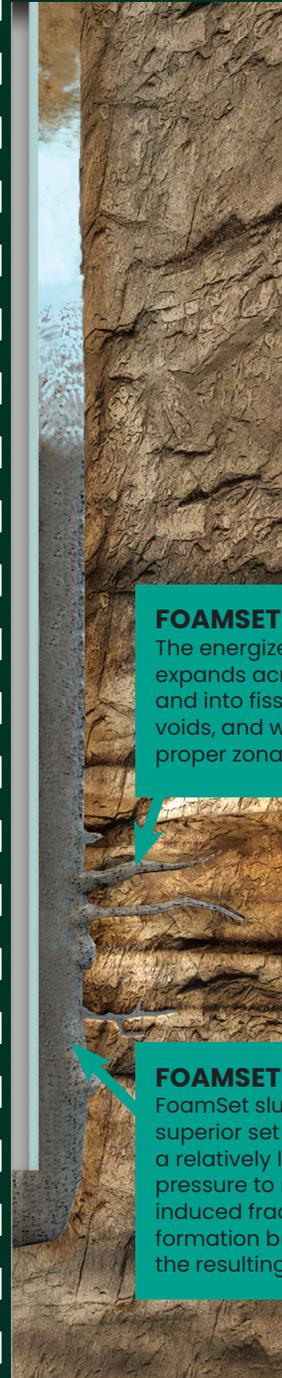
CHALLENGE

Heavier conventional fluids are known to induce fractures in weak formations.

CHALLENGE

Conventional cement slurries follow the path of least resistance and often travel directly up the annulus—bypassing faults, thief zones, and gaps in an irregular wellbore.

FOAMSET CEMENT



FOAMSET ADVANTAGE

The energized FoamSet system expands across the annulus and into fissures, cracks, voids, and washouts—ensuring proper zonal isolation.

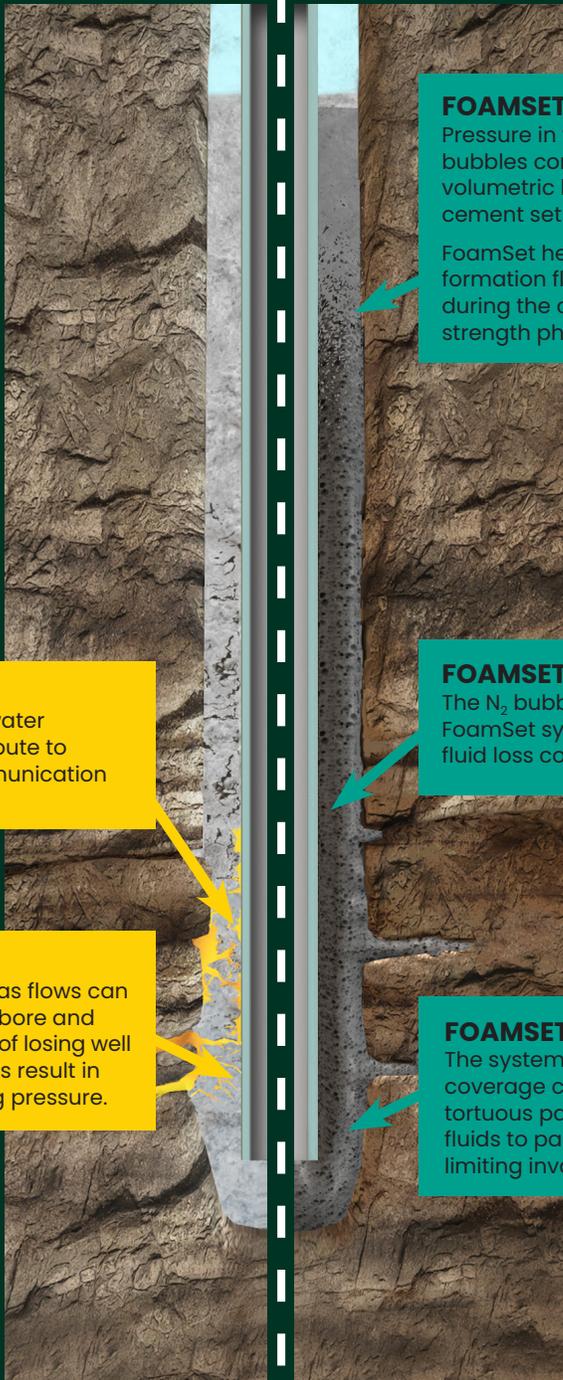
FOAMSET ADVANTAGE

FoamSet slurries deliver superior set properties at a relatively low hydrostatic pressure to minimize induced fracture risks or formation breakdown and the resulting losses.

Control shallow water and gas flows

CONVENTIONAL CEMENT

FOAMSET CEMENT



CHALLENGE

Shallow gas or water flows can contribute to unwanted communication between zones.

CHALLENGE

Shallow water/gas flows can infiltrate the wellbore and increase the risk of losing well control, as well as result in sustained casing pressure.

FOAMSET ADVANTAGE

Pressure in the system's N₂ bubbles compensates for volumetric losses as the cement sets.

FoamSet helps hold formation fluids in place during the critical static gel strength phase.

FOAMSET ADVANTAGE

The N₂ bubbles in the FoamSet system enhance fluid loss control.

FOAMSET ADVANTAGE

The system's improved coverage creates more tortuous paths for influxing fluids to pass through—limiting invasion risks.

In the Gulf of Mexico and other offshore environments, controlling shallow water and gas flows is critical to rigsite safety and wellbore integrity. Should these flows occur, there is a substantial risk of interzonal communication and, in a worst-case scenario, the possibility of losing control of the well. During cementing operations, wells are especially susceptible to shallow water and gas flows as the slurry transitions from a liquid to a solid.

The FoamSet system offers increased protection against these hazards because it maintains a more constant pressure to keep the water or gas in the formation and out of the cement in the annulus.

Get an integrated foam cement solution

FoamSet systems represent more than just a foamed cement slurry. Each job is carefully planned and executed using a process designed to ensure proper zonal isolation for the life of the well while maximizing operational efficiency and reliability.

Design a safe, efficient foam cement application

Using **CemMaster™ software**, Baker Hughes engineers model foam cement performance including cement placement, the displacement of drilling muds and spacers, optimal pump rates, and shutdown limits.

In addition to its use in job design, the CemMaster software also provides field personnel with an invaluable real-time simulation tool if unplanned events force them to deviate from plan—allowing them to update job parameters and proactively address any potential issues before they occur.

CemMaster is also used for post-job analysis, and that knowledge is incorporated into future jobs to help accelerate learning curves and the adoption of best practices.





Leverage advanced foam cementing technology

FoamSet systems are engineered using an advanced, all-liquid additive package including the **FCS-1™ foam cement stabilizer**. This unique solids-free additive is integrated into the slurry after mixing—eliminating unwanted viscosity in the mixing tub and the need for surface de-foaming agents. It also allows greater slurry design flexibility with a wide range of potential densities and rheologies.

The all-liquid additive package allows the operator to use neat cement on the rig and permits the adjustment of cement properties on location. It also reduces or eliminates the quality control issues, decreases transportation logistics, and disposal costs associated with typical, pre-blended lightweight cements.

In addition, we can also design and “foam” a dry system, such as a **DeepSet™ deepwater cementing system**, to meet specific job requirements.

Deploy state-of-the-art process control

In the past, some operators have been slow to embrace foam cement due to the perceived added risk associated with an energized system. However, with Baker Hughes’ new automated process control system, the application of a FoamSet system is safer and more efficient than most conventional cementing deployments.

With real-time monitoring and control, the system can automatically adjust the nitrogen injection rate to precisely mirror the job design, regardless of whether the plan calls for a constant nitrogen ratio or a constant slurry density.

And each operation is staffed with a crew possessing advanced classroom and field training on the application of foamed cement systems. This experienced field team is assisted 24/7 by a network of engineering and laboratory support personnel.



OFFSHORE SETUP

Data cabin

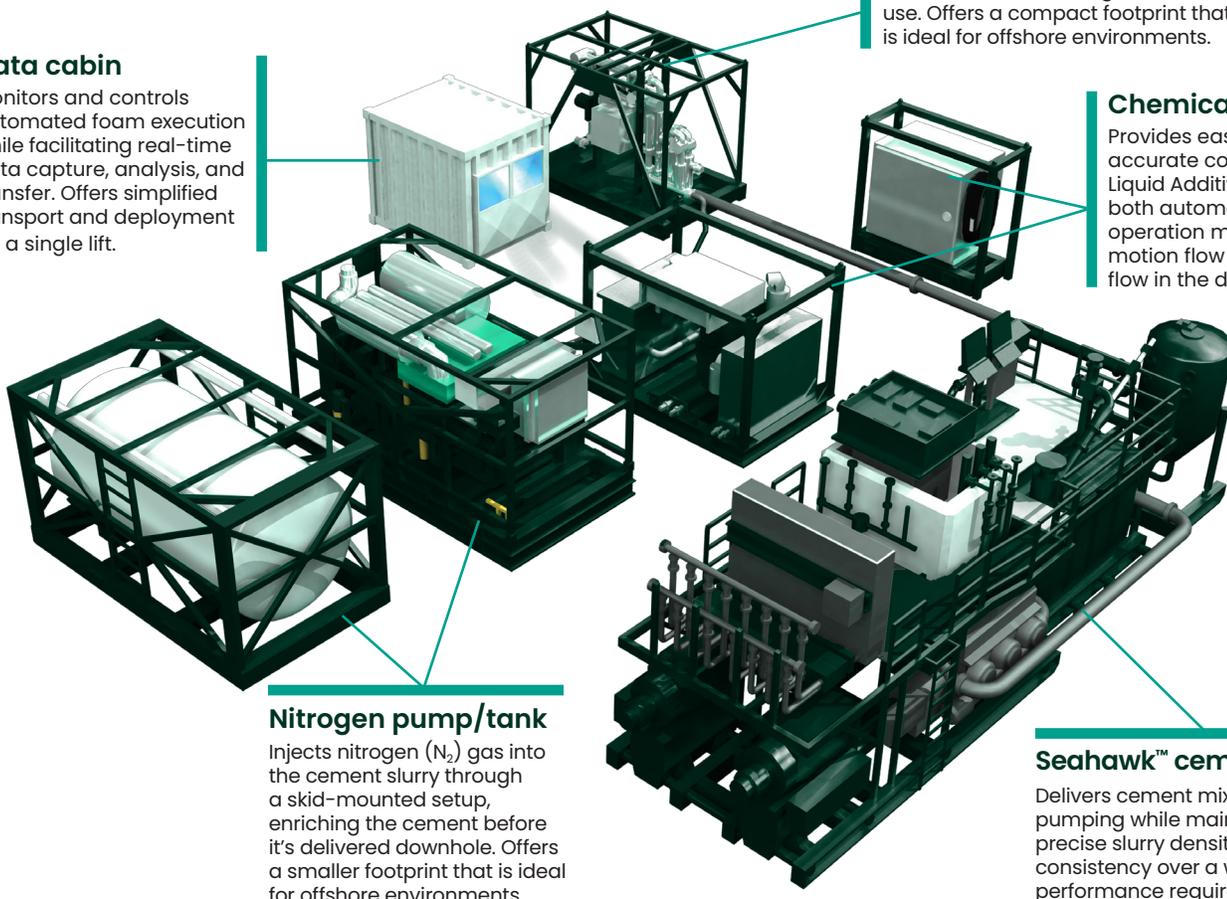
Monitors and controls automated foam execution while facilitating real-time data capture, analysis, and transfer. Offers simplified transport and deployment for a single lift.

Foam manifold

Delivers cement and nitrogen mixture using a pre-configured, three-connection design for ease of use. Offers a compact footprint that is ideal for offshore environments.

Chemical pump/HPU

Provides ease of operation and accurate control through the Liquid Additive System, featuring both automatic and manual operation modes. Uses micro-motion flow meters to monitor flow in the data cabin.



Nitrogen pump/tank

Injects nitrogen (N_2) gas into the cement slurry through a skid-mounted setup, enriching the cement before it's delivered downhole. Offers a smaller footprint that is ideal for offshore environments.

Seahawk™ cement pump

Delivers cement mixing and pumping while maintaining precise slurry density control and consistency over a wide range of performance requirements.

Benefit from customized offshore and onshore cementing systems

Each FoamSet application is executed using an automated system designed to provide the critical performance and reliability required by the operating environment—whether offshore or onshore.

ONSHORE SETUP

Hawk™ cement pump

Delivers cement mixing and pumping, using a self-contained, trailer-mounted unit.

Cement bulk truck

Delivers blended and unblended cement to onland locations.

Chemical pump/HPU

Delivers ease of operation and accurate control through the liquid additive system, featuring both automatic and manual operations modes. Uses micro-motion flow meters to monitor flow in the data cabin.

Data cabin

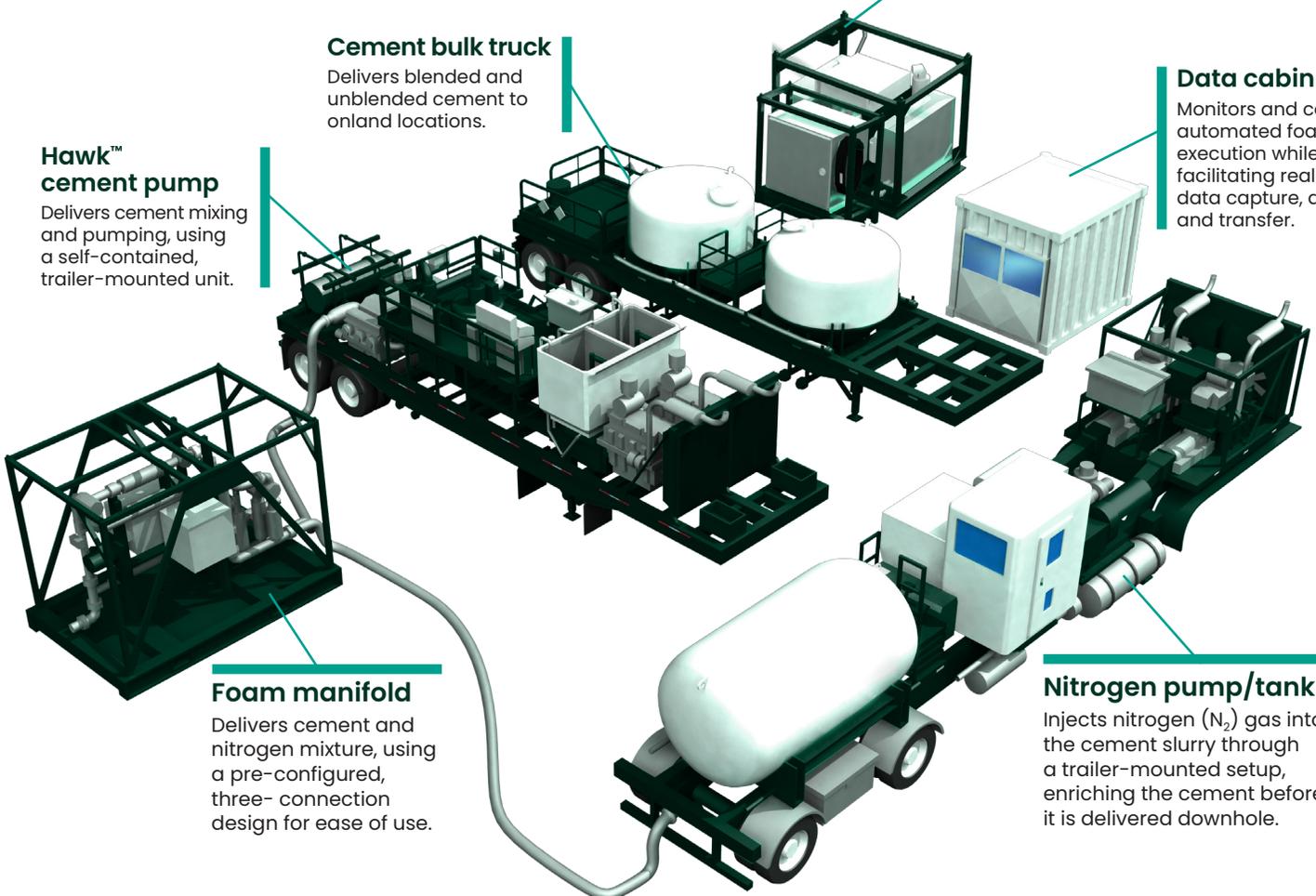
Monitors and controls automated foam execution while facilitating real-time data capture, analysis, and transfer.

Foam manifold

Delivers cement and nitrogen mixture, using a pre-configured, three-connection design for ease of use.

Nitrogen pump/tank

Injects nitrogen (N_2) gas into the cement slurry through a trailer-mounted setup, enriching the cement before it is delivered downhole.



Count on flawless field execution

Baker Hughes is committed to providing world-class engineering, consistent and high-quality cement products and additives, well-trained personnel, and high-performance equipment to ensure dependable, long-term cement integrity. Not just on every FoamSet application. On every application, every time.

Because foam cementing applications present their own set of unique challenges that must be addressed, our teams undergo rigorous, specialized training. This includes both classroom sessions and hands-on training with the foam cementing equipment. The individual learning is supplemented with a full week of team training that teaches all four core members of a foam cement team (Field Coordinator, Field Specialist, Field Engineer, and Nitrogen Supervisor) how to better understand the critical role they play and how their work impacts the work of others.

Subsequent to the training, these crews undergo competency reviews to ensure that they are following the necessary processes and procedures. If any competency gaps are identified, supplemental training is implemented immediately to address the problem.





Demand excellence from your foam cementing program

A few years ago, Baker Hughes established the goal of being the industry's most reliable foam cement provider. We carefully evaluated, analyzed, and addressed any gaps, whether they were in the area of job design, field or lab technology, application support, or field execution.

Today, the FoamSet system represents the industry's most versatile and reliable foam cementing solution. Combining our advanced design capabilities with a unique, all-liquid additive package, automated process control, and well-trained crews allow us to execute each FoamSet application safely and efficiently—delivering a well with superior zonal isolation that is set for life.

