



Maintain long-term zonal isolation with a cement system that repairs itself

InvictaSet self-regenerating cement system

The Baker Hughes InvictaSet™ self-regenerating cement system provides a durable cement sheath to help ensure well integrity and zonal isolation for the life of the well. For more conventional cement systems, pressure and temperature changes over time can lead to cracking or failure of the cement sheath and a buildup of annular pressure, resulting in:

- Sustained casing pressure
- Cross flow
- Lost production
- Collapsed casing
- Contaminated water zones
- Increased workover costs

INNOVATING BEYOND CONVENTION

The Baker Hughes InvictaSet self-regenerating cement system is specially designed to address these problems. InvictaSet cement contains an embedded material that induces crystalline growth when contacted by any fluid—water or hydrocarbon. This crystal growth plugs and seals fractures and flow paths, shutting off flow through the cement matrix and micro-annulus. In addition to recovering zonal integrity, the crystal matrix provides mechanical strength to the damaged area.

The Baker Hughes InvictaSet self-regenerating cement system is not just a one-time fix. It can regenerate multiple times, delivering a robust cement sheath in a wide range of field conditions. Its easy field mixability and adaptable mechanical properties further underscore its versatility, making it a reliable choice for specific well challenges.

PROVEN ISOLATION PERFORMANCE

The InvictaSet cement is thoroughly tested with a custom-engineered, patented test device that quantifies crack sizes and helps ensure that the cement system maintains long-term zonal isolation.

The device tested a 15.8 ppg Class G cement, cured at 180°F (82°C) and 3,000 psi (21 MPa), without the InvictaSet system. After 15 days of freshwater exposure, the cement showed no signs of self-healing. By contrast, a 13.5 ppg Class G cement containing the InvictaSet system, cured at 100°F (38°C) and 3,000 psi (21 MPa), exhibited self-healing over multiple damage cycles and exposure to both brine and crude oil.

Contact your Baker Hughes representative to discuss how InvictaSet cement can deliver reliable well integrity and zonal isolation for the life of your well.

APPLICATIONS

- Cementing in fields with a history of sustained casing pressure or high tectonic stress areas
- Wells with a risk of annular cement damage under varied temperature conditions
- Wells that did not follow all cementing best practices
- Wells without optimal centralization or pipe movement
- Plug and abandonment operations

BENEFITS

- Plugs and seals fractures to prevent flow through cement matrix, induced cracks, or microannuli
- Activates in as little as 24 hours, while preventing unwanted quick-set of cement
- Maintains API standards for cement slurries, with optimized particle size distribution for mixing and pumping
- Reduces risk of sustained casing pressure
- Reacts and reseals for effective zonal isolation through multiple damage cycles

TYPICAL PROPERTIES

Regenerating environment	Water/Oil/Gas
Temperature range	Tested to 250°F (121°C)
Density range	13.5 ppg to 16 ppg
Sealing time	As little as 24 hours
Maximum crack width	0.25 mm

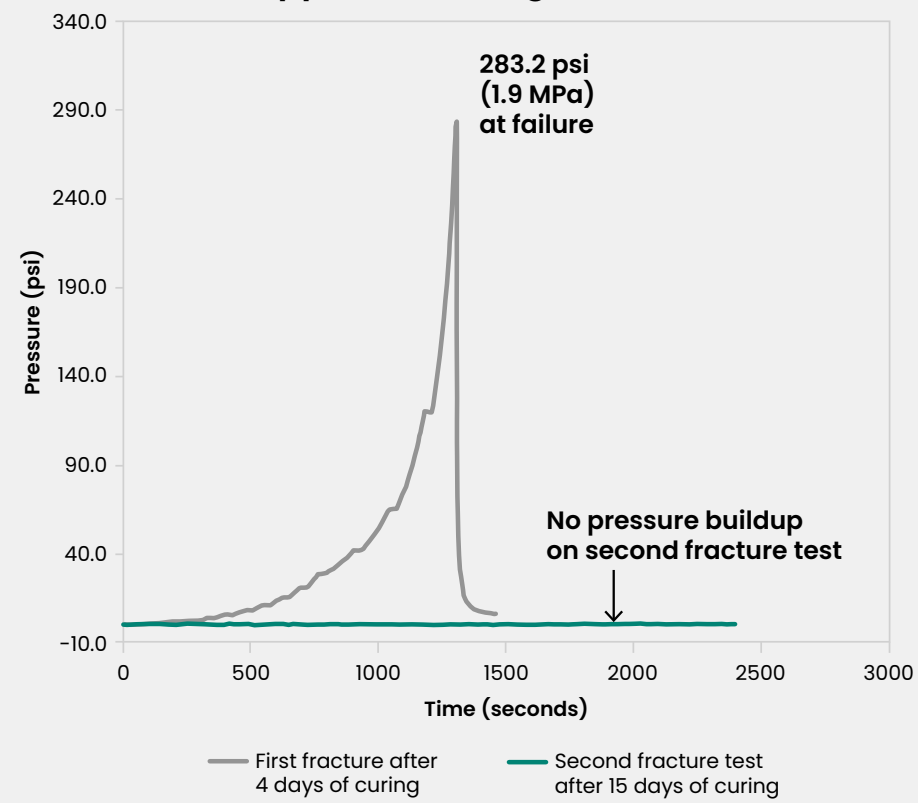


Photomicrographs of a cement containing InvictaSet show a crack before brine exposure (left) is fully sealed after brine exposure thanks to crystalline growth (right).

Without InvictaSet

15.8 ppg Class G cement showed no signs of strength recovery under freshwater exposure.

Self-regenerating test with Baker Hughes apparatus using freshwater

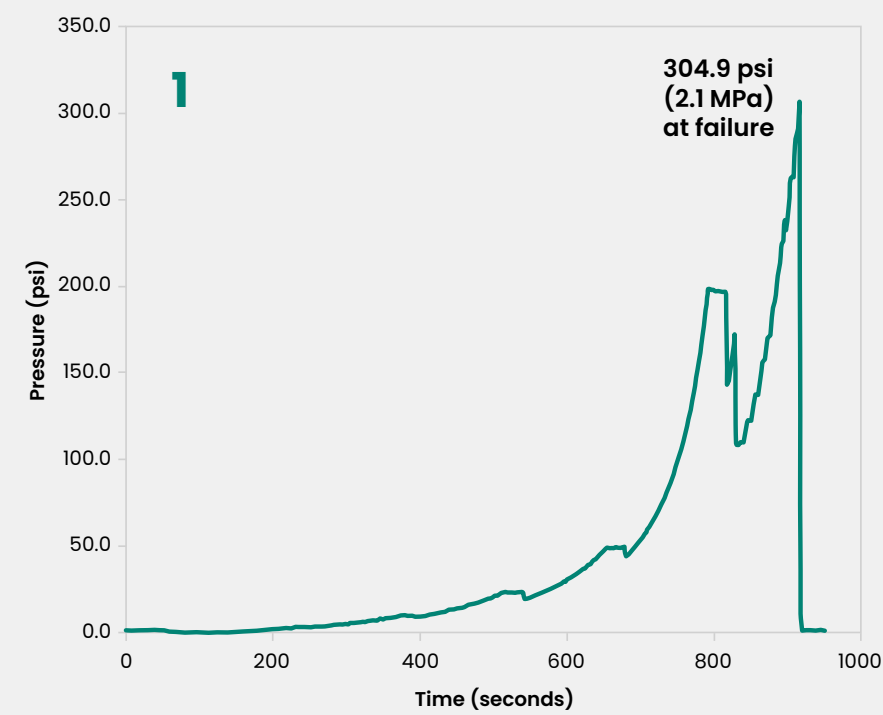


With InvictaSet

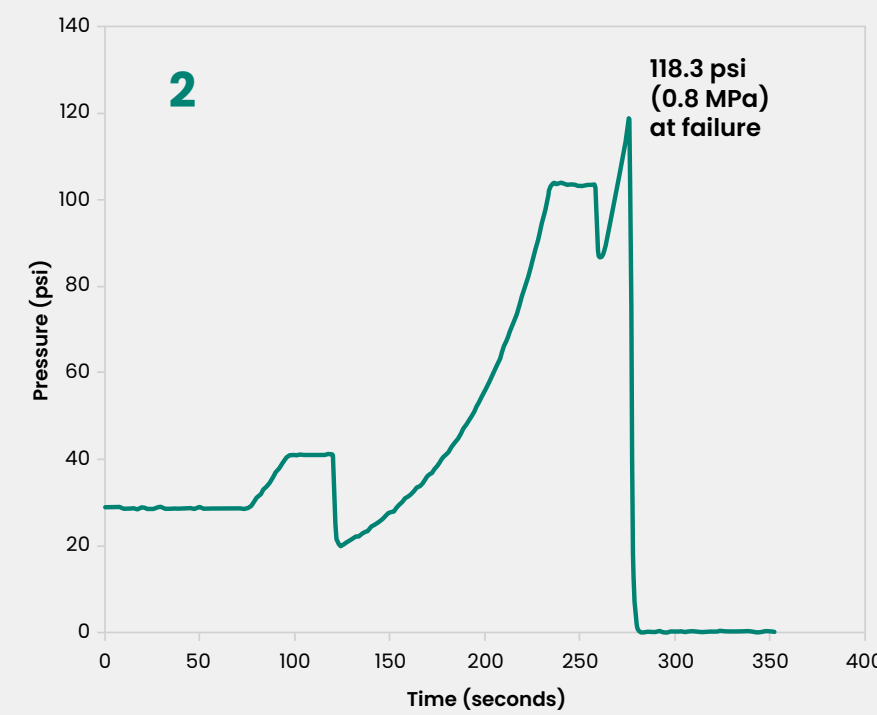
13.5 ppg Class G cement self-regenerated over multiple cycles in both brine and oil.

InvictaSet™

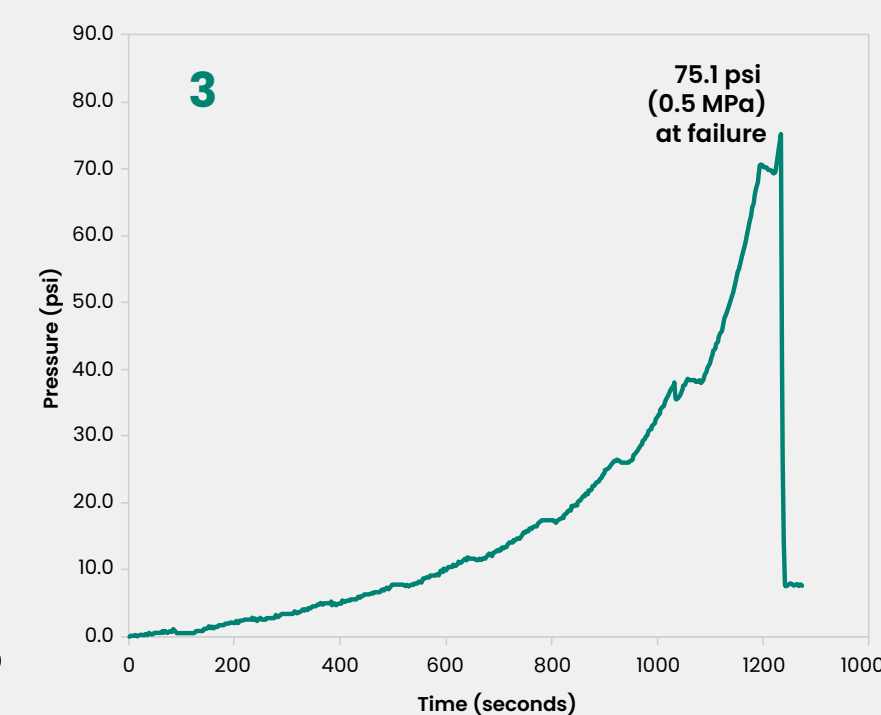
First fracture, brine



Second fracture, 6 days later, brine



Third fracture, 7 days later, oil



Fourth fracture, 1 day later, oil

