

Cementing Solutions
Cement Systems and Additives

WellLock[®] resin system

Deep-penetration, high-performance sealant

FEATURES AND BENEFITS

- Chemically resistant to CO₂ and acidic environments
- High compressive strength with low Young's modulus and superior elasticity as a solid
- Ultralow permeability
- Temperature range up to 280°F
- Density range 9.2-14.5 ppg
- Continually transmits hydrostatic pressure for extended period(s) of time
- Ideal for squeezing tight channels as a solids-free solution



Overview

WellLock[®] resin system is a high-strength, elastic polymer that functions as a dependable barrier to mitigate fluid flow. It can be formulated for delivery into the wellbore as a solids-free pure liquid or contain solids for density control. After placement, a crosslink reaction occurs to transform the liquid into a solid polymer with a three-dimensional network structure. With more than 500 successful case histories documented, WellLock resin has experienced global success in every region Halliburton operates.

The capability of the WellLock resin to be formulated solids-free makes it ideal for remedial operations, such as to seal casing leaks and perforations, annular gas and post-frac remediation, and shoe and liner top squeeze operations. The advantage of a solids-free treatment compared to a conventional particle-laden treatment is the eliminated risk of solids bridging at the pore throat of the channel.

In addition to exceptional mechanical properties, WellLock resin exhibits strong chemical resistance to acid. It is often used as the primary cement material in the injection zone for Class I chemical disposal or acid gas injection wells.

Carbon storage

Cementing wells for carbon capture, utilization, and storage (CCUS) presents unique challenges to barrier integrity and long-term stored CO₂ containment. CCUS projects aim for permanent underground CO₂ storage, which requires long-term cement sheath chemical and mechanical stability. WellLock resin is a non-Portland system that does not chemically react with CO₂ and has ultralow permeability. Those two features help the system provide outstanding CO₂ corrosion resistance. WellLock resin also provides superior mechanical properties to deliver enhanced performance. The high elasticity of the system compared to conventional cement barriers helps the system better withstand the stresses induced by the cyclic load of injection operations, which helps prevent mechanical failure of the barrier. Welllock resin also provides improved shear bond strength, which helps the system better anchor to the casing and formation. This can significantly minimize debonding, which can create pathways for CO₂ flow up to the surface.

Chemical disposal wells

The achievement of zonal isolation with long-term dependability across the injection zone of chemical disposal wells is critical. Conventional Portland-based cement and many specialty cement blends are not suitable for use in such low-pH environments. The WellLock® resin exhibits excellent chemical resistance to most low-pH fluid and is used during the primary cement operation to isolate the well's injection zone. During the design process of a chemical disposal well, it is recommended to perform an immersion test of the set WellLock resin in the specific disposal fluid because of the nature and variability of fluid waste. Contact your local representative to facilitate this test.

Annular gas remediation/sustained casing pressure

Ineffective mud displacement can cause sustained casing pressure, cement sheath damage, or the formation of microannuli. In situations of compromised zonal isolation, formation fluid travels from the wellhead source and creates pressure observable at the surface. This channel might have only a micron-sized effective diameter, but the length can range from a few to thousands of feet.

Resin temperature range

TEST TEMPERATURE (°F)	COMPRESSIVE STRESS AT YIELD (PSI)	YOUNG'S MODULUS (PSI)
70	1.77E+04	4.9E+05
175	7.55E+03	2.6E+05
225	7.14E+03	2.2E+05
275	4.92E+03	1.9+E05

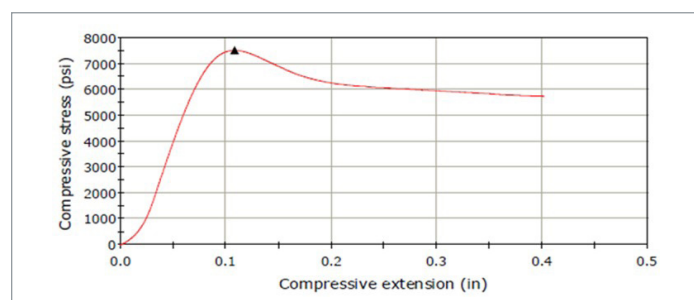
Compared to particle-laden fluid, the use of WellLock resin to repair this type of channel has resulted in a significantly higher success rate and improved reliability, which can reduce remedial treatment costs.

Tight casing leaks

Tight casing leaks are conventionally characterized by a "pressure-up and bleed-off scenario" opposed to the acceptance of a continuous injection rate. WellLock resin can penetrate the channels much more readily to form a seal. Casing leaks remediated using WellLock resin have the capability to withstand up to 42 hydraulic fracturing stages at pressure greater than 10,000 psi.

Permanent plug and abandonment

WellLock resin is best suited for use in permanent plug and abandonment operations to control the flow of unwanted gas with a squeeze operation. When WellLock resin is used in these application types, it is not intended to be the only plug-forming material and should not comprise more than 20% of the total plug length. The other 80% or more of the plug length should be a cement-based barrier.



Welllock® resin system shows superior elasticity. Sample length is 2 in. and strain of >0.2 with no failure. Test temp is 250°F. of supercritical CO₂ exposure.

For more information, contact your local Halliburton representative or visit us on the web at www.halliburton.com

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