

WellLock® Resin System

DEEP PENETRATION HIGH PERFORMANCE SEALANT

OVERVIEW

WellLock® Resin System is a high-strength, elastic polymer that functions as a dependable barrier to prevent fluid flow. It can be formulated, for delivery into the wellbore, as a solids-free, pure liquid or may contain solids for density control. After placement, a cross-linking reaction takes place to transform the liquid into solid polymer having a three-dimensional network structure. Having over 500 case histories to date, WellLock resin has seen global success in every region Halliburton operates.

The ability of WellLock resin to be formulated solids-free makes it ideal for remedial operations such as sealing casing leaks and perforations, annular gas and post frac remediation, as well as shoe and liner top squeezes. The advantage of using a solids-free treatment in comparison to a conventional particle-laden treatment is that the risk of solids bridging at the pore throat of the channel is eliminated.

In addition to exceptional mechanical properties, WellLock resin also exhibits strong chemical resistance to acids. Therefore, it is often used as the primary cementing material across the injection zone for class I chemical disposal wells or acid gas injection wells.

ANNULAR GAS REMEDIATION/SUSTAINED CASING PRESSURE

Sustained casing pressure can be the result of ineffective mud displacement, damage to the cement sheath, or the formation of a microannulus. In these situations where zonal isolation has been compromised, formation fluids travel from their source to the wellhead and produce pressure that is observable at the surface. This channel may have only a micron-sized effective diameter, but their length may range from a few feet up to thousands of feet. Use of WellLock resin to repair channels of this type has exhibited a significantly higher success rate and improved reliability in comparison to particle-laden fluids, which results in a reduced total cost to the operator for the remedial treatment.

BENEFITS

- » Can be formulated for placement into tight channels as a solids-free liquid
- » High compressive strengths with low Young's modulus, and superior elasticity as a solid
- » Can be placed adjacent to many aqueous fluids and hydrocarbons in the fluid train
- » Resists fluid contamination to form a high strength solid
- » Continually transmits hydrostatic pressure for extended period(s) of time enabling extended squeezing
- » Chemically resistant to acids, bases and hydrocarbons



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TIGHT CASING LEAKS

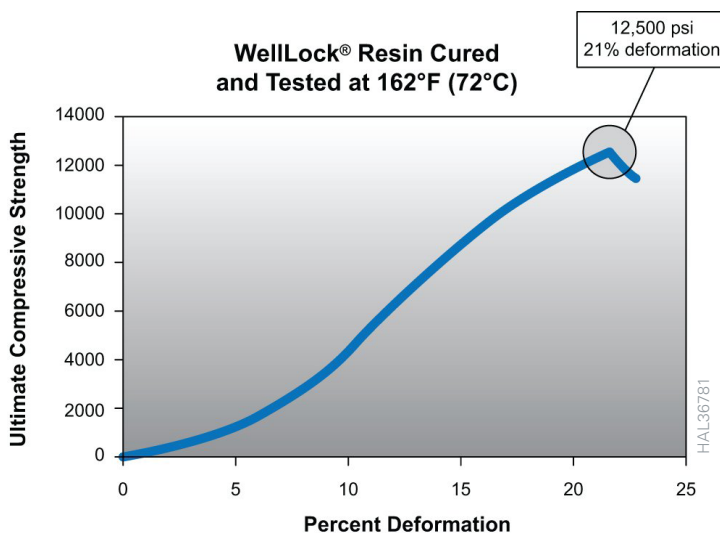
Conventionally, “tight” casing leaks are classified as those that experience a pressure up and bleed off scenario as opposed to accepting a continuous injection rate. WellLock® resin is able to penetrate the channels much more readily and form a seal. Casing leaks that have been remediated using WellLock resin have withstood up to 42 hydraulic fracturing stages at pressures 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 by performing a squeeze operation. When WellLock resin is used in these types of applications it is not intended to be the only plug forming material and should not comprise more than 20% of the total plug length. The remaining 80% or more of the plug length should be a cement-based barrier.

CHEMICAL DISPOSAL WELLS

Achieving zonal isolation with long-term dependability across the injection zone of chemical disposal wells is critical. Conventional Portland cements and even many specialty cement blends are not suitable for use in such low pH environments. WellLock resin exhibits excellent chemical resistance to most low pH fluids and is used during the primary cementing operation to isolate the injection zone of these wells. During the design process of the chemical disposal well it is recommended to perform an immersion test of set WellLock resin in the specific fluid to be disposed due to the nature and variability of waste fluids. This can be facilitated by contacting your local representative.



PROPERTIES

Both the fluid and mechanical properties of the set solid can be tailored to meet a variety of wellbore challenges. As a fluid, WellLock resin has low miscibility with aqueous-and oil-based fluids allowing it to form a competent solid when placed in these types of environments. As a set solid, WellLock resin is chemically inert and has strong resistance to acid, base and hydrocarbons. Long-term integrity of the material has been studied using advanced thermal degradation techniques, and an upper service temperature of 280 °F is recommended. Mechanical properties are strongly related to temperature. Generally, elasticity and strain-to-failure increase with temperature while Young's modulus is reduced as temperature increases. Depending upon the temperature, strain-to-failure rates greater than 40% are commonly observed.

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

Specifications

SAP Number	721271
Function	wellbore sealant
Form	liquid
Color	clear to dark amber
Service Temperature Range	50 °F (10 °C) to 280 °F (138 °C)
Density	6.5 lb/gal to 15 lb/gal

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

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