PermSeal® Service
Versatile, Cost-Effective Sealants for Conformance Applications

The Halliburton PermSeal® service family of well conformance products has been designed specifically to help reduce production expenses and help re-establish well productivity. It is one of the most versatile gelation systems in the industry providing durable deep matrix and fracture sealing.

Operators can count on the PermSeal service to help:

- Minimize waterflood and CO₂ channeling, pinhole casing leaks and channels behind pipe
- Seal high pressure zones and control gas migration and lost circulation at the kick-off point in deviated wells
- Stabilize subsiding zones, faulting zones and deep or shallow water flows
- Regain sweep efficiency and re-establish recovery potential by stopping the cycling of water or CO₂ in high-perm streaks and inter well communication

Highly Effective Permeability Reduction
Laboratory core studies indicate that PermSeal™ gel can help reduce permeability to water more than 99% in both matrix and fractured Berea cores. The cores, held at 200°F (93°C), were treated with 2 to 3 pore volumes of PermSeal material. They were then shut in to allow complete polymerization before flow was resumed. Matrix permeability decreased from 150 to 0.4 md. In the fractured core, permeability decreased from 3200 to 10.8 md. Even with a 1000-psi differential pressure across the 3-in. core, little flow was attained through either treated core and no extrusion occurred.
Stable: The PermSeal service system is thermally stable to 300°F (149°C) and is designed to help operators regain production and revenue lost to coning and poor sweep efficiency in the low to mid-temperature range of 40°F-200°F (4.4°C-93°C).

Environmental: Contains no heavy metal crosslinkers. PermSeal material can be used with minimal environmental effect unlike heavy metal crosslinked systems.

Versatile: Seals matrix or fractures in most reservoir or formation lithology. PermSeal material is versatile and can be cost-effectively applied in most reservoir or formation lithology in matrix, natural or induced fractures requiring conformance sealing.

Resistant: An effective sealant where a harsh environment is present. PermSeal material is resistant to acid and is substantially unaffected by H₂S, CO₂ or multivalent cations in formation brines.

Reliable: Polymerizes in-situ to form an insoluble, thick, viscous, elastomeric gel. Because PermSeal material transforms into a polymeric gel inside the rock matrix or fracture, it does not extrude from the rock under pressure and significantly reduces the rock’s water permeability.

Quality Control: Predictable gel setting times. The system contains thermally activated initiators that help provide predictable, practical gel times across the entire applicable temperature range.

PermTrol™ Service
PermTrol service is one of the most effective ways to improve volumetric sweep efficiencies in waterfloods and one of the easiest to use. PermTrol material is injected as a low viscosity solution (1.3 cp), entering the high permeability streaks of the zone in the same proportion as the injection water. Once in the formation, a chemical reaction causes the water-thin PermTrol solution to become a highly viscous polymer (40,000 to 400,000 cp) with viscosity and solubility to satisfy individual well characteristics. After a short shut-in time to allow for polymerization, the waterflood is resumed.

A PermTrol service treatment is never static. Initially it diverts injection water to less permeable portions of the zone, forcing the floodwater to sweep new areas of the interval. Over time, the water gains viscosity as it fingers through the soluble PermTrol polymer, creating an in situ polymer flood with an increase in volumetric and unit displacement sweep efficiency.

PermTrol service can be used in sandstone and limestone reservoirs. It is compatible with nearly every conformance control, clay stabilizing, and enhanced oil recovery chemical, and is suitable for projects involving CO₂. The application temperature range for PermTrol service is 40°F-200°F (4°C-93°C).

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**Advantages**

PermSeal™
- Stable in matrix
- Not compromised by matrix movement
- Inexpensive in matrix
- Seals fractures in matrix
- Versatile matrix or fracture
- Resistant to acid
- Reliable in-situ

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**Lab Core Study Data**

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<thead>
<tr>
<th></th>
<th>Core Samples</th>
<th>Before Treatment</th>
<th>After Treatment</th>
<th>Reseal</th>
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<tbody>
<tr>
<td>PermSeal™</td>
<td></td>
<td>750 mD</td>
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<td>375</td>
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For more information about how the PermSeal® service can help improve your profitability, contact your local Halliburton representative or e-mail stimulation@halliburton.com.

www.halliburton.com