ABOUT HALLIBURTON

Founded in 1919, Halliburton is one of the world’s largest providers of products and services to the energy industry. With more than 80,000 employees, representing 140 nationalities in approximately 80 countries, the company serves the upstream oil and gas industry throughout the lifecycle of the reservoir—from locating hydrocarbons and managing geological data, to drilling and formation evaluation, well construction and completion, and optimizing production through the life of the field. Visit the company’s website at www.halliburton.com.
Multi-Chem understands that a properly engineered and implemented chemical treatment program can contribute to significant savings in deepwater/CAPEX projects. That's why we dedicate the time and technology to help assure that every treatment will continue to flow through every umbilical, every time—no matter how long the deepwater line runs.

Our DeepSEAL℠ service solutions include a full line of products that are deepwater-qualified for capillary and umbilical applications using the most rigorous standards in the industry today. Operators can rest assured that DeepSEAL chemical treatments will flow—and continue to flow after weeks of standing in lines—and will perform when they reach the injection point, with no harm to the umbilical or capillary tubing in the process.
DEEPSEAL™ PRODUCT LINE

Multi-Chem DeepSEAL solutions include a full line of products for integrity management, flow assurance, and production enhancement:

- Corrosion Inhibitors
- Scale Inhibitors
- Anti-Agglomerate Hydrate Inhibitors
- Paraffin and Asphaltene Inhibitors and Dispersants
- Blended Products Custom Formulated as Needed

DEEP WATER CERTIFICATION

In order to help ensure stabilized chemical application for greater safety in deep water umbilical systems, Multi-Chem’s DeepSEAL products are deepwater-certified through a rigorous testing process. The certification process focuses on helping ensure the quality of all products designated for delivery via subsea umbilical and capillary infrastructure at low, mid and high temperatures (4°C, 60°C and 120°C), testing specific product characteristics to ensure all DeepSEAL qualified products exceed strict standards for quality, purity, and application compatibility.

- **Hydrate Formation Tendency** — calculates the appropriate amount of thermodynamic hydrate inhibitor required to prevent formation of gas hydrates on product formulations that contain water. Computer modeling is conducted to determine the propensity for hydrate formation at 15000 psig and 4°C.

- **Hot / Cold Centrifuge Testing** — quickly exposes inherent stability issues for candidate products. It comprises an accelerated test to determine product stability at 60°C and 4°C while exposing material to centrifugal forces at 2000 rpms for four hours. Any observed gels, solids, haze or separation constitute a failure.

- **High-Pressure Viscosity Testing** — quantifies product rheology and stability at extreme pressures. Viscosity is measured at two temperatures (4°C and 20°C) and five pressures (0, 5000, 10000, 15000, and 20000 psig). Requirements for passing this test include viscosity <100 cP at 15000 psig.

- **Particle Size Analysis** — requires that products be filtered in the lab through a 2 µm filtration rig before conducting any DeepSEAL certified products testing. Particle size and counting is then evaluated using a HIAC ABS 2 particle size analyzer capable of batch analysis of volatile or viscous fluids. Products that pass particle size analysis testing must meet SAE Class 8 specifications.

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| 1       | Plastics: <10% change in all parameters measured  
          Metals: <1 MPY average corrosion rate |
| 2       | Plastics: 10-20% change in one or more parameters  
          Metals: 1-5 MPY average corrosion rate |
| 3       | Metals: >5 MPY average corrosion rate |
• **Materials Compatibility Testing** — involves submerging selected materials (metals, plastics, and elastomers) in the specified chemical and heating to 60°C for 28 days. Mass, volume, hardness, and corrosion rates are measured and the compatibility of products is ranked from 1 to 3 ratings.

• **Filter Resistance Testing** — used to quantify long-term product stability after 60 days at 4°C, 20°C, and 60°C. After aging, products are passed through a 2 µm filtration rig to determine ΔP across the filter. Statistical analysis of the ΔP data is conducted to determine pass or fail, with any change in ΔP slope greater than 5 percent considered a fail.

**CAPILLARY CERTIFICATION**

• **Materials Compatibility Testing** — Tests are conducted by submerging selected suite of metal samples at BHT up to 400°F for seven days. Formation of solids, corrosion products, phase separation, >2 pH change, or corrosion rates >1 MPY are considered a failure.

• **Thermal Stability** — Chemicals are exposed to temperatures equal to BHT of application for seven days. Any observed gels, solids, haze, or separation are considered a failure.

• **Capillary String Rig** — Product is loaded into a 1000 ft capillary simulation rig equipped with a 10 µm filter. Product is tested for seven days at maximum temperature and pressure conditions. ΔP change across the filter must be <10% for product to pass test.

**ENGINEERED SOLUTIONS**

From the start, Multi-Chem technical professionals stand ready to help you devise the right treatment strategy for your application. We work closely with operators to proactively identify potential flow assurance problems and production enhancement opportunities, and can find and prepare solutions in planning stages of development.

Our services include:

• Piping and Instrumentation Diagram (P&I) Design Review
• Fluid Testing and Characterization
• Production Chemistry / Fluid Review
• Modeling and Prediction for Asphaltenes, Paraffins, Hydrates, Scale, and Corrosion
• Engineered Solution Design / Implementation Plan
• Laboratory Services Recommendations
• Supply Chain Management Review
• Recommendation / Implementation of System-Wide Total Chemical Solutions

**MULTI-CLEAN™ INSPECTION PROCESS**

To maintain product purity, all DeepSEAL certified products receive special handling through Multi-Chem’s exclusive Multi-Clean™ process. This ensures our chemicals and containers are of the exceptional quality and cleanliness required for capillary/umbilical delivery. Comprising verified inspections, multiple sample retentions, and multiple filtering to stringent specifications, the Multi-Clean process provides a chain of custody for each batch and container, documented by serial number.

• **Filtration and Manufacturing** — All DeepSEAL totes are prepared through a rigorous cleaning process before filling, and once filled the contents are verified to meet SAE 4059 Class 8 or better filtration standards before sealing and custody transfer.

• **Product Shipment and Handling** — Samples are retained for a year and monitored monthly to ensure quality. In addition to supplying totes, Multi-Chem also can filter directly into 6000 gallon ISO tanks.
ASSURED PERFORMANCE FROM LEADING TECHNOLOGY

With Multi-Chem DeepSEAL solutions, you’re assured of leading performance and Best in Class service quality for your deepwater chemical program. While other companies focus on selling chemicals, Multi-Chem focuses on helping get you the right solution at the right time, so you get the most out of your equipment and return on your investments.

High pressure viscosity test quantifies product rheology and stability at extreme pressures and requires a viscosity <100 cP at 15000 psig in order to qualify as a DeepSEAL product.
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