

Friction Reducer and Thickener for Acids and Brines

Drilling Specialties' HE® 150 Polymer is a high viscosity synthetic polymer that is useful in thickening hydrochloric acid, brines or fresh water. It shares the excellent high temperature stability found in the previous DSGA® Polymer, yet provides greater efficiency by producing more viscosity with each pound of polymer. The HE® 150 Polymer is particularly effective as a friction reducer in fresh water, various brines and in hydrochloric acid, and has been widely used for that purpose. The HE® 150 Polymer may be purchased as a dry polymer or as a liquid packaged as a concentrated particle suspension in order to reduce dusting, speed hydration and enhance field handling.

Product Descriptions

There are currently two suspension formulations available, both having unique properties and advantages. The **Liquid HE® 150 Polymer** is a suspension of the polymer in iso-alkane oil. This formulation provides a number of advantages, including;

- **Ease of handling** - This suspension flows readily, even in severe winter conditions. The actual pour point of the suspension is below -30°F. This allows the product to be easily poured out of a bung, or metered through a positive displacement pump.
- **Rapid polymer hydration** - Test results show complete viscosity development in 2% KCl within one minute at 75°F. This performance suggests the potential use of this product in continuous mix applications, such as Slick Water Fracturing treatments. Under adverse field mixing conditions, the Liquid HE® 150 Polymer has been successfully applied directly to an 11.6 ppg calcium chloride brine, with very rapid viscosity development.
- **Superior, long term suspension stability** - This formulation utilizes a base fluid system that has been successfully used for other polymer suspensions for well over a decade. The Liquid HE® 150 Polymer has proven to be stable, with no indication of particle settling or phase separation for more than a year under normal storage conditions.
- **Thermal Stability** - HE® 150 Polymer is stable to 375°F.

For those areas of operation where specific environmental factors or regulations preclude the use of the hydrocarbon base oil, a second suspension formulation is available. The **Greenbase™ HE® 150 Polymer** is a suspension of this high viscosity synthetic polymer in glycol ether. This formulation also provides a number of advantages, including:

- **Ease of Handling** - Applying the polymer as a liquid suspension provides for efficient dispersion of the particles in the treating fluid, without dusting or lumping. The Greenbase™ HE® 150 Polymer also allows for metering the polymer during continuous mixing operations.
- **Rapid polymer hydration** - The Greenbase HE® 150 Polymer disperses readily in aqueous fluids, allowing the suspended polymer to dissolve and produce viscosity quickly.
- **Lack of Sheen** - Because the glycol ether base fluid is fully miscible in water, no sheen is formed.

The properties of this suspension are detailed below. Because the Greenbase HE® 150 Polymer uses a polar organic solvent, it is more affected by reductions in temperature than is the oil-based product. As the temperature is reduced, the glycol ether system increases in bulk viscosity at a greater rate than the Liquid HE® 150 Polymer. Its pour point appears to be around -10°F. Greenbase™ HE® 150 Polymer is registered for use in the North Sea. A copy of the HOCNF, generic format, is available upon request.

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GREENBASE™ HE® 150



Suspension Properties

Property	Liquid HE® 150 Polymer	Greenbase™ HE® 150 Polymer
colored liquid	cream	cream
Density	8.2 lb/gal	8.8 lb/gal
Activity	3.6 lb/gal	3.0 lb/gal

Packaging

Container	Liquid HE® 150 Polymer	Greenbase™ HE® 150 Polymer
Pail	40 lb Net (5 gal)	44 lb Net (5 gal)
Drum	440 lb Net (54 gal)	477 lb Net (54 gal)
Disposable Tote	2,250 lb Net (274 gal)	2,370 lb Net (269 gal)

Applications

- As an acid viscosifier, for reducing fluid loss, extending acid spending time and improving stimulation results by increasing live acid penetration.
- As a thickener for Slick Water Fracturing.
- As a friction reducer for acids and brines.
- As a thickener for fresh water or brines in workover or completions operations.
- As a thickener or aqueous lubricant for use in pipeline, fiber optics and related drilling and placement.

Slick Water Friction Reduction

Many slick water fracturing treatments utilize a polyacrylamide emulsion polymer (PHPA) which is added on the fly. Although the PHPA tends to be relatively inexpensive, it poses certain limitations. As an invert emulsion additive, complete inversion of the emulsion must be achieved before the polymer can perform to reduce drag. In some field brines, that inversion can be problematic. Incomplete inversion leads to lower achievable pump rates due to higher friction pressure. This problem can be rectified by using a co-surfactant, but that adds another component to the system. PHPA can also be sensitive to brine components and contaminants, particularly multivalent cations (Ca+2, Mg+2, Fe+3, etc.). These cations can attach to the hydrolyzed (the carboxylic acid) portion of the polyacrylamide, resulting in cross linking and loss of solubility.

HE® 150 Polymer is an excellent friction reducer (ref: paper #AADE-08-DF-HO-03, dated April, 2008). When added to water, it dispersed readily, so lumping is avoided. It also dissolves extremely fast. One distinct advantage of the HE®150 Polymer suspension is that it does not require an "inversion" in order to expose the polymer to the frac fluid, like the emulsion polymers do. Because of that, common water contaminants do not tend to interfere with the rate of viscosity development.

HE®150 Polymer is a significantly more efficient friction reducer than polyacrylamide, so lower concentrations of polymer will produce the same results normally expected from PHPA. The Liquid HE150 Polymer suspension delivers more active polymer (3.6 lb/gal) than a typical emulsion polymer (2.6-3 lb/gal), so it should require less volume to produce the same results. Start a slick water fracturing treatment with 25% less volume (GTG) than when using traditional emulsion polymers. Adjust the concentration up, or down, to

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GREENBASE™ HE® 150



maximize the injection rate. The Liquid HE®150 Polymer is an oil-based suspension with sufficiently low bulk viscosity making it relatively easy to meter into a fluid stream, even in winter weather.

Polymer Cleanup

Particularly in completions applications, there are often concerns about how to remove residual polymer for the near wellbore area after the operations are finished. The HE® 150 Polymer is a very robust polymer, which remains soluble and does not degrade under normal conditions, making it generally useful in the oilfield. It can, however, be degraded under downhole conditions and removed with solutions of commonly used oilfield oxidizing agents, such as ammonium persulfate.

Availability

The Liquid HE® 150 Polymer and Greenbase™ HE® 150 Polymer suspensions can be made available at the following worldwide stock points.

North America:	Lafayette, LA Houston, TX Blackfalds, Alberta, Canada	Elk City, OK Midland, TX	Casper, WY
Europe:	Rotterdam	Aberdeen, Scotland	
Asia:	Singapore		
Middle East:	Jebel Ali		

Customer Service

To Place an Order: **Western Hemisphere: +1-800-423-3985**
 Europe/Africa/Middle East: +32-2-689-1202
 Asia Pacific: +65-6517-3229

Literature

1. Fox, Kelly B., Stouffer, Carl E., and Utley, Beau, "Evaluation of a New Friction Reducer for Brines", AAE-08-DF-HO-03, presented at the 2008 AAE Fluids Conference.
2. Fox, Kelly B., Stouffer, Carl E., and Utley, Beau, "A New Friction Reducer for Brines", presented at the 2008 Southwest Petroleum Short Course.

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