

## BORATE CROSS-LINK FLUID

Many of the oil-bearing formations in the Illinois Basin have high permeability, but are also high in natural silts and fines. To sustain production, most formations must be hydraulically fractured. To complete fracturing treatments in high permeability zones, a viscous fluid must be pumped to control leak-off. Reliable breakers are also critical due to the low BHST in the Illinois Basin.

Borate cross-linked Guar Gels will develop high viscosity, which will carry proppants effectively and allows higher proppant concentrations, which increases the fracture width. Fracturing fluid leak-off is reduced, which assists in increasing the fracture half-length.

Franklin's borate cross-link fluid yields a high-quality, temperature-stable gel system with very accurate break times at very low temperatures. Borate cross-linkers can be used with both WGA-1, HPG and WGA-2, GUAR gel. Normal concentrations of crosslinked fluid gel loading range between 20 to 40 lbs per 1,000 gallons of frac fluid. Borate gels will normally cross-link at a pH of between 8.5 and 9.0.

Temperatures for borate fluids are generally limited to wells with a BHST of 140 degrees Fahrenheit, but with proper testing can be designed for use at much higher temperatures. Once cross-linked, borate gels can develop in excess of 2,000 cps of viscosity. When broken, viscosities will return to +/- 10 cps.

The biocide, gel, oxidizer breaker, cross-linker, surfactants, and clay stabilizers are pre-gelled in the frac tank. The low temperature breaker aid and cross-link activator will be added on the fly.