



HYBRID CHEMICAL  
TECHNOLOGIES

# HIGH VISCOSITY FRICTION REDUCER

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## HVFR-990Z

HVFR-990Z is a zwitterionic emulsion polyacrylamide copolymer friction reducer. The HVFR was developed with a surfactant package that provides fast inversion and generates significant viscosity in high TDS waters, up to 300K mg/L. The loading can be optimized to accommodate water changes during operations or to achieve greater viscosity for higher proppant concentrations. The SFR-990Z is breakable using traditional oxidizing breakers, for improved proppant pack cleanup.

**Table 1: Physical Properties**

Appearance	White opaque liquid
S.G.	1.10
Flash Point	>93°C (Non-flammable)
Pour Point	-30°C
pH (1% in water)	4.7

**Loadings:**

The HVFR-990Z is typically added at a loading of 0.5 L/m<sup>3</sup>- 1.0 L/m<sup>3</sup> to observe a >70% reduction in friction pressure, in waters up to 300K mg/L TDS (total dissolved solids). If higher viscosities are required, depending on the TDS of the water, the loading can be increased to 3-5 L/m<sup>3</sup>.

**Viscosity Measurements:**

Viscosity measurements were taken on an Ofite 900 Viscometer at a 100/sec shear rate. A 5 L/m<sup>3</sup> loading of SFR-990Z was tested in a range of brines with TDS of 5K-250K mg/L. Viscosity measurements are shown in Figure 1 below:

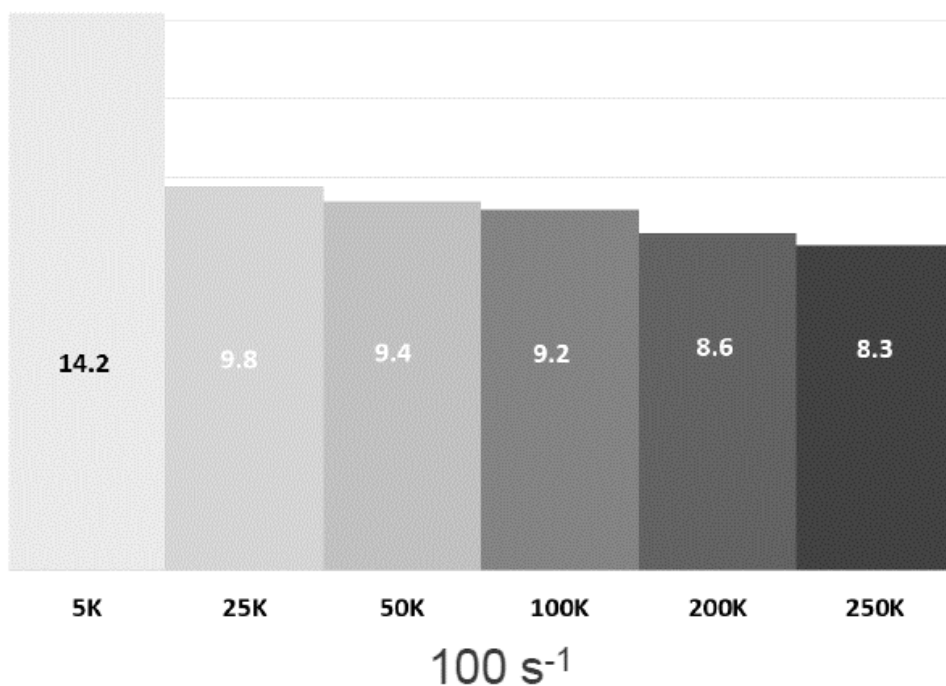


Figure 1: Viscosity measurements in various brines, 100/sec shear rate

## Friction Reduction Testing:

Friction reduction performance of HVFR-990Z in 3% KCl, Modified API Brine (8% NaCl, 2% CaCl<sub>2</sub>) and Modified API Brine (16% NaCl, 4% CaCl<sub>2</sub>), at a 0.5 L/m<sup>3</sup> loading of SFR-990Z, at a flow rate of 38 L/min, 0.5" OD pipe.

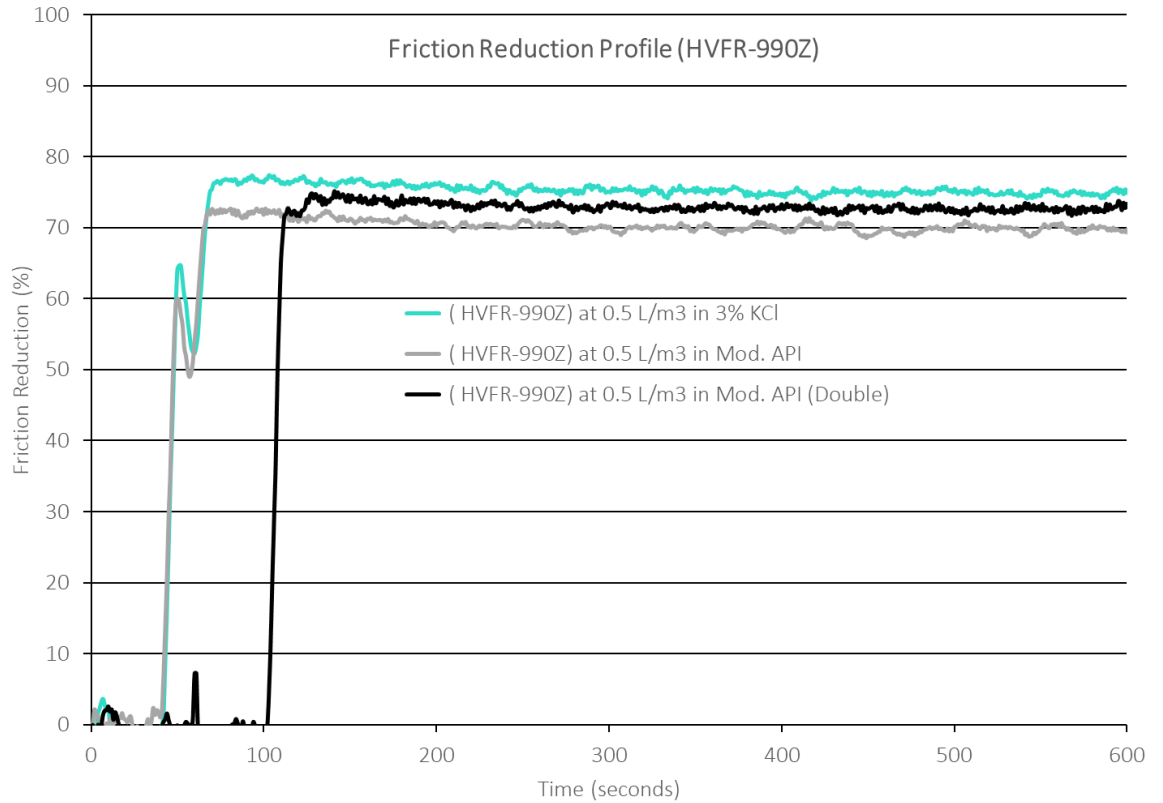


Figure 2: Friction Reduction Profiles, HVFR-990Z in Various Brines