STEP energy services

LINEAR GELS AND FOAMS

STEP-CO2

STEP CO2 is a linear gel system which includes the addition of carbon dioxide before the fluid enters into the wellbore. Carbon dioxide provides the benefits of creating additional viscosity, as well as enhancing cleanup. This is especially beneficial in low pressure reservoirs. It should be noted that the addition of carbon dioxide can have effects on the pH of the system and that carbon dioxide can cause the precipitation of asphaltenes from oils. However, it provides the most effective means of energizing a fracturing fluid. In addition, CO2 treatments make use of less water, which provides benefits in water sensitive formations, and reduces overall water consumption.

STEP CO2 is typically made up of the gellant SWG-201, a derivatized guar polymer. Either the liquid version, SWG-201L, or the solid version can be used in conjunction with a dry-add hydration unit. This provides the benefit of rapid hydration and a clean, low residue break. This is also compatible with STEP's clay control additives, scale inhibitors, and most potential additives. In addition, an emulsifying surfactant is typically used, which should ideally be tested for compatibility with formation fluids to ensure no detrimental emulsions are created.

Operational Benefits:

- Hydrates rapidly to form a viscous linear gel
- Easy to mix, no formation of fish eyes
- Compatible with most chemical additives
- Clean gel, little to no residue upon breaking
- Emulsifying with CO2 creates additional viscosity beyond linear gel

Technical Data:

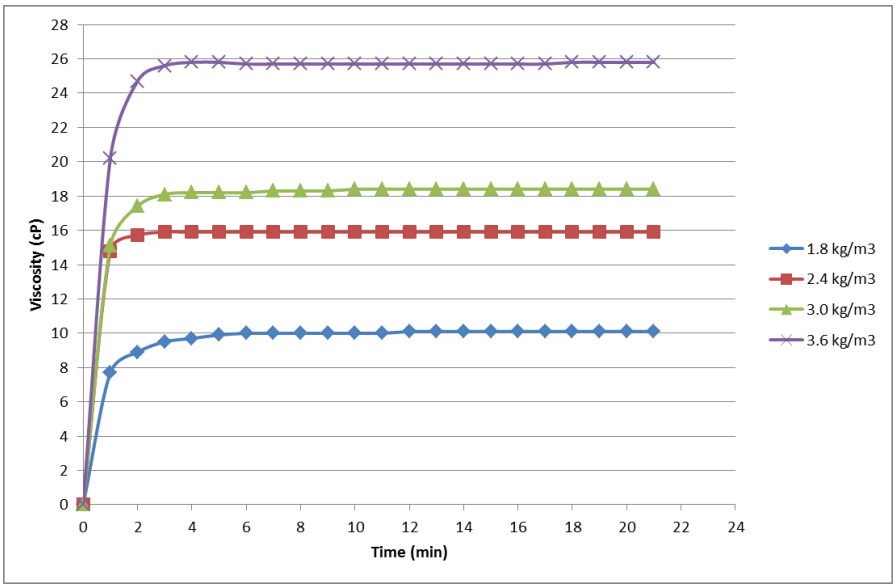

Figure 1: Hydration of various loadings of SWG-201

Temperature (˚C)	Gel Loading (per m^3)	Breaker Loading
20	3.0kg (6.4 L)	0.3 L/m^3 SBE-1
	3.6 (7.7 L)	0.4 L/m^3 SBE-1
30	3.0kg (6.4 L)	0.2 L/m^3 SBE-1
	3.6 (7.7 L)	0.25 L/m^3 SBE-1
40	3.0kg (6.4 L)	0.1 L/m^3 SBE-1
	3.6 (7.7 L)	0.1 L/m^3 SBE-1
50	3.0kg (6.4 L)	0.4 kg/m^3 SBO-1
	3.6 (7.7 L)	0.5 kg/m^3 SBO-1
60	3.0kg (6.4 L)	0.3 kg/m^3 SBO-1
	3.6 (7.7 L)	0.3 kg/m^3 SBO-1
70	3.0kg (6.4 L)	0.1 kg/m^3 Encap LT
	3.6 (7.7 L)	0.1 kg/m^3 Encap LT
80	3.0kg (6.4 L)	0.1 kg/m^3 Encap HT
	3.6 (7.7 L)	0.2 kg/m^3 Encap HT
90	3.0kg (6.4 L)	0.1 kg/m^3 Encap HT
	3.6 (7.7 L)	0.1 kg/m^3 Encap HT

Figure 2: Proposed Breaker Loadings of STEP-LG