



Optimized Milling Operations ECWS Fluid Rheology System

Fluid Rheology

Essential Coil Well Service provides a Fluid Rheology System (FRS) that comprises of our Fluid Pump, Chemical Van and Engineered Job Modeling. This setup provides real-time monitoring and optimizing of Fluid Rheology by determining the Reynolds Number to maintain ideal flow regime.



Features and Benefits

- Optimization of Rheological metrics for solids transport
- Reduce cycle meters with less wiper trips
- Optimization of chemical consumption (eliminates gel sweeps)
- Reduced operating hours
- Real-time monitoring of Fluid Rheology

Case Study – 8 Well Bridge Plug Mill-Out

On a recent post-frac bridge plug milling project, using the newly designed milling metrics, ECWS was able to reduce operating time, decrease chemical costs and improve overall efficiencies.

Comparison of Bridge Plug Mill-Out Campaigns in Montney

Description	Milling using Old Metrics	Optimized Milling using FRS
Deepest Well TD (mMD)	5030	5656
Total Plugs Milled	132	139
Gel Pumped (L)	730	0
Average Wiper Trips/Well	1.5	0
Operating Hours/Plug Milled	2.68	2

- 32% reduction in milling costs using the optimized milling
- Elimination of gel costs
- Elimination of wiper trips
- Reduced cycle meter charged

Chemical Van – Technical Specifications

- 2 x Waukesha & 4 x Eagle PC Pumps
- Accurate Chemical Injection to 0.05 L/min
- 6-10 Heated 1,000 L Chemical Tote Storage
- Lab Area including OFITE 900 Automated Viscometer
- Data Recording System
- PID system allowing remote and automated operation with feedback control system to keep required chemical loading consistent under changing pump rates



Twin Fluid Pumps – Tech. Specifications

- 10,000-15,000 psi Operating Pressure Rating
- 660 hp to 1,500 hp Deck Engines
- Dual 2.0-5.0 m³ Mixing Tanks with Overfill Alarms
- Shear Pumps and Chemical Injection Ports
- Pump-to-Coil Data Network onto OrionNET
- Fluid Rates, Fluid Totals, and Annular Velocity (AV)
- Real-Time Density Measurement
- Data Recording System



Fluid Rheology

Fluid Rheology Tracking Sheet

- Daily Chemical Treatment Report
- Measurements of Viscosity, Density, Annular Velocity, and Reynolds Number
- Specialized Chem Van Operator
- 24 Hour Engineering and Field Superintendent Support
- AV and Viscosity vs. Time Graph
- Reynolds Number vs. Time Graph

Fluid Rheology Metrics AV and Reynolds Number (Input and Return Parameters) Chemical Usage and Loading Records

ESSENTIAL COIL WELL SERVICING TOUR REPORT

Client:		Chem Van#:	Pump #:	Job #:
Oil Company:		Operator:	Rig #:	Ticket #:
UWI (Downhole):		OD of C.T (mm): 60.30	Type of Service:	
Province:		Casing ID (mm): 111.90	Date:	

Event #	Time	Elapsed	Comments	Visc. Reading: 300 rpm (SS)	Visc. Reading: 600 rpm (SS)	Visc. Reading: Marsh Funnel (SS)	Salinity (%)	pH Reading (0-14)	Fluid Temp. (°C)	Density (g/cm ³)	Dynamic Viscosity (cP)	Effective Viscosity (cP)	Annular Velocity (m/s)	Reynolds Number (Injection)	Reynolds Number (Return)	Return Rate (l/min)	Pump Press (BPP)	Pump Rate (l/min)	# of Chems	Type of Chemical	Loading (L/m ²)	Chem. Volume (L)	Coil Tube Total (L)	PPR Total (L)	HPG Total (L)
1	0:01	0:00	Fluid Sample	0.9	2.0	25.0	0.9	7.0	90.0	1005.0	1.0	1.0	0.962	43,976.6	43,976.6	400.0	35.0	400.0					5.0	0.0	0.0
2	0:01	0:30	Start HP Rig 0.5L/HP										0.120			50.0	35.0	50.0	1	Coil Tube	0.1	22.0	22.0	0.0	0.0
3	1:00	1:00	Return Fluid Sample	0.9	2.5	27.0	1.2	7.0	21.0	1090.0	1.3	2.0	0.601	24,301.7	24,301.7	250.0	35.0	250.0					22.0	0.0	0.0
4	2:00	1:00	Fluid Sample	0.9	2.4	26.0	3.0	7.0	22.0	1020.0	1.2	1.0	0.962	41,964.3	41,964.3	400.0	35.0	400.0					22.0	0.0	0.0
5	3:00	0:00	Fluid Sample	1.0	2.3	26.0	7.0	7.0	24.0	1040.0	1.2	1.0	0.962	44,647.5	44,647.5	400.0	35.0	400.0					22.0	0.0	0.0
6	3:05	0:32	Fluid Sample	1.0	2.4	26.0	7.0	7.0	15.0	1009.0	1.2	1.0	0.601	25,944.9	25,944.9	250.0	35.0	250.0					22.0	0.0	0.0
7	4:00	1:00	Fluid Sample	1.0	2.5	26.0	2.0	7.0	18.0	1071.0	1.3	1.0	0.962	33,330.3	33,330.3	400.0	35.0	400.0					22.0	0.0	0.0
8	5:00	1:00	Fluid Sample	0.9	2.6	26.0	4.5	7.0	22.0	1028.0	1.3	1.0	0.962	39,040.1	39,040.1	400.0	35.0	400.0					22.0	0.0	0.0
9	6:00	1:00	Fluid Sample	1.0	2.4	26.0	1.2	7.0	17.0	1005.0	1.2	1.0	0.601	25,942.0	25,942.0	250.0	35.0	250.0					22.0	0.0	0.0
10	7:00	1:00	Fluid Sample	0.9	2.3	26.0	3.1	7.0	12.0	1052.5	1.5	1.0	0.962	34,473.7	34,473.7	400.0	35.0	400.0					22.0	0.0	0.0
11	8:00	1:00	Fluid Sample	1.0	2.5	26.0	2.8	6.0	16.0	1052.5	1.3	1.0	0.962	33,369.5	33,369.5	400.0	35.0	400.0					22.0	0.0	0.0
12	9:00	1:00	Fluid Sample	1.1	2.9	26.0	2.8	7.0	18.0	1005.0	1.4	1.0	0.601	21,460.5	21,460.5	250.0	35.0	250.0					22.0	0.0	0.0
13	10:00	0:42	Fluid Sample	1.0	5.0	26.0	2.8	7.0	18.0	1052.5	2.5	1.0	0.962	19,594.8	19,594.8	400.0	35.0	400.0					22.0	0.0	0.0



Fluid Rheology

Real-Time Reynolds Number

- Data acquisition of Fluid Density and Annular Velocity with multiple samples of Viscosity per hour to provide accurate and up to date Reynolds Number
- Data Connection between Fluid/N2 Pumps and CT Rig to display Real-Time Reynolds Number on CTES OrionNET
- Display Von Mises criteria real-time to ensure operating within CT limits
- Real-time data acquisition to generate WOB, accurate surface weight vs. depth graph and live CoF matching.



