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# Optimized Milling Operations

# ECWS Fluid Rheology System

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**ECWS FLUID PUMPING SYSTEMS**

# 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

**24 Hour Engineering Support - Job Monitoring - 24 Hour Dispatch Hotline**
**Call 1-844-ESN-COIL (376-2645) for Service**

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# 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

Fluid Rheology

# 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

# Fluid Rheology

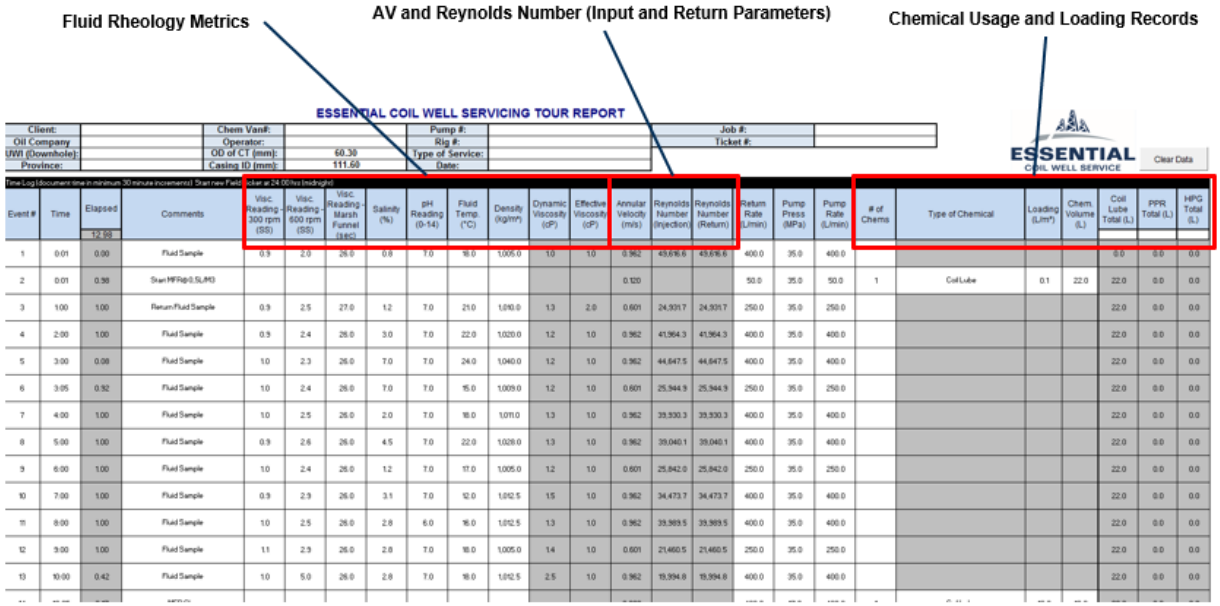
## Twin Fluid Pumps – Tech. Specifications

- 10,000-15,000 psi Operating Pressure Rating
- 660 hp to 1,500 hp Deck Engines
- Dual 2.0-5.0 $m^3$ 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

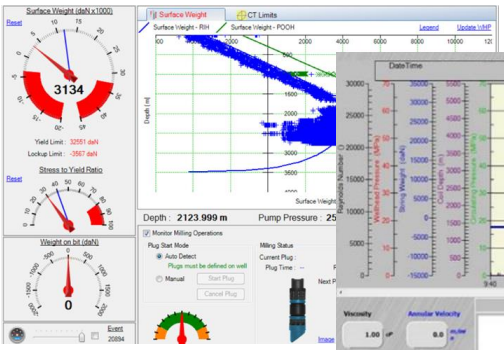
- Daily Chemical Treatment Report
- Measurements of Viscosity, Density, Annular Velocity, and Reynolds Number
- Specialized Chem Van Operator
- 24 Hour Engineering and Field Superintendent Support
- AV and Viscosity vs. Time Graph
- Reynolds Number vs. Time Graph

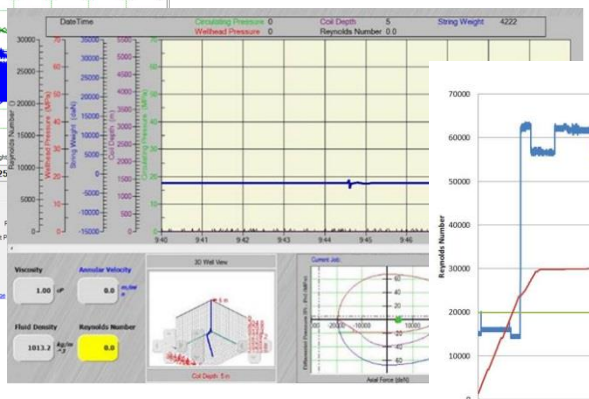


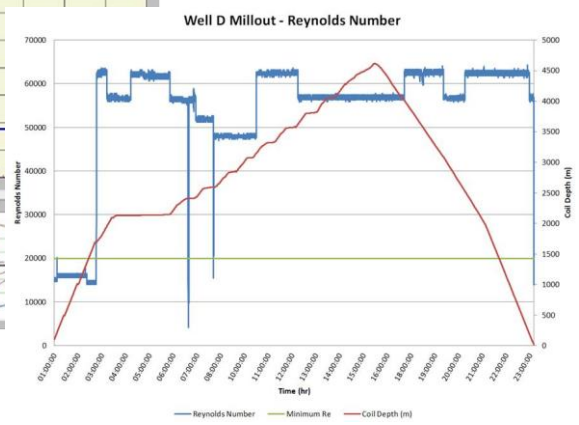
# Fluid Rheology

## 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.







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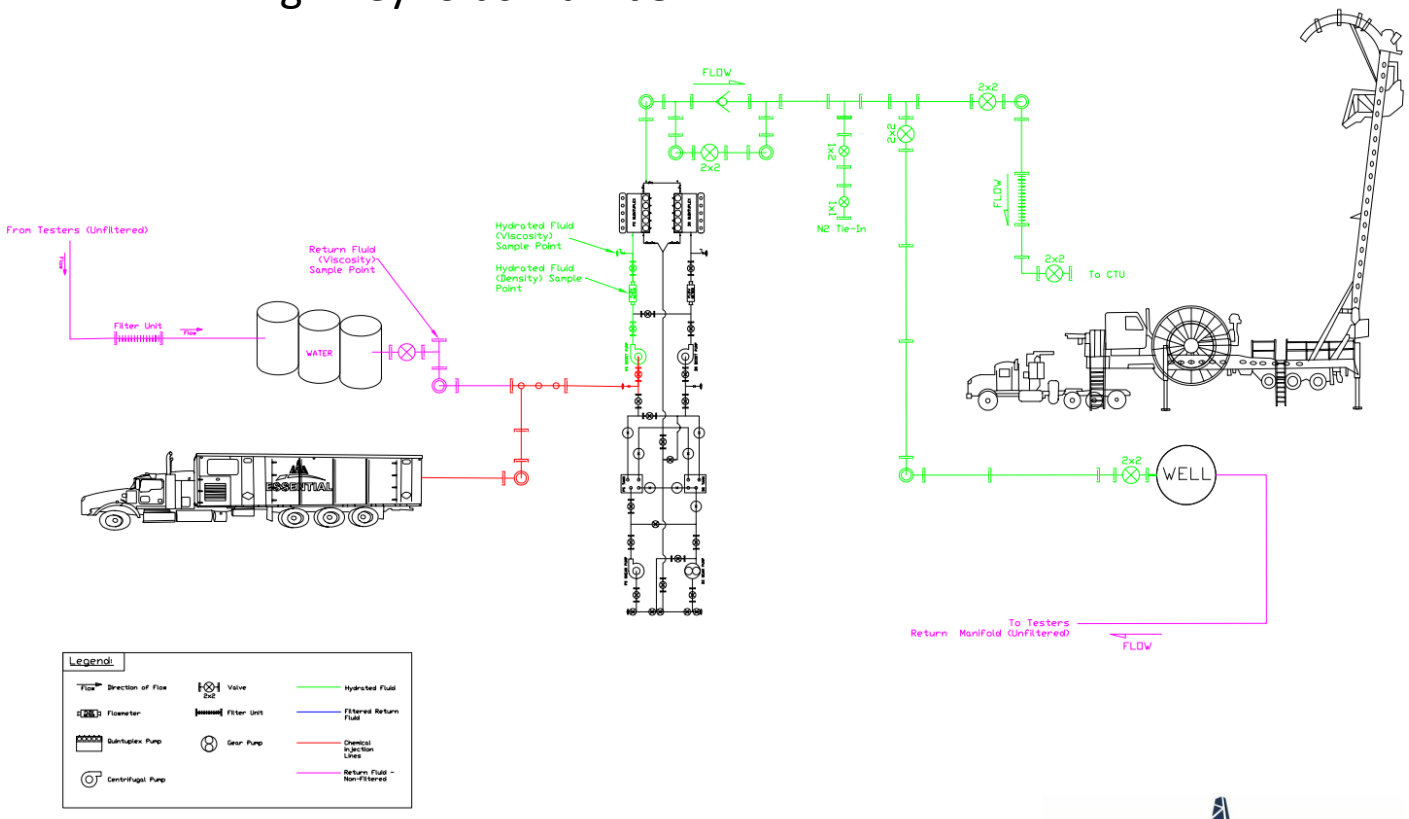
# Fluid Rheology

## P&ID

- Viscosity reading will be obtained from sample point on Fluid Pump
- Density reading will be recorded by Fluid Pump DAS
- Optimize flow regime for High AV, Low Viscosity and High Reynolds Number



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