

### HYBRIDRILL EDE™

**Generic System Name:** Oil sands drilling fluid

**Introduction:**

Category: An encapsulating, anti-accretive water-based polymer mud system for heavy oil reservoirs.

Application: Drilling SAGD wells or conventional wells in heavy oil and oil sand formations.

Replacement for: Other oil sand drilling fluids.

**Components:** HYBRIDRILL EDE™

<i>QMax Product</i>	<i>Function</i>
<i>Water</i>	Continuous phase
<i>*QXAN</i>	Viscosifier
<i>*QPAC LV</i>	Fluid loss control
<i>*QSTAR ENV</i>	Fluid loss control
<i>*MAXCAP D</i>	Encapsulator
<i>*QCLEAN</i>	Anti-accretive
<i>Caustic Soda</i>	Alkalinity control

#### Key aspects

- Q It does not provide clay inhibition
- Q Maintain concentration of QCLEAN
- Q Keep alkaline environment
- Q Optimize use of PHPA for low MBTs

## Specialized Drilling Fluids

<i>Supplemental Materials</i>	<i>Function</i>
<i>*Super Sweep</i>	Hole cleaning sweep
<i>*QBREAK</i>	Polymer breaker
<i>*Corinox</i>	Corrosion inhibitor
<i>*QCIDE</i>	Bactericide
<i>Sulphamic acid</i>	pH reducer
<i>Bleach, Ascorbic acid</i>	Water pre-treatment

\* Proprietary or brand name products

### Key aspects

- Q Add min. 0.4 gpb biocide before tripping
- Q Reduce Ca<sup>++</sup> to less than 200 mg/l
- Q Keep alkaline environment
- Q Optimize use of PHPA for low MBTs

## Typical System Properties

### Hybridrill EDE

<i>Property</i>	<i>Range</i>	<i>Min/Max Recommended</i>
<i>Mud Weight, ppg (kg/m<sup>3</sup>)</i>	8.6 - 8.9 (1030 - 1060)	<8.9 (< 1065)
<i>Plastic Viscosity - cP</i>	5 - 20	< 25
<i>Yield Point, lb/100ft<sup>2</sup> (Pa)</i>	8 - 14 (16 - 28)	<30 (< 15)
<i>Gels, lb/100ft<sup>2</sup> (Pa)</i>	2/16 - 10/30 (1/8 - 5/15)	As required
<i>pH</i>	10.0 - 10.5	< 10.5
<i>Calcium, mg/l</i>	40 - 100	< 100
<i>MBT, ppb-eq (kg/m<sup>3</sup>)</i>	2.5 - 7.5 (7 - 20)	<7.5 (< 20)
<i>API Fluid Loss - cc/30min</i>	3 - 5	< 8
<i>Oil water ratio</i>	5:95 - 10:90	< 20:80

### Key aspects

- 🔍 Recommended for low densities
- 🔍 Hole cleaning must be monitored
- 🔍 Keep laminar flow in the annulus
- 🔍 If high oil content, treat the fluid

## Field Operations

### Mixing Procedures

For New System: Start with clean tanks and pre-treated (bleach and ascorbic acid) water. Reduce calcium content to below 200 mg/L with soda ash. Add viscosifier and fluid loss additives to desired properties. Mix caustic soda to desired pH. Add minimum 2 % v/v QCLEAN™. Circulate system to homogenize the concentrations. Recommend to drill out cement with water and viscosified sweeps from a short circulating system.

For mix “on the fly”: Not recommended

### Maintaining Properties

Add QCLEAN™ in the suction tank or in pre-mix volumes. Maintain the required concentration as per retort analysis (QCLEAN distills at 345°C). The required concentration depends on cleanliness of tubulars and sands/solids at the shakers. Small additions of viscosifier may be required to maintain or improve rheology. Mix fluid loss additives as required. Maintain calcium below 200 mg/L with additions of soda ash.

### Fluid Specific Tests and Equipment

- Complete WBM testing kit
- 50 mL digital retort
- Bacteria test strips for use in multi-well project
- Send sample of water to lab for pre-treating procedure and concentrations
- “Procedure for determining the concentration of QCLEAN™ in Hybridrill EDE System”

### Contaminants: effect and treatment

<b>Contaminant</b>	<b>Mud Effect</b>	<b>Treatment</b>
<b>Aeration</b>	Pump cavitation, foaming	Defoamer
<b>Bacteria</b>	Odour, viscosity or filtration change, carb/bicarb change	Bactericide
<b>Calcium</b>	Adversely affects polymer efficiency	Reduce with additions of Soda Ash
<b>Cement</b>	High alkalinity and increase in calcium ion content	Citric or Sulphamic Acid, Soda Ash
<b>CO<sub>3</sub><sup>2-</sup>/HCO<sub>3</sub><sup>-</sup> /CO<sub>2</sub></b>	"Gritty" look, reduces pH	Caustic soda, Lime
<b>H<sub>2</sub>S</b>	Odour, loss in alkalinity	Zinc carbonate or other H <sub>2</sub> S scavenger
<b>High oil content</b>	NA	Process for oil recovery
<b>Low inhibition</b>	Sticky cuttings, accretion	Increase Q'Clean™ concentration
<b>LGS</b>	High PV's	Centrifuge and / or dilution
<b>High pH</b>	Polymers will not work effectively if pH above 10.5	Citric or Sulphamic Acid, Soda Ash
<b>Salt</b>	Increased chlorides, reduced viscosity	Dilute with fresh water if necessary
<b>Surfactant</b>	Pump cavitation, foaming	Defoamer
<b>Water influx</b>	Loss of fluid properties	Replenish products to recommended levels, Density increase required to stop flow

### Operational Recommendations and “Best Practices”

- Concentrated pre-mixes for maintaining or manipulating properties an option.
- Use “Procedure for determining the concentration of QCLEAN™ in HYBRIDRILL EDE System” to determine concentrations of water, QCLEAN™, bitumen and solids.