

## Specialized Drilling Fluids

### CBMax 100™

**Generic System Name:** Coal bed methane drilling fluid, coal bed methane coring fluid, coal bed methane drill-in fluid.

**Introduction:**

Category: A water based or brine based fluid used for drilling in coal beds.

Application: Drilling wet or dry coals in vertical or horizontal profiles. It is recommended that CBMax 200™ be used in horizontal wells while either system (CBMax 100 or 200) may be used in vertical wells.

Replacement for: No known replacement system.

**Components: CBMax100™**

<i>QMax Product</i>	<i>Function</i>
<i>Water</i>	Continuous phase
<i>Bentonite</i>	Viscosifier
<i>*MAXCAP D</i>	PHPA
<i>Caustic Soda</i>	Alkalinity control
<i>*QPAC LV</i>	Fluid loss control
<i>*QSTAR ENV</i>	Fluid loss control
<i>*CBMax</i>	CB stability additive

\* Proprietary or brand name products

#### Key aspects

- Q Specially designed to drill CBM wells
- Q Preferred to be used in vertical wells
- Q Keep bentonite concentration for LSYF
- Q Maintain alkaline environment

## Typical System Properties

<b>CBMax 100™</b>		
<b>Property</b>	<b>Range</b>	<b>Min/Max Recommended</b>
<b>Mud Weight, ppg (kg/m<sup>3</sup>)</b>	8.8 – 9.2 (1,050 – 1,100)	< 9.2 (< 1,100)
<b>Plastic Viscosity, cP</b>	5 – 10	< 20
<b>Yield Point, lb/100ft<sup>2</sup> (Pa)</b>	10 – 20 (5 – 10)	< 12
<b>Gels, lb/100ft<sup>2</sup> (Pa) 10" / 10'</b>	4-12 / 10-24 (2-6 / 5-12)	As required
<b>pH</b>	10.0 - 11.0	> 10.0
<b>Calcium, mg/l</b>	40 - 100	< 100
<b>MBT, ppb-eq (kg/m<sup>3</sup>)</b>	0 – 10 (0 – 28)	< 12 (<35)
<b>API Fluid Loss, cc/30min</b>	5- 8	< 10
<b>Sand Bed Invasion Test, cm</b>	3.0 - 4.5	< 4.5

## Field Operations

### Mixing Procedures

For New System: Mix new systems in a premix tank with hopper and bring to suction as premix. Treat fresh water with bleach and ascorbic acid for bacteria, reduce calcium to below 100 mg/L with additions of soda ash. Mix bentonite up to 9 ppb (25 kg/m<sup>3</sup>) and allow time to fully hydrate, raise the pH to 10.5 with caustic soda. Add 7 – 10.5 ppb (20 – 30 kg/m<sup>3</sup>) CBMax at 5 – 10 min per sack, mix QPAC LV and QSTAR ENV at a ratio of 1:1 up to 1:4 to reduce fluid loss. Mix MAXCAP D to a minimal concentration of 0.7 ppb (2 kg/m<sup>3</sup>) then adjust rheology if required – use small additions of QXAN if possible. Increase MAXCAP D concentration while drilling ahead.

### Key aspects

- Q Keep drilled solids content at minimum
- Q Monitor PHPA content
- Q Hole cleaning must be monitored
- Q Recommended for low densities

For mix “on the fly”: Not recommended

### Maintaining Properties

- pH at 10.5 with caustic if carbonates/bicarbonates are noted.
- Maintain density as low as possible with all solids control equipment when drilling or circulating the hole.
- Viscosity as required with bentonite in the CBMax100™, although QXAN is preferred to help keep MBT below 10 ppb-eq (28 kg/m<sup>3</sup>).
- Fluid loss at less than 8cc per 30min with QPAC LV, and QSTAR ENV at a ratio of 1:4 over 2 circulations.
- Maintain CBMax concentration at 10 ppb (28 kg/m<sup>3</sup>) by adding CBMax every 2 - 4 hours while drilling ahead.

### Fluid Specific Tests and Equipment

- Complete WBM testing kit
- Sand Bed invasion test kit (recommend 3 – 4.5 cm sand invasion)
- PHPA test kit (if MAXCAP D is added)

### Contaminants: effect and treatment

<b>Contaminant</b>	<b>Mud Effect</b>	<b>Treatment</b>
<b>Aeration</b>	Gritty appearance. May cause pump cavitation, increased corrosion	Treat with small additions of silicon defoamer
<b>Bacteria</b>	Odour, reduce viscosity, increased filtration, carb/bicarb change	Bactericides
<b>Calcium</b>	Clay flocculation	Soda ash
<b>Cement</b>	High alkalinity and increase in calcium ion content	Sodium bicarbonate
<b>CO<sub>3</sub><sup>2-</sup>/HCO<sub>3</sub><sup>-</sup>/CO<sub>2</sub></b>	Reduces pH	Caustic Soda
<b>H<sub>2</sub>S</b>	NA	NA
<b>Inhibition</b>	NA	NA
<b>LGS</b>	High PV, filtration and filter cake	Centrifuges, dilution
<b>High pH</b>	Polymers will not work effectively if pH above 10.5	Citric acid, sodium bicarbonate
<b>Salt</b>	Clay flocculation	Thinners, dilution
<b>Surfactant</b>	Foaming	Silicon defoamer
<b>Water influx</b>	Mud dilution, reduction of viscosity etc.	Replenish to required levels with premix and/or additives.

### Operational Recommendations and “Best Practices”

- Foaming will occur when mixing the CBMax additive although it rarely affects pumps or downhole equipment while drilling. Shut down mixing hopper when not in use and keep hopper valve closed at all times except when mixing, keep suction tank volume high and use defoamers sparingly as any surfactants adversely affect CBMax component. Best to spray problem tanks with a spray gun with a silicone based defoamer.

In order to minimize the formation of coal fines that could produce formation damage impairment, the following practices are recommended:

- Prior to trips, pump to surface a hi-vis hole cleaning sweep from the pill tank consisting of 3.0 m<sup>3</sup> of active mud with 1 sack of CBMax and 1-2 vis cups of QXAN XCD.
- Run in hole trip speed should be a maximum of 2-3 min per stand to avoid surge pressures which could induce formation fractures.
- Slide as much as possible rather than rotate to prevent coal crushing on the lower part of the hole. Exercise as low bit RPM as possible for the same reason as above.
- Employ the use of a big bowl centrifuge at all times. Process the entire flow and adjust centrifuge settings for high RPM, as high G force as possible and long retention times.
- The use of tri-cone bits rather than PDC bits is recommended.
- Sweeps can be utilized if hole conditions indicate tight connections, higher than expected torque or rounded cuttings are noticed at the shakers. Mix QSTOP & CBMax @ 2:1 ratio in 6 – 12 bbl (1 - 2 m<sup>3</sup>) of water in the pill tank and pump around. Monitor results on the shaker and drilling data.
- Employ “Dry Reaming” technique.
- Use bits with back reaming capability.