

QNCa

Generic System Name: Water based polymer system with calcium nitrate.

Introduction:

Category: Water based polymer system with moderate inhibition levels provided by calcium nitrate.

Application: The QNCa mud system can be used for drilling surface holes where reactive clays are present and the risk of bit balling and mud rings is high. Because the system is based on Ca^{2+} ion, it is a good option for drilling through anhydrite formations. The system is tolerant to cement contamination as well. Suitable for drilling wells with CO_2 presence; carbon dioxide will react with calcium to precipitate carbonates.

Replacement for: Water / spud mud / extended bentonite mud systems.

Components: QNCa

<i>QMax Product</i>	<i>Function</i>
<i>Water</i>	Continuous phase
<i>*QNCa</i>	Inhibitor / salt
<i>*QXAN</i>	Viscosifier

* Proprietary or brand name products

Key aspects

- Q Moderate inhibitive WBM
- Q Excellent to prevent bit balling
- Q Easy to maintain
- Q Closely monitor Ca^{++} content

Typical System Properties

QNCa		
Property	Range	Min / Max recommended
Mud Weight, ppg (kg/m ³)	8.6 - 9.5 (1,030 - 1,140)	< 10.5 (< 1,250)
Plastic Viscosity, cP	5 - 10	< 10
Yield Point, lb/100ft ² (Pa)	6 - 8 (3 - 4)	6 - 8 (3 - 4)
Gels, lb/100ft ² (Pa)	1/3 - 3/5 (1/2 - 2/3)	NA
pH	7.0 - 8.5	7.0 - 9.5
Calcium, mg/l	As required	1,500 / 9,000
MBT, ppb-eq (kg/m ³)	0 - 10 (0 - 28)	< 15 (< 43)
API Fluid Loss - cc/30min	NC	NC

Key aspects

- Q Low rheology drilling fluid
- Q Hole cleaning must be monitored
- Q Filtration rate is not controlled
- Q Ca⁺⁺ content depletes rapidly

Field Operations

Mixing Procedures

For New System: Start with clean tanks and fresh water. Add calcium nitrate to required percentage. Mix xanthan gum to required viscosity.

For mix “on the fly”: Not recommended

Maintaining Properties

Close monitoring of the calcium level is crucial. Depending on the clay reactivity of the formations drilled, it has to be at a certain value to provide some inhibition. It is recommended that CST tests are run on area formations to evaluate the grade of inhibition and estimate the amount of calcium nitrate that is needed prior to drilling. Adjust polymer additions to maintain viscosity.

Fluid Specific Tests and Equipment

- Complete WBM testing kit

Contaminants: effect and treatment

Contaminant	Mud Effect	Treatment
Aeration	Foaming mud; Pump jacking	Turn off surface mixing equipment
Bacteria	Low pH; odour	Add biocide and caustic soda
Calcium	None	NA
Cement	Loss of viscosity	Decrease pH < 12.5 with sulfamic or citric acid
CO₃²⁻/HCO₃⁻ /CO₂	Low pH; changes in Pf, Mf; Mud aeration	Add lime or caustic soda for pH > 9.0
H₂S	Odour; black mud; corrosion	Add zinc carbonate; zinc chelates or scavenging amines
Inhibition	Soft, sticky cuttings	Increase additions of calcium nitrate
LGS	High PV	Centrifuge and/or dilution
pH	High pH	Citric or Sulfamic Acid
Salt	None	NA
Surfactant	Foaming	Prevention from cement water and rig wash; Antifoam agents premixed in the makeup water and/or defoamers
Water influx	Dilution – Decrease of calcium ion content	Increase MW; adjust calcium nitrate concentration

Operational Recommendations and “Best Practices”

- Typically calcium nitrate concentration is between 10 -12 ppb (28 – 35 kg/m³) for drilling surface formations.
 - Initially the fluid will show low viscosity. If it is necessary to add polymer, use a high quality Xanthan Gum.
 - It is recommended to run PHB sweep for hole cleaning at 15 – 20 ppb (50 – 60 kg/m³) in fresh water.
 - It is recommended to add QSTOP or sized calcium carbonate when drilling permeable formations.
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