MAXDIRECT PLUS

Generic System Name: Low density direct emulsion water based mud.

Introduction:

Category: Inhibitive Water based mud with a density lower than water. The system can also be transformed into a stable foam direct emulsion system.

Application: This system is used for drilling depleted zones due to the density that can be achieved 7.3 – 7.7 ppg (880 - 920 kg/m^3). The formations where this system is generally used are dolomites, limestones and marl.

Replacement for: Low densities invert emulsions, foam and aerated systems

Components: MAXDIRECT PLUS

QMax Product	Function
Water	Continuous phase
Bentonite	Viscosifier and FLC
Caustic Soda	Alkalinity control
**QSTAR ENV*	Fluid loss control
**QMUL DIRECT*	Emulsifier
Diesel	Discontinuous phase
**QM-11*	Clay inhibition
KCl	Clay inhibition

* Proprietary or brand name products

Key aspects

- Designed for drilling depleted zones
- For mud densities between 7.3 – 7.7 ppg
- Easy to maintain
- Can be recycled and re-used

Supplemental Materials	Function
Soda Ash	Precipitates Ca^{++}
*QLig Sulf	Thinner
$CaCO_3$	Bridging agent
Barite	Weighting agent
Zinc Oxide	H_2S Scavenger

Typical System Properties

MAXDIRECT PLUS

Property	Range	Min/Max Recommended
Mud Weight, ppg (kg/m^3)	7.3 - 7.7 (880 - 920)	< 8.4 (< 1,000)
Plastic Viscosity, cP	20 - 40 cP	< 60 Cp
Yield Point, $lb/100ft^2$ (Pa)	30 - 70 (15 - 35)	< 80 (<40)
Gels, $lb/100ft^2$ (Pa)	16/20 - 20/30 (8/10 - 10/15)	As required
API Fluid Loss, cc/30min	4.0 - 10.0	< 14.0
pH	10.0 - 11.0	< 12.0
Calcium, mg/l	40 - 120	< 240
Oil / Water ratio	10:90 - 75:25	80:20

Key aspects

- Max OWR is 80:20 for a stable emulsion
- QMUL DIRECT is a key product
- Do not allow contamination with OBM
- Efficient SCE is needed to control MW

Field Operations

Mixing Procedures

For New System: Make-up water should be checked for calcium and magnesium. If the hardness check indicates a calcium ion concentration in excess of 150 mg/L, the water can be pre-treated with soda ash. This product can change from being beneficial in removing the calcium contaminant, to being detrimental by increasing the carbonate radical anion which is a clay flocculent. After the make-up water quality is acceptable, mix 1.75 – 3.5 ppb (5 – 10 kg/m^3) of Bentonite. Add required QSTAR ENV polymer to achieve fluid loss control. Mixing rate will vary between 2 to 10 minutes per sack depending on the efficiency of the mixing equipment. Add 0.2 – 0.35 ppb (0.5 - 1 kg/m^3) of Caustic Soda. Add slowly and at the same time QMULDIRECT and diesel. Allow the system to homogenize by mixing vigorously for a least 60 minutes. Add QM11 to recommended concentration.

For mix “on the fly”: Not recommended

Maintaining Properties

Small additions of bentonite and polymer may be required to maintain or improve rheology. Maintain calcium below 200 mg/L with additions of soda ash. The pH must be maintained between 10 and 11 with caustic soda additions.

Fluid Specific Tests and Equipment

- Complete WBM testing kit

Contaminants: effect and treatment

Contaminant	Mud Effect	Treatment
Aeration	Pump cavitation, foaming	Turn off surface mixing equipment
Bacteria	Odour, viscosity or filtration change, carb/bicarb change	Bactericide (Not very common)
Calcium	Flocculates bentonite	Reduce with Soda Ash additions
Cement	High pH and Ca^{++}	Sodium Bicarbonate
CO_3^{2-}/HCO_3^- /CO_2	Flocculates bentonite	Add lime for ions precipitation
H_2S	Odour, loss in alkalinity	Zinc Oxide, Caustic Soda
pH (low)	Reduced bentonite hydration	Caustic soda
Water influx	Dilutes concentrations	Replenish to recommended levels, density increase may be required to stop inflow

Operational Recommendations and "Best Practices"

- Always run all solids control equipment to avoid undesirable LGS incorporation into the active system.
- Avoid foaming; this could be from adding at the same time the emulsifier (QMUL DIRECT) and diesel.
- Always pay special attention to the chemical properties (Pm, Pf and Mf values). A viscosity increase could be related to CO_3^{2-}/HCO_3^-/CO_2 contamination.