ELEMENTIS
A global specialty chemicals company

Enhanced Performance Through Applied Innovation

BENTONE® 990

Suspension additive for oil-based drilling fluids

GENERAL INFORMATION

BENTONE 990 rheological additive is an organophilic amino-attapulgite which controls the settling of solids in oil-based drilling muds and other drilling fluids. **BENTONE 990**'s unique rheological structure suspends weighting materials and other solids with less increase in viscosity and gel strength than conventional bentonite or hectorite based organoclays. This allows the formulation of low viscosity muds with undiminished penetration rates and cuttings removal. **BENTONE 990** can be used alone or in combination with conventional organoclay gellants.The solids suspension capacity of a fluid which is already thickened with an organoclay can be increased by the addition of **BENTONE 990**, without substantially increasing the viscosity of the system.

CHEMICAL & PHYSICAL PROPERTIES

Composition	organically modified attapulgite clay
Color	light tan
Form	finely divided powder
Specific gravity	2.0 g/cm^3
Bulk density	0.6 g/cm^3
Moisture	5.5% maximum, as shipped

These are typical properties not to be used for specification purposes.

APPLICATIONS

Suspending solids in drilling fluids including:
- Oil-based drilling muds
- Invert emulsion muds
- Packer fluids
- Completion fluids
- Workover fluids

Based on:
- diesel oil
- crude oil
- mineral oil
- synthetic

- Conditioning mud before storage
- Controlling settling in diesel oil without the use of other additives
- Reducing the syneresis or separation of oil from

INCORPORATION

BENTONE 990 disperses readily in oils. As with other insoluble additives, good agitation should be used when incorporating **BENTONE 990** into the drilling system. The amount of stirring needed will depend on the temperature of the oil, with the rate of suspension control development increasing with increasing temperature, as well as with the level of shear available.

ATTRIBUTES

BENTONE 990 gellant

- Effectively suspends weighting materials and other solids
- Controls settling with minimal increases in viscosity and gel strength
- Reduces top separation of oil
- Maintains suspension over a wide range of water contents
- Maintains suspension over a wide temperature range
- Increases the suspension of solids in fluids thickened with organoclay gellants
- Has little effect of filtration; this must be controlled separately

LEVEL OF USE

The level of **BENTONE 990** use depends on the degree of solids suspension needed, on whether it is being used alone or in combination with a conventional gellant, and on the type of base oil being used. Pilot trails are recommended to optimize performance before field use.

Typical loadings are:

1 - 5 pounds/barrel	3 - 15 kg/m

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BASE MUD FORMULATION

80/20 OWR, 14 ppg

Components		Grams
Base Fluid	Isomerized C16/C18 Alpha Olefins	156
Primary Emulsifier	TOFA	10
Secondary Emulsifier	Polyimde	6
Brine	30w % Calcium Chloride Solution	74.5
Lime	Calcium Hydroxide Powder	10
Rheological Additive/Suspension Additive		**See Below**
Fluid Loss Additive	Amine Treated Liginte	8
Weighting Agent	Barium Sulfate	325

Mixed on a Hamilton Beach/Multimixer with a single sinusoidal blade at Low speed.

Mud Properties		
Primary Rheological Additive	**BENTONE 38/5 ppb**	**BENTONE 38/5 ppb**
Suspension Additive		**BENTONE 990/5 ppb**
Initial Properties		
Plastic Viscosity, cp	32	35
Yield Point, lbs/100 ft^2	16	30
Apparent Viscosity, cp	40	50
Fann 35 6/3 rpm	11/10	16/15
Gels,10 sec/10 min, 100 lbs/ft^2	11/18	18/22
Brookfield 0.3 rpm, cp	25,200	46,000
Emulsion Stability, V	1135	1290
400° F, 16 Hr. Static Aged Properties		
Plastic Viscosity, cp	77	73
Yield Point, lbs/100 ft^2	34	34
Apparent Viscosity, cp	94	90
Fann 35 6/3 rpm	10/8	13/11
Gels,10 sec/10 min, 100 lbs/ft^2	18/23	16/21
Brookfield 0.3 rpm, cp	13,200	22,000
Emulsion Stability, V	508	705
Syneresis, mm	**8**	**3**
Appearance	**medium gel**	**medium- soft gel**

Note: Initial properties - aged 16 hours at 150˚F

Health and Safety Data

Before using this product please consult our Material Safety Data Sheet for information on safe handling.

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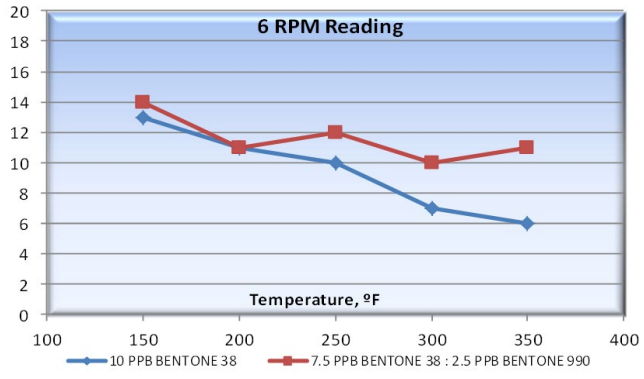
BENTONE® 990

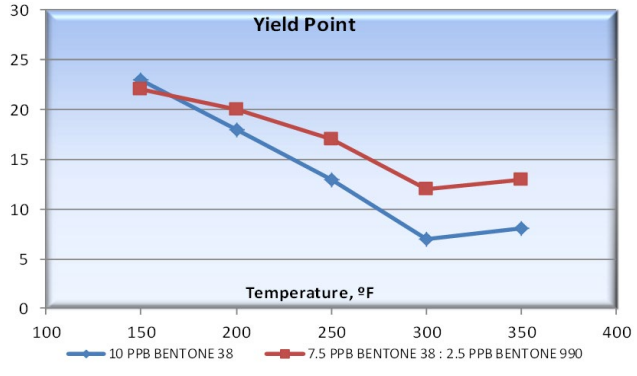
ENTONE 990 Suspension Aid Profile
Fann iX77 Temperature/Viscosity Results

BENTONE 990 Suspension Aid Profile
Fann iX77
BENTONE 38: BENTONE 990-MO

Formulation	Lbs/BBL
mud weight, #bbl	14.0
oil:water	85:15
LVT, gms	172.1
Primary Emulsifier, gms	15.0
BENTONE 38, gms	10.0
BENTONE 990, gms	0.0
25% $CaCl_2$ Brine, gms	48.0
Lime, gms	10.0
Barite, gms	337.2

Test Conditions		10 PPB BENTPNE 38						7.5 PPB BENTONE 38:2.5 PPB BENTONE 990					
		PRM Reading @				PV	YP	PRM Reading @				PV	YP
Temp(°F)	Pres(psi)	600	300	6	3	(cPs)	(lb/100 ft²)	600	300	6	3	(cPs)	(lb/100 ft²)
150	1000	57	40	13	11	17	23	52	37	14	11	15	22
200	5000	54	36	11	9	18	18	52	36	11	10	16	20
250	7000	51	32	10	8	19	13	47	32	12	9	15	17
300	9000	47	27	7	6	20	7	46	29	10	7	17	12
350	11000	46	27	6	5	19	8	79	46	11	9	33	13





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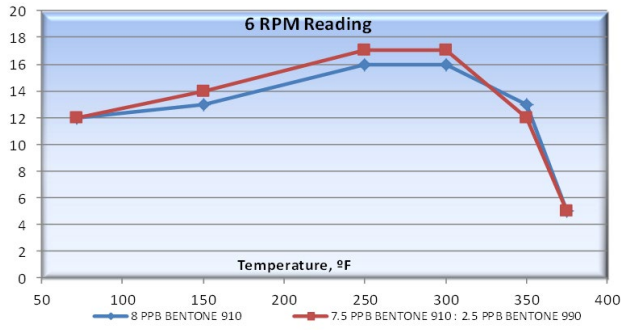
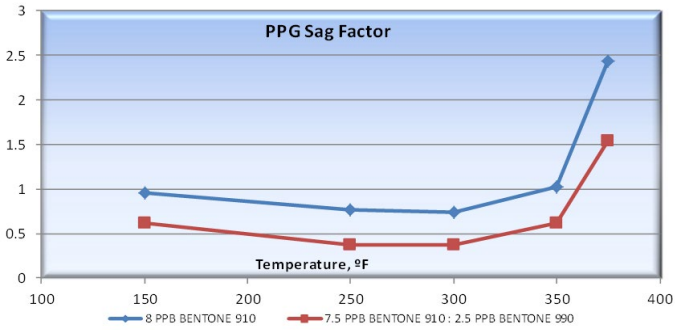
BENTONE 990 Suspension Aid Profile
Jefferson Sag Results

BENTONE 990 Suspension Aid Profile
Jefferson/Sag Shoe Test-Hot Roll
BENTONE 910: BENTONE 990-#2 DO

Formulation	Lbs/BBL
mud weight, #bbl	14.0
oil:water	80:20
#2 Diesel Oil, gms	168.0
Primary Emulsifier, gms	6.0
BENTONE 38, gms	x
BENTONE 990, gms	y
30% $CaCl_2$ Brine, gms	74.5
Lime, gms	5.0
Barite, gms	325.0

Hot Roll Temp		8 PPB BENTPNE 910						7.5 PPB BENTONE 910:2.5 PPB BENTONE 990						
		PRM Reading @				PV	YP	Sag	PRM Reading @				PV	YP	Sag
Temp(°F)	Test temp(°F)	600	300	6	3	(cPs)	(lb/100 ft²)	(#/gal)	600	300	6	3	(cPs)	(lb/100 ft²)	(#/gal)
72	120	90	58	12	11	32	26		103	66	12	11	37	29	
150	120	105	67	13	12	38	29	0.95	100	63	14	12	37	26	0.62
250	120	98	64	16	14	34	30	0.76	103	66	17	16	37	29	0.37
300	120	97	63	16	15	34	29	0.74	100	64	17	15	36	28	0.37
350	120	103	65	13	11	38	27	1.02	103	62	12	10	41	21	0.62
375	120	81	47	5	4	34	13	2.44	75	41	5	4	34	7	1.54





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North America
Elementis
469 Old Trenton Road
East Windsor
NJ 08512, USA
Tel.: +1 609 443 2500
Fax: +1 609 443 2422

Europe
Elementis UK Ltd.
c/o Elementis GmbH
Stolberger Strasse 370
50933 Cologne, Germany
Tel.: +49 221 2923 2066
Fax: +49 221 2923 2011

Asia
Deuchem (Shanghai) Chemical Co., Ltd.
99, Lianyang Road
Songjiang Industrial Zone
Shanghai, China 201613
Tel.: +86 21 5774 0348
Fax: +86 21 5774 3563