



# BENSEAL<sup>®</sup> and EZ-MUD<sup>®</sup> SLURRY

## Sealing and Plugging System

**Description** The BENSEAL<sup>®</sup> and EZ-MUD<sup>®</sup> slurry combines two widely used Baroid products into a patented technique that provides a simple, economical method to seal and grout boreholes, well casings and earthen structures. The slurry develops a high quality grout with low permeability.

### Applications/ Functions

*The use of BENSEAL and EZ-MUD slurry assists or promotes the following:*

- Seal or grout plastic and steel casings
- Seal downhole instrumentation in test and observation holes
- Plug abandoned boreholes for mineral, water and seismic exploration
- Stabilize broken or unconsolidated formations
- Grout ground source heat pump loops

### Advantages

- Develops strong bond between grout, casing and formation
- Forms a flexible seal with a very low permeability that prevents commingling of aquifers and entry of surface contaminants
- Delays bentonite swelling on surface so that unyielded bentonite will swell in situ
- Pumps at reduced pressure
- No heat of hydration
- Easy to mix
- Re-hydratable
- Minimal grout level subsidence
- Allows hole reentry
- Both products are NSF/ANSI Standard 60 certified

### Typical Properties

- Slurry weight 9.5 lb/gal (1.14 g/cm<sup>3</sup>)
- Total active solids 20% by weight
- Permeability 1.2 x 10<sup>-8</sup> cm/sec (in fresh water)
- Yield volume 26.3 gal (0.1 m<sup>3</sup>) per 50-lb (23-kg) bag of BENSEAL bentonite
- Thermal conductivity 0.43 btu/hour-ft.°F (0.74 watts/meter °C)

### Recommended Treatment

Effective use of BENSEAL<sup>®</sup> and EZ-MUD<sup>®</sup> slurry requires the use of specific equipment capable of mixing and placing a reactive, pumpable bentonite grout such as a commercial grouter. BENSEAL and EZ-MUD slurry can also be mixed using a proven low-shear mixing device then pumped into place using a piston, diaphragm, or gear-type pump.

The procedures described below must be followed closely to ensure proper mixing. To pump BENSEAL and EZ-MUD slurry, use a piston, diaphragm or gear-type pump.

**Do not overmix and do not use a centrifugal pump.**

**Recommended  
Treatment  
(continued)**

**Typical mixing procedure:**

- 1.) Pre-treat make-up water with Soda Ash to less than or equal to 100 mg/l total hardness and to a pH range of 8.5 – 9.5.
- 2.) Accurately measure 24 U.S. gallons (91-liters) of freshwater into grout mix tank and mark tank to ensure repeatability.
- 3.) With mixing paddles at high speed, add 8-10 fluid ounces (240-300 ml) of EZ-MUD liquid polymer to the pre-measured freshwater.  
 With mixing paddles maintained at high speed, blend one sack of BENSEAL into EZ-MUD/water mixture. *Rate of BENSEAL addition should be controlled; Normal application rate is 15 to 30 seconds\* per 50-lb (23 kg) bag.* Mixing of grout should continue only long enough to achieve uniform suspension of granular BENSEAL within the EZ-MUD/water mixture prior to pumping.  
*\*Rate of addition will vary based on mixing efficiency of selected grouting equipment.*
- 4.) Pump BENSEAL and EZ-MUD slurry through a 1.0–1.25 inch (25-32 mm) ID tremie pipe into hole without delay. Paddle stirring should be maintained at a moderate speed during active pumping to ensure continuous suspension of the granular BENSEAL. Grout slurry should be pumped through tremie pipe from bottom of interval to surface to ensure effective displacement. Maintain submergence of tremie pipe a minimum of 10-feet within grout column for uniform displacement.
- 5.) For continuous grouting operations, pump until the grout returned at the surface is of the same consistency as the grout being pumped into the hole.

**Heat loop grouting:**

Refer to typical mixing procedure steps 1-5. **Air entrainment due to overmixing will result in reduced thermal conductivity.**

Grout Volume Requirements					
Diameter (inches)	Diameter (mm)	gal/ft	m <sup>3</sup> /meter	ft/gal	meter/m <sup>3</sup>
2	51	0.16	0.002	6.25	493.3
3	76	0.37	0.005	2.70	219.2
4	102	0.65	0.008	1.54	123.3
5	127	1.02	0.013	0.98	78.9
6	152	1.47	0.018	0.68	54.9
7	178	2.00	0.025	0.50	40.3
8	203	2.61	0.032	0.38	30.8
9	229	3.30	0.041	0.30	24.4
10	254	4.08	0.051	0.25	19.7
12	305	5.87	0.073	0.17	13.7
14	356	8.0	0.099	0.13	10.1
16	406	10.5	0.130	0.10	7.7
18	457	13.2	0.164	0.08	6.1
20	508	16.3	0.203	0.06	4.9
24	610	23.5	0.292	0.05	3.4
36	914	52.9	0.657	0.03	1.5

*Note:* Volume of annular space = volume of hole - volume of casing O.D

**Recommended  
Treatment  
(continued)**

**Sealing casing:**

**Note:** In sealing casing, make sure that a "casing shoe shut-off" has been established between the bottom of the casing and the hole. This ensures that the sealing slurry remains in the annulus.

Refer to typical mixing procedure steps 1-3.

- 1.) Pump the prepared BENSEAL<sup>®</sup> and EZ-MUD<sup>®</sup> slurry through a 1.0–1.25 inch (25-32 mm) ID tremie pipe inserted down the annular space to the bottom of the hole.
- 2.) Fill the annulus uniformly from the bottom up, and withdraw the tremie pipe slowly as the slurry is discharged. Pump until the grout returned at the surface is of the same consistency as the grout being pumped into the hole.

**Plugging and abandoning boreholes:**

- 1.) Pump the prepared BENSEAL and EZ-MUD slurry through an open-ended drill pipe.
- 2.) Fill the hole from the bottom up and withdraw the drill pipe slowly as the hole fills to prevent pipe from becoming stuck.

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**Additional  
Information**

- The grouting material and method selected will depend upon the specific subsurface environment including all prevailing geological and hydrological factors and any existing regulatory requirements. The grouting process may not be complete until the grout is static at the desired level.
- The use of bentonite may not be appropriate in environments where the formation water chemistry has a total hardness greater than 500 parts per million and/or a chloride content of greater than 1500 parts per million.
- If questions arise regarding subsurface environments it is always best to consult your local Baroid IDP representative to determine if the Baroid product of choice is appropriate for the given conditions.

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**Packaging**

BENSEAL sealing and plugging material is packaged in 50-lb (22.7 kg) multiwall paper bags, containing 0.7 ft<sup>3</sup> (0.02 m<sup>3</sup>).  
EZ-MUD liquid polymer is packaged in 5-gal (19 liter) plastic containers. It is also available in cardboard cartons, which contain four 1-gal (3.8 liter) containers.

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**Availability**

BENSEAL sealing and plugging material and EZ-MUD liquid polymer can be purchased through any Baroid Industrial Drilling Products Retailer. To locate the Baroid IDP retailer nearest you contact the Customer Service Department in Houston or your area IDP Sales Representative.

**Baroid Industrial Drilling Products  
Product Service Line, Halliburton**  
3000 N. Sam Houston Pkwy E.  
Houston, TX 77032

<b>Customer Service</b>	(800) 735-6075 Toll Free	(281) 871-4612
<b>Technical Service</b>	(877) 379-7412 Toll Free	(281) 871-4613

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