



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

## Sealing and Plugging System

**Description** The BENSEAL/EZ-MUD 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

- 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 per one 50-lb sack BENSEAL<br>0.1 m <sup>3</sup> per 22.7 kg sack BENSEAL |
| • Thermal conductivity | 0.74 watts/meter °C 0.43 btu/hour ft °F  |

### Recommended Treatment

The procedure described below must be followed closely to ensure proper mixing. To pump EZ-MUD/BENSEAL slurry, use a piston, diaphragm or gear-type pump. **Do not use a centrifugal pump.**

**Recommended  
Treatment  
(continued)**

**Typical mixing procedure:**

Note: Effective mixing and placement of BENSEAL®/EZ-MUD® grout requires the use of specific equipment capable of mixing and placing a highly reactive, pumpable bentonite grout such as a commercial grouter or proven low-shear mixing device and pump.

*Do not over mix and do not use a centrifugal pump.*

- 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 24 U.S. Gallons (91-liters) of freshwater.
- 4.) With mixing paddles maintained at high speed, blend one sack of BENSEAL into EZ-MUD/water mixture. Rate of addition for BENSEAL should always be controlled and consistent. Normal application rates will generally range from 15 to 30 seconds per 50-lb (22.7 kg) bag. Rate of addition will vary based on mixing efficiency of selected grouting equipment. Mixing of grout should continue only as long as necessary to achieve uniform suspension of granular BENSEAL within the EZ-MUD/water mixture prior to pumping.
- 5.) Pump BENSEAL/EZ-MUD grout through a 1.0–1.25 inch (25-32 mm) ID tremie pipe into hole without delay. Paddle speed should be maintained at a moderate speed during active pumping to ensure continuous suspension of the granular BENSEAL. Grout 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.
- 6.) Continuous grouting operations should continue until competent grout is present at the surface.

**Heat loop grouting**

Refer to typical mixing procedure. Do not over mix to avoid entrapment of air that will result in reduced thermal conductivity.

For grout volume requirements refer to the following table:

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***

1. Pump the prepared BENSEAL®/EZ-MUD® slurry through a 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.

*Notes:*

- 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.
- 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/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 method selected will depend upon, and you should carefully consider, 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 subsurface environment that the respective bentonite sealing material or grout is to be placed into should always be taken into consideration when selecting the appropriate material to compose the well seal. If the formation water chemistry has a total hardness of greater than or equal to 500 parts per million and/or a chloride content of greater than or equal to 1500 parts per million the use of a bentonite material may not be appropriate for this environment. In the event that questions regarding subsurface environments arise 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® 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® 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 and EZ-MUD 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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