

When it comes to the Binary System,  
there are:  
**10**  
types of people  
Those who understand  
and  
Those who do not.



*Perfect Fit!  
Everything  
Slides Right In*

*Mr. Wel D. Zine*

*My calculations  
say it works*



*Mr. Wel D. Zine*

*Perfect Fit!  
Calcs Work!  
Only in your Dreams!*



*Mr. Wel D. Zine*

*What are we  
attempting to do!*



*Mr. Wel D. Zine*

*When there is a problem*

*What  
happened?*



*We have a  
problem!*



*We have to  
figure this  
out!*





## Case Study

- **Intent:** Prevent surface contamination
- **Contact Interpretation:** Granulated bentonite around casing while driving
- **Actual Result:** Unable to comply with contract specification to fill with granulated bentonite
- **Improved Result:** Understand intent and methods

## Specification Language


1. Contractor shall drill hole which will permit the driving and permanent placement of 30" diameter casing to a depth of 200' (or to refusal) and 24" diameter casing with a drive shoe to a depth of 344'.
2. When driving casings, a cone shaped depression or temporary outer casing filled with bentonite grout must be maintained around the outside of each casing.

## Cliff's Notes History of Grouting

- Control of water well construction
- Bentonite grouting provided controlled fill for the annular space around the casing for rotary drilling
- Good for rotary = Good for cable tool
- Mound bentonite around casing while driving
- Casing pulls bentonite to 1<sup>st</sup> water (max. 30')
- Effective in shallow sand wells – Florida

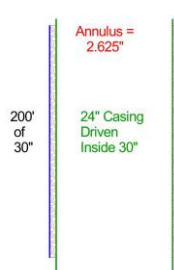
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*a "cone shaped depression" of bentonite - that is an engineering sounding term.*


**24" Casing**



Annulus = 2.625"

24" Casing Driven Inside 30"

200' of 30"




How is a "cone shaped depression" of bentonite formed?

### 24" Casing

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200' of 30"

24" Casing Driven Inside 30"



Annulus = 2.625"

200' of 30"

24" Casing Driven Inside 30"

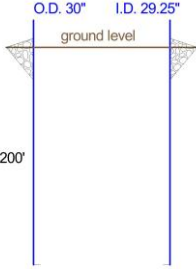
- How to fill 200' of 2.625" Annular Space With Bentonite?
- How to Install Temporary Outer Casing?
- If Annular Space Filled, Difficult to Drive Casing!

### Problematic Specification Language



What is accomplished with grout between the casings?

### 30" Casing



- Mounding granular bentonite around casing does seal the upper outer annulus
- The depth of the "pulled" bentonite 20' - at best = No couplings!

The depth of the "pulled" bentonite 20' - at best No couplings!

Annulus = 2.625"

200' of 30"

24" Casing Driven Inside 30" to a depth of 344' with Drive Shoe



Is Sealing Required between the casings? If so, This Design Does Not Work!

## Case Study

- Maximum Demand = 240 gallons in 30 seconds  
= (480 gpm)
- Minimum Demand = 1 gpm
- Minimum Run Time Pump = 4 minutes (VFD)

## Water Well Parameters

- Water Well Diameter      8 in
- Well Depth                    300 ft
- Casing Depth                80 ft
- Static Water Level         45 ft
- Test Pumping Rate         400 gpm
- Pumping Level              80 ft
- Maximum Well Yield      400 gpm

## Operating Parameters

- Maximum Demand    240 gals/30 secs (480 gpm)
- Maximum Well Yield    200 gals/30 secs
- Minimum Make-up Water    40 gals
- Maximum Demand Cycle = 1 every 2 mins
- System Off Pressure    60 psig
- System On Pressure    50 psig

## Issues

- 1) Make-up Water = 40 gals in 30 sec use
- 2) Pump Runs for a Minimum of 4 mins
- 3) After Demand Use, Pump Runs for a Minimum of 3.5 mins.



*Solution:*  
Install a Restricted-Fill  
Water Storage Tank

- Fill tank in 3.5 minutes
- Provide a Minimum of 40 gals in Draw Off
- Restrict fill rate to 8 gpm (VFD Pump) =  
28 gals of Draw Down
- Effective Pressure Cycle – High 60 psig and  
Low 30 psig (precharge)
- 120 gal Captive Air Tank = 46 gal Draw Down

## 2 Minute Cycle

- Restrictive Tank = 18 gals
- Need Additional 22 gals.
- Additional 90 gal Captive Air Tank = 35 gals



*Design Works;  
Minimum Run Time  
4 minutes 22 seconds*

## Discussion Points

- What difficulties do you experience?
- How can you help contractors perform better?
- Importance of the pre-bid meeting?
- How do you evaluate the contractor qualifications?
- What type of methods/resolutions have worked best for you?

(cont. slide)