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

My calculations say it works

Perfect Fit!
Calcs Work!
Only in your Dreams!

What are we attempting to do!

When there is a problem

What happened?
We have a problem!

We have to figure this out!
Case Study

- **Intent:** Prevent surface contamination
- **Contract 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 1st water (max. 30’)
- Effective in shallow sand wells – Florida

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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.
How is a “cone shaped depression” of bentonite formed?

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?

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

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No couplings!

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

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?