Calculating Required Surface Pressure to Pressure Test Casing Shoe

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Calculating Needed Surface Pressure to Test Casing Shoe

Many cautionary steps are taken to ensure safety when drilling an oil and gas well. One particular step is pressure testing the casing shoe shortly after cementing casing in place. Casing is set in the hole to utilize higher mud weights to hold deeper, higher pressured hydrocarbons in the formation without fracturing more shallow rock formations. The casing is set in place by pumping cement slurry down the casing and up the back side of the casing. After the cement hardens, excess cement in the bottom of the hole is drilled out and drilling continues. The bottom of the casing is referred to as the shoe and must be tested to make sure there is a sufficient cement bond between the formation and the casing. An insufficient bond could cause loss of drilling fluid. More importantly, if hydrocarbons enter the well-bore a blowout could occur at the casing shoe.

To pressure test the casing shoe a series of steps must be implemented. The first step is to know what equivalent mud weight the shoe is to be tested to. This is determined by using the maximum mud weight needed to complete the following casing section. The hydrostatic pressure of the actual mud weight is then subtracted from the hydrostatic pressure of the equivalent mud weight. The difference of the two pressures is then implemented to the well-bore by pumping mud into the well and monitoring the surface pressure. A list of steps to calculate the surface pressure for given mud weight, equivalent mud weight, and casing shoe depth follows.

Steps to calculating surface pressure applied when pressure testing a casing shoe.

**Step 1:** Make sure you have the following given data:

a. Mud weight in hole in lbs/gallon
b. Depth to the shoe in feet
c. Equivalent mud weight density to be tested to
**Step 2:** Open Microsoft Excel.

**Step 3:** In Cell A1, enter the given mud weight.

**Step 4:** In Cell A2, enter the given depth of the shoe.

**Step 5:** In Cell A3, enter the given equivalent mud weight to be tested to.

**Step 6:** Enter the following equation into Cell A4:

\[=0.052(A1)*(A2)\]
This represents the hydrostatic pressure gradient \((0.052 \rho d)\) in psi.

**Step 7:** Enter the following equation into Cell A5:

\[=0.052(A3)*(A2)\]
This represents the hydrostatic pressure of the equivalent mud weight to be tested to in psi.

**Step 8:** Enter the following equation into Cell A6:

\[=(A5)-(A4)\]
This represents the increase in pressure to be administered from surface to pressure test the shoe to the equivalent mud density.

Congratulations on successfully calculating the surface pressure to be administered with the use of Microsoft Excel. Future pressures can be calculated with easy by changing the mud weight, equivalent mud weight, and casing shoe depth for specific data.