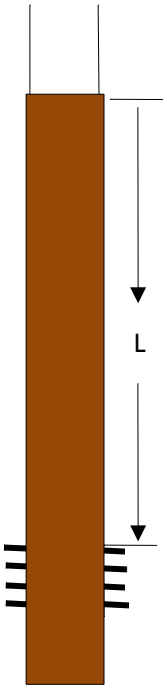
Why a Sand Plug Works

By Alfred R. Jennings, Jr., Enhanced Well Stimulation, Inc.

Sand plugs are often used in wells as a means of staging hydraulic fracturing treatments. This technique has been around for a very long time but continues to offer an economic alternative for staging fracturing treatments in deep wells where several zones are being sequentially fractured.

Sand plugs may be used in new wells. In these cases, the lowermost interval is perforated and treated with the first of the planned fracture treatments. Then a pre-determined quantity of sand (often the same type as is being used for the fracturing treatment) is dropped into the well from the surface and time must be given (usually a couple of hours) to allow time for the sand to settle to the bottom of the well and cover the perforations. After the sand has had time to settle to bottom, the top of the sand fill should be tagged with slickline to verify the top of the plug. If desired, the wellbore can be pressured up to pressure test the plug. Sometimes additional sand may be necessary to bring the top of the sand up to the desired level. A lower zone covered by a sand plug is illustrated in Figure 1.



Example:

Casing Size: 5-1/2 in. (ID =4.892 in.)

Area (A)= πr^2 = 18.76 in^2

Water Viscosity (μ) = 1.0 cp

L= 30 ft = Height of column from top perforation to top of sand plug

20/40 Sand Permeability: 120 D

Pressure on Sand Pack: 6,000 psi

Calculate Q (flow rate through the pack, BPM) using Darcy's Law of Linear Flow:

$$Q = \frac{k\ \Delta P\ A}{\mu\ L} = \frac{(120)(6000/14.5)(18.76)(6.4516)(60)(6.29\times10^{-6})}{(1.0)\ (30)(30.48)}$$

= 0.0013 BPM through the 30 ft column of 20/40 Sand*

* This flow will also be diminished quickly by frac fluid residue (filter cake) buildup at the top of the plug helping render fluid leak-off through the plug negligible.

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