

Casing Integrity During Fracturing Operations

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Abstract

With high rate fracturing operations, casing integrity during and post stimulation is of the utmost importance. There have been numerous high profile wellbore failures presented in the media over recent years, simple processes can be utilized to mitigate the failure risk. The author will present factors that influence wellbore integrity. Pressure and temperature effects on the wellbore system will be analyzed. The author will present various fracturing techniques that can reduce the net effect of the various influencing factors on the wellbore, cement and formation interaction.

Casing deformation due to pressure, and temperature are visually and numerically analyzed by casing size and casing weight. In order to accommodate increasing frac rates, the casing size will in most cases also increase. As casing size is increased, the net deformation also increases. This can potentially create micro annuli between the casing and wellbore cement.

Once a micro annuli is formed there is very little recourse to repair without further casing damage due to perforating or alternate repair approaches.

The net effect of surface pressure and casing sizes of the following fracturing techniques will be discussed. The focus will be on mitigating failures due to potential wellbore system failure mechanism discussed above.

Limited entry: Limited Entry provides a means of diverting fracturing treatments over several zones of interest at a given injection rate. Effectiveness of the process depends directly upon “back pressure” or perforation friction generated in the wellbore throughout the treatment due to a pre-determined rate/perforation relationship. In this fracturing process, perforation friction is desirable during the entire treatment.

Plug and perf The plug-and-perf system creates multiple hydraulic fractures in a horizontal well completed with a cemented casing/liner. This system combines elements of two common fracturing techniques: limited entry and segmented fracturing using bridge plugs

Ball drop :Sliding of each sleeve is triggered by dropping progressively larger frac balls . Once the frac balls seat pressure increase shears a pin within the sliding sleeve. The fracturing fluid is transmitted through the ports into the openhole annulus, and a fracture is created within the interval isolated by openhole packers. This process continues until all of the ports have been opened and all of the well segments have been fractured.

Frac down Annulus with coil: Instead of sliding sleeves, the Frac down annulus system uses abrasive jet perforating at planned frac points. The Frac down annulus system potentially utilizes lower rates and pressures.

Frac down Tubing: In some formations and areas this technique is utilized to optimize fracturing time and costs. The Frac down tubing technique isolates the annulus from friction and reduces displacement volumes.