WellSET® Lost Circulation Treatment

HELPS PREVENT LOST CIRCULATION BY STRENGTHENING THE WELLBORE

There most likely is no segment of drilling non-productive time (NPT) in which it is more difficult to make an economic decision than lost circulation. Estimations of economic impact in this area vary widely, but are on common ground in their very large magnitude. Improvements in technology that reduce drilling NPT can translate into millions of dollars of operating cost savings.

Halliburton's Wellbore Strength Enhancement Technology (WellSET) workflow provides engineered solutions that are designed to improve wellbore strength and help reduce drilling non-productive time related to lost circulation. This fully engineered approach requires both unique planning software and materials. Planning includes investigating the means to prevent lost circulation as well as to stop losses quickly after they occur. Improving the wellbore strength is a key factor in helping prevent lost circulation. This is accomplished by designing and applying WellSET.

The goal of WellSET Treatments is to increase the hoop stress (and thus the wellbore pressure containment ability) in the near-wellbore region. When a fracture is induced, it redistributes stress around the circumference of the wellbore while exposing the tip of the fracture to pressures extending the fracture. Placing a plugging material in an induced fracture helps prevent further pressure and fluid transmission to the fracture tip, while at the same time propping and protecting the fracture. This generally is done by using correctly sized lost circulation materials (LCM) such as STEELSEAL® resilient graphitic carbon, BARACARB® ground marble, and sized WALLNUT®.

PREDICTIVE DFG™ SOFTWARE IN PRODUCT SELECTION AND TREATMENT DESIGN

Another essential component of the WellSET treatment is the simulation of actual wellbore conditions. Baroid’s DFG modeling software can predict the equivalent circulating density (ECD) over an interval and estimate the width of a fracture that may be initiated. The Baroid Engineer can use the Particle Size Distribution data contained in the WellSET database to select and design a proper material and particle size distribution that can efficiently prop and plug that fracture.

Figure 1 > Fracture with modelling module
The DFG software is able to model the change in rheology resulting from the addition of the specialized lost circulation materials. These changes in rheological properties may be cycled back to update the ECD calculations and enhance the accuracy.

The image above provides data to the operator on the Particle Size Distribution (PSD) for the background LCM coupled with the API No. Screen to most efficiently minimize the amount of background LCM removed while maximizing the drill solids removal. The PSD position for each screen size selected is shown so the decision can be made if the size material removed should be maintained, or accept the modified PSD after the background is exposed to the screen size and the larger material is removed.

**RESILIENT STEELSEAL LCM HELPS PLUG FRACTURES CONTINUOUSLY UNDER CHANGING PRESSURES**

The type, concentration, and PSD of the LCM are important factors in controlling lost circulation. Of these parameters, particle type seems to be the most important variable for obtaining a fracture sealing response. In a joint industry project (GPRI 2000) repeated fracture sealing responses were seen in tests using STEELSEAL in a variety of core materials, from high permeability Castlegate sandstone to low permeability Pierre 1 shale. One of the more unique characteristics of STEELSEAL is its resiliency, a compressive property allowing it to mold itself into the fracture, promoting screen-out. If the pressure is released, the material rebounds, thus continuing to plug the fracture completely.

These resilient graphitic carbon lost circulation materials are produced by a patented process and Halliburton is the only provider of these materials to the petroleum industry. In addition to the original STEELSEAL 400, four other resilient graphitic carbon materials of varying particle size distributions are available: STEELSEAL 1000 for lost circulation and wellbore strengthening applications; and STEELSEAL 100, 50 and 25 for wellbore strengthening and fracture plugging applications.

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