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Struggling Against Sticking of the Drill during Well Drilling

Abdirazakov A.I., Jurayev E.I., Samatov Sh.Q., Ibotov O.Q., Xidirov J.Ch.

Senior Lecturer, Department of "Development and operation oil and gas deposits", Karshi engineering-economics institute, Karshi city, Uzbekistan.
Senior Lecturer, Department of "Development and operation oil and gas deposits", Karshi engineering-economics institute, Karshi city, Uzbekistan.
Assistant Professor, Department of "Development and operation oil and gas deposits", Karshi engineering-economics institute, Karshi city, Uzbekistan,
Assistant Professor, Department of "Development and operation oil and gas deposits", Karshi engineering-economics institute, Karshi city, Uzbekistan,
Assistant Professor, Department of "Development and operation oil and gas deposits", Karshi engineering-economics institute, Karshi city, Uzbekistan.

ABSTRACT: The sticking of the drill string can also occur from the difference in reservoir pressure and column pressure of the flushing fluid, when the drill string, left motionless, lies on the wall of the well against the zone of permeable rocks. Puffs and small stickings are usually eliminated by pacing (repeated, alternating lowering and lifting of the string) and turning the drill string by the rotor. The elimination of sticking of the drill string is successfully applied method of unscrewing drill pipes using an explosion: The shock wave passing through the threaded joint of the pipe causes a sharp weakening of it. This method allows in most cases to release pipes located above the sticking point, without resorting to the use of drill pipes with a left-hand thread.

KEY WORDS: flushing, bottom hole, clay, barrel, stick, solution, pressure, pacing, acid, wells, unscrewing, pipe, solution

I. INTRODUCTION

The main causes of drill string sticking when using a mud as a flushing fluid are:

1) washing the face with a clay solution with a very high water loss; such a solution forms a thick clay crust on the walls of the borehole, which leads to a narrowing of the diameter of the borehole, when lifting the drill string, the crust peels off and a gland is formed over the bit, which becomes denser when lifting, which leads to sticking;

2) buckling of plastic rocks (clays) with a large pressure difference in the strata and in the wellbore under the influence of water penetrating from the mud; swelling and bulging rocks narrow the wellbore, causing a sharp increase in pressure on the pumps and sticking of the drill string in the interval of buckling;

3) poor and irregular cleaning of mud from cuttings; as a result of this, clay mud is pumped into the well together with previously drilled particles;

4) leaving the drill string without movement in the well for a long time with a quality of the solution that does not meet the drilling conditions;

5) stepped well profile; when drilling a well with bits of different diameters at the point of transition from a large diameter to a smaller one, fragments of drill cut out accumulate in this place, which leads to a narrowing of the shaft and sticking of the drill string;

6) Flushing in threaded joints of the drill string; at the same time, the solution does not tolerate the rock and the bit "burrows" into the rock without washing;

7) Insufficient speed of movement of the solution in the annular space during drilling.

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II. METHODOLOGY

The sticking of the drill string can also occur from the difference in reservoir pressure and column pressure of the flushing fluid, when the drill string, left motionless, lies on the wall of the well against the zone of permeable rocks. The clay crust under the pressure of the drill pipes lying on it gradually begins to compact and less and less transmit hydrostatic pressure through itself. When the clay crust becomes impenetrable, pressure transfer ceases. Since the reservoir pressure is less important than the pressure of the column of the drilling fluid at a given depth, the drill string is affected by the forces of the unbalanced part of the pressure of the solution column, which prevents the drill string from being removed from the well.

The reason for the sticking of the drill string in turbine drilling when using water as a flushing fluid is insufficient flushing of the well before building up or raising the drill string.

To prevent sticking necessary:

1) apply high-quality clay solutions that give thin dense crusts on the walls of the wells;
2) to provide the highest possible rate of upward flow of clay mud; before lifting the drill string, the well must be flushed until the drill cuttings are completely removed and the clay solution parameters are brought into line with those specified in the design specification;
3) to ensure complete cleaning of mud from the cuttings;
4) regularly work out during the drilling process areas of possible intense formation of thick crusts;
5) weighting the mud with producing a rotating drill string;
6) monitor the temperature of the ascending mud in deep wells, since a sharp decrease in the latter indicates the erosion of threaded joints in the drill string above the bit;
7) during forced shutdowns of the drilling process, it is necessary:

a) every 3-5 min pacing drill string and rotate its rotor;

b) in the absence of electricity to connect the emergency diesel generator and periodically pacing the drill string; if it is absent, unload the drilling tool by approximately the weight corresponding to that part of the pipe string that is in the open hole of the trunk and stop flushing, periodically resuming it with a long stop;

c) in case of failure of the pneumatic clutch of the lifting mechanism, install emergency bolts and walk the drill string or raise it;

8) to prevent sticking of the drill string when using a heavier clay solution, prophylactic additives should be systematically used: more than 0.8% graphite, I – 3% sulfonol (in the form of a 1-3% aqueous solution); the selection of formulations in each individual case should be clarified by the laboratory of clay solutions.

In drilling practice, a number of methods are used to eliminate sticking of drill and casing strings.

Puffs and small sticking are usually eliminated by pacing (repeated, alternating lowering and lifting of the string) and turning the drill string by the rotor. The amount of force that is applied to the pipes during pacing can far exceed the own weight of the column and is limited by the strength of the pipes and the hoist system. Therefore, before pacing, the condition of the tower, tackle system, winch and their strength, as well as the status of the weight indicator, should be carefully checked. If pacing does not manage to eliminate the stick, and the circulation of the flushing fluid has not stopped, resort to the installation of an oil, water or acid bath.

The practice of producing oil baths in wells, where they drilled with flushing the bottom of the water and the well was filled with water, showed that oil floats very quickly. In these cases, to get the effect of the oil bath, it is necessary to pump several cubic meters of clay solution before and after oil injection. A clay solution limits the speed of oil flooding, and the oil bath gives a result.

An acidic bath is used to release stuck drill strings and eliminate jamming of bits, turbodrills in carbonate, clay (limestone, dolomite) and other rocks that are susceptible to acid. A water bath is effective when replacing a clay solution with oil can lead to an ejection if collapsing clays are found in the sticking zone, and especially when the drill string is stuck or stuck in deposits of magnesium and sodium salts.

III. CONCLUSION

In order to successfully carry out the bath installation operation, it is necessary to correctly determine the distance from the sticking point to the wellhead, i.e., the sticking depth. In field practice, the tack depth is usually found by the magnitude of the elongation of the free unattached part of the drill pipe while the drill string is pacing.

To determine the depth of sticking, drilling, casing or tubing there are special devices - sticking determinants.

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The work of the sticking determinant is based on the property of ferromagnetic materials that are demagnetized by deformation of pre-magnetized sections. A device descends into the zone of the supposed sticking point to obtain the magnetization characteristics of the stuck pipes. The first control measurement is taken at the sticking point. Next, in the sticking zone, control magnetic marks are established by supplying current through an electromagnet to sections of the column located at a distance of 10 m from each other. At the same time, a pipe section 15–20 cm long is magnetized in each section.

The second control measurement records the magnetic induction curve along the entire area where the magnetic marks are installed. The latter on the magnetic induction curve are distinguished by clear anomalies. On the diagram, smaller anomalies also break locks and couplings. After this, the stuck pipe string is paced for a short time, while the metal of the non-stuck pipe undergoes deformation, as a result of which the magnetic marks disappear. In the sticking zone, the magnetic marks do not disappear, because this section does not deform.

The third control measurement determines the area where the magnetic marks have not disappeared, i.e., the sticking interval is determined.

If the oil (acid or water) bath does not give positive results, resort to a continuous flush with oil or water. Continuous flushing with water is possible when drilling in stable formations. When switching to a continuous oil flushing, an abrupt transition from clay to oil should be avoided, since high pressure is required to lift heavy clay in the annulus and to move light oil inside the drill pipe. The circulation of oil in the well has a number of negative sides: violates the claying of the walls of the well, creates a danger of oil or gas emissions.

If, in spite of the measures taken, the drill string cannot be released, it is loosened in parts using drill pipes with a left-hand thread. When loosening the stuck part, it is first necessary to mill the oil seal formed around the pipes. This process is very long and inefficient. Therefore, if it takes a long time to extract the stuck portion of the drill string, it is usually left in the well and bypassed. Such a deviation of the trunk, called “sidetracking”, is performed using deviated well drilling methods.

To eliminate the sticking of the drill string, the method of unscrewing drill pipes using an explosion is successfully used: The shock wave passing through the threaded joint of the pipe causes a sharp weakening of it. If a reverse torque was applied to the pipes before the explosion, and the threaded connection was unloaded from the weight of the overlying pipes, then the explosion detaches the threaded connection against the location of the torpedo, which is then easily unscrewed by the rotor. This method allows in most cases to release pipes located above the sticking point, without resorting to the use of drill pipes with a left-hand thread.

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