Application of Gas Drilling Technology in Sulige Gas Field

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Abstract

Horizontal gas drilling technology is of great significance to the actual production of Sulige gas field. The position of window opening is in Shiqianfeng formation, and drilling is easy to lose. Gas drilling can be used in the horizontal section of a slim hole sidetracking horizontal well. The slim hole is stable in Shihezi section, reduces drilling cost and accelerates drilling speed.

Keywords

Sulige gas field, Well drilling, Gas drilling, Effect analysis

Introduction

For Sulige gas field, the general window opening point is at or above Shiqianfeng formation, which is easy to leak, but the borehole wall is stable in Shihezi formation. The traditional drilling fluid is used to drill the stable deviated hole with slow drilling speed, frequent leakage accidents and poor sand carrying capacity, which leads to long drilling cycle and drilling cost [1]. Using gas drilling technology can avoid the accident of easy leakage in Shihezi section, and its gas drilling speed is fast, which can shorten the drilling work cycle and drilling cost [2]. This is in line with the requirements of comprehensive and long-term stable production in Sulige gas field, so it is necessary to use gas drilling technology in the inclined section of slim hole sidetracking the horizontal well in Sulige gas field.

Advantages of gas drilling

Gas drilling machinery has high drilling speed; According to the data comparison, the drilling speed is much faster than the conventional drilling speed, which can be 3~5 times faster. This is due to the rock-breaking principle of gas drilling. In the process of rock-breaking in gas drilling, the gas column at the bottom of the well significantly improves the stress distribution. This is because there is almost no gravity at the bottom of the well. A pressure difference is established between the formation pressure and the borehole pressure, creating a negative pressure condition over a large range around the drill bit.

Under low confining pressure, the smaller the pressure, the stronger the brittleness, resulting in a thrust that is conducive to rock breaking, and the broken rock can be pushed forward, thus greatly improving the gas drilling speed [3].

Gas drilling is especially suitable for wells with hard strata and long drilling length. Conventional drilling with drilling fluid has great confining pressure on underground rocks, but the greater the pressure under high confining pressure, the smaller the brittleness and the greater the plasticity, which increases the difficulty of breaking and increases the drilling duration. Gas drilling, on the other hand, grasps the weakness of rock brittleness [4]. Gas drilling forms a negative pressure condition, reduces the confining pressure of rock at the bottom of the well, enhances the brittleness of rock and reduces the plasticity, which is beneficial to rock breaking. Its rock breaking efficiency is much higher than that of mechanical shear rock breaking method of drilling fluid drilling, and this effect is more obvious with the hardness of formation rock or the length of drilling section [5]. Gas drilling is especially suitable for reservoirs with low formation permeability and serious formation leakage. Since no drilling fluid is used, formations prone to leakage do not experience fluid loss, and wear on drilling tools is greatly reduced [6]. Air drilling requires that the formation being drilled must have sufficient stability, and the borehole wall must remain stable to prevent issues such as borehole wall

instability and collapse [7].

Measures to improve drilling efficiency

The drilling efficiency of gas drilling is affected by ROP and pure drilling time rate. How to improve the drilling efficiency of gas drilling is a question of how to use gas drilling extensively in the development of Sulige gas field. If there are more available gas drilling sections, the drilling efficiency of natural gas will be high. Therefore, the first method to improve the drilling efficiency of gas drilling is to ensure that the trajectory passes through the reservoir and gas drilling can be used in large sections when designing the borehole trajectory, which can not only improve the drilling efficiency of gas drilling [8].

In terms of increasing the rate of pure drilling time, it can be seen from the data that the time to deal with complex problems accounts for about 23% of the total working time, and the time to install and debug equipment accounts for about 22% of the total working time. To improve the time rate of pure drilling, we can take measures to reduce the installation and debugging time of air drilling equipment and the handling time of underground accidents [9].

Well deviation control of gas drilling technology

In the process of Sulige gas drilling, the well deviation of gas drilling is particularly difficult to control. The reasons are as follows:

Firstly, the deviation of drilling tools used in gas drilling is unclear, which is caused by technical aspects. Second, the drilling hole deviation already exists, and the drilling tools are close to the lower side of the borehole wall, which makes the high-speed air flow speed on the lower side of the borehole wall decrease and the circulating gas flow speed decrease, so that the cuttings at the bottom of the well cannot be discharged in time, and the drilling tools are like being padded up to drill, which makes the borehole deviation expand. Third, the accumulation of cuttings during gas drilling reduces the effective circulation velocity of gas in the well, further aggravating well deviation. For the well deviation control in gas drilling, the “prebending + double-assisted drilling tool assembly” should be used to control the well deviation. Downhole conditions should be assessed by combining various drilling parameters, formation resistivity, upward cuttings, and other data, and the appropriate drilling tool assembly should be replaced in a timely manner. Secondly, cooperate with the underground EMWD equipment to monitor the well deviation in time [10]. Once the well deviation occurs, adjust the ground turntable to adjust the well deviation in time to resume the normal drilling of gas drilling.

Conclusion

In practical applications, gas drilling technology has not shortened the drilling operation time. The reason is that the supporting facilities of gas drilling are imperfect, downhole accidents are frequent, and the time saved by high-speed rock breaking by gas drilling is wasted. Therefore, if we want to realize gas drilling and save drilling time, we must improve the supporting facilities of gas drilling to reduce or avoid accidents in gas drilling.

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Conflicts of Interest

The authors declare no conflict of interest.

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