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钻井工程

水平井尾管固井技术及其在苏里格气田的应用

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摘要：

针对水平井长水平段尾管固井存在的尾管下入困难、尾管居中度不易保证、环空间隙小、高边自由水窜槽和低边泥浆窜槽等技术难题，在试验研究的基础上，总结出提高水平井尾管固井质量的实用技术：①选用沉降稳定性好、低失水、零析水、防气窜的水泥浆体系；②选用黏滞性前置液，使环空浆柱结构的密度成梯度（$\rho_{钻井液}<\rho_{前置液}<\rho_{水泥浆}$）分布，确定环空前置液流态达到紊流状态的合理施工排量，可以更好地清洁井眼，提高顶替效率；③模拟尾管刚度通井，采用单铣柱、双铣柱和三铣柱3种钻具组合分别进行3次通井，破坏井眼低边“死泥饼”，消除井眼不规则带来的阻卡，确保尾管顺利下入到位；④合理选用及安放扶正器，保证套管居中度达到67%。在苏里格气田苏5区块进行了2口水平井尾管固井实践，结果表明：固井合格率分别达93.78%和99.83%，优质率为70.93%和81.88%，为该区增产改造提供了技术保障。

关键词： 水平井 固井 长水平段 尾管固井 套管居中 顶替效率 苏里格气田

Liner cementing in horizontal wells and its field practices in the Sulige Gas Field

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Abstract:

Long horizontal section liner cementing in horizontal wells has many difficulties, including difficult tail pipe running, difficult tail pipe centralizing, small annulus clearance, free water channeling at the high side and mud channeling at the low side. Based on the analysis of the critical points and difficulties of liner cementing in horizontal wells, the following technical measures have been presented. (1) A cement slurry system is selected with good sedimentation stability, low water loss, zero water separation, and anti channeling performance. (2) A viscous preflush system is adopted to make the densities within the annulus slurry column distributed in grades as $\rho_{fluid}<\rho_{preflush}<\rho_{slurry}$, the proper pump rate is chosen to help the pumped preflush to be in turbulent flow in annulus so as to better clean the well and improve the displacement efficiency. (3) The liner cementing is simulated and three types of BHA including single, double and triple casing strings are used to run a single trip respectively to eliminate pipe sticking or jamming caused by irregular boreholes and to destroy the "deadly sticky mud cake" at the lower sides, thereby to ensure smooth liner running to the right position. (4) The proper centralizers are selected and installed to keep the casing centralized to 67%. All the above measures were adopted in liner cementing in 2 wells of Block Su 5 of the Sulige Gas Field, as a result, the qualification rates were 93.78% and 99.83% and the superior quality rates were 70.93% and 81.88%, respectively, which provides a guarantee for the coming up stimulation jobs.

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