Discussion on Fracturing Stimulation and Reconstruction Technology in Oil Field

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Abstract. Oil field fracturing technology is based on fracturing principle and plays an important role in oil field production. However, there may be safety problems, technical problems and environmental problems when applying oil field fracturing stimulation technology. Therefore, it is necessary to make clear the breakthrough point of oilfield fracturing technology, and transform the oilfield fracturing stimulation technology through horizontal well staged fracturing technology, repeated fracturing technology and clean water fracturing technology to improve the application quality of oilfield fracturing technology.

Keywords: Oil field, Fracturing technology, Increase production and reform.

1. Introduction

The rapid development of social economy has promoted the development of oil exploration technology. All sectors of society also attach great importance to the oil exploration industry, and are actively exploring how to improve the development and utilization efficiency of reservoir resources. Fracturing technology is the key means to realize efficient exploitation of oil and gas reservoirs, so it is necessary to transform the fracturing technology of oil field and give full play to the role of fracturing technology of oil field.

2. Oilfield analysis

Oilfield refers to the sum of oil and gas reservoirs in the same oil and gas producing area controlled by a single geological structure factor [1]. In the same area, oil fields mainly belong to oil reservoirs and gas fields mainly belong to gas reservoirs. In recent years, China's oilfield chemical technology has developed rapidly, expanding the oilfield chemical market. However, the reserves of newly discovered oilfields in China are few, and the task of excavating old oilfields is very arduous, which requires our country to strengthen the exploration and development of oilfields, improve the recovery ratio of oilfields, and develop more new and efficient oilfield chemicals.

3. Application status of oilfield fracturing technology

Oilfield fracturing technology applies the fracturing principle, and there are few types of oilfield fracturing technology at first. With the increase of oilfield production activities, technicians have developed a variety of oilfield fracturing technologies, such as development fracturing technology, integral fracturing technology, two-stage high-energy gas fracturing technology, bottom water reservoir reconstruction technology, etc. First, integral fracturing technology. In China, the concept of integral fracturing technology was formed in the early 1990s, and it was gradually used in Yangjiaba Oilfield and Gan 'an Oilfield. Up to now, integral fracturing technology is the most commonly used and plays an important role in oilfield exploitation. The overall fracturing technology is based on fracturing development well pattern, fracturing simulation and fracturing reservoir simulation, and using corresponding technical means to optimize the fracturing scheme of oil and water wells, thereby improving the degree of oilfield recovery and the ultimate recovery factor, Increase the economic benefits of the enterprise [2]. In the long-term development process, the fracture propagation model of the integral fracturing technology has gradually developed from a two-dimensional model to a three-dimensional model; the dynamic prediction model of fracturing wells has also developed into a three-dimensional three-phase unstable model; fracturing fluids are becoming more and more harmful The lower, and the proppant gradually develops from natural quartz sand to

low-density hollow ceramsite. Second, develop fracturing technology. Development fracturing technology is also widely used in oilfield production. Third, two-stage high-energy gas fracturing technology. The two-stage high-energy gas fracturing technology, also known as stress fracturing technology and controllable pulse fracturing technology, mainly uses the high-temperature and high-pressure gas generated by the combustion of oil-water target layer of rocket propellant to fracture the formation, clean up the formation blockage and pollutants, so as to reduce the skin coefficient and improve the production of oil wells. China began to study this technology in 1984. At present, it has been tested in some oil fields, and the fracturing theory and method have been gradually formed. The application of two-stage high-energy gas fracturing technology mainly depends on mechanical action, chemical action, thermal action and hydraulic action. Among them, the mechanical function is mainly reflected in the pressurization stage, the rupture stage and the extension stage; Chemistry can cause the change of strata; Heat can change the temperature in and around the oil well, thus removing wax, asphaltene and colloid in the formation; Hydraulic force can destroy the cohesive force between the plugging particles in the stratum and the reservoir rock, and improve the permeability of oil and gas. Fourth, bottom water reservoir reconstruction technology. The bottom water reservoir reconstruction technology started late and the technology is not mature enough. Although it can improve the oil field production, the cost is relatively high, so its application in oil field production is limited. In short, there are many types of fracturing technology in the current oilfield, which should be selected according to the actual situation.

4. Application risk of fracturing stimulation technology in oil field

4.1 security risks

The application of oilfield fracturing technology needs the support of a large number of mechanical equipment. Currently, commonly used mechanical equipment include sand mixer truck, instrument truck and fracturing truck, etc. At the same time, if the displacement of the oil well is large or the pressure is high, other mechanical equipment needs to be applied. This will lead to the concentration of construction personnel and mechanical equipment, and if there is a problem with the mechanical equipment, it will cause personal injury or death. Secondly, during fracturing or repeated fracturing of old oil wells, it is easy to have safety problems, such as drilling sticking, wellbore structural damage and sand blocking of tubing, which may cause blowout or object impact, and then threaten the life safety of construction personnel [3].

4.2 Technical risks

The operation scope of oil field exploitation is large, and there are safety risks in the production process. If technicians do not adopt appropriate technical means according to the actual situation, it may cause danger. Therefore, it is necessary to apply reliable oilfield fracturing technology to enhance the safety of technology application and improve oilfield production efficiency and quality.

4.3 environmental risk

There is not only oil in the oil field, but also some toxic gases and liquids. If the pressure is not properly controlled when the oil field is exploited and the oil field fracturing technology is applied, it may lead to the fracturing string cracking or pipeline leakage, and also lead to the volatilization of toxic substances. This will not only affect the air quality, but also affect people's health. In recent years, China attaches great importance to ecological and environmental protection, and it is necessary to continuously reform fracturing technology to enhance the environmental protection of oil field exploitation.

5. Breakthrough of oilfield fracturing technology

Oilfield fracturing technology mainly includes single-layer fracturing technology, multi-layer fracturing technology and well pattern fracturing technology. If you want to improve the oil field fracturing technology on the existing basis, you need to comprehensively analyze the traditional fracturing technology, and make clear the breakthrough point of the traditional fracturing technology, so as to lay the foundation for the technological transformation.

5.1 Breakthrough point of single-layer fracturing technology

Single-layer fracturing technology refers to the oilfield well layer to be exploited as a point, and comprehensively analyzes and studies the parameters of this point without studying other factors. In the first mock exam of single layer fracturing technology, we need to use the finite conductivity model, that is, technicians need to use this model to clarify the effect of fracturing technology and clarify the technical difficulties, and make technical breakthroughs according to the actual situation, so as to achieve the goal of improving fracturing technology [4]. From the finite conductivity model, the following formula can be used to calculate the maximum flow capacity of single-layer cracks.

$$Q=(1f, Fcd, h, ke, \Phi s, u)\text{-}f(Ks)$$

According to the calculation rules and working experience, the correction function of climate can be calculated to be between 0.3 and 0.5. After that, technicians can use the average permeability to determine the actual oil field output and the specific factors affecting the oil field output, and make detailed calculations. Finally, it can be found that the breakthrough point of single-layer fracturing technology lies in how to reduce the matrix.

5.2 Breakthrough point of multi-layer fracturing technology

Multi-layer fracturing technology is based on single-layer fracturing technology, which takes the oil well layers to be exploited as multiple points on a line to ensure that one point corresponds to one reservoir. According to the practice results, if you want to transform the multi-layer fracturing technology, you also need to focus on how to reduce the matrix and fractures.

5.3 Breakthrough points of well pattern fracturing technology

Single layer fracturing technology takes the oil field well layer to be exploited as a point, and well pattern fracturing technology is the fracturing of a single combination of oil wells. Therefore, the application of well pattern fracturing technology in exploration requires comprehensive analysis of oil well exploitation and water injection of oil well units. That is, technicians need to comprehensively analyze all reservoir units, and then build a complete oil well model to fracture the whole oil well. When reforming the well pattern fracturing technology, it is necessary to focus on the fracturing parameters of the whole well pattern and the unit fracturing scale, and the breakthrough point is how to reduce the matrix and fractures.
All in all, no matter how to reform single-layer fracturing technology, multi-layer fracturing technology or well pattern fracturing technology, the breakthrough point should be how to reduce the matrix. Therefore, it is necessary to pay more attention to how to reduce the matrix when reforming oilfield fracturing technology.

6. Technical analysis of fracturing stimulation and reconstruction in oil field

6.1 Horizontal well staged fracturing technology

Horizontal well staged fracturing technology is often used in the exploration of shale gas in oil fields, mainly by increasing the contact area between the reservoir of horizontal wells and the lens, so as to achieve the purpose of increasing oil field production. From the actual situation, the staged fracturing technology of horizontal wells mainly includes different types such as chemical isolation technology, mechanical isolation technology and current limiting fracturing technology. First, chemical isolation technology. Chemical isolation technology refers to fracturing the tubing after shooting the first section, and then isolating the fractured well section with sand and liquid rubber plug until all modified well sections are crushed. Second, mechanical isolation technology. Mechanical isolation technology refers to the use of mechanical combination to fracture tubing. Technicians can adopt different mechanical combination methods according to the actual situation. For example, a technician can combine an annulus divider with a double packer single card, or a packer with a mechanical bridge plug. In shallow oil fields, the use of annular separation for tubing fracturing can reduce the probability of accidents. Third, flow limiting fracturing technology. In the process of pressure, it is necessary to let the pressure fluid pass through the perforation and enter the reservoir at high speed, which will cause perforation friction, and when the pumping displacement increases continuously, perforation friction will also increase continuously, which will increase the bottom hole pressure [5]. If the bottom hole pressure exceeds the fracture pressure of multiple fracturing intervals, the perforation friction can be used to adjust the fracture pressure of each interval, so that the fracture pressure is close to the bottom hole pressure.

6.2 Clean water fracturing technology

The application of clean water fracturing technology in oilfield exploitation needs the support of surfactant, and some purified water, preventive agent and drag reducer are added, and then the workflow is fractured (the principle is shown in Figure 1). Clean water fracturing technology has less damage to the reservoir and low cost, so it is widely used in the reconstruction of low permeability oilfield. However, when applying this technology, it is necessary to inject high concentration fracturing proppant in the fracturing process, and strictly control the concentration of fracturing proppant to avoid affecting the fracturing effect. Simply put, technicians can use clean water as power fluid, and the formation will form hydraulic fractures under the action of clean water, which can make up for the shortcomings of traditional injection enhancement measures. In the process of fracturing, rock debris will fall off and fall into the cracks, which not only has the effect of supporting, but also can make the cracks open and cause the cracks to appear shear displacement.

6.3 Repeated fracturing technology

Repeated fracturing technology refers to waiting for a period of time after the first fracturing, and then multiple fracturing. After multiple fracturing, the conductivity of proppant fractures will be improved, and the fractures connecting well pattern can be effectively optimized. At the same time, in order to enhance the reliability of fracturing, it is necessary to strictly control the diversion of oil shale gas fractures. During shale gas exploitation, it is necessary to carry out multiple fracturing to ensure that the fracture is extended according to the direction of previous fracture cracking. And some oil shale formations lack uniformity, cracks can form a joint network.

7. Conclusions

In the application process, oilfield fracturing stimulation technology has certain risks, such as safety risks, technical risks and environmental risks. Before the transformation of oilfield fracturing technology, it is necessary to comprehensively analyze the process technology and clarify the breakthrough points of single-layer fracturing technology, well pattern fracturing technology and multi-

layer fracturing technology. And flexibly apply horizontal well staged fracturing technology, clean water fracturing technology and re fracturing technology to promote the development of the petroleum industry.

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