

Electric submersible pump fault diagnosis



1 Basic principle of electric submersible [pump production system](#)

The electric submersible pump works mainly through the multi-stage centrifugal pump in the process of oil recovery in the entire oil field. Its working object is the oil pipe. Simply put, the power supply current is transmitted to the electric submersible pump of the ground through the related current equipment such as the voltage device on the ground, so as to drive the electric motor of the electric submersible pump to rotate, thereby converting the electric energy into mechanical energy. It is this process of electric energy conversion to carry out crude oil extraction and collection in the formation, and finally to rely on pressure to output the ground. The most important part of the overall operation of the electric submersible pump is how to accurately control it, so as to ensure the normal operation and production of the electric submersible pump.



2 Research status of fault diagnosis technology for electric submersible pump

2.1 [Traditional electric submersible pump fault diagnosis method](#)

There are two main methods for traditional fault diagnosis of electric submersible pumps, namely current card diagnosis and pressure diagnosis. The current card diagnosis method mainly uses the current card to judge the fault. The specific operation is: when the electric submersible pump is running, the pointer on the ammeter will automatically draw a curve on the current card, through the curve Analysis to determine if there is a problem with the electric submersible pump. The pressure diagnosis method is slightly more complicated than the current card diagnosis method, and the accuracy of the fault is also higher. The specific operation is: when the electric submersible pump is in normal operation, the production valve of the wellhead is closed for rolling, The whole rolling process should record the oil pressure change at the wellhead at the same time, so as to draw a graph, and finally analyze the characteristics of the

graph drawn to determine whether the electric submersible pump has hidden troubles.



Before the shut-off production valve is closed, the oil pipe is mainly in a state of gas-liquid mixed flow. Once the production valve is closed, the gas will flow to the upper part of the oil pipe, and the liquid will settle down, and the pressure inside the pipe will rise. At the beginning of the rolling treatment, the pressure at the wellhead is not static and changes with time. When the pressure reaches a certain level, the volume of gas in the entire oil pipe will become smaller. Under such circumstances, pressure and time The resulting compression factor will exhibit a linear relationship.

2.2 [Modern electric submersible pump fault diagnosis method](#)

With the continuous development of science and technology, the method of fault diagnosis of electric submersible pumps has also changed. There are three main types of diagnostic methods commonly used in modern times: fault tree analysis method, fuzzy mathematics

analysis method and neural network analysis method. The fault tree analysis method mainly uses the tree shape result to analyze the fault cause of the electric submersible pump. This diagnosis method mainly analyzes the working principle of the electric submersible pump, and combines the working data according to the working principle with the working data for each electric submersible pump. The probability that a component may fail is quantitatively analyzed in the form of a tree diagram, and finally a comprehensive calculation is performed to determine the probability of failure of the electric submersible pump. The fuzzy mathematics analysis method is to fuzzily diagnose the fault probability generated by the electric submersible pump, so as to establish a fuzzy matrix of related faults and symptoms, and calculate the set of faults to judge. The neural network analysis method uses the BP neural network method in diagnosing the electric submersible pump fault. The network model adopted by this method belongs to the one-way propagation mode, and it will represent the fault characteristic value of the electric submersible pump by the input value. The type of fault is represented by the output value.