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The monitoring system of an actual technical condition for pumping units with frequency analysis

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Abstract

Maintenance and repair of pumping units requires a lot of high material costs and time. Planned maintenance is usually used now. But in inter-maintenance period nobody knows real technical condition of units. Automated control system of vibration parameters in real time is presented. It show actual state of a pump at every time moment. Developed by the authors diagnostic system includes a complex diagnosis of the spectral characteristics of the unit and trend analysis change of the vibration characteristics in real time. Comparison of current vibration spectrum with typical vibration spectrum of defects allow to identify a defect with a certain probability. Therefore, control of vibration and parametric characteristics of pumping units in real time allows to identify defect of pumping units at an early stage.

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1. Introduction

In the oil and gas Russian company the most common species of the main production machines are pumping-compressor equipment (PCE) of the centrifugal type.

Nowadays in order to transport large volume of hydrocarbons pumping equipment of high power is required. Constantly growing rate of consumption of hydrocarbons makes their claims of efficiency and reliability of the transportation and processing of hydrocarbons.

Production evaluation of this type of equipment is usually based on a periodic monitoring of vibration parameters produced manually. Vibration diagnostic laboratories mainly use the spectral method of analysis of vibration signals based on the primary Fourier transformation.

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Along with advantages of manual diagnosis there are obvious disadvantages:

- 1) human factor;
- 2) low efficiency of the diagnosis;
- 3) a large amount of work for a small staff of experts.

Manual diagnosis is included in the plan service system. It is realized by making up, observing and fulfilling schedule of preventive work, which consists of current and general repairs at fixed time.

The purpose of the diagnosis is to eliminate failures and prevent unexpected costs, achieved through planning and maintenance takes place the most probable failure of the mechanism.

Scheduled maintenance is the most common type of maintenance at Russian oil and gas companies, as this strategy is ensured methodological and appeared earlier than other methods (used from 70-80 years of XX century till the present day).

Maintenance of the system according to the plan is technically and theoretically based on the history of equipment failure data. Statistical data on the rate and nature of defected parts, wear of mechanism with increasing operating time allows to determine the optimum process equipment inter repair interval with minimum probability of failure and wear.

However, the designated amount of maintenance exceeds the required one, or repair is not required at all. It is usually provided for securing reliable operation.

The wear of a pumping unit depends on its work conditions and staff qualification; for one particular unit the maintenance may be premature, for another be late.

The information of real technical condition of the aggregates can be obtained from a planned maintenance and unplanned PCE vibration diagnostics, i.e. every 2-3 thousand working hours [3]. During this period the technical condition of the units is unknown. Moreover, a significant part of the PCE is worked out hence the technical condition of the machine can change rapidly.

So, defects can be found only when their effect on vibration level is significant that can be detected by stationary vibration control system.

An analysis of pumping units operating shows that maintenance and repair occupy 11-12% of calendar time (including 3-4% of the time spend on unscheduled repairs). It causes high material costs. It inevitably increases transport operating costs.

PCE with undetected defects can result in an accident, as well as additional unplanned repair costs, downtime costs, etc.

2. Maintenance based on an actual state

Modern development of instrumentation allows us to assess the actual state of the mechanism by monitoring the technical parameters, and also plan only necessary repairs of a specific unit.

This type of service is based on preventive measure precautionary and refers to the service in accordance with the actual technical condition.

The basic idea of the service based on real technical condition, allows preventing equipment failure by monitoring parametric vibration-acoustic data of the unit in real time.

Every recognizable defect of a rotary mechanism has a distinctive diagnostic feature that allows determining the presence of defects and its parameters.

Analytical comparison of current vibration-acoustic parameters of aggregate data with defective ones allows assessing a real technical condition of the mechanism.

Vibration of pumping equipment characterizes a set of technical indicators, which include the cyclic stress, strain, resonance modes of the various components, the degree of wear particularly stressful elements, etc. The whole set of indicators is determined on a running machine with a given frequency, and thus allows to control vibration conditions of a pumping equipment at the moment. Therefore, vibration and parametric characteristics of pumping equipment are analyzed in real time, so defects can be identified an early stage.

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