

CONTROL SYSTEM FOR HYDRAULIC DIAGNOSTICS OF PUMP UNITS COMPACS-RPG

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Annotation

In operation, the pump units, installed in the pump station, are constantly in deformed state, wheels and blades of pumping units are subjected to complex action on the part of the transported water. Therefore, the proposed method in comparison with the known technical solutions is a significantly improved diagnosis based on the COMPACS-RPG system.

STATE OF QUESTION

One of the urgent tasks for the water transportation industry is the early diagnosis of faults in the blades and wheels of the pump unit. The need to assess the technical condition and the residual life (service life) of water pumping station equipment is due to its high energy intensity and significant influence on the reliability and efficiency of water pipeline transport. The problem of ensuring efficient, reliable and safe operation of the main canals becomes very important due to the changed conditions and long service lives, the wear and tear of the main technological equipment, in particular, the main and retaining pumping units, as the most energy-intensive equipment of pumping stations. The entire water supply system and each of its elements must be reliably worked from the beginning of operation to the limit state. The limiting state is the state of the equipment in which its further operation is technically impossible or expedient due to non-compliance with safety requirements or an unavoidable reduction in operating efficiency [1]. Therefore, during operation of main and retaining pumps, it is necessary to control the dimensions and technical condition of the landing and threaded surfaces of the shaft, blades and impeller discs, the impeller of the pump must not have cracks of any size and location, the seats and end faces must be free of nicks, burrs etc., should not have wear of the blades and discs from corrosion and erosion more than 25% of the nominal thickness. Bending of the blades is not allowed. All faults associated with blades and wheels lead to a change in the characteristics of the pump, depending on the development of its service life [2].

The COMPACS-RPG system is a modification of the COMPACS computer monitoring system and is intended for controlling hydraulic tests and diagnostics of pumping units during production or after repair and checking the compliance of the parameters of pumping units with normative and technical documentation. The system automatically detects the most dangerous object with the worst technical condition and position with the cursor, gives a voice warning through the loudspeaker and a visual warning, displaying messages at the top of the screen and on the left - the values of all measured parameters for the object with threshold values in accordance with " GOST R 53565-2009: Monitoring of the state of equipment of hazardous industries. Vibration of centrifugal pumping and compressor units ".During the tests and diagnostics of the measured parameters: pump speed, discharge pressure, flow rate, fluid temperature, pump temperature and motor bearings, vibration of bearing housings, temperature and level of liquid in the tank, temperature and current consumption of vacuum pump, current consumed power, frequency and voltage of the network, flow and head. During the test, the

automatic determination of pressure, energy, cavitations and vibration of the pump unit is issued and a protocol of acceptance or periodic testing is issued.

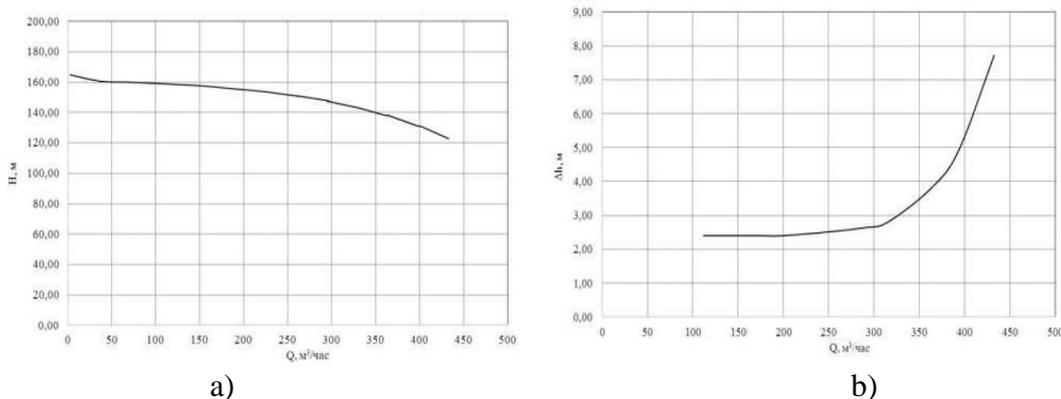


1 pic. Screen of the diagnostic station in the "MONITOR" mode

THE ADVANTAGES OF THE COMPACS-RPG SYSTEM

According to automation generation of test reports; management of three objects intended for testing is performed both in automatic and manual modes;

- the system diagnoses a large nomenclature of pumps (with engine power from 4 to 400 kW); the same sensors with extended measuring ranges (without their re-installation);
 - high performance: two computers are used;
 - the measuring part of the system corresponds to class 1 according to GOST 6134-2007 "Dynamic pumps. Test methods ";
 - all means of measuring the system have verification certificates;
 - realization of vibrodiagnostic, thermal, electrical, parametric and other methods of nondestructive testing;
 - automatic disconnection of pumping units in case of malfunctions in work or on the stand;
- materials objective test data for product quality management.



2 pic. Examples of test reports automatically generated by the system
a) Pressure characteristic b) cavitations characteristic

The system consists of control stations, a diagnostic station, measurement cabinets, control cabinets, sensors and a set of cables. The hardware of the system is located in two rooms.

Control station and diagnostic station in the control room. Control cabinets are located near the site. Measuring cabinets are located on test sites near the sites of testing and diagnostics. Control station and diagnostic station, performing in the form of an operator's console in the laboratory, monitor and keyboard. The control station is based on an industrial computer and is designed to monitor and test pumping units, display the status of nodes and system components, compile test protocols, provide remote access through the local network and remote debugging and software updates via the Internet. The COMPACS-RPG software is installed on an industrial computer. The diagnostic station is based on a diagnostic solution and is designed to collect, process, display and record the results of measurements of diagnostic functions. Diagnostic controller with COMPACS-RPG software with an automatic expert system. Control cabinets and measuring cabinets are made in the form of industrial cabinets of floor design. Cabinets for control and monitoring of the state and control of technological equipment. Measuring cabinets provide the collection and processing of measured parameters. Pressure sensors, pressure differences, flowmeters, multifunction converters and thermoelectric converters are permanently installed. Vibration sensors, temperature sensors and photo sensors.

Conclusions

This system allows you to monitor the dynamics of changing the picture received signals at the moments of starting and stopping the pump unit, gradually filling the database of various spectral components received signal, facilitating the interpretation and increasing its accuracy due to comparison of the received signal and the dynamics of its change in the start-up mode and stop in steady state.

Referances:

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2. Способ виброакустической диагностики машин периодического действия и устройство для его осуществления/Kostikov.V.N: effective model № 1280961 Russian Federation , МКИ 6F04B51/00; proposal. № 3505038/06 от 22.10.1982, public. 20.08.1996. Order. 1996. № 23.// freepatent.ru

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