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INTEGRATED FLEX SYSTEM OF CONTROL AND TECHNICAL DIAGNOSIS OF BELT CONVEYORS

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The relevance of the work is identified by the need of increasing the level of technical control and automation of belt conveyor operation. The general block diagram of the integrated flex system of belt conveyor control and diagnosis is recommended. The use of the flex system of control and technical diagnosis of the condition allows ensuring the quality of required up-to-date belt conveyor operation modes.

Keywords: conveyor operation, integrated flex system, technical diagnosis, feedback.

The following new features are inherent to up-to-date belt conveyors that distinguish them as new generation automated belt conveyors.

- variety and wide range of changes of various technical conditions of the belt conveyor components with auxiliary devices of automation and mechanization;
- need of centralized automated coordination of operating and auxiliary movements of belt conveyors when conveyed loads, belt conveyor location and operation modes change;
- impact of considerable amount of changeable effects and various parameters on the belt conveyor elements;
- non-linearity of most characteristics of the ties between inlet and outlet changeable processes occurring during a belt conveyor operation;
- high level of disturbances and difficulties to control a number of outlet parameters;
- construction and technical limitations on control actions and controlled variables of disturbing effects;
- necessity of using the control and diagnosis tools having required metrological characteristics in a wide range of measurements.

Maintaining of the tools of control and technical diagnosis of the belt conveyor components into the belt conveyor construction requests to follow prescriptions as /1/on:

- hardness, compactness and minimal material consumption of constructions;
- manufacturability of the construction of a singled out component;
- protection from potential damages and thefts;
- limitations on gaps and clearances in belt conveyor construction for operating conditions (adjustment, test and transporting) of belt conveyors;
- need of singling out several information components in belt conveyors;
- availability of tools of automation and pre-conditions for expansion of functional possibilities of equipment.

According to GOST 20911-75, built-in technical diagnostic tools are recognized as diagnosis tools manufactured together with object of diagnosis into one overall construction /2/. In reference to belt conveyors it is understood as a diagnosis tool fabricated instead of or based on one of standard parts of diagnosed component of a belt conveyor that quickly detects defects of the component at its work continuously comparing the current technical condition with given list of most feasible serviceable conditions and concludes about state of the examined component .It also indicates the type and location of detected defects, and generates the commands of belt conveyor equipment operation control.

In case of complicated conditions of belt conveyor operation, branched correlations between components of equipment and considerable change of conditions caused by external destabilizing influences, the solution of the following problems becomes important:

- assurance of high reliability operation of automated belt conveyors;
- increase of conveyance capacity;
- assurance of the quality of the required conveyance modes.

To solve these tasks the control and diagnosis instruments having system properties of mobility of readjustment, wide range of measurement and possibility of operability automatic actions to provide belt conveyor operation are used. It is evident, that the solution of the indicated tasks and requirements should be based on the complex approach at the step of investigating the processes of belt conveyor operation and a system approach at the step of control and diagnosis systems design.

As the integrated flex system of belt conveyor control and diagnosis we will understand the group of automatically operated technical tools that include the autonomous control means and built-in devices of technical diagnosis united by the systems of control of the upper and lower levels and available variable compositions and structures (depending on solved tasks of control, time and location of taken measurements). The upper level is occupied by a central calculating device designed to coordinate operations of whole lower level process equipment. The lower level is controlled by microcontrollers (micro-machines). As autonomous tools of control are regarded the technical devices additionally fabricated to the equipment with standard metrological properties placed inside or outside the working area of the belt conveyors and executing automatically the procedures of finding or comparing actual parameters of one of the conveyor system tested components with its design value, highlighting of the resultant data in the convenient format for perception and generating control (correction) commands. The overall block diagram of the integrated flex system of control and diagnosis of belt conveyors is shown in Picture 1.

The overall block diagram of the integrated flex system of control and diagnosis of belt conveyors includes the following: a design system – selection of control and technical diagnosis options; a technical diagnosis system; a active (in-process) control system; an automated data base of belt conveyor diagnosis.

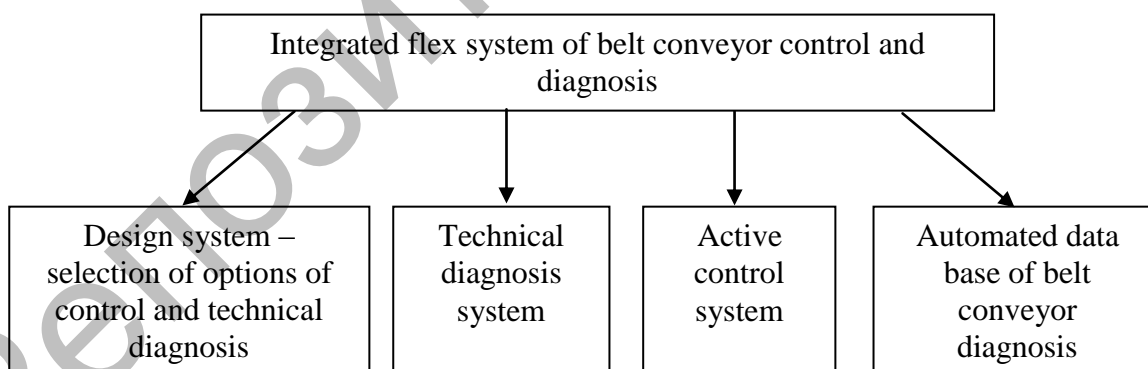


Fig. 1 General block diagram of integrated flex system of belt conveyor control and diagnosis

To solve the required tasks of technical diagnosis of belt conveyors, the technical diagnosis system should have the following operational blocks: a block of diagnostic messages generation, a block of transformations, a library (list) of installations, an identifier of conditions, a block of alarms, a block of control commands generation, etc.

The technical diagnosis tool selects an information signal, completely characterizing the condition of the object under diagnosis, and then the block of diagnostic messages generation transforms the diagnostic data according to accepted algorithms at the phase of training and tracking. The block of transformations sends the selected signal into the type convenient to use

further. The list (library) of the units is based on the package of standard diagnosis signals received at the phase of training that correspond to the potential deviations from the normal operation of belt conveyors (impermissible wear, transverse displacement, ingress of foreign objects into the operation area of belt conveyors). The condition identifier compares current and standard diagnosis conditions and takes a decision on condition compliance. The result is the issued diagnosis of the object under diagnosis.

The block of control commands generation on the diagnosis results forms the control actions on the object of diagnosis and works out a complex of actions to maintain the belt conveyor or some specific component in a serviceable condition.

The integrated flex system of control and technical diagnosis of the belt conveyor condition is intended to provide adaptive control of the belt conveyors actuators and, as well as, its own actuating devices. The control systems by one or several dominant disturbing effects, more often by elastic deformation of the process system and control systems of selected output parameters have become widespread in the machine-building industry.

The effect is identified by the decreasing of the current average parameter and, as well as, the output parameter field of dissipation. The mandatory condition for the second system is the availability of feedback /3/.

The use of the integrated flex system of the condition control and technical diagnosis allows increasing the reliability of conveyor operation.

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