

1.10.6. REAL TIME CONDITION MONITORING OF WHEEL ROLLING MILL STATE

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Two primary tasks – direct control of technological process and equipment technical state are solving during manufacturing process control at mining and metallurgical enterprises. During technological process it's necessary to ensure stability, which depends not just on correct actions of technical personnel, but also on the equipment state, because instability results in significant financial losses, and can lead to breakdowns and anthropogenic situations. That's why, assurance of safe resource-saving maintenance with providing of observability and manageability of equipment technical state is a paramount task of the whole enterprise management system. First, there was an effort to solve the task of reduction of losses, resulting from unexpected emergency breakdowns and the following shutdowns of equipment, by means of large-scale use of portable diagnostic instruments to control trains state, but this did not lead to positive effect for the industry. The reason for this was the high level of subjectivity, the broken management ring between the operation and management staff, unreliable information because of object's observability lack during its operating modes, when unforeseen damages are happened. The problem was solved by real time condition monitoring.

In 2005 the stationary equipment condition monitoring system COMPACS® was implemented on the wheel rolling mill (WRM) in the wheel rolling complex of OJSC “VSW”. The mill performs hot rolling of railway wheels. The production line capacity is minimum 100 wheels per hour. As per regulatory documents, the hot roller line was shut-down every day for 1 hour for technical inspection and every week – for 8 hours for maintenance. The emergency shutdowns normally take from 1 to 10 hours and the prevention of one such stop means a saving of 8 – 10 mln rubles.

The wheel rolling mill consists of upper and lower edger shafts, driven by direct current engines through double reduction gear, and also from the unit of pressure rollers and carriage, controlled by a hydraulic system. The COMPACS®-WRM system provides monitoring of the mill's technical state (22 vibration channels, four – temperature channels, two – rotation frequency channels, three – liquid pressure channels in the hydraulic system), and also controls workpieces temperature using a pyrometer.

The system presents the current information about the mill's state to the technical personnel and is integrated into the diagnostic network of the enterprise – Compacs-Net®, through which the information reaches the mechanical and the technology engineers, as well as the laboratory of technical diagnostics. One of the special characteristics of this system is the automatic expert system for diagnostics of low speed equipment, based on the method SPD-filtration; new algorithms of diagnostics of the mill's technical state at no load, i.e. COMPACS®-WRM system mode for control repair quality control in production mode; algorithms for mill diagnostics in start-stop mode; in-line bearings replacement module (same unit may contain bearings of different manufacturers).

The real-time condition monitoring has allowed the wheel rolling mill failures to pass from the emergency category to gradual ones as a result of their early detection and reporting to the personnel about any failure developments. Furthermore, after repairs the mill is put into operation only under the supervision of the COMPACS®-WRM systems. This allows detecting and correcting any arising defects by maintenance or repair

before the mill is put into production mode. Real-time condition monitoring ensures the timely maintenance of scope as necessary and the equipment shutdown for repair depending on its state, operation conditions and the negative impact of the “human factor”. The stationary system COMPACS® provides high level of safety when the equipment is operated based on its actual state. The considerable reduction of the unexpected failures number, the number and duration of the rolling line shutdowns, as well as the losses of equipment, due to damage or destruction, becomes the key source of profitability. The duration of putting the equipment to operation mode after repairs is reduced substantially. Another important factor is the raising of equipment operation culture, thus considerably increasing the resource of the equipment.

For two years of operation the COMPACS®-WRM systems a technology of safe resource-saving operation of the mill is mastered, and there was not a single incident or emergency situation due to unexpected equipment failure. And one can always define the quality of maintenance and production personnel works and find the fundamental causes of equipment failures based on the log-book of the system mechanical-electrical engineer and trends of the equipment state. The elimination of such causes allows to prevent a number of failures previously occurring, have a real-time safe resource-saving operation, eliminate any destructive unit loads in time and expediently.

Thus, after the complex equipment condition monitoring systems COMPACS®-WRM has been implemented on the wheel rolling mill in VSW over a period of 6 months a transition was made to condition-based operation and maintenance in real time, and this allowed, quoting just officially published data, the prevention of more than 30 critical situations. System was paid-off more than 10 times, ensuring a direct economic effect of more than 50 mln rubles.

The implementation of the automated control system of safe resource-saving operation of equipment ACS SRSM™ COMPACS® in the enterprises of mining and metallurgical complex allows transition to real-time actual condition-based equipment operation, expand the run to failures between repairs of production plants up to duration of the production cycle, substantially increase equipment reliability and availability at 100% load of production facilities and total exclusion of the “human factor” influence in the process of monitoring both equipment state, and the quality, timeliness and expediency of personnel action related to the safe resource-saving operation of the process complex.