NEW HIGH-EFFICIENCY LOW-WASTE TECHNOLOGY
AT THE VYKSA METALLURGICAL PLANT FOR
OPERATING METALLURGICAL EQUIPMENT WITH
THE USE OF KOMPAKS® MONITORING SYSTEMS

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Introduction of the BER™ KOMPAKS® automated system at the Vyksa Metallurgical Plant to safely and efficiently manage the operation of the plant’s equipment has allowed the facility to begin operating that equipment based on real-time evaluations of its actual physical condition. Introduction of the new system has also allowed better coordination of repair-scheduling with ongoing production operations, significantly improved the reliability and readiness of the equipment for operation at 100% capacity, completely eliminated the human factor from the process of monitoring the condition of equipment, and made it possible to check the quality and timeliness of equipment maintenance and repair work so as to ensure safe, efficient operation of the entire production complex.

There are two main objectives pursued in the course of managing production operations at metallurgical plants – control the production process directly and control the technical condition of the equipment. In controlling the production process, it is necessary to ensure that the process is stable. Its stability depends not only on having the equipment operators execute the process correctly, but also on having the equipment in the proper condition. Instability during production operations can lead to large financial losses and accidents. It is necessary to consider that most of the existing equipment at metallurgical plants is worn or obsolete and is operating beyond its rated service life. For example, Rostekhnadzor estimates that 50% of the equipment is in an advanced state of wear and that wear has reached 70–75% on some production units [1]. Thus, the highest priority for the management of metallurgical plants is to ensure safe, low-waste operation of the equipment and monitor and manage their use on an ongoing basis.

The Vyksa Metallurgical Plant first attempted to reduce losses from accidents and the subsequent equipment downtime by introducing portable diagnostic tools and establishing a diagnostics center at the plant in 2001 to monitor the condition of various types of facilities (rolling mills, mill stands, presses, etc.). The center uses the above-mentioned tools to periodically evaluate the status of different pieces of equipment. Despite these efforts, unplanned equipment breakdowns continued to happen at the plant. The main reasons were the lack of direct monitoring of the equipment’s condition, the high degree of subjectivity built into the system that was set up, breaks in the chain of command between management and production staff, and the fact that some of the diagnostic information turned out to be unreliable. It is essential to have a satisfactory amount of accurate, timely information on the equipment’s condition to correctly manage its use and provide for its stable operation.
Thus, it became apparent that continuous monitoring would be necessary, i.e., that the equipment diagnosis would have to be performed with a period significantly shorter than the period over which problems typically develop in the equipment. The results of the diagnosis also need to be automatically (independently of the equipment operators) transmitted to the parties ultimately responsible for the operation of the facilities. The purpose of a monitoring system is to detect problems that develop during production operations and provide a timely warning to personnel that maintenance needs to be performed on the corresponding equipment.

**BER™ KOMPAKS® automated systems for managing the safe operation and repair of equipment.** These systems take systems designed to monitor the equipment of production facilities and stand-based systems designed to evaluate the quality of new and reconditioned equipment and combine them into a single factory-wide diagnostic network called Compacs-Net®, which gives all interested subdivisions and the management of the plant an objective picture of the condition of the equipment in real time [2, 3].

The BER™ system provides for safe, efficient equipment operation using the SM™ (Safe Maintenance) technology. The BER system is an MES system (MES – Manufacturing Execution System) that allows evaluation of the condition of new, reconditioned, and operating equipment, control of its quality at all stages of its service life, and stable, safe, and efficient production.

The BER™ automated control system is based on three components:

- a system (KOMPAKS®) that monitors the condition of production equipment in real time;
- a system that diagnoses the quality of new and reconditioned equipment;
- the factory-wide diagnostic network Compacs-Net®.

Figure 1 shows the structure of BER™ system, the core of which consists of KOMPAKS® stationary equipment-monitoring systems. The latter have a built-in automated expert system that is invariant to the design of the production equipment. This allows the factory management to employ the strategy of diagnosing the minimum cost (SDMS™), i.e., it makes it possible to do the following: continuously and automatically obtain and make use of objective information on the condition of production facilities for maintenance and repair of their equipment (TORO); find and eliminate the basic causes of equipment failures (LiFPO™ technology); improve production discipline by providing for objective monitoring and timely correction of the actions of factory personnel.

The system KOMPAKS® includes the following:

- a distributed system of transducers that monitor the main parameters of the equipment;
- a distributed system of portable modules which provide for initial conversion of the signals from the transducers and their translation into a diagnostic controller; the system of modules also checks the working condition of the transducers and the communication lines;

![Fig. 1. Structure of the BER KOMPAKS® automated control system for the safe, efficient operation of metallurgical equipment.](image-url)