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System for Inspection of Railroad Axles using Eddy Current and Ultrasonic Methods

The system of automated integrated control of finished railway axles of wheel pairs on cars, **SNK Os-3**, ensures the application of all mandatory and additional methods of ultrasonic inspection and VTK, according to the RD, to each controlled axle with documentation of the entire control process and its results.

The installation provides 100% ultrasonic testing, followed by analysis of the results to decide on if to reject the axle, as well as issuing a complete test protocol in electronic form. The conclusion of the summary protocol is provided on paper. All ultrasound results in the form of B-Scans for all channels for each monitored axis are stored on the hard disk with the possibility of archiving.



The structure of the metal is estimated by comparing the amplitude of the echo signal from the opposite end of the axis when sounding from each end surface by longitudinal waves in the axial direction with the amplitude of the echo in a standard sample (method T1), as well as by the mirror-shadow method from a cylindrical surface in the radial direction - by assessing the attenuation of the bottom signal (method T2).

Control for the absence of internal defects is carried out by echo-pulse methods:

- A1 from each end surface by longitudinal waves in the axial direction;
- A2 from cylindrical surfaces by longitudinal waves in the radial direction;
- A3 from cylindrical surfaces with shear waves in the axial direction.

The installation also provides 100% eddy current control of the cylindrical surface of the axle, fillet transitions, as well as the axle ends with the possibility of detecting class B defects according to RD 32 144-2000.



Fig.2 External view of the system of automated complex control of finishing railway axles of wheel pairs of cars "SNK Os-3".



Axle control starts by pressing the corresponding button in the installation software, after which the beam with the transducers fixed on it is lowered and the latter are installed on the axle body. Each sensor has its own monitoring zone and takes a position at the beginning of this zone. Then the supply of couplant (oil) is switched on and the axis is set in rotation. The probes are displaced along the axis, ensuring uniform scanning of the part. After the sensor is at the end of its control section, it is retracted from the axis. When the last pair of sensors reaches the end position, all installation elements are retracted to their original position. In the meantime, the control computer processes the data, issues a short report of the control results and saves the complete results in the database.



Main Advantages of the System

- 100% comprehensive non-destructive testing of the axis;

- Detection of internal (ultrasonic), surface and subsurface defects (VTC);

- The control process is fully automated;
- Control productivity up to 10 axes per hour;

- Saving all control results with the possibility of issuing protocols;

- Stability of acoustic contact due to the special design of the transducers and their attachment;

- Light and sound alarm when defects are detected.



Fig. 3 Scanning the surface of the axis with ultrasonic and eddy current transducers

All stored data can be viewed at any time on a computer. Here you can get detailed information about each detected defect:

- Spatial orientation of the defect;
- Defect coordinates;
- The amplitude of the echo signal from the defect;
- The length of the defect;
- Equivalent area of the detected defect;
- Equivalent diameter of the detected defect.



Fig. 6 Operation of the system of automated integrated control of finishing railway axles of wheel pairs of cars "SNK Os-3" at the enterprise ODO "Popasnyanskiy car-repair plant", Popasnoye.