OKO-3 ULTRASONIC MULTI-CHANNEL FLAW DETECTOR

WITH THE EQUIPMENT SET FOR TESTING THE ELEMENTS OF RAILCAR WHEELSETS

EN 12668-1 Compliant
OKO-3 multi-channel ultrasonic flaw detector with a special-purpose set of manual ultrasonic probes and scanners for the testing of used axles and wheelsets during all types of planned wheelset maintenance.

OKO-3 flaw detector with a set of UT probes and scanning devices assures the sounding by pulse echo, echo-mirror and echo-images techniques from the axle centre hole, pre-wheel seat part of axle and from the rim of solid-rolled wheel for detection of main defect types.

Technological objects for ultrasonic testing are axles of railway wheelsets and locomotives (Schlieren (ART.IRT), Y28, E8000, Y25 22,5T.+120KMH, Y32, Schlieren Duz, DE24000, DE18000, E14000, DE22000), along with solid-rolled wheels or wheelsets.

Cone single crystal angle-beam probes for axles testing from the center hole side in combination with multi-channel ultrasonic flaw detector OKO-3 are intended for manual ultrasonic testing of axles without removing the wheelsets from under the railcars for the presence of cross-oriented cracks deeper than 3 mm on cylindrical surfaces of the journal, pre-wheel seat part and wheel seat part of the axle.


Combined special-purpose single crystal probes P121-2.5-0 and 30-TR-003 in combination with multi-channel ultrasonic flaw detector OKO-3 are intended for manual ultrasonic testing of axles with hollow journals such as Schlieren (ART.IRT) without removing the wheelsets from under the railcars for the presence of cross-oriented cracks deeper than 3 mm on cylindrical surfaces of wheel seat area of axle and deeper than 4 mm on the middle part of axle.

- Axles Y32, Schlieren Duz, DE24000, DE18000, E14000, DE22000:


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In a complex with a special-purpose scanner USO-01 the flaw detector ОКО-3 provides detection of the surface defects in the testing area of axles of wheelsets (axle journal, pre-wheel seat and wheel seat part of the axle) and internal defects that are equivalent to or greater by its reflective properties than artificial reflectors in the form of sawcuts with a depth 3 mm, made in various parts of the axle.

Surface wave probes P121-0.4-90-RS-003 in combination with the multi-channel ultrasonic flaw detector ОКО-3 are intended for manual ultrasonic testing by surface waves of the rolling surface of wheels and wheel tires of railcars and locomotives during the ordinary and full inspection. They have a modular structure consisting of wedge with the angle of 65° and screwed in it resonator P111-0.4-P20-RS-003.

Application of these probes provides detection of flaws on the rolling surface of the wheel rim and internal defects in the wheel rim at the depth of 10 mm from the testing surface, in equivalent to or greater than the reflectivity of the reference reflector in the testing sample wheels provided on the circle of riding as a hole diameter of 7 mm and depth of 3 mm.

In a complex with a special-purpose scanner USO-01 the flaw detector ОКО-3 provides detection of the surface defects in the testing area of axles of wheelsets (axle journal, pre-wheel seat and wheel seat part of the axle) and internal defects that are equivalent to or greater by its reflective properties than artificial reflectors in the form of sawcuts with a depth 3 mm, made in various parts of the axle.

In a complex with a special-purpose scanner USO-01 the flaw detector ОКО-3 provides detection of the surface defects in the testing area of axles of wheelsets (axle journal, pre-wheel seat and wheel seat part of the axle) and internal defects that are equivalent to or greater by its reflective properties than artificial reflectors in the form of sawcuts with a depth 3 mm, made in various parts of the axle.

Channel 1 - Testing from the cylindrical surface of pre-wheel seat part of axle by transverse waves in the axial direction in order to detect transverse cracks in balancing groove and under internal edge of bearing ring.

Channel 2 - Testing from the cylindrical surface of pre-wheel seat part of axle by transverse waves in the axial direction in order to detect transverse cracks between the bearing rings.

Channel 3 - Testing from the cylindrical surface of pre-wheel seat part of axle by longitudinal waves in the radial direction in order to detect internal flaws and cracks.

Channel 4 - Testing from the cylindrical surface of pre-wheel seat part of axle by transverse waves in the axial direction in order to detect transverse cracks in the area under the outer edge of the wheel seat part.

Channel 5 - Testing from the cylindrical surface of pre-wheel seat part of axle by transverse waves in the axial direction in order to detect transverse cracks in the area on the inner edge of a wheel hub.
In complex with a special-purpose scanning device USK-01 the flaw detector OKO-3 provides detection of surface and internal defects in the testing area of all-rolled wheel (rolling surface, the outer and inner surface of a wheel rim), that are equivalent to or greater by its reflective properties of artificial reflectors made in different parts of all-rolled wheel.

- **DR1** - Testing from the rolling surface of the rim in the radial direction by the longitudinal waves at positioning of probes over the outer side of the rim edge (DR1.1) or in the middle of the rim (DR1.2) in order to identify the longitudinal fatigue cracks, nonmetallic inclusions, and other internal defects in the main section of the rim.
- **DR2** - Testing from the inner surface of the wheel rim in the axial direction by longitudinal waves under the rolling surface (DR2.1) or at a distance of 30 mm from the bottom edge of the rim (DR2.2) in order to identify defects such as longitudinal fatigue cracks developing predominantly perpendicular to the rolling surface in the main section of the rim.
- **DR3** - Testing from the inner side of the rim surface in the circumferential direction by the transverse waves at positioning the probe under the rolling surface in order to detect a transverse fatigue cracks of outer side edge (DR3.1)
- **DR3.3** - Testing of the inner surface of the wheel rim by the transverse waves in order to detect transverse cracks and internal discontinuities in the flange of the rim.

**SERVICE FUNCTIONS OF THE INSTRUMENT**

- Possibility of excluding the actual spatial position of probe in the scanner for the proper results of processing while working with the scanners.
- Presence of a “Freezing” mode of A-scan image.
- Accumulation mode of the maximum signal in A-scan.
- Testing results can be saved to an external USB storage device.
- Displaying the testing results in a form of B-Scan simultaneously via all active channels.

**SPECIFICATIONS**

- The flaw detector consists of a central electronic unit OKO-3, ultrasonic multiplexer units in the quantity from one to four.
- Ultrasonic vibration frequency range of the flaw detector is from 0.4 to 10.0 MHz.
- The amplitude of initial pulse of the flaw detector’s pulser is not less than 180 V at a duration of (60 ±10) ns and duration of the leading edge of the pulse of no more than 20 ns.
- Range Gain of the flaw detector’s receiving path is from 0 to 100 dB with a step of 1 and 10 dB.
- Range of testing for detection of defects in steel is between 1 to 6000 mm at velocity 6000 m/s.
- Number of ultrasonic sounding channels is not less than 8.
- Setting range of sound velocity is from 2000 to 8000 m/s with a step 1 set of 1; 10; 100 and 1000 m/s.
- Dynamic range of time corrected gain (TCG) is not less than 20 dB with a step of 1 dB and point step of TCG is not less than 2 mm; maximum number of points of TCG is 10 (with maximum points step TCG).
- Setting range of scan delay relative to the excitation of pulse is from 0 to 6000 ns at velocity of 6000 m / s with a step of 0.1; 1.0; 10.0 and 100.0 μs.
- The flaw detector construction provides light and sound ALARM for defects detection. Maximum number of gates of automatic defect alarm (ALARM) is no more than two in one cycle.
- Setting range of a probe angle is between 0 to 90 angle deg. with a step 1; 10 angle deg.
- Electrical power of the flaw detector is provided from the following sources:
  - AC mains voltage (220 V ± 10%) and frequency (50 ± 1) Hz;
  - Independent power source - battery rated voltage of 12 V and rated capacity of 9 Aч.
- Setup time of the Flaw Detector is no more than 10 minutes.
- Continuous work time of the flaw detector from a fully charged battery is at least 8 hours.
- Design of the flaw detector allows connection with a PC via Wi-Fi or using Ethernet cable.
- Overall dimensions of the flaw detector without a handle, with one connected ultrasonic unit and battery - no more than 330x180 x140 mm.
- The flaw detector weight with one connected ultrasonic unit and storage battery pack - no more than 4.2 kg.