

ROBOSCOPE VTM-5000/KP

LASER SCANNING AND FLAW DETECTION TEST BENCH

for a complete non-destructive testing cycle
of rolling stock wheelsets



1 APPLICATION

Roboscope VTM-5000/KP laser scanning and flaw detection test bench (hereinafter Roboscope VT-5000/KP) is designed for automated measurement of geometric parameters and complex non-destructive testing (NDT) of car wheelsets (WS).

Roboscope VTM-5000/KP provides the following methods of non-destructive testing:

- WS geometric parameters laser measurement;
- ultrasonic NDT;
- eddy current testing.

2 TECHNICAL FEATURES

Roboscope VTM-5000/KP is an automated software and hardware complex capable to operate autonomously or to be integrated into technological chain of subway cars maintenance and repair. General view and dimensions of Roboscope VTM-5000/KP, installed in the working cell, are shown in Fig.1, Fig.2.

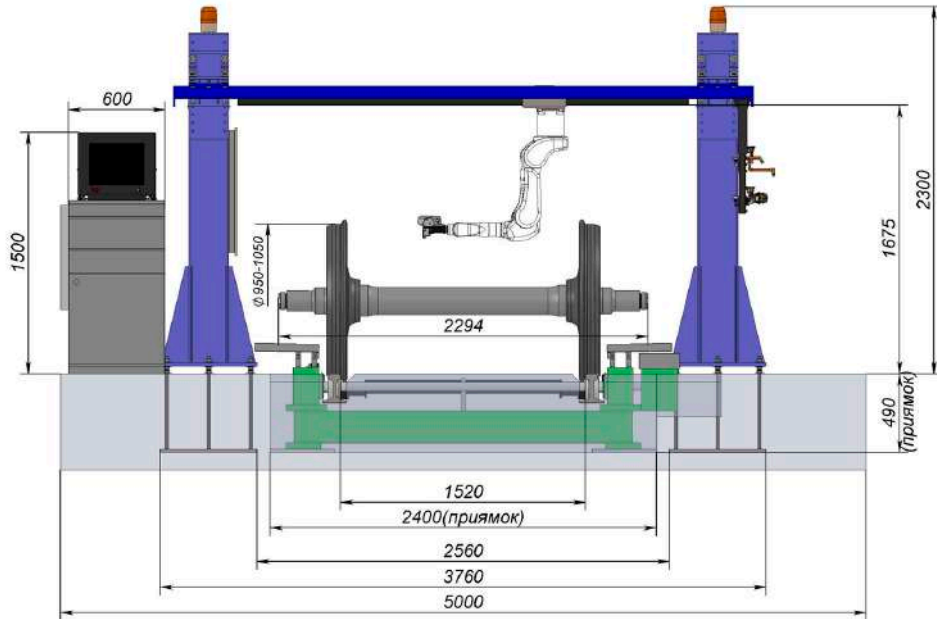


Fig. 1

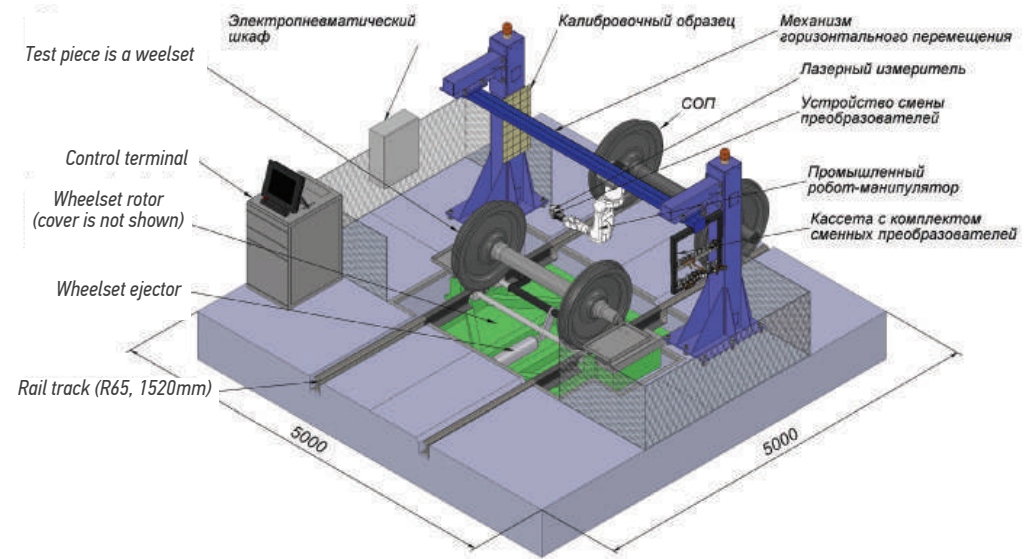


Fig. 2

2.1 General specifications of Roboscope VTM-5000/KP are shown in Table 1.

Table 1

Features	Value
Power supply - mains voltage, V - frequency, Hz	380 50±1
Maximum power consumption, kVA	6
Time of operating mode setting, min, not more	10
Supported simultaneously NDT methods: laser measurement of geometrical parameters, ultrasonic, eddy current	+
Full cycle test time, min, no more	20
Continuous operation time, hours, at least	24
Probe velocity on a test piece, m/c	0 ÷ 1,0
Couplant	water
Mean time between failures, h, not less	20000

Features	Value
Test piece maximum dimensions, mm	1500x1500x3000
Total weight of all equipment, kg, not more	3500
Control cabinet overall dimensions of a (length, width, height), mm	800x600x1500
Mechanical part overall dimensions of a (length, width, height), mm	+
Control, display and information processing tools (industrial computer, general control terminal, touch display of information processing)	+
Self-diagnosis system	+
Sound and light defect detection alarming	+
Automatic probe change	+
Automatic couplant supply system	+
Safety barriers	+
Operating temperature, °C	от +10 до +40
Relative humidity (at 35 °C), %, not more	80

2.2 The features of laser scanning module **Roboscope VTM-5000/KP** are presented in **Table 2**.

Table 2

Features	Value
Operating range of measured distances in the direction of a laser beam, mm	100÷350
Absolute tolerance, mm	±0,01
Basic coordinate system (axis number)	X0Z (2)
Wave length, nm	660
Frequency of data updates, profiles/sec, not less	1200

2.3 The features of **Roboscope VTM-5000/KP** NDT system are presented in **Table 3**.

Table 3

Features	Value
Ultrasonic testing of axles is managed by contact method from cylindrical surface of a journal and an axle end (ultrasonic input angles 00, 500)	+
Ultrasonic testing of a rim and wheel flange main section of solid-rolled wheels is managed by contact method (angle of entry UZK - 00; 400; 500)	+
Automatic gain control (AGC) to maintain the required level of sensitivity of ultrasonic channels	+
Automatic acoustic contact check mode	+
Measuring range of signal amplitudes at a receiver input, dB	67÷107
Absolute tolerance of signal amplitudes measurement at a receiver input, dB	±0,5
Absolute tolerance of threshold indicator setting (dead zone), dB	±0,3
Temporary instability of a threshold indicator trigger level for 8 hours of operation, dB	±0,5
Time full automatically re-set, min, not more:	1
Nominal values of excitation pulse amplitude at resistance of 50 Ohms, V	75; 150; 225
Reference tolerance of amplitude pulse setting, %	±20
Half-wave duration of the excitation pulse generator (EPG), ns	25÷1250
Reference tolerance setting of EPG half-wave duration, %	±10
Discreteness of pulse duration EPG setting, ns	12,5
Pulse repetition frequency of EPG, Hz, not less than	1000
Maximum sensitivity at a frequency of 5 MHz at a signal/ noise ratio of 6 dB, mV	150
Receiver bandwidth should be at minus 3 dB, MHz	1÷10
Receiver sensitivity adjustment range, dB, not less than	90
The number of points to fit a distance-amplitude compensation (DAC) curve	256

2.4 The features of **Roboscope VTM-5000/KP** eddy current scanning module are presented in **Table 4**

Table 4	
Features	Value
Eddy current testing for surface and subsurface defects check in the areas of: a rim, a rim-disk transition, a disk-hub transition, a hub edge, an axle middle part.	+
EPG operating range, kHz	(1÷1000) ±10%
Pulse repetition frequency of the generator, Hz, not less	1000
Nominal amplitude of excitation pulses at an equivalent load of 150 Ohms, V	9 ± 2
Minimum depth of a detectable defect, mm	0,15
Full automatic reconfiguration time, min., max.	
Separate signal scaling Supported operating modes Types of displaying the zone of automatic defect alarm (ASD)	1
Gain control range, dB	0 ÷ 50
Signal representation methods of	1) on a complex surface, 2) amplitude-time
Separate signal scaling	by OX and OY axis
Supported modes	1) static 2) dynamic
Types of displaying of automatic defect alarm (ADA) zone	1) horizontal gate 2) ring sector

2.5 Technical features

Technical features of **Roboscope VTM-5000/KP** main components

Industrial robotic arm

- axis number.....6
- movement accuracy, mm.....±0.03
- maximum tool travel speed, m/s.....9,3
- manipulator body protection class.....IP67, IP65
- working area radius, mm.....903

- power supply:
 - voltage, V.....220
 - frequency, Hz.....50
 - power, kW.....3.00

Linear (horizontal) transfer mechanism

- maximal transfer weight, kg.....100
- maximal transfer speed, m/s.....1
- power supply:
 - voltage, V.....220
 - frequency, Hz.....50
 - power, kW.....0,62

Wheelset rotator:

- load capacity, kN.....30,00
- automatic wheelset ejector.....1
- wheelset rotation frequency rpm.....0 ÷ 20
- operating air pressure in the line, MPa, not less.....0,4
- engine power:
 - voltage, V.....380
 - frequency, Hz.....50
 - power, kW.....1,50
 - pneumatic ejecting cylinder pushing force, kN.....7,90

Control terminal (operator workplace):

- flaw detection tools,
- touchscreen display,
- component servo controllers Roboscope VT-5000/KP-M,
- emergency power off.

3 SUPPLY SET

- industrial robotic arm, pcs.....1
- mechanical portal construction, pcs.....1
- mechanism of the arm linear (horizontal) movement, pcs.....1
- wheelset rotator, pcs.....1
- laser meter, pcs.....1
- control terminal, pcs.....1
- cassette set (UT, ET) NDT probes, pcs.....1
- calibration table with measures of defects and standard blocks, kit.....1

4 RELIABILITY

Life span is not less than **10 years**.

Average life of equipment before an overhaul (update) is not less than **5 years**.

5 WARRANTY

Warranty period - **18 months** from delivery date, excluding consumables (connecting cables and probes).

Warranty storage period – **6 months**.