

EDDY-2K

EDDY CURRENT STRUCTUROSCOPE

automated eddy current instrument for
hardness and structural testing of
steel crankshafts in flow production



1 APPLICATION

EDDY-2K is a multifunctional flaw detector DAMI-C09 in the configuration to analyse crankshaft structure (hereinafter EDDY-2K) is designed for automated non-destructive testing of mechanical properties (structure) of crankshaft forging of cars with eddy current in production process.

2 MEASURING INSTRUMENT DESCRIPTION

EDDY-2K consists of the following modules:

- electronic module DAMI-C09;
- shaft positioning device;
- automatic feed mechanism / retraction of the transducer and the marking unit;
- automatic defect signal unit ADS (three-color warning light);
- control and PC-feedback unit;
- personal computer;
- software CD.

EDDY-2K implements low-frequency methods of eddy currents based on recording of alternations in electromagnetic field of eddy current induced by an exciting coil in an electrically conductive test piece depending on alternation in material specific conductance.

A pulse of an drive pulse generator (DPG) is applied to an excitation coil of the eddy current transducer (ECT) at a frequency of 7 kHz, as a result eddy currents are generated in test material. The amplitude of generated eddy current is directly proportional to the material specific conductance, which in turn depends on the test piece structure. A received signal from the measuring coils of the ECT is interpreted by amplitude-phase method. During adjustment, the amplitude-phase plane is rotated to a fixed angle to eliminate any influence of transducer positioning and roughness of a test piece. A result of processing a received signal from the test piece is displayed on the computer screen (when working in automatic mode) or on the screen of DAMI-C09 electronic unit (when working in manual mode) in graphical form, and when a set threshold is exceeded (set by the strobe), an automatic defect signal sounds.

The block diagram of component interaction is presented in Fig. 1.

A personal computer is not included in the delivery kit. The appearance of DAMI-C09 is shown in Fig. 2.

Appearance of the positioning device, automatic transducer feed/retraction unit, marking unit, ADS unit, control unit and PC-feedback unit (control and moving unit (CMU)) are presented in Fig. 3.

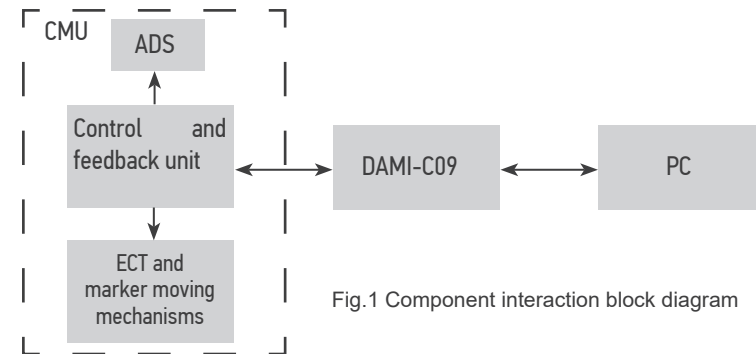


Fig.1 Component interaction block diagram



Fig.2 Electronic module DAMI-C09 appearance

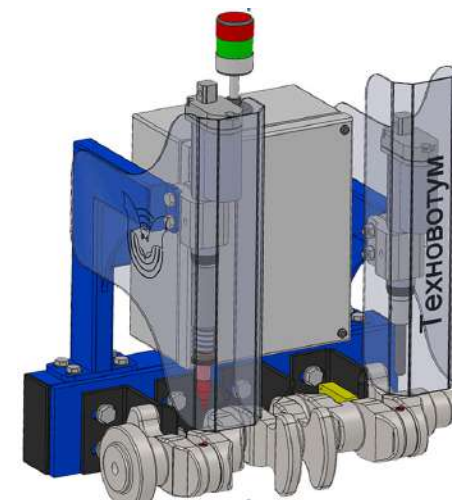


Fig.3 CMU appearance

3 DELIVERY KIT

The scope of delivery of multifunctional flaw detector **DAMI-C09** in the configuration for crankshafts structure testing is given in Table 1

Table 1

| Nº | Name | Quantity |
|----|--|----------|
| 1 | DAMI-C09 electronic module (without software) | 1 |
| 2 | AC adapter 110-240V / 12V, 2.5 A | 1 |
| 3 | Built-in rechargeable Li-ion battery | 1 |
| 4 | Headphones | 1 |
| 5 | Application software: «ARM DAMI» V2. 0 | 1 |
| 6 | USB interface cable-Lemo4 | 1 |
| 7 | Set of fastening belts | 1 |
| 8 | Storage and carrying bag | 1 |
| 9 | Specialized low-frequency surface transducer VTP-2-N for eddy current material structure testing | 1 |
| 10 | Software «Eddy current testing method» | 1 |
| 11 | Software «Eddy current structurescope» for PC | 1 |
| 12 | Cable to eddy current transducer (Lemo10-Lemo10) | 1 |
| 13 | Shaft positioning device | 1 |
| 14 | Mechanism of automatic transducer feed / retraction to a product | 1 |
| 15 | Automatic signalling unit (tri-color warning light) | 1 |
| 16 | Remote control and PC feedback to start a measurement process | 1 |

| Nº | Name | Quantity |
|----|-------------------------|----------|
| 17 | Test methods | 1 |
| 18 | Spare parts kit | 1 |
| 19 | Technical documentation | 1 |

4 TECHNICAL DATA

4.1 Flaw detector operation is possible in manual and automated modes.

4.2 The operation procedure in automated and manual modes is specified in DAMI-C09 operating instructions.

4.3 Technical data on electronic module **DAMI-C09** is given in Table 2.

Table 2

| Features | Value |
|---|----------------------------|
| Drive pulse generator operating frequency range, kHz | $(0,2 \div 1000) \pm 10\%$ |
| Drive pulses nominal amplitude at equivalent load of 150 Ohms, V | 9 ± 2 |
| Receiver gain control range, dB | 50 |
| Continuous operation time: AC power, frequency | 24 |
| Battery power at screen brightness is not more than 50%, h at least | 7 |
| Setting time, min, max | 10 |
| Time for one measurement, sec, not more | 10 |
| Module weight, kg | 1 |
| Operating temperature, °C | -10 +40 |

4.4 Technical data on the control and moving unit is given in Table 3.

Table 3

| Features | Value |
|--|--------------------|
| Supply voltage, V | ≈220 ±10% |
| Rated power, W | 80 |
| Max. noise level of sound signals, dB | 80 |
| Types of light signals | Red, yellow, green |
| Maximum travel speed of the transducer, mm / s | 90 |
| Operating temperature, °C | -10 + 40 |
| Emergency shutdown | + |
| Overall dimensions (length, width, height), mm | 430 x 290 x 500 |
| Unit weight, kg (not more) | 25 |
| Ingress protection class | IP 65 |
| Protection class of ADS | IP 50 |

4.5 Reference block requirements:

Reference blocks must be made of the same material as the test products. The roughness of reference blocks is not to differ from one of the test products by more than 40 microns.

4.6 Test products requirements:

There should be no dust, dirt, oxide scale or other mechanical impurities on the product at a test point. In case of any contamination, the test product must be cleaned with a non-metallic brush or rag before testing.

5 INSTALLATION AND CONNECTION

5.1 DAMI-C09 multi-function flaw detector for crankshaft structure testing is supplied assembled.

5.2 Installation of the equipment in a shop is to be done with fastening bolts M12x40. In the table on which the equipment will be installed, pre-drill holes of 13 mm diameter. Mounting holes are shown in Fig. 4, 5.

5.3 Connection of the instrument is described in the manual on **DAMI-C09** (Vitometr).

5.4 After the detector installation set up the eddy current probe. For this purpose:

- power a CMU to AC 220 V;
- load a shaft;
- press the error reset button (eddy current transducer will go down and stay at a check point);
- make sure that the eddy current transducer is installed strictly at the center of the shaft and does not fall on protrusions;
- if necessary, adjust the eddy current probe position with the adjustment screws 1 and 2 (Fig. 6).

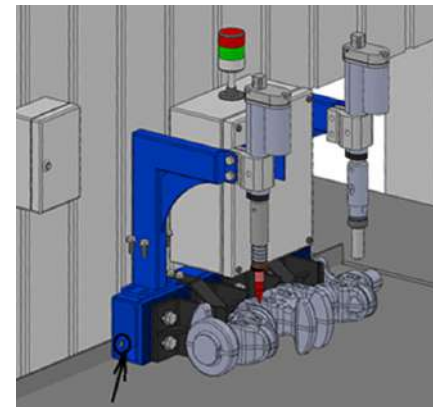


Fig. 4

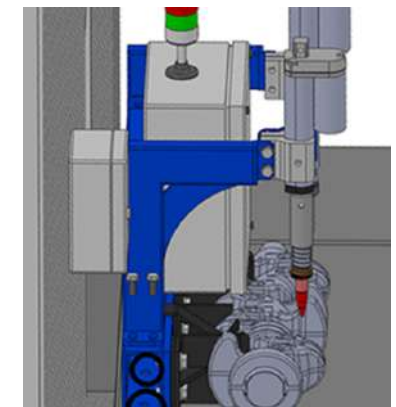


Fig. 5



Fig. 6 Adjusting screws

6 SAFETY PRECAUTIONS

- 6.1** The flaw detector meets the safety requirements of GOST 12.2.007.0-75.
- 6.2** Regarding to electric shock protection the flaw detector corresponds to class I according to GOST 12.2.007.0-75.
- 6.3** Resistance between the grounding bolt (screw, stud) and each non-conductive metal part of the CMU that may be energised shall not exceed 0.1 Ohms.
- 6.4** Only the employees who have passed the safety training and the operational training on how to use this equipment are permitted to work with the device.

DO NOT MOVE A TEST PIECE WHILE THE TRAVEL MECHANISMS ARE IN OPERATION (YELLOW OR RED ADS SIGNALS ARE ON).

7 ENVIRONMENTAL PROTECTION REQUIREMENTS. DISPOSAL

- 7.1** There are no special requirements for components disposal.
- 7.2** Requirements for soil protection from pollution by municipal and industrial waste are according to SanPiN 42-128-4690.

8 TRANSPORTATION AND STORAGE

- 8.1** A packed flaw detector shall be transported in any kind of closed transport protecting the cargo from moisture according to GOST R 52931-2008, GOST 15150-69 (conditions 1.2) and to the rules and norms acting on this mode of transport.
- 8.2** When transporting by air, the packed flaw detector should be placed in sealed and heated compartments. At sea freight conditions of transportation shall correspond to storage conditions 1.2 according to GOST 15150-69.
- 8.3** During transportation, loading, unloading and storage in warehouses flaw detectors shall not be subjected to any impacts, shocks or moisture exposure. The container position is to correspond to the marking indicated on the container.
- 8.4** Arrangement and fastening of containers with packed flaw detectors in vehicles shall prevent from any displacement, impacts, shocks, jamming.
- 8.5** Packed flaw detectors should be stored in a room with controlled temperature and humidity in accordance with the storage conditions 1.2 according to GOST 15150-69 at a temperature from 5°C to 15°C, maximal relative humidity should not exceed 55%, and average annual level should not exceed 40 % at 15°C. In the storage room there should be no conductive dust, vapors of acids, alkalis, as well as aggressive gases that cause corrosion and deteriorate electrical insulation.
- 8.6** At storage more than 6 months the flaw detectors shall be free from transport packing and be kept according to storage conditions 1.2 (GOST 15150-69). The distance between any heaters and the component parts of the flaw detectors shall not be less than one meter.

9 WARRANTY TERMS

- 10.1** The Manufacturer guarantees the flaw detector serviceability in case the customer with the requirements for transportation, storage and operation.
- 10.2** The warranty period of the flaw detector serviceability is 36 months since the date of its commissioning, this warranty period does not apply to transducers and connecting cables.