



**INDICATOR OF DEFECTS
OF ELECTRICAL MACHINE BEARINGS
IDP-07**

Operation manual
IDP-07.00.000.OM

1 Purpose

1.1 The indicator is designed to monitor vibration of electrical and other rotary machines, the condition of their rolling bearings and provides the following checks:

- 1) machine vibration;
- 2) wear of bearing raceways and rolling bodies;
- 3) quality of lubrication and bearing installation;
- 4) the level of bearing local defects (cracks, nicks, cavities);
- 5) bearing heating.

1.2 The main users of the indicators are enterprises operating electrical and other rotary machines with a rotation frequency of 300 to 6000 rpm.

2 Technical data

1)	parameters to be controlled:	
	- when checking machine vibration	vibration velocity (root mean square value);
	- when checking wear of bearing raceways and rolling bodies, quality of lubrication and installation	vibration acceleration (root mean square value);
	- when checking level of bearing local defects	peak impact acceleration (maximum value for series of impact pulses);
	- when checking bearing heating	temperature;
2)	dynamic ranges to be controlled:	
	- when checking machine vibration, dB	49;
	- when checking wear of bearing raceways and rolling bodies, quality of lubrication and installation, level of bearing local defects, dB	40;
3)	frequency ranges to be controlled:	
	- when checking machine vibration	5-1000;

	- when checking wear of bearing raceways and rolling bodies	500-1800;
	- when checking quality of lubrication and installation	2000-10000;
	- when checking level of bearing local defects	25000-31000;
4)	temperature range to be controlled, °C	-10...+120;
5)	indication	LED and liquid-crystal one;
6)	power	self-contained or from external power supply;
7)	power voltage, V	$4^{+0,2}_{-1,0}$;
8)	power consumption, W, not more than	1;
9)	overall dimensions, mm	205 x 80 x 50;
10)	weight*, kg, within	0.4;
11)	operating position	arbitrary;
12)	parameters of external power supply:	
	- rated DC output voltage, V	4;
	- rated output current, A	1;
	- rated AC input voltage, V	220.

* The weight of the indicator is pointed out with the storage battery; the weight of the delivery set is 0.80 ± 0.04 kg.

3 Delivery set

- | | | |
|----|---|----|
| 1) | IDP-07, pcs | 1; |
| 2) | storage battery (Li-ion, type 14500), pcs | 1; |
| 3) | power supply BPID-3, pcs | 1; |
| 4) | vibration sensor, pcs | 1; |
| 5) | temperature sensor, pcs | 1; |
| 6) | operation manual, copies | 1; |
| 7) | case, pcs | 1. |

4. Indicator design and operation

4.1 Indicator design (Fig. 4.1, 4.2).

Structurally, the indicator is made in the form of a portable device, the plastic housing of which consists of two parts pulled together with rubber edge strips.

On the front side of the housing, there is a liquid crystal display and LEDs, as well as inscriptions explaining the purpose of the controls.

On the top wall of the housing, there is jack «» - for connecting the vibration sensor or the temperature sensor to the indicator, as well as a window of the built-in stroboscope.

On the left wall of the housing there are two buttons: «» - to turn on / off the indicator - and «**Enter**» - to control the indicator.

On the right wall of the housing, there are jacks: «**4V, 1A**» - for connecting to the indicator of the external power supply BPID-3 (hereinafter referred to as «power supply»), in order to charge the battery - and «» - for connecting to the indicator of head phones with an input resistance of at least 8 Ohm, as well as buttons «**▲**», «**▼**» - to select the required item of display menu and to change the values of parameters shown on the display: machine power **P** (in kW), rotation speed **n** (in rpm) and shaft diameter for bearing **d** (in mm).

On the back side of the housing there are located inscriptions explaining the purpose of the indicator jacks and containing the basic information about it.

Inside the housing there is a printed circuit board with elements of the indicator circuit and storage battery.

General view of IDP-07 indicator



Fig. 4.1

Accessories for IDP-07 indicator

Vibration sensor



Temperature sensor



BPID-3 power supply



Fig. 4.2.

4.2 Principle of indicator operation

4.2.1 When checking machine vibration, wear of raceways and rolling bodies, quality of lubrication and installation, level of bearing local defects, the indicator measures the values of the appropriate monitored parameters and indicates the assessment zones and the intervals within these zones, in which the measured values fall.

4.2.2 When checking heating of the bearing, the indicator measures the bearing temperature (in a non-contact way using an infrared sensor), compares it with the maximum permissible one (100°C) and shows the result of this comparison.

5. Safety requirements

5.1 Read this manual before working with the indicator.

5.2 The inspected machine shall be reliably grounded.

6. Preparation for operation

6.1 Carry out an external visual inspection of the indicator.

6.1.1 Check the completeness according to the delivery set.

6.1.2 Check that there is no external damage to the housing and cables of the vibration and temperature sensors.

6.2 Check indicator power supply.

6.2.1 Turn on the indicator by pressing the «» button.

In this case, following the message «**Battery**», the indicator will show the battery charging level («**I I I I I**» - the maximum level, «**_ _ _ _ _ I**» - the minimum one).

If the display shows the message «**Charge Battery**» (Charge the battery), then it is necessary to charge the storage battery. For this purpose:

- 1) switch off the indicator by pressing «» button;
- 2) connect the power supply to the indicator;
- 3) connect the power supply to alternating current network with voltage of 220 V, 50 Hz. In this case, LEDs «» and «**Charge**» shall light up on the housing of the power supply. The end of the battery charging is evidenced by switching off the «**Charge**» LED;
- 4) disconnect the power supply from the indicator and from the network.

Notes

1. The storage battery shall be charged only from the power supply included in the delivery set.

2. The storage battery is also charged when the indicator is energized from the power supply.

6.2.2 Turn off the indicator by pressing the «» button.

7. Operating procedure

7.1 Check of machine vibration

7.1.1 Connect the vibration sensor to the indicator (see Fig. 4.1, 4.2).

7.1.2 Turn on the indicator by pressing «» button. In this case, after indication of the battery charge level, the display will show blinking «**Vibratio**» (Vibration) and stationary message «**Bearing**»

7.1.3 Press «**Enter**» button to activate item «**Vibratio**». In this case, the display will show message «**Input P**» and the power value stored in the indicator memory.

7.1.4 By pressing buttons «**▲**», «**▼**», set on the display digit-by-digit any value of power **P** (in kW) from the range <15 kW, 15-75 kW or > 75 kW, into which the power of the controlled machine falls, passing from digit to digit by simultaneously pressing buttons «**▲**», «**▼**».

7.1.5 Press «**Enter**» button. In this case, the display will show the message «**v, mm/s**».

7.1.6 Install the vibration sensor on the end shield in the appropriate direction (radial vertical, radial horizontal, axial), press it with a force of 1.0 - 1.5 kg, wait for steady readings of the display and LED scale («1», «2», «3» .., «10»), and digital indication of vibration velocity **v** (in mm/s).

7.1.7 Assess vibration of the machine in the examined direction, using the indicator readings.

Notes

1. The machine vibration assessment zones – green one (normal), yellow one (satisfactory), red one (unsatisfactory) - are accepted on the basis of international standard ISO 10816-1.

2. The threshold values of vibration velocity are shown in Table 7.1.

7.1.8 Remove the vibration sensor from the machine.

Table 7.1 Machine vibration assessment zones

Vibration velocity	Nos. of LEDs			Machine vibration assessment zones		
	Class I	Class II	Class III	Class I (<15 kW)	Class II (15-75 kW)	Class III (>75 kW)
18	10	10	10	unsatisfactory		
11.2	10	10	9			
7.1	10	9	8			
4.5	9	8	7			
2.8	8	7	6	satisfactory		
1.8	7	6	5			
1.12	6	5	4			
0.71	5	4	3	normal		
0.45	4	3	2			
0.28	3	2	1			

and parameters of technical condition of rolling bearings

Levels of vibration acceleration and peak impact acceleration, dB*	Nos. of LEDs	Wear assessment zones of bearing raceways and rolling bodies, quality of lubrication and installation, level of bearing local defects
36	10	unsatisfactory
32	9	
28	8	satisfactory
24	7	
20	6	
16	5	
12	4	normal
8	3	
4	2	
0	1	

* Initial values for determination of vibration acceleration and peak impact acceleration levels in dB are specified by the manufacturer.

7.2 Check of wear of the bearing raceways and rolling bodies.

7.2.1 Press «**Enter**» button.

7.2.2 Press button «**▼**» to select item «**Bearing**». In this case, the display flashes the message «**Bearing**».

7.2.3 Press the «**Enter**» button to activate the item «**Bearing**». In this case, the display will show the inscription «**Input n**» and the value of the rotational speed available in the memory of the indicator.

7.2.4 By pressing buttons «**▲**», «**▼**», set the value of the rotor speed **n** (in rpm) on the display digit by digit, passing from digit to digit by simultaneously pressing the buttons «**▲**», «**▼**». If the rotation speed of the rotor speed is unknown, then it can be determined by following the recommendations presented in clause 7.6.

7.2.5 Press «**Enter**» button. In this case, the display will show the message «**Input d**» and the value of the diameter stored in the memory of the indicator.

7.2.6 By pressing buttons «**▲**», «**▼**», set on the display digit by digit the value of the shaft diameter for the bearing d (in mm), passing from digit to digit by simultaneously pressing buttons «**▲**», «**▼**».

7.2.7 Press «**Enter**» button. In this case, the display will show the message «**Raceways**».

7.2.8 Install the vibration sensor on the end shield (as close as possible to the bearing) perpendicular to the axis of rotation of the shaft, press it down with a force of 1.0 - 1.5 kg and wait for steady readings.

7.2.9 Assess the wear of the raceways and rolling bodies, using the indicator readings.

7.3 Check of quality of bearing lubrication and installation

7.3.1 Press «**Enter**» button. In this case, the display will show the message «**Lubricat**» (Lubrication).

7.3.2 Wait for steady readings of the display and LED scale.

7.3.3 Assess bearing quality of lubrication and installation, using indicator readings.

7.3.4 Remove the vibration sensor from the machine.

7.4 Check of level of local bearing defects.

7.4.1 Press «**Enter**» button. In this case, the display will show the message «**Defects**».

7.4.2 Carry out the recommendations of Item 7.2.8.

Notes

1. The surface in the place of vibration sensor installation shall be flat.

2. If there is dirt or thick paint in the place of vibration sensor installation, remove them.

3. There shall not be more than one media interface (between the outer ring of the bearing and the end shield) on the path of impact impulses from the bearing to the vibration sensor installation place. Otherwise, the indicator either will not detect them, or register them

as very weak (for example, when installing the vibration sensor on the bearing cover or if there is a bushing between the outer bearing ring and the end shield).

4. The time of indicator reading stabilization is 4 s.

7.4.3 Assess the level of bearing local defects, using the indicator readings. In this case, it should be borne in mind that an unsatisfactory level of bearing local defects at normal or satisfactory wear of the raceways and rolling bodies, quality of the lubrication and installation of the bearing indicates the beginning of the stage of accelerated destruction of the latter.

7.4.4 Remove the vibration sensor from the machine.

7.4.5 Turn off the indicator and disconnect the vibration sensor from it.

Notes

1. A long (for more than 1 s) pressing «**Enter**», when assessing wear of the raceways and rolling bodies, quality of lubrication and installation and level of bearing local defects, returns the indicator to the «**Vibratio, Bearing**» menu.

2. To predict dynamics of the technical condition of the bearings, it is necessary to periodically monitor the vibration generated by them and enter the results to the log. This will make it possible prevent the failure of the machine in advance by taking the necessary measures.

The recommended frequency of bearing monitoring is at least once a quarter, and if the level of local defects is at the end of the yellow zone - at least once a week.

During periodic bearing monitoring, the vibration sensor shall always be installed in the same place.

3. The technical condition of the bearings can be assessed subjectively by the acoustic signal in the headphones.

7.5 Check of bearing heating

7.5.1 Connect to the indicator the temperature sensor (see Figs. 4.1 and 4.2).

7.5.2 Switch on the indicator. In this case, after the indication of the battery charge level, a blinking message «**Heat**» will appear.

7.5.3 Press «**Enter**» button to activate the «**Heat**» item. In this case, the display will show message «**T, °C**», the digital reading of the temperature T (in °C), and the green LEDs will light up.

7.5.4 Approach the temperature sensor to the end shield or to the bearing housing being at a distance of 1-5 mm and observe the digital temperature.

7.5.5 Assess the heating of the bearing, using the indicator readings.

7.5.6 Remove the temperature sensor from the controlled surface.

7.5.7 Turn off the indicator.

7.6 Determination of rotation speed of the rotor

7.6.1 Switch off the indicator and disconnect the vibration sensor from it.

7.6.2 Stop the machine.

7.6.3 Apply a contrast mark (for example, with a black marker or white crayon) on the end surface of the free end of the shaft (Fig. 7.1 a) or two marks on opposite sides (crossing) on the side surface of the free end of the shaft (Fig. 7.1 b).

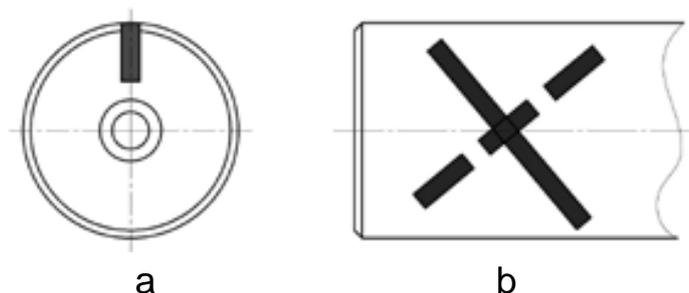


Fig. 7.1. Examples of marking end (a) and lateral (b) surfaces of free end of the shaft.

7.6.4 Start the machine.

7.6.5 Turn on the indicator. In this case, the stroboscope will switch on and the display will show a blinking message «**Rotation speed**».

7.6.6 Press «**Enter**» button. In this case, the display will show message «**n, rpm**» and the rotation speed value equal to 6000 rpm.

7.6.7 Aim the stroboscope at the surface of the free end of the shaft with the mark (s), press «**▼**» button and hold it until one mark appears on the illuminated surface of the image. Then, using buttons «**▲**», «**▼**»,

achieve a stop of the mark image, that is its movement at a rotation speed of not more than 0.1 rev/s.

7.6.8 Read the value of rotation speed of the rotor from the display and by pressing «**Enter**» button input it into the indicator memory.

7.6.9 Turn off the indicator and proceed to fulfillment of the recommendations of Item 7.2.

8. Monitoring of indicator serviceability

8.1 Connect the vibration sensor to the indicator.

8.2 Switch on the indicator, activate "**Vibratio**" item and install the vibration sensor on a surface with a known root mean square value of vibration velocity. In this case, the indicator shall be illuminated by the LED displaying the highest threshold value of vibration velocity, which exceeds the vibration velocity of the surface, and a digital reading corresponding to the known vibration velocity.

8.3 Turn off the indicator.

8.4 Disconnect the vibration sensor from the indicator.

8.5 Connect the temperature sensor to the indicator.

8.6 Turn on the indicator, activate "**Heat**" item and approach the temperature sensor to any surface with a known temperature that does not go beyond $-10 \dots + 120 \text{ }^{\circ}\text{C}$, to a distance of 1-5 mm. In this case, a digital reading corresponding to a known temperature shall appear on the indicator, and green (at $T \leq 100^{\circ}\text{C}$) or red (at $T > 100^{\circ}\text{C}$) LEDs shall light up.

8.7 Remove the temperature sensor from the surface and turn off the indicator.

8.8 The indicator is serviceable if the requirements of Section 8 are met.

9 Operating and storage conditions

9.1 Temperature range operation: -10°C to $+ 40^{\circ}\text{C}$ ($+14^{\circ}\text{F}$ to $+112^{\circ}\text{F}$).

9.2 Temperature range storage: -20°C to $+ 50^{\circ}\text{C}$ (-4°F to $+122^{\circ}\text{F}$).

9.3 Humidity: 0-80% relative humidity, non-condensing.

