INDICATOR OF ELECTRICAL MACHINES WINDINGS DEFECTS IDVI-04

Operating manual

IDVI-04.00.000.OM

1 Purpose

1.1 The indicator is designed to control the windings of electrical machines and provides checks as follows:

1) coils of windings laid in grooves, and pole coils for the presence of turn-to-turn short circuits;

2) coils of windings laid in grooves for the presence of mechanical damage to the turn-to-turn insulation;)

3) condition of winding insulation relative to the machine casing and between the windings

1.2 The main consumers of indicators are the enterprises operating or repairing electrical machines with voltage up to 1000 V.

2 Operating data

1) testing parameters:	
-when checking coils of windings laid in grooves for the presence of turn-to-turn short circuits and and damage to the turn-to-turn insulation	current in the tested coil;
– when checking pole coils for the presence of turn-to-turn short circuits	coefficient of difference of impulses of test voltage of coils (K_d);
– when checking condition of winding insulation relative to the machine casing and between the windings	insulation resistance (R_i);
2) range under testing K_d, %	0-99;
3) range under testing R_i, MOhm	0-500;
4) Kd value when one turn is closed in a coil, %, not less	10;
5) impulse testing voltage amplitude:	
– when checking coils of windings laid in grooves, V/turn	1,2,4,8,16;
– when checking pole coils, V	400;
6) output DC voltage when measuring R_i, V	1000±100;
7) indication	LED;
8) power supply	autonomous or from external power supply;
9) supply voltage, V	$4^{+0,2}_{-1,0}$;
10) consumed power, W, no more	4;
11) overall dimensions, mm	205x80x50;
12) weight*, kg, no more	0,4;
13) operating position	free;

14) external power supply parameters:
– rated DC output voltage, V 4;
– rated output current, A 1;
– rated AC input voltage, V 220.

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* weight with battery specified, delivery set weight – 0.85 ± 0.04 kg.

3 Delivery set

1)	IDVI–04, pcs.	1;
2)	battery (Li-ion, 14500 type), pcs.	1;
3)	power supply BPID-3, pcs.	1;
4)	connecting cable, pcs.	1;
5)	induction sensor, pcs.	2;
6)	connecting wire, pcs.	2;
7)	operating manual, copy	1;
8)	case, pcs.	1.

4 Indicator structure and functioning

4.1 Indicator design (Fig. 4.1, 4.2)

Structurally the indicator is made in the form of a portable device, the plastic case of which consists of two parts, tightened with rubber edging.

There is a seven-segment three-digit display and LEDs, as well as inscriptions explaining the purpose of the indicator buttons on the front side of the casing.

There are sockets: «**1000 V**», «⏚» – to connect the connecting wires to indicator on the top wall of the casing when checking condition of winding insulation relative to the machine casing and between the windings, - to connect to indicator variable inductance transducer when checking coils laid in grooves or the connecting cables when checking pole coils.

There are two buttons: «⏻» – to turn on / off the indicator - and «**Enter**» - to control the indicator on the left side of the casing.

General view of IDVI-04 indicator

Fig. 4.1

Accessories to IDVI-04 indicator

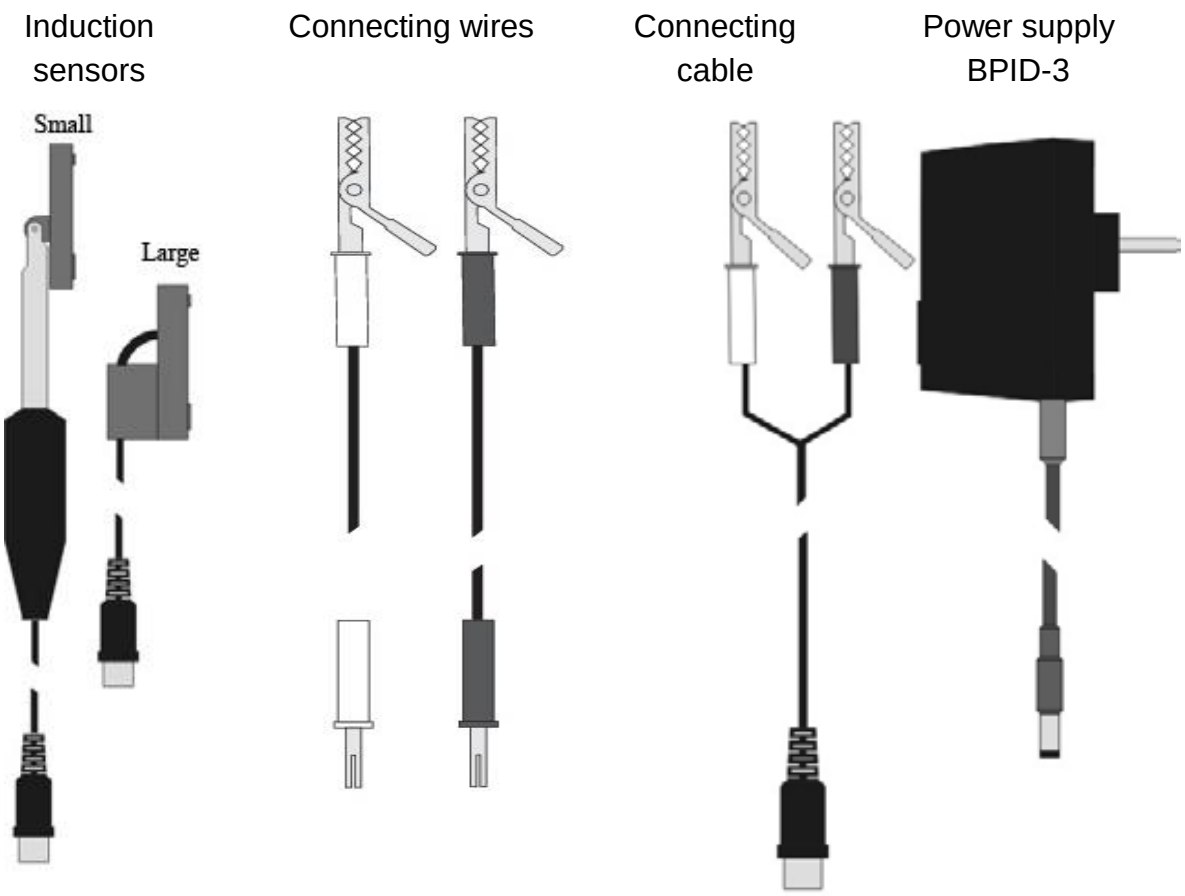

Fig.4.2

There is a socket «**4V, 1A**» – to connect to the external power supply BPID-3 (hereinafter referred to as «power supply») on the right wall of the casing.

On the back side of the case there are inscriptions explaining the purpose of the indicator sockets and containing basic information about it.

Inside the case there is a printed circuit board with elements of the indicator circuit and an accumulator battery (hereinafter referred to as «battery»).

4.2 Principle of indicator operation

4.2.1 When checking the coils of the distributed windings laid in the grooves for the presence of turn-to-turn short circuits and damage to the turn-to-turn insulation, the operating principle of the indicator is based on the induction of a pulse EMF in the tested coil. If there are short-circuited turns in the coil or damage to the turn-to-turn insulation, a pulse of magnetic induction of the field generated by the short-circuit current flowing through the existing or emerging short-circuited turns is recorded

4.2.2 When checking the pole coils for the presence of turn-to-turn short-circuits, the principle of operation of the indicator is based on a comparison of the integral estimates of

the test voltage pulses generated by damped oscillatory discharges at the terminals of the coils:

$$I_i = \int_0^{\infty} |u_i(t)| dt,$$

where i = A, b, C, d, E, F, H, L index of the tested coil.

If there are short-circuited turns in the coil, the corresponding integral estimate will be less than the integral estimate corresponding to the good coil. The degree of this difference is set by the value of the difference coefficient of the test voltage pulses on the coils Kdi:

$$К_{d1i} = \frac{I_{max} - I_i}{I_{max}} * 100\%,$$

where I max – the maximum of the values of the integral estimates Ii.

4.2.3 When checking condition of the insulation of windings with respect to the machine casing and between the windings, a DC voltage is applied to the winding, the value of the insulation resistance is determined and the latter is compared with the threshold value (0.5 MOhm).

5 Safety measures

5.1 The indicator casing has the following signs:

«  » Attention! Read this manual before using the indicator.

«  » Attention! Dangerous voltage is generated at the clamps of connecting cables and wires.

5.2 The windings of the testing machine should be de-energized.

5.3 When checking the insulation condition of windings relative to the machine casing and between the windings turn off the protection devices (if any) and do not touch the clamps of the connecting wires. After its completion, the windings should be discharged to the grounded machine frame.

5.4 When checking the pole coils for the presence of turn-to turn short circuits, do not touch the terminals of the connecting cable when the symbol «  » is flashing on the indicator.

6 Prestarting procedure

6.1 Carry out visual examination of the indicator.

6.1.1 Check out completeness in accordance with a delivery set.

6.1.2 Ensure that there is no external damage to casing, induction sensor cables, connecting cable and connecting wires.

6.2 Check indicator power supply.

6.2.1 Turn on indicator by pressing the button «⏻». In this case, after indicating the battery charge level («**I I I I I I**» – maximum level, «**_ _ _ _ _ I**» – minimum) the reading «**500**» and green LED will light up.

If the reading «**LO**» appears and the green and red LEDs flash, then the battery needs to be charged. For this:

1) turn off indicator by pressing the button «⏻»;

2) connect the power supply to indicator (see Fig. 4.1, 4.2);

3) turn on the power supply into the AC 220 V, 50 Hz. In this case, the LEDs « ∿ » and «**Charge»** will light up on the case of power supply. The end of the battery charge is indicated by switching off the «**Charge»** LED;

4) disconnect the power supply from the indicator and from the mains.

Note

1. The battery should be charged only with the power supply unit included into a delivery set.

2. The battery is also charged when the indicator is operating from the power supply unit.

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

7 Operation procedure

7.1 Checking the coils of the windings laid in the groovess for the presence of turn-to-turn short circuits and damage to turn-to-turn insulation.

7.1.1 Determine the rated voltage per one turn of the tested coils, and select the nearest higher value from the range of amplitudes of the impulse test voltage 1, 2, 4, 8, 16 V / turn.

7.1.2 Taking into account the amplitude of the impulse test voltage, select the appropriate induction sensor and connect it to the indicator (see Fig. 4.1, 4.2). It should be borne in mind that with the help of a small induction sensor a pulse test voltage is generated with an amplitude of 1, 2 or 4 V / turn, and with the help of a large one - 4, 8 or 16 V / turn.

7.1.3 Turn on the indicator In this case, after the indication of the battery charge level the value of the amplitude of the impulse test voltage generated by the indicator will appear.

If this value does not correspond to the required one, then by pressing the «**Enter**» button one by one, bring it into conformity.

7.1.4 Positioning the variable inductance transducer along the axis of the groove and pressing it tightly against the surface of the core stack, alternately «pass» through all the grooves. In case of detection of a coil with short-circuited turns, the indicator emits an intermittent sound signal, gives a blinking indication " " and lights up a red LED (Table 7.1).

Table 7.1 Possible conditions and defects of the winding and options for their indication

Indicator readings	Winding condition or defect
1	2
At rated test voltage **001** **...** **...** **...** **016** **green LED**	No turn-to-turn short circuits
At increased test voltage **001** **...** **...** **...** **016** **green LED**	Turn-to-turn short circuits and damage to turn-to-turn insulation no
At rated test voltage  **red LED**	Turn-to-turn short circuits
At rated test voltage **001** **...** **...** **...** **016** **green LED** At increased test voltage  **red LED**	Turn-to-turn insulation damaged

Table 7.1 continued

1	2
A00 – A09 **...** **...** **...** **L00 – L09** **green LED**	No turn-to-turn short circuits
A10 – A99 **...** **...** **...** **L10 – L99** **red LED**	Turn-to-turn short circuits
0.50 – 500 **green LED**	Insulation of windings relative to the machine casing and between windings in normal condition
0.00 – 0.50 **red LED**	Insulation of windings relative to the machine casing and between windings in poor condition

7.1.5 If there are no short-circuited turns at the selected test voltage, check the coils for the presence damage to the turn-to-turn insulation by doubling the amplitude of the test voltage and following the recommendations of clause 7.1.4.

7.1.6. Turn off the indicator.

7.1.7 Disconnect the variable inductance transducer from the indicator. If

7.2 Checking pole coils for the presence of turn-to-turn short circuits

7.2.1 Connect the connecting cable to the indicator (see Fig. 4.1, 4.2).

7.2.2 Turn on the indicator. In this case, the indication "PR2" will light up, displaying the number of the tested coils set in the indicator memory, equal to two. If you need to change it, then press the «**Enter**» button the required number of times.

7.2.3 Connect the connecting cable using clamps to the terminals of the coil «**A**».

7.2.4 Press «**Enter**» for a long time (more than 2 s)**.** In this case, a blinking indication «〓» will appear, indicating the supply of a pulse test voltage and the process of auto-tuning of the indicator. After the end of auto-tuning, the designation of the first checked coil ("A") should light up.

7.2.5 Press «Enter». In this case, blinking symbols «〓» will appear, indicating the presence of test voltage pulses at the terminals of coil **A**. After removing the test voltage, «**b**» reading is displayed**.**

7.2.6. Connect the connecting cable with clamps to the terminals of the next tested coil.

7.2.7 Press «**Enter**» and wait for the next reading («**C**», «**d**», «**E**», «**F**», «**H**», «**L**» or «**End**»).

7.2.8 If the indicator shows «**End**», then follow the recommendations of cl. 7.2.9, and if «**C**», «**d**», «**E**», «**F**», «**H**», «**L**» follow cl. 7.2.6, 7.2.7

7.2.9 By pressing «**Enter**» in turn, follow the values of the coefficients K_{d1} according to the indicator readings for all the tested coils.

7.2.10 By the value of Kp and the glow of green or red LEDs, establish the presence or absence of turn-to-turn short circuits in the coil (see Table 7.1).

7.2.11 Turn on the indicator.

7.2.12 Disconnect the connecting cable from the indicator.

7.3 Checking the condition of insulation of the windings relative to the casing and between the windings

7.3.1 Connect the connecting wires to the indicator (see Fig. 4.1, 4.2).

7.3.2 Connect «**1000 V**» clamp to one of the windings, and «⏚» clamp to the casing of the machine.

7.3.3 Turn on the indicator. The value of R and the green or red LED will light up.

7.3.4 According to the indicator readings evaluate the conditions of insulation of the winding relative to the machine casing and between the windings (see Table 7.1).

7.3.5 Turn off the indicator.

7.3.6 Disconnect the connecting wires from the indicator.

8 Indicator operability control

Connect a large induction sensor to the indicator.

8.2 Make a short-circuited turn from a piece of insulated wire and lay it on one side in the groove of the unwound stator or the unwound rotor of any machine.

8.3 Turn on the indicator. In this case, the display should light up the indication «**004**».

8.4 Place the variable inductance transducer along the axis of the groove with short-circuited turn, pressing it firmly against the surface of the core stack. In this case, the intermittent sound signal and a flashing reading «⊏⊐» will appear

8.5 Open the short-circuited turn. In this case, the sound signal should stop, and «⊏⊐» reading will change to «**004**» reading.

8.6 Turn off the indicator.

8.7 Disconnect variable inductance transducer from the indicator.

8.8 Connect the connecting cable to the indicator and connect its clamps to the terminals of one of the machine coils.

Note

There must be no open circuit in the electrical circuit of the selected coil.

8.9 Turn on the indicator. In this case, the indication «**nP2**» should light up.

8.10 Long press the «**Enter**» button. In this case, a blinking symbol «≡» should appear, indicating the supply of an impulse test voltage and the process of automatic adjustment of the indicator. After the end of the adjustment, the indication "A" should light up.

8.11 Press «"Enter". In this case, a flashing symbol «≡» should appear, indicating the presence of test voltage pulses. After removing the test voltage, the indication "b" should appear.

8.12 Press «**Enter**». In this case, blinking symbol «≡» will appear, and after his disappearance – «**End**» reading.

8.13 Press «**Enter**» twice. In this case, after the first press, the indication «**A00**», «**A01**», «**A02**», «**A03**» or «**A04**», should appear, and after the second - «**b00**», «**b01**», «**b02**», «**b03**» или «**b04**».

8.14 Turn off the indicator.

8.15 Disconnect variable inductance transducer from the indicator.

8.16 Connect the connecting wires to the indicator.

8.17 Turn on the indicator. In this case after indication of the battery charge level, «**500**» reading.

8.18 Turn off the indicator.

8.19 Close the clamps of the connecting wires to each other.

8.20 Turn on the indicator. In this case after indication of the battery charge level «**0.00**» reading

8.21 Turn off the indicator.

8.22 The indicator is operative if all the requirements of Section 8 are met.

9 Typical malfunctions and methods of their elimination

Form of malfunction and its event	Probable reason	Remedy
The indicator does not respond to the simulated short-circuited turn	Breakdown of the induction sensor cable	Find the breakdown point and restore contact

10 Operating and storage conditions

10.1 Temperature range operation: -10°C to + 40°C (+14°F to +112°F).

10.2 Temperature range storage: -20°C to + 50°C (-4°F to +122°F).

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

11 Acceptance certificate

The indicator IDVI-04 No. _____ corresponds to TU U14105464.005-97 and is classified as fit for operation.

Head of QC Department

Place of Seal _____ _____

Personal signature Full name

_____

Date

12 Warranty liabilities

12.1 The manufacturer guarantees the indicator performance if the owner observes the operating rules set out in the operating manual.

12.2 The warranty period is 24 months from the date of sale.

12.3 During the warranty period, the manufacturer undertakes to repair or replace the indicator free of charge. If the indicator fails, contact the manufacturer.

Date of sale _____

Developer and manufacturer:
TETRA CO., LTD.
18 Gudanova str., Kharkiv, Ukraine, 61024,
tel. / fax +380(57) 714-09-43,
tel. +380(57) 720-22-13, 714-38-38
mark@tetra.kharkiv.com,
www.tetra.kharkiv.com