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Diagnostic Device of Electrical Equipment of Combat Machines and the Principle of its Operation

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ABSTRACT: The article deals with one of the most pressing issues - a device for diagnosing the electrical equipment of combat vehicles in extreme field conditions, the principle of its operation, its advantages over other devices, convenience and efficiency.

KEYWORDS: Battery, resistor, two-function switch, LED, buzzer, three-digit seven-element command anode.

I.INTRODUCTION

One of the pressing issues at the moment is the rapid diagnostics of electrical equipment of combat machines and the provision of quality technical services to them. It's not a secret that there are inconveniences in the study of the armpits for the size of the diagnostic instruments used, the use of which costs a lot of energy, and the use of a specialist who does not have special knowledge, of course. With this in mind, a diagnostic tool was created, which checked three parameters. This proposed instrument was compared with the EM 415 Pro and UT 51 multimeter instruments close to it, and also received positive results.

The function of this tool is designed to determine the voltage in the electrical equipment of military combat machines in extreme field conditions, the location of cable disconnection and disconnection, as well as what pole the cable is connected to. This is due to the fact that the instrument is different from other instruments, the parameters that are checked using the instrument are three, and the instruments that are close to it are cost-effective. The tool is adapted to measure the voltage of 0-30 V in the unchanged current chain. It is used to quickly determine the voltage in the accumulator and cables, as well as to find the place of disconnection in the cable, at which pole the cable is connected. Another distinctive feature of the instrument is that its power source is not a battery it is the presence of a long-lasting service and rechargeable accumulator.

To use this tool, knowledge of electrotechnics is not required.

How the instrument checks for malfunctions:

1) the cable determines which pole (positive “+” or negative “–”) is connected;

2) in the second case, the cable determines whether it has a break or not (if it is disconnected, then the break can be found somewhere);

3) in the third case, determine the voltage in the accumulator and the cable.

Principle of operation of the instrument:

1) to determine which pole the cable is connected (positive “+” or negative“–”), the key is placed in the I position, the clamp end of the tool is connected to the body (body) of the machine, and the second end of the nozzle is attached to the cable or to the accumulator pole. Depending on the burning of the diodes in the instrument, the pole is determined. If the green diode is burned negative, if the red diode is burned, it is possible to determine the cable connected to the positive pole, and for the accumulator, which pole.
2) The key (netral 0 Zero) is placed in the middle part, the clamp of the tool is attached to the Zummer connected key, the end of the nozzle is touched to the second end when the cable is clamped to one end, if the sound of zummer exits the cable will be available to the whole otherwise disruption. The place of interruption is determined by the speed in the mathematical method. For him, the length of the cable is stretched over the protective layer (insulation) to the middle (because the diameter of the nina is very small, it does not damage the protective layer with 99 % accuracy) and the Zummer button is pressed, if the sound comes out the whole, the same process is continued for the next half.

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To do this, the clamp is transferred to the second end of the cable, and the Nine end of the tool, as above, is touched to the middle of the cable and the zummer button is pressed, if the sound comes out the whole, the same process is continued for the next half. The process will continue to do the same if the interruption in this process is on the clasp side, otherwise, the second replacement needle will have to be used, because the clamp causes more damage to the protective layer of the cable than the needle. The process can be found by the formula of mathematical infinitely decreasing geometrical progression. In this, the denominator of the infinitely decreasing geometric progression will be equal to $q = \frac{1}{2}$.

$$b_1 = 0,5L;\ \ b_2 = 0,25L;\ \ b_3 = 0,125L;\ \ b_4 = 0,0625L;$$

$$b_5 = 0,03125L;\ \ b_6 = 0,0156L$$

Six times the check indicates that 0,9844 part of the cable or 98,44 % is whole.

For example, if the length of the cable in the combat car is $L = 2m$, then the result of this check is $L = \frac{b_1(1-q^6)}{1-q} = 1,96875m$. The remaining $0,03125m = 3,125sm$ part can be used to tamirlash the cable by opening the disconnected

It evaluates the values obtained as a result of the calculation and the degree of its usefulness. Below is the method of finding the place of damage to the cable.

- in one measurement 50 % $b_1 = 0,5L$ and $L = b_1 = 1m$;
- in the second measurement 75 % $b_1 = 0,5L;\ b_2 = 0,25L$ and $L = b_1 + b_2 = 1,5m$;
- in the third dimension 87,5 % $b_1 = 0,5L;\ b_2 = 0,25L;\ b_3 = 0,125L$ and

$$L = b_1 + b_2 + b_3 = 1,75m;$$

- in the fourth measurement 93,75 % $b_1 = 0,5L;\ b_2 = 0,25L;\ b_3 = 0,125L;$

$$b_4 = 0,0625L \text{ and } L = b_1 + b_2 + b_3 + b_4 = 1,875m;$$

- in the fifth measurement 96,875 % $b_1 = 0,5L;\ b_2 = 0,25L;\ b_3 = 0,125L;$

$$b_4 = 0,0625L;\ b_5 = 0,03125L \text{ and } L = b_1 + b_2 + b_3 + b_4 + b_5 = 1,9375m;$$

- in the sixth measurement 98,44 % $b_1 = 0,5L;\ b_2 = 0,25L;\ b_3 = 0,125L;$

$$b_4 = 0,0625L;\ b_5 = 0,03125L;\ b_6 = 0,0156L \text{ and}$$

$$L = b_1 + b_2 + b_3 + b_4 + b_5 + b_6 = 1,96875m.$$

It can be seen that if the machine cable is shorter than 2 meters, the inspection step is also reduced and means that fast service is possible.

3) the clamp end of the tool is attached to the body (body) of the machine by putting the switch II into the situation and the tip with the second needle is straightened to the cable or to one of the accumulator poles. The result is displayed on the command anode screen, which consists of 3 digits 7 parts.(figure 1)

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Figure 1. The Proposed Instrument

Now let's compare the EM 415 Pro Tool, which is so close, with this tool. First, the EM 415 Pro determines 2 parameters, the disconnection in the cables, as well as its location and the accumulator pole, to which pole the accumulator of the cable is connected. This instrument consists of two parts. The cost-effective price is three and a half times more expensive than the price of the Proposed Instrument. Since the principle of operation of this tool is quoted in internet sources, we can not dwell on it. (figure 2)

Figure 2. EM 415 Pro Tool

I found it permissible to bring a multifunctional UT 51 multimeter instrument, which is used to check for malfunctions in another electrical appliance. This instrument is larger in size than the one offered, determines the voltage in the accumulator, at which pole the cable accumulator is connected and the cable is disconnected. But the cable can not provide information on how to find the place of disconnection. True, this tool performs quite a few other than the above functions, but there is a disadvantage in the function of finding the place of disconnection of the cable we need, as well as the UT 51 multimeter tool, which is twice as expensive as the cost-effective tool offered. (figure 3)

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Figure 3. UNI-T UT51 multimeter detector

In conclusion, the experience conducted shows that the result of the tests, the proposed instrument proved to be superior in all respects to the nearest instruments by exceeding 98.44% in determining the place of voltage, cable disconnection and disconnection in electrical equipment of military combat machines in extreme field conditions, as well as in determining which pole the cable is connected. The advantage of this tool is that it is cost-effective if three parameters are checked using the tool and introduced into production. And in the nearest instruments it is clear that one is disconnected, and the cable is connected to which pole the accumulatorlasa, and the other can not find the place of disconnection. The tool is adapted to an unchanged current chain and measures the voltage of 0-30 V and to use it generator or the battery is not required to be removed, there is its own accumulator. On the above devices, a 9-volt battery is used in place of the accumulator.

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