

DTE-40

**High-voltage testing device for
solid dielectrics.**

USER MANUAL



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1. Application:

1. High-voltage cables testing with operating voltages of 6,10,15,20 (kV) of all types – paper-oil insulation, XLPE and PILC insulation, for checking the cable sheath.
2. Insulators testing and other electrical equipment by AC high voltage of industrial frequency.
3. Testing vacuum chambers of high-voltage circuit breakers.
4. Laboratory and research work.

Features: the device consists of units, which provides ease of transportation and use.

For example, when testing insulators at transformer substations, only one high-voltage unit is used, without a switching unit.

* Transport cart is optional and not included in standard package contents.

2. Technical parameters

General data:

1. AC supply voltage, V 220±10% (50Hz).
2. Maximum current consumption, A, max 5
3. Ambient temperature -10...+45 °C
4. Storage temperature -20...+45 °C
5. Relative air humidity at +25°C, %, max 80
6. Atmospheric pressure, mm Hg. from 630 to 800
7. Total weight including the transport cart, kg, max 115
8. Continuous operating mode, min 120 minutes
9. Average service life, years 10

Output voltage:

10. Maximum output voltage in very-low frequency mode, cosine-rectangular (squarewave) form kV 40
11. Three fixed frequencies of the very-low frequency generator, (Hz) 0.1; 0.05; 0.02.
12. Maximum voltage in DC voltage output mode, +, -, (kV) 40.
13. Maximum voltage in AC mode 50 (Hz), (kV) 50.
14. Maximum load capacity in the ULF generator mode with a frequency of:
0.1 Hz 0.25 (uF);
0.05Hz 0.5 (uF);
0.02Hz 1.0 (uF).
15. Output voltage measurement accuracy, (%).....3.
16. Output voltage measurement resolution, (V.)..... 100

Output current:

17. Maximum output current in all modes (mA)..... 14.5.
 18. Two measuring ranges of output current 1 / 20 (mA).
 19. Output current measurement accuracy, (%).....3.

Additionally:

Built-in timer with three fixed time intervals, 1min., 5min., 30min., with real time clock function. When the time setting is reached, it automatically turns off the running test, with sound and light indication.

3. Package content:

Table No. 1 - Delivery set

No	Description	Qty	Note
1	Operational unit CU	1	
2	High voltage unit HVU-50	1	
3	Switching unit SU-40	1	
4	Transport cart	1	
5	Power supply cable	1	1,75 m
6	High voltage cable	2	3,5 m
7	Grounding cable	4	3,5 m
8	Interconnection high-voltage cable	1	1 m
9	Fuse 5×20	2	250 B, 1 A
10	Fuse 6×30	2	250 B, 10 A
11	User Manual	1	
12	Passport	1	

4. Security requirements

1. Please note that the operation of the DTE-40 device requires the **mandatory** presence of protective earthing electrical circuits. **It is strictly forbidden to work with the unit without connection to the protective earth.**

2. The operation and maintenance the device is allowed to personnel who have studied and know the device and how to operate the DTE-40, in accordance with this user's manual. It is not allowed to work with a faulty or damaged device and violate the procedure for working with it.

3. It is strongly recommend that the personnel to operate the device consisted of at least two people with a qualification group for admission to work with high voltage electrical equipment and who have passed the appropriate safety instructions.

4. All high voltage objects, to be tested, must be completely **POWERED OFF** and isolated from any power source. Grounding of the objects must remain unchanged.

5. All high voltage test cables and connections must be kept reliable and clean. Additional grounding should be used if possible. Checking the reliability of grounding should be implemented out each time before testing.

6. Do not connect homemade parts or wires to the device. It is forbidden to make any modifications to the equipment or accessories, as this may lead to additional risk. In order to be completely confident in the safe use of the device, it is required that any repair or modification be implemented by the manufacturer or an authorized service.

7. Use special warning signs, fencing to protect the test site from personnel not directly involved in test sequence. The personnel must be informed in advance about the place and time of tests to avoid accidental entry into the high voltage test area.

8. Switching off the device does not lead to a rapid removal of direct voltage. The discharge of the cable capacitance occurs after several switches.

9. Since long cables have a large capacitance, they can retain a charge even after the end of the test. Therefore, leave the installation and the cable under test grounded after the test is completed, in order to allow the accumulated charge to drain to the ground. Always check for residual voltage, as this is associated with an electric shock hazard.

5. Design and operation

The high-voltage installation "DTE-40" is structurally made of units:

Operational and measurement unit, hereinafter - OU.

High voltage unit, hereinafter referred to as HVU-50.

Switching unit, hereinafter - SU - 40.

The package optionally includes a special transport cart for easy transportation of the device in the premises of substations, manufacturing facilities, etc. It is not allowed to operate the unit on the transportation cart.

Interconnections are made with cables, see page 8 Interconnection diagram. The appearance view of the units of the DTE-40 tester is shown in fig. No. 1.

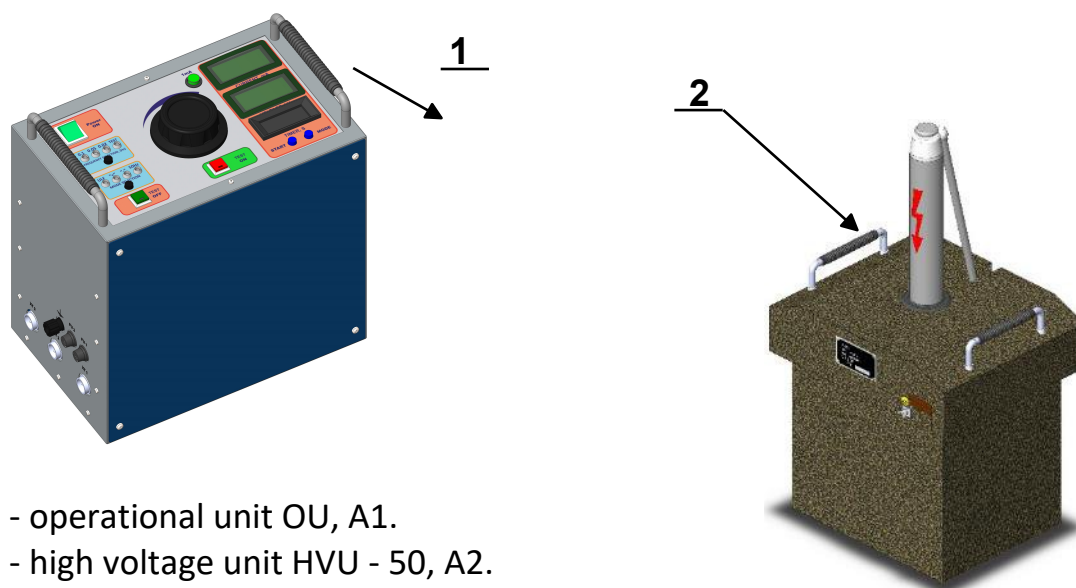
The operational and measurement unit OU, A1 (see Fig. No. 1) is intended to operate and indicate the operating modes of the tester, also measure and display the values of the output voltage and current.

The high voltage unit HVU-50, A2 (see Fig. No. 1) is intended to generate AC high voltage of industrial frequency up to 50 kV and is a step-up transformer. The source is connected to the operational unit using two cables (see wiring diagram). The test voltage in the operating mode of the installation "50 (Hz)" is measured on the secondary winding of the HVU-50 high-voltage transformer.

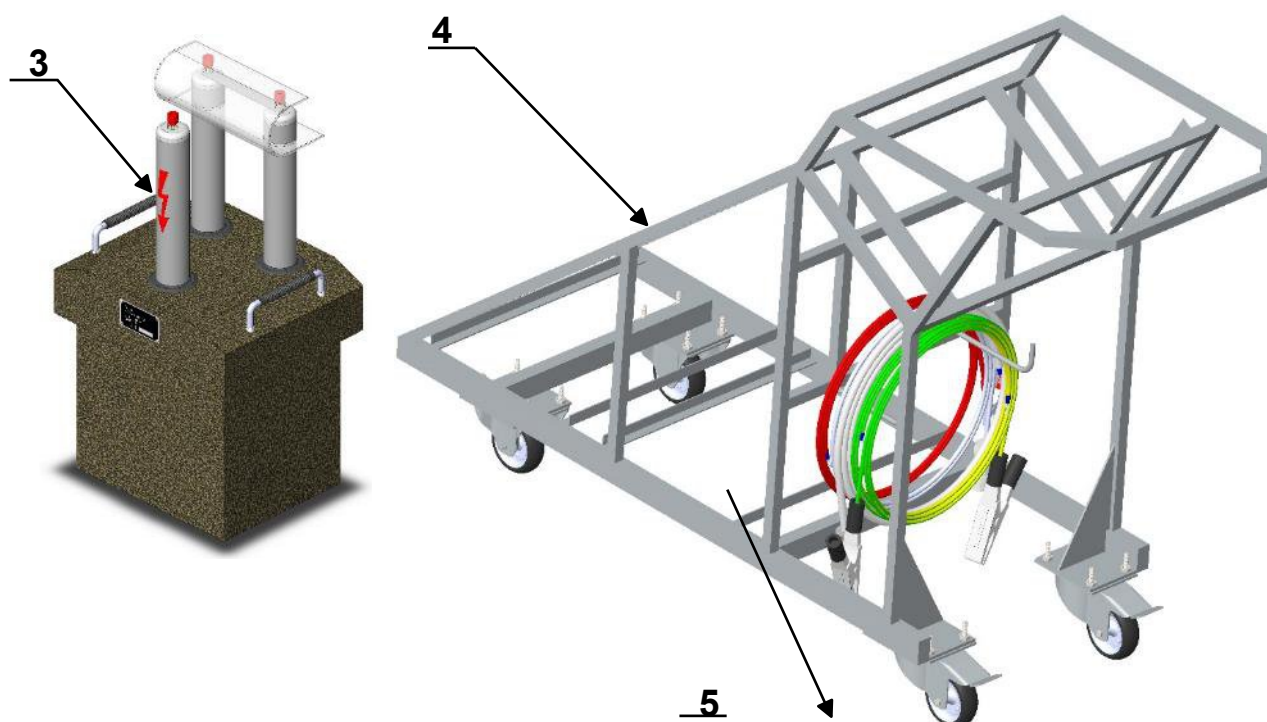
The switching unit SU-40, A3 (see Fig. No. 1) is intended to generate high voltage of ultra-low frequency. Frequencies fixed: 0.1(Hz); 0.05(Hz); 0.02(Hz). The frequency value is selected by the operator in the control unit. The form of the output voltage is cosine-rectangular (squarewave). The advantages of a cosine-rectangular shape over a sinusoidal are higher power and efficiency of the device, with equal weight and size parameters, as well as the reliability of the installation as a whole.

Attention. *The manufacturer reserves the right to make changes to the control program and design of the device deterioration its technical and operational characteristics, , without noticing the user. The illustrations of the views of the device shown in this manual may differ from the actual ones.*

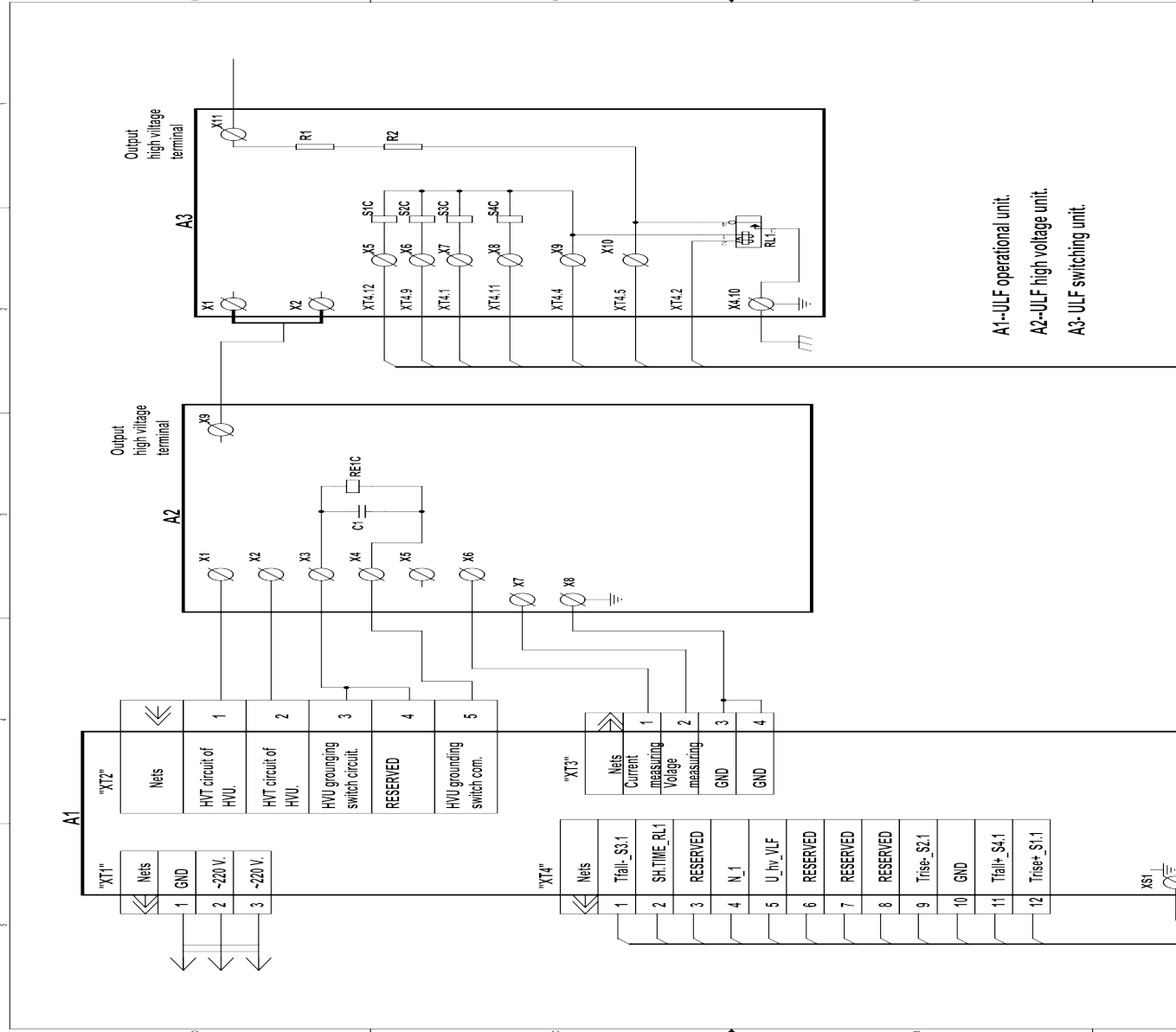
Figure. No. 1. External design of the DTE-40 device



- 1 - operational unit OU, A1.
- 2 - high voltage unit HVU - 50, A2.
- 3 - switching unit SU - 40, A3.
- 4 – transport cart.
- 5 - set of test wires and cables



Wiring Diagram of DTE-40 Device Components



- A1--ULF operational unit.
- A2--ULF high voltage unit.
- A3- ULF switching unit.

5.1 Design and operation of the operational unit, OU.

The design of the front panel of the control unit is shown in fig. No. 2, the location of the connectors on the right and left panels of the control unit is shown in fig. No. 3. The circuit diagram of the control unit is shown below.

The control unit includes a control and measurement board B1, a board for power sources and power switching B7, a board for selecting modes and indications B5, B6, meters-indicators B2, B3, B4 located on the front panel of the unit, a voltage regulator T3 (adjustable autotransformer), power circuit switch SW1 "SET POWER" with built-in green light indication, SB1 "TEST_ON" button with built-in red light indication LP1, SB2 "TEST_OFF" button with built-in red light indication LP2, limit switch SB3 initial position of the voltage regulator (LATR), button SB4 "1mA" with built-in green light indication LP4, connectors for external connections XT1-XT4, XS1, fuse inserts SI1.2 (10A).

The control and measurement board B1 provides:

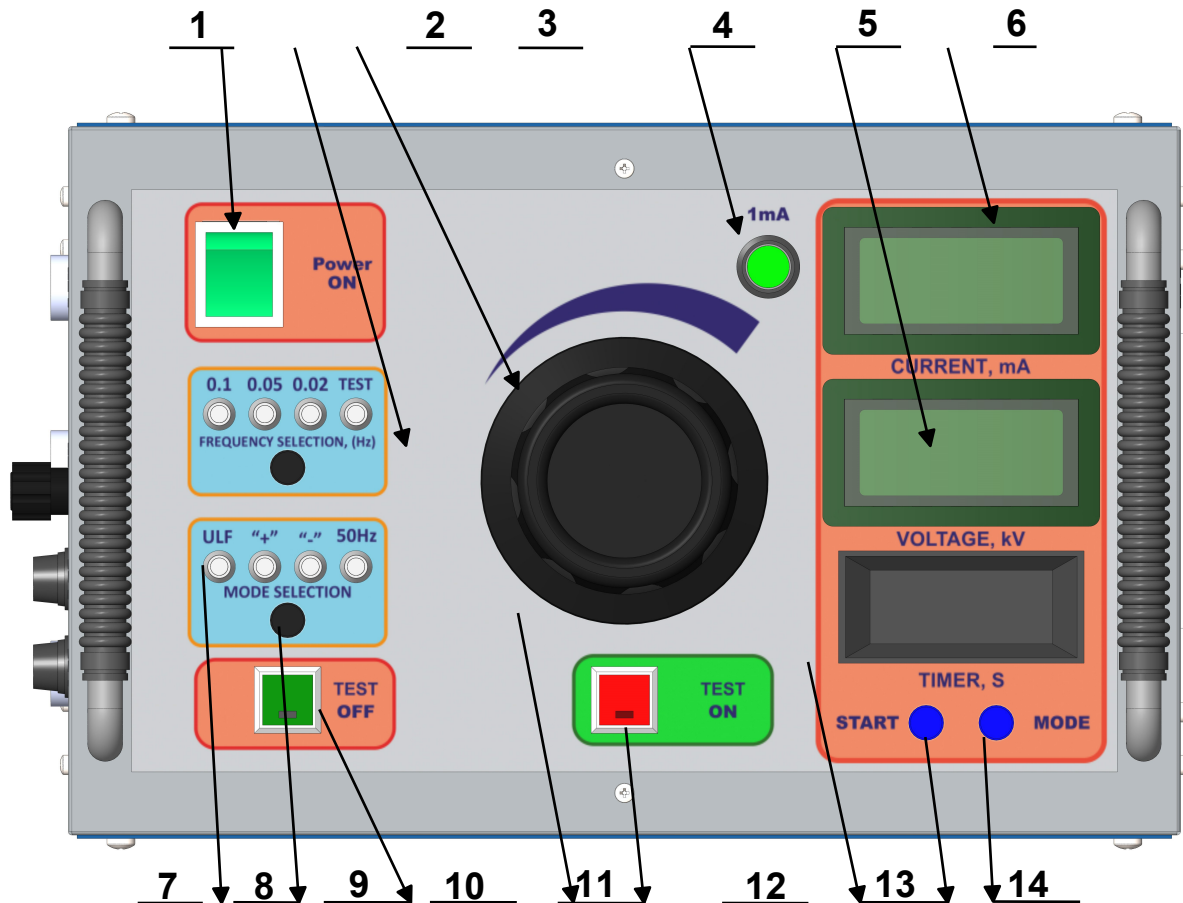
- control of device's operating modes;
- measurement of output current and voltage values;
- breakdown registration in the measuring circuit;
- support of the "TEST ON" mode with sound and light signal;
- disconnection the output power circuits when the supply current increases more than 6 A;

The B7 Power Supply and Power Switching Board provides:

- formation of stabilized supply voltages for board B1, meters-indicators of the output current and voltage of the installation B2, B3, timer B4. It also performs switching of electrical circuits of the primary winding of a high-voltage transformer, a high-voltage unit, with an output

provide power supply of voltage regulator (autotransformer), control unit. The power switch is made on the basis of a small-sized electromagnetic contactor K1.

Figure No. 2 Operational unit top view



1 – button "**POWER ON**" turns on and turns off power supply.

2 – button for selecting generator's frequency in the ULF mode.

3 – LED indicators of selection frequency of the ULF generator.

4 – 20/1 mA output current measuring range selection button. When pressed corresponds to the range of 10 μ A-1mA. Not pressed – 20mA range. The built-in light indicator of the button signals an overcurrent warning (blinking) and a breakdown of the object under test – a continuous glow.

5 – output voltage display, readings in kV.

6 – output current display, readings in mA.

7 – LED indicators of selection operating mode of the device.

8 – button for selecting operation mode of the device.

9 – "**TEST OFF**" button turns off the high voltage at the output terminals of the device. The built-in light indicator of the button signals the readiness of the unit for operation. When it blinks, there is no initial position of the high voltage regulator. Rotate the regulator knob fully counterclockwise until it stops. This position of the regulator corresponds to the minimum output voltage of the installation.

10 – output high voltage regulator knob, clockwise adjustment.

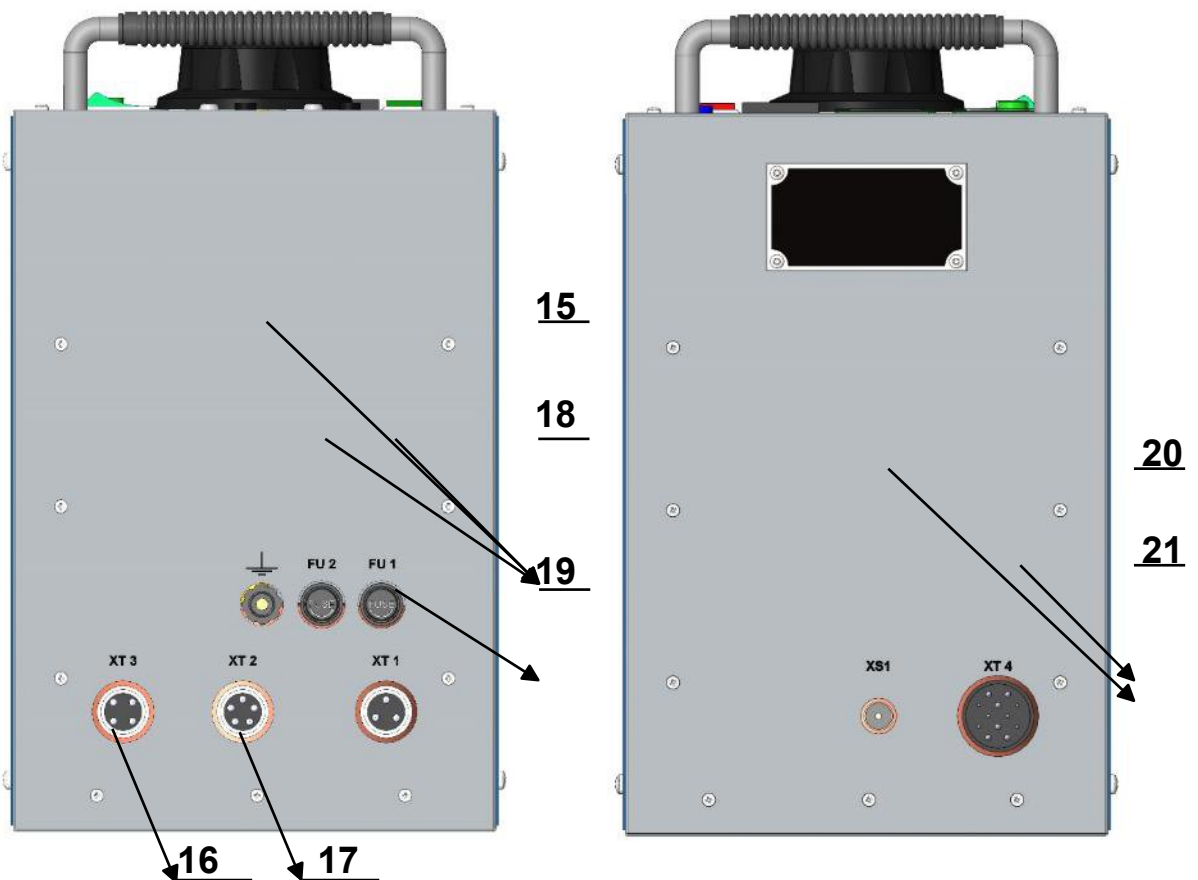
11 – "TEST ON" button turns on the high voltage at the output terminals of the device. A continuous glow of the built-in light indicator of the button signals of high voltage test running.

12 – digital timer, with three test duration time settings: 1 min.; 5 minutes.; 30 minutes.

13 – button "START" switching on and off the countdown of the time setting of the timer.

14 – button "MODE", selection of the test duration time of the digital timer.

Figure No. 3 Control unit side view



15 – ground terminal of the operational unit.

16 – XT3 connector, connection of the measurement cable from the HVU-50 unit.

17 – XT2 connector, connection of the operational cable from the HVU-50 unit.

18 – Fuses, 6×30, 10A.

19 – connector XT1, connection of the power supply cable.

20 – connector XS1, connection of an external oscilloscope to control the form of the output voltage of the device. (completed according to the customer's request).

21 – XT4 connector, connection of the operational cable from the SU-40 unit.

The electrical circuit diagram of the control unit is shown below

The DTE-40 device is supplied by 220 V/50 Hz through connector XT1 and is powered on by the main switch of operational unit SW1. Turning on the switch SW1 powers the power supply and switching board B7 and through the fuses SI1, SI2, located on the left side panel of the operational unit, to the T3 autotransformer. The T3 autotransformer is intended to regulate the output high voltage of the device by turning the high-voltage regulator knob. The output electrical circuits T3 are connected to the power contactor K1. Contactor K1 switches the output voltage of the voltage regulator to the HVU-50 unit. K1 is controlled through a small-sized relay K2 located on the B7 board. The electrical connection of the operational unit with the HVU-50 unit is implemented through the XT2, XT3 connectors located on the left side panel of the operational unit. On board B7 power supplies are built according to classical circuitry, and do not require special explanations.

Button SB1 "TEST ON" switches on the solenoid K1 of the power contactor. The feeding of high voltage on the test object is possible only at the initial position of the voltage regulator T3, when the contacts of the limit switch SB3 are closed. The periodic flashing of the LED indicator LP2, built into the button SB2 "TEST OFF", indicates a non-initial position of the voltage regulator T3 or the presence of a voltage above 10 kV on the test object. When the button SB1 "TEST ON" is pressed, before the high voltage is turned on, a OU generates sound warning signal with durability of 3 seconds. After a time delay, a high voltage is applied to the test object. The supply of high voltage is accompanied by light indication, the indicator LP1 of red color built into the button SB1 "TEST ON" is lit. The operation algorithm for switching on the "TEST" mode is different for each pre-selected operating mode of the installation.

Button SB2 "TEST OFF" turns off the voltage from the solenoid K1. The operation algorithm for turning off the "TEST" mode is different for each pre-selected operating mode of the installation.

Meters-indicators B3, B2, located on the front panel of the operational unit, digitally display the measured values of the output high voltage and leakage current, accordingly. Kilovolt meter B2 displays the value of the output voltage in kilovolts. Leakage current meter B3 displays the current value in milliamps.

Digital timer B4 is used to set the time interval of the "TEST" mode. The timer is controlled by two buttons "START" and "MODE". The test duration time is being selected by pressing and holding the "MODE" button. In this case, the timer indicator will sequentially display the values of the time setting in the format – minutes : seconds. The countdown of the timer is started and stopped by short pressing the "START" button. When the timer setting is reached, the "TEST" mode will be turned off, with a simultaneous warning sound signal to the operational unit.

Under the main switch of the unit SW1 "POWER SUPPLY OF THE UNIT" there is a board for selecting and indicating the frequency of the ultra-low frequency generator B6. Frequency selection is implemented by pressing and holding the button labeled "FREQUENCY SELECT". In this case, cyclic switching of the frequency value occurs, accompanied by a light indication. Releasing the "FREQUENCY SELECT" button fixes the selected frequency value. The TEST mode is a service mode designed to test the

operation of the SU-40 switching unit. When the "TEST" mode is turned on, the operation of the "FREQUENCY SELECTION" button is blocked.

Board B5, for selecting and indicating the mode of operation of the device, is located below board B6. Preliminary selection of the operating mode of the device is implemented by pressing and holding the button "MODE ". In this case, cyclic switching of the operating modes of the device occurs, accompanied by light indication. Releasing the "MODE " button fixes the selected operating mode. When the "TEST" mode is turned on, the operation of the "MODE " button is blocked.

The button with fixation SB4 "1mA" switches the ranges of the output leakage current meter. In the released state of the button, the range of the current meter is 20mA, in the pressed state - 1mA. The built-in indicator light of the SB4 button is used to indicate:

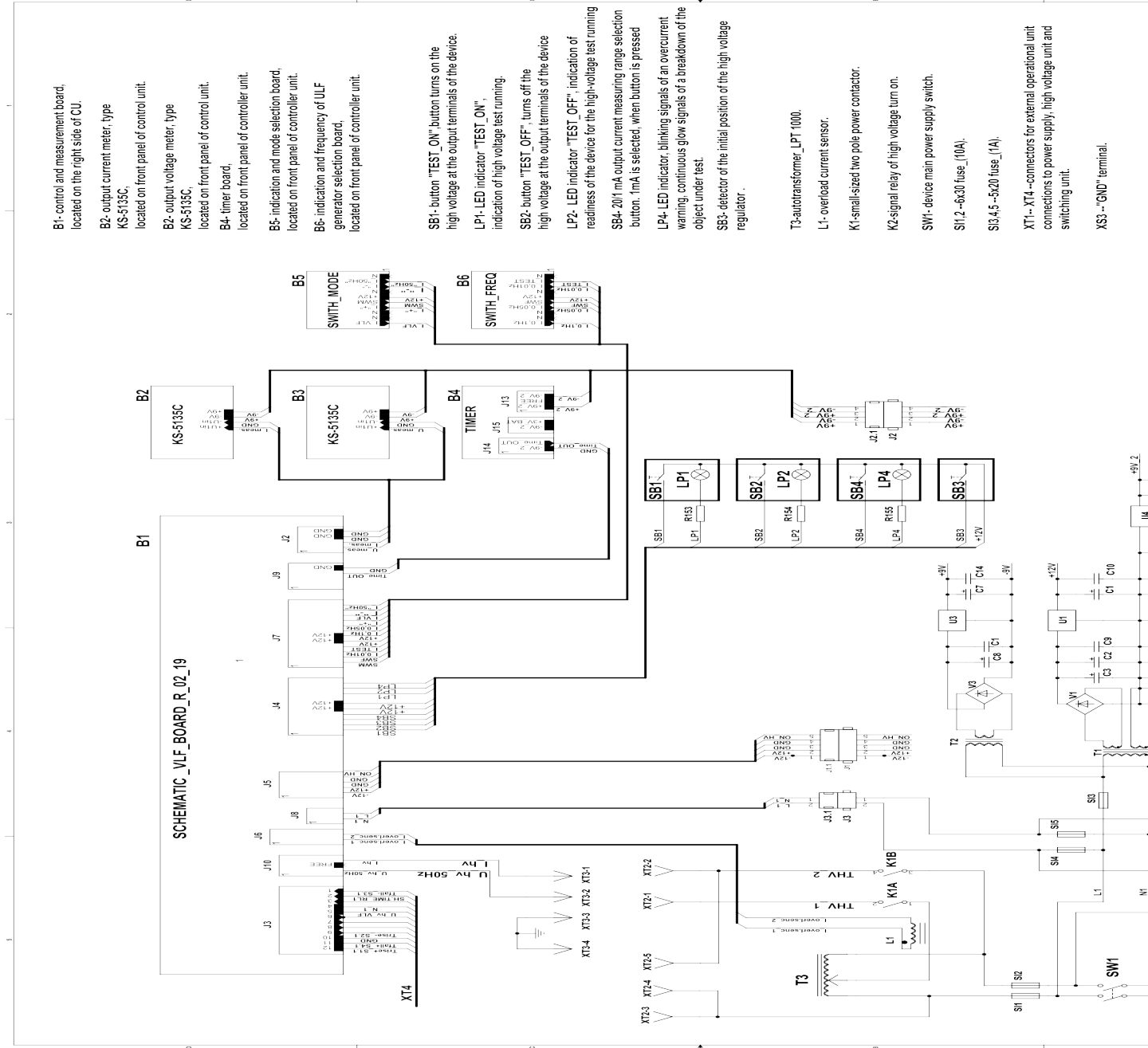
- overcurrent - periodic flashing;
- breakdown of the test object - continuous glow.

Connectors XT4 and XS1 are located on the right side panel of the operational unit. The control and measurement cable from the SU-40 switching unit is connected to the XT4 connector. This connector outputs the operational voltages of the solenoids of the ULF generator commutators. Connector XS1 is a service connector for adjusting and controlling the output voltage shape. Note: XS1 connector is installed by additional agreement with the customer.

When the main switch SW1 is turned on, the control microcontroller of the control unit sets the initial mode of the unit:

- the "ULF" mode selection indicator lights up, the ULF generator mode is selected;
- the ULF generator frequency selection indicator "0.1Hz" lights up, the frequency of the very-low frequency generator is selected.

Diagram of the Control Unit of the DTE-40



B1- control and measurement board, located on the right side of CU.
 B2- output current meter, type KS-5135C, located on front panel of control unit.
 B3- output voltage meter, type KS-5133C, located on front panel of control unit.
 B4- timer board, located on front panel of controller unit.
 B5- indication and mode selection board, located on front panel of controller unit.
 B6- indication and frequency of ULF generator selection board, located on front panel of controller unit.

SB1- button "TEST_ON", button turns on the high voltage at the output terminals of the device.
 LP1- LED indicator "TEST_ON", indication of high voltage test running.
 SB2- button "TEST_OFF", turns off the high voltage at the output terminals of the device
 LP2- LED indicator "TEST_OFF", indication of readiness of the device for the high-voltage test running

SB4- 20 mA output current measuring range selection button. 1mA is selected, when button is pressed
 LP4- LED indicator, blinking signals of an overcurrent warning, continuous glow signals of a breakdown of the object under test.
 SE3- detector of the initial position of the high voltage regulator.

T3- autotransformer_LPT1000.

L1- overload current sensor.

K1- small-sized two pole power contactor.

K2- signal relay of high voltage turn on.

SW1- device main power supply switch.

SI1,2-6x30 fuse (10A).

SI3,4,5-5x20 fuse (1A).

XT1-, XT4- connectors for external operational unit connections to power supply, high voltage unit and switching unit.

XS3- "GND" terminal.

5.2 Design and operation of the high voltage unit, HVU-50.

The appearance of HVU-50 is shown in Figure 4.

Schematic diagram of HVU-50 is shown below

1 - oil-filled tank of a high-voltage transformer;

2 - removable tank cover;

3 - high-voltage output terminal of the unit;

4 - button for external connection to the high-voltage output terminal;

5 - rod of the short circuit mechanism;

6 - terminal for connecting the grounding conductor.

7 - high voltage insulator

Explanation: a short circuit mechanism is a switching electrical device designed to create an artificial short circuit in an electrical circuit (GOST 17703-72).

Figure No4 High voltage unit

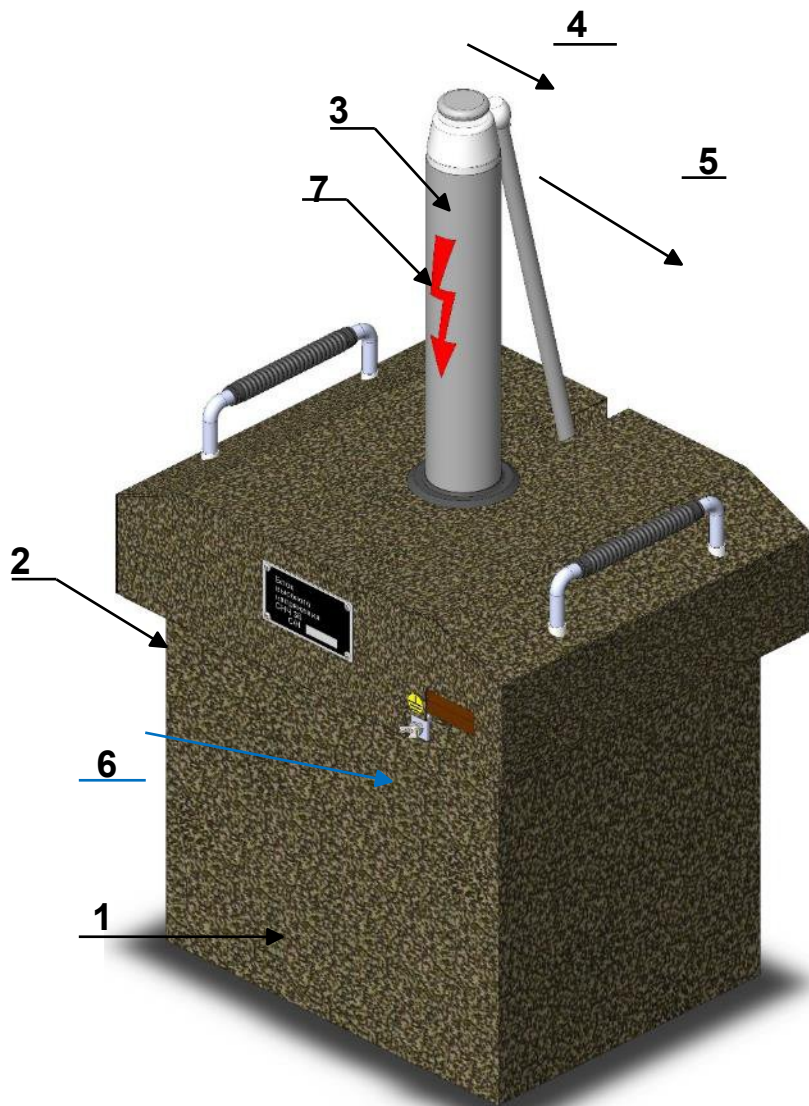
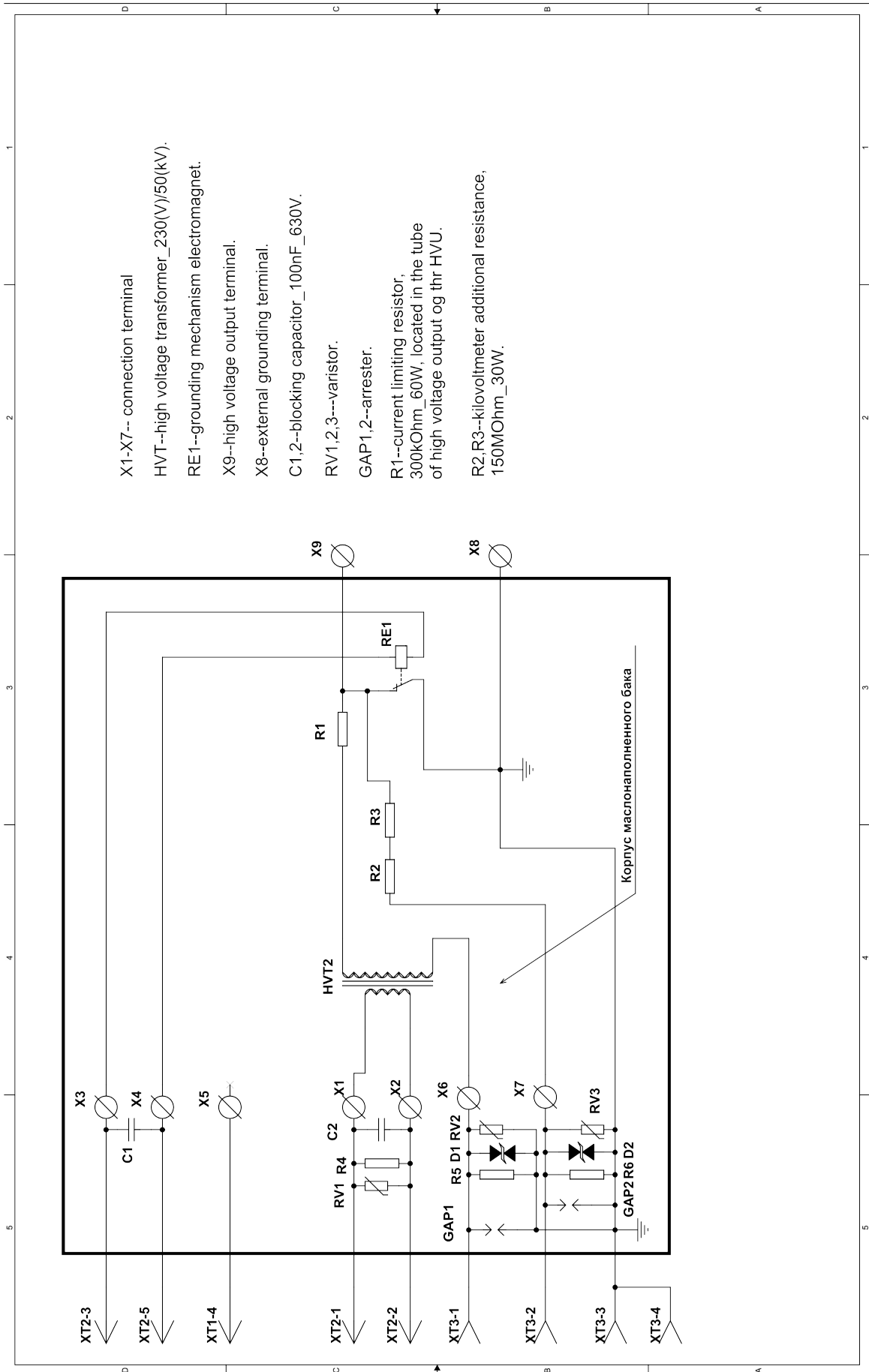


Diagram of the High Voltage Unit of the DTE-40



HVU-50 high voltage unit consists of:

- step-up high-voltage transformer HVT1 220V/50kV;
- electromagnet and short circuit mechanism RE1;
- current-limiting resistor R1;
- R2, R3 kilovolt meter additional resistances;
- current shunt R6 for leakage current measurement;
- overvoltage protection elements in power and measuring circuits;
- two operational and measurement cables with connectors XT2, XT3.

HVU-50 high-voltage elements are placed inside a hermetically sealed oil-filled tank. Oil, type T-1500, performs the functions of electrical insulation and cooling medium for a high-voltage transformer. The oil level in the tank of the HVU-50 unit should be within 1.3–1.9 (cm) from the lower plane of the upper dielectric plate of the tank. The oil level is controlled by filling holes in the tank dielectric plate.

Under the removable cover of the HVU-50 tank (see Figure 4, item 2) there is a short circuit mechanism, contact pins X1–X7 and protective elements (arresters, varistors, protective diodes and capacitors).

Output current is measured on the secondary winding by the external shunt that is located in the operational unit.

Measuring current and voltage outputs of are protected by a complex of overvoltage protection elements.

The HVU-50 unit is connected to the operational unit using two cables, see the unit's electrical connection diagram on page No. 8.

High AC voltage of industrial frequency from the oil-filled tank goes through the bushing high-voltage insulator (see Figure No. 4, pos. 7) to the high-voltage output of the unit. Depending on the selected operating mode of the device, the high-voltage output of the unit is connected by the operator:

- * to the OU-40 unit, in the ULF generator and rectified voltage modes.
- * by the high-voltage wire to the object that is to be tested, in the "50 Hz" mode.

5.3 Design and operation of the switching unit, SU-40.

The design of SU-40 is shown in Figure No. 5.

Schematic diagram of SU-40 is shown below

- 1 – oil-filled tank of the switching unit;
- 2 – removable tank cover;
- 3 – plate with unit's name, serial number and manufacturing date.
- 4 – transporting handles;
- 5 – insulators with built-in rectifiers;
- 6 – aluminum connecting bus;
- 7 – high-voltage insulator;
- 8 – high-voltage output terminal;
- 9 – grounding terminal.

Figure No. 5 Switching unit

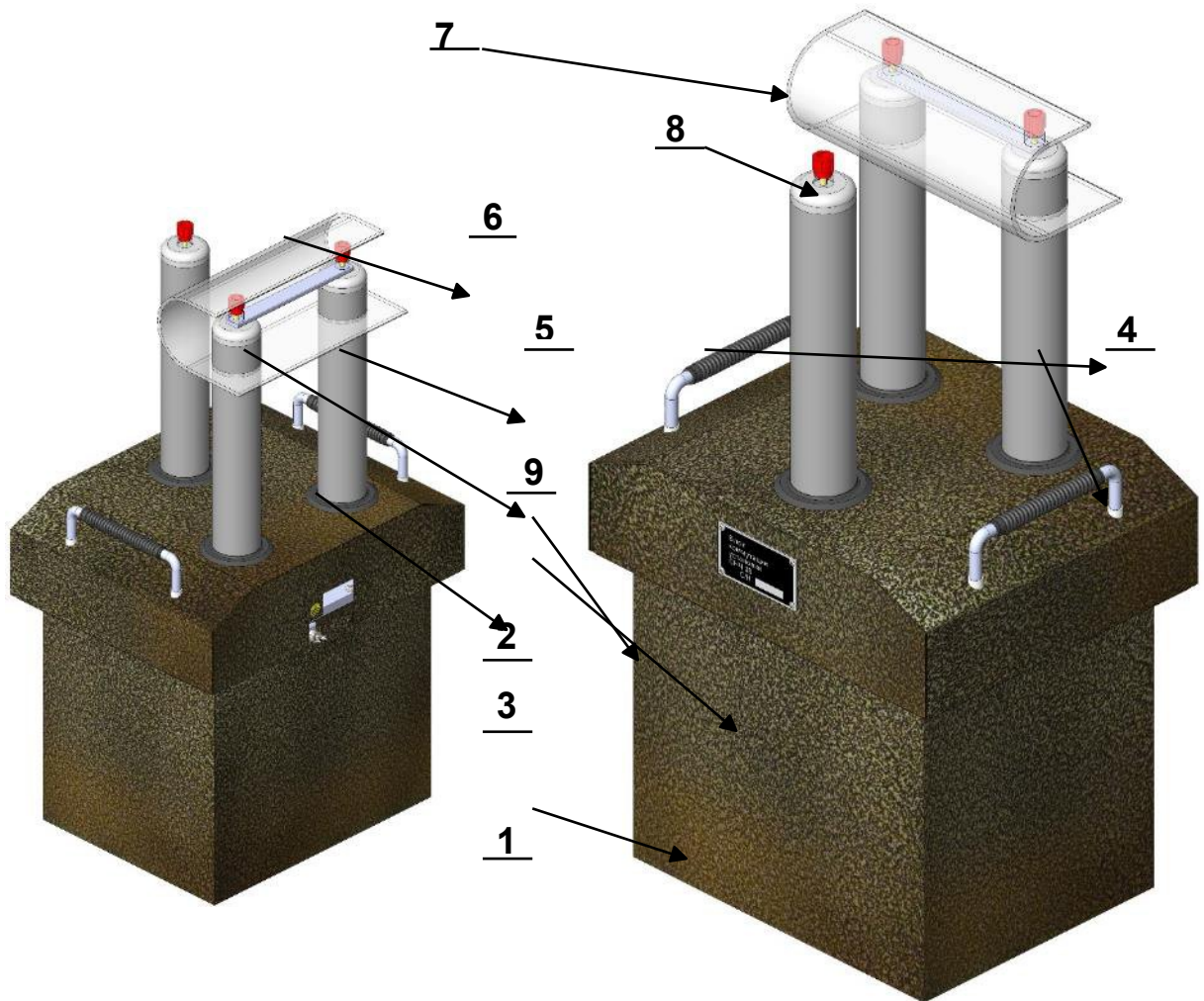
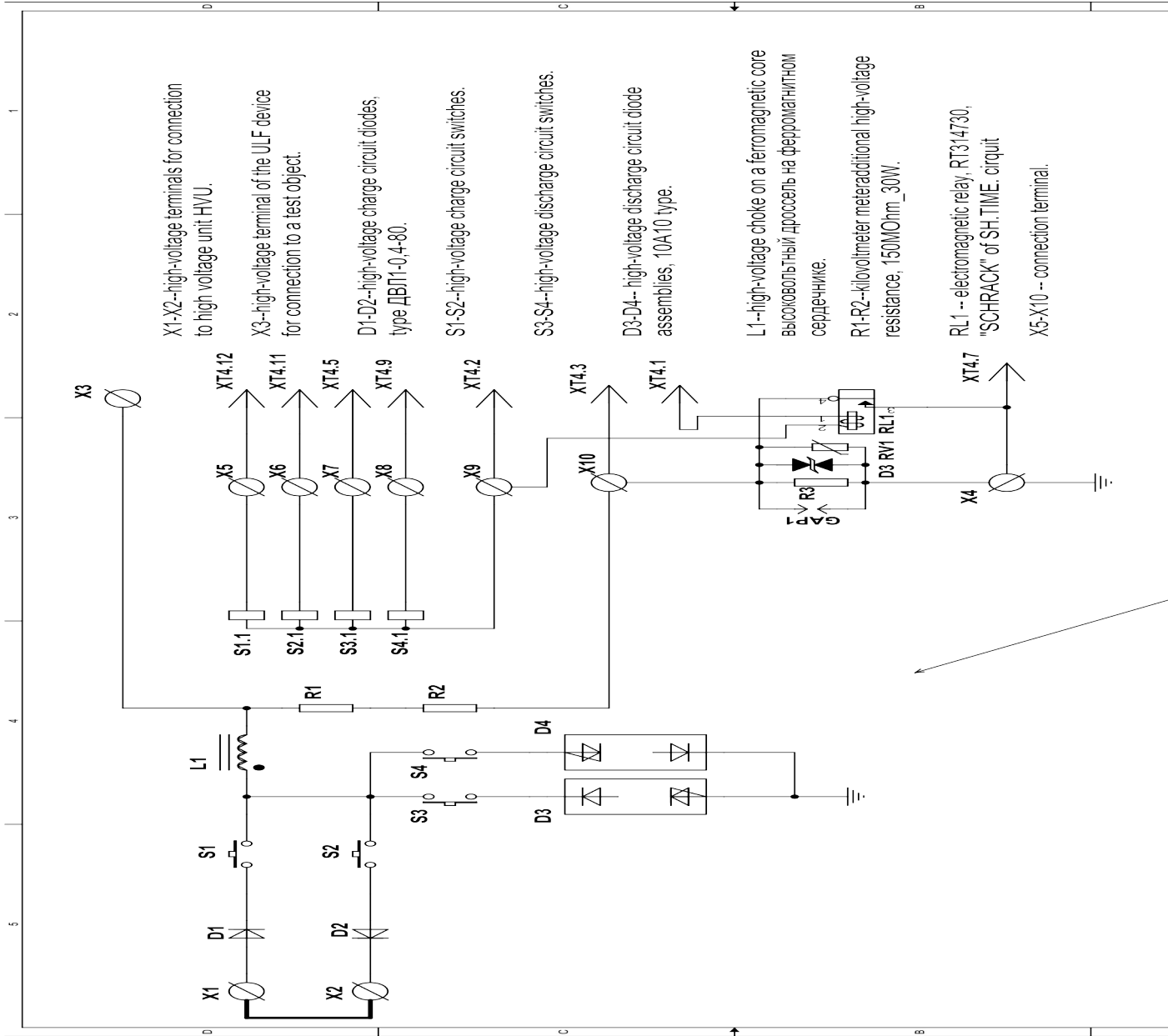
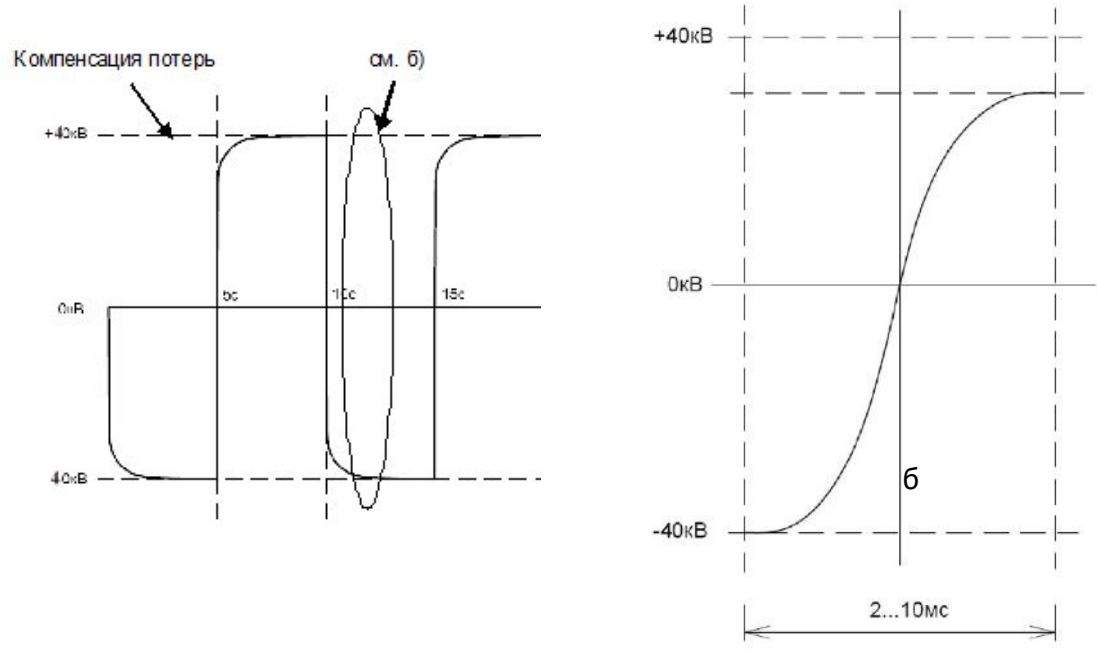


Diagram of the DTE-40 Switching Unit



SU-40 unit structurally consists of an oil-filled tank, which contains a switching choke L1, four high-voltage electromagnetic switches S1-S4, discharge diode assemblies D3, D4, high-voltage additional resistors R1, R2, for measuring the output voltage of the block. Under the removable cover of the tank there are connection terminals for electrical connections of the operational and measurement cable and overvoltage protection elements of the measurement circuit. Three high-voltage bushing insulators are brought out from the top of the tank through the cover. Inside the insulators with terminals X1, X2 there are high-voltage charging diodes. Terminals X1, X2 are connected to each other by a conductive aluminum bus, to which high voltage is supplied from the HVU-50 unit by using an external high-voltage wire. The output of the SU-40 unit, terminal X3, is connected to the object to be tested using an external high-voltage wire. Required shaping of the output voltage: a rectified voltage of any polarity or a cosine-rectangular ultra-low frequency, is controlled by the solenoids of high-voltage switches. The high-voltage switches are controlled by the signals generated by the operational unit OU through connecting cable of the switching unit SU-40. Figure No. 6 shows: a - the form of the output voltage SU-40; b - the form of the transient process when switching the polarity of the test voltage.

Figure № 6



6. Marking

The marking is applied on the right side of the OU panel: "HIGH VOLTAGE TESTING DEVICE; MODEL: DTE-40; Operational unit; S / N No. _____," (the number consists of 6 digits); product year.

On the removable cover of the HVU-50 tank, there is a plate: "HIGH VOLTAGE TESTING DEVICE; MODEL: DTE-40; High voltage unit; S / N No. _____," (the number consists of 6 digits); product year.

On the removable cover of the SU-40 tank there is a plate: "HIGH VOLTAGE TESTING DEVICE; MODEL: DTE-40; ULF switching unit; S / N No. _____," (the number consists of 6 digits); product year.

7. How to operate the device

7.1 Preparing the unit for use

Ensure a safe and convenient location of the testing device at the test site. Make all electrical interconnections of the device according to the wiring diagram. Pay special attention to connecting the grounding conductors of each unit to a common grounding loop. **Attention!, it is strictly forbidden to operate the device without a protective grounding circuit.** Ground the object to be tested. Connect the high-voltage output of the unit to the test object with a high-voltage wire included in the package. At the same time, ensure that the high-voltage wire does not touch the device's body and the ground surface. To obtain a smooth rectified test voltage or when testing short cables with a capacitance of less than $0.005 \mu\text{F}$, it is necessary to connect an external high-voltage capacitor with a capacity of $(0.1 - 0.25) \mu\text{F}$ (not included in the package set) in parallel with the high-voltage output of the testing device. Disconnect the previously connected protective grounding from the test object. Connect the supply voltage to the operational unit. The testing device is ready for operation.

7.2 Using the unit

Switch on the main switch of the unit "**POWER ON**" on the operational unit of the device. At turning on, the meters indicators backlight should light up, and the control program of the controller in the operational unit sets the initial operating mode of the installation: "ULF", frequency "0.1 Hz". Turn the output voltage regulator knob counterclockwise until it stops. Depending on the type of test object, by pressing the "MODE " button, select the operating mode of the testing device. The selected operating mode is indicated by the light of the red LED on the front panel of the control unit. When the unit is operating in the "ULF" mode, by pressing the "FREQUENCY

SELECTION" button, select the frequency value of the ULF generator. The selected frequency value is indicated by the red LED. The frequency of the test voltage, in the "ULF" operating mode, is being selected depending on the length of the cable to be tested. Switch on the test mode by pressing the "TEST ON" button. After pressing the "TEST ON" button, a warning sound signal will sound for 3 seconds, after which voltage appears at the high-voltage output of the testing device. By smoothly rotating the voltage regulator knob on the control unit clockwise, set the required value of the testing high voltage to the object under test. The control of the output voltage value is implemented by the readings of the built-in kilovoltmeter with digital indication. The charge and leakage currents of the tested object are controlled according to the readings of the built-in milliammeter with digital indication. Set the required test time by pressing "MODE" button and start the built-in timer by pressing the "START" button of the timer. At the end of the timer, an sound signal will sound and the test mode will be switched off at the same time. The test mode can also be switched off by pressing the "TEST OFF" button.

A feature of the algorithm for switching off the test mode is that the controller continues to operate the switches of the SU-40 until the voltage of the object under test drops below 4 kilovolts. When the voltage at the test object drops below 4 kV, the controller turns on the solenoids of the discharge switches of the SU-40 unit. This ensures a complete discharge of the capacitance of the test object.

After testing the object, turn off the main switch of the device "POWER SUPPLY OF THE UNIT". contact a ground rod with the test object. Disconnect the high-voltage wire connecting the high-voltage terminal of the device with the test object. Disconnect the power supply voltage from the operational unit.

8. Practical recommendations for testing cables made of cross-linked polyethylene (SPE insulation).

For the correct and unambiguous selection of the test voltage and test time, it is necessary to follow the recommendations of the manufacturer of the cable to be tested. In addition, the life time factor of the cable to be tested should be taken into account. Cables that are in operation for a long time are recommended to be tested with a lower voltage, in comparison with cables that has not been used. The test voltage of cables after laying can be calculated from the value of the rated voltage of the cable:

$$U_{ucn} = 3 \cdot U_0$$

$$U_0 = \frac{U_{nom}}{\sqrt{3}}$$

where:

U_{test} – value of test voltage;

U_0 – line (phase) voltage of cable;

U_{nom} – nominal voltage of cable to be tested.

Table № 2. Value of test voltages for different cables with cross-linked insulation

Nominal voltage of cable, kV	Test voltage, kV
6	10
10	18
15	25
20	34
35	60

The recommended test duration at a frequency of 0.1 (Hz) - 30 minutes. For frequencies of 0.05, 0.02 (Hz), increase the duration to 1 hour.

ATTENTION: THE EXACT TEST VOLTAGE AND TEST TIME MUST BE AGREED WITH THE PERSONS RESPONSIBLE FOR THE OPERATION AND MAINTENANCE OF THE CABLE!

9. Packing

OU, HVU-50 and SU-40 are wrapped with packaging film in such a way that there is no access of dust and moisture, and they are placed in wooden boxes with transportation markings and storage rules and a plate with the name of the product.

The gaps between the walls of the boxes and units of the device are densely filled with damping material.

The cart is wrapped with a packing film.

Documentation and components for the installation are placed in boxes with OU and HVU-50.

10. Transportation and storage

Transportation of the product is allowed only in packaging in accordance with Section No. 9 of this UM.

The conditions for transporting the product in terms of exposure to climatic factors must comply with those specified in this UM and storage conditions L1 in accordance with GOST 15150.

When transporting the product, especially units HVU-50 and SU-40, strictly observe the marks of the position of the device's units, avoid vibrations and shocks.

The storage conditions of the product in terms of the in part of climatic factors correspond to the group of storage conditions L12 in accordance with GOST 15150. The presence of acidic and other impurities that adversely affect the materials from which the product is made is not allowed in storage places.

Note: Storage conditions L1 - heated and ventilated warehouses, storage facilities with air conditioning, located in any macroclimatic regions, where temperature fluctuations are from + 5 ° C to + 40 ° C and relative air humidity is 60% at a temperature of + 20 ° C.

11. Maintenance

The main purpose of maintenance, from the day the unit is put into operation, is to identify and prevent malfunctions, by timely performance of work that ensures the operability of the unit.

It is strongly recommend that the personnel to operate the device consisted of at least two people with a qualification group for admission to work with high voltage electrical equipment and who have passed the appropriate safety instructions.

Maintenance of the unit is allowed for electrical personnel, consisting of at least two people, not younger than 18 years old, with a qualification group for admission to work with high voltage electrical equipment (group IV), who have passed the appropriate safety instructions and who fully knows the procedure how to operate the device.

Work that ensures the operability of the unit include:

- checking the continuity of protective grounding;
- checking the provision of reliable contact of the short-circuiting rod with the PMF-50 high-voltage output terminal and, if necessary, adjusting the operation of the short-circuiting device;
- checking the absence of cable breaks;
- checking the condition of the power cable insulation and high-voltage wires connecting the test object;
- checking the absence of mechanical damage;
- wiping the outer surfaces of the HVU-50 and SU-40 high-voltage terminals with a rag moistened with alcohol or aviation gasoline.