



Electrostatic discharge
test generator
IGE 15.2a

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1. Product features.

1.1 Electrostatic discharge test generator IGE 15.2a is designed to generate rated test pulses for testing of electrical engineering, radioelectronic and electronic products, devices and technical equipment (hereinafter - TE), which may be exposed to electrostatic discharge, in accordance with GOST 30804.4.2-2013, (IEC 61000-4-2:2008).

1.2 Electrostatic discharge test generator (hereinafter – the generator) is manufactured by "PRORYV" Research and development enterprise.

1.3 It stands out from the other electrostatic generator models made by LLC RDE "Proryv" with its capability to operate on an internal battery.

2. Technical specifications.

• total capacitance (C load + C coupling), pF, ±10%	150
• discharge resistance, Ohm, ±5%	330
• charging resistance, MOhm, min	50
• rated output (test) voltage:	
- contact discharge, kV, ±10%	2, 4, 6, 8
- air discharge, kV, ±10%	2, 4, 6, 8, 14, 15
• generated pulses parameters in contact discharge	ref. Table 1
• current discharge pulse wave form in contact discharge	ref. Figure 1
• output voltage polarity	positive and negative
• hold time, sec, minimum	5
• operation mode	single/ 1 Hz frequency/ 5 Hz frequency
• dimensions:	
- generator, mm	225 x 88 x 210
- electrical power unit	88 x 65 x 54
• mass of the generator, kg, max	1
• import power, W, max	12
• integrated battery runtime	up to 4 hours.
• service life	10 years

Table 1.

Generated output pulses parameters in contact discharge

Selector switch position "AMPLITUDE, kV"	2	4	6	7	8	Permissible fractional accuracy, %
Test voltage, kV	2.0	4.0	6.0	7.0	8.0	± 10
Building-up period, tb, ns	0.8	0.8	0.8	0.8	0.8	± 25
First maximum current, A	7.5	15.0	22.5	26.3	30.0	± 15
Discharge current at 30 ns, A	4.0	8.0	12.0	14.0	16.0	± 30
Discharge current at 60 ns, A	2.0	4.0	6.0	7.0	8.0	± 30

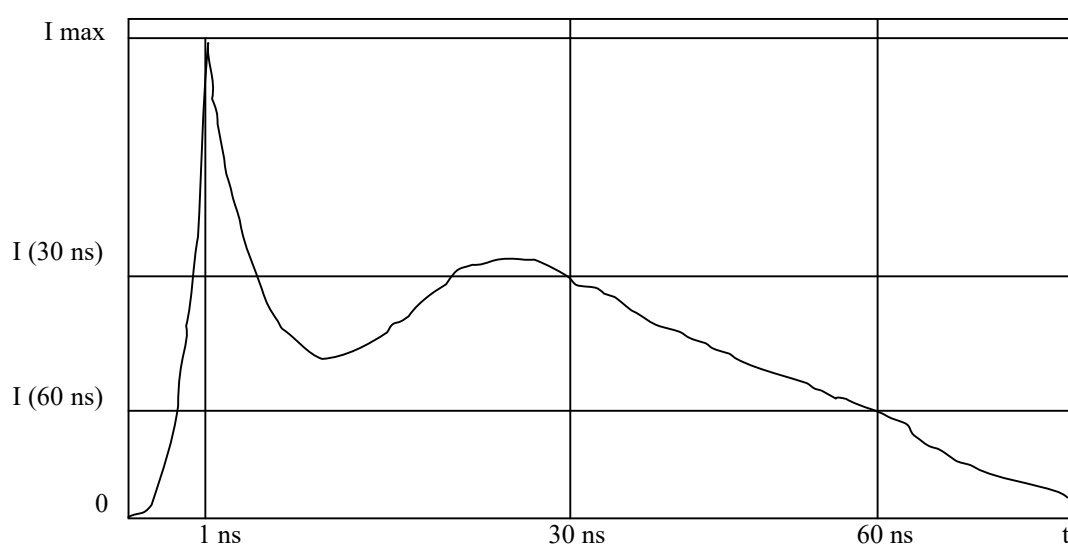


Fig. 1 Current discharge pulse wave form in contact discharge.

3. Packing contents.

The package includes:

- test generator IGE 15.2a 1 unit
- power supply unit 1 unit
- interchangeable head for contact discharge 1 unit
- interchangeable head for air discharge 1 unit
- grounding loop 1 unit
- carrying case 1 unit
- technical passport 1 unit

4. Feature and operation concept.

4.1 The functional chart of the test generator IGE 15.2a is shown in Figure 2.

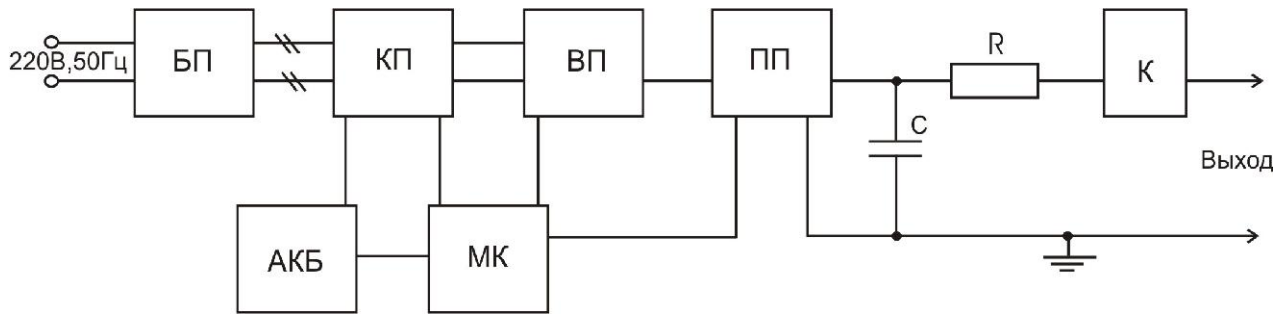


Fig. 2 The functional chart of the test generator IGE 15.2a

1. Power Unit (PU (БП))
2. Power Controller (PC (КП))
3. High Voltage Transducer (HVT (ВП))
4. Microprocessor Controller (MC (МК))
5. Polarization Switch (PS (ПП))
6. Discharge Key (DK (К))
7. Storage Capacitor (SC (C))
8. Discharge Resistor (DR (R))
9. Battery Unit (BU (АКБ))

4.2. Power unit (PU) generates 12V voltage that is necessary to charge the battery.

4.3. The high voltage transducer (HVT) generates voltage ranging from 2 to 15 kV, that is required for charging the pulse former storage capacitor (SC).

4.4. The microprocessor controller (MC) is designed to control the operation of LCD display, control buttons, power controller, high voltage transducer, polarization switch, and discharge key.

4.5. The power controller (PC) is designed to control the battery charge when the generator is powered from mains and to provide the required voltage for the rest of the generator units.

4.6. The polarization switch (PS) provides polarity inversion of the charge voltage and output pulse.

4.7. The discharge key (DK) ensures the test generation operation in contact discharge mode. The key is constantly closed in air discharge mode.

4.8 The battery unit (BU) ensures off-line operation of the generator.

5. Safety precautions.

5.1. Only persons who have read and understood "The rules of technical operation of electric installations of consumers", have an approved group-based electrical safe work practices (not less than level 3), have been instructed on safety measures for work with electronic test equipment, and have examined technical specification and the manual, are permitted to use the test generator.

5.2. The repair of the generator shall be done only by the manufacturer's representatives.

5.3. Interchangeable heads for contact and air discharges shall be changed only when the generator power is turned off, having previously discharged the capacitor by touching the discharge head to the grounded area.

5.4. It is prohibited to use IGE 15.2a generator when there is no the grounding braid connected to the earth bar.

5.5. Do not touch the discharge head when the generator operates.

5.6. After the generator work is completed, the discharge head shall be discharged by touching the discharge head to the grounded area.

5.7. It is prohibited to use IGE 15.2a generator when the power unit is connected.

6. Preliminary starting procedure.

6.1. After transfers in winter or high humidity conditions, the product should be kept under normal conditions 8 hours (minimum) before using.

6.2. While working off-line mode, the charge level of the BU has to be monitored, and if it is necessary to charge the BU. (when the BU is completely discharged the "**Low battery**", sign appears on the screen, the LED shows red thrice and the generator is turned off.)

6.3. In order to the charge the BU, connect the PU cable to the connecting device of the generator, connect the PU to the supply network socket 220 V; 50 Hz and turn the generator on by pushing the ON/OFF (BKЛ/БЫКЛ) switching key.

6.4. To perform the charging over the required amount of time, monitoring the charge indicator icon on the LCD screen (the process of charging takes 3-5 hours if the battery is completely discharged). **The battery may be recharged when the BU is not completely discharged.**

7. Working sequence.

Note: It is not prohibited to use the generator in charge.

7.1. Connect the grounding braid to the appropriate generator connector device and the ground bar.

7.2. Set the discharge head consisted with the test mode to a high voltage slot of the generator. (sharpened one for contact discharge, rounded one for air discharge).

7.3. Turn on the generator by the switching key on the generator handle. After the screen saver, a menu appears on the LCD display of the generator as shown on Figure 3, and the illumination is turned on.

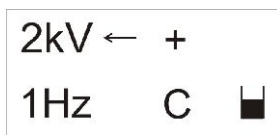


Figure 3

7.4. The cursor is moved over menu lines by "▶" key. The upper-left position sets the value of the charge voltage, the upper-right sets the polarity (+ or -), lower-left – generation frequency (**1 Hz** and **5 Hz**), the lower right – test mode (**C** – contact, **A** – air). The parameter values are set by "+" and "-" keys.

7.5. The lower-right corner of the display indicates the pictograph showing the battery charge level.

7.6. The tests are carried out according to the methods specified in GOST 30804.4.2-2013. To get single discharges, push briefly "Start (Иык)" button located on the front side of the handle. The LED in the control panel shows red. If the button is constantly pressed, the output pulses are generated at a 1 Hz or 5 Hz frequency, depending on the set startup mode. When the pulses are brought, the display indicates the value and polarity of the output voltage, and the pulse meter from 1 to 255 (ref. Figure 4).



Figure 4

7.7. **Attention.** The present generator has a long charge retention time. Therefore, when the test severity is lowered (for example, 8kV to 4kV), it is necessary to discharge the storage capacitor of the generator. For that purpose, click Start button briefly, touching the discharge head to the ground bar in contact discharge mode.

7.8. When the tests have been completed, discharge the generator storage capacitor **ref. item 7.7.**, turn off the generator.

8. Generator off-line work.

8.1. When there is no pressures on any of the generator buttons over 10 seconds, the display light is turned off, and in 2 minutes the generator goes to sleep mode, which turns off the display. In sleep mode all settings are saved, and when clicking any button the generator returns to work mode.

8.2. The battery charge level is displayed as a pictograph in the lower-right corner of the display. When the battery charge is under the lower allowable limit while operating, "**Low battery**" sign appears on the display, LCD shows blinking red thrice and the generator shuts down.

8.3. It is recommended that the generator was turned off before connecting and disconnecting the power supply unit to the generator.

9. Maintenance.

9.1. The maintenance of the test generator after the end of the warranty period shall be performed by the manufacturer under a particular contract.

9.2. The manufacturer shall provide warranty service for the generator over 24 months after work acceptance is made in accordance with the contract.

9.3. Biennially at a minimum, the test generator shall be checked in accordance with periodical qualification procedure.

10. Problems and solutions.

10.1. Otherwise, contact the manufacturer.

11. Equipment qualification procedure.

11.1. The qualification of the generator is conducted with accordance with GOST R8.568-97, GOST 30804.4.2-2013, (IEC 61000-4-2:2008).

11.2 The qualification frequency of IGE 15.2a test generator during its operation and storage process is to be defined by an enterprise using the equipment in accordance with the conditions and intensity of its operation. It is recommended to conduct it biennially.

11.3. The rated technical specifications to be determined and controlled:

11.3.1 Walk-around inspection.

11.3.2 The list of the test generator characteristics to be calibrated in contact discharge mode is shown in Table 1.

11.3.3 Calibrated characteristics of the test generator in air discharge mode:

- the error value of the output voltage shall not exceed $\pm 10\%$ for all levels of severity;
- hold-up time shall be 5 sec minimum.

11.4. Conditions for the qualification:

surrounding air temperature, $(15 - 35)^\circ C$;

relative air humidity, (30-60)%;
atmospheric pressure (86.0-106.0) kPa
supply voltage 50 Hz, (220±11) V.

11.5. The recommended measurement tools for testing the test generator are shown in Table 2.

Table 2.

Measurement tools	Technical specifications	Recommended type
Digital-storage oscilloscope	Pass-band 2 GHz minimum, Cl. 3	LeCroy WP-740Zi
Attenuator	$\rho = 50$ Ohm, frequency attenuation 3 dB, calibration error ± 0.1 dB	D2-27
Attenuator	$\rho = 50$ Ohm, frequency attenuation 6 dB, calibration error ± 0.1 dB	D2-29
Attenuator	$\rho = 50$ Ohm, frequency attenuation 10 dB, calibration error ± 0.1 dB	D2-31
Current transducer (instrument shunt)	Pass-band 4 GHz minimum, resistance 2 Ohm	As per GOST R 51317.4.2-2010
Kilovoltmeter	2-30 kV, Cl. 1.0	C196
Stop-watch timer	Time measurement resolution is 0.1 sec maximum	

Notes:

1. The measurement devices specified in the table can be substituted with other equivalent ones providing adequate accuracy measuring of the corresponding parameters.
2. All measurement devices shall be in good operating conditions and accepted (calibrated) in due compliance.

11.6. Generator qualification and measurement of main metrological characteristics.

11.6.1. The preliminary starting procedure and walk-around inspection (the contents of delivery and the absence of damages, the availability of current documents, and testing equipment characteristics values recorded in the previous qualification procedure) of the generator are conducted in accordance with the product specification. All measured devices involved shall be grounded.

11.6.2 The measurement of the test generator main metrological characteristics.

11.6.2.1. Set the air discharge and the following generator parameter values:

- polarity – positive "+".
- mode – air "A"
- start mode – "5 Hz";

11.6.2.2. Perform the following actions for all severity levels:

- connect the generator grounding braid to the connecting device of the kilovoltmeter case;
- set the appropriate measurement limit of the kilovoltmeter;
- touch the generator discharge head of the kilovoltmeter high-voltage connecting device and press "Start (Ныск)" button briefly. Having fixed the value of the output voltage, discharge the storage capacitor by touching the connecting device terminal of the kilovoltmeter case. The measured output voltage value is recorded in the protocol (ref. Table 3).

11.6.2.3. Set the negative polarity of the output voltage. Repeat the actions according to item 10.6.2.2 for the negative polarity. The results of the measurements are recorded in the protocol (ref. Table 3).

11.6.2.4. Set the discharge head for contact discharge. Set the following generator parameter values:

- polarity – positive "+".
- mode – contact "C"
- start mode – "5 Hz";

11.6.2.5. Measure the actual values for all possible output voltage values of positive and negative polarity. It is necessary to produce multiple discharges at the each output voltage value to reduce the kilovoltmeter input capacity impact. The results of the measurements are recorded in the protocol (ref. Table 3 and Table 4).

11.6.2.6. Set LeCroy WP-740Zi oscilloscope sensitivity of 1 V/division pattern for output voltage 2 kV by connecting the corresponding attenuators. Locate the grounding braid in the shape of the maximum diameter loop. Push the discharge head to the center of the current sensor input electrode integrated in the Faraday Shield, when the generator is perpendicular to the surface of the current sensor. Push briefly "Start (Пуск)" button to make a discharge.

11.6.2.7. Measure the discharge current pulse-rise time at levels 0.1-0.9 and the current amplitude according to the oscillograph in points, corresponding to the following parameters: the current first-maximum pulse, at 30 nsec and 60 nsec. Make calculations according to the formula:

$$I_{\text{output}} = U_{\text{msrt}} * 10^{A/20},$$

where I_{output} is the corresponding value of the output current, A;

U_{msrt} is the measured voltage, V;

A is the total reduction of the used attenuators, db.

11.6.2.8. Repeat the measurement of the discharge current pulse-rise time and current amplitude values for all output voltage values, and the results of the measurements are recorded in the protocol (ref. Table 4).

11.6.2.9. Set the negative polarity of the output voltage. Repeat the actions according to item 10.6.2.6-10.6.2.8 for the negative polarity of the output pulses. The results of the measurements are recorded in the protocol (ref. Table 5).

11.7. Test equipment approval report.

11.7.1. The results of the test equipment qualification shall be recorded in a protocol, the contents of which is shown in the annex to GOST R 8.568-97.

11.7.2. When the qualification is successful the appropriate mark is made in the technical passport (record book) and the the label with the date of the test and the period of the subsequent periodic qualification shall be attached to the test device, and (or) the "Certificate" shall be issued, as shown in Annex B GOST R 8.568-97.

11.7.3. When the qualification failed, the measures necessary to bring up the technical specifications of the test device to the required values shall be indicated in the protocol.

Table 3.

The results of the measurements in the air discharge mode.

Polarity	Output voltage, kV	2	4	6	8	14	15
+	Output voltage, kV						
	deviation, %						
-	Output voltage, kV						
	deviation, %						

Table 4.

The results of the measurements for the output voltage positive polarity in contact discharge.

Output voltage, kV		2	4	6	8
Output voltage, kV,	rated	2.0	4.0	6.0	8.0
	measured				
deviation, %	-				
First maximum current, A,	rated	7.5	15.0	22.5	30.0
	measured				
deviation, %	-				
Discharge current at 30 nsec, A,	rated	4.0	8.0	12.0	16.0
	measured				
deviation, %	-				
Discharge current at 60 nsec, A,	rated	2.0	4.0	6.0	8.0
	measured				
deviation, %					
Current pulse-rise time as of 0.1-0.9 level, nsec	rated	0.6-1.0	0.6-1.0	0.6-1.0	0.6-1.0
	measured				

Table 5.

The results of the measurements for the output voltage negative polarity in contact discharge.

Output voltage, kV		2	4	6	8
Output voltage, kV,	rated	2.0	4.0	6.0	8.0
	measured				
deviation, %	-				
First maximum current, A,	rated	7.5	15.0	22.5	30.0
	measured				
deviation, %	-				
Discharge current at 30 nsec, A,	rated	4.0	8.0	12.0	16.0
	measured				
deviation, %	-				
Discharge current at 60 nsec, A,	rated	2.0	4.0	6.0	8.0
	measured				
deviation, %					
Current pulse-rise time as of 0.1-0.9 level, nsec	rated	0.6-1.0	0.6-1.0	0.6-1.0	0.6-1.0
	measured				

12. Maintenance conditions

12.1. Climate conditions.

The generator shall be operated under the following climate conditions surrounding air temperature, $(15 - 35) ^\circ C$;
relative air humidity, $(30-60)\%$;
atmospheric pressure $(86.0-106.0)$ kPa

12.2. General requirements of electric power.

The generator is powered by a single-phase AC network with a frequency of 50 Hz, nominal voltage of $220 V \pm 10\%$.

13. Shipment

The packed device is transported by all kinds of transport, provided that it is protected against precipitation.

When the device is transported by an air plane, it shall be placed in a heated sealed compartment.

The holds of ships and carboodies used for shipment shall not have cement, coal, chemicals, etc.

The shipment of the generator shall be carried out at air temperature ranging from $-25 ^\circ C$ to $+55 ^\circ C$, relative air humidity up to 95% at $+55^\circ C$ temperature.

14. Storage precautions

The device shall be stored in heated space under the following conditions:

- air temperature from 283 to 308 K (from 10 to 35 °C);
 - relative air humidity 80% at 298 K (25 °C) air temperature;
- there shall be no dust, acid vapor, grease alkali and corroding gases in the storage space;
do not store unpacked devices on the top of one another.

The storage of the packed device is acceptable.

15. Certificate of acceptance.

Test generator IGE 15.2a, manufacturing number _____, meets the technical requirements and is approved as ready for service.

Manufacturing date " __ " _____ 20__.