

Huazheng Electric Manufacturing(Baoding) Co., LTD

ADD: Electicity Valley Tech Centre, No.3088 Lekai Street, Hi-tech Zone, Baoding , Hebei , China

HZCJ-400 Lighting Impulse Tester

I Scope of application

This generator is suitable for standard lightning impulse voltage full wave test for air gaps , reactor switches, insulator strings, bushings, power transformers and transformers of 35KV and below.

II Conditions of use

Altitude: $\leq 1000\text{m}$

Environment temperature :
 $-25^{\circ}\text{C} \sim +45^{\circ}\text{C}$

Relative humidity: $\leq 90\%$ (at 20°C)

Maximum daily temperature difference: $\leq 25^{\circ}\text{C}$

The installation location: Indoor

No conductive dust

No fire and explosion hazard

Gases that do not contain corrosive metals and insulation

The waveform of the power supply voltage is the actual sine wave, and the waveform distortion rate is $< 5\%$.



III Technical Data

1, nominal voltage: 400kV

2, rated voltage: 100kV

3. Nominal energy: 20kJ

4, the total impact capacitance: 0.25 microfarad (single pulse capacitor 2

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microfarad / 50 kV, a total of 8).

5, the total number of levels: 4

6, standard waveform parameters:

(1) Standard lightning impulse voltage full wave, $\pm 1.2/50 \mu s$ voltage utilization factor >85% (more than 90% when no load 400PF);

The impulse voltage waveform parameters and their deviations are in line with the requirements of the national GB311 and GB16927 standards.

7, the lowest output voltage is greater than 10% of the nominal voltage

8. Duration of use: Above 70% of rated voltage, it can be continuously operated every 120 seconds after charging and discharging. It can be continuously operated after charging and discharging every 60 seconds under 70% of rated voltage.

IV Main components

1, the charging part

(1) using a constant current charging device;

(2) Oil-immersed charging transformer with secondary voltage of 85kV and rated capacity of 5 kVA;

(3) Using 2DL-200kV/200mA high voltage rectifier silicon stack, reverse withstand voltage $\geq 200kV$, average current 0.2A, high voltage rectifier silicon stack is installed next to the charging transformer, the drive mechanism can automatically reverse the charging voltage polarity. Polarity switch conversion button;

(4) The high-voltage rectifying silicon stack protection resistor is made of an enamel-coated resistance wire which is wound around the insulating tube;

(5) Adopt bilateral symmetric constant current charging mode;

(6) During automatic control, the constant current charging device is within 10%~100% of the rated charging voltage range, the actual charging voltage

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and the setting voltage deviation are not more than $\pm 1\%$, the charging voltage instability is not more than $\pm 1\%$, and the charging voltage Adjustable accuracy is 1%;

(7) DC resistance divider 2, 50kV , 300M Ω , oil-immersed metal film resistor. Low-voltage arm resistor is installed in the bottom flange of the voltage divider, the voltage signal on the low-voltage arm is introduced into the console with shielded cable;

(8) The automatic grounding switch adopts the electromagnet to separate the grounding mechanism, and the main capacitor can be automatically short-circuited and grounded through the protective resistor when the test is stopped;

(9) Constant current charging inductors, capacitors, charging transformers (including high voltage rectifier silicon stacks and polarity switching devices) and their protective resistors, automatic grounding switches and insulating posts are mounted on a chassis

2. Body part

(1) The main structure adopts a four-column structure. The steel body bracket consisting of 4 flanges is connected with two capacitors in parallel, forming a stable structure consisting of 1 level, and the main equipment is 4 stages, forming a combined tower structure. Level stacking, easy to disassemble and test, and stable overall structure;

(2) The main body adopts asymmetric constant current charging mode, constant current voltage regulation, continuously adjustable from zero to set voltage, and the charging power supply is automatically turned off at the instant of ignition and discharge, and the rated voltage of each stage is 100kV;

(3) The four-stage tower structure of the main body insulation pillar. Each stage includes two MWF50-2.0 iron casing oil-immersed pulse capacitors, charging resistors, wave head resistance, wave tail resistance and ignition ball gap, etc.

All synchro discharge balls are housed in a closed insulation, and the ball gap can be adjusted automatically through the console.

(4) Single pulse capacitor is $2.0 \pm 0.05 \mu\text{F}$, DC working voltage is 50kV, capacitor inductance is $\leq 0.2 \mu\text{H}$, composite film oil is immersed in insulation, capacitor under normal working condition and working environment, capacitor outlet

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bushing can withstand vertical pulling force 15kg, while ensuring No damage or leakage of oil;

(5) The wave head (front) resistance and the wave tail resistance are both plate-shaped and non-inductive, and their self-inductance is $\leq 2.5 \mu H$ (The purpose of reducing the inductance is to increase the load capacity, for a load with a large capacity (such as greater than 5000PF) This item can be used to increase the load by using a suitable combination of externally-adjusted capacitors and modulating resistors.), the joints are spring-loaded;

(6) The wave head (front) and wave tail resistance brackets can be connected in parallel by four resistors at the same time. The wave head (front) and wave tail resistors are equal in length and can be used universally, and each stage is provided with excess modulation resistors and The position of the shorting rod; it is convenient to make the generator run in series by plugging with the shorting rod;

(7) Full set

7.1 3 sets of lightning wave head resistance;

7.2 2 sets of wave tail resistance;

7.3 1 set of charging resistors (1 spare);

(8) The first-stage ball gap adopts bilateral bipolar triggering, and the second-to fourth-stage ball gap adopts three-gap ball gap ignition, and the synchronous misoperation rate or rejection rate is not more than 2%; the synchronization range is $\geq 20\%$. .

(9) The ball gap distance of each level is linearly adjusted by the motor drive, the control system indicates the charging voltage corresponding to the ball pitch, and the transmission structure has upper and lower limit switches;

(10) The ball gap distance can be adjusted manually or automatically on the control system;

(11) The main body can be used in parallel every two or three stages, and the parallel connecting rod adopts a unified connector to facilitate the exchange. The excess modulating resistor can be placed on the device without affecting the electrical performance;

(12) Each stage of the test shall store the modulating resistor and the bracket of the connecting rod;

(13) Two-stage sealed insulation cylinders are used at all levels, and the sealing performance is good;

(14) Anti-corona measures are taken between the levels, and no obvious corona will appear during the whole charging process.

(15) Inter-stage insulation and mechanical support can withstand 100kV DC without generating discharge.

(16) A pressure equalizing hood is placed on the top of the generator.

3, 400KV weak damping capacitor divider

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The high-voltage arm capacitor consists of 1 section, rated at 400kV/300 picofarads, and rated lightning impulse withstand voltage of 400kV.

The voltage divider is equipped with a low voltage arm capacitor, the partial pressure ratio is 1500, and the partial pressure ratio precision is less than $\pm 1\%$;

The square wave response characteristics of the weakly damped capacitor divider meet the requirements of GB311

4, 400kV multi-stage intercept gap device

Including 900 picofarad / 150kV voltage equalizing capacitors, six pairs of chopping ignition ball gaps, $2 \sim 5 \mu s$ delay trigger device. The chopping time is $2 \sim 6 \mu s$, the standard deviation of the time of dispersion of the chopping time is not more than $0.1 \mu s$, and the distance of the multi-ball chopping ball gap is adjusted by the console through the electric drive mechanism



V HZCJ-400 impulse voltage generator control and computer waveform analysis system

1. Overview
2. Main function of the control system.



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- 1) Manual charging mode: manually adjust the voltage and fine-tune;
- 2) Synchronize the charging voltage of the ball gap, manually adjust the ball gap distance, and display the actual distance value. When the ball gap limit switch is activated.
- 3) Charging speed selection, the user can select the charging speed in 2 steps according to the test needs.
- 4) Standardized waveform editing system, the measurement of the waveform can be completed by mouse dragging, and the waveform can be conveniently scaled;
- 5) Overvoltage, overcurrent protection, automatic grounding;
- 6) Auto-ignition: manual control
- 7) Emergency trip, different from manual trip, emergency trip directly through the button to cut off the main loop power for abnormal conditions, such as power outage in the control room.

3. System structure

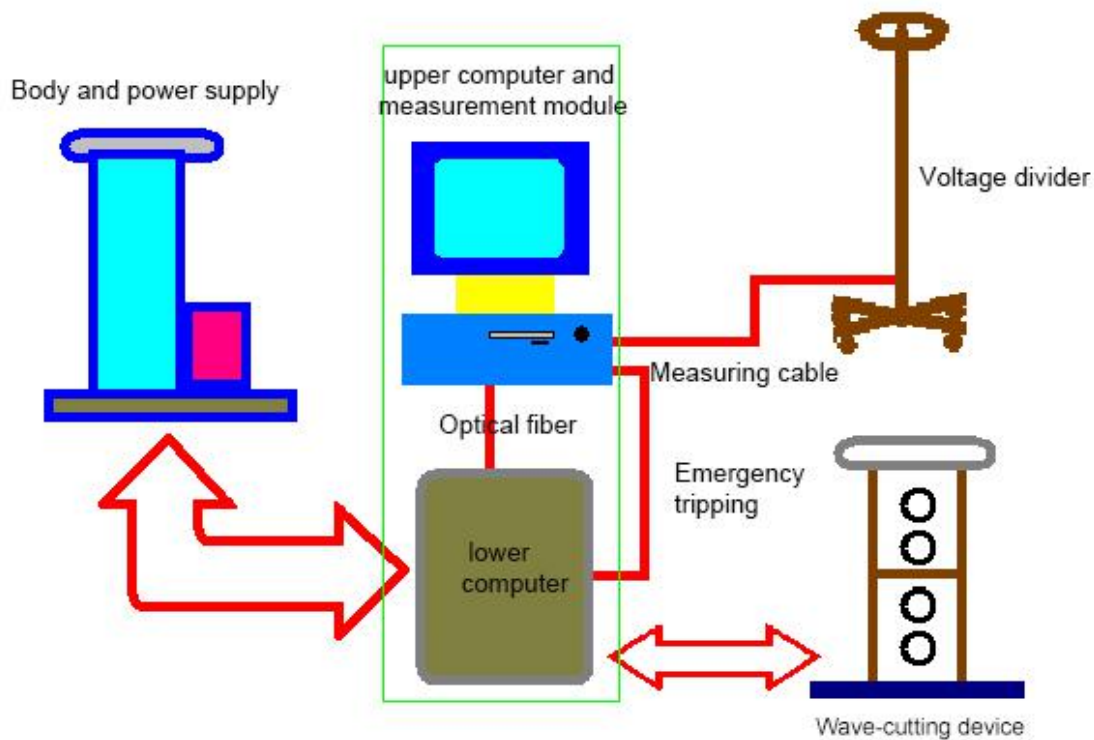


Figure 2 system structure diagram

The structure of the system is shown in Figure 2:

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The part surrounded by the green line in Figure 2 is an integrated measurement and control system. The lower position machine is directly connected with the impulse voltage generator body, the power supply and the intercepting device. All the bottom operations such as relay opening and closing are controlled by the lower position machine, and the upper computer is connected to the lower position machine through the optical fiber, and sends the command to the lower position machine to drive the body and the power supply. The chopper device continuously collects data and acquires the current state, and simultaneously transmits the collected data to the upper computer without interruption, and the voltage and current signals of the voltage divider are connected to the upper computer through the acquisition module.