HZJC-900kV/67.6 kJ Impulse Voltage Generator

(complete equipment)

Technical solution

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Contents

1. Scope of application

This generator is used for the full-wave and cut wave tests of standard lightning impulse voltages for power transformers, transformers, reactors, lightning rods, switches, bushings, insulators and other test products with voltage classes of 20kV and below.

2. Conditions of use

Altitude：≤1000m

Environment temperature：-25℃～+45℃

Relative humidity：≤90%（at 20℃）

Maximum daily temperature difference：≤25℃

Anti-seismic ability：≤8 intensity

The installation location：Indoor

The waveform of the power voltage is the actual sine wave

Waveform distortion rate <5%

3. Follow standards

GB / T 311.1 Insulation and coordination of high voltage transmission and transformation equipment

GB / T 16927.1 High voltage test technology Part I General test requirements

GB / T 16927.2 High-voltage test technology Part 2 Measurement system

GB / T 16896.1 Digital recorder for high voltage impact test

JB / T 7616 High-voltage line insulator withstand shock test

DL / T 557 high voltage line insulator steep wave impact test, definition, test method and criteria

ZBF 24001 detailed implementation of impulse voltage test

4. Rated parameter value

1. Nominal voltage: 900kV

2. Rated voltage: 150kV

3. Nominal energy: 67.6kJ

4. Total impact capacitance: 0.167 microfarad (single pulse capacitor 2.0 microfarad / 75 kV, 12 in total)

5, the total number of levels: 6

6. Standard waveform parameters:

(1) Full lightning surge voltage

Wave head time: 1.2us ± 30% uS, wave tail time: 50us ± 20%

Voltage utilization factor> 85% (greater than 90% at no load 300PF);

(2) Standard cut-off: cut-off time 2-6uS, zero-crossing coefficient ≤0.3%, voltage utilization coefficient> 85%

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

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

8. Duration of use: Above 70% of rated voltage, continuous operation can be performed after charging and discharging every 120 seconds, and below 70% of rated voltage, continuous operation can be performed after charging and discharging every 60 seconds.

5. Main components

(1) DC charging part

(1) Adopt constant current charging device;

(2) Charging transformer with oil-immersed insulation case, secondary voltage 80kV,

rated capacity 5 kVA; primary voltage is 220V,

(3) 2DL-200kV / 200mA high-voltage rectified silicon stack, with a reverse withstand voltage of 200kV and an average current of 0.5A. The high-voltage rectified silicon stack is installed beside the charging transformer, and the charging voltage polarity can be automatically switched by the transmission mechanism. Polarity switch switch button;

(4) The high-voltage rectifier silicon stack protection resistors are wound on the insulation tube with an enameled resistance wire.

(5) Unilateral asymmetric constant current charging method;

(6) During automatic control, the constant current charging device is within the range of 10% to 100% of the rated charging voltage, the deviation between the actual charging voltage and the set voltage is not greater than ± 1%, the instability of the charging voltage is not greater than ± 1%, and the charging voltage The adjustable precision is 1%;

(7) Two DC resistance voltage dividers, using 75kV, 200M, oil-immersed metal film resistors. The low-voltage arm resistor is installed in the bottom flange of the voltage divider, and the voltage signal on the low-voltage arm is introduced into the console with a shielded cable;

(8) The automatic grounding switch adopts the electromagnet opening and closing and grounding mechanism. When the test is stopped, the main capacitor can be shorted automatically and grounded by the protective resistor;

(9) Constant current charging inductors, capacitors, charging transformers (including high-voltage rectifier silicon stacks and polarity conversion devices) and their protective resistors, automatic grounding switches and insulated pillars are installed on a chassis;

(2)Body Part

(1) The main structure adopts a four-column structure, and a steel body consisting of four flanges is externally connected with two capacitors in parallel, forming a stable structure composed of level 1, the main equipment is level 6, and a combined tower structure is formed. Level stacking, convenient for disassembly and inspection, and stable overall structure;

(2) The body adopts asymmetric constant current charging method, thyristor constant

current voltage regulation, continuously adjustable from zero to the setting voltage, and the charging power is automatically turned off at the moment of ignition and discharge, and the rated voltage of each stage is 150kV;

(3) 6-level tower structure of main body insulation pillars. Each stage includes 2 MWF75-2.0 iron shell oil-immersed pulse capacitors, charging resistors, wave head resistors, wave tail resistors, and ignition ball gap, etc.

All synchronous discharge balls are installed in a closed insulation. Transparent windows are used at the ball gap, and the ball gap can be automatically adjusted through the console with clean and dry air.

(4) A single pulse capacitor is $2\pm0.05\mu F$, a DC working voltage of 75kV, a capacitor inductance of $0.2\mu H$, and a composite film oil-immersed insulation. Under normal working conditions and working conditions, the capacitor outlet bushing can withstand a vertical tension of 15kg. At the same time, it is guaranteed not to damage and leak oil;

(5) The wave head (front) resistance and wave tail resistance both use a plate-shaped structure and are wound without induction. The self-inductance is $\leq 2.5\mu H$ (the purpose of reducing the inductance is to increase the load capacity. 5000PF) This item can use the appropriate combination of external wave-adjusting capacitors and wave-adjusting resistors to achieve the purpose of increasing the load.), The connectors are spring pressure contact force type;

(6) The wave head (front) and wave tail resistance brackets can be connected in parallel by four resistors. The wave head (front) and wave tail resistances are equal in length and can be used universally. The position of the short-circuit pole; plugging in with the short-circuit pole can make the generator run in series conveniently;

(7) Complete set

7.1 3 sets of lightning wave head resistors;

7.2 2 sets of wave tail resistance;

7.3 1 set of charging resistors (1 spare);

7.4 2 wave-adjusting capacitors

(8) the ball gap of the first stage is triggered by bilateral heteropolarity, and the ball gap of the second stage to the sixth stage is ignited by three-gap ball gap, with synchronous

misoperation rate or rejection rate not more than 2%;Synchronization range ≥20%.

(9) the ball gap distance at all levels shall be adjusted linearly driven by the motor, and the control system shall indicate the charging voltage of the corresponding ball distance. The transmission structure shall be equipped with upper and lower limit switches;

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

(11) the ontology can be used in parallel for every second or multiple stage. The parallel connecting rod adopts a unified connector, which is convenient for switching.The equipment can be used to adjust the excess wave resistance without affecting the electrical performance;

(12) the body is equipped with an insulating ladder, whose load is designed according to 120kg, so as to make it convenient for workers to replace the modulating components. Each stage of the test shall store the modulating resistance and the connecting rod bracket;

(13) the bottom level of the body adopts solid insulating column, and the other levels adopt two-end sealing insulating cylinder, which has good sealing performance;

(14) anti-halo measures shall be taken at all levels, so there will be no obvious corona during the whole charging process.

(15) a safety grounding system is provided to enable the tester to start the grounding system when changing the resistance or repairing the climbing body, and all capacitors are short-connected and grounded.

(17) stage insulation and mechanical support can withstand 165kV dc voltage without discharging.

(18) the climbing insulated ladder installed on the body is convenient to work and safe and reliable, and the body machinery can fully meet the mechanical and electrical strength.

(19) the top of the generator is provided with a pressure equalizing cover, which is composed of aluminum pieces of turtle block.

(3) Weakly damped capacitor voltage divider

Main technical parameters ：

The high-voltage arm capacitor is composed of 1 section, and the rated parameter of each section is 900kV/400 pico-method, and the rated lightning shock withstand voltage is 900kV.

The voltage divider is equipped with a low-voltage arm capacitor, the partial voltage ratio is 3000, the accuracy of partial voltage ratio is less than ± 1%;

The square wave response characteristics of the weakly damped capacitive voltage divider meet the requirements of GB311 standard

(4) 900kV multi-stage intercept gap device

Including 1800 piconitrine /150kV equalizing capacitor six, cut off ignition ball gap six, 2 ~ 5μs delay trigger device.The cut-off time is 2 ~ 6μs, the standard deviation of cut-off time dispersion is no more than 0.15μs, and the ball gap distance of multi-ball cut-off wave is adjusted by the console through the electric drive mechanism.

(5)Manual/Automatic Console (In kind)

Full measurement and control integration; high integration;

High precision (12Bit) and high speed data sampling (100MS / s) replace the conventional oscilloscope plus peak meter mode;

The system adopts the upper and lower machine mode, and the upper and lower machines are connected by optical fiber.

Display the waveform and waveform parameters in real time during the test, including peak, wave head time, wave tail (cutoff) time, and store data;

Waveform analysis software passed IEC1083-2 inspection disc test;

The industrial integrated design has high stability, high reliability and excellent

electromagnetic compatibility, and does not require any additional shielding devices;

Automatically generate test reports and charts;

Simultaneously display the waveforms of the test voltage and the current of the test product for comparison and analysis;

Remote control and data transmission through the network (LAN), and measurement data can be shared in real time;

The parameters preset by the user according to the test content can be saved and recalled to avoid repetitive work;

The upper and lower computers are separated by optical fibers to ensure the safety of the operation platform.

The upper and lower computer communication adopts full-duplex mode and uses a dedicated communication protocol to ensure the reliability of communication.

Chain of hardware and electrical appliances to ensure the correctness and reliability of operation;

Software two-level operation is interlocked. The upper computer (industrial control computer) will block illegal operations according to the current status. The lower computer must perform legality judgment based on the current status before performing any operation, and then execute.

The closed-loop control of constant-current charging and voltage trimming are used to ensure charging accuracy and shorten charging time.

3. Main functions of the control system

Automatic charging mode: set the charging voltage value of each level to automatically charge and maintain;

Manual charging method: manually adjust the voltage and fine-tune;

Synchronized ball gap automatically adjusts the ball gap distance according to the set charging voltage, and displays the actual distance value. When the ball gap limit switch is activated, an instruction is issued; the special ball gap distance is fine-tuned to facilitate small-scale adjustment of the ball distance.

Charging speed selection, users can choose charging speed in 5 steps according to the needs of the test.

Standardized waveform editing system, the measurement of the waveform can be completed by dragging with the mouse, and the waveform can be easily scaled;

Automatically change the polarity of the charging voltage and display it on the screen;

Over-voltage and over-current protection, automatic grounding;

Auto-ignition: According to the set parameters, including the set voltage value and set time value, a process of boosting, holding and ignition is automatically completed;

Can visually display the status of each discharge, including discharge voltage value, normal discharge or self-discharge;

The emergency opening is different from the manual opening. The emergency opening cuts off the main circuit power directly through the button, which is used for abnormal conditions, such as power outage in the control room.

3.System structure

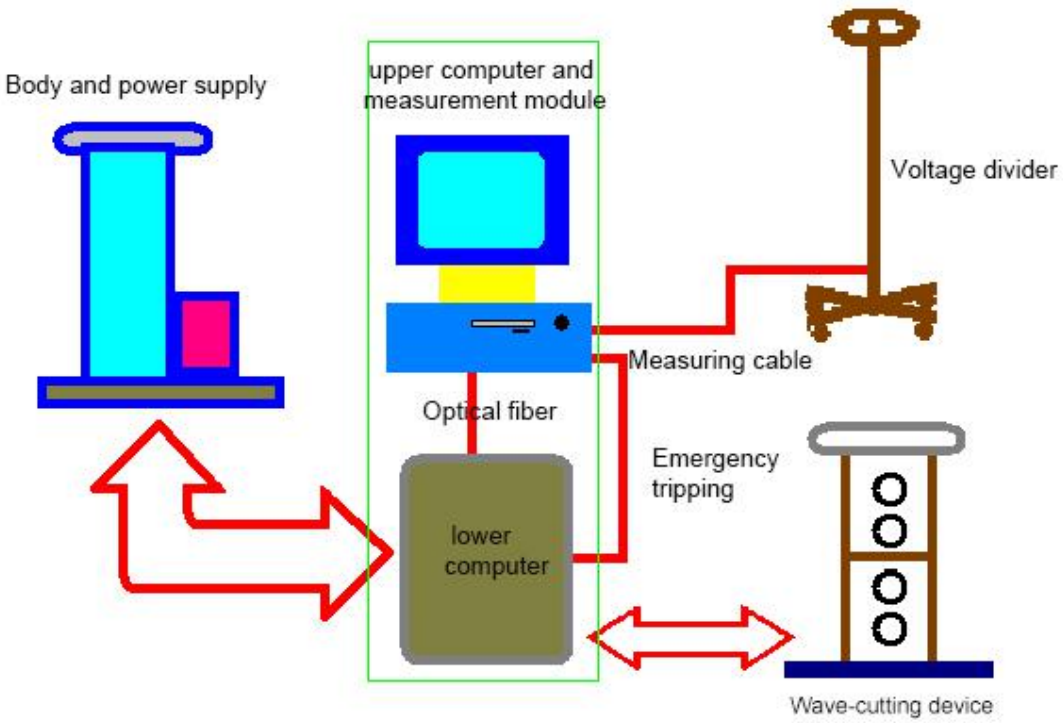

Figure 2 system structure diagram

The structure of the system is shown in Figure 2:

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.

Chanel	2
Sampling speed 100MS/s	
Amplitude resolution	9Bits
Amplitude error	<1%
Display	15”LCD，1024×768