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Winding wires test methods - Part 21: Electrical endurance under high frequency voltage impulses

绕组线试验方法

第 21 部分：耐高频脉冲电压性能

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Winding wires test methods - Part 21: Electrical endurance under high frequency voltage impulses

1 Scope

This part of GB/T 4074 stipulates the test method (also known as corona resistance test method) for using high-frequency pulse voltage to determine the resistance of the winding wire to high-frequency pulse voltage in atmospheric air, including the terms and definitions of the test, test equipment, specimen preparation, test procedures, test parameters and test records.

This part applies to the following winding wires:

- Corona-resistant enameled round winding wire;
- Grade-240 aromatic corona-resistant polyimide film wrapped sintered round and flat winding wire;
- Glass fiber wrapped film winding flat winding wire;
- Mica tape wrapped flat winding wire.

2 Normative references

The following documents are essential to the application of this document. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) are applicable to this standard.

GB/T 4074.5-2008 Winding wires - Test methods - Part 5: Electrical properties

GB/T 4074.7-2009 Winding wires - Test methods - Part 7: Test procedure for the determination of the temperature index of enameled winding wires

GB/T 30435 Electric gravity convection and forced ventilation ovens

3 Terms and definitions

The following terms and definitions apply to this document.

U_p - Pulse peak voltage;

U_a - Steady state impulse voltage;

U_b - Peak voltage;

t_r - The time required for the voltage to rise from 10% to 90% of the zero-peak voltage.

Figure 1 -- Waveform of bipolar symmetrical pulse voltage

3.4

Impulse width

t_w

The time difference between the first instant and the last instant when reaching the specified impulse amplitude or specified threshold's impulse instantaneous value.

[IEC 62068:2013, definition 3.17]

3.5

Peak impulse voltage

U_p

The maximum voltage value reached during the unipolar surge voltage period (see Figure 1).

Note: For bipolar pulse voltage, the pulse peak voltage is half of the pulse peak-peak voltage ($U_{pk/pk}$). The pulse peak-peak voltage ($U_{pk/pk}$) is as shown in Figure 1.

3.6

Steady-state impulse voltage magnitude

U_a

The final value of the impulse voltage (see Figure 1).

3.7

Voltage overshoot

U_b

Impulse voltage waveform: Bipolar pulse with symmetrical square wave;

Impulse frequency range: (2 ~ 20) kHz;

Impulse rise time: (50 ~ 100) ns;

Steady state impulse voltage range (U_a): (0 ~ ±1500) V;

Voltage overshoot: It shall not exceed 2% relative to the steady state impulse voltage (U_a);

The ratio of positive or negative pulse width to pulse period: < 50%; the closer to 50%, the higher the test accuracy.

Note 1: Because the rise time is related to the specimen's capacitance, try to avoid using a repetitive pulse power supply to test more than one specimen at the same time, otherwise it will affect the test results.

Note 2: Refer to Appendix A for the method of verifying the output waveform polarity of the equipment.

Note 3: If there is demand, both supplier and purchaser may negotiate the use of a corona-resistant tester of steady-state impulse voltage range (0 ~ ± 2000) V.

Note 4: For bipolar pulses with symmetrical square waves, the relationship between steady-state impulse voltage, peak voltage and pulse peak voltage is as shown in Figure 1.

5.3 Timing device

Each specimen shall be timed separately. When the tested specimen is short-circuited, the timer stops counting and records the test value.

5.4 Hot state tester

The electric heating oven used for the test shall meet the requirements of GB/T 30435. Room temperature ~ 200 °C, temperature deviation is ± 3 °C.

The test fixture shall ensure close contact with the specimen. The fixture may use a container containing stainless steel beads, a container containing nickel-plated iron beads or other suitable fixtures. In the case of using metal beads, their diameter shall not exceed 2 mm. In addition, it shall use appropriate methods clean the metal beads or other fixtures regularly.

Appendix A

(Informative)

Method for verifying polarity of output waveform of equipment

A.1 Overview

A bipolar symmetrical square wave is a pulsed square wave whose waveform polarity alternates from the negative pole to the positive pole or from the positive pole to the negative pole with respect to the reference ground point (generally zero potential), which is characterized by the same positive and negative half-wave waveforms, meanwhile every two positive half waves or negative half waves differ by half a cycle.

This Appendix provides a method to verify the polarity of the output waveform of the equipment.

A.2 Measurement method

The measured signal of bipolar symmetrical square wave pulse can be divided into single-ended signal and differential signal. Single-ended signals shall provide a measurement reference ground; the differential signal can provide no reference ground, that is, double-end suspended measurement.

Single-ended signals can be measured by the use of single-ended probes or differential probes. The grounding clamp of the single-ended probe is connected to the reference ground; the probe at the other end directly measures the signal source. The two ends of the differential probe can be arbitrarily connected to the reference ground and the signal source.

For the differential signal that provides the reference ground, it may use two single-ended probes for measurement. The two grounding clamps are connected to the reference ground. The two probes measure the two ends of the differential signal, respectively. It may also use the differential probe for measurement directly. The two ends of the differential probe can be arbitrarily connected to the two ends of the differential signal.

If the equipment does not provide a measurement reference ground, single-ended probes cannot be used for measurement, to avoid voltage breakdown. Only differential probes can be used for measurement at this time.

A.3 Determination of waveform polarity

A.3.1 Measurement results of single-ended signal

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