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Stator coils of high-voltage rotating electrical machines - Specification

高压电机定子线圈 技术条件

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1 Scope

This standard specifies the test samples, technical requirements, test methods, and inspection rules for stator coils (frame coils) of high-voltage AC motors, which have a heat resistance grade 155 (F) and rated voltage U_N of 3 kV, 6 kV, 10 kV, including stator coils manufactured by molding and VPI (Vacuum Pressure Impregnating) processes.

This standard applies to the quality appraisal of the insulation structure of finished coils of high-voltage AC motors, which have a rated voltage of 3 kV, 6 kV, 10 kV.

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) is applicable to this standard.

GB 755-2008 Rotating electrical machines - Rating and performance

GB/T 17948.3-2006 Functional evaluation of insulation systems for rotating electrical machines - Test procedures for form-wound windings - Thermal evaluation and classification of insulation systems used in machines up to and including 50 MVA and 15 kV

GB/T 22715-2016 Impulse voltage withstand levels of form-wound stator coils for rotating a.c. machines

GB/T 22718-2008 Thermal evaluation methods of insulation systems for high-voltage electrical machines

JB/T 6204 Specifications for withstand voltage test on stator coil and winding insulation of high voltage AC machines

JB/T 7608-2006 Test method and limited value of loss factor of coil for HV and AC electric machine

calculated according to the nominal size of the drawing (excluding the anti-corona layer).

The breakdown voltage value is the lowest value on both sides of a single coil; the breakdown field strength is the average value.

5.6 Corona starting voltage

The specimen is subjected to a corona starting voltage test in a dark room. The test voltage waveform shall be an actual sine wave, which is subject to visual inspection.

5.7 Dielectric loss tangent

5.7.1 Normal dielectric loss tangent tanδ and its increment Δtanδ

The measurement shall be carried out at room temperature. The length of the measuring electrode (see 5.1) shall be the length of the coil slot; the measuring electrode shall be connected to the guard electrode. The width of the guard electrode shall be no less than 10 mm. The gap between the guard electrode and the measuring electrode shall be no more than 4 mm, generally within 2 mm ~ 4 mm. The measuring voltage starts from $0.2U_N$ and is measured every $0.2U_N$ until $1.0U_N$. The main test equipment shall meet the requirements of JB/T 7608-2006.

5.7.2 Hot dielectric loss tangent tanδ

The specimen shall be placed in an oven with hot air circulation, and the test temperature shall be controlled at 155 °C ± 2 °C. After keeping it for 1 h, measure it under the test voltage of $0.6U_N$. The length of the measuring electrode is the length of the coil slot; the measuring electrode shall be connected to the guard electrode. The main test equipment shall meet the requirements of JB/T 7608-2006.

5.8 Voltage durability test

5.8.1 Quality assurance test

Before the voltage durability test, the quality assurance test shall be carried out according to the following requirements:

- Specimen appearance inspection;

- Voltage withstanding test according to GB 755-2008;

- Impact voltage level test according to GB/T 22715-2016.

5.8.2 Voltage durability test

Under room temperature conditions, apply a power frequency AC voltage of 2.17 U_N or 2.53 U_N to the insulation of the coil slot until the coil insulation breaks down. The

test voltage waveform shall be an actual sine wave. The accumulated time of electrical aging is the failure time of the specimen.

The specimen shall be at least 2 frame coils or 4 bar coils. Any slot of the frame coil and its end or the entire bar coil is regarded as one specimen. Anti-corona measures shall be taken for all specimens.

5.8.3 Judgment criteria

The judgment criteria for voltage durability test are as follows:

a) If the failure time of all specimens is not less than 400 h (test voltage is $2.17U_N$) or 250 h (test voltage is $2.53U_N$), it can be judged that the product it represents meets the test requirements.

b) If the failure time of the specimen is within 200 h ~ 400 h (test voltage is $2.17U_N$) or 125 h ~ 250 h (test voltage is $2.53U_N$), but the number of failed specimens is not more than 26% of the total, then an additional frame coil or 2 bar coils shall be selected for testing. If the number of specimens put into the electrical aging test is not less than 6, no additional specimens are required. All remaining coils (including additionally selected coils) shall pass the test. If there are still specimens with a failure time of less than 400 h (test voltage is $2.17U_N$) or 250 h (test voltage is $2.53U_N$) during the repeated test, it shall be judged that the product it represents does not meet the test requirements.

c) If the failure time of the specimen is within 200 h ~ 400 h (test voltage is $2.17U_N$) or 125 h ~ 250 h (test voltage is $2.53U_N$), meanwhile the number of failed specimens is greater than 26% of the total, it shall be determined that the product it represents does not meet the test requirements.

d) If the failure time of the specimen is less than 200 h (test voltage is $2.17U_N$) or 125 h (test voltage is $2.53U_N$), it shall be determined that the product it represents does not meet the test requirements; the breakdown coil shall be dissembled and analyzed; improvement measures shall be formulated and retested.

6 Inspection rules

6.1 Sampling inspection

Sampling inspection shall be carried out every six months; the number of inspections can be increased if necessary. The sampling inspection items are as follows:

a) Test of insulation withstand power frequency voltage to ground;

b) Withstand impulse voltage level;

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