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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 21707-2025

Replacing GB/T 21707-2018

Insulation specification for frequency conversion machine

变频调速电机绝缘规范

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1 Scope

This document specifies the technical requirements, test methods, test equipment and inspection rules for insulation of frequency conversion machine.

This document is applicable to frequency conversion machine with rated voltage of 1 140 V and below. It serves as a reference for the implementation of high-voltage variable-frequency motors with a rated voltage higher than 1 140 V.

2 Normative references

GB/T 4074.7-2024

GB/T 5591.3-2018

GB/T 6109.1

GB/T 7095.1

GB/T 11026.4-2012

GB/T 17948.1-2018

GB/T 17948.3-2017

GB/T 20629.3-2019

GB/T 22720.1-2017

GB/T 22720.2-2019

3 Terms and definitions

For the purposes of this document, the following terms and definitions, as well as those given in GB/T 22720.1-2017, apply.

3.1 type I insulation systems

The insulation structure, for converter-powered motors, which is not subject to partial discharge during its service life.

3.2 type II insulation systems

The insulation structure, for converter-powered motors, which is subject to partial discharge in any part during its service life.

Note. Generally, motors with a rated voltage greater than or equal to 700 V are of type II insulation systems.

3.3 impulse voltage insulation class; IVIC

The safe peak-to-peak voltage, for inverter-powered motors, specified by the manufacturer and related to the rated voltage, which shall be indicated in the instructions and on the nameplate.

[Source. GB/T 22720.1-2017, 3.19, modified]

3.12 rated voltage

UN The voltage value of the motor under power frequency operating conditions, which is specified by the manufacturer and marked on the nameplate.

Note 1. The rated voltage is the line end rated voltage and is the effective value.

Note 2. For electric vehicle drive motors, the rated voltage is the nominal voltage of the DC bus declared by the manufacturer, in which case $U_N = U_{dc}$.

[Source. GB/T 22720.1-2017, 3.18]

3.13 overshoot factor; OF

The ratio of the motor terminal display voltage to the converter voltage.

[Source. GB/T 22720.1-2017, 3.24]

4.1.1.1 General requirements

In addition to meeting the requirements of Table 1, the electromagnetic wire shall also withstand the tension during the winding process, and the paint film/insulation layer shall have a certain degree of flexibility during the winding process, without cracking or losing adhesion.

4.1.1.2 High-frequency impact resistance

The chemical structure and coating process of the electromagnetic wire paint film shall enable the electromagnetic wire to effectively withstand the long-term impact of high-frequency impulse voltage. Under the conditions described in 4.3.1.2, the high- When using mica tape for insulation, its general performance shall meet the technical requirements of the relevant mica tape product standards.

4.1.4 Slot wedge

The heat resistance grade of the slot wedge shall not be lower than 155(F), and its conventional performance shall meet the technical requirements of JB/T 10508-2020.

4.1.5 Lead wire

The conductor inside the lead wire shall be guaranteed to operate continuously at a temperature not lower than 125 °C. The connection between the lead wire and the winding wire can be protected by corresponding thermal-setting adhesive tape, and its general performance shall meet the relevant product technical requirements.

4.1.6 Casing

The heat resistance grade of the casing shall not be lower than 155(F), and its conventional performance shall meet the relevant product technical requirements.

4.2.1 Heat resistance grade

The heat resistance grade corresponding to the continuous use design life of the insulation structure shall not be lower than 155(F).

4.2.2 Technical requirements for type I insulation systems

Type I insulation systems shall meet the technical requirements of GB/T 22720.1-2017.

4.2.3 Technical requirements for type II insulation systems

Type II insulation systems shall meet the technical requirements of GB/T 22720.2-2019.

4.2.4 High-frequency impact resistance requirements

The design and manufacturing process of type II insulation systems shall enable the insulation structure to effectively withstand long-term impact of high-frequency impulse voltage. For the high-frequency impact resistance of the insulation structure evaluated under the conditions described in 4.3.6.2, the insulation structure shall meet the requirements of Table 4.

Bipolar high-frequency impulse voltage is preferred for testing. If the test voltage is too high to meet the requirements, such as exceeding 20 kV, the test method in Appendix C of GB/T 22720.2-2019 may be used after consultation between the supply and demand parties, and its requirements shall be met.

5.1.1 Test sample

For the evaluation of the high frequency impact resistance of electromagnetic wire, prepare the test samples as follows.

- a) Enameled round copper wire. Prepare into "twisted pair" form according to the provisions of 5.1.1 of GB/T 4074.7-2024.
- b) Enameled rectangular copper wire. Prepare into "back-to-back" form according to the provisions of 5.1.2 of GB/T 4074.7-2024. Straightening can be done by stretching the sample by no more than 1% of its total length, and tying the two lines tightly together with a high-temperature binding wire that can withstand long-term use of 155°C and above. The length of the "back-to- back" straight part is 150 mm.

5.1.2 Test conditions

In an aging oven at a temperature of 155 °C (the aging oven shall meet the relevant provisions of GB/T 11026.4-2012), the electromagnetic wire samples are continuously tested using a high-frequency impact tester with the parameters shown in Table 5. The measurement guidelines for waveform parameters of high-frequency impact testers are given in Appendix A.

5.1.3 Test results

When evaluating the high-frequency impact resistance of 5 samples, take the median and minimum values as the sample results.

5.2 Determination of volatile matter of impregnating resin

The method for determining the volatile matter of the impregnating resin is shown in