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

GB/T 22669-2008

**Test procedures for three-phase permanent magnet
synchronous machines**

三相永磁同步电动机试验方法

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1 Scope

GB/T 22669-2008 is the Chinese national standard on test procedures for three-phase permanent magnet synchronous machines, in the field of electrical engineering. The /T suffix marks it as a recommended standard: it is not compulsory by itself, but it becomes binding as soon as a contract, a tender or a customer specification calls it up - which in practice is how most foreign buyers meet it. It was issued on 31 December 2008 by the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China; Standardization Administration of China, and has been in force since 1 November 2009. Classification: ICS 29.160.30, CCS K21. This page is published from the official record of the standard held by the Chinese standards administration: the identification, the dates, the classification and the issuing body are taken from there. The clause text, the tables and the numeric limits are in the document itself, which is delivered complete in English translation.

This Standard specifies the test procedures for three-phase permanent magnet synchronous machines. This Standard is applicable to self-starting three-phase permanent magnet synchronous machines. The test for synchronous machines powered by static variable frequency power supply may refer to use. It is not applicable to synchronous machines with DC excitation winding.

2 Normative references

The provisions in following documents become the provisions of this Standard through reference in this Standard. For dated references, the subsequent amendments (excluding corrigendum) or revisions do not apply to this Standard, however, parties who reach an agreement based on this Standard are encouraged to study if the latest versions of these documents are applicable. For undated references, the latest edition of the referenced document applies.

GB 755-2008, Rotating Electrical Machines - Rating and Performance (IEC 60034-1.2004, IDT)

GB/T 1029-2005, Test procedures for three-phase synchronous machines

GB/T 1032-2005, Test procedures for three-phase induction motors

GB 10068-2008, Mechanical vibration of certain machines with shaft heights 56 mm and higher-measurement evaluation and limits of vibration severity (IEC 60034-14.2003, IDT)

GB/T 10069.1-2006, Measurement of airborne noise emitted by rotating electrical machines and the noise limits - Part

1.Method for the measurement of airborne noise emitted by rotating electrical machines (ISO 1680.1999, MOD)

GB/T 13958-2008, Test procedures for non-direct current excitation winding synchronous motor

IEC 60034-2-1.2007, Rotating electrical machines - Part 2-

1. Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles)

3 Main symbols

- Power factor; f - Power frequency (Hz); I_1 - Stator line current (A); I_0 - No-load line current (A); I_K - Stalled line current (A); I_N - Rated current (A); I_a - DC motor armature current (A); K_1 - Reciprocal of temperature coefficient of resistance of conductor material at 0°C. Copper $K_1 = 235$; Aluminum $K_1 = 225$ Unless otherwise specified; k_d - Torque reading correction value (N·m); J - Moment of inertia (kg·m²); n - Rotating speed measured during test (r/min); p - Number of pole pairs of the motor; P_1 - Input power (W); P_2 - Output power (W); P_N - Rated (output) power (W); P_{Fe} - Iron consumption (W); P_{fw} - Wind abrasion (W); P_L - Residual loss (W);

4.1.2 Frequency

4.1.2.1 Frequency deviation During the test, the difference between the power supply frequency and the specified frequency shall be within $\pm 0.3\%$ of the specified frequency.

4.1.2.2 Frequency stability No rapid changes in frequency are allowed during the test because the rapid frequency change affects not only the motor under test, but also the output measurement device. The frequency change during the measurement shall be less than 0.1%.

4.2 Measuring instrument

4.2.1 Overview The accuracy level of most instruments is usually expressed as a percentage of full scale. Therefore, try to select low-range meters according to the actual reading needs. Factors that affect the accuracy of instrument measurement results.

4.2.2 Electricity measuring instrument In general, the accuracy of electricity measuring instruments shall not be less than 0.5 (full scale, except megohmmeter). When using method B to measure the motor efficiency, in order to maintain the accuracy and repeatability of the test results, it is required that the accuracy level of the instrument is not less than 0.2 (full scale).

4.2.3 Torque measuring instrument The accuracy level of torque tester (including dynamometer and sensor) for general test should not be lower than level 0.5. When method B (see 10.2.2) is used to determine efficiency, the accuracy level of the torque measuring instrument shall not be lower than level 0.2 (full scale).

4.2.4 Rotating speed and frequency measuring instrument Tachometer reading error is within $\pm 1r/min$. The accuracy level of the frequency meter shall not be lower than level 0.1 (full scale).

4.2.5 Resistance measuring instrument The DC resistance of the winding is measured with a double-arm bridge or a single-arm bridge, or a digital micro-ohmmeter. The accuracy shall not be lower than level 0.2.

4.2.6 Temperature measuring instrument The maximum allowable error of the temperature measuring instrument is $\pm 1^{\circ}C$.

4.3 Measurement requirements

4.3.1 Voltage measurement The signal line of the measuring terminal voltage shall be connected to the motor terminal. If such a connection is not allowed on site, the resulting error shall be calculated, and the reading shall be corrected. Take the arithmetic average of three-phase voltage to calculate the motor performance. The symmetry of the three-phase voltage shall meet the requirements of 4.1.1.2.

4.3.4 Torque measurement A torque tester of a suitable specification shall be used for the load test. In addition to the stall test, out-of-step torque, pull-in torque and minimum torque measurements, the nominal torque of the torque measuring instrument shall not exceed 2 times the rated torque of the tested motor.

4.3.5 Synchronous speed determination and speed measurement

4.3.6 Operating procedures In any test, when reading a series of gradually increasing or decreasing data, it shall be noted that the order of operations to increase or decrease must not be changed to avoid reversing the direction of the test.

4.4 Safety The starting current and starting torque of the self-starting three-phase permanent magnet synchronous motor are large. The test shall involve dangerous current, voltage and mechanical force, so the installation and operation of the motor under test shall be checked. Safety precautions shall be taken for all tests to ensure the smooth progress of each test. All tests shall be performed by personnel with relevant knowledge and experience, and necessary safety protection measures shall be taken.

5.1 Determination of insulation resistance

5.1.1 State of the motor at the time of measurement When measuring the insulation resistance of the motor winding, it shall be carried out under the actual cold state and hot state. During the inspection test, it is allowed to be carried out under actual cold state.

5.1.2 Selection of megohmmeter According to the rated voltage of the motor winding, select the megohmmeter according to Table 1.