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**Insulation coordination for equipment within low-voltage systems - Part
2-1: Application guide - Explanation of the application of the IEC 60664
series, dimensioning example and dielectric testing**

低压系统内设备的绝缘配合 第2-1部分：应用指南 GB/T 16935系列应用解释，定
尺寸示例及介电试验

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1 Scope

This part lays down an application guide for the explanation of the application of the GB/T 16935 series and for the dimensioning requirements.

The important matters to be taken into account are: the nominal system voltage or the rated insulation voltage; the overvoltage category of the product, abbreviated OV cat.; overvoltage of any type; the frequency of the voltage; the characteristics of the solid insulating material; and the pollution degree together with the humidity level.

2 Normative references

The following documents are indispensable for the application of this document. For a dated reference, only the edition cited applies; for an undated reference, the latest edition, including all amendments, applies.

GB/T 16895.10-2010, Low-voltage electrical installations-Part 4-44: Protection for safety-Protection against voltage disturbances and electromagnetic disturbances (IEC

60364-4-44:2007, IDT).

GB/T 16935.1-2008, Insulation coordination for equipment within low-voltage systems-Part 1: Principles, requirements and tests (IEC 60664-1:2007, IDT).

GB/T 16935.3-2005, Insulation coordination for equipment within low-voltage systems-Part 3: Use of coating, potting or moulding for protection against pollution (IEC 60664-3:2003, IDT).

GB/T 16935.4-2011, Insulation coordination for equipment within low-voltage systems-Part 4: Consideration of high-frequency voltage stress (IEC 60664-4:2005, IDT).

GB/T 16935.5-2008, Insulation coordination for equipment within low-voltage systems-Part 5: Method for determining clearances and creepage distances not exceeding 2 mm (IEC 60664-5:2007, IDT). The English wording above renders the Chinese title as printed in this document.

GB/T 17045-2008, Protection against electric shock-Common aspects for installation and equipment (IEC 61140:2001, IDT).

IEC 60085:2007, Electrical insulation-Thermal evaluation and designation.

IEC 60112:2003, Method for the determination of the proof and the comparative tracking indices of solid insulating materials, together with Amendment 1 (2009).

IEC 60216 (all parts), Electrical insulating material-Property of thermal endurance.

3 Terms and definitions

The following terms and definitions apply to this document. A note states that all the definitions may be found in the various parts of the GB/T 16935 series, as shown below.

3.1 Approximately homogeneous field: a field is regarded as approximately homogeneous when its frequency is above 30 kHz and the radius of curvature of its conductive parts is greater than or equal to 20 % of the clearance. Source: GB/T 16935.4-2011, definition 3.1.

3.2 Base material: an insulating material on which a conductive pattern may be formed. Source: GB/T 16935.3-2005, 3.1.

3.3 Basic insulation: insulation applied to hazardous live parts that provides basic protection. Source: GB/T 16935.1-2008, 3.17.2. A note adds that this concept does not apply to insulation used exclusively for functional purposes.

3.4 Clearance: the shortest distance in air between two conductive parts. Source: GB/T 16935.1-2008, 3.2.

3.5 Coating: insulating material such as varnish or dry film on the surface of an assembly. Source: GB/T 16935.3-2005, 3.5. A note adds that the coating and the base material of the printed board form an insulation system with characteristics similar to those of solid

insulation.

3.6 Conductor: a single conductive path within a conductive pattern. Source: GB/T 16935.3-2005, 3.3.

3.7 Creepage distance: the shortest distance between two conductive parts along the surface of a solid insulating material. Source: GB/T 16935.1-2008, 3.3.

3.8 Double insulation: insulation made up of both basic insulation and supplementary insulation. Source: as printed, GB/T 16935.3-2005, 3.17.4.

3.9 Electrical breakdown: the failure of insulation under electrical stress when the discharge completely bridges the insulation, so that the voltage between the electrodes falls to nearly zero. Source: GB/T 16935.1-2008, 3.20.

3.10 Electric field strength: the voltage gradient per unit length, usually expressed in kV/mm. Source: GB/T 16935.4-2011, 3.7. The document prints no English term for this entry.

3.11 Environment: the surrounding conditions that may affect the performance of equipment or of a system. Source: GB/T 16935.1-2008, 3.12. A note lists air pressure, temperature, humidity, pollution, radiation and vibration.

3.12 Flashover: an electrical breakdown along the surface of solid insulation in a gaseous or liquid medium. Source: GB/T 16935.1-2008, 3.20.2.

3.13 Functional insulation: insulation between conductive parts that is necessary only for the proper functioning of the equipment. Source: GB/T 16935.1-2008, 3.17.1.

3.14 Homogeneous field: a field in which the voltage gradient between the electrodes is basically constant, that is, a uniform field, for example the field between two spheres each of which has a radius greater than the distance between them. Source: GB/T 16935.1-2008, 3.14. The English term is printed on the page as homogeneous field.

3.15 Impulse withstand voltage: the highest peak value of an impulse voltage of prescribed form and polarity that does not cause breakdown of the insulation under specified conditions. Source: GB/T 16935.1-2008, 3.8.1.

3.16 Inhomogeneous field: a field in which the voltage gradient between the electrodes is basically not constant, that is, a non-uniform field. Note 1 states that, as regards voltage withstand capability, the inhomogeneous field condition of a point-to-plane electrode arrangement is the worst case, called case A, and may be represented by a point electrode of 30 μm radius and a plane electrode of 1 m x 1 m. Note 2 states that at frequencies above 30 kHz a field is regarded as inhomogeneous when the radius of curvature of the conductive parts is less than 20 % of the clearance. Source: GB/T 16935.1-2008, 3.1.5 modified, and GB/T 16935.4-2011, 3.2.

3.17 Insulation: that which is used in an electrotechnical product to separate conductive

parts at different potentials. Source: GB/T 16935.1-2008, 3.17.

3.18 Insulation coordination: the mutual relation of the insulation characteristics of electrical equipment, taking into account the expected micro-environment and other influencing conditions. Source: GB/T 16935.1-2008, 3.1 modified.

3.19 Macro-environment: the environment of the room or of the other place in which the equipment is installed or used. Source: GB/T 16935.1-2008, 3.12.1.

3.20 Micro-environment: the environment near the insulation that particularly affects the dimensioning of the creepage distance. Source: GB/T 16935.1-2008, 3.12.2.

3.21 Overvoltage: any voltage whose peak value is greater than the corresponding peak value of the maximum steady-state voltage under normal operating conditions. Source: GB/T 16935.1-2008, 3.7.

3.22 Overvoltage category: a numeral defining a transient overvoltage condition. Source: GB/T 16935.1-2008, 3.10 modified.

3.23 Partial discharge, PD: a discharge that partially bridges the insulation. Source: GB/T 16935.1-2008, 3.18.

3.24 Partial discharge inception voltage, U_i with subscript i: the lowest peak value of the test voltage at which, when the test voltage is raised above the value below which no discharge occurs, the apparent charge is greater than the specified discharge magnitude. A note adds that the r.m.s. value may be used for an AC test. Source: GB/T 16935.1-2008, 3.18.4.

3.25 Pollution: any combination of foreign matter, solid, liquid or gaseous, that reduces the electric strength and the surface resistivity of the insulation. Source: GB/T 16935.1-2008, 3.11.

3.26 Pollution degree: a numeral characterising the expected pollution of the micro-environment. Source: GB/T 16935.1-2008, 3.13.

3.27 Printed board: the general name for a completely processed printed circuit and printed wiring structure. Source: GB/T 16935.3-2005, 3.2. A note adds that printed boards include single-sided, double-sided and multi-layer boards with rigid, flexible or rigid-flexible base material.

3.28 Protection: any means by which the influence of the environment can be reduced. Source: GB/T 16935.3-2005, 3.4.

3.29 R.m.s. withstand voltage: the highest r.m.s. value of a voltage that does not cause breakdown of the insulation under specified conditions. Source: GB/T 16935.1-2008, 3.8.2.

3.30 Rated impulse voltage: the impulse withstand voltage value assigned by the manufacturer to the equipment or to a part of it, characterising the specified withstand capability of its insulation against transient overvoltages. Source: GB/T 16935.1-2008,