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**Application guide of insulators for overhead lines with a
nominal voltage over 1000V - Part 1: Ceramic or glass
insulators for A.C. system**

标称电压高于 1000V 架空线路绝缘子使用导则 - 第 1 部分：交流系
统用瓷或玻璃绝缘子

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Application guide of insulators for overhead lines with a nominal voltage over 1000V - Part 1: Ceramic or glass insulators for A.C. system

1 Scope

This standard specifies the general technical requirements, selection principles, inspection, acceptance, on-site storage and transportation, installation and operation and maintenance of AC overhead line insulators which have a nominal voltage higher than 1000 V.

This standard applies to disc-shaped suspended porcelain and glass insulators (hereinafter referred to as insulators) for AC overhead power lines, power plants, substations, which have a nominal voltage higher than 1000 V and a frequency of 50 Hz. The installation site is below 1000 m above sea level; the ambient temperature is between $-40\text{ }^{\circ}\text{C} \sim +40\text{ }^{\circ}\text{C}$.

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/T 311.1 Insulation coordination - Part 1: Definitions, principles and rules

GB/T 772 High-voltage insulator porcelain parts - Technical conditions

GB/T 1001.1 Insulators for overhead lines with a nominal voltage above 1000V - Part 1: Ceramic or glass insulator units for a.c. systems - Definitions, test methods and acceptance criteria

GB/T 2900.5 Electrotechnical terminology - Electrical insulating solids, liquids and gases

GB/T 2900.8 Electrotechnical terminology - Insulators

GB/T 7253 Insulators for overhead lines with a nominal voltage above 1000 V - Ceramic or glass insulator units for a.c. systems - Characteristics of insulator units of the cap and pin type

GB/T 16927.1 High-voltage test techniques - Part 1: General definitions and test requirements

GB/T 20642 Impulse puncture test in air on insulators for overhead lines

GB/T 24623 Radio interference test on high-voltage insulators

GB/T 25318 Locking devices for ball and socket couplings of string insulator units - Dimensions and tests

GB/T 26218.1 Selection and dimensioning of high-voltage insulators intended for use in polluted conditions - Part 1: Definitions, information and general principles

DL/T 626 Testing procedures of degradation of suspension insulator

JB/T 4307 Cement mortar for insulators

JB/T 8177 The hot dip galvanized coating of metallic parts for insulators general technical specification

JB/T 8178 Technical specification of cap for cap and pin insulators

JB/T 9677 Steel pins of cap and pin insulators

JB/T 9678 Appearance quality of toughened glass insulator bodies for cap and pin insulators

3 Terms and definitions

The terms and definitions defined in GB/T 2900.5, GB/T 2900.8, GB/T 1001.1 apply to this document.

4 General technical requirements

4.1 Component characteristics

The characteristics of insulator components shall comply with the provisions of GB/T 7253.

4.2 Insulator

4.2.1 Porcelain components

Porcelain components shall meet the following requirements:

- a) The appearance quality of porcelain components shall comply with the provisions of GB/T 772 and GB/T 1001.1. They shall not have warping, cracks, sand holes,

shrinkage crimping or any other process with more than one piece of material.

- g) The iron cap of the insulator shall not touch the upper surface of the insulating part; the iron cap, insulator, steel foot are on the same axis.
- h) The iron cap and steel foot of the insulator, which has a strength level of 160 kN and above, shall be tested by flaw detection one by one.

4.4 Locking pin

The locking pin shall meet the following requirements:

- a) The locking pin shall comply with the provisions of GB/T 25318 and GB/T 1001.1.
- b) The locking pin shall be made of stainless steel; the material shall not have an anti-corrosion surface layer. To prevent leakage, the size of the bent part at the end of the pin leg shall meet the provisions of GB/T 25318.
- c) Insulators with strength levels of 160 kN and above shall use R-type pins. The R-type pin shall have two separate ends, to prevent it from completely falling out of the ball socket when it is locked and connected.
- d) Special tools shall be used to assemble the locking pin, to avoid damaging the galvanized layer of the metal accessories.

4.5 Cement adhesive

Cement adhesive shall meet the following requirements:

- a) Insulators shall be glued with silicate cement of strength grade 42.5 (R) or above, or adhesive prepared with specially made high-strength low-expansion aluminate cement.
- b) After the cement adhesive is cured, the iron cap and steel foot of the insulator shall not be loose.
- c) The cement adhesive shall completely fill the gap between the insulating part and the metal part and eliminate bubbles.
- d) The autoclave expansion rate of the cement adhesive shall not exceed 0.10%.
- e) The cement adhesive shall not chemically react with metal accessories.
- f) The flatness of the exposed surface of the cement adhesive shall not exceed 2 mm, meanwhile there shall be no cracks or damage.
- g) The prepared cement adhesive shall comply with the provisions of JB/T 4307. The manufacturer shall provide a type test report and a sampling test report, that

the cement adhesive complies with the relevant standards.

Note: The steel foot can be considered as loose, when the horizontal rotation angle is not greater than 3°.

4.6 Deterioration rate (self-explosion rate) of insulators

If the average annual degradation rate (self-explosion rate) of the insulator from installation to commissioning exceeds 0.04%, it is necessary to analyze the cause and take corresponding measures.

The average annual degradation rate (self-explosion rate) of the insulator shall not be greater than 0.04%, within 2 years after commissioning; the average annual degradation rate (self-explosion rate) shall not be greater than 0.02% during the inspection cycle after 2 years, OR the annual degradation rate (self-explosion rate) shall not be greater than 0.1%.

Note: Experience shows that nickel sulfide homogenization treatment of glass parts is an effective measure to reduce the self-explosion rate.

5 Selection principles

5.1 General principles

The selected insulators shall have mature technology, advanced process, reliable quality, operating experience; follow the following principles:

- a) Comprehensively consider the purpose of safe, stable, economical, high-quality power supply of the power grid.
- b) The insulator has a type test report provided by a qualified inspection organization.
- c) The new product has a successful supply record of not less than 1 year of trial operation and not less than 2000 trial operation units.
- d) The mechanical strength of the insulator shall be compatible with the design and operation requirements of transmission lines of different voltage levels and shall be selected in accordance with GB/T 7253.
- e) The pollution characteristics of different types of insulators shall be compared according to the voltage level, operating conditions, use environment; it shall give priority to the insulators, which have high pollution withstand voltage, excellent pollution accumulation characteristics, self-cleaning characteristics under unit structural height.
- f) When the insulator is used at an altitude of more than 1000 m, its external insulation shall be corrected for altitude according to the provisions of GB/T

8 On-site storage and transportation

8.1 On-site storage

On-site storage shall meet the following requirements:

- a) The storage site shall be flat and solid; have necessary drainage measures.
- b) Different insulators shall be stacked separately; the stacking height of the same type of insulators shall be appropriate.
- c) The packaging status shall be checked regularly; the damaged packaging shall be repaired or stacked separately.
- d) Other engineering materials or construction tools shall not be placed on the insulators.

8.2 On-site transportation

On-site transportation shall meet the following requirements:

- a) Choose a reasonable transportation method based on the site conditions.
- b) Avoid opening the packaging as much as possible during transportation; take necessary measures to alleviate the pressure and impact during transportation.
- c) Handle with care during transportation; do not throw or drag.

9 Installation

9.1 Appearance inspection

Before installation, the appearance of the insulators shall be inspected one by one according to GB/T 1001.1 and this Part. Insulators that do not meet the relevant requirements are prohibited from use.

9.2 Insulation resistance measurement

Before installing the porcelain insulators, measure the insulation resistance one by one using an insulation resistance meter of not less than 5000 V. Under dry conditions, the insulation resistance shall not be less than 500 M Ω . Insulators that fail the inspection shall not be installed and used. When the number of unqualified in the same batch is greater than 0.02%, it shall analyze the reasons; carry out dry power frequency withstanding voltage tests one by one.

9.3 Precautions

Installation precautions include:

- a) Be careful to handle with care; do not throw or drag; avoid collision or friction with hard objects.
- b) Take appropriate measures to avoid collision between insulators or between insulators and iron towers.
- c) Use appropriate tools and correct methods to pull the locking pin out to the connection position or put it back to the locking position; confirm the state of the locking pin after completing the connection.
- d) When replacing insulators, working tools or fixtures shall not act on the gap between the iron cap opening and the insulating part.
- e) Insulators shall not be used as hanging points.

10 Operation and maintenance

10.1 File creation

The operating organization shall establish an insulator file in accordance with the provisions of DL/T 626.

10.2 Inspection

When inspecting and checking the insulator, if the locking pin is missing or the insulating part is damaged, it shall be supplemented or replaced in time.

If one of the following situations occurs, the insulator can be determined to be invalid:

- a) The iron cap, insulating part, steel foot are not on the same axis.
- b) The iron cap, insulating part, steel foot are severely burned or burned by the arc.
- c) The iron cap, insulating part, steel foot are cracked, split, or damaged.
- d) The steel foot is bent.
- e) The cement adhesive at the steel foot is obviously detached.

10.3 Degradation detection

Degradation detection shall be carried out in accordance with the relevant provisions of DL/T 626.

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Contact: Wayne Zheng, Sales@ChineseStandard.net

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