# GB

ELECTRIC POWER INDUSTRY STANDARD

OF THE PEOPLE'S REPUBLIC OF CHINA

ICS 29.080.10

K 48

Reference No.: 36391-2012

# DL/T 627-2012

Replacing DL/T 627-2004

# Room temperature vulcanized silicon rubber anti-pollution coating for insulators

绝缘子用常温固化硅橡胶防污闪涂料



**Issued on: April 6, 2012** **Implemented on: July 1, 2012**

**Issued by: National Energy Administration**

# Table of Contents

Foreword ..... 3

1 Scope ..... 4

2 Normative references ..... 4

3 Terms and definitions ..... 6

4 Basic technical requirements ..... 6

5 Inspection rules ..... 9

6 Packaging and storage ..... 10

7 Selection principle ..... 11

8 Acceptance ..... 11

9 Construction ..... 12

10 Operation maintenance ..... 12

11 Technical management ..... 15

Annex A (Normative) Test method for shear strength ..... 16

Annex B (Normative) Self-cleaning test method ..... 19

Annex C (Normative) Test method for impact breakdown voltage ..... 22

Annex D (Normative) Aging test under operating voltage and simulated climate ..... 24

Annex E (Normative) RTV coating thickness measured by slice method ..... 25

# Foreword

This Standard replaces DL/T 627-2004 Room temperature vulcanized silicon rubber anti-pollution coating for insulators. Compared with DL/T 627-2004, the main differences in this Standard are as follows:

- modified the “Terms”, “Basic technical requirements”, “Inspection rules” and “Operation maintenance” in DL/T 627-2004;
- added “Overhaul” and “Technical management”.

This Standard was proposed by China Electricity Council.

This Standard shall be under the jurisdiction of National Technical Committee on Power Industry Insulators of Standardization Administration of China.

Main revising organization of this Standard: State Grid Electric Power Research Institute.

The drafting organizations of this Standard: State Grid Corporation, Hebei Electric Power Research Institute, Hebei Silicon Valley Chemical Co., Ltd., East China Electric Power Design Institute.

Main drafters of this Standard: Wu Guangya, Ye Tinglu, Gao Jun, Zhang Yue, Zhang Qin, Zhang Zhigang, Song Furu, Huang Weizhong, Jia Boyan.

Send any opinions or suggestions during the implementation of this Standard to China Electric Power Enterprise Federation Standardization Management Center (address: No. 1, 2nd Lane, Baiguang Road, Beijing, 100761)

# Room temperature vulcanized silicon rubber anti-pollution coating for insulators

## 1 Scope

This Standard specifies the basic technical requirements, inspection rules, packaging and storage, selection principle, acceptance, construction, operation maintenance and technical management of room temperature vulcanized silicon rubber anti-pollution coating for insulators (referred to as RTV).

This Standard is applicable to RTV coating used for insulators that are operating under the pollution conditions that AC system rated voltage is higher than 1000 V, ambient temperature is at -40°C ~ +40°C.

This Standard shall be used for DC system as reference.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 529-2008, *Rubber vulcanized or thermoplastic - Determination of tear strength (Trouser，angle and crescent test pieces)*

GB/T 775.1-2006, *Test method for insulators - Part 1: General test methods*

GB/T 775.2-2003, *Test method for insulators - Part 2: Electrical test methods*

GB/T 1408.1-2006, *Electrical strength of insulating materials - Test methods - Part 1: Tests at power frequencies*

GB/T 1409-2006, *Recommended methods for the determination of the permittivity and dielectric dissipation factor of electrical insulating materials at power, audio and radio frequencies including meter wavelengths*

GB/T 1692-2008, *Vulcanized rubber - Determination of the insulation resistivity*

GB/T 1720-1979, *Method of test for adhesion of paint films*

GB/T 1723-1993, *Determination of viscosity of coatings*

GB/T 1725-2007, *Paints varnishes and plastics - Determination of non-volatile-matter content*

GB/T 1768-2006, *Method of test for abrasion resistance of paint films*

GB/T 2900.5, *Electrotechnical terminology - Insulating solids, liquids and gases*

GB/T 2900.8, *Electrotechnical terminology - Insulators*

GB/T 2900.19, *Electrotechnical terminology - High-voltage test technique and insulation co-ordination*

GB/T 6553-2003, *Test methods for evaluating resistance to tracking and erosion of electrical insulating materials used under severe ambient conditions*

GB/T 6753.2, *Paints and varnishes - Surface-drying test - Ballotini method*

GB/T 9274-1988, *Paints and varnishes; Determination of resistance to liquids*

GB/T 10707-2008, *Rubber - Determination of the burning*

GB/T 13936, *Rubber, vulcanized - Method for determination of strength properties of adhesive to metal in shear by tension loading*

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

GB/T 16927.2, *High-voltage test techniques - Part 2: Measuring systems*

GB/T 19519, *Insulators for overhead lines - Composite suspension and tension insulators for a.c. systems with a nominal voltage greater than 1000 V - Definitions, test methods and acceptance criteria*

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

DL/T 859, *Artificial Pollution Tests on Composite Insulators Used on High-voltage AC Systems*

DL/T 864, *Application guide of composite insulators for AC overhand lines with a nominal voltage over 1000 V*

# 3 Terms and definitions

For the purposes of this document, the terms and definitions defined in GB/T 2900.5, GB/T 2900.8 and GB/T 2900.19 as well as the follows apply.

### 3.1 anti-pollution coating

A layer of room temperature curing silicone rubber coating on the insulating surface of the insulator under the condition of pollution, referred to as RTV anti-pollution coating. This Standard divides RTV coating products into ordinary RTV-I type and enhanced RTV-II type.

### 3.2 RTV coating

a thin film of a layer of room temperature cured silicone rubber coated on the insulating surface of the insulator is called a coating

### 3.3 Self-cleaning

the ability of RTV coating inhibiting the adhesion of dirt to its surface

# 4 Basic technical requirements

### 4.1 Coating

#### 4.1.1 Appearance

A viscous liquid of color uniformity, no obvious mechanical impurities and floc.

#### 4.1.2 Solid content

The solid content is not less than 50%.

#### 4.1.3 Viscosity

At 25°C, the viscosity of the coating is not less than 80s (coated with -4 viscometer).

#### 4.1.4 Hydrophobicity

The hydrophobicity shall meet requirements of Annex A in DL/T 864.

#### 4.1.5 Insulation performance

The insulation performance shall meet the following:

a) the volume resistivity is not less than 1.0×1012 Ω•m;

Respectively soak in the 25°C acid, alkali, salt reagent (concentration of 3%) 24h, there shall be no shedding, wrinkling, blistering, discoloration or other phenomena.

#### 4.1.9.2 Oil resistance

Soaking in the 100°C transformer oil 24h, there shall be no shedding, wrinkling, blistering, discoloration, etc.

### 4.2 RTV coating

#### 4.2.1 Appearance

RTV coating is flat, smooth and free of bubbles.

#### 4.2.2 Pollution pressure performance

For reference disc-type suspension insulators（e.g. U160B）, according to the test method specified in DL/T 859, when the salinity (SES) is 20 kg/m$^3$ and above, or the test salt density (SDD) is 0.1 mg/cm$^2$ and the gray density (NSDD) is 0.5 mg/cm$^2$, after the hydrophobicity of polluted layer surface is removed, under the same test conditions, the insulator pollution voltage with RTV coating $U_1$, comparing to the the insulator pollution voltage with RTV coating $U_2$, shall not be less than 2.0 when using solid layer method, not less than 1.5 when using salt spray method.

#### 4.2.3 Impact breakdown performance

The impact breakdown performance of disc-type suspension porcelain (glass) insulator that uses RTV-II type with 160 kN and above shall comply with the provisions of GB/T 20642. See Annex C for its test method and determination rules.

#### 4.2.4 5000h artificial accelerated aging test

The 5000h artificial accelerated aging test shall be carried out by both parties based on negotiation. See Annex D for 5000h artificial accelerated aging test method.

#### 4.2.5 Coating thickness

In general, RTV coating thickness is required not less than 0.3 mm. The coating thickness using RTV-II type coating insulator in factory is 0.4 mm ± 0.1 mm. Use slice method to measure RTV coating thickness. See Annex E for coating thickness test method.

#### 4.2.6 Curing time

b) the packaging container must be marked with the product model, name, manufacturer, production time, storage warranty, inspection qualification mark and number.

### 6.2 Storage

The storage shall meet the following:

a) the RTV coating is stored at room temperature in a cool and dry place, away from fire, sunlight and rain;

b) the product storage warranty period is not less than 6 months. If it exceeds 6 months, the test shall be carried out according to the sampling test items specified in this Standard. It shall be used when qualified.

## 7 Selection principle

The selection of RTV coating shall following the following principles:

a) the RTV coating selected shall meet the requirements of this Standard and must have the type test report provided by qualified testing organization;

b) priority is given to RTV coating with successful operation experience and single component in local environment;

c) in the factory spraying, it shall give priority to the use of RTV-II anti-pollution coating;

d) good self-cleaning product shall be selected for heavy dust, DC equipment and heavy pollution areas.

## 8 Acceptance

### 8.1 Acceptance content

The acceptance content usually contains:

a) the exit-factory certificate (including batch sampling test report);

b) the consistency of packing list and accessories;

c) the instructions for use.

### 8.2 Objection

# Annex A

(Normative)

**Test method for shear strength**

## A.1 Principle and basic requirements

This test method specifies the method of determining the tensile shear strength of the coating with the surface of the spinach or porcelain plate.

This test method is applicable to the preparation of the coating with two parallel glass plates (or porcelain plate) bonded shear specimen. The coating is bonded to the glass plate (or porcelain plate) by vulcanization. The sample is a coating that is sandwiched between two parallel glass plates (or porcelain plates). A tensile shearing force is applied to the adhesive surface of the sample. Measure the maximum tensile shear force of the sample. The maximum tensile shearing force on the unit adhesive surface of the sample shall be the bond tensile shear strength of coating and glass plate (or porcelain plate).

The measuring tool accuracy of measuring the length and width of the sample is not less than 0.05 mm. The tensile testing machine shall be equipped with a self-aligning device after the test force to ensure that the direction of loading force is consistent with the sample centerline.

The following shall take the bonding of coating and glass plate as example. The test of coating and porcelain plate can refer to the implementation.

## A.2 Sample

### A.2.1 Sample preparation

Use a glass plate and an aluminum plate to form a shear sheet (see Figure A.1). The length of the glass plate is 70.0 mm ± 0.2 mm, width is 20.0 mm ± 0.2 mm, thickness is 5.0 mm ± 0.1 mm. The length of the aluminum plate is 150.0 mm ± 0.2 mm, width is 20.0 mm ± 0.2 mm, thickness is 2.0 mm ± 0.1 mm. The bonding length between the glass plate and the aluminum plate is 70 mm ± 1 mm and the bonding width is 20.0 mm ± 0.2 mm.

### A.2.3 Test results and evaluation method

The tensile shear strength of the coating with the glass plate (or porcelain plate) is calculated according to the following equation:

$$\tau = p/(L \times W) \qquad (A.1)$$

where,

$\tau$ - tensile shear strength of the coating with the glass plate (or porcelain plate), MPa;

p - maximum load of the sample shear failure, N;

L - length of sample adhesive surface, mm;

W - width of sample adhesive surface, mm.

The results of the test results are expressed as the arithmetic mean of the tensile shear strength, taking 3 significant digits. The sample destruction type is represented by the following symbols:

R for coating vulcanization damage; G for coating and glass plate bonding surface damage.

# Annex B

(Normative)

**Self-cleaning test method**

## B.1 Materials and instruments

a) Glass bead: diameter of 125 μm ~ 250 μm.

b) Electronic balance: accuracy not less than 0.1 mg.

c) 0.003 mm ~ 0.01 mm polyethylene film (it can be replaced by food fresh-keeping film).

## B.2 Sample

Apply coating on three pieces of 10 cm × 8 cm. Under standard laboratory conditions (temperature of 25°C ± 2°C, 40%RH ~ 70%RH), solidify it more than 96h for use.

## B.3 Glass bead method

This method is applicable to quantitative evaluation of paint self-cleaning in laboratory.

a) Place the sample horizontally on the test bench (the 10 cm-long side is in the horizontal direction, the 8 cm-long side is in the vertical direction). Place a barrier at 0.5 cm from the top edge of the sample. The barrier is in close contact with the coating surface.

b) Weigh 0.3 g of glass beads. Carefully dump them on top of the sample surface barrier to pave a glass bead layer with length of 5 cm, width of 0.5 cm.

c) Place the sample together with the barrier and the glass beads, rotate horizontally to 45°. At this time, the barrier shall be able to effectively ensure that the glass beads remain in the original position without falling along the slope of the coating.

d) Quickly remove the barrier from the coating surface. The glass beads slide along the slope of the sample coating.

e) Remove the sample. The glass beads from the sample surface to the lower in the collector are collected and weighed m (unit: g).

# Annex C

(Normative)

**Test method for impact breakdown voltage**

## C.1 General requirements

The test shall be carried out according to the provisions of GB/T 16927.1, GB/T 16927.2. Before the test, the sample surface shall be cleaned and in a heat balance state with the environment.

The generation and measurement of testing voltage shall comply with the provisions of GB/T 20642.

## C.2 Sample preparation

The insulator shall be determined by the supplier and the purchaser.

It shall use normal construction process to apply the RTV coating to the outer insulation surface of the porcelain or glass insulator using. And fully solidify it.

Unless otherwise agreed by the supplier and the purchaser, the number of type test items is 10.

The sample installation method shall be in accordance with GB/T 20642.

## C.3 Test procedure

The test method shall be in accordance with the amplitude method specified in GB/T 20642. Each impulse voltage amplitude is (2.8 ~ 3.08) $U_{50}$.

NOTE: $U_{50}$ refers to 50% flashover voltage of negative polarity lightning impulse of a single insulator. General U160BL ordinary insulator -$U_{50}$ can take 120 kV, or obtain its monolithic insulator -$U_{50}$ by lifting method according to GB/T 20642.

## C.4 Acceptance criteria

### C.4.1 Conventional criteria

If there is no product breakdown or insulation damage, it shall pass the test.

### C.4.2 Special criteria

When the test voltage is above or below the allowable range of the specified value, these criteria apply when a breakdown occurs.

# Annex D

(Normative)

**Aging test under operating voltage and simulated climate**

## D.1 Scope

This method specifies the artificial accelerated aging test method of anti-pollution coating used by AC system insulator - the aging test under operating voltage and simulated climate. The RTV anti-pollution coating used for insulator of DC system can use it for reference.

## D.2 Reference

GB/T 19519-2004 Annex C

## D.3 Sample

The sample includes two strings of insulators, one string used to simulate linear string and the other to simulate resistance string. Each string of insulators consists of two insulators. The creepage distance of each string of insulator shall be between 519 mm ~ 956 mm. Insulators should be coated with anti-pollution coating based on the normal construction process. The coating thickness is not less than 0.3 mm.

## D.4 Test equipment and test procedure

In accordance with Annex C of GB/T 19519-2004.

## D.5 Determination principle

a) Each string of samples does not exceed 3 overcurrent interrupts.

b) Coating etching depth is not more than 0.3 mm.

c) Hydrophobic migration properties of coating: hydrophobicity classification is generally HC2 ~ HC3 levels and no more than one sample for HC4 ~ HC5 levels.

d) Refer to DL/T 864 recommended hydrophobicity test and evaluation method. The highest level of hydrophobicity classification is HC1 level, the lowest level is HC7 level.

**This is an excerpt of the PDF (Some pages are marked off intentionally)**



**------ The End ------**