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Generality of Rat and Termite Proof Wires and Cables

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Foreword

This Standard was drafted in accordance with the rules in GB/T 1.1-2009.

This Standard was proposed by China Electrical Equipment Industry Association.

This Standard shall be under the jurisdiction of National Technical Committee on Wire and Cables of Standardization Administration of China (SAC/TC 213).

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Generality of Rat and Termite Proof Wires and Cables

1 Scope

This Standard stipulates the product classification, marking, technical requirements, inspection rules and test methods of rat and termite proof wires and cables.

This Standard is applicable to wires and cables equipped with rat-proof characteristic; wires and cables equipped with termite-proof characteristic; wires and cables which have both characteristics in rat and termite proof.

2 Normative References

The following documents are indispensable to the application of this document. In terms of references with a specified date, only versions with a specified date are applicable to this document. In terms of references without a specified date, the latest version (including all the modifications) is applicable to this document.

GB/T 2900.10 *Electrotechnical Terminology - Electric Cables*

GB/T 2951.12 *Common Test Methods for Insulating and Sheathing Materials of Electric and Optical Cables - Part 12: Methods for General Application - Thermal Ageing Methods*

GB/T 50768 *Standard for Basic Terminology of Termite Control Project*

JB/T 10696.9-2011 *Test Methods for Determining Mechanical, Physical and Chemical Properties of Electric Cables and Wires - Part 9: Termite Test*

JB/T 10696.10-2011 *Test Methods for Determining Mechanical, Physical and Chemical Properties of Electric Cables and Wires - Part 10: Rat Gnawing Test*

3 Terms and Definitions

What is defined in GB/T 2900.10 and GB/T 50768, and the following terms and definitions are applicable to this Standard.

3.1 Rat Proof

Rat proof means under the stipulated test conditions, after the test piece and the test rat co-exist for a stipulated period of time, the characteristic of test piece area loss in the most severely bitten area within a limited range.

NOTE: the test piece itself has the ability to protect from rat bites.

3.2 Termite Proof

Termite proof means under the stipulated test method and test conditions, the characteristic of the extent, to which, the test piece is eroded by termites within a limited range. In other words, it refers to the test piece's ability to protect from erosion by termites.

NOTE: the test piece itself has the ability to protect from erosion by termites.

3.3 Rat and Termite Proof Wires and Cables

Rat and termite proof wires and cables is a generic term for wire and cable products that comply with corresponding wire and cable standards and have the characteristic and function of rat-proof and/or termite-proof stipulated in this Standard.

NOTE: it includes rat-proof wires and cables; termite-proof wires and cables; wires and cables which have both characteristics in rat and termite proof.

3.4 The Basic Model

The basic model refers to stipulated models for wire and cable products included in the existing national standards, industrial standards and other standards approved by the market.

3.5 Type Tests

Type tests refers to tests that are conducted on the type of wires and cables included in this Standard before the delivery in accordance with general business principles, with the purpose of proving that the wires and cables have satisfying performance that can satisfy the expected service conditions.

NOTE: the characteristic of the tests is: unless a change in cable materials, or design, or manufacturing process, may vary the characteristics of the cable, there is no need to re-conduct the tests after the tests have been performed.

4 Product Classification and Marking

4.1 Rat-proof and Termite-proof Characteristic Code

Rat-proof and termite-proof characteristic code and applicable places of rat-proof and termite-proof wires and cables are shown in Table 1.

Table 1 -- Rat-proof and Termite-proof Characteristic Code

Code	Protection/Erosion Grade	Applicable Places
FS1	Rat-proof (significant) Grade-1	It is applicable to regions and environments with

FS2	Rat-proof (good) Grade-2	damage and severe damage caused by rats. Cables may be laid in cable trenches, cable troughs, cable bridges, tunnels and pipe corridors, ships, etc. Cables may also be directly buried underground at a certain depth; improve the safety and reliability of power and communication line operations.
FY1	Termite-proof Grade-1	It is applicable to comprehensive termite management and prevention in areas damaged by termites described in GB/T 50768; improve the safety and reliability of power and communication line operations.
FSY11	Rat-proof (significant) Grade-1 and Termite-proof Grade-1	It is applicable to regions and environments with damage and severe damage caused by rats and termites. Cables may be laid in cable trenches, cable troughs, cable bridges, tunnels and pipe corridors, ships, etc. Cables may also be directly buried underground at a certain depth; improve the safety and reliability of power and communication line operations.
FSY21	Rat-proof (good) Grade-2 and Termite-proof Grade-1	

When there is demand, through the negotiation between the demand-side and the supply-side, other protection grades and erosion grades of rat-proof and termite-proof wires and cables that are assessed in JB/T 10696.9-2011 and JB/T 10696.10-2011 may also be manufactured and used. The identification and delivery of products should be determined by the demand-side and the supply-side through negotiation.

4.2 Product Representation Method

Rat-proof and termite-proof wire and cable products shall be represented by the liaison of “rat-proof and termite-proof characteristic code-basic model, specification, and serial number of corresponding standards being implemented”.

In the identification of wire and cable products which have multiple additional characteristics and functions, regardless of the sequence of the characteristic codes, use “-” to separate and connect them. In addition, in accordance with the adopted sequence, successively write down the standards respectively implemented. Use half blank character to separate two adjacent standards.

Example 1: rat-proof Grade-1; copper core crosslinked polyethylene insulated steel tape armored PVC sheathed power cable; rated voltage: 0.6/1 kV, 3 + 1 core; nominal cross-sectional area: 95 mm²; neutral cross-sectional area: 50 mm²; implemented standard: GB/T 12706.1-2008, shall be represented as:

FS1-YJV22-0.6/1 3×95+1×50 GB/T 34016—2017 GB/T 12706.1—2008

Example 2: rat-proof Grade-1; copper core PVC insulated steel tape armored PVC sheathed control cable; used for fixed laying; rated voltage: 450/750 V, 24 core; 1.5 mm²; steel tape armoring; without green/yellow two-color insulated wire core; implemented standard: GB/T 9330.2-2008, shall be represented as:

FY1-KVV22-450/750 24×1.5 GB/T 34016—2017 GB/T 9330.2—2008

Example 3: rat-proof Grade-2 and termite-proof Grade-1; flame retardant Class-B; ethylene propylene rubber insulated copper wire braided armored elastic outer sheathed marine control cable; rated voltage: 150/250 V, 19 core; nominal cross-sectional area: 1.5 mm²; implemented standard: GB/T 9332-2008 and GB/T 19666-2005, shall be represented as:

FSY21-ZB-CKE84-150/250 19×1.5 GB/T 34016—2017 GB/T 19666—2005 GB/T 9332—2008

5 Technical Requirements

5.1 General Requirements

5.1.1 During the operation, rat-proof and termite-proof wires and cables shall continuously and effectively be equipped with the expected protection performance stipulated in 5.2, 5.3 or 5.4.

5.1.2 No matter what kind of physical protection or chemical protection measures are taken, as long as products with rat-proof, termite-proof or rat and termite-proof characteristics are added, type tests shall be conducted in accordance with the stipulations in 6.1.

5.1.3 Cable materials and their processing technology (including after certain protective measures are adopted) that are selected to implement the rat-proof and termite-proof characteristics shall not affect human health or destroy the surrounding natural ecology and environment.

5.2 Rat-proof Characteristic

The magnitude of rat-proof characteristic of wires and cables shall adopt protection rate value-*P*, which is determined in JB/T 10696.10-2011, and test piece surface descriptive evaluation after the tests. In addition, it shall also comply with the stipulations in Table 2.

Table 2 -- Magnitude Requirements of Rat-proof Characteristic of Wires and Cables

Code	Characteristic Magnitude	Test Piece Surface Description after Tests
FS1	$P \geq 0.9$	There are no teeth marks or visible bite marks on the surface of the test piece sheath, and the bite depth shall be less than 1 mm.

FS2	$0.9 > P \geq 0.7$	There are bite marks that are more than 1 mm on the surface of the test piece sheath, but the value shall be not more than 1/2 of the thickness of the outer sheath.
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5.3 Termite-proof Characteristic

5.3.1 The termite-proof characteristic of wires and cables shall adopt experimental population method in JB/T 10696.9-2011 for evaluation. When the customer has demands, through the negotiation between the demand-side and the supply-side, ant nest method in JB/T 10696.9-2011 may also be adopted for evaluation.

5.3.2 The determination result of the experimental population method and the ant nest method shall comply with the requirements in Table 3.

Table 3 -- Magnitude Requirements of Termite-proof Characteristic of Wires and Cables

Code	Description of Wire and Cable Erosion after Tests
FY1	There shall be no teeth marks of erosion by termites on the surface of wires and cables

5.4 Rat and Termite-proof Characteristic

The rat and termite-proof characteristic of wires and cables shall adopt test pieces that are taken from the same sample. In accordance with the requirements in 5.2 and 5.3, respectively conduct evaluation of rat-proof characteristic and termite-proof characteristic; the characteristic magnitude shall comply with the stipulations in Table 4.

Table 4 -- Magnitude Requirements of Rat and Termite-proof Characteristic of Wires and Cables

Code	Characteristic Magnitude	Test Piece Surface Description after Tests
FSY11	Rat-proof Grade-1 & Termite-proof Grade-1	There shall be no rat bite teeth marks or visible bite marks on the surface of the test piece sheath, and the bite depth shall be less than 1 mm; there shall be no marks of erosion by termites on the surface.
FSY21	Rat-proof Grade-2 & Termite-proof Grade-1	There are rate bite marks that are more than 1 mm on the surface of the test piece sheath, but the value shall be not more than 1/2 of the thickness of the outer sheath; there shall be no marks of erosion by termites on the surface.

6 Inspection Rules

6.1 Type Tests

6.1.1 The rat and termite-proof characteristic of wires and cables shall adopt type tests for evaluation, which includes characteristic tests of unaged and after accelerated ageing treatment (6.2).

6.1.2 Type test items of rat and termite-proof wires and cables shall comply with, or, fully cover the requirements of various implemented standards provided in the basic model, and the rat-proof and termite-proof characteristic.

6.1.3 In terms of the same model of rat-proof and termite-proof wires and cables of multiple specifications, at least one specification of products shall be taken for tests of the characteristic index. If the test pieces are qualified, then, it can be determined that all the specifications of the model have the stipulated characteristic.

6.1.4 If the manufacturer has a valid type test report of the same basic model of products, which are not attached with the rat-proof and termite-proof characteristic, test pieces for the type tests of corresponding rat-proof and termite-proof products may be randomly taken from the manufacturer, or, from the user's current stock.

6.1.5 Test pieces used for the tests of the rat-proof characteristic of wires and cables shall be taken from any specification of products whose external diameter is not more than 30 mm. When there are multiple options, preferably choose the specification with a smaller external diameter.

6.1.6 Test pieces used for the tests of the termite-proof characteristic of wires and cables may be taken from any specification of products. When there are multiple options, preferably choose the specification with a larger external diameter.

6.1.7 Test pieces used for the tests of the rat-proof and termite-proof characteristic of wires and cables may be taken from any specification of the same product whose external diameter is not more than 30 mm, or, be respectively taken from different specifications of products on the premise of satisfying 6.1.5 and 6.1.6.

6.1.8 Type tests shall be completed by a third-party inspection institution entrusted by the manufacturer. When the user has demands, through the negotiation between the demand-side and the supply-side, type tests may be re-conducted. Under the circumstance that there are no changes in cable materials, or design, or manufacturing process, the re-conducted type test items can merely include characteristic index tests in accordance with the stipulations in 5.2, 5.3 and 5.4.

6.2 Determination of Continuity and Effectiveness

6.2.1 After the accelerated ageing treatment of test pieces of wire and cable products, determine the rat-proof, termite-proof, or rat and termite-proof characteristic magnitude in accordance with the test methods described in 5.2, 5.3 and 5.4. Adopt this method to evaluate its continuity and effectiveness.

6.2.2 The recommended ageing treatment conditions are shown in Table 5. Test

method shall comply with the requirements in GB/T 2951.12. When other wire and cable outer sheath materials are involved, it is recommended to adopt the conditions stipulated in the implemented standards of the basic model of products.

Table 5 -- Ageing Treatment Conditions of Test Pieces

Outer Sheath Materials of Wires and Cables	Ageing Treatment Temperature ℃	Ageing Treatment Time h
PVC (ST ₁ , ST ₂)	100	168
Polyethylene (ST ₇)	110	240
Halogen-free Flame Retardant (ST ₈)	100	168
Elastomer (SE ₄)	100	168

6.2.3 When the characteristic magnitudes determined in two times of unaged and after ageing treatment of the same batch of products, or products within the coverage of the same valid type test report are in the same grade, then, the characteristic function shall be determined as continuous and effective.

6.2.4 When there is demand, under the circumstance that there are no changes in cable materials, or design, or manufacturing process, re-conducted type test items may allow to use test pieces after the ageing treatment in one-time characteristic determination, and the determination of continuity and effectiveness.

6.3 Confirmatory Test

6.3.1 If necessary, when the type test items of the same type of products are all qualified, the rat-proof characteristic of wires and cables whose external diameter is more than 30 mm in the same type of products may be confirmed in accordance with the test method in Appendix A.

6.3.2 Test pieces in confirmatory test shall be randomly taken from the batch of products that are already confirmed.

6.3.3 When confirmatory test is conducted, the test result after the ageing treatment may be simultaneously used to determine the stipulated characteristic function, and the continuity and effectiveness.

Appendix A

(normative)

Confirmatory Test Method of Rat-proof Characteristic of Large-diameter Wires and Cables

A.1 General Principle

This Method is applicable to the confirmation of the rat-proof characteristic of wires and cables (external diameter is more than 30 mm) which are qualified in type tests.

This Method is not applicable to relevant rat-proof characteristic test requested in type tests.

A.2 Variety and Breeding of Rats

The variety and breeding of rats shall comply with the stipulations in JB/T 10696.10-2011.

A.3 Test Methods

A.3.1 Test conditions

A.3.1.1 SD rats: around 12-week-old; mass of female rats: (250 ± 20) g, mass of male rats: (300 ± 20) g; quantity: 10 female rats and 10 male rats; 5 rats of the same gender in each cage; respectively 2 cages of rats. Add rat breeding necessities to each cage, namely, sawdust, feeds and water. Breed the rats in a clean-level facility, or above.

A.3.1.2 Test pieces: from finished cables, produce sheath strip test pieces; flatten or grind the test pieces to the thickness of (2.0 ± 0.2) mm. Then, cut 300 mm \times 30 mm strip test pieces. Produce 8 test pieces in total.

A.3.1.3 Environmental conditions: clean-level, or above.

A.3.1.4 Other articles: micrometer, air condition, balance, water bottle, rat feeds, sterilized clothes, gloves and masks, etc.

A.3.2 Test procedures

Place 2 test pieces in each cage. The test pieces shall be hanged in the middle of the rat cage. Conduct the test for 14 successively days. Maintain normal feeding every day; observe the rats' activities, diet and the biting of the test pieces. In addition, complete surface description and the record of time.

A.4 Evaluation of Test Results

A.4.1 During the test, test rats' diet and activities shall be normal; there shall be no phenomena of intoxication or death. If there is death, the test institution shall find out the cause. If the cause is determined as intoxication of rat-proof repellent, then, the test shall be terminated; test result shall be determined as disqualified. If it is other causes, use the same variety and the same size of healthy rats as a replacement, then, continue the test.

A.4.2 The qualification evaluation of the confirmatory test result shall comply with one of the following two stipulations:

- a) There are no teeth marks or slight teeth marks of rat bite on the surface of the test pieces;
- b) Within the test cycle, it has significant or obvious ability of protecting from rat bite.

Bibliography

- [1] GB/T 9330.2-2008 *Plastic Insulated Control Cables - Part 2: Polyvinyl Chloride Insulated and Sheathed Control Cables*
- [2] GB/T 9332-2008 *Electrical Installations in Ships - Cables for Control and Instrumentation Circuits 150/250 V (300 V)*
- [3] GB/T 12706.1-2008 *Power Cables with Extruded Insulation and Their Accessories for Rated Voltages from 1 kV ($U_m = 1.2$ kV) up to 35 kV ($U_m = 40.5$ kV) - Part 1: Cables for Rated Voltage of 1 kV ($U_m = 1.2$ kV) and 3 kV ($U_m = 3.6$ kV)*
- [4] GB/T 19666-2005 *Flame Retardant and Fire Resistant Wires and Cables*

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