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**Copper-Conductor Extruded Plastic Insulated Cables
with Pre-Fabricated Branches for Rated Voltage of
0.6/1kV ($U_m=1.2kV$)**

额定电压 0.6/1kV ($U_m=1.2kV$) 铜芯塑料绝缘预制分支电缆

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Copper-Conductor Extruded Plastic Insulated Cables with Pre-Fabricated Branches for Rated Voltage of 0.6/1kV ($U_m=1.2kV$)

1 Scope

This Standard specifies the product structure, technical requirements, cable test, acceptance rules, marking and packaging of copper-conductor extruded plastic insulated cables with prefabricated branches for a rated voltage of 0.6kV/1kV.

This Standard is applicable to cables with prefabricated branches used in air-laid buildings and supply mains for rated voltages of 0.6kV/1kV and below; and cables with prefabricated branch for illumination of tunnels and bridges, as well as for other similar purposes.

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/T 1040-1992 Plastics - Determination of Tensile Properties

GB/T 1408.1-1999 Methods of Test for Electric Strength of Solid Insulating Materials -Tests at Power Frequencies (eqv IEC 60243-1:1988)

GB/T 1410-2006 Methods of Test for Volume Resistivity and Surface Resistivity of Solid Electrical Insulating Materials (IEC 60093:1980, IDT)

GB/T 2406-1993 Plastics - Determination of Flammability by Oxygen Index (neq ISO 4589:1984)

GB/T 2900.10 Electrotechnical Vocabulary - Electric Cables (GB/T 2900.10-2001, idt IEC 60050(461):1984)

and Conductivity (GB/T 17650.2-1998, idt IEC 60754-2:1991)

GB/T 18380.1 Tests on Electric Cables under Fire Conditions - Part 1: Test on a Single Vertical Insulated Wire or Cable (GB/T 18380.1-2001, idt IEC 60332-1:1993)

GB/T 18380.3 Tests on Electric Cables under Fire Conditions - Part 3: Tests on Bunched Wires or Cables (GB/T 18380.3-2001, idt IEC 60332-3:1992)

GB/T 19216.21-2003 Tests for Electric Cables under Fire Conditions - Circuit Integrity - Part 21: Procedures and Requirements - Cable of Rated Voltage up to and Including 0.6/1.0 kV (IEC 60331-21:1999, IDT)

JB/T 8137.1~8137.4 Delivery Drums for Electric Wires and Cables

IEC 60332-3 Tests on Electric and Optical Fibre Cables under Fire Conditions – Part 3: Burning Test Method for Bundled Wires or Cables

3 Terms and Definitions

For the purposes of this Standard, the terms and definitions given in GB/T 2900.10 and the following apply.

3.1 Cable with pre-fabricated branches

The cables with pre-fabricated branches are a complete and continuous set of cables pre-fabricated by the factory. At the specified positions and requirements of the trunk cable, the conductors of the trunk cable and the branch cable are compressed and connected by copper or copper alloy tubes; and perform the complete insulation treatment. When laying vertically, the upper end has a suitable device for hanging; when laying horizontally, the traction member can be optional. The cable end at the device for hanging or traction mechanism shall also have a complete insulation treatment.

3.2 Branch-jointer

The sealed components that the conductors of trunk and branch cables are compressed and connected by copper or copper alloy tubes and perform the complete insulation treatment.

3.3 “C” shaped connector for conductors

A device that is used to connect conductors of cables with prefabricated branches. Its cross-section is like a C-shaped copper or copper alloy connecting tube, which facilitates the snap-in and compression connection of the conductors of trunk and

U_m is the highest allowable working voltage of the cable, and the unit is kV.

NOTE: The working voltage of the system is allowed to exceed 10% of the nominal voltage of the system for a long time. If the rated voltage of the cable is at least equal to the nominal voltage of the system, the cable can be used at a working voltage higher than 10% of the rated voltage.

4 Model and Specification

4.1 Symbol and code

Serial codes:

Cable with pre-fabricated branches: FZ;

Classify according to the characteristics:

Copper conductor: ignored;

Polyvinyl chloride: V;

Crosslinked polyethylene: YJ;

Polyethylene (polyolefin): Y;

Codes of combustion characteristics:

Flame-retardant: Z;

Fire-resistant: N;

Halogen-free: W;

Low-smoke: D.

4.2 Product representation method

Products are represented by model, specification and standard number; and specification include rated voltage, the number of cores, and conductor cross-sectional area, etc. In order to facilitate to distinguish the cross-sectional area specifications of the trunk cable and the branch cable, use the symbol "/" to separate the former and the latter.

Example:

a) Copper core PVC insulated PVC sheathed cable with prefabricated branches, rated voltage 0.6kV/1kV, single core, trunk cable of 120mm², two branch cables of 10mm² and 6mm², which

group of cables with prefabricated branches shall be the same. The specifications and length of the trunk cable, the specifications of branch cables and the number of branch cables, the positioning of the centre point of the branch connector on the axis of the trunk cable and its tolerances, etc. shall be manufactured in accordance with the technical requirements of the user. Unless otherwise required, the length of each branch cable shall not exceed 3m.

5.1.2.2 For the same group of cables with prefabricated branches, only one branch cable per core is allowed to be connected to the branch point of the multi-core trunk cable; and two or less branch cables are allowed to be connected to the branch point of the single-core trunk cable. Unless otherwise required, all branch cables shall be led out in the same direction.

5.1.2.3 When the trunk cable is multi-core, the branch cable can be multi-core or single-core cable. When the trunk cable is single-core, the branch cable can be a single-core or two-core cable.

5.2 Pre-fabricated branch-jointer

5.2.1 Compression connection of conductor

5.2.1.1 The conductor connection fittings of the cable with prefabricated branches can be copper or copper alloy. The copper material shall be no lower than the provisions of No. 2 Copper (T2) in GB/T 5231 or suitable copper alloy materials. Copper or copper alloy materials must not contain harmful corrosive and cracking components during use.

5.2.1.2 Select the size of the conductor connection fittings according to the sum of the actual cross-sectional areas of the trunk cable and branch cable conductors. When using a C-shaped connector for conductor, the size of its opening shall be appropriately larger than the diameter of the trunk cable conductor before compression, so that the conductor can be snapped-in. For the size of the C-shaped connector for conductor, please refer to Appendix A.

5.2.1.3 When a symmetrical confining-pressure die is used for conductor compression connection, the inner wall of the confining-pressure die can have appropriate ridges to increase the gripping force of the conductor connection fittings on the conductor.

5.2.1.4 During the conductor connection operation, the trunk cable conductor shall not be cut, and the single copper wire of the cable conductor shall not be cut or damaged, nor shall it be supplemented with other single copper wires.

5.2.1.5 When stripping the core insulation of a multi-core trunk cable, if the bare conductors are arranged longitudinally, they should be separated by an insulation distance of 10mm~25mm. If the bare conductors are arranged radially, appropriate insulation and isolation measures are allowed.

5.3 Device for hanging

5.3.1 The device for hanging can adopt multiple combined structures such as hooks, insulating components, clamps, porcelain insulators, steel mesh sleeves, etc. The cables with prefabricated branches shall be fixed within 24h after hanging.

5.3.2 The cable end at the device for hanging shall be completely insulated to ensure the sealing and insulation of the end.

5.3.3 The water immersion voltage test or spark test of the device for hanging shall meet the requirements of Table 4.

5.3.4 The static load test of the device for hanging shall meet the requirements of Table 4.

5.3.5 After the device for hanging has passed the static load test, its water immersion voltage test and water immersion insulation resistance test shall meet the requirements of Table 4.

5.4 Identification mark

5.4.1 The finished cable shall be marked with the factory name or trademark on the branch-jointer. Appropriate methods can be used to indicate the product name, model and specification, the length of the trunk cable and the total number of branch-jointers.

5.4.2 For single-core cables or cables stranded with multiple single-core cables, the sheath of each cable is allowed to use colour or digital identification marks, and meet the requirements of GB 6995.

5.4.3 The scratch resistance of the identification mark of the finished cable shall meet the requirements of Table 4.

6 Test of the Finished Cable

The finished cable with prefabricated branches shall be tested in accordance with Table 4. When sample test and type test are required, the test samples can be reserved or additionally produced with the same materials, specifications and processes during the production of the cable.

7 Test Method

7.1 Conductor continuity (conduction)

Check with a multi-meter or buzzer.

2951.1. For multi-core cable branch boxes, the insulation thickness between the connector for conductor and its adjacent conductors shall also be measured on the cut section.

7.3.3 Insulation section quality

Observe the above section with normal eyesight for pores or impurities.

7.4 Water immersion voltage test or spark test for branch-jointer

7.4.1 Spark test electrode

The principle of the electrode device is the same as insulated core power frequency spark test method specified in GB/T3048.9. The inner cavity of the metal box of the electrode shall be able to accommodate the largest specimen; and the distribution density of the metal bead chain shall comply with the provisions of GB/T3048.9; and the length of the bead chain shall be greater than the maximum transverse dimension of the specimen. The metal box has an insulating shell, and has sufficient ground insulation level and safety protection measures.

7.4.2 Test

During the spark test, the spark test electrode is connected to the high voltage end of the test transformer; and all conductors of the cable are grounded according to GB/T 3048.8. During the water immersion voltage test, the conductor of cable is connected to the high voltage end and the water tank is grounded according to GB/T 3048.8.

7.4.3 Voltage test between conductors of multi-core cable branch-jointers

Conduct test between conductors of multi-core cables according to GB/T 3048.8.

7.5 Water immersion voltage test of branch-jointer

7.5.1 Specimen

Unless otherwise required, the manufacturer respectively chooses one piece of branch-jointer for single-core and multi-core with appropriate lengths as specimens.

7.5.2 Test

Immerse the branch-jointer in a water tank at room temperature. At the roots of both ends of the branch box, there shall be at least 0.4m cables that are basically straight with the branch box; and there shall be a cable of appropriate length extending out of the water to meet the test requirements. The water tank shall be effectively grounded; and shall be tested according to GB/T 3048.8.

7.6 Water immersion insulation resistance test of branch-jointer

7.6.1 Specimen

Specimens that have passed the 7.5 water immersion voltage test.

7.6.2 Test

Perform the tests on each conductor against all other conductors and water tanks in accordance with GB/T 3048.6 successively.

7.7 Thermal cycle test of branch connection fittings

Carry out the test in accordance with Appendix C.

7.8 Vertical combustion test of branch-jointer

7.8.1 Test equipment

Meet the requirements of GB/T18380.1.

7.8.2 Specimen

Take a single-core cable branch-jointer of any specification, cut off the branch cable along its root, and reserve a trunk cable of appropriate length at both ends for fixing the specimen.

7.8.3 Fire time

30s.

7.8.4 Test

Fix the specimen on the upper and lower clamps of the combustion test box; and adjust the upper and lower positions of the branch-jointer; so that the blue inner cone tip of the blowtorch flame can roughly touch the surface of the axial centre part of the branch-jointer.

7.8.5 Evaluation of results

When the fire supply is stopped, if the self-extinguishing time of the specimen flame is no more than 15s, it shall be judged as qualified.

7.9 Water immersion voltage test or spark test of device for hanging

During the spark test, all the exposed metal parts of the device for hanging and the spark test electrode shall be grounded; connect all the conductors of the cable to the high-voltage end of the test transformer; and conduct the test according to GB/T

Appendix C

(Normative)

Thermal Cycle Test of Branch Connection Fittings

C.1 Selection of test samples

In principle, the thermal cycle test selects the branch connection fittings of the single-core cable for the test. When the user or the cable manufacturer requires the thermal cycle test for the branch connection fittings of the multi-core cable (three-, four- and five-core cables), then the test can be carried out by referring to this Appendix through consultation between the two parties.

C.2 Test environmental conditions

The thermal cycle test shall be carried out in a test room without natural ventilation and no forced air convection. The temperature of the test room is at 20°C~30°C. The indoor temperature shall be basically stable during the thermal cycle test.

C.3 Specimen layout

For laying of cable specimens, the distance from the ground and the roof is 0.6m or more, and the distance from the wall is 0.3m or more. When multiple cables are laid in parallel for testing, the distance between the cables is 0.2m or more.

C.4 Main test equipment

- a) Strong current transformer: rated input voltage 220V, rated output voltage 10V, output current greater than 1200A;
- b) Voltage-regulating transformer: rated input voltage 220V, rated output voltage 0V~220V, capacity is matching with strong current transformer;
- c) Current transformer: no less than Level-1.0, the range shall be matched with the measured current;
- d) Ammeter: with the error not exceeding $\pm 2\%$;
- e) Thermocouple: indexing error 0.5°C; insulation heat resistance Class-F;
- f) Micro-potential measuring instrument: no less than Level-0.05.

C.5 Preparation of specimen

The specimen for the thermal cycle test shall be a single-core prefabricated branch

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