



Research Article

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**The Development and Research of The 1kv multi-Chips Full Cold Shrink Cable Terminal Products**

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**ABSTRACT**

*The purpose of this paper is to develop a 1kV multicore full shrinkage cable terminal products, introduces the cable attachment base formulation and production process. Tested the electrical performance of the four core cable terminations product, and the indicators are in line with the standard. Compared with similar products, the cable terminal products can avoid the damage in the role of shear stress and the corrosion of the cone surface, solves the flash problem after the injection molding and the edge crack problem after the extension.*

**Keywords:** Full cold shrink, Cable accessories, Silicone rubber, Energy-conservation and environment-protection

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**INTRODUCTION**

With the development of power cable accessories industry development, the high-tech products of energy conservation and environmental protection -- the cold shrinkable cable accessories is gradually to replace the heat shrinkable cable accessories, which is widely used in various fields of the national economy, such as national defense, power, aviation, industrial and mining enterprises, and the market space gradually increased.

**EXPERIMENTAL SECTION**

**1. The development of cold shrink cable accessories products**

The technology of Cold Shrink is also called pre expansion technology, which is first invented in the 1960s by the 3M company and applied in the power cable accessories industry and communication industry due to the simplicity of its use, safety and reliability favored by users, and quickly applied to the whole power system. At the beginning of nineties, the cold shrink cable accessories began to enter the Chinese market, but the product was three times higher price compared to heat shrinkable cable accessories, combined with the Chinese do not understand the product, and from the United States to China after the short life storage and so many factors, it leads to the development of the application of cold shrink cable accessories in China is slow. At the beginning of this century, America, Japan, Germany, Korea and other developed countries have all use cold type cable accessories, and most domestic still use heat shrink cable accessories. At that time, few companies can produce cold cable accessories in domestic enterprises.

At present, our country has considered the cold type cable accessories as key national torch plan project. The development and research in domestic cold type cable accessories have reached a certain level, especially in production and application. Due to the shortage of equipment, technology, capital, professional talents which makes the quality of products and the use of technology still exist many problems, especially the serious shortage of production capacity which has larger gap as for the international advanced level.

## 2. The 1 kv multi-chips full cold shrink cable terminal product's research and development

### 2.1 Main problems and key technologies

- (1) The product structure design, which solve the structural defect of the products on the market at present to avoid the products' thickness in the abrupt change and the steps lead to the expansion of products under the action of shear force when torn or damaged.
- (2) The design and manufacturing of cold shrink cable accessories solve the problem when the diameters of metal expansion cone are changed for angle of head and the slope is too steep, when expansion under the effect of shear force increased damage in terminal head products and metal expansion tiny corrosion is easy to scratch the surface of the conical head products inside surface problem.
- (3) To solve terminal head behind burrs on port of the injection molding products which needs using scissors to cut after the expansion of individual products have the problem of craze.
- (4) Improve the product's safety, reliability, convenience, economy and environmental protection.

### 2.2 The main economic indicators

Currently 1kv full cold shrink cable accessories whose price on the market situation is the proportion of production costs, the dealer price, user price for 1:3:5, the project is to develop a new type of 1kv multi-fiber full cold shrink cable end products used in guarantee under the condition of high performance, strive for a lower cost than other similar products, make the products reached the international advanced level, but for the price reduced to one-third of similar foreign products.

### 2.3 Adopt the technology of process route and implementation plan

- (1) The product structure design determine the shape, size of various kinds of parts: □ Design the four fingers of 1kv full cold shrink cable terminal and insulating tubes product drawings. □ According to the drawing processing 1kv 4 refers to the set of the mould and insulating tube products, in order to reduce development risk, the first four refers to the set of mold processing and insulating tube, of the mouth of the extruder die trial mold production product, according to the evaluation of company product inspection and testing standards, the indicators qualified after each processing other types of mold; Tracking and evaluation, improvement and acceptance. □ In accordance with the above way, according to the drawing processing 1kv 4 refers to the set of the product and insulating pipe mold, try mode production, tracking, evaluation, improvement and acceptance.
- (2) The design and manufacture of cold shrinkable cable accessories stress cone control components. □ Design control unit drawings; □ According to the drawing processing mould; □ Test production, tracking, evaluation, improvement and acceptance.
- (3) The transformation expansion equipment, making 1kv four refers to the set of expansion claw and 1kv insulating tube sizing.
- (4) To product 1kv core full cold shrink cable terminal products, and make improvement.
- (5) To test the product mechanical properties, electrical properties and use of the performance.
- (6) The installation process, and the table of the product of form a complete set product manuals and other technical information, and do installation operation test.

## 3. Three or four core 1kv full cold shrink cable terminal product trial production

We first develop market demand in the most cold type 1kv four core cable terminal products.

### 3.1 Basic material formula of cable accessories

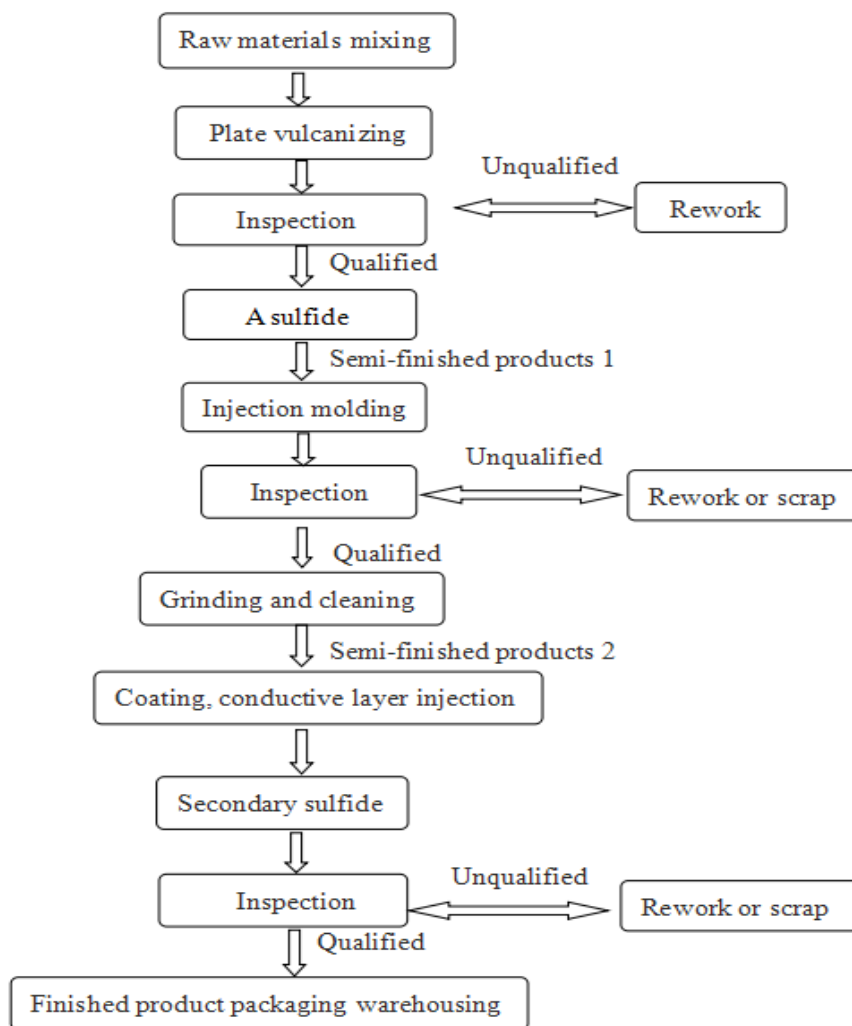
- (1) The master batch; Collagen: rubber color (red, yellow, green, black) : SC - 8 vulcanizing agent = 10 kg: 19 g, 250 g;
- (2) Ribbon; Collagen: rubber color (red, yellow, green), double 24:27 and vulcanizing agent = 10 kg, 40 g: 100 g;
- (3) Since the adhesive tape; Collagen: PT color glue: double 24:27 and vulcanizing agent = 10 kg: 10 g, 100 g.

### 3.2 Product electrical performance test

Makes basis JB8144.3-1995 standard, developed by two sets of 1kv quad cold cable terminal products, cable for 150 was. Specific test project:

- (1) 1 min power frequency voltage test: 4kv, 1 min not breakdown.
- (2) The load cycle test: wire heated to 95 °C, 100 °C, each cycle is 8 h, which add hot 5 h, 3 h of cooling, a total of three times circulation.
- (3) 4 h power frequency voltage test: 2.4 kV, 4 h no breakdown.
- (4) The appearance inspection, no crack, no deformation.

### 3.3 The production process flow diagram



### 3.4 Product installation operation experiment



Fig.1 The product installation materials



Fig.2 after installation products

### 3.5 The use of performance testing

Through the use of performance test, the product has the following features:

- (1) It has excellent weather ability, normal operating temperature range - 40°C-200 °C;
- (2) It has a high elastic resilience, the cable maintains continuous radial pressure, partial discharge is low;
- (3) It is engineering installation, do not need to use open flame, the operation is simple, convenient and reliable safety.

## RESULTS AND DISCUSSION

By the four core cold type 1kv cable terminal products’ development, production with independent intellectual property rights, we have reached the international standard of qualified products to replace imported as far as possible and change urgently needed in China at present. In the future from the cold type cable accessories series product

research, development of production and supply structure, product research and development, we should expand capacity and strengthen further meet the increasing demand for such product which has important economic significance and social significance. At the same time for the full cold shrink cable terminal products, because of its safety and reliability, simple operation, energy conservation and environmental protection characteristics, we also should have got the favor of consumer to create enormous economic benefits for the operator.

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