# TECHNOLOGIES FOR TOMORROW

## 12kV/50A Enclosed Cylindrical Type Fuse Cut-out

### 1. Introduction

In recent years, the insulation covering of energized parts has been improved in both reliability and safety for use on distribution lines. Currently cut-outs with exposed energized parts are still used as protective devices for transformers, resulting in problems such as electric shock by accidental contact of energized parts. In addition there is the potential for earth faults and short circuits through contact with trees and wild animals, as well as causing corrosion of the exposed energized parts etc.

To overcome this, we have developed the 12kV/50A enclosed cylindrical type fuse cut-out applicable for the 10kV distribution system as used by the SHANGHAI MUNICIPAL ELECTRIC POWER COMPANY of China.

Our device offers excellent insulation and anti-pollution performance by covering the energized parts for increased reliability and safety of the distribution line.

### 2. Construction and Characteristics

Our developed product satisfied the Standard requirements in China. To achieve its insulating properties it adopts the cylindrical porcelain concept with its excellent and well proven insulating properties, to provide safety and pollution withstand performance for its energized parts making it particularly suitable for the 10 kV distribution system in Shanghai.

(1)In the design and construction particular attention has been given to reduce any electrical potential stress concentrations through:
- Selection of materials and their shape to achieve electric field relaxation.

(2)In the insulation and pollution design particular attention has been given to achieve requirements for a 10 kV distribution system through:
- Selection of the structure to ensure the withstand voltage performance.
- Selection of the structure to ensure the necessary creepage distance.

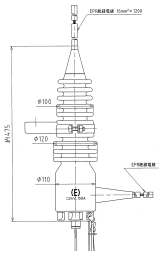
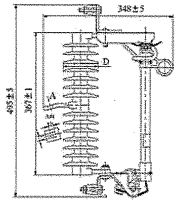
(3)Additionally sufficient breaking capacity is achieved through:
- Selection of the materials and construction to withstand inner gas pressure forces during the interruption process.
- Selection of the materials and construction to achieve excellent arc suppression performance during the interruption performance.

### 2-1. Comparison between Developed Product and Existing Product.

Table 1 shows the construction and characteristics of our developed product and the existing product.

The existing cut-out with its exposed energized parts has the disadvantage to be affected by rain, dust and pollution. On the other hand, our developed product with its covered construction is quite excellent where safety, reliability and pollution withstand performance of the energized parts are concerned.

Table 1 Construction and characteristics

| Item | | Our developed product | Existing product (open cut-out) |
|---|---|---|---|
| Construction | |  Enclosed type |  Open type |
| Characteristics | | | |
| | Safety | ○ | × |
| | Reliability | ○ | × |
| | Pollution performance | ○ | × |

○:Good ×:No good

### 3. Specifications

Table 2 shows the basic performance of the enclosed cylindrical type fuse cut-out .

Table 2 Basic performance

| Item | | Specifications |
|---|---|---|
| Rated voltage / current | | 12 kV / 50A |
| Rated breaking current | | Sym 8 kA rms |
| Min. creepage distance | | 350 mm |
| Withstand voltage (kV) | Power frequency | To earth: Dry/Wet : 42 /30 |
| | | Across isolating distance: Dry 48 (without fuse tube) |
| | Lightning impulse | To earth : Dry 75 |
| | | Across isolating distance: Dry 85 (without fuse tube) |
| Max. temperature rise | | 35 °C |
| Breaking test | Rated breaking current : Sym 8kA rms | |
| | Min.breaking current : 175A | |
| Switching Test | Load current switching : 50A | |
| | Excitation current switching : 3A | |
| | Charging current switching : 1A | |
| Mechanical endurance test | | 300 times |
| Short Time Current | | 1000A 1 sec |

## 4. Main performance evaluation

The following are the main performance evaluation results.

### 4-1. Interruption performance

At the start of the project, the effective breaking value was 4 kA at a test voltage of 12 kV( originally designed for 7.2 kV as used in Japan). After adopting improvement of materials and construction for arc suppression performance, we could secure 8 kA breaking performance for the first time at 12 kV for the cylindrical enclosed type cut-out. Photo 1 shows the test situation with test voltage 12 kV / breaking current 8 kA at SHANGHAI ELECTRIC POWER TRANSMISSION & DISTRIBUTION TESTING CENTRE CO.,LTD..

Photo 1. breaking test situation

### 4-2. Safety performance

We also confirmed that no flashover would occur at a power frequency voltage 18 kV for 1 min between inside energized parts and a conducting sheet covering adhesive part of top mold cone and bottom open end. Photo 2 shows the safety test situation.

Photo 2. Safety test situation

### 4-3. Corona

We carried out electric field analysis, and confirmed that there were no structural problems such as radio influence by corona. Figure 1 shows the result of electric field analysis.

## 5. Field test

We have checked the performance by field test

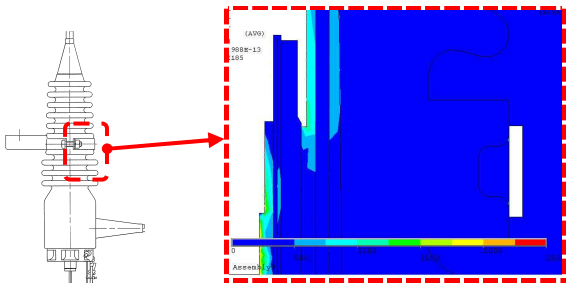


Figure 1. Result of electric field analysis

on a distribution line by Shanghai Power from July 2008 to the present date. Since then, there aren't any problems and filed test is continuing. Photo 3 shows the field test situation.

Photo 3. Field test situation

## 6. Conclusion

Our developed product offers increased reliability, safety and anti-pollution performance over the existing product, and will contribute to overall power service performance by improving the reliability and safety of distribution lines to service current social needs.

Currently we are engaged in further improving our new product by increase its breaking performance from the existing 8 kA to 12.5 kA to expand its range of application.

This product was jointly developed by the following companies, according to the request from SHANHAI MUNICIPAL ELECTRIC POWER COMPANY.
This article was prepared by NGK Insulators, Ltd. which is an affiliated company of ENERGY SUPPORT CORPORATION.

-SHANGHAI MUNICIPAL ELECTRIC POWER COMPANY
-SHANGHAI ELECTRIC POWER LIVE WORKING COMPANY, LTD
-SHANGHAI FUJIKURA CHENGLONG CABLE ACCESSORY CO.,LTD
-ENERGY SUPPORT CORPORATION

By **Junichi Matsumoto**
**Power Distribution Division**
**NGK INSULATORS, LTD.**
1 Kamikobari, Inuyama, Aichi 484-8505, Japan
Tel:+81-568-67-2614, Fax:+81-568-67-4579
http://www.ngk.co.jp/english/index.ht