

## Quick Replacement of Transmission-Class Cable Termination with Dry-Type Terminations

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### ABSTRACT

*Some older design porcelain fluid-filled terminations have shown to be sensitive for fluid leakage and moisture ingress. These conditions can impact the environment and ultimately cause failures. To avoid these critical situations, porcelain terminations are preventively replaced by dry-type composite terminations. This paper describes the retrofitting of porcelain terminations in New York City and focuses on the design and qualification program executed on the new terminations.*

*The article can be interesting for cable and accessories manufacturers, and utility professionals looking for quick replacement of an existing obsolete, leaking, or damaged solid dielectric outdoor termination without riser cable replacement.*

### KEYWORDS

Retrofit, Porcelain Termination, Composite Termination, Dry-Type, Plug-In, Self-Supporting, Quick Replacement, Solid Dielectric Cable, Transmission Class Cable, Partial Discharge, Obsolete Terminations, Cable Risers, Leaking Outdoor Terminations, IEEE 48 Type Test, Service Life, Shirt-Circuit Failure Test, Grounding, Thermo-Mechanical Tests.

### INTRODUCTION

Many power utilities in the World utilize various solid dielectric cable systems for their transmission-class network. Installation of these systems began in early 1990's and extensively continue through 2000's.

Substantial number of these systems have been in service for 20-30 years and start developing some maintenance issues related to their terminations. All earlier installations utilized porcelain terminations filled with dielectric fluid. Some of these cables having expansion tanks and leak detection systems for outdoor terminations. Several years ago, these terminations start developing dielectric fluid leaks. The leaks developed in the bottom of terminations due to many expansion and contraction cycles of the cable, and rule of Gravity. The leaks intensify withing service years and cable load.

Some of the 1990's and 2000's cable system supply companies left the market, some acquired by others, effectively making their supplied terminations obsolete. This makes a repair of leaking terminations a very difficult task, which in any case will not eliminate leak issue.

Replacement of these terminations can be time consuming and very costly because it will require not only termination replacement, but also riser cables and a splice replacement.

Existing outdoor terminations design require cable conductor continue through termination up to a very top

with proper cable insulation preparation and stress-cone installation. Replacement of existing termination with a new one may be impossible without existing riser cable spare.

The developed solution for this issue is very important for many power utilities having numerous solid-dielectric fluid-filled terminations and utilizing duct-bank system for cable circuit installation.

### DRY TYPE PLUG-IN OUTDOOR CABLE TERMINATION

In the recent years various designs of dry type cable terminations have been introduced into the market by the manufacturers.

In order to choose the best technology for this particular retrofit project, the new cable termination should fulfil the following criteria:

- The insulation bodies of the termination must be:
  - comprised out of solid dielectric insulation material (dry type).
  - prefabricated.
  - delivered pre-assembled.
  - factory tested.
- The main body of the termination is self-supporting thus there is no need for an external support insulator.
- Minimum length of the existing cable to be prepared for the connection of the new termination.
- The termination must fit with the existing support structures and respect clearance distances.
- Quick installation via a plug-in process.
- No lifting of existing cable or installing additional cable and joint.

### Technology

The termination utilizes the plug-in technology (figure 1), a technology well proven in the past decades for HV/EHV cable systems.

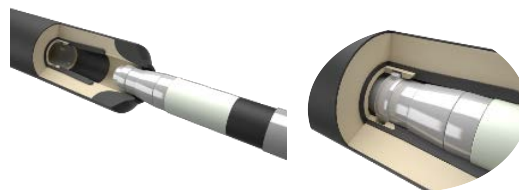


Figure 1. Plug in cable end technology.

Contrary to conventional terminations, which are essentially built onsite around the cable itself, a plug-in