

CABLE ACCESSORIES WORKMANSHIP – US PERSPECTIVE

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ABSTRACT

In this article we describe the difference in skills required for installation of cable accessories for extruded and laminated paper cables. We also describe practices in training splicers in those skills in some US utilities and manufacturing companies.

KEYWORDS

Cable Accessory, Workmanship, Splicing Skills, Splicer

INTRODUCTION

The significance of proper installation of cable accessories and the reliable operation of the cable system is highly recognized. The significance remains the same regardless of what kind of cable system, laminated paper or extruded, is being installed.

CIGRE WG B1.22 was launched to establish guidelines on how to maintain and/or improve the quality during installation process of the accessories while maintaining high reliability of the cable system. Specific technical risks and the associated skills needed to mitigate these risks were analyzed for each phase of the installation process of the cable accessories for extruded cables. The skills necessary for installing accessories on laminated cables were not considered.

Laminated paper, oil or gas filled cables, both high-pressure pipe-type and low-pressure self-contained cable systems have been traditionally used in the United States for underground transmission systems at 69 kV and above. Due to the environmental concerns of oil leaks and maintenance costs, usage has shifted towards extruded cables over the last decade. Still, new circuits are being built using traditional technology and some older paper cable systems are being refurbished.

Most domestic manufacturers of transmission voltage laminated cables in the past did not make cable accessories nor had crews for field installation. The single remaining domestic manufacturer of such cables does not manufacture cable accessories. Cable and cable accessories are purchased separately and installation and commissioning tests are done by the end user or contractor.

In the case of extruded cable systems the practice is somewhat different. A number of cable manufacturers now offer turn-key systems from manufacturing cable and cable accessories through laying the cable, installing the accessories and commissioning testing. The majority of large utility companies have adopted the turn-key practice for extruded cables, mostly for systems 138 kV and above. Some industrial users and generating plants still follow the practice of purchasing cable and accessories separately, even for extruded cables.

SPLICING SKILLS

The performance of any cable system highly depends on the skills of the splicers who install joints and terminations. There are many differences in cables, accessories, installation procedures, installation condition requirements and so on, which require different knowledge and skills. For example it is wrong to assume that experience at medium voltage is sufficient for installation of high voltage cable accessories. The electrical and often (thermal) mechanical stress levels in high voltage (HV) applications are significantly greater and imperfections in workmanship that may be forgiving at medium voltage may cause catastrophic failures of HV accessories.

A splicing crew for installation of HV cable accessories consists of several people with different skill levels. A helper or "ground man" hands over necessary materials and tools to an experienced splicer who performs delicate operations that require trained skills. The crew leader makes sure that all phases of installation are done in accordance to requirements from installation instructions. It is mandatory that at least one member of the splicing team is trained in installation of that particular cable accessory. Installation is often supervised by a highly experienced person from the accessory manufacturer.

The splicer has to be physically and mentally fit for prolonged periods of splicing work without letting focus to detail diminish, as there are many details requiring attention. Some of them require general and some specific installation skills.

General skills

Apart from awareness to hazard conditions and use of personal protective equipment, the splicer must follow safety protocols of the particular job site. He also has to cope with different conditions at different job sites.

Heat, cold, excessive humidity, precipitation and dust are site conditions that have to be dealt with. Quite often conditions may change during splicing and changes in weather conditions have to be anticipated. Delicate dielectric components of cable and accessory, and interfaces between dielectrics, have to be protected against moisture and dust (solid) contamination.

Humidity and temperature of the work area during splicing is more critical for installation of cable accessories for laminated cables. The dielectric breakdown strength and dissipation factor of laminate dielectric is highly influenced by moisture content.

It is also imperative to provide comfortable work conditions for splicers. Excessive sweating or freezing and stiff hands may significantly impair workmanship quality.

A protective shelter with temperature and humidity control is mandatory for building laminated cable splices and most often a shelter is required when cable terminations