IEEE Standard for the Electrical Protection of Communication Facilities Serving Electric Supply Locations through the Use of Optical Fiber Systems

IEEE Power and Energy Society

Sponsored by the
Power System Communications Committee

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IEEE Standard for the Electrical Protection of Communication Facilities Serving Electric Supply Locations through the Use of Optical Fiber Systems

Sponsor

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of the
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Abstract: Safe and reliable methods for the electrical protection of telecommunication facilities serving electric supply locations through the use of optical fiber systems for the entire facility are presented in this standard.
Keywords: electric power stations, electric supply locations, electrical protection, fiber optic systems, ground potential rise, high-voltage environment, IEEE 487.2™, optical fiber systems

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Introduction

This introduction is not part of IEEE Std 487.2-2013, IEEE Standard for the Electrical Protection of Communication Facilities Serving Electric Supply Locations through the Use of Optical Fiber Systems.

Some electrical environments, collectively called electric supply locations, require the application of unique electrical protection techniques because of their special nature. One such environment is the electric power station or substation. Another is at, or near, power line transmission and distribution structures such as towers or poles. Such structures often provide a convenient site for the location of wireless, personal communications service, and cellular antennas and their associated electronic equipment that is served by a link to the wired telecommunications network.

This standard assumes that optical fiber cables are to be used to provide electrical isolation for telecommunications services to these electric supply locations. Refer to IEEE Std 367™ or IEEE Std 487™ for other applications.

This standard describes applications consisting entirely of optical fiber cables. For applications where both metallic cables and fiber cables are used (i.e., hybrid applications), the user is referred to IEEE Std 487.3™.

Some delays in site activation often occur due to the time involved in obtaining electrical information data for most high-voltage tower or pole sites. The delays may be eliminated by using the optical fiber solutions described in this standard.

This project is part of a reorganization of IEEE Std 487™ in which the main document is broken down into a family of related documents (i.e., dot-series) segregated on the basis of technology:

— 487
— 487.1 [Metallic wire-line]
— 487.2 [Optical fiber systems]
— 487.3 [Hybrid facilities]
— 487.4 [Neutralizing transformers]
— 487.5 [Isolation transformers]

This standard has been prepared by the Wire-Line Subcommittee of the Power System Communications Committee of the IEEE Power and Energy Society. This standard represents the consensus of both power and telecommunications engineers.

This standard, along with IEEE Std 487.3™, will replace, in its entirety, the existing IEEE Std 1590™-2009.

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1. Overview

During a power fault that occurs externally to an electric supply location, some portion of the fault current will return to the power system's source(s) of generating power in the network through the electric supply location grid impedance. This current return may cause a large increase in potential to be developed in and around the electric supply location [i.e., ground potential rise (GPR) zone of influence (ZOI)] with respect to remote earth locations. This GPR will result in current flowing into the wire-line networks or the power system neutral or any metallic infrastructures connected to the grid under study. For telecommunication facilities, this creates a transferred voltage condition as defined in 8.1.6 and 17.9 of IEEE Std 80™-2000.

When a fault occurs on the power line transmission and distribution towers or poles, the current will return to the source(s) via the earth and various metallic paths available. The fault current will divide, and the resulting currents will return to their source(s) in proportion to their individual path impedances. Some power systems have a neutral return path while others do not. The absence of the neutral return path tends to produce a higher GPR. When metallic telecommunications cables and secondary neutrals are extended into electric supply locations, they represent remote earth and provide a significant discharge path during faults. A properly engineered and installed all-dielectric optical fiber cable will provide immunity from the effects of fault-produced GPR and induction, as well as lightning-induced phenomena, at these locations. Although the use of non-dielectric optical fiber cables is not recommended, guidance is provided for existing non-dielectric optical fiber cables.