



IEEE Recommended Practice for the Electrical Protection of Communication Facilities Serving Electric Supply Locations Using Optical Fiber Systems

IEEE Power & Energy Society

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**Power System Communications Committee
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IEEE Power & Energy Society**

Approved 13 May 2009

IEEE-SA Standards Board

Abstract: The main emphasis of this recommended practice is the engineering design of optical fiber communication facilities serving, or connected to, electric supply locations. This recommended practice includes methods for providing telecommunication facilities serving electric supply locations using optical fiber cables, and their related electronic systems, extending across the zone of influence (ZOI).

Keywords: CFJ, copper-fiber junction, electric power stations, electric supply locations, fiber optic systems, ground potential rise, high-voltage environment

Acknowledgments

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Introduction

This introduction is not part of IEEE Std 1590-2009, IEEE Recommended Practice for the Electrical Protection of Communication Facilities Serving Electric Supply Locations Using 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. IEEE Std 487TM-2007^a provides additional details on these locations.

This recommended practice 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 367TM-1996 or IEEE Std 487-2007.

This recommended practice describes applications consisting entirely of fiber and optics where both metallic cables and fiber cables are used. In the latter case, i.e., hybrid applications, the user is referred to IEEE Std 487-2007 for the metallic portion of the application.

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 fiber optical solutions described in this recommended practice.

This recommended practice has been prepared by the Wireline Working Group of the Power System Communications Committee of the IEEE Power & Energy Society. This recommended practice represents the consensus of both power and communications engineers.

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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 systems source(s) of generating power in the network, through the electrical supply location grid impedance. This 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 communication facilities, this creates a “transferred voltage” condition as defined in 6.1 of IEEE Std 80™-2000.¹

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 wire-line telephone and secondary neutrals are extended into electric supply locations (no neutral return path), they represent remote earth and provide a significant discharge path during faults. A properly engineered and installed all-dielectric optical fiber cable will provide

¹ Information on references can be found in Clause 2.

immunity from the effects of fault-produced GPR and induction, as well as lightning-induced phenomena, at these locations. Although the use of nondielectric optical fiber cables is not recommended, guidance is provided for existing nondielectric optical fiber cables.

The main emphasis of this recommended practice is the electrical protection of communication facilities serving electric supply locations using optical fiber systems. The overall electrical protection scheme for the particular location should be coordinated to promote personnel safety and to minimize damages to equipment and service outages.

This recommended practice includes methods for providing telecommunication facilities serving electric supply locations using optical fiber cables, and their related electronic systems, extending across the ZOI.

1.1 Scope

This recommended practice presents engineering design procedures for the electrical protection of communication facilities serving electric supply locations using optical fiber systems. Services utilizing wire-line protection systems are addressed in IEEE Std 487™-2007. Other telecommunication alternatives such as radio and microwave systems are excluded from this document.

1.2 Purpose

This recommended practice presents safe and reliable methods for the protection of communication facilities serving electric supply locations using optical fiber systems.

1.3 Not covered

This recommended practice does not cover hybrid applications where the equipment, i.e., wire-line–fiber cable (e.g., copper, steel, aluminum) junction (CFJ), is inside the ZOI or where all the equipment, i.e., CFJ and optical equipment interface (OEI), is on the same grid or ground mat. These applications are covered in IEEE Std 487-2007.

2. Normative references

The following referenced documents are indispensable for the application of this recommended practice (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this recommended practice is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

Accredited Standards Committee C2-2007, National Electrical Safety Code® (NESC®).^{3, 4}

IEEE Std 80™-2000, IEEE Guide for Safety in AC Substation Grounding.^{5, 6}

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