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IEEE Recommended Practice for Determining the Electric Power Station Ground Potential Rise and Induced Voltage from a Power Fault

IEEE Power & Energy Society

Sponsored by the
Power System Communications Committee

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Abstract: Guidance for the calculation of power station ground potential rise (GPR) and longitudinal induction (LI) voltages is provided, as well as guidance for their appropriate reduction from worst-case values, for use in metallic telecommunication protection design.

Keywords: electric power stations, ground potential rise, IEEE 367, induced voltage, longitudinal induction voltages, power faults, power stations, telecommunication protection design, telecommunications

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The following members of the individual balloting committee voted on this recommended practice. Balloters may have voted for approval, disapproval, or abstention.

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Introduction

This introduction is not part of IEEE Std 367-2012, IEEE Recommended Practice for Determining the Electric Power Station Ground Potential Rise and Induced Voltage from a Power Fault.

Wire-line telecommunication facilities serving electric power stations often require that extraordinary protection measures be taken to protect against the effects of fault-produced ground potential rise (GPR) or induced voltages, or both. In the presence of a hostile electromagnetic environment, suitably rated protection equipment is required at the power station for personnel safety, for the protection of the serving telecommunication facilities, and to help ensure the desired continuity of telecommunication transmission at times of power system faults. There is a fundamental need, therefore, to determine the appropriate values of fault-produced GPR and induction, including considerations of their probability and duration, to be used in developing the specifications and ratings for the protection equipment to be used in any given application.

This recommended practice provides information for the determination of the appropriate values of fault-produced power station GPR and induction for use in the design of protection systems. Included are the following:

a) The determination of the appropriate value of fault current to be used in the GPR calculation

b) The consideration of the waveform, probability, and duration of the fault current

c) The determination of inducing currents, the mutual impedance between power and telephone facilities, and shield factors

d) The vectorial summation of GPR and induction

e) The considerations regarding the power station GPR zone of influence (ZOI)

f) The communications channel time requirements for noninterruptible services

This standard was originally prepared in 1987 by the Joint High Voltage Interface Working Group (WG) with members from the IEEE Transmission and Access Systems Committee of the IEEE Communications Society and the Power System Communications Committee of the Power Engineering Society. This WG later merged with the Inductive Coordination Electrical Protection (ICEP) Subcommittee (SC). Over time most of the members of the ICEP SC moved to the Wire-line SC, under the Power Engineering Society Power System Communications Committee. The Wire-line SC assumed ownership of this standard during the revision process in 1996.

The WG determined during this revision process (2011) that there are no international standards to determine the ground (or earth) potential rise at electric power stations or similar locations. The WG did locate, through an Internet search, two international documents that appear to deal with the subject but were not validated for harmonization purposes, as follows:

— AS/NZS 3835.1:2006, Earth potential rise—Protection of telecommunications network users, personnel and plant—Part 1: Code of practice

— AS/NZS 3835.2:2006, Earth potential rise—Protection of telecommunications network users, personnel and plant—Part 2: Application guide

Further, Volume II of the ITU-T Directives concerning the protection of telecommunication lines against harmful effects from electric power and electrified railway lines, *Calculating Induced Voltages and Currents in Practical Cases*, also appears to deal, in part, with the subject of this standard.

This standard was revised and updated by the Wire-line Working Group of the IEEE Power System Communications Committee of the IEEE Power & Energy Society.

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1. Overview

Difficulties are experienced by telecommunication, protection, and relay engineers in determining the *appropriate* values of power station ground potential rise (GPR) or the longitudinally induced (LI) voltages into wire-line telecommunication facilities including their probability, waveform, and duration, which are to be used in developing the specifications for systems and component protection.

Suitably rated protection devices are required for personnel safety and for the protection and continuity of service for wire-line facilities that either enter electric power stations or that are otherwise exposed to the influence of high-voltage electric power circuits. (See IEEE Std 487™.)[1]

1.1 Scope

This standard provides guidance for the calculation of power station GPR and LI voltages and guidance for their appropriate reduction from worst-case values for use in metallic telecommunication protection design. Information is also included for the determination of the following:

[1] Information on references can be found in Clause 2.