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IEEE Application Guide for Surge Protection of Electric Generating Plants

IEEE Power and Energy Society

Sponsored by the
Surge Protective Devices Committee

IEEE
3 Park Avenue
New York, NY 10016-5997
USA

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Abstract: This guide consolidates most electric utility power industry practices, accepted theories, existing standards/guides, definitions, and technical references as they specifically pertain to surge protection of electric power generating plants. Where technical information is not readily available, guidance is provided to aid toward proper surge protection and to reduce interference to communication, control, and protection circuits due to surges and other overvoltages. It has to be recognized that this application guide approaches the subject of surge protection from a common or generalized application viewpoint. Complex applications of surge protection practices may require specialized study by experienced engineers.

Keywords: electric utilities, electric power, electric generating plants, generating plants, IEEE C62.23™, power plants, surge protection

The Institute of Electrical and Electronics Engineers, Inc.
3 Park Avenue, New York, NY 10016-5997, USA

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Thomas Barnes
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Kenneth Bow
Derek Brown
Gustavo Brunello
William Bush
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Introduction

This introduction is not part of IEEE Std C62.23-2017, IEEE Application Guide for Surge Protection of Electric Generating Plants.

The need for an application guide for surge protection of electric generating plants was indicated in 1979 when the US Nuclear Regulatory Commission published a draft regulatory guide and value/impact statement entitled, "Lightning Protection for Nuclear Power Plants."

After meetings between members of the IEEE Power and Energy Society's Surge Protective Devices Committee and members of the US Nuclear Regulatory Commission, it was agreed that the task of writing an application guide for the surge protection of electric generating plants would be performed by a specially assigned working group of the IEEE Surge Protective Devices Committee.

The first function of this working group was to publish a bibliography containing many standards and technical papers pertaining to the protection of all elements inside a power plant complex. The "Bibliography on Power Generating Plants Surge Protection" was published in *IEEE Transactions on Power Delivery* in 1991.[1]

The working group also decided that nuclear power plants should be included among the electric generating plants covered by this application guide. Furthermore, because the method of surge protection applies to nuclear as well as all other electric generating plants, no special differentiation should be made.

The first version of this application guide was published in 1999 as the result of efforts of the working group over more than 10 years. The working group is part of the application of the Surge Protective Devices Subcommittee, which is sponsored by the Surge Protective Devices Committee of the IEEE Power and Energy Society. Comments were also solicited from the following committees:

- IEEE Power and Energy Society
  - Transmission and Distribution Committee
  - Power System Relaying Committee
  - Nuclear Power Engineering Committee
  - Substations Committee
  - Power System Communications Committee
  - Energy Development and Power Generation Committee
  - Electric Machinery Committee
- IEEE Industry Applications Society's Power Systems Engineering Committee

In the 2017 edition, the working group

- Updated the organization of Clause 1 so the overview conforms to IEEE's current presentation of a standard's overall scope and purpose as well as its contents and context.
- Removed the edition dates associated with active references to assure that the latest edition always applies.
- Added in 4.2.2.2 an example of a comparison of the insulator voltage stress for a shielded line versus an unshielded line.

[1] *IEEE Transactions on Power Delivery*, vol. 6, no. 2, pp. 754–793, April 1991.

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IEEE Application Guide for Surge Protection of Electric Generating Plants

1. Overview

1.1 Scope

This application guide covers surges entering an electric generating plant via transmission and distribution lines and methods to reduce them as well as methods of protecting indoor and outdoor equipment, controls, and communication systems within the plant switchyard, the plant proper, and ancillary facilities within the premises (such as fuel, ash, water, cooling, weather and warning systems) against direct strokes, incoming surges, and internally generated surges.

1.2 Purpose

This application guide aids engineers at all levels of surge protection knowledge to decide whether particular generating plants or parts of plants should have surge protection. The guide may be used in estimating the lightning surge and switching surge exposure of electric generating plants in usual, not extreme, exposures. For plants or parts of plants that should be protected, the purpose of this document is to provide guidance in selecting and applying surge protective devices (SPDs).

1.3 Contents and context

This application guide consolidates most electric utility power industry practices, accepted theories, existing standards/guides, definitions, and technical references as they specifically pertain to surge protection of electric power generating plants. Where technical information is not readily available, guidance is provided to aid toward proper surge protection and to reduce interference to communication, control, and protection circuits due to surges and other overvoltages. It has to be recognized that this application guide approaches the subject of surge protection from a common or generalized application viewpoint. Complex applications of surge protection practices may require specialized study by experienced engineers.

Surge overvoltages can cause equipment damage, system malfunction, or power interruptions at electric power generating plants if plants are not adequately protected against them. Excessive surge voltages have to, therefore, be controlled or reduced to permissible levels. These overvoltage surges in power generating plants may be generated by lightning or by system events such as switching, faults, load rejections, or by some combinations of these.