



IEEE Guide for Connection of Surge Arresters to Protect Insulated Shielded Electric Power Cable Systems Up to 46 kV

IEEE Power and Energy Society

Developed by the
Insulated Conductors Committee

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STANDARDS

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Insulated Conductors Committee
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Abstract: Surge arrester installation methods at distribution cable terminal poles to minimize the total impressed transient voltage on medium-voltage distribution cables are suggested in this guide. Grounding electrode techniques, pole ground values, and system ground grid values are not addressed or considered in this document.

Keywords: cable, IEEE C62.22.1™, installation method, surge arrester, transient voltage

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Introduction

This introduction is not part of IEEE Std C62.22.1-2024, IEEE Guide for Connection of Surge Arresters to Protect Insulated Shielded Electric Power Cable Systems Up to 46 kV.

This guide concentrates on the connection of surge arresters for distribution system terminal pole and underground applications to help minimize the total impressed transient voltage that the cable system experiences during surge current discharge. It shows the detrimental effects of the inductance of long connection leads to the arrester. It is not the intent of this guide to recommend the use of surge arresters, as that is addressed in IEEE Std C62.22™, IEEE Guide for the Application of Metal-Oxide Surge Arresters for Alternating-Current Systems. Pole or system grounding values and techniques are not addressed. Practical, simple examples are provided in an informative annex to estimate margins of protection depending upon the arrester installation technique used.

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IEEE Guide for Connection of Surge Arresters to Protect Insulated Shielded Electric Power Cable Systems Up to 46 kV

1. Overview

1.1 Scope

This guide suggests surge arrester installation methods at distribution cable terminal poles and on dead-front equipment to protect insulated shielded power cable systems up to 46 kV. Grounding electrode techniques, pole ground values, and system ground grid values are not addressed or considered in this document.

1.2 Purpose

The purpose of the guide is to recommend suitable installation techniques to improve transient voltage protection schemes and, thereby, help ensure long-term reliability. Historical surge arrester installation techniques for cable system protection may not have provided required margins of protection. Variables include the terminal-pole arrester characteristics, connection lead length, inductive voltage drop, and cable system open-point and mid-point arrester utilization. Different protection schemes are presented to assist the user who is designing transient voltage protection for cable systems to estimate available margins of protection.

1.3 Word usage

The word *shall* indicates mandatory requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted (*shall* equals *is required to*).^{6,7}

The word *should* indicates that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required (*should* equals *is recommended that*).

The word *may* is used to indicate a course of action permissible within the limits of the standard (*may* equals *is permitted to*).

The word *can* is used for statements of possibility and capability, whether material, physical, or causal (*can* equals *is able to*).

⁶ The use of the word *must* is deprecated and cannot be used when stating mandatory requirements; *must* is used only to describe unavoidable situations.

⁷ The use of *will* is deprecated and cannot be used when stating mandatory requirements; *will* is only used in statements of fact.

2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document 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.

IEEE Std C62.11™, IEEE Standard for Metal-Oxide Surge Arresters for AC Power Circuits.^{8,9}

IEEE Std C62.22™, IEEE Guide for the Application of Metal-Oxide Surge Arresters for Alternating-Current Systems.

3. Definitions, acronyms, and abbreviations

3.1 Definitions

For the purposes of this document, the following terms and definitions apply. The *IEEE Standards Dictionary Online* should be consulted for terms not defined in this clause.¹⁰

arrester: *See:* surge arrester.

basic lightning impulse insulation level (BIL): The electrical strength of insulation expressed in terms of the crest value of a standard lightning impulse.

crest (peak) value (of a wave, surge, or impulse): The maximum value that a wave, surge, or impulse attains.

dead-front arrester: An arrester assembled in a shielded housing, providing system insulation and conductive ground shield, intended to be installed in an enclosure for the protection of underground and pad-mounted distribution equipment and circuits.

discharge current: The surge current that flows through an arrester.

discharge voltage: The voltage that appears across the terminals of an arrester during passage of discharge current.

distribution arrester: An overvoltage protection device designed for use on a medium voltage power distribution system rated over 1000 V and up to 46 kV.

end-point: The location at the end of a radial circuit or at the normal open point of a loop circuit.

flashover: A disruptive discharge around or over the surface of a solid or liquid insulator.

heavy duty arrester: An arrester normally used to protect overhead distribution systems exposed to severe lightning currents.

impulse: A surge of unidirectional polarity.

insulation level: A combination of voltage values (both power frequency and impulse) that characterize the insulation of equipment with regard to its capability of withstanding dielectric stresses.

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