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IEEE Guide for Application of Neutral Grounding in Electrical Utility Systems, Part VI—Systems Supplied by Current-Regulated Sources

IEEE Power and Energy Society

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Approved 23 September 2017

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Abstract: Applications to three-phase electrical utility systems are described in this Part VI of the IEEE C62.92™ series. Definitions and considerations related to system grounding where the dominant sources of system energization are current-regulated or power-regulated power conversion devices are provided.

Keywords: current-regulated source, ground-fault overvoltage, grounding, IEEE C62.92.6™, inverter, temporary overvoltage

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Introduction

This introduction is not part of IEEE Std C62.92.6-2017, IEEE Guide for Application of Neutral Grounding in Electrical Utility Systems, Part VI—Systems Supplied by Current-Regulated Sources.

This document is the sixth part of a six-part series of guides on the subject of electric utility system neutral grounding practices and serves as an introduction. When the series was first approved, it replaced IEEE Std 143™-1954, IEEE Guide for Ground-Fault Neutralizers, Grounding of Synchronous Generator Systems, and Neutral Grounding of Transmission Systems. The first part of the series provides an introduction to the subject of neutral grounding and provides basic definitions. The next five parts address a specific part of the utility system to serve as a guide for neutral grounding. This part addresses the particular circumstances of a system predominately energized by current-regulated sources, such as inverters. The six parts are as follows:

a) IEEE Std C62.92.1, IEEE Guide for the Application of Neutral Grounding in Electrical Utility Systems—Part I: Introduction.

b) IEEE Std C62.92.2, IEEE Guide for the Application of Neutral Grounding in Electrical Utility Systems—Part II: Grounding of Synchronous Generator Systems.

c) IEEE Std C62.92.3, IEEE Guide for the Application of Neutral Grounding in Electrical Utility Systems—Part III: Generator Auxiliary Systems.

d) IEEE Std C62.92.4, IEEE Guide for the Application of Neutral Grounding in Electrical Utility Systems—Part IV: Distribution Systems.

e) IEEE Std C62.92.5, IEEE Guide for the Application of Neutral Grounding in Electrical Utility Systems—Part V: Transmission and Subtransmission Systems.

f) IEEE Std C62.92.6, IEEE Guide for the Application of Neutral Grounding in Electrical Utility Systems—Part VI: Systems Supplied by Current-Regulated Sources.

This series of guides is intended for application to three-phase electrical utility systems. They provide definitions and considerations that are general to all types of neutral grounding for electrical utility systems as well as basic considerations of the selection of neutral grounding parameters that will provide for the control of overvoltage and ground-fault current in all parts of three-phase electrical utility systems. They are not intended to be used with the grounding, for example, of industrial systems, which is covered in other guides and standards. These guides and standards should be referenced, when appropriate, to gain a full picture of other grounding practices.

The sources of energization of electrical utility systems have conventionally been rotating generators, which are well characterized as voltage sources in series with predominately inductive impedances. The conventional understanding of system grounding has been based on the assumption that all sources can be characterized as voltage sources. New forms of generation and energy storage are now being interconnected to three-phase electric utility systems via power-electronic conversion devices that are controlled as constant current or constant power devices. Situations where the current- or power-regulated devices become the dominant energization sources for a portion of the utility system can occur. The conventional understanding of system grounding is inadequate to address these situations. This sixth part fulfills the need to re-define and apply the principles of system grounding in the context of these regulated sources.

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IEEE Guide for Application of Neutral Grounding in Electrical Utility Systems, Part VI—Systems Supplied by Current-Regulated Sources

1. Overview

1.1 Scope

This guide is intended for application to three-phase electrical utility systems and is Part VI of the IEEE C62.92™ series. This part provides definitions and considerations related to system grounding where the dominant sources of system energization are current-regulated or power-regulated power conversion devices.

1.2 Purpose

This guide defines neutral grounding in the context of current-regulated and power-regulated sources and presents basic considerations of the selection of neutral grounding parameters that will provide for the control of overvoltage on three-phase electrical utility systems in which such sources are dominant.

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 C62.92.1™, IEEE Guide for the Application of Neutral Grounding in Electrical Utility Systems, Part 1—Introduction.[1, 2]

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