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IEEE Guide for the Application of Neutral Grounding in Electrical Utility Systems—Part IV: Distribution

IEEE Power and Energy Society

Sponsored by the
Surge Protective Devices Committee

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USA

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(Revision of
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Abstract: The neutral grounding of single- and three-phase ac electric-utility primary distribution systems with nominal voltages in the range of 2.4 kV – 34.5 kV is addressed. Classes of distribution-systems grounding are defined. Basic considerations in distribution-system grounding concerning economics, control of temporary overvoltages, control of ground-fault currents, and ground relaying are addressed. Also considered is the use of grounding transformers, grounding of high-voltage neutral of wye-delta distribution transformers, and interconnection of primary and secondary neutrals of distribution transformers.

Keywords: distribution-system grounding, distribution systems, electric utilities, grounding, IEEE C62.92.4™, neutral grounding, primary distribution systems

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Introduction

This introduction is not part of IEEE Std C62.92.4-2014, IEEE Guide for the Application of Neutral Grounding in Electrical Utility Systems—Part IV: Distribution.

This guide is a part of a series of standards on neutral grounding in electrical utility systems. When the series was first approved and published, it replaced IEEE Std 143™-1954, IEEE Guide for Ground-Fault Neutralizers, Grounding of Synchronous Generator Systems, and Neutral Grounding of Transmission Systems. In this series of documents, individual considerations and practices have been given to the grounding of synchronous generator systems, generator-station auxiliary systems, and distribution systems.

IEEE Std 143-1954 is a revision of AIEE No. 954, October 1954, which was a compilation of the following three AIEE Transaction papers:

— AIEE Committee Guide Report, "Application of Ground-Fault Neutralizers," AIEE Transactions (Power Apparatus and Systems), vol. 72, pt. III, pp. 183–190, April 1953.

— AIEE Committee Report, "Application Guide for the Grounding of Synchronous Generator Systems," AIEE Transactions (Power Apparatus and Systems), vol. 72, pt. III, pp. 517–530, June 1953.

— AIEE Committee Report, "Application Guide on Methods of Neutral Grounding of Transmission Systems," AIEE Transactions (Power Apparatus and Systems), vol. 72, pt. III, pp. 663–668, August, 1953.

The contents of Parts I–V of the revision of IEEE Std 143-1954 are based on these documents but are amplified and updated with new material from the IEEE tutorial course "Surge Protection in Power Systems" (79EH0144-6-PWR) and other sources.

In Part I through Part V of this series, the emphasis is on power-system grounding practices as contrasted 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.

It is impossible to give recognition to all those who have contributed to the technology and practices of grounding of power systems, since work involving the preparation of this guide has been in progress for more than 30 years. However, the assistance of members, past and present, of the Neutral Grounding Devices Subcommittee of the Surge Protective Devices Committee, and other similar groups with comparable purposes, should be acknowledged.

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IEEE Guide for the Application of Neutral Grounding in Electrical Utility Systems—Part IV: Distribution

1. Overview

1.1 Scope

This part of the guide is concerned with the neutral grounding of single- and three-phase ac electric-utility primary distribution systems with nominal voltages in the range of 2.4 kV – 34.5 kV. For the purpose of this guide, the term "distribution" includes the substation providing power to distribution feeders, the distribution feeders, and the distribution transformers providing service at utilization voltages. The scope of this guide does not include the grounding of the low-voltage secondary systems supplied by distribution transformers or consumer-owned facilities that are covered by other documents such as the National Electrical Code® (NEC®) (NFPA 70, 2011 Edition)[1] [B28][2]

1.2 Purpose

The purpose of this guide is to provide information regarding neutral grounding of electric-utility primary distribution systems with nominal voltages in the range of 2.4 kV – 34.5 kV. Classes of distribution systems grounding are defined while basic consideration is given to economics, control of temporary overvoltages (TOVs), control of ground fault currents, and ground relaying.

[1] National Electrical Code, NEC, and NFPA 70 are registered trademarks of the National Fire Protection Association, Inc.
[2] The numbers in brackets correspond to those of the bibliography in Annex C.