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IEEE Guide for Safety in AC Substation Grounding

IEEE Power and Energy Society

Sponsored by the
Substations Committee

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USA

IEEE Std 80™-2013
(Revision of
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IEEE-SA Standards Board

Abstract: This guide is primarily concerned with outdoor ac substations, either conventional or gas-insulated. These include distribution, transmission, and generating plant substations. With proper caution, the methods described herein are also applicable to indoor portions of such substations, or to substations that are wholly indoors. No attempt is made to cover the grounding problems peculiar to dc substations. A quantitative analysis of the effects of lightning surges is also beyond the scope of this guide.

Keywords: ground grids, grounding, IEEE 80™, substation design, substation grounding

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Introduction

This introduction is not part of IEEE Std 80™-2013, IEEE Guide for Safety in AC Substation Grounding.

This fifth edition represents the third major revision of this guide since its first issue in 1961. Previous editions extended the equations for calculating touch and step voltages to include L-shaped and T-shaped grids; they introduced curves to help determine current division, changed the criteria for selection of conductors and connections, and provided more information on resistivity measurement interpretation; and added the discussion of multilayer soils.

This edition introduces the calculations to determine *TCAP* for materials not listed in Table 1. This information can be used to calculate *TCAP* for different combinations of bi-metallic electrodes used in grounding systems. This edition also introduces benchmarks. The benchmarks have two purposes. First, the benchmarks compare the equations in IEEE Std 80 to commercially available ground grid design software. The benchmarks show where IEEE Std 80 equations work well and their limitations. Second, the benchmarks provide software users a way to verify their understanding of the software.

The fifth edition continues to build on over 50 years of work by dedicated members of working groups: AIEE Working Group 56.1 and IEEE Working Groups 69.1, 78.1, and D7.

As required by IEEE Std 80-2013/Cor 1-2015, corrections were made to Clause 11, Clause 17, Annex C, Annex H as well as to Table 1 and Table 2; two equations following Figure 45; Table H.5 was replaced by a new Table H.5, and Table H.6 through Table H.10 were added.

Contents

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1. Overview

1.1 Scope

This guide is primarily concerned with outdoor ac substations, either conventional or gas-insulated. Distribution, transmission, and generating plant substations are included. With proper caution, the methods described herein are also applicable to indoor portions of such substations, or to substations that are wholly indoors.

No attempt is made to cover the grounding problems peculiar to dc substations. A quantitative analysis of the effects of lightning surges is also beyond the scope of this guide.

1.2 Purpose

The intent of this guide is to provide guidance and information pertinent to safe grounding practices in ac substation design.