IEEE Guide for the Design and Installation of Cable Systems in Substations

IEEE Power Engineering Society

Sponsored by the
Substations Committee

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Substations Committee
of the
IEEE Power Engineering Society

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IEEE-SA Standards Board

Abstract: The design, installation, and protection of wire and cable systems in substations are covered in this guide, with the objective of minimizing cable failures and their consequences.

Keywords: acceptance testing, cable, cable installation, cable selection, communication cable, electrical segregation, fiber-optic cable, handling, power cable, pulling tension, raceway, recommended maintenance, routing, separation of redundant cable, service conditions, substation, transient protection

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Figure J.1 was replaced as required by IEEE Std 525-2007/Cor1:2008.

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Introduction

This introduction is not part of IEEE Std 525-2007, IEEE Guide for the Design and Installation of Cable Systems in Substations.

This revision of the guide incorporates various changes in cable installation philosophies that have occurred since the 1992 version of the guide. Significant changes have been made in the following areas:

a) Re-ordered much of the common information for all cables into the annexes, and rearranged the clauses to align with specific information for each differing type of cable

b) Added a clause to cover communication cable

c) Expanded and updated the clause for fiber-optic cable

d) Arranged the annexes to better follow the flow of control cable systems selection and design

e) Expanded and updated the annex for cable selection to include a table of common cable sizes and additional equations for calculating resistance effects, and added considerations for jacketing, attenuation and capacitance

f) Added an annex as a design checklist for communication cables

g) Expanded and updated the annex for transient protection (shielding)

h) Added recommended maintenance

i) Added a flowchart in Annex A that references each annex

j) Added an example of cable system design in Annex O for a small substation

k) Removed the fire systems clauses and recommended these be included in the updating of IEEE Std 979™-1994 [B63] [a]

l) Updated to latest version of the IEEE Standards Style Manual

m) Corrected some of the axis labels for percent occupancy in Figure J.1 as required by IEEE Std 525-2007/Cor1:2008

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[a] The numbers in brackets correspond to those of the bibliography in Annex P.

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1. Overview

The main clauses of the guide are organized by cable type and each of these clauses has been organized to match the general steps involved in the design process for a substation cable system (see Annex A for a flowchart diagram). Common information for each type of cable is placed in the annexes and is referenced from the body of the guide. The rationale for organizing the guide in this manner is to make it easier for the user to find the information needed as quickly and efficiently as possible, especially for those individuals unfamiliar with the design of cable systems in substations.

1.1 Scope

This document is a guide for the design, installation, and protection of insulated wire and cable systems in substations with the objective of minimizing cable failures and their consequences. This guide is not an industry standard or a compliance standard.

1.2 Purpose

The purpose of this guide is to provide guidance to the substation engineer in established practices for the application and installation of metallic and optical cables in electric power transmission and distribution substations with the objective of minimizing premature cable failures and their consequences. This guide emphasizes reliable electrical service and safety during the design life of the substation.