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IEEE Guide for Planning and Designing Transition Facilities between Overhead and Underground Transmission Lines

IEEE Power and Energy Society

Sponsored by the
Insulated Conductors Committee

IEEE
3 Park Avenue
New York, NY 10016-5997
USA

IEEE Std 1793™-2012

8 January 2013

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Approved 5 December 2012

IEEE-SA Standards Board

Abstract: Careful consideration of the physical and electrical characteristics of overhead lines and transmission cables are necessary in designing a transition structure between the two systems. Environmental and social factors also play a role in designing a transition. By considering the factors contained in this guide, the user will be better able to design a suitable transition that balances cost, operability, environmental factors, and future flexibility.

Keywords: IEEE 1793, riser poles, transition stations, transition structures

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3 Park Avenue, New York NY 10016-5997, USA

PDF: ISBN 978-0-7381-8114-1 STD98079
Print: ISBN 978-0-7381-8115-8 STDPD98079

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Introduction

This introduction is not part of IEEE Std 1793-2012, IEEE Guide for Planning and Designing Transition Facilities between Overhead and Underground Transmission Lines.

It is sometimes necessary to incorporate an underground cable segment into an overhead transmission line. An underground segment may be needed in areas where it is impractical to obtain overhead right-of-way, to avoid environmentally sensitive areas, to cross obstacles such as rivers or major highways, to cross airport runway safety zones, or to permit other land uses that would not be feasible with overhead lines. When an underground segment is added to an overhead transmission line, a transition facility is required. The transition facility provides a means to terminate the overhead transmission line, terminate the underground cable, connect the overhead and underground segments, and accommodate any ancillary systems associated with the underground cable. Underground cables have electrical and operating characteristics which are different from those of overhead lines, and which can affect the design of transition facilities. Underground transitions facilities are needed for short underground sections ("dips"), which might be measured in the hundreds to thousands of meters. Transition facilities are also required for longer underground segments, which can be several kilometers in length. The length of the underground segment can affect the transition facility design. Overhead to underground transition facilities have planning, siting, design, construction, and maintenance considerations that should be evaluated beginning in the initial stages of a transmission line project.

Participants

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IEEE Guide for Planning and Designing Transition Facilities between Overhead and Underground Transmission Lines

1. Overview

The overhead to underground transition facilities of a hybrid overhead/underground transmission line should be carefully planned and designed. The purpose of this guide is to provide general recommendation of the factors that need to be considered in the planning and design of the transition facility. This guide assumes that the decision to install an underground section has already been made. The intent of this guide is to assist with the selection and installation of the appropriate transition facility. Although this guide is primarily intended for use on alternating current (AC) transmission class underground cable circuits operating at 69 kilovolts (kV) and higher, much of the information presented herein is applicable to high voltage direct current (HVDC) transitions as well. Further, some of the information presented herein can be applied to distribution class electric power cable systems.

1.1 Scope

This guide presents factors to be considered in the planning and design of transition facilities between overhead and underground transmission lines. These include the system implications of a hybrid installation as they relate to the transition facility.

While this document focuses on transmission lines only, some of the considerations listed in this guide are common to both transmission and distribution installations.