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IEEE Guide for Establishing Basic Requirements for High-Voltage Direct-Current Transmission Protection and Control Equipment

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Abstract: The ac/dc substation control equipment, pole control equipment, protection equipment, and auxiliary secondary equipment of high-voltage direct-current (HVDC) transmission systems are the focus of this guide. Based on analyzing the existing HVDC transmission projects, specifications for structure, configuration, performance and test of HVDC control and protection equipment, which could be applied to HVDC transmission system with the voltage range up to and including 800 kV are provided in this guide.

Keywords: ac substation control equipment, auxiliary secondary equipment, dc substation control equipment, HVDC transmission system, IEEE 1899™, pole control equipment, protection equipment

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Introduction

This introduction is not a part of IEEE Std 1899-2017, IEEE Guide for Establishing Basic Requirements for High-Voltage Direct-Current Transmission Protection and Control Equipment.

In recent decades, high-voltage direct-current (HVDC) technology has become a very popular topic both in the academic world and the industrial world. Due to significant advances achieved in the development of high-power devices, HVDC transmission systems have been greatly promoted in today's electrical network. As one of the most important parts in an HVDC transmission system, the control and protection equipment plays an irreplaceable role to help ensure the system's stability, reliability, and safety. Although much work has been devoted to the control and protection equipment, unified international technical guidelines on control and protection equipment have not yet been established. Therefore, this guide is proposed where specifications are stated for structure, configuration, functionality, performance, and test of HVDC control and protection equipment.

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IEEE Guide for Establishing Basic Requirements for High-Voltage Direct-Current Transmission Protection and Control Equipment

1. Scope

This guide specifies the basic norms for protpection and control equipment of high-voltage direct-current (HVDC) transmission systems that have the voltage range up to and including 800 kV. It also defines and specifies requirements for control and protection equipment used in the design, manufacturing, research, and testing of HVDC control and protection equipment.

These guidelines apply to the control and protection equipment for monopolar, bipolar, and two-terminal LCC (line commutated converter) HVDC systems with the main circuit structure of one 12-pulse converter or two series 12-pulse converters per station pole. This guidance can also be used as reference for HVDC applications with other topologies like back-to-back links, parallel converter systems, and multi-terminal/multi-circuit HVDC transmissions.

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.

IEC 60633:2015, Terminology for high-voltage direct current (HVDC) transmission.[1]

IEC 61975:2010, High-voltage direct current (HVDC) installations – System tests.

IEEE Std 1378™-1997, IEEE Guide for Commissioning High-Voltage Direct-Current (HVDC) Converter Stations and Associated Transmission Systems.[2,3]

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