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IEEE Guide for the Application of Transient Recovery Voltage for AC High-Voltage Circuit Breakers with Rated Maximum Voltage above 1000 V

IEEE Power and Energy Society

Sponsored by the
Switchgear Committee

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USA

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(Revision of IEEE Std C37.011-2011)

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Abstract: The procedures and calculations necessary to apply the standard transient recovery voltage (TRV) ratings for ac high-voltage circuit breakers rated above 1000 V are covered in this guide. The breaking capability limits of these circuit breakers are determined to a great degree by the TRV. The TRV ratings are compared with typical system TRV duties. Examples of TRV calculation are given with suggested options if the TRV duty exceeds the TRV ratings of the circuit breaker.

Keywords: high-voltage circuit breakers, IEEE C37.011, transient recovery voltage (TRV)

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Introduction

This introduction is not part of IEEE Std C37.011™-2019, IEEE Guide for the Application of Transient Recovery Voltage for AC High-Voltage Circuit Breakers with Rated Maximum Voltage above 1000 V.

This application guide has been revised to align the new TRV requirements introduced in IEEE Std C37.04™, IEEE Std C37.09™, and IEEE Std C37.06.1™.

The main changes implemented in this guide concern:

— Revision of 3.2 to develop the part on arc-circuit interaction

— Revision of 3.3 to incorporate information formerly in IEEE Std C37.04b™ but not incorporated in the latest revision of IEEE Std C37.04

— Revision of 3.3.4 to give more detailed explanations on TRV modification during interruption of asymmetrical currents

— Revision of 4.2.3 on short-line faults

— Revision of 4.4.1 to update with IEEE Std C37.06.1 and give guidance

— Addition of 4.5.2 to incorporate TRVs on series capacitor banks

— New Clause 5 to cover testing issues

— New Annex D on guidance for TRV calculation by electromagnetic transients program

— New Annex E on abbreviations

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IEEE Guide for the Application of Transient Recovery Voltage for AC High-Voltage Circuit Breakers with Rated Maximum Voltage above 1000 V

1. Overview

1.1 Scope

This application guide covers procedures and calculations necessary to apply the standard transient recovery voltage (TRV) ratings for ac high-voltage circuit breakers with rated maximum voltage above 1000 V. The breaking capability limits of these circuit breakers are determined to a great degree by the TRV. This application guide is not included in other existing circuit breaker standards. In this document, the TRV ratings are compared with typical system TRV duties. Examples of TRV calculation are given with suggested options if the TRV duty exceeds the TRV ratings of the circuit breaker.

1.2 Purpose

The purpose of this guide is to provide an application guide on the TRV ratings given in IEEE Std C37.04™ for ac high-voltage circuit breakers rated on a symmetrical current basis. Definitions, rating structure, test procedures, and preferred transient voltage ratings and related required capabilities are included in IEEE Std C37.04, IEEE Std C37.09™, and IEEE Std C37.06.1™. IEEE Std C37.010™ applies in other respects to these circuit breakers.

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 62271-100, High-voltage switchgear and controlgear—Part 100: Alternating-current circuit-breakers.[1]

IEC 62271-101, High-voltage switchgear and controlgear—Part 101: Synthetic testing.

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