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IEEE Guide for the Application of Shunt Reactor Switching

IEEE Power & Energy Society

Sponsored by the
Switchgear Committee

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Abstract: Guidance for the application of ac high-voltage circuit breakers for shunt reactor switching is provided. Overvoltage generation for the three cases of shunt reactors being directly grounded, ungrounded, or grounded through a neutral reactor is addressed in terms of derivation and limitation methods. Circuit breaker specification for the purpose and the use of laboratory test results to predict field performance is also covered by this guide.

Keywords: ac high voltage circuit breakers, application, inductive load switching, overvoltages, shunt reactor switching, small inductive currents

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Introduction

This introduction is not part of IEEE Std C37.015™-2009, IEEE Guide for the Application of Shunt Reactor Switching.

The subject of shunt reactor switching is complex. The approach taken in the main text of the guide is to present a basic method for the application of circuit breakers for the purpose, which considers only load side circuit characteristics. The method is conservative and will be adequate in many instances. However, by reference to a series of notes, the general case (which incorporates the influence of the source side characteristics and the parallel capacitance of the circuit breaker) is presented. The user of this application guide is encouraged to exercise due discretion in the choice of the basic or general method for the application under consideration. Consideration should, in addition, be given to the magnetic effects associated with air core shunt reactors.

This standard is a revision of IEEE Std C37.015™-1993.

Listed as follows, for information and guidance, are the substantive changes:

- The terms “medium voltage” (MV), “high voltage” (HV), and “extra high voltage” (EHV) have been replaced by a voltage range.
- Subclause 5.2.2 (gapped surge arresters) of the 1993 edition has been moved to an annex (Annex H).
- A list of symbols has been added (Annex G).
- Some of the figures have been redrawn.

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IEEE Guide for the Application of Shunt Reactor Switching

1. Overview

1.1 Scope

This application guide applies to ac high-voltage circuit breakers rated for shunt reactor switching.

The guide covers the specific cases of switching directly grounded shunt reactors, ungrounded shunt reactors, and shunt reactors grounded through a neutral reactor. Directly grounded reactors are common on systems having a voltage of 60 kV and above, whereas ungrounded reactors are commonly applied on systems having a voltage below 60 kV. Schemes where the reactor is grounded through a neutral reactor are usually applied only on systems having a voltage of 60 kV and above.

Whereas this application guide is directed toward circuit breakers, it is recognized and accepted that other switching devices such as high-voltage load break switches and circuit switchers are capable of shunt reactor switching and this guide may be applied as appropriate.

1.2 Purpose

This guide is intended for general use in the application of ac high-voltage circuit breakers for shunt reactor current switching.

The current to be interrupted is generally less than 300 A rms; however, shunt reactor switching imposes a unique and severe duty on the connected system and the circuit breaker. Successful interruption is the result of a complex interaction between the circuit breaker and the circuit; this interaction can result in significant overvoltages. The purpose of the guide is to describe, principally for the benefit of the user, the shunt