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IEEE Guide for Field Testing of Shielded Power Cable Systems Rated 5 kV and Above with Damped Alternating Current (DAC) Voltage

IEEE Power and Energy Society

Sponsored by the
Insulated Conductors Committee

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Abstract: The application of Damped ac (DAC) for field testing of power cables is described. DAC voltage withstand testing and diagnostic tests and measurements that are performed in combination with DAC voltage application in the field on shielded power cable systems are discussed. Whenever possible, cable systems are treated in a similar manner to individual cables. Tables and figures are included to show the effectiveness of the DAC ac voltage test, the diagnostic evaluation and the user experiences in the past years for field testing of different medium and (extra) high voltage cable system.

Keywords: after-laying testing, asset management, cable fault locating, cable system testing, cable testing, condition assessment, condition monitoring, damped ac voltage testing, diagnostic testing, dielectric losses, electric breakdown, grounding, high-voltage testing, IEEE 400.4™, nondestructive testing, oil-filled cables, partial discharge measurement, power cable insulation, safety, tangent delta testing.

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Introduction

This introduction is not part of IEEE Std 400.4™-2015, IEEE Guide for Field Testing of Shielded Power Cable Systems Rated 5 kV and Above with Damped Alternating Current (DAC) Voltage.

This guide provides an overview of an available method for performing electrical tests in the field on shielded power cable systems using damped alternating current (DAC) voltages. It is intended to help the reader select a test that is appropriate for a specific situation of interest. It provides a brief description of the use of DAC voltage sources to perform field tests with a short discussion of specific tests. The material presented is descriptive and tutorial. Based on the current state of the art using this testing method, the guide addresses the evaluation of test results, the specification of test voltage levels and time of application.

If applicable, additional details are provided in the omnibus standard, IEEE Std 400™[1], IEEE Guide for Field Testing and Evaluation of the Insulation of Shielded Power Cable Systems Rated 5 kV and Above, or in "point" documents, such as IEEE 400.1™, IEEE Guide for Field Testing of Laminated Dielectric, Shielded Power Cable Systems Rated 5 kV and Above with High Direct Current Voltage; IEEE 400.2™, IEEE Guide for Field Testing of Shielded Power Cable Systems Using Very Low Frequency (VLF); and IEEE 400.3™, IEEE Guide for Partial Discharge Testing of Shielded Power Cable Systems in a Field Environment.

[1] Information on references can be found in Clause 2.

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1. Overview

1.1 Background

This guide provides a description of the methods and practices to be used in the application of damped alternating current (DAC) voltages for field testing of shielded power cable systems.

DAC voltage testing is one of the alternative methods of ac voltage testing and is applicable for a broad range of medium-voltage (MV), high-voltage (HV), and extra-high-voltage (EHV) cable types. As the DAC test procedure has been used for several years for diagnostic, maintenance and acceptance (commissioning) tests, it provides a method of evaluation of the insulation condition and helps to fill the need for more complete information on the condition of cable systems.

This guide addresses DAC voltage testing in the frequency range from 20 Hz to 500 Hz [B12], [B14], [B16], [B31], [B45], [B78][1].

The information contained in this guide is intended to provide the methodology, the voltage levels, and test procedures as well as other factors to be considered when utilizing DAC voltages, whether for withstand or

[1] The numbers in brackets correspond to those of the bibliography in Annex F.