IEEE Standard for Test Procedures and Requirements for Alternating-Current Cable Terminations Used on Shielded Cables Having Laminated Insulation Rated 2.5 kV through 765 kV or Extruded Insulation Rated 2.5 kV through 500 kV

IEEE Power & Energy Society

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21 August 2009

IEEE Std 48™-2009
(Revision of
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Approved 17 June 2009

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Abstract: All indoor and outdoor cable terminations used on alternating-current cables having laminated insulation rated 2.5 kV through 765 kV or extruded insulation rated 2.5 kV through 500 kV are covered, except for separable insulated connectors, which are covered by IEEE Std 386™-2006.
Keywords: accelerated contamination testing, correction factors, dielectric field tests, environmental exposure, nonstandard service conditions, rating, solar radiation, standard service conditions, test requirements, ultraviolet light

The Institute of Electrical and Electronics Engineers, Inc.
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PDF: ISBN 978-0-7381-5988-1 STD95939
Print: ISBN 978-0-7381-5989-8 STDPD95939

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Introduction

This introduction is not part of IEEE Std 48-2009, IEEE Standard for Test Procedures and Requirements for Alternating-Current Cable Terminations Used on Shielded Cables Having Laminated Insulation Rated 2.5 kV through 765 kV or Extruded Insulation Rated 2.5 kV through 500 kV.

This standard supersedes IEEE Std 48-1996, IEEE Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV.

This standard has been harmonized with IEEE Std 404™-2006 [B21][a] to allow for simultaneous testing of terminations and joints.

Definitions specific to this standard are contained in Clause 3. All other definitions and terminology used herein can be found in *The IEEE Standards Dictionary: Glossary of Terms & Definitions*.[b]

In Clause 7, the tables for extruded dielectric cable terminations have been split into two tables; Table 1 is for cable terminations rated 2.5 kV to 46 kV, and the Table 2 is for cable terminations rated 69 kV to 500 kV.

In Clause 8, 8.2.1, provisions have been made to allow either the 10 s or the 60 s precipitation test.

Subclause 8.4.3 for leak test has been completely rewritten.

Clause 9 has been expanded to include a pollution severity guide to assist the user in defining a particular environment and helping determine the type of termination and creepage length needed.

Clause 10 has been added to discuss the effects of solar radiation and test methods are recommended. The user is also advised to refer to the manufacturer for contamination testing, particularly if difficult environments are encountered.

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[b] *The IEEE Standards Dictionary: Glossary of Terms & Definitions* is available at http://shop.ieee.org/.

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1. Scope

This standard covers all indoor and outdoor cable terminations used on alternating-current shielded cables having laminated insulation from 2.5 kV through 765 kV and extruded insulation rated 2.5 kV through 500 kV, except separable insulated connectors, which are covered by IEEE Std 386™-2006 [B18].[1]

Cable terminations and component parts shall be capable of withstanding the tests specified in this standard.

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

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2. Normative references

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IEC 60270, High Voltage Test Techniques—Partial Discharge Measurements.[2]

IEEE Std 4™, IEEE Standard Techniques for High-Voltage Testing (ANSI).[3, 4]

IEEE Std 82™, IEEE Standard Test Procedure for Impulse Voltage Tests on Insulated Conductors (ANSI).

IEEE Std 835™, IEEE Standard Power Cable Ampacity Tables (ANSI).

3. Definitions

For the purposes of this document, the following terms and definitions apply. *The IEEE Standards Dictionary: Glossary of Terms & Definitions* should be referenced for terms not defined in this clause.[5]

The definitions and terminology used herein apply specifically to cable terminations treated in this standard.

3.1 apparatus termination: A termination designed for use in sealed enclosures where the external dielectric strength is dependent upon liquid or special gaseous dielectric and where the ambient temperature of the medium immediately surrounding the termination may reach 65 °C.

NOTE—The temperature change from 55 °C to 65 °C was recommended to match the switchgear specification of 65 °C.[6]

3.2 high-voltage cable termination: A device used for terminating power cables having laminated or extruded insulation rated 2.5 kV and above, which are classified according to the following:

a) Class 1 termination: Provides electric stress control for the cable insulation shield terminus; provides external insulation between the cable conductor(s) and ground; and provides a seal to the end of the cable against the entrance of the external environment and maintains the operating design pressure, if any, of the cable system. This class is divided into the following three types:

   1) Class 1A: For use on extruded dielectric cable

   2) Class 1B: For use on laminated dielectric cable

   3) Class 1C: Expressly for pressurized cable systems

[2] IEC publications are available from the Central Office of the International Electrotechnical Commission, Case Postale 131, 3 rue de Varembé, CH-1211, Geneva 20, Switzerland (http://www.iec.ch/). IEC publications are also available in the United States from the American National Standards Institute, Customer Service Department, 25 W. 43rd Street, 4th Floor, New York, NY 10036, USA (http://www.ansi.org/).
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b) Class 2 termination: Provides electric stress control for the cable insulation shield terminus, and provides external insulation between the cable conductor(s) and ground.

c) Class 3 termination: Provides electric stress control for the cable insulation shield terminus.

3.3 indoor termination–dry: A termination intended for use where it is protected from solar radiation and precipitation and not subject to periodic condensation, or other excessive humidity [90% relative humidity (RH) or more]. May be installed in air conditioned or heated areas.

3.4 indoor termination–wet: A termination intended for use where it is protected from direct exposure to both solar radiation and precipitation, but is subjected to climatic conditions that can cause condensation onto the termination surfaces. These are Class 1A, 1B, or 1C terminations.

3.5 outdoor termination: A termination intended for use where it is not protected from direct exposure to either solar radiation or precipitation. These are Class 1A, 1B, or 1C terminations.

3.6 outdoor termination–polluted: A termination intended for use where it is not protected from direct exposure to either solar radiation or precipitation, and is exposed to nonstandard (unusual) service conditions such as extreme seacoast salt deposits, solid precipitates, etc. Often requires extra maintenance, such as washing or extra creepage length.

3.7 partial discharge extinction voltage: The voltage at which partial discharge is no longer detectable on instrumentation adjusted to a specified sensitivity, following the application of a specified higher voltage.

3.8 routine tests: Tests made on each high-voltage cable termination or upon a representative number of devices, or parts thereof, during production for purposes of quality control.

3.9 termination insulator: An insulating housing used to protect each cable conductor passing through the device and provide complete external leakage insulation between the cable conductor(s) and ground.

3.10 weathersheds: The external part of the termination insulator that protects the core and provides the wet electrical strength and leakage distance.

3.11 withstand test voltage: The voltage for which the device must provide insulation under specified conditions without flashover, disruptive discharge, puncture, or other electrical failure.

3.12 100% insulation level: Cables in this category may be applied where the system is provided with relay protection such that ground faults will be cleared as rapidly as possible, but in any case within 1 min.

NOTE—For power frequency voltages, the values specified are RMS values applied for a specified time. For lightning or switching impulse voltages, the values specified are crest values of a specified wave. For direct voltages, the values specified are average values and for a specified time.

4. Service conditions

4.1 Standard service conditions

Devices conforming to this standard shall be capable of successful operation under the following service conditions. Refer to ICEA T-24-380 (2007) [B15] for more information.

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