IEEE STANDARDS ASSOCIATION

IEEE Standard for High-Voltage Direct-Current (HVDC) Composite Post Insulators

IEEE-SA Board of Governors

Sponsored by the
Corporate Advisory Group

IEEE
3 Park Avenue
New York, NY 10016-5997
USA

IEEE Std 1898™-2016

IEEE Standard for High-Voltage Direct-Current (HVDC) Composite Post Insulators

Sponsor

Corporate Advisory Group
of the
IEEE-SA Board of Governors

Approved 22 September 2016

IEEE-SA Standards Board

Abstract: Outdoor and indoor composite station post insulators used in high-voltage direct-current power transmission systems are covered in this standard. The composite station post insulators covered by this standard consist of a load-bearing insulating core (or tube), a housing (outside the insulating solid core or tube) made of elastomer material (e.g., silicone or ethylene-propylene), and end fittings attached to the insulating core (or tube).

Keywords: composite station post insulator, core (or tube) material, electrical performance, HVDC, IEEE 1898™, mechanical performance, tracking and erosion

The Institute of Electrical and Electronics Engineers, Inc.
3 Park Avenue, New York, NY 10016-5997, USA

PDF: ISBN 978-1-5044-3669-4 STD22376
Print: ISBN 978-1-5044-3670-0 STDPD22376

Important Notices and Disclaimers Concerning IEEE Standards Documents

IEEE documents are made available for use subject to important notices and legal disclaimers. These notices and disclaimers, or a reference to this page, appear in all standards and may be found under the heading "Important Notices and Disclaimers Concerning IEEE Standards Documents." They can also be obtained on request from IEEE or viewed at http://standards.ieee.org/IPR/disclaimers.html.

Notice and Disclaimer of Liability Concerning the Use of IEEE Standards Documents

IEEE Standards documents (standards, recommended practices, and guides), both full-use and trial-use, are developed within IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Association ("IEEE-SA") Standards Board. IEEE ("the Institute") develops its standards through a consensus development process, approved by the American National Standards Institute ("ANSI"), which brings together volunteers representing varied viewpoints and interests to achieve the final product. IEEE Standards are documents developed through scientific, academic, and industry-based technical working groups. Volunteers in IEEE working groups are not necessarily members of the Institute and participate without compensation from IEEE. While IEEE administers the process and establishes rules to promote fairness in the consensus development process, IEEE does not independently evaluate, test, or verify the accuracy of any of the information or the soundness of any judgments contained in its standards.

IEEE Standards do not guarantee or ensure safety, security, health, or environmental protection, or ensure against interference with or from other devices or networks. Implementers and users of IEEE Standards documents are responsible for determining and complying with all appropriate safety, security, environmental, health, and interference protection practices and all applicable laws and regulations.

IEEE does not warrant or represent the accuracy or content of the material contained in its standards, and expressly disclaims all warranties (express, implied and statutory) not included in this or any other document relating to the standard, including, but not limited to, the warranties of: merchantability; fitness for a particular purpose; non-infringement; and quality, accuracy, effectiveness, currency, or completeness of material. In addition, IEEE disclaims any and all conditions relating to: results; and workmanlike effort. IEEE standards documents are supplied "AS IS" and "WITH ALL FAULTS."

Use of an IEEE standard is wholly voluntary. The existence of an IEEE standard does not imply that there are no other ways to produce, test, measure, purchase, market, or provide other goods and services related to the scope of the IEEE standard. Furthermore, the viewpoint expressed at the time a standard is approved and issued is subject to change brought about through developments in the state of the art and comments received from users of the standard.

In publishing and making its standards available, IEEE is not suggesting or rendering professional or other services for, or on behalf of, any person or entity nor is IEEE undertaking to perform any duty owed by any other person or entity to another. Any person utilizing any IEEE Standards document, should rely upon his or her own independent judgment in the exercise of reasonable care in any given circumstances or, as appropriate, seek the advice of a competent professional in determining the appropriateness of a given IEEE standard.

IN NO EVENT SHALL IEEE BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO: PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE PUBLICATION, USE OF, OR RELIANCE UPON ANY STANDARD, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE AND REGARDLESS OF WHETHER SUCH DAMAGE WAS FORESEEABLE.

Translations

The IEEE consensus development process involves the review of documents in English only. In the event that an IEEE standard is translated, only the English version published by IEEE should be considered the approved IEEE standard.

Official statements

A statement, written or oral, that is not processed in accordance with the IEEE-SA Standards Board Operations Manual shall not be considered or inferred to be the official position of IEEE or any of its committees and shall not be considered to be, or be relied upon as, a formal position of IEEE. At lectures, symposia, seminars, or educational courses, an individual presenting information on IEEE standards shall make it clear that his or her views should be considered the personal views of that individual rather than the formal position of IEEE.

Comments on standards

Comments for revision of IEEE Standards documents are welcome from any interested party, regardless of membership affiliation with IEEE. However, IEEE does not provide consulting information or advice pertaining to IEEE Standards documents. Suggestions for changes in documents should be in the form of a proposed change of text, together with appropriate supporting comments. Since IEEE standards represent a consensus of concerned interests, it is important that any responses to comments and questions also receive the concurrence of a balance of interests. For this reason, IEEE and the members of its societies and Standards Coordinating Committees are not able to provide an instant response to comments or questions except in those cases where the matter has previously been addressed. For the same reason, IEEE does not respond to interpretation requests. Any person who would like to participate in revisions to an IEEE standard is welcome to join the relevant IEEE working group.

Comments on standards should be submitted to the following address:

Secretary, IEEE-SA Standards Board
445 Hoes Lane
Piscataway, NJ 08854 USA

Laws and regulations

Users of IEEE Standards documents should consult all applicable laws and regulations. Compliance with the provisions of any IEEE Standards document does not imply compliance to any applicable regulatory requirements. Implementers of the standard are responsible for observing or referring to the applicable regulatory requirements. IEEE does not, by the publication of its standards, intend to urge action that is not in compliance with applicable laws, and these documents may not be construed as doing so.

Copyrights

IEEE draft and approved standards are copyrighted by IEEE under U.S. and international copyright laws. They are made available by IEEE and are adopted for a wide variety of both public and private uses. These include both use, by reference, in laws and regulations, and use in private self-regulation, standardization, and the promotion of engineering practices and methods. By making these documents available for use and adoption by public authorities and private users, IEEE does not waive any rights in copyright to the documents.

Photocopies

Subject to payment of the appropriate fee, IEEE will grant users a limited, non-exclusive license to photocopy portions of any individual standard for company or organizational internal use or individual, non-commercial use only. To arrange for payment of licensing fees, please contact Copyright Clearance Center, Customer Service, 222 Rosewood Drive, Danvers, MA 01923 USA; +1 978 750 8400. Permission to photocopy portions of any individual standard for educational classroom use can also be obtained through the Copyright Clearance Center.

Updating of IEEE Standards documents

Users of IEEE Standards documents should be aware that these documents may be superseded at any time by the issuance of new editions or may be amended from time to time through the issuance of amendments, corrigenda, or errata. An official IEEE document at any point in time consists of the current edition of the document together with any amendments, corrigenda, or errata then in effect.

Every IEEE standard is subjected to review at least every ten years. When a document is more than ten years old and has not undergone a revision process, it is reasonable to conclude that its contents, although still of some value, do not wholly reflect the present state of the art. Users are cautioned to check to determine that they have the latest edition of any IEEE standard.

In order to determine whether a given document is the current edition and whether it has been amended through the issuance of amendments, corrigenda, or errata, visit the IEEE Xplore at http://ieeexplore.ieee.org/ or contact IEEE at the address listed previously. For more information about the IEEE-SA or IEEE's standards development process, visit the IEEE-SA Website at http://standards.ieee.org.

Errata

Errata, if any, for all IEEE standards can be accessed on the IEEE-SA Website at the following URL: http://standards.ieee.org/findstds/errata/index.html. Users are encouraged to check this URL for errata periodically.

Patents

Attention is called to the possibility that implementation of this standard may require use of subject matter covered by patent rights. By publication of this standard, no position is taken by the IEEE with respect to the existence or validity of any patent rights in connection therewith. If a patent holder or patent applicant has filed a statement of assurance via an Accepted Letter of Assurance, then the statement is listed on the IEEE-SA Website at http://standards.ieee.org/about/sasb/patcom/patents.html. Letters of Assurance may indicate whether the Submitter is willing or unwilling to grant licenses under patent rights without compensation or under reasonable rates, with reasonable terms and conditions that are demonstrably free of any unfair discrimination to applicants desiring to obtain such licenses.

Essential Patent Claims may exist for which a Letter of Assurance has not been received. The IEEE is not responsible for identifying Essential Patent Claims for which a license may be required, for conducting inquiries into the legal validity or scope of Patents Claims, or determining whether any licensing terms or conditions provided in connection with submission of a Letter of Assurance, if any, or in any licensing agreements are reasonable or non-discriminatory. Users of this standard are expressly advised that determination of the validity of any patent rights, and the risk of infringement of such rights, is entirely their own responsibility. Further information may be obtained from the IEEE Standards Association.

Participants

At the time this standard was submitted to the IEEE-SA Standards Board for approval, the Standard Specifications of HVDC Composite Post Insulators Working Group had the following membership:

Bing Luo, *Chair*
Xidong Liang, *Vice Chair*

Zhenping Dang
Guofang Gao
Ying Huang
Shaohua Li
Xiaolin Li
Bo Liu
Tong Liu
Yunpeng Song
Jiafu Wang
Yang Xiang
Zhongli Xu
Jie Yu
Yunfeng Yue
Fuzeng Zhang
Jun Zhou
Shuchen Zhou
Yong Zhu

The following members of the entity balloting committee voted on this standard. Balloters may have voted for approval, disapproval, or abstention.

ABB, Inc.
Beijing Sifang Automation Co., Ltd.
China Datang Corporation
China Energy Engineering Group Co. Ltd.
China Southern Power Grid Co., Ltd.
China XD Group Corp.
General Electric
Institute of Electrical Engineering Chinese Academy of Sciences
Jiangsu Shenma Electric Co., Ltd.
North China Electric Power University
Shanghai Jiao Tong University
Siemens Corporation
Southeast University, China
Southwest Jiaotong University
Tsinghua University

When the IEEE-SA Standards Board approved this standard on 22 September 2016, it had the following membership:

Jean-Philippe Faure, *Chair*
Ted Burse, *Vice Chair*
John D. Kulick, *Past Chair*
Konstantinos Karachalios, *Secretary*

Chuck Adams
Masayuki Ariyoshi
Stephen Dukes
Jianbin Fan
J. Travis Griffith
Gary Hoffman
Ronald W. Hotchkiss
Michael Janezic
Joseph L. Koepfinger*
Hung Ling
Kevin Lu
Annette D. Reilly
Gary Robinson
Mehmet Ulema
Yingli Wen
Howard Wolfman
Don Wright
Yu Yuan
Daidi Zhong

*Member Emeritus

Introduction

This introduction is not part of IEEE Std 1898-2016, IEEE Standard for High-Voltage Direct-Current (HVDC) Composite Post Insulators.

This standard was prepared by the Working Group P1898 to establish standard specifications for high-voltage direct-current (HVDC) composite post insulators. Although composite post insulators for HVDC applications have been built and operated for over several years, only a limited number of papers, guides and standards are available and can be directly used for the manufacturing and testing of such insulators. The IEC polymeric insulator standard IEC 62217:2012 also covers insulators used in dc applications; however, a tracking and erosion test procedure for dc applications is not specified. Given the increased activity in HVDC transmission, a significant need has arisen for a standard that specifically covers the requirements and testing of composite post insulators for HVDC applications.

Significant accomplishments of this standard include the following:

a) Establishment of a tracking and erosion test for HVDC composite post insulators

b) Integration of test methodology for composite insulators with ceramic core, resin impregnated fibers solid core, and hollow insulator

The purpose of this document is to define the requirements and test code for HVDC composite post insulators. This standard utilizes feedback from manufacturers and end users. Radio interference and corona tests are not specified in this standard because the radio interference and corona performances are not characteristics of the insulator alone.

Contents

IEEE Standard for High-Voltage Direct-Current (HVDC) Composite Post Insulators

1. Scope

The standard describes the terms and definition, use condition, technical requirement, and test methods of composite post insulators for high-voltage direct-current (HVDC) power transmission systems up to ±800 kV.

This standard applies to outdoor and indoor composite station post insulators used in HVDC power transmission systems. The composite station post insulators covered by this standard consist of a load-bearing insulating core (or tube), a housing (outside the insulating solid core or tube) made of elastomer material (e.g., silicone or ethylene-propylene), and end fittings attached to the insulating core (or tube).

This standard covers the following three types of post insulators:

a) Composite post insulator with a ceramic core

b) Composite post insulator with a resin impregnated fibers solid core

c) Composite gas-filled hollow post insulator

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.

CIGRE Technical Brochure 361:2008, Outdoor Insulation in Polluted Conditions: Guidelines for Selection and Dimensioning—Part 1: General principles and the AC case.[1]

CIGRE Technical Brochure 555:2013, Artificial Pollution Test for Polymer Insulators.

IEC 60071-1:2006, Insulation co-ordination—Part 1: Definitions, principles and rules.[2]

IEC 60071-2:1996, Insulation co-ordination—Part 2: Application guide.

[1]CIGRE publications are available from the Council on Large Electric Systems (http://www.e-cigre.org/).
[2]IEC publications are available from the International Electrotechnical Commission (http://www.iec.ch) and the American National Standards Institute (http://www.ansi.org/).