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(Reaffirmation and redesignation of ANSI C92.1-1982)

IEEE Standard for Power Systems—Insulation Coordination

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Abstract: Equipment for three-phase alternating-current (ac) systems having a system voltage above 1 kV nominal is discussed. Except for some definitions, this standard includes only phase-to-ground insulation. The object of this standard is to guide the preparation of specifications for insulation of the various items of equipment in a given installation.
Keywords: alternating-current systems, insulation, system voltage, system voltage testing

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Introduction

(This introduction is not a part of IEEE Std 1313-1993, IEEE Standard for Power Systems—Insulation Coordination.)

This standard is a major revision of the previous standard, ANSI C92.1-1971, and presents the process of insulation coordination. Two discrete areas are addressed: self-restoring and nonself-restoring insulation. The statistical procedure of insulation coordination is applicable only for self-restoring insulations.

The basic lightning impulse insulation levels (BIL) and the basic switching impulse insulation levels (BSL) for self-restoring insulations are statistically defined as the crest value of a lightning or switching impulse test voltage at which the insulation exhibits a 90% withstand probability (or a 10% flashover probability). The distribution of lightning or switching overvoltages is defined by a single value that is the crest value of an overvoltage having a 2% probability of being exceeded. The statistical or probabilistic method for insulation coordination allows for insulation failures to occur and attempts to quantify the probability of an insulation flashover. This method statistically compares the voltage stresses on the insulation with the strength of the insulation.

The conventional method for insulation coordination presently required for nonself-restoring insulations consists of comparing the conventional BIL or BSL with the maximum lightning or switching overvoltage. The probability of a flashover is not calculated using the conventional method.

For purposes of insulation coordination, maximum system voltages above 1 kV are divided into three voltage classes:

Medium Voltage. Greater than 1 kV and equal to or less than 72.5 kV.
High Voltage. Greater than 72.5 kV and equal to or less than 242 kV.
Extra-High and Ultra-High Voltage. Greater than 242 kV.

This standard, although applicable to the three voltage classes, places primary emphasis on voltages greater than 242 kV. For the purposes of insulation coordination, extra-high and ultra-high voltages are considered one class. Work on the medium- and high-voltage classes is now in progress in cooperation with the equipment committees and, upon completion, this standard will be revised.

This standard applies only to phase-to-ground insulation except for some definitions. Future revisions will treat phase-to-phase insulation and also the area of the lightning chopped wave insulation strength.

In the development of this standard, IEC Publication 71-1 (1976), Insulation coordination—Part 1: Terms, definitions, principles, and rules, was used as the primary guide. The major differences between this standard and the IEC standard are as follows:

a) Maximum system voltage of 550 kV and 800 kV are used instead of 525 kV and 765 kV.
b) Values of BILs and BSLs of 825 kV and 900 kV are used instead of 850 kV and 950 kV.
c) Values of BILs and BSLs above 1800 kV increase in increments of 125 kV, whereas in the IEC standard, increments of 150 kV are used.
d) The terms BIL and BSL are maintained in this standard, whereas the IEC standard uses the term rated lightning (or switching) impulse withstand voltage.
e) In this standard, the specific combination of values of BIL and BSL for an apparatus is not specified. In the IEC standard, a specific set of values of BIL are tied to each value of BSL.

Suggestions for improvement and revision of this standard will be welcome. They should be sent to the IEEE Standards Department, 445 Hoes Lane, Piscataway, NJ 08855-1331.