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(Revision of
IEEE Std C57.19.01-1991)

IEEE Standard Performance Characteristics and Dimensions for Outdoor Apparatus Bushings

Sponsor

Transformers Committee
of the
IEEE Power Engineering Society

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Abstract: Electrical, dimensional, and related requirements for outdoor power apparatus bushings that have basic impulse insulation levels (BILs) of 200 kV and above are covered. Specific values for dimensional and related requirements that are to be interpreted, measured, or tested, in accordance with IEEE Std C57.19.00-1991, are provided.

Keywords: basic impulse insulation levels (BILs), cantilever test, capacitance, creepage distance, flashover, line-to-ground voltage, nominal system voltage, power apparatus bushings, power factor

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Introduction

(This introduction is not part of IEEE Std C57.19.01-2000, IEEE Standard Performance Characteristics and Dimensions for Outdoor Apparatus Bushings.)

The tables and other information contained in this document were originally in ANSI C76.1-1943 through ANSI C76.1-1964. In August of 1968, the ANSI C76.1 Committee decided to divide the standard into three parts. The first (ANSI C76.1) covers general requirements and test procedures, the second (ANSI C76.2) covers explicit ratings and dimensions, and the third (ANSI C76.3) covers the application guide.

ANSI C76.2-1977/IEEE Std 24-1977 incorporated changes that included

- a) Adding dual current ratings for 115–196 kV insulation class bushings for transformers and circuit breakers
- b) Adding voltage class ratings for 362–800 kV with wet switching impulse test values and coordination with switching surge sparkover values of arresters
- c) Adding and updating acceptance limits for partial discharge, power factor, and capacitance

ANSI/IEEE Std 24-1984 incorporated revisions in Table 1 and Table 9 to make them compatible with the concept of IEEE Std 262B-1977.

IEEE Std C57.19.01-1991, sponsored by the IEEE Transformers Committee, incorporated changes to make it compatible with the new test procedures established by its companion standard, IEEE Std C57.19.00-1991. These changes included Table 9 and Table 10.

During the work on the latest revision, IEEE Std C57.19.01-2000, major changes have been incorporated. These changes were the result of feedback from the Edison Electric Institute (EEI), original equipment manufacturers (OEMs), and users. The ratings were standardized in an effort to create fewer ratings and reduce the need for large inventories of spare bushings, which have accumulated from decades of special designs. Bushings in inventory incur a large tax burden from accruing bushing costs in 2–5 y. In addition, the requirement for bushings for application on new bulk oil circuit breakers ceased because these breakers were no longer being produced. The working group reviewed this information and agreed to revise the standard to reduce the number of ratings, promote standardization, improve bushing characteristics for new transformers, and achieve overall cost improvements. This work has resulted in the reduction of designs/ratings from 56 to 21. These changes include the following:

- *Table 1, Electrical insulation characteristics.* The number of voltage classes has been reduced from 19 to 7 to cover the 34.5–765 kV voltage range. Voltage/insulation classes, which were a part of Table 1 in IEEE Std C57.19.01-1991, but not included in Table 1 of this standard, are included in Annex A to provide information on replacement bushings. The system voltage designation has been changed to indicate nominal rating in conformance with transformer standard IEEE Std C57.12.00-1993. The BIL rating for each voltage class is based on the highest BIL specified in IEEE Std C57.12.00-1993 for the same voltage class. A BIL of 2050 kV has been adopted for 756 kV rating. A column on creepage distance has been added to provide information on values corresponding to contaminated (heavy) environments as per IEEE Std C57.19.100-1995.
- *Table 2, Dimensions for bushings up to 69 kV.* Current ratings of 400/1200 A, 2000 A, 3000 A, and 5000 A have been standardized. A current transformer pocket length of 534 mm (21 in) has been standardized for these ratings. The bottom-end length has been standardized in each voltage class. The top terminal diameters have been standardized at 1.5 in for current up to 2000 A, 2 in for 3000 A, and 4 in for 5000 A rating. The bottom terminal configuration for ratings 2000 A and above have been changed from threaded stud to two- and four-hole bladed configurations similar to those in NEMA CC1-1993. Information on transformer and circuit breaker interchangeable (TBI) and

breaker ratings has been taken out. The footnote on draw-lead application has been revised to define the current-carrying limit.

- *Table 3, Dimensions for bushings above 69 kV.* Current ratings of 800/1200 A, 2000 A, and 3000 A have been standardized. A current transformer pocket length of 584 mm (23 in) has been standardized for these ratings. The bottom-end length has been standardized in each voltage class. The “D” diameter for the 196/230 kV rating has been reduced. The top terminal diameters have been standardized at 1.5 in for current up to 2000 A, and 2 in for 3000 A rating. Dimensions for 500 kV and 765 kV ratings have been added. Information on TBI and breaker ratings has been taken out. The footnote on draw-lead application has been revised to define the current-carrying limit.
- *Table 4, Cantilever test requirements.* The table has been simplified and expanded to include information on bushings above 345 kV. The permanent deflection at the bottom end has been revised to reflect transformer bushings requirement. Information on TBI and breaker ratings has been taken out.
- *Table 5, Partial discharge limits.* The requirement at maximum L-G voltage has been taken out.
- *Table 6, Power factor and capacitance limits.* The limit for power factor for oil-impregnated, paper-insulated bushings has been lowered from 0.55% to 0.50%. Also, the power factor change limits for these bushings have been changed from +0.02/–0.06 to +0.02/–0.04.
- In addition, metric units have been adopted as primary units followed by inch-pound-based units in parentheses. Units/dimensions that are dependent upon inch-sized dies/tools have not been converted to metric units. Threads/inch and flange bolt hole diameters fall into this category.
- *Annex A, Electrical insulation characteristics.* This annex has been added to include the insulation characteristics for ratings, which were a part of IEEE Std C57.19.01-1991, but not included in Table 1 of this standard. This information has been provided for replacement purposes only.

At the time this standard was completed, the Working Group on Performance Characteristics and Dimensions for Outdoor Apparatus Bushings had the following membership:

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