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(Revision of IEEE Std C37.59-1996)

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IEEE Standard Requirements for Conversion of Power Switchgear Equipment

IEEE Power Engineering Society

Sponsored by the
Switchgear Committee



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Abstract: Directions and requirements are provided for the conversion of qualified power switchgear equipment. Examples such as low-voltage power circuit breakers; high-voltage outdoor and medium-voltage indoor drawout power circuit breakers; low- and medium-voltage fused contactors; low- and medium-voltage ground and test devices; medium-voltage fused load interrupter switches; and all metal-enclosed switchgear are covered. Existing design standards are referenced with appropriate guidance on design testing necessary to design-verify the conversions. Reconditioning, which concerns the maintenance of existing equipment without alteration, is not covered.

Keywords: conversion, power switchgear equipment, qualified design

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Introduction

(This introduction is not part of IEEE Std C37.59-2002, IEEE Standard Requirements for Conversion of Power Switchgear Equipment.)

This revised standard covers conversions of power switchgear equipment only, rather than a complete power switchgear equipment replacement. A conversion of power switchgear equipment reuses some portion of the qualified design switchgear.

This standard has been revised to correct some specific reference errors; to separate low-voltage and medium-voltage conversions for clarity; to include low and medium-voltage ground and test (G&T) devices; to clarify nameplate modification and additions; to include conversion of low- and medium-voltage circuit breakers to alternating current fused contactors and conversion of interrupter switchgear to add or substitute power fuses. It has also been revised to stress the importance of drawout interlocking and auxiliary functions known to have caused field problems.

Converted circuit breakers may or may not be interchangeable with existing non-converted circuit breakers. Where converted circuit breakers are not interchangeable with non-converted circuit breakers, it will be so indicated in the converter's instruction book and the blocking/rejection interlock shall be changed.

It is stressed that at least the minimum tests recommended and outlined in specific references are to be carried out as applicable on each differing design (or model) of a converted device. Reliance only on production tests with statements that the conversion has been "ANSI tested," unsubstantiated by formal documented design verification, can mislead users and may result in field failures. Production tests are not design tests. The basic and fundamental philosophy of this standard is that a converted product is a new design and must be design verified to substantiate that it meets its nameplate ratings as well as applicable standards. A recommended design verification form is included.

The lack of design verification of some conversions was the reason for the creation of the original (1991) version of this document. Experience gained with use of the original document and the 1996 revision has been incorporated into this revision of the standard.

There are many forms of conversion, and this document provides the logic that should cover all power switchgear equipment conversions, with examples of current areas of conversion and testing. As additional types of switchgear products are converted, criteria for the new conversion products will be added in future revisions of this standard.

Annex A, though not a normative part of this standard, is provided for guidance in the design verification of the converted power switchgear equipment. It provides additional guidance regarding conversion examples and the minimum testing required for design verifications.

Examples of components that may be converted include, but are not limited to:

Circuit breakers

- Frame
- Insulation structures
- Contacts, supports, and primary disconnecting devices
- High-voltage arc-interrupting structures
- Low-voltage arc-interrupting structures

NOTE—This includes substitution of low-voltage and medium-voltage alternating current fused contactors in place of circuit breaker elements.

- Low-voltage direct-acting trip device systems
- Drawout parts/interlocking and auxiliary functions
- Mechanism parts and control wiring

Switchgear vertical sections

- Drawout parts/interlocking and auxiliary functions
- Frame
- Bus, bus connections, and insulation
- Instrumentation and control wiring

Ground and test devices

Metal-enclosed interrupter switchgear

- Addition or substitution of power fuses

This standard is not intended to cover maintenance procedures when reconditioning power switchgear equipment in accordance with the manufacturer's instruction manuals.

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IEEE Standard Requirements for Conversion of Power Switchgear Equipment

1. Overview

This standard covers power switchgear equipment that is converted from a qualified design. It provides direction and guidance in those conversions and specifies required design verification in accordance with applicable American National Standards Institute (ANSI), National Electrical Manufacturers Association (NEMA), Underwriters Laboratories Inc. (UL), or IEEE standards.

This standard also recognizes that production/field testing does not provide design verification. This can only be accomplished by means of design testing and technical evaluation.

1.1 Scope

Present industry conversions involve low- and medium-voltage power circuit breakers used in metal-enclosed and metal-clad switchgear; low- and medium-voltage fused contactors; switchgear vertical sections; power fuse addition or substitution in metal-enclosed interrupter switchgear, and certain ratings of other circuit breakers. This document outlines criteria for conversion of this type of equipment.

This standard cannot detail each test that must be carried out to qualify a conversion. The specific tests shall be selected by the converter considering exact changes made from the previously qualified design. The converter shall conduct thorough and formal design verification for the completed conversion, and shall perform all additional tests determined to be necessary.

A vital part of the circuit breaker conversion process is the electrical and mechanical coordination of the mechanism-operated cell (MOC) switches with the converted circuit breaker to ensure proper operation. New, sealed interrupter modular units may have much less mechanism power than that of the circuit breakers they replace, and may not have the ability to operate all installed MOC switches. Accordingly, this may necessitate substantial revision to or replacement of the MOC switches and their operating linkage in the existing vertical sections to assure proper operation.

Any conversions performed on third-party labeled, or listed equipment, or equipment requiring Nuclear Regulatory Commission conformance will void the label, listing, or certification of the equipment. It will be necessary to reapply to the third party for continued certification of the equipment. For instance, typical examples are: if any UL-listed switchgear assembly is converted to use molded case circuit breakers in place of UL-listed power circuit breakers, the converted switchgear assembly must be submitted to the UL, and if a UL-listed low-voltage power circuit breaker is converted to change the electro-mechanical series trip units to an electronic type trip unit, the converted breaker must be submitted to UL.

A converter shall not knowingly convert a design which he knows to be defective without taking or recommending appropriate action to correct the defect in any assembly being converted.

1.2 Other conversions

The conversion and testing processes outlined in this standard are based on known examples and are outlined for general guidance and direction. However, alterations can be made to other equipment, not discussed in detail in this document, that will require design verification in accordance with appropriate standards. Whenever there is any question, the converter should be consulted.

Additionally, while this standard specifically does not cover reconditioning of power switchgear equipment, it does recognize the process and the fact that appropriate production/field testing is necessary.

2. References

The following standards are referred to in this document and are the most recently published editions of the standards. When a standard is superseded by an approved revision, the revision shall apply. However, when conversions are made to older total current rated circuit breakers, it is essential that the converted device ratings are correlated to at least meet the applicable ratings and design requirements of the original circuit breaker designs described in the appropriate edition of the standard.

2.1 Low-voltage equipment

ANSI C37.16-2000, American National Standard Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors—Preferred Ratings, Related Requirements, and Application Recommendations.¹

ANSI C37.17-1997, American National Standard for Trip Devices for AC and General Purpose DC Low-Voltage Power Circuit Breakers.

ANSI C37.50-1989 (R2000), American National Standard for Switchgear—Low-Voltage AC Power Circuit Breakers Used in Enclosures—Test Procedures.

IEEE Std C37.13TM-1990 (R1995), IEEE Standard for Low-Voltage AC Power Circuit Breakers Used in Enclosures.^{2, 3}

IEEE Std C37.14TM-1999, IEEE Standard for Low-Voltage DC Power Circuit Breakers Used in Enclosures.

IEEE Std C37.20.1TM-2002, IEEE Standard for Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear.

NEMA ICS 2-2000, Industrial Control and Systems: Controller, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.⁴

NFPA 70-2002, National Electrical Code[®] (NEC[®]).⁵

UL 489 (2002), Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures.⁶

UL 508 (1999), Industrial Control Equipment.

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⁴NEMA publications are available from Global Engineering Documents, 15 Inverness Way East, Englewood, Colorado 80112, USA (<http://global.ihs.com/>).

⁵NFPA publications are published by the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269, USA (<http://www.nfpa.org/>).

⁶UL standards are available from Global Engineering Documents, 15 Inverness Way East, Englewood, Colorado 80112, USA (<http://global.ihs.com/>).