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# IEEE Standard for Requirements for Conversion of Power Switchgear Equipment

IEEE Power and Energy Society

Sponsored by the
Switchgear Committee

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USA

**IEEE Std C37.59™-2018**
(Revision of IEEE Std C37.59-2007)

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# IEEE Standard for Requirements for Conversion of Power Switchgear Equipment

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**IEEE-SA Standards Board**

**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; medium-voltage fused contactors; medium-voltage ground and test devices; medium-voltage fused load interrupter switches; and metal-enclosed switchgear are covered in this standard. 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:** circuit breakers, compartment adapter, conversion, definite-purpose switching device, IEEE C37.59™, interrupters, modular assembly, power switchgear equipment, qualified design, remote racking device, retrofill, retrofit, switchgear, vacuum

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## Introduction

This introduction is not part of IEEE Std C37.59-2018, IEEE Standard for Requirements for Conversion of Power Switchgear Equipment.

This edition of the standard continues to cover conversions of power switchgear equipment only, rather than complete power switchgear equipment replacement. A conversion of power switchgear equipment reuses some portion of the qualified design switchgear.

The technology and extent of conversions is a continually changing and expanding practice. This revised standard addresses clarifications needed on the required performance of a converted product such as those involved in low-voltage power circuit breaker control system replacements, medium-voltage (up to 7.2 kV) alternating current (ac)-fused contactors, as well as new information on conversions of low-voltage direct-current (dc) general-purpose circuit breakers. Subclause 6.7 was amended to add medium voltage compartment adaptor requirements using concepts based on low-voltage adaptor applications. New guidance has been added in 6.8 on energy storage systems installed in dc transit systems. Subclause 6.9 adds new testing requirements for switchgear when viewing windows and ports are added.

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 shall be so indicated in the converter's instruction book and the blocking/rejection interlock shall be changed. Clarification has been provided for interlocking where compartment adapters are used.

With personal safety at the forefront of all applications, the minimum design 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 shall be design verified to substantiate that it meets its nameplate ratings as well as applicable standards. A recommended design verification form is included. This revision of the standard includes the design verification form as a downloadable electronic document available at the IEEE Standards Association website.

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, 2002, and 2007 revisions is incorporated into this revision of the standard.

Many forms of conversion exist 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, although 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. This revision adds new sections on dc overcurrent trip system conversions, test requirements for metal-enclosed switchgear conversions, test requirements for viewing windows and ports, additional information and requirements for compartment adapters, and updates in test requirements for medium-voltage ac fused contactors.

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

- Circuit breakers
  - Frame
  - Insulation structures

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

  NOTE—Medium- and low-voltage arc-interrupting structure conversions include substitution of low-voltage (up to 600 V ac) and medium-voltage (up to 7.2 kV) ac-fused contactors in place of circuit breaker elements.[1]

- — Low-voltage direct-acting trip systems
- — Drawout parts/interlocking and auxiliary functions
- — Mechanism parts and control wiring
- — Low- and high-voltage conversions using circuit-breaker compartment adapters

— Switchgear vertical sections

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

— Ground and test devices

— Definite-purpose switching devices

- — Low-voltage (600 V ac and below)

— AC fused contactors

- — Medium-voltage (7200 V ac and below)

— 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.

Although "conversion" is the preferred term, conversions may be categorized by numerous other names by the manufacturers of those conversions. Clause 3 provides the preferred names for the various categories of conversions. Reflecting the change in the marketplace since the first edition of this standard was issued, the term "retrofit" does not accurately describe the conversions now available as this standard is written.

The bibliography (see Annex B) is updated to provide list of documents with their reference dates. Clause 2 and Clause 5 include statements that require reference to the standards that were in effect at the time of the original equipment's manufacture. The bibliography provides a list of dated standards associated with the types of equipment covered by this standard.

[1]Notes in text, tables, and figures of a standard are given for information only and do not contain requirements needed to implement this standard.

## Contents

# IEEE Standard for Requirements for Conversion of Power Switchgear Equipment

## 1. Overview

### 1.1 General

Current industry conversions involve low- and medium-voltage power circuit breakers used in metal-clad, and metal-enclosed switchgear (including interrupter switchgear), low- and medium-voltage fused contactors, switchgear vertical sections, power fuse addition or substitution in metal-enclosed interrupter switchgear, traction power energy storage systems integration, and certain ratings of other circuit breakers.

This standard cannot detail each test that is necessary to 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 the converter shall perform all additional tests determined to be necessary.

*Example:*

— 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. New, sealed interrupter modular assemblies 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 situation may necessitate substantial revision to or replacement of the MOC switches and their operating linkage in the existing vertical sections to maintain proper operation of the circuit breaker.

For any conversions performed on third-party certified (labeled, listed, or otherwise certified) equipment, or equipment requiring Nuclear Regulatory Commission conformance, that voids the label, listing, or certification of the equipment, it is necessary to reapply to the third party for continued certification of the equipment. For example, if an Underwriters Laboratories (UL)-listed switchgear assembly is converted to use a non-UL-listed circuit breaker, then the converted switchgear assembly shall be submitted to UL and approved to maintain the UL listing. Another example is if a low-voltage power circuit breaker is converted to change the direct-acting trip system, then the converted circuit breaker shall be submitted to UL to maintain the UL listing (see 8.3).

A converter shall not convert a design that the converter knows to be defective without taking or verifying that appropriate actions were taken to correct the defect in any assembly being converted.