

# IEEE Std 3004.5™ -2014

Recommended Practice for the  
Application of Low-Voltage Circuit  
Breakers in Industrial and  
Commercial Power Systems





# **IEEE Recommended Practice for the Application of Low-Voltage Circuit Breakers in Industrial and Commercial Power Systems**

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**Abstract:** Information for selecting the proper circuit breaker for a particular application is provided. Application engineers are aided in specifying the type of circuit breaker, ratings, trip functions, and accessories. Circuit breakers for special applications, e.g., instantaneous only and switches are discussed. In addition, information for applying circuit breakers at different locations in the power system and for protecting specific components is provided.

**Keywords:** circuit breakers, circuit breaker evaluation, IEEE 3004.5™, insulated case, insulated-case circuit breakers, low-voltage circuit breaker, low-voltage power circuit breaker, low-voltage protection, low-voltage protection device, miniature circuit breaker, molded case, molded-case circuit breaker, overcurrent protection, power circuit breaker, rating

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When this project is completed, the technical material in the thirteen IEEE Color Books will be included in a series of new standards—the most significant of which will be a new standard, IEEE Std 3000™, IEEE Recommended Practice for the Engineering of Industrial and Commercial Power Systems. The new standard will cover the fundamentals of planning, design, analysis, construction, installation, startup, operation, and maintenance of electrical systems in industrial and commercial facilities. Approximately 60 additional dot standards, organized into the following categories, will provide in-depth treatment of many of the topics introduced by IEEE Std 3000:

- Power Systems Design (3001 series)
- Power Systems Analysis (3002 series)
- Power Systems Grounding and Bonding (3003 series)
- Protection and Coordination (3004 series)
- Emergency, Standby Power, and Energy Management Systems (3005 series)
- Power Systems Reliability (3006 series)
- Power Systems Maintenance, Operations, and Safety (3007 series)

In many cases, the material in a dot standard comes from a particular chapter of a particular IEEE Color Book. In other cases, material from several IEEE Color Books has been combined into a new dot standard.

### IEEE Std 3004.5™

This recommended practice provides an engineer a comprehensive reference source to aid in deciding what type of low-voltage circuit breaker to use for a particular application, and how to apply the circuit breaker. It is likely to be of greatest value to the power-oriented engineer with limited experience with this equipment. It can also be an aid to all engineers responsible for the electrical design of industrial and commercial power systems based on North American product standards. Similar related devices are covered by other standards, including International Electrotechnical Commission (IEC) standards, predominant in Europe and other regions. This recommended practice includes a comparison between the standards of low-voltage power circuit breakers and molded-case circuit breakers so that an engineer can make better, more informed choices. Pertinent tables have been extracted from other standards to provide the basis for the selection and application guidelines. In addition, specific application examples are provided.

The material in this recommended practice was originally published in the first edition of IEEE Std 1015™ (*IEEE Blue Book*™) in 1997 and is an update of the material in Chapters 1 through 4, and Chapter 6 of the 2006 edition. It also encompasses the material in Chapter 7 of IEEE Std 242™-2001 (*IEEE Buff Book*™).

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## 1. Overview

### 1.1 Scope

This recommended practice covers the selection and application of low-voltage circuit breakers used in industrial and commercial power systems.

### 1.2 Low-voltage circuit breaker classifications

For low-voltage circuit protection in North America, circuit breaker designs are based on the requirements of three standards organizations: the American National Standards Institute (ANSI), Underwriters Laboratories (UL), and the National Electrical Manufacturers Association (NEMA).