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Recommended Practice for Motor Protection in Industrial and Commercial Power Systems

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IEEE Recommended Practice for Motor Protection in Industrial and Commercial Power Systems

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Technical Books Coordinating Committee
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IEEE Industry Applications Society

Approved 7 December 2016

IEEE-SA Standards Board

Abstract: The protection of motors used in industrial and commercial power systems is covered. It is likely to be of greatest value to the power-oriented engineer with limited experience in the area of protection and control. It can also be an aid to all engineers responsible for the electrical design of industrial and commercial power systems.

Keywords: coordination, IEEE 3004.8, induction motors, inverse-time overcurrent element, motor protection, motor protection relay, negative sequence characteristics, overcurrent protection, permanent magnet motors, relay protection, resistive temperature detector, rotors, rotor thermal protection, stators, stator thermal protection, synchronous motors, temperature detector voting, temperature sensors, thermal model overload protection, unbalanced protection

The Institute of Electrical and Electronics Engineers, Inc.
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PDF: ISBN 978-1-5044-3608-3 STD22343
Print: ISBN 978-1-5044-3609-0 STDPD22343

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Introduction

This introduction is not part of IEEE Std 3000.8–2016, Recommended Practice for Motor Protection in Industrial and Commercial Power Systems.

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When this project is completed, the technical material in the 13 IEEE Color Books will be included in 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 (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 3004.8

A general update was made to the material from Chapter 10 of the *IEEE Buff Book*™. Material added or expanded includes details for reduced-voltage motor starting, recommended protection functions using multifunction motor protection relays for contactor controlled fused starters and breaker controlled starters, along with single-line and three-line diagrams, adjustable speed drive applications, dc motor protection, motor bus transfer, partial discharge monitoring, and a detailed example of motor protection using a multifunction motor protection relay.

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1. Scope

This recommended practice covers the protection of motors used in industrial and commercial power systems. It is likely to be of greatest value to the power-oriented engineer with limited experience in the area of protection and control. It can also be an aid to all engineers responsible for the electrical design of industrial and commercial power systems.

2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

API Std 541, Form-Wound Squirrel Cage Induction Motors—500 Horsepower and Larger, 5th Edition.[1]

API Std 546, Brushless Synchronous Machines—500 kVA and Larger, 3rd Edition.

API Std 547, General-Purpose Form-Wound Squirrel Cage Induction Motors—250 Horsepower and Larger, 1st Edition.

IEEE Std 43™, IEEE Recommended Practice for Testing Insulation Resistance of Electric Machinery.[2,3]

IEEE Std 112™, IEEE Standard Test Procedure for Polyphase Induction Motors and Generators.

IEEE Std 115™, IEEE Guide for Test Procedures for Synchronous Machines Part I—Acceptance and Performance Testing Part II—Test Procedures and Parameter Determination for Dynamic Analysis.

IEEE Std 141™-1993 (Reaff 1999), IEEE Recommended Practice for Electric Power Distribution for Industrial Plants (*IEEE Red Book*™).

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