ABSTRACT

Transformer engineers may come across some IEEE standards on Industrial Power Systems. Even though not directly related to transformers, these will be referred to in connection with the application and protection of transformers. IEEE Color Books were the most comprehensive collection of recommended practices for industrial power systems, prepared and issued by IEEE. They are being superseded by IEEE 3000 Standard Collections, also known as the 3000 series "dot" standards.

KEYWORDS

IEEE Color Books, Industrial Power Systems, "dot" standards, IEEE 3000 series, Recommended practices, Power systems design, Power systems analysis

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IEEE Color Books were the most comprehensive collection of recommended practices for industrial power systems, prepared and issued by IEEE for electrical engineers working in industrial or commercial applications

Standards relevant to transformers – Part XIII

IEEE Color Books & 3000 series "dot" standards

1. Introduction

Transformer engineers may come across certain IEEE standards on Industrial Power Systems during their practice. Even though these standards are not directly related to transformers, these will be referred to in connection with the application and protection of transformers. This group of standards used to be called the Color Books, which are now being superseded by the IEEE 3000 series of "dot" standards.

2. Standards

IEEE Color Books were the most comprehensive collection of recommended practices for industrial power systems, prepared and issued by IEEE for electrical engineers working in the industrial or commercial application environment. They were developed by the technical committees of the IEEE Industry Applications Society (IAS)-Industrial and Commercial Power Systems (I&CPS) Department. Their name comes from the colors of their cover pages, and they are in fact, 300–700-page long tutorial books intended for power engineers covering a particular topic comprehensively.

For decades, electrical engineers have turned to the IEEE Color Books to find practical, workable solutions to their questions on the design, installation, maintenance, and operation of industrial, commercial, and institutional electrical power systems. The Color Book set is composed of 13 volumes listed below. These 13 books were a collection of carefully screened recommendations that represent the best practices for analyzing, planning, calculating, coordinating, protecting, and assuring the safety of the power system elements.

These books were organized into two general approaches. Some dealt with specific facilities such as commercial buildings (Red Book), industrial plants (Gray Book) or health care facilities (White Book). Other Color Books cover specific technical topics such as grounding (Green Book), powering and grounding sensitive loads (Emerald Book), emergency and standby power systems (Orange Book), protection and coordination (Buff Book), power systems analysis (Brown and Violet Books), and reliability (Gold Book). The Yellow Book covers the maintenance, operation, and safety of industrial and commercial power systems.

Sl No	Colour of the Book Cover	IEEE Std No	Title of the colour book Recommended Practice for
1	Red	141-1993 (R 1999)	Electric Power Distribution for Industrial Plants
2	Green	142-2007	Grounding of Industrial and Commercial Power Systems
3	Grey	241-1990 (R 1997)	Electric Power Systems in Commercial Buildings
4	Buff	242-2001	Protection and Co-ordination of Industrial &Commercial Power Systems
5	Brown	399-1997	Industrial &Commercial Power System Analysis
6	Orange	446-1995 (R 2000)	Emergency and Standby Power Systems for Industrial and Commercial Applications
7	Gold	493-2007	Design of Reliable Industrial and Commercial Power Systems
8	Violet	551-2006	Calculating Short Circuit Currents in Industrial and Commercial Power Systems
9	White	602-2007	Electric Systems in Healthcare Facilities
10	Bronze	739-1995 (R 2000)	Energy Management in Industrial and Commercial Facilities
11	Yellow	902-1998	Guide for Maintenance, Operation, and Safety of Industrial and Commercial Power Systems
12	Blue	1015-2006	Applying LV Circuit Breakers Used in Industrial and Commercial Power Systems
13	Emerald	1100-2005	Powering and Grounding Electronic Equipment

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

3. IEEE 3000 Standards

IEEE Color books are being superseded by IEEE 3000 Standard Collections, also known as the 3000 series "dot" standards.

The IEEE Color Books were revised and updated by the technical committees of the IEEE Industry Applications Society (IAS) Industrial and Commercial Power Systems (I&CPS) Department. The goal of the 3000 project is to speed up the revision process, eliminate duplicate material, and facilitate the use of modern publishing and distribution technologies.

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 is combined into a new dot standard. Standards that have already been published in this new series are the following:

Sl No	3000 series Dot Standard No	Title IEEE Recommended Practice for
1	3001.2-2017	Evaluating the electrical service requirements of Industrial and commercial power systems
2	3001.4-2020	Estimation of cost of Industrial and Commercial Power Systems
3	3001.5-2013	Application of Distribution Apparatus in Industrial and Commercial Power System
4	3001.8-2013	Instrumentation and Metering of Industrial and Commercial Power Systems
5	3001.9-2023	Design of Power Systems Supplying Lighting Systems in Commercial and Industrial Facilities
6	3001.11-2017	Application of Controllers and Automation to Industrial and Commercial Power System
1	3002.2-2018	Conducting Load-Flow Studies and Analysis of Industrial and Commercial Power Systems
2	3002.3 -2018	Conducting Short-Circuit Studies and Analysis of Industrial and Commercial Power Systems
3	3002.7-2018	Conducting Motor-Starting Studies and Analysis of Industrial and Commercial Power Systems
4	3002.8-2018	Conducting Harmonic Studies and Analysis of Industrial and Commercial Power Systems
1	3003.1-2019	System Grounding of Industrial and Commercial Power Systems
2	3003.2 -2014	Equipment Grounding and Bonding in Industrial and Commercial Power Systems
3	3003.4 -2022	Practice for Connections to Earth for Alternating Current (AC) Industrial and Commercial Power Systems Facilities
1	3004.1-2013	Application of Instrument Transformers in Industrial and Commercial Power Systems
2	3004.3 -2020	Application of Low-Voltage Fuses in Industrial and Commercial Power Systems
3	3004.5-2014	Application of LV Circuit Breakers in Industrial and Commercial Power Systems
4	3004.7-2021	Conductor Protection in Industrial and Commercial Power Systems
5	3004.8-2016	Motor Protection in Industrial and Commercial Power Systems
6	3004.11-2019	Bus and Switchgear Protection in Industrial and Commercial Power Systems

Sl No	3000 series Dot Standard No	Title IEEE Recommended Practice for
1	3005.4-2020	Improving the Reliability of Emergency and Stand By Power Systems
1	3006.1-2022	IEEE Draft Recommended Practice for Reliability Planning and Design of Industrial and Commercial Power Systems
2	3006.2-2016	Evaluating the Reliability of Existing Industrial and Commercial Power Systems
3	3006.3-2017	Determining the Impact of Preventive Maintenance on the Reliability of Industrial and Commercial Power system
4	3006.5-2014	Use of Probability Methods for Conducting a Reliability Analysis of Industrial and Commercial Power Systems
5	3006.7-2013	Determining the Reliability of 7x24 Continuous Power Systems in Industrial and Commercial Facilities
6	3006.8- 2018	Analyzing Reliability Data for Equipment Used in Industrial and Commercial Power Systems
7	3006.9-2013	Collecting Data for Use in Reliability, Availability, and Maintainability Assessments of Industrial and Commercial Power Systems
1	3007.1-2010	Operation and management of Industrial and Commercial Power Systems
2	3007.2-2010	Maintenance of Industrial and Commercial Power Systems
3	3007.3-2012	Electrical safety in Industrial and Commercial Power Systems

4. Conclusion

This paper offers a summary of various available IEEE Standards on Industrial Power Systems that may be useful for transformer engineers for the selection, application, and protection of transformers.

5. Reference

https://ieeexplore.ieee.org/browse/standards/number/ieee?selectedValue=StandardRange:3000%20-%3E

Authors

P. Ramachandran started his career in the transformer industry in 1966 at TELK, Kerala, a Hitachi Joint venture, in India. He worked with ABB India during 1999-2020. He has more than 50 years of experience in the design and engineering of power products, including power transformers, bushings, and tap-changers. He received a Bachelor of Science Degree in Electrical Engineering from the University of Kerala, India, and a Master of Business Administration Degree from Cochin University, India. He is a Fellow of the Institution of Engineers (India), and he represented India in CIGRE Study Committee A2 for transformers during 2002 – 2010.