



Understanding the Latest and Greatest Data Center Construction Codes and Standards

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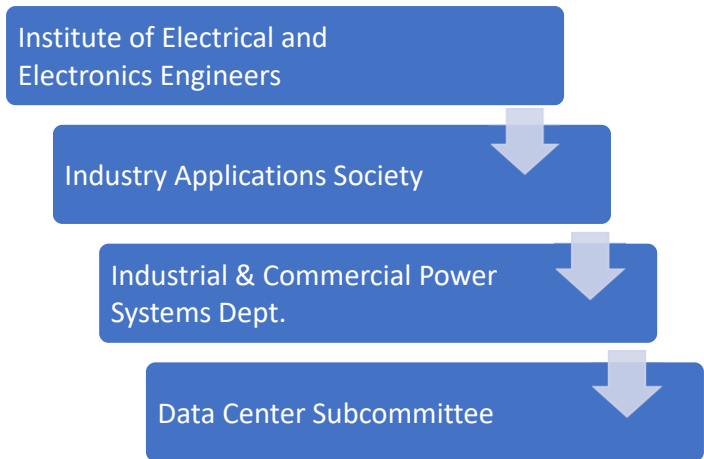
Qais Alsafasfeh,
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Who We Represent:



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Introduction to IEEE

(Institute of Electrical and Electronics Engineers)


IEEE is the world's largest technical professional organization dedicated to advancing technology for the benefit of humanity.

- **Mission:** IEEE's core purpose is to foster technological innovation and excellence for the benefit of humanity.
- **The IEEE Today:** IEEE and its members inspire a global community through its highly cited publications, conferences, technology standards, and professional and educational activities.
 - **460,000 + Members in over 190 countries**
 - **39 IEEE Societies/8 Technical Councils**
 - **10 Regions**
 - **Publishes approximately a third of the world's technical literature in electrical engineering, computing, and electronics.**
 - **Holds more than 2,000 annual conferences and events worldwide**
 - **Has more than 1,144 active standards, with 1,018 under development**

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Industry Application Society (IAS)



- IAS is a global organization that focuses on the needs of industry and commerce within the IEEE. The IAS's mission is to advance the theory and practice of electrical systems, equipment, and services.
- **IAS offers many benefits to its members, including:**
 - **Professional Connections:** Build relationships with other professionals and access a global network.
 - **Professional Development:** Members can grow their skills and qualities.
 - **Publications:** IAS produces or contributes to the IAS Newsletter, *Industry Applications Magazine*, and IEEE Transactions on Industry Applications
 - **Events:** Members can attend IAS's regional, national, and international events and conferences.
 - **Mentorship Program:** The IAS offers online resources and tools to help young professionals advance their careers

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Industrial & Commercial Power Systems Dept. (I&CPS):



Part of IEEE's Industry Applications Society (IAS).



Focus: electric power generation, transmission, and distribution technology in industrial, commercial, and institutional facilities. It also includes rural or agricultural applications.



I&CPS's annual technical conference brings together both experienced and younger engineers. It features papers and industry presentations on many aspects of industrial and commercial power systems.



I & CPS
Industrial & Commercial Power Systems

IEEE IAS I&CPS Department

I&CPS is responsible for many IEEE standards. The largest effort recently has been converting the "Color Books" to the IEEE 3000 Standards Collection.

- PSE | Power Systems Engineering Committee ▶
- PSP | Power Systems Protection Committee ▶
- ESC | Energy Systems Committee ▶
- C&S | Codes & Standards Committee ▶
- REPC | Rural Electric Power Committee
- SDC | Standards Development Committee

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About the Industry Applications Society's *Data Center Subcommittee*

IAS Links Research to Practice: We meet the engineering needs of industry and commerce through the advancement of theory and practice in design, manufacturing, and application.

Scope of the IAS Data Center Subcommittee: The treatment of all matters within IAS that specifically relate to Data Center "Gray Space"

- This encompasses electrical supply, distribution, and utilization of equipment on the customer side of the utility meter
- We are the data center authority for the IAS' Industrial and Commercial Power Systems Dept.

We Seek Your Subcommittee Participation: You can give back to our industry while raising your profile! Contribute to technical papers, application guides, industry application presentations, thought leadership activities, and learn about many industry-specific topics. We work in cooperation with the Society Standards Department.

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Color Books and 3000 Standards:



The IEEE Color Book standards series include 13 books with each one focusing on different aspects of electric power.



The Working Groups responsible for Color Book standards, development and revisions are sponsored by the IAS's Industrial & Commercial Power Systems Dept.'s technical committees.



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Color Books and 3000 Standards:

COLOR BOOK	IEEE STD. No.	TOPIC
Red	141-1993 [2]	Electric Power Distribution for Industrial Plants
Green	142-2007 [3]	Grounding of Industrial and Commercial Power Systems
Gray	241-1990 (R1997)[4]	Electrical Power Systems in Commercial Buildings
Buff	242-2001[5]	Protection and Coordination of Industrial and Commercial Power Systems
Brown	399-1997 [6]	Industrial and Commercial Power Systems Analysis
Orange	446-1995 (R2000)[7]	Emergency and Standby Power Systems for Industrial and Commercial Applications
Gold	493-2007, [8]	Design of Reliable Industrial and Commercial Power Systems
White	602-2007, [9]	Electrical Systems in Health Care Facilities
Bronze	739-1995 (R2000) [10]	Energy Management in Industrial and Commercial Facilities
Yellow	902-1998, [11]	Guide for Maintenance, Operation, & Safety of Industrial and Commercial Power Systems
Blue	1015-2006 [12]	Applying Low-Voltage Circuit Breakers Used in Industrial & Commercial Power Systems
Emerald	1100-2005 [13]	Powering and Grounding Electronic Equipment
Violet	551-2006 [14]	Short-Circuit Calculations in Industrial and Commercial Power Systems

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Color Books and 3000 Standards:

The IEEE Red Book: Provides a recommended practice for the electrical design of industrial facilities, and provides detailed procedures for planning the electric power distribution system of an industrial plant

The IEEE GREEN BOOK: Reviews practices and methods of system grounding in detail, addresses many different aspects of grounding

The IEEE BUFF BOOK: Deals with the proper selection, application, and coordination of the components that constitute system protection for industrial plants and commercial buildings

The IEEE BROWN BOOK: Is a valuable source of information about the purpose for and techniques involved in power system studies, tying together the essential fundamentals of power system analysis

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Color Books and 3000 Standards:

The IEEE ORANGE BOOK: Presents the recommended engineering practices for selecting and applying emergency and standby power systems; several chapters deal with the selection of power sources

The IEEE WHITE BOOK: Promotes the use of sound engineering principles in the design and operation of health care facilities, and aid electrical system designers in many aspects – such as safety of life and preservation of property

The IEEE BLUE BOOK: Provides information for selecting the right circuit breaker for specific low-voltage applications and aids in specifying the type of circuit breaker, ratings, trip functions, accessories, tests, and maintenance requirements

The IEEE GOLD BOOK: Presents sufficient information so that reliability analysis can be performed on power systems without requiring cross-references to other texts; contains many reliability aspects

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Color Books and 3000 Standards:

The IEEE VIOLET BOOK: Provides the understanding and application of analytical techniques of short circuit analysis in industrial and commercial power systems.

The IEEE EMERALD BOOK: Presents recommended engineering principles and practices for power and grounding sensitive electronic equipment

The IEEE YELLOW BOOK: Provides a reference source for the fundamentals of safe and reliable maintenance and operation of industrial and commercial power systems, regardless of system size or complexity

The IEEE BRONZE BOOK: Furnishes a recommended practice for electrical energy management in industrial and commercial facilities

The IEEE GRAY BOOK: Provides extensive information on each of the various specialized subjects involved in planning the power system of a new or modernized commercial structure

Public

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The Color Books Have Transformed into the IEEE 3000 Standards Collection™ for Industrial & Commercial Power Systems

The IEEE 3000 Standards Collection is the ultimate guide for the electrical power systems industry. It sets guidelines and establishes the requirements for all aspects of the power generation process.

Formerly known as the IEEE Color Books, the IEEE 3000 Standards Collection includes the same content as the Color Books but is now organized into approximately 70 IEEE "dot" standards and eight separate recommended industry practices.

The IEEE 3000 Standards are designed to be shorter, more narrowly focused, and user-friendly.

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The New Standards Products

IEEE 3000 Standards Collection™ Standards and Projects

- IEEE 3001™ Standards: Power Systems Design**
- IEEE 3002™ Standards: Power Systems Analysis**
- IEEE 3003™ Standards: Power Systems Grounding**
- IEEE 3004™ Standards: Protection & Coordination**
- IEEE 3005™ Standards: Energy & Standby Power Systems**
- IEEE 3006™ Standards: Power Systems Reliability**
- IEEE 3007™ Standards: Maintenance, Operations & Safety**

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IEEE 3001™ Standards: Power Systems Design

Standards:

IEEE 3001.2™-2017 >
IEEE Recommended Practice for Evaluating the Electrical Service Requirements of Industrial and Commercial Power Systems

IEEE 3001.4™-2020 >
IEEE Recommended Practice for Estimating the Costs of Industrial and Commercial Power Systems

IEEE 3001.9/IES RP-48™-2023 >
IEEE/IES Recommended Practice for the Design of Power Systems Supplying Lighting Systems in Commercial and Industrial Facilities

IEEE 3001.11™-2017 >
IEEE Recommended Practice for Application of Controllers and Automation to Industrial and Commercial Power Systems

Projects:

P3001.1™ >
Recommended Practice for the Planning and Design of Industrial and Commercial Power Systems

IEEE P3001.3™ >
IEEE Draft Recommended Practice for the Design of Industrial and Commercial Power Systems: Voltage Considerations

Public

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IEEE 3002™ Standards: Power Systems Analysis

Standards:

IEEE 3002.2™-2018 >

IEEE Recommended Practice for Conducting Load-Flow Studies and Analysis of Industrial and Commercial Power Systems

IEEE 3002.3™-2018 >

IEEE Recommended Practice for Conducting Short-Circuit Studies and Analysis of Industrial and Commercial Power Systems

Projects:

P3002.9™ >

Recommended Practice for Conducting Transient Stability Studies and Analysis of Industrial and Commercial Power Systems

IEEE 3002.7™-2018 >

IEEE Recommended Practice for Conducting Motor-Starting Studies and Analysis of Industrial and Commercial Power Systems

IEEE 3002.8™-2018 >

IEEE Recommended Practice for Conducting Harmonic Studies and Analysis of Industrial and Commercial Power Systems

Public

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IEEE 3003™ Standards: Power Systems Grounding

Standards:

IEEE 3003.1™-2019 >

IEEE Recommended Practice for System Grounding of Industrial and Commercial Power Systems

IEEE 3003.2™-2014 >

IEEE Recommended Practice for Equipment Grounding and Bonding in Industrial and Commercial Power Systems

Projects:

IEEE P3003.4™ >

IEEE Draft Recommended Practice for Connections to Earth for Alternating Current (AC) Industrial and Commercial Power Systems Facilities

Public

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IEEE 3004™ Standards: Protection & Coordination

<p><u>Standards:</u></p> <p>IEEE 3004.3™-2020 ></p> <p>IEEE Recommended Practice for the Application of Low-Voltage Fuses in Industrial and Commercial Power Systems</p> <p>IEEE 3004.7™-2021 ></p> <p>IEEE Recommended Practice for Conductor Protection in Industrial and Commercial Power Systems</p> <p>IEEE 3004.11™-2019 ></p> <p>IEEE Recommended Practice for Bus and Switchgear Protection in Industrial and Commercial Power Systems</p>	<p>IEEE 3004.5™-2014 ></p> <p>IEEE Recommended Practice for the Application of Low-Voltage Circuit Breakers in Industrial and Commercial Power Systems</p> <p>IEEE 3004.8™-2016 ></p> <p>IEEE Recommended Practice for Motor Protection in Industrial and Commercial Power Systems</p> <p>P3004.8™ ></p> <p>Recommended Practice for Motor Protection in Industrial and Commercial Power Systems</p>	<p><u>Projects:</u></p> <p>P3004.1™ ></p> <p>Recommended Practice for the Application of Instrument Transformers in Industrial and Commercial Power Systems</p> <p>IEEE P3004.5™ ></p> <p>IEEE Draft Recommended Practice for the Application of Low-Voltage Circuit Breakers in Industrial and Commercial Power Systems</p> <p>P3004.9™ ></p> <p>Recommended Practice for the Protection of Transformers Used in Industrial and Commercial Power Systems</p>
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IEEE 3005™ Standards: Energy & Standby Power Systems

<p><u>Standards:</u></p> <p>IEEE 3005.4™-2020 ></p> <p>IEEE Recommended Practice for Improving the Reliability of Emergency and Stand By Power Systems</p>	<p><u>Projects:</u></p> <p>P3005.2™ ></p> <p>Recommended Practice for Application of Generator Systems for Emergency and Standby Power in Industrial and Commercial Power Systems.</p> <p>P3005.7™ ></p> <p>Recommended Practice for Application of Metering for Energy Management of Industrial and Commercial Power Systems</p>
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IEEE 3006™ Standards: Power Systems Reliability

Standards:

IEEE 3006.2™-2016 >

IEEE Recommended Practice for Evaluating the Reliability of Existing Industrial and Commercial Power Systems

IEEE 3006.5™-2014 >

IEEE Recommended Practice for the Use of Probability Methods for Conducting a Reliability Analysis of Industrial and Commercial Power Systems

IEEE 3006.3™-2017 >

IEEE Recommended Practice for Determining the Impact of Preventative Maintenance on the Reliability of Industrial and Commercial Power Systems

IEEE 3006.8™-2018 >

IEEE Recommended Practice for Analyzing Reliability Data for Equipment Used in Industrial and Commercial Power Systems

Projects:

IEEE P3006.1™ >

IEEE Draft Recommended Practice for Reliability Planning and Design of Industrial and Commercial Power Systems

Public

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IEEE 3007™ Standards: Maintenance, Operations & Safety

Projects:

P3007.2™ >

Recommended Practice for the Maintenance of Industrial and Commercial Power Systems

Public

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How are Standards Developed?

The IEEE Standards Association (SA) even provides a style guide. This helps ensure that everyone is on the same page when it comes to understanding how a standard is implemented.

- At IEEE SA, the development of technical standards can be broken down into six main stages:



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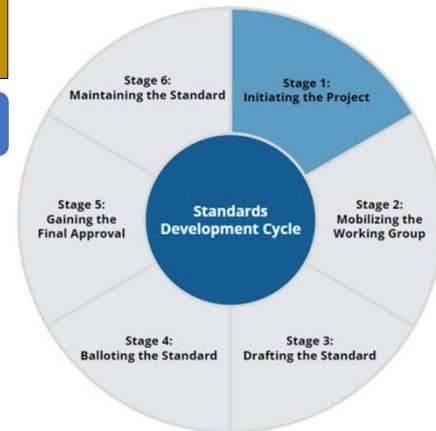
How are Standards Developed?

The development of an IEEE standard begins with an idea. Individuals, companies, or other entities may contact each other and discuss the need for a standard.

If a need for a standard is identified, the project's Standards Committee assumes responsibility for that area of standards development, including the organization of a Working Group and its activities. The Standards Committee will submit a formal request to IEEE SA to begin the project.

Types of IEEE Standards Projects are classified as:

- Standards – documents with mandatory requirements
- Recommended Practices – documents in which procedures and positions preferred by IEEE are presented
- Guides – documents in which alternate approaches to good practices are suggested but no explicit recommendations are made
- Trial-Use – documents in effect for no more than three years; the documents can be a Standard, Recommended Practices, or Guide



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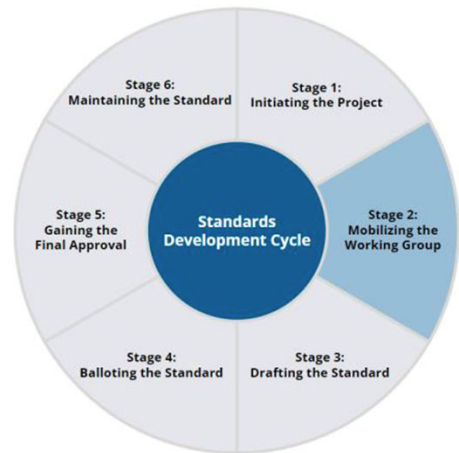
How are Standards Developed?

Working Groups are composed of individuals or entities (companies, organizations, non-profits, government agencies) who volunteer to participate in the development of the standard. These volunteer participants have an interest in a specific area of the development of the standard (e.g., producers, sellers, buyers, users and/or regulators of a particular material, product, process or service).

All participants in Working Groups should have technical expertise, knowledge and/or an interest in the technology being standardized.

For individual standards projects, IEEE or IEEE SA membership is not required to participate.

For entity standards projects, IEEE SA advanced corporate membership is required to be a member of the working group.



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How are Standards Developed?

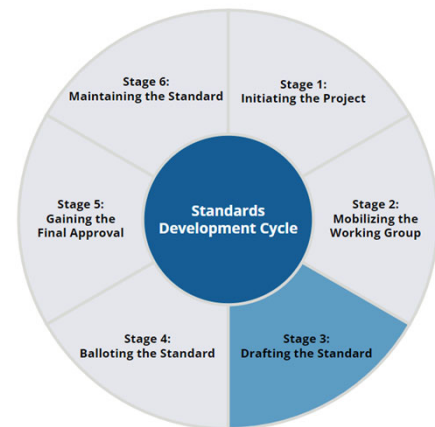
- The IEEE SA provides editorial draft development support to more than 500 Working Groups and publishes more than 100 standards a year.
- Generally, Working Groups interact with editorial staff three times during their standards development journey: The drafting stage, the balloting stage (MEC), and the post-SASB approval publishing stage.
- The IEEE SA professional staff includes two types of Program Managers: staff liaisons and staff project editors.

Contact your staff project editor for help with the following:

- Editorial requirements
- Figure requirements
- Guidance with copyright permission

Please contact your staff liaison for help with the following:

- PAR submittal/revision
- Draft submittal for MEC
- Draft submittal for balloting and recirculation
- Draft submittal to RevCom



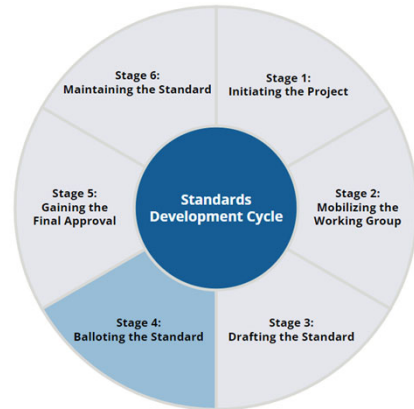
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How are Standards Developed?

- Once a draft standard has been reviewed, finalized, and approved by the Working Group, it is submitted to the Standards Committee for approval to move forward to the IEEE SA Ballot
- Upon successful completion of the IEEE SA Ballot process, the draft standard is submitted to the Review Committee (RevCom).
- The balloted draft standard is reviewed by RevCom and then submitted to the IEEE SASB for approval. After final approval by the IEEE SASB, the approved standard is published and made available for distribution and purchase.

The IEEE SA balloting process is an important part of the strength of IEEE SA consensus standards. All stakeholders have an opportunity to participate.

Those who join the ballot group have an obligation to submit ballot responses.

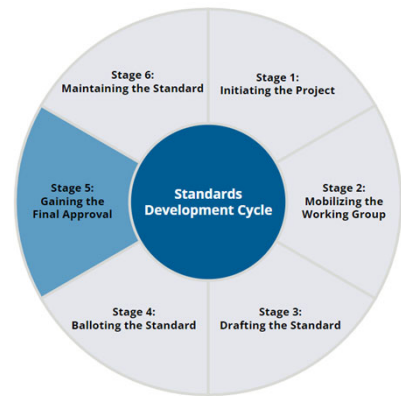


How are Standards Developed?

- The IEEE SA Standards Board (SASB) approves or disapproves draft standards based on the recommendation of its Standards Review Committee (RevCom).
- Once a standard has been approved by the IEEE SASB, it receives a thorough, detailed edit from a professional IEEE Standards editor. The role of the editor is to ensure that the standard is grammatically and syntactically correct using American English. It is not an editor's role to make any changes that affect the technical meaning of the standard.

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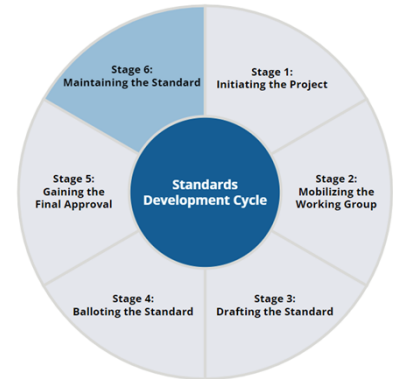
How are Standards Developed?

- An IEEE standard is active for 10 years from the IEEE SA Standards Board approval year.

Within the 10-year period, Standards Committees can take the following actions:

- Revise the standard by opening the entire document for updates, changes, or additions
- Submit Amendments for additional material to the standard
- Submit Corrigenda for corrections to the standard that does not introduce new material
- Withdraw the standard from active to inactive-withdrawn status through an SA Ballot

If a standard has not been revised before the end of the 10-year maintenance cycle, it may be administratively withdrawn by the IEEE SASB.



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**We Welcome
You to Join the
Data Center
Subcommittee!**

Industry professionals are warmly welcomed to join the Data Center Subcommittee.

- You can help set standards and guides that affect the entire industry.
- Contact Chair Daleep Mohla at dcmohla@comcast.net or Vice Chair Keith Waters at keith.waters@se.com to join or ask questions.

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