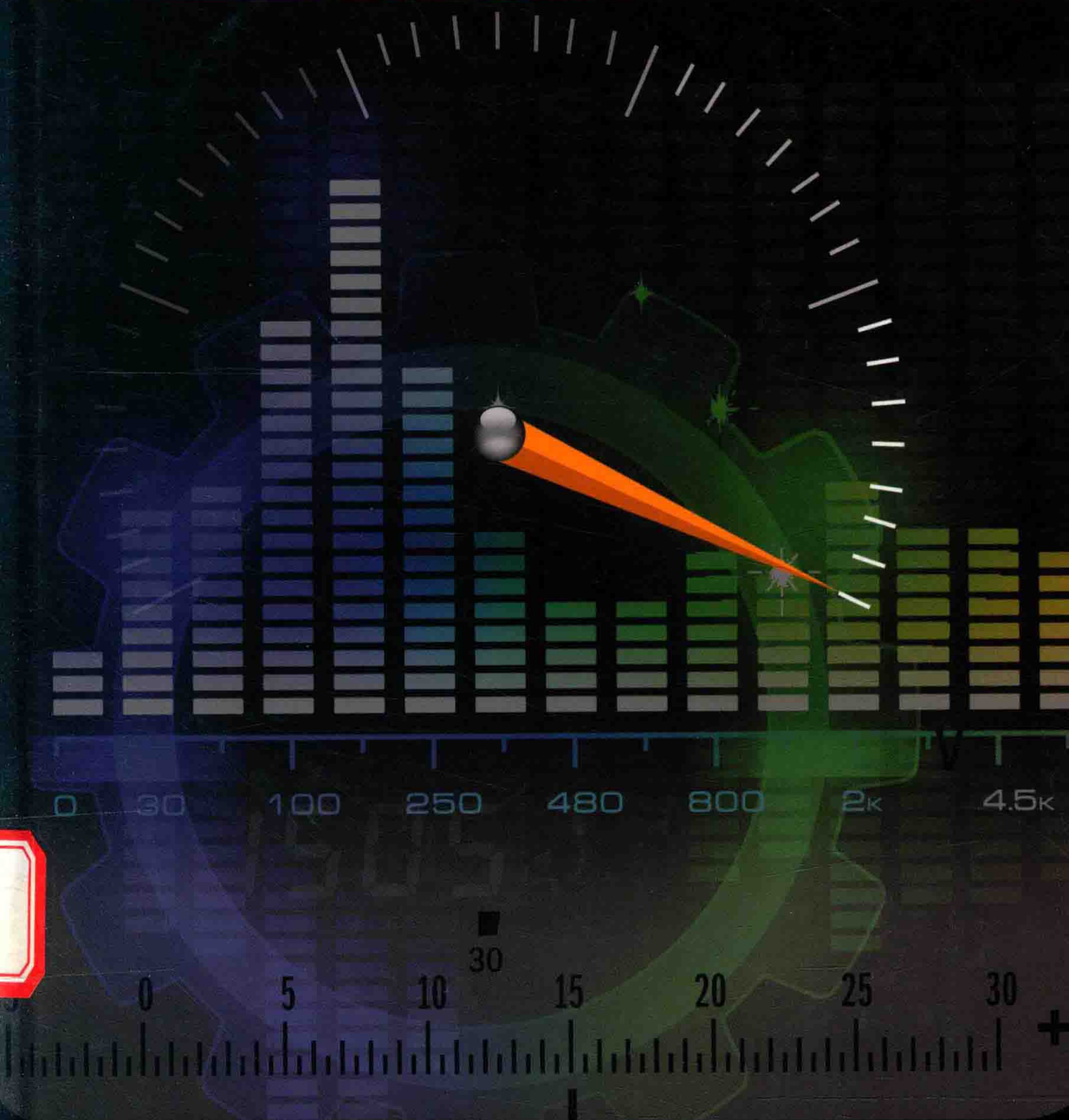
PRACTICAL GUIDE TO INTERNATIONAL STANDARDIZATION FOR ELECTRICAL ENGINEERS

IMPACT ON SMART GRID AND e-MOBILITY MARKETS



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Foreword by Mark Waldron

At first glance, standards, and particularly international standards, appear to have a very clear and singular function: to define widely applicable technical performance requirements within their scope of application. Of course this **is** a key purpose of standards but the role and influence of standards and the standardization process are much broader than they might at first appear. Knowledge of, and engagement with, standards and the processes by which they are produced is invaluable for engineers and scientists throughout the life cycle of any product of service, from research and development, through production and service, to end of life and disposal.

Development of new standards should always take place to address a market need. This need may derive directly from a customer desire to implement new technology, services or facilities; it may be driven by developments in technology within the suppliers of products and services but more typically it is a combination of these factors. In any case, prestandardization activities will typically be undertaken among international experts to establish the maturity of the intended field of standardization and to establish a common language, definitions and mutual understanding within the field. Whether done internally by standardization bodies or externally by organizations such as CIGRE this process of establishing a common language and understanding is key to effective standardization. Prestandardization activity also commonly highlights areas where critical knowledge is lacking and thereby provides feedback for further research and development required prior to the establishment of a standard or standards. Finally prestandardization can also identify aspects that should not be Standardized, for example because there is no common approach possible or because they are subject to specific local requirements.

Once initiated, a key strength of the standardization process itself is that it brings together a wide range of stakeholders with a need to establish clear, unambiguous requirements that are deliverable (at reasonable cost) and are mutually acceptable to all. Since standards address aspects such as technical performance, operation and operational facilities, safety, environmental impact, testing and interoperability, it is common for researchers, designers, manufacturers, testing facilities, users, regulators and consultants to be engaged in their development. As well as resulting in an effective standard, this process provides every participant with a valuable insight into the perspectives of other stakeholders in the field, which is difficult to gain effectively by other means. It is also a great training ground in the arts of negotiation and compromise!

Finally, even the best standard will have scope for improvement once it has been applied and used by a wide range of stakeholders. Feedback into the standard-making process from the widest possible stakeholder base is vital to ensure the best possible standard and to ensure that developments within the scope of application are addressed.

So, in summary, standards and the processes by which they are prepared have a considerable influence on the activities of engineers working in the field of electrical engineering and a knowledge of, and ideally participation in, this activity is undoubtedly advantageous and may even be considered essential.

Mark Waldron
CIGRE TC Chairman

Foreword by Bernhard Thies

Modern societies would not work properly without standards. From basic commodities like bulbs or a sheet of paper to highly complex machineries and power plants: Nothing runs without technical rules. Norms and standards as commonly recognized state of the art lay down not only interfaces as precondition for exchangeability, comparability and interoperability. The user independent of being a consumer or an integrator also obtains assurance regarding the required level of safety and quality.

In this manner the term safety means to comprehensively protect humans, animals and objects against any harm regardless of the threat scenario. The key is to already take the necessary precautions at the design phase of a new product to reduce any risk to a minimum. A standard represents the extensive experience of many experts – engineers, scientists, safety experts, environmentalists as well as consumer advocates. If a product fulfills the requirements of such a consensus-driven standard a high level of safety is automatically classified. Designers and developers benefit from the standard in the way that their work becomes more efficient and reliable. Thereby, the standard only provides basic requirements so that there is still enough space for innovation and creativity. Hence, standards by no means impede innovation but lay down a level playing field on which competitors can build different solutions with unique selling propositions.

However, standardization requires the input of many experts that provide their knowledge for the common property. Moreover, companies delegating experts into standardization bear the costs of travelling and personnel. But, companies also benefit from direct participation within standard committees by shaping the standard to their advantage or gaining knowledge prior to the publication of a standard. To sum up, not only the individual standard setters, but also the whole society benefits from standardization since standards promote technological acceptance and open-mindedness. Standardization can achieve a highly operational and economical benefit which is estimated around 16 billion Euros per year for Germany.

Bernhard Thies
Chairman of the Board of Directors
DKE Technical Standardization
Electric, Electronic and Information Technology
Frankfurt, Germany

Foreword by Markus Reigl

Many assertions are made about standardization and standards – and the most of them are true! Now let us take a look at them from various perspectives.

Firstly, from a governmental perspective, standards support regulatory requirements and help to achieve societal goals such as safety in operation, user and environmental friendliness, energy efficiency and sustainability. Further, standards set the scene by stipulating the commonly accepted basic requirements that various vendors have agreed on. These same vendors compete in markets based on product features, performance, quality and price. Through this mechanism standards help to intensify competition.

If true international standards are widely adopted in global target markets the major advantage for vendors using the standards is to capitalize on their broad market acceptance so reducing country specific re-design or re-engineering.

Finally product users benefit from the extensive variety of products made by different vendors and at the same time they can be confident with the conformity to legal regulations. In addition they benefit from interoperability in heterogeneous multi-vendor solutions. Furthermore these standards provide investment security from simple machinery to complex large scale industrial plants.

After extolling all the merits of using standards we should not however forget to honor those who make them – the innumerable technical experts in the committees and working groups of standards developing organizations. Any such committee can consider itself more than fortunate if it has highly skilled, knowledgeable and experienced industry experts contributing to its standardization work. Experts such as Dr. Hermann J. Koch.

I can thoroughly recommend Hermann J. Koch's practical guide which provides "hands on" expert knowledge. The international standardization community would benefit greatly if there were more key experts like Hermann J. Koch. Enjoy the guide.

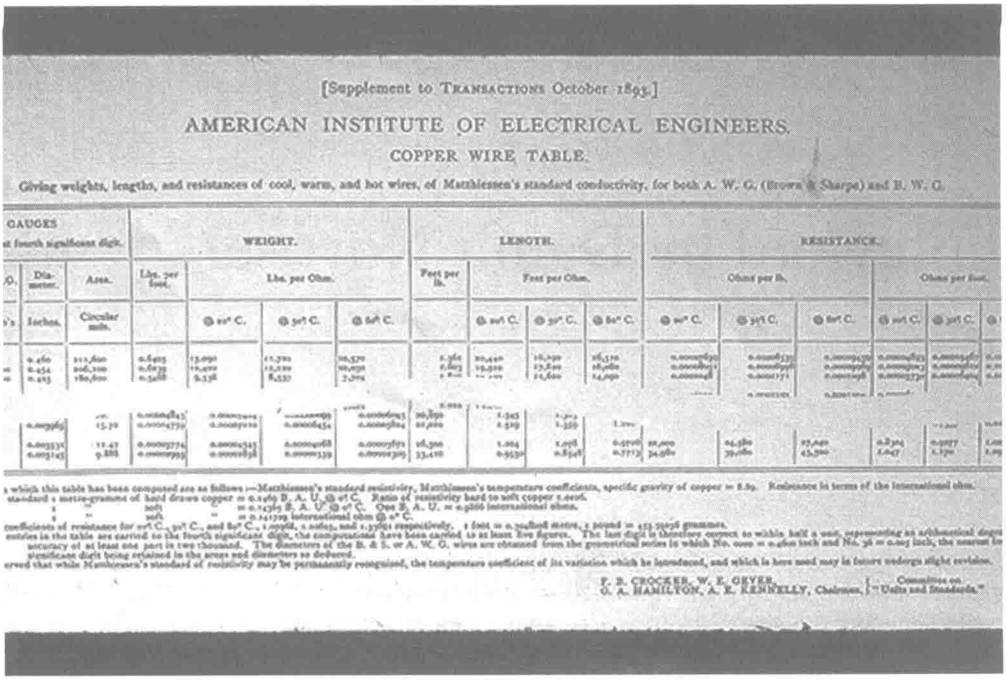
Markus Reigl, Dipl-Ing, MA
Head of the Corporate Department for
Technical Regulation and Standardization
Siemens AG
Berlin and Munich, Germany

Foreword by Damir Novosel

Major technological innovations in the areas such as renewable energy resources, storage, electric vehicles, automation, measurement devices, protection and control, materials, DC technology and robotics resulted in a paradigm shift of how we use electricity. The electric power and energy industry is in a crucial transition phase as initiatives we take today will affect how the grid is operated for years to come. In this fast-pace environment, standards are even more critical for both users and vendors to streamline deployment of both existing and new technologies and support interoperability among devices and systems as well as the use of best industry practices.

Active participation in development of Standards has been helping our membership to enhance and protect current and future investments, shape industry practices, and influence new developments. IEEE members need to be even more engaged and with support and leadership from the IEEE Standards Association continue working diligently to better serve our industry in releasing standards in timely fashion.

As we emphasize importance of IEEE standards and technical reports, it is important to remember that they have been providing fundamental value to our industry since the dawn of electricity. Figure below shows first AIEE (IEEE predecessor) standard published in 1893.


[Supplement to TRANSACTIONS October 1893.]

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

COPPER WIRE TABLE.

Giving weights, lengths, and resistances of cool, warm, and hot wires, of Matthiessen's standard conductivity, for both A. W. G. (Brown & Sharpe) and B. W. G.

Figure 1 First IEEE (AIEE) Standard

Presently, a lot of countries in the world have industry regulations/codes based on IEEE related standards. The goal of IEEE, including IEEE Power and Energy Society (PES) which publishes over 40% of IEEE standards, is to continue developing required standards and focus on promoting them globally.

This book by one of the industry leaders in developing standards, Dr. Herman Koch, is very important to raise the awareness and communicate importance of standards, including recent developments.

Damir Novosel
IEEE PES President

Preface

Standardization today is a complex business. With influences at international, regional and national level it is like an ever-moving target and it is hard to follow, with its own processes. At the same time standardization is becoming increasingly important for the management of successful technical innovation and new products and services. In modern business strategies, Having the right standards in place when a new product or service is offered to the market is a key factor in the success of modern business strategies. Innovation may be the basis for success but the standard related to the innovation will open the market for the new product or service internationally, in a region, or in one country. As Werner von Siemens said in the late 1800s: 'He who owns the standards owns the market!' This is still valid today.

Standardization is changing fast and continuously adapting to market situations following market trends. One big goal of recent decades in international standardization was to reduce the time it takes to finish a standard. Standardization organizations developed new standard products like the publicly available specification (PAS). Another topic in recent years has been the trend towards globalization in industry. Standardization needs to keep up with this. Many national or regional organizations became international and opened new offices all over the world. The German DIN was used in Asia and South America; the British BSI was rolled out to all continents and the American-based IEEE opened offices in Europe, Asia, Africa and South America. All these activities influence the availability and acceptance of standards by users in the region. New types of standardization organizations based on industrial consortia create new standards in a fast-changing market of new technical products such as smart phones and software services. Most recently, the Internet of things has led to standards organized on the Internet, Linux software being an impressive example. All of this influences the impact of technical standards on new products and services.

The author is an active participant for more than 25 years for Siemens high voltage division. He is participating in standardization at the international, regional and national level in the field of electrical technology. Based on his experiences with IEC, IEEE, DKE and CIGRE and personal contact with other standardization organizations in France, Netherlands, the United Kingdom, Denmark, Russia, China, Japan, the United States, Canada, Brazil, South Africa, Egypt, India and other countries, this book has been written to provide guidance and an overview of the subject. It also helps the reader to evaluate standardization activities.

The book gives a quick understanding of how standardization organizations work, how they are structured and how participation in standardization work is possible. It also provides useful information on general aspects of standardization.

Because of the nature of standardization, standardization activities and plans must be set up directly with the related standardization organization. The author cannot accept liability in relation to information given by this book.

Hermann J. Koch
Gerhardshofen

Acknowledgements

This book reflects my experience of international, regional and national standardization gained over 25 years. Contributions to this book came from many experts in the field.

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Much of the material in the book has been taken from my university lecture at the Hochschule für Technik und Wirtschaft (HTW) Berlin – a compilation of information mainly provided by the Deutsches Institut für Normung (DIN), the Verband der Elektrotechnik, Elektronik und Informationstechnik (VDE) and the Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE (DKE) in Germany, the British Standards Institute (BSI), the American National Standards Institute (ANSI) and Institute of Electrical and Electronics Engineers (IEEE) in the United States, the Association Française de Normalisation (AFNOR) in France, the Nederlands Normalisatie Instituut (NEN) in the Netherlands, the Asociación Española de Normalización y Certificación (AENOR) in Spain, the Italian Comitato Elettrotecnico Italiano (CEI) and the Ente Nazionale Italiano di Unificazione (UNI) in Italy, the Russian Federal Agency on Technical Regulation and Metrology (GOST), the Standardization Association of the People's Republic of China (SAC), the Bureau of Indian Standards (BIS), the Japanese Standard Association (JAS) and the Standards Council of Canada (SCC).

The material has been collected using information from many Internet sites. Not everyone who has contributed to this book can be mentioned here but I would like to acknowledge the following in alphabetical order:

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Support from my family helped me to write the book and motivated me to bring it to a successful end. Thanks to my wife Edith, my son Christian and friend Britta, my daughter Katrin and friend Christopher for their support and the design of the front cover of the book.

Abbreviations

AA	DIN Arbeitsausschuss (committee)
AAL	Ambient Assisted Living
ABNT	Associação Brasileira de Normas Técnicas
AC	alternating current
AC	IEC Advisory Committee
AC ART	IEC Advisory Committee on Applications of Robot Technology
AC EA	IEC Advisory Committee on Environmental Aspects
AC EC	IEC Advisory Committee on Electromagnetic Compatibility
AC EE	IEC Advisory Committee on Energy Efficiency
AC OS	IEC Advisory Committee on Safety
AC SEC	IEC Advisory Committee on Security
AC TAD	IEC Advisory Committee on Electricity Transmission and Distribution
ADETEF	Cross-Ministry of Finance, Economy and Sustainable Development (France)
AEA	National Electrotechnical Association of Argentina
AENOR	Asociación Española de Normalización y Certificación (Spanish Association for Standardization and Certification)
AFNOR	Association Française de Normalisation (French Association for Standardization)
AG	CENELEC/CEN – Assemblage General (General Assembly)
AHG	ad hoc group
AK	DIN Arbeitskreis (task force)
AMD	amendment
AMN	American Mercosur Nations
ANAB	American National Standards Institute – American Society for Quality National Accreditation Board (United States)
Annex 7	EU European annexes on normative references to international publications
ANS	American National Standard (United States)
ANSI	American National Standards Institute
ASA	American Standards Association (United States)

ASD	ANSI Accredited Standards Developer (United States)
ASIL	Automotive Safety Integrity Level of ISO 26262
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
BDI	Bundesverband der Deutschen Industrie (German Association of Industry)
BIS	Bureau of Indian Standards
BNQ	Bureau de Normalisation du Québec (Canada)
BS	British Standard
BSI	British Standards Institution
BSR	ANSI Board of Standards Reviewer (United States)
BT	CENELEC Technical Office (Bureau Technique)
BTTF	CENELEC Technical Board Task Force
BTWG	CENELEC Technical Board Working Group
CA	CENELEC/CEN – Committee Administrative (Administration)
CAB	IEC – Conformity Assessment Board
CACC	CEN – Committee Administrative Consulting Committee
CAE	Audit and Evaluation Committee (France, AFNOR)
CANENA	Council of Harmonization of Electrical Standardization of the Nations of America
CAS	China Association for Standardization (China)
CB-Scheme	IEC – B219Certification Bodies Scheme
CC	IEC – Compilation of Comments of Committee Draft
CCC	China Compulsory Certification (China)
CCMC	CEN-CENELEC Management Center
CCPN	Standardization Coordination and Steering Committee (France, AFNOR)
CD	IEC Committee Draft
CDV	IEC Committee Draft for Vote
CE	European Conformity
CEA	(Electrical Committee of Argentina) Comite Electrotecnico Argentino
CEI	Italian Electrotechnical Committee
CEM	Mexican Electrotechnical Committee
CEN	European Committee for Standardization (English); Comité Européen de Normalisation (French); Europäisches Komitee für Normung (German)
CEN/BT	CEN Technical Board
CENELEC	European Committee for Electrotechnical Standardization
CIF	ANSI Consumer Interest Forum (United States)
CIGRE	International Council on Large Electric Systems
CIM	Common Information Model
CIRED	International Conference on Electricity Distribution
CMC	CENELEC/CEN – Management Centre
CMF	ANSI Company Member Forum (United States)
CNAS	China National Accreditation for Conformity Assessment
CNE	National Commission of Energy (Chile)
CNIS	China National Institute of Standardization (China)
CO	IEC Central Office
COBEI	Brazilian Committee for Standardization in Electricity, Electronic, Illumination and Telecommunication

COPANT	PanAmerican Standards Commission
COR	corrigendum
CQC	China Quality Certification Centre (China)
CSA	Canadian Standardization Association
CSEE	Chinese Society of Electrical Engineering
CSIC	China Standards Information Centre (China)
CSP	China Standards Press (China)
CWA	CEN-CENELEC Working Group Agreement
DAR	Deutscher Akkreditierungsrat (Germany)
DC	direct current
DER	distributed energy resources
DGBMT	Deutsche Gesellschaft für Biomedizinische Technik im VDE
DIN	Deutsches Institut for Normung e. V.
DKE	Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE
DLMS	Device Language Messaging Specification
doc	CENELEC date of conformity
DoC	Department of Commerce (United States)
DoE	Department of Energy (United States)
dop	CENELEC date of publication
dor	CENELEC date of recognition
dow	CENELEC date of withdrawal
Draft prEN	CENELEC draft preliminary European norm
ECISS	European Committee for Iron and Steel Standardization
EEG	Germany – Erneuerbare Energien Gesetz (Renewable Energy Law)
EFTA	European Free Trade Association
EISA	Energy Independence and Security Act (United States)
EMC	electromagnetic compatibility
EMI	electromagnetic interferences
EN	EN:B82 European standard
FR	European normative
ENEC	European Mark for Electric Product Quality and Safety
ENTSO-E	European Network of Transmission System Operators (Europe)
EPO	European Patent Offices
EPRI	Electric Power Research Institute (United States)
ESO	European Standards Organization
ESS	European Standardization System
Essential Requirement	EU Requirement of European Union Directive on matters of safety, health or other matters covered by the New Approach Directive
ETG	Die Energietechnische Gesellschaft im VDE
ETSI	European Telecommunications Standards Institute
ETSI TC IST	Intelligent Transport Systems and Car to Car Communication
Euro NCAP	Test Procedures for Safe Cars (Europe)
FCC	Federal Communication Commission (United States)
FDA	Federal Food and Drug Administration (United States)
FDIS	IEC Final Draft International Standard
FDN	National Standardization Body (Venezuela)