SMB/6988/R

STRATEGIC BUSINESS PLAN (SBP)

IEC/TC OR SC:	SECRETARIAT:	DATE:
TC 22	**Switzerland**	**2019-10-25**

A. TITLE AND SCOPE OF THE TC

Title: POWER ELECTRONIC SYSTEMS AND EQUIPMENT

Scope:
To prepare international standards covering systems, equipment and their components for electronic power conversion and electronic power switching, including the means for their control, protection, monitoring and measurement.

Note 1- Components in this context include electronic devices.

Note 2- The scope does not include telecommunications apparatus other than power supplies to such apparatus.

Rationale: TC 22 is responsible for group safety publications covering a broad range of power electronic products. The power electronic products themselves are covered by the TC 22 subcommittees.
The scope considers new and emerging technologies that are closely monitored by the TC 22 and subcommittee officers. The coverage of new and emerging technologies may require establishing new subcommittees in future.

B. MANAGEMENT STRUCTURE OF THE TC

TC 22 Chair and Secretary

Chair's Advisory Group (CAG):
The TC 22 Chair's Advisory Group (CAG) was established in 2009-11 with the aim to ensure, based on broad consensus, the continued organizational and strategic development of TC 22 and its SCs. The CAG comprises all officers of TC 22 and its subcommittees as well as the convenors of the standardization teams directly reporting to TC 22 and the TC 22 representatives in IEC's Advisory Committees. The CAG meeting shall be held bi-monthly with the preference to use internet conferencing to keep the effort low.

Standardization Teams:

- Maintenance Team MT 3: for IEC 60146 series and IEC 61148
- Maintenance Team MT 8: for IEC/TS 62578
- Maintenance Team MT 9: for IEC 62477-1
- Project Team PT 62477-2: for development of the new IS IEC 62477-2 Ed. 1.0

Subcommittees:

- SC 22E Stabilized Power Supplies
- SC 22F Power Electronics for Electrical Transmission and Distribution Systems
- SC 22G Adjustable Speed Electric Drive Systems Incorporating Semiconductor Power Converters
- SC 22H Uninterruptible Power Systems (UPS)

C. BUSINESS ENVIRONMENT

The market size for power electronic converters can be estimated to be in the range of 133 billion USD. This value was determined considering that power semiconductors typically represent about 15% of the value of a power electronic converter and that the 2019 world market size for discrete power semiconductor devices and modules was estimated to be 20 billion USD.

Multiple large, medium size and small companies are active in the power electronic converter market. New applications and market dynamics of this business has encouraged the start-up of new companies and countries to invest heavily into their own industries active in this field.

D. MARKET DEMAND

Established companies and organizations expect TC 22 to cover new products and trends.

All companies require a well maintained and consistent basic set of standards that open the globalized markets to their products. This is of special interest for companies operating in the business of new applications.

E. TRENDS IN TECHNOLOGY AND IN THE MARKET

Power Electronic Converter technology trends

The development of new topologies of power electronic converters is driven by aspects that include:

- emerging technologies of power semiconductors and of materials for passive power electronic components permitting operation at switching frequencies, voltages and currents previously prohibitive for various reasons;
- requirements by emerging electromagnetic compatibility standards especially concerning conducted noise in electrical power supply systems. Such requirements are typically related to harmonic voltage and current control as well as to mains communication systems (MCS);
- requirements by emerging standards on environmental aspects and on energy efficiency;
- industrial focus on monolithic or hybrid combinations of mechanical and electrical systems (mechatronic systems) for the purpose of reducing overall costs and dimensions and of increasing reliability; and
- requirements to further increase the productivity of systems applying power electronic converters.
- DC applications: integration of renewables and micro grids for households will drive LVDC applications, while increase of energy efficiency requirements results in a trend to MVDC for commercial size renewable power plants.
- Ongoing progress in data processing enables to control more complex topologies and introduces possibilities to implement sophisticated algorithms like predictive maintenance and useful remaining lifetime prediction. These features come along with requests for interconnecting power electronic converters via the web for centralized coordination or remote diagnostics. Cyber security becomes by that an important topic to be considered by the power electronic converter manufacturers.

New and emerging power electronic converter topologies include multi-level converters e.g. for

variable speed driven systems.

Market trends

Driven by the general public policy targets for reducing greenhouse gas emission, the utilization of renewable energy resources, improved ways to store electrical energy and better use of the transmission and distribution systems by smart grid operation, all require power electronic converters. The same is true for electric and hybrid cars. Power Electronics is the key enabling technology for the future electrical energy market. It has also been noted that an increasing trend exists towards utilizing power electronics in applications where functional safety is a consideration.
An example of the fast growing power electronic business can be found in HVDC transmission: Current total capacity of commissioned HVDC projects alone exceeds 100 GW. Some more HVDC projects with the total capacity of about 300 GW are planned to be commissioned by 2020.

Ecological environment

Power electronics is the enabling technology for reducing the energy consumption of most of the industrial processes, for building facilities or for infrastructures management systems while converting energy (e.g. electrical energy to mechanical energy or vice versa). For the purpose of evaluating the best possible efficient use of energy across various motor system applications, SC 22G has developed the IEC 61800-9-1, which can be used by various IEC/ISO technical committees with the responsibility of final applications where motor systems are used. The IEC61800-9-1 has been given a group energy efficiency status by ACEE.
For the ecological generation of electrical energy power electronics is also an enabling technology for the utilization of regenerative energy resources.
Additionally, the increasing depletion of environmental resources for the increasing production of efficient components shall be balanced by an appropriate design aiming to reduce the consumption of these resources per component, known under the key word “eco-design”.

Digitally enhanced electrification

Future infrastructure, future society and future power electronic devices are all characterized by extensive data exchange between devices, between individuals and between devices and individuals. Key words like “Internet of Things” or the German initiative “*Industrie 4.0”* and the intensive discussion about “Smart Grids” are pointing to various requirements that have to be considered in standardization, e.g.

- cyber security of interconnected power electronic devices
- structures and protocols for information exchange
- standardized functions to be provided by the power electronic devices.

Another aspect may result from new specification, purchase and sales structures based on electronic data exchange. In order to enable a fair electronic trading and product data exchange process, standardization is required for evaluating and providing the required set of data.

Decentralization of energy generation and future energy distribution and transmission grid structures

The future structure of the energy distribution and generation is characterized by decentralized generation, coupling of various distribution grid structures like d.c. grids, islanding a.c. grid and public grids. These structures will not only be found in the classical energy transmission and distribution area, but also within low voltage distribution in industry, buildings and households.

Examples are multi-terminal HVDC systems, d.c. collection grids in large scale solar plants, local grid structures in evolving countries and small local structures in households combining small scale renewable energy harvesting, charging stations for electrical cars, small energy storage devices for riding through power outages and coupling to the public grid.

All these new structures require power electronic devices, which may not only have a completely new functionality, but also new requirements due to new applications and new regulations.

Besides providing the required basis for new products and applications in form of group safety publications, TC 22 and its subcommittees have to take care that product standards will be available in time. In a first approach, besides TC 22 covering the group aspects, SC 22E has the responsibility for the new products for low voltage applications while SC 22F has the responsibility for the new products for high voltage applications.

F. SYSTEM APPROACH ASPECTS (REFERENCE - AC/33/2013)

System Approach Relevance

For the TC 22 the system approach is an overall result of a collaborative standardization work together with other committees (multiple approaches).
This includes the necessity of a close cooperation with machine building and system integration industries. This often relies on platforms e.g. from ISO standards.

> NOTE: In the origins of standardization it seemed to be reasonable to clearly divide the standardization landscape into areas of responsibility, with TCs and SCs that covered what was in their scope and from time to time informed others that might be concerned. This way of working can still be found in IEC, but is clearly outdated. In future almost all electronic devices will be interconnected, will interact and contribute to common goals. That's why TC 22 is fully convinced that only by system thinking and a collaborative standardization work future product standardization can be done. The manufacturers of electronic products require a well-coordinated set of standards applicable to their products in order to efficiently develop, produce and maintain their products and ensure interoperability in customer owned systems.

The extent to which each committee or subcommittee support systems containing specific power electronic products is stated in the scope of the relevant committee or subcommittee.
The collaborative relation with other committees is given in the list of liaisons and the table of related contribution:

Committees which are customers of IEC TC 22 and SC 22x (our product is part of their system) **C**
Committees that are suppliers to IEC TC 22 and SC 22x (their product is part of our system) **S**
Other Committees (partner committees, committees providing generic guidance, etc.) **O**

Organization		TC 22	SC 22E	SC 22F	SC 22G	SC 22H
IEC TC 1	Terminology	O	O	O	O	O
IEC TC 2	Rotating machines				O	
IEC TC 3	Information structures, documentation and graphical symbols	O				
IEC TC 7	Overhead electrical conductors			S		
IEC TC 8	Systems aspects for elec. Energy supply	C	C	C	C	C
IEC SC 8B	Decentralized Electrical Energy Systems	C			O	
IEC TC 11	Overhead lines			S		
IEC TC 14	Power transformers			S	O	S
IEC SC 17A	Switching devices			S	S	
IEC SC 17C	Assemblies			S	C	
IEC TC 20	Electric cables			S		S

IEC TC 21	Secondary cells and batteries					S
IEC SC 23B	Plugs, socket-outlets and switches	S	S		S	S
IEC TC 31	Equipment for explosive atmospheres				C	
IEC TC 32	Fuses	S	S		S	S
IEC SC 32B	Low-voltage fuses	S	S		S	S
IEC TC 33	Power capacitors			S	S	S
IEC TC 36	Insulators			S		
IEC SC 36A	Insulated bushings			S		S
IEC TC 37	Surge arrestors			S		
IEC SC 37A	Low-voltage surge protective devices	S	S		S	S
IEC TC 38	Instrument transformers			S		S
IEC TC 40	Capacitors and resistors for electronic equipment				S	S
IEC TC 44	Safety of machinery - Electrotechnical aspects		C		C	
IEC SC 47E	Discrete semiconductor devices	S	S	S	S	S
IEC TC 48	Electromechanical components					S
IEC TC 57	Power system management and associated information exchange			C		C
IEC TC 59	Performance of household electrical appliances				C	
IEC TC 61	Safety of household and similar electrical appliances				C	
IEC TC 62	Medical equipment					C
IEC SC 62A	Common aspects of electrical equipment used in medical practice		C			
IEC TC 64	Electrical Installations and protection against electric shock	O	O	O	O	O
IEC TC 65	Industrial-process measurement, control and automation		C		O	
IEC TC 66	Safety of measuring, control and laboratory equipment	O	C/S			C
IEC TC 69	Electric vehicles	C				
IEC TC 70	Degrees of protection of enclosures	O			O	O
IEC TC 73	Short circuit currents	O		O		O
IEC TC 77	Electromagnetic compatibility	O			O	O
IEC SC 77A	Electromagnetic compatibility – Low frequency phenomena	O	O		O	O
IEC SC 77B	Electromagnetic compatibility – High frequency phenomena	O	O		O	O
IEC TC 82	Solar PV energy systems	C	C			C
IEC TC 88	Wind Turbines	C	C		C	
IEC TC 89	Fire hazard testing	O		O	O	
IEC TC 91	Electronic assembly technology					S
IEC TC 96	Transformers, reactors, power supply units and similar products for low voltage up to 1100 V		O		S	S

IEC TC 99	Insulation Coordination and System engineering of high voltage electrical power installations above 1,0 kV A.C. and 1,5 kV D.C.	O		O	O	O
IEC TC 104	Environmental conditions, classification and methods of test	O	O		O	O
IEC TC 105	Fuel cells	C	C			C
IEC TC 106	Methods for the assessment of electric, magnetic and electromagnetic fields associated with human exposure	O	O	O	O	O
IEC TC 108	Safety of IT / Communication	O	C/S			C
IEC TC 109	Insulation coordination for low-voltage equipment	O	O		O	O
IEC TC 111	Environmental standardization for electrical and electronic products and systems	O	O		O	O
IEC TC 112	Evaluation and qualification of electrical insulating materials and systems	O	O		O	O
IEC TC 114	Marine energy - Wave and tidal energy converters	C	C		C	
IEC TC 115	High Voltage Direct Current (HVDC) transmission for DC voltages above 100 kV			C		
IEC TC 117	Solar thermal electrical plants	C	C		C	
IEC PC 118	Smart grid user interface	O	O		O	
IEC TC 120	Electrical Energy Storage (EES) Systems	C	C			O
IEC SC 121A	Low-voltage switchgear and controlgear				S	S
IEC SC 121B	Low-voltage switchgear and controlgear assemblies				C	C/S
IEC CISPR	Electromagnetic Compatibility	O	O		O	O
ISO TC 115	Pumps				C	
ISO TC 117	Fans				C	
ISO TC 118	Compressors and pneumatic tools, machines and equipment				C	
ISO TC 301	Energy management and energy savings				C	
ISO TC 184	Industrial automation systems and integration (particularly SC1 – Physical device control)				C	

G. CONFORMITY ASSESSMENT

The standards of TC 22 are structured in a way that each subcommittee provides a comprehensive set of requirements for the testing (methods, limit values, set-up) of their dedicated product or system to prove the appropriate conformity.

Conformity can be assessed under responsibility of the manufacturers or supplier (first party), and/or of a user or purchaser (second party), and/or of an independent body (third party) and they can be outsourced to external independent testing institutes.

In all cases, the standards provided by TC 22 and its subcommittees include all aspects required for conformity assessment.

Establishment of further conformity assessment schemes or systems, or other documents specifying conformity assessment systems or schemes or sector specific operating procedures for use by conformity assessment bodies and others for conformity assessment purposes are therefore not indicated.

The interconnection of products within the scope of TC 22 and its subcommittees with other electronic products, especially with respect to data exchange via open access networks may require the application of test procedures that are not developed within TC 22 or its subcommittees. Conformity assessment schemes established to cover these aspects might have to be applied also to the products covered by TC 22 and its subcommittees.

H. 3-5 YEAR PROJECTED STRATEGIC OBJECTIVES, ACTIONS, TARGET DATES

STRATEGIC OBJECTIVES 3-5 YEARS	ACTIONS TO SUPPORT THE STRATEGIC OBJECTIVES	TARGET DATE(S) TO COMPLETE THE ACTIONS
Establish the IEC 62477-series as the core documents for all product safety standards in TC 22 and its subcommittees except products for voltage levels >36 kV a.c.	Revise all safety publications within TC 22 and its SCs taking the IEC 62477 series as the reference standard. Maintain the document IE 62477-2 in cooperation with TC 99.	Review state of the art during plenary 2021.
Digital integration of power electronic: • Functionality • Cyber security	Collaborate with TC 65.	Review state of the art during plenary 2021.
Application-independent definitions.	To establish a basic set of application-independent definitions of terms for power electronic systems for internal use in TC 22 and its subcommittees.	Review state of the art during plenary 2021.
Material efficiency for environmentally conscious design.	Observe TC 111. Start discussion on this topic and eventually to build a PWI with an AhG for standardization survey.	To be reviewed in the plenary 2021.

The following items are monitored on a regular basis and if relevant included in the strategic objective list with dedicated action items.

- To establish a seamless portfolio of standards covering of energy management, energy efficiency and ecological requirements for power electronic converters and systems.
- To determine the needs for appropriate standardization of power electronics in a mechatronic environment.
- To continuously review the structure of the committee in order to adapt it effectively to future needs.
- To scan the globalized market requirements and determine the need of further standardization of power electronic systems.
- To detect and avoid overlapping of standardization tasks with other technical committees, especially within a system framework approach.
- To proceed using contemporary IT resources for standardization work for travelling cost reduction purposes.

I. USEFUL LINKS TO IEC WEB SITE

TC 22 home page provides access to Membership, TC/SC Officers, Scope, Liaisons, WG/MT/PT structure, Publications issued, Work and Maintenance Programs and to similar information for SCs.

Chairman TC 22

Dr. Benno Weis

Secretary TC 22

Dr. Chuanhong Zhao