STRATEGIC BUSINESS PLAN (SBP)

IEC/TC OR SC:	SECRETARIAT:	DATE:
TC 17	**Sweden**	**2020-02-18**

Please ensure this form is annexed to the Report to the Standardization Management Board if it has been prepared during a meeting, or sent to the Central Office promptly after its contents have been agreed by the committee.

A. STATE TITLE AND SCOPE OF TC

Title: High-voltage switchgear and controlgear

Scope: To prepare standards, technical specifications and technical reports covering high-voltage switchgear and controlgear as well as their assemblies having a rated voltage above 1 kV AC and above 1,5 kV DC, together with associated control digital communication, measuring, signalling, protective, and other equipment.

TC 17 closely monitors emerging technologies and will act once the need for standardisation has been identified.

B. MANAGEMENT STRUCTURE OF THE TC

The structure of TC 17, SC 17A and SC 17C has been adapted to the change in technology and market needs in 2015 and has been approved by SMB.

TC 17 is taking care directly of standards and activities common to all switchgear and control-gears. It has the two following subcommittees:

SC 17A: Switching devices

SC 17C: Assemblies

SC 17A prepares international standards, technical specifications and technical reports related to switching devices having a rated voltage above 1 kV AC and/or above 1,5 kV DC.

SC 17C prepares international standards, technical specifications and technical reports related to assemblies incorporating one or more switching devices having a rated voltage above 1 kV AC and/or above 1,5 kV DC. Assemblies may include associated control, digital communication, measuring, signalling, protective, regulating and other equipment. Gas insulated transmission lines and interfaces with cables, overhead lines, power transformers etc. are also part of the scope of SC 17C.

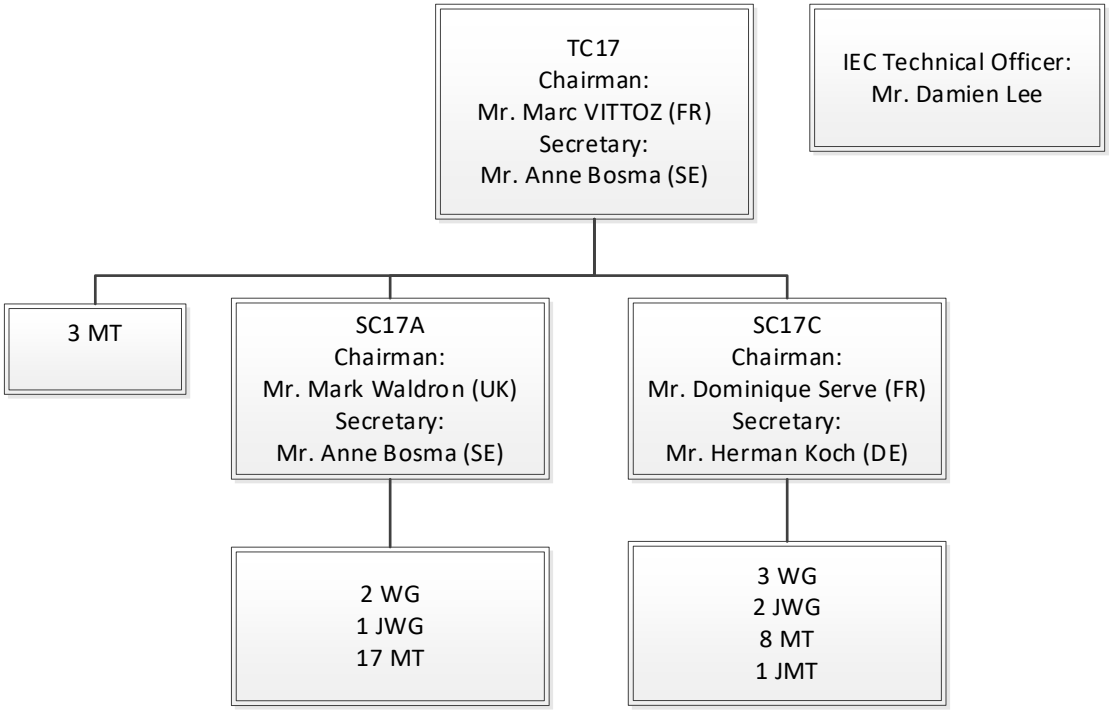
TC 17 has a total of 36 P-members and 17 O-members, with a number of 332 experts, coming from 27 different countries all around the world.

TC 17 is responsible for 4 publications. It coordinates the work between its subcommittees and its work between other technical bodies within and outside IEC.

SC 17A is responsible for 21 publications.

SC 17C is responsible for 16 publications.

The current structure of TC 17 is the following:



New WGs will be launched soon to take care of new needs for standardization of HVDC products and mobile substations.

C. BUSINESS ENVIRONMENT

IEC standardization for high-voltage switchgear and controlgear worldwide has reached a level far higher than that for most other types of equipment, today, covering various fields of technology.

As the development of electric power systems is a key issue for less industrialized and developing countries, and as these countries to a large extent lack experienced personnel, IEC standards on high-voltage switchgear and controlgear also serve as means for the transfer of knowledge and as guideline for planning.

In many cases high-voltage switchgear and controlgear serves as the ultimate safety device in transmission and distribution networks. This aspect has great influence on the philosophy of work of the subcommittees dealing with high-voltage equipment and substations. Also, the interaction of high-voltage switchgear with networks and loads as well as the system's reaction to switching operations have to be taken into account.

IEC standards on switchgear and control gear assemblies serve as a basis for contracts between manufacturer and user. They are used in the planning status, for erection, operation, maintenance, and decommissioning. The IEC standards of TC 17 and its SCs are giving leading guidance, orientation, rules and state of the art information about high voltage switchgear assemblies.

Requirements to the switchgear are following the state of the art with the highest possible quality and safety level at economical basis. The global impact with new industries in the emerging countries of Asia, Africa and South America give new tasks and requirements related to those regions. IEC standardization is in these continents more in competition to other standard organisations and needs to serve the market with high quality standards. Common to all types of switchgear are requirements for the utmost reliability. This leads to high levels of testing during development and manufacture which are based on comprehensive standards for type and routine tests.

The standards for the different spectra of products and applications of high-voltage switchgear and controlgear address, along with the manufacturers of the equipment, mainly two groups of users in the field of high-voltage power transmission and distribution: utilities and industrial groups.

While, generally speaking, the manufacturers and testing facilities of high-voltage switchgear and controlgear are adequately represented in TC 17 and its subcommittees it would be desirable to have a more active participation from the users' side, in particular in the distribution voltage range (above 1 kV and up to and including 52 kV) of products.

The evolution of high-voltage switchgear and controlgear technologies, the trends toward higher degrees of automation, the integration of various additional functions into primary equipment, the changing political environments – saving of energy, deregulation, etc. – and the growth of the international trade require the maintenance of the existing as well as the development of new IEC standards on high- voltage switchgear and controlgear.

The implementation of renewable energy sources may lead to an expansion of the use of distributed generation, which may lead to an increased use of switchgear and controlgear the lower end of the "high-voltage" range.

At distribution voltage levels (above 1 kV and up to and including 52 kV) and transmission voltage level (above 52 kV) the market is asking for alternative gases to SF_6 to reduce the global warming potential of gas enclosed in equipment. Some technical solutions are already in the market or in progress to anticipate market change. This opens new technical discussions between users and manufacturers, as some new issues or specifications are not covered by the actual standards. After the first return of experience and in order to facilitate the introduction of these new technologies, standards are getting adapted to allow as for example the use of alternative gases to SF_6. This trend will continue for the next years, depending on the speed for these products to cover the complete market. Technical studies and return of experience will continue to supply the work to be done for the standardization update.

D. MARKET DEMAND

Global market expansions continue to create high demands for international standards on high-voltage switchgear and controlgear. Upon this background the harmonization of existing national standards through their integration into IEC is of major importance.

This period of time sees very important trends: introduction of renewable energy production, digitalization of products and great effort to reduce the impact on the environment of the products during their life cycle.

Political and economic constraints links to politics of asset management, including investements, maintenance, end of life, will continue to reduce equipment and operational costs, and enforce development trends for higher reliability and availability, at same safety levels in a circular economy policy.

Global market expansion for electric power continues to create high demands for international standards on high voltage switchgear and control gear assemblies. For this reason, the harmonisation of existing national and regional standards through their integration into IEC is of major importance to facilitate the global market trade.

Nevertheless, new technologies emerge, leading to build more compact equipment, operating with advanced switching technology, and using electronics and information technology.

These technology developments are driven by the need for higher power transmission ratings, higher power concentration in metropolitan areas, less available space, more stringent reqirements with regards to the environment, higher reliability, and lower market prices.

New technical applications which use several product standards are creating new system-oriented standards. The changes of the transmission and distribution network today and in next future will turn the network from a top down hierarchy into a more complex structure often identified as Smart Grid, Smart Energy, Smart Cities, Micro Grids or Distributed Generation.

This will require basic changes in the network and will lead to more complex systems using digital communication in a wide field of applications. One major driver is the increase of renewable energy. The existing standards will need to get adapted and new standards are required to cover the system related aspects. (For example development of HVDC GIS)

In the field of voltages higher than 800 kV, product standards have been extended in voltage ranges and new system standards are in development in TC 122. The DC gas-insulated technology is emerging first into application in offshore substations and will continue to create space saving solutions for compact on-land converter stations. DC gas-insulated switchgear assemblies are now studied in detail for the need of standardisation in SC 17C AHG 37. The global business of assemblies related to SC 17C standards also is asking for harmonisation with ANSI/IEEE standards in the same field. Conflicting standards are harmonised and in some cases new common projects are started. A close cooperation between the related working groups is under constant investigation.

E. TRENDS IN TECHNOLOGY AND IN THE MARKET

The expectations from users from standards cover a wide domain: buy performances for a time duration, buy products to satisft needed functions in an existing network. By consequences, what are the best bechnologic solutions? This is a compromise in regards to technical constraints, economical and environmental issues, for a certain time scale.

In high-voltage switchgear, electronic circuits and digital functions are being incorporated for the integration of the switchgear into automated substation and network controls. Monitoring and life management are a global approach on the life cycle. On of the aims is to lower the operational costs. High-voltage switchgear assemblies are installed to save space and further improve reliability.

New technologies emerge with alternative gases to SF_6 to reduce Global Warming Potential (GWP) (on the complete range of products), and the extension of performance of the vacuum interrupters in the first part of the transmission sector (up to 245 kV today, and possibly extension to higher voltages) are starting to modify deeply the technologies used in high voltage switchgear and controlgear equipment and assemblies.

The operation conditions of switchgear assemblies will change with the application e.g. off-shore, on-land, wind farms, increased number of operations in renewable networks (mission profile).

The change of the power grid towards increased renewable energy sources will result in a demand for a much higher number of switching operations for switchgear associated with the changing power input coming from solar or wind. This will increase the mechanical endurance requirements to even higher numbers of operation (e.g. 20 000) when compared to today and it will shift the technical requirement to new limits.

Technology changes in the AC network are also partly driven by higher ratings requirements and digital technologies. Low maintenance and compact design on the other side comes as requirement from users. The smart grid will impact more the medium voltage switchgear than the high voltage switchgear because the integration of renewable energies and their management is mainly first made at medium voltage network level. This will increase the need for sensors and operation control. Analytics will complete the measurements to support decisions process during the phase of operation, optimizing the asset management. Lot of digital information aims to represent a so-called digital twin of the high-voltage switchgear and controlgear. The information to characterize the digital twins, at different phases of the product life, should migrate along the life cycle and follow an IEC catalogue data recorded whithin the common data dictionary (CDD).

For temporary use mobile substations are increasingly required. In cases of natural desasters, they are required to reconnect the electric power supply or in cases of refurbishment of existing substations, they are required to provide a temporary by-pass.

The DC gas-insulated technology is new in the market with HVDC GIS projects in existence and HV DC GIL will follow in some years. TC 17 has investigated the standardization requirements and based on this information TC 17, SC 17A and SC 17C will start standardization soon. A lot of new products are appearing in this field including classic technlogies, as well as new technologies with power electronic systems. It is seen that the standardization work will lead to new standards, as the DC requirements vary significantly from those of AC.

The standardisation activities are focussed on those fields with new working groups and maintenance teams. The maintenance of existing standards has its main focus on keeping the content in line with the technical developments.

In the field of voltages above 800 kV, product standards have been extended in voltage ranges.

To face the introduction of voltages above 800 kV (1 100 kV in China and 1 200 kV in India) to bring high power transmission from renewable energy sources in the mountains to the load centres over distances of 1 000 km and more, all relevant existing standards of TC 17, SC 17A and SC 17C have been reviewed to meet these requirements.

Other projects in standardisation are related to the sustainability, covering environmental questions and corporate social responsibility. The identified topics are for example, EMF, the optimization of the environemental foot print including material and energy efficiencies such as

losses reductions (transmission and distribution). The whole life cycle will be more considered in circular economy business model from the design phase up to the new life where asset management aims to extend the lifespan of the high-voltage switchgear and controlgear. These approaches should consider the dependability of the high-voltage switchgear and controlgear versus the life cycle cost.

Gas-insulated transmission lines (GIL) is available for the market with high power transmission capabilities. New applications for GIL are seen in the electric power supply of large metropolitian areas and cities (city GIL).

The interaction with other TCs and SCs is given in the table below.

Electromagnetic emission will have to be considered very carefully due to the higher complexity of the high-voltage switchgear and controlgear and the extensive application of electronic devices.

The IEC White Paper on Global energy interconnection initiating standardisation activities is in the focus of TC 17.

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

The interaction of TC 17 with other TCs and SCs is given in Table 1. When interactions are common for SC 17A and SC 17C, they are dealt with at TC 17 level.

The interaction of SC 17A with other TCs and SCs is given in Table 2.

The interaction of SC 17C with other TCs and SCs is given in Table 3.

Table 1 - Liaisons of TC 17 with other TCs/SCs

System Committees (TC 17 role as a customer)	TC 1 – Terminology TC 10 - Fluids for electrotechnical applications TC 15 - Solid electrical insulating materials TC 99 – Insulation co-ordination and system engineering of high voltage electrical power installations above 1,0 kV AC and 1,5 kV DC SC 32A - High-voltage fuses TC 36 - Insulators SC 36A - Insulated bushings SC 36C - Insulators for substations TC 42 - High-voltage and high-current test techniques TC 77 - Electromagnetic compatibility TC 95 – Measiring relays and protection equipment TC112 - Evaluation and qualification of electrical insulating materials and systems TC115 – HVDC transmission for DC voltage above 100 kV TC 121A – Low-voltage switchgear and controlgear TC3-SC3D – Product properties and classes and their identification
System Committees (TC 17 role as supplier)	SC 32A - High-voltage fuses TC 33 - Power capacitors and their applications TC 99 - Insulation co-ordination and system engineering of high voltage electrical power installations above 1,0 kV AC and 1,5 kV DC TC3-SC3D – Product properties and classes and their identification
Other Committees (TC 17 in contact with for technical consistency)	TC 9 - Electrical equipment and systems for railways TC 28 - Insulation co-ordination TC 42 - High-voltage and high-current test techniques

Table 2 - Liaisons of SC 17A with other TCs/SCs

System Committees (SC 17A role as a customer)	TC3-SC3D – Product properties and classes and their identification

System Committees (SC 17A role as supplier)	SC 17C - High-voltage switchgear and controlgear assemblies TC 33 - Power capacitors and their applications TC3-SC3D – Product properties and classes and their identification
Other Committees (SC 17A in contact with for technical consistency)	

Table 3 - Liaisons of SC 17C with other TCs/SCs

System Committees (SC 17C role as a customer)	TC 2 - Rotating machinery TC 8 - Systems aspects for electrical energy supply SC 17A - High-voltage switchgear and controlgear TC 38 - Instrument transformers TC 99 - Insulation co-ordination and system engineering of high voltage electrical power installations above 1,0 kV AC and 1,5 kV DC (including former TC 28) TC 106 - Methods for the assessment of electric, magnetic and electromagnetic fields associated with human exposure TC 111 - Environmental standardization for electrical and electronic products and systems TC3-SC3D – Product properties and classes and their identification
System Committees (SC 17C role as supplier)	TC 14 - Power transformers TC 20 – Electric cables SC 17A - High-voltage switchgear and controlgear SC 36A - Insulated bushings TC 37 - Surge arresters TC 38 - Instrument transformers TC3-SC3D – Product properties and classes and their identification
Other Committees (SC 17C in contact with for technical consistency)	TC 18 - Electrical installations of ships and of mobile and fixed offshore units TC 78 - Live working

SC 17A has external liaisons with CIGRE Study Committee A3 (Category A), and to further promote the harmonization of IEEE and IEC standards in the field of the equipment a category D has been established between SC 17A and the IEEE Switchgear Committee.

SC 17C has category A liaison with CIGRE Study Committee B3 Substations.

TC 17 has also a liaison with the Short-Circuit Testing Liaison (STL), which is a technical liaison between test labs, in order to verify the adaptation of standards with the testing capabilities.

To further promote the harmonization of IEEE and IEC standards in the field of Gas Insulated Switchgear (GIS) and Substations Communications, SC 17C has established the following category D liaisons:

- IEEE/PES Substations Subcommittee K0 GIS with IEC SC 17C MT 16 HV-GIS;
- IEEE/PES Switchgear Committee with IEC SC 17C MT 14 MV-GIS.

G. Conformity Assessment

The publications of TC 17 and its SCs are in the process of being aligned with 6.7 of Part 2 of the ISO/IEC directives. The main standard, IEC 62271-1 has been revised in 2017 and all associated standards are in the process to be updated.

The publications of TC 17 and its SCs may be used for IEC Conformity Assessment Systems.

Most standards of TC 17 and its SCs contain tests specifications, reproducible test requirements, and test methods.

Standards of SC 17C include specific test requirements which need to be approved with certified test laboratories according to ISO 61000 series.

H. Horizontal issues

The interaction with horizontal committees is provided in item F.

TC 17 has liaison officers participating in the meetings of ACOS and ACTAD. The information from these ACs is a standing point on the TC 17 agenda.

I. 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
Revision of IEC 62271-4	Cooperation with TC 10	Forecasted publication 2022-09
Revision of IEC 62271-206	Cooperation with TC 78	Pending revision of IEC 61243-3
Revision of IEC/IEEE 62271-37-013	Revision & updating	Forecasted publication 2021-01
Revision of IEC 62271-100	Revision & updating	Forecasted publication 2021-02
Revision of IEC 62271-101	Revisions to align with 62271-100	Forecasted publication 2022-02
Revision of IEC 62271-103	Revision & updating	Forecasted publication 2022-03
Revision of IEC 62271-104	Revision & updating	Forecasted publication 2020-09
Revision of IEC 62271-105	Revision & updating	Forecasted publication 2021-02
Revision of IEC 62271-106	Revision & updating	Forecasted publication 2020-10
Revision of IEC 62271-107	Revision & updating	Publication 2019-05
Revision of IEC 62271-108	Revision & updating	Forecasted publication 2020-04
Revision of IEC 62271-109	Revision & updating	Publication 2019-04
Revision of IEC 62271-113	New document	Cancelled
Medium Voltage Severe climatic conditions IEC 62271-304 by	Revision and updating	Time: TS 2019-01 Milestones: CD2 2017-05

MT 19		
Medium Voltage Internal arc classification for pole-mounted devices IEC 62271-214 by WG	Revision and updating	Time: IS 2018-10 Milestones: CD2 2017-05
High Voltage Seismic Requirements IEC 62271-207 MT22	Revision and updating	Start of work 2019-09
High Voltage Cable connections IEC 62271-209 by JMT 18	Revision and updating	Time: IS 2018-10 Milestones: CDV 2017-07
Transferability of tests results IEC 62271-312 WG38	New project	Time: TR 2017-08 Milestones: NP 2017 Forecasted publication 2020-10
Medium Voltage GIS above 1 kV and up to and including 52 kV 62271-200 by MT 14 next revision	Revision and updating	Time: IS 2020-06 Milestone: CD 2018-12 Forecasted publication 2021-03
Medium Voltage above 1 kV and up to and including 52 kV 62271-202 by MT 29	Revision and updating	Time: IS 2021-12 Milestone: CD 2019-12 Forecasted publication 2023-10
High Voltage GIS above 52 kV 62271-203 by MT 16 next revision	Revision and updating	Time: IS 2021-06 Milestone: CD 2019-12 Forecasted publication 2021-07
Voltage detecting and indicating system 62271-213 by JWG 34	Revision and updating	Time: IS 2018-12 Milestone: CDV 2018-01 Forecasted publication 2021-01
Phase comparator 62271-215 by JWG 34	To handle as new project	Time: IS 2020-07 Milestone: CD 2019-12 Forecasted publication 2021-02
DC High Voltage Switchgear Assemblies NWIP	New project	NWIP 2019-06 Forecasted publication 2023-03
HV AC mobile substations NWIP	New project	NWIP 2019-04 Forecasted publication 2023-09
Direct current transfer switches 62271-315	New project	17/1225/NP Forecast publication 2022-05
Direct current by-pass switches and paralleling switches	New project	17/1226/NP Forecast publication 2022-04

Note: The progress on the actions should be reported in the RSMB.