	C/2174/DV
For IEC use only	
	2018-12-21

INTERNATIONAL ELECTROTECHNICAL COMMISSION

COUNCIL

SUBJECT

Document for NC vote: Proposal for a new project committee entitled *Low-voltage auxiliary power systems for electric power plants and substations*

BACKGROUND

The attached proposal from the Chinese NC is submitted to all IEC National Committees (NCs) in accordance with the ISO/IEC Directives Part 1, §1.10 and Annex K.

K.1 Proposal stage
Votes shall be returned within 12 weeks.
Acceptance requires:
a) approval by a 2/3 majority of the National Bodies voting;
b) a commitment to participate actively by at least five National Bodies that approved the new work item proposal and nominated technical experts.

ACTION

IEC National Committees are invited to vote on the establishment of the proposed new project committee, providing a statement justifying their decision, using the Council voting/commenting system **by 2019-03-15**. **NCs not providing a statement justifying their decision will not have their votes taken into account.**

Those NCs intending to participate actively (P-Members) in the new PC, if approved, are invited to advise accordingly using the commenting system by the same date.

Secretariat note*: For administrative purposes it is requested that National Committees use the accompanying comment form in Word format when commenting.*

Attachment
Annex: presentation

C/2174/DV

PROPOSAL FOR A NEW FIELD OF TECHNICAL ACTIVITY

PROPOSER:	DATE OF CIRCULATION:
China	**2018-12-21**

A proposal for a new field of technical activity shall be submitted to the Central Office, which will assign it a reference number and process the proposal in accordance with ISO/IEC Directives, Part 1, 1.5. Guidelines for proposing and justifying a new field of activity are given in the ISO/IEC Directives, Part 1, Annex C.

THE PROPOSAL (to be completed by the proposer):

TITLE (the title shall be described unambiguously and as concisely as possible)

Low-voltage auxiliary power systems for electric power plants and substations

SCOPE (the scope shall define precisely the limits of the proposed new field of activity and shall begin with "Standardization of ..." or "Standardization in the field of ...")

Standardization in the fields of low-voltage auxiliary power systems for electric power plants and substations, including:
- system design;
- installation and acceptance;
- commissioning;
- operation and maintenance;
- safety and reliability;
- ...

and excluding: NUCLEAR POWER, RAILWAYS AND SHIPPING.

PURPOSE AND JUSTIFICATION (the justification shall endeavour to assess the economic and social advantages which would result from the adoption of International Standards in the proposed new field)

As one of the elements critical to secure and reliable operation in power generation, transmission and distribution, low-voltage auxiliary power system (APS) is a power system indispensable to the normal operation of electric power plants and substations. It provides DC supplies to auxiliary equipment in the stations (e.g., pulverised coal feeders, coolers of converter valves, switching actuators of breakers, microcomputer-based protective devices, illumination devices, etc.), and provides emergency supplies to isolate faults and restore service in accidents (e.g., breaker switching, emergency lighting, etc.) so as to prevent growing accidents and guarantee quick recovery.

A fault within the APS is very likely to disable the protection and control functions for main equipment. Under such cases, faults of the grid cannot be quickly cleared, causing more time for the gird to recover and sometimes considerable damage and losses because of escalating failures. This has been proved repeatedly by the accidents in recent years. For instance, in a certain 330kV substation, the DC APS was failed due to improper handling of a fault in the AC APS, disabling all protective devices and the supplies for switching actuators of the whole station. The failure later passed on to the grid of higher ratings and evolved into the explosion of one 330 kV transformer and loss of power of two 220 kV transformers, generating huge economic losses.

Nevertheless, the auxiliary power system has been paid no due attention for years. Systematic research is still absent today. Characterized by complex networks, various load types and widely distributed circuits, auxiliary power systems throughout the globe are not uncommon to be found of facing challenges such as inappropriate design of system capacity and network topology, unsuitable coordination of protective devices and voltage disturbances from monitoring devices. Therefore, to achieve a reliable and economical auxiliary power system, standardization is required to focus on system design, installation & acceptance, commissioning, operation and maintenance (O&M), safety and reliability, etc.

Meanwhile, the development of the modern grid presents higher requirements for the reliability and safety of low-voltage auxiliary power systems. The power system is becoming more automatic and intelligent due to progress in computer science and wide penetration of integrated automation (e.g., distributed control system (DCS) of power plants, automatic sequence control (ASC) of converter stations, etc.). For this reason, the secure operation of the main equipment relies even more heavily on low-voltage auxiliary power systems.

According to the work of CIGRE WG B3.42, auxiliary power systems vary from country to country concerning voltage ratings, grounding methods, supply configuration and O&M. These variations, to some degree, hinder the worldwide penetration of high-quality products and prevent the sharing of novel concepts and best practice. Presently, IEEE is developing standards on APSs, e.g., IEEE P1818-*Guide for the Design of Low Voltage Auxiliary Systems for Electric Power Substation*s.

Hence, it is essential to establish a Committee specifically for low-voltage auxiliary power systems for power plants and substations in IEC. Standardization of this field would help to facilitate equipment applications and improve design

efficiency, thereby reducing the O&M cost and the costs of transnational/cross-regional projects.

ACCORDING TO SMB DECISION 163/12, THE PROPOSAL FROM THE CHINESE NC SHOULD PREFERABLY BE CHANGED TO PROPOSE THE SETTING UP OF A PC, AND IT WOULD ALLOW SMB TO DETERMINE IN TWO YEARS WHETHER FURTHER WORK MIGHT BE NEEDED.

PROGRAMME OF WORK (list of principal questions which the proposer wishes to be included within the limits given in the proposed scope, indicating what aspects of the subject should be dealt with, e.g. terminology, test methods, dimensions and tolerances, performance requirements, technical specifications, etc.)

The standardization of LV auxiliary power systems will focus on such aspects as terminology, installation & acceptance, commissioning, operation & maintenance, safety & reliability, etc. Firstly, establishing three working groups:

WG 1: Terminology
- Terminology of low-voltage auxiliary power systems;

WG 2: Design of DC auxiliary power system
- Design of low-voltage DC auxiliary power systems Part1: Substations;
- Design of low-voltage DC auxiliary power systems Part2: Electric power plants;

WG 3: Design of AC auxiliary power system
- Design of low-voltage AC auxiliary power systems Part1: Substations;
- Design of low-voltage AC auxiliary power systems Part2: Electric power plants;

PREFERRED TYPE OF DELIVERABLES

IS, TS, TR, PAS

RELEVANT EXISTING DOCUMENTS AT THE INTERNATIONAL, REGIONAL AND NATIONAL LEVELS (relevant documents to be considered: national standards or other normative documents)

CIGRE TB- Reliability Analysis and Design Guidelines for LV **DC** Auxiliary Systems
CIGRE TB- Reliability Analysis and Design Guidelines for LV **AC** Auxiliary Systems

IEEE P1818- Guide for the Design of Low Voltage Auxiliary Systems for Electric Power Substations

RELATION TO AND IMPACT ON EXISTING WORK

The proposed PC, if established, will establish liaisons with relevant IEC committees, such as TC 121, TC 21, TC 22, TC 23, SC 37B and TC64.

RELEVANT COUNTRY PARTICIPATION

Participants of CIGRE B3.42 (AU, CA, CN, DE, ES, IE, PL, SA, SL, UK, US) are invited to participate in the proposed PC, if the PC is established. Other NCs are also welcomed.

LIAISON ORGANIZATIONS (list of organizations or external or internal bodies with which co-operation and liaison should be established)

CIGRE B3 Substations
IEEE P1818 Guide for the Design of Low Voltage Auxiliary Systems for Electric Power Substations

IEC TC 121 Switchgear and controlgear and their assemblies for low voltage
IEC TC 21 Secondary cells and batteries
IEC TC 22 Power electronic systems and equipment
IEC TC 23 Electrical accessories
IEC SC 37B Components for low-voltage surge protection
IEC TC 64 Electrical installations and protection against electric shock
IEC TC 99 Insulation co-ordination and system engineering of high voltage electrical power installations above 1,0 kV AC and 1,5 kV DC

STAKEHOLDERS

Power utilities, design institutes…

LEADERSHIP COMMITMENT

If the proposed PC is established, IEC Chinese NC would like to take the secretariat.

OTHER COMMENTS (if any)

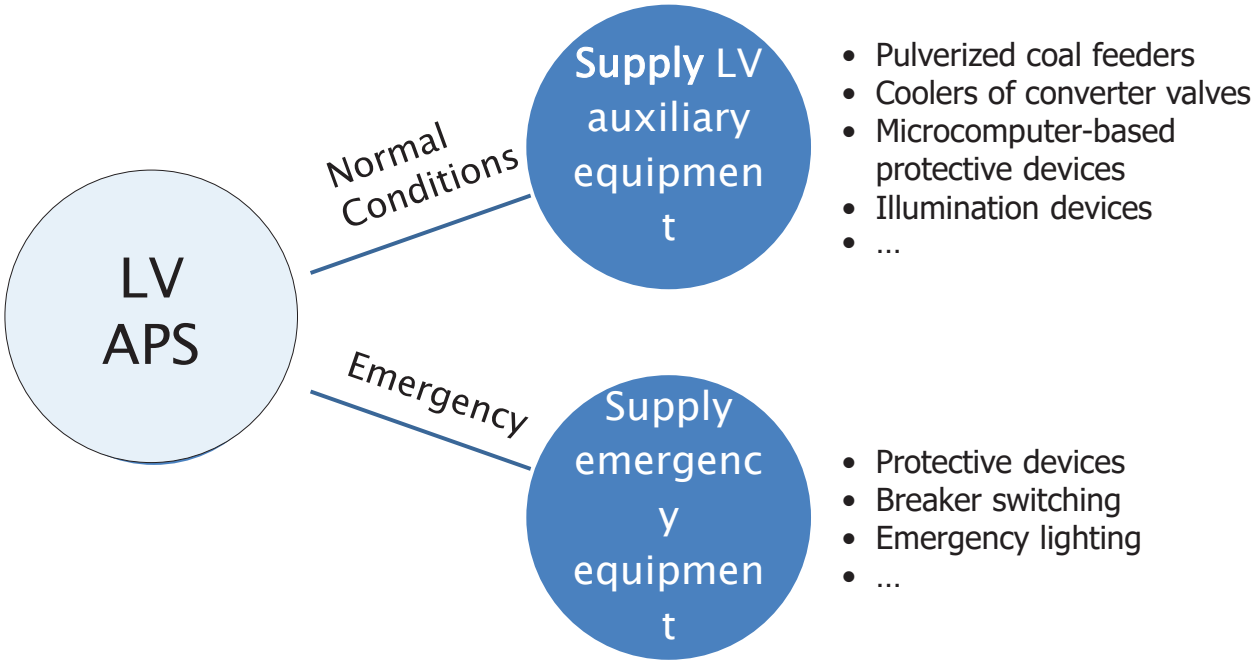
COMMENTS OF THE GENERAL SECRETARY (to be completed by the Central Office):

This proposal was initially reviewed by the SMB at its meeting in Busan on 2018-10-22. The SMB recommended that the proposal be amended to propose the setting up of a new Project Committee (PC), which has been done by the Chinese NC. It then decided to circulate it for formal ballot, taking into account the comments made and following a web conference which took place on 2018-12-03 and to which participants from the SMB, NCs and TC/SCs concerned contributed. The objectives of the web conference were to present the proposed new PC in further detail and to permit those concerned to pose questions and receive answers from the proposer.

A New Field of Technical Activity proposal on Low-voltage Auxiliary Power Systems for Electric Power Plants and Substations

IEC Chinese NC
2018. 11

What is Low-voltage APS?



- Such low-voltage APSs are used in **electric power plants and substations**.
- Low voltage APSs used in nuclear facilities and railway application are not covered.

What is Low-voltage APS?

- **The main components of AC APS are:**
  - Station auxiliary transformer(s),
  - AC main distribution switchgear,
  - AC sub-distribution board(s) and
  - The cable network

- The **main components of DC APS are:**
  - Battery & battery charger
  - distribution system
  - switching and protective devices, and
  - monitoring equipment

Photos from https://electrical-engineering-portal.com/substation-dc-auxiliary-supply-battery-and-charger-applications

Typical voltages of Low-voltage APS

- The typical nominal voltage of auxiliary power system varies from country to country. For example:
  - China adopts a three-phase AC system of 400 V and a corresponding single-phase AC system of 230 V;
  - In Europe, 690 V/400 V AC and 400 V/230 V AC are adopted;
  - In Australia, 415 V/240 V AC and 400 V/230 V AC are used.

Low-voltage APS	Typical nominal voltage (V)
AC APS	380, 380/220, 400/230, 415/240, 690/400
DC APS	24, 48, 110, 125, **220**

- According to survey results from CIGRE WG B3.42, **220 V DC is commonly used for protection and control circuits in a number of countries**.

Consequence of APS faults

APS faults are very likely to disable the protection and control for main equipment. If the failure continues to grow, there may be severe damage to the equipment and huge economic losses.

Case 1:

The DC APS of a 330 kV substation was failed due to improper handling of a fault of the AC APS, disabling all protective devices and switching supplies of the station. The failure later passed on to the grid of higher ratings and evolved into **explosion of a 330 kV transformer** and **loss of two 220 kV transformers**.

Burnt chargers

Explosion of batteries

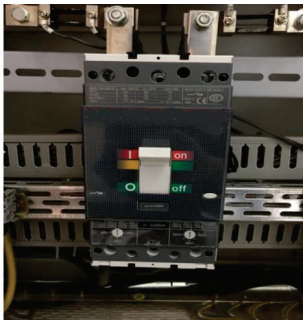
Fire caused by explosion of the MT

Consequence of APS faults

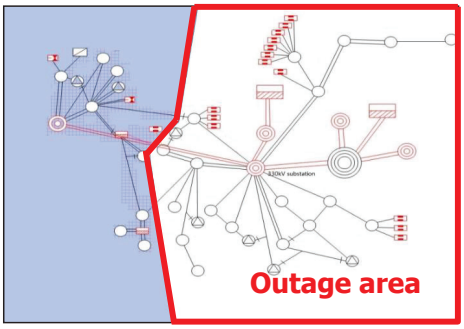
APS faults are very likely to disable the protection and control for main equipment. If the failure continues to grow, there may be severe damage to the equipment and huge economic losses.

Case 2:

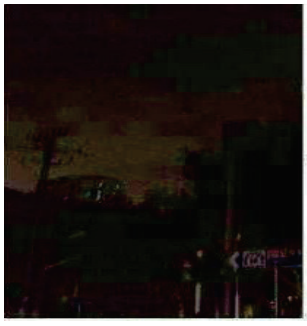
In a 330 kV substation, the grounding fault of a line could not be cleared by protective devices due to a failed DC breaker of the LV APS, resulting in a widespread blackout, including loss of power of 15 110 kV substations and 5 substations for railway traction and loss of loads of 92 MW. The number of outage users reached 172, 270.



Failed DC breaker



Schematic of the outage area



Blackout of the downtown

Market demand for Low-voltage APSs

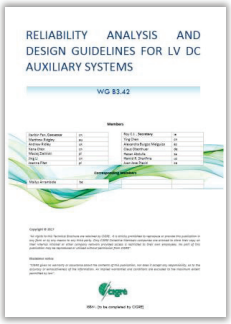
Market demand

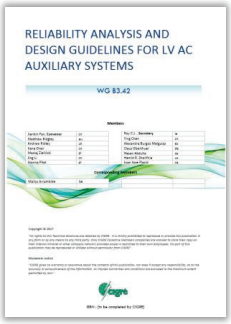
1. The secure operation of the main equipment relies on the low-voltage auxiliary power systems.
2. The development of the power system has called for requirements for the reliability and safety of low-voltage APSs.
3. The power system is becoming intelligent due to improved information technology and wide penetration of integrated automation.

Existing APS-related publications – CIGRE

CIGRE WG B3.42, convened by China and consisting of 14 specialists from 10 countries (China, Ireland, Germany, etc.) has studied reliability and design guidelines of APSs and will publish 2 TBs soon.

WG B3.42 TB – Reliability Analysis & Design Guidelines for LV **DC** Auxiliary Systems

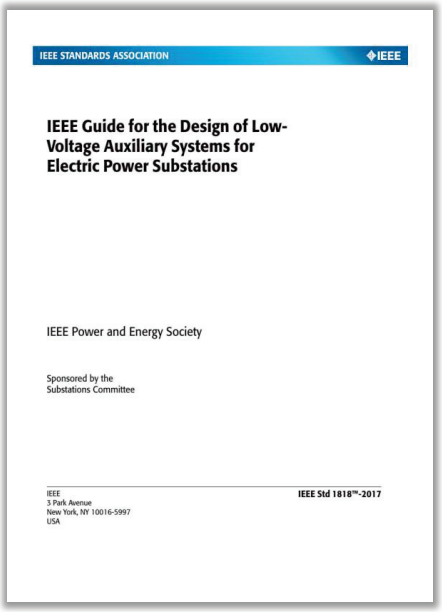




WG B3.42 TB – Reliability Analysis & Design Guidelines for LV **AC** Auxiliary Systems

These documents intend to provide professionals with a comprehensive knowledge of AC/DC auxiliary power systems, including reliability analysis and design guidelines in terms of configuration, operation and maintenance (O&M). It also discusses novel technology and devices used in APSs as well as state of art of the standardization on APSs.

Existing APS-related publications – IEEE



Considered in this guide are the components of both the AC and DC systems and the provided guidelines and recommendations for designing the appropriate systems for the substation under consideration.

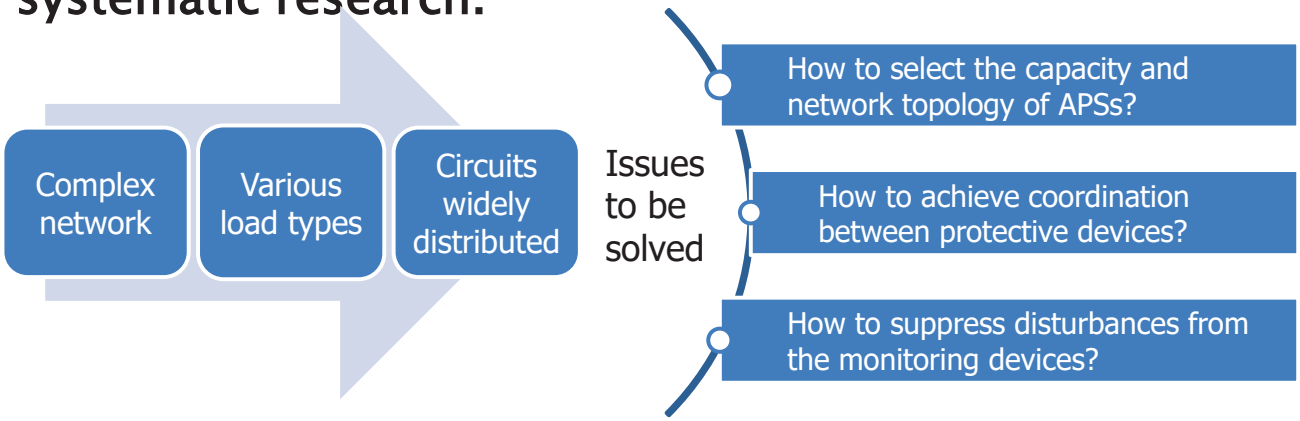
This guide includes the low-voltage auxiliary systems from the source(s) to the distribution point(s).

Reliability requirements and load characteristics are discussed and distribution methods are recommended.

IEEE 1818-2017 Guide for the Design of Low-Voltage Auxiliary Systems for Electric Power Substations

Need for standardization

Auxiliary power system is a critical but often overlooked system lacking due attention and systematic research.



Standardization is required to achieve a reliable auxiliary power system.

Original proposal as a TC

Presently, there is no TC specifically for LV APSs in IEC.

Establishing a TC for low-voltage auxiliary power systems for electric power plants and substations would:

1. Facilitate applications of high-quality auxiliary equipment
2. Improve design efficiency
3. Reduce O&M costs and save the investment of transnational/cross-regional projects.

Proposed Scope of a TC

Low-voltage auxiliary power systems for electric power plants and substations

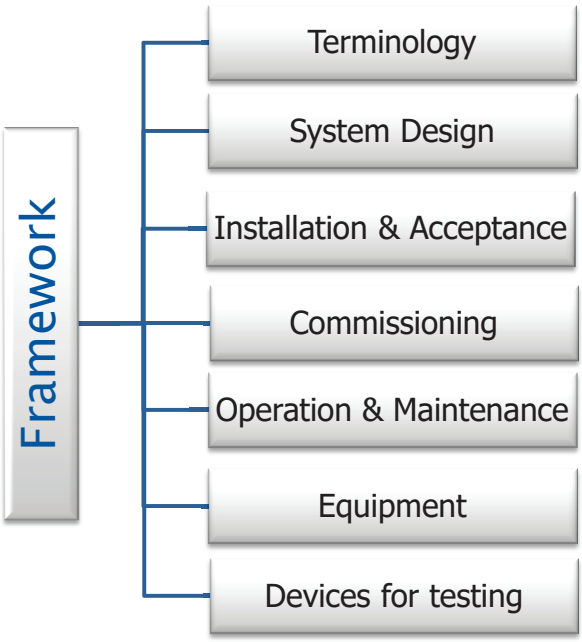
Standardization in the fields of low-voltage auxiliary power systems for electric power plants and substations, including:

- - system design;
- - installation and acceptance;
- - commissioning;
- - operation and maintenance;
- - safety and reliability;
- - ...

- Auxiliary power systems in special fields such as nuclear power, railways and shipping are not covered by this TC.
- The auxiliary power systems in the TC proposal only apply to the electric power system.

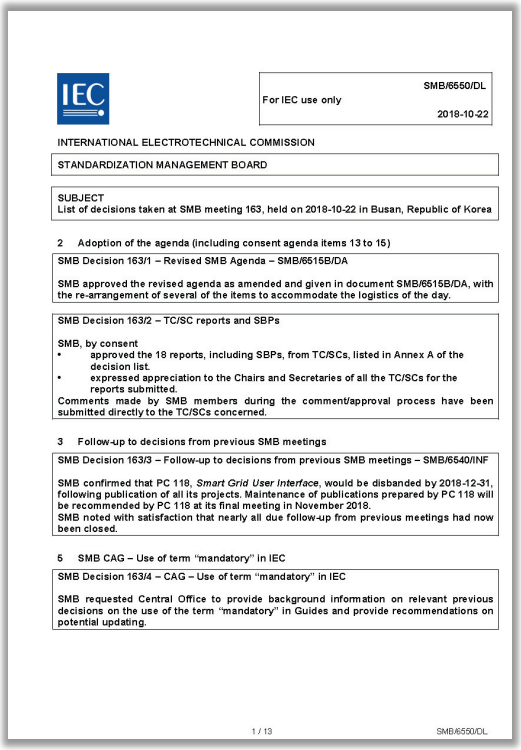
Proposed program of work in TC

- The standardization of LV auxiliary systems will focus on the aspects of terminology, installation & acceptance, commissioning, operation & maintenance, safety & reliability, etc.



- Terminology of low-voltage auxiliary power systems
- Design of low-voltage DC auxiliary power systems
- Design of low-voltage AC auxiliary power systems
- Specifications for the installation, commissioning and acceptance of low-voltage auxiliary power systems
- Specification for the operation and maintenance of batteries for LV DC auxiliary power systems
- ...

SMB Decision 163/12



IEC

SMB/6550/DL
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2018-10-22

INTERNATIONAL ELECTROTECHNICAL COMMISSION

STANDARDIZATION MANAGEMENT BOARD

SUBJECT
List of decisions taken at SMB meeting 163, held on 2018-10-22 in Busan, Republic of Korea

2 Adoption of the agenda (including consent agenda items 13 to 15)

SMB Decision 163/1 – Revised SMB Agenda – SMB/6515B/DA

SMB approved the revised agenda as amended and given in document SMB/6515B/DA, with the re-arrangement of several of the items to accommodate the logistics of the day.

SMB Decision 163/2 – TC/SC reports and SBPs

SMB, by consent
- approved the 18 reports, including SBPs, from TC/SCs, listed in Annex A of the decision list.
- expressed appreciation to the Chairs and Secretaries of all the TC/SCs for the reports submitted.

Comments made by SMB members during the comment/approval process have been submitted directly to the TC/SCs concerned.

3 Follow-up to decisions from previous SMB meetings

SMB Decision 163/3 – Follow-up to decisions from previous SMB meetings – SMB/6540/INF

SMB confirmed that PC 118, *Smart Grid User Interface*, would be disbanded by 2018-12-31, following publication of all its projects. Maintenance of publications prepared by PC 118 will be recommended by PC 118 at its final meeting in November 2018.
SMB noted with satisfaction that nearly all due follow-up from previous meetings had now been closed.

5 SMB CAG – Use of term "mandatory" in IEC

SMB Decision 163/4 – CAG – Use of term "mandatory" in IEC

SMB requested Central Office to provide background information on relevant previous decisions on the use of the term "mandatory" in Guides and provide recommendations on potential updating.

1 / 13 SMB/6550/DL

SMB Decision 163/12

- SMB recommended that the proposal from the Chinese NC should preferably be changed to propose the setting up of a PC.
- The setting up of a PC would allow SMB to determine in two years whether further work might be needed.

Working groups of PC

- PC Title: Low-voltage auxiliary power systems for electric power plants and substations

WG 1 Terminology

- Terminology of low-voltage auxiliary power systems

WG 2 Design of DC auxiliary power system

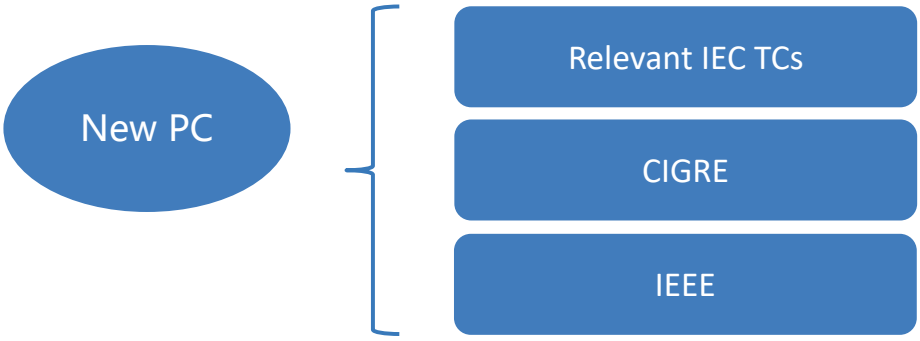
- Design of low-voltage DC auxiliary power systems Part1: Electric power plants
- Design of low-voltage DC auxiliary power systems Part2: Substations

WG 3 Design of AC auxiliary power system

- Design of low-voltage AC auxiliary power systems Part1: Electric power plants
  Design of low-voltage AC auxiliary power systems Part2: Substations

Liaisons

The proposed PC will establish liaisons with relevant IEC committees and other international organizations.



- IEC TC 121 Switchgear and controlgear and their assemblies for low voltage
- IEC TC 21 Secondary cells and batteries
- IEC TC 22 Power electronic systems and equipment
- IEC TC 23 Electrical accessories
- IEC SC 37B Components for low-voltage surge protection


Thank you for your attention !