

Insulated cables

by Marco Marelli, Chairman of SC B1

Evergreen!

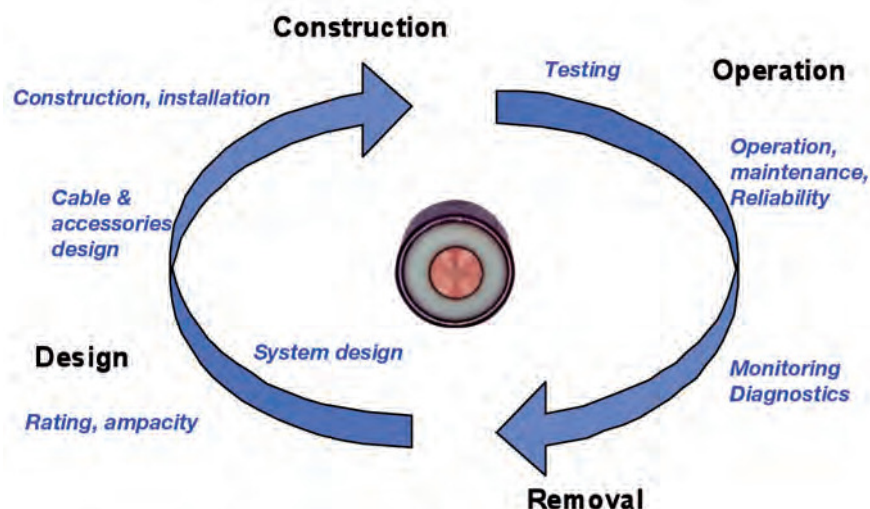
Insulated cables were addressed by CIGRE from the very beginning, starting with a discussion in the 1921 Session under the heading “construction of lines” and the sub heading “underground and submarine lines”. Six years later it was founded a specific Study Committee dealing with Power Cables that was initially designed as SC 2, then evolved to SC 21 and finally changed to SC B1 with the name of “Insulated cables”. Study committee B1 will thus celebrate its 90th anniversary in 2017.

The history of the Study Committee is about a technical community capable of balancing rootedness in history with a constant attention to the evolution of the electrical system, with the ability to renew itself in the structures and relationships to better serve evolving stakeholders. It is therefore the history of an evergreen Study Committee.

In 1921 CIGRE discussed about “utilization limits of single and multi core cables for AC and DC, determination of electric constants, after-laying tests”. This developed in a more structured and wide coverage of related topics.

In 2016 the field of activities of SC B1 concerns the development and operation of all types of AC and DC insulated cable systems for land and submarine power distribution and transmission applications. The main focus of SC B1 remain on high voltage (HV) and extra high voltage (EHV) transmission applications, but with a renewed shift in the coming years to focus also on distribution, embedded generation and smart grids medium voltage (MV) cable system applications.

Within this field, the scope of work of SC B1 covers theory, design, applications, manufacture, installation, testing, operation, maintenance, end of life and diagnostic techniques of insulated cable systems.



Core technologies and expertise of SC B1 are insulated components and equipment for power transmission and distribution, while for other cable related aspects SC B1 relies on good relations and cooperation with other Study Committees and other interest groups, in particular for what concerns materials, emerging technologies as well as asset, operational and environmental management.

Structure, membership, organization

Strategic Directions and activities of the Study Committee SC B1 are fully aligned with strategies and guidelines coming from the Technical Committee of CIGRE. SC B1 is organized and structured accordingly. SC B1 has therefore a Chairman, a Secretary and a number of members. Pierre Argaut (FR) has been the Chairman of the Study Committee since 2010 and concluded his term at the end of the General Session in August in Paris. The new Chairman is Marco Marelli (IT) while the Secretary is still Alain Gille (BE) who gives continuity to the action of SC B1. At the end of 2016, the membership of SC B1 was 24 regular members and 15 Observer Members.

The technical work is done through Working Groups. Each year, new Working Groups are launched to address the need coming from stakeholders. The new work items are normally decided during the Annual Study Committee Meeting. Following decision of the Study Committee the Terms of Reference (TOR) are most often prepared by Task Forces. The proposals of New Work Items submitted to the Study Committee are prepared by the Customer Advisory Group (CAG) and formally established by the Strategic Advisory Group (SAG) of the Study Committee. Each Region of the world is represented in the CAG to gather the needs of the Regional Target Groups. At each CIGRE Session, questionnaires are proposed during the Group Discussion Meeting to identify the needs of the Target Groups of the Study Committee. A Prospective Advisory Group (PAG) helped to identify the long-term needs.

The work of Study Committee SC B1 is also kept tuned with IEC, IEEE, and other interest groups, as well as with Local and Regional CIGRE organizations.

What happened in 2016

As always in even years, the most important events for SC B1 happened in Paris during the CIGRE General session.

The plenary Annual meeting of Study Committee B1 was hold in August with around 100 SC Members, AG and WG Conveners, and invited experts. Six new SC members attended the meeting. To ensure that all the items of the agenda could be addressed, the plenary meeting of the Study Committee had been scheduled on 1.5 days (Monday 22nd afternoon and Tuesday 23rd). Pierre Argaut chaired the meeting, recalling that this was his last SC meeting as SC Chairman and wishing good luck to the incoming Chairman. He also underlined the crucial role of the Secretary of the Study Committee and reminded that in the past twenty five years, SC 21/B1 had six Chairmen but only three Secretaries. The Chairman introduced also the new SC B1 webmaster (Gabriel De Robien, FR), who explained the status of the two web sites currently in use for B1:

- Existing website: <http://b1.CIGRE.org>
- New collaborative tool: <http://CIGREgroups.org>
- Meeting has been very positive. On-going works from Working Groups have been revised and new work items were launched. ...



From left to right: Marco Marelli, Chairman of SC B1, Alain Gilles, Secretary of SC B1, Yves Maugain, past Secretary of SC B1 and current Secretary of the Technical Council, Pierre Argaut and Fredrik Rüter, past Chairmen of SC B1, Aldo Bolza, past Chairman of SC B1 and past Chairman of the Technical Committee

At the end of second day, with participation of past chairmen and past secretary, SC B1 paid tribute a long applause to Pierre Argaut in recognition of his excellent works during the six years of his term.

The Group Discussion Meeting of Study Committee B1 took place on August 25th, 2016 and was chaired by the Study Committee Chairman, Mr. Pierre Argaut, with Mr. Walter Zenger as Special Reporter and Mr. Alain Gille as SC B1 Secretary. The incoming Study Committee Chairman of B1, Marco Marelli was also present. This event was attended by an average audience of around 300 delegates from around 30 countries. The Special Report was proposing 15 questions based on 39 papers submitted for the 2016 CIGRE Session, from 24 different countries addressing three Preferential Subjects. The 48 prepared contributions coming from 18 different countries showed a very high quality preparation of the presentations by the authors and fostered interesting discussions and caused 51 valuable spontaneous contributions. Two invited contributions from Young UK CIGRE Members and from Study Committee D1 were also presented. Main interest have been around new developments in particular for HVDC and for testing and monitoring strategies, but also operational aspects attracted many questions from the floor. Of course, not all questions could be answered conclusively; however, this was not the intention and the expectation of the auditorium. Open questions are considered as the input for future activities of Study Committee B1 “Insulated Cables”.

On Friday August 26th in the morning, a Poster Session was organised. This Session had been prepared by Wim Boone (NL) and chaired by Detled Wald (CH) and Harry Orton (CA). 33 authors were attending this Poster Session which attracted around 310 visitors. The Customer Advisory Group (CAG) of SC B1 and several Working Groups were also attending this Session to present their activities.

SC B1 gives lot of value to this event. To express the importance of the papers in the framework of this CIGRE event, all the authors – without any selection procedure – have an equal chance to present their papers in a separate poster session to interested visitors. The format has been once again very much appreciated, authors and WG convenors were very happy with the given opportunity to communicate in an animated and lively way with interested visitors.

In addition to the events in Paris, SC B1 has been actively participating to several regional meeting and conferences, including:

- AORC CIGRE Technical Meeting (India, Feb 2016)
- Colloquium UHV (Canada, May 2016)
- IEEE/ICC Spring (USA, Apr 2016)
- AORC CIGRE Technical Meeting (Thailand, Nov 2016)
- GCC CIGRE Power Conference (Qatar, Nov 2016)
- IEEE/ICC Fall (USA, Nov 2016)

The UHV Colloquium in Canada and the ICC Fall Meeting in Arizona in particular have been the occasion to a total of four deliver high quality tutorials.

As the most important part of SC B1 technical activities are done within Working Groups, the publication of their outcomes through Technical Brochures is of primarily importance. Four TBs were foreseen to be published in 2016. Unfortunately two have been delayed, thus the following were published:

WG number	Name of the publication	Publication date	Electra and Technical Brochure
WG B1.37	Guide for the operation of self-contained fluid filled cable systems	Availability on eCIGRE: June 2016	Electra 286 Technical Brochure 652
WG B1.34	Mechanical Forces in Large Conductor Cross-Section XLPE Cables	Availability on eCIGRE: December 2016	Electra 290 Technical Brochure 669

Technical Brochures are highly considered and regarded as fundamental documents within the technical community; SC B1 aims to monitor and constantly improve their quality, which is already very good. The time-to-market of Technical Brochures shall be as good as the quality; SC B1 aims to improve in the preparation of final reports and in their revision and approval process thus being able to publish a larger number of documents in 2017 and to stabilize around four Technical Brochures published every year.

Awards

Year 2016 was characterized by three different and significant awards.

During the Opening Ceremony of CIGRE General Session in Paris, on Sunday 21st August, Pierre Argaut (FR) received the CIGRE Honorary Member Award in recognition of his leadership role as Chairman of Study Committee B1 “Insulated Cables” (2010 – 2016). During the same event, Wim Boone (NL) received the CIGRE Fellow Award in recognition of his activity as Convener, Special Reporter and Tutorial lecturer for Study Committee B1. Finally, Frank de Wild (NL) received the TC Award for SC B1 in recognition of his outstanding contribution to the work of the SC. He was given with his official certificate during the Group Discussion Meeting, on Thursday 25th August.

These awards have been highly appreciated by the whole SC B1 community, as Pierre, Wim and Frank are well recognised as active and passionate leaders in their activities for CIGRE.

Technical activities

Technical work of SC B1 is developed by means of working bodies - Task Forces, Working Groups, Advisory Groups – that are all made of valuable people that are often spending their free time for CIGRE to deliver tangible results. In fact, without their work, there wouldn't be any CIGRE, even! The Study Committee have the deepest respect and appreciation of these people, as well as of their employer.

There are many technical activities currently on-going within SC B1, at different degrees of progress. The following WGs were approved beginning of 2016:



♦ **WG B1.55 - Recommendations for additional testing for submarine cables from 6 kV ($U_m = 7.2$ kV) up to 60 kV ($U_m = 72.5$ kV)**

This work comes from a preparatory work done in a UK regional WG that proposed guidelines for wet type cables up to 72.5 kV, for use on offshore wind farms. On those bases a new work item had to be considered in 2015 and a WG dedicated to this subject was set up for a two-year period. Terms of Reference were approved in early 2016. The Convener of this WG is Marc Jeroense (SE) and the WG is expected to complete a report during the second half of 2017.

♦ **WG B1.56 - Cable rating verification**

As it is rather difficult to verify calculations of calculation tools, especially when these tools provide transient or dynamic ratings, or real life situations which are not precisely covered by IEC, the WG B1.35 (TB 640) recommended helping the cable community by setting up a uniform calculation verification protocol, which can be used to ensure a correctly working software within a certain (limited) domain. WG B1.56 is therefore defining the scope of the verification protocol in detail, setting a series of cable designs, duty aspects and installation types, making and reporting calculations for defined situations, establishing verification protocols. The final outcome may also suggest a future revision of TB 640. Frank de Wild (NL) is the Convener of this WG, which was initially set up for a two-year period but during last SC B1 a further 1 year extension was granted; the final report is therefore expected around mid-2018.

♦ **WG B1.57 - Update of service experience of HV underground and submarine cable systems**

In 2009, the WG B1.10 published a Technical Brochure (TB 379) which collated survey data relating to the installed quantities of underground and submarine cable systems together with their service experience and performance. The surveys covered a 5 year period ending December 2005 for land cables and a 15 year period ending December 2005 for submarine cables. WG B1.57 had the Terms of Reference approved in early 2016 and it is due to update the service experience to the end of 2015, using a format comparable to earlier publications. Information will ...

include land and submarine cables for AC and DC operating at 60 kV and above; internal and external faults will be investigated with the aim to provide statistic bases to decision makers and in general to all stakeholders. The Convener of this WG is Søren Mikkelsen from Denmark. Target for this group is to circulate the first draft of a Technical Brochure in the second half of 2018.

Three new WGs have instead been decided during SC Meeting. Their Terms of Reference were prepared during the second half of 2016 and approved in early 2017 by the TC Chairman. They are the following:

♦ **WG B1.58 - Asset Management in MV cable systems**

This is the first-ever work of SC B1 entirely focused on MV systems. It comes from the need of DSO Companies to look for possibility to analyze condition of MV cables. It is considered good to connect knowledge from different DSOs about their practices about diagnostics systems. The WG will look into details of diagnostic methods used in MV cable network, cable diagnostics requirements in electrical tests after installation and after repair, diagnostics in assessing technical condition of the cable line, management of data received from diagnostic tests. The Convener of this Working Group is Slawomir Noske from Poland. WG is given with a three year period to prepare a report.

♦ **WG B1.60 - Maintenance of HV cable systems**

Maintenance procedures and maintenance strategies are important to pursue the direction of “making the best use of the existing power system”. TB 279 is currently more than 10 years old and need to be updated as there seem to be a variety of new developments in the past 10 years, the present Technical Brochure does only consider AC land cable, and also because TB 279 initially excluded the important aspect of costs. A new Working Group has been therefore established to cover above aspects and to address also predictive maintenance. Bart Mampaey from Belgium is the Convener of this Working Group, that is expected to work for a period of three years to deliver a Technical Brochure.



♦ **WG B1.61 - Installation of HV cable systems**

In the past years Study Committee B1 widely discussed the need to update the Technical Brochure 194 “Construction, laying and installation techniques for extruded and self-contained fluid filled cable systems”: this document is considered an important reference for construction works. Since its publication many techniques have been developed and many installation issues have been further studied. CIGRE B1 contributed and still contributes to report about many specific aspects, but it’s now time to integrate all of them into a new reference document. In particular the following reports will be considered: TB 640 “A guide for rating calculations of insulated cables”, TB 669 “Mechanical forces in large conductor cross-section XLPE cables”, Final Report from WG B1.41 “Long term performance of soil and backfill of cable systems”, Final Report from WG B1.48 “Trenchless technologies”. According to conclusions from a previous Task Force (TF B1.53), a revision of TB 194 should include also guidelines on how to coordinate cable design, engineering and installation given project interfaces between different companies, should add best practices and practical examples to the installation guidelines, should add examples of cable damage related to installation errors. In order to cover all these issues, Study Committee B1 formed a new WG that will be convened by Eugene Bergin (IE), with the target to prepare a final report in three years.

In addition to all mentioned Working Groups, during the meeting In August SC B1 decided to launch preparatory Task Forces to evaluate the need for future WGs on the following subjects:

- TF B1.62: Updating of TBs for EHVDC & UHVDC Cable Systems
- TB B1.63: Specifications for HVAC Dynamic Cables above 36kV
- TB B1.64: Evaluation of Armour Losses
- TB B1.65: Installation of Offshore Cable Systems

These Task Forces will report to SC Meeting in 2017 and – in case they will recommend to launch Working Groups – they will propose respective Terms of Reference.

At the end of 2016, SC B1 is convening 19 WGs and convening or officially participating in 4 JVGs. B1 is also having representatives in 1 JVG and in 2 WGs of other SCs.

A view on 2017

In conclusion, 2016 has been a very positive and fruitful year for Study Committee B1, mainly due to the excellent chairmanship of Pierre Argaut during the past years.

Year 2017 will be characterized by the celebration of the 90th anniversary from the foundation of the committee dedicated to insulated cables. Celebration will be primarily associated to the Annual Study Committee meeting, that will take place in New Delhi (India) in the week from the 9th to the 13th of October. In the same occasion SC B1 plan to deliver 5 tutorials on recent Technical Brochures. Other tutorials will be planned elsewhere during the year.

Beside tutorials, SC B1 plan to be present with representatives at the most significant Regional events (e.g. in Australia, India, Oman, South Africa) as well as at IEEE/ICC biannual meetings. An important event for the engineering community of insulated cables will be the Jicable HVDC '17, in Dunkerque (France) on 20-22 November 2017: this is an International Symposium on HVDC cable systems, co-organized by CIGRE B1.

If 2016 suffered lack of publication, 2017 will show a clear recovery with five or six Technical Brochures being published as soon as the relevant Working Groups will conclude the fine tuning of their work.

Finally, during 2017 it will be published a new Strategic Plan for SC B1. This document will span a period of 10 years and it is intended to define the mid to long term goals of the SC and to provide a global framework on which to base its activities. The new Strategic Plan will be the tool to keep renewing the Study Committee B1 while maintaining the original spirit, to remain an evergreen organization. ■

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