

2002 SC B1 PROGRESS REPORT

(INSULATED CABLES)

by Y.MAUGAIN, Secretary of the Study Committee

1 Overview

2002 was one of the important years of our Study Committee:

- We celebrated the 75th anniversary of our Study Committee since its launch in 1927. This was highlighted by several events, one of those being a lunch taken together with the top management of CIGRE, the past Chairmen and Secretaries as well as all the attendants to the SC Meeting.
- As other Committees, we had to turn to the new organisation of the SCs decided by the Technical Committee. Regarding ours, the change was rather light as it mainly led to a better appropriation of what could be done on the distribution level and to check that our work will satisfy the target groups interested in insulated cables. It followed that our name changed from SC 21 "HV Insulated Cables" to SC B1 "Insulated Cables". As it is only the third change in the SC's life, it remains an important matter.
- There was a change in the Chairmanship as our past Chairman, Aldo Bolza (IT) was called to lead the Technical Committee. He was replaced by Reinhard Schroth (DE).

The activities of CIGRE Study Committee B1 concern all types of AC and DC insulated cable systems for land and submarine connections and are focused mainly on high voltage applications. Whenever appropriate, however, lower voltage applications are also considered.

Within this field, the scope of work of the Study Committee covers theory, design, applications, manufacture, installation, testing, operation, maintenance and diagnostic techniques.

The main goals of the SC B1 are the following:

- to contribute effectively to the progress in insulated cable systems technology,
- to facilitate the integration of insulated cable systems in electric power networks and in the environment, covering the complete life cycle of cables,
- to maintain its leading position in the field of power cables by providing unbiased and neutral information on all essential cable aspects,
- to be recognised by the Electric Power Industry as a leading and reliable partner with competence in all engineering issues related to insulated cable systems, i.e. technical, economical, ecological and social.

The basic operating structures of the SC are its Working Groups. Their effective performances are based on a clear definition of their terms of reference and on work plans with specific time limits (typically three to four years).

In order to achieve this, it was the normal practice of SC 21 to set up an **ad hoc** Task Force (TF) to define the terms of reference of a new WG prior to its establishment. The duration of this type of TF must not exceed one year. The same policy will be kept by SC B1.

SC TFs may also be set up to study and/or update specific topics that do not justify the establishment of a full WG.

2 Administrative matters

The last annual meeting of SC21 was held in Paris (France) in connection with the Session on August 30, 2002 with an attendance of 48 members and experts.

Some Members that had reached their term of office in 2002 were replaced and we welcomed a new observer Member from Croatia.

As regular members Alain Gille (BE) replaces Pascal Couneson, Carlos Alberto Godinho (BR) replaces Aloisio Oliveira Lima, Lauri Nyyssönen (FI) replaces Martti Torikka, Matthias Kirchner (DE) replaces Reinhard Schroth, Susumu Sakuma (JP) replaces Sadao Fukunaga, Wim Boone (NL) replaces Glijn Van der Wijk, Gunnar Evenset (NO) replaces Georg Balog, Walter Zenger (US) replaces Mike Buckweitz.

As observer members Ahmed Ismail (EG) replaces Ahmed Hussein, Abidin Zakaria (MY) replaces Wahab Mohd Nordin.

As new observer member arrives Josip Antic (HR) from Croatia.

The SC is now composed by 24 Regular Members, 8 Observer Members, a Secretary and a Chairman, 11 coming from Utilities, 15 from Manufacturers and 8 from Universities/Institutes.

The SC B1 has its web site at the following address: www.cigre-sc21.org. The SC Secretary is also the web master.

A White Book was initiated within the SC to gather all the documents published by the SC since 1969. This will be both a consultation document and a tool for planning future work.

Jean Becker (BE) and Yves Maugain (FR) were honoured with the CIGRE Technical Committee Award 2002 for their contributions to the work of the Study Committee.

The first SC B1 Meeting will be held in 2003 in South Africa. It will be the first time ever that the Insulated Cables Committee will meet on this continent.

3 Technical matters

Two WGs and one TF finished their work and were disbanded. The WGs kept an editorial team to finalise the documents to be published as Technical Brochures or Electra papers.

- **WG 21-01** *"Recommendations for testing DC extruded cable systems for power transmission"*, (published in ELECTRA No. 206, Febr. 2003, Technical Brochure No. 219)
- **WG 21-20** *"HTS cable systems"*, (to be published in ELECTRA No. 208, June 2003)
- **TF 21-05** *"Experiences on AC after laying tests"* (published in ELECTRA No. 205, Dec. 2002)

A Joint Working Group and a Joint Task Force in which SC 21 was involved finished their work.

- **JWG 23/21/33** *"Gas Insulated Lines"* (published in ELECTRA No. 206, Febr. 2003, Technical Brochure No. 218)
- **JTF 23/12/13/21/22** *"Guidelines for collection and handling of reliability data"* (to be published shortly)

In 2002, SC 21 launched one new Working Group, one Task Force and a Strategic Advisory Group:

- **WG B1-06** *" Revision of qualification procedures for underground HV cable systems "* limited to AC extruded technologies
- **TF B1-12** *"Statistics on underground cable in transmission networks"*
- **SAG** *to consider all strategic issues of the SC, e.g. target groups, tutorials, new work items etc.*

SC B1 currently has seven WGs and four TFs. Moreover, SC B1 is involved in one Joint TF with other CIGRE SCs.

4 Working Groups

Following the CIGRE reorganisation, all the WGs and TFs were renumbered from 21-xx to B1-xx.

4.1 WG B1-18 "Special bonding of HV cables"

Convener: Ray Awad (Canada)

WG B1-18 was set up in 1998 and, after a change of convenership, re-launched in 2000.

The terms of reference are:

- to make a recommendation on the design of the special bonding equipment to be used on HV and EHV cable systems.

The different stages of the work will be the following:

- Background from previous papers in ELECTRA (28, 47, 128).
- Experience with existing systems
- Identification and analysis of system electrical transient
- Insulation Co-ordination Criteria
- Additional important considerations on system design and application (multiple circuits, influence of special bonding on adjacent installations etc.)

The progress is satisfactory and the WG is due to present its final report in 2003.

4.2 WG B1-19 "Technical and environmental issues regarding the integration of HV underground cable systems in the network"

Convener: Pierre Argaut (France)

WG B1-19 was set up in 1999 with Pierre Argaut (FR) as Convener and is due to present its final report in 2003.

The terms of reference are the following:

- To establish the appropriate terminology,
- To identify and review existing transmission systems and reasons for choosing these solutions in the voltage range 45 kV-500 kV,
- To review emerging problems caused by changing environmental and economical pressure (including market, deregulation),
- To identify technical and environmental issues of integration of cable systems in HV transmission networks throughout the life-time of the cable.

This WG presented a paper during the 2002 Session.

The work is progressing satisfactorily and is in close contacts with IEEE ICC Group, other WGs within SC B1 and other CIGRE SCs.

4.3 WG B1-02 "Thermal monitoring of underground HV cable systems"

Convener: Robert Rosevear (United Kingdom)

WG B1-02 was set up in 2000 and is due to present its final report in 2003.

The terms of reference are the following:

- To review the existing and emerging technologies and applications of underground cable monitoring systems in order to provide a better understanding of the capabilities of the equipment and associated software to enable users to make a more informed selection,
- To make recommendations regarding the utilisation of thermal monitoring and dynamic rating capability,
- To make recommendations concerning any areas of uncertainty or risk (hardware, interfacing, accuracy, etc. in order to facilitate the continued utilisation,
- The scope of the WG should cover both MV and HV applications. Both thermal monitoring aspects and dynamic rating capability should be considered.

The WG is still continuing to make good progress. The WG is also in close contacts with IEE ICC Group.

A Final Report (Technical Brochure) is under preparation.

4.4 WG B1-03 "Large conductors and composite screens"

Convener: Eric Dorison (France)

WG B1-03 was set up in 2001 and is due to present its final report in 2004.

The terms of reference are the following:

To elaborate some recommendations for HV and EHV extruded power cables calculation and measurement on:

- AC resistance of large conductor cross section cables,
- Short circuit performance and losses assessment of composite screens.

4.5 WG B1-04 "Maintenance of HVAC underground cables and accessories"

Convener: William Boone (The Netherlands)

WG B1-04 was set up in 2001 and is due to present its final report in 2004.

The terms of reference are the following:

- To define different types of maintenance, in co-ordination with similar work already done within other CIGRE study committees,
- To list technical problems (maintenance issues) in different types of cable and accessories, to specify related detection/repair methods, to compare different approaches and if possible to develop common criteria for decisions (condition assessment tools)
- To collect case studies about how maintenance has been accomplished in practice,
- To indicate how certain maintenance actions can be improved from a technical and from an economical point of view,
- To recommend guidelines for structured maintenance, tailored to the different type of cable/accessory and adjusted to system requirements and to customer needs.

The different failure modes are under study as well as the condition assessment. The remaining life strategies are still a hard work especially when deregulation faced maintenance problems.

The Convener will take care of the under representation of cable manufacturers.

4.6 WG B1-05 " Transients affecting long cables "

Convener: Georg Balog (Norway)

WG B1-05 was set up in 2001 and is due to present its final report in 2004.

The terms of reference are the following:

- To review the literature on the subjects: transients on long cables, experience with long cables, modelling of end terminations. JWG 21/33 has published a paper "Overvoltages in HV AC underground cable systems". This paper should be used in the studies.
- To gather as much utility experience on long cables as possible.
- To define and limit the term "long cable".
- To make recommendations regarding the transient voltage withstand levels for long cables.
- To make recommendations on testing of the system. Some parts may also have to be tested with higher stresses than others.

A part of the work will be done in connection with the Norwegian Research Council.

4.7 WG B1-06 " Revision of qualification procedures for underground HV cable systems"

Convener: Jean Becker (Belgium)

WG B1-06 was set up in 2002.

The terms of reference are :

For the range of AC extruded underground cable systems for voltages above 30 kV up to 500 kV, review and complete the qualification procedures for the different HV voltage ranges with the goal to come quickly and economically to the market with innovative solutions but without jeopardising the reliability of the installed system:

- propose tests where there are lacks: e.g. short circuit tests, climatic tests on terminations etc.,
 - evaluate whether in high voltage systems up to 150 kV a long term test has to be recommended above given dielectric service stresses or where the innovation is not built on earlier experience,
 - define what "earlier experience" means,
 - in case of major innovations in EHV cable systems evaluate whether long term tests can be replaced by shorter ones, which should be defined by the WG,
- in order to build up a guide of qualification procedures depending on earlier qualification(s) at the same and/or different voltage levels and on field experience.

The WG is due to present its final report in 2005, if possible in 2004.

5 Task forces

5.1 TF B1-10 " Thermal rating of HV accessories "

Convener: Henk Geene (The Netherlands)

TF B1-10 was set up in 2001 on request of IEC TC 20 and is due to present its final report in 2003.

The terms of reference are the following:

- To clearly specify the terms "thermal and thermo-mechanical ratings" of accessories
- To review existing test specifications with regard to appropriate verification of thermal and thermo-mechanical performance of accessories
- To consider, if applicable, improved or new test procedures for thermal verification of accessories
- To prepare recommendations to IEC, whether and how specific thermal and thermo-mechanical tests should be combined with and/or integrated into the existing test specifications for extruded HV and EHV cables (IEC 60840 and IEC 62067).
- To prepare guidelines how to relate the findings of basic laboratory tests to the multitude of practical configurations.

5.2 TF B1-12 "Statistics on underground cable in transmission networks"

Convener: Steve Swingler (United Kingdom)

The TF is due to present in 2002 the terms of reference of a potential full WG on the above subject.

In preparing the terms of reference for a new WG, TF B1-12 is considering:

- Who is the target audience?
- What information would they find useful?
- How easy will it be to gather this information?

- How long would it take?

Is some of the information already being gathered within the CIGRE or IEEE/ICC groups looking at underground cables in a largely overhead network.

5.3 Ad hoc TF " White Book "

Convener: Yves Maugain (France)

This Ad hoc TF was set up in 2001 and was due to present its final report in 2002.

Its task was to look at all the way done during the last 15 or 20 years within the SC.

A structured summary of the work should be presented to the SC during its 2002 meeting. Said work will be subdivided into three main categories:

- No longer relevant and of historical interest only,
- Still relevant but in need of update,
- Still relevant.

It was presented during the SC meeting in 2002 with all the documents published along the past 33 years. It will be published after collecting the comments from the SC Members.

5.4 Strategic Advisory Group "

Convener: Reinhard Schroth (Germany)

A permanent Strategic Advisory Group (SAG) was launched, which terms of reference are to consider the strategic items of the SC.

The SAG will prepare the terms of reference of two groups that will be discussed during the next SC meeting: the Strategic Advisory Group and a Customer Advisory Group, the latter being dedicated to study the mapping of the Target Groups, their needs and their satisfaction regarding the work produced by the SC. In addition the SAG will consider the issues of Tutorials, Symposia etc. organised by SC B1.

5.5 JTF SCB1/ICC " Interactions between CIGRE SCB1 and IEEE/PES Insulated Conductors Committee "

Convener: William Boone (The Netherlands)

This JTF was set up in 1999 as a permanent institution with the tasks:

- Exchange of information, representation at meetings by respective Chairmen or their delegates,
- Presentation of ICC and SC B1 activities at respective meetings
- Consideration of possible joint activities.

6 Joint Task Forces

6.1 JTF C3/B1/B2/B3 "Electromagnetic fields and the impact of proposed exposure limits"

Convener: Jarmo Elovaara (Finland)

This JTF was set up in 2001 and is due to present its final report in 2004.

Scope:

To study the economic, technical, operational and other implications of the proposed exposure limits (mainly ICNIRP/EU) and to suggest a process for developing exposure limits to be adopted in future transmission systems. The study shall be conducted in co-operation with relevant external bodies (e.g. ICNIRP, WHO, EU, EURELECTRIC) and include:

- examination of typical magnitudes of electromagnetic fields, for both general public and occupational exposures in or close to substations, overhead lines and power cable systems (mainly collection of data). Typical magnitudes arising in office, factory and domestic environments will also be included for reference.
- summary of means available to reduce field levels
- possible implications for system design (occupational exposure limits may influence the operational security of the system)
- consideration of broad frequency spectrum fields (effects of harmonics)
- survey of cost implications of the recommended exposure limits considering general public as well as occupational exposure; both in the case of existing power transmission systems and in case of future transmission systems
- to elaborate the process of defining exposure limits considering all relevant aspects, such as technical, economical and risk management