



**2007 SC B1 PROGRESS REPORT
(INSULATED CABLES)**

by Y. MAUGAIN, Secretary of the Study Committee

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1 Overview

The main highlights of 2007 are:

- SC B1, founded in 1927, dedicated from the beginning to Insulated Cables celebrated its 80th anniversary,
- An ever growing interest in the work of the Committee with 158 experts contributing,
- The active participation of the Study Committee in the Osaka Symposium, with a well attended tutorial on Maintenance of HV cable systems including diagnostic methods, remaining life management and replacement planning,
- The disband of one Working Group (WG B1.07) at the foreseen deadline after publishing one important technical brochure "Statistics on underground cable in transmission networks", as the topic was to compare currently installed lengths of underground and overhead circuits and the main technical factors influencing the cost of overhead and underground connections,
- The launch of one WG on "Test recommendations on XLPE AC submarine cables from 170 kV to 500 kV", and three Task Forces whose work is to prepare the terms of reference of potential WGs,
- The issue of a new Strategic plan for the 10 coming years, 2008-2018,
- The issue of a new Action Plan for the 4 coming years, 2007-2010.

During 2007, our Greek SC Member, Demosthenes Agoris, unfortunately deceased.

2 SC organisation

The activities of CIGRE Study Committee B1 concern all types of AC and DC insulated cable systems for land and submarine power 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,
- to monitor and assess current trends in cable technology,
- to promote advancements in cable technology.

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 years).

In order to achieve this, it is the normal practice of SC B1 to set up a 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 SC is presently composed by 23 Regular Members, 11 Observer Members, a Secretary and a Chairman, 16 coming from Utilities, 12 from Manufacturers and 8 from Universities/Institutes.

The SC B1 has its web site at the following address: www.cigre-b1.org. The SC Secretary is also the web master.

3 Publications

Published in 2007

WG/TF number	Name of the Publication	Publication date	Electra issue and number of TB
WG B1.07	Revision of qualification procedures for underground HV cable systems	December 2007	Electra 235 TB 338

To come

WG/TF number	Name of the Publication	Publication date	Publication type
WG B1.09	Remaining life of existing HV AC underground lines	2008	Electra TB
WG B1.11	Upgrading and uprating of existing cable systems	2008	Electra TB
WG B1.26	Earth potential rises in specially bonded screen systems	2008	Electra 237 TB
JWG B3/B1.09	GIL in tunnels	2008	Electra TB

TB : Technical brochure

4 2007 main events

The 2007 SC B1 Meeting was hosted by Japan in Osaka from October 30th to October 31st, 2007 and a symposium was held after the Meeting from November 1st to November 4th in cooperation with SC C1, B4 and C5 which title was "System Development and Asset Management under restructuring". Meanwhile, SC B1 offered a tutorial on Maintenance of HV cable systems including diagnostic methods, remaining life management and replacement planning.

5 2008 main events

As usual, CIGRE will hold a Session from August 24 – 29 in Paris. The SC B1 Discussion Group Meeting will be held on Wednesday, August 27th, 2008 during which 24 accepted papers will be discussed (8 for PS1, 5 for PS2 and 11 for PS3).

The Preferential Subjects for the SC B1 Discussion Meeting are:

The Preferential Subjects are:

PS 1: Technical challenges overcome in newly installed underground and submarine transmission systems

- Current state-of-the-art in design, testing of AC and DC, submarine and underground cable systems (including High Temperature Superconducting, HTS) and Gas Insulated Lines (GIL).
- Innovations in cable systems installation.

PS 2: Current and future methods supporting efficient operation, maintenance and upgrading/replacement decisions of cable systems.

- Maintenance policies.
- Diagnostic methods applied to Cable Systems.
- Remaining Life Assessment Methods.

PS 3: Future technical solutions of underground and submarine transmission systems addressing environmental and economical considerations.

- Balancing environmental requirements against economy.
- Electromagnetic Fields (EMF) mitigation, restricted access, installation in tunnels, bridges and along motorways and railways.
- Development trends towards higher voltages and ratings.

6 Administrative report

6.1 SC Meeting

Three WGs, one preparatory TF and a JWG finished their work. Each WG kept an editorial team to finalise its documents to be published as Technical Brochure and Executive summary in Electra. Then, they will be officially disbanded.

- **WG B1.09** "*Remaining life of existing HV AC underground lines*", to be published as a technical brochure, an executive summary will be published in Electra by mid 2008,
- **WG B1.11** "*Upgrading and uprating of existing cable systems*", to be published as a technical brochure, an executive summary will be published in Electra during the last 2008 quarter,
- **WG B1.26** "*Earth Potential Rises in specially bonded screen systems*", to be published as a technical brochure, an executive summary will be published in the June 2008 Electra issue,
- **TF B1.27** "*Test recommendations on XLPE AC submarine cables from 170 kV to 500 kV*". The work of TF B1.27 launched last year was to consider whether a full working group was desirable on issuing Test recommendations on XLPE AC submarine cables from 170 kV to 500 kV,
- **JWG B3/B1.09** "*GIL in tunnels*" to be published as a technical brochure, an executive summary will be published in Electra during the last 2008 quarter,

Two WGs saw their lifetime duration extended for one more year.

- **WG B1.08** "*Cable systems in multipurpose or shared structures*", the final report being now expected in 2008,
- **WG B1.10** "*Update of Service experience on underground and submarine cables*", the final report being now expected in 2008.

In 2007, SC B1 launched one new Working Group and three preparatory Task Forces:

- **WG B1.27** "*Test recommendations on XLPE AC submarine cables from 170 kV to 500 kV*" which term of office is 2010,
- **TF B1.28** "*On site Partial Discharges Detection*" which term of office is 2008,
- **TF B1.29** "*Review of HV cable accessories performance*" which term of office is 2008,
- **TF B1.30** "*Cable characteristics*" which term of office is 2008,

SC B1 currently has three Advisory Groups, eleven WGs and three TFs and participates in one JWG with another SC and in one JTF with another organization.

6.2 TC Award

Walter Zenger (US) was honoured with the CIGRE Technical Committee Award 2007 for his contribution to the work of the Study Committee.

6.3 Web site

The new SC B1 web site is on line since June 15, 2005 (www.cigre-b1.org). It offers an open space to the public and private pages to SC Members. Each Working body has private pages where documents can be exchanged among members.

The number of visits confirms that Internet is a very important tool for internal and external communication.

7 Technical report

7.1 Advisory Groups

7.1.1 Strategic Advisory Group

Convener: Fredrik Rüter (Sweden)

A permanent Strategic Advisory Group (SAG) was set up in 2002, which terms of reference are to assist the Chairman in the definition of the strategic directions that should be followed by SC B1.

The SAG is composed of a limited number of members: the Chairman, who will convene, the SC Secretary, and a few other SC Members or experts, all chosen by the Chairman.

The Conveners of the other SC B1 Advisory Groups are permanent members of the SAG.

The SAG will consider, if needed, the set up of other specialized Advisory Groups and will decide about the use of their outcomes.

The SAG will initiate, whenever appropriate, the set up of new TFs or WGs.

The SAG will meet at least once a year, but will communicate as required.

All the items discussed during the 2007 SAG meeting were covered in the 2007 SC B1 meeting agenda.

7.1.2 Customer Advisory Group

Convener: Eugene Bergin (Ireland)

A permanent Customer Advisory Group was installed in SC B1 with the Scope to implement CIGRE TC's suggestion, that "Study Committees have to ensure that the needs of their Target Groups are fulfilled." The B1-CAG is the working body within SC B1 to co-ordinate all activities in this field. It works in close contact with the SC Chairman and the Strategic Advisory Group B1-SAG and involves all SC B1 members as contacts and interfaces to their national or local customers.

The Terms of Reference (ToR) of the B1-CAG are as follows:

1. Identification of Target Group
 - systematically identify SC B1's Target Groups in different countries
 - listing of respective organizations, persons, social groups, etc.
 - analyzing of organizational levels and hierarchies
 - identifying of most important and influential addressees
2. Communication means with TGs
 - develop systematic and effective concepts for active contacts and communication
 - consider how to implement sustainable communication links to organizations and persons
 - consider how to disseminate most effectively B1's activities and outcomes to TGs
 - propose appropriate presentations (Paris Session, Tutorials, Symposia, etc.) in accordance with the TAG
3. Collection and mapping of TG's needs
 - identify problems and map systematically needs of TGs
 - propose review/revision of current SC B1 activities with regard to needs of TGs
4. Collection and evaluation of feed-back from TGs
 - collect and map the degree of TG's satisfaction
 - evaluate the findings and derive, if necessary, measures for improvements and new actions
 - identify opportunities to increase TG's satisfaction
 - coordinate activities at national level where appropriate

Letters with a B1 presentation were prepared by the CAG and validated by the SAG. Members were encouraged to discuss with their NC on how to disseminate the information towards the target groups. It was underlined that the presentation towards target groups should not be what CIGRE does, but what CIGRE does for you.

7.1.3 Tutorial Advisory Group

Convener: Pierre Argaut (France)

A permanent Tutorial Advisory Group was installed in 2004 in SC B1 with the Scope to implement CIGRE TC's suggestion, that "Study Committees have to deal with education, continuous training, tutorials and publications". The B1-TAG is the working body within SC B1 to co-ordinate all activities in this field. It works in close contact with the EPEE, the SC Chairman, the Strategic Advisory Group B1-SAG and the Customer Advisory Group B1-CAG. It involves all SC B1 Members and Conveners as contacts.

The Terms of Reference (ToR) of the B1-TAG are as follows:

1. Identification of the potential groups interested in education, continuous training, tutorials or technical presentations
 - identify SC B1's Tutorial Target Groups in different countries,
 - listing of respective organisations: students, young or older engineers, universities, etc...,
 - identification of the respective expected topics to be taught and training levels,
 - identification of other learned societies, IEE, IEEE,....
2. Identification of the means to disseminate the SC B1 knowledge
 - prepare the structure of appropriate presentations (Paris Session, Tutorials, Symposia, events organised by other learned societies, etc.) in accordance with the CAG
3. Collection of SC presentations
 - establish an education and training procedure
 - preparation of a standard presentation,
 - each SC working body will prepare a full presentation (up to 30 slides),
 - the TAG will prepare a synthetic presentation (up to 4 slides)
4. Coordination of activities with EPEE and with other SCs

To compensate the lack of expertise, one solution is to propose technical education and training through tutorials that could be addressed from basic to advanced experts, from students and teachers to managers and public.

The TAG proposed a common tutorial structure that could be easily managed according to the depth needed by the public.

Each current and new WG will have in its terms of reference the production of a tutorial. For the past WGs, some SC B1 experts are preparing the relevant tutorials.

By the end of 2007, the list of validated tutorials is:

- Thermal Environment of Underground Links
- Thermal Monitoring of Underground Cables
- Dynamic Rating of Underground Cables
- Environmental Impact Assessment
- Technical and Environmental Issues regarding the integration of a new cable system in the Network
- Special Bonding of High Voltage Power Cables
- Large Cross-sections design
- Composite Screens design
- Maintenance for HV Cables and Accessories

Tutorials can be offered by SC B1 Members or experts on demand.

7.2 Working Groups

7.2.1 WG B1.08 Cables systems in multipurpose or shared structures

Past Convener: Ken Barber (Australia), Present Convener: Ray Awad (Canada)

WG B1.08 was set up in 2004 and was due to present its final report in 2007.

The Convener explained that the WG work was on delay as it was very difficult to get the information from the different countries. As a consequence, it was not possible to present the final report at the time requested in the terms of reference. He informed that there was still one year of work ahead. The Chairman was not happy with the delay, but accepted to postpone the end of the WG for one more year.

The terms of reference are the following:

- To establish the appropriate terminology,
- To collect comprehensive information and experience on the use of multipurpose or shared structures for the installation of cable systems. It is anticipated that a comprehensive questionnaire developed by the WG will be necessary. The survey should not be limited to technical aspects such as type of cables, structure design, construction, installation, other infrastructure installed, mutual impacts, maintenance and operational constraints. It should also consider economical aspects, occupational health and safety aspects, administrative aspects, legal aspects and decision-making aspects,
- To collate, summarise and review the information,
- To identify the issues that need to be considered when installing underground cable systems in multipurpose or shared structures,
- To recommend guidelines for the practical application of for the installation of cables.

The scope of work should cover:

- MV, HV, and EHV cables,
- Solid, fluid and gas insulated cables,
- Multi-purpose tunnels and structures shared with pipe services (water including hot or cooled, oil, gas and sewage) and other utilities (other electricity services and telecommunications), Transport services (Roads, Railways and Subways).

There is a low probability of fault on cables installed in tunnels but when it occurred, the impact is high, justifying such a group.

The Chairman nominated Ray Awad (CA) to take the lead. The final report is expressly awaited for June 2008.

7.2.2 WG B1.09 Remaining life of existing HV AC underground lines

Convener: Willem Boone (The Netherlands)

WG B1.09 was set up in 2004 and was due to present its final report in 2007. The WG Convener presented the draft of the final report. He explained that the most important part was dedicated to the methodology and the practical guidelines.

The terms of reference are the following:

- To prepare proper definitions for "End of life/Remaining life"
- To list relevant cable and accessory types,
- To list information to be collected,
- To review relevant ageing mechanisms for paper cable- and extruded cable systems,
- To list defects that contribute to dramatic ageing,
- To review appropriate diagnostic methods,
- To review experience in remaining life estimation (RLE), the techniques used and the success of these techniques,

- To develop a strategy for RLE of paper- and extruded cable systems, based on condition assessment, ageing mechanisms, condition extrapolation to failure for the related cable/accessory types,
- To collect a few case histories,
- To give guidelines for practical application of a strategy for RLE, indicating the accuracy, the effectiveness and the efficiency of applied techniques and methodology.

The scope of work is for voltage over 50 kV:

- Paper cable systems (SCFF and HPFF) for AC application on land,
- Extruded cable systems for AC applications on land,

The remaining life model presented in the report is based on a combination of technical, economical and strategical criteria, such as increased number of failures, evolution of operating conditions, progress of the maintenance costs. The practical guidelines help to first separate good circuits from questionable ones through a simplified approach and then to estimate the remaining life of the questionable circuits through a detailed approach.

The report should be published as a Technical brochure in 2008.

7.2.3 WG B1.10 Update of Service Experience of HV cable systems

Convener: Robert Rosevear (United Kingdom)

WG B1.10 was set up in 2004 and was due to present its final report in 2007.

The SAG identified service experience as a topic which was not addressed since long, as the last figures published by CIGRE regarding underground cables dealt with the experience gained between 1982 and 1986, those regarding accessories for HV cables with extruded insulation dealing with the experience gained up to 1992 and the last figures regarding submarines cables being published in 1986.

The terms of reference are:

To update up to 2003 existing service experience and previously published information studying at least:

- Technology,
- Laying zone (urban, rural, submarine,...),
- Type of current (AC, DC),
- Internal or external faults,
- Type of cable burial, (protection or not)
- Number of faults per year per mileage,
- Fault duration,
- Repair duration.

It was possible to collect information up to the end of 2005.

Scope of work :

- The voltage range will be above 50 kV limited to transmission levels according to the countries.
- AC and DC cables,
- Land and submarine cables.

The WG prepared two questionnaires, one on land cable systems covering the years 2000 to 2005 and one on submarine cable systems covering the period from 1991 to 2005, in order to collect the new data.

The Convener explained that the replies to the questionnaire were awaited for July 2006. In spite of several reminders, it was only at mid 2007 that the number of replies was consistent enough to build good statistics. Unfortunately replies were not received from some important regions including Australia and New Zealand, China, India, Malaysia, Mexico, Russia, Hong Kong, Thailand, Africa and the Middle East. Regarding land cables, 64 replies were collected, representing 32,900 km of circuits.

The Chairman considered that B1.10 progress was good, but that they need one more year to fully analyse the answers they received from their questionnaires. The extension was agreed.

The final report is awaited for end of June 2008.

7.2.4 WG B1.11 Upgrading and Uprating of Underground Cable Systems

Convener: Frederic Lesur (France)

WG B1.11 was set up in 2004 and was due to present its final report in 2007.

The difficulties to obtain planning permission for new sites favour the life extension of existing facilities, with the goal of transmitting more power with higher reliability.

The terms of reference are:

- To review the literature on similar subjects (IEC, CIGRE, IEEE publication),
- To establish the appropriate terminology,
- To inventory the possible technical solutions for increasing the transmitted power in an existing cable system, or extending the life duration of the cable system
- To gather available utility experience in such cases,
- To list the technical and environmental issues to be addressed in such cases,
- To propose a step by step approach.

Scope of work :

- AC and DC cables
- Extruded and lapped cables
- Land and submarine cables
- Cooling systems.

The study will be limited to whole cable systems, not considering the components themselves.

The Convener presented the final report which was considered of good value.

Some concerns were raised as upgrade may lead to legal problems. A great warning is awaited at the beginning of the report.

The report should be published as a Technical brochure in 2008.

7.2.5 WG B1.21 Third party damages on underground and submarine cables

Convener: Christian Jensen (Denmark)

WG B1.21 was set up in 2005 and is due to present its final report in 2008.

Utilities are already suffering for a long time from third party damages, the damages caused to cables from so-called external origins: usually digging activities but also indirect aggression such as overheating, corrosion or change of backfill due to other utilities. Compared with the efforts to solve "internal" damage, issues are usually treated in an off-hand or unmanaged way, although in terms of money it is a very serious problem.

The terms of reference are:

To give guidance to all relevant parties involved (cable owners, utilities dealing with electricity, contractors, authorities, other utilities) as follows:

- To define the right terminology.
- To collect information worldwide about third party damage failure statistics. To collect information about main "damagers", the most sensitive areas and the most "dangerous" civil works techniques.
- To collect information about existing practices to control/solve the problem in different countries around the world.

- To propose improvements to present methods, after examination and comparison of present methods/practices.
- To propose guidelines on how to effectively control/reduce third party damages of cables.

Scope of work :

- AC and DC cables.
- Land and submarine cables.
- MV (whenever appropriate), HV and EHV.
- Mechanical, thermal damages and, more generally, all damages caused by human activities.

The WG will try to get information about the main damagers, the most sensitive areas and the most dangerous civil works techniques by analysing the already received questionnaires or by asking specific questions to utilities on the fault caused by third party damages.

The Convener presented the progress of WG B1.21 which is good.

A specific questionnaire was prepared by WG B1.21 and sent to the utilities that replied to WG B1.10 one and received good response.

Then, the WG addressed the Burial Protection Index (BPI) that is used for submarine telecom cables and pipelines and accepted by insurance companies, and examine whether it could be extended to underground cable systems after having defined specific criteria relevant for this technique. This Index proposed by the WG is a relative assessment, not an absolute one.

The final report is awaited for end of June 2008.

7.2.6 WG B1.22 Cable accessories workmanship

Convener: Kieron Leeburn (South Africa)

WG B1.22 was set up in 2005 and is due to present its final report in 2008.

One of the trends in the cable technology is the reduction of the cable insulation thickness and therefore the growing of electrical stress based on a better knowledge of the insulating material and the extrusion process. As the cables are made under well-defined factory conditions, their quality and reliability are usually assured. Accessories, however, are mounted on site, and even if this job is done by skilled and trained jointers, it is realized in more delicate and undefined conditions than in the factory.

In view of safeguarding the cable system's reliability which utilities rely on, it is important to study the electrical stress limits in the different types of joints, to learn about the safety margins between theoretical and practical strength levels, to examine the necessary skills of jointers and relative Quality Assurance and to study the recent service experience of high stressed cables.

The terms of reference are:

- To review the literature on the subject
- To complete the terminology not covered by TB 177 "Accessories for HV cables with extruded insulation"
- To prepare an easy to understand guide that could be useful for non-technical customers aligned to IEC voltage ranges
- To prepare guidelines for jointers training. The objective is to have this document referenced in call for tenders

Scope :

- HV Extruded AC >30kV cable systems only (MV and HTS cables are excluded)
- Land and Submarine cable systems
- Special considerations may be needed for large conductors
- Types of joints and terminations
- Interface preparation (Different methods)

It was agreed during the SC to reword the terms of reference of the WG by changing "type of joints" by "accessory designs".

Moreover, it was considered that the experts' skills were not sufficient to cover the submarine cables. It was agreed to delete these types of cable systems from the ToR and validated by the TC Chairman.

One important point is presently considered whether the necessary skills to prepare an accessory were voltage dependant or section dependant.

The Convener introduced the annual report. Even if some problems have occurred to get the information, it was considered sufficient to ensure adequate quality and progress.

Some Members explained that they are more interested in the way to repeat the accessories mounting process than in the mounting techniques which are specific to each accessory and each manufacturer and that they are not interested in how the job is done, but in what are the needed skills.

The final report will give the topics to be covered by jointing schools, not the content of the training.

7.2.7 WG B1.23 Impact of EMF on current ratings and cable systems

Convener: Harry Orton (Canada)

WG B1.23 was set up in 2006 and is due to present its final report in 2009.

Numerous methods have been devised by electric utilities and various research organizations to manage power frequency magnetic field levels in the vicinity of underground cable systems. Although information will be available (ongoing work TF C4.2.04) concerning considerations for implementing the various methods, their impact on construction, their cost effectiveness, and their impact on cable ratings needs to be evaluated. In particular, there are differing opinions about the derating effects of transmission cables placed in ferromagnetic shielding structures such as pipes and casings. Past work at CIGRE and elsewhere addressed magnetic field calculation procedures (with and without ferromagnetic components), however, they do not address the derating impact of the magnetic field management methods or their practical application to electric utility systems.

Terms of Reference:

- To define the correct terminology for field management techniques.
- To review practical magnetic field management methods that are currently used for underground transmission cable systems.
- To quantify the shielding effectiveness of practical methods.
- To review practical design and construction considerations relating to engineering, standardization of components, scalability, constructability, environmental suitability of component materials, impact by third party damage, reduction of rating due to air inclusions, corrosion, theft of materials, logistics, and worker skill level.
- To review the cost effectiveness of different field management methods.
- To quantify the cable ampacity de-rating aspects of the various field management methods

This working group will neither cover any environmental or biological effects of EMF, nor discuss any specific levels of EMF.

Scope of work :

The work shall focus on single conductor, high voltage, AC land cable systems, excluding pipe type cables with :

- Extruded dielectric insulation
- Laminar dielectric insulation

Health affects will only be covered very briefly as this is not within the Working Group Scope.

Since there is no electrical field external to an underground transmission cable, the Working Group will focus on magnetic field mitigation techniques, their effects on cable ratings and their related costs.

De-rating of cables due to magnetic field mitigation must be based upon existing standards and regulations. Reference will not be given to magnetic field absolute values, but only to the shielding factors required to mitigate the field.

Investigation of commercially available software to determine magnetic field levels for specific mitigation designs will be included in the study.

It was confirmed that the pipe type cables will be excluded from the scope of work as the EMF level is low for this cable technique.

The progress of the WG is satisfactory.

7.2.8 WG B1.24 Test procedures for HV transition joints

Convener: Marco Marelli (Italy)

WG B1.24 was set up in 2006 and is due to present its final report in 2009.

Extruded cable is increasingly being used for transmission and distribution circuits in preference to cables with lapped insulation. It is becoming more common for a length of extruded cable to be introduced into a lapped cable circuit, when the latter is repaired or diverted. International cable specifications are generally written to cover a specific insulation technology e.g. IEC 60840 applies to cables with extruded insulation and their accessories. Applications that involve cables with more than one insulation system are not usually considered. The test regimes differ between lapped paper and extruded polymeric insulation ; for example an AC after laying test might be used with extruded cable and a DC test with paper cable.

Terms of Reference:

- To review the range of transition joints currently available
- To review the existing international standards and the extent to which they cover the testing of transition joints
- Align voltage levels to those specified in IEC Standards for extruded cable systems
- To propose test regimes for transition joints and their associated cables. Type, routine, sample and after-laying tests should be considered.

Scope of work :

The WG should take into account AC cables and accessories for rated voltages above 30 kV up to 500 kV. Transition joints in submarine or DC cable systems are not considered. Priority should be given to jointing paper cables with extruded cables, in particular SCFF cables with XLPE cables. All forms of testing should be considered. Priority shall be given to after-laying and type tests.

The Convener was satisfied with the progress of his group and considered that the composition is well balanced.

The SC agreed to consider a transition joint as a joint between two different insulations.

7.2.9 WG B1.25 Advanced design of laminated metallic coverings

Convener: Pierre Mirebeau (France)

WG B1.25 was set up in 2006 and is due to present its final report in 2009.

WG 21.14 published in 1992 "Guidelines for tests on high voltage cables with extruded insulation and laminated protective coverings". Numerous improvements appeared on laminated coverings since then in parallel with field experience. We now have a feed back relative to their use as a function of the length to be laid, the installation method (ducts, directly buried...), the environment, the design of the metallic screen (aluminium, copper wire screen + aluminium, copper...), the connection and grounding of the screen (single point, cross bonding, double point)...

In parallel, new processes and new installation methods have appeared.

Terms of Reference:

- To review and update the tests on cables with extruded insulation and laminated protective coverings taking into account the system view, i.e. the installation of accessories. Tests on cable, on accessories and on the system itself should be addressed, including the short circuit one
- To issue a Guide to Use for non experts explaining what could be the different cable designs

Scope of work :

- Extruded cable systems only
- AC cable systems only with a focus above 36 kV

- Land cables

The SC confirmed the definition of a laminate covering which consists of several layers of plain (not corrugated) metal and plastic materials bonded together to get a special set of properties: bending ability, radial watertightness. It can be used to carry the capacitive, circulation and short circuit currents, according to the cable system design.

The WG will look at radial fatigue more than the bending one which is tested during cable qualification. The structure of the final document was already under discussion within the WG. The SC agreed that the WG will prepare a questionnaire.

7.2.10 WG B1.26 Earth potential rises in specially bonded screen systems

Convener: Eric Dorison (France)

TF B1.26 was set up in 2005 and was due to present its final report in 2007.

Earth potential rises on cross bonded cable systems connected at each end to a substation are generally considered negligible but recent breakdowns seem to deny this opinion.

It is proposed to make a general study focused on earth potential rises on cross bonded cable systems connected to overhead lines called hybrid systems and on cross bonded cable systems directly linking two low resistance substations.

The Terms of Reference are:

To improve the design of special bonded screen systems, dealing with EPR, providing :

- more information on EPR which may occur during single phase to earth faults
- details of a calculation method based on the Complex Impedance Model.
- calculation examples for typical situations.

Scope of work :

- The voltage range will be limited to transmission levels according to the countries.
- Specially screen bonded links, using AC single-core cables,
- Land and submarine cables

The Convener was happy with the results which were close to the target.

The WG carried out a large set of EPR calculations, comparing various calculation methods.

The final report:

- stressed upon situations where EPR may be harmful: the most vulnerable cable systems are those connected to overhead lines and those connected into substations having high earthing impedances.
- provided EPR estimates for typical situations and gave details of simplified methods for EPR calculations, which might be sufficient to detect potential problems.

Both internal (cable) and external faults were considered.

The interest of cross bonded systems is to avoid having an earth continuity conductor (ecc) along the cable system. The Convener considered that the addition of an ecc in case of important earth potential rises should be done only when necessary on a case by case study.

All the SC welcomed the report which was considered very good. The results regarding OHL was considered so important that other SCs should be informed about this problem.

The report should be published as a Technical brochure in 2008.

7.2.11 WG B1.27 Test recommendations on XLPE AC submarine cables from 170 kV to 500 kV

Convener: Gunnar Evenset (Norway)

WG B1.27 was set up in 2007 and is due to present its final report in 2010.

For a long time the prevailing highest voltage for XLPE submarine AC cables was 170 kV. A recent submarine installation of single-core XLPE AC cables at 420 kV has moved the technology forward significantly. The existing Recommendations on AC submarine cables are presently limited to 170 kV.

It is considered necessary to prepare test recommendations on XLPE AC submarine cables from 170 kV to 500 kV.

Terms of Reference:

- Examination of relevant IEC standards / CIGRE recommendations and documentation.
- The work should adopt a system approach. Particular attention should be paid to repair joints as part of the sub-marine cable system and the Working Group should consider tests with external water pressure, heat cycling and mechanical handling (during installation of a repair joint).
- The work should propose development and prequalification tests for the EHV submarine cable system and re-qualification in case of minor or major changes and define the range of prequalification and type approval for EHV submarine cable systems.
- The work should propose tests for long submarine cable lengths - both in the factory and after installation and explain clearly the basis for the recommended tests and the range of application.
- The work should include a review of the currently available technologies for sub-marine cable and joint design and consider possible implications for testing
- A Technical Brochure should be prepared for publication

A recommendation should be prepared to Cigré B1 on the revision of "Recommendations for testing of long AC submarine cables with extruded insulation for system voltage above 30 (36) to 150 (170) kV". This review should be performed based on the new edition of IEC 60840.

7.2.12 JWG B3/B1-09 Application of long high capacity Gas Insulated Lines in structures

Convener: Hermann Koch (Germany)

JWG B3/B1-09 was set up in 2004 by SC B3 and was due to present its final report in 2007.

As GIL is in SC B1 scope and as the relative expertise derives mainly from GIS depending on SC B3, it was decided by the CIGRE Technical Committee that this topic will be studied by a JWG led by SC B3.

The terms of reference are:

- To collect information on existing GIL installations in structures
- To identify the issues that need to be considered when installing GIL in specific or shared structures
- To give information how to handle large scale projects and to define what "long GIL" means

The study shall be limited to:

- Mechanical and thermal design,
- Ambient conditions,
- Laying, installation, and gas handling
- Testing, commissioning, and Quality control,
- Repair process,
- Safety risks,
- Life cycle analysis.

It was noticed that the number of experts involved in this working body was shrinking due to the change of position for some experts. Nevertheless, a first draft of the final report was presented during the SC meeting.

As Hermann Koch was prevented from attending the SC meeting, Pierre Mirebeau (FR), WG member, presented the final report.

The report, that was presented, was considered a good document, but overpassing the original terms of reference as the report is not limited to tunnels.

Brian Gregory (UK) said that the final report gives the impression that the technique is under controlled when laid in structures, but it is wrong as the experience is limited to short distances.

A question was also raised about the quality of the insulation gas during 40 years.

The whole SC agreed on the deletion of costs in the report and the reworking of the chapter on costs.

Three experts from B1 will revise the document.

7.3 Task Forces

7.3.1 TF B1.28 On site Partial Discharges Detection

Convener: Willem Boone (The Netherlands)

On site partial discharge detection is more and more frequently used to test the cable system.

It was considered of interest to address the performance requirements necessary for adequate commissioning and diagnostic tests.

7.3.2 TF B1.29 Review of HV cable accessories performance

Convener: Steve Swingler (United Kingdom)

HV cable terminations are often installed in substations where there is a high density of plant and equipment. The aim of the study is to review the performance of HV cable accessories to ensure that they will not give rise to any local damage or disturbance.

The TF is due to present in 2008 the Terms of Reference for a potential full WG on the above subject.

7.3.3 TF B1.30 Cable characteristics

Convener: Pierre Argaut (France)

The literature about cable characteristics is rather limited and restrictive. However, knowledge of these data is essential when carrying out planning studies to set the protection relays and for the dispatching centres to operate the network.

The operators should know the active and reactive data in both normal running, at standard operating frequency regime, and short circuit periods where homopolar values are necessary.

The TF is due to present in 2008 the Terms of Reference for a potential full WG on the above subject.

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

Convener: Willem Boone (The Netherlands)

This JTF was launched in 2000 and the evaluation made in 2005 concluded that the cooperation should continue. A Discussion Group CIGRE/IEC International Organizations E10D, was launched by ICC which purpose is to exchange information about both organizations, to give information from SC progress, to present tutorials prepared by SC B1 WGs. Presently, six B1 WGs exchange information with ICC.

The future activities will be:

- Continuation of process of exchange of information within the Discussion Group Meeting
- Cooperation/coordination between working groups of CIGRE and ICC
- Exchange of information on how to motivate effective participation (CAG)
- Consideration of a joint WG seminar

During the 2007 SAG meeting, it was decided to hold the 2008 SAG meeting in conjunction with the Spring ICC meeting to strengthen the links between both associations.

7.3.5 Relations with other CIGRE Study Committees

Apart from the JWG B3/B1.09 on GIL, we don't have at present formal relations to other SCs, however SC B1 has some common issues with other SCs (B2, B3, B4, C1, C3, C4, D1).

SC B1 was asked by SC D1 to provide them with some potential studies. Our reply was:

- Is there further potential in higher temperatures for super-conducting materials?
- Are there improvements foreseen for the DGA technology in insulating fluids?
- How could stress cracking of HDPE be minimised?

7.3.6 AORC

SC B1 is a very good contributor to the AORC (Asia Oceania Regional Committee) as the AORC B1 panel, led by Ken Barber (AU) meets regularly with the experts from the AORC countries. In return, the experts provide subjects of interest for themselves that could be taken into consideration at the SC level.

This AORC B1 panel met in Beijing (China) at the end of 2006 and in Kuala Lumpur (Malaysia) in November 2007.

7.3.7 IEC

The close liaison between CIGRE SC B1 and IEC TC 20 is very well established and the IEC TC 20 Chairman is permanently invited to the SC meetings.

IEC TC20 relies on CIGRE SC B1 expertise for the development of particular technical matters that are necessary for the preparation of new standards or for the maintenance and revision of existing standards. The work produced by WG B1.06, WG B1.22, WG B1.23, WG B1.24, WG B1.25, WG B1.26 will be addressed by IEC for further consideration.