

11/04/01

2000 PROGRESS REPORT OF STUDY COMMITTEE 22 (OVERHEAD LINES)**B. DALLE, Secretary of the Study Committee****INTRODUCTION**

The field of activity of the "Overhead Lines" Study Committee 22 covers all subjects relating to the design, construction and operation of overhead lines including the mechanical and electrical sizing of overhead line components, certification tests, studies of the behaviour of works in service, the control of works components in service, maintenance, and refurbishment as well as increasing the operating voltage or transit capacity.

The aims of Study Committee 22 must enable the quality of service of overhead lines to be improved as well as their transit capacity, availability, and maintainability, whilst improving their funding possibilities and their financial coverage by insurance companies.

Study Committee 22 is composed of 24 members, 12 observers, 1 chairman and 1 secretary. These members represent:-

- network owners and operators, 38%
- industrialists, 23%
- university lecturers, 9%
- consultants, 30%.

To address these problematics, within the framework of its strategic plan, Study Committee 22 is divided into 4 general working groups and four specialised working groups.

The **strategic** orientations adopted by the Committee therefore concern the following:-

- **Management** of **existing** lines
- **Improvement** of their **reliability**
- **Integration** of works in the **environment**
- **Maximum** transport **capacity** usage

Activities of the Working Groups**1. General Working Groups**

- **WG 06:** Principles of overhead line design
- **WG 12:** Electrical aspects of overhead lines
- **WG 13:** Maintenance and management of existing overhead lines
- **WG 15:** Life cycles of overhead lines and environmental concerns

2. Specialised Working Groups

- **WG 03:** Insulators
- **WG 07:** Foundations
- **WG 08:** Transmission structures
- **WG 11:** Mechanical behaviour of conductors and fittings

A new working group is being created. It will deal with the climatic hypotheses to be considered when designing works.

Working Group Activities

1 - WORKING GROUP 03: INSULATORS

Convenor: C. de TOURREIL (Canada)
Secretary: G. RIQUEL (France)

Terms of Reference: Electrical and mechanical aspects of insulators used in overhead line systems, assessment of performance and reliability.

2000 Results: In 2000 the particular subjects studied were as follows:

- Service experience for composite insulators on AC HV and EHV lines. The report " Use of Composite Insulators" was published in Electra N° 191 (08/2000). The results of the survey reveal that composite insulators are now substitutes for porcelain or glass insulators, that are accepted by the majority of overhead line designers and operators.
- Dynamic bending of composite post insulators: the report "Dynamic bending tests" was published in Electra N° 192 (10/2000). The conclusion is that the procedure of static tests on post insulators is also adapted to dynamic tests and that it is not necessary to develop a new test to verify the dynamic bending behaviour of composite post insulators.
- Compilation of a guide for the installation of composite insulators. Indeed, serious damage has been reported during installation if precautions are not taken. The report was finalised in 2000 and will be published within the scope of an ELECTRA technical brochure in 04/2001

2- WORKING GROUP 06 : PRINCIPLES OF OVERHEAD LINE DESIGN

Convenor: E GHANNOUM (Canada) replaced by JAN ROGIER (BELGIUM) in 09/00
Secretary: H. STRUB (Switzerland) replaced by P. FRONIK (CZECH Rep.) in 09/00

Terms of Reference: WG 06 activities cover the principles of the probabilistic design of overhead lines, line reliability and the design methods aiming at reducing the environmental impact of overhead lines.

2000 Results:

- The document that accompanies the IEC 60826 standard "Probabilistic design of overhead transmission lines" has been published in the form of an ELECTRA Brochure N° 178 02/2001. It enables the reliability of existing installations to be assessed or it can be used for lines with special destinations requiring a high level of reliability.
- The report "Control devices for loading overhead transmission lines" was published in ELECTRA brochure N° 174 and was presented in N° 193 in December 2000. It presents the different techniques used throughout the world, i.e. absorption devices for dynamic overloads (JAPAN), release clamps (France, Belgium, Rumania), etc..
- The report "Guidelines for on-site measurement of ice loading on overhead line conductors", by the task force on atmospheric icing of structures was published in brochure 179 and presented in ELECTRA N° 194 in 02/2001. It describes the chief observations and measurements to be undertaken to obtain series of data enabling a statistical definition of the design loads to apply to works.

- The Working Group also took part in the definition of a system to manage a database that offers access to the information necessary to quantify risk management. This report was published in brochure 175 and was presented in ELECTRA N° 193 (12/00).

3 - WORKING GROUP 07 : FOUNDATIONS

Convenor: M.J. VANNER (UK)

Secretary: N. CUER (UK)

Terms of Reference: This working group deals with problems concerning the sizing, verification and upgrading of the foundations of overhead lines.

2000 Results:

In 2000 this working group finalised an internal report on the influence of non-vertical loads on the sizing of foundations. This task, led by M. Eugenius DEMBICKI (Poland) shows the influence of the inclination of forces up to 10° on the foundation's extraction strength. However, this very theoretical report, needs to be completed before publication.

4 - WORKING GROUP 08 : TRANSMISSION STRUCTURES

Convenor: J.B. DA SILVA (Brazil)

Secretary: David HUGUES (UK)

Terms of Reference: Design, verification and upgrading overhead line structures

2000 Results

The objectives of the working group are focused on the following:-

- New designs for overhead line structures
- The means of assessing existing structures.
 - A report on the variation of the mechanical strength of towers according to the material properties and their dispersion was published in April 2000 in ELECTRA report N°189. This task is led by R. MENEZES (Brazil) and is continuing with the compilation of two other parts whose aims are to assess the strength of lattice towers from a statistical point of view. This study is linked to the probabilistic sizing of works (c.f. WG 06).
 - The report on the improvement of tower testing methods has been finalised. Standard IEC 60652 is undergoing approval on an international level. This task is led by D. HUGHES.

5 - WORKING GROUP 11: MECHANICAL BEHAVIOUR OF CONDUCTORS & FITTINGS

Convenor: K.O. PAPALIOU (Switzerland)
Secretary: Dr. A. MANENTI DIANA (ITALY)

Terms of Reference:

The field of this working group concerns the behaviour under static and dynamic loads of:-

- Conductors and overhead earthwires in all types of materials and of different design,
- Fittings: Suspension and anchoring hardware, vibration dampers, spacers and anti-galloping devices, etc.

2000 Results:

- **Fittings**

The second part of the "Guide to fittings for optical cables on transmission lines" was published in ELECTRA (N° 188 in February 2000). This document aims at supplying a reference guide for the testing methods for types of fittings directly in contact with optic cables of overhead transmission lines.

A second report " Guide to fittings for optical cables on transmission lines " was published in ELECTRA N° 191 (08/2000). This is the reference guide for the type testing methods. It completes the previous report by applying it to all dielectric, self-supporting optical cables and the fittings of optical attached cables. This task is now led by D. SHUNKLE (USA).

- **Guide for the choice of conductor tension**

The second part of the guide for the selection of tension for single damped conductors has been finalised and will be published in 2001 in ELECTRA. This task is led by C. HARDY (CANADA).

- **Conductor Galloping**

This group has presented the actual state of the art of overhead line conductor galloping and prevention devices in ELECTRA report N° 191 (08/2000). The phenomena are fully presented as well as the utility of methods or fittings to limit the effects. This task is led by Mr. J.L. LILIEN (BELGIUM).

6- WORKING GROUP 12 : ELECTRICAL ASPECTS OF OVERHEAD TRANSMISSION LINES

Convenor: Rob. G. STEPHEN (South Africa) replaced by DALE DOUGLASS (USA)
Secretary: Michèle GAUDRY (France)

Terms of Reference:

The scope of this working group covers the power transfer rating of transmission lines in steady, unsteady and transient states. The calculation methods used are either deterministic or probabilistic. Moreover, studies are undertaken on the following:-

- Real-time monitoring,
- Use of weather forecasts to optimise power transfer
- Ageing of conductors and joints
- Usage properties of new types of conductors.

2000 Results:

A report was written on the replacement criteria of conductors. It presents the principal ageing modes of connectors and offers different control methods, i.e. infra-red thermography, measurement of the resistance of the conductor, x-Ray, etc.. This report will be edited in 2001 on the CIGRE-WEB and will be summarised in ELECTRA.

A report was presented to the members of the Study Committee on the continuous monitoring of conductor temperature. It will be published on the web in the form of an ELECTRA report in 2001.

Finally, a technical brochure on the calculation of the overheating of conductors in steady and unsteady states is being finalised. It will be published in 2001.

7 - WORKING GROUP 13 : MANAGEMENT OF EXISTING OVERHEAD LINES

Convenor: VAN der WIJK (THE NETHERLANDS)

Secretary: Keith E. LINDSEY (USA)

Terms of Reference: This work group's task is to suggest methods for managing assets and inspecting works, as well as processing service experience and data management.

2000 Results

All the reports dealing with the management of existing overhead transmission lines were published in the form of an ELECTRA brochure, ref. 175 in 12/2000. It is made up of 4 parts:

1. The first part is the guide to set up a management programme for the maintenance of existing overhead lines. In particular, it stipulates how to manage failure risks according to maintenance work costs.
2. The second part deals with the processing of service experience and the collection of data on failures, incidents and faults on works.
3. The third part is a comparative review of the methods, procedures and diagnostic tools for inspecting lines.
4. The fourth part describes the management of works data.

8 - WORKING GROUP 15 : LIFE CYCLE OF OVERHEAD LINES

Convenor: O'LUAIN (IRELAND)

Secretary: Norman BELL (CANADA)

This new working group's objectives are to assess existing methods, and develop a methodology of the life cycle of overhead lines, by suggesting recommendations with regard to the environment, and the end of their useful life.

A preliminary report was presented at the CIGRE 2000 session by R. LINDGREN on the application of these methods to overhead lines in Scandinavian countries, i.e. Sweden and Denmark.