# 2005 PROGRESS REPORT
# STUDY COMMITTEE A2 (Transformers)

## 1. Highlights

P. Boss, as new chairman, will conduct the activities during the period 2004-2008. He has replaced Ph. Guuinic. The SC A2 has been reorganised as shown in the strategic plan (see WEB site A2).

## 2. Status of SC reference model implementation

SC A2 has fully implemented the reference model for SC (see strategic plan on the WEB site of A2).

## 3. Main technical directions pursued

The two strategic directions of SC A2 are :

- To continue on transformer technology issues and to consider new information technologies (data, communication, web services …
- To provide services to CIGRE customers (reliability and availability including impact of accessories, life management, economical issues, tutorials, etc).

## 4. SC WG & TF

Full progress report, scope and membership of the different groups are on the WEB site of A2

### 4.1 Working groups disbanded or transferred to an other SC

WG 12.16 – Instrument Transformer (P. Tantin) is definitively transferred to SC A3

WG 12.18 – Life Management (V. Sokolov) has been disbanded after publication of the brochure N° 227 in June 2003

WG 12-20 - Economics of transformer management (P. Boss) has been disbanded after publication of the brochure N° 248 in July 2004.

### 4.2 Activities of WG or TF

JWG A2/A3/B3.21 – Electrical environment of transformers (M. Glinkowski) .
This JWG has finalised their work with a report transferred to CO for Electra. It is planned to have this report published in the first part of 2005. The JWG will be disbanded after this publication. The JWG proposed to continue an activity in this field; leadership, scope, etc shall be discussed with SC A3 and B3.

WG A2.23 - Lifetime data management for transformers (N. Fantana)
WG created in 2001. Scope & Aim are : "Methods, strategie and recommendation for collecting and using data to support decision making for lifetime management of transformer assets". A reorganisation of the WG with N. Fantana as new Convenor was approved in Merida in 2003.

A systematical approach for lifetime management is however often constraint due to economical reasons. Transformer lifetime data management is influenced the utility historical background, the present operation and maintenance strategy. From an engineering and decision making point-of-view, the condition of a power transformer can be more accurately determined by analyzing the entire history of the device and therefore a transformer lifetime data management is required. The lifetime data management practices for power transformers are continuously changing and evolving and may differ by area and utility. A questionnaire on status, best practices, trends and needs on lifetime data management for power equipment may well cover most geographic areas. Such a survey may well involve some other type of equipment from utilities and place it as a joined work with other CIGRE SC and WG.
The transformer lifetime data management can then be placed in the system, substation but also in the IT perspective for power electric industry. There are a couple of challenges and steps to go basically implementing the lifetime data concept on a broad basis and then moving towards transforming this data into information and ultimately support specific decisions and actions.

This WG shall finalize their work in 2005.

WG A2.24 - Thermal performances (J. Declerq)
WG created in 2003. The work is oriented in 3 directions, namely: a) Fundamentals on thermal ageing, b) Ratings of new transformers, c) Practical applications for in service transformers.
The WG objectives has been discussed with IEC TC 14. The priority is to work in parallel with IEC to support them in 2003 and 2004. The final report / brochure is planned for 2006.

WG A2.25 - Bushing reliability (G. Polovick)
Created in 2003. The aim of the WG is to improve the bushing reliability or at least to prevent the decrease of the bushing performance (trend due to economic pressure) the long term impact of which can be catastrophic for the transformer reliability. The objectives are to review and to examine the common modes and mechanisms of bushing failures and how this might be impacted by the design, testing and applications.

WG A2.26 - Mechanical condition assessment of transformer windings (P. Picher)
Created in 2003. The aim of the WG is to prepare a guide with the following content : Introduction, review of typical FRA practices, review of other methods, general guidance, limitations, examples demonstrating advantages of FRA, proposals of possible standardization (measurement techniques, procedures), recommendation for further improvements (interpretation, complementary methods, modelling, etc).
The WG is working in close liaison with experts from D1.33.

### 4.3 New working Groups and Task Force

WG A2.27 (previous TF A2.27) - Recommendations for condition monitoring facilities (P. Jarman)
Created as TF in 2003 and as WG in 2005. The markets in transformer condition monitoring sensors, hardware and software are relatively new and potentially some standardisation of the interfaces could be beneficial.

TF A2.29 - Reliability (K. Ryen)
Created in 2005. Preparation of a reliability survey in conjunction with A3/B3". The main objective is to check the format of the survey prepared by A3/B3 which is performed each 5 years. If necessary, TF A2-29 shall revised or issued a new questionnaire related to transformer. The support from previous “Reliability AG” shall be granted.

TF A2.30 - Moisture in transformer (V. Sokolov)
Created in 2005. Preparation of a report (brochure) on moisture in transformers to support the understanding of moisture mechanism in transformer.

## 5. Joint WG & TF

### 5.1 New joint working Groups

JWG A4.04/A2.01 - HVDC System Performance correlated to Converter Transformer (M. Christofersen)
The group has published in 2004 a report in ELECTRA No. 212 and a Brochure No. 240. The group has been disbanded. A continuation of this work has been proposed and will be concentrated mainly to the transformer technology under leadership of A2 with the following identity JWG A2/B4-28.

JWG A2/B4-28 - HVDC Converter Transformers (M. Saravolac)
Created in 2004. All agreed with the strong message conveyed by the system users: a) Higher reliability of HVDC Converter Transformers is necessary, b) Better understanding of the failure causes is required, c) Actions/means for increasing reliability of HVDC CT are required.
It has been agreed that the initial focus should be placed and the highest priority associated with producing a dedicated Design Review Guide for HVDC Converter Transformers. As it is too early to draw conclusions on the effectiveness of the recent modifications effected to the IEC 61378-2 standard the JWG should work on recommendation on harmonising the IEC and IEEE standards. The available information on performance of HVDC Converter Transformers needs to be analysed with the objective to provide more detailed breakdown of failure causes behind the reported average failure rates focusing on the possible systematic aspects.

5.2 Activities with other Study Committee

TF D1.01.09 - Dielectric responses methods for diagnostics of power transformer (S. Gubanski)
The Brochure was published under ref. N° 254 in August 2004. An extension of this activity is in preparation, with the support of A2.

TF D1/A2.01.11 - New advances in DGA interpretation (M. Duval)
The proposal of the group has been accepted finally by IEC TC 14. Therefore IEC TC 10 will finalize the revision of IEC 60599. The group will be disbanded in 2005.

## 6. SC Publications and publication plan

- Brochure N° 227 – June 2003 "Life Management"
- Report Electra – February 2004 "Analysis of HVDC Thyristor Converter Transformer Performances"
- Report Electra – June 2004 "Gas insulated transformers in Japan" (on behalf of A2)
- Brochure N° 248 – July 2004 "Economics of transformer management"
- Brochure N° 254 – August 2004 "Dielectric responses methods for diagnostics of power transformer" (Joint activity with SC D1.01)
- Report Electra – 2005 – Electrical environment of transformers

Additional information regarding publications of reports in Electra or brochures can be seen under item 2, 3 and 4 of the action plan (see WEB site A2).

## 7. SC Website

An effort has to be made by all delegates in order to have a very efficient and good looking WEB site. It has been decided to have only information from the current years under NEWS. All relevant other information will be placed under Technical Issues; mainly from previous meeting. Important information related to the preparation of previous meeting will be put under Private Access in order to get traces for further actions.

## 8. SC Strategic plan & Action plan

The strategic & action plans have been updated. See WEB site of A2

## 9. SC meetings

The committee met on the 3rd of September 2004 in Paris. The composition has been modified in a large amount as numerous delegates arrived to their term of office (9 new members (Australia, Austria, Canada, Denmark, Germany, Japan, Russia, Switzerland and United State) and 5 new observers (Greece, Korea, Singapore, Thailand and Venezuela)). SC A2 has presently only 23 regular members, as China did not nominate an expert in due time, and 14 observers. The candidature from Cuba is still in discussion.
Four advisory groups have been created: two AG to support the chairman regarding the need for a strong support in the field of Transformer Technology and Transformer Application; one AG shall cross-checked key activities for A2 within other SC of CIGRE and one AG is devoting to the strategic aspects. In addition, the previous AG devoted to the tutorial and customer need have been kept as such. The AG related to the reliability issues has been disbanded and transferred in a new TF.

The general session 2004 of SC A2 was devoted to: PS1: Thermal Performance of Transformers and PS2: On Site Operations. The number of participants was quite big (around 300). Practical and usable information's were presented. It was not enough time left for discussion during the session. Many prepared contributions were not delivered on time and some were out of scope, especially during the session on PS2. We may observe a need for printed copies of contributions before the conference.

In 2005, the SC meeting will be hold in Moscow (see item #10).

In 2006, the following PS's have been selected:

PS #1 : Transformers Reliability, Technical, Economical and Strategical Aspects
PS #2 : Phase Shifter Transformers
PS #3 : New Development of electrical transients on transformer performances
(event. workshop with SC C4).

## 10. SC participations to regional meetings, Colloquium and Symposia

- Tutorial in Athens organised by Greek CIGRE NC with the support of SC D1 (2004).
- Support to a Conf. on Transformers in Vigo/Spain (2004).
- Support to a Conf. on Transformer in Pieczyska/Poland (2005)
- Support to a Conf. on Transformer in Zaporozhye/Ukraine (2005)
- Support to the CMD 2006, Changwon (Korea) (2006)
- In 2005, the SC A2 meeting will be organised in conjunction with a colloquium in Moscow.
  The colloquium will include 2 days for presentation; ½ day for tutorials, ½ day for WG meetings or visits, 1 day for SC (possible technical visits the day after the SC)

  A call of paper has been prepared for :

  Subject 1: Transformer Reliability on Technical, Economical and Strategic Aspects

  - Failure statistics (causes, etc),
  - Environmental impact of transformer failures,
  - Economical aspects (life expectancy, loading, failures, etc),
  - How to improve transformers reliability (specification, manufacturing, design review, testing, operation, maintenance)
  - Can on-line monitoring improve reliability ?

  Subject 2: Effect of transients on transformer performance (over-voltage, resonance)

  - Switching surges
  - Power electronics
  - Experiences with GIC events
  - Impact on insulation system,
  - Testing techniques & standards,
  - Mitigation techniques)

  A tutorial is in preparation.

SC A2 shall reinforced his presence to promote more efficiently the SC A2 tutorial activity. For future Tutorial, a simultaneous translation is needed, in order to capture a large national audience.

## 11. Relation with other organisation

- Good relations are established with IEC TC 14 and IEEE Transformers as two delegates are reporting regularly to SC A2.
- The interaction with CIRED is the base of many discussions but no real progress have been achieved. If SC A2 start activities related to transient in the distribution network, CIRED shall be contacted again.