



2007 PROGRESS REPORT

STUDY COMMITTEE A2 (Transformers)

1. Highlights

In 2006 activities were related to the problem of oil corrosivity, data management, condition assessment, reliability issues and support to CIGRE management for the preparation of the 2007 Symposium in China about UHV. For that purpose a new AG "UHV AC & DC Transformers" has been created. SC A2 will have to support A3-22 by a liaison to cover some specific aspects in relation with the development of 1000 kV equipments. SC A2 will have probably to work in the field of 1000 kV technology for transformers. In 2006, three new WG's have been created in the domain of: a) fire behavior, b) maintenance and c) experience accumulated with new insulating fluids. Nine tutorials have been presented in four countries.

2. Status of SC reference model implementation

The strategic plan on the WEB site of SC A2 shows how the reference model for SC is fully implemented.

3. Main technical directions pursued

The two strategic directions of SC A2 have not been changed and are:

- To continue on transformer technology issues and to consider new information technologies (data, communication, web services)
- o 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 A2-23 - Lifetime data management for transformers (N. Fantana) has issued the brochure n° 298 with a summary in Electra n° 227 August 2006. The WG is disbanded.

WG A2-25 - Bushing reliability (G. Polovick). The aim of the WG was to improve the bushing reliability or at least to prevent the decrease of the bushing performance. This item was covered within the workshop on Reliability during the 2006 SC meeting. The WG is disbanded.

TF A2-29 - Reliability Survey (K. Ryen). Prepare a reliability survey in conjunction with A3/B3. The main objective was to check the format of the survey prepared by A3/B3. As the survey A3/B3 has already been issued, no formal activity in the field of "Reliability Survey" has been undertaken. This item was covered within the workshop on Reliability during the 2006 SC meeting. The TF is disbanded.

4.2 Activities of WG or TF

WG A2-24 - Thermal performances (J. Declercq) created in 2003. The WG is considering: fundamentals of thermal ageing of insulation system, thermal modeling of transformers (for monitoring system) and thermal testing of transformers (contribution to measuring uncertainties at heat run tests). The work has been reactivated recently. We may expect a closing of this group in 2007.

WG A2-26 - Mechanical condition assessment of transformer windings (P. Picher) created in 2004. The CIGRE Working Group A2.26 main objective is to develop a guide on the mechanical condition assessment of transformer windings using the Frequency Response Analysis (FRA) method. The working group is divided in three task forces: 1-Guidance and introduction to FRA, 2-Techniques and 3-Interpretation. The WG should deliver a final report in 2007 before to be disbanded.



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WG A2-27 - Recommendations for condition monitoring facilities (P. Jarman) created as TF in 2003 and as WG in 2005. A definite pattern and commonality to the requirements of the diverse monitoring systems has emerged. Communication protocols were not be considered, but the WG output may help to guide transformer data requirements for example for IEC 61850 application. The final report has been circulated within the SC and a final brochure will be issued during the first part of 2007.

TF A2-30 - Moisture in transformer (V. Sokolov) created in 2004. This TF shall prepare a report (brochure) on moisture in transformers to support the understanding of moisture mechanism in transformer. A draft of the report has been circulated and will be finalized as a brochure before 2007 SC meeting next October.

WG A2-32 - Copper sulphide in power transformer insulation (M. Dahlund) created in 2005. The WG is splitted presently in sub-tasks: a) Test and specification and b) "Metal passivator long term stability study". IEC TC 10 has created the WG 35 to work in close relation with CIGRE WG A2-32 for the preparation of a new standard to check the corrosivity of insulating oil. WG A-32 has issued his recommendation to IEC at mid May 2006. This recommendation has been posted on the A2 WEB site and a summary has been sent to Electra for a publication at the beginning of 2007.

4.3 New working Groups and Task Force

WG A2-33 - Fire Safety (A. Petersen/AU) Fire hazard and fire risk of transformers is separated into two categories: fire victim and fire origin. Precautions for each category should be taken into account in the design and the installations requirements. IEC TC 14 has shown an interest to integrate recommendations regarding transformer fire into the relevant standards. SC B3 will support this work. The aim is to prepare recommendations for transformer fire safety practices that will help transformer designers and users to define and apply best practices in the domain of transformer fire. The scope shall cover different parts, mainly: a) Avoidance of tank rupture, b) Precaution to fire victim and c) Precautions to fire origin

WG A2-34 Guide for Transformer Maintenance (C. Rajotte/CA) The aim is to prepare a guide for transformer maintenance that will help transformer users to define and apply best practices for transformer maintenance. The intent is to include transformers rated 69 kV and above, and larger than 25 MVA. The activity is partly a response on a request of IEC TC 14. The Scope shall be accomplished in the three following parts: a) define a best practices list of periodic actions applied in service or with outage, for checking and testing in order to evaluate transformers condition, b) address advanced maintenance activities, usually referred as condition based maintenance, such as oil additives, oil filtering, oil regeneration, and insulation drying and c) human and material aspects of transformer maintenance, with maintenance planning, maintenance tasks tracking, maintenance resources, cost references, level of competences required for different tasks, training, on-site repair, etc.

WG A2-35 Experiences in service with new liquids (R. Martin/UK) In the eighties, the same type of fluids have been used to improve the physical (thermal, dielectrical) or/and the environmental performances and other safety issues of all type of power transformers. In some applications, the new fluids are combined with new solid insulating materials. Such applications are now defined in new standards like IEC 60076-14-2004. IEC TC 14 has shown an interest to consider the results which will be obtained by the WG A2.35 in the maintenance of the existing standard. The aim is to collate and review the in-service experience of using the new fluids in a way which is relevant and beneficial to the electrical industry. Domains to be covered are : a) Basic properties like physical and chemical and electrical differences between the new fluids and mineral oil, fire safety, toxicity, etc. b) Design considerations, c) Maintenance, Retrofilling practice, Handling, experiences of these new fluids with cellulose, d) Standards: Review what standards exist for these fluids, highlight deficiencies, propose remedies and e) Further work: identify the knowledge gaps/concerns and propose solutions, or work for other groups.

4.4 Advisory Groups (AG) within A2.

Actually SC A2 has 7 AG's to support the management of A2. They are related to : a) tfo technology, b) use of the equipment, c) relation with other SC's, d) tutorial, e) A2 customers, f) development of UHV transformers and g) A2 strategy.



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5. Joint WG & TF

5.1 Joint working Groups

JWG A2/B4-28 - HVDC Converter Transformers (M. Saravolac) created in 2004. A need to set up a task force to address specifications for HVDC transformers which fully takes into account interaction with converter valves has been identified. The new guide will be based and derived from the existing document, "Guidelines for Conducting Design Reviews for Transformers 100 MVA and 123 kV and above" created by the CIGRE WG 12.22 and published in 2002 as CIGRE Brochure No. 204. The extension 3 of the original design review guide will address specific aspects of HVDC transformers and their application. Concerning test specification, it is likely that JWG will come up with some recommendations of the modifications of the test requirements and procedures covered by the existing standards in order to ensure higher reliability in service. One of the areas under consideration is the duration of the Polarity Reversal test. The remaining long term actions are: shown as follows: by the 2007 A2 Colloquium, to have a final version of the design review document and a draft proposal for the test recommendations, end of 2007, to have a final document on the specifications, the CIGRE 2008 Session, to have a final document on the test recommendations and a final document on the life management and by the end of 2008 to have a tutorial on reliability of HVDC Transformers.

JTF B3/A2/A3/B2/C2.19 - Dynamic Loading (Dale Douglass /US). This JTF shows few activities.

5.2 Activities with other Study Committee

- WG D1-01: Impregnated insulation (L. Lundgaard / NO)
- TF D1-01-10: Paper Ageing (L.Lundgaard / NO)
- TF D1-01-12: Oil maintenance - Insulating oil reclamation and and dechlorination (B. Pahlavanpour / UK)
- TF D1-01-13: Furans for diagnostics (Marie-Claude Lessard / CA)
- TF D1-01-14: Dielectric response diagnoses for transformer windings (S. Gubanski / SE).
- TF D1-01-15: Progress in DGA techniques and diagnoses (M.Duval / CA)
- WG C1-10: CIGRE Glossary (A. Popescu /RO) & W. Reinke / US)
- WG B5-05 - Modern techniques for protecting, controlling and monitoring power transformers' – S. Sachdev (CA)

6. SC Publications and publication plan

- Final report of TF A2-31 "Copper Sulphide in transformer insulation" – Electra N° 224 - February 2006
- Report on SC A2 Colloquium - Moscow – Electra N° 225 – April 2006
- Report on JTF D1-01/A2 "Recent developments in the interpretation of DGA"- Electra N° 226 – June 2006 and as Brochure N° 296 - 2006
- Final report of WG A2-23 "Transformer lifetime data management" in Electra N° 227 – August 2006 and as Brochure N° 298 – 2006
- Report prepared by AG "Reliability" – Electra N° 227 August 2006
- Intermediate report of WG A2-26 "Mechanical condition assessment of transformer windings" – Electra N° 228, October 2006
- State-of-the-art report on 'The resonances overvoltages in power transformer' , prepared by A. Lokhanin/RU, posted on the WEB site of SC A2 http://www.cigre-a2.org/Site/Publications/pa_ws.asp – January 2007
- Intermediate report of WG A2-32 "Copper sulphide in power transformer insulation" – to be published in Electra - first part of 2007
- State-of-the-art report on 'Fire Avoidance in Transformer Substation', prepared by Prof. D. Allan with the support of J. Declerq and A. Petersen – to be published in Electra – Avril 2007.
- Final report/brochure of WG A2-27 – "Recommendations for condition monitoring facilities" – to be published in Electra - second part of 2007
- Final report/brochure of TF A2-30 – "Moisture in transformer" – to be published in Electra - second part of 2007



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7. SC Website

The new CIGRE format is fully implemented and a lot of relevant reports for the branch of the transformers have been put on this important interface. The last updating has been performed on 30.1.07. Under the part 'Publication', multiple important reports dealing with the current activities of SC A2 are available.

8. SC Strategic plan & Action plan

The strategic & action plans are available on the WEB site of A2. No modification has been made since last year.

9. SC meetings

The committee met on August 29, 2006 in Paris. Nine new regular members (Brazil, Canada, China, France, Ireland, Italy, Netherlands, Poland, Sweden) and six new observer members (Czech Rep., GCC, Israel, Korea, Romania, South Africa). Moreover two new countries are joining SCA2 (Argentina, Portugal). Egypt has not requested a membership as observer for the period 2006-2008. SC A2 has presently 24 regular members and 15 observers. A workshop on reliability issues has been organised during the SC meeting. Eight presentations were made about Transformer Reliability (presentations available on the SCA2 website). The presentations were followed by a brainstorming. In 2007, the SC meeting will take place in Bruges/Belgium with a joint colloquium SC A2/D1. SC A2 has received an invitation from South-Africa to hold the 2009 SC meeting and an invitation from Japan for 2011.

The 2006 session in Paris was attended by approximately 300 delegates. 27 papers were covered by SC A2. The discussion included 57 prepared contributions.

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

SC A2 has prepared a series of tutorials in the field of Short-circuit, Economic of transformer management, Life management, Condition assessment, Design review, Overload and Thermal aging of Transformers, Partial discharge application in factory and in the field (with support WG D1.01). Other tutorials are in preparation in the field of Data Management. These tutorials have been, or will be, presented in conjunction with the events listed hereafter.

- TRAFOTECH-2006, Mumbai, India, January 2006
- IV WORKSPOT, Brazil, March 2006
- CMD 2006 Conf., Korea, April 2006
- CIGRE Tech Con Conf., Sydney Australia, May 2006
- Symposium on Power Transformers – 2nd edition, Curtea de Arges, Romania, Sept. 6-8, 2006
- Support to the Conf. on Transient Phenomena in Large Electric Power Systems in Zagreb/Croatia (April 2007). SC A2 is member of the technical committee.
- International Conference on Power Transformers, May 30-31, 2007 - Torun, Poland

11. Relation with other organisation

- Good relations are established with IEC TC 14 and IEEE Transformers as delegates are reporting regularly to SC A2.
- Contact with ISO does exist (see activity WG A2-27)

P. Boss
12.2.07