Study Committee A2

Working Group Form

WG N°: A2.43 **Name of convenor: A. Mikulecky (HR)**

Title of working group: Transformer bushings reliability ($U_m \geq 72{,}5$ kV)

1. Background

Bushings are among the most frequent transformer failure cause. According to the data from various researches and electric power utilities, bushings cause from 5 to 50 %, or in average, one quarter of the total number of transformer failures. Bushing failures are the most common cause of transformer fires that can cause huge collateral and ecological damages at the switchyard.
Bushings are transformers crucial part and one transformer can have more than 10. A failure of any of them has a transformer failure as a consequence. Two main bushing roles are: conductive and dielectric role. Beside these roles, bushings divide two insulation media (eg. oil and air, oil and SF6 ...) and because of that oil-filled transformer fire protection property is fairly determined by bushings.
HV bushings are a tin and fragile structure, sensitive to mechanical forces because of the connection to the switchyard, earthquakes or vandalism. A bushing burst damages a transformer in many different ways. Upper porcelain cover burst launches fragments of it at an enormous speed. They possess a destructive power even at a distance of a hundred meters or so. The burst of the bushing's lower part damages a transformer in such a way that the conductive and burned debris of the condenser body pollutes its active part. Cleaning of the transformer's active part from bushing fragments is a difficult job with doubtful results.
Bushings are normally mounted on the hottest part of the transformer and they are exposed to both the highest and the lowest temperatures. Combined with external mechanical forces that results in huge demands on bushing insulation and sealing system.
And last but not the least the electrical field strength in bushings HV condenser body is among the highest in HV technique.

2. Scope of work:

The essential aim is a contribution to the improvement of bushings reliability ($U_m \geq 72{,}5$ kV). Attention will be given to bushing failures (including failures during the transformer acceptance tests), failure mechanisms and impacts to bushing failure rates. Basic principle of data collecting will be a survey based on an appropriate questionnaire.

3. Tasks for the proposed WG:

- Bushing failure definition (clarifying relationship between bushing failure and transformer failure) (in collaboration with WG A2.37)
- Bushings failure rate (in service and during the transformer acceptance tests) (in collaboration with WG A2.37)
- Failure mechanisms for RBP, OIP, RIP
- Impacts on bushings failure rate (design and testing, connection to the switchyard, service condition, overloading, overvoltage protection, maintenance, on line and off line condition monitoring ...)
- Predicted life time of RBP, OIP and RIP bushings
- Bushing maintenance, off line and on line condition monitoring praxis, decision criteria especially for C and $\tan\delta$
- Standardization of test tap, and oil sampling (if appropriate)

Deliverables/time schedule

1. Paris session 2010 : Tasks distribution between WG members, presenting and discussing bushing failure survey questionnaire
2. End 2010 : Finalization, acceptance and promotion of bushing failure questionnaire
3. 2011-2012 : Survey data collection and analyses
4. End 2012 : Survey results promotion
5. End 2013 : Final report (brochure) and tutorial

Papers issued :

Approved by TC chairman: Klaus Fröhlich **Date : 15/06/2010**