MINUTES OF MEETING
BUSHING SUBCOMMITTEE
OF THE
IEEE/PES TRANSFORMER COMMITTEE
SAN DIEGO, CA
MARCH 10, 2004

7.3 Bushing Subcommittee – Fred Elliott, Chair

7.3.1 Introduction/Attendance

Chairman, Fred Elliott opened the meeting at 3:00 PM and welcomed the members and guests. There were 35 attendees with 15 members and 20 guests present. Two guests requested membership to the Bushing Subcommittee.

7.3.2 Approval of Minutes of Last Meeting

The minutes were approved as written.

7.3.3 Chairman's Remarks

The Chair made the following remarks after attending the Administrative Subcommittee.

- The Fall 2004 Transformer Committee meeting is expected to be held in Las Vegas, NV. Details to follow.
- The Spring 2005 Transformer Committee meeting will be held in Jackson, MS
- Transformer committee meeting format was discussed and is expected to stay at 3.5 days. Thursday meeting will be more efficient. All the reports should be short and to the point

In addition, the Chair informed that P. Singh has expressed a desire to handover the job of Secretary to an interested member. Bushing subcommittee members interested in taking over this responsibility can either contact Fred Elliott (Chair) or P. Singh (Secretary) of the Bushing Subcommittee.

7.3.4 Working Group and Task Force Reports

7.3.4.1 WG - Revision of C57.19.00 - Keith Ellis, Chair

Because of negative ballots, Draft 6 will be recirculated.

7.3.4.2 TF - Revision of C57.19.100 – Tommy Spitzer, Chair

The TF Chair opened the meeting at 11:00 AM and welcomed members and guests. There were 38 attendees with 20 members and 18 guests. Three guests requested for membership.

The agenda was reviewed and the following items were discussed for the proposed revisions to the document.

- P. Singh's proposal on draw lead guidelines was discussed and it was decided to have separate guidelines on draw lead cables and draw rod conductors. P. Singh agreed to revise the draw lead proposal to add cable related information on overload time and temperature limits. Keith Ellis agreed to write new guidelines on draw rod conductors that carry current.
- It was decided that the section on temperature calculations for short time overloads should remain unchanged for now.
- C. Monoski's proposal on bushing repair was discussed and it was decided to break the section into two sections. One on porcelain bushings and the other on composite bushings with silicone insulators. It was agreed to add information on type of insulator damage/repair and terminal overheating/threaded connections etc.

- It was agreed to add a section on-line monitoring. Information will be available for discussion at the next meeting.
- The subject of sampling oil for DGA analysis was again discussed at this meeting. Because of the concern about opening the bushing and possible oil contamination, it was decided not to include any guidelines in the Application Guide.

7.3.4.3 Bulk Bushings – Bob Hartgrove Chair

Bob Hartgrove reported that the meeting on Bulk Bushings TF was held on March 9, 2004. There were 33 attendees out of which, 16 requested membership to the TF. The following were reported.

- Discussed the purpose of TF and then identified the types and range of bushings to standardize.
- The group decided that the definition in C57.19.00 would be used for Bulk Bushings.
- The group voted not to work on GSU high current bushings but recommended to create a new TF to standardize these, because they are both solid and capacitance graded.
- The group decided to work on 1.5 kV through 46 kV bushings with current ratings up through 6000A.
- H-J Enterprises and Warco agreed to provide a list of their most popular bushings with dimensions as a starting point.
- Meeting was adjourned at 4:15 PM

7.3.4.4 IEC Bushing Standards Activity - John Graham of Trench Ltd., UK

7.3.4.4.1 Bushings for DC Applications – SG26A WG4 / IEC 62199 - Proj. Leader: Gilles Desilet, TransEnergie, Canada

A final draft (36A/117/FDIS) is in circulation with final date for comments being the end of March 2004. This standard is very similar to IEEE Std. C57.19.03 – 1996. This draft includes the following changes:

- No DC tests on bushings rated 150 kV and below.
- Discussions on possible conditioning prior to withstand test in order to avoid test tank oil related particle contaminants, reached a compromise. The voltage can be raised to transformer test level (100 %) in one minute and then to bushing test level (115 %) in the next minute. Maximum number of partial discharge pulses greater than 2000 pC is 10 (from 7).

This standard will be published before the end of 2004

7.3.4.4.2 Insulated Bushings for Alternating Voltages above 1 kV – SC36A MT5 / IEC 60137 – Proj. Leader: John Graham, Trench, UK

- This standard (IEC 60137) was published in August of 2003. However, due to comments received from the IEC Transformer committee TC14, work was immediately started to resolve the issues. The comments were based on the difference between the tests on bushings and the latest requirements in IEC 60076-3. The new MT has held two meetings.

- Some compromises have been reached to increase the voltage class range for routine impulse tests. For transformer bushings in the lightning impulse range 380 kVp to 850 kVp, full wave and chopped wave lightning will be included as type test (based on testing of three bushings to increase the statistical margin/security). A new AC long duration type test has been added for transformer bushings equal to and above 170 kV rating. In addition, an EMC test has been added for all bushings above 123 kV rating

- The altitude correction factors have been revised following the procedures given in IEC 60694 and IEC 60071-1 (switchgear and other equipment standards). The correction factor k is based on altitude above 1000m with different corrections for impulse, power frequency, and switching impulse voltages. The change gives higher correction factor than the present 1 % per 100 m. For example, the correction factor at 3000 m becomes 1.28 instead of 1.2.

- In addition, several clauses have been added on handling, safety, and environment following the IEC Guide 111 (Equipment in high voltage substations).

A committee draft (CD) will be issued for National comments by the end of March 2004 for discussions in Seoul.

7.3.4.4.3 Seismic Qualification of Bushings – SC36A MT7 / IEC 61463

A new revision team will be set up to review the 1997 standard. This standard offers a more simplified approach to qualification than IEEE Std. 693, allowing static calculations. No work yet.

7.3.4.4.4 Capacitance Graded Bushings 52 to 420 kV for Oil filled Transformers – CENELEC TC36A WG4

CENELEC is the European equivalent of IEC and produces standards or harmonization documents for use in European Community. As standards, they have a legal status and override similar standards in member states. This document will standardize on dimensions. Efforts are being made to reach a compromise between the utilities and the manufacturers. Agreement has been difficult to achieve and the document is now at draft 15. The latest draft will go to the National Committees in April of 2004.

7.3.5 Old Business

7.3.5.1 Bushing Monitoring Devices

The Chair was contacted by U.S. Bureau of Reclamation regarding bushing monitoring devices. It is not clear whether this belongs in bushing subcommittee or instrument transformer subcommittee. Comments from bushing subcommittee members were requested. Chair will explore this further by contacting the instrument transformer committee Chair. Further discussions are expected at the next meeting.

7.3.5.2 Bushing Tutorial

As an extension to information presented by Keith Ellis at the Doble Seminar (Life of a Transformer), it was agreed to have a bushing tutorial at the spring 2005 transformer committee meetings. The following members volunteered to participate.

L. Wagenaar, M. Rivers, C. Monoski, K. Ellis, and P. Singh

7.3.6 New Business

John Graham made a comment about CIGRE. They are setting up a new group on Bushing Reliability. The Chair offered to find more information about this group's activity.

7.3.7 Adjournment

The meeting was adjourned at 3:35 PM.

Minutes Submitted By,

Pritpal Singh, Secretary
Bushing Subcommittee

Note: Information on Bulk Bushings activity was added on August 10, 2004.