Insulation Life Subcommittee - Unapproved Meeting Minutes
March 14, 2012 – Nashville, TN

5.11 Insulation Life Subcommittee – Bruce Forsyth, Chairman

The Insulation Life Subcommittee met in Nashville on March 14, 2012 at 8:00 AM.

Bruce Forsyth was not able to attend this meeting. Barry Beaster, the Vice-Chair, conducted the meeting.

A hand count of the members revealed that a quorum was present. The minutes of our meeting in Boston, MA meeting on November 2, 2011 were approved as written.

The attendance rosters show that the meeting was attended by 195 people, 59 of 95 members and 136 guests. 19 guests requested membership.

5.11.1 Chair's Report

The requirements to be an IEEE Transformer Committee Member were reviewed. Members must be a member of the PES and SA.

The PAR report lists the expiration dates of Standards and PAR. Bill Bartley clarified that PARs can be extended but the standards would still expire.

This is the first meeting with the revised meeting format. In addition to these changes, it has been proposed to make the Tuesday Luncheon an awards lunch.

The recent Spectrum contained an article on geomagnetic effects, "A Perfect Storm of Planetary Proportions." This article indicated that hundreds of EHV transformers would probably fail during an extreme event. The Transformers Committee disagrees and will provide a formal response.

Tutorials presented at the Transformers Committee are being provided to the IEEE Technical Resource Center. Due to copyright issues, these tutorials are being moved to the password protected area of the Transformers Committee's website.

Fluids have been described using various terms in the standards. The use of these terms will be normalized through the standards.

People making comments during the meeting should use the microphones and state their name and affiliation.

5.11.2 Project Status Reports

5.11.2.1 C57.91 Loading Guide

C57.91 was sent to the printers on March 7, 2012.

5.11.2.2 1276 Guide for the Application of High Temperature Insulation Materials in Liquid-Immersed Power Transformers

The first meeting of this Working Group will be held at the next meeting in Milwaukee, WI.

5.11.3 Working Group and Task Force Reports

5.11.3.1 Task Force on High Temperature Liquid-Immersed Transformers (PC54.154) – Richard Marek

The eighth meeting took place on Monday, March 12, 2012 in the Ryman Meeting Room at 3:15 pm, at the Renaissance Nashville Hotel, Nashville, Tenn. Introductions were made and attendance sheets were circulated. A quorum call was made at the beginning and end of the meeting, and as only 17 members were present, the minutes from the Boston meeting will be circulated to the members for approval. In addition to the 17 members, 39 guests were present.

The chair provided the attendees with an update on the status of the document. A survey ballot of Draft 8.2 was sent to the working group, requesting approval to submit the document for ballot. 100% of the working group members responded, with comments from four individuals. The chair then noted that he modified the document to incorporate these editorial comments, along with new curves for Annex B provided by John Luksich plus the MEC comments from IEEE. The document was submitted for ballot as Draft 9.

Concurrent with this revision, a ballot pool was formed, with 142 signed up to vote on the document. The pool has a good split of groups, with the largest group at 33.1%, which was less than the 50% limit for ballots opened before April 1. Some working group members had issues with not receiving notification of the opening of the ballot pool, and the chair assisted them with resolving this issue by contacting Erin Spiewak. The ballot opened on March 3rd, and will close on April 1st. The chair strongly urged all to vote on the document to help with a successful ballot. As of the meeting time, 29 ballots had been returned, with 27 approved, 2 abstained and no comments.

The chair completed the meeting by asking for volunteers from the working group to become members of a ballot resolution group, in case they are needed to help with resolving comments. Members who volunteered are:

Roberto Asano, Terry Drees, Bill Henning, Gary Hoffman, Marion Jaroszewski and John Luksich

The chair outlined the need for this resolution work after the completion of the ballot so that the document can be completed prior to the next meeting in Milwaukee. There was no new business, and the meeting adjourned early at about 3:45 pm.

5.11.3.2 Working Group for Temperature Rise Test Procedures Section 11 of C57.12.90 - Paulette Powell

The Working Group met in the West Ballroom of the Renaissance Nashville Hotel in Nashville, TN on Tuesday March 13, 2012 at 11am. Present were fourteen (14) members and forty-seven (47) guests.

There were no corrections to the Minutes of the previous meeting, but as the WG did not have a quorum, the request for approval by the WG will be conducted via an email survey.

There was considerable discussion on clause 11.1.2.2 loading back method at the last meeting concerning that both transformers, supply and under test, be identical. Mr. Bertrand Poulin agreed to prepare a new proposal, but was unable to complete it in time this meeting.

The chair noted that the completed survey for clause 11.2.2 was posted on the webpage prior to the last WG meeting. Steve Antosz asked about the procedure for the WG in forwarding completed proposals for inclusion in C57.12.90. The Chair stated that there is an editorial correction to be made on 11.2.2 before the proposal can be forwarded to the Chairperson for C57.12.90 WG and that the issue concerning the loading back method is the only item to be resolved to finalize clause 11.1.2.2.

There was no new business. Being no other business, the meeting adjourned at 11:20am.

Respectfully submitted,
Paulette Powell, Chairperson
Juan Castellanos, Vice-Chair

5.11.3.3 Task Force on Furan Testing – Shuzhen Xu

This Task Force did not meet in Nashville.

5.11.3.4 Task Force on Moisture Estimation in Transformer Insulation – Jin Sim

Monday, March 12, 11:15 AM at the Music City Room, Renaissance Nashville Hotel.

Meeting started with an establishment of a quorum: 7 of the 11 members of the TF were in attendance, so a quorum was established. This TF meeting was attended by 89 people.

A presentation made by Tom Prevost on a proposed outline based on the latest Draft 3 of the document was made. Highlighting the changes suggested from previous meetings, the next draft will have the following structure.

1 Introduction
- 1.1 Moisture Sources in Transformer Insulation
- 1.2 Hazards of High Moisture levels
  - 1.2.1 Reduction in Dielectric Breakdown Strength
  - 1.2.2 Bubble Generation from Overload
  - 1.2.3 Partial Discharges
  - 1.2.4 Power Factor of Insulation
  - 1.2.5 Loss of Life
  - 1.2.6 Historical Background

2 Direct Moisture Measurement by Karl Fischer Titration

3 Indirect Methods of Moisture Estimation
- 3.1 Power Factor Measurements and Loss Measurements
- 3.2 Vapor Pressure Piper Charts
- 3.3 Moisture Equilibrium Curves for Oil and Paper
- 3.4 Moisture Assessment under Dynamic Conditions
- 3.5 Advanced Treatment of Moisture Equilibrium in Paper – Oil System in Transformers
  - 3.5.1 Distribution of Moisture between Paper, Oil and Gas Components
  - 3.5.2 Distribution of Moisture in Transformers with Natural Oil Flow
  - 3.5.3 Distribution of Moisture in Transformers with Forced Oil Flow
- 3.6 Dielectric Response Methods for Moisture Determination
  - 3.6.1 Recovery Voltage Method RVM
  - 3.6.2 Polarization and Depolarization Currents PDC
  - 3.6.3 Dielectric Response in Frequency Domain
  - 3.6.4 Modeling of the Dielectric Response by the XY-Model
- 3.7 Infrared Spectroscopy to Measure Moisture Content
- 3.8 Method Accuracy

4 Case Studies
- 4.1 Drying of a Power Transformers
- 4.2 Moisture Determination in a Heavily Aged Transformer
- 4.3 Assessment of New Transformers in the Factory

5 Special Reports on Moisture Evaluation in Transformers
- 5.1 CIGRE Working Group A 2.30 (2007) Moisture in Transformers
- 5.2 EPRI Workshop on Moisture Management in Transformers
- 5.3 Panel Session of IEEE Transformer Committee
- 5.4 EPRI Project on Moisture Management in Transformers
- 5.5 CIGRÈ Task Forces on Dielectric Response Methods D1.01.09 and D1.01.14
- 5.6 Doctoral Thesis "Reliable Moisture Determination in Power Transformers"

6 References

7 Bibliography of Moisture in Transformer Insulation

Questions and Comments:

a) There is a need to make recommendations of what method to use and when.
b) What is the impact of temperature based on the technique used?
c) Will it address only mineral oil and paper insulation? ANSWER.. YES, only paper (cellulose)/oil insulation systems
d) Motion put forward to the members of the TF, Will you approve the proposed outline for re-organization of the contents, based on this presentation, and forward it to the TF members and ILSC for review and comments? ANSWER Yes majority 6 of 7 voted YES.

Once the new draft is completed, it will be circulated to the TF and members of the ILSC for their review and comments. Publication of the document will be based on the procedures for an IEEE Special Publication.

Presentation by Valery Davydov, Proposal for a New Reference Document:
"Moisture Phenomena in Insulating Systems of Dry, Gas Insulated and Liquid Immersed Transformers & Reactors"

A presentation that proposes an in depth investigation of the moisture issues in the 'whole' of the transformer, looking into aspects of moisture in the gas phase, all parts of the solid insulation, and all commonly used dielectric fluids.

Copies of the presentation will be on the Committee web site.

After the presentation, a proposal was made to those in attendance;

"Do we as a group wish to propose to the ILSC to proceed with development of the Title, Scope and Purpose of a new guide following the concepts presented in this presentation?"

By show of hands, the majority agreed and the proposal carried. Tom Prevost will be recommended to the ILSC as the Next Chairman of this TF, to carry this work forward.

Recorded by Brian Sparling

Respectfully submitted by H. Jin Sim, Chair of the TF

5.11.3.5 Task Force on Winding Temperature Indicators - Phil McClure

The meeting was called to order at 9:45am and the members and guests introduced themselves. There were 4 members and 38 guests present. This was the first official meeting since Spring of 2006, although there was a break-out meeting at the Spring 2011 meeting in San Diego.

Thirteen guests requested membership at this meeting. Presently there are 15 members on the roster, but many of them were inactive even in 2006. Historically it has been difficult to achieve a quorum in this group and not all members have contributed materially to the

group's work. Adding more members immediately might make the task of achieving a quorum even more difficult. After the next meeting the existing membership list will be trimmed and guests will be required to attend at least three meetings and contribute materially to the effort prior to becoming members.

That being said, three persons who have contributed materially to the group's efforts over the past 18 months; Jorge Gonzalez de la Vega, Josh Herz and Tim Rinks, will be granted membership at the next meeting.

The minutes of last meeting on March 21, 2006 meeting in Costa Mesa, CA were distributed to the members, but since there was not a quorum, they could not be approved.

A brief discussion of the group's history was given to familiarize attendees with how the group arrived at this point in time.

In support of the primary objective of the group, an experiment has been undertaken to test the response times of several types of heated-sensor simulating (HSS) WTI's in several simulated operating conditions, including overload. The experiment required the collection of test subjects and measurement standards and design and fabrication of a test tank with variable circulation and heat and a means of installing baffles to direct fluid flow.

The experiment was begun two weeks ago. Several sequence changes were incorporated as a result of detailed review of the procedure while preparing data sheets. The changes resulted in a more intensive workload, but much more useful data. Changes to the experiment and preliminary results were presented for the first two of three objectives of the experiment in a document that was circulated to the members. The document was screened and discussed for the attendees at the meeting.

The preliminary results suggest that the response times of HSS WTI's are much faster than some have maintained. In addition, the data suggests that the response times may be highly independent of initial thermal conditions when those initial conditions are within "normal" operating temperatures of 25 and 60 °C.

It was stated that the experiment would be completed, with data and conclusions, within eight weeks. The experiment would then need to be edited into a form that would be suitable for publishing in a trade magazine, technical journal or other peer-reviewed media. Volunteers with experience publishing technical papers were solicited, but no persons with actual experience came forward.

A Q&A period was had after the experiment was discussed.

The first question asked was why there were steps that called for applying twice the thermowell current signal rating during response time testing. It was explained that the purpose was to simulate a condition in which one of a pair of tandem transformers that were sharing full capacity loads had to be removed from service and the remaining transformer had to carry 200% capacity.

The second question asked was if we planned to test with mineral oil in addition to the Envirotemp FR3 that the experiment was presently being conducted with. It was explained that the high flash point made it safer for testing in the confines of our small chemical lab and the low odor reduced the objections of personnel working next to the lab. In addition, similar thermal properties make testing with another fluid unnecessary.

The final question asked was if we planned to test for only liquid immersed transformers or if we had considered testing dry type transformers as well. The answer was that our charter only applied to liquid immersed transformers.

We had planned to discuss the direction of the group beyond publishing the paper, but there were too few members present and no quorum to make a decision for recommendation to the subcommittee. At the Spring 2006 meeting in Costa Mesa both the Task Force and Subcommittee thought that a WTI guide was preferred, but that was six years ago and the choices of that time need to be reviewed.

The choices at this time, as in 2006 are to continue the work of the group to produce a standard, to produce a guide or stop work where we are.

With no more business to conduct, the meeting was adjourned at 10:35.

Adjourn

5.11.4 Old Business:

No old business.

5.11.5 New Business:

5.11.5.1 Proposal for a new Task Force on Moisture Estimation: Jin Sim proposed that a new Task Force should be formed to prepare a Title, Scope, and Purpose for a new document on moisture. This motion was seconded. After discussion, 29 people voted for this proposal and 9 people voted against it. The motion passed and will be brought to the Administrative Subcommittee.

5.11.5.2 C57-100: Roger Wicks presented preliminary results of the sealed tube tests. His presentation is available on the Insulation Life Sub-Committee website.

5.11.5.3 Tutorials: Tom Prevost reminded everyone that tutorials are presented at every Transformers Committee meeting. Topics for tutorials should be presented to the SC Chair.

5.11.6 The meeting adjourned at 9:00 AM.

Barry Beaster
Vice-Chair, Insulation Life Subcommittee