Insulation Life Subcommittee - Unapproved Meeting Minutes
March 10, 2009 – Houston, TX

8.4 Insulation Life Subcommittee – Bruce Forsyth, Chairman

The Insulation Life Subcommittee met in Houston, TX on March 10, 2010 at 8:00 AM.

At the commencement of the meeting there were 52 out of 110 members present, so a quorum did not exist. According to the final attendance roster the meeting was attended by 164 people, 59 of 110 members and 105 guests.

8.4.1 Approval of the Meeting Minutes

The minutes of the meeting in Lombard, IL on October 28, 2009 were reviewed but not approved since a quorum was not present at the time the minutes were reviewed. .

8.4.2 Chair's Report

The Fall 2010 IEEE Transformers Committee Meeting will be held in Toronto, ON on October 24-28. The Spring 2011 meeting will be help in San Diego on April 10-14.

The Chair reminded members and guests of the importance of establishing a quorum at meetings and suggested that individuals that want to be involved in the balloting process, but are unable to actively participate otherwise, should do so through SA membership rather than requesting membership on the activity groups. In addition, the Chair encouraged all activity chairs to review their membership rosters in an effort to ensure only active participants remain on the list.

8.4.3 Project Status Reports

8.4.3.1 C57.91 Loading Guide

C57.91 and its PAR expire at the end of this year. A PAR revision is required to ensure the wording of the PAR matches wording in the document.

8.4.3.2 C57.100 Thermal Evaluation Guide

The PAR for C57.100 expires the end of 2010.

8.4.4 Working Group and Task Force Reports

8.4.4.1 Working Group for the Revision to C57.91 Loading Guide – Don Duckett

The working group was called to order by Bruce Forsyth at 9:30 am. Chair Don Duckett suffered a stroke on Friday, March 5th and therefore was not able to attend. Vice Chair Carlo

Arpino was also unable to attend. Bruce Forsyth stepped in to help with the meeting. Secretary Susan McNelly was also present.

There were 28 of 55 members were present (quorum was achieved) and 54 guests with 13 guests requesting membership to the WG. Susan explained that only guests requesting membership that actually participate in the effort to get the Guide to ballot at this point would be considered for membership. At this time, only one of the guests (Roger Verdolin) requesting membership will be considered for addition to the WG pending follow-through on his request to participate on the ballot resolution group.

Agenda:

1. **Roll Call/Introductions**
2. **Patent disclosure announcement**
3. **Previous meeting minutes approval**
4. **Status of the present Guide**
5. **Draft 7.1 Discussion**
6. **Plans for Completion**
7. **Adjournment**

A roll call of members present and introductions of members and guests were made.

The IEEE Patent disclosure requirements were discussed and a request was made for disclosure of any patents that may be related to the work of the WG. There were no responses to the request for disclosure.

Approval of minutes from the Fall 2009 meeting in Lombard, Illinois was requested. A motion to approve the minutes was made to approve the minutes and was passed.

Status of the present Loading Guide:

The Guide is set to expire and be withdrawn at the end of this year unless this working group is successful with getting a version of the Guide out for ballot and approved.

A PAR modification was submitted for the December NESCOM meeting requesting a two year extension as PAR was set to expire at the end of 2009. NESCOM granted a one year extention to December 2010. This means that the WG must get a draft out for Ballot soon to prevent withdrawal of the Guide at the end of this year. If the document is out for ballot prior to the end of the year, then it is likely that REVCOM would grant an additional one year extension for resolution of comments and any negative responses. The mandatory editorial review must still be done on the document before it can be sent out for ballot.

A decision was made at the Fall 2009 meeting to go with a minimal modification to insert the voltage regulation section and any other critical items such as bubble generation. In addition, the Guide would be brought up to present IEEE requirements regarding style, metrification, equation presentation, etc.

The floor was opened to discussion on the ballot and where we might go from here. Don Platts gave a synopsis of the recent changes and the need to get an interim document out that we can live with to get this to ballot.

Draft 7.1 Discussion/Review

Juan Castellanos provided a review of Draft 7. Most of his comments and corrections have been incorporated into the present draft 7.1 that is posted on the web site. There are some additional revisions pending from Juan's review that are being worked through.

A question was raised if there was a possibility of making changes to Table 7 & 8. A comment was made that if changes to these tables were made, it would definitely cause them to vote negatively on the ballot. This would also apply to Table 6.

Suggestion to add a short not to Table 7 indicating that either the temperature or the maximum load limit apply, that they do not need to both be satisfied. An amendment was made to change the word "and" in the title of 9.2.1 and Table 7 as well as in the first sentence of 9.2.1.

Discussed removing the second line of Table 8. This is a design consideration not a transformer loading issue. There were objections to removing the line. An alternate of removing the words in parenthesis in the first column was suggested. It was determined to leave the

A request was made to verify if the values in Table 6 are valid for voltage regulators or to add a column with the different values.

Jin Sim volunteered to do a technical review of the equations and variable definitions to verify that they were properly translated from the original document.

A PAR modification will be needed to make the minor changes to the Scope (addition of the word "step-" before "voltage regulator" and a missing degree symbol for the "55C" reference.

A request for volunteers to serve on a ballot resolution group was made. Dave Wallach, Juan Castellanos, Don Platts, Tom Prevost, and Roger Verdolin volunteered to help go through comments received.

The meeting was adjourned at 10:47am.

Respectfully Submitted

Susan McNelly
WG Secretary

8.4.4.2 Working Group On Thermal Evaluation Of Power And Distribution Transformers (C57.100) – Roger Wicks

1.0 Introduction and Rosters and Quorum Call

The working group met on Monday, March 8, 2010 at 11:00 AM with 28 members and 82 guests attending, with 5 guests requesting membership. At this time the membership numbers are being reduced to match those involved in the revision of the document, and only one of these guests falls into the category of those guests who will be offered to be included in the final membership list.

As there were only 28 members of the 90 on our roster, we could not conduct official business during this meeting.

2.0 Approval of minutes from October 26, 2009 meeting

The minutes of the October 26, 2009 meeting in Lombard, Illinois had no issues, but could not be formally approved due to the lack of a quorum.

3.0 Patent Disclosure

The chairman asked if anyone knew of any patents that could pertain to this project. There were none.

4.0 Document Feedback

- Questionnaire Results
    - 17 questionnaires were returned by the 90 members of the working group.
    - Information from the questionnaires were reviewed and discussed during the last fall's meeting.
    - This input was used to develop a Draft 1

- Revisions C57.100 in Draft 1
    - 12 responses were received from the 350 recent attendees to our working group.
    - These responses were incorporated into Draft 2
    - Draft 2 has been submitted to IEEE for MEC review

5.0 The Ballot pool for the this document is being formed. At the time of the meeting 105 balloters had signed up, however only 12 members of the working group had signed up at this time. The chair pleaded with the members of the working group and all who attended to sign up for the ballot.

A ballot resolution team was formed for assisting the chair with resolving any potential negative ballot issues during the ballot process. These volunteers are Claude Beauchemin, Terry Drees, John Luksich, Don Platts, Tom Prevost and Roger Wicks.

Further discussions were held within the remaining time of the meeting. John Luksich provided in writing concerns about the use of 50% tensile strength as the end of life criteria, which differs from the list of options described in C57.91. This same issue was raised at our last meeting and addressed by the chair – a number of techniques can

be used to evaluate relative performance of materials, however for a standard, we need to select one method, and specifically one which is broadly applicable to as many potential materials as possible. Tensile strength retention has been found to be broadly applicable, unlike Dp (works well with cellusose only) or burst strength (doesn't work well with tape samples), etc. Additionally, the use of 50% tensile strength with the dual temperature test gave a close match to curves previously established with the distribution model test (Lockie test).

Another question was raised regarding the difference in aging data from preliminary aging work using the dual temperature method (and presented by McNutt, et. al.), vs. more recent work by Wicks/Prevost in support of this working group. The chair noted that the previous work used kraft paper of an unknown nitrogen content (which has been shown to affect the life), and the data John shared used the highest nitrogen content paper which provides much higher life. Additionally, the historical test used wrapped conductor tapes vs. precut tensile strips, which added a lot of variability to the test.

Other points were raised by Jin Sim related to the use of dual temperature vs. other methods (due to complexity of a potential power transformer model test), etc. He also noted that this method could be improved by better moisture control. Valery Davydov also noted the much different life available to insulation when moisture is present.

The chair noted that one of the things we have tried to do with this revision is to make all of the methods use similar conditions. We have added the use of moisture in all test methods (though only as an initial moisture content), as well as specifying the sealing method of the system for the test to mirror what would be used in the end application. These were not required in the past. The chair noted that future revisions could be modified to allow for new technology that would allow different modeling of the effect of moisture, but that this work would not be complete to allow this addition in this current revision of the document.

The chair noted, that again – whatever change is made to one method should be made to all of them.

6.0 The meeting adjourned at 12:10 PM

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

The Working Group met at 11:00am March 9, 2010 in Colonnade AB of the Omni Houston Hotel in Houston, Texas USA. In attendance there were fifteen members and fifty-six guest; six members requested in advanced and were granted to be excused for their absence. Subsequent to balloting activities after the Fall meeting, non-responsive members were removed from the WG. The membership now stands at twenty-eight.

There were no patent disclosures.

The minutes of the October 27, 2009 were distributed prior to the meeting and also displayed at the meeting. The minutes were approved as written.

Projects:

Modified Temperature Test

The Straw Ballot results for the proposal were presented. The ballot was unsuccessful having only a 66% return, i.e. 25 of 38 members and the majority response was negative; 15 of the returned ballots were negative. The WG expressed no interest in pursuing the proposal further.

TF – Sub-clause 11.2.2e
(Addressing scenarios wherein hot-resistant time data unsuitable for fitting to an exponential decay curve)

Sanjib Som gave a presentation on an Alternate Method for Determining Average Oil Temperature. In this methodology readings were recorded for 30 minutes. The resistance in the first five minutes followed an exponential curve, and during the last five minutes was linear. The presentation generated the following noteworthy discussion.

1. Bertrand Poulin indicated that his practice is to directly measure the oil through the headers. Bertrand noted that it is not average oil temperature that was determined; instead it is the measured oil temperature to which the winding is cooling down to – which is the oil surrounding the coil for ONAN and ONAF, or bottom oil for ODAF AND OFAF - for which we have no name. Bertrand agreed to prepare specifics on the topic.
2. Oleg Roizman concurred with Bertrand's comment and posed the question as to how the information could be used.
3. Shamaun Hakim commented on Sanjib Som's premise on radiator length indicating that the shorter height brings down the winding gradient of ONAN/ONAF transformers.
4. Baitun Yang indicated that it is not practical to extend test time to 30 minutes as it necessitates reheating the transformer between shutdowns. Bertrand Poulin concurred suggesting there may be other ways to extract the information.

11.2.2b Straw Ballot – With removal of the order of tests, the recirculation ballot for lower capacity heat runs on power transformers was successful. Clause 11.2.2 has been finalized and is posted on the Insulation Life webpage.

Unfinished Business

There was no unfinished business.

New Business

There was no new business.

The meeting adjourned at 11:45am.

Respectfully submitted,

Paulette Payne Powell, Chair
Juan Castellanos, Co-Chair

8.4.4.4 Task Force on High Temperature Transformers – Richard Marek

The fourth meeting of the WG took place on Monday, March 8, 2010 in the Regency D Meeting Room at 1:45 pm, at the Omni Houston Hotel, Houston, TX, USA

There were 18 members and 46 guests present. Introductions were made and attendance sheets were circulated. The IEEE patent policy was discussed and there were no concerns regarding patents. At 31 members, a quorum was established with 58% of the members present. Accordingly, the minutes from the Lombard meeting were approved as written.

The results of two surveys were presented by the Chair. The first survey concerned approval of the minutes from the Miami meeting, which was deferred since no quorum was established at the Lombard meeting. Due to a poor response to the surveys and the lack of a quorum from the previous meeting, 8 members were removed from the roster, bringing the total to 31. All received explanatory emails, with one response and no objections. This allowed a successful ballot of a 57% positive response and no negatives, resulting in approval of the revised minutes.

The second survey presented a proposal to revise the scope with one alternative version. 22 responses or 73% resulted in a successful ballot with 18 approving the revision. Two ballots favored the original scope and two preferred the alternate proposal.

A concern had been raised at previous meetings concerning the content of the draft and whether it should be called a standard, a guide or a recommended practice. Since the document has been changing due to revisions, the Chair decided to delay this decision. Since the PAR authorization is to develop a standard, he felt that the working group should first work toward this goal and make a decision after one or two additional drafts. Don Platts stated that he felt the document is still more guide-like and suggested that the document be sent to the IEEE editors for an opinion. The chair agreed to consult with Matt Ceglia to determine how to request the review. After this review, the Chair will submit an amended PAR to revise the scope and the title, if necessary.

Attention was then directed to the many revisions made in Draft 4, with a number of those present noting that the figures had not been reproduced in the pdf document of the draft which was sent to all interested parties. The Chair stated that he would send out the MS Word doc version immediately to all on the mailing list.

The Chair displayed the definitions and Table 1 as examples of some of the changes. The temperature rise was specifically noted, since the table now shows a range of acceptable temperatures, rather than a fixed number, with a corresponding range of reference temperatures. The Chair cited the precedent set by dry-type standards where, multiple temperature rises are acceptable, depending on the temperature capability of the insulation system selected. A short discussion resulted with George Reitter clarifying that there would be only one reference temperature equal to the temperature rise plus 20°C. Don Platts stated that the range made it look more like a guide than a standard.

Dinesh Sankurakurup noted an apparent inconsistency in Table 1 which refers to "hottest spot temperature rise for conventional solid insulation", compared to "winding hottest spot temperature" found in a table in IEEE Std 1276. After comparing the wording of the two documents, the Chair presented one explanation by referring to the definition section of the document, where the modifier "conventional" is elaborated. The Chair also stated that he felt a more general limit was necessary rather than referring specifically to the winding hottest spot, since there may be other hot areas than just the winding.

The discussion moved on to written comments to Draft 4 that the Chair had received before the meeting, provided by Hasse Nordman, Michael Botti, Eduardo Tolcachir and Vijayant Krishnamurthy. Due to a shortage of time, only short presentations were made by those who had commented. The Chair noted that these comments would be sent to the group for a closer review.

A brief discussion took place concerning the preliminary natural ester annex submittal by John Luksich, which was developed along with Don Cherry. The text was reviewed by the Chair who requested that the annex be expanded to include high temperature application and support for the temperature limits established in the standard. Since John lead the effort but was not present, Patrick McShane and Jerry Corkran were requested to relate the request. The annex will be circulated to the group for comments after the upgrade.

The Chair requested ideas on how shell form technology could be included in the document after receiving a request for the addition. Mathieu Sauzay agreed to review the possibility and report back before the next meeting.

Draft 5 is expected to be circulated before the fall meeting. The WG was requested to review the draft 4 document and make comments or suggestions which would be incorporated into the next draft.

The meeting adjourned at 3:05

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

The Task Force on Moisture estimation in Transformer Insulation did not meet during the Spring 2010 Transformer's Committee meeting. Jin Sim briefly reported that the current draft does not meet the objectives of the Task Force. He commented on the following:

- some methodologies are not accurate
- the need to address moisture in the hot spot location
- adding a CIGRE evaluation report

8.4.4.6 Task Force on Furan Testing – Kent Haggerty

Don Platts reported on the meeting activity. Kent Haggerty will resign as chair of the task force due to personal issues. A volunteer to head the task force has stepped forward. The task force has been developing a document that will be completed soon. The issue today is how this paper can be presented as the document is currently over thirty pages and eight pages is the limit for IEEE Transactions. Changes to the IEEE Transformers Committee O&P manual may assist in the solution. The task force is still asking that data from all sources continue to be provided.

8.4.4.7 Task Force on Winding Temperature Indicators - Phil McClure

The Task Force on Winding Temperature Indicators did not meet during the Spring 2010 Transformer's Committee meeting.

A discussion took place regarding what to do with this Task Force. It was suggested that a vote be held to disband the Task Force due to lack of interest.

8.4.4.8 Task Force on Metallic Surface Temperatures – Jeff Ray

The meeting was called to order by the Chair.

Roll was taken and it was determined that there were 11 of the 13 members present. There were 42 guests in attendance and 6 of them requested membership in the TF. The 53 attendees were asked to introduce themselves.

An attendance roster was circulated.

Minutes of the F2009 meeting were approved.

The IEEE patent disclosure regulations were noted. No one had any items to bring forward.

The subject of this TF was reviewed by the Chair for the benefit of new guests.

The following paragraphs were introduced at proposed modifications to C57.12.00, section 5.11.1.3 to clarify temperature rise limits for non-current carrying surfaces inside a liquid-filled transformer.

C57.12.00 is rather vague on this matter, stating: "… shall not attain excessive temperature rises at max rated load".

> *5.11.1.3 Rises of metallic parts other than windings*
> *Metallic parts in contact with current-carrying conductor insulation shall not attain a temperature rise in excess of the winding hottest-spot temperature rise.*

Metallic parts other than those described above shall not attain excessive temperature rises at maximum rated load.

Suggested wording:

Metallic parts other than those described above shall not attain excessive temperature rises at maximum rated load. Excessive temperature shall be interpreted to mean a temperature that exceeds the operational temperature rating of the insulation material that is in contact with the metallic part[1]. This limit applies to all solid or liquid insulation materials.

[1] The temperature rise for non-thermally upgraded cellulose based materials shall not exceed 65C, for limits on other materials refer to C57.154-xxxx [if/when it becomes a standard]

- After much discussion, it was determined that the group present was not in favor of adding the footnote (in red) shown above.
- At this point, the group was asked whether they would support the proposed wording (in blue above), if it was presented for balloting in a future revision of C57.12.00. Six people (not sure if members or guests) said they would vote negative unless the last sentence concerning liquid insulation was deleted. They felt temperature limits for liquid insulation are already covered adequately in the IEEE standards.
- Some members indicated a preference to leave the wording about liquid insulation, but said they would not strongly object if it was deleted.
- Chair indicated, he would circulate both versions (with and w/o liquid insulation wording) to the membership to vote on which version they prefer. The results of this straw poll will be presented at the F2010 meeting in Toronto.
- The meeting was then adjourned.

8.4.5 Old Business

8.4.5.1 Should We Establish A 75 Degree C Rise?

A discussion took place regarding the need for a 75 degree C rise transformer. Jin Sim suggested that the WG on High Temperature Transformers would be an appropriate group to address the issues related to such transformers. It was recommended that the Subcommittee be surveyed regarding this issue.

8.4.6 New Business

Joe Foldi asked what the correct hot spot temperature rise is for transformers using the reduced average winding temperature rise of 55 degree C. As time ran out there was little discussion and no resolution.

8.4.7 The meeting adjourned at approximately 9:15 AM.

Bruce Forsyth
Chair, Insulation Life Subcommittee