7.10 INSULATION LIFE SUBCOMMITTEE - D.W. Platts Chair

The Subcommittee met at 8AM on October 8, 2003 in Pittsburgh PA. Attendance was 25 members, 62 guests, and 9 guests accepted as new members.
The minutes of the previous meeting in Raleigh in March were approved.

7.10.1 Chair's Report

Harry Gianakouros, our previous Vice Chair & Secretary, will no longer be able to participate, and has resigned these duties. Eric Davis will be our new Secretary.

Administrative Subcommittee
Emeritus, Corresponding Members discussion of requirements and expectations for these grades of membership
Reaffirmation – The IEEE process allows for no changes at all to the document.
When conducting a ballot we are likely to get negative comments, but no changes can be made to resolve those issues.
Committee has agreed to wording which explains this. It should be used with future ballots and we hope it will simplify the process.

Next Meeting: Mar 10, 2004

C57.12.76 Re-affirmation – Balloting was complete 2 years ago and it is still not resolved. We need to commit to get this work completed.

7.10.2 Working Group Reports

7.10.2.1 TF Winding Temperature Indicators P. McClure

The meeting convened at 8:00 AM. Six members and 58 guests were present. Ten guests requested membership and three guests who requested membership at the last meeting, were accepted as members.

It must be reiterated that the objective of the Task Force is to write a technical paper and present a panel session on the subject of winding temperature indicators. An obvious requirement for membership in the group must therefore be a substantial contribution towards the completion of that objective. To require less would diminish the efforts of those who have contributed to the effort.

The minutes of the previous meeting in Raleigh were presented and approved.

Old Business:

Progress on the technical paper was described. A substantial contribution was made by Andreas Garnitschnig in the areas of Virtual WTI's and transformer manufacturer's perspective. Draft five of the paper was not released, however; because it was desired to add new data from a recent heat run that was run with the specific intention of determining the time constant of a heated thermowell.

New Business:

At the previous meeting in Raleigh, transformer manufacturers and owners were asked if there were any transformers in production that could be used as subjects of a specially sequenced heat run designed to determine the time constant of a heated thermowell. The transformer's equipment requirement was imbedded fiber optic temperature sensors and a heated thermowell. Duke Energy had one such transformer and offered to run our test sequence in conjunction with a special sequence that they were running.

The test was run in mid-September and unfortunately equipment failure rendered the data for the heated thermowell unusable. Despite this setback, valuable data was collected from the other devices which were monitoring the transformer, and the level of cooperation and coordination made this an overall positive experience.

Hopefully this will be the first of many such tests. The task force would like to thank all parties involved for their efforts in this prototype test.

The group was asked if any other such transformers existed and if so, whether their owners would be willing to allow a survey to be conducted. Two owner's representatives said that they knew of transformers which were equipped with the necessary equipment and offered to review the test sequence and ask the transformer manufacturer if it would be willing to run the sequence.

The meeting was adjourned at 9:00 AM.

Respectfully Submitted

Phillip G. McClure
Chairman

7.10.2.2 WG Thermal Evaluation of Power and Distribution Transformers C57.100 R. Wicks

The Working Group met at 9:30 AM on October 6, 2003, with 10 members and 44 guests attending, with 16 guests requesting membership. This brings the number of members for the working group up to 38 members.

After introductions, the Chairman presented the agenda for the meeting, and circulated the attendance rosters, and asked for and received approval of the minutes from the March 17th meeting in Raleigh.

Following this, the Chairman provided background on the status of this document which needs to be either revised or reaffirmed prior to the end of 2004. He also discussed the results of a working group ballot regarding the Title of the document and the Scope which was conducted in order to submit a PAR for this work. The Chairman was disappointed with a 50% response to the ballot. All respondents were in favor of the title as balloted:

Title: IEEE Standard Test Procedure for Thermal Evaluation of Insulation Systems for Liquid-Immersed Distribution and Power Transformers

The vote on the scope was less favorable with ½ of the balloters offering suggested wording. This led to a delay in the PAR submittal to make sure that all in the working group were in consensus. The following is the scope which was balloted:

1.1 Scope - This standard provides test procedures to evaluate the thermal aging characteristics of the insulation system used in liquid-immersed distribution or power transformers. The dielectric liquid is part of the insulation system. The test procedure shall simulate practical service conditions of the insulation system as close as technically reasonable.

The Chairman then turned the floor over to Don Platts, Insulation Life Subcommittee Chair to discuss his comments related to our document. Don spent a considerable amount of time looking at our document in both the 1986 version and the 1999 version and felt there were some issues that needed to be resolved prior to beginning work on the document. This includes:

This document, which appears to require an insulation system test for each type of transformer design varies from the original intent of C57.100 which called out a test for each insulation system. It is this requirement of a test per design which creates a major issue for power transformer manufacturers which makes the requirements in this standard unrealistic.

Also, Don felt that we need to place an insulation thermal life expectancy requirement in C57.12.00, and that this document should specific tests, not specification and test.

This led to some spirited discussions related how this document should be utilized. Don asked if anyone was present who was involved in the completion of the 1999 version of the document to better understand why the change in emphasis from the 1986 version had

happened. No one in the room could recall the rationale for these changes made between versions, though several of the working group members were in attendance.

It was pointed out that the distribution transformer testing per the standard worked well for certain ranges of equipment, but that a large quantity of test units would have to be built to be statistically significant. Additionally, if a full life curve were to be developed, then multiple points (3 or 4) would be required adding to cost and complexity.

Power transformer manufacturers confirmed that such testing for their designs would be impractical, but that they were comfortable with model testing of insulating materials (such as the sealed tube tests described in the Annex). They have done this type of testing over the years to evaluate new materials. It was noted that they need to be in compliance with IEEE standards (as are often requested by customers), and that this standard is impossible to meet as currently written (separate test for each design).

It was voted and agreed that the Task Force on Thermally Upgraded Insulation would have the lead on the inclusion of the performance requirement (to meet or exceed the curve from C57.91) into C57.12.00. This will then leave our working group to update and/or add to the test methods to evaluate insulation systems for liquid-immersed power and distribution standards. This may end up being either two or three methods, which include the distribution model, the sealed tube test and likely one other transformer model.

A brief review on the IEC working group to develop such a new model was discussion by the Chair of that Working Group (Dick Provost), with promises to provide copies of the document to members of the Working Group when allowed to (at the correct stage of the IEC voting process).

With all of this discussed, the Chairman then asked for final discussion on the Title and Scope in order to facilitate a PAR submittal by the October 21st submission deadline.

It was a consensus in the room that the title was OK, but that some tweaking of the scope was needed. The Chairman will try and circulate a proposal to the working group members by the 15th in order to submit the PAR in time.

Work Assignments: The Working Group Chair will send copies of the document to those new members and guests who were not copied after the first meeting in March.

After work begins on the document, the Chair agreed to solicit information from equipment manufacturers who would be willing to share evaluations they have made in the recent past which may apply to this document. A few people in the room noted to the Chair that they had such information.

The meeting concluded at 10:45 AM.

Respectfully submitted,

Roger Wicks
Chairman

Robert Whearty
Secretary

7.10.2.3 WG Temperature Rise Test Procedure in Section 11 of C57.12.90 - P. Payne

The first meeting of the Working Group was held October 6, 2003 at 11:00 am in Grand Salon III at Sheraton Station Square in Pittsburgh, Pennsylvania. There were forty-nine (49) attendees; twenty-seven (27) of which requested membership. *Subsequent to the meeting, one additional person requested membership.*

The Chair outlined three work items:

1. Standardized methodology for determining the cooling curve.
2. Whether or not the time for resistance measurement after shutdown should be reduced from 4 minutes to 2 minutes.
3. Proposal for revision of 11.5.2.1.

Item 1: The Chair briefly summarized the Cooling Curve Survey. The level of response being low did not provide sufficient data for analysis. The Chair will review the survey documentation to identify methodologies detailed and provide this information to the Working Group.

Item 2: The attendees agreed that the time for measurement of resistance after shutdown should not be decreased from 4 minutes to 2 minutes based upon various factors that affect the time for winding stabilization including:

1. Transformer size and winding type.
2. Transformer parameters (R, L and C)
3. Manufacturer's measurement equipment.
4. Time required to safely disconnect connections (~ 1.5 to 2 minutes).

It was noted that the settling time for delta connected windings could be 10 to 15 minutes. This time can be lowered if the delta is broken. The delta winding has a long time constant due to high inductance and low resistance. The time constant can be decreased by reducing inductance either by polarization of saturation of the core.

Joe Foldi and Thang Hochanh will prepare an explanatory clause of the factors that affect time to stabilization.

Item 3: The chair will poll the Working Group members on the proposed change to clause 11.5.2.1.

There being no other business, the meeting adjourned at 11:50am.

Respectfully submitted,

Paulette A. Payne,
WG Chairperson

7.10.2.4 TF Defining Thermal Upgraded Insulation - D. Platts

Several members of the subcommittee and many guests met on Tuesday October 8, 2003, to review efforts to find a definition of thermally upgraded insulation. Attendance was 46.

Minutes of the March meeting in Raleigh were approved.

Harold Moore reported on Westinghouse research test results for hundreds of tests at 120C for the upgraded paper, vs. the 105C for standard kraft paper. The aging of the upgraded paper was not greater than the aging of the old paper.

Later testing programs demonstrated the improvement in aging at elevated temperatures as found during overloads. These were sealed tube accelerated aging tests. The end of testing was a 50 % retention of degree of polymerization. At 150C, the base paper had a life of 80 hours, while the upgraded paper lasted 675 hours.

He also provided curves from English studies that showed an improvement in the aging rate of upgraded paper when controlled moisture was introduced. Another curve demonstrated the improvement of aging with elevated oxygen content.

Tim Raymond reported that he found a GE paper that compared the aging of Permalex insulation vs. kraft paper. It also includes information on the nitrogen testing to confirm the upgrading process. The curves in that paper were similar to those Harold presented.

Tom Prevost presented review of the temperature requirements. He also showed a curve provided by P McShane of Cooper test results comparing loss of tensile strength vs. aging at 150C

He explained that Weidman is performing aging tests on insulation samples in sealed aging tests where the chemical content of the upgrading additive was varied, and the measured nitrogen content varied. He expects to have the results to report at the next meeting.

Tom provided a draft definition for consideration.

> Thermally Upgraded Paper
> Cellulose based paper which has been chemically modified to reduce the rate at which the paper decomposes. Ageing effects are reduced either by Partial elimination of water forming agents (as in cyanoethylation) or by inhibiting the formation of water through the use of stabilizing agents (as in amine addition, dicyandiamide). A paper is considered as thermally upgraded if it meets the life criteria as defined in ANSI/IEEE C57.100; 50% retention in tensile strength after 65,000 hours in a sealed tube at 110C or any other time/temperature combination given by the equation:
>
> $$\text{Time (hrs)} = e^{(15{,}000/(T+273)-28.082)}$$
>
> Because the thermal upgrading chemicals used today contain nitrogen, which is not present in Kraft pulp, the degree of chemical modification is determined by testing for the amount of nitrogen present in the treated paper. Typical values for nitrogen content of thermally upgraded papers are between 1 and 4 percent, when tested per ASTM D-982.

The group discussed a variety of topics.

- Other chemicals are used for upgrading paper, should we test for them? --No support for that.
- Since the process used to apply the chemical to the paper can affect the test results, should we also require an aging test to confirm the thermal upgrading? --No we already have C57.100, do not need to develop another testing procedure.
- We confirmed again that the existing C57 documents do not contain sufficient information to eliminate the need for the definition.
- Review of the differences in the temperature and performance requirements in IEC and IEEE.
- Since European papers are also described as upgraded, how do we know that the performance of North American papers are better, (lower aging rates) --Papers collected for the TF all demonstrate the improved aging performance.
- Is the Task Force to define thermally upgraded paper or thermally upgraded insulation? --Chair selected title arbitrarily, pressboard products are not usually upgraded, and are not usually exposed to the elevated temperatures. Definition will be for thermally upgraded Paper.
- Discussion of the fact that the loading guide has moved from discussion of loss of tensile strength to DP when discussing aging, while Thermal Evaluation guide 57.100 still refers to tensile strength, and only mentions DP as another way to evaluate aging of cellulose. –This will need to be addressed by appropriate working groups.
- Discussion about the fact that it is very confusing to try to compare IEC to IEEE requirements because of the use of temperature rises, and varying standard ambient. Suggestions that we should move from rises to absolute temperature values. –This may be addressed by appropriate working groups.

Frank Heinricks made a motion to accept the proposed definition after removing reference to C57.100. Discussion centered on having that reference to tie the definition into the testing procedures to evaluate aging. The motion was not seconded.

Tom Provost made a motion to accept proposed definition as stated. It was seconded, and received unanimous support.

Don Platts proposed inserting the definition into C57.12.00 as a new clause 5.11.3. He also suggested removing the requirement that the insulation system meets the aging criteria in the definition from c57.100 which is a guide for performing thermal evaluation testing, and placing it into the new clause.

Discussion again followed on the expected minimum insulation life value of 65000 hours based on tensile strength vs. 85,000 hours based on DP measurements.

Work will be done before the next meeting to try to resolve those questions, and to develop a viable proposal for these changes to C57.12.00

The meeting adjourned at 9:18 AM.

Respectfully submitted by:
Donald W. Platts, Chair

7.10.2.4.1 Discussion during subcommittee meeting

Jin Sim asked if the reference to C57.100 (another IEEE document) within the definition would be acceptable to IEC? Hasse Nordman commented that he thought it would be fine, but he will check and provide a response.
Questions were raised about utilization of the word “paper” in the definition.

Comments: Thermal stability is design independent. Will it exclude those who use pressboard - Should we change 'paper' to 'cellulose'? Is tensile strength a relevant test criteria to use for a pressboard insulation material, since is not usually used in tension?

Tom Prevost reiterated statements from the TF meeting that no manufacturers are making thermally upgraded pressboard. So, right now there is no use of thermally upgraded pressboard.

Subcommittee Vote = 41 to 0 against change to cellulose.

7.10.2.5 WG Thermal Duplicate Guide PC57.145 B. Beaster

The working group met on Tuesday, October 7, 2003 with eight members and 22 guests attending. An agenda, a copy of the Spring 2003 meeting minutes, a proposal to address ballot comments on draft 6.0, and a rough draft 7.0 of the guide were electronically distributed to the working group prior to the meeting. Additional paper copies were available for guests. After introductions, the Spring 2003 meeting minutes were approved as issued.

To resolve several draft 6.0 negative ballots related to the need for detailed thermal evaluation on distribution class transformers, the aforementioned proposal was offered. A general recommendation was proposed to eliminate the evaluation of thermal duplicates and provide the thermal results without adjustment from the previously tested transformer or not to provide any thermal data unless specifically requested by the customer's specification. There was consensus among several distribution manufacturers that this has been a generally accepted industry practice, at least for certain transformer sizes. In order to accommodate both the need for detailed thermal evaluation when requested and when a simpler approach is acceptable, Subhash Tuli suggested a footnote be added to Table 2 (where tolerances for transformer size are outlined). This footnote would clarify what would be provided to the user if no specific thermal evaluation were specified. This keeps the guide format roughly the same. The next guide will incorporate this suggestion.

Another general recommendation was proposed for the larger transformers, 5 to 100 MVA. Ballot comments on draft 6.0 were received regarding the comparison of design values of the new transformer to the tested values of the thermal duplicate transformer as a necessary selection requirement. These comments came from designers who preferred to compare design-to-design characteristics. Malcolm Thaden and Don Fallon stating the preference to use actual test data contested this proposal. In the discussion, it was felt that test data eliminated one degree of variability between the original design calculation and test results. This may be especially true for those who haven't refined their thermal models to predict thermal results with higher accuracy. Hasse Nordman commented that many designers of larger transformers adjust new calculations based on test results of the proposed thermal duplicate so some of this variability is removed. It was agreed to keep the comparison as design-to-test for the added confidence it provides.

Jeff Ray expanded on this ballot 6.0 comment regarding the lack of consideration of hottest spot rise in the guide. Discussion followed about the desire to use the latest FEA techniques to the 'pool' of tested transformers to pre-quality some selections [it was suggested that some of these original

transformers may not meet the latest hottest spot requirements]. The next draft will incorporate the hottest spot rise with the other thermal performance calculations.

An issue of how to address using 55/65°C rise transformers for thermal duplicates of 65°C designs was raised by Raman Subramanian. Based upon the current limits in Table 2 of the guide, this comparison is not clearly defined. Further study will be needed prior accepting or rejecting this comparison.

Don Platts raised the final issue addressed at the meeting. Don commented that the latest standards define the requirement to have detailed thermal models and calculations supported by test for hottest spot temperature calculation. If this has been developed, then the manufacturer already has the capability to provide all the thermal performance information required by the guide [in order to calculate hottest spot, winding gradients and oil rises are needed as intermediate steps]. Don suggested that the Insulation Life Subcommittee be polled to assess the need for continuing to develop a thermal duplicate document with this methodology [As chairman of the Insulation Life Subcommittee, Don Platts will conduct this poll of the subcommittee]. This poll will be done in parallel with continued revision of the document and feedback will be reviewed at a future working group meeting.

Time had expired and the meeting adjourned.

Respectively submitted,

Barry L. Beaster
Chairman

7.10.2.6 TF Revision to Temperature Ratings in C57.12.00 D. Marlow
D. Platts

The task force met on Tuesday, October 7, 2003 at 11:00. Attendance was 9 members and 25 guests. Dennis Marlowe, the chair, could not attend the meeting. Don Platts led this meeting.

Minutes of the March meeting in Raleigh were approved.
Prior to the meeting a survey of the Insulation Life Subcommittee was conducted to determine if the proposed topics were still recommended for addition to the standard, and where acceptable as proposed.

During this meeting, we reviewed the comments that were submitted with the negative votes.

The first proposal -- to allow an exception to the allowable average temperature rise for transformers built with pumped directed oil flow to harmonize with IEC. Our review found several of the comments to be unrelated to the question of inserting this wording, or were not valid. We did find that the reference to limiting the top oil temperature to 65C would not agree with IEC and should be reviewed.

The second proposal deals with transformers built with concentric winding arrangements where windings may be situated one above the other. It will state that the separate temperature test results for the windings shall be averaged and then compared to the allowable temperature limits for average winding rise. The hot spot limit is not to be altered.

Again the comments submitted discussed the potential problems with this type of winding construction, but did not address temperature rise issues. The consensus was that there is concern about the temperatures that could be found under unequal loading conditions, or with only one of the windings loaded. Therefore, we recommend that the proposal be changed to state the hottest spot limit of 80C will still apply to each winding, and should be evaluated for all loading conditions.

Those attending the meeting were polled again to determine if we should proceed with the plans to insert these items into C57.12.00.
For the first proposal only ½ expressed an opinion with the vote being split between the yes and no votes.
For the second proposal, after we added the requirement to evaluate the hottest spot limit for all loading conditions, about ¾ voted to approve, with none voting to eliminate it.

This information will be relayed to Dennis for his discussions with those submitting the comments, and for future task force activities.

The meeting adjourned at 11:51 AM.

Respectfully submitted by:
Donald W. Platts, for Dennis Marlow, Chair

7.10.2.7 WG Revision to Loading Guide C57.91 T. Raymond

The Working Group met at 2:00pm on Tuesday, 7 October 2003 with 74 total attendees, 21 were members and 53 guests.

C57.91-1995 Reaffirmation (w/ Corrigenda)

- Reaffirmation ballot opened 11SEP03
- As of 07OCT03, 97.1% Approve with 68.2% return
- Ballot closes on 11OCT03

Several comments have been received, and will be reviewed for the revision. A significant portion of these comments were concerns over the base document/errata/corrigenda relationship. One negative ballot was cast due to some typos in the base document that were corrected by the errata sheet issued several years ago. This errata was not, for some reason, provided with the ballot. The Chair has been informed by IEEE representatives that the errata will be combined with the new version of the published document.

C57.91 Revision

Organization

Volunteers were solicited to sign up for the following three task forces:

- Risks – Identify and evaluate risks of elevated temperatures
- Temperature calculation – Develop practical thermal model of in-service transformers and associated ancillary equipment
- Ratings – Develop loading criteria and methodology for mitigating loading risks in everyday use

The purpose of these "task forces" is to provide a pool of expertise, to which a particular section or issue will be assigned. Several volunteers have come forward, and emails will be sent in the coming weeks to charge each group with some initial tasks.

Changes from 1995 revision to Draft 2

The following is a list of changes made between the original document and the last draft (Draft 2) produced by Linden Pierce. The working group re-examined each item to ensure that the group was still in agreement with these initial changes.

1. **The scope was expanded to include voltage regulators**
   - Discussed at previous meeting. Keep addition of voltage regulators.

2. **The scope was expanded to include silicone and high fire point fluids.**
   - Discussed at previous meeting.

Comment from Lin Pierce: I wish that the WG would reconsider including silicone fluid and HTHC in the scope of the documents. In looking at the minutes I feel the WG got sidetracked by the discussion of vegetable oils, etc.

Both silicone fluid and HTHC have IEEE standard numbers and ASTM numbers. But more importantly they are included in C57.12.00. Vegetable oils are not.

I believe the changes to include them are EASY. In referring to C57.91-1995, they are already included in the Annex G equations. In regard to Clause 7 all you have to do is adjust the thermal capacity equations in Clause 7.2.5. All you have to do is multiply the factors in front of the gallons of fluid by the specific heats of the new fluids divided by the specific heat of mineral oil. These specific heats are given in the ASTM specs. No other factors are affected.

I suspect that there will be little or no change for HTHC.

There is a large group of industrial users that do not attend our meetings but use our standards. If we exclude their transformers they are going to write their own standards.

There was some discussion at the meeting that this was not a simple task. For now, maintain original scope of mineral oil only.

3. **Insulation life was clarified to be 180,000 hours as given in C57.100-1999.**
   - The sections on loss-of-life will be reviewed and revised. In particular, the justification for the selection of a specific life time or endpoint criteria must be given.
4. **The material on gas evolution in the prior guide was deleted and new material added.**
   - Old material on gas evolution was unusable in the form given. The new material shows promise as a practical evaluation method, however some aspects need to be discussed further. In particular, the gas evolution temperature is highly dependant upon moisture content of the cellulose. The determination of insulation moisture content is difficult and a subject of great debate within the committee.
5. **The temperature prediction methods were changed as described previously.**

- This will be changed, as described later.

6. **Suggested loss of life limits were added for power transformers.**
7. **Temperature limits for bushings for power transformers were added**
8. **Limits were added for loading of 55 °C transformers.**
9. **Many normative annexes were moved into the main document.**

- There is a great deal of excellent content in the Annexes of the 1995 standard. At minimum, the Annex discussing the effect of overload on bushing, LTCs, CTs, etc. should be brought to the main body of the guide. Some of the more esoteric content will be left as Annexes.

10. **The effect of over or under excitation, non-sinusoidal load currents were incorporated into the temperature equations.**

- Most of this content will be moved to an Annex, to make the body of the guide easier to understand and more readable. The consensus was that these effects are rarely included in rating calculations. However, the subject of over-excitation has been brought to the forefront by the tutorial on overvoltage requirements given at this meeting on Monday. The working group should review this subject.

11. **Information on frequent short term overloads greater than 2 times normal was added.**

- This section will be removed in the next draft.

12. **Numerous editorial changes were made to improve the guide.**

Where to go from here?

Little work was done on the actual document since the last meeting. Some decisions need to be made on how much revision is needed. One option would be to simply start with the 1995 revision and address comments and issues raised regarding that document. The Chair believes the 1995 revision has some shortcomings, so more than this will be necessary. As a start, the chair recommended the following:

1. A refined and expanded section detailing the risks of overload. Essential to any discussion of transformer loading is the evaluation of risk. The maximum load a transformer can carry is the highest load that maintains an acceptable risk level. Traditionally, an acceptable risk level is maintained by setting limits on temperatures and loss of life. Currently, section 5.1 includes a list of possible risks of elevated load levels. This list should be "fleshed out" to add more details of each reasonable risk, giving the user of the guide a feel for the potential consequences. These risks could be divided into 2 categories of risk: short-term and long-term.
2. The temperature calculations, as outlined in draft 2 section 10, are unwieldy and complex. In my opinion, it is not very usable. I am well acquainted with the thermal models, and I still get confused when reading through it. The temperature calculations should be reduced to two models: 1) a model similar to Annex G of the old guide, with some minor simplifications to make it more practical. 2) a top oil only modification to the first model. These models need to be practical and efficient for all users of the guide. A spreadsheet implementing these models is available on the WG web site.
3. A note should be added in the discussion of loss of life that the loss-of-life equations represent a moisture content of 0.2%-0.3% by weight and that transformers with higher insulation moisture contents may exhibit significantly higher rates of aging.

4. Sections 11 and 12 should be re-thought. These sections should be updated to include current utility practice.

Following this, the membership made the following comments:

- Jin Sim expressed concerns over expanding the scope of the document to cover liquids other than mineral oil. For the time being, the scope will be restricted to mineral oil only. If it is decided at a later date that other liquids can be incorporated, the issue can be raised again then.
- T. V. Oommen gave some background on the his bubble formation research.
- Following the discussions during the WG meeting for the definition of thermally upgraded insulation, it was recognized that the areas of the loading guide specific to thermally upgraded paper are not properly identified.
- Hasse Nordman mentioned evidence that distribution transformers rated < 2500kVA do not exhibit the same rapid duct oil rise that is seen in power transformers. These transformers most closely followed the standard Clause 7 equations. As a result, two models may be recommended; one distribution transformers <2500kVA and one for transformers >2500kVA.
- Following Dr. Preininger's excellent tutorial presentation on Monday regarding overexcitation, the impact of system voltage and overexciation on loading capability should be reviewed, and at least merits a mention in the guide.

Schedule

Have Draft 3 with first cut at the above, along with any other suggestions and comments incorporated, by the next meeting. With any luck, I'll send this out early so the WG members have sufficient time to review.

I hope to make better use of the time between meetings by communicating more via email and using the various electronic tools available. I will find out what's available and try to get it set up in the near future.

The meeting was adjourned at 3:00pm.

Respectfully Submitted,

Tim Raymond
Working Group Chairman

7.10.3 Old Business

None

7.10.4 New Business

Jin Sim – Noted that moisture content in operating transformers has become an active issue in the industry. There are several papers around that discuss the issue and various testing methods, such as the Recovery Voltage Method.
He suggested that the transformers committee look at initiating a project, and that the Insulation Life, Insulating Fluids and probably Dielectric Tests Subcommittees would all need to participate.

D. Platts-Reported that at this meeting, he had been given two papers regarding Distribution Transformer Loading, and Test procedures to test under overload conditions. They were described as being similar to existing procedures in our documents. He will review them to determine if we need to work with this information and if an existing WG or TF could include this.

The Chair mentioned that the Minutes had been posted on website, and the Agenda was also posted on website but not mailed to members.
It was suggested that the members should get an email reminder to check website. There was overwhelming support, and we will follow that practice from this point on.
Another question was raised, is Access to the Web a problem for members? Everyone appears to have access to the web.

The meeting Adjourned at 9:16

Donald W. Platts
Chair

Eric Davis
Secretary