9.2 Performance Characteristics Subcommittee – Stephen Antosz, Chairman; Ed teNyenhuis, Vice-Chair; Craig Stiegemeier, Secretary

9.2.1 Introduction / Attendance

The Performance Characteristics Subcommittee (PCS) met on Wednesday, March 10, 2010 with 62 members and 43 guests in attendance. 8 of those guests requested membership. Prior to this meeting, the total membership of PCS was 121 members; therefore with 62 present, we did have a 50% quorum.

9.2.2 Approval of Meeting Minutes

The minutes of the last meeting in Lombard, IL were approved as written.

9.2.3 Chairman's Remarks

9.2.3.1 Administrative Subcommittee Notes

Upcoming IEEE – PES Meetings

- IEEE T&D Conference & Expo: April 19-22, 2010 New Orleans, LA
- PES General Meeting: July 26 – 30, 2010, Minneapolis, MN. There will be 16 papers presented there; sponsored by the Transformers Committee.
- Next Transformer Committee meeting dates and locations is as follows:
  - Fall 2010, October 24-28, – Toronto, ON, Canada; Hilton Hotel Downtown; hosted by Trench Ltd.
  - Spring 2011, April 10-14, – San Diego, CA; Catamaran Hotel at Mission Bay; hosted by San Diego Gas & Electric.

Quorums and Rosters:

1. The Officers feel that the best way to get a quorum is to have a bona fide roster, representative of **active** members.
2. WG Chairs (or Secretary) must maintain accurate and up-to-date list of active members and attendance. AM system has tools to make this easy.
3. Admin SC is working on a Working Group Practices & Procedures (P&P) Manual, which will contain some guidance on this subject.
4. The consensus seems to be that people who have not attended the previous 2 meetings of a WG should be removed from the roster, unless they express a desire to stay on and participate. An option is to consider them a 'Corresponding Member'.
5. New members should not automatically be added unless there is a commitment of participation.

Update on status of revisions of C57.12.00-2006 and C57.12.90-2006:

- 12.00 is in (final) recirculation.
- 12.90 has been waiting for 12.00 to catch up, and now is ready for final recirculation prior to submittal to IEEE.

New WG or TF Chairmen should see Ed Smith or Greg Anderson for a copy of the handbook on Robert's Rules of Order.

The Chair accepted Craig Stiegemeier as the new PCS Secretary. Thanks to Craig for accepting this post.

9.2.4 Working Group (WG) and Task Force (TF) Reports

9.2.4.1 WG on Loss Evaluation Guide C57.120 – Don Duckett, Chair; Alan Traut, Vice-Chair

PAR Status: PAR Request Submitted to IEEE

Attendance: 54 Total. 14 of 25 Members present. 1 Requesting membership. 40 Guests.

Chair reported that Don Duckett, WG Chair, was not able to attend this meeting due to sudden, unexpected health reasons and that Al Traut, WG Vice-Chair, would preside at this meeting. Alan Wilks volunteered to serve as acting Secretary for this meeting.

Attendance of membership was taken and 14 of 25 members were present therefore a quorum was established. The minutes of the Fall 2009 Lombard meeting were approved as submitted. A request was made for disclosure of any patents that may be related to the work of the WG, and there were no responses to the request for disclosure.

Chair reported that the PAR for revision of C57.120 has been submitted to IEEE and is on the March 24, 2010 NESCOM agenda. The title, scope and purpose as submitted in the PAR are as follows:

Guide for Loss Evaluation of Distribution and Power Transformers and Reactors

1.1 Purpose
This guide offers a methodology to determine and thereby specify the economic value of no-load, load, and auxiliary losses. The use of this guide allows manufacturers to tailor the design to the unique economic situation of each user, and allows the user to evaluate multiple designs.

1.2 Scope
This guide covers the economic loss evaluation of liquid filled and dry type distribution and power transformers and reactors.
The following participants volunteered to assist in the development of C57.120/D1 prior to the Fall 2010 Toronto meeting. David Harris, Jerry Allen, Steve Shull, Jose Izquierdo, Jerry Murphy, Gael Kennedy, C.R. Bell.

There was no other new business.

9.2.4.2 PCS WG on "Test Code C57.12.90" – Mark Perkins, Chairman; Kirk Robbins, Secretary

The meeting of the Working Group on PCS Revisions to C57.12.90 took place at 9:30am on March 8, 2010. The Chair for the meeting was Mark Perkins (Steve Antosz substitute as Mark could not attend) and Craig Stiegemeier performed Secretary duties. (Kirk Robbins was also unable to be in Houston)

1. Introduction of members and guests
   A total of 71 people attended the meeting, of which 35 were members and 36 were guests of the Working Group.
2. Patents
   - A call for knowledge of any patent issues was made, and no patent issues were identified by any of the attendees.
3. Approval of minutes of the Lombard Meeting

- Motion and second, minutes approved unanimously

4. Old Business
   - Revision of Section 6 & 7. Polarity and Phase relation tests and ratio tests – the latest changes still need to be surveyed.
     - Clause 7.1.4 Three-phase transformers with inaccessible neutrals - ratio tests was reviewed – method B will be removed from the document to address Dennis Marlowe's concern, so the new method A will be the only one in the standard.
   - Section 12 on short circuit testing – Marcel Fortin
     - Marcel's Task Force has finished their work – he was not at the WG meeting so we could not clarify the concern. He'll need to provide more information if anything else needs addressed.
   - Testing of buried tertiary windings – Ratio, polarity and resistance, review suggested change submitted by Subhash Tuli.
     - Subash suggested that buried tertiary windings be tested for:
       - Turns Ratio Test
       - Insulation Resistance (Megger) test
       - DC Resistance Test
     - Steve Snyder noted that this was brought up some time ago in the C57.12.00, and the tests were not identified as they didn't want to call out tests that cannot be repeated in the field. This was addressed and resolved in October 2008.
     - The terms "tertiary" and/or "stabilizing winding" also needs clarified in C57.12.00 as they are not necessarily the same thing.
5. New Business
   - None

9.2.4.3 PCS WG on "Guide for the Application and Interpretation of Frequency Response Analysis for Oil Immersed Transformers", PC57.149 –– Chairman; Charles Sweetser

There were 58 people in attendance.

The first order of business was to show the two slides regarding patents, assurances and inappropriate behavior.

The minutes from the Lombard, IL 2010 meeting were approved by unanimous vote.

Draft 8 was presented to the Working Group, which the final "formatted draft" that that will be submitted for the balloting process.

Peter Balma provided the formatted draft to the group. The Working Group Chair presented a brief report on what had been prepared for this final "formatted draft." The document has not been technically edited or has additional contributions been made this time around. The only changes are as follows:

1.) The member list has been seriously edited (shortened).
2.) Line numbering has been added to each page for reference during balloting process.
3.) Several basic format changes, such as bullets and numbering; nothing technical has been edited.
4.) Add missing Introduction Section to the document format requirement:
"Frequency Response Analysis (FRA) testing has gained popularity for assessing the mechanical integrity of oil immersed transformer. Due to limited understanding and available information regarding FRA requirements and specifications for instrumentation, procedures for performing the tests, and analysis of results, the

Performance Characteristics Subcommittee formed the Working Group PC57.149. The primary objective of the Working Group PC57.149 was to compile and validate FRA experiences and techniques to develop a trail-use FRA application and interpretation guide that would benefit the industry".

Technical Comments Submitted:

- The definition in Section 2.24 - Winding Self Admittance is misleading for the FRA application; it is recommended that it be removed.
- We have changed the "wording" from Transfer Admittance TA/Inter-Winding IW to Capacitive Inter-Winding and Inductive Inter-winding. All configuration tables need to be updated
- Add a note: describe how an Auto tertiary is connected during measurement, e.g. if only two terminals brought out they should be connected together, but preferably not connected to ground.
- The applied voltage can influence the Open measurements at low frequencies. The applied voltage level should be stored in data file.

Editorial Comments Submitted:

- Add to end of statement: "Refer to clause 4.7 for details."
- Referenced clause should be "Clause 4.4."
- Some may find the explanation for item c objectionable; perhaps it could be changed to: "for procedural documentation and auditing" or something similar.
- Short circuit impedance is listed, but the relationship to FRA as noted in 6.2.2 is not provided.
- Figure 5 – the dotted box section of the figure indicates an amplitude change – to see it I had to magnify the figure to 200% - so it's not going to be very apparent once the standard is published if the intent was to show a change in impedance – if this is the case, we probably should include that in the figure title.

The ballot process will be initiated once the changes are made.

9.2.4.4 PCS WG on "General Requirements C57.12.00" – Steve Snyder, Chairman; Enrique Betancourt, Secretary

The WG met at 3:15 PM on Monday, March 8, 2010 with **30** members and **54** guests present. The current Working Group membership stands at **87** members ; therefore we did not have a quorum. The chairman stated that he will review and revise the working group roster before the next meeting to limit the membership to active participants. The following seven (7) guests requested membership, however new members will be accepted only after attending two (2) consecutive meetings. Therefore, their membership will be effective after attending the next WG meeting:

Jose Gamboa	Siemens
Krishnamurthy Vijayan	CG Power System Canada
Peter W.Derner	ABB Inc.
Roger Verdolin	ENMAX
Shankar Nambi	Bechtel
Steve Schroeder	ABB
Steven Schappell	Waukesha Electric Systems

Following introductions, the minutes of the October 26, 2009 Lombard meeting were noted as having been posted on the committee web site since the October meeting, but lacking a quorum at this meeting no action was taken for approval. Working Group members were then asked if anyone was aware of any applicable patent activity that might impact our work. No patent issues were disclosed by anyone.

The chairman provided an update on the latest C57.12.00 ballot. Draft 3 of the Standard was recirculated in December last year, with one new negative received. New draft 4 was launched March 2, closing March 12.

The meeting began with Old Business, WG item 82:

WG Item 82, Clause 7.1.4.4 Stabilizing Windings

Addresses an issue raised in earlier ballot of standard C57.12.00 which requested:

(a) Recommendations for guidelines to determine MVA rating of buried tertiary windings,
(b) To define the conditions under which this MVA is applicable, and
(c) Determine the tests or calculations necessary to prove the tertiary MVA rating.

A report was received from the Tertiary Stabilizing Windings Task Force chairman Enrique Betancourt. Enrique presented a summary of the task force work since the prior meeting, including proposed wording for a new Clause within C57.12.00 that would address the thermal rating of stabilizing windings. It was clarified that the short circuit duty of stabilizing windings was considered appropriately covered within Clause 7.1.4.4 of C57.12.00.

There was some discussion from the floor, addressing a better specification of allowable winding temperatures and additions to clarify what is meant under “unbalanced loads on the main windings”. The chairman encouraged submittal of further comments on the proposed wording, before submitting the new Clause for survey within the Performance Characteristics SC. Further discussion on the same subject would be part of the agenda for the next TF Meeting, scheduled for the following day, March 9, 2010.

The question was raised if the current scope of work for TF Tertiary Stabilizing Windings included the testing of those windings for DC resistance, ratio, phase angle, polarity, etc.. The WG chair reported that subject had already been addressed and resolved within a previous WG meeting, with the conclusion of the WG that a factory test which cannot be repeated in the field is considered a quality assurance test, and does not belong in the standard.

WG Item 87, Table 18 Short-circuit apparent power of the system

This item is based on a comment (negative ballot from 2006) that the system short circuit current levels listed in Table 18 are unrealistically high, leading to designs that may be uneconomical. The suggestion was to limit these assumed fault current levels to 63 kA and lower. This topic was first brought up for discussion at the previous meeting, where it was determined more information was needed for a proper evaluation of the suggestion. Subsequently, the chairman conducted a survey of various participants asking for their input. This feedback was presented in the meeting materials sent to the members, and is posted on the web site. One utility participant explained that the data they provided were for projected values of system short circuit currents expected for the next decades (in order of 50 years), and that today’s figures are about 60% of those levels. Discussion continued on the calculation of short circuit power based on rated system voltage (as shown today) versus maximum system voltage (a possible consideration).

While this feedback is useful, it was felt that additional information is still needed, so the chairman has made a request to the Transformers Committee Standards Coordinator to solicit feedback from other entities outside the Transformers Committee. It is expected that additional information will be available prior to the next meeting, so the topic will be continued in the next WG meeting.

Under New Business, the discussion began with WG item 90:

WG Item 90, Section 4.1.8 Step down operation

This item is based on a comment received during the 2008 ballot of C57.12.00 where the balloter suggested this clause be changed to state : "Transformers shall be designed for step-down or step-up operation or both, as specified by the user." The discussion was open to the floor. A comment was made that there is currently a note on Table 10 (Nameplate Information) in the standard that states: "the nameplate shall state when the transformer is suitable for step-up operation". It was also pointed out that the question on suitability of transformers for bidirectional flow will come up more frequently with distributed generation facilities. Finally, it was stated that the standard should set a basic requirement and not list all the possible options, forcing the user to specify. The general consensus of the WG was for leaving the wording of the standard as it is - no further action proposed.

9.2.4.4.1 Task Force on Tertiary/Stabilizing Windings Enrique Betancourt

The Task Force Group met at 11:00 AM on Tuesday, March 9, 2010 with **16** members and **51** guests present. There were **11** (eleven) guests that stated interest on further participating as members of the Task Force.

Bill Griesacker	Doble Engineering
Eduardo Tolcachir	Tubos Transelectric
Hemchandra Shertukde	University of Hartford
Jennifer Yu	Pacific Gas and Electric
Jose Izquierdo	Siemens Transformadores
Jose M. Lopez-Fernandez	University of Vigo
Kiran Vedante	ABB Inc.
Leandro Paladini	Siemens Brazil
Mark McNally	Kansas City Power and Light
Shankar Nambi	Bechtel Power
Stephen Antosz	Pennsylvania Transformer

Following introductions, with 12 of 24 members present, the minutes from the previous meeting were approved. Working Group members and guests were then asked if anyone was aware of any applicable patent activity that might impact our work. No patent issues were disclosed by anyone.

1. Old Business
The chairman provided a report with the background of the TF and a summary of present discussions, as described next.

The TF Tertiary Stabilizing Windings was formed to address an issue raised on an earlier ballot of standard C57.12.00, which requested:
a) Recommendations for guidelines to determine MVA rating of buried tertiary windings,
b) To define the conditions under which this MVA is applicable, and

c) Determine the tests or calculations necessary to prove the tertiary MVA rating.

Following the progress of the TF activity, a new version of the proposed clause for thermal rating of Stabilizing Windings was presented for discussion. Following text includes in bold the changes proposed during the meeting:

> "Stabilizing windings shall be designed to withstand thermal duty of the circulating current resulting from temporary load and, or voltage unbalance on the main windings, as specified by the user. Main windings' unbalanced load currents and, or supply voltages should be specified in magnitude, angle and duration by the user, to allow verification of compliance with maximum allowable temperatures according to C57.12.00.
>
> In the event no continuous thermal duty for the stabilizing winding can be established from the user's specification, the manufacturer shall design the stabilizing winding considering the circulating current resulting from a full single phase load in the **largest** main secondary winding (33.3% of the transformer rating, or 33.3% ~~equivalent two winding rating~~ [**to rephrase this statement**] of autotransformer) and infinite bus supply from the primary winding.
>
> The manufacturer shall verify transient and continuous loading calculations for stabilizing windings temperatures, in order to demonstrate adequacy to requirements established in foregoing clauses. Initial conditions for those calculations will be considered as the transformer or autotransformer operating at its maximum continuous rating, before switching to the single phase loading conditions specified. Manufacturer to provide the user the calculated values of hotspot and average temperatures for stabilizing winding to demostrate that they comply with maximum allowable temperatures."

As a result of the discussions, some editorial changes will be addressed by volunteers within the TF membership, and the new Clause will be circulated within the PCS for further comments.

2. New Business

2.1 A new question was then discussed: Should every delta-connected Tertiary Winding comply with what is established here for Stabilizing Windings?

The TF Chairman recommended not to change the proposed clause, as for the case of Tertiary Windings, the performance under balanced loads is specified by the users, and tested by the manufacturers. Further, as tertiary windings have terminals brought out, their performance can be tested for every combination of balanced and unbalanced loads. There were no further comments.

2.2 Discussion on the extension of the scope for the TF towards development of an Application Guide for Tertiary and Stabilizing Windings, or to start with preparation of a "Position Paper", to call attention upon the relevance of our subject matter.

A quick count within attendance gave 19 people in favor of the Guide, none for the Position Paper, and two people for "no further action".

The request will be submitted to the chairman of the PCS for evaluation.

For the next meeting of the TF, one of the members (Xose Lopez-Fernandez) will present a report on application of tertiary and stabilizing windings within an european utility, and the chairman of the TF will request inputs to compose a brief tutorial on modelling of tertiary windings. Mr. S. Patel, TF member, made a paper on Application of Tertiary Windings available for the rest of the TF participants.

In preparation for a positive response regarding development of the new guide, some topics on the New Guide were just sketched:

1. Need for the Guide
2. Function of the Stabilizing and Tertiary windings
2.1 In the Transformer (Models)
2.2 In the Network
3. Application of SWs and TWs
3.1 Network interconnection transformers and autotransformers (1P, 3P)
3.2 Primary Distribution transformers (3P)
3.3 Windfarm Collector transformers (3P)
3.4 Other
4. Behavior (performance) of transformers with SW/TW under short circuit
5. Behavior under transient and continuous unbalanced conditions on main windings
5.1 Unbalanced loads
5.2 Unbalanced voltages
6. Behaviour of Transformers and Autotransformers without SW/TW
7. (Recommendations for design and testing?)

The meeting was adjourned at 12:00 PM.

After the minutes were read at the PCS meeting, a discussion of scope definition of this Task Force was held. The SC Chair asked the TF Chair to come up with a scope definition and to bring it to the next meeting to review and accept or modify.

9.2.4.5 WG on "IEEE Standard Requirements, Terminology, and Test Procedures for Neutral Grounding Devices", PC57.32 – Steve Schappell, Chairman; Peter Balma, Vice-Chair

The WG was called to order at 9:30 AM on March 9, 2010. There were 21 attendees: 7 members and 14 guests, with 2 requesting membership. Copies of the previous minutes and Draft 8 of the standard were distributed.

1. IEEE patent policy was reviewed and the group was asked if there were any disclosures. There were none.
2. It was determined that a quorum was present.
3. The minutes from the Lombard, Illinois meeting on October 27, 2009 were approved.
4. The PAR has been modified to remove capacitors from the scope, and was approved. A PAR extension was also requested and approved.
5. Copyright request will be needed for use of material on ground fault neutralizers. Peter Balma volunteered to initiate this process.
6. The group would like to have a straw ballot of the Performance Characteristics subcommittee by June or July of this year
7. The working group had an extensive discussion concerning Draft 8 of the document.
   - Table 8, the dielectric table for this standard, was discussed in detail. It was suggested that a single table trying to describe all devices might not be practical.

After group discussion, a motion was made to separate the tables for each device and to include them in the appropriate clauses. The motion was seconded, and after discussion, was approved by a majority vote. The following individuals volunteered to develop the new tables.

- Resistors Sergio Panetta
- Ground fault neutralizers -Richard Dudley/Klaus Pointner
- Transformers Devki Sharma

Combination devices will refer to the individual devices of which the combination device is composed. Based on this decision the need for Table 6 was questioned, and Sergio Panetta volunteered to provide an example of including this table with the dielectric table he is preparing for resistors.

- Limiting temperatures and multipliers, Table 9 and 10 of the document, were discussed. Can the table be updated and/or if it should be eliminated. It was indicated that grounding transformers manufacturers are still using the table, but that manufacturers of other grounding devices were not utilizing it. There was also discussion of related Table 4, and it was suggested that the table could be removed and clause 6.2.1 revised accordingly. It was decided that the information could be provided in different formats for each device. The following individuals volunteered to develop new input.
  - Resistors Sergio Panetta
  - Reactors Michael Sharp
  - Ground fault neutralizers -Richard Dudley/Klaus Pointner
  - Transformers Sheldon Kennedy
- There was a discussion of Table 1, insulating material, and it will be reviewed with IEEE Std.1. Steve Schappell volunteered to do this.
- The subject of minimum temperatures for grounding devices was reviewed. A motion was made to utilize -20C as the usual minimum temperature condition for grounding devices, and was approved. Additional wording will be added to Clause 4 to clarify usual and unusual operating temperatures.
- The last sentence in Clause 8.2, stating equipment specific hot spot temperatures, will be eliminated. In addition, the paragraphs discussing DC field-testing in clause 16.2.1.3 will be removed.
- Other general updates and revisions to Draft 8 were reviewed.

8. It was requested that all that volunteered to provide input at this meeting, please complete their assignments within a month and sent to the chair or vice-chair.

9.2.4.6 TF on "Semi–Conductor Rectifier Transformers", C57.18.10 – Sheldon Kennedy, Chairman

The WG met on Tuesday, March 9, 2010 at 3:15 PM with 10 members and 5 guests present. Sheldon Kennedy chaired the meeting. We did not have a quorum.

The IEEE disclosure statement was discussed. There were no patents pertaining to this standards work for which any members had awareness.

The minutes of the October 27, 2010 meeting in Lombard, Illinois were read but could not be approved due to the lack of a quorum..

This TF is to work on a few special items while we still have the group together.

There was a discussion about the standards being written in the Vehicular Transportation Society of IEEE. A traction rectifier transformer standard, rectifier standard and many C37 switchgear standards are being revised by this organization with emphasis on the needs of the transit and rail industry. Concerns about duplication of standards and conflicts in the standards were raised. This standard has been in pre ballot for over a year and nobody knew when it may actually come to ballot.

The chair announced that the IEC Converter Transformers for Industrial Applications IEC 61378-1 standard is under revision again. The chair discussed some of the highlights of their latest draft. We will ask IEEE to request a copy of their work for harmonization with our document. To date, I have not been able to get approval to share the information.

The chair made a proposal for a clause on electrostatic ground shields. After much discussion, Dhiru Patel and Subhas Sarkar volunteered to offer some revisions to this proposal and submit them before the next meeting.

Phase shifted secondary windings with multi-pulse secondary windings such as 18 pulse, 24 pulse, 36 pulse, 48 pulse and 54 pulse are becoming a great part of the motor drive transformer applications, as well as higher current rectifier transformers. There is no discussion about these in the present C57.18.10 and this will need some work. We began to discuss how we would incorporate these circuits into C57.18.10 since this is all relatively new work since the document was originally published in 1998. Numerating additional rectifier and transformer circuits was discussed. At our meeting in Lombard, Dhiru Patel informed us that there were patents on a lot of the methods of phase shifting windings by the drive and rectifier companies. Not wishing to have a problem with patents, the Task Force decided to just propose general discussions of phase shifting windings and not give any of the exact phase shifts that are being used in industry. This seemed the best way to accomplish this. The Chair submitted a proposal of a general discussion of the topic for the Task Force to consider. It was well received but needs some polishing. Members will give comments to the chair and a more complete proposal will be submitted by next meeting.

There was a discussion about determining the losses in specific regions due to harmonics. IEC has tackled this subject already in an Annex and this should be done in our next revision, as well. An example of the response of the windings to the 5^{th}, 7^{th}, 11^{th}, and 13^{th} harmonic, for instance, is much different than the fundamental current when we examine the leakage fields and loss densities with finite element methods.

There were no further comments. Since we didn't have a quorum, we couldn't make a motion to adjourn, so we all just faded away at 4:15 PM.

9.2.4.7 WG on "Switching Transients Induced by Transformer / Breaker Interaction", PC57.142 – Robert Degeneff, Chairman; Bill Griesacker, Secretary

1. There was no meeting of the working group this session. Bob Degeneff provided a progress report to update the status on PC57.142.
2. The guide was recirculated a second time between January 29 and February 10, 2010. There were 154 eligible voters. 134 voted with 118 voting affirmative, 4 negative, and 12 abstentions. 9 comments were received. This was a 96% affirmative vote.
3. The guide was recircutated a third time between February 25 and March 7, 2010. There were 154 eligible voters. 135 voted with 120 voting affirmative, 3 negative, and 12 abstentions. 15 comments were received. This was a 97% affirmative vote.

4. The guide will be recirculated at least once more before the next meeting in a effort to conclude the balloting portion of the process.

9.2.4.8 WG on "Loss Tolerance and Measurement" – Ed teNyenhuis, Chairman; Andy Steineman, Secretary

There was no meeting of the WG at this Houston conference, but Chair Ed teNyenhuis provided a brief status report. Ed noted that this guide has gone out for ballot and two recirculations. Changes have been made to be in line with specific comments of reference to C57.12.00.

9.2.5 Old Unfinished Business

1. A question was raised whether or not the Standards should contain a requirement for no-load loss guarantee to be based on testing before or after impulse testing. The Chair noted that there's nothing in the standard to call for no-load measurements before or after impulse testing. A discussion was conducted with the following opinions:

   Phil Hopkinson suggested the measurements should be before impulse. He also suggested that a requirement to measure core losses at 100% before impulse be added to the standard.

   Ramsis Girgis noted that 1-2% additional losses would be expected after impulse testing. After some time, the core losses of a healthy transformer should return to the before impulse measurement. However, if the impulse has reduced the core interlaminar resistance the measurement will not return to the before impulse value.

   Additional discussion was held concerning experience with core losses and it was decided that this issue should be considered further. The chair will forward this subject to Mark Perkins [C57.12.90] and/or Steve Snyder's [C57.12.00] WG.

2. Load loss reference temperature conflict in 12.00 & 12.90; by Sanjib Som. C57.12.00 Clause 5.9 calls for the standard reference temperature for load losses to be 85°C. In C57.12.90 11.1.2.1.1 the temperature rise test calls for losses at rated average winding rise plus 20°C. After brief discussion, it was decided that no change is necessary.

9.2.6 New Business

None