8.11 Performance Characteristics Subcommittee – Ramsis Girgis, Chairman; Stephen Antosz, Secretary

8.11.1 Introduction / Attendance

The Performance Characteristics Subcommittee (PCS) met on Wednesday, October 89, 2008 with 46 members and 35 guests in attendance. Six of those guests requested membership and were granted membership. See last page of these minutes for summary of attendance.

8.11.2 Approval of Meeting Minutes

The minutes of the last meeting in Charlotte, NC were approved as written.

8.11.3 Chairman's Remarks

8.11.3.1 Administrative Subcommittee Notes

- Next Transformer Committee meeting dates and locations are as follows:
  - Spring 2009, April 19 – 23, Miami, FL
  - Fall 2009, October 25 – 29, Chicago, IL
  - Spring 2010, March 7-11, – Location is to be determined.
- IEEE PES Meeting: July 26 – 30, 2009, Calgary, AB, Canada. Transformer paper sessions are typically on Wednesday.
  - Call for papers opens 11/3/08
  - Paper submission closes 12/3/08
  - Authors will be notified of decision on papers by 2/2/09.
  - The two Transformers sessions will be held on Wednesday, July 29, 2009.
- 4 Standards related to PCS were recently approved. These are:
  - C57.21 "Standard Requirements, Terminology, and Test Code for Shunt Reactors over 500 KVA", R. Dudley Revision
  - C57.110 "IEEE Recommended Practice for Establishing Liquid-Filled & Dry-Type Power & Distribution Transformer Capability When Supplying Non-Sinusoidal Load Currents" R. Marek Revision
  - C57.105 "IEEE Guide for Transformer Connections in Three-Phase Distribution Systems" G. Reitter Reaffirmation
  - C57.109 "IEEE Guide for Liquid-Immersed Transformer Through-Fault Current duration" B. Patel Reaffirmation

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

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

The PCS Working Group for Revisions to test code C57.12.90 met in Porto, Portugal, on October 6, 2008 at 10:15 A.M. There were 81 in attendance, 35 members and 46 guests of which 11 requested membership

Announcements

The chair asked if anyone had any patent issues relating to this standard. Being none, this discussion was closed. The minutes from the last meeting were then reviewed and approved by oral vote as written.

Task Force Report

The report out from the TF assigned to revise Section 12: Short Circuit testing was provided by M. Fortin and is as follows:

The Task force met with 51 persons attended the meeting; 9 members and 42 guests, 3 guests requested membership but this being the end of the project no new members are accepted.

The minutes of the previous meeting, spring 2008, was presented and approved. The IEEE patent slides have been presented. The attendees have no patent issues.

- The TF approved a clarification of wording on when the visual inspection is to be done. This wording will be incorporated into the proposed revision of section 12 and the changed section will be sent to members of the PCS SC for survey by the WG.
- Depending on the comments, the TF may or may not continue.
- Even though there was a PAR for a guide on short circuit testing, it was decided not to produce this guide since it would only cover the LVI test, which is no longer used.

Thanks to Marcel and the TF for the work completed.

Old Business

The proposed changes in C57.12.90 Sections 6 and 7 that were presented in the last meeting were reviewed and some additional proposed changes were agreed to:

- The arrows shown on figures 2, 3, and 4 will be removed so as not to infer that the windings must have a particular direction.
- Section 6.3.4.2: The term ratio bridge was replaced by ratio meter.
- Section 7.1.1: Change “normal” to “nominal” for clarity.
- Section 7.1.2: The wording on the requirement for the test frequency was discussed, and it was agreed that the acceptable frequency could be between 50 and 100 Hz or at the nominal frequency in case this is outside the 50 – 100 Hz range.
- Section 7.1.4: Three – phase transformers with inaccessible neutrals, will be discussed at the next meeting.
- Comment was discussed on whether or not to add a tolerance on the ratio test or to recommend that it just be added in C57.12.00 along with the other tolerances, and it was agreed to just have it in C57.12.00.
- Section 7.3.3: Ratio Meter proposed wording was discussed. It was agreed to only have a paragraph, and have it say: “The ratio meter is a device that measures both the ratio and polarity together. Other standard measurements may also be included such as the phase sequence or vector group verification or the excitation current”
- A proposal was made to provide a section on ratio measurement using a capacitance bridge. M. Kennedy took an action to provide suggested wording.

New Business

- Recommendation for testing of buried tertiary windings was presented by Subhash Tuli. The group agreed that this should first be considered in the WG on PCS revision to C57.12.00.

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

The Working Group met on Monday, October 06 at 4:15 PM. There were **22** members and **19** guests present. The following two guests requested membership, bringing the Working Group membership to **73** members:

Amit Mukerji	ABB Inc.
Sanjay Patel	Smit Transformer Sales Inc

Following introductions, the minutes of the March 17, 2008 Charlotte meeting, were approved as submitted. WG members were then asked about any applicable patents pertaining to our work. No patents were disclosed by anyone.

The chairman presented an update on the C57.12.00 ballot. This document, together with standard C57.12.90, has been officially out for ballot for approximately 1 week, and closes on October 30, 2008.

Old Business

WG Item 82, Clause 7.1.4.4 Stabilizing Windings- TF Report and Discussion

The chairman (Enrique Betancourt) of the TF on Stabilizing Windings presented a progress report including the first, proposed new wording for Clause 7.1.4.4 of C57.12.00. Highlights from the discussion:

It is recommended to clearly differentiate the concepts of "tertiary windings" from "stabilizing windings".

A consensus was reached on the concept that stabilizing windings for three phase transformers and autotransformers are delta connected and that they may have one or two terminals brought out through bushings, in order to close and ground one corner of the delta, external to the tank.

It is necessary to describe in explicit form the load MVA required for sizing stabilizing windings in Y-Y connected transformers and autotransformers. Some basic concepts from commonly available literature were referenced (Blume).

The new Clause 7.1.4.4 requires demonstration of the adequacy of Stabilizing Windings for transient and continuous loads by means of calculation for thermal and mechanical performance; no actual test is recommended by the TF.

As next steps, the TF will evaluate and assimilate the received feedback for development of a new wording of Clause 7.1.4.4, which will be submitted to the chairman of the WG on General Requirements C57.12.00 before the next meeting, for review and comments by members and registered guests.

New Business

WG Item 84: "Request for Test Requirements on Buried Tertiary Windings of Ratio, Phase Angle, Polarity, and DC Resistance"

A request from Mr. Subash Tuli for factory testing on buried tertiary windings (now, according to foregoing paragraphs, just "stabilizing windings" of transformation ratio, phase angle, polarity and DC resistance, was presented for discussion.

It was first recognized that manufacturers perform several QC tests for internal control purposes that would not be included on the test report, unless specified by users.

It was strongly questioned if it would be of any value to report any tests that would not be possible to replicate in the field, for diagnostic purposes. After much discussion, a survey of the attendees showed 20 "in favor" and 1 "opposed" for requesting that manufacturers report only the ratio and DC resistance (with temperature) of stabilizing windings, and only when two terminals are brought out of the tank for closing and grounding of the delta connection.

The chairman will formulate appropriate language for this for insertion into C57.12.00, and determine where this new requirement should be placed in the document. This will be presented to the WG at, or before, the next meeting.

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

- 6 members and 7 guests attended.
- The IEEE Patent Policy was reviewed and an opportunity for WG members to identify or disclose patents that the WG member believes may be essential for the use of that standard. No responses were given.
- Minutes from the Mar 18, 2008 Charlotte Meeting were reviewed and approved.
- *Frequency Conversion Factors of Transformer Performance Parameters* – The status of the proposed wording for inclusion in C57.12.00 and C57.12.90 was reviewed. The status is as follows:
  - C57.12.00 and C57.12.90 are currently being balloted with the proposed wording.
  - There will be a tutorial this afternoon (Oct 7th) to introduce the frequency conversion factors to the entire Transformers Committee.
- *C57.123-2002 – Guide for Transformer Loss Measurement* – The status of the Guide was reviewed:
  - Guide was balloted, and returned with 2 negative votes (74 comments total).
  - Negative comments have been resolved.
  - All other comments were discussed and incorporated into the guide.
  - The revised document will be sent for a 10-day recirculation.
- Dual Logo IEEE/IEC document status for the Loss Measurement Guide:
  - All comments from the IEC were reviewed. Most dissenting comments were in regard to the references to IEEE documents. These references have been moved to an informative bibliography, and the document has been resubmitted.
  - It is anticipated that IEC responses will be available for review at the next meeting.

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

The WG met at 9:00 AM on Oct 7, 2008. There were 42 attendees, 22 members, and 20 guests. The minutes from the March 2008 meeting in Charlotte, NC were approved.

- Request for any patent issues to be made known, there were none voiced.

- An overview of Draft 5.1 was presented. This draft includes input from Switchgear and Transformers Committees. On August 20, 2008, Draft 5.1 was submitted to IEEE for editorial review. Two issues remain. The first issue is attaining copyright permission for five figures. The second issue is resolving the difference in the scope of the PAR and the scope of draft 5.1. It was recommended to request the IEEE editorial board's invitation letter for ballot to include a statement that the guide was a developed through a joint effort between the Switchgear and Transformers Committees.

- Unfinished business – Some topics for future consideration include high frequency excitation, electronic loads, excitation other than switchgear, insulation characteristics at high frequency, mitigation for high voltage systems, and factory testing.

- A recent technical paper on this topic was published. CIGRE – Brazil JWG A2/C4-03. Eleven failures were discussed and a factory acceptance test was explored. This paper will be placed on the TC web site.

8.11.4.5 WG on "Semi–Conductor Rectifier Transformers", C57.18.10 – Sheldon Kennedy, Chairman

The WG met on Tuesday, Oct 7, 2008 at 4:15 PM with 4 members and 2 guests present.

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 16, 2007 meeting in Minneapolis were approved.

The Chair announced that the Amendment, C57.18.10a had been approved and published in March 2008. The Errata was produced by IEEE in 2006. We now have these three documents as a group. C57.18.10 expires in 2008. A Reaffirmation ballot pool for C57.18.10 is being formed with a copy of the Errata and the Amendment, C57.18.10a included. This ballot pool closes on October 12. Balloting on the reaffirmation will proceed afterwards. Interested SA members may sign up to join this ballot pool. We had expected to go for a PAR for a Revision, but the chair was asked to try to get the Standard reaffirmed without a full revision process. There were negative ballots during the 2003 reaffirmation process that were satisfied by stating that issues they had with the existing document would be taken into consideration during the revision process. I see some of those names in the reaffirmation ballot pool and would expect negative ballots.

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.

The chair announced that the IEC Converter Transformers for Industrial Applications IEC 61378-1 Standard is under revision again.

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

No Meeting Held.

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

The WG met for the development of the Frequency Response Analysis (FRA) Guide in Porto Portugal on October 6, 2008 at 2:45 PM. There were 60 people in attendance.

The meeting was chaired by G. Matthew Kennedy as Charles Sweetser was unable to attend.

The FRA Working Group meeting was called to order at 2:45 PM.

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

The minutes from the Charlotte 2007 meeting were approved by unanimous vote.

Working Chair Update

- A 2 year extension of the PAR was granted.
- Draft 6 to include comments from the past two meetings will be submitted no later than November 15, 2008. The chair asks that all members review and submit comments by February 1, 2009.
- The goal of the WG is to go to ballot by Fall 2009 with release of the guide by Fall 2010

Review of Comments from Draft 5

1.2.2 FRA Magnitude: Suggestion was made to include in the definition that magnitude is often plotted in dB-Scale.

1.2.3 FRA Phase: Suggestion was made that the definition should include that the most frequently used units are degrees.

1.2.6 – 9: Winding Self Admittance: Several members voiced their concern that the description and figure for winding self-admittance was confusing. Perhaps a clearer description would help make the section more useful and understandable. Peter Werelius will submit proposed changes for items 1.2.2, 1.2.3 and 1.2.6-9 as outlined above.

1.2.14 Noise: Te definition of noise may not be entirely correct. Discussion by the group resolved that noise, as it pertains to FRA measurements, is either broad band or narrow band noise. It may be possible that broad band noise is band limited over a range. The solution may be that a more applicable definition of noise is required as well as case study examples of noise should be provided in the interpretation section. G. Matthew Kennedy will propose changes to 1.2.14 with comment by Peter Werelius and Alexander Kraetge

1.2.16 Amplitude Displacement: Given that both "Amplitude" and "Magnitude" are used interchangeably it was brought up that this could lead to confusion. After discussion within the group the consensus is that "Amplitude" should be used when referring to the results, but "Magnitude" will remain the plots name.

1.2.17 Phase Displacement: Earlier use of the term "ratio" when referring to changes in phase is incorrect. The proper term is "displacement". Members of the group agreed and will use the term "displacement" to describe variations in phase angle.

2.4 Recommended FRA Measurement Test Parameters: The current D5 states: "The test set shall be capable of measuring sufficient dynamic range, over the frequency range in order to accommodate all transformer test objects (> 60 dB)".

The recently released CIGRE Guide 342 states: “Concerning the measurement range, the most problematic region appears to be the first resonance using the end-to-end measurement (typically -90 dB with a 50-Ω measurement). A measurement range of -100 dB to +20 dB should be enough to cover all cases.

There may be some conflict between the two guide’s recommended ranges. Discussion ensued among the group as to whether the CIGRE guide was correct and may be too conservative and the upper range doe not match their stated purpose (+20dB). An agreement on what should be stated or changed in D5 was not reached. The Chair asked that members consider these changes and be prepared to discuss at the next scheduled meeting.

3.6 Test Leads: In CIGRE Guide 342 there are different terms used to describe the various tests. Below is a table showing these differences:

CIGRE Guide 342	IEEE PC57.149
End-to-End	Open Circuit Self Admittance (OC)
End-to-End Short Circuit	Short Circuit Self Admittance (SC)
Capacitive Inter-Winding	Inter-Winding (IW)
Inductive Inter-Winding	Transfer Admittance (TA)

Discussion concluded that neither naming convention was optimal but improvement could be made to the PC57.149 naming convention to limit confusion.

3.8 Test Connections: A more descriptive explanation, e.g. Measure Top to tail, is needed. Peter W will propose a paragraph.

1.2.17 Cross Correlation: A typographical error was pointed out in that a cross correlation coefficient of 1.0 does not indicate randomness but unity correlation. G. Matthew Kennedy will make corrections to the document.

“I-I-I” Type Transformer Testing: Alexander Kraetge presented the case where some delta windings have a split busing design. This split bushing design allows for each winding to be separated and there is confusion on how this type of transformer should be tested. After much discussion by the group, the recommendation was to test this as a normal delta, but to include an optional/diagnostic test that allows for splitting of the winding. This should be included in the list of tests and note added.

New Business

Required versus Optional Tests: Several members voiced their concern that there are some transformer designs that can quickly exceed 18 tests. This can be unwieldy and may be unnecessary. It was proposed that some of the more lengthy tests should be reviewed and consideration should be given for splitting them into “required” and “optional” to allow for quicker testing. Members were not prepared to discuss this difficult subject. The chair asked that all members consider this issue and be prepared to discuss at the next scheduled meeting.

CIGRE Activity and Cooperation: Paul Jarman, head of TC14, reported that CIGRE will start up standardization in IEC and this group should become involved in the activity. The Chair will make contact with the IEC group and report to the working group at the next meeting

Draft 5 and future Draft 6 Review: The chair encourages all members to review and provide comments on the discussed items if willing. In addition, all members should review the upcoming Draft 6 and provide comments to expedite balloting by February 1, 2009 once Draft 6 becomes available.

8.11.1 Old Business

None

Attendance at this Meeting

MEMBERS

1. Stephen Antosz
2. Jim Antweiler
3. Javier Arteaga
4. Barry Beaster
5. Enrique Betancourt
6. Bill Chiu
7. Donald Chu
8. Craig Colopy
9. Alan Darwin
10. Bob Degeneff
11. Don Fallon
12. Joe Foldi
13. Bruce Forsyth
14. Marcel Fortin
15. Eduardo Garcia
16. Ramsis Girgis
17. E. Gomez-Hennig
18. Roger Hayes
19. William Henning
20. Laszlo Kadar
21. Sheldon Kennedy
22. Vladimir Khalin
23. Alexander Kraetge
24. Tamyres Machado
25. Richard Marek
26. Dennis Marlow
27. Van Nhi Nguyen
28. Miguel Oliva
29. Mark Perkins
30. Christoph Ploetner
31. Bertrand Poulin
32. Jean-Chris Riboud
33. Kirk Robbins
34. Marnie Roussell
35. Mathieu Sauzay
36. Ewald Schweiger
37. Hem Shertukde
38. Jin Sim
39. Steven Snyder
40. Andy Steineman
41. Ed teNyenhuis
42. Alan Traut
43. Subhash Tuli
44. Dharam Vir
45. Peter Werelius
46. Jennifer Yu

GUESTS

1. Jose Gamboa
2. Paul Jarman **
3. Sanjib Som
4. S. Tenbohlen **
5. Amit Mukerji
6. YuanZhong Cui**
7. Yan Xu
8. Jeewan Puri
9. Ron Nicholas
10. Wayne Johnson
11. Derek Hoch
12. Randall Kyle
13. Pat Pries
14. YB Bae
15. Roberto Asano
16. Jose Davila
17. Mike Lau
18. Sue McNelly
19. Rudolf Ogajanov
20. Miguel Cuesto
21. Jose Grijuela
22. Marta Munoz
23. G. M. Kennedy **
24. HansWalter Krop
25. Jim Graham
26. Sanjay Patel
27. John Darby
28. Juan Castellanos
29. Xose M. Lopez
30. Ernst Hanique **
31. Rodrigo Ocon
32. Richard Amos **
33. Dave Ostrander
34. Valery Davydov
35. Oleg Roizman

** Guests requesting Membership.