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

8.8.1 Introduction/Attendance

The Performance Characteristics Subcommittee (PCS) met on Wednesday, March 14, 2007 with 65 members and 47 guests in attendance. 5 of those guests requested membership in PCS. See last page of these minutes for attendance summary.

8.8.2 Approval of Meeting Minutes

The minutes of the last meeting in Montreal, QC, Canada were approved as written.

8.8.3 Chairman's Remarks

8.8.3.1 Administrative Subcommittee Notes

- Next Transformer Committee meeting dates and locations are as follows:
  - Fall 2007, October 14-18, Hilton Minneapolis Hotel, Minneapolis, MN
  - Spring 2008, March 16-20: Westin Hotel, Charlotte, NC
  - Fall 2008, October 5-9: Sheraton Hotel, Porto,Portugal
  - Spring 2009, April 19 -23, Southern US location
- IEEE PES Meeting: June 24 – 28, Tampa, Florida. There will be 2 transformer sessions on Wednesday, June 27.
- The PAR for updating / revising the “Loss measurement and tolerances” Guide C57.123 has been approved with a completion date of December 2011.
- IEC committee expressed concern regarding the IEEE references in the dual IEEE / IEC Logo of the “Loss measurement and tolerances” Guide C57.123. The Administrative Subcommittee suggested reviewing the technical differences between the IEEE references and the IEC Standards before deciding whether to continue with the dual Logo for this Guide.
- Those who are active in the SC and still not members of the committee are encouraged to apply for membership.

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

8.8.4.1 PCS WG on Test Code C57.12.90 – Mark Perkins, Chairman; Gerry Rosselli, Secretary

There were 73 persons in attendance, 32 members and 41 guests.

After introductions, Mark asked if there were any patent issues relating to this standard. Being none, this discussion was closed.

The minutes from the last meeting were then reviewed and approved as written.

Mark presented Gerry Rosselli as the new secretary and also thanked Rowland James for his role as past secretary of the WG.

Task Force Reports

1. Gerry Rosselli reported on the final survey that was conducted of the PCS subcommittee on Zero Sequence Test for Interconnected Winding Transformers. There were 26 responses, 20 approved, 4 approved with comments, zero disapproved and 2 abstained. The suggested comments were implemented in the final draft and then it was sent to Mr. Stephen Antosz for inclusion in the next issue of the Standard.

2. Gerry Rosselli presented test results on 2 transformers with interconnected windings with very low zero sequence impedance values and some of these values were negative. These values were not expected to be this low and after some discussion with the group, it was decided to look at all the test data to determine the validity of the numbers. Gerry asked the group for help. Several members / guests promised to check the numbers and report the findings before the next meeting. Subhash Tuli suggested that we did not have enough test data to move the documents for print, but Gerry responded that the test done on the previous four transformers with interconnected windings and additional tests on several other types of Delta Wye transformers proved the test method to be correct and suggested that there was no need to hold the document. Also, Dr. Ramsis Girgis suggested that the document proves that the method works and there was no need to put it on hold. Some members suggested that based on design these numbers may be correct within the instrumentation error and low zero sequence impedances values or negatives may be correct.

3. Marcel Fortin's report on Short-circuit test revision was not given since the meeting was held later in the week. WG met on Tuesday 12 March from 11h to 12h15.

   CIGRE and WG surveys show a high failure rate of transformers on short circuit tests, particularly for higher ratings; in the range of 50 to 60%. The short circuit application methods have been extensively discussed. The pre-set method is the preferred if not the only method. Their may be some inrush current, particularly for auto-transformers, axial split transformers and when the power source is from the inner concentric winding. Text will be proposed, including some wording from the actual IEC CDV before the next meeting. DGA will be included in diagnostic measurements and FRSL, FRA and TOP will be mentioned as additional diagnostic tools.

   Some text should be added to C57.12.00 regarding inrush currents when a short-circuit fault occurs on an autotransformer or an axial-split winding transformer.

4. Mark Perkins reported on the TF on Resistance Measurements (section 5 of C57.12.90) He discussed the need to de-magnetize the core after the resistance measurement and provided three methods to do it. Some discussion on how to demagnetize a D -Y transformer followed with comments and suggestions from the group.

5. Mark asked if a tutorial on short circuit test was beneficial to members and the majority of the group responded with a positive yes.

6. Subhash Tuli provided information about Wye-Zig Zag phasor diagram that is missing from Figure 7, and should be included.

8.8.4.2 PCS WG on General Requirements C57.12.00 - Steve Snyder, Chairman; Enrique Betancourt, Secretary

The WG met on Monday, March 12 at 1:45 PM. There were 18 members and 47 guests present. No guests requested membership, leaving the WG membership at 69 members.

The new WG Secretary, Enrique Betancourt, was introduced, replacing Dennis Marlow, who has served as secretary since 2001.

Following introductions, the minutes of the October 23, 2006 Montreal 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 then promoted the upcoming meeting of the PCS "Core Over-Excitation Task Force" chaired by Craig Stiegemeier. The work of this task force is reaching a conclusion, and their recommendations will be forwarded to this WG for consideration. It is expected that a survey will be conducted at the PCS Subcommittee level on this topic prior to the next meeting.

Old Business:

The chairman presented a new version of Table 21 - Draft 5 - (Routine, design, and other tests for liquid-immersed transformers) that incorporates all the previous changes agreed to by this WG. Since the table is now structured along the lines of Distribution, Class I, and Class II Power Transformers, the new format exposes the ambiguity of just what constitutes a distribution class transformer. This is particularly true today now that transformers rated up to 10 MVA can be considered distribution class (see scope of C57.12.36), although many may be Class I power.

A question was raised if the notes of Table 21 are "informative" or "normative". The chairman explained that from the context, the notes are normative, as they add critical information necessary to properly interpret the table and conduct the tests.

Even with the new table format, the WG was still not completely satisfied with this structure. Some suggested a separate table for distribution and another for power. Other suggestions were to "landscape" the present table and add a column for comments, thereby eliminating the notes. Another concept proposed would create a "hybrid" table. The chair will study these proposals and offer some new options before the next meeting.

Details of changes to Table 21 :

Resistance measurements: The WG felt that additional work is needed to better clarify the difference in the resistance measurement requirements between the three transformer classes. The chairman will work on this.

Ratio tests: It was agreed to change the statement "all tap connections" to "all tap positions as listed on the nameplate" to ensure that sufficient tests for multiple winding and dual voltage units were performed.

Insulation power factor testing: It was agreed to include capacitance measurements too since this data can be valuable and is available from the same instrument at the same time that the power factor is measured.

Zero-phase sequence impedance voltage and load loss: This will be expanded to state "on the rated tap connection", as is the current practice during factory testing.

No-load loss and excitation current: The test at 110% will be a routine test for Class I and Class II Power transformers. This is a change from the present requirements.

A suggestion was made by Loren Wagenaar to move the induced test in the table so that it immediately precedes the partial discharge test. At the same time, another suggestion was made to add a statement in the section immediately before Table 21 stating that the order the tests are listed does not imply the sequence they must be conducted.

8.8.4.3 WG on Loss Tolerance and Measurement - Ed teNyenhuis, Chairman; Andy Steineman, Secretary

- 19 members and 11 guests attended
- IEEE Patent Policy - The policy was reviewed by the WG and an opportunity was provided 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 Montreal Meeting held on Oct 24th, 2006 were read and approved.
- There was no report from TF for "Guide for Low Power Factor Power Measurements" as no meeting was held this time. There was discussion on how to proceed with the issuing of the Low PF Power Factor Guide since it is proceeding slowly.
- Frequency Conversion Factors of Transformer Performance Parameters - The final wording for C57.12.00 and C57.12.90 is ready for submittal. Ramsis Girgis presented changes / additions made to the sound level frequency conversion part of this document and agreed upon at the Audible noise WG. These are:
  - Added conversions for conversion of Load Noise
  - Added conversions for the frequency spectrum of Core noise
  - Added "winding resonance" to the types of resonance a transformer can have
  - Removed the part on resonance under rated frequency and added a sentence for resolution of that situation
  - Editorial improvements - This part of the document will be sent for Survey at the Audible noise SC level. Based on the feedback from this Survey, the document will be revised and finalized before it is sent for ballot with the rest of the C57.12.90 early in 2008.
  - The chairman is to prepare the introduction on the frequency conversion factors to send along with the wording.
- C57.123 -2002 – Guide for Transformer Loss Measurement – The PAR for the revision was received in Feb 2007. The guide was submitted to IEC for potential dual logo IEEE/IEC status. The WG went through all the comments and agreed upon changes. The WG also reviewed comments received from the WG and TC members. Below are the items that were discussed and agreed upon:
  - The bridge method will be moved from 5.3 into 4.5. A note will be added that this method is only occasionally used to measure transformers and shunt reactors with very low power factor.
  - Further information on amorphous core steel will not be added (it is mentioned in 3.2 under core material)

- The words “full voltage” in 3.2.11 will not be added (test can be done at any voltage)
- The year of issue is not necessary to have in the IEEE references
- TM should be added to all IEEE references
- Chairman will check what IEEE references are necessary for the Guide otherwise these references could be moved to the bibliography. This is expected to help resolve issues the IEC members raised regarding the Dual Logo of this Guide.
- WG agreed to proceed to ballot with the agreed upon changes since none of the revisions is of a critical technical nature. Even the removal of the 2 – Wattmeter method from the Guide follows removing it from the balloted C57.12.90 Test Standard. The introductory paragraph in the Ballot letter needs to state this clearly to avoid negative votes.

8.8.4.4 WG on Switching Transients Induced by Transformer / Breaker Interaction, PC57.142 - Robert Degeneff, Chairman; Peter Balma, Secretary

The WG was called to order at 8:01 AM on March 13, 2007. There were 56 attendees, 17 members and 37 guests, 2 requesting membership. The minutes from the October 24, 2006 meeting in Montreal, Canada were approved, and copies of the minutes and Draft 2.1 of the guide, were distributed.

1) IEEE patent policy was reviewed and the group was asked if there were any disclosures. There were none.

2) The old PAR for this project was withdrawn and a new PAR application, with joint sponsorship with the Switchgear Committee, has been submitted. It is expected the PAR will be approved in the next several weeks. Furthermore, it has been requested that we maintain the existing standard number of C57.142.

3) Peter Balma then provided a general overview of all the changes made to this revision of the document. The purpose of this revision was to capture all of the comments made during the balloting process. This included updating the style of the document, embedding the figures in the text, clarifying equations and figures, editorial comments, and content change to address many of the concerns of negative balloters.

4) There was discussion on how to proceed with the document, and it was recommended that the efforts of the group continue to finalize the document, prepare a ballot letter, and to take the required steps to go to ballot.

5) Under old business, Bob Degeneff described his efforts to coordinate this work with that of the FRA group. The coordination has been achieved, however although prepared, a possible future annex will be held for a future version of this document.

6) Under new business Phil Hopkinson presented some additional information on this interaction problem, and suggested a possible explanation for the transformers response. One possible explanation is that the complex waveform that results during switching and re-ignition of the switching device consists of two critical frequency components. One is that typically seen in transient recovery voltages and the other, is that produced by the circuit frequencies that develop due to the traveling waves on the cable connected between the switching device and the transformer. There was further discussion, as to whether it was even possible to define this complex function.

7) The group then had a discussion on the overall philosophy of the document and its user. Bob Degeneff reiterated that the intent of this document was to make the user and industry more aware of this potential problem. The document tries to strike a balance for all the potential users of this document, as a result not all of the material will be of use to each of its readers. The problem is complex and it is extremely difficult if not impossible to succinctly define all of the variables.

There was no other new business brought before the group.

8.8.4.5 WG on Revision of C57.21- Standard Requirements, Terminology, and Test Code for Shunt Reactors over 500 KVA – Richard Dudley, Chairman

The WG met in Dallas, Texas on March 12, 2007 from 11:00 a.m. to 12:15 p.m. There were 13 members and 16 guests present. The following are the highlights.

1. Introductions were made.
2. The minutes of the W.G. meeting in Montreal were approved.
   Note: The minutes of the Dallas W.G. meeting will not be formally approved until the next meeting of the W.G. in Minneapolis, Minnesota.
3. IEEE patent policy was reviewed and no patent issues were identified.
4. The remainder of the meeting was devoted to discussing Draft #9 of the Revision of IEEE C57.21. The following are the highlights.
   (i) Draft #9 was submitted for Mandatory Editorial Coordination and the chairman has now received feedback from IEEE; MEC has been distributed to W.G. members. The chairman will prepare Draft #10 and include the MEC results. Input from W.G. members re the MEC results was requested.

   (ii) Draft #10 will be balloted. Other editorial input will be included in Draft #10; Gene Blackburn etc. The chairman requested input from other W.G. members re any editorial issues.

   (iii) Annex B was discussed regarding any possible issues with IEEE Switchgear Committee members during the balloting process. Coordination with IEEE Switchgear Committee was achieved several years ago. The purpose of the annex is to support the elimination of reduced BILs from Table 5 and to address dielectric stresses seen by shunt reactors during switching. The focus is on the shunt reactor and not the switching device. The annex will again be reviewed from this perspective to ensure that the focus is on the shunt reactors; switching dielectric stresses.

   (iv) The Chairman will discuss with IEEE staff the “References” in Annex A and “Bibliography” in Annex B; is this practice acceptable? The W.G. feels that the references and bibliography should be in the annex to ensure that the reader’s attention will be focused. If the material has to be included in the “Reference” clause and in the Annex D “Bibliography” then a note may be added to Annex A and B drawing attention to the material. Is this acceptable? The Chairman will discuss with the IEEE editor.

   (v) The usage of maximum system voltage vs 105% nominal voltage was discussed. The W.G. again endorsed this as the correct approach; except as documented in the revision.

(vi) The Chairman stated that his plan was to complete Draft #10, initiate the invitation to ballot process and complete the formal ballot process by May. The focus of the Minneapolis meeting should be issues, if any, resulting from the IEEE formal ballot process.

(vii) Specific editorial comment; remove reference to Pierre Riffon from Clause 10.9.

8.8.4.6 WG on Revision of C57.110 – IEEE Recommended Practice for Establishing Liquid-Filled & Dry-Type Power & Distribution Transformer Capability When Supplying Non-Sinusoidal Load Currents – Rick Marek, Chair; Kent Haggerty, Co-Chair

The meeting opened on Tuesday at 1:45 PM with 14 members and 13 guests present. Following introductions, the minutes from the October 24, 2006 meeting in Montreal, Quebec, Canada were approved as submitted.

No guests or members present indicated knowledge of any patent activity applicable to the work at this meeting.

The WG members were requested to carefully review the draft, since the next step will be to ballot this version of the document. No comments have been received on this draft to date. The group agreed that surveys of the WG and the Subcommittee were unnecessary and draft 3 will proceed directly to a formal ballot.

It was previously agreed that the flux plot in the tutorial Annex D is outdated and should be improved. The plots from IEC 61378 were suggested as replacements, but rejected by the chairman, since they all refer to three-winding rectifier transformers. This type of transformer is specifically excluded from the scope of the document. A volunteer was proposed to provide replacement plots that would demonstrate the different patterns for the fundamental and higher harmonics. This resulted in a lengthy discussion concerning the accuracy of the selected plots. The concerns were that the reader might be misled and that the topic was far too technical for the scope of this document. Accordingly, a team of four was selected to review the proposed replacement figure to insure technical accuracy. However, revision of this figure will not delay the balloting process.

Dr. R. Hasegawa presented the results of a technical paper by ERDA (Electric Research Development Association) in India, which compared the no load losses of mechanically scribed grain oriented wound core transformers with amorphous wound core transformers. Two sets of 25 kVA and 250 kVA transformers were compared. According to the ERDA study, both cores had significantly higher core losses due to the very high harmonic load current. Dr. Hasegawa suggested modifying the equations in the C57.110 document to account for this extra loss. However, WG members pointed out that the magnetic loss equation in the ERDA paper is not totally accurate as the current harmonics will cause only minor changes in the core loss. While the study indicates that these losses are indeed lower for the amorphous core, the additional losses measured are actually stray losses, not true core losses and stray losses are already accounted for in the C57.110 document. This topic of increased core losses due to current harmonics has been discussed before and the group concluded that the effect is too small to warrant any elaboration in this document.

Sheldon Kennedy suggested a paper that will be added to the bibliography before the document is submitted for ballot.

8.8.4.7 TF on Semi-Conductor Rectifier Transformers, C57.18.10 – Sheldon Kennedy, Chairman

The WG met on Tuesday, March 13, 2007 at 3:15 PM with 9 members and 6 guests present. Sheldon Kennedy chaired the meeting.

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 24, 2006 meeting in Montreal were approved.

The Chair announced that the Amendment, C57.18.10a/D2, had been put out for a survey in the WG. Only 10 votes were received to date. They were all positive with no comments. It is not expected that there will be any negatives to Draft 2. Draft 2 will either be surveyed with the Performance Characteristics Subcommittee next or sent on to ballot based on direction from the Performance Characteristics Subcommittee.

The Chair reminded the WG that IEEE had published an Errata in January 2006, correcting some of the problems that occurred when the Word copy was converted to a PDF file. Also, with this Amendment, the standard cannot be reaffirmed in 2008. When it comes due it will have to go to a full revision. The Chair discussed some of the tabled topics from the reaffirmation and previous work and asked members to begin to think about things they would like to work on for the next revision. The Chair also expressed concern for all of the work that will be needed to bring this document into the new IEEE format. This standard contains many tables and formulas which will be a lot of work to convert.

8.8.4.8 WG on IEEE Standard Requirements, Terminology, and Test Procedures for Neutral Grounding Devices, PC57.32 – Steve Schappell, Chairman

The WG was called to order at 9:32AM on Tuesday March 13th by Peter Balma. There were 11 attendees. Minutes from the previous meeting were unavailable.

1) IEEE patent policy was reviewed and the group was asked if there were any disclosures. There were none.
2) The progress and history of the WG was reviewed, and the meeting was opened to New Business. There was good discussion from the attendees and the follow items summarize the salient points discussed:
   - The continuous current ratings for neutral grounding devices is unclear, can the document clarify this requirement.
   - How can the testing of these devices be coordinated with testing these devices as part of a system, e.g., how should testing of a transformer proceed when a neutral ground device is attached to the transformer. Can this guide provide some guidance or considerations that could be made?
   - As previously discussed, short circuit currents in this document are calculated differently than indicated in C57.12. Richard Dudley indicated that both are correct, but start from different base assumptions. An explanation of this will be placed in the standard.
   - It was pointed out that the resistor section of the document does not consider stainless steel resistors; only copper and aluminum. The resistor industry makes extensive use of stainless steel, and guidance is needed in this area for both the users and manufacturers. Many types of stainless steels are utilized and their characteristics vary substantially.

- It was suggested that an informative tutorial annex and a more extensive bibliography on neutral grounding would be beneficial to this document and users.
- Another question was raised on the insulation levels for the ground terminal of neutral resistors, and the validity of these requirements. This area will require investigation by the WG.
- Sergio Panetta, offered to the group a draft guide for Proposed Requirements for Neutral Grounding devices. He will send an electronic copy for the WG's use.

8.8.4.9 WG on the 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 a guide for Frequency Response Analysis (FRA) in Dallas, TX on March 12, 2007 at 1:45 PM. There were 55 persons in attendance, 27 members and 28 guests of which 3 guests requested membership.

The first order of business was to show the two slides regarding patents and inappropriate behavior. The minutes from the last meeting were presented and approved without comment. The WG Chair presented a brief report on what had been done in the last six months. It was estimated that the document is over 94% complete. The latest contributions were identified and discussed.

Edits to Section 1: Scope and Application George Frimpong completed reviewing and editing the "Definitions" section.

Edits to Section 3: Making an FRA Measurement

Richard Breytenbach was unable to contribute to this section for this meeting, however has agreed to supply the alternate connection instructions, including a purpose, description, and terminal connection table as soon as possible.

A statement was included by the WG chair stating, "Test connection variations on the basis test sequence and polarity are acceptable if specified by the end user." This statement will be removed once Richard Breytenbach's contribution has been submitted and approved by the WG.

Edits to Section 5: Analysis and Interpretation
Larry Coffeen provided several comments to Section 5. He proposed the following:

a.) Adding winding looseness and insulation degradation as additional failure modes detected by FRA to 5.2.1 (Open Circuit Test).
b.) Adding information regarding asymmetry techniques to 5.3.3 (Phase Comparison)
c.) Adding the statement "Plots can also be graphed as impedance or admittance versus frequency; either linear or logarithmic scales can be applied" to 5.3 Trace comparisons.

The rest of the meeting focused on reviewing the work required to finish each section.

- Section 1: Scope and Application - Two definitions, 1.2.8 Winding Self Admittance and 1.2.9 Inter-Winding Admittance will be edited by the chair for clarification. Also, all other definitions will be modified to remove the constricting meaning of "admittance" and refer more generically to the test setup.

- Section 2: FRA Test Parameters – The WG agreed to add the statement, "Plots can also be graphed as impedance or admittance versus frequency; either linear or logarithmic scales can be applied."

- Section 3: Making a FRA Measurement – If Richard Breytenbach is unable to provide the information, Larry Coffeen will provide the necessary contribution. The FRA WG will review this contribution at the next meeting.

  The WG decided to not include online FRA discussion in this document.

- Section 4: Test Records – The WG requested and received 4 volunteers (Paulette Payne Powell, Alexander Kraetge, Kurt Robbins, Greg Anderson) to provide recommendation regarding required and optional fields for test records. The WG chair recommended that "special ID" be included as a required field.

- Section 5: Analysis and Interpretation – The discussions focused on failure modes and trace comparison strategies. Jeff Britton offered to edit Section 5.3.3 Phase Comparison for clarification. Alexander Kraetge also offered to do a general review of Section 5.

  A discussion occurred regarding what qualifies a transformer to be similar or identical in design. Joe Watson offered to provide a description to be offered at the next meeting.

- Section 6: Appendix FRA Theory – Alan Darwin started a short discussion regarding FRA theory. This discussion focused on the modeling work done by Dr.Zhongdong Wang from the University of Manchester. Alan Darwin submitted this work for inclusion in the next draft D4.

The PC57.149 FRA WG plans to have an updated draft D4 at the next meeting.

8.8.4.10 TF on Core Overexcitation – Craig Steigemeier,Chairman; Tim Raymond, Secretary

The seventh meeting of the Core Over-Excitation TF authorized by the Performance Characteristics Subcommittee took place at 3:15pm on Monday, March 12, 2007 in Dallas. This TF is charged with the identification of limits for core over-excitation and development of suggestions for modification of appropriate standards. There were 70 attendees – 25 members and 45 guests. Twenty-six (26) of the 70 attendees were first time attendees. Two (2) attendees requested membership and will be added to the TF membership roster.

Attendees were reminded of the need to adhere to the IEEE patent policy and the chair asked for anyone aware of patentable situations to bring it before the group. No one offered the chairman suggestions during or after the meeting of patentable work or identified any inappropriate topics covered during the meeting.

A discussion was opened to review the minutes from the fall 2006 Montreal meeting published on the Committee website. A vote was taken and the Montreal meeting minutes were approved as reported.

It was noted that the purpose of this TF is to clarify and remove ambiguity concerning the over-voltage capability of large power transformers, primarily used at generating facilities.

The text developed to aid in improving the alignment between users and producers was reviewed at the meeting. After the Montreal meeting, an additional clause (4.1.6.4) was added to the proposed text:

> 4.1.6.4 Metallic surface temperature limit
> The core surface temperatures, including interior cooling ducts and the surface temperature of all metallic parts shall be limited by the temperature capability of the insulation materials in contact with the metallic surface. For non-thermally upgraded pressboard, this limit would be 95°C.

A discussion of the proposed text was taken. The significant item taken from that discussion, as suggested by Donald Chu, will be the incorporation of text to highlight that the full insulation system must be considered in the surface temperature limit.

The TF believes that it is time to take the various text developed in this TF to the WGs responsible for revising C57.12.00, C57.91 and C57.104. The details of those are:

WG revising C57.12.00 (PCS) – Steve Snyder:

1. Improved wording for section 4.1.6.1, which will aid in the clarification of the over-voltage capability of the transformer.
2. Addition of section 4.1.6.3, which provides new limits to the core hot-spot temperature to avoid gassing due to mild core overheating.
3. Note that the limit applies only to mineral oil insulated transformers.
4. Capacity limits or capabilities should be included on the nameplate that makes the transformer design unique.

WG revising C57.91 Loading Guide (Insulation Life SC) – Tim Raymond:

1. Inclusion of core hot spot temperature limit in C57.91.
2. Addition of sections 4.1.6.3 and 4.1.6.4

WG revising C57.104 Gas Guide (Insulating Fluids SC) – Rick Ladroga:

1. Text should be included to note that moderate core overheating doesn't place the transformer at risk.
2. A guideline for low levels of gas generation with a H_2/CH_4 (hydrogen to methane) ratio in the range of 6-8 should be considered for incorporation into a future revision of C57.104.

Don Platts questioned the proper way to use these limits in C57.91. Ramsis disagreed, suggesting that the limits were needed to improve the producer/user understanding. Don clarified that temperature limits in C57.91 require some method for users to assess the temperature for various conditions. Tim Raymond reiterated this and added that he believes core temperature limits are design criteria and belong in C57.12.00, though he is not opposed to adding information wording to the loading guide.

The TF does not plan to meet again. It will be resurrected only if questions or modification suggestions are received from any of the three WGs after they review the improved and new text provided by this TF.

8.8.4.11 WG for Revision of Short-Circuit Test Codes, C57.12.90 and PC57.133 – Marcel Fortin, Chairman

The WG met from 11h to 12h15. 40 persons attended the meeting; 14 members and 26 guests, 2 guests requested membership and are welcome as new members. The minutes of the Fall 2006 Montreal meeting were presented and approved. The IEEE patent slides were presented. The attendees have no patent issues to report.

Clause 12 of C57.12.90: Short-circuit test code
Two members sent late comments. Those are not included in Draft 3, but will be considered for Draft 4.

CIGRE and WG surveys show a high failure rate of transformers on short circuit tests, particularly for higher ratings; in the range of 50 to 60%.

Pierre Riffon's contribution on axial- split coils have been included. The short circuit application methods have been extensively discussed. The pre-set method is the preferred if not the only method. The post set method requires laboratory capability of 10 times or more the transformer kVA rating.

There may be some inrush current, particularly for auto-transformers, axial split transformers and when the power source is from the inner concentric winding. Text will be proposed, including some wording from IEC 60076-5 2006 before the next meeting. DGA will be included in diagnostic measurements and frequency response of stray losses (FRSL), frequency response analysis (FRA), and transient oil pressure (TOP) will be mentioned as additional diagnostic tools. Papers will be proposed to be added to the bibliography.

Some text should be added to C57.12.00 regarding inrush currents when a short-circuit fault occurs on an autotransformer or an axial-split winding transformer.

Course of Action

- The Chairman will produce Draft 4, review it with some key members, and then survey the WG before the Fall 2007 meeting.
- The Chairman will contact some labs to get more data.

PC57.133: Short-circuit test guide
Time did not allow starting discussion on the guide and we should resolve clause 12 of C57.12.90 before extensive work on this guide.

Course of Action

- The Chairman will produce a table of contents and survey the WG for opinions on what should be included, or which sub-clauses of 12.90 need to be in the guide.

8.8.5 Old Business

None

8.8.6 New Business

None.

Attendance at this Meeting

MEMBERS

1. David Aho
2. Stephen Antosz
3. Jim Antweiler
4. Javier Arteaga
5. Barry Beaster
6. EnriqueBetancourt
7. William Boettger
8. Jeffrey Britton
9. Carl Bush
10. Alvaro Cancino
11. Arnaldo Carlos
12. Donald Chu
13. Larry Coffeen
14. Craig Colopy
15. John Crouse
16. Robert Degeneff
17. Dan de la Cruz
18. Richard Dudley
19. Fred Elliott
20. Reto Fausch
21. Joseph Foldi
22. Bruce Forsythe
23. Marcel Fortin
24. Robert Ganser
25. Charles Garner
26. Ramsis Girgis
27. E. Gomez-Hennig
28. Roger Hayes
29. Bill Henning
30. Virenda Jhonsa
31. Sheldon Kennedy
32. Vladimir Khalin
33. Richard Marek
34. John Matthews
35. Gary McCulla
36. Gylfi Olafsson
37. Samuel Oriti
38. Mark Perkins
39. Don Platts
40. Christoph Ploetner
41. Bertrand Poulin
42. Paulette Powell
43. Jean-Chris Riboud
44. Girolamo Rosselli
45. Marnie Roussell
46. Mahesh Sampat
47. Devki Sharma
48. H. Shertukde
49. Jin Sim
50. Steven Snyder
51. Andy Speegle
52. Andy Steineman
53. Craig Stiegemeier
54. Craig Swinderman
55. Valeriu Tatu
56. Ed teNyenhius
57. Juan Luis Thierry
58. Robert Thompson
59. Robert Tillman
60. George Tolbert
61. Subhash Tuli
62. Dharam Vir
63. Loren Wagenaar
64. Jim Zhang
65. Peter Zhao

GUESTS

1. Geore Frimpong **
2. Kipp Yule
3. Jerry Kazmierczak
4. Hasse Nordman
5. Jim Campbell
6. Robert Perlichek
7. Herman Vogel
8. Gene Blackburn
9. Randy Rensi
10. Wilington Ayala
11. Mark Ashford
12. Edilson Ayala
13. Val Tatu
14. C.J. Kalra
15. Jermel Miller
16. Rudolf Ogayanov
17. Terry Rennich
18. Carlo Arpino **
19. Alan Traut **
20. Dave Ostrander
21. Clarence Bell
22. Mike Craven
23. Tom Lundquist
24. Larry Davis
25. Pierre Riffon **
26. Alexander Kraetge**
27. Ramon Garcia
28. Richard Graham
29. Arthur Molden
30. Jerry Harlan
31. Sanjay Patel
32. Shinish Mehta
33. Tony Reiss
34. Edgar Trummer
35. Nicolas Jacquenet
36. Lin Tong
37. Rick Ryman
38. Jurgen Gerth
39. Dale Corel
40. Shawn Patterson
41. Michael Spurlock
42. Jane Ann Verner
43. Matthew Kennedy
44. E. Tom Jauch
45. Paul Mushill
46. John Progar
47. Greg Anderson

** Guests requesting Membership.