7.12 Dielectric Test Subcommittee – Loren B. Wagenaar, Chairman; Stephen Antosz, Secretary

The Dielectric Test Subcommittee (DTSC) met on Wednesday, October 26, 2005, in Memphis, TN with 58 members and 62 guests present. Ten of the guests requested membership and are welcomed into the Subcommittee. See the last page of these minutes for attendance list.

7.12.1 Chairman's Remarks

1) The Chair reviewed highlights of the Administrative Subcommittee meeting held on Sunday:

   a) Next meeting date and location is March 19-23, 2006 in Costa Mesa, CA. Host will be Bill Chiu of Southern California Edison.

   b) The IEEE Editor for Transactions on Power Delivery is Stephen Antosz, whose 2-year term expires at the end of 2005. The officers of The Transformers Committee are seeking a replacement. Anyone interested should contact Don Fallon for consideration.

   c) IEEE will now accept standards documents in the Word format. Previously, only the Framemaker format was accepted.

   d) Everyone was encouraged to sign up and keep their profile information updated on the Association Management System, AMS.

   e) Ken Haggerty (n-kent.haggerty-1@usa.dupont.com) is maintaining a list of future panel session presentations.

2) The minutes of the Spring 2005 meeting in Jackson, MS were approved as written, and are available on the IEEE Transformers Committee Web Site.

7.12.2 Working Group Reports

7.12.2.1 Working Group on Acoustic Partial Discharge Tests in Transformers - J.W. Harley, Chair; Alan Darwin, Secretary

Attendance: 11 members and 8 guests attended the meeting. Attendees introduced themselves.

The minutes from the March 14, 2005 Jackson MS meeting were approved.

IEEE Patent disclosure requirements were discussed and a request was made for attendees to identify or disclose any patents that may be related to the work of the WG. It was noted that an ABB attorney has filed the Patent Letter of Assurance relevant to the Three-Sensor System in Section 5.7 of the PC57.127 Guide with the IEEE. This assures users of the Guide that the system can be licensed.

There are several systems combining acoustic signals with RF or EMI signals that are in the commercial or near-commercial stage of development. Robert Langan presented information on one such system that AEP and his company, Physical Acoustics, has developed.

Members of the DTSC were invited to participate in a Pre-Ballot Survey of the PC57.127, Guide for the Detection and Location of Acoustic Emissions from Partial Discharges in Oil-Immersed

Power Transformers and Reactors. There were 16 responses. None of the responses was negative. Most of the comments were editorial; several were technical. The technical comments were discussed with the WG and the Guide changed in several instances.

Discussions and technical changes to Guide due to the Pre-Ballot Survey include the following:

1. The title should remain "Oil-Immersed" rather than changing to "Liquid-Immersed." There are a number of uncertain areas with the introduction of different liquids. It was decided to handle this in a future revision or update of the Guide.
2. The Purpose was made more descriptive by changing the first sentence to read "The guide is intended to provide information that should be helpful in planning, installing and operating acoustic monitoring equipment and in meaningful interpretation of resulting data."
3. A suggestion was made to shorten the warning section. However, some people performing acoustic tests are experts in acoustics and not necessarily familiar with transformers. It was decided to leave the warning in the present form even though utility people accompany acoustic test personnel in the work areas.
4. Wording about the application of sensors was changed to alert users to avoid the ends of transformers that have cores with unwound return limbs.

The consensus of the WG is that the PC57.127 Guide, with the changes identified by the Pre-Ballot Survey and the WG, is ready to go to Ballot. This will be done in the near future.

7.12.2.2 Working Group on Revision of Low Frequency Tests – Bertrand Poulin, Chair

The meeting was held on Monday Oct. 24th at 11h00 am. After the usual introduction and display of IEEE's Patent policy, the minutes of the previous meeting were approved as written.

Next, Dr. Lemke presented his report on the task force meeting for the revision of C57.113 (IEEE Guide for Electrical Measurements of Partial Discharges in Transformers). The minutes of this meeting are found here. The main topics are:

I. The process of revision of the guide is going well. Most comments and suggestions after drafts 1 and 2 were incorporated in draft 3 and circulated. New comments were received and will be addressed in draft 4 before the next meeting.
II. The main topic of discussion during the meeting was around the train pulse response of detectors. (see minutes for details)

Unapproved Minutes of the TF Meeting, C57.113; Eberhard Lemke, Chair

1. Introduction of TF Members and Guests, distribution of Attendance Sheets
The Chairman opened the meeting at 8:00 a.m. and welcomed the members and guests. There were 47 attendees present, 16 of them TF members and 31 of them guests, where 9 requested for future membership.

2. IEEE Patent Policy
The IEEE Patent Policy was discussed based on the submitted transparency. There were no patent issues for this TF Meeting.

3. Approval of Agenda
The submitted Tentative Agenda was approved as it was.

4. Approval of Minutes of the TF-Meeting in Jackson, MS

The submitted Minutes were approved without significant changes.

5. Activities for revision the IEEE Guide C57.113

5.1 Survey on PD Detectors

The PD Survey approved by the TF members at the last meeting in Jackson has been distributed to all Dielectric Subcommittee Members prior this meeting.

5.2 Revision of IEEE Guide C57.113

All comments submitted to the Draft No. 2 have been incorporated in the Draft No. 3. This version has been distributed before this meeting to all TF members and reviewed. Discussion focused mainly on the specification of the pulse train response of PD detectors. Because few commercially available PD detectors, presently used for PD testing of power transformers, do not meet the IEC requirements completely, the following statements were made:

a) Harmonization with IEC 60270 is the ultimate goal, where a specification of the pulse train response is required in order to ensure well comparative PD measurements using different instrumentation.

b) With respect to noise rejection few available PD detectors are equipped with a tool for elimination of pulses having repetition rate below 120 Hz. This feature have to be considered critically, because a non-symmetrical occurrence of real PD pulses appearing in each half-cycle may also be rejected, which causes erroneous PD measurements.

c) In this context Bertrand Poulin presented typical practical examples of PD patterns which underlined the necessity to evaluate PD events in both half-cycles.

d) In order to overcome the disadvantage of the above mentioned feature for noise rejection additional notes were inserted in the 3rd Draft as a caution with recommendations. After a comprehensive discussion, the attendances agreed with the wording of these notes.

The further activities of the TF will deal with the following topics:

- Incorporation of the results of the discussion in the new Draft No. 4.
- Contributions of TF Members to Annex F: Practical Experiences, where practical examples of characteristic patterns of both PD events and noises are welcome.
- Updating of Annex D: Bibliography.
- Updating of the References (last IEEE Standards)

The Draft No. 4 will be distributed to all TF members prior the next TF meeting.

The rest of the WG meeting was devoted to review and discussion of comments and suggestions received in last circulation of C57.12.90 concerning low frequency dielectric tests.

- 10.6.1, Applied Test: No need for the exact power frequency for the test. Comment accepted and new wording will be proposed.
- 10.7.3, Induced test on Class I power transformers: Application of voltage in less than 15 sec. It is suggested to drop the requirement of raising the voltage in less than 15 sec because not every plant has that capability and this has little impact, if any, on the validity of the test. The group accepted this change. As a consequence, paragraph 10.7.3.1 is not required anymore and will be dropped.

- 10.8.2, Induced test on class 2 power transformers – test procedure: For the case of transformers equipped with pumps, make it mandatory to run the pumps during the induced test. This suggestion raised discussions and few people agreed. Among other things, this would require all cooling equipment to be mounted on transformers during induced test, even for duplicate units not having temperature rise tests. This comment was not accepted as such, but a proposal will be circulated before the next meeting.
- For the induced test, since the next revision of the standard is moving from RIV to apparent charge measurements, it is suggested to take the reference reading at the one hour test level before the enhancement and apply the maximum increase criteria of 150 pC based on this base reading. This also raised discussions and objections. A proposal will be circulated before the next meeting.
- 10.8.5, Indent c was omitted in the last proposed revision of the standard. Why? Answer: editorial error. It is back in the document for the next ballot.
- 10.9.1: A member stated that he will object to make the apparent charge measurement the required method of measuring pd on transformers. The group reaffirmed its intention of making the apparent charge measurement the only valid method of measuring partial discharges on transformers in order to comply with C57.12.00. The chairman will address the issue with the member.

There was no more time to address more comments and they will be reviewed at the next meeting of the working group. Meeting adjourned.

7.12.2.3 Working Group on Revision of Impulse Tests – Pierre Riffon, Chair; Peter Heinzig, Vice-Chair

The WG met on October 25, 2005, from 3:15 pm to 4:30 pm. Seventeen members and twenty-eight guests attended the meeting. The agenda was accepted as written. The minutes of the Jackson meeting were approved as written.

The IEEE patent disclosure requirement policy was discussed. Reference to the package posted on the IEEE Transformers Committee Web site was made. None of the members and guests present during the meeting were aware of any patents related to the work of the WG.

The first technical subject on the agenda was the review of the survey made on impulse test procedure for transformers having non-linear devices. The survey has been sent to the Dielectric Tests SC and to the WG membership on April 20 2005. A total of 132 surveys have been sent and only 28 surveys were returned. Out of these 28 returned surveys, 25 were affirmative (89,2%), 2 were negative (7,1%) and one abstained (3,6%). The various editorial and technical comments received were reviewed during the WG meeting as well as the negative ballots. The two negative ballots were contradictory, one asking to delete the intermediate reduced full wave tests while the other requesting to have more intermediate reduced full wave levels. The WG proposal is a compromise between the two negatives. After discussion, one of the negative balloter agreed to the WG proposal. The WG voted to forward the WG proposal to Subhash Tuli for inclusion into the next draft revision of C57.12.90.

The second technical subject on the agenda was the review of the survey made within the WG membership on April 20, 2005 concerning the revised proposal on lightning impulse test procedure for cases where the tail time of the impulse waveshape can not be obtained. A total of 71 surveys have been sent and only 24 surveys were returned. Out of these 24 returned surveys, 19 were affirmative (79,2%), 4 were negative (16,7%) and one abstained (4,1%). The

various editorial and technical comments received were partially reviewed during the WG meeting as well as the main topic of the negative ballots. After a lengthy discussion, it was agreed to delete from the testing standard, the table of minimum suggested impulse generator capacitance and energy levels and to transfer it into C57.98 (Impulse Test Guide). Because this table was not anymore mandatory and gives only guidance, its best location is in the guide not in the standard. This table will replace the existing capacitance value table of the Impulse Test Guide.

A revised proposal will be surveyed once more time within the WG membership. The transfer of the table giving minimum impulse generator capacitance and energy levels from the standard to the guide will probably resolve the negative ballots, and the compromise reached is a significant step forward to get an acceptable proposal to all parties. The remaining mandatory requirements of the proposal (e.g. use of the optimum generator configuration, use of resistors, as well as the mandatory advice from the manufacturer to the user for cases where the tail time can not be achieved) will be kept as drafted.

Because the WG meeting was running out of time, the remaining comments on the survey as well as the remaining subjects of the agenda were not discussed and will be postponed to the next WG meeting.

7.12.2.4 Working Group for Revision of the Impulse Test Guides C57.98 and C57.138 – Art Molden, Chair; Joe Melanson, Secretary

The meeting started at 3:15PM on Monday October 24th with 35 attendees present, of which 11 were members and 26 were guests. Two guests requested membership. Our Secretary, Joe Melanson, was unable to attend due to other business commitments.

The IEEE Patent Policy was read to the members. There were no known patent issues to disclose relative to our Impulse Test Guide.

The Minutes of the last meeting in Jackson, MS were approved.

Additional modified sections were added to the guide just before the meeting and copies were sent to all the members for comment. Extensive editorial revisions still need to be made to the revised guide and an updated section on typical impulse records and an annex have yet to be added. No additional material was introduced at this meeting.

Thang Hochanh reported that of the 13 sets of transformer impulse records that had been promised for the Hydro Quebec sponsored review of Transfer Function software features only two sets had been received. The members were encouraged to participate in this review by sending records to Thang as soon as possible.

Pierre Riffon, WG Chair for the Revision to Impulse Tests reported that one of the participants in a recent survey he had performed had suggested that the non-linear device test procedure being proposed in the survey would be better placed in the Impulse Test Guide. WG Chair Art Molden was of the opinion that the non-linear test procedure should be included in C57.12.90 with an elaboration of that procedure included in the Guide.

Bertrand Poulin reported that he is in the process of preparing a tutorial section on transfer function techniques, as applicable to transformer impulse testing. A copy of this tutorial will be made available for review by the WG and will be considered for possible inclusion in our guide. Bertrand also suggested that, based on the present revisions and remaining time before our Par

expires (December 2006), existing revisions should be compiled into a document ready for ballot.

7.12.2.5 Task Force on Liquid-Filled Transformers Dielectric Test Tables – Phil Hopkinson, Chair; Scott Choinski, Secretary

- The group discussed Revision 10 of the dielectric test tables listing the following:
  - Dielectric Test levels for Distribution and Class I Transformers.
  - Dielectric Test levels for Class II Transformers
  - Table 2 for High frequency tests.
- Subhash Tuli proposed that the three tables should be combined in to one table. It was agreed that Subhash will propose the table and it will be sent to the subcommittee and the working group for discussion in the next meeting.
- It was agreed that the present tables will also be circulated for Subcommittee's comments.
- Pier Riffon proposed that a note should be added to the Class II Transformer test tables stating that the listed BIL levels apply to grounded neutral systems. Higher BILs will be needed to floating neutral windings.
- It was agreed that Note 5 of Class I & Distribution Transformer test tables sound not refer to Class II Transformers.
- Test tables for Class II transformers should be extended to include system voltages down to 1.2 kV to cover the LV windings of the transformers.
- The issue to the appropriate tap position for making induced was discussed. It was agreed that Bertrand Pouland will draft a note that will address this issue.
- It was agreed that Note 5 from Class I and Class II test tables will be removed and a statement will be included in earlier text stating that the tests levels for the HV and the LV windings will be chosen from the following applicable tables.

7.12.3 Liaison Reports

7.12.3.1 Surge Protection Devices – Bob Degeneff

No report.

7.12.3.2 High Voltage Test Techniques (HVTT), IEEE Standard 4 - Arthur Molden

Editorial work on the extensively revised Standard 4 continues. There is to be another meeting in Lake Placid, NY on November 14th. The intent is to continue this meeting until the editorial work is finished.

7.12.4 Old Business

7.12.4.1 Status of C57.12.00 and C57.12.90

Subhash Tuli reported that both main documents C57.12.00 and C57.12.90 have been sent to IEEE, and a recirculation ballot should be coming out in November 2005.

7.12.4.2 Steep Front Test Levels

This issue has been lingering for several meetings. Do we or don't we put the test levels back into C57.12.00? There were several opinions expressed for and against. After considerable discussion, a hand vote was taken on the following four proposed options:

Put test levels in Main Body	9 votes
Put test levels in Annex	2 votes
Put test levels in a Guide	4 votes
Do not put test levels anywhere	Many votes, too many to count. A clear majority.

The general feeling is that this test is a very special test, so special that it need not be included in standards but rather included in the user's specification when it is needed. Therefore, this issue will be dropped (again). Subhash Tuli noted that, as a consequence of this action, steep front tests should be removed as an Other test in Table 19.

7.12.5 New Business

7.12.5.1 Simplification of C57.12.90

Mark Perkins raised this issue, and sent this note to the Chair of the DTSC:

"It seems that there are several projects under way for additions to C57.12.90 that address special cases. For example, the case where the working group on impulse testing is adding some specific instructions for impulse testing on transformers that have non-linear devices (Zenox) connected across windings. It seems logical to me that special cases like this should be addressed in a guide whenever possible rather than in C57.12.90. Otherwise the test code will be cluttered up with a lot of information about these special cases. There is a similar case in the Performance Characteristics subcommittee for the zero sequence test on transformers with interconnected windings, which is a special case handled differently than the vast majority of transformers being tested in the industry.

So my proposal is that for special cases like these, the first choice should be to put the detailed test procedures in a guide if one is available and just include a reference in C57.12.90. This would have at least 2 advantages:

1) C57.12.90 would not grow to be so large.
2) There would be less controversial material in C57.12.90 and fewer negatives from the ballots.
3) The process of 2 year ballots and updates would be simpler and more efficient.

Mark Perkins"

Some discussion ensued, and the following points were made:

- Cover the simple issues in 12.90 and more complex ones in a Guide
- This can create timing problems with publication dates of 12.00, 12.90, and various Guides
- Guides cannot contain requirements
- Put requirements in 12.00 & 12.90 and refer to a Guide; but does the Guide then become "Required"?
- Maybe the decision should be made on a case-by-case basis, rather than trying to establish a one size fits all policy

This same topic was discussed in the Performance Characteristics SC meeting and will be tabled for future consideration.

7.12.6 Meeting Adjourned

Attendance at this Memphis meeting of the Dielectric Test Subcommittee

Members Present

1. Ahuja, Raj
2. Antosz, Stephen
3. Arpino, Carlo
4. Artiega, Javier
5. Enrique Betancourt
6. Bill Boettget
7. Britton, Jeffrey
8. Charles Caruso
9. Donald Chu
10. Corkran, Jerry
11. Darwin, Alan
12. Davis, Eric
13. Degeneff, Bob
14. Fallon, Donald
15. Joe Foldi
16. Ganser, Robert
17. Garcia, Eduardo
18. Saurabh Ghosh
19. Gomez-Hennig, Eduardo
20. Griesacker, Bill
21. Gruber, Myron
22. Hanique, Ernst
23. Hayes, Roger
24. Heinzig, Peter
25. Hochanh, Thang
26. Hopkinson, Philip
27. Kennedy, Sheldon
28. Vladimir Khalin
29. John Lackey
30. Lemke, Eberhard
31. Dennis Marlow
32. Matthews, John
33. Sue McNelly
34. Miller, Kent
35. Art Molden
36. Moore, Harold
37. Bipin Patel
38. Sanjay Patel
39. Perkins, Mark
40. Platts, Don
41. Poulin, Bertrand
42. Raymond, Tim
43. Riboud Jean-Christophe
44. Riffon, Pierre
45. Rossetti, John
46. Ewald Schweiger
47. Shteyh, Ibrahim
48. Sim, H. Jin
49. Snyder, Steve
50. Speegle, Andy
51. Thomas Spitzer
52. Steineman, Andrew
53. Stiegemeier, Craig
54. Robert Thompson
55. Tuli, Subhash
56. Roger Verdolin
57. Wagenaar, Loren
58. Peter Zhao

Guests Present

1. Clair Claiborne
2. Dan de La Cruz
3. Ulf Radbrandt
4. Frank Bray
5. Josh Herz
6. David Wallach
7. Dwight Parkinson
8. Joao Baldauf
9. Jim McIver *
10. Wayne Hicks
11. Sten Andersson
12. Roberto Asano Junior *
13. Axel Uraemer
14. Ramon Garcia *
15. Dharam Vir
16. Randy Rensi
17. Bob Langan
18. John Darby
19. Wayne Gibson
20. John Stein
21. Peter Balma
22. Van Nhi Nguyen
23. Mostafa Jafarnia *
24. Flavio Neuls
25. Shibao Zhang
26. Richard Marek *
27. Mike Martin
28. William Allen
29. Gael R Kennedy
30. Marcel Fortin
31. Miguel Medina
32. Pritpal Singh
33. Alvaro Cancino
34. Sergiy Razurayev
35. Tom Bassett
36. Jim McBride *
37. Rob Mayer
38. Alexander Neves
39. Martin Navarro
40. George Tolbert *
41. Jim Zhang *
42. Juan Castellanos
43. Jose Salva
44. Charles Garner
45. Sam Mehta
46. Richard Tellez
47. Robert Pealichek
48. Barry Beaster *
49. Laszlo Kadar
50. Arturo Del-Rio
51. Richard Benson
52. Brian Twibell
53. James Kilgore
54. C.J. Kalra
55. Charlie Drexler
56. Jitendra Mamtora
57. Greg Troxell *
58. Don Dorris
59. Bruce Fairris
60. Jerry Allen
61. Alex Hsu
62. Samuel Oriti

* Requested Membership.