8.12 Dielectric Test Subcommittee – Loren Wagenaar, Chairman; Thang Hochanh, Vice-Chair; Stephen Antosz, Secretary

The Dielectric Test Subcommittee (DTSC) met on Wednesday, October 17, 2007, in Minneapolis, MN with 59 of 109 members, and 71 guests present. 6 of the guests requested membership and are welcomed into the Subcommittee. See the last page of these minutes for attendance list.

8.12.1 Chairman's Remarks

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

   a) The next meetings:
      1) Spring 2008, March 16-20: Westin Hotel Charlotte, NC
      2) Fall 2008, October 5-9: Sheraton Hotel Porto,Portugal
      3) Spring 2009, April 19 -23, Southern USA location TBD

   b) The issue of dual logo status of an IEEE and IEC Standard has hit a snag. Since there are many other IEEE documents referenced in an IEEE Standard, these other documents also become a required part of the Standard. There are then possibly additional deeper references in the referenced document. IEEE's immediate solution is to use only references necessary to implement the Standard in the normative body of the document, and all others go to the Bibliography which is informative only. This problem will be a significant ongoing hurdle to overcome related to dual logo status of all future documents.

2) The Chair announced that Thang Hochanh has agreed to become Vice-Chair of the SC.

3) The minutes of the Spring 2007 meeting in Dallas, TX were approved as written, and are available on the IEEE Transformers Committee Web Site.

8.12.2 Working Group Reports

8.12.2.1 Working Group on Acoustic Partial Discharge Tests in Transformers - Jack W. Harley, Chair

C57.127-2007 IEEE Guide for the Detection and Location of Acoustic Emissions from Partial Discharges in Oil-Immersed Power Transformers and Reactors was published August 31, 2007. This is therefore the final report of this Working Group.

The PAR for the writing of the Guide was approved in February of 2003. The first ballot closed at the end of June 2006 and the recirculation ballot closed February 2007. RevCom approval was received in March 2007.

I want to thank the many Working Group members, the WG Secretary Arturo Nunez, Dielectric Test Subcommittee Chair Loren Wagenaar, and others who participated in the writing of this Guide. It was truly a community effort. The general format of our meetings was to have an expert presenter on a particular part of acoustic testing when this was appropriate, and then break-out groups, each with a leader to edit a designated part of the document. Over the course of writing the Guide, those leaders included Alan Darwin, Fred Elliott, Mark Perkins, Ron Daubert, Dirk Russwurm, Hem Shertukde, Thang Hochanh and Barry Ward. There was also substantial input from experts outside our Working Group on specific topics.

A tutorial on acoustic testing was presented by WG members and others in Raleigh NC in March 2003. The presenters represented users of transformers, manufacturers of transformers, manufacturers of acoustic testing equipment and researchers in new uses for acoustic tests.

Tord Bengtsson, a physicist with ABB in Vasteras, Sweden with extensive acoustic PD theoretical, laboratory and field experience came to the WG early in the writing process to lecture the Working Group on PD basics, made the written contributions that demonstrate the fundamentals of PD systems and acted as a technical back-up for me through the writing and balloting processes. I have recommended that an award for outstanding contributions be given to Tord.

A round of applause was given at the SC meeting for Jack Harley and members of his working group in appreciation for their excellent work on this guide.

8.12.2.2 Working Group on Revision of Low Frequency Tests – Bertrand Poulin, Chair; Bill Griesacker, Secretary

The meeting was held on Monday October 15th 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 Recommended Practice for Electrical Measurements of Partial Discharges in Transformers). The minutes of this meeting are found in Appendix 1. The main topics are:

I. The process of revision of the document is advanced. Comments and suggestions after draft 6 were incorporated in the document.
II. The latest revision is being surveyed within the DTSC.
III. The PAR has been approved by IEEE. The document is ready for the formal ballotting process which includes mandatory editing coordination with IEEE staff and the forming of a ballotting pool.

Next, the Chairman presented a brief overview of the proposed changes to sections 10.5 to 10.11 of C57.12.90. These proposed changes have been discussed an agreed on in the past several years. They will be part of the next official ballotting of the document within IEEE and should be incorporated in the next revision of C57.12.90. There are two items left which have been discussed in the recent past but not yet agreed on.

1. A request for adding the following criteria to section 10.8.6:
   The enhancement of the voltage has not created a significant and steady increase in partial discharge activity. In this context, the partial level recorded during the one hour level must be compared to the level recorded just before the enhancement. The increase if any should not be more than 150 pC.
   The wording of this proposal needs to be better defined. A new proposal must be prepared and circulated before the next meeting

2. A request for the following addition to section 10.8.2:
   For transformers with ODAF cooling, the first unit of a design shall be tested with all pumps running during the induced test.
   The main objection to this request is that it would require that all transformers be tested with their cooling equippment installed. This is not always practical for those transformers which cannot be moved with their cooling equippment. A new compromise will be proposed and circulated before the next meeting.

On new business, one request has been sent to the WG for a clearer pass/fail criteria for induced test on class II transformers. The present standard is rather vague on this subject. It was explained that PD does not lend itself to this type of criteria on power transformers as easily as RIV measurements did. The present pC measurement of PD is very subjective, relying on engineering judgment in determining if a problem does exist in the transformer. Dr. Bartnikas added that the problem is that due to the wide variability of the discharge physical nature, origin and intensity, it is not yet possible to closely correlate the intensity and the severity of a PD problem in its relation to the health of a transformer. It was suggested that a tutorial section on pd measurements on transformers be added to the standards, possibly as an annex to C57.12.90.

Meeting adjourned. Minutes submitted by the chairman of the WG

Appendix 1

Working Group: Revision of Low Frequency Tests (Bertrand Poulin)
Task Force: Electrical Partial Discharge Measurement (Eberhard Lemke)

Unapproved Minutes of the TF Meeting
Minneapolis Hilton Hotel
October 15, 2007

1. The Chairman opened the meeting at 8:00 a.m. and welcomed the members and guests. There were 42 attendees present, 14 of them were TF members and 28 guests; 7 attendees requested for membership.

2. The IEEE Patent Policy was discussed based on the submitted transparencies. There were no patent issues to be discussed.

3. The tentative agenda was approved as submitted.

4. The minutes of the previous TF meeting in Dallas were approved as written.

5. Information and discussion on the status of IEEE Guide C57.113
   5.1 on 07 May 2007 the IEEE-SA Standard Board approved the project.
   5.2 A brief survey on the content of the current document was presented
   5.4 The discussion was focused on the specification of PD circuits, in particular on the parameters of PD calibrators. In this context it was pointed out that the calibrator must not simulate real PD pulses due to the strong distortion if PD pulses traveling through transformer windings. Another fact is the comparatively low upper cut-off frequency of PD measuring circuits, which covers only a very low frequency spectrum range of real PD events.

6. Future Work
   6.1 A pre-ballot editorial review of the Study Committee has been initiated.
   6.2 A copy of the draft C57.113 will be sent to the Office of the IEEE Standards Department for review prior to the final vote by the Working Group before the Sponsor Balloting begins.
   6.3 It was also discussed if this document could be used as a basis for PD testing guides applicable for dry-type transformers, instrument transformers and bushings. This matter will be discussed more in detail in the SC Dielectric Tests.

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

The WG met on October 1, 2007, from 3:15 pm to 4:30 pm. Eighteen members and thirty-five guests attended the meeting. Three guests requested membership.

The agenda was accepted as written.

The minutes of the Dallas 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 this WG.

The first technical item of business was the results of the 2nd survey made on a proposal modifying Clause 10.2.2.1 "Switching impulse waves". The proposal was surveyed for the second time within the WG and within the Dielectric Tests SC membership. The return rates were 50.5% in the SC and 27.4% in the WG. Out of these returned surveys, 100% were affirmative both within the SC membership and within the WG. No negative surveys were received. Three abstained within the SC. Three comments were received, two were strictly editorial in nature and were accepted. The third comment was from Art Molden who wants to add the DC method as an alternative method for biasing the core. After discussion and because this method is still in use, it has been agreed upon to consider the comment.

A revised proposal taking into account the decisions made during the meeting will be will be forwarded to Stephen Antosz for implementation in the next revision of C57.12.90 .

The second technical subject on the agenda was the results of the 2nd survey made on a proposal modifying Clause10.3.1.3 "Chopped-wave Test". The proposal was also surveyed within the WG and within the Dielectric Tests SC membership. The return rates were 39.5% in the SC and 25.3% in the WG. Out of these returned surveys, 88.4% were affirmative within the SC membership and 91.3% affirmative within the WG. Two negative survey were received. Three abstained within the SC membership. Fifteen (15) comments were received. The first negative ballot was given by Gustav Preininger who requests to keep the maximum time-to-chop limit to 5 µs as recommended in IEEE Std 4. This subject has been discussed in previous WG meetings and it has been agreed upon to harmonize this value with the IEC value of 6 µs. A large majority of members and guests present during this meeting were still in favor to have an harmonized value with IEC by keeping the proposed 6 µs value. Only one member was against. The WG decided to not accept this negative ballot.

The second negative ballot was given by Loren Wagenaar who requests to have a mandatory maximum duration for voltage collapse of 1.0 µs. The text has been reworded by using "shall" instead of "should" and the exception related to transformer windings not exhibiting an oscillatory mode after chopping has been moved from a note to the main text. Loren Wagenaar and the WG did agree with the new proposed wording. In addition, if the requirement of maximum duration of the voltage collapse is conflicting with the amplitude of the overswing in opposite polarity, the priority will be given to the duration of the voltage collapse. The wording will be modified according to the decisions made during the meeting.

Some other comments received were discussed and the decisions have been compiled in the Survey Compilation of Comments. Because the WG meeting was out of time, the remaining technical comments weren't discussed but the most significant comments are adequately resolved by resolution of Loren Wagenaar's negative ballot. The remaining comments are mostly editorial in nature and will be considered in the rewording.

The WG agreed upon that the changes needed to be made will not necessitate a 3rd survey and the revised proposal will be forwarded to Stephen Antosz for implementation in the next revision of C57.12.90.

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

The meeting started at 3:15PM on Monday October 15, 2007, with 40 attendees present of which 10 were members and 30 were guests. There were 15 requests for membership. Introductions were made of the attendees. The Minutes of the spring 2007 meeting in Dallas were approved.

The IEEE Patent Policy slides were reviewed with the group. The group was asked if there were any known copyright or patent issues associated with any of the material content of our Guide. None were indicated by any of the attendees.

Two items discussed at the last meeting that related to impulse testing of transformers that include non-linear devices and, to optimization of the impulse test circuit so as to obtain the best possible tail duration, have been adopted in the latest revision of C57.12.90. The wording of the clauses in our Guide that discuss those topics will therefore be changed to complement those revisions. Other impulse test items currently being discussed for the next revision of C57.12.90 include chopped wave undershoot and switching impulse test voltage polarity. Wording of the Impulse Guide clauses pertaining to chopped waves and SI polarity will not be changed until those revisions are approved for the next revision

Two items were submitted for addition to our Guide just prior to this meeting. One item, a Figure of the high voltage and return conductor interconnections between the components of a typical impulse test circuit, provides a clearer indication of the correct method of connecting the voltage divider and chopping gap to the transformer terminal under test. The second item was a long awaited and much appreciated treatise, provided by Bertrand Poulin, on the practical application of Transfer Function software during a transformer impulse test. This document so inspired some amongst us, namely Jim McBride, that he spontaneously and without provocation, offered to add additional content to a section in that document relating to the Coherence Function.

As an item of new business the Chair asked if there was any interest in starting a discussion of some of the items relating to impulse testing, that had recently been surveyed by the Chair of the Dielectric Subcommittee, Loren Wagenaar. Items 1, 5 and 6 of that survey related to transformer impulse testing in general, impulse testing of neutral terminals in particular and to the location of information relating to front of wave test levels. This idea was greeted with a stunned silence, followed by a total lack of coherence, followed by quizzical, pained expressions of sympathy for my obvious state of deteriorating mental health. Those items would be better left to the Dielectric Test Subcommittee was the obvious, general consensus and, as far as the front of wave test tables where concerned, I could put them where the pacoderms put the cabbages. Chair's note: See Section 8.12.4.1 below for the plan to resolve all of these issues.

8.12.2.5 Working Group on Liquid-Filled Transformers Dielectric Test Tables – Phil Hopkinson, Chair; Scott Choinski, Secretary

The WG was called to order at 1:45 PM. There were 49 attendees, 23 members, and 22 guests with 2 requesting membership. Reviewed the agenda for the meeting. The Minutes from the March 13, 2007, meeting in Dallas, Texas, were approved.

WG members reviewed the tables and recommended the following changes:

Class I Table:

- Note 3: Delete all after "tested." The justification is that if fully insulated, it is at BIL so there is no need to state that it is to be tested at the BIL levels at line terminals.
- Note 4: Delete "When specified"
- Note 5: Add "Nominal" in front of voltage, delete "s." Change "rated" to "nominal"
- Induced test column changed "2U / 1.732" to "2 times rated voltage"
- Nominal System Voltage column: replace "35" with "34.5"

Class II Table:

- Max System Voltage column: replace "38" with "36"

Reviewed additions of tables as they would appear in C57.12.00 Clause 5.10. More work is required in the notes. Action: Mr. Patel and Mr. Tuli to review and modify notes, as appropriate.

8.12.3 Liaison Report

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

There has not been a meeting of the High Voltage Testing Techniques working group so far this year. The editorial work has been mainly completed, but for some late revisions to the definition of (impulse voltage) overshoot used in an Annex on k-factor impulse voltage parameter extraction. The IEC have recently revised their definition of this overshoot parameter and it was deemed prudent that we also adopt the same definition. The first draft of this revised standard should be completed soon.

8.12.4 Old Business

8.12.4.1 Results of Latest Survey on Impulse Testing, Class II transformers, Impulse Testing on Neutral Terminals, etc.

The SC Chair re-reviewed results of the Feb 2007 survey on various possible changes to the Standards related to dielectric testing. It was clear that some additional work would need to be done to study and recommend possible changes. Therefore, a Task Force was formed with the following initial members volunteering:

Javier Arteaga	Jin Sim
Jerry Corkran	Subhash Tuli
Gylfi Olafsson	Dharam Vir
Pierre Riffon	

A Monday or Tuesday meeting slot will be sought for the next meeting in Charlotte for this TF to decide on a TF name, TF Chair, define the scope, etc., and begin work.

8.12.4.2 External Phase-to-Phase and Phase-to-Ground Clearances

The SC Chair reiterated this lingering issue of adding clearance tables to C57.12.00 is still not moving forward, so a Task Force will be formed to study and make a recommendation to the SC. Following are the initial volunteer TF members:

Loren Wagenaar	Vinay Mehrota
Eric Davis	David Wallach
Roger Hayes	

Eric Davis volunteered to be the chair of this task force. Loren Wagenaar will serve as the link to the work that was done some 20 years ago.

8.12.4.3 Electrical Measurement of PD in CT's and Bushings

At the last meeting Vladimir Khalin asked the question whether it is helpful to develop an IEEE document describing electrical PD in CT's and bushings. Discussion established that instrumentation for measuring PD in these apparatus is somewhat different than for transformers and shunt reactors. An IEC document already exists; IEC 60270. Is this adequate or should we develop a separate guide. This issue is now referred to Bertrand Poulin's WG on Low Frequency Testing to consider whether a new guide is needed, and/or if a task force should be formed to work on this.

8.12.5 New Business

8.12.5.1 Dielectric Frequency Response

Mark Perkins suggested that a future tutorial session, sponsored by the DTSC, will be set up to present additional information on this topic. Afterwards it will be decided if this test method should be considered for inclusion into the Standards.

8.12.6 Post Meeting Discussion

After the meeting, there was considerable e-mail correspondence between leaders of the DTSC and the PCS. Discussion started with the question of where to place the section on single-phase excitation tests developed several years ago by Bruce Forsyth's WG on PCS Revisions to C57.12.00. This subsequently led to the question of whether the Dielectric Test SC should also consider this text. Therefore, a survey was sent to members of both SCs requesting approval and/or comments on the text to be included in the next revision of C57.12.90.

Attendance at this Meeting of the Dielectric Test Subcommittee:

MEMBERS

1. Raj Ahuja
2. Stephen Antosz
3. Javier Arteaga
4. Ray Bartnikas
5. Barry Beaster
6. EnriqueBetancourt
7. Craig Colopy
8. Jerry Corkran
9. John Crouse
10. Alan Darwin
11. Eric Davis
12. Fred Elliott
13. Bruce Forsythe
14. Eduardo Garcia
15. Charles Garner
16. E. Gomez-Hennig
17. David Goodwin
18. James Graham
19. Bill Griesacker
20. Myron Gruber
21. John Harley
22. Roger Hayes
23. Bill Henning
24. Thang Hochanh
25. Phillip Hopkinson
26. Sheldon Kennedy
27. Vladimir Khalin
28. Dong Kim
29. Alexander Kraetge
30. John Lackey
31. Eberhard Lemke
32. T. Machado Junior
33. Richard Marek
34. Dennis Marlow
35. John Matthews
36. James McBride
37. Joseph Melanson
38. Kent Miller
39. Arthur Molden
40. Harold Moore
41. Gylfi Olafsson
42. Bipin Patel
43. Mark Perkins
44. Bertrand Poulin
45. Jean-Chris Riboud
46. Pierre Riffon
47. Ewald Schweiger
48. Ibraham Shteyh
49. H. Jin Sim
50. Steven Snyder
51. Andy Steineman
52. Craig Stiegemeier
53. Juan Luis Thierry
54. George Tolbert
55. Subhash Tuli
56. Dharam Vir
57. Loren Wagenaar
58. Jim Zhang
59. Peter Zhao

GUESTS

1. Paul Mushill
2. Jennifer Yu **
3. Peter Werehius **
4. Jeff Foley
5. Alvaro Cancino
6. Van Nhi Nguyen
7. Kent Haggerty
8. Mark Scarborough
9. Mark Hammer
10. Clair Claiborne
11. Gary King
12. Robert Perlichek
13. Samuel Oriti
14. Peter Carhart
15. John Progar
16. Joe Garza
17. Dwight Parkinson
18. Kirk Robbins
19. Prem Patni
20. John Stein
21. Kipp Yule
22. Vinay Mehrota **
23. Juan Castellanos
24. Terry Rennich
25. Don Dorris
26. Bruce Fairris
27. Wolfgang Knorr
28. Axel Kraemer
29. Bill Darovny
30. Martin Navarro
31. Bill Chiu
32. Alan Wilks
33. Ryan Brady
34. Ulf Radbrandt
35. Shawn Patterson
36. Fran Huguet
37. David Wallach
38. William Bartley
39. Stan Linsenbardt
40. Brian Penny
41. Jim McIver **
42. Adnan Farooqui
43. Virenda Jhonsa
44. Nathiev Sauzay
45. Aurelien Grinand
46. Mike Lau
47. Roberto Linan
48. Mark Peterson
49. Jeremy Guardado **
50. Waldemar Ziomek **
51. Shamaun Hakiz
52. David Seaguetti
53. Don Anderegg
54. Steve Jordan
55. Ryland Revelle
56. Richard Websper
57. Martin Heathcote
58. Jesse Patton
59. Richard Tellen
60. Dardan Muria
61. Stefan Thoren
62. Kent Brown
63. Pat Pries
64. Do-Gyoon Kim
65. Patrick Wang
66. Jim Cai
67. John Graham
68. Mike Craven
69. Randall Kyle
70. Beu Hopez
71. Rudolf Ogajanov

** Guests Requesting Membership