8.8 Dielectric Test Subcommittee – Loren Wagenaar, Chair; Thang Hochanh, Vice-Chair; Dennis Marlow, Secretary

The Dielectric Test Subcommittee (DTSC) met on Wednesday, October 08, 2008 at 12:00 pm in Porto, Portugal with 53 of 113 members, and 49 guests present. 5 of the guests requested membership and are welcomed into the Subcommittee.

8.8.1 Chair's Remarks

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

   a) The next meetings:
      1) Spring 2009, April 19 -23 (Hilton$129) – Miami Florida, North American Substation Services
      2) Fall 2009, October 25-29 (Westin $149) – Lombard IL USA Exelon
      3) Spring 2010, March 7-11 (firm) – location to be determined

   b) You should all note the official name change of PES is now Power and Energy Society. The reason for the change is to absorb the new technologies that are emerging.
   c) Harmonization and copyright issues are becoming a problem with IEC and IEEE. A new Task Force to be chaired by Jeewan Puri has been set up to address these issues and inform the TC of its implications. This has been a moving target in the past, and the goal of the new TF will be to write a position paper as viewed from the Transformers Committee.

2) The Chair announced that Dennis Marlow has accepted the position as Secretary of the SC.

3) The minutes of the spring 2008 meeting in Charlotte, NC were approved as written, and are available on the IEEE Transformers Committee Web Site.

8.8.2 Working Group Reports

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

IEEE/PES TRANSFORMERS COMMITTEE

The Working Group on Revision to Low Frequency Tests was called to order at 12:00 PM on October 6, 2008. There were 49 attendees comprised of 14 members and 35 guests; 5 guests requested membership. The minutes from the March, 2008 meeting in Charlotte, North Carolina were approved. The IEEE patent policy was mentioned and the group was asked if there were any disclosures. There were none voiced.

TF Electrical Partial Discharge Measurements Guide C57.113 - Dr. Lemke presented minutes of the TF meeting. Draft 3 was a thorough re-write of Draft 2 and will be available on the TC website within a few weeks of this meeting. This document will be circulated among the WG before sending out for balloting. Draft 3 was written to keep this document from conflicting with copyright of the IEC 60270, Measurement of Partial

Discharges standard. At this point, the draft is considered harmonized but not in copyright infringement of the IEC standard.

Old Business:
Impulse test for Class I transformers to be a routine test – This issue is transferred to the Special Dielectric Test Issues Task Force.

Insulation power factor and capacitance routine for Class I transformers – This test will be changed to a required test for Class I transformers. No objections were voiced to the Chairman's proposal. It was also requested to change the category of Winding Insulation Resistance Test to "routine".

Low frequency tests of auxiliary devices on Class I or distribution transformers – It was stated that this change was already implemented in the standard C57.12.00.

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. Loren Wagenaar will prepare a new proposal for this topic.

Loren Wagenaar will write a proposal on the issue of running all pumps during the induced test. It was stated that only running the pumps may not be enough to initiate possible electrostatic electrification; temperature may be an important factor. It is understood that this is an ODAF condition, it was questioned if OFAF transformers have been affected by static electrification; the response was "no".

TF on PD measurement for bushings and CTs. This topic will be discussed at the meeting of the Instrument Transformer SubCommittee.

New Business:

Should the 1 hr. test be performed on all Class I transformers? It was stated that this test is overkill. It was also stated that there may be a need in the field to know the PD level. It was suggested that it may be appropriate to measure PD during the 1 min. level. Subash Tuli was asked and agreed to research and submit a proposal to incorporate PD measurement to help resolve this issue.

The meeting adjourned at about 1:00 p.m.

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

The WG met on October 6, 2008, from 4:15 pm to 5:30 pm. Thirteen members and twenty-two guests attended the meeting. The meeting was chaired by Pierre Riffon, chair of the WG.

The agenda has been reviewed and accepted as written.

The minutes of the Charlotte meeting were approved as written.

The IEEE patent disclosure requirement policy was discussed. None of the members and guests present during the meeting was aware of any patents related to the work of this WG.

The first technical item of business was dedicated to a new proposal related to the grounding of neutral terminal(s) during switching impulse tests. The actual edition of IEEE C57.12.90 does not describe the condition of neutral terminal(s) during switching impulse tests. A new clause will be added saying that accessible neutral terminal(s) which are intended to be grounded during service shall be solidly grounded or grounded through a low-ohmic shunt during switching impulse tests. An informative note will be added giving information on what is meant by a low-ohmic shunt. A revised proposal will be surveyed prior to the next meeting within the WG and Dielectric Tests Subcommittee.

The second item of business was to discuss a new proposal related to the tap changer position during lightning impulse tests. The actual edition of IEEE C57.12.90 does prescribe all tests to be performed with the tap changer position set to the minimum effective turns. A proposal aligned on IEC 60076-3 philosophy has been presented. This proposal asks to change the tap changer position from minimum effective turn to neutral position and finally to the maximum effective turn positions, one tapping for each of the individual phase of three-phase transformers and one tapping for each of the different units of a three-phase transformer bank consisting of single-phase units. Contrary to IEC practice, the proposal gives the same rules without consideration to the tapping range in order to simplify testing requirements and to adequately test windings with de-energized taps such as in some power transformers and in distribution transformers. A revised proposal will be surveyed prior to the next meeting within the WG and Dielectric Tests Subcommittee.

Finally the last item of business was related to the number of impulses to be applied during lightning impulse test and switching impulse tests. The proposal was to align the IEEE C57.12 90 impulse testing practice with IEEE Std. 4 and IEC impulse testing practices by requiring 3 full impulses in addition to the two chopped-wave tests for non self-restoring insulation systems such as transformer insulation. Statistical figures were presented comparing the IEEE C57.12.90 practice with the IEEE std. 4 and IEC practices. The actual IEEE C57.12.90 practice is fully adequate if the probability of withstand during impulse test is greater than 99% but does not permit to discard, in an efficient way, weaker units having a lower probability of withstand. Thus, the IEEE Std. 4 and IEC practices are more adequate to detect problematic transformers having a lower probability of withstanding its impulse rated values. The proposal will be surveyed, prior to the next meeting, within the WG and Dielectric Tests Subcommittee.

On old business, specific impulse test procedures regarding the phase-to-phase insulation are still on hold until the TF working on phase-to-phase insulation and air clearances finishes their work.

The meeting adjourned at 5:30 pm on October 6, 2008.

Pierre Riffon P. Eng.WG Chair October 6, 2008

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

No working group meeting was held at Porto

The latest draft of the guide was posted on the Transformers Committee web site earlier this year but only one response was received. Gustav Preininger provided an extensive list of technical and editorial suggestions and corrections, which I'm still working on. I will have them incorporated into a new draft by the end of the year.

8.8.2.4 Working Group on Liquid-Filled Transformers Dielectric Test Tables – Phil Hopkinson, Chair; Scott Choinski, Secretary; Al Traut, Acting Secretary for meeting

Dielectric Test Tables, Liquid-Filled
Porto Meeting
October 7, 2008

1. Meeting convened at 2:45pm by WG chair Phil Hopkinson.
2. 51 in attendance, 22 members and 29 guests
3. Review of minutes from Charlotte Meeting. Minutes approved as submitted.
4. There are no patents that affect the work done in this WG.
5. Chair reviewed the present status of the test tables as incorporated in the draft of C57.12.00 currently being balloted.
6. No further action required of the WG until the ballot is complete. Any comments that need resolution will be addressed at the Miami meeting.
7. Meeting adjourned at 3:55pm.
8. Next meeting scheduled for April 2009 at the Miami Meeting, pending comments resulting from the present C57.12.00 ballot.

8.8.2.5 Task Force on External Dielectric Clearances – Eric Davis, Chair

The TF met on October 7, 2008, at 12:00 pm. Twenty-one people attended this second meeting, 8 members and 13 guests with one guest requesting membership.

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 was aware of any patents related to the work of this TF.

The TF reviewed the progress in determining the technical basis of the clearances contained in CAN/CSA C88, IEEE C57.12.00, the NESC, NEMA TR-1 and IEC 60076-3.

Roger Hayes reported that the CAN/CSA C88 clearances appear to be based on CAN/CSA C308, "The Principles and Practices of Insulation Coordination." This standard provides three different formulas for calculating the critical flashover voltage based on various gap distances; < 2m, 2m – 10m and > 2m. These formulas will be posted on the Committee website.

Loren Wagenaar had previously provided background information regarding the inclusion of the phase – phase clearances in C57.12.00. These values are based on a linear approximation of the work done by T. Udo.

The NESC provides an alternate method of calculating the required external clearances in Section 232D. This method is based on the work of L. Paris and R. Cotina and is discussed in a 1972 paper by the IEEE Working Group 59.1, Transmission Substation Committee of the IEEE Substation Committee. The TF will continue to pursue the basis of the clearances in the tables.

The TF is still tracking down information on the clearances contained in NEMA TR-1 and IEC 60076-3.

The next step is determining how the various formulas were applied to create the clearances contained in the standards. The findings will be reported to the TF prior to the next meeting.

After the meeting, Dennis Marlow agreed to be vice-Chair/secretary for future meetings

8.8.2.6 Task Force on Special Dielectric Test Issues – Bruce Forsyth, Chair

The Task Force on Special Dielectric Test Issues met in Porto, Portugal on October 6, 2008 at 2:45 PM. There were 46 people in attendance, 8 members and 38 guests, with 10 guests requesting membership, bringing the total membership to 34.

The Chairman opened the meeting by briefly reviewing the minutes from the spring 2008 meeting in Charlotte, NC. The minutes were approved as written. The purpose of the TF, which is to make recommendations to the Chairman of the Dielectric Test Subcommittee regarding how to proceed with certain dielectric test issues, was reviewed before moving on to regular business.

The first item of regular business was a review of the proposal to place front-of-wave test level information in the annex of PC57.12.00/D2c that is currently out for ballot. The TF had previously been asked to recommend a suitable place for this information and after some discussion the TF agreed that the annex of C57.12.00 is an appropriate location and that no further discussion of this issue is required. As a follow-up, the TF agreed that a panel discussion by industry experts on front-of-wave issues with specific emphasis on how the conditions modeled by front-of-wave tests can occur on an electric system, what effect these conditions may have on transformers, and how modern protective equipment can be used to protect transformers from these conditions would be beneficial. Therefore, by inclusion of this note in these minutes, the TF Chair shall recommend to the Subcommittee Chairman that such a panel discussion be arranged.

The next item of business was a review of the current definition of Class I and Class II transformers. This was initiated as a result of the review at the last meeting of the responses to a survey that asked the following questions:

1. Should lightning impulse tests be made on all power transformers, regardless of voltage ratings?

2. Should the scope of Class II power transformers be extended down to include transformers with high voltage terminals of 69 kV, and if so, should the scope be extended to a voltage lower than 69 kV?

A long discussion took place after reviewing the current definitions of Class I and Class II power transformers as well as the current definitions of distribution and power transformers. It was mentioned that a new standard, C57.12.36, adequately addresses the requirements for distribution transformers rated up to 10 MVA with HV terminal ratings of up to 69 kV. One member noted that he had previously suggested the use of the terms “Class I” and “Class II” for power transformers should be abandoned in favor of the more general definition of “power transformer” given the existence of the new C57.12.36 standard. A poll of the meeting attendees did not show strong majority support for such a change. There was also discussion related to the additional tests required on Class II power transformers as compared to Class I power transformers, as well as discussions related to the design implications of including transformers in the Class II definition as opposed to the Class I definition. After more discussion, a proposal was made to extend the scope of Class II power transformers down to include transformers with high voltage terminals of 69 kV. This proposal received a strong majority support. Therefore, by inclusion of this note in these minutes, the TF Chair shall recommend to the Subcommittee Chairman that the scope of Class II power transformers be extended down to include transformers with high voltage terminals of 69 kV.

A follow-up discussion regarding impulse testing of all power transformers took place. A proposal to perform lightning impulse tests on all power transformers, regardless of voltage ratings received a strong majority approval. Therefore, by inclusion of this note in these minutes, the TF Chair shall recommend to the Subcommittee Chairman that the necessary changes be made to make impulse tests routine for all power transformers regardless of voltage ratings.

The final item of business was a review of a survey question regarding impulse testing of neutral terminals. It was noted that the current standards require impulse testing of neutral terminals rated 200 kV BIL and higher. In addition, it was reported that the IEC standard does not required impulse testing of neutral terminals that will be solidly grounded in service. A quick poll of attendees willing to vote showed no strong majority in favor or against routine testing of all neutral terminals. Many attendees abstained from voting. As time was running out the discussion was tabled for further review at the next TF meeting.

There was no new business raised and the meeting adjourned at 4:00 PM.

Respectfully submitted,

Bruce Forsyth

8.8.3 Liaison Reports

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

Editorial work on the new revision of High Voltage Testing Techniques, IEEE Standard 4 continues and is now at the point where IEEE staff is reviewing the document. It is hoped that it will be ready for balloting next year.

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8.8.4 Old Business

8.8.4.1 A tutorial on **Dielectric Frequency Response Testing** will be scheduled for the fall 2009 meeting, and be sponsored by the Dielectric Test SC. A suggestion was made that this presentation will be presented first at the spring 2009 meeting in Bertrand's WG on Low Frequency Tests. The Chair and Mark Perkins have enlisted 3 experts in this area to prepare the presentation. Equipment Supplier-Pax Diagnostics, Transformer Manufacturer-ABB and Utility-SCE (Don Kim). Note: The Chair mistakenly stated that Omicron was the equipment supplier at the meeting.

8.8.5 New Business

8.8.5.1 During discussion of a proposal from the floor at the Charlotte meeting of the main committee to eliminate Class I and Class II, the Chair of the main committee requested that SC chairs look at the effect of eliminating these classes. The Chair has consulted the latest proposal of C57.12.00, Class II transformers require the following routine tests whereas Class I transformers do not:

- Lightning impulse tests
- Auxiliary/cooling power loss measurement
- Winding insulation resistance
- Power factor and capacitance
- Core insulation resistance
- Low frequency withstand tests on auxiliary devices, control and CT circuits
- Partial discharge measurements
- Dissolved gasses in oil analysis
- No-load losses and excitation test at 110 % of rated voltage
- Zero sequence impedance.

The Chair asked all WG/TF chairs to look at the additional effects of eliminating the differences between class I and class II transformers**.**

8.8.5.2 Joe Foldi suggested that the SC consider specifying the tap position to be used during induced tests. The Chair referred this subject to the WG on Revision of Low Frequency Tests for its consideration.

8.8 Meeting adjourned 1:05 PM