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

The Dielectric Test Subcommittee (DISC) met on Wednesday, April 22, 2009 at 11:00 am in Miami with 63 of 119 members, and 67 guests present. 14 of the guests requested membership and are welcomed into the Subcommittee.

#### 8.8.1 Chair's Remarks

1) Loren Wagenaar was unable to attend for personal reasons. Thang Hochanh. Chaired the meeting

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

   a) The next meetings:
      1) Fall 2009, October 25-29 (Westin $149) – Lombard IL USA Exelon
      2) Spring 2010 , March 7-11 ( firm date) – location to be determined

3) After introductions a count showed 59 members were in attendance. Subsequent arrival of 4 members met the new quorum requirements

4) The minutes of the fall 2008 meeting in Porto 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

At 1:45 PM on April 21, 2009 the meeting was called to order by Chairman B. Poulin. The meeting was attended by 11 members and 18 guests. After introductions were made, the IEEE patent disclosure set of slides was presented. No patent issues were raised. The agenda was presented and the minutes of the Porto meeting were accepted as issued. The next order of business was the Task Force reports:

**A) TF Electrical Partial Discharge Measurements Guide C57.113**

Chairman Dr. Lemke presented minutes of the Task Force meeting held on April 20th at 8:00 AM where he presented the status of the document, discussion of comments, and resolution of the next steps. Of the 119 eligible voters, 108 ballots were returned. This is an 86% return which exceeds the 75% minimum. There were 98 approvals, no negative votes, and five abstentions. There are 78 comments, 4 of which had to be rejected because there involved modification of the scope, which must match the PAR. There was a comment about retaining IEC 60270 in the normative reference and moving the other IEC references to the bibliography. This was acceptable to the task force. Other comments would be incorporated within the next month in order that the document would be ready for a recirculation ballot within the next three months. The objective of the Working Group would be that the Task Force would have the revisions uploaded in the comment resolution spreadsheet, incorporate the revisions into the document, and initiate the recirculation ballot in hopes that the document would be completed by end of the year.

**B) Task Force Partial Discharge in Bushings and PTs/CTs**

Chairman T. Hochanh presented minutes of the Task Force meeting held on April 20th at 3:15 PM. This is a new task force and during this meeting two presentations were held on measurement of PD in new bushings. The intention of this Task force is to develop a guide on PD testing in a test lab setting and not to include field testing. The need was expressed that Utilities were seeking an IEEE guide for PD testing on these products. The present IEC 602770 and C57.113 would be the foundation documents for this guide. During this discussion, there were comments by Working Group members that the balanced bridge method should not be the only method presented in this guide. It was suggested that the Single-Ended method is also used in making measurements.

The Working Group Chairman gave authorization for the Task Force to research other applicable methods to be incorporated into the guide. Since this will be a guide and not a recommended practice, this would be an acceptable approach.

Other discussion on application of the method presently in C57.113 was held where it was commented that this method would be acceptable if the ambient levels could be achieved. Other ideas, such as alternative frequencies, were suggested since the circuit of bushings and instrument transformers were not as complex as transformers.
The Chairman noted that since a large number of ballot comments were made regarding the language structure in C57.113, the guide for the PD measurement in bushing and instrument transformer would benefit from this review at the initial writing of the guide. Volunteers were forthcoming to assist the Task Force Chairman with this task.

**Old Business:**
There were three remaining issues from the previous meetings.
Loren Wagenaar was not able to respond to the issue of pumps running during the Induced test and whether any measurements should be made before and during the enhanced portion of the test. Since Loren had other priorities, the Chairman would contact him to check where any information would be forthcoming.

The last open issue regarding the Induced test was a review of the one hour test for 69 kV and below by Subhash Tuli. This information will be provided before the next meeting.

With no new business, the meeting was adjourned.
Respectfully submitted Bertrand Poulin**,**

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

The WG met on April 21, 2009, from 3:15 pm to 4:30 pm. Twenty-seven (27) members and thirty-three (33) guests attended the meeting. Eleven (11) guests requested membership. The meeting was chaired by Pierre Riffon, chair of the WG.

The agenda was reviewed and accepted as written.

The minutes of the Porto 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 related to the survey results on a new proposal related to the grounding of neutral terminal(s) during switching impulse tests. Negatives comments were discussed and the WG chairman counterproposal was unanimously accepted as is. The revised proposal will be forwarded to the WG responsible of C57.12.90 for inclusion in the next IEEE C57.12.90 draft for ballot.

The second item of business was to discuss the comments received on the survey made on a new proposal concerning the tap changer position during lightning impulse tests. After discussion, the proposal will be modified in order to request a lightning impulse test on a tap position giving a bridging position close to the middle tap position for reactor-type tap changers. Additional wording will be added stating that the generator components should be set for the first phase to test. Impulse generator settings shall be kept as is for the remaining two phases even if the resultant wave-shape is out of the prescribed tolerances. The revised proposal will be surveyed within the WG and Dielectric Tests Subcommittee prior to the next meeting.

Finally, the last item of business was related to comments received on the survey made on the number of impulses to be applied during lightning impulse test and switching impulse tests. Due to lack of time, the comments received were not fully discussed and the discussion on the comments received will be postponed to the upcoming meeting in Chicago.

The meeting adjourned at 4:30 pm on April 21, 2009. Submitted by Pierre Riffon, P.Eng.

#### 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 Miami

Editorial work on our guide is continuing slowly. Much still has to be done, including transferring the guide into the new template, translation of JPEG files into TIFFs and including a revised bibliography. It is hoped that a completed guide will be available before the next meeting.

Arthur Molden Working Group Chair

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

Phil thanked all the members for finally completing this work. He indicated that the final values were not included in the latest ballot of C57.12.00 and that the correct values will be included in the recirculation ballot.

#### 8.8.2.5 Task Force on External Dielectric Clearances – Eric Davis, Chair; Dennis Marlow, Secretary

The TF met on April 20, 2009 at 11:00 am at the Hilton Downtown Miami. Thirty-eight people attended this third meeting, 5 members and 33 guests were present with 3 guests requesting membership, bringing the total membership to 12.

The minutes from the fall 2008 meeting in Porto were approved as submitted.

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 Chair outlined the purpose as:

- To review and revise as necessary the external dielectric clearances in C57.12.00 Section 6.8 and Table 14
- Document the technical rational for the clearances

The TF again 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 again reported that the CAN/CSA C88 clearances appear to be based on CAN/CSA C308, "The Principles and Practices of Insulation Coordination." This standard refers to an IEEE paper presented in Montreal in early 1970 which has been obtained with the help of Pierre Riffon. **Formulas from this standard will be posted on the Committee website.**

The Chair made a presentation which summarized the clearances used for system voltages <=230 kV based on LIL and for system voltages >230 kV based on Switching Surge levels. **This presentation will be posted on the Committee website.**

In general, for system voltages <=230 kV, the NEMA TR-1 phase to ground values are lower than those contained in the IEC and Canadian standards. The NEMA TR-1 phase to phase values are similar to the values contained in the IEC standard. The phase to phase values in both of these standards are lower than the values contained in the Canadian standard.

For system voltages >230 kV, IEEE does not provide values for phase to ground clearances. The phase to ground values contained in the Canadian standard are lower than those contained in the IEC standard. The phase to phase values contained in the IEC and Canadian standards are comparable. The C57.12.00 phase to phase values are much lower.

There were various comments from members and guests about minimum clearances needed for different altitudes, animals, special cable geometry, bushing grading and other special conditions as well as the effect of lightning arresters. These have already been noted in section 6.8 of C57.12.00

The NEMA TR-1 clearances for system voltages <=230 kV appear to be based on the values contained in the 1954 AIEE paper, "A Guide for Minimum Electrical Clearances for Standard Basic Insulation Levels." In order to determine the basis of the clearances we need to determine the test parameters used for the 1954 AIEE paper:

- Electrode shape…rod to rod?
- Positive or negative wave shape
- Altitude
- Atmosphere conditions ( wet or dry)
- Statistical probability of flashover (50 or 10%)

A straw vote from all attendees indicated that there appears to be no reason to reduce the phase to ground clearances used in NEMA TR-1 1980 (Secretary notes that the present TR1-2000 does not include any clearances). The TF also is in favor of adding phase to ground clearances to C57.12.00.

There was considerable discussion regarding the clearances for system voltages >230 kV. The TF felt the phase to phase clearances in C57.12.00 appeared to be very low and the basis for them should be carefully examined. The TF is also in favor of adding phase to ground clearances. Further investigation is required.

Once the investigation is concluded, we need to follow the guidelines from IEC, CSA or TR-1 for both phase to ground and phase to phase clearances. Recommendations must come from just one standard and should not be a mix of two

**Comment [EJD1]:** Dennis: Did we really say this? I can see us establishing one set of criteria for <=230 kV and another for >230.

If we keep this paragraph, we should consider saying it was recommended that the TF recommendations be based on consistent criteria for phase to phase and phase to ground clearances.

The next step is determining the basis of the CAN/CSA and IEC clearances, investigating the insulation coordination standards IEEE 1313.2 and IEC 60071-2 and -2, and investigating the substation clearances in IEEE 1427. The findings will be reported to the TF prior to the next meeting.

**Comment [EJD2]:** I guess I can be dyslexic at times.

Meeting adjourned 12:05 pm Respectfully submitted, Dennis Marlow

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

The Task Force on Special Dielectric Test Issues met in Miami, FL on April 20, 2009 at 1:45 PM. There were 39 people in attendance, 9 members and 30 guests, with 8 guests requesting membership, bringing the total membership to 42.

After introductions of attendees the minutes of the Fall 2008 meeting in Porto, Portugal 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 business was a review of a survey question regarding impulse testing of neutral terminals. The specific question was “Should neutral terminals on all power transformers be impulse tested routinely?” It was noted that the current standards require impulse testing of neutral terminals rated 200 kV BIL and higher. There was some discussion related to the relative value of impulse testing neutral terminals and that in most cases, especially when the neutral is solidly grounded, the neutrals will not see the same type of impulse stresses as line terminals. In addition, it was noted that the presence of devices such as load tap changers complicate the issue since impulse tests are primarily intended to test windings, and depending upon the tap position required for the test, severe upswings in voltage can occur during test that may never occur in service. Some attendees expressed support for routine impulse testing based upon factory test floor problems during neutral terminal impulse testing that they had witnessed. One attendee recalled a test failure due to poor neutral lead routing. There was some subsequent discussion related to whether that type of problem would be detected by the routine applied potential test if the neutral terminal had not been impulse tested. During all of these discussion there appeared to be many attendees who felt there may be some merit to routinely impulse testing neutral terminals, but that there are many questions and conditions that would need to be adequately addressed before they were willing to support a proposal at this time. Some attendees were very clear that they did

not believe it was necessary to routinely impulse neutral terminal at all. Other attendees were very clear that they believed the neutral impulse test is necessary and that is why they call for it in every specification.
The Chair brought the discussion to a close and asked the TF members to vote on whether there was sufficient support to pursue this issue further at this time. By a vote of 10-7 the answer was "NO". Therefore, by inclusion of this note in these minutes, the TF Chair shall recommend to the Subcommittee Chairman that no further action be taken on this issue.

The next item of business was a general discussion of the definition of distribution, power, Class I and Class II transformers. The purpose of the discussion was to begin a dialog related to whether the TF could (or should) arrive at any recommendation(s) that may benefit the industry since there have been reports of some confusion regarding the application of these definitions. The confusion appears to be related to that fact hat the terms "distribution" and "power" are defined by application whereas the terms "Class I" and "Class II", which relate only to power transformers, are defined by voltage. It was mentioned that IEEE Std C57.12.36 addresses the requirements for distribution transformers with HV terminal ratings of up to 69 kV, but some 69 kV transformers are considered to be Class I power transformers according to the current definitions. As time was running out the discussion was tabled for review at a later time.

There was no new business raised and the meeting adjourned at 3:00 PM

Respectfully submitted, Bruce Forsyth

**SUBCOMMITTEE DISCUSSION:**
The **DI** subcommittee questioned the recommendation of the TF with respect to the question about routine impulse testing of neutral terminals, especially since there were few members of the task force present at the TF meeting.
**After a heated discussion it was passed by a vote of 37 to 22 that it is the will of the DI subcommittee that the TF continue with their investigation concerning routine impulse testing of neutral terminals.**

### 8.8.3 Liaison Reports

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

This par will expire at end of 2009. The standard is from 1995 and must be balloted or it will be withdrawn. Editorial work on the new revision of High Voltage Testing Techniques, IEEE Standard 4 continues. The working group has received the first full draft of the newly revised Standard 4. It is hoped that we can finish the editorial work and arrange a meeting to review the document ready for submission to the IEEE later this year.

### 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. This will be given at the fall meeting and the 6 presenters will discuss the merits of including diagnostic technique as a standard or optional test

#### 8.8.4.2 Class I and Class II Transformers

The WG/TF chairs are again reminded to report on the additional effects of eliminating differences between Class I and II transformers.

Jin Sim requested the results of this from the SC. Pierre Riffon and Bertrand Poulin made a hastily verbal report and during the subsequent discussions, it appears a more detailed analysis is necessary from the DI SC as well as other SCs.

**This will be a formal action item to be reported on at the fall 2009 meeting**.

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This is repeated again in these meetings for ease of reference:
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 **and formally report before the next meeting**

### 8.8.5 New Business

There was a motion from Phil Hopkinson to eliminate the reference to Class I and Class II from the dielectric test tables in C57.12.00. There would only be two classes of transformers: Distribution and Power Transformers with all transformers presently designated as Class I or Class II to be named Power Transformers.

This was not approved by a vote of 14 YEA and 28 NO

**8.8.6 Meeting adjourned 1:05 PM** Respectfully submitted: Dennis Marlow