5.4 Dielectric Tests Subcommittee – Loren Wagenaar, Chair; Thang Hochanh, Vice-Chair; Dennis Marlow, Secretary

The Dielectric Tests Subcommittee (DISC) met on Wednesday, October 24 at 11:00 am with a record 181 persons in attendance. There were 79 of 123 members, and 46 of the 108 guests present were new. Eight of the 73 returning guests requested membership and will have their participation status reviewed prior to acceptance. The Secretary, Dennis Marlow, was not able to attend this meeting. Eric Davis served as the Secretary.

5.4.1 Chair's Remarks

1. The Chair briefly reviewed highlights of the Administrative Subcommittee meeting held on Sunday afternoon. The main points have already been discussed in the Main Committee meeting on Monday and were not repeated

2. The following meetings of the TC are:
    a) Spring March 17-21,2013 – (Dolce Munich ($190, £142 with breakfast) Munich, Germany – hosted by Reinhausen
    b) Fall October 20-24, 2013 – St. Louis, MO – hosted by H-J Enterprises

    Additional meeting sites are listed on the main committee website.

5.4.2 Quorum and Approval of Minutes

1. The membership list was shown and a show of hands of committee members present showed that a quorum was not present at the start of the meeting. The chair assumed that a few more people would come in during the course of the meeting, and the presence of 79 who signed the attendance register shows that this was a correct assumption.

2. A motion to approve the minutes of the spring 2012 meeting in Nashville was made by Don Saur and seconded by Thang Hochanh. The minutes were approved as written.

5.4.3 Working Group Reports

5.4.3.1 Working Group on External Dielectric Clearances, Eric Davis, Chair; Dennis Marlow, Secretary

The Task Force met on October 22, 2012 at 9:45 am with 48 people attending the meeting; eight members, one corresponding member, and 39 guests. Since a quorum was not present, no official business was conducted. The membership list will be reviewed to include only those members who have attended at least one of the last 2 meetings.

The proposed clearance table for 1.2 through 230 kV was discussed. The table is based on the existing C57.12.00, Table 11 with BILs shown by voltage. The BILs match those included in the existing C57.12.00 Tables 4 and 5. Phase to ground clearances for distribution and power transformers were also added. These clearances were taken from the NEMA TR1-1980 as previously agreed to by a survey of the Dielectric Test Subcommittee.

The clearances are about 10% higher than the 50% withstand clearances with two exceptions. The 110 kV and 125 kV BILs for distribution transformers are right about the 50% withstand clearances. Those in attendance felt these two values should be increased so they are

consistent with the other values. These two values will be increased and the proposed table included in a survey to the Dielectric Test Subcommittee.

A few of the proposed values were compared to the existing IEC clearance values contained in IEC 60076-3. The IEC values are much higher than those proposed in the table. Paul Jarman pointed out that the IEC values are conservative and to be used if the User does not provide any requirement. It is expected that most IEC users will specify smaller clearances. It was also pointed out that the IEEE values are a minimum recommended clearance.

The bushing to bushing clearances were discussed. The majority of the folks in attendance felt that these clearances were useful and should be retained. At this time, we do not know how the existing clearances were established. We will continue to research this issue.

The BSL basis for clearances was also discussed. The BSL basis for the existing BSL clearances in C57.12.00, 345 kV+, is based on a switching surge factor (SSF) of 3.8. The BSL values contained in C57.12.00 Table 6 have SSFs ranging from 2.4 to 3.3. Those in attendance felt that the User was responsible for selecting the correct BIL and BSL for their system and application. The clearances given in Table 11 should be based on the BSLs listed in Table 6.

Meeting adjourned at 11:00 am

Respectfully submitted, Eric Davis

5.4.3.2 Working Group on Revision of Low Frequency Tests; Bertrand Poulin, Chair; Bill Griesacker, Secretary March 13, 2012, 1:45 pm

1. There were 52 attendees, 22 members and 30 guests, present at the meeting; two guests requested membership. More than 50 % of the working group members were in attendance at the meeting, therefore a quorum was present at the meeting.

2. A motion was made by the chairman to approve the minutes from the Spring 2012 meeting in Nashville, TN; the minutes were approved.

3. TF - PD in Bushings and Instrument Transformers:
    a. Significant progress was made in changes to the document, a final draft is expected to be ready by the next meeting.
    b. A small modification to the PAR will be required since it has been recognized that a change in terminology is needed to harmonize with IEC. The term “PD detector” will be changed to “PD measuring instrument”. “Detection” will be replaced with “measurement” throughout the document.

4. Proposal to change selection of LTC tap position during the induced voltage test:
    a. Clause 10.8.1 –Wording was proposed that would require bridging type load tap changers to be tested in a bridging position so that the PA (preventive autotransformer) is energized with elevated volts/turn during this test. Yang Baitun stated 1) that there may be some test equipment that will not be able to supply the additional exciting current (i.e. additional energy), 2) for neutral connected PAs, the main windings will act as an inductive filter between the measuring points and a possible PD source in the PA. The working group plans to survey the Dielectric Test

Sub Committee immediately, Class II and Class I transformers will have separate test proposals. Bill Boettger requested to change wording so that the test is based on the worst case tap position when there are un-equal regulating winding taps, another asked that series transformers be tested on the LTC tap extremes and in bridging position to excite the turns at higher voltages.

b. 10.8.2 – Propose to measure PD on line terminals 69 KV (15 MVA 3-ph, 10 MVA 1-ph) and greater.

c. Paul Morakinyo requested that PD is recorded on 1 min. intervals in place of the present 5 min. interval.

5. C57.12.00-2012 Table 5: Propose to revert to the 1.5 and 1.7 multipliers (of the maximum system voltages) that were used historically; Note 2 of the table would need to be changed. This would only affect the 500 kV row in the table. The "Low Voltage" section of the table should be listed "for reference only", or a similar note; the present wording in the table presents possible conflicts in meeting both HV and LV winding requirements in the table due to the induction effect of the transformer.

6. The meeting adjourned at 2:50 p.m.

Submitted by Bill Griesacker, Secretary
Reviewed and approved by Bertrand Poulin, Chairman

5.4.3.3 Working Group for Revision of the Distribution Impulse Test Guide C57.138, Recommended Practice for Routine Impulse Test of Distribution Transformers; John Crotty, Chair

Opened meeting at 11am

Took Roster - Only 6 of the 16 members attended.
No Quorum

Minutes were reviewed but not approved

Old Business. Reviewed items from the last meeting that were from the reaffirmation in 2005

- Tolerances - 5.1.2 – Chair to rewrite for review at next meeting.
- Analog Detection – 7.3.1 – The group suggested moving to the appendix. Manufacturer present stated they use digital detection
- GL 2050 Tube – 7.3.1 – Dan Sauer to research if this tube still exists and how to change the drawing.
- Drawing Updates – Various - to be done by the St Louis Meeting
- Standards References – To Be Done by St Louis Meeting

Chair will post standard for members to review for next meeting.

Meeting adjourned at 11:55am

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

As neither Chair Pierre Riffon and Vice Chair Peter Heinzig was able to attend the meeting, Loren Wagenaar served as chair and called the meeting to order at 3:00 p.m. Bill Griesacker volunteered as secretary for the meeting. There were 75 attendees, 14 members and 61 guests present; 13 guests requested membership. More than 50 % of the working group members were in attendance at the meeting, therefore a quorum was present at the meeting.

The chair asked for a motion to approve the meeting minutes from the Spring 2012 meeting in Nashville, TN. A motion for approval was made by Dave Wallace and seconded by Raj Ahuja. The motion was approved unanimously.

The committee first reviewed WG/SC survey results to revise clause 5.10.7.2 of IEEE Std. C57.12.00 concerning switching impulse tests. The 1980 revision of the standard, when switching impulse voltages were initially well defined, essentially stated "switching impulse tests to the HV terminals shall be controlling, even though such voltages on other windings may exceed their designated BSL."

"When the application of the switching impulse to the HV terminals result in a voltage on another winding less than the BSL requirement, no additional test is necessary to demonstrate switching surge insulation withstand capability on that winding."

This requirement continued until the 2006 revision, when "less" was replaced by "greater," which means that the LV and other terminals shall be tested to their rated voltage capability. No one can remember why the word was changed, and a WG/SC survey was sent out to change the word back to "less." This received a combined approval rate of 84 %. Raj Ahuja stated at the meeting that IEC is changing to require the transformer taps to be adjusted so that the largest voltage results within the transformer, and the group was reminded that the latest revision of the Impulse Guide, C57.98, states the "less" requirement.

Bertrand Poulin offered a motion to make the LV test voltage to be "less" than the LV terminal capabilities; Vinay Mehrotra offered a second to the motion; a vote was taken and 20 to 1 voted in favor of the motion. The change will be referred to the chair of WG on Revision of C57.12.00.

A WG/SC survey proposal to require routine impulse tests on 15 MVA 3-phase and 10 MVA 1-phase, 69 kV transformers passed with an approval rate of 90 %. Loren Wagenaar has already made a proposal to Bertrand Poulin regarding the wording changes required on an identical proposal for the low frequency tests. That proposal will be updated and surveyed within the Dielectric Tests SC.

Another WG/SC survey proposal to require 3 full waves, no chop waves on all other Class I transformers did not pass an e-mail ballot. The approval rate was 65 %, and was considered to have failed. About half of the negative votes did not wish to make any tests on remaining 69 kV transformers and the other half thought that chopped waves should be included.

A proposal was made in the above survey to leave the choice of dielectric testing per Class I or Class II to the purchaser by introducing a new designation, Class I and Class II tests. Some users are presently specifying some or all of the individual tests required for Class II on transformers rated less than 115 kV. Under the proposal, users would simply specify whether transformers are to be tested as Class I or Class II transformers. This proposal did not receive any support at the meeting on the basis that many purchasers would become confused by the new designation.

The meeting adjourned at 3:50 p.m.

5.4.3.5 Task Force on Dielectric Frequency Response – Peter Werelius, Temporary Chair

The TF on DFR met on Monday, October 22, 2012, at 3:15 PM. 14 members out of 25 and 72 guests were present. 7 guests requested membership.

The minutes from the Spring 2012 meeting in Nashville, TN were approved as written. It was announced that the Task Force completed the scope of work and is now under the Dielectric Tests Subcommittee.

PAR Proposal. A discussion followed regarding the wording of the proposed Title, Scope and Purpose. Summary vote of the members present agreed on the following:

- **Title:** Guide for the use of Dielectric Frequency Response for estimation of moisture in solid insulation of transformers.
- **Scope:** This guide is applicable to the methods of Dielectric Frequency Response (DFR) of liquid immersed transformers. The guide includes recommendations for instrumentation, procedures for performing the tests and techniques for analyzing the data. This guide can be used in both field and factory applications.
- **Purpose:** The purpose of this guide is to provide the user with information that will assist in performing Dielectric Frequency Response measurements and interpreting the results from these measurements.

The next course of action will be to submit the PAR proposal including title, scope and purpose to the Dielectric Tests SC and request approval to create a new working group dedicated to what is described in the title, scope and purpose of the PAR proposal.

The meeting was adjourned at 4:10 PM

5.4.4 Liaison Reports

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

IEEE Standard 4 working group has completed the editorial changes suggested in comments from the first ballot and the document is now ready for a second ballot. The recirculation ballot will probably occur in November with publication in the early part of next year.

5.4.5 Old Business

5.4.5.1 Comments from C57.12.00 Ballot on Dielectric Test Tables

Phil Hopkinson reported that Columns 12 and 13 of Table 5 were incorrectly labeled as "Impedance grounded wye." Column 12 should be labeled "Grounded wye" and Column 13 "Impedance grounded wye."

Jin Sim pointed out that the applied test values in Table 5, Column 4 do not match the Neutral BIL values listed in Table 5, Column 13 for 36-kV, 48-kV and 73-kV when compared to the values contained in C57.12.00-2006, Table 6.

Col 1 (kV)	Col 13(kV Crest)	Col 13 (Proposed)
36	125	150
48	150	200
73	200	250

The DI SC Chair directed that comments on Table 5 be submitted to Phil Hopkinson by the end of the year.

Don Platts made a motion that the DI SC immediately prepare a Corrigenda correcting Table 5. The motion was seconded by Ajith Varghese. During discussion on the motion, Stephen Antosz pointed out that the committee has a WG on the Continuous Revision of C57.12.00. The motion was modified that the WG on the Continuous Revision of C57.12.00 immediately prepare a Corrigenda correcting Table 5. This motion was approved.

5.4.5.2 Front of Wave Table in Annex A

The changes to the Front of Wave Table and text in Annex A were reviewed. The latest SC survey results were:

Affirmative	61	76.3 %
Affirmative with Comment	12	15.0 %
Negative	2	2.5 %
Abstain	5	6.3 %
Total	80	

The chair suggested that the following revised wording be used:

“Annex A (Informative)

“Front-of-wave test levels

“With improved arrester technology, front-of-wave tests are no longer necessary or standard for distribution or power transformers, so these tests were removed as a requirement from IEEE Std. C57.12.00. Gapped silicon carbide arresters have switching characteristics that closely mimic front-of wave shapes. Metal oxide varistor (MOV) surge arresters have clamping characteristics that more nearly emulate full-wave and chopped-wave conditions. They have replaced silicon carbide arresters, negating the need for front-of-wave testing. However, a few users continue to specify front-of-wave tests, and as a historical reference, the table below lists the front-of-wave test levels published in IEEE Std C57.12.00-1980.”

Front-of-wave test, voltages in kV The front-of wave test is no longer specified in IEEE C57standards, but is documented for historical purposes			
Application	BIL, kV	Minimum Crest Voltage, kV	*Specific Time to Sparkover, µs
Distribution	30	--	--
	45	--	--
	60	--	--
	75	--	--
	95	--	--
	125	--	--
	150	--	--
	200	--	--
	250	--	--
	350	--	--
Power	45	--	--
	60	--	--
	75	--	--
	95	165	0.5
	110	195	0.5
	150	260	0.5
	200	345	0.5
	250	435	0.5
	350	580	0.58
	450	710	0.71
	550	825	0.825
	650	960	0.96
	750	1070	1.07
	825	1150	1.15
	900	1240	1.24
	1050	1400	1.40
	1175	1530	1.53
	1300	--	--
	1425	--	--
	1550	--	--
	1675	--	--
	1800	--	--
	1925	--	--
	2050	--	--
	2175	--	--
	2300	--	--
	2425	--	--

*Tolerance on time-to-flashover is minus 0.1 and plus 0.3 µs

During the discussion on the motion, Phil Hopkinson pointed out that multiple high frequency transients were more likely to produce killer waves than a front of wave which is typically a

single occurrence. He also pointed out that the standards do not have a test for the high frequency transients at this time.
After the review, Don Saur made a motion to revise the wording of the paragraph. Jim Graham seconded the motion.

The motion to revise the wording passed. The annex will be referred to the WG on Continuous Revision of C57.12.00.

Adding 975 kV back into the Annex A Table was raised. The chair stated that it was removed because it has been removed from Table 6 in C57.12.00. Discussion indicated that it was not necessary to leave it in.

5.7.5.3 Tutorial on IEEE 4 Revision

The tutorial on IEEE 4 Revision will be held Thursday, October 25, 2012.

5.7.5.4 Class I/Class II Classification for Transformers

The Chair identified four (4) changes that would be required in C57.12.00 and C57.12.90. These changes will be circulated in the subcommittee.

Bertrand Poulin asked if changes to Table 5 should be done now by Corrigenda. After discussion, it was agreed to wait to make the changes.

5.7.6 New Business

Loren Wagenaar, the DI SC Chair, announced that, after 18 years, he was stepping down as Chair. Someone has been identified to replace him and has accepted contingent on approval of his employer.

The DI SC thanked Loren for his service with a standing ovation.

5.5.7 Meeting adjourned 12.15 PM. Minutes respectfully submitted by Eric Davis