1. Dielectric Tests Subcommittee (Rev 1)

October 22, 2014

Washington D.C

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| **Dielectric Tests Subcommittee** | | |
| **Chair: Michael Franchek** | **Vice-Chair: Thang Hochanh** | **Secretary: Ajith M. Varghese** |
| Room : Fairfax Ballroom | Date : October 22 ,2014 | Time: 11:00 am to 12:20 pm |
| Members : 103 | Present at time of checking : 53 | Present per attendance roster & recorded to AM System: 74 |
| Guests : 86 | Membership requested :11 | Membership accepted: 6 |

# Chair’s Remarks

The Chair briefly highlighted the requirement that while introducing one need to state their employer/ company and sponsor if difference from company.

The Chair reminded the WG on attendance requirement for new membership and for continuation and touched upon scope of DTSC and requirement to have attendance updated in AM system. Chair noted the changes related to corresponding members requiring their status to be changed to guest or active members.

19 new membership requests were received during Savannah meeting and 11 were accepted. 8 requests were not granted based on attendance requirements. List of new members were presented during the meeting.

The Chair shared details of upcoming PES sponsored meeting as well as details of next transformer committee.

Current Status of PARs was presented. Bertrand Poulin noted that C57.160 was missed on list presented and Title of C57.113 should be recommended practice and not guide.

# Quorum, Approval of Minutes and Agenda

The membership list was shown and a show of hands of committee members present showed that a quorum of members were in attendance at the start of the meeting. 53 out of 103 members were present at time of checking, so there was a quorum

All attendance is recorded in AM System.

The revised minutes of the Spring 2014 meeting in Savannah were approved without correction unanimously.

Chair presented agenda for the meeting. A motion to approve agenda for the meeting was made by Phil Hopkinson and was seconded by Don Platt.

# Working Group Reports

## Working Group on External Dielectric Clearances, Eric Davis, Chair; Troy Tanaka, Secretary

The Working Group met on October 20, 2014 at 9:30 am with 52 people attending the meeting; 13 of 24 members, and 39 guests. Four guests requested membership. A quorum was achieved. The full attendance record is available in the AM System.

David Wallace moved that the Spring 2014 meeting minutes be approved as written. Luke Dorpmanns seconded the motion. There were no revisions or additions to the minutes. The motion passed unanimously.

The WG reviewed the results of the recent Survey sent to the Working Group.

* A concern was raised with the reference to C57.12.22-1993 for pad mounted compartment type distribution transformers as the standard is not an active standard. It was noted that the reference verbiage should be changed to C.57.12.34-2009 (3 phase units) and C.57.12.38-2014 (single phase units). The Chair agreed to review the two references and send the results of his findings to the Working Group.
* In response to a survey comment that clearances are sometimes much shorter for distribution transformers than for power transformers at the same BIL, the working group agreed to use a single value for both, eliminating the distinction between them. The Working Group decided to use the smaller clearances as specified for distribution transformers.
* The Working Group agreed to add another line into the table for 1550 kV BIL at system 735 kV System Voltage to be in accordance with Table 6 of IEEE C57.12.00 -2010.
* In response to a concern that potential additional clearances may be required to accommodate issues such as animal intrusion, the Working Group agreed to move language from the text to a note to the in the table.

* A question was raised regarding Note (a) below the proposed table 11; bushings in enclosed space require lower clearance. The request to include reference to other IEEE document that allows lower distance in enclosed space will be researched and findings will be shared with the group.
* After discussion regarding clearances between top sheds of adjacent bushings, the Working Group confirmed its decision to eliminate these clearances from the table.
* The Working Group agreed to eliminate the mm column and instead follow the convention with inches and mm in parenthesis in order to be consistent with the format in other IEEE documents.
* In response to a comment regarding “BIL is not the only dominant factor in a transformer for external clearance of phase to ground and phase to phase”, David Wallace made a motion to “Add values contained in the survey to the table and to add an explanation in either the text or the table that the shown clearances are based upon BIL.” The motion was seconded by Chris Steineman. The vote was ten (10) votes in favor or and one (1) vote against the motion. The motion passed. It is important to note that the negative vote was cast because the member felt that the scope of the table had become too specific rather than taking other considerations such as testing clearances into consideration.
* In response to a request to round the mm dimensions to the nearest 100 mm, the WG agreed to seek guidance from IEEE C57.144-2004 - IEEE Guide for Metric Conversion of Transformer Standards. After studying this reference, the Chair will respond with his findings and the request may be considered.

As the work associated with the tables nears completion, the Chair asked for volunteers to help with modifications to the text. Baitun Yang and Javier Arteaga volunteered.

The WG intends to complete its activity at the next IEEE Transformer Committee Meeting in San Antonio and send its findings to the Subcommittee for action.

## WG on Dielectric Frequency Response Analysis (DFR)

The meeting was called to order by the WG Chair Ali Naderian at 3:15 PM. This was the third Working group meeting. There were a total of 75 attendees; 24 members and 51 guests and 6 requested to become members.

1. The minutes of meeting from the WG Spring 2014 meeting in Savannah could not be approved since there was no quorum. To have a quorum we needed 26 members to be present

1. There are several sections of the document that are in a position to be circulated for review. The WG Chair has circulated them once- please review and give feedback to the responsible section leader.
2. The leaders of the various task forces covering the chapters of the guide gave updates of their work:
3. Mario Locarno updated the group about Chapter 3 – DFR measurement overview. He addressed a couple of open questions, such as when should a DFR measurement be done.
4. Chuck Sweetser updated the attendees about Chapter 4 – Making a DFR measurement. No revision between the meeting in Savannah and Washington D.C. has been made. One comment was raised regarding the stop frequency – in Figure 4- there is not a consistent message in the document regarding the stop frequency. In some places it states 0.1 mHz and in other places 1 mHz. When is 1 mHz good enough and when is it recommended to do measurements down to 0.1 mHz. Rewording of this section is needed.

Cigre document states to measure down to 0.1 mHz stop frequency.

1. Nathan Jacob updated the group about status of Chapter 5 – Test Records. This chapter is in good condition and ready for review by the entire WG One comment came up that it meant with weight/weight in section 5.3.4. This needs a little clarification in the text.
2. Peter Werelius is working on a first draft of Chapter 6 – Measurement Analysis, Interpretation and Report-expected to complete by Thursday of this week. Once finished he will circulate it to his team members for additional inputs and modifications. Some sections of Annex A maybe able to move to Chapter 6. Peter to work with George on looking into this.
3. George Frimpong presented Annex A – DFR Theory and Validation. This chapter is in good condition and ready for review.
4. Poorvi Patel updated the group about Annex B – DFR Other Application. Her team met face to face on the 20th of October at 1.30 pm to discuss the structure and content of Annex B. The suggested title of Annex B is “Non-Moisture Related Factors influencing the DFR Measurements”.

The section will begin with an introduction describing the purpose of Annex B. Cases that are suggested by the team to include are

* 1. Cu2S contamination influence
  2. Carbon contamination influence
  3. High core ground resistance influence.
  4. Broken interlaminate shield influence

The section will conclude with a conclusion of other factors that could influence the dielectric frequency response – in Table form and also indicting which set-up it could influence (CHL, CH or CL or all)

If there is a request of other cases to include – talk to Poorvi, Ali or Peter.

1. Mario Locarno presented Annex C – Typical Measurement Challenges. A large portion of this chapter has been completed. Please review this section. There is an extensive section on how temperatures could influence the DFR measurements.

As we did not have quorum in this meeting, the Spring Savannah meeting notes will be sent out by the WG Chair for email approval

1. No new business was discussed
2. Meeting was adjourned at 4.00 pm

Ali Naderian, WG Chair

Poorvi Patel, Secretary

Peter Werelius, Vice WG Chair

## Working Group for Revision of the Distribution Impulse Test Guide C57.138 Recommended Practice for Routine Impulse Test of Distribution Transformers; Arthur Molden, Chair ; Susmitha Tarlapally, Vice-Chair

Docoment #: C57.138 Current Standard Date: March 9,1998

PAR Date: 2/01/2011 PAR Expiration Date: 12/31/2015

Meeting Date -10/21/2014

Members: 10 Members Present: 6

Guests Present: 27

Total Attendance: 33 Quorum achieved Attendance recorded in AM system

Location: Presidential Theatre

Time: 11:00AM – 11:17AM

New Chair Arthur Molden was introduced. Working group and guests introduced themselves. Quorum was verified and meeting had quorum with 6 members Chair. Chair requested for a motion to approve the meeting minutes. Jeff Britton passed a motion to approve the meeting minutes, Alain Bollinger seconded the motion.

Chair asked if anyone has any comments or new questions. Chair answered the question from spring 2014 meeting that the current standard scope does not include step voltage regulators.

Some of the drawings need editorial corrections and will be corrected by spring 2015 meeting.

Analog fault detection diagram will be redrawn as a functional block diagram. Jim Mcbride is working on the block diagram.

Meeting was adjourned at 11:17 AM.

## Working Group on Revision of Impulse Tests – Pierre Riffon, Chair; Martin Hinow, Vice-Chair

The WG met on October 21, 2014, from 4:45 pm to 6:00 pm. Thirty (30) members and forty-one (41) guests attended the meeting. Three (3) guests requested membership. The meeting was chaired by Pierre Riffon, Chair of the WG and Mr. Peter Heinzig co-chaired the meeting in replacement of the actual vice-Chair Martin Hinow who was not able to attend the meeting.

Attendance has been recorded in the AM system.

Required quorum was met, 30 members were present, and presence of at least 25members was required. The working group membership has been reviewed after the Savannah meeting and members who did not attend the last two meetings were moved as guests. The WG has 3 corresponding members and will probably be moved to guests unless they are planning to attend further meetings.

The agenda has been reviewed and on New Business, Mr. Ajith Varghese requested to add a new item of discussion regarding a possible modification to the chopping time limit given in clause 10.3.1.3 of C57.12.90.

The motion to approve the agenda, as modified, has been made by Mr. B. Poulin and seconded by Mr. Paul Jarman. The agenda was approved by all members present.

Minutes of the St-Louis meeting have been sent via Email to the WG membership for approval after the Savannah meeting. The minutes of St-Louis meeting were approved, as written, by 28 members. None disapproved nor abstained. Minutes of the Savannah meeting were approved, as written, by all members present at the meeting. The motion for approval of Savannah meeting minutes was made by Mr. D.

Wallace and seconded by Mr. P. Heinzig.

The first item of business was related to a survey made via Email within WG membership on a revised proposal defining a non-mandatory order for impulse tests (clause 10.1.5.1 of IEEE C57.12.90 “Test order”). Changes introduced at the Savannah meeting from earlier proposal versions, which were positively surveyed within the WG and the Dielectric Tests SC, were mainly editorial. This revised proposal has been approved by a majority of members having responded (28 members voted affirmative as written). None disapproved nor abstained. The proposal has been already sent to Steve Antosz for inclusion in the next draft of IEEE C57.12.90 which will be balloted in the upcoming weeks.

The second item of business was related to the questionnaire circulated within the WG on front time test parameters that shall be prioritized during lightning impulse tests (front time value and/or overshoot amplitude). Even if the number of responses to the questionnaire was extremely low, a small majority of persons did prefer to have a maximum limit on the front time and did agree to have no limit or a higher limit on the overshoot value. As additional input from the answers received, a clear majority (71%) of peoples having responded did agree to have a single set of front time test parameter tolerances regardless of the transformer winding design. For the time being, the Chair proposed that the best option would be the follow the IEC wording e.g. having a firm maximum limit of 2.5 μs on the front time and having no maximum limit on the overshoot amplitude. As stated in IEC 60076-3, the overshoot shall be corrected with the test voltage function in case that the overshoot is higher than 5%. After discussion, all members present did agree to remove the 5% limit where the test voltage function shall apply. It has been agreed upon that the test voltage function shall be applied to all impulse waves regardless of its overshoot amplitude. This motion was made by Mr. B. Poulin and was seconded by Mr. J. McBride.

All members did agree to circulate, prior to the next meeting, the modified wording for survey within the WG and within the Dielectric Tests SC. This motion was made by Mr.

J. McBride and was seconded by Mr. Vladimir Khalin.

As a new business, Mr. Ajith Varghese requested to change the requirement regarding the maximum chopping time value of 1 μs given during chopped-wave tests. His proposal was to add the following sentence for clarifying cases were the voltage collapse after chopping is not oscillatory but rather over damped "In such cases, voltage zero may be considered as 20% of impulse test levels". Since members and guests have not seen his proposal, the Chair will circulate his proposal to the WG membership together with typical oscillograms for comments prior to the next meeting.

The next meeting is planned to be held in San Antonio, Texas, on April 14, 2015.

The meeting adjourned at 6:00 pm on October 21, 2014. The adjournment motion was made by Mr. J. Puri and seconded by Mr. P. Jarman.

## Working Group on Revision of Low Frequency Tests Chairman: Bertrand Poulin, Secretary: Bill Griesacker

There were 67 attendees, 23 members and 44 guests present at the meeting; 2 guests requested membership. The attendance has been recorded into the Committee AM system. More than 50 % of the working group members were in attendance at the meeting, therefore a quorum was present.

The agenda for the meeting was presented and unanimously approved.

A motion was made by the chairman to approve the minutes from the Spring 2014 meeting in Savannah, Georgia. No objections or comments were made; therefore the minutes were unanimously approved.

**Old business**

It was previously questioned why C57.12.90, section 10.5, calls for an induced, low frequency test, with a voltage factor of 3.46. This applies to single phase transformers that have an internally grounded neutral and BIL less than 150 kV. This only applies to single phase transformers since at the time this value was assigned, in general, only single phase transformers were constructed with an internally grounded neutral. The 3.46 factor was simply based on two times the phase-to-phase voltage. This voltage condition can occur during fault conditions. It is noted that Table 4 of C57.12.00, for Class 1 transformers, does not agree with the 3.46 factor. This value should be removed from C57.12.90 since the test level should be specified in C57.12.00. A proposal will be written by the Chair with recommendations to resolve this issue.

Tap Changer Position During Induced Test

The Chair and a volunteer (Shamaun Hakim, CG Washington) will work on writing a proposal. The objective is to test all magnetic devices within the transformer, excluding CTs.

**New Business**

Applying internal over-pressure to a transformer during induced test in order to reduce the risk of pd. Steve Antosz asked if an over-pressure should be excluded or limited during induced voltage testing. Comments in general were in agreement that during the official acceptance test, no over-pressure should be applied to the main tank. The tank pressure may be different for sealed tank, inert gas and conservator type of oil preservation systems. Steve Antosz moved and was seconded by Raj Ahuja, made a motion to request the working group to look into this topic to see if tank pressure during induced testing should be addressed in the standards. The motion was unanimously approved.

The meeting adjourned at 2:28 p.m.

**B.3.6** WG **- IEEE Guide for the Detection of and Location of Acoustic Emissions from Partial Discharges in Oil-Immersed Power Transformers and Reactors (C57.127) Chair: Detlev Gross Chairs Vice Chair: Jack Harley Secretary: David Larochelle**

# Meeting Attendance

The working group met at 11 AM. 41 persons were in the room and 17 members were present. Quorum requirement was met. Complete attendance record is available in the AM System.

# Discussions

With reference to Don Platts' comments during the opening session concerning inappropriate influence on standard documents, Detlev Gross pointed out that it is the intention with the revision of C57.127 to concentrate on signal properties, methods, and practice, while removing any unnecessary reference to individual instrument. On the other hand, to provide the working group with the overview needed, it is intended to continue devoting 20 minutes of the upcoming meetings to have non-commercial presentations covering available technology, experience, and case studies by instrument manufacturers and users.

A technical presentation was then made by Charles Sweetser. Characteristics of acoustic waves were shown as well as the spherical solution system that leads to a localisation when considering a direct propagation path in the oil. He also introduced a concept of survey used to confirm the presence of PD prior to a complete acoustic investigation.

Nathan Jacob raised a motion to approve our agenda for the meeting, seconded by Alexander Kraetge.

The group unanimously approved the minutes from the Savannah meeting.

The Title, Scope and purpose were reviewed. A comment was made stating that “Electrical Discharges” does not include mechanical noise produced by bubbling oil or vibrating elements inside the transformer. After discussing the idea, it was agreed by the group that the guide should describe the mechanical vibrations that can be encountered but that the title of the guide should stay as proposed.

The Title, Scope and Purpose were approved by the group with 16 votes for and 1 abstention. Below is the approved wording.

**Title:**

IEEE Guide for the Detection, Location and Interpretation of Sources of Acoustic Emissions from Electrical Discharges in Power Transformers and Power Reactors

**Scope:**

This guide is applicable to the detection and location of sources of acoustic emissions from partial discharges and other sources in power transformers and power reactors. There are descriptions of acoustic instrumentation, test procedures, and interpretation of results.

**Purpose:**

This guide is intended to provide information that may be helpful in planning, installing, and operating acoustic measuring equipment and in meaningful interpretation of resulting data.

Hemchandra Shertukde volunteered to prepare the technical presentation of the San Antonio meeting.

# Adjournment

The meeting was adjourned at 12:15 PM by Michael Franchek and Ali Naderian.

## B 3.7 Working Group for PD in bushings, PTs and CTs – PC57.160 WG Secretary: Thomas Sizemore; WG Chair: Thang Hochanh

The meeting of this working group was led by Thang Hochang. Roster sheets were circulated for attendees and guests to sign in. Attendance is to be recorded in the AM system based on these roster sheets. Interested individuals could also indicate an interest in joining the working group on these forms.

A check was made to determine if a quorum was present. A total of 17 WG members were present which did fulfill the quorum requirements. This was followed by introductions.

The chairman presented comments in the format of a spreadsheet gathered from a circulation of the draft. Shibao Zhang, Reiner Krump and one other individual provided an extensive set of comments in response to the draft being circulated. These comments were discussed as detailed below.

Figure 1 c-2 was shown and discussed. The focus of this conversation was about if typical values for C1, C2 and C3 could be presented in the document. David Geibel commented that C3 was unusual and is often shielded. Detlev Gross commented on test taps and voltage taps. Both David Geibel and Shibao Zhang commented that C3 is not in existing standards so consideration needs to be given to how this should be represented for consistency sake. Several comments were made that concerned the detailed test procedures. Bertrand Poulin commented on the need to stay on topic and within the scope of the working group. It was commented that guidance may need to be added for how to deal with situations involving high capacitance.

The second comment on the draft was discussed. It was noted that voltage taps are relatively rare. Zhang mentioned situations where the signal to noise ratio would be a concern. In many cases this relates to the laboratory performing the test. This comment was also made in the email from Reiner Krump. Dirk Russwurm asked about calibration in this type of circuit. Shibao Zhang requested the calibration circuit be shown.

It was noted that for instrument transformers an example is needed showing a grounded case.

Detlev Gross next mentioned that IEC 6270 is progressing as a standard and is relevant to this guide.

Pierre Riffon commented on the text requiring that the background noise is not to exceed 50% of the limit to be measured. In some cases this requirement may be too strict. This is a desirable goal but is unnecessary as a requirement. Dirk Russwurm and Detlev Gross comment that in cases where this stipulation cannot be met it may be necessary to perform calibration at a higher point. David Geibel requested clarification about the conditions present when defining the background noise. Does this include only the laboratory conditions or everything except the unit to be tested? At this point Thang Hochang moved to showing partial discharge test patterns for bushings and asking for comments from the attendees. Several patterns were discussed briefly including some due to internal voids and the power source. A few patterns for instrument transformers were shown. Most of these patterns were of void type defects. One particular pattern was noted as not being clear as to the type of issue. Detlev Gross suggested the pattern might be easier to interpret if the scale was linear instead of logarithmic.

The meeting concluded due to time constraints.

# Liaison Reports

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

The Working Group of High Voltage Test Techniques (HVTT) Subcommittee met in conjunction with the IEEE Power Engineering Society (PES) General Meeting at the Gaylord National Resort and Conference Center, National Harbor, Marylandon July 31st, 2014. There were 7 members and 19 guests in attendance.

At that meeting members of the subcommittee presented a Panel Session on High Voltage Test and Measurement Techniques, that included much of the same material included in a similar presentation made during our WG meeting at Milwaukee in October 2012.

The actual Working Group meeting convened at 11 AM and continued for 1 hour. During that meeting two items discussed that would be of particular interest to our members were, future meeting locations and possible future work for the HVTT Subcommittee.

The HVTT Subcommittee is sponsored by the Power System Instrumentation and Measurement Committee (PSIM) and working group meetings have historically been scheduled independently, as convenient for those WG members wishing to attend. It has been proposed that future meetings should be paired with either the PES General Meetings and, or with meetings of the various apparatus committees, such as the Transformer Committee. Possible future scheduling of such meetings has yet to be explored.

Now that the latest revision of IEEE Standard 4 has been published (as of May 2013) possible future work for the HVTT Subcommittee is being considered. Items of interest are:

IEEE Standard for Digital Recorders for Measurement in High Voltage Impulse Tests (IEEE 1128) and, to expand the scope of that standard to include the software requirements for such measurements.

IEEE Recommended Practices for Safety in High-Voltage and High-Power Testing (IEEE 510). This was last published in 1983 and has been withdrawn but, there is an interest in producing a revised edition.

The meeting was adjourned at 12PM.

# Old Business

## Survey of Correction for dielectric Table 4 and 5

* All the 3 negative votes from previous surveys were changed to positive after editorial changes were made. Corrected table is forwarded to include in revision to C57.12.00 which will be coming up for ballot.

## Survey for change of definition to class II

* Survey results for class II definition changes were presented during previous meeting. This change is now approved and will be part of revision to C57.12.00 which will be coming up for ballot.

No other old Business was brought for discussion

# New Business

Three new items were brought up.

* Based on Low Frequency test WG discussions related to C57.12.90 Section 10.5, Bertrand Poulin brought a motion to survey within WG and DTSC the proposal to delete reference to 3.46 Voltage factor for induce test of 1 phase distribution transformer with internally grounded neutral and BIL less than 150 KV from C57.12.90. After discussions, scope was increased to include distribution SC also in survey. Amended motion was seconded by Don Platts and motion was approved unanimously.
* A motion was brought by Susmitha Tarlapally to establish a TF to investigate if limits for winding insulation power factor and insulation resistances can be established for mineral oil and alternative liquid filled transformers. After many discussion and amendments, an amended motion was passed 22 in favor and four against. Passed Motion was seconded by Phil Hopkinson and request; “Setting up a task force to review and determine if limits for, winding insulation power factor and insulation resistance for power and distribution class transformers that includes both mineral oil and alternate liquids, can be established. “
* Phil Hopkinson presented the concern with respect to Core gassing in wound core transformer with HV close to core and need for introducing partial discharge test as design test. This proposal will be surveyed in performance characteristic subcommittee.

# Adjournment

Meeting adjourned 12.20 PM.

Minutes respectfully submitted by:

**Ajith M. Varghese**

Secretary DTSC.

Revision History:

R1: Formatting changes only Ajith M. Varghese 01/18/2015.

R2: Corrected the statement “*The Working Group agreed to add another line into the table for 1550 kV SIL at system 735 kV System Voltage to be in accordance with Table 6 of IEEE C57.12.00 -2010”* on page 2 of minutes as “*The Working Group agreed to add another line into the table for 1550 kV BIL at system 735 kV System Voltage to be in accordance with Table 6 of IEEE C57.12.00 -2010”* per comment noted during approval of minutes. Ajith Varghese 05/25/2015