

Dielectric Tests Subcommittee

**March 27<sup>th</sup>, 2019**  
**Anaheim, California**

<b>Dielectric Tests Subcommittee</b>		
<b>Chair: Ajith M. Varghese</b>	<b>Vice-Chair: Thang Hochanh</b>	<b>Secretary: Poorvi Patel</b>
Room: California Ballroom B	Date: March 27 <sup>th</sup> 2019	Time: 11:00 am to 12:15 pm
Members: 139	Present at time of checking: 94	Present per attendance roster & recorded to AM System: 100
Guests present: 100	Membership requested: 14	Membership accepted: 12

**B.1 Chair’s Remarks**

The Chair briefly highlighted the requirement that while introducing one need to state their employer/ company and sponsor if the difference from the company. The chair also reminded that IEEE and transformer committees are non-commercial organizations and standards shall focus only on developing performance and functional requirement and not design and construction details.

The Unapproved minutes from the Fall 2018 meeting and the agenda for Spring 2019 meeting was sent out to members and guests 14 days before the Spring meeting in Anaheim, and it’s also posted on the website.

An area that WG and TF have been late with and we need to improve is to send out the Agenda at least 14 days before the meeting. This also applies to on-line WG and TF meetings.

All TF and WG **MUST** record the attendance in the AM System- The WG/TF minutes do not need to include the list of attendees. The Roasters circulated in the meetings should not have the email addresses included to follow the data privacy policy. WG/TFs are urged to keep website information current. Any presentation presented during the meetings should be posted

All attendees should have updated information, such as email address in the AM system, as for all correspondence, this system is used.

The Chair reminded the WG and TF leaders to submit their minutes from the meetings within 15 days to the SC chair and secretary. The SC Secretary then has to submit the SC minutes within 45 days of the SC meeting. To minimize revision and errors in the sub-committee level and transformer committee level minutes, please send the final version of your minutes.

The Chair reminded WGs that call of the patent is required a during every WG meetings including on-line/Teleconference meeting. If there are any patent claim, it shall be noted but not discussed at the working group meetings. Calls for Patents is not required for TF.

Per new guidelines from IEEE, Audio/Video recording or photography is not allowed during SC, WG and TF meetings. The secretary could record the meeting for writing the minutes of meetings but this needs to be notified, and recording must be deleted after the use. The subcommittee Secretary would be recording the audio of the SC meeting for this reason today.

The Chair informed that there are changes to copyright policy – Clause 7 of IEEE standards Boards bylaws and Clause 6.1 of IEEE-SA Standards board operation Manual. There will be two webinars in April with more information.

Sue McNelly is in a process to update the IEEE transformer committee website. The new web.layout will be rolled out in about 2 weeks. Once the website is transitioned please make sure all the relevant documents have been transitioned for your TF/WGs. Please contact Sue if something is missing. This goes also for presentations.

Some of WG/TG were late in sending the agenda for the spring meeting. The invitation with agenda should be sent out 14 days before the meeting. Its required for the meeting conducted offsite or online/Teleconference as well. Agenda shall include more details of topics that will be discussed so invitees can decide whether to participate or not.

The Chair shared details of upcoming PES sponsored meeting as well as details of next transformer committee. The fall committee meeting 2018 will be held in Columbus, Ohio on the 27<sup>th</sup> -31<sup>st</sup> of October 2019. Spring meeting 2020 will be held in Charlotte, NC on the 22<sup>nd</sup> -26<sup>th</sup> of March 2020.

The Current Status of PARs was presented by The Chair.

- C57.127 Guide for the Detection of Acoustic Emissions from Partial Discharges in Oil-Immersed Power Transformers is now approved and published. Congratulations to the WG team.
- C57.160 Guide for the Elec. Measurement of PD in HV Bushing and Instrument Transformers was received back from ballott and is now in comment resolution state. The Par expires in 2019. If Par needs extension September 17<sup>th</sup> is the last for doing so.
- C57.113 Recommend Practice for Partial Discharge Measurement Power - Par expires 2021.
- C57.98 Guide for Transformer Impulse Tests the WG had their 2nd meeting here in Anaheim. Par expires in 2022
- C57.138 Recommended Practice for Routine Impulse Tests for Distribution Transformers there is no activity on as the guide does not expire until 2026. If new WG needs to be formed earlier, please advise to the chair
- C57.161 Guide for DFR Measurements is approved and published. There is no activity on as the guide as it does not expire until 2026.
- C57.168 Low-Frequency Test Guide is a new guide and had their second meeting here in Anaheim; PAR expires 2022

- C57.200 Bushing Frequency Domain Spectroscopy Guide (ENTITY WG) is a new guide and had their second meeting in Anaheim 2019. PAR expires in 2022.
- The Chair reminded the WG on attendance requirement for membership and the continuation and the requirement to have attendance updated in AM system, i.e., to attend two out of last three meetings or three out of five last meetings.

As there was an issue with the roaster in Jacksonville meeting no new members were added or removed. The total membership of the Dielectric Subcommittee is today 139 members. To obtain Quorum 70 members is required.

## **B.2 Quorum, Approval of Minutes and Agenda**

The membership list was presented, and a quorum of members was established through the AM system. 100 out of 139 members were present. Thus 71.9% of members were present at the meeting, and a quorum was reached. For request of membership, please reach out to the chair or secretary.

Motion to approve the agenda was made by Dan Sauer and seconded by Diego Robalino. The chair presented the agenda, and it was unanimously approved.

The Motion to approve the Fall 2018 minutes was made by Deepak Kumari and seconded by Arup Chakraborty. The minutes of the Fall 2018 meeting at Jacksonville meeting was approved unanimously.

### **B.3 Taskforce and Working Group Reports**

#### **Working Group Low-Frequency Dielectric Testing for Distribution, Power and Regulating Transformers Dan Sauer (Chair) at the meeting Tuesday 26/03/2019, Anaheim, CA.**

The Chair called the meeting to order at 9:30am.

Meeting attendees introduced themselves.

Number of attendees: 59.

Number of members: 46.

Number of members in attendance was 24, which is 52.2% quorum.

The Chair moved on to the Call for Patents—no patent was noted during the meeting.

The agenda was approved anonymously (1st approver of agenda was Amit Sarkar and 2nd approver was John Foschia).

Fall 2018 meeting minutes were anonymously approved.

The Chair moved on to the Old Business.

The Chair proposed the following definition that he displayed on the screen:

Low Frequency Dielectric Test:

Dielectric tests in which the test voltages are alternating voltages with frequencies less than 500 Hz from an external source.

The Chair entertained a motion to adapt the above proposed definition.

The motion was approved to use Low Frequency Dielectric Test: Dielectric tests in which the test voltages are alternating voltages with frequencies less than 500 Hz from an external source as a definition for low frequency dielectrics test (1st approver: John Foschia and 2nd approver: Sen Cihangir).

The Chair showed the basic outline and approach he received from Dave Giebel and generally agreed upon without any verbal objections. This outline will be used in writing the guide.

Phil Hopkinson asked what the scope of this guide is supposed to be. The Chair clarified that this guide will provide guidelines for any low frequency test defined in the test code.

There was a discussion on which tests to be included in this guide. Induced voltage test with PD measurement, applied voltage test, and power factor test with capacitance measurement were suggested to be included in this guide.

Xavier Artega asked the question on whether or not auxiliary equipment such as CT testing should be included. Jeff Britton recommended to only include the tests that raise questions amongst manufacturers

and end users that this guide can help with. The Chair will start with induced and applied tests for the development of this guide.

Don Platts mentioned that the reason for this guide was to move all tutorial material from standards to this new guide.

Dan Sauer and Ajit Varghese will review IEEE C57.12.00 and C57.12.90 and determine which information needs to be moved to the new guide.

The Chair asked for volunteer experts to help with writing different sections of the new guide.

There was no new business.

A motion was approved to adjourn.

Meeting was adjourned at 10:24am.

**WG C57.113 - Recommended Practice for PD Testing, March 25th, 2019 – Laguna room**  
**Ali Naderian – Chair, Janusz Szczechowski – Vice Chair**  
**John Foschia – Secretary**

**Meeting Attendance**

The working group met at 9:30am. There were 118 attendees and 18 members present. Quorum was achieved at 62.1%.

**Discussions**

- Motions were made to approve the minutes of the Fall 2018 WG meeting (D. Gross, A. Winter) and the agenda of the Spring 2019 meeting (D. Gross, A. Winter) and both were unanimously approved.
- No essential patent claims were brought to the working group's attention.
- A request was made for the title and scope of the working group to be included in the minutes.
  - The PAR details which include both the title and scope of the working group are included as an attachment to the minutes.
- The chair reviewed the title and scope of the working group.
  - UHF and other PD measurement methods cannot be included in this guide due to the scope, however it may be possible to include UHF methods as an annex.
  - The current PAR expires in 2021.
- D. Gross gave a presentation regarding partial discharge which included recommendations for revisions to the guide.
  - Section 4 - Change of the coupling capacitor abbreviation 'Ck' to 'Cc'.
  - Section 4.2 – With the appropriate quadrupole, smaller values of coupling capacitance than presently stated become feasible.
  - Section 4.4.1 - Modify/remove the frequency band limits.
  - Section 4.4.2 - Add the pulse train response graph from IEC 60270.
    - The chair noted that permission from IEEE must be obtained before including any graphical materials from outside sources.
  - Section 4.4.2 – Remove the note regarding deviations of pulse train response; all modern PD measurement equipment incorporates this.
  - Section 4.4.3 – Add more information regarding parallel acquisition.
  - Section 4.4.5 – Add note regarding calibrations at noise levels close to the new floor because of 'fake linearity.'
  - Investigate calibration response criteria alignment with IEC. IEC allows for a 3% deviation of calibration response where IEEE allows for 5% deviation.
  - Remove references of scale factor references – possibly remove the entire paragraph.
- D. Gross recommended the addition of information regarding phase resolved patterns to an appendix.
- R. Kuppaswamy recommended the addition of information regarding the measuring impedance.
  - It was noted that:
    - Measuring impedance is a critical component of the measurement circuit.
    - Tests can inflict damage to the measuring impedance.
    - Multiple concepts of measuring impedance are applicable.
  - R. Kuppaswamy volunteered to provide information to A. Kraetge for revisions to section 5.

- D. Gross gave another presentation regarding partial discharge patterns and the basic physics regarding partial discharge.
  - It was recommended to include information of the cross-calibration matrix into the guide. The chair noted that this is not included within IEC and that the 2010 revision of the guide did not support inclusion of this information.
- It was recommended to include requirements regarding the noise floor limits as well as measurements on all external terminals of the transformer.
  - The membership noted that these requirements would be a component of the test code standards and that the requirements are not within the scope of the guide.
- The vice-chair noted that within Annex F, it is recommended to include information regarding the noise generated in power electronics because of their prevalence within the industry.
- R. Kuppaswamy noted that the current annexes do not include 'PD fingerprints,' and recommended the following:
  - There is a need to recognize the 'cross-talk' between phases.
  - Reword Annex F to 'Visual Recognition of PD Patterns.' There was no motion.
- Consensus within the working group supported PD patterns being supplied from users and not specific instruments or instrument suppliers.
  - The chair requested that users provide patterns to enrich Annex F.

Upon request from the WG, a word document of the present guide has been circulated.

### **Adjournment**

A motion to adjourn the meeting was made by D.Gross and seconded by D. Wallace. The meeting was adjourned at 10:45am.

John Foschia

## **Working Group for Impulse Guide – PC57.98**

**WG Secretary: John Foschia; WG Chair: Thang Hochanh; WG Vice Chair: Reto Fausch  
Meeting Minutes March 25, 2019, at 1:45 – Anaheim, CA, Malibu 4**

### **Meeting Attendance**

The working group met at 1:50pm. There were 149 attendees and 33 members present. Quorum was achieved at >97%.

### **Discussions**

A larger room will be requested for the next meeting, based on Spring 2019 attendance.

The chair presented the reasons that justify the use of the beta as an indicative information due to the facts below:

- For beta below 5%, the correction factor to the peak wave value is minimal. (beta is the difference between the base curve/high frequency removed measured curve)
- For beta at 10% or up to 30%, as shown on example on projector, the correction is also minimal, due to the fact that the frequency related to this example is lower than 200 kHz.
- Any correction or k-factor is directly dependent of the frequency of the first oscillation (as stated in IEC 60060-1).
- For a manufacturer test lab, when a test curve has a first pulse frequency high to very high, the correction will be high and for a beta-prime of 30% and a frequency of 1 MHz, the correction is up to 50% of the beta-prime value.
  - In this case the test lab will have the incentive to adjust the wave form to reduce the beta value.
  - When the impulse circuit is optimal, the first pulse frequency is usually low, i.e. well under 500 kHz and the correction is far under 50% (as presented to the WG).
  - The chair provided examples of full wave impulse shots with beta values less than 10% and greater than 30%.
- The WG have discussed about the k-factor and the chopped waves. The chair mentioned that in IEC 76-4, the problem was solved when the charging voltage is adjusted to 110% of the 100% Full wave.
- Pierre Riffon mentioned that provisions in the Standard has been provided to take in account high values of T1 (virtual front time).

### **New Business**

- In situations where a chop wave is applied without a previous full wave, what method is the peak of the chop wave to be measured and reported? (Jim McBride, JMX)
  - This could be addressed within WG C57.98 and will be discussed at the next meeting. There was no concern voiced regarding the use of peak voltage measurement in this specific situation.
- The guide should make clear that waveform comparisons are to be made on the recorded traces and not the corrected traces.
  - This may not be clear in the standard and it should specifically refer to the recorded trace being used for waveform comparison.
- The chair proposes that the beta values be provided on report screens, and also that an identification of 'K-factor' utilization should be provided on the reports.

**Adjournment**

The meeting was adjourned at 3:00pm

Thang Hochanh / John Foschia

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

This working group did not meet in Anaheim, CA. The document was submitted for ballot. The return rate and the approval were above the minimum. The comments will be addressed and the document will be revised and recirculate for balloting.

At this time PAR extension is not expected.

## Working Group for Bushing DFR – PC57.12.200

WG Secretary: Bo Qi; WG Chair: Jun Deng; WG Vice Chair: Zhanlong Zhang  
Meeting Minutes March 26<sup>th</sup>, 2019, at 3.15pm – Anaheim, CA, Capistrano,

### Minutes of the 2<sup>nd</sup> WG Meeting

#### 1. Call to Order

- Meeting convened in Anaheim, USA, 28 participants
- The meeting was called to order at 3:15pm
- All present introduced themselves and declared their affiliations.
- A sign in sheet will capture attendance each day.

#### 2. Introduction to entities: membership and associated DR & DRA

- WG membership consists of China Southern Power Grid(CSG), Electric Power Research Institute(EPRI), Xi'an XD, Tsinghua University(THU), North China Electric Power University(NCEPU), Xi'an Jiaotong University(XJTU)
- Observer consists of South China University of Technology, TBEA, Nanjing Electric Group), MEGGER, OMICRON
- DRs and DRAs of the entity WG members attended the meeting are:
- Jun Deng (DR, CSG), Yuliang Hao(DR, Xi'an XD), Zhicheng Pan(DRA, XJTU), Poorvi Patel (DRA, EPRI), Xu Yang (DRA,NCEPU), Yao Xiao (DRA,THU)
- Participants: Ajith M.Varghese(Chair for Dielectric Test Sub Committee (DTSC)), Charles Sweetser(Omicron), Jialu Cheng(MEGGER), Weiqiang Jin(Omicron), Lei Wang(Peakdemand), Diogo M.Robalino(Megger), Shibao Zhang(HUBBELL), Peter Werelius(Megger), Ronald Hernandez(Doble), Mario Locarno(Doble)

#### 3. Approval of agenda

- Chair Deng presented the agenda [PC57.12.200 2nd WG Meeting Agenda.pdf](#).
- *Motion #1*  
*Approve the agenda for PC57.12.200 2nd WG Meeting as presented in [PC57.12.200 2nd WG Meeting Agenda.pdf](#).*  
*Moved: Poorvi Patel, Electric Power Research Institute, USA*  
*Seconded: Zhicheng Pan, Xi'an Jiaotong University, China*  
*(Procedural, required  $\geq 50\%$ )*  
*Motion passed without opposition.*

#### 4. Approval of Minutes from Prior Meeting

- Chair Deng presented the minutes from prior meeting [PC57.12.200 1st WG Meeting minutes.pdf](#).
- *Motion #2*  
*Approve the minutes from prior meeting PC57.12.200 1st WG Meeting minutes.[dox](#).*  
*Moved: Poorvi Patel, Electric Power Research Institute, USA*  
*Seconded: Zhicheng Pan, Xi'an Jiaotong University, China*  
*(Procedural, required  $\geq 50\%$ )*

*Motion passed without opposition.*

- **IEEE Patent Policy**

- Patent Slides were presented to the WG.
- Chair Deng made a call for potentially essential patents at 3:22pm. No potentially essential patent claims were declared, and no holders of potentially essential patents were identified.

**5. Approval of the WG P&P**

- *Motion#3*  
*Moved: Poorvi Patel, Electric Power Research Institute, USA*  
*Seconded: Zhicheng Pan, Xi'an Jiaotong University, China*  
*(Procedural, required  $\geq 50\%$ )*  
*Motion passed without opposition.*

**6. Approval of the WG Technical Experts**

- *Motion#4*  
*Approve Charles Sweetser (Omicron), Jialu Cheng(MEGGER), Weiqiang Jin(Omicron), as WG Technical Experts.*  
*Moved: Poorvi Patel, Electric Power Research Institute, USA*  
*Seconded: Zhicheng Pan, Xi'an Jiaotong University, China*  
*(Procedural, required  $\geq 50\%$ )*  
*Motion passed without opposition.*

**8. Technical Discussion**

- At 3:56pm, Xu Yang(NCEPU) gave a technical speech on an applications of FDS in detecting bushing defects.
- At 4:08pm, Diogo M.Robalino(Megger) gave a technical speech on Frequency domain dielectric spectroscopy measurement of Transformer Bushings.
- At 4:14pm, Peter Werelius(Megger) gave a technical speech on Frequency domain dielectric spectroscopy measurement technology.

**9. Next Work Plan**

The WG has obtained good experience in FDS applications for OIP type bushings. But we have less experience in FDS applications for RIP and RIS bushings. The WG has contacted the observer Nanjing Electric Group to provide some RIP and RIS bushings with defects for further FDS testing. The chairman company is going to perform the tests. Is any company willing to join the tests with us, and analyze the data to establish the FDS interpretation criteria for RIP and RIS bushings. We hope to discuss the test results at the next meeting.

**10. Unfinished business**

- No unfinished business was brought before the WG.

**11. New Business**

- No new business in the WG meeting.

## **12. Future Meeting**

- The next WG meeting is tentatively scheduled in July 2019 and in Shenyang, China

- *Motion #5*

*Move to adjourn the meeting.*

*Moved: Poorvi Patel, Electric Power Research Institute, USA*

*Seconded: Zhicheng Pan, Xi'an Jiaotong University, China*

*(Procedural, required  $\geq 50\%$ )*

*Motion passed without opposition.*

The WG adjourned at 4:30 pm.

**B.3.4 TF on Revision of Impulse Tests**  
**Pierre Riffon, Chair; Daniel Sauer, Vice-Chair**

The TF met on March 26, 2019, from 4:45 pm to 6:00 pm. Twenty (20) members and twenty-eight (28) guests attended the meeting. Four (4) guests requested membership. The meeting was chaired by Pierre Riffon, Chair of the TF. Mr. Daniel Sauer was the vice-chair.

Meeting has been called to order by the Chair at 4:45 pm.

Attendance has been recorded in the AM system.

Required quorum was not met, presence of at least 22 members was required. The TF membership roster has been reviewed after the Jacksonville meeting and members who did not attend the last three meetings have been moved as guests. Guests who have not attended the last five meetings have been removed from the TF roster. 94 guests have been removed from the TF roster.

Because of the lack of quorum, the meeting agenda and the Jacksonville meeting minutes have not been approved. Approval by Email will be done.

The first item of business was related to a proposal of modifications to clause 10.3.2.1 of C57.12.90 concerning the condition of tertiary and stabilizing winding terminals during lightning impulse tests. This proposal was already surveyed within the TF membership and guests with an approval rate of 100%. The proposal was now surveyed within the Dielectric Tests Subcommittee and got an approval rate of 98.7%. Comments received have been presented and discussed during the meeting and it was no objections to the TF Chair observations made on these comments.

The second item of business was related to a proposal of modifications to clause 10.2.4 of C57.12.90 concerning the tap changer position during switching impulse tests. This proposal was already surveyed within the TF membership and guests with an approval rate of 92.9%. The proposal was now surveyed within the Dielectric Tests Subcommittee and got an approval rate of 96.5%. Comments received have been presented and discussed during the meeting and it was no objections to the TF Chair observations made on these comments.

Since the quorum was not achieved and that both proposals were approved by a large majority of Dielectric Tests SubCommittee members and guests who reply to the survey, the final wordings will be sent to the Dielectric Tests SubCommittee Chair for transmission to Steve Antosz for inclusion in the next draft of IEEE C57.12.90.

The meeting adjourned at 5:30 pm on March 26, 2018.

The next meeting is planned to be held in Columbus, Ohio on October 29, 2019.

Pierre Riffon P. Eng.  
TF Chair  
March 26, 2019

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Following text will be sent to Steve Antosz for inclusion in the next IEEE C57.12.90 draft once the minutes and agenda is approved.

**10.3.2.1 Terminals not being tested**

Neutral terminals shall be solidly grounded. Line terminals, including those of autotransformers and regulating transformers, shall be either solidly grounded or grounded through a resistor with an ohmic value not in excess of the values given in Table 3.

Tertiary winding terminals shall be considered as line terminals.

When buried stabilizing winding terminals have been temporarily brought out of the tank for testing purposes only, they shall be connected the same way as they will be in service during impulse tests (grounded or in open circuit).

When a stabilizing winding terminal is brought out of the tank for grounding purposes, this terminal shall be grounded during impulse tests.

When stabilizing winding terminals are brought out of the tank for the purpose of grounding the winding and closing the delta, these terminals shall be connected as intended for service during impulse tests.

**Table 3 —Grounding resistor values**

Nominal system voltage (kV)	Resistance (Ω)
345 and below	450
500	350
765	300
NOTE—These values are representative of typical transmission-line surge impedances.	

The following factors shall be considered in the actual choice of grounding for each terminal:

- a) The voltage to ground on any terminal that is not being tested should not exceed 80% of the full-wave impulse voltage level for that terminal.
- b) When a terminal has been specified to be directly grounded in service, then that terminal shall be solidly grounded.
- c) When a terminal is to be connected to a low-impedance cable connection in service, then that terminal shall be either directly grounded or grounded through a resistor with an ohmic value not in excess of the surge impedance of the cable.
- d) Grounding through a low-impedance shunt for current measurements may be considered the equivalent of a solid ground.

**As well as the following text**

10.2.4 Tap connection

The choice of the tap connection shall follow the following rules:

- The tap position shall be selected in order to induce, as close as possible (preferably within ±3%), the rated switching impulse withstand voltage value on the LV winding terminal.

- If the LV winding has no rated switching impulse level, the tap position shall be selected in order to induce, as close as possible (preferably within  $\pm 3\%$ ), 83% of the LV winding rated BIL value on LV winding terminal.

It should be noted that for some cases, the LV winding may receive a voltage which is less than its rated switching impulse level, or 83% of its rated BIL and, this shall be accepted.

It should be also noted that for some other cases, the LV winding may receive a voltage which is higher than its rated switching impulse level, or 83% of its rated BIL, this shall be accepted and the transformer shall be designed for it.

For transformers having a preventive autotransformer, the tap changer shall be in a bridging position, if this operational mode is permitted for continuous operation.

**B.3.5 TF on Revision of Low-Frequency Tests**

**Anaheim, CA – March 26, 2019, 1:45 p.m., Chair: Bill Griesacker, Vice Chair: Daniel Blaydon (acting secretary), Secretary: Myron Bell (not present).**

1. The meeting was called to order at 1:45 PM.
2. Attending members were counted and quorum was verified by the RFID system report, which is provided in summary below:

<b>Attendance</b>	
	<b>RFID</b>
Total Attendees	88
Total # Of Members	57
Members Present	34
Quorum Present	59.6%

Note that paper rosters were not used at this meeting, however a signup sheet was provided to guests who wanted to requested membership.

3. A motion was made to approve the the meeting agenda by Hugo Flores, which was seconded by Dan Sauer. There were no objections to unanimous approval of the agenda.
4. A motion was made to approve the meeting minutes from the 2018 Fall meeting in Jacksonville by Vinay Mehrotra, which was seconded by Hugo Flores. There were no objections to unanimous approval of the meeting minutes.
5. Task Force for PD Factory Limits report by Vinay Mehrotra (Appendix A – Meeting Minutes)  
Vinay provided a summary report on the Task Force meeting that occurred on Monday, which included the adoption of the partial discharge acceptance criteria from the IEC for Class II transformers. Vinay Mehrotra made a motion to forward this in a survey to the Dielectric Test Subcommittee. The motion was seconded by Raj Ahuja. The floor was opened for discussion. There were questions about the original scope of the Task Force and whether the work of the Task Force was complete. It was determined that the work was completed, that the Task Force would be dissolved, and the coments from the Subcommittee survey would be handed by the Task Force for Revision to Low Frequency Dielectric Test.

The chair requested a vote on the motion, the results of which are provided below:

32 Approved  
1 Disapproved  
2 Abstentions

The motion passed.

6. Old business

- a. Clarification of measuring voltage during low frequency dielectric tests – Bertrand Poulin

A brief background on this topic was provided during the meeting. It was stated that Bertrand Poulin has not yet drafted a proposal and that no further action has been taken.

- b. Class I Partial Discharge Testing – Don Ayers

A brief background on this topic was provided during the meeting. A motion was made during the Spring 2018 meeting by Don Ayers to form a task force to revise the test procedure, test levels, and acceptance limits for partial discharge testing of Class I transformers. The motion was seconded by Mickel Saad. The meeting time expired and the motion discussion was tabled until the Fall 2018 meeting. Don Ayers was not present at the Fall 2018 meeting, so the motion continued to be tabled until this meeting.

Don Ayers recommended that we form a Task Force to revise the test procedure, test levels, and acceptance limits for PD testing of Class I transformers. The floor was opened for discussion, based on the motion previously presented. There were questions about whether there is sufficient experience for Class 1 transformers within the TF to develop this scope of work.

The chair requested a vote on the motion, the results of which are provided below:

19 Approved  
0 Disapproved  
9 Abstentions

The motion passed. There will be further discussion on how to involve the Distribution Transformer Subcommittee in this work.

- c. Gassing issue for certain types of transformers with wound cores – Phil Hopkinson

A brief background on the status of this topic was provided at the meeting. Phil Hopkinson requested information on the next steps for including the proposal in the upcoming revisions of C57.12.00 and C57.12.90. It was stated that these documents are likely to go to ballot by the end of 2019. The Chair requested a summary of the survey results on the proposal including the comments and voting results to be distributed. Phil Hopkinson requested a list of everyone that needs to receive the results of the survey so that it could be distributed.

7. New business

There were no new business items. A reminder was made to attendees regarding the application for membership.

8. The meeting was adjourned at 2:32pm.

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- ***During DTSC, Bill Griesacker (TF chair) motioned***
  - ***To survey in the Dielectric Test Subcommittee the proposed text related to PD during Transformer Factory Acceptance testing***
    - ***Second Dan Sauer.***
    - ***The motion was unanimously approved***
    - ***0 Disapproved***
    - ***0 Abstentions***

### **Draft Text of PD Limits for Class II transformer for Survey within DTSC**

C57.12.90 Clause 10.8.5 Failure detection

Failure may be indicated by the presence of smoke and bubbles rising in the oil, an audible sound such as a thump, or a sudden increase in the test current. Any such indication shall be carefully investigated by observation, by repeating the test, and by other diagnostic tests to determine whether a failure has occurred. In terms of interpretation of partial discharge measurements, the results shall be considered acceptable and no further partial discharge tests required under the following conditions:

- a) The magnitude of the partial discharge level does not exceed ~~500 pC~~ **250pC** during the 1 h test period.
- b) The increase in partial discharge levels during the 1 h period does not exceed ~~150~~ **50 pC**.
- c) The partial discharge levels during the 1 h period do not exhibit any steadily rising trend, and no sudden sustained increase in the levels occurs during the last 20 min of the test.

Judgment should be used on the 5 min readings so that momentary excursions of the partial discharge readings caused by cranes or other ambient sources are not recorded. Also, the test may be extended or repeated until acceptable results are obtained. A failure to meet the partial discharge acceptance criterion shall not warrant immediate rejection, but it shall lead to consultation between purchaser and manufacturer about further investigations.

No changes to C57.12.00 Cl.5.10.5.5.

**B.3.4 TF on Impulse Transient (Part of C57.142)  
WG Chair Jim McBride; WG Secretary Tom Melle; WG Vice Chair Xose Lopez-Fernandez;  
Meeting Minutes March 26<sup>th</sup>, 2019, at 3.15pm – Anaheim, CA, California Ballroom B,**

- 1) Meeting called to order at 3:15 PM.
  - a. Welcome and Chair's Remarks
- 2) Circulation of Attendance Sheets
  - a. 97 Attendees were present (54 Guests)
  - b. 43 of 53 Members present (quorum was achieved)
- 3) No essential patent claims made
- 4) Approval of Agenda (motion by Pierre Riffon and 2<sup>nd</sup> by Deepak Kumaria) and meeting minutes from Fall 2018 (motion by Klaus Pointner and 2<sup>nd</sup> by Akash Joshi) without objection.
- 5) Status of Current Draft and Comments – Jim McBride
  - a. The present draft of the Guide is posted on the Working Group website
  - b. Review of C57.142 Draft 6 – The Chair noted that editorial changes continue, but the WG members and guests have not provided many comments since Draft 5. Some additional editing / cleanup may be needed and continued review by the WG is appreciated. Additional examples are included in D6 (GSU in backfeed mode, failing autotransformers, instrument transformers, and reactor switching).
  - c. The chair requested that the members and guests please continue to review and comment on the existing draft over the next few weeks before the draft is handed to the IEEE Switchgear Committee for review.
- 6) Status of Task Force Paper – Jim McBride
  - a. IEEE requested the TF paper be reformatted to include CV's for the paper authors. This will be handled by WG Vice Chair Xose Lopez-Fernandez.
- 7) Mitigation Methods Task Force Update – Phil Hopkinson
  - a. In the past, EHV reactors that were failing in the field were passing factory test levels. Special Terminated Lightning Impulse Tests (STLI) were then incorporated and failures reduced dramatically.
  - b. Phil requested manufacturers data using RSG (recurrent surge testing) in order to understand the stresses on windings. Phil reminded the WG that many old

transformers had electrostatic shields. Line shields increase series capacitance and greatly reduce capacitance to ground. In the past (for 34.5 kV and below) static shields added to the winding seemed to increase probability of surviving re-strikes

- c. Shielding solves many issues with series resonance and is relatively easy to apply. The conclusion is that increasing the series capacitance and reducing the capacitance to ground should improve the design. Phil urged the group to focus on improving transformer designs and developing new test methodologies.
  - d. Mitigation methods with some success have included: higher BIL, open terminal special impulse test, and fast-front switching surge with a long tail time.
  - e. The Chair added that more communication is required between the end-user of the transformer and the manufacturer with regard to the potential for exposure to high-energy transients in the field. Advanced modeling will be necessary in order to mitigate these issues. Experts who can model/analyze disc and layer winding designs are necessary in order to move the WG efforts forward. Multiple mitigation methods are also being discussed and will be addressed in the Guide.
- 8) STLI Presentation by Mike Spurlock of AEP (will be posted on the WG website) using standard impulse waveforms (1.2 x 50 us)
- a. Pierre Riffon asked if arrestors are used in the testing (on the X terminal) and if full voltage is applied on the H terminal. No arrestors were used and full voltage was applied.
  - b. Phil Hopkinson commented there was significant focus on the current traces in the presentation, but pointed out some significant collapse on the non-impulsed terminals. The chair commented that the significant point is how quickly the voltage appears on the non-impulsed terminals and that the arrestors are clamping.
  - c. Mike Spurlock added that the manufacturers tests show the stresses are higher and deeper into the winding than a standard impulse test. The chair added the STLI test better represents how the transformer is connected in service. Phil agreed this assessment matches prior failure modes and mitigation. Discussion by Amitabh Sarkar and others ensued regarding various testing arrangements (open versus terminated windings for example).
  - d. Manush Safar asked a question regarding whether an opening breaker versus closing breaker scenarios have been investigated and included in the Guide. Phil commented that different phenomenons (pre-strike and re-strike?) cause different stresses when opening or closing. The energy following a strike/restrike tends to move back-and-forth between the internal inductance and capacitance The Chair added that re-strike/re-ignition can cause severe issues and several examples are included in the draft guide.

- e. Phil Hopkinson suggested shielded versus unshielded winding designs should be modeled and studied and further tested with the different STLI test configurations to gather more data. Mike Spurlock further commented that rather than arrester terminated, testing with capacitor terminated windings can be used to better simulate certain circuits (GSU's for example).
- 9) Switchgear Liaison Update – Dave Caverly
- a. The C57.142 Guide is a co-sponsored document between Switchgear and Transformers and run by Transformers Committee.
  - b. The last Switchgear liaison meeting was held with 50 people present,
  - c. There is now an official liaison TF between the Switchgear and Transformers committees. The next IEEE Switchgear Committee Meeting will be held April 28-May 2, 2019 in Burlington, VT.
- 10) JWG A2/C4.52 HF TDSF Modeling principles – Xose Lopez-Fernandez/Jim McBride
- a. TDSF for Transformer Modeling has been added to the monitoring circuit utilized by Jim McBride for High Frequency Transient Measurements.
  - b. Presentation topics included transformer modeling during Transformer Impulse Transients. Measured transients were then imposed on a detailed model of the transformer. The presentation will be posted on the WG website.
- 11) New Business: none
- 12) Next Meeting: (Columbus, OH)
- 13) Adjournment at 4:35 PM without objection

Respectfully,  
Thomas R. Melle  
Secretary

**B 3.8 Task Force Winding Insulation Power Factor & Winding Insulation Resistance Limits  
Diego Robalino (Chair) and Aniruddha Narawane (Secretary) at the meeting  
Tuesday 26/4/2019, California Ballroom A, Anaheim, CA.**

- Meeting was called to order at 8.00 am Total 86 attendees. 30 members, 56 guests with 6 guests requesting membership.
- Quorum achieved. Agenda for S19 meeting and minutes from F18 were approved.
- Clarification was provided on guides and references to complete the data acquisition spreadsheet
  - Reminder that the data is to define limits for transformer acceptance / commissioning.
- Non-disclosure agreement provided to members and guests. Questions to be addressed directly to IEEE SA.
  - Ernesto Vega Janica [e.vegajanica@ieee.org](mailto:e.vegajanica@ieee.org)
- Action plan for this TF:
  - Minor revisions requested during this meeting will be incorporated in the data acquisition spread sheet
  - The revised spread sheet will be shared with all members and guests of the TF.
  - Data collection will go until June 1<sup>st</sup>. Data goes directly to:
    - Ernesto Vega Janica [e.vegajanica@ieee.org](mailto:e.vegajanica@ieee.org)
  - Meetings will be set up to analyze data and formulate report to DTSC
  - Next meeting expecting to be the last for this TF.

With no other business meeting was adjourned at 8.50 am.

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The whole DTSC is invited to provide PF and Resistance data. The template will be circulated by the chair and the collection deadline is 1<sup>st</sup> of June 2019.

#### B.4 Liaison Reports

**IEEE High-Voltage Testing Techniques Subcommittee  
Liaison Report to Dielectric Tests Subcommittee of IEEE Transformers Committee  
Submitted by Jeff Britton (HVTT Subcommittee Chair)  
March 27<sup>th</sup>, 2019  
Anaheim, CA**

- ❖ Subcommittee met at January 2019 PES Joint Technical Committee Meeting in Anaheim, CA
- ❖ Active Projects Include
  - ❖ IEEE P1122 – Impulse Digitizer Standard. Draft 3 in development. PAR expires end of 2019 – Will request 1 year PAR extension. Chair: Jeff Britton, Phenix Technologies, Inc.
  - ❖ IEEE P510 – High Voltage Safety Guide. The Guide is presently in draft development, with drafts submitted for all sections. PAR expires end of 2020 – Chair: Jeff Hildreth, Bonneville Power Administration
  - ❖ IEEE P2426 – Field Measurement of Fast Front and Very Fast Front Overvoltages in Electric Power Systems (Entity PAR). In draft development, PAR expires end of 2021. WG Met in Xi'an China in January, 2019 Chair: Shijin Xie, State Grid Corporation China
  - ❖ New WG for Fall 2019: “Guide for the Detection, Measurement and Interpretation of Partial Discharges” (General IEEE PD Guide). Chair: Detlev Gross, Power Diagnostix
  - ❖ New WG for Fall 2019: “Guide for the Practical Implementation of IEEE Std4-2013 on High-Voltage and High-Current Measurement Systems”, Chair: Bill Larzelere, Evergreen High Voltage
  - ❖ New TF for Fall 2019: Topics for Revision of IEEE Standard 4 - 2013
- ❖ Next HVTT Meetings
  - ❖ Scheduled during week of September 16<sup>th</sup>, 2019 in Fayetteville, GA
  - ❖ Electronic attendance is offered for most HVTT SC, WG and TF meetings via web meeting, so physical attendance is not required to participate and qualify for membership
  - ❖ Contact Jeff Britton ([jeff@phenixtech.com](mailto:jeff@phenixtech.com)) or Jim McBride ([jim@jmxhv.com](mailto:jim@jmxhv.com)) to participate

**B.5 Old/ Unfinished Business**

No Old business at this time was brought up and discussed.

**B.6 New Business**

No New business at this time was brought up and discussed.

**B.7 Adjournment**

Meeting adjourned 12.20 PM. Motion to adjourn made by Tauhid Ansari and Deepak Kumari.

Minutes respectfully submitted by:

**Poorvi Patel**

Secretary DTSC.