Dielectric Tests Subcommittee

April 28th, 2021
Virtual meeting

Dielectric Tests Subcommittee		
Chair: Ajith M. Varghese	**Vice-Chair: Thang Hochanh**	**Secretary: Poorvi Patel**
Room: Virtual	Date: April 28th 2021	Time: 11:00 am to 12:15 pm
Total DTSC Members: 136	Members present at the meeting: 109	Attendance according AMS: 254
Guests present: 145	Membership requested: 25	Membership accepted:23

B.1 Chair's Remarks

The Chair welcomed members and guests to the Spring 2021 virtual meeting. The Chair briefly highlighted the requirement that while introducing one need to state their employer/ company and sponsor if the difference from the company. This is especially important in a virtual setting. 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 2020 meeting and the agenda for Spring 2021 meeting was sent out to members and guests 14 days before the Spring virtual meeting, and it's also posted on the website.

All TF and WG **MUST** record the attendance in the AM System (no expectations that the meeting was held in an virtual setting) - The WG/TF minutes do need to include the list of attendees. The attendance for the virtual meetings should be recoded with the Poll feature in Webex and 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/TF leaders that if a PAR extension is needed – this should have a WG approval before proceeding. However, the WG should try to complete the revision/guide within the given timeline. If the document is almost complete and new information comes to attention, in that case the WG-leader makes the call to include it or if the new information could wait until the next revision.

To keep the PAR timeline it is also recommended to have on-line meetings between the scheduled Fall and Spring meetings- to get the revision work moving. The on-line working meeting agenda should be posted before the meeting as well as minutes and attendance should be recorded.

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 must submit the SC minutes within 45 days of the SC meeting- June 11th 2021. 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 advised the WG/TF leaders to in advance before the DTSC meeting to submit any important motions or new Agenda to be discussed and approved during the DTSC meeting to the Chair. Motion could also be posted on the chat during the meeting.

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.

Highlights from ADCOM:

a) If a PAR Extension is needed then the following must be followed:
   - WG should get opportunity to discuss and shall approve extension
   - Same shall be documented in minutes

b) For all Online meetings the following should be performed:
   - Shall provide notice and shall be posted on webmaster
   - Attendance and Minutes are required.

Ballot update of C57.12.00 and C57.12.90 related to DTSC. The Ballot comments were forwarded to the WG/TF leaders. Comments related to Impulse Testing was reviewed and responded during TF meeting on Tuesday 27th of April 2021. All comments have been responded. Comments related to low Frequency Testing couldn't get reviewed during S21. Resolution study group has been set-up to go over the comments.

Per new guidelines from IEEE, Audio/Video recording or photography is not allowed during SC, WG and TF meetings. In this virtual setting the sessions will be recorded and sent to the secretary for assisting in writing the minutes of meeting. The recording will be deleted after the use.

The Chair shared details of upcoming PES sponsored meeting as well as details of next transformer committee. The Fall committee meeting 2021 will be held in Milwaukee on the 17th -21th of October 2021. A survey will be sent out in June-July and based on the outcome of the survey decision will be taken if this meeting will again be virtual or in person. The Spring 2022 meeting is planned to be in Denver, CO on March 27th to 31st.

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 was published in 2019. Next revision 2028. Currently is inactive.

- C57.160 Guide for the Elec. Measurement of PD in HV Bushing and Instrument Transformers is in ballot resolution. The guide expired in 2020. Par is exteded to 2022.

- C57.113 Recommend Practice for Partial Discharge Measurement Power - Par expires 2021. The guide expired in 2020. The WG approved a motion to apply for PAR extension to December 2022.

- C57.98 Guide for Transformer Impulse Tests. The Guide expires 2021 and Par expires in 2022. No major changes needed, so should be in good shape.

- C57.138 Recommended Practice for Routine Impulse Tests for Distribution Transformers there is no activity on as the guide does not expire until 2026.

- C57.161 Guide for DFR Measurements is approved and published 2018. There is no activity on as the guide as it does not expire until 2028.

- C57.168 Low-Frequency Test Guide is a new guide; PAR expires 2022.

- C57.200 Bushing Frequency Domain Spectroscopy Guide (ENTITY WG) is a new guide. PAR expires in 2022. There was no TF this Fall 2020.

If PAR extension is needed the last date for that next year is **18 October 2021**.

The secretary 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.

There was an issue with the Poll results from the Fall virtual meeting. So, if you had requested a membership- please email the secretary. One guest email requested membership and was granted membership and 1 member were moved to guest status. 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

In this virtual meeting the quorum was performed with the WebEx pooling system. According to the poll results total attendance were 254. Members attendance was 109. And 25 requested membership and 23 members were granted.

Attendance Summary

	Webex
Total Attendees	254
Total # Of Members	136
Members Present	109
Quorum Present	YES (80%)

The virtual DTSC meeting had quorum.

The chair presented the agenda, and it was unanimously approved.

The minutes of the Fall 2020 Virtual meeting was approved unanimously.

B.3 Taskforce and Working Group Reports

B.3.1 Working Group Low-Frequency Dielectric Testing for Distribution, Power and Regulating Transformers

Unapproved Meeting Minutes
Virtual - WebEx | April 27th, 2021 | 9:25 – 10:40 AM CDT

Chair: Dan Sauer
Vice Chair: -
Secretary: -

Meeting Attendance
The working group met at 9:30am. There were 83 attendees and 29/53 members present. Quorum was achieved.

Attendance

	WebEx
Total Attendees	83
Total # Of Members	53
Members Present	29
Quorum Present	54.7%

Discussions
- No essential patent claims noted.
- The IEEE copyright policy was shown, no objections were noted.
- The chair noted that the WG is currently seeking a secretary.
- The agenda of the Spring 2021 meeting was approved (Motion made by Bertrand Poulin, seconded by Brian Penny).
- The minutes of the Fall 2020 meeting were approved (Motion made be Fabian Stacy seconded by Ajith Varghese).
- The minutes of the Fall 2019 meeting were approved (Motion made by Bertrand Poulin, seconded by Eduardo Garcia Wild).

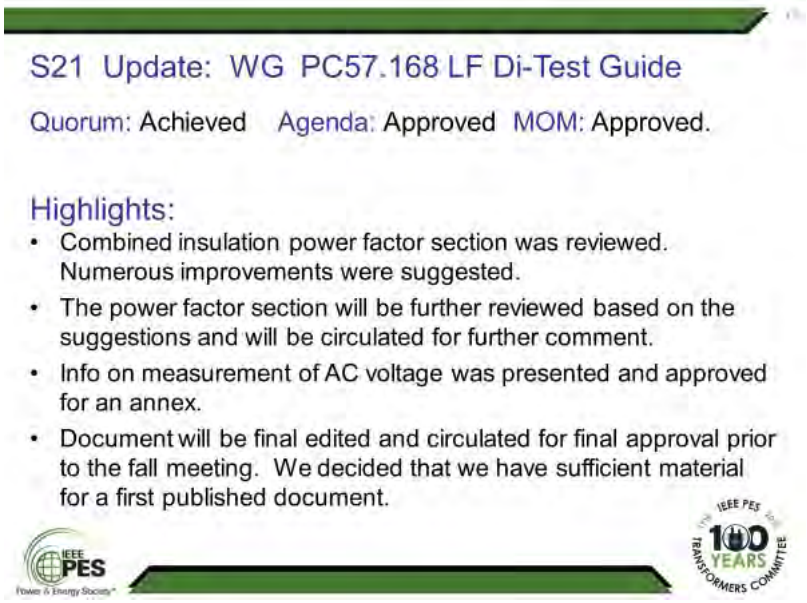
Old Business
- Section 7 – Insulation Power Factor Testing
  - Change lead references in the section from “Red” and “Blue” to R1 & R2
  - Sergio Hernandez Cano will provide updated figures 7.2, 7.5, & 7.6
  - Bertrand & Fernando Leal will propose a test sequence for multi-winding transformers
  - In section 7.6.1.2 in the table remove the reference to temperature correction.
  - Include a note about oil types impacting permittivity (submitted by Waldemar Ziomek)
  - Table 7.6.1.6 update with info from the TF on Power Factor Limits
  - Bertrand Poulin has volunteered to review the section for additional changes, additions, and edits
- Annex A – AC Measurement during dielectric test
  - No additional comments
- Section 6 – update with proper margins & layout to have tables & graphs side-by-side

New Business

- The chair mentioned that the PAR is valid until December 2022, and with that in mind the document should be finalized at the Fall meeting and sent to ballot to permit time to resolve any negative comments.

Meeting adjourned by a motion made by Bertrand Poulin and seconded by Tauhid Haque Ansari.

Dan Sauer



Attendee List:

Name	Email	Company
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Tauhid Haque Ansari	tauhid.ansari@hitachi-powergrids.com	Hitachi ABB Power Grids
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B.3.2 WG C57.113 - Recommended Practice for PD Testing,

Ali Naderian – Chair, Janusz Szczechowski – Vice Chair
John Foschia – Secretary
VIRTUAL MEETING | April 26th, 2021 | 10:10am – 11:35am ET

Chair: Ali Naderian
Vice Chair: Janusz Szczechowski
Secretary: John Foschia

Meeting Attendance
The working group met at 10:10am ET. There were 101 attendees and 15/17 members present. Quorum was met.

Discussions

- No essential patent claims or copyright violations noted.
- An updated membership list was presented based on attendance.
- Through WebEx, a poll was conducted to determine member attendance and requests for membership. Quorum was met with 15/17 members present.
- The spring 2021 meeting agenda was approved.
  - Motion by Tauhid Ansari
  - Second by Detlev Gross.
  - No discussion and unanimous consent.
- IEEE copyright and patent claim slides were presented. No copyright or patent concerns were brought to the attention of the WG.
- The minutes of the Fall 2019 meeting were approved.
  - Motion by Tauhid Ansari
  - Second by Detlev Gross.
  - No discussion and unanimous consent.
- The minutes of the Fall 2020 meeting were approved.
  - Motion by Detlev Gross
  - Second by Hemchandra Shertukde
  - No discussion and unanimous consent.
- The current PAR will expire at the end of 2021.
  - The chair solicited approval of a PAR extension of 1 year
    - Motion by Detlev Gross
    - Second by Alex Winter
    - No discussion and unanimous consent.
  - **PAR extension of 1 year was approved by the WG and approval of the Dielectric Test subcommittee is necessary to submit the PAR extension request.**
- The updated draft of the guide was presented and feedback was solicited.
  - Discussion amongst multiple members centered around removal of the phase-resolved partial discharge patterns from the guide because they are not in the scope of the guide. Reference was made to IEEE 454 and additional CIGRE documents.
- A motion was made to “modify the wording of Annex G, removed the phase-resolved partial discharge patterns, and reference ‘upper’ IEEE documents.”
  - Motion by Hemchandra Shertukde
  - Second by Detlev Gross
  - Removal of the noise identification patterns in Annex F and G was discussed.

  - The motion was amended to:
    "Modify the wording of Annex G, removed the phase-resolved partial discharge patterns in Annex F and Annex G, and reference 'upper' IEEE documents."
    - Second by Detlev Gross
    - No further discussion and unanimous consent.
- A motion was made "to remove an example of the calculations provided in Annex A and to only include formulae in Annex A."
  - Motion by Detlev Gross
  - Second by Hemchandra Shertukde
  - It was noted that these calculations were initially included as a tutorial for less experienced users of the guide but that it would be acceptable to remove.
  - Unanimous consent to approve the motion.
- A motion was made "to remove the example patterns in Annex B but to keep the pulse repetition rate graph and frequency response graph."
  - Motion by Detlev Gross
  - Second by Hemchandra Shertukde
  - Discussion centered around the extension of the graph to a frequency lower than 1 Hz.
  - No opposition to unanimous consent.
- The meeting was adjourned at 11:25am ET.

Attendance (as reported by electronic survey during the meeting)

mark lachman	Jeff Door	Brady Nesvold
Jacques Vanier	Troy Tanaka	Andy Downey
suresh babanna	dervis serhat tekin	Raymond Curtiss Frazier
Peter Kleine	Derek Hollrah	1871913115
YaquanBill Li	Eric Schleismann	Bertrand Poulin
Malia Zaman IEEE SA	Anand Zanwar	Zach Millard
Mana Yazdani	Jaroslaw Chorzepa	Stacey Kessler
Polo Rodriguez	Wallace Binder	Ali Naderian
Waldemar Ziomek	Kyle Stechschulte	Gael R Kennedy
David Walker	Myron Bell	Jose Gamboa
William Boettger	Dipak Patel	Dan Schwartz
Onome A	Cihangir Sen	Nick Walder
Muhammad Abdullah Sohail	Dave	Sanjib
Moonhee Lee	Harry Pepe	Janusz Szczechowski
John Foschia	Hemchandra Shertukde	Markus Söller
Reto Fausch	HSahin	Alain Bolliger
Fernando Leal	Steve Jordan	Alexander Winter
Jean-Noel Berube	Pragnesh Vyas	Detlev Gross
Taylor Gray	Tom Melle	Lina Sandsten
DANIELA EMBER BACIU	Steve Snyder	Markus Schiessl
Feras Fattal	Nitesh patel	Robert Mayer
asarkar	Rob	Mihai Huzmezan
Juan Alfredo Carrizales Baaldua	Christopher Whitten	Tauhid Ansari
Monil Patel	Everton De Oliveira	Donald Ayers
Steve Brzoznowski	Fabian Durand Stacy	Zoltan
Ajith Varghese	Shibao zhang	DAVID ELLIS
Sergio Hernandez Cano	Dinesh Sankarakurup	Shawn Gossett
Eduardo Garcia	Steve Holsomback	Hampton Steele
Jeff Benach	Hugo Flores	Ross McTaggart
Kipp J Yule	mfg18	Ed Van Vooren
J.Dennis Marlow	domenico corsi	David Calitz Guest
z0016t5d	Allan Bartek	akash joshi
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Raj Ahuja	David Larochelle, NDB Tech	

S21 Update: WG C57.113 PD Measurement Guide

Quorum: **Achieved**
MOM & Agenda: **Approved**

Highlights:

- Reviewed the current status and discussed annex content
- WG agreed to:
  - Omit PRPD patterns in Annex F and G, deemed to be out-of-scope
  - Omit example calculations of quadrupoles in Annex A
  - Omit patterns in Annex B but maintain/enhance the pulse repetition rate and frequency response graphs
  - Include reference to IEEE documentation of common PRPD patterns
- Request for SCDT approval of 1 year PAR extension
  - Approved by WG in S21 meeting

B.3.3 Working Group for Impulse Guide – PC57.98

WG Secretary: John Foschia; WG Chair: Thang Hochanh; WG Vice Chair: Reto Fausch

VIRTUAL MEETING | April 26th, 2021 | 3:20pm – 4:35pm ET

Chair: Thang Hochanh

Vice Chair: Reto Fausch

Secretary: John Foschia

Meeting Attendance

The working group met at 3:20pm ET. There were 63 attendees and 12/21 members present. Quorum was met.

Discussions

An updated membership list was presented based on attendance.

Through WebEx, a poll was conducted to determine member attendance and requests for membership. Quorum was met with 12/21 members present.

The fall 2020 meeting minutes were approved.

Motion by Hemchandra Shertukde
Second by Reto Fausch
No discussion and unanimous consent.

IEEE copyright and patent claim slides were presented. No copyright or patent concerns were brought to the attention of the WG.

The chair presented the IEEE 4 text proposal which limit the beta-prime value (relative overshoot) to 10% for HV apparatus. As C57.98 is a guide, the decision for transformers test to specify or remove the above limitation of 10% overshoot, has to be handled by C57.12.90.

- This request will be transmitted to Pierre Riffon's WG for consideration.

The Chair reviewed the test voltage factor procedure for chop waves (front and tail chops) when the test voltage overshoot calculation is inconsistent (voltage reduction ratio method IEEE Std 4 2013 Annex A)

The WG was asked about more example of impulse traces, notably of common failure modes.

- There was no feedback provided from the membership.
- An email will be sent to the WG to solicit input of updated impulse traces.

The Chair provided example of IEC CD-60076-4 draft which demonstrates that high beta prime value does not necessarily lead to high voltage correction. It was noted that the voltage correction is dependent on the frequency and not on the high value of beta-prime. Examples show beta-prime= 25%, correction= 1.4%, f=167 kHz and for beta-prime= 26%, correction= 13.7%, f= 756 kHz.

A motion was made that IEC CD-60076-4:2021, annex C.1 be copied as an annex in C57.98 revision.

Motion by Hemchandra Shertukde
Second by Reto Fausch
No discussion and no objection to unanimous approval.

A motion was made to include an example of impulse trace of an improperly grounded bushing on the top cover of a transformer (part of IEC CD-60076-4:2021).

Motion by Reto Fausch

Second by Hemchandra Shertukde
No objection to unanimous approval.

Adjournment

The meeting was adjourned at 4:27pm ET. Motion by Hemchandra Shertukde and seconded by Reto Fausch.

Chair's proposed text:
4.1.2.1 The transformer effect on the waveshape
Remove "Large transformers …… in IEEE Std 4".
4.1.2.1.1 Waveshape with overshoot (peak oscillations) and test voltage factor procedure
In IEEE Std-4-2013 clause 8.2.1.1 and Annex A, when an lightning impulse waveshape shows an relative overshoot ß', it is recommended to limit ß' to 10% for HV apparatus.
In impulse testing for transformers and reactors, due to low winding inductance and/or high surge capacitance, it is recommended to proceed with the test when the test circuit is optimal and the test voltage procedure is enable.
For test voltage factor procedure and chopped wave, see clause 4.2.2.1.
NOTE – In case of an high ß' value and an overshoot frequency above 500 kHz, the test voltage procedure reduce the test voltage value Vt significantly against the recorded peak value Ve. This may lead to higher electrical stress and possible breakdown of the insulation system.
For lightning impulse tests on transformers and reactors, a manual evaluation of the test function procedure is not reliable. A test laboratory who does not have the Test function procedure available, should inform the customer at the stage of quotation.
4.1.2.1.1 Test voltage factor procedure when performing chopped wave
In general, for liquid immersed transformers the chopped wave is 110% of the full wave, while in Dry-type transformers, the chopped wave is 100%. The test voltage procedure evaluation of a chopped wave of 110% of the wave, should give a peak value of 110% of the full wave.
When the test voltage procedure calculation of Vt is inconsistent, the following steps are recommended:
a) Front chopped wave lightning impulse:

There is no correction and Vt is equal to Ve.
b) Tail chopped lightning impulse:

Voltage reduction ratio Method (IEEE Std 4TM 2013, Annex A)

- Apply a reduced full wave (RFW)
- The test voltage procedure provide the test voltage Vt and the peak value Ve of the original recorded curve.
- If Ve is not available, Ve can be determined graphically on the recorded oscillogram
- Calculate the voltage reduction ratio Rv= Vt / Ve
- Apply a full voltage chopped wave, having a recorded voltage V'e.

The calculate V't is defined as:
V't= Rv * V'e
c) The value of front time T1 of the reduced full wave (RFW) is used to determine the T1

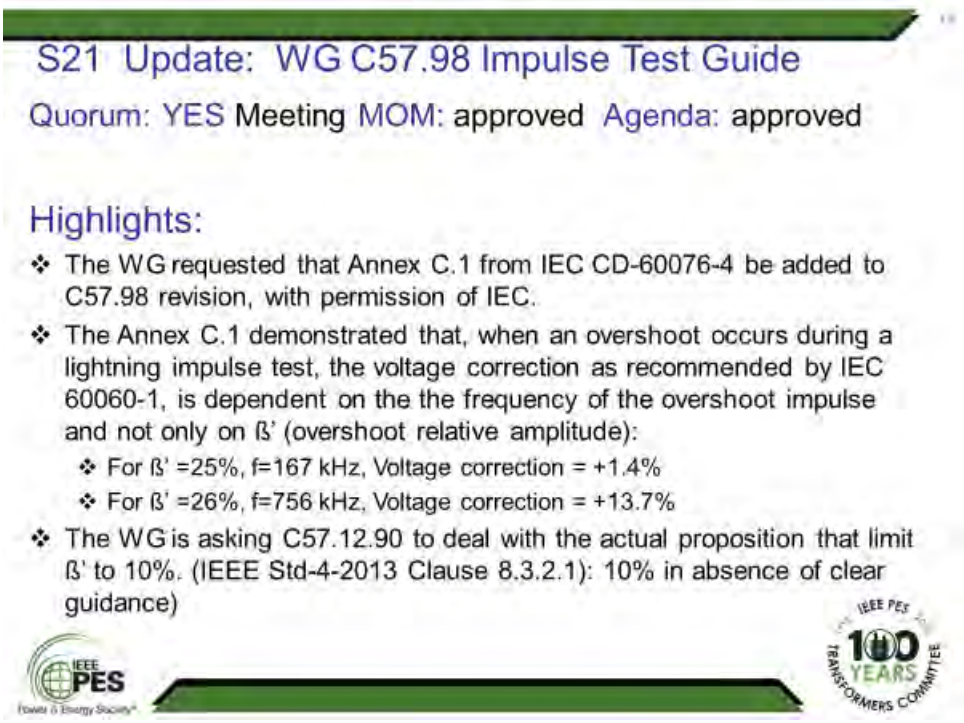
value of the chopped wave.
4.1.2.1.2 Test voltage factor procedure and presentation of test results
When the test voltage procedure is enable, the following test results should be displayed:

- Vt is the test voltage
- ß' is the relative overshoot magnitude

- The following optional value should be available for display:
- Ve the peak value of the original noise free recorded curve

****
The TF inputs will be included in the WG revision. Pierre Riffon will send that within a week.
There was a discussion around the impulse correction factor- the requirement is in C57.12.90. Overshoot is taken care of it as well in this standard. Discussion should be discussed in the next WG meeting. Maybe there will be a new business in the next DTSC meeting.

Request to add the Annex C should be done to have the TF look into it.



Attendance (as reported by electronic survey during the meeting)

Orlando Giraldo	Paul Florida	Sergio Hernandez Cano
Thang Hochanh	Zach Millard	DANIELA EMBER BACIU
Waldemar Ziomek	David Murray	Mana Yazdani
Polo Rodriguez	Brady Nesvold	Monil Patel
YaquanBill Li	Brandon Dent	Mark Perkins
John Foschia	Tiffany Lucas - SPX	Jeff Ray JLR Consulting
Eduardo Garcia	Jorge Cruz	Hampton Steele
Curtiss Frazier	Baitun Yang	dervis serhat tekin
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William Boettger	Alain Bolliger	Gael R Kennedy
Feras Fattal	Erich Buchgeher	Alexander Winter
Fernando Leal	Hemchandra Shertukde	Lina Sandsten
Parminder	Peter Kleine	jos veens
Tommy Eagle	Rudolf Ogajanov	Donald Ayers
Paul Morakinyo	Rodrigo Ocon	Harry Pepe
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B.3.4 Working Group for PD in bushings, PTs and CTs – PC57.160, WG Chair: Thang Hochanh -Meeting Minutes: April 27th, 2021 | 3:45pm - 5:00pm CT

Secretary: Reto Fausch; WG VIRTUAL MEETING |

Meeting Attendance

The working group met at 3:45pm CST
There were 36 attendees 17 Guest 4 requested membership
and 15/27 members present.
Quorum was achieved to conduct official business.

Discussions

- No essential patent claims or copyright violations noted.
- The Minutes from Fall 2020 meeting were approved.

- Based on the Ballot return there very many comments, approx. 500; most editorial, from that pool there are 85 technical to be resolved.
- The Chair asked for volunteers to get the workload distributed among the members of the group.
  - Review of actual members who asked to be part of the CRG (Comments Resolution Group) who were present on this meeting

  Some of the volunteers from Previous meeting had changed work position and were unable to attend or contribute CRG
  For editorial in English Sanket Bolear volunteered as one

Additional contribution with samples suppose to come from but they were unable to attend this meeting
Raja Kuppuswamy
Zoltan Roman
There are 7 members from the present group are volunteering to be on the CRG resolution team

Adjournment

The meeting was adjourned at 4:35pm CST
Motion: Detlev Gross / 2nd by Reto Fausch

Reto Fausch

****

The Chair requested the ballot resolution group to meet and resolve most of the issues between now and next meeting. The PAR is about the expire and the Guide is expired last year.

PC 57.160 - MEMBERS PRESENT

VIRTUAL MEETING - Spring 2021

	First Name	Last Name		First Nam	Last Name
1	Sanket	Bolear	11	Pierre	Riffon
2	Feras	Fattal	12	Thomas	Sizemore
3	Reto	Fausch	13	Steven	Snyder
4	Detlev	Gross	14	Fabian	Stacy
5	Thang	Hochanh	15	Eric	Weatherbee
6	Kurt	Kaineder	16	Barrett	Wimberly
7	Marek	Kornowski	17	Shibao	Zhang
8	Ross	McTaggart	18	Robert	Middleton
9	Depak	Patel	19	Risto	????
10	Juan Jose	Ramirez Gomez			

PC 57.160 - GUEST PRESENT

VIRTUAL MEETING - Spring 2021

	First Name	Last Name		First Nam	Last Name
1	Allan	Bartek	11	George Jr	Partyka
2	Steve	Brzoznowski	12	Johnathar	Reimer
3	Daniela	Ember Baciu	13	Markus	Soeller
4	Eric	Euvrard	14	William J.	Solano
5	Neder	Frank	15	Loren	Wagenar
6	Orlando	Giraldo	16	Christoph	Whitten
7	Derek	Hollrah	17	Malia	Zaman
8	Fernando	Leal			
9	Jim	Mcbride			
10	Hossein	Nabi-Bidhendi			

WG C57.160 PD Guide Bushings/PTs/CTs

Quorum: Yes Meeting MOM: Approved Agenda: Approved

- Since last meeting major work had been made on the resolutions comments following the ballot.
- The high number of comments was reduced to 85 and are related only to technical issues.
- The document have also been revised by Pierre Riffon.
- The working group has identified members who are willing to take time to revised the technical comments from ballot.
- Sanket Bolear accepted to revise the English language of the document.

B.3.5 Task Force for Bushing DFR – PC57.12.200, TF Secretary: Diego Robalino; TF Chair: Poorvi Patel; TF Vice Chair: Charles Sweetser.

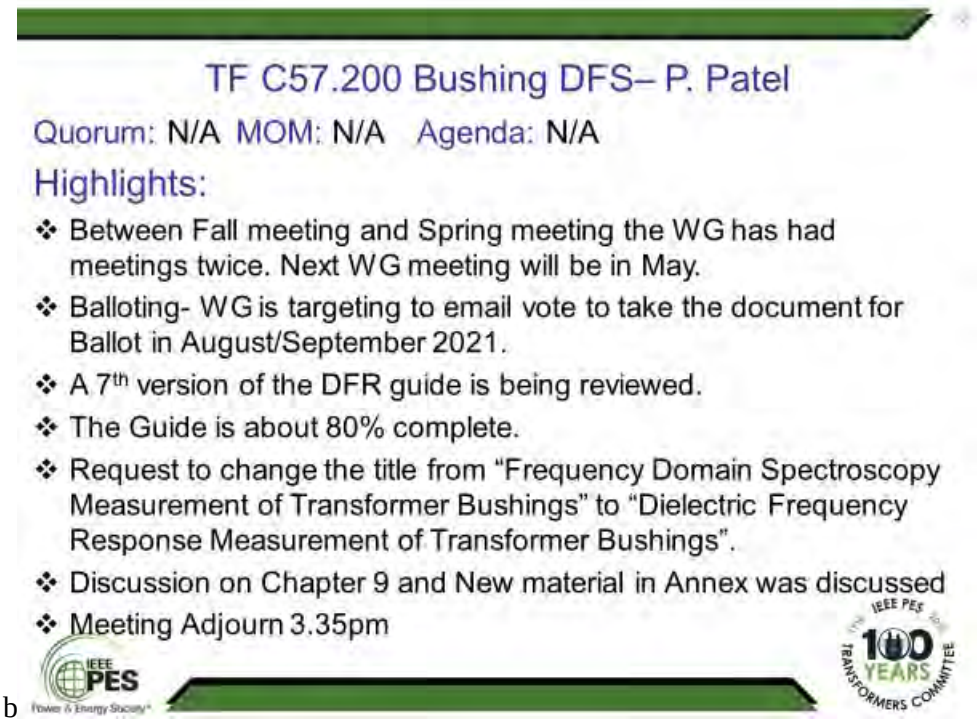
VIRTUAL MEETING | April 27th, 2021 | 2.20pm – 3.45pm CT

Meeting initiated by Chairperson Poorvi Patel at 2:20 PM Central time.

- Attendance verified with the system poll, counted 23 attendees at the beginning of the meeting
- Poorvi indicated that the WG would like to complete the work by August 2021 to initiate ballot process
- Expected WG meeting around end of May for final revision approval of existing document
- Poorvi indicated that there is a conflict with the title of the guide:
    - Existing IEEE documentation refers to Dielectric Frequency Response, but the title as created by the IEEE team in China describes it as Frequency Domain Spectroscopy
    - Evgenii Ermakov and Diego Robalino agreed that DFR and FDS terms are synonyms but to be consistent with existing material from IEEE, it is suggested the use of DFR
    - Poorvi consulted with Malia (IEEE SA) and a change of the Title is allowed. Need to bring this up to the WG.
- Poorvi went through the latest changes in the document. Rev. 07.
    - Evgenii Ermakov explained changes in figures 12 to 15
        - Ronald Hernandez requested the value used for activation energy in those figures. Evgenii indicated that the information was not approved for disclosure.
        - General discussion around the importance of the values to be incorporated in example figures. The value is material specific and it can be measured if someone requires it.
    - Peter Werelius discussed revisions and additions to the Annexes in the document
        - Annex B – Temperature dependence and use of Arrhenius equation
        - Annex C – Influence of stray losses
            - Suggested to add one more figure showing resonant frequency around 0.1 Hz
        - Annex D – Use of HV DFR
            - Suggested to add a paragraph related to noise not only directly related to the Substation Voltage level.
            - Possible additional example of HV DFR measurement from colleagues in China.

****

There was some discussion about the title change- it was agreed that the suggested title should be Dielectric Frequency Response Measurement of Transformer Bushings. This will be taken to the Chinese WG leader.



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Attendee list

First Name	Last Name	Company
Peter	Zhao	Hydro One
Charles	Sweetser	OMICRON electronics Corp USA
Shibao	Zhang	PCORE Electric
John	Herron	Raytech USA
Peter	Werelius	Megger
Sebastien	Riopel	Electro Composites ULC
Eric	Weatherbee	PCORE Electric
Poorvi	Patel	Electric Power Research Institute (EPRI)
Mario	Locarno	Doble Engineering Co.
Ali	Naderian	Metsco
Diego	Robalino	Megger
Stephanie	Denzer	Alliant Energy
Hugo	Flores	Hitachi ABB Power Grids
Ronald	Hernandez	Doble Engineering Co.
Fabian	Stacy	Hitachi ABB Power Grids
Ismail	Guner	Hydro-Quebec
Sanket	Bolar	Megger
Wesley	Schrom	Carolina Dielectric Maint & Testing Co.
Feras	Fattal	Manitoba Hydro
Mickel	Saad	Hitachi ABB Power Grids
Janusz	Szczechowski	Maschinenfabrik Reinhausen
George	Partyka	PTI Transformers
Afshin	Rezaei-Zare	York University
Evgenii	Ermakov	Hitachi ABB Power Grids
Olle	Benzler	Megger
Jacques	Vanier	Electro Composites (2008) ULC

Rakesh	Patel	Hitachi-Powergrid
Giovanni	Hernandez	Virginia Transformers Corporation
Muhammad	Sohail	Trench Limited

B.3.6 TF on Revision of Low-Frequency Tests

Virtual Meeting – April 27th , 2021 12:55 p.m,
Chair: Bill Griesacker, Vice Chair: Daniel Blaydon (acting secretary), Secretary: Myron Bell.

1. The meeting was called to order at 12:55 PM.

2. A poll was conducted via Webex to determine whether a quorum was present. Based on the preliminary results, a quorum was achieved.

   Attending members were counted and quorum was verified by the Webex Report, which is provided in summary below:

Attendance

	Webex
Total Attendees	80
Total # Of Members	56
Members Present	49
Quorum Present	YES

3. The chair requested the working group to approve the the meeting agenda. There were no objections to unanimous approval of the agenda.

4. The chair requested the working group to approve the meeting minutes from the 2020 Spring Transformers Committee meeting held virtually. There were no objections to unanimous approval of the meeting minutes.

5. Task Force on PD Testing of Class 1 Power Transformers report by Don Ayers (Appendix A – Meeting Minutes)

   Don provided a summary report on the Task Force meeting that occurred on Monday, April 26th. A quoum was achieved at the meeting. A motion was made to "Establish a section on C57.12.00 to express the agreed acceptance levels for PD for Class I Power Transformers as those contained in C57.12.90-2015 (500 pC for Max Acceptable, and 150 pC for Max Increase)".

   Don Ayers agreed to draft language and proposed section numbering in both C57.12.00 and C57.12.90. The draft language will be circulated to the voting membership for comments and vote for approval.

6. PD Limits in Factory Testing

   Language for factory PD limits was sent to the C57.12.90 members for comment.

   A study group will be formed for the further development of the Class II power transformer partial discharge testing procedure and limits. These additional develpments

would be for the next revision of the C57.12.90 standard after the current revision is published. The chair asked for volunteers for this new study group.

7. Review of Survey Results for PD in Bushings During Transformer Factory Testing

The chair reviewed the history of this survey and provided a detailed summary of the results and comments received. A discussion was held with various individuals providing feedback on their experience with venting bushings during factory testing, with proposed wording to be added to standards.

The proposed wording was as follows:
"If the partial discharge is observed during the induced testing of the transformer and appears to be generated within an OIP bushing(s), it is permissible to "vent" the bushing(s) to the atmosphere using the bushing manufacturer's instructions to allow for the dissipation of gas bubbles in the oil. Gas bubbles sometimes form following a temperature rise test during cool down or may be present for other reasons. Reestablishment of the bushing gas space blanket and resealing of the bushing must also be performed in accordance with the bushing manufacturer's instructions following completion of the induced test."

Eric Weatherbee, Bushing SC chair, joined the meeting at 2:59 PM and was read a synopsis of the discussion, along with proposed wording for addition to standards. Eric suggested Bill Griesacker should present the wording to the Bushing SC on Thursday, 4/28/21. This proposal was accepted.

Further discussion was tabled until feedback is received from the Bushing SC.

8. Old business

None.

9. New business

C57.12.90 Ballot Comment resolution
- 14 comments were received, regarding low frequency tests

Raj Ahuja made a motion to, "Form a study group to resolve all ballot comments for low frequency dielectric tests."

A 2nd for the motion was received from Akash Joshi.

This motion passed without objection.

The chair asked for volunteers for this study group, and for the comment resolution to be completed within the next 30 days.

10. The meeting was adjourned at 2:08pm CDT

11. Our next meeting will occur in October of 2021, during the fall committee meeting.

Meeting Attendance

First Name	Last Name	Company	Member?
Raj	Ahuja	Raj Ahuja Consulting	Yes
Tauhid Haque	Ansari	Hitachi ABB Power Grids	Yes
Elise	Arnold	SGB	
Javier	Arteaga	Hitachi ABB Power Grids	
Donald	Ayers	Ayers Transformer Consulting	Yes
Suresh	Babanna	SPX Transformer Solutions, Inc.	
Christopher	Baumgartner	We Energies	Yes
Myron	Bell	Delta Star Inc.	Yes
Daniel	Blaydon	Baltimore Gas & Electric	Yes
William	Boettger	Boettger Transformer Consulting LLC	Yes
Jeffrey	Britton	Phenix Technologies, Inc.	Yes
David	Calitz	Siemens Energy	Yes
Juan	Carrizales	Prolec GE	
Nikolaus	Dillon	Dominion Energy	
Thomas	Eagle	SPX Transformer Solutions	
Megan	Eckroth	EATON Corporation	
Feras	Fattal	Manitoba Hydro	
Reto	Fausch	RF Solutions	Yes
John	Foschia	SPX Transformer Solutions, Inc.	Yes
Anthony	Franchitti	PECO Energy Company	Yes
Eduardo	Garcia Wild	Siemens Energy	
Shawn	Gossett	Ameren	Yes
Bill	Griesacker	Duquesne Light Co.	Yes
Detlev	Gross	Power Diagnostix	Yes
Kyle	Heiden	EATON Corporation	
Sergio	Hernandez Cano	Hammond Power Solutions	Yes
John	Herron	Raytech USA	Yes
Philip	Hopkinson	HVOLT Inc.	Yes
John	John	Virginia Transformer Corp.	Yes
Stephen	Jordan	Tennessee Valley Authority	Yes
Akash	Joshi	Black & Veatch	Yes
Anton	Koshel	Delta Star Inc.	
Axel	Kraemer	Maschinenfabrik Reinhausen	
Mark	Lachman	Doble Engineering Co.	Yes
Fernando	Leal	Prolec GE	Yes
Yaquan (Bill)	Li	BC Hydro	
Weijun	Li	Braintree Electric Light Dept.	Yes
Dennis	Marlow	DenMar TDS Transformers	
James	McBride	JMX Services, Inc.	

Matthew	McFadden	Oncor Electric Delivery	
James	Mciver	Siemens Energy	
Vinay	Mehrotra	SPX Transformer Solutions, Inc.	Yes
Thomas	Melle	HIGHVOLT	
David	Murray	Tennessee Valley Authority	Yes
Hossein	Nabi-Bidhendi	ABB Inc.	
Ali	Naderian	Metsco	Yes
George	Partyka	PTI Transformers	Yes
Sanjay	Patel	Royal Smit Transformers	
Monil	Patel	Pacific Gas & Electric Company	
Brian	Penny	American Transmission Co.	
Harry	Pepe	Phenix Technologies, Inc.	Yes
Mark	Perkins	D4EnergySolutions LLC	
Sylvain	Plante	Hydro-Quebec	
Bertrand	Poulin	Hitachi ABB Power Grids	Yes
Ulf	Radbrandt	Hitachi ABB Power Grids	
Ion	Radu	Hitachi ABB Power Grids	Yes
Pierre	Riffon	Pierre Riffon Consultant Inc.	
Leopoldo	Rodriguez	Transformer Testing Services LLC	Yes
Marnie	Roussell	Entergy	Yes
Hakan	Sahin	Virginia and Georgia Transformers	Yes
Daniel	Sauer	EATON Corporation	Yes
Markus	Schiessl	SGB	Yes
Jeffrey	Schneider	Power Partners/Spire Power Solutions	Yes
Christopher	Slattery	FirstEnergy Corp.	Yes
Steven	Snyder	Hitachi ABB Power Grids	Yes
Sanjib	Som	Pennsylvania Transformer	Yes
Mike	Spurlock	Spurlock Engineering Services, LLC	Yes
Kyle	Stechschulte	American Electric Power	Yes
Janusz	Szczechowski	Maschinenfabrik Reinhausen	Yes
Ajith	Varghese	SPX Transformer Solutions, Inc.	Yes
Krishnamurthy	Vijayan	PTI Transformers	Yes
Dharam	Vir	SPX Transformer Solutions, Inc.	Yes
Pragnesh	Vyas	Sunbelt-Solomon Solutions	
Loren	Wagenaar	WagenTrans Consulting	
Michael	Warntjes	American Transmission Co.	
Dr. Alexander	Winter	HIGHVOLT Pruftechnik Dresden	Yes
Baitun	Yang	R.E. Uptegraff	Yes
Anand	Zanwar	Siemens Energy	
Michael	Zarnowski	Carte International	
Kris	Zibert	Allgeier, Martin and Associates	Yes

Appendix A

Minutes for Task Force on PD Testing of Class 1 Power Transformers

Chair: Don Ayers
Vice Chair: Javier Arteaga
Secretary: Israel Barrientos
Meeting Date: Monday 26th April 2021
Time: 10:45

Attendance:

Members:	23
Guests:	75
Total attendance:	98

The meeting was called to order at 10:45 AM and attendance was recorded via a Poll.
Membership requirements were explained.
The Patent and Copyright Slides were presented, no comments were made.

Current TF Membership is 35.
Quorum is 18, or more TF Members.
As the Member attendance reached 23, Quorum was attained.

The Chair then presented the Meeting Agenda, and was shown in the screen Ajith Varghese moved to approve the Agenda as shown. James Cross seconded. After no further discussion, the Agenda was approved as submitted.

The Nov 2020 Meeting Minutes as published were presented.
James Cross moved for them to be approved. Peter Kleine seconded the motion.
After no further discussion, the Meeting Minutes were approved as submitted.

The Chair presented the Scope of the TF, and a list of Subjects to Consider.

After some initial discussion, a motion was made by John Foschia:
"Classify PD Tests for Class I Power Transformers as Other Tests".
Pougazhenthi Selvaraj seconded.
After a brief discussion and some explanation by Don Ayers and Betrand Poulin, John Foschia withdrew his motion.

Some additional discussion ensued on the Need for Notes for Bushings or other items.
No motion was made.

Discussion moved to the topic of how to further define the PD acceptance values in C57.12.90-2015, as Don Ayers indicated that the newest C57.12.90-2021 Draft 4, included different (reduced) values to those agreed by TF.

Phil Hopkinson made a motion to:
"Establish a section on C57.12.00 to express the agreed acceptance levels for PD for Class I Power Transformers as those contained in C57.12.90"

As Phil Hopkinson was not a member of the TF at this time, Ajith Varghese made an identical motion and after some discussion, he agreed to a friendly amendment as follows:
"Establish a section on C57.12.00 to express the agreed acceptance levels for PD for Class I Power Transformers as those contained in C57.12.90-2015 (500 pC for Max Acceptable, and 150 pC for Max Increase)".
Sergio Hernandez seconded the motion.

After some discussion, a call for opposition was made, hearing none, the motion passed.

At 11:59 Peter Kleine moved to adjourn the meeting.
Onome Avanoma seconded.

A request for those against was made, hearing non, the motion carried unanimously.

The meeting was adjourned at 12:00.

Respectfully submitted
Israel Barrientos
TF Secretary.

Role	First Name	Last Name	Company
Guest	Tauhid Haque	Ansari	Hitachi ABB Power Grids
Vice-Chair	Javier	Arteaga	Hitachi ABB Power Grids
Member	Onome	Avanoma	MJ Consulting
Chair	Donald	Ayers	Ayers Transformer Consulting
Guest	Suresh	Babanna	SPX Transformer Solutions, Inc.
Secretary	Israel	Barrientos	Prolec GE
Guest	Allan	Bartek	Spruce Run Engineering LLC
Guest	Wallace	Binder	WBBinder Consultant
Guest	Ryan	Bishop	Minnesota Power
Guest	Piotr	Blaszczyk	Specialty Transformer Components LLC
Guest	Daniel	Blaydon	Baltimore Gas & Electric
Guest	William	Boettger	Boettger Transformer Consulting LLC
Guest	Joshua	Bohrn	PacifiCorp
Guest	Sanket	Bolar	Megger
Guest	Alain	Bolliger	HV TECHNOLOGIES, Inc .
Guest	Jeffrey	Britton	Phenix Technologies, Inc.
Member	David	Calitz	Siemens Energy
Guest	Jaroslaw	Chorzepa	ABB Inc .
Member	James	Cross	Kinectrics
Member	Jorge	Cruz	PTI Transformers
Guest	Larry	Dix	Quality Switch, Inc.
Guest	Eric	Doak	D4EnergySolutions LLC
Guest	Evgenii	Ermakov	Hitachi ABB Power Grids
Guest	Marco	Espindola	Hitachi ABB Power Grids
Guest	Feras	Fattal	Manitoba Hydro
Guest	Reto	Fausch	RF Solutions
Guest	Paul Gabriel	Florida	Howard Industries, Inc.
Member	John	Foschia	SPX Transformer Solut ions, Inc.
Member	Jose	Gamboa	H-J Family of Companies
Member	Carlos	Gaytan	Protec GE
Member	Zoran	Goncin	PTI Transformers
Guest	Shawn	Gossett	Ameren
Guest	Jeff rey	Gragert	Xcel Energy
Member	Detlev	Gross	Power Diagnostix
Guest	Attila	Gyore	M&I Materials Ltd
Guest	Kyle	Heiden	EATON Corporation
Member	Sergio	Hernandez Cano	Hammond Power Solutions
Guest	John	Herron	Raytech USA
Guest	Steve	Holsomback	Southern Company Services
Guest	Philip	Hopkinson	HVOLT Inc.
Guest	Akash	Joshi	Black & Veatch
Guest	Sheldon	Kennedy	Niagara Transformer
Guest	Gary	King	Howard Industries
Member	Peter	Kleine	US Army Corps of Engineers
Guest	**Mark**	Lachman	Doble Engineering Co.

Role	First Name	Last Name	Company
Member	David	Larochelle	NDB Technologies
Guest	Fernando	Leal	Prolec GE
Guest	Moonhee	Lee	Hammond Power Solutions
Guest	Aleksandr	Levin	Weidmann Electrical Technology
Guest	Tiffany	Lucas	SPX Transformer Solutions, Inc.
Guest	Dennis	Marlow	DenMar TDS Transformers
Guest	Lee	Matthews	Howard Industries
Member	Matthew	McFadden	Oncor Electric Delivery
Guest	James	Mciver	Siemens Energy
Guest	Thomas	Melle	HIGHVOLT
Guest	Zachary	Millard	Great River Energy
Guest	Martin	Munoz Molina	Orto de Mexico
Member	Ali	Naderian	Metsco
Guest	Kristopher	Neild	Megger
Guest	Rodrigo	Ocon	Industrias IEM
Guest	Rudolf	Ogajanov	ABB Inc.
Member	Parminder	Panesar	Virginia Transformer Corp.
Guest	Harry	Pepe	Phenix Technologies, Inc.
Guest	Mark	Perkins	D4EnergySolutions LLC
Guest	Chris	Pitts	Howard Industries
Guest	Alvaro	Portillo	Ing. Alvaro Portillo
Guest	Bertrand	Poulin	Hitachi ABB Power Grids
Guest	Jeffrey	Ray	JLR Consulting, Inc.
Member	Leopo ldo	Rodriguez	Transformer Testing Services LLC
Guest	Daniel	Sauer	EATON Corporation
Member	Pugal	Selvaraj	Virginia Transformer Corp.
Guest	Adam	Sewell	Quality Switch, Inc.
Guest	Peter	Sheridan	SGB USA, Inc.
Guest	Hemchandra	Shertukde	University of Hartford
Guest	Christopher	Slattery	FirstEnergy Corp.
Guest	Steven	Snyder	Hitachi ABB Power Grids
Guest	Markus	Soeller	Power Diagnostix
Guest	Brian	Sonnenberg	Instrument Transformers, LLC
Guest	Hampton	Steele	TVA
Member	Charles	Sweetser	OMICRON electronics Corp USA
Member	Janusz	Szczechowski	Maschinenfabrik Reinhausen
Guest	Dervis	Tekin	Meramec Instrument Transformer Co.
Guest	Risto	Trifunoski	Trench Limited
Member	Ajith	Varghese	SPX Transformer Solutions, Inc.
Guest	Dharam	Vir	SPX Transformer Solutions, Inc.
Member	Pragnesh	Vyas	Sunb elt -Solomon Solutions
Guest	Loren	Wagenaar	WagenTrans Consulting
Guest	Nicholas	Walder	EATON Corporation
Guest	Hugh	Waldrop	Memphis Light, Gas & Water
Guest	Evanne	Wang	DuPont

Role	First Name	Last Name	Company
Guest	Daniel	Weyer	Nebraska Public Power District
Guest	Dr. Alexander	Winter	HIGHVOLT Pruftechnik Dresden
Guest	Jeffrey	Wright	Duquesne Light Co.
Guest	Baitun	Yang	R.E. Uptegraft
Guest	Mana	Yazdani	Trench Limited
Guest	Joshua	Yun	Virginia Transformer Corporation
Guest	Anand	Zanwar	Siemens Energy
Guest	Michael	Zarnowski	Carte International

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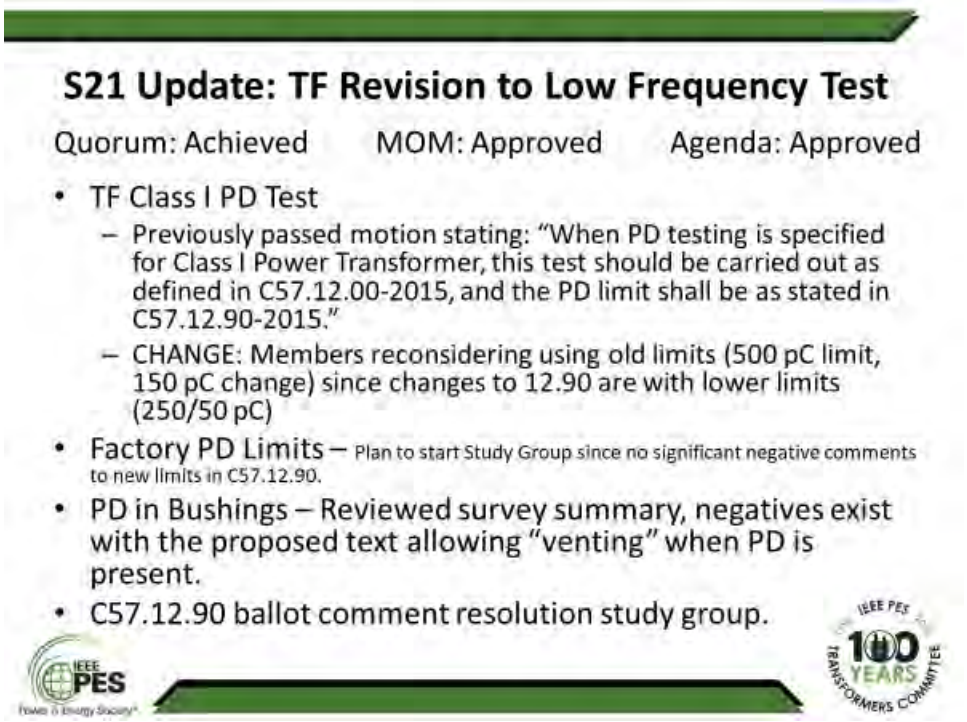


Role First Name Last Name Company

B.3.7 Task Force for Impulse Guide – PC57.98

TF Chair: Pierre Riffon

VIRTUAL MEETING | April 27th, 2021 | 10.50 am – 12.05 CET

The TF met on April 27, 2021, from 10:50 am to 12:05 pm (CET). Twenty-one (21) members and twenty-six (26) guests attended the meeting. Eleven (11) guests requested membership but only 4 are eligible having attended to at least two meetings.. 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 10:50 am (CET).

Attendance has been recorded in the AM system.

Required quorum was met, presence of at least 21 members was required. The TF membership roster has been reviewed after the Anaheim (CA) meeting and members who did not attend one of the last three meetings have been moved as guests. Guests who have not attended one of the last five meetings have been removed from the TF roster. Twenty-two (22) guests have been removed from the TF roster.

The meeting agenda and the Anaheim (CA) meeting minutes have been approved unanimously. Motion have been made by J. John and was seconded by Tauhid Ansari.

The first item of business was related to the review of the comments related to impulse testing received on the Sponsor Ballot of PC57.12.00 D1.0 dated January 2021. There were no comments received on impulse testing during this ballot.

The second item of business was related to the review of the comments related to impulse testing received on the Sponsor Ballot of PC57.12.90 D4 dated February 2021. A total of eighteen (18) comments were received, 12 were editorial and 6 technical.

Seven (7) of the comment received have been discussed during the meeting. The other comments are simple editorial comments that could be easily fixed. The main outcomes of the discussion are:

- Comment no.1 related to surge impedance of cables, GIS and GIL: Chair resolution proposal accepted by the TF, a note will be included in Table 3.

- Comment no.2 related to examples of transformers having induced switching impulse level less than 83% of the BIL value on LV terminals has been accepted in principle. This should be part of the impulse guide IEEE C57.98, not part of the standard. Following a motion from B. Poulin and seconded by J. McBride, this comment will be sent to the Chair of the WG in charge of the revision of IEEE C57.98 for inclusion of such examples.

Role First Name Last Name Company

- Comment no.3 related to possible redundant sentence is rejected, both sentences are needed. Chair resolution proposal accepted by the TF.

- Comment no,4 related to the use of the term "peak voltage" instead of "overshoot" has been rejected. Chair resolution proposal accepted by the TF.

- Comment no. 5 related to shorten a sentence of line 25 of clause 10.3.1.3 has been rejected. This sentence cannot be shortened. Chair resolution proposal accepted by the TF.

- Comment no.6 related to the measurement of the voltage collapsed during chopped-wave tests has been accepted in principle. This comment will be sent to the WG Chair responsible to the revision of IEEE C57.98 for inclusion of a proper explanation.

- Comment no. 7 related to a change of a sentence in clause 10.3.2.1 been rejected because actual sentence is needed. Chair resolution proposal accepted by the TF.

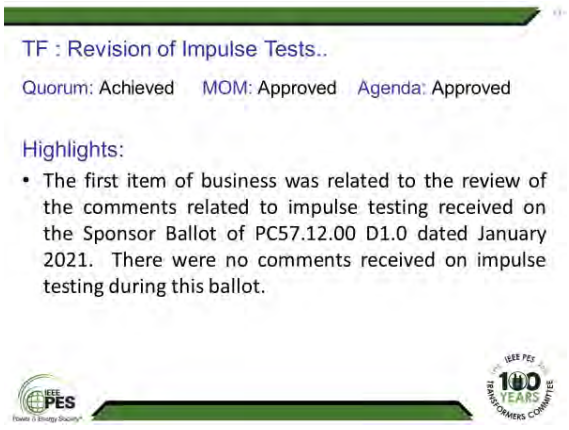
There were no old businesses.

On new business, D, Sauer highlighted an inconsistency between design and routine lightning impulse tests for distribution transformers rated 15 kV and less having series connected windings. D. Sauer will prepare a proposal for discussion at the next meeting.

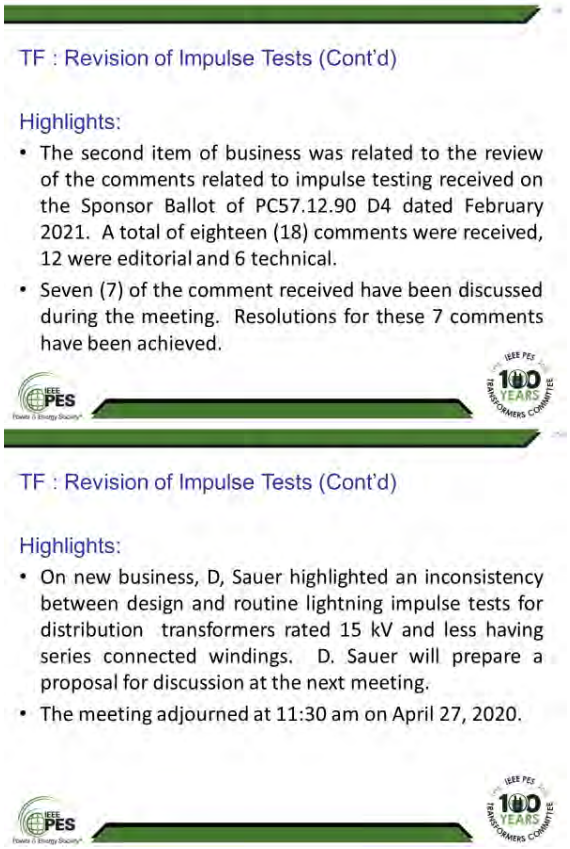
The meeting adjourned at 11:30 am on April 27, 2020.

The next meeting is planned to be held in Milwaukee, Wisconsin on October 19, 2021.

Pierre Riffon P. Eng.
April 27, 2021



Role First Name Last Name Company



Attendee list

First Name	Last Name	Company
Raj	Ahuja	Raj Ahuja Consulting
Tauhid Haque	Ansari	Hitachi ABB Power Grids
Onome	Avanoma	MJ Consulting
Christopher	Baumgartner	We Energies
William	Boettger	Boettger Transformer Consulting LLC
Alain	Bolliger	HV TECHNOLOGIES, Inc.
Jeffrey	Britton	Phenix Technologies, Inc.
Steven	Brzoznowski	Bonneville Power Administration
Erich	Buchgeher	Siemens Energy
David	Calitz	Siemens Energy
Juan	Carrizales	Prolec GE
David	Caverly	Trench Limited
Jaroslaw	Chorzepa	ABB Inc.
Eric	Davis	Burns & McDonnell
Everton	De Oliveira	Siemens Ltda
Scott	Dennis	Hitachi ABB Power Grids
Don	Dorris	Nashville Electric Service
Daniela	Ember Baciu	Hydro-Quebec - Laboratoire Haute Tension
Reto	Fausch	RF Solutions

Role	First Name	Last Name	Company
	Michael	Franchek	Retired
	Eduardo	Garcia Wild	Siemens Energy
	Shawn	Gossett	Ameren
	Jeffrey	Gragert	Xcel Energy
	Sergio	Hernandez Cano	Hammond Power Solutions
	John	John	Virginia Transformer Corp.
	Stephen	Jordan	Tennessee Valley Authority
	Akash	Joshi	Black & Veatch
	Gael	Kennedy	GR Kennedy & Associates LLC
	Peter	Kleine	US Army Corps of Engineers
	Dmitriy	Klempner	Southern California Edison
	Mark	Lachman	Doble Engineering Co.
	Fernando	Leal	Prolec GE
	Yaquan (Bill)	Li	BC Hydro
	Tim-Felix	Mai	Siemens Energy
	James	McBride	JMX Services, Inc.
	David	Murray	Tennessee Valley Authority
	Dwight	Parkinson	EATON Corporation
	Harry	Pepe	Phenix Technologies, Inc.
	Sylvain	Plante	Hydro-Quebec
	Bertrand	Poulin	Hitachi ABB Power Grids
	Chris	Powell	Intermountain Electronics
	Jarrod	Prince	ERMCO
	Pierre	Riffon	Pierre Riffon Consultant Inc.
	Leopoldo	Rodriguez	Transformer Testing Services LLC
	Hakan	Sahin	Virginia and Georgia Transformers
	Amitabh	Sarkar	Virginia Transformer Corp.
	Daniel	Sauer	EATON Corporation
	Jeffrey	Schneider	Power Partners/Spire Power Solutions
	Pugal	Selvaraj	Virginia Transformer Corp.
	Michael	Sharp	Trench Limited
	Christopher	Slattery	FirstEnergy Corp.
	Mike	Spurlock	Spurlock Engineering Services, LLC
	Kyle	Stechschulte	American Electric Power
	Ajith	Varghese	SPX Transformer Solutions, Inc.
	Jason	Varnell	Doble Engineering Co.
	Krishnamurthy	Vijayan	PTI Transformers
	Loren	Wagenaar	WagenTrans Consulting
	Hugh	Waldrop	Memphis Light, Gas & Water
	David	Walker	MGM Transformer Company
	Dr. Alexander	Winter	HIGHVOLT Pruftechnik Dresden
	Shibao	Zhang	PCORE Electric
	Kris	Zibert	Allgeier, Martin and Associates

Role First Name Last Name Company

B.3.8 Task Force Winding Insulation Power Factor & Winding Insulation Resistance Limits, Diego Robalino (Chair) and Aniruddha Narawane (Secretary) at the meeting

Minutes of Meeting held on 4.27.2021: Virtual Meeting via WebEx

1. Meeting was called to order at 8.00 am by Chairman Diego Robalino
2. Chairman checked for any patents and copy rights and there were none.
3. There were 26+1 (one member accidently selected guest option) members present out of 41. Based on the attendance, quorum was established.
4. Agenda was approved Unanimously. (Motion: Mickel Saad, Second: Dan Sauer)
5. Minutes of Fall 2020 meetings were approved Unanimously. (Motion Daniel Sauer, Second: Dave Wallach)
6. Chairman explained the work carried out by the TF members since last meeting in F20.
    a. IEEE SA revised the population of the usable data
    b. Important categorization was made based on transformer Class I and II.
    c. Testing temperature was analyzed, information separated in groups ever 5 C.
    d. With the revision carried out the total usable data reached ~ 143k samples.
    e. Approximately 5000 samples were not possible to classify due to lack of clear information.
    f. Additional Statistical para meter were incorporated to the plots provided: max, min, average, std. deviation, 90th percentile and median.
7. TF members met during the last two months to prepare a final report for the Dielectric Tests SC.
8. The text in the report was presented to all members and guests.
    a. Important highlights:
        i. Update latest revisions of technical references
        ii. Accuracy of instrumentation
        iii. Section includes factors affecting Power factor values during factory and/or field measurements.
9. The construction of the transformer was also discussed and the impact of processing of insulation and construction.
    a. Dan Sauer mentioned that a transformer with properly processed insulation can achieve a PF of about 0.5%.
    b. It was also mentioned that type of insulation especially on LV winding close to core may also impact the results.
10. Chairman also presented data of PF and impact on it with reference to different temperature and for different classes of transformers.
11. There was a comment made by Evgenii Ermakov about PI/IR and readings after 10 min and test procedure. Chairman mentioned that it is an important aspect however it is not in scope of the TF. Nevertheless, recommendations can be always addressed.
12. After looking at the information and the documentation in the report, Chairman presented the recommendations to be made to the Dielectric Subcommittee:

Role First Name Last Name Company

a. Line-frequency PF limits are better presented as a range. Members agreed with the approach. Members also mentioned that it can be recommended to use this data to harmonize the information in:
    i. C57.152. – Field test guide
    ii. C57.12.90 – Test Code
    iii. C57.168 – WG LF Test Guide.

13. It was requested to have a motion to send the recommendations regarding Power Factor Limits to the Dielectric subcommittee and was unanimously approved. (Motion: Poorvi, Second: Mario)
14. Chairman indicated that IEEE SA is making a final revision of the data related to IR. Suggested complete this task before making a final statement for IR to the Dielectric Test SC.
15. Chairman thanked all those who contributed and made a special mention of IEEE SA representative Mr. Ernesto Vega for helping in data management and analysis.
16. Meeting adjourned at 9.15 am.

Annex A: attendance from PSAV report
Total attendance was 85 (76 at the time of Quorum Poll)
Annex B:
Quorum established. As reported by PSAV at the beginning of the meeting, out of 41 members there were 27 members (1 member accidently selecting a guest option)

A. Member 26/76 (34%)
B. Guest 38/76 (50%)
C. Requesting Membership 9/76 (12%)
D. No Answer 3/76 (4%)

Annex C: Relevant chat recorded during the meeting:
April 27, 2021 8:08 AM from David Wallach to everyone: David Wallach - Duke Energy April 27, 2021 8:08 AM from Dinu A to everyone: Dinu Amarasinghe - Bruce Power April 27, 2021 8:08 AM from Israel Barrientos to everyone: Israel Barrientos - ProlecGE April 27, 2021 8:08 AM from Eric Doak to everyone: Eric Doak - D4EnergySolutions April 27, 2021 8:08 AM from David Calitz Guest to everyone: David Calitz - Siemens Energy April 27, 2021 8:09 AM from John K John to everyone: John K John, Virginia Transformer Corp. April 27, 2021 8:10 AM from Mickel Saad to everyone: Mickel Saad - HAPG April 27, 2021 8:10 AM from Roger Hayes to everyone: Roger Hayes, GE Grid Solutions April 27, 2021 8:11 AM from Evgenii Ermakov to everyone: Evgenii Ermakov, Hitachi ABB Power Grids April 27, 2021 8:11 AM from Aniruddha Narawane to everyone: Sanket..Noted April 27, 2021 8:11 AM from Cihangir Sen to everyone: Cihangir J. Sen - Duke Energy April 27, 2021 8:11 AM from Aleksandr Levin to everyone: Aleksandr Levin - Weidmann Electrical Technology April 27, 2021 8:12 AM from Parminder to everyone: Parminder Panesar, Virginia Transformer Corp. April 27, 2021 8:12 AM from Rodrigo Ocon to everyone: Rodrigo Ocon, IEM-Condumex April 27, 2021 8:14 AM from Marco Espindola to everyone: Marco Espindola - HAPG April 27, 2021 8:16 AM from Alan Sbravati to everyone: Alan Sbravati (guest) - Cargill April 27, 2021 8:37 AM from Don Dorris to everyone: They are both core & shell. April 27, 2021 8:55 AM to Diego Robalino (privately): 20 minutes left in this session April 27, 2021 9:00 AM from ISMAIL GUNER to everyone: Is the trend analysis in any of the scope of any C57 dielectric testing guides? April 27, 2021 9:00 AM from Thomas Hartmann to everyone: Thomas Hartmann - Exelon April 27, 2021 9:10 AM to Diego Robalino (privately): 5 minutes left

Role First Name Last Name Company

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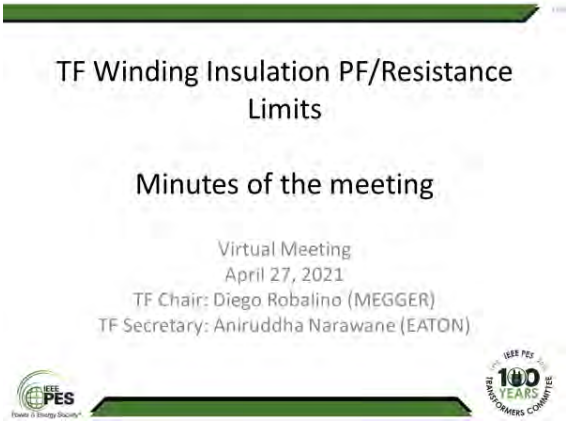
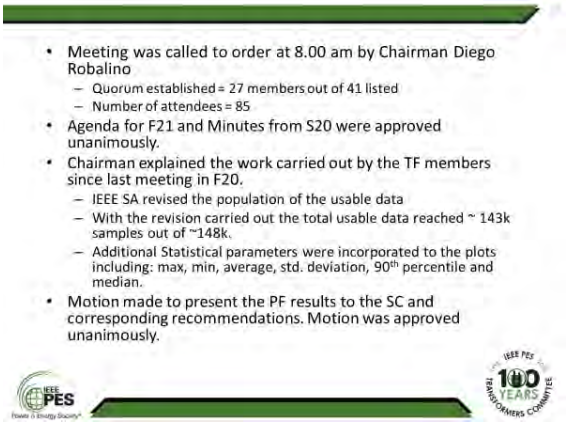
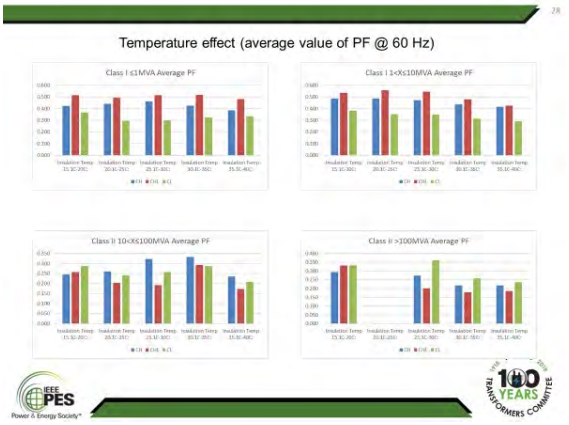
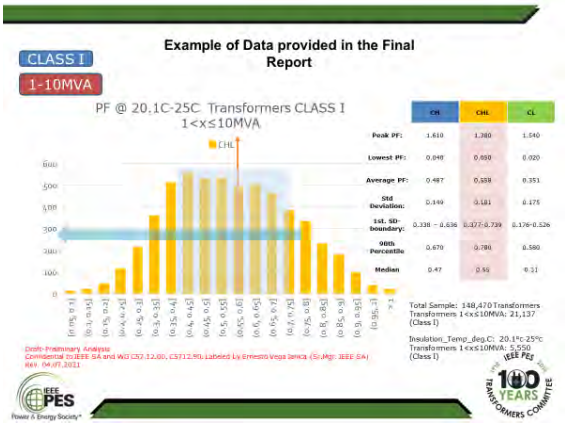
The Chair suggested to circulate the documents to the DTSC members and guests and chairs for C57.152. – Field test guide, C57.12.90 – Test Code, C57.168 – WG LF Test Guide and take the discussion in the fall meeting were the information should reside.

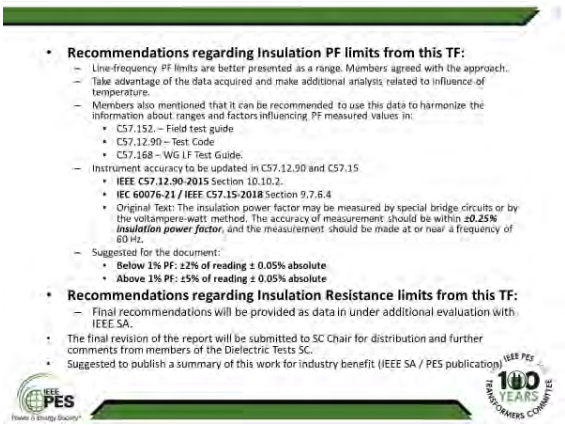


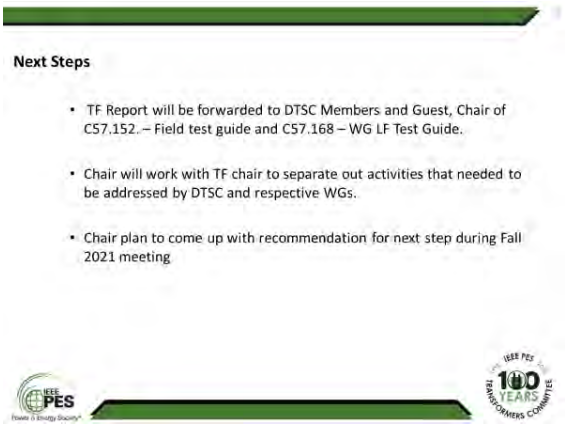




Role First Name Last Name Company







Role First Name Last Name Company

Role	First Name	Last Name	Company
Chair	Diego	Robalino	Megger
Guest	Joe	Nims	Allen & Hoshall, Inc.
Guest	Lee	Matthews	Howard Industries
Guest	Michael	Franchek	Retired
Guest	Ewald	Schweiger	Siemens Energy
Guest	Kumar	Mani	Duke Energy
Guest	James	Cross	Kinectrics
Guest	Rogelio	Martinez	Georgia Transformer
Guest	Jean-Noel	Berube	Rugged Monitoring Inc.
Guest	Thomas	Spitzer	City Transformer Service Co.
Guest	Clemens	Reiss IV	Custom Materials, Inc.
Guest	Neil	Strongosky	Memphis Light, Gas & Water
Guest	Donald	Lamontagne	Arizona Public Service Co.
Guest	Rodrigo	Ocon	Industrias IEM
Guest	Marco	Espindola	Hitachi ABB Power Grids
Guest	Anthony	Natale	HICO America
Guest	Huan	Dinh	Hitachi ABB Power Grids
Guest	Ali	Naderian	Metsco
Guest	Marc	Foata	Maschinenfabrik Reinhausen
Guest	Parminder	Panesar	Virginia Transformer Corp.
Guest	Egon	Kirchenmayer	Siemens Energy
Guest	Stephanie	Denzer	Alliant Energy
Guest	Anil	Sawant	Virginia Transformer Corp.
Guest	Christopher	Steineman	Delta Star Inc.
Guest	Erich	Buchgeher	Siemens Energy
Guest	Kevin	Biggie	Weidmann Electrical Technology
Guest	Thomas	Hartmann	Pepco Holdings Inc.
Guest	Ismail	Guner	Hydro-Quebec
Guest	Jeffrey	Gragert	Xcel Energy
Guest	Piotr	Blaszczyk	Specialty Transformer Components LLC
Guest	Anand	Zanwar	Siemens Energy
Guest	Nigel	Macdonald	Trench Limited
Guest	Attila	Gyore	M&I Materials Ltd
Guest	Jinesh	Malde	M&I Materials Inc.
Guest	Alan	Sbravati	Cargill, Inc.
Guest	Martin	Munoz Molina	Orto de Mexico
Guest	Ryan	Bishop	Minnesota Power
Guest	Brady	Nesvold	Xcel Energy
Guest	Israel	Barrientos	Prolec GE
Guest	Drew	Welton	Intellirent

Role	First Name	Last Name	Company
Guest	Shiva	Rampersad	Dow Chemical Company
Guest	Brad	Staley	Salt River Project
Guest	Muhammad Ali Masood	Cheema	Northern Transformer
Guest	Kyle	Heiden	EATON Corporation
Guest	Suleman	Khan	Ontario Power Generation
Guest	Hugh	Waldrop	Memphis Light, Gas & Water
Guest	Samragni	Dutta Roy	Siemens Energy
Guest	Eric	Doak	D4EnergySolutions LLC
Guest	Jonathan	Sinclair	PPL Electric Utilities
Guest	Tim	Rocque	SPX Transformer Solutions, Inc.
Guest	William	Knapek	OMICRON electronics Corp USA
Guest	Onome	Avanoma	MJ Consulting
Guest	Kayland	Adams	SPX Transformer Solutions, Inc.
Guest	Zachary	Millard	Great River Energy
Guest	Evgenii	Ermakov	Hitachi ABB Power Grids
Guest	Brandon	Dent	Memphis Light, Gas & Water
Guest	Brandon	Dent	Memphis Light, Gas & Water
Guest	Derek	Hollrah	Burns & McDonnell
Guest	Balakrishnan	Mani	Virginia Transformer Corp.
Guest	Nicholas	Walder	EATON Corporation
Guest	Mauricio	Soto	Hitachi ABB Power Grids
Guest	Dinu	Amarasinghe	Bruce Power
Guest	Taylor	Gray	Portland General Electric (PGE)
Guest	Rakesh	Patel	Hitachi-Powergrid
Guest	Thomas	Eagle	SPX Transformer Solutions
Guest	ANDY	DOWNEY	SPX TRANSFORMER SOLUTIONS
Guest	George	Jalhoum	PPl
Member	William	Boettger	Boettger Transformer Consulting LLC
Member	Charles	Sweetser	OMICRON electronics Corp USA
Member	Don	Dorris	Nashville Electric Service
Member	David	Wallach	Duke Energy
Member	Roger	Hayes	General Electric
Member	Peter	Werelius	Megger
Member	Zan	Kiparizoski	Howard Industries
Member	Poorvi	Patel	Electric Power Research Institute (EPRI)
Member	David	Sheehan	HICO America
Member	Daniel	Sauer	EATON Corporation
Member	Aleksandr	Levin	Weidmann Electrical Technology
Member	Ajith	Varghese	SPX Transformer Solutions, Inc.
Member	Mario	Locarno	Doble Engineering Co.
Member	Krishnamurthy	Vijayan	PTI Transformers
Member	David	Murray	Tennessee Valley Authority

Role	First Name	Last Name	Company
Member	Fernando	Leal	Prolec GE
Member	John	John	Virginia Transformer Corp.
Member	Kristopher	Neild	Megger
Member	Lorne	Gara	Shermco
Member	Rhea	Montpool	Schneider Electric
Member	Sanket	Bolar	Megger
Member	Mickel	Saad	Hitachi ABB Power Grids
Member	Cihangir	Sen	Duke Energy
Member	Jaber	Shalabi	VanTran Industries, Inc.
Member	David	Calitz	Siemens Energy
Secretary	Aniruddha	Narawane	Power Distribution, Inc. (PDI)

Role First Name Last Name Company

B.3.9 Task Force Transient Failure Mitigation (WG PC57.142), Jim McBride (Chair), Xose Lopez-Fernandez (Vice Chair) and Tom Melle (Secretary)

Minutes of Meeting held on 4.27.2021: Virtual Meeting via WebEx 2.20-3.35 PM Central Time

Meeting called to order at 2:20 PM Central Time.

Welcome and Chair's Remarks

2) Attendance Poll was taken at 2:25 PM. 102 Attendees were present (66 Guests)? 36 of 54 Members present (quorum was achieved)

3) IEEE Patent Policy and Copyright slides (no essential patent claims or copyright issues)

4) It was noted the IEEE Transactions Paper developed by members of the C57.142 WG has been published and is now available on the IEEE website (https://ieeexplore.ieee.org/document/9161400).

5) Approval of meeting Agenda without objection. Approval of Fall 2020 Meeting Minutes without objection (motion to approve by Rogerio Verdolin / 2nd by Phil Hopkinson).

6) Switchgear Liaison Task Force Update – Dave Caverly

The WG continues to receive excellent comments from Switchgear experts via the Switchgear Liaison TF. The present Draft 9B was created to address all prior comments. The Switchgear task force met on April 21, 2021 and reviewed changes made in D9B. All prior comments were resolved to the satisfaction of the SG task force. There was a motion by the SG TF to take the current document to Ballot. The TF had a quorum and the motion passed by consensus with no objections or abstentions (The comments and conclusions were presented to the WG in this meeting and will be posted on the WG website).

7) Status of Draft 9B and comments – Jim McBride

A copy of the present draft of the guide (D9B) was provided to all WG members prior to the meeting and is posted on the WG webpage of the Transformers Committee (PCS) website. In summary, the old guide focused on primarily MV systems. The new guide adds HV systems as well as additional related examples and mitigations. The excitation mechanisms are now based on steep front voltages and/or repetitive "pulse train" excitations which may "line up" and coincide with transformer internal resonance frequencies.

The revision to the Guide is complete and the draft is ready to proceed to ballot. The Chair noted the WG has filed for a PAR extension as a precaution (since all work must be completed by the end of 2021).

Role First Name Last Name Company

A motion was made by Phil Hopkinson / 2nd by Rogerio Verdolin to take the present Draft 9B to ballot. The motion was approved by online ballot with 36 members approving (0 disapproving / 0 abstentions).

8) Mitigation methods task force update and presentation – Phil Hopkinson

The presentation is posted on the WG webpage. Following the presentation there was discussion on several topics, including the DEIS feature article from September 2016 IEEE Electrical Insulation Magazine 32(5):32-40 "Impulse voltage distribution and frequency response of inter-shield windings". There was also a lengthy discussion of the guidance requested from the Switchgear committee for fast/very fast reignition transients from the Transformers Committee.

9) New Business: the WG authorized the formation of the Ballot Resolution Group without objection.

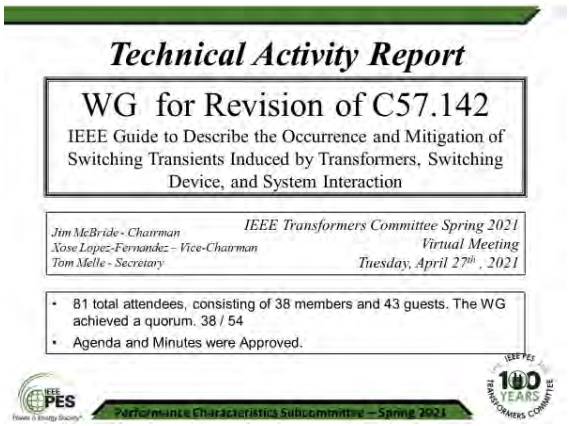
10) Next Meeting: (Fall 2021 – Milwaukee, WI the week of October 17-21)

11) Motion to Adjourn made by Phil Hopkinson / 2nd by Tom Melle. Meeting was adjourned at 3:37 PM without objection.

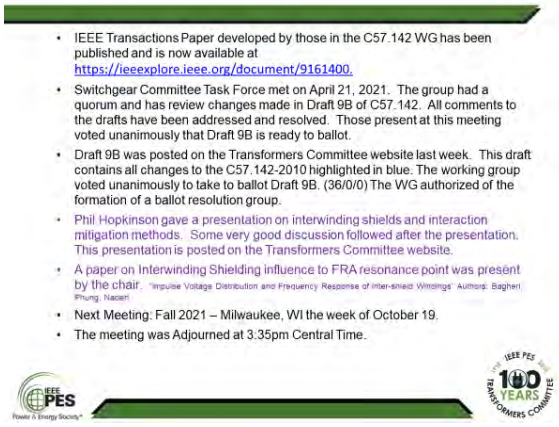
Respectfully,

Thomas R. Melle

Secretary



Role First Name Last Name Company



Role	First Name	Last Name	Company
Chair	James	McBride	JMX Services, Inc.
Vice-Chair	Xose	Lopez-Fernandez	Universidade de Vigo
Secretary	Thomas	Melle	HIGHVOLT
Member	Israel	Barrientos	Prolec GE
Member	Enrique	Betancourt	Prolec GE
Member	William	Boettger	Boettger Transformer Consulting LLC
Member	Jeffrey	Britton	Phenix Technologies, Inc.
Member	David	Caverly	Trench Limited
Member	Huan	Dinh	Hitachi ABB Power Grids
Member	Eduardo	Garcia Wild	Siemens Energy
Member	Kyle	Heiden	EATON Corporation
Member	Sergio	Hernandez Cano	Hammond Power Solutions
Member	Philip	Hopkinson	HVOLT Inc.
Member	John	John	Virginia Transformer Corp.
Member	Akash	Joshi	Black & Veatch
Member	Egon	Kirchenmayer	Siemens Energy
Member	Moonhee	Lee	Hammond Power Solutions
Member	Colby	Lovins	Federal Pacific Transformer
Member	Nigel	Macdonald	Trench Limited
Member	Ross	McTaggart	Trench Limited
Member	Vinay	Mehrotra	SPX Transformer Solutions, Inc.
Member	Harry	Pepe	Phenix Technologies, Inc.
Member	Klaus	Pointner	Trench Austria GmbH
Member	Bertrand	Poulin	Hitachi ABB Power Grids
Member	Afshin	Rezaei-Zare	York University
Member	Pierre	Riffon	Pierre Riffon Consultant Inc.
Member	Marnie	Roussell	Entergy
Member	Amitabh	Sarkar	Virginia Transformer Corp.
Member	Cihangir	Sen	Duke Energy
Member	Michael	Sharp	Trench Limited
Member	Hemchandra	Shertukde	University of Hartford
Member	Thomas	Sizemore	ABB Inc.
Member	Steven	Snyder	Hitachi ABB Power Grids
Member	Mike	Spurlock	Spurlock Engineering Services, LLC
Member	Shankar	Subramany	KEMA Labs
Member	Vijay	Tendulkar	Power Distribution, Inc. (PDI)
Member	Kiran	Vedante	Ritz Instrument Transformers
Member	Rogerio	Verdolin	Verdolin Solutions Inc.
Member	Dharam	Vir	SPX Transformer Solutions, Inc.
Member	Sukhdev	Walia	New Energy Power Co.
Member	Baitun	Yang	R.E. Uptegraff

Role	First Name	Last Name	Company
Member	Waldemar	Ziomek	PTI Transformers
Guest	Tauhid Haque	Ansari	Hitachi ABB Power Grids
Guest	Suresh	Babanna	SPX Transformer Solutions, Inc.
Guest	Christopher	Baumgartner	We Energies
Guest	Jeff	Benach	Consultant
Guest	Steven	Brzoznowski	Bonneville Power Administration
Guest	Muhammad Ali Masood	Cheema	Northern Transformer
Guest	Michael	Craven	Phoenix Engineering Services
Guest	James	Cross	Kinectrics
Guest	John	Crouse	Roswell Alliance
Guest	Don	Dorris	Nashville Electric Service
Guest	Feras	Fattal	Manitoba Hydro
Guest	Reto	Fausch	RF Solutions
Guest	Raymond	Frazier	Ameren
Guest	John	Harley	FirstPower Group LLC
Guest	Charles	Johnson	Hitachi ABB Power Grids
Guest	Stephen	Jordan	Tennessee Valley Authority
Guest	Laszlo	Kadar	Hatch
Guest	Axel	Kraemer	Maschinenfabrik Reinhausen
Guest	Tim-Felix	Mai	Siemens Energy
Guest	Susan	McNelly	Xcel Energy
Guest	Randolph	Mullikin	ABB Inc.
Guest	Hossein	Nabi-Bidhendi	ABB Inc.
Guest	Anthony	Natale	HICO America
Guest	Sylvain	Plante	Hydro-Quebec
Guest	Christoph	Ploetner	Hitachi ABB Power Grids
Guest	Tejasvi	Prakash	Schweitzer Engineering Labs
Guest	Samuel	Reed	EATON Corporation
Guest	Leopoldo	Rodriguez	Transformer Testing Services LLC
Guest	Andre	Rottenbacher	Ritz Instrument Transformers
Guest	Daniel	Sauer	EATON Corporation
Guest	Brian	Sonnenberg	Instrument Transformers, LLC
Guest	Joseph	Tedesco	Hitachi ABB Power Grids
Guest	Ajith	Varghese	SPX Transformer Solutions, Inc.
Guest	Jason	Varnell	Doble Engineering Co.
Guest	Jos	Veens	SMIT Transformatoren B.V.
Guest	Kannan	Veeran	Georgia Transformer
Guest	Loren	Wagenaar	WagenTrans Consulting
Guest	Alan	Washburn	Burns & McDonnell
Guest	Malia	Zaman	IEEE

Role First Name Last Name Company

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)
Virtual Meeting 10st of January 2021.

- The HVTT Subcommittee and its active working groups met virtually during the week of 10th of January, 2021

Active Projects Include

- IEEE P1122 – Impulse Digitizer Standard. PAR extended to end of 2022. Will seek WG approval to go to ballot with Draft 6.1. Expected to go to ballot mid 2021. – Chair: Jeff Britton, Phenix Technologies, Inc.
- IEEE P510 – High Voltage Safety Guide. PAR extended to end of 2022. Draft development complete with Draft 4. Currently in editing by editorial TF. Expected to go to ballot before the end of 2021. – Chair: Jeff Hildreth, Bonneville Power Administration.
- IEEE P2426 – Field Measurement of Fast Front and Very Fast Front Overvoltages in Electric Power Systems (Entity PAR). Draft 5.5 in comment resolution at Subcommittee level. Expected to go to ballot in 2021. PAR will need extended. – Chair: Shijin Xie, State Grid Corporation China.
- WG P454 – "Guide for the Detection, Measurement and Interpretation of Partial Discharges". Draft in development. PAR expires end of 2023. – Chair: Glenn Behrmann, Hitachi ABB Power Grids.
- WG P4.1 – "Guide for the Practical Implementation of IEEE Std 4 on High-Voltage and High-Current Measurement Systems". Draft in development. Chair: Bill Larzelere, Evergreen High Voltage.
- IEEE Std. 4 Revision PAR to be opened before end of 2021 – Target Date for Completion: End of 2023
- Next HVTT Meetings
- Planned for Fall of 2021 – Exact meetings dates, format and location (if an in-person meeting is held) to be announced by end of May.
- Contact Jeff Britton (jeff@phenixtech.com) or Jim McBride (jim@jmxhv.com) to participate, or join the PSIM Committee 123SignUp database at: https://www.123signup.com/mailinglist?Org=ieee-psim

Role First Name Last Name Company

B.5 Old/ Unfinished Business

- Addition of STLI (**S**pecial **T**ermination **L**ightning **I**mpulse) to standard
  - Parked till (Part of WG C57.142) TF on Risk mitigation on Transient failures presents their recommendation to DTSC

The WG is working on this. Phil has a presentation that is posted in Performance Characteristic Subcommittee site. It could be a few more meetings before it will come to the DTSC for the Impulse part.

- C57.138 Recommended guide for Impulse Testing (Distribution transformers) – Standard valid 2026
  - Is there an opportunity to adapt/incorporate requirement into C57.98- Impulse guide for power transformers ? General feedback was to keep distribution Xmer guide separate from Power

The test procedures and current monitoring methods included in this document were developed by manufacturers of small pole mount, and pad mount transformers that required a simple, and fast routine impulse test (not a design test), that could easily be incorporated into the "conveyor belt" production line test routines used to process these units.

A motion was made to set-up a TF and initiate a PAR: 1st motion was Jim McBride and 2nd was Dan Sauer. The motion was unanimously approved. A new chair is to be decided.

B.6 New Business

A question of new business from Ronnie Minhaas was mentioned -should standard adopt a limit for Insulation resistance between core and Frame? Should this value be 1000 megaohm minimum during final factory acceptance test.
There was some discussion on this topic however due to short of time this item was parked to be further discussed in the Fall DTSC in Milwaukie.

B.7 Adjournment

Meeting adjourned 12.20 PM.

Minutes respectfully submitted by:
Poorvi Patel
Secretary DTSC.

Role First Name Last Name Company

Attendee List- April 28th 2021- INCLUDING NEW MEMBERS

Role	First Name	Last Name	Company
Guest	Mubarak	Abbas	Siemens Industry
Guest	Kayland	Adams	SPX Transformer Solutions, Inc.
Member	Raj	Ahuja	Raj Ahuja Consulting
Member	Gregory	Anderson	GW Anderson & Associates, Inc.
Member	Tauhid Haque	Ansari	Hitachi ABB PowerGrids
Member	Elise	Arnold	SGB
Member	Javier	Arteaga	Hitachi ABB PowerGrids
Member	Onome	Avanoma	MJ Consulting
Guest	Hugo	Avila	Hitachi ABB PowerGrids
Member	Donald	Ayers	Ayers Transformer Consulting
Guest	Gilles	Bargone	FISO Technologies Inc.
Guest	Israel	Barrientos	Prolec GE
Guest	Jared	Bates	Oncor Electric Delivery
Member	Christopher	Baumgartner	We Energies
Guest	Barry	Beaster	H-J Family of Companies
Guest	Myron	Bell	Delta Star Inc.
Guest	Ramon	Benedict	SPX Transformer Solutions, Inc.
Guest	Olle	Benzler	Megger
Guest	Mats	Bernesjo	Hitachi ABB PowerGrids
Guest	Jean-Noel	Berube	Rugged Monitoring Inc.
Member	Enrique	Betancourt	Prolec GE
Member	Daniel	Blaydon	Baltimore Gas & Electric
Member	William	Boettger	Boettger Transformer Consulting LLC
Guest	Joshua	Bohrn	PacifiCorp
Guest	Sanket	Bolar	Megger
Guest	Alain	Bolliger	HV TECHNOLOGIES, Inc.
Member	Dominique	Bolliger, Ph.D.	HV TECHNOLOGIES, Inc.
Guest	Jeremiah	Bradshaw	Bureau of Reclamation
Member	Jeffrey	Britton	Phenix Technologies, Inc.
Guest	Darren	Brown	Howard Industries
Guest	Steven	Brzoznowski	Bonneville Power Administration
Member	David	Calitz	Siemens Energy
Guest	Edward	Casserly	Ergon, Inc.
Member	Juan	Castellanos	Prolec GE
Guest	Jaroslaw	Chorzepa	ABB Inc.
Guest	Rhett	Chrysler	ERMCO
Member	Craig	Colopy	EATON Corporation
Guest	Michael	Craven	Phoenix Engineering Services
Member	Jorge	Cruz	PTI Transformers
Guest	Juan Carlos	Cruz Valdes	Prolec GE
Member	Eric	Davis	Burns & McDonnell
Member	Everton	De Oliveira	Siemens Ltda

Role	First Name	Last Name	Company
Member	J. Arturo	Del Rio	Siemens Energy
Member	Scott	Dennis	Hitachi ABB PowerGrids
Guest	Stephanie	Denzer	Alliant Energy
Guest	Scott	Digby	Duke Energy
Guest	Nikolaus	Dillon	Dominion Energy
Member	Huan	Dinh	Hitachi ABB PowerGrids
Member	Eric	Doak	D4EnergySolutions LLC
Guest	Jeffrey	Door	H-J Family of Companies
Member	Don	Dorris	Nashville Electric Service
Guest	ANDY	DOWNEY	SPX TRANSFORMER SOLUTIONS
Member	Samragni	Dutta Roy	Siemens Energy
Guest	Thomas	Eagle	SPX Transformer Solutions
Guest	Megan	Eckroth	EATON Corporation
Guest	Daniela	Ember Baciu	Hydro-Quebec - Laboratoire Haute Tension
Member	Evgenii	Ermakov	Hitachi ABB PowerGrids
Guest	Marco	Espindola	Hitachi ABB PowerGrids
Member	Feras	Fattal	Manitoba Hydro
Member	Reto	Fausch	RF Solutions
Member	Hugo	Flores	Hitachi ABB PowerGrids
Guest	Paul Gabriel	Florida	Howard Industries, Inc.
Member	Joseph	Foldi	Foldi & Associates, Inc.
Member	Bruce	Forsyth	Bruce Forsyth and Associates LLC
Member	John	Foschia	SPX Transformer Solutions, Inc.
Member	Michael	Franchek	Retired
Member	Anthony	Franchitti	PECO Energy Company
Guest	Raymond	Frazier	Ameren
Member	George	Frimpong	Hitachi ABB PowerGrids
Guest	Jose	Gamboa	H-J Family of Companies
Member	Eduardo	Garcia Wild	Siemens Energy
Guest	James	Gardner	SPX Transformer Solutions, Inc.
Member	David	Geibel	Hitachi ABB PowerGrids
Member	Rob	Ghosh	General Electric
Guest	Orlando	Giraldo	H-J Family of Companies
Member	Shawn	Gossett	Ameren
Guest	Jeffrey	Gragert	Xcel Energy
Member	James	Graham	Weidmann Electrical Technology
Guest	Taylor	Gray	Portland General Electric (PGE)
Member	Bill	Griesacker	Duquesne Light Co.
Member	Detlev	Gross	Power Diagnostix
Guest	Attila	Gyore	M&I Materials Ltd
Guest	Kendrick	Hamilton	Power Partners, Inc.
Member	John	Harley	FirstPower Group LLC
Guest	Thomas	Hartmann	Pepco Holdings Inc.
Member	Roger	Hayes	General Electric

Role	First Name	Last Name	Company
Member	Kyle	Heiden	EATON Corporation
Guest	Giovanni	Hernandez	Virginia Transformers Corporation
Member	Sergio	Hernandez Cano	Hammond Power Solutions
Member	John	Herron	Raytech USA
Vice-Chair	Thang	Hochanh	Surplec Inc.
Member	Saramma	Hoffman	PPL Electric Utilities
Guest	Ryan	Hogg	Bureau of Reclamation
Guest	David	Holland	ExxonMobil
Guest	Derek	Hollrah	Burns & McDonnell
Member	Philip	Hopkinson	HVOLT Inc.
Guest	George	Jalhoum	PPl
Guest	Paul	Jarman	University of Manchester
Guest	Nicholas	Jensen	Delta Star Inc.
Member	John	John	Virginia Transformer Corp.
Member	Toby	Johnson	Pacificorp
Member	Stephen	Jordan	Tennessee Valley Authority
Member	Akash	Joshi	Black & Veatch
Guest	Laszlo	Kadar	Hatch
Member	Kurt	Kaineder	Siemens Energy
Member	Sheldon	Kennedy	Niagara Transformer
Guest	Gael	Kennedy	GR Kennedy & Associates LLC
Member	Stacey	Kessler	Basin Electric Power Cooperative
Guest	Gary	King	Howard Industries
Member	Egon	Kirchenmayer	Siemens Energy
Guest	Ken	Klein	Grand Power Systems
Guest	Peter	Kleine	US Army Corps of Engineers
Guest	Dmitriy	Klempner	Southern California Edison
Guest	William	Knapek	OMICRON electronics Corp USA
Guest	Anton	Koshel	Delta Star Inc.
Member	Axel	Kraemer	Maschinenfabrik Reinhausen
Guest	Donald	Lamontagne	Arizona Public Service Co.
Guest	Fernando	Leal	Prolec GE
Member	Moonhee	Lee	Hammond Power Solutions
Member	Aleksandr	Levin	Weidmann Electrical Technology
Member	Weijun	Li	Braintree Electric Light Dept.
Guest	Chao	Li	EATON Corporation
Member	Yaquan (Bill)	Li	BC Hydro
Member	Mario	Locarno	Doble Engineering Co.
Guest	Tiffany	Lucas	SPX Transformer Solutions, Inc.
Guest	Nigel	Macdonald	Trench Limited
Member	Tim-Felix	Mai	Siemens Energy
Member	Darrell	Mangubat	Siemens Power Operations Inc.
Guest	Kumar	Mani	Duke Energy
Guest	Balakrishnan	Mani	Virginia Transformer Corp.

Role	First Name	Last Name	Company
Guest	Richard	Marek	Retired
Guest	Dennis	Marlow	DenMar TDS Transformers
Member	James	McBride	JMX Services, Inc.
Guest	Matthew	McFadden	Oncor Electric Delivery
Guest	James	Mciver	Siemens Energy
Guest	Susan	McNelly	Xcel Energy
Member	Vinay	Mehrotra	SPX Transformer Solutions, Inc.
Member	Thomas	Melle	HIGHVOLT
Guest	Zachary	Millard	Great River Energy
Member	Kent	Miller	T&R Electric Supply Co.
Member	Rashed	Minhaz	Transformer Consulting Services Inc.
Guest	Paul	Morakinyo	PSEG
Member	Emilio	Morales-Cruz	Qualitrol Company LLC
Member	David	Murray	Tennessee Valley Authority
Guest	Ryan	Musgrove	Oklahoma Gas & Electric
Guest	Hossein	Nabi-Bidhendi	ABB Inc.
Member	Ali	Naderian	Metsco
Guest	Shankar	Nambi	Bechtel
Guest	Kristopher	Neild	Megger
Guest	Ashmita	Niroula	Ergon, Inc.
Member	Rodrigo	Ocon	Industrias IEM
Guest	Rudolf	Ogajanov	ABB Inc.
Guest	Anastasia	O'Malley	Consolidated Edison Co. of NY
Member	Parminder	Panesar	Virginia Transformer Corp.
Member	Dwight	Parkinson	EATON Corporation
Guest	Sanjay	Patel	Royal Smit Transformers
Secretary	Poorvi	Patel	Electric Power Research Institute (EPRI)
Member	Nitesh	Patel	Hyundai Power Transformers USA
Guest	Rakesh	Patel	Hitachi-Powergrid
Guest	Monil	Patel	Pacific Gas & Electric Company
Member	Brian	Penny	Retired
Member	Harry	Pepe	Phenix Technologies, Inc.
Guest	Mark	Perkins	D4Energy Solutions LLC
Member	Sylvain	Plante	Hydro-Quebec
Guest	Cornelius	Plath	OMICRON Energy Solutions GmbH
Member	Bertrand	Poulin	Hitachi ABB Power Grids
Guest	Chris	Powell	Intermountain Electronics
Guest	Tejasvi	Prakash	Schweitzer Engineering Labs
Member	Jarrod	Prince	ERMCO
Member	Ulf	Radbrandt	Hitachi ABB Power Grids
Member	Ion	Radu	Hitachi ABB Power Grids
Member	Timothy	Raymond	Electric Power Research Institute (EPRI)
Guest	John	Reagan	Oncor Electric Delivery
Guest	Larry	Rebman	EMLS, Inc.

Role	First Name	Last Name	Company
Guest	Jonathan	Reimer	FortisBC
Member	Pierre	Riffon	Pierre Riffon Consultant Inc.
Member	Diego	Robalino	Megger
Guest	Tim	Rocque	SPX Transformer Solutions, Inc.
Guest	Leopoldo	Rodriguez	Transformer Testing Services LLC
Guest	Andre	Rottenbacher	Ritz Instrument Transformers
Member	Mickel	Saad	Hitachi ABB Power Grids
Member	Hakan	Sahin	Virginia and Georgia Transformers
Guest	Mahesh	Sampat	EMS Consulting Inc.
Guest	Lina	Sandsten	Hitachi Power Grids
Guest	Dinesh	Sankarakurup	Duke Energy
Member	Amitabh	Sarkar	Virginia Transformer Corp.
Member	Daniel	Sauer	EATON Corporation
Guest	Roderick	Sauls	Southern Company Services
Member	Alan	Sbravati	Cargill, Inc.
Member	Markus	Schiessl	SGB
Member	Jeffrey	Schneider	Power Partners/Spire Power Solutions
Member	Ewald	Schweiger	Siemens Energy
Member	Pugal	Selvaraj	Virginia Transformer Corp.
Guest	Cihangir	Sen	Duke Energy
Guest	Jaber	Shalabi	VanTran Industries, Inc.
Member	Devki	Sharma	Entergy
Member	Hemchandra	Shertukde	University of Hartford
Guest	Kunal	Shukla	PECO Energy Company
Guest	Stephen	Shull	BBC Electrical Services, Inc.
Member	Jonathan	Sinclair	PPL Electric Utilities
Guest	Kushal	Singh	ComEd
Member	Kenneth	Skinger	Scituate Consulting, Inc.
Guest	Christopher	Slattery	FirstEnergy Corp.
Member	Steven	Snyder	Hitachi ABB Power Grids
Guest	Markus	Soeller	Power Diagnostix
Guest	William	Solano	Instrument Transformer Equip Corp
Member	Sanjib	Som	Pennsylvania Transformer
Member	Fabian	Stacy	Hitachi ABB Power Grids
Member	Brad	Staley	Salt River Project
Member	Kyle	Stechschulte	American Electric Power
Guest	Hampton	Steele	TVA
Guest	Neil	Strongosky	Memphis Light, Gas & Water
Member	Babanna	Suresh	Southwest Electric Co.
Member	Charles	Sweetser	OMICRON electronics Corp USA
Member	Janusz	Szczechowski	Maschinenfabrik Reinhausen
Member	Troy	Tanaka	Burns & McDonnell
Guest	Marc	Taylor	Cogent Power Inc.
Guest	Dervis	Tekin	Meramec Instrument Transformer Co.

Role	First Name	Last Name	Company
Member	Vijay	Tendulkar	Power Distribution, Inc. (PDI)
Guest	Risto	Trifunoski	Trench Limited
Guest	Parag	Upadhyay	ABB Inc.
Guest	Jacques	Vanier	Electro Composites (2008) ULC
Chair	Ajith	Varghese	SPX Transformer Solutions, Inc.
Member	Jason	Varnell	Doble Engineering Co.
Member	Kiran	Vedante	Ritz Instrument Transformers
Guest	Kannan	Veeran	Georgia Transformer
Member	Rogerio	Verdolin	Verdolin Solutions Inc.
Member	Krishnamurthy	Vijayan	PTI Transformers
Member	Dharam	Vir	SPX Transformer Solutions, Inc.
Member	Pragnesh	Vyas	Sunbelt-Solomon Solutions
Guest	Loren	Wagenaar	WagenTrans Consulting
Member	Hugh	Waldrop	Memphis Light, Gas & Water
Member	Sukhdev	Walia	New Energy Power Co.
Member	David	Wallach	Duke Energy
Guest	Evanne	Wang	DuPont
Guest	Michael	Warntjes	American Transmission Co.
Guest	Alan	Washburn	Burns & McDonnell
Guest	Joe	Watson	JD Watson and Associates Inc.
Member	Eric	Weatherbee	PCORE Electric
Member	Bruce	Webb	Knoxville Utilities Board
Guest	Drew	Welton	Intellirent
Member	Peter	Werelius	Megger
Member	Daniel	Weyer	Nebraska Public Power District
Guest	William	Whitehead	Siemens Energy
Guest	Barrett	Wimberly	GE Grid Solutions
Member	Dr. Alexander	Winter	HIGHVOLT Pruftechnik Dresden
Guest	Jeffrey	Wright	Duquesne Light Co.
Member	Baitun	Yang	R.E. Uptegraff
Member	Joshua	Yun	Virginia Transformer Corporation
Guest	Malia	Zaman	IEEE
Guest	Anand	Zanwar	Siemens Energy
Member	Peter	Zhao	Hydro One
Member	Kris	Zibert	Allgeier, Martin and Associates
Member	Waldemar	Ziomek	PTI Transformers