IEEE PES TRANSFORMERS COMMITTEE

Annex B DIELECTRIC TEST SUBCOMMITTEE

The meeting was held at the Hyatt Regency, St. Louis, Missouri, USA

Dielectric Tests Subcommittee		
Chair: Poorvi Patel	**Vice-Chair: Thang Hochanh**	**Secretary: Diego Robalino**
Room: Grand Ballroom E	**Date:** Wednesday, October 30, 2024	**Time:** 11:00 am to 12:15 pm
Total DTSC Members: **155**	Members present at the meeting: **104**	Attendance according to sign in sheet: **213**
Guests present: **109**	Membership requested: **27**	Membership accepted: **3**
Members moved to Guest Status: **19**		

Chair's Remarks

The SC Chair welcomed members and guests to the fall 2024 meeting in St. Louis, Missouri.

Five sets of the SC roster were distributed for attendance record. SC Secretary requested unanimous approval to record the meeting for the sole purpose of minutes reporting. None are against it, and the meeting is recorded (only voice no video).

Considering the lack of a better system, SC Secretary prepared a QR code for the attendees to record attendance and SC meeting attendees were requested to use it.

Explanation about the roaster sheet provided to review e-mail address and provide any corrections to update the attendance list.

First, SC Chair reviewed policies and procedures according to IEEE SA. It was stated the need to identify potential essential patent claims. DTSC members and guests are reminded to inform SC Chair, SC Secretary or IEEE SA representative for our SC (Patrycja Jarosz, +19087268288, p.jarosz@ieee.org) of potential patent claims. Copyright policies, participation behavior, compliance with all applicable laws, including antitrust and competition laws.

It was requested to all attendees approach the microphone for questions and comments during the meeting stating name and affiliation.

Future events:

2025 IEEE PES- Grid Edge	January 21-23, San-Diego, CA
IEEE PES Transformer Committee Meeting Spring 2025	March 23-27, Denver, CO
IEEE PES General Meeting	July 27 – 31, Austin, TX
IEEE PES Transformer Committee Meeting Fall 2025	TBD, Bonita Springs, FL
IEEE DEIS Electrical Insulation Conference 2025	June 8 – 12, South Padre Island, TX

Next, SC Chair requested all TF and WG leaders to submit minutes on or before November 13th, 2024 including revised and updated attendance list. The information to be sent to SC Secretary via e-mail (diego_robalino@ieee.org). The information must be consolidated and submitted to the Main Committee by December 05, 2024. Also, a reminder was made for any online meeting happening in-between the in-person meetings also should keep a recorded attendance and minutes.

- **ADCOM highlights**

Patrycja Jarosz is now the Standards Program Coordinator for the entire Transformer Committee. She looks after any questions related to PAR generation or extensions. Her contact information was provided for guests and members if questions arise.

Patrycja Jarosz

p.jarosz@ieee.org

+1 9087268288

Regarding WG and SC officer Training, it has become optional but highly recommended. IEEE SA's Antitrust, Competition, and Commercial Terms Policies remain mandatory for Standards Committee / Working Group Officers to complete within 90 days of appointment.

Training link: https://iln.ieee.org/Public/ContentDetails.aspx?id=AE404C2328DA4A39AAD7AB5117681F05

- **Optional** training that all current and future officers need to complete
- **Mandatory-** IEEE SA's Antitrust, Competition, and Commercial Terms Policies training shall be performed after appointment
  - Standards Committee/Working Group Officers within 90 days of appointment
  - Training is on demand
- **Recommend everyone to go through the training**

Memberplanet

- Testing is ongoing with no target date when it will be released.

List Serv-email address

- The SC Vice-Chair indicated that all WG and TF leaders are requested to send the list of members or non-members to Patrycja to be updated in **MyProject**., she will generate the email address and set you up as admin to be able to change the list as well. Let her know if you want one email address for Members and Guests

- **PAR Changes, Modification and Extension**
  - Must have WG Approval
  - Must have SC Approval

- **Status of Active Standards**

Project	Title	Valid until	PAR Status
C57.127	Guide for the Detection of Acoustic Emissions from Partial Discharges	2028	WG inactive
C57.160	Guide for the Elec. Measurement of PD in HV bushings and Instrument Transformers	2033	WG inactive - PUBLISHED
C57.113	Recommended practice for PD Measurement Power	2034	WG Inactive Published
C57.98	Guide for Transformer Impulse Tests	2021	PAR 2024 extension granted (2 years)
C57.138	Recommended Practice for Routine Impulse Tests for Distribution Transformers	2026	PAR 2028
C57.161	Guide for DFR Measurements	2028	PAR 2028
C57.168	Low-Frequency Test Guide	2034	WG inactive
C57.12.200	Bushing Dielectric Frequency Response Guide (ENTITY WG)	2032	WG inactive

Next, NesCom/RevCom meeting dates and deadlines were reviewed.

Standard Board Meeting	Submittal Deadlines
29th -30th of October 2024	
09th-10th of December of 2024	
29th of January 2025	20th of December 2024

SC Secretary's Report

SC Secretary brought back the attention to the use of the QR code, and some answers were recorded indicating that not all attendees were aware of their status (member or guest).
Agreed to display the members' names before scanning the QR code. Lesson learned. It is part of using an alternative system.
Sign-in sheet explanation. Emphasizing on where to sign attendance and where to request membership.

- Total Attendees to DTSC S24 meeting: **196**
    - Total Members attended: **94** (out of 151)
- Requested Membership: **6**
    - Rejected Membership: **0**
    - Approved Membership: **6**

FIRST NAME	LAST NAME
Gabriel	Delgado
Rich	Frye
Alireza	Gorzin

Ravi	Gupta
Evan	Knapp
Xose	Lopez-Fernandez

- Total Members for Fall 2024 meeting: **157**
- Required for Quorum: **79**
- Requirements to become a DTSC Member:
    - Attend **3** out of the last **5** DTSC meetings

A list of members was presented to the audience to establish a quorum during this meeting and QR code was displayed. Looking at the list of members, we requested to raise hands for headcount.
The headcount was completed with **88** members attending the meeting. **Therefore, the quorum was achieved.** The final review will be carried out against roster signatures and QR code data.

- **Quorum, Approval of Minutes, and Agenda**

Once quorum was established, SC Chair requested a motion to approve the agenda for today's meeting:

- Motion by Evgenii Ermakov, second Sanjib Som.
- No objection to the unanimous approval of the agenda hence approved.

Chairperson requested a motion to approve the Spring 2024 minutes from Vancouver meeting including revisions made later to its publication:

- Motion by Jim McBride, second Sami Debass
- No objection to the unanimous approval of the agenda for the Fall 2024 meeting, hence approved.

Attendance Summary

	By Roster	By QR code
Total Attendees	213	181
Total # Of Members	155	155
Members Present	104	84
Quorum Present	**YES (67.1%)**	**YES (54.2%)**

SC Discussions and Motion passed.

New Business:

1. During the past meeting it was raised the question to form a DFR guide for Instrument Transformers
    - Diego Robalino indicated that a DFR guide was published in 2018, a DFR guide dedicated to bushings was published in 2022. There is experience within the group in the application of DFR on Instrument Transformers and a TF could be created to investiagte the topic.

- SC Chair indicated that instrument transformer testing for DFR is different to that of power transformers and bushings and therefore the topic will not fit within the C57.161 DFR guide. A dedicated document is an option for this SC to consider. SC Chair opened a discussion on the topic.
- Diego Robalino brings the **motion to start a Task Force for a DFR guide for instrument Transformers**.
- Motion seconded by Evgenii Ermakov. No discussion and no objections to the motion. **Motion carries**.

2. Tauhid Ansari – indicated that to his TF in the continuous revision of C57.12.00 a topic was identified not to belong to this task force and it is brought up to the DTSC.
   - Section 6.8. related to clearance between bushings.
   - Dan Sauer indicated that external dielectric clearance belongs to DTSC. A dedicated table was generated by a task force led by Eric David. The table and the text attached to it belongs to this SC. At the moment there is no TF or WG dealing with the topic but it is suggested to create one.
   - Bertrand Poulin made a statement about connectors not to be specified by manufacturers but by utilities in a way that those will not interfere with needed clearances. He suggested to leave the topic as is and the utility should be consulted in the selection of corona shield or other accessory.
   - Additional comments include the need for this table as it has been removed.
   - The ideal condition would be to have the utility and the manufacturer working together on the selection of those accessories but the discussion indicates low probability of that happening.
   - Dan Sauer clarified that Table 10 does exists in the document. SC Chair asked for follow up action.
   - Tauhid Ansari makes a **motion to create a Task Force to review section 6.8 text and table and report suggestions to this SC**. Thang Hochanh seconds the motion.
     - Ajith Varghese opens discussion around the Table 10 in the document, explanation is required for the text and the table.
     - Motion clarified by Tauhid Ansari.
   - SC Chair asks for any one against the motion. None heard. **Motion carries** and Tauhid Ansari will lead the TF and get the people to support this effort.

3. Ajith Varghese – During the presentation of TF on Low frequency Dielectric Tests made the following motions:
   a. Motion to for the DTSC to approve the modifications revisions on the text of the following sections:
      - C57.12.90 section 10.8.1 General
        - Each Class II power transformer shall receive an induced-voltage test with the required test voltage levels from IEEE Std C57.12.00-2021 Table 4 columns 6 and 7 based on the HV voltage class corresponding to the maximum system voltage. The required test voltage levels shall be induced in the high-voltage winding. The tap connections shall be chosen, when possible, so that test levels developed in the other windings during the one-hour test are *x* times their nominal system ~~maximum operating~~ voltages, as specified in Table 4 of IEEE Std C57.12.00-2021, where *x* (also referred to as the "overvoltage factor" in the text that follows) is the ratio of the line-to-line test voltage on the high-voltage winding to the nominal system ~~maximum operating~~ voltage.

      - C57.12.00 Table 4 – Note b
        - [b] The induced-voltage tests~~s~~ levels in the table above are based on an overvoltage factor of approximately ~~shall be conducted at~~ 1.58 × nominal system voltage for the one hour test and 1.80 × nominal system voltage for the enhanced 7200 cycle test

      - C57.12.00 section 5.10.5.5 Induced-voltage test for Class II power transformers
        - ~~o~~ With the transformer connected and excited as it will be in service, an induced-voltage test shall be performed as indicated in Figure 2, at voltage levels indicated in Columns 6 and 7 of Table 4. ~~Minimum line-to-ground induced test levels for Class II power transformers shall be a multiple of corresponding line-to-ground nominal system voltage as follows: 1.58 times for one-hour tests and 1.8 times for 7200 cycles enhancement level tests.~~
      - Dan Sauer seconds the motion
      - Ajith elaborated on the topic. No additional discussion.

- SC Chair asked if anyone opposed approval, none heard.
- SC Chair asked for anyone abstain, none heard.
- **The motion to modify the text passes with DTSC approval.**

b. Motion for the DTSC to approve the text that was surveyed and is attached in the TF report below.
   - Class I PD : RLFT surveyed text (C57.12.90) that was approved for Motion at DTSC, scheduled 10/30/2024

     10.7 Induced-voltage tests for distribution and Class I power transformers for distribution and Class I power transformers without partial discharge test

     No changes to existing clauses 10.7.1 to 10.7.7.4
     10.8 Induced-voltage tests for Class I power transformers with partial discharge test specifically requested by the purchaser

   - Dan Sauer seconds the motion
   - Minor discussion within the group. Less than 34 kV is excluded, 34.5 kV is included. Important to mention nominal system voltage. Document is based on nominal system voltage and not BIL.
   - SC Chair asked for objections to unanimous approval. None heard.
   - SC Chair asked for abstains to approval. None heard. **Therefore, motion carries with approval from the DTSC.**

4. During DFR revision presentation by Evgenii Ermakov a question from the floor. Brian McBride asked if to be consistent with the language of other standards, the title should read “Liquid Filled” instead of “Liquid Immersed”?
   - The discussion analyzed that a PAR is already in place and a change of the title implies a new PAR. Therefore, consideration for a future revision. There is no preference established in the standards.

Old Business: No old business

Taskforce and Working Group Reports

Reports are in the order presented during the meeting

TF Core Ground and Winding Insulation Resistance

Chair: Diego Robalino

Acting Secretary: Swapnil Marathe

Monday, October 28, 2024.

Hyatt Regency, St. Louis at the Arch – Missouri Grand Ballroom A/B (4) 16:45 – 18:00

Minutes prepared by Swapnil Marathe, Secretary (in absence of Aniruddha)

- The meeting called to order by the WG Chair at 16:45

Total TF Members: **53**	Members present at the meeting: **23**	Attendance according to sign in sheet: **86**
Guests present: **63**	Membership requested: **20**	Membership accepted: **8**
Members moved to Guest Status: **12**		

- **Attendance Summary**

	By Roster	By QR code
Total Attendees	86	62
Total # Of Members	53	53
Members Present	23	19
Quorum Present	**NO (43.4%)**	**NO (35.8%)**

- Patent statement from IEEE SA presented to attendees
- IEEE SA Policies presented to attendees
- Welcome new members of this TF:

Aikons	Tom
Duffy	Jesse
Ermakov	Evgenii
Leal	Fernando
Shaikh	Abdulmajid
Van Dreel	Cole
Vyas	Pragnesh

- Presentation by Tubos Trans Electric: 359 Units were tested by Mr. Eduardo Tolcachir
    - Two Construction type on Low Voltage side: Helical and Foil
    - Primary side is always cylindrical.
    - Questions from attendees:
        - Fernando Luis Garcia, EPRI - Was there any other test conducted to compliment or correlate with the IR testing done on the 359 transformers

        - No additional testing has been performed to validate good or bad IR results as part of this experimental work
        - Mixed transformers in the fleet – new and in-service.

- Presentation by Mr. Ajith M. Varghese: "IR Core to Ground"
    - To verify only one grounding from core to ground.
    - Test at 500V to 2.5kV DC for 1 Min:
    - Measurement shows a random selection of factory units
        - Generally speaking, results are around 6 GOhm
        - As a general rule of thumb, values greater than 2 GOhms are considered acceptable
        - Nameplate should show if core is internally grounded.
        - Tank and Frame should be grounded.
        - IR test to core is dependent on temperature but there are no IEEE references for temperature correction.
        - Natural Esters liquid typically have a lower IR value.
    - Abnormal Results and Possible causes
        - Core is shorted to gnd
        - Bolt stuck between the core and gnd.
        - Core laminations edges touching tank /frame
        - 10X or lower values compares to previous results.
        - Overheating Core= DGA
        - Moisture increase= Vacuum/ Dry
    - Question from attendees:
        - Tauhid Ansari, Hitachi Energy:
            - Any study done with PI on transformers core-ground test?
            - Ajith Varghese: Not many cases. New transformers have more than 2.0 . IR rises from 1 min to 10 min

- Sub Task Force Groups and Leader selection

Sub Task Force	Scope	Leader	Volunteers
1	Test Performance – Consistency and Best Practices	Diego Robalino	Eduardo Tolcachir Marcos Ferreira Zach Weiss
2	Factors Affecting IR measurements – Consistency and Best Practices	Jesse Duffy	Joseph Tadesco Samragui Dutta Roy Eduardo Tolcachir Pragnesh Vyas Mario Alonso Zach Weiss
3	Magnitude and Interpretation	Tauhid Ansari	Dan Sauer Tauhid Ansari Krish Vijayan Ali Naderian
4	Core Ground Resistance	Ajith Varghese	Sanjib Som Fernando Leal Jean Carlos Hernandez Krish Vijayan Parminder Panesar Joseph Tadesco Jesse Duffy

5	Frame (core clamp) to ground: Depending on the design – to include Ground Resistance	Eduardo Tolcachir	Krish Vijayan Jaber Shalabi

- Fernando Leal - Prolec GE - Sent results to Diego for IR frame to gnd on new transformers.
- Without quorum no minutes were approved

- Meeting was adjourned at 17:35.

Role	First Name	Last Name	Affiliation
M	Kayland	Adams	Prolec-GE Waukesha
M	Tauhid	Ansari	Hitachi Energy
M	Onome	Avanoma	MJ Consulting
G	Alejandro	Ayala	
G	Orlando	Benitez	
G	Edwin	Betancourt	
G	Daniel	Blaydon	Baltimore Gas and Electric
M	William	Boettger	
G	Michael	Botti	Hyosung HICO
G	Garrett	Bradshaw	Howard Industries
G	Steven	Brzoznowski	BPA
M	David	Calitz	Siemens Energy
G	Adriana	Cisco	Salt River Project
G	Gabriel	Delgado	Invenergy
G	Gustavo	do Prado	Siemens Energy
G	Fernando	Duarte	
M	Jesse	Duffy	Nashville Electric Service
G	William	Elliott	AEP SWEPCO
G	Eric	Elson	
G	Marco	Espindola	Hitachi Energy
G	Lorne	Gara	Shermco Industries
G	David	Garcia Paredes	
G	Orlando	Giraldo	THE H-J FAMILY OF COMPANIES
M	Attila	Gyore	MIDEL and MIVOLT Fluids Ltd
G	Roger	Hayes	
G	Sergio	Hernandez Cano	Hammond power solutions
G	Giovanni	Hernandez Decanini	Virginia Transformer
G	Benjamin	Hershberger	Midwest Transformer
G	Saramma	Hoffman	
G	Ryan	Hogg	Bureau of Reclamation
G	Thomas	Holifield	Howard Industries
G	MD Rashid	Hussain	Mississippi State University
G	Fawaz	Iqbal	OMICRON
M	John	John	Virginia Transformer Corp
G	Ryan	Jonak	Portland General Electric
M	Zan	Kiparizoski	Howard Industries
G	Egon	Kirchenmaya	
G	Brian	Klaponski	Carte
G	Arvind	Kumar	Delta Star Inc
G	Mathieu	Lachance	
M	Fernando	Leal	PROLEC GE

G	Kangjin	Lee	Cheryong Electric
G	Junho	Lee	HD Hyundai Electric
G	Jihun	Lee	HD Hyundai Electric
G	Mario	Locarno	
G	Luc	Loiselle	Tetra tech
M	Kushal	Mahajan	Sungrow
G	Swapnil	Marathe	Megger
G	Daniel	Martinez	
G	Nader	Masoud	Central Moloney
G	Fernando	Meza	
G	Ismael	Naja	Eaton Corp.
G	Anthony	Natale	HICO America
G	Brody	Nesudd	
G	Joe	Nims	Allen & Hoshall
G	Michael	Nolte	Kiewit
G	Cuauhtemoc	Ortiz	NPT
G	Dwight	Parkinson	Eaton
M	Poorvi	Patel	
M	Rakesh	Patel	
G	Harry	Pepe	Phenix Technologies
Chair	Diego	Robalino	
G	Alberto	Sandoval	
G	Garret	Sarkinen	Xcel Energy
G	Markus	Schiessl	SGB
M	Cihangir	Sen	Duke Energy
M	Abdulmajid	Shaikh	Delta Star Inc
M	Jaber	Shalabi	
G	Steven	Snyder	
G	Andy	Speegle	
G	Kyle	Stechschulte	AEP
G	Andrew	Steineman	Delta Star, Inc.
G	Mathew	Sze	
G	Jonathan	Tan	Northern Transformer
M	Marc	Taylor	JFE Shoji Canada
G	Fernando	Tirado	Prolec GE
M	Eduardo	Tolcachir	Tte Transformers
G	Risto	Trifunoski	Trench group
M	Ajith	Varghese	Prolec GE Waukesha
M	Krish	Vijayan	
G	John	Wagner	AEP
M	David	Wallach	Duke Energy
G	Joshua	Watson	
M	Zachery	Weiss	WEG transformers
G	Michael	Zarnowski	Carte
G	Jie	zhang	CHINT ELECTRIC CO.,LTD.

TF Revision to Low Frequency Dielectric Tests

St. Louis, Missouri, USA Meeting – October 29, 2024 1:45-3:30pm CST

Chair: Ajith Varghese

Vice Chair: Markus Schiessl

Secretary: Jason Varnell

1. The meeting was called to order at 1:45 PM.
2. 94 individuals were in attendance. A quorum was achived with 35 of 58 total members present. 17 individuals requested membership; however, only 15 were given member status based on attendance and participation and will be added after the F24 meeting. 12 Members that were not present had missed two out of the last three meetings and will be moved to guest after the F24 meeting, which means there will be 61 members.
3. A motion was made by Philp Hopkinson (HVOLT) and seconded by Don Ayers (Ayers Transformer Consulting) to approve the Fall 2024 meeting agenda. There were no objections to unanimous approval of the agenda. A motion was made by Detlev Gross (Power Diagnostix) and seconded by Daniel Sauer (Eaton Corp.) to approve the Spring 2024 task force meeting minutes. There were no objections to unanimous approval of the Spring 2024 task force meeting minutes.
4. Overvoltage Factor for Induced Voltage Testing:

   The chair shared the survey results from the March 21, 2024 TF survey on the topic of contradictions within C57.12.00 and C57.12.90 related to the overvoltage factor for induced voltage testing. There were 39 responses. 34 approved without comment. 1 approved with comment. 2 dissapproved with comment. The chair shared all comments from the survey. The TF unanimous agreed to leave the surveyed text as-is and the recommended changes were not incorporated. There was one minor editorial correction to the surveyed text. A motion was made by Steve Antosz (Stephen Antosz & Associates, Inc) to send the modifed surveyed text to the DTSC SC meeting that is scheduled for October 30, 2024. The motion was seconded by Detlev Gross (Power Diagnostix). The motion passed with unanimous approval. The TF approved text is as stated below:

C57.12.90
10.8.1 General

Each Class II power transformer shall receive an induced-voltage test with the required test voltage levels from IEEE Std C57.12.00-2021 Table 4 columns 6 and 7 based on the HV voltage class corresponding to the maximum system voltage. The required test voltage levels shall be induced in the high-voltage winding. The tap connections shall be chosen, when possible, so that test levels developed in the other windings during the one-hour test are *x* times their nominal system ~~maximum operating~~ voltages, as specified in Table 4 of IEEE Std C57.12.00-2021, where *x* (also referred to as the "overvoltage factor" in the text that follows) is the ratio of the line-to-line test voltage on the high-voltage winding to the nominal system ~~maximum operating~~ voltage.

C57.12.00
Table 4 – Note b

[b] The induced-voltage test~~s~~ levels in the table above are based on an overvoltage factor of approximately ~~shall be conducted at~~ 1.58 × nominal system voltage for the one hour test and 1.80 × nominal system voltage for the enhanced 7200 cycle test

C57.12.00
5.10.5.5 Induced-voltage test for Class II power transformers

With the transformer connected and excited as it will be in service, an induced-voltage test shall be performed as indicated in Figure 2, at voltage levels indicated in Columns 6 and 7 of Table 4. ~~Minimum line-to-ground induced test levels for Class II power transformers shall be a multiple of corresponding line-to-ground nominal system voltage as follows: 1.58 times for one-hour tests and 1.8 times for 7200 cycles enhancement level tests.~~

Note: Above approved changes to section 5.10.5.5 (deletion of last sentence) will be incorporated into previously approved changes to this section for addition of testing at 1.05 X NSV.

5. Task Force on PD Testing of Class 1 Power Transformers – Don Ayers

The Task Force did not meet in person during the week of the Fall 2024 IEEE Transformers Committee meeting. Don Ayers (Ayers Transformer Consulting) surveyed the RLFT TF and DTSC on March 28, 2024. The survey had 81 % approval the recommended changes to C57.12.00 and 80 % approval for the recommended changes to C57.12.90. Don Ayers presented the 14 negative comments. The TF on PD Testing of Class 1 Power Transformers agreed that technical changes to the surveyed text were not required. The RFLT agreed to accept the surveyed text as-si with only minor editorial changes. A motion was made by Don Ayers to send the modifed surveyed text to the DTSC SC meeting that is scheduled for October 30, 2024. The motion was seconded by Tuahid Ansari (Hitachi Energy). The motion passed with unanimous approval.

The TF approved text is as stated in Annex A (Below).

6. Task Force on PD Testing and Limits – Liquid DTR, Wind and Solar Transformer - Andrew Larison

   The TF chair was not present for the RLFT and no update was given. The minutes from their TF meeting is included in Annex B (Below).

7. Old business

   There was no old business.

8. New business

   There was no new business.

9. The meeting was adjourned at 3:00 p.m. The next meeting will be in Denver, Colorado, USA at the Spring 2025 IEEE Transformers Committee Meeting.

Attendance Record

Role	First Name	Last Name	Company
Guest	Kayland	Adams	Prolec-GE Waukesha
Member	Tauhid Haque	Ansari	Hitachi ABB Power Grids
Member	Stephen	Antosz	Stephen Antosz & Associates, Inc
Member	Elise	Arnold	SGB
Member	Donald	Ayers	Ayers Transformer Consulting
Member	Christopher	Baumgartner	We Energies
Guest	Duvier	Bedoya	Hitachi ABB Power Grids
Guest	Edwin	Betancourt	Siemens Energy
Member	Daniel	Blaydon	Baltimore Gas & Electric
Member	William	Boettger	Boettger Transformer Consulting LLC
Member	Alain	Bolliger	HV TECHNOLOGIES, Inc.
Member	Dominique	Bolliger	HV TECHNOLOGIES, Inc.
Guest	Michael	Botti	Hyosung HICO
Member	David	Calitz	Siemens Energy
Guest	Juan	Carrizales	Prolec GE
Guest	Bhaumik	Choksi	Hitachi Energy
Guest	Eric	Davis	Consultant
Guest	Scott	Dennis	Hitachi ABB Power Grids
Guest	Nikolaus	Dillon	Dominion Energy
Guest	Eric	Elson	SDG&E
Guest	Reto	Fausch	RF Solutions
Guest	Joseph	Foldi	Foldi & Associates, Inc.
Member	Raymond	Frazier	Ameren
Member	Rich	Frye	Eaton
Guest	Renjie	Fu	ERMCO
Guest	David	Garcia-Pareoles	Virginia Transformer Company
Guest	Eduardo	Garcia Wild	Siemens Energy
Guest	Alexander	Gaun	Coil Innovation GMBH
Guest	Carlos	Gaytan	Prolec GE
Guest	Jose Antonio	Gonzalez Ceballos	Virginia/ Georgia Transformers
Member	Bill	Griesacker	Consultant
Member	Detlev	Gross	Power Diagnostix Consult GmbH
Member	Sergio	Hernandez Cano	Hammond Power Solutions
Member	Saramma	Hoffman	PPL

Member	Philip	Hopkinson	HVOLT Inc.
Guest	Miljenko	Hrkac	Hitachi Energy
Guest	Marion	Jaroszewski	Delta Star Inc.
Guest	Nick	Jensen	Delta Star
Guest	Sheldon	Kennedy	SHELDON P. KENNEDY ENGINEERING
Guest	Yeounsoo	Kim	MEPPI
Guest	Zan	Kiparizoski	Howard Industries
Guest	Evan	Knapp	Eaton
Guest	Nihat	Kosedagi	Hitachi Energy
Guest	Arvind	Kumar	Delta Star
Member	Mark	Lachman	Doble Engineering Co.
Guest	David	Larochelle	NDB Technologies
Guest	Jihun	Lee	Hyundai Electric
Guest	Junho	Lee	HD Hyundai
Guest	Kang Jin	Lee	Changong Electric
Guest	Moonhee	Lee	Hammond Power Solutions
Guest	Xose	Lopez-Fernandez	Universidade de Vigo
Member	Gabriel	Mamede	Siemens Energy
Guest	Moses	Manzano	Hyosung HICO
Guest	Swapnil	Marathe	Megger
Guest	Alberto	Martinez	WEG USA
Guest	James	McBride	JMX Services, Inc.
Member	Marta	Munoz	Hitachi Energy
Guest	Hugo	Murillo	The H-J Family
Guest	Joe	Nims	Allen & Hoshall, Inc.
Guest	Cuauhtemol	Ortiz	NIAGARA POWER TRANSFORMERS
Guest	Manan	Pandya	Siemens Energy
Member	Harry	Pepe	Phenix Technologies, Inc.
Member	Sylvain	Plante	Hydro-Quebec
Guest	Klaus	Pointner	Trench Austria GmbH
Guest	Bertrand	Poulin	Hitachi ABB Power Grids
Guest	Ulf	Radbrandt	Hitachi ABB Power Grids
Guest	Juan	Reyes Perez	Hitachi Energy
Guest	Michael	Richardson	Ameren
Member	Rodrigo	Ronchi	WEG-Voltran
Member	Hakan	Sahin	Virginia and Georgia Transformers
Member	Daniel	Sauer	EATON Corporation
Vice-Chair	Markus	Schiessl	SGB
Member	Eric	Schleismann	Southern Company Services
Guest	Cihangir	Sen	Duke Energy
Guest	Aron	Sexton	Kinectrics
Member	AbdulMajid	Shaikh	Delta Star Inc.
Member	Christopher	Slattery	FirstEnergy Corp.
Member	Kyle	Stechschulte	American Electric Power
Guest	H. Allen	Steele	TVA
Member	Matthew	Sze	OMICRON electronics Corp USA
Guest	Jonathan	Tan	Northern Transformer
Guest	Samuel	Tekle	WEG Transformers USA Inc.
Guest	Andreas	Thiede	Highvolt Dresden
Guest	Pedro	Tryillo	Hyundai
Chair	Ajith	Varghese	Prolec-GE Waukesha
Secretary	Jason	Varnell	Doble Engineering Co.
Guest	Kannan	Veeran	Virginia Georgia Transformer
Member	Krishnamurthy	Vijayan	Pennsylvania Transformers
Member	Pragnesh	Vyas	Sunbelt-Solomon
Guest	David	Wallach	Duke Energy
Guest	Jeffrey	Wright	Duquesne Light Co.
Guest	Fei	Yang	Hitachi Energy
Guest	Hongzhi	Zhang	Hitachi Energy
Member	Kris	Zibert	Allgeier, Martin and Associates

Annex A-1

Class I PD : RLFT surveyed text (C57.12.90) that was approved for Motion at DTSC, scheduled 10/30/2024

10.7 Induced-voltage tests for distribution and Class I power transformers for distribution and Class I power transformers without partial discharge test

No changes to existing clauses 10.7.1 to 10.7.7.4

10.8 Induced-voltage tests for Class I power transformers with partial discharge test specifically requested by the purchaser

10.8.1 General

Each Class I power transformer shall receive an induced-voltage test with the required test levels induced in the high-voltage winding. The tap connections shall be chosen, when possible, so that test levels developed in the other windings during the one-hour test are *x* times their maximum operating voltages, as specified in Table 3, Part C of IEEE Std C57.12.00-2021, where *x* (also referred to as the "overvoltage factor" in the text that follows) is the ratio of the test voltage on the high-voltage winding to the maximum operating voltage.

For a transformer built with a single magnetic core holding all windings, all windings are excited at a unique induction level, often referred to as "volts-per-turn." During an induced-voltage test, with the transformer connected and excited as in service, all windings are excited at the same overvoltage factor, regardless of what tap is selected. Each winding turn receives the same voltage. The tap connections shall be chosen, when possible, such that voltages developed across other windings meet or exceed the required overvoltage factor.

The situation is quite different when transformers are equipped with auxiliary devices with separate magnetic cores, such as preventive autotransformer (reactor), series (booster) transformer, or series regulator. Different magnetic cores can be excited at different levels during operation or testing. In certain tap positions, these auxiliary devices do not have their core excited at all and no voltage appears across their windings. For such cases, the selection of the tap-changer position shall be guided by the principles described below. One exception is when such auxiliary devices are not excited on a permanent basis but used only as transitional devices. If equalizing windings are used, the highest voltage impressed across the preventive autotransformer will occur in either the bridging or non-bridging positions. This is because the preventive autotransformer is energized in all tap positions (bridging and non-bridging).

NOTE 1—Equalizing windings are described in IEEE Std C57.131 and IEC 60214-1.

For transformers equipped with a series (booster) transformer, preventive autotransformer (reactor), or any other device, the selected tap position of the load tap-changer (LTC) shall be the one that produces the highest voltage across the windings of the series transformer, preventive autotransformer, and other auxiliary devices as applicable. There can be a conflict of choosing such a tap position when more than one such device is present. In such a case, the selected tap position of the LTC should be the best compromise so that all devices are tested with overvoltage. One common example is the case where a series transformer and preventive autotransformer are both present. In this case, the tap selected shall be the one that is closest to the position that produces the highest voltage across the windings of the series transformer and simultaneously excites the preventive autotransformer,

which is typically a bridging position (not applicable when the preventive autotransformer is energized only during transition).

In order to test the series (booster) transformer, preventive autotransformer, and other devices, at the required minimum overvoltage factor, the voltage developed on the terminals of other windings may exceed the one-hour level mentioned in Table 3, Part C of IEEE Std C57.12.00-2021. In such cases, an alternative tap position may be selected by agreement between the manufacturer and the purchaser to avoid overstressing components such as bushings. Annex D shows examples that can serve as a guide to select the LTC tap position for transformers having series (booster) transformer and/or preventive autotransformers.

For certain types of devices such as series reactors used as current limiting devices, there is no voltage developed across their windings during the induced voltage test as these devices are only excited when current flows in their windings. There is no option available to apply any overvoltage for these devices during the induced test.

NOTE 2-The selection of the tap-changer position for induced test should be agreed upon between manufacturer and purchaser prior to design to avoid conflicts during final acceptance tests.

10.8.2 Test procedure

The voltage shall first be raised to the one-hour level and held for a minimum of 1 min or until a stable partial discharge level is obtained to verify that there are no partial discharge problems. The level of partial discharges shall be recorded just before raising the voltage to the enhancement level. The voltage shall then be raised to the enhancement level and held for 7200 cycles. The voltage shall then be reduced directly to the one-hour level and held for 1 h.

During this 1 h period, partial discharge measurements shall be made at 5 min intervals. Partial discharge acceptance criteria shall be per subclause 10.8.5 and these measurements shall be made in accordance with 10.10.

The pressure inside the transformer tank during the induced test shall not be increased by artificial means for the purpose of reducing the PD level. The liquid level and pressure inside of the transformer tank and/or conservator tank shall be configured such that the oil head pressure during the induced test does not exceed the pressure under usual service conditions. Any exceptions that increase tank pressure by more than 3.5 kPa (0.5 psi) over normal operating pressure, such as the use of an elevated test facility conservator tank, requires customer approval prior to test. A note shall be added to the certified test report confirming this approval.

NOTE—Increasing the pressure for diagnostic purposes, such as to identify and possibly reduce suspected bubbles in the liquid, may be done as a remedial step to diagnose a source of high PD. To be considered valid, the test needs to be repeated with no added pressure as stated previously.

10.8.3 Connections

The transformer shall be excited exactly as it will be in service. The voltage may be induced from any winding or from special windings or taps provided for test purposes. Single-phase transformers shall be excited from single-phase sources. Three-phase transformers shall be excited from three-phase sources. The neutral terminals and other terminals that are normally grounded in service shall be solidly grounded. This will stress all of the insulation at the same per unit of overstress.

10.8.4 Frequency

The test frequency shall be increased, relative to operating frequency, as required to avoid core saturation. The requirements in 10.7.2 are also applicable in the case of this induced test.

10.8.5 Failure detection

Failure may be indicated by the presence of smoke and bubbles rising in the insulating liquid, 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) For transformers with nominal system voltage (NSV) of 34.5KV and above, the magnitude of the partial discharge level does not exceed 250 pC during the 1 h test period. For transformers below 34.5 kV NSV, the magnitude of the partial discharge level shall be set by agreement between the purchaser and the manufacturer.

b) For transformers with nominal system voltage (NSV) of 34.5 kV and above the increase in partial discharge levels during the 1 h period does not exceed 50 pC. For transformers rated below 34.5 kV NSV, the increase of the partial discharge level shall be set by agreement between the purchaser and the manufacturer.

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.

Note: Wording " with nominal system voltage (NSV) of was not part of Text approved by RLFT but added to the text approved by DiElectric SC

Annex A-2

Class I PD: RLFT surveyed (C57.12.00 Table 3) that was approved for Motion at DTSC, scheduled 10/30/2024

Table 3—Dielectric insulation levels for distribution and Class I power transformers, voltages in kV

Maximum system voltage (kV rms)	Nominal system voltage[a, g] (kV rms)	Applied- voltage test[f] (kV rms)			Induced-voltage test[b, f] (phase to ground) (kV rms)	Winding line-end BIL[a, f] (kV crest)			Neutral BIL[d, f, h] (kV crest)	
		Delta or fully insulated wye	Grounded wye	Impedance grounded wye or grounded wye with higher BIL		Minimum	Alternates		Grounded wye	Impedance grounded wye or grounded wye with higher BIL
Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7	Col 8	Col 9	Col 10	Col 11
Part A - Distribution transformers										
1.5	1.2[c]	10	-	10	1.4	**30**			30	30
3.5	2.5[c]	15	-	15	2.9	**45**			45	45
6.9	5[c]	19	-	19	5.8	**60**			60	60
11	8.7[c]	26	-	26	10	**75**			75	75
17	15	34	-	34	17	**95**	110		75	75
26	25	40	-	40	29	**125**	**150**		75	95
36	34.5	50	-	50	40	125	**150**	**200**	75	125
48	46	95	-	70	53	200	**250**		95	150
73	69	140	-	95	80	250	**350**		95	200
Part B - Class I power transformers without partial discharge testing										
1.5	1.2	10	10	10	1.4	**30**	**45**		45	45
3.5	2.5	15	15	15	2.9	**45**	**60**		60	60
6.9	5	19	19	19	5.8	**60**	**75**		75	75
11	8.7	26	26	26	10	**75**	**95**		95	95
17	15	34	26	34	17	**95**	**110**		95	110
26	25	50	26	40	29	**150**			95	125
36	34.5	70	26	50	40	**200**			95	150
48	46	95	34	70	53	200	**250**		110	200
73	69	140	34	95	80	250	**350**		110	250

Maximum system voltage (kV rms)	Nominal system voltage[a, g] (kV rms)	Applied- voltage test[f] (kV rms)			Induced- voltage test[f, i] (phase to ground) (kV rms)		Winding line-end BIL[a, f] (kV crest)		Neutral BIL[d, f, h] (kV crest)	
		Delta or fully insulated wye	Grounded wye	Impedance grounded wye or grounded wye with higher BIL	Enhanced 7200 cycles	One hour	Minimum	Alternate	Grounded wye	Impedance grounded wye or grounded wye with higher BIL
Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7	Col 8	Col 9	Col 11	Col 12
Part C - Class I power transformers with partial discharge testing specifically requested by purchaser										
1.5	1.2	10	10	10	1.2	1.1	**30**	**45**	45	45
3.5	2.5	15	15	15	2.6	2.3	**45**	**60**	60	60
6.9	5	19	19	19	5.2	4.6	**60**	**75**	75	75
11	8.7	26	26	26	9	7.9	**75**	**95**	95	95
17	15	34	34	34	16	14	**95**	**110**	95	110
26	25	50	34	40	26	23	**150**		95	125
36	34.5	70	34	50	36	32	**200**		95	150
48	46	95	34	70	48	42	200	**250**	110	200
73	69	140	34	95	72	63	250	**350**	110	250

[a] For nominal system voltage greater than maximum system voltage, use the next higher voltage class for applied-voltage test levels.

[b] Induced-voltage tests shall be conducted at 2.0 × nominal system voltage for 7200 cycles.

[c] Bold typeface BILs are the most commonly used standard levels.

[d] Y-Y-connected transformers using a common solidly grounded neutral may use neutral BIL selected in accordance with the low-voltage winding rating.

[e] Single-phase distribution and power transformers and regulating transformers for voltage ratings between terminals of 8.7 kV and below are designed for both Y and Δ connection, and are insulated for the test voltages corresponding to the Y connection so that a single line of transformers serves for the Y and Δ applications. The test voltages for such transformers, when connected and operated, are therefore higher than needed for their voltage rating.

[f] For series windings in transformers, such as regulating transformers, the test values to ground shall be determined by the BIL of the series windings rather than by the rated voltage between terminals.

[g] Values listed as nominal system voltage in some cases (particularly voltages 34.5 kV and below) are applicable to other lesser voltages of approximately the same value. For example, 15 kV encompasses nominal system voltages of 14 440 V, 13 800 V, 13 200 V, 13 090 V, 12 600 V, 12 470 V, 12 000 V, and 11 950 V.

[h] Neutral BIL shall never exceed winding BIL.

[i] Induced voltage tests shall be conducted at 1.58 x nominal system voltage for one hour and 1.8 x nominal system voltage for enhanced 7200 cycle test.

Annex B –

Task Force on PD Testing and Limits – Liquid DTR, Wind and Solar Transformer

Meeting notes from 10/28/2024 meeting:

Task Force on Partial Discharge Testing in Distribution, Wind and Solar Transformers

St. Louis, MO

Monday, October 28, 2024

9:30 AM – 10:45 AM CST

Grand Ballroom E

Chairman – Andrew Larison – Hitachi Energy

Vice Chair/Secretary – Nabi Almeida – Prolec GE

1. IEEE Copyright Reminder was presented, no comments from the audience
2. IEEE Patent Claim Reminder was presented, no comments from the audience
3. **Attendance** – For this meeting a QR code is being used to record attendance as well as membership requests, the results will be shared before the end of the meeting. As a task force, quorum is not required.

First Name	Last Name	Position	Email	Roster Fall 2024
Nabi	Almeida	Vice-Chair	nabi.almeida@prolec.energy	Y
Tauhid	Ansari	Member	tauhid.ansari@hitachienergy.com	Y
Onome	Avanoma	Member	o.avanoma@outlook.com	Y
Donald	Ayers	Guest	Donald.ayers@ieee.org	Y
Hugo	Bayona	Guest	hugob@h-j.com	y
Jason	Beaudoin	Guest	Jason.beaudoin@weidmann-group.com	y
Duvier	Bedoya	Member	Duvier.bedoya@hitachienergy.com	y
Orlando	Benitez	Guest	Oblopez98@gmail.com	y
Dominique	Bolliger	Member	d.bolliger@hvtechnologies.com	y
Alain	Bolliger	Member	bolliger@hvtechnologies.com	y
Sudip	Chanda	Member	sudip.chanda2503@yahoo.com	Y
Eric	Davis	Guest	esctdavis@aol.com	y
Luiz	de Oliveira	Guest	batiacabeca@gmail.com	y
Gabriel	Delgado	Member	gdelgado@invenergy.com	y
Scott	Dennis	Member	scott.dennis@hitachienergy.com	y
Gustavo	do Prado	Guest	gustavo.prado@sirmens-energy.com	y
Jose	Gamboa	Member	joseg@h-j.com	y
Lorne	Gara	Guest	lgara@shermco.com	y
Gilberto	Garza	Member	Gilberto.garza@prolec.energy	y
Carlos	Gaytan	Member	carlos.gaytan@prolec.energy	y
Orlando	Giraldo	Member	orlandog@h-j.com	y
Detlev	Gross	Member	dwg@mailbox.com	y
Grace	Guang Yuan	Member	guang.yuan@hitachienergy.com	y
Brooke	Harvey	Guest	Bharvey@mgpowerassociates.com	y

Miljeno	Hrkac	Guest	Miljenko.hrkac@hitachienergy.com	y
Mihai	Huzmezan	Guest	mihai.huzmezan@megger.com	y
Fawaz	Iqbal	Guest	fawaz.iqbal@omicronenergy.com	y
Akash	Joshi	Member	Akash.d.joshi@ieee.org	y
Yonghui	Kim	Guest	yonghui.kim@iljin.co.kr	y
Nihat	Kosedagi	Member	nihat.kosesagi@hitachienergy.com	y
Mathieu	Lachance	Member	mathieu.lachance@omicronenergy.com	y
Andrew	Larison	Chair	andrew.t.larison@hitachienergy.com	y
Fernando	Leal	Member	ferleal@gmail.com	y
Mario	Locarno	Member	mlocarno@doble.com	y
Kumar	Mani	Member	kumar.mani@duke-energy.com	y
Lee	Matthews	Guest	lmatthews@ieee.org	y
Ali	Naderian	Member	ali.naderian@ieee.org	y
Cuauhtemoc	Ortiz	Guest	cortiz@niagaratransformer.com	y
Poorvi	Patel	Member	Poorvi.patel@hotmail.com	y
Dan	Sauer	Member	dmsauer@mtu.edu	y
Cody	Schott	Member	Codys@h-j.com	y
Mathew	Sze	Member	matthew.sze@omicronenergy.com	y
Andreas	Thiede	Guest	a.thiede@highvolt.com	y
Joe	Watson	Guest	transformerconsulting@gmail.com	y
Zach	Weiss	Member	zweiss@weg.net	y
Trenton	Williams	Guest	trenton.ee@gmail.com	y
Shyzen	Xu	Guest	shuzen.xu@fmglobal.com	y
Joseph	Youn	Guest	joseph.youn@iljin.co.kr	y
Hongzhi	Zhang	Member	alan-hongzhi.zhang@us.abb.com	y

4. **Introductions** – A round of introductions throughout of the room was performed.

5. **Review Record of previous meeting**

The records of the previous meeting were reviewed and a quick evaluation of the previously defined targets was mentioned.

Main topics of interest are:

- Accurate voltage levels of the simulation and tests
- Components should also be included on the requirements of tests
- Is there a correlation between PD/Local Corona with a specific component?
- The impact of current limiting fuses on this test.

6. Scope of TF – It was proposed to the task force members the following scope definition:
" Intended scope to focus on DTR transformers and wind and solar at 35 kV and less, manufactured with DTR components. No inclusion of "large" DTR or Power Transformers"

The TF then reviewed a proposed survey for mfgs using IEEE anonymous survey. A quick review of the PD processes of the existing standards was performed and no comments were made.

7. Collaborate to create a survey for manufacturers on current PD practices for DTR and wind and solar

The Chair started sharing an initial list of questions to be posed to manufacturers with a total of 15 questions. No IP information is included on the list.

John Ayers – Consultant shared his opinion. He referred to the 5-legged transformer requirements. And, he mentioned a proposal for class 1 PTs that has not reached consensus on his TF

Ali Nauderian – Consultant, he mentioned that most components have better performance than the transformer under oil. His proposal is that it should be worth seeing if testing the transformer with the components has an impact. His second point is to also include the lab background PD in the survey.

Dan Sauer – Eaton Corp. – He mentions that is very important to consider that the DT transformers is tested in the production line and several components will create a lot of background noise. What is the problem we are trying to solve? Are these transformers having too many failures in the field that we are trying to prevent? The Chair contested that the current percentage of DT transformers being tested is not high. Dan continued that there are components in the DT transformers have components that naturally generate corona and PD. The chair contested that the intent of the TF is to come back to the WG and propose what should be done on this type of transformers ensuring that there is a compromise between what is feasible for manufacturers and the field conditions. Dan Sauer continued that the time duration on this test is also very important for this type of transformer.

Ali Nauderian came back to the podium to report that some end users are reporting gassing transformers. And that could be the motivation of the request for a general PD testing on DT transformers. He mentions that the challenge is to try and reproduce the load condition during the test and what the end-user thinks about the interaction between the harmonics on the load and the PDs. The Chair added that in his company there are additional tests when PD testing.

Detlev Gross – Consultant. He mentions that he understands that the test on the shop floor is difficult to perform the test, but his experience is that it is possible to execute. The Chair mentioned that there are some special booths that could be used, but this should be a special test. Edel agreed that this should be a design test.

Joe Watson – JD Watson and Assoc. He mentions that his biggest concern with this type of transformers is that throughout the years the requirements for these transformers have changed and the specs and RFQs are not up to the requirements of these transformers. It's unknow if it is the transformer or the site problem. In his opinion, is a mis-usage of the equipment. He believes it needs to be either a Class 1 or defined as a new class of transformers. He asks, do we really need fuses on this type of transformer. PD is important for the right type of transformer and DT is not this type of transformer.

Mathew Sze– Omicron. He does not see an issue in the field. He mentions that it should be a sample (design/special) test.

Akash Joshi – Kimley-horn. He mentions that they also help a lot of users and now that the rating of the transformer is now around 4 MVA and that the users do not know what they are doing. Users should step up and give the data from their installation. The date of installation is also important. The Chair mentioned that in the NEMA meeting a new class of transformers has been discussed to separate the normal DT and Wind and Solar DT.

Carlos Gaytan – Prolec GE – He suggested that the survey questions are good and that we should confirm which test method should be used. Let's not assume that the manufacturers would be testing a certain percentage of units and that the manufacturers do design or routine tests.

Kumar Mani – Duke Energy. He shared that some solar application transformers of his company show gassing. He asked why they are classified as DT transformers since in his opinion they are rectifier transformers. He mentions the importance of core grounding, he mentions that the manufacturers should at least test one unit out of every batch.

Zach Weiss – Weg transformers. He agrees with all the questions. He mentions that his company does all solar units. But they do not follow the IEEE. They ramp up then ramp down and hold for 10s only. With this they have a very high success rate.

Ali came back to the podium to share that maybe due to the differences of current wind/solar/BESS we should request also what is the population that the manufacturers see for each type. The Chair also agreed that BESS is its own niche

Mario Locarno – Doble Energy. He asked Dan Sauer how much work it would be to pull a unit from the line to test in a PD room. Dan answered that their factory does not have the proper room. Marl mentioned that it seems to be a problem in the field, and that they have a crew out doing more and more PD tests. He believes a compromise between the OEMs and the users are necessary. To eliminate PD as a problem.

Dan Sauer – Eaton Corp. Came back to the podium to mention that every DT transformer already goes through the induced test at 200%, if the PD could be done together with that test, it should not add time to the process. He mentions that the test sequence using a 10s seems to be very benign.

Detlev came back to the podium to disagree that you would need to take the transformer out of the line

Joe Watson came back and reported that he had some discussion with manufacturers in the past and they reported that they wanted to energize the transformers from the user inverter instead of the normal test. He also mentions that all the big inverters are exposed to a lot of harmonics that are using the same common ground

Jason Beaudoin - Weidmann. Mentions that the DC component is very important and needs to be taken into consideration.

Akash – C57.159 already defines solar application transformers. And that we should review that.

Mathew came back to the podium and he mentions that the way the transformer is energized is important. Testing under high dv/dt is very complicated. If the OEM is testing around 100 pC already at 60Hz and they want to test under this higher dv/dt will increase the complexity of the test

Dan came back to the podium to share that the inverter is a key component. And that the voltage line to neutral is not clean and that the ground point of the transformer and the inverter is very important. You should ground the midpoint instead of negative or positive bus. The inverter being designed poorly could mis represent the failure

Mihai Huzmezan - Megger – His experience shows that solar farms and they need the tests because their customers have reported many problems. There should be ways to test at the floor. He also wants to state that in the field the background noise is higher but the criteria to pass or fail is also higher.

Alan Hongzhi – Hitachi Energy. Neutral grounded or not during the test. Also, the temperature of the site is important and cannot be reproduced during the test.

8. Collaborate to create a survey for wind and solar developers and end users

The chair shared a list and no comments from the audience were heard.

9. Collaborate to create a survey for DTR component manufacturers.

The chair shared a list of participants recommended, no comments from the audience.

The chair adjourned the meeting, mentioning that the next step is to work on a survey with the manufacturers.

Task Force on Revision of Impulse Tests

Chair: Sylvain Plante

Vice Chair: Daniel Sauer

St-Louis, MO, Fall 20242024

Unapproved meeting minutes

The TF met on October 29th, 2024, from 08:00 am to 09:15 am.
Thirty-seven (37) members and ninety-one (91) guests attended the meeting (see attached attendance list). Thirty-three (33) Guests were attending for the first time the Task Force. Seven (7) guests requested membership but only four (4) are eligible to have attended at least 2 of the last 3 meetings. Two (2) members request membership. After this meeting, six (6) members has been moved to guest list, not having attended 2 of the last 3 meetings. The meeting was chaired by Sylvain Plante, Chair of the TF. and Mr. Daniel Sauer was the vice-chair.
The meeting has been called to order by the Chair at 08:10 am. The meeting start late du to the fat that a lot of people were coming in the room. The meeting is after the breakfast.
Attendance has been recorded in the TF's attendance EXCEL spreadsheets and include in the annex.
IEEE Patents and Copyright slides were presented. There were no comments or requests regarding Patents and Copyrights.
Required quorum was met, presence of at least 27 members out of 52 members was required, we had 32 members during Quorum verification. The TF membership roster has been reviewed after last meeting and this one.
The meeting agenda has been approved unanimously. Motion has been made by Sanjib Som and was seconded by John John.
The S24 meeting minutes held in Vancouver have been approved unanimously. Motion has been made by Bertrand Poulin and was seconded by Jim McBride.
The first item of business was related to the modification of clause 10.3.4.1 of C57.12.90 regarding the current detection. After a few discussions, a motion to move the point to the table and send a survey to the member and guests has been made by Dan Saur and seconded by Jim McBride. The motion has been voted unanimity.
The old business has not been discussed du to the fact that the group has not met during the summer.
The meeting adjourned at 09:00 am on October 29th , 2024, proposed by Sanjib Som and seconded by Bertrand Poulin. Voted Unanimity.
The next meeting is planned to be held in Denver, Colorado, March 23-27, 2025.

Minutes wrote by: Sylvain Plante, Eng.
TF Chair
November 12th , 2024

Role	First Name	Last Name	Company
Member	Kayland	Adams	GE Prolec
Guest	Nabi	Almeida	ProlecGE
Member	Stephen	Antosz	Stephen Antosz & Associates, Inc
Guest	Donald	Ayers	Ayers Transformer Consulting
Guest	sean	barker	
Guest	Christopher	Baumgartner	We Energies

Guest	Barry	Beaster	H-J Enterprises, Inc.
Guest	Duvier	Bedoya	Hitachi Energy
Guest	Eolwin	Betancourt	Siemens Energy
Guest	Kevin	Biggie	Weidmann
Member	William	Boettger	Boettger Transformer Consulting LLC
Guest	Alain	Bolliger	HV TECHNOLOGIES, Inc.
Member	Dominique	Bolliger, Ph.D.	HV TECHNOLOGIES, Inc.
Member	Steven	Brzoznowski	Bonneville Power Administration
Member	David	Calitz	Siemens Energy
Member	Juan Alfredo	Carrizales	Prolec GE
Member	camilo	casallas	
Guest	Jaroslaw	Chorzepa	ABB Inc.
Guest	Adriana	Cisco Sullberg	Salt River Project
Guest	Eric	Davis	Consultant
Guest	Luiz	de Oliveira	Hitachi Energy
Member	Gabriel	Delgado	Invenergy
Guest	Nikolaus	Dillon	Dominion Energy
Guest	Jeffrey	Door	The H-J Familly of companies
Guest	luc	Dorpranns	Royal SMIT Transformers
Guest	Jesse	Duffy	
Member	Janko	Dzodan	Koncar
Guest	Eric	Elson	
Guest	Joe	Foldi	Foldi & Associates, Inc.
Member	Richard	Frye	EATON Corporation
Guest	Robert	Ganser	Transformer Consulting Services, Co.
Guest	Eduardo	Garcia Wild	Siemens Energy
Guest	David	Garcia-Paredes	Virginia Transformer Corp
Guest	Dragana	Gasic	Koncar
Guest	Orlando	Giraldo	THE H-J FAMILY OF COMPANIES
Guest	Jose Antonio	Gonzalez Ceballos	Georgia Transformer
Guest	Kyle	Heiden	Eaton
Member	Sergio	Hernandez Cano	Hammond Power Solutions
Guest	Giovanni	Hernandez Decanini	Virginia Transformer Corp
Guest	Thang	Hochanh	Surplec Inc.
Member	Saramma	Hoffman	PPL
Guest	Thomas	Holifield	Howard Industries
Member	saif	Hossain	Trench limited
Guest	Miljenko	Hrkac	Hitachi Energy
Guest	Zinan	Huang	Sieyuan Electric
Guest	Marion	Jaroszewski	Delta Star Inc
Guest	Chanho	Jeong	ILJIN Electric
Member	John	John	Virginia Transformer Corp.
Guest	christopher	Johnson	
Member	Qasim	Khan	
Guest	Yonghui	Kim	ILJIN ELECTRIC
Member	Evan	Knapp	Eaton corp
Guest	Nihat	Kosedagi	Hitachi Energ
Guest	Arvind	Kumar	Delta Star Inc
Member	Mark	Lachman	Doble Engineering Co.
Guest	David	Larochelle	Ndb technologies
Member	Fernando	Leal	Prolec GE
Member	Moonhee	Lee	Hammond Power Solutions
Member	Junho	Lee	Hyundai Electric
Guest	Weijun	Li	
Guest	Dongki	Lim	Iljin electric
Guest	Gabriel	Lopes Mamede	Siemens Energy

Member	Xose	Lopez-Fernandez	Universidade de Vigo
Guest	Tim-Felix	Mai	Siemens Energy
Guest	Mbouombouo	Mama	Hitachi Energy
Member	Moses	Manzano	
Guest	Daniel	Martinez	Jfe canada
Guest	Nader	Masoud	Central Moloney
Guest	lee	Mattews	
Guest	Joseph	Mc Bride	
Member	James	McBride	JMX Services, Inc.
Guest	Marta	Munoz	Hitachi Energy
Member	David	Murray	Tennessee Valley Authority
Guest	Nam Tran	Nguyen	TT Electronics
Guest	Boris	Nissle	MGC Poser Glaser
Guest	Cuauhtemoc	Ortiz	Niagara Transformer Corp
Guest	Manan	Pandya	Siemens Energy
Guest	Harry	Pepe	Phenix Technologies, Inc.
Chair	Sylvain	Plante	Hydro-Quebec
Guest	Goran	Plisic	Siemens Energy
Guest	Klaus	Pointner	Trench Austria GmbH
Member	Bertrand	Poulin	Hitachi Energy
Guest	Ulf	Radbrandt	Hitachi Energy
Guest	Ion	Radu	Hitachi Energy
Guest	Juan	Reyes	Hitachi Energy
Guest	Michael	Richardson	Ameren
Member	Rodrigo	Ronchi	WEG Transformers USA Inc.
Member	Hakan	Sahin	Virginia/Georgia Transformer
Guest	Dinesh	sankarakurup	
Vice-Chair	Daniel	Sauer	EATON Corporation
Guest	Eric	Schleisman	Southern Company Services
Guest	Cody	Schott	The H-J Family of Companies
Member	Cihangir	Sen	Duke Energy
Guest	Aron	Sexton	Kinectrics
Member	Mike	Shannon	REA Magnet Wire
Guest	Michael	Sharp	Trench Limited
Member	Hemchandra	Shertukde	University of Hartford
Member	Christopher	Slattery	FirstEnergy Corp.
Guest	William	Solano	Voltyx
Member	Sanjib	Som	Pennsylvania Transformer
Member	Kyle	Stechschulte	American Electric Power
Guest	Hampton	Steele	Tennessee Valley Authority
Guest	Andrew	Steineman	Delta Star Inc.
Guest	Can	Takan	MGC Moser-Glaser INC.
Guest	Jonathan	Tan	
Guest	Troy	Tanaka	
Guest	Samuel	Tekle	
Guest	Andrewa	Thiede	
Member	cole	van dreel	american transmission
Member	Ajith	Varghese	SPX Transformer Solutions, Inc.
Member	Jason	Varnell	Doble Engineering Co.
Guest	Krishnamurthy	Vijayan	PTI Transformers
Guest	John	Wagner	
Member	David	Wallach	Duke Energy
Guest	Luke	Wang	BC hydro
Guest	Alan	Washburn	
Guest	Joe	Watson	Joe Watson & Associates
Member	Matthew	Weisensee	PacifiCorp

Guest	Drew	Welton	Intellirent
Guest	Paul	Weyandt	Schneider Electric
Member	Terry	Wong	
Guest	Fei	Yang	Hitachi energy
Guest	Joseph	Youn	ILJIN Electric
Guest	Shibao	Zhang	PCORE Electric
Guest	JIE	ZHANG	CHINT ELECTRIC CO.,LTD.
Guest	Hongzhi	Zhang	Hitachi Energy
Member	Kris	Zibert	Allgeier, Martin and Associates
Member	Waldemar	Ziomek	PTI Transformers

WG Revision of C57.161 "Guide for Dielectric Frequency Response Measurements"

Chair: Evgenii Ermakov (Hitachi Energy – Sweden)

Vice Chair: Ismail Guner (HydroQuebec – Canada)

Secretary: Diego Robalino (Megger – USA)

Meeting in Grand Ballroom F (4) at the Hyatt Regency, St. Louis, Missouri

Unapproved meeting minutes

This is the very first meeting of this working group. WG Chairman started the session at 13:45 and welcomed all attendees and participants.

The attendees were communicated that this is the first meeting of this WG and all are welcome to become members. Approval of the agenda does not require a quorum today.

1. Introduction of attendees
2. The agenda for this first meeting was presented
    a. Poorvi Patel moved a motion to approve the agenda
    b. Mickel Saad seconded the motion
    c. Agenda approved

Total TF Members: **N/A**	Members present at the meeting: **N/A**	Attendance according to sign in sheet: **66**
Guests present: **N/A**	Membership requested: **42**	Membership accepted: **42**
Members moved to Guest Status: **N/A**		

- Patent statement from IEEE SA presented to attendees
- IEEE SA Policies presented to attendees
- Chair informed that PAR (project authorization) was received for this WG on May 22nd, 2024.

- C57.161 – 2018 document went through circulation
- PAR items to be considered:
    - Change of Document Title
    - Change of Document Scope with a focus on measurements and analysis
- As suggested by the WG Chair, four (4) Task Forces are required to complete the work on this revision.
    - Task Force 1 – Revision of Chapter 4
    - Task Force 2 – Revision of Chapters 5 & 6
    - Task Force 3 – Revision of Chapter 7
    - Task Force 4 – Revision of Anexess, Literature and Case Studies
- During the discussion, and after describing the scope of each task force, additional comments we addressed including:
    - The document now focuses on mineral oil, the intention is to extend the scope to alternative fluids
    - Extended discussion is considered in the algorithms used to estimate moisture
    - WG Chair presented his observations on each of the chapters for revision. That is to provide clarity to TF working on the revision.
- Open floor to attendees:
    - Peter Werelius – Words supporting the need to extend the scope of the document and modify the title
    - M. Locarno – Confused about what to add, Peter Werelius summarized the experience of the last 10 years.
    - Poorvi Patel – Emphasized the well-understood moisture issue, but additional anomalies have been observed, not all related to dielectrics. So knowledge has to be incorporated as well as the application on reactors.
    - Marcos Ferreira – Discussed some experience in Puerto Rico.
    - Charles Sweetser – Supports the idea of the nomination of leaders to run the TF out of the group of attendees. Also concerned about GST measurements and other failure modes. Considered construction as well.
    - Tom Prevost – Closely involved in the 1st document looking at percentage moisture in solid insulation (%mc). He suggested other items be picked up as informative.
    - Evgenii Ermakov – Mentions the use of UST of inter-winding insulation and the cylindrical model.
    - Tom Prevost – Scared about the application of DFR on reactors and GST measurement.
    - Poorvi Patel – highlighted the use of GST measurements and observed issues such as high core-ground resistance.

- **Task Forces**

TF	Scope	Leader	TF Volunteers
1	Chapter 4	Ron Hernandez	Charles Sweetser Peter Werelius William Herron Samson Debass Evgenii Ermakov
2	Chapters 5 & 6	Peter Werelius	Poorvi Patel Drew Welton Ron Hernandez Mario Locarno Fawaz Iqbal Evgenii Ermakov
3	Chapter 7	Poorvi Patel	Swapnil Marathe Ron Hernandez Peter Werelius

			Sudip Chanda Kumar Mani Alireza Gorzin Marcos Ferreira
4	Annex/Literature / Case Studies	Ismael Guner	Diego Robalino Samson Debass Rakesh Patel Ron Hernandez Evgenii Ermakov

WG Vice Chair requested for case studies any additional measurements using alternative fluids.

- Initial project draft document to be formally requested from IEEE SA (Patrycja Jarosz)
- Patrycja to provide the Word document to initiate revisions
- Poorvi Patel requested to have the case studies during the in-person meetings for knowledge and open discussion with the group.

The meeting adjourned at 2:50 PM.

Attendance Sheet

Role	**First Name**	**Last Name**	**Company**
Member	Onome	Avanoma	MJ Consulting
Member	Edwin	Betancourt	Siemens Energy
Guest	Dominique	Bolliger	HV Technologies
Member	Alain	Bolliger	HV Technologies
Member	Michael	Botti	Hyosung HICO
Guest	Garrett	Bradshaw	Howard Industries
Member	Sudip	Chanda	Delta Star
Member	Sami	Debass	EPRI
Member	Gabriel	Delgado	Invenergy
Guest	Will	Elliott	AEP/SWEPCO
Chair	Evgenii	Ermakov	Hitachi Energy
Member	Marco	Espindola	Hitachi Energy
Member	Marcos	Ferreira	Luma Energy
Guest	Mark	Finn	Hitachi Energy
Guest	Marc	Foata	MR GmbH
Guest	Chris	Franklin	MG Power
Member	Miguel	Garcia	Hitachi Energy
Guest	James	Gardner	Prolec GE Waukesha
Member	Alireza	Gorzin	VTC & GTC
Vice Chair	Ismail	Guner	Hydro-Quebec
Member	Niklas	Gustavsson	Hitachi Energy
Guest	Roger	Hayes	General Electric
Member	Ronald	Hernandez	Doble Engineering Co.
Member	Bill	Herron	MR

Member	Fawaz	Iqbal	OMICRON
Guest	Patrycja	Jarosz	IEEE SA
Guest	Ryan	Jonak	PGE
Guest	Braxton	Jones	SD Myers
Member	Qasim	Khan	
Member	Zan	Kiparizoski	Howard Industries
Guest	Mark	Lachman	Doble Engineering Co.
Guest	David	Larochelle	NDB Technologies
Member	Mario	Locarno	Doble Engineering Co.
Member	Kumar	Mani	Duke Energy
Member	Swapnil	Marathe	Megger
Guest	Mohammed	Megdad	IPS
Member	David	Murray	Tennessee Valley Authority
Member	Ali	Naderian	METSCO Energy Solutions Inc.
Guest	Boris	Nissle	MGC
Member	Poorvi	Patel	Electric Power Research Institute (EPRI)
Member	Rakesh	Patel	Hitachi Energy
Guest	Sylvan	Plante	HQ
Guest	Thomas	Prevost	Weidmann
Guest	Michael	Richardson	Ameren
Secretary	Diego	Robalino	Megger
Member	Rodrigo	Ronchi	WEG-Voltran
Member	Mickel	Saad	Hitachi Energy
Member	Paul	Salvato	Intellirent
Guest	Preston	Simon	ETSI
Member	Andy	Speegl	Entergy
Member	Brad	Staley	LTCE
Member	Gerry	Suman	ETSI
Member	Sunny	Swarna	VTC
Member	Charles	Sweetser	OMICRON electronics Corp USA
Member	Matthew	Sze	Omicron Electronics
Guest	Can	Takan	MGC
Guest	Andreas	Thiede	Highvolt
Guest	Eduardo	Tolcachir	Tubos Trans Electric S.A.
Member	Kannan	Veeran	Georgia Transformer
Member	Luke	Wang	BC Hydro
Member	Drew	Welton	Intellirent
Member	Peter	Werelius	Megger
Guest	Guang	Yuan	Hitachi Energy
Member	Shibao	Zhang	PCORE Electric
Member	Mark	Newbill	Hitachi Energy
Guest	Alexander	Gauen	Coil Innovation

TF C57.127- Revision of IEEE Guide for the Detection, Location and Interpretation of Sources of Acoustic Emissions from Electrical Discharges

Detlev Gross
Unapproved Meeting Minutes
Saint-Louis, October 29th, 2024, Room: Grand Ballroom AB(4)

Meeting Attendance

The working group met at 9:30 AM. 32 participants were in the room including 10 of the 24 members. Quorum was not met. Attendance list is shown at the end of the present minutes.

Discussions

After the call for essential patent claims and showing the copyright policy, the group addressed an external proposal from an entity member, which was mentioned in the opening session on Monday. The proposal suggests a Recommended Practice document covering online substation monitoring using acoustic fingerprint. This is achieved by installing multiple acoustic sensors in a substation to record and process acoustic signals for detecting or locating incipient failure.

Steve Shull explained the context in which an IEEE entity member can suggest the creation of a document. In the present case, it is agreed that although acoustic principles are involved, the proposed method (airborne acoustic in open air) does not fit within the C57.127 scope (solid / liquid propagation path inside transformers). Moreover, the technique is applicable to all equipment within a substation, not only power transformers and reactors. It is then suggested that this analysis be brought to the dielectric subcommittee with the recommendation that PCS handles the new project.

A tutorial on acoustic localization was then presented by Mathieu Lachance. It covered the basic principles of acoustic localization as well as case studies involving different methods and sensors (bushing tap, HFCT, UHF, or TEV) to acquire the electric signal that serves as a reference for time-of-arrival calculations. To answer questions about the sensitivity of the localization process, it was mentioned that although a PD as low as 10 pC can be localized in a laboratory with direct oil propagation path, field constrains involving noise, availability of clean electrical signals and complex propagation path renders every localization case unique.

Two contributions were received since Vancouver meeting. The new merged version of our document will be circulated before the next WG meeting for new comments. Again, the chair called for new localization case studies that could complete the ones already in the annexes.

Adjournment

The meeting was adjourned at 10h30.

David Larochelle

Attendance List

Complete name	Status	Affiliation
Jason Beaudoin	**G**	Weidmann
Sudip Chandra	**G**	Delta Star inc.
Marcos Czernorucki	**G**	Hitachi Energy
Fernando Duarte	**G**	EPRI
Eric Elson	**G**	San Diego Gas & Electric
Egui Espitia	**G**	Reinhausen
Marco Foata	**G**	Reinhausen
Eloy Gasperin	**M**	Mistras
Brad Graeaves	**G**	Weidmann
Detlev Gross	**C**	Independent
John Harley	**VC**	FirstPower Group LLC
Gary Hoffman	**M**	Advanced Power Tech
Patrycja Jarosz	**G**	IEEE SA
Zhang Jig	**G**	Chian Electric co
Mathieu Lachance	**M**	Omicron
David Larochelle	**S**	NDB Technologies
Jose Lopez-Fernandez	**G**	Universidad de WGO
Nader Masoud	**G**	Central Moloney
Omar Mendez	**G**	Prolec GE
Ali Naderian	**G**	EnerPars
Daniel Obregon	**G**	TTE transformers
Klaus Pointner	**G**	Trench Austria
Yuri Rossini	**G**	Siemens Energy
Mickel Saad	**M**	Hitachi Energy
Aron Sexton	**M**	Kinectrics
Hemchandra Shertukde	**G**	UHART / DDI
Leena Shimpi	**G**	MGM Transformers
Matthew Sze	**M**	Omicron
Eduardo Tolcachir	**G**	TTE transformers
Mark Tostrud	**M**	Dynamic Ratings
Karsten Viereck	**G**	Reinhausen
Guang Yuan	**G**	Hitachi Energy

WG C57.138 - Recommended Practice for Routine Impulse Tests

Unapproved Meeting Minutes
Saint-Louis, October 29th, 2024

Chair:	**Hakan Sahin**	**Vice-Chair**	**Reto Faush**
Secretary	**David Wallace**	**Percent Complete**	**70%**

Current Draft Being Worked On:	**Draft not started**	**Dated:**	**n/a**
PAR Expiration Date:	**December 31, 2026**		

Meeting Date:	**29 October 2024**	**Time:**	**3:15pm**
Location:	**St. Louis, MO, USA**		

Attendance:	**Members**	**10**
	Guests	**23**
	Guests Requesting Membership	**4**
	Total*	**34**

*** Attendance list for this meeting is shown at end of meeting minutes**

Meeting Minutes / Significant Issues / Comments:

Meeting was called to order at 3:15pm, October 29, 2024.

1. Administrative
    a. IEEE Patent Policy and Call for Patents
        i. No comments from group.
    b. IEEE SA Copyright Policy
        i. No comments from group.
    c. Review of agenda
        i. No comments from group.
    d. Introductions of the attendees
        i. Attendance sheets were passed out.
    e. Updated membership review and count for quorum
        i. 34 people were in attendance with 10 out of 15 members present. Quorum was **achieved.**
        ii. Spring_24 unapproved meeting minutes and Fall_24 agenda were approved with no objections from the members.
        iii. 0 attendees requested membership.
    f. Dan Sauer Motioned for approval of agenda and Spring 24 minutes; Jim McBride seconded. No objections noted. Motioned passed

2. Old Business

WG continued to review the document from clause 8.3.2, where we had stopped at the end of Spring_24 meeting, thru clause 8.3.2, which is where we will continue from during the Spring_25 meeting. Proposed changes approved during the meeting. Below is the summary of the review comments.

8.3.2 – Proposed to remove the last sentence of the first paragraph. 7 voted to approve. No abstain. Motion Passed.

Reviewed Figure 26. Leave as is.

Proposed to Remove the first sentence of the fourth paragraph and the following word "However".
After EMI. Add "An off the shelf oscilloscope does not include the software required for the measurement of the peak voltage.". 7 voted to approve a abstain. Motion passed.

Proposed to remove the 3rd paragraph. 7 approved, Motion passed

Discussed figures 27 and 28. Suggested replacing the waveforms with ones that will clearly demonstrate the problem. Jim McBride recommends three curves to highlight the errors.

Replace figures 29 and 30 with better representing figures.

Look into possibly replacing figures 31 and 32.

Change the last sentence in the paragraph before figures 33 and 34. Update figures 33 and 34.
Stopped on 8.3.2

No objections to adjourning.

WG is well on track to complete the review, revise the document per all approved revisions by the par expiration date of 12/31/2026

3. Next meeting: SPRING 2025 MEETING DENVER, COLORADO, USA March 23 - 27, 2025

4. Close of meeting
    a. Dan Sauer Motioned to adjourn, Jim McBride seconded. No objections
    b. Meeting adjourned at 4:30 pm.

Submitted by: Hakan Sahin Date: 11/15/24

WG C57.138 Members and Guests list

Below membership as of Fall_24 meeting, which will be updated by the Spring-25 meeting

Last Nan	First Name	Company	Status
Abdalla	Isaac	Hico America	Guest
Alonso	Mario	Georgia Transformers	Guest
Ansari	Tauhid	Hitachi Energy	Guest
Arnold	Elise	SGB	Guest
Avanoma	Onome	MJC	Guest
Beaudoin	Jason	Weidmann	Guest
Betancourt	Edwin	Siemens Energy	Guest
Binder	Wallace	Consultant	Guest
Bolliger	Alain	HV Technologies	Member
Bolliger	Dominiques	HV Technologies	Guest
Britton	Jeffery	Phenix Technology	Guest
Brzoznowsk	Steven	BPA	Guest
Calitz	David	Siemens Energy	Guest
Carr	Deniss	GE	Guest
Costa	Florian	Corimpex	Guest
CruzValdes	Juan Carlos	Prolec GE	Guest
Davis	Eric	Consultant	Guest
Derouen	Craig	ERMCO	Guest
Diaz	Cesar	Eaton	Guest
Dolloff	Paul	EKPC	Guest
Door	Jeffrey	H-J	Guest
Doppcmair	Peter	Trench Group	Guest
Elliott	William	Prolec GE	Guest
Eshenroder	Jacob	Burns and McDonnell	Guest
Fausch	Reto	RF Solutions	Member
Fayad	Fadi	ASD	Guest
Flores	Hugo	Hitachi	Guest
Frye	Richard	Eaton	Member
Garcia	Eduardo	Siemens Energy	Guest
Gaytan	Carlos	Prolecge	Guest
Ghosh	Rob		Guest
Givaldo	Orlando	HJ Family	Guest
Hernandez	Giovannie	Virginia Transformers	Member
Himow	Monkin	Highvolt	Guest
Hochanh	Thang	PowerTech	Guest
Hopkinson	Phil	Hvolt	Member
Hussain	MD Rashid	Mississippi State University	Guest
Jarosz	Patrycja	IEEE SA	Guest
Jordan	Steve	TVA	Guest
Katz	Nathan	Pacificorp	Guest
Kennedy	Gael	GRKennedy&Associates L	Guest
King	Gary	Howard Industry	Guest
Knapp	Evan	Eaton	Guest

Last Nan	First Name	Company	Status
Lachman	Mark	Doble	Guest
Lagos	Fernando	Ge Vernova	Guest
Lambert	Jason	JST Power	Guest
Leal	Fernando	Prolec GE	Guest
Lee	Moonhee	Hammond power solutio	Guest
Mani	Balakrishnan	ITEC	Guest
McBride	Jim	JMXHV	Member
Masond	Nader	Central Maloney	Guest
Meza	Fernando	Ermco	Guest
Montanha	Juliano	Siemens Energy	Guest
Moreno	Andre	Siemens Energy	Guest
Morris	Tim	Walton EMC	Guest
Morrow	Gianetta	Crane Aerospace	Guest
Murray	David	TVA	Guest
Nissle	Boris	MGC Mozer-Glaser Inc.	Guest
ogajanov	Rudolf	Hitachi Energy	Guest
Orozco	Polo	GE Grid Solutions	Guest
Ortiz	Cuauhtemoc	Niagara Transformer Co	Guest
Owen	John	PowerTech Labs	Guest
Parrales	Herman	Prolec GE	Guest
Patel	Poorvi	EPRI	Member
Pepe	Harry	Phenix Technology	Guest
Plante	Sylvain	Hydro-Quebec	Guest
Plisic	Goran	Siemens Energy	Guest
Posadas	Daniel	CELECO	Guest
Pousset	Baptiste	Transformer Protection C	Guest
Prince	Jarrod	ERMCO	Guest
Rhett	Chrysler	ERMCO	Guest
Ronchi	Rodrigo	WEG	Guest
Sahin	Hakan	Virginia and Georgia Transformer	Member
Salinas	Fernando	Power Partners	Member
Sarkar	Amitabh	VA Transformer	Guest
Sauer	Dan	Eaton	Member
Schott	Cody	H-J Family	Guest
Schrammel	Alfons	Siemens Energy	Guest
seluargj	Pugual	VA Transformer	Guest
Sexton	Aron	Kinectrics	Guest
Shaikh	Abdul Majid	Delta Star	Guest
Shalabi	Jaber	Vantran	Guest
Sharp	Michael	Trench, LTD	Guest
Slattery	Chris	First Energy	Member
Snyder	Steve	Hitachi Energy	Guest

Last Nan	First Name	Company	Status
Som	Sanjib	PTI, LLC	Guest
Steele	Hampton	TVA	Guest
Stretch	Kerwin	Siemens Energy	Guest
Sze	Matthew	Omicron Energy	Guest
Takan	Can	MGC Mozer-Glaser Inc.	Guest
Thibolt	Mike	PG&E	Guest
Thiede	Andreas	Highvolt Dresden	Guest
Thomas	Scott	Hitachi Energy	Guest
Tillery	Tim	Howard Industry	Guest
Traut	Alan	Howard	Member
Verdell	Joshua	ERMCO	Guest
Verdolin	Rogerio	Verdolin Solutions	Guest
Waldrop	Mike	MLGW	Guest
Walker	David	MGM Transformers	Guest
Wallace	David	Mississippi State University	Member
Weisensee	Matt	Pacificorp	Guest
Wimbery	Barret	GE	Guest
Winter	Alexandar	Highvolt	Guest
Yun	Joshua	Virgina Transformer Corp	Member
Zaman	Malia	IEEE-SA	Guest
Zanwan	Anand	Siemens Energy	Guest
Zhang	Shibao	PCORE	Guest
Ziger	Igor	Kovear	Guest

WG – Transformer Impulse Test Guide PC57.98

Unapproved Meeting Minutes
Saint-Louis, October 29th, 2024, Room
Chair: Thang Hochanh
Vice Chair: Reto Fausch
Secretary: vacant

- No meeting.
- C57.98 is in process for balloting.

Liaison Report – HVTT

(J. Britton)

Standards Activity:

- IEEE 1122 – IEEE Standard for Digital Recorders for Measurements in HV Impulse Tests
  - Standard is Published (Jeff Britton)
- IEEE 510 – IEEE Guide for Electrical Safety in High-Voltage Testing
  - Draft Development Adding Clearances for Voltages 1kV-50kV (Jeff Hildreth)
- IEEE P4.1 Implementation Guide for IEEE 4
  - Draft Development – Uncertainty Estimation and K-Factor(Bill Larzelere)
- IEEE P454 – Guide for the Detection, Measurement and Interpretation of Partial Discharges
  - Draft Development (Glenn Behrmann)
- IEEE P2426 – Guide for Field Measurement of Fast-Front and Very Fast-Front Overvoltages in Electric Power System
  - Guide is Published (Shijun Xie)
- IEEE 4 – Standard for High-Voltage Testing Techniques
  - PAR for Revision Approved (Jeff Britton)

Meeting Activities:

- All PSIM meetings are hybrid
- JTCM – Annually (All PSIM Groups)
- IEEE GM – Annually (Sensors and Electricity Metering)

Upcoming Meetings:

- IEEE P454 – March 25th, 2024 (Virtual)
- HVTT Groups - IEEE P454 , IEEE 510, and IEEE 4 – November 20th - 21st , 2024, Fayetteville, GA (Hybrid)

WG to Investigate the Interaction between Substation Transients and Transformers in HV and EHV Applications and Revision of C57.142

St. Louis, Missouri, USA
Tuesday, October 29, 2024
11:00 AM – 12:15 PM
Hyatt Regency - Grand Ballroom D

Chairman – Jim McBride
Vice Chair – Xose Lopez-Fernandez
Secretary – Tom Melle

1. Welcome and Chair's Remarks
2. Circulation of Attendance Sheets. Quorum was achieved with 34 of 43 Members present. Guest attendance was 61 for a total of 95 attendees.
3. IEEE Patent Policy Slides – no patent claims
4. Approval of Agenda and Minutes from Last Meeting: Spring 2024 Minutes (motion by Akash Joshi / 2nd by Rogerio Verdolin) and Fall 2024 Agenda (motion by Phil Hopkinson / 2nd by Akash Joshi) unanimously approved.
5. C57.142 Ballot and Comment Resolution – Jim McBride
   The Chair presented the list of BRG Members. The BRG has reduced the unresolved comment list to just 15 unresolved comments and plans to address at least five per month in online meetings between now and the Spring 2025 meeting.
   Question from Phil Hopkinson: "what is the expected lifetime of MOV's internal to a transformer?"; Eduardo Garcia commented they are designed to last the lifetime of the transformer. Rogerio Verdolin commented that simulations of these arrestors in the circuit should be a key element of the designed resilience of the transformer. Bertrand Poulin commented that arrestors inside the winding are only required to absorb several hundred amperes at most and that failure of these arrestors is extremely rare. This is totally different from needing to absorb the external line energy (perhaps ~10kA / ~1MV or more).

6. Mitigation Methods Task Force Update – Jim McBride / Phil Hopkinson
   The Chair presented the list of TF Members. A tutorial in the main session is being planned for Fall 2025 (latest Spring 2026).
   Rogerio Verdolin mentioned a paper he presented on the application of surge arrestors which he provided to the WG. The Chair also presented a list of the mitigation methods being considered so far that will be part of the tutorial and possibly added as a future Annex to the Guide. The Chair provided an overview of the few remaining comments (mostly general, but a few would require extensive changes to the organization of the Guide).
   Phil Hopkinson made a comment about older circuit breaker design utilizing "insertion of resistance" or "pre-insertion resistors" having dual sets of contacts (the first step closing on a resistor and the second step shunting the resistor). Phil suggested there should be some review of these designs, as the breakers have increased voltage ratings since the original designs.
   Jesse Duffy commented that newer circuit breakers (vacuum, SF6) typically do not have pre-insertion resistors. This usage has become more specialized (as needed) rather than common. Kumar Mani commented that zero-voltage closing breakers now very common. Bertrand Poulin commented that certain utilities prefer closing at approx. 40º (phase angle), rather than zero-crossing, as this avoids the maximum potential for inrush currents. Phil Hopkinson discussed capacitance grading as an option, but suggested this was a more difficult approach. The Chair mentioned pending changes to vacuum-interrupter designs, as the industry moves away from SF6 breakers, as something to keep in mind.
   Extensive discussions regarding the challenges of high-magnitude, high-frequency transients that the Guide is intended to address ensued. It was noted there are few (if any) factory tests that can simulate these occurrences. It was also mentioned that multi-contact vacuum interrupters rated 145 kV are increasingly common with 230 kV usage growing as well.
7. New Business – no new business
8. Next Meeting (Denver, CO March 23rd – 27th, 2025)
9. Adjournment at 12:05 PM

Meeting Attendance:

Role	Last Name	First Name	Company
Chair	McBride	James	JMX High Voltage
Vice	Lopez-Fernandez	Xose	Universidade de Vigo
Secretary	Melle	Thomas	HIGHVOLT
Member	Betancourt	Enrique	Prolec GE
Member	Boettger	William	Boettger Transformer Consulting LLC
Member	Espindola	Marco	Hitachi Energy
Member	Frazier	Raymond	Ameren
Member	Garcia	Miguel	Hitachi Energy
Member	Garcia Wild	Eduardo	Siemens Energy
Member	Heiden	Kyle	EATON Corporation
Member	Hernandez	JC	Georgia Tech - NEETRAC
Member	Hoffman	Saramma	PPL Electric Utilities
Member	Hopkinson	Philip	HVOLT Inc.
Member	Hossain	Saif	Trench Limited
Member	John	John	Virginia Transformer Corp.
Member	Joshi	Akash	Kimley-Horn
Member	Lee	Moonhee	Hammond Power Solutions
Member	Li	Weijun	Braintree Electric Light Dept.
Member	Pepe	Harry	Phenix Technologies, Inc.
Member	Plisic	Goran	Siemens Energy
Member	Pointner	Klaus	Trench Austria GmbH
Member	Poulin	Bertrand	Hitachi Energy
Member	Ronchi	Rodrigo	WEG-Voltran
Member	Roussell	Marnie	Entergy
Member	Sarkar	Amitabh	Virginia Transformer Corp.
Member	Sen	Cihangir	Duke Energy
Member	Sharp	Michael	Trench Limited
Member	Shertukde	Hemchandra	University of Hartford
Member	Varghese	Ajith	Prolec-GE-Waukesha
Member	Verdolin	Rogerio	Verdolin Solutions Inc.
Member	Vir	Dharam	Prolec-GE Waukesha
Member	Yun	Joshua	Virginia Transformer Corp.
Member	Zhang	Shibao	PCORE Electric
Member	Ziomek	Waldemar	PTI Transformers
Guest	Avelino	Pavel	Hitachi Energy Brazil
Guest	Beaster	Barry	H-J Family of Companies
Guest	Bohrn	Josh	Pacificorp
Guest	Botti	Michael	Hyosung HICO
Guest	Calil	Wilerson	Hitachi Energy

Guest	Calitz	David	Siemens Energy
Guest	Carrizales	Juan Alfredo	Prolec GE
Guest	Casallas	Camilo	Trench LTD
Guest	Choksi	Bhaumik	Hitachi Energy
Guest	Czernorucki	Marcos	Hitachi Energy
Guest	de Oliveira	Luiz	Hitachi Energy
Guest	Dolloff	Paul	East Kentucky Power
Guest	Duffy	Jesse	Nashville Electric Service
Guest	Dugan	Roger	RE Dugan
Guest	Elson	Eric	SDGE
Guest	Finn	Mark	Hitachi Energy
Guest	Garcia	David	Virginia Transformer Corp.
Guest	Gardner	James	Prolec-GE-Waukesha
Guest	Harley	John	FirstPower Group LLC
Guest	Hernandez	Giovanni	Virginia Transfomrer Corp.
Guest	Hrkac	Miljenko	Hitachi Energy
Guest	Iman	Mohammad	MGM Transformer Company
Guest	Jaroszewski	Marion	Delta Star Inc.
Guest	Johnson	Christopher	Oncor
Guest	Khan	Qasim	Georgia Tech - NEETRAC
Guest	Kim	Yeounsoo	MEPPI
Guest	Kosedagi	Nihat	Hitachi Energy
Guest	Kumar	Arvind	Delta Star Inc.
Guest	Leal	Fernando	Prolec GE
Guest	Lee	Junho	HD Hyundai Electric
Guest	Leigl	Angela	EATON Corporation
Guest	Mani	Kumar	Duke Energy
Guest	Mantoan	Francis	Siemens Energy
Guest	Mbouomboyo	Mama	Hitachi Energy
Guest	Nissle	Boris	Moser-Glaser
Guest	Ortiz	Cuauhtemoc	Niagara Transformer
Guest	Pandza	Tihomir	Siemens Energy
Guest	Panetta	Sergio	I-GARD Corp
Guest	Parkinson	Dwight	EATON Corporation
Guest	Ploetner	Christoph	Siemens Energy
Guest	Prado	Gustavo	Siemens Energy
Guest	Radbrandt	Ulf	Hitachi Energy
Guest	Raymond	Tim	Inductive Reasoning
Guest	Rossini	Yuri	Siemens Energy
Guest	Sahin	Hakan	Virginia Transformer Corp.
Guest	Schleismann	Eric	Southern Company Services
Guest	Sharifi	Masoud	Siemens Gamesa Renewable Energy

Guest	Steele	Hampton	Tennessee Valley Authority
Guest	Steineman	Andrew	Delta Star Inc.
Guest	Tolcachir	Eduardo	TTE
Guest	Trujillo	Pedro	Hyundai Power Transformers USA
Guest	Velasqez	Juan	Magnetron
Guest	Vijayan	Krishnamurthy	Pennsylvania Transformer
Guest	Wagner	Jolin	American Electric Power
Guest	Wang	Luke	BC Hydro
Guest	Washburn	Alan	Burns & McDonnell
Guest	Watson	Joshua	Nebraska Public Power District
Guest	Wong	Terry	Trench LTD
Guest	Yang	Fei	Hitachi Energy
Guest	Yuan	Guang	Hitachi Energy
Guest	Zhang	Hongzhi	Hitachi Energy

List of Attendees to the DTSC meeting of October 30, 2024

Role	First Name	Last Name	Company
Member	Kayland	Adams	Prolec-GE Waukesha
Member	Tauhid Haque	Ansari	Hitachi Energy
Member	Donald	Ayers	Ayers Transformer Consulting
Member	Christopher	Baumgartner	We Energies
Guest	Jason	Beaudoin	Weidmann
Guest	Orlando	Benitez	Hyosung HICO
Guest	Edwin	Betancourt	Siemens Energy
Guest	Enrique	Betancourt	Prolec ge
Guest	Naveen	Bhardwaj	Trench Group
Guest	Wallace	Binder	WBBinder Consultant
Member	Daniel	Blaydon	Baltimore Gas and Electric
Member	William	Boettger	Boettger Transformer Consulting LLC
Guest	Joshua	Bohrn	PacifiCorp
Guest	Sanket	Bolar	Oncor Electric Delivery
Guest	Michael	Botti	Hyosung HICO
Guest	Garrett	Bradshaw	Howard Industries
Guest	Samuel	Brodeur	Hitachi Energy
Guest	Steven	Brzoznowski	Bonneville Power Administration
Guest	Wilerson	Calil	Hitachi Energy
Member	David	Calitz	Siemens Energy
Member	Juan Alfredo	Carrizales	Prolec GE
Member	Juan	Castellanos	Prolec GE
Guest	Vivian	Chan	Hitachi energy
Guest	J. Arturo	Del Rio	HSP US LLC

Guest	Bhaumik	Choksi	Hitachi energy
Guest	Adriana	Cisco	Salt River Project
Member	Craig	Colopy	Retired from EATON
Guest	Janet	Crockett	Fayettville PWC
Member	Juan Carlos	Cruz Valdes	Prolec GE
Guest	Marcos	Czernoruck	
Member	Roberto	Da Silva	Maschinenfabrik Reinhausen
Guest	Caleb	Colby	
Member	Eric	Davis	Consultant
Guest	Pouneh	Davoudi	Delta Star Inc.
Guest	Tim	Dappen	Cargill
Member	Sami	Debass	Electric Power Research Institute (EPRI)
Member	Gabriel	Delgado	Invenergy
Guest	Scott	Digby	Duke Energy
Guest	Nikolaus	Dillon	Dominion Energy
Guest	Paul	Dolloff	East Kentucky Power
Guest	Jeffrey	Door	The H-J Family of Companies
Guest	Fernando	Daurte	
Guest	Luiz	de Oliveira	Hitachi Energy
Guest	Eric	Doak	
Member	Evgenii	Ermakov	Hitachi Energy
Member	Reto	Fausch	RHF Solutions
Guest	Peter	Dopplmair	Trench Group
Member	Raymond	Frazier	Ameren
Member	Richard	Frye	EATON Corporation
Member	Eduardo	Garcia Wild	Siemens Energy
Member	Alireza	Gorzin	Black & Veatch
Member	Detlev	Gross	Power Diagnostix Consult GmbH
Guest	Kenneth	Dugger	Voltyx/NASS
Guest	Attila	Gyore	MIDEL and MIVOLT Fluids Ltd
Guest	Jack	Harley	
Member	Roger	Hayes	GE Vernova
Guest	Kyle	Heiden	EATON Corporation
Guest	Eric	Elson	San Diego Gas & Electric
Member	Ronald	Hernandez	Doble Engineering Co.
Member	Sergio	Hernandez Cano	Hammond Power Solutions
Guest	Mark	Foata	
Vice-Chair	Thang	Hochanh	Bc Hydro
Member	Saramma	Hoffman	PPL Electric Utilities
Guest	Ryan	Hogg	Bureau of Reclamation
Guest	Derek	Hollrah	Burns & McDonnell
Member	Philip	Hopkinson	HVOLT Inc.
Guest	Saif	Hossain	Trench Group
Guest	Miljenko	Hrkac	
Guest	Patrycja	Jarosz	IEEE SA
Guest	Marion	Jaroszelski	Delta Star Inc

Guest	Nicholas	Jensen	Delta Star Inc.
Member	John	John	Virginia Transformer Corp.
Guest	Christopher	Johnson	Oncor
Member	Akash	Joshi	Kinley-horn
Guest	JOSEPH	Foldi	Foldi & Associate
Member	Kurt	Kaineder	Trench
Member	Jerzy	Kazmierczak	Hitachi Energy
Member	Sheldon	Kennedy	Sheldon P Kennedy Engineering PLLC
Guest	Brad	Graves	
Guest	Yeoundoo	Kim	MEPPI
Guest	Ismail	Guner	Hydro-Quebec
Guest	Miljenko	Hekac	Hitachi Energy
Guest	Zan	Kiparizoski	Howard Industries
Member	Egon	Kirchenmayer	Siemens Energy
Member	Evan	Knapp	EATON Corporation
Guest	William	Herron	Reinhausen
Guest	Anton	Koshel	Delta Star Inc.
Guest	Rafal	Kowalski	
Guest	Kevin	Juchem	Hitachi Energy
Guest	Mick	Kasonga	
Guest	Fernando	Lagos	GE Vernova
Guest	Andrew	Larison	Hitachi Energy
Member	David	Larochelle	NDB Technologies
Member	Fernando	Leal	Prolec GE
Member	Moonhee	Lee	Hammond Power Solutions
Guest	Junho	Lee	HD Hyundai Electric
Guest	Dugger	Kenneth	
Member	Weijun	Li	Braintree Electric Light Dept.
Guest	Qasim	Khan	NEETRAC -Georgia Tech
Guest	Seungmo	Kim	Hyosung HICO
Guest	Luc	Loiselle	Tetra tech
Member	Xose	Lopez-Fernandez	Universidade de Vigo
Guest	José Luis	Machain	Prolec GE
Guest	Jinesh	Malde	MIDEL & MIVOLT FLUIDS INC.
Guest	Gabriel	Mamede	Siemens Energy
Guest	Yonghui	Kim	ILJIN ELECTRIC
Guest	Moses	Manzano	Hyosung HICO
Guest	Swapnil	Marathe	Megger
Guest	Nihat	Kosedagi	Hitachi Energy
Member	Brian	McBride	Cargill, Inc.
Member	James	McBride	JMX High Voltage
Member	Thomas	Melle	HIGHVOLT
Guest	Omar	Mendez	
Member	Francis	Mills	POWER Engineers
Member	Emilio	Morales-Cruz	Qualitrol Company LLC
Guest	Arvind	Kumar	Delta Star Inc
Guest	Marta	Muñoz	Hitachi Energy
Guest	Andreas	Kurz	

Member	David	Murray	Tennessee Valley Authority
Guest	Ryan	Musgrove	Oklahoma Gas & Electric
Guest	Mark	Newbill	Hitachi
Guest	Ashwini	Labh	Hitachi Energy
Guest	Jihun	Lee	HD hyundai electric
Guest	Anastasia	O'Malley	Consolidated Edison Co. of NY
Member	Parminder	Panesar	Virginia Transformer Corp.
Member	Dwight	Parkinson	EATON Corporation
Chair	Poorvi	Patel	Electric Power Research Institute (EPRI)
Guest	**Rakesh**	**Patel**	**Hitachi Energy**
Guest	Dongki	Lim	Iljin electric
Guest	Verena	Pellon	
Member	Harry	Pepe	Phenix Technologies, Inc.
Member	Sylvain	Plante	Hydro-Quebec
Member	Klaus	Pointner	Trench Austria GmbH
Member	Bertrand	Poulin	Hitachi Energy
Guest	Rafael	Llamuza	Hitachi Energy
Member	Ion	Radu	Hitachi Energy
Member	Timothy	Raymond	Inductive Reasoning
Member	Scott	Reed	MVA
Guest	Michael	Richardson	Ameren
Secretary	Diego	Robalino	Megger
Member	Rodrigo	Ronchi	WEG Transformers México
Guest	Kumar	Mani	Duke Energy
Member	Mickel	Saad	Hitachi Energy
Member	Hakan	Sahin	Virginia Transformer Corp
Member	Amitabh	Sarkar	Virginia Transformer Corp.
Member	Daniel	Sauer	EATON Corporation
Member	Markus	Schiessl	SGB
Guest	Eric	Schleismann	Southern Company Services
Member	Ewald	Schweiger	Siemens Energy
Member	Cihangir	Sen	Duke Energy
Guest	Nader	Masoud	Central Moloney
Member	Abdulmajid	Shaikh	Delta Star Inc
Member	Hemchandra	Shertukde	University of Hartford
Guest	Mohammed	Megdad	
Guest	Stephen	Shull	BBC Electrical Services, Inc.
Member	Jonathan	Sinclair	Black and Veatch
Member	Christopher	Slattery	FirstEnergy Corp.
Member	Steven	Snyder	Hitachi Energy
Guest	Nader	Mfysous	
Member	Sanjib	Som	Pennsylvania Transformer
Member	Brad	Staley	Salt River Project
Member	Kyle	Stechschulte	American Electric Power
Guest	Hampton	Steele	Tennessee Valley Authority
Member	Andrew	Steineman	Delta Star Inc.
Member	Charles	Sweetser	OMICRON electronics Corp USA

Member	Matthew	Sze	Omicron Electronics
Guest	Jonathan	Tan	Northern Transformer
Member	Troy	Tanaka	Burns & McDonnell
Guest	Marc	Taylor	JFE Shoji Power Canada Inc.
Guest	Shivkumar	Morkhande	Siemens Energy
Guest	Andreas	Thiede	
Guest	Scott	Thomas	Hitachi
Guest	Mark	Tostrud	Dynamic Ratings, Inc.
Guest	Cole	Van Dreel	American Transmission Co.
Guest	Fredy	Murcia	Siemens Energy
Member	Ajith	Varghese	Prolec GE Waukesha
Member	Jason	Varnell	Doble Engineering Co.
Member	Rogerio	Verdolin	Verdolin Solutions Inc.
Guest	Krishnamurthy	Vijayan	Pennsylvania Transformer
Member	Dharam	Vir	Prolec GE Waukesha
Member	Pragnesh	Vyas	Sunbelt-Solomon Solutions
Guest	John	Wagner	American electric power
Member	David	Wallace	Mississippi State University
Member	David	Wallach	Duke Energy
Guest	Nam Tran	Nguyen	TT Electronics
Guest	Alan	Washburn	Burns & McDonnell
Guest	Joshua	Watson	NPPD
Member	Bruce	Webb	Knoxville Utilities Board
Member	Matthew	Weisensee	PacifiCorp
Member	Drew	Welton	Intellirent
Member	Peter	Werelius	Megger
Member	Daniel	Weyer	Monolith
Guest	Joe	White	
Member	Barrett	Wimberly	GE Vernova
Guest	Terry	Wong	Trench Limited
Guest	Jeffrey	Wright	Duquesne Light Co.
Guest	Fei	Yang	
Guest	Michael	Nolte	Kiewit
Guest	Joshua	Yun	Virginia Transformer Corp.
Guest	Jesus	Nunez	
Guest	Shibao	Zhang	PCORE
Guest	Sanjay	Patel	SGB-Smit USA
Member	Kris	Zibert	Allgeier, Martin and Associates
Member	Waldemar	Ziomek	PTI Transformers
Guest	Gustavo	Prado	Siemens Energy
Guest	Marnie	Roussell	Entergy
Guest	Aron	Sexton	Kinectrics
Guest	Leena	Shimpi	Mgm Transformers co.
Guest	Jason	Snyder	FirstEnergy
Guest	Samuel	Tekle	WEG Transformers USA
Guest	Alwyn	Vanderwalt	Electrical Consultants Inc
Guest	Luke	Wang	BC hydro
Guest	Koray	Yavuz	Noark Electric US

Guest	Jie	Zhang	CHINT ELECTRIC CO.,LTD.
Guest	Hongzhi	Zhang	Hitachi Energy
Guest	Zhu	ZHIXIANG	Chint

SC Chair requested a motion to adjourn the meeting.

Sanjib Som made a motion, Dan Sauer second.

Meeting Adjourned at 12:15 PM.