Annex J Performance Characteristics Subcommittee (PCS)

March 26th, 2027, Hyatt Regency, Denver, CO

UNAPPROVED MINUTES

Chair: Sanjib Som
Vice Chair: Kris Zibert
Secretary: John Wagner

J.1 Introduction / Attendance

Quorum was achieved with 76 members present. In addition, 117 guests were present at the meeting. The total attendance at the meeting was 193. Guests should contact the Vice Chair to request membership. Their requests for membership and past attendance will be reviewed. If they meet the membership requirements, they will be granted membership before the next meeting in Bonita Springs, Florida October 19-23 2025.

J.2 Chairman's Remarks

The Chair gave the Chairman's Remarks.

The Chair introduced himself, the Vice Chair and secretary and provided the below updates and comments.

The Chair discussed that the meeting would be recorded for minutes purposes and then deleted.

The Chair asked anyone with new business to submit said business in writing prior to the meeting.

The Chair gave a reminder regarding affiliation data as a requirement and to continue updating attendance manually.

PCS Responsibilities: Defined by the Transformers Committee Organization and Procedures Manual.

The Performance Characteristics Subcommittee shall be responsible for the following:

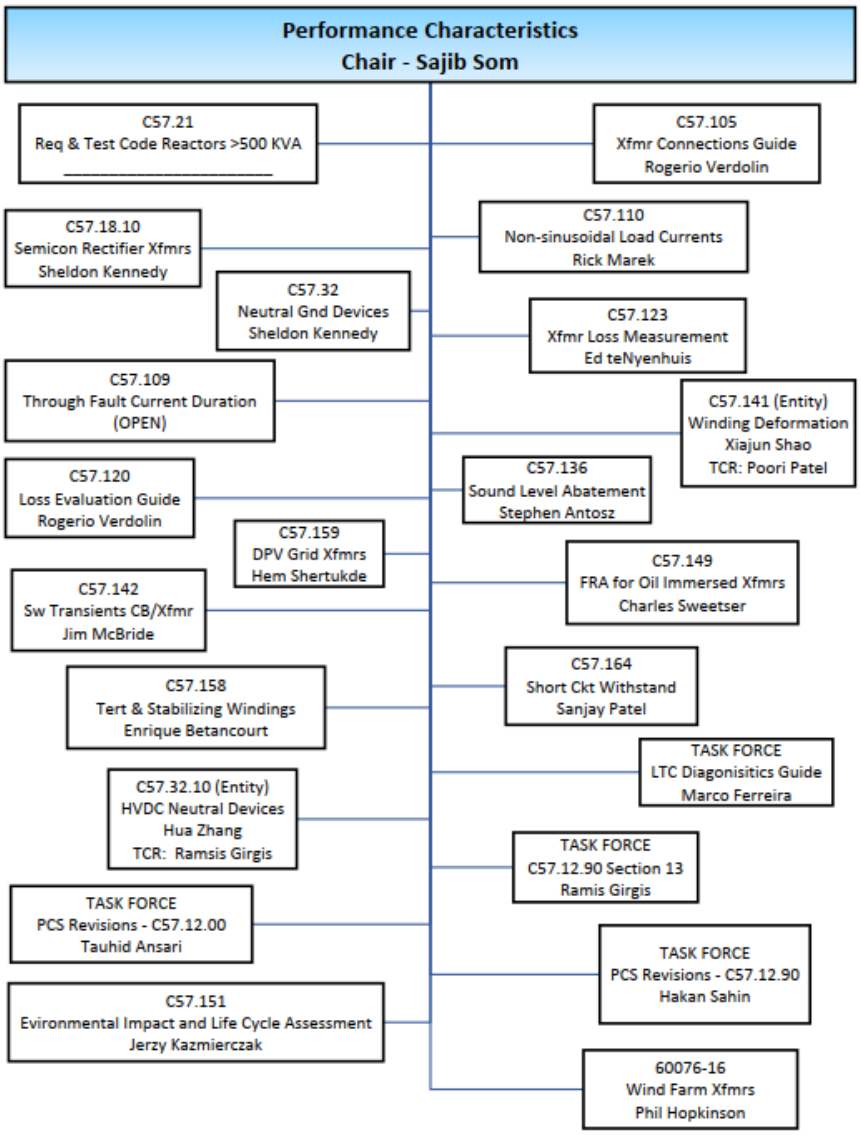
- Studying and reviewing the treatment of loss, impedance, exciting current, inrush current audible sound and vibration, and other performance characteristics and their methods of application, measurement, or test for liquid filled transformers and liquid filled and dry type reactors.

- Studying and reviewing the treatment of the performance characteristics of other special use transformers e.g. photovoltaic, wind, and rectifier transformers.

- Developing and maintaining related standards, recommended practices, and guides for such criteria

- Coordinating with other technical committees, groups, societies, and associations as required

Standards Supported by PCS:



- C57.12.00 – TF to provide PCS revisions – T. Ansari
- C57.12.90 – TF to provide PCS revisions – H. Sahin (test code) & R. Girgis (audible sound)
- C57.18.10 – Semiconductor rectifier transformers – S. Kennedy

- C57.21 – Requirements & Test Code For Shunt Reactors >500kVA – S. Som
- C57.32-2015 – Neutral Grounding Devices (2025) – S. Kennedy
- C57.32.10 – Entity WG Neutral Grounding Reactors Guide for HVDC Converter Transformers – H. Zhang (TCR: R. Girgis)
- C57.105 – Transformer connections guide – R. Verdolin
- C57.109 – Through Fault Current Duration – OPEN
- C57.110 – Xfrmr Capability when Supplying Nonsinusoidal Load Currents – R. Marek
- C57.120 – Guide for loss evaluation – R. Verdolin
- C57.123 – Transformer Loss Measurement – E. teNyenhuis
- C57.136 – Sound Abatement Guide – S. Antosz
- C57.141 - Entity - Winding Deformation – X. Shao (TCR: P. Patel)
- C57.142 – Switching Transients Circuit breaker/Transformer – J. McBride
- C57.149 – FRA for Oil Immersed Transformers – C. Sweetser
- C57.158 – Tertiary & Stabilizing Windings (2027) – E. Betancourt
- C57.159 – DPV Transformers (2026) – H. Shertukde
- C57.164 – Short Circuit Withstand – S. Patel
- TF for Insulating Fluid for Factory Testing – E. teNyenhuis
- TF for LTC Diagnostics Guide – M. Ferreira
- 60076-16 – Wind Turbine Generator Transformers – P. Hopkinson
- C57.151 Eval Guide Environmental Impact of Transformers & Reactors – J. Kazmierczak

Status of Active PAR's:

- **2025 PAR's**
  - **C57.142 Transient Guide (Comment Resolution)**
  - **C57.141 Entity WG Guide for Detection, Monitoring and Evaluation of Winding Deformation**
- **2027 PAR's**
  - **C57.32 Neutral Grounding Devices**
  - **C57.158 Application of Tertiary and Stabilizing Wdgs Guide**
- **2028 PAR's**
  - **C57.159 DPV Transformers Guide**
  - **C57.151 Enviro & Life Cycle Assessment (New WG)**

Status of Standards without active PARs

- **C57.120-2017 – Loss Evaluation Guide (2027)**

- **60076-16-2018 – Wind Turbine Generator Transformers (2028)**
- **C57.109-2018 – Through Fault Current Duration (2028)**
- **C57.110-2018 – Transf. Capability when Supplying Nonsinusoidal Loads (2028)**
- **C57.105-2019 – Transformer connections guide (2029)**
- **C57.123-2019 – Loss Measurement Guide (2029)**
- **C57.164-2021 – Short Circuit Withstand Guide (2031)**
- **C57.21-2021 – Shunt Reactors over 500kVA (2031)**
- **C57.18.10-2021 – Semiconductor Rectifier Transformers (2031)**
- **C57.136-2023 – Sound Level Abatement Guide (2033)**
- **C57.149 – FRA Guide (2034)**

Performance Characteristics Subcommittee Membership Requirements

- Voting membership may be requested and granted after attending three of the last five meetings.
- If a voting member misses more than two consecutive meetings, his or her voting privileges may be revoked. Notification will be sent if voting privileges are revoked.
- Refer to TC P&P 4.3.1 for more information.

Performance Characteristics Subcommittee WG / TF Leaders

- Issue agenda at least 30 days ahead of time
- Minutes are due in 15 days; please get a rough draft of them to us today in MS Word (not PDF) format
- Please keep your webpages up to date – review regularly and send any content/files to tc-webmaster@ieee.org.
- A patent and copyright call must occur at every WG/TF meeting
- Please send to Patrycja Jarosz (p.jarosz@ieee.org) your WG roster by April 10th, 2025, including last name, first name, email address, and voting status.

Performance Characteristics Subcommittee Meeting Minutes

- Name of the group, time, date, and location of meeting
- Officers' names, meeting participants, member status, and affiliations
- Chair's remarks and reminders of IEEE policies (Patent and Copyright)
- Approval of minutes of previous meeting and agenda
- Technical topics: Brief summary (discussions and conclusions, motions exactly as they are stated, including the names of proposer and seconder, and the outcome of each motion)
- Action items, items reported out of executive session
- Recesses and time of final adjournment
- Next meeting—date, time, and location

WG / TF Balloting Reminder

- Working Groups must achieve a 2/3 majority to submit a document for Sponsor Ballot.
- The Subcommittee must achieve a simple majority to submit a document for Sponsor Ballot.

Attendance / Membership – moved to Guest status

The following member missed more than 2 consecutive meetings and have been moved to "Guest" status:

Barry Beaster

Please contact Kris by sending him a message or see him after the meeting if you believe your membership status is not accurate and/or you would like to become a member.

Attendance / Membership – New Members

The following Guests requested membership at the Fall 2024 meeting and have attended 3 of the past 5 meetings:

Christopher Johnson	Akash Joshi
Hugo Murillo	Jason Snyder
Krishnamurthy Vijayan	

Attendance / Membership – Quorum determination

- Current breakdown of the Subcommittee:
  - 108 Members
  - 55 are needed for a quorum
- Quorum was established with 76 members in attendance.

J.3 Approval of Agenda

The Chair presented the agenda and entertained a motion to approve. The agenda had been sent to the members by email several weeks prior to the meeting. The motion was made by J. McBride and seconded by R. Ghosh. The motion passed by unanimous consent.

J.4 Approval of Last Meeting Minutes

The Chair presented the minutes of meeting held in October 2024 and entertained a motion to approve. The minutes had been sent to the members by email several weeks prior to the meeting. The motion was made by D. Sauer and seconded by A. Sarkar . The motion passed by unanimous consent.

J.5 Minutes from Working Groups and Task Force

The following WG and Task Force reports were received (the reports are appended later).

- **WG Eval Guide Environ Impact of Trans & Reactors PC57.151 J. Kazmierczak**
- **TF Audible Sound Rev to Test Code R. Girgis**
- **TF Transformer Data Required for System Studies J. Watson**
- **TF Continuous Revisions to C57.12.00 T.Ansari**
- **WG Standard for DPVTs C57.159 H. Shertukde**
- **TF Continuous Revisions to Test Code C57.12.90 H. Sahin**
- **WG Sw Transients Ind by Xfmr/Bkr Interaction PC57.142 J. McBride**
- **WG C57.158 App. Guide for Tertiary and Stabilizing Windings E. Betancourt**
- **WG IEEE Neutral Grounding Devices PC57.32 S. Kennedy**
- **WG PC57.32.10 Entity HVDC Neutral Grounding Device Guide Z. Hua**
- **WG PC57.141 Entity Winding Deformation Guide X. Shao**

Below are highlights that were discussed at the PCS meeting:

1) WG Eval Guide Environ Impact of Trans & Reactors PC57.151 J. Kazmierczak

- **Quorum was taken. There were 78 attendees total with 36 being members. 37 members were needed to achieve quorum. Therefore, quorum was not achieved**
- **The Agenda was presented, but couldn't be approved due to lack of quorum.**
- **Approval of MoM's from St. Louis could not be approved due to lack of quorum.**
- **M. Nolte with Kewitt presented section 3 outline, as this is the initial section that will drive the rest of the guide**
- **J. Sen, Duke Energy, asked about low loss design aspects, suggested just listing losses.**
- **L. Chem, Hittachi Energy, suggested having additional focus of operation (loading) & maintenance. Also would consider the strategy to have spares, etc.**
- **V. Valori, Hittachi Energy, suggested to show/compare both concepts of cradle to gate vs. cradle to grave**
- **S. Kabir, Hitachi Energy, asked if we will include alternative liquids as well.**
- **Hitachi Energy if we consider in the LCA the loading profile**
- **V. Valori, Hitachi Energy, why is noise level included in the LCA?**
- **C. Ploetner, Siemens Energy, the guide must be equally applicable for everyone**
- **J. Sen, Duke Energy, how will this agenda be allocated to work on?**
- **J. Tan, Northern Tx, the design aspects included are interesting & relevant. We neeed to make sure we can also look at heat & noise emissions, as the guide's title does reference environmental impacts as well as LCA.**
- **P. Wench, Schneider Electric, happy to be included in scoping piece.**
- **L. Kovacic, Koncar, regarding the losses & noise level it is not the LCA basis to look at heat or noise emissions, but to look at it from CO2 emissions.**

- **H. Zhang, Hitachi Energy, need to also mention the heating/cooling of the tx. (temp rise).**
- **F. Mills, other aspects should be included in the design aspects (thermal capability, dielectric capability, losses, noise, etc.)**
- **E. Kricic, Hitachi Energy, will it be related only to Tx. & Reactor or will this be extended to other aspects, such as substations (i.e. alternative liquids allow for smaller substation footprint). Also, use sensitivity calculation for loading, evaluate the effect at different loading points**
- **P. Patel, EPRI, the detailed discussions should be had in the task forces.**
- **J. Sen, Duke Energy, use design optimization as a title, with the sections listed as losses, noise, etc. instead of using low.**
- **J. Tan, Northern Tx., also volunteered to work on section 3.**
- **J. Sen, Duke Energy, motioned to dismiss & M. Schiessl (SGB) seconded.**

2) TF Audible Sound Code Revision R. Girgis

- **The TF met at 1:45 PM, on Monday, March 24, 2024. The meeting was attended by 32 members and 89 Total.**
- **Main item TF is working on is how to specify the Sound level of PAs to limit impact of PA noise on noise of the main transformer**
- **S. Digby presented experience that Duke Energy have had with noisy PAs and how these incidents required un-tanking of Power transformers and replacing the PAs.**
- **After some discussions, the proposed text will be shared with attendees of the TF meeting and comments will be reviewed and presented at the Fall meeting of the TF**

3) TF Transformer Data Required for System Studies J. Watson

- **The TF met for at 9:30AM on Monday, 3/24/25 with 47 attendees, including 9 of our 17 members for a quorum. The Agenda and previous minutes were approved.**
- **There were two presentations on transformer data required for system studies programs. These will be posted on the TX Committee Website on the PCSC page.**
- **Dr. Rohitha Jayasinghe and Dr. D. Muthumuni from Manitoba Hydro's Power Systems Technology Centre presented remotely and Y. Liang from RTDS Technologies presented in person. Both presentations discussed the different types of studies and the transformer data required for the transformer models in those programs on a remote.**
- **The TF plans to have a remote meeting in 4-6 weeks to start work on its report.**

4) TF Continuous Revisions to C57.12.00 T. Ansari

- **Discussion on adding an informational note in section 7.1.2 for Table 11, "The kVA values for single-phase and three-phase in the table intentionally do not adhere to a 1-to-3 ratio for all values. Notably, for values near 500 kVA, the table presents 500 or 501 kVA for both single-phase and three-phase. This is historically due to an old distribution transformer kVA limit."**

- **Motion of adding for table 11 is informational note. by T. Ansari, seconded by D. Sauer. The motion passed with unanimous approval.**
- **Discussion on modifying the notes in table 17 for the load loss on Min and Max tap of distribution transformer to add the statement " For Class II power transformers"**
- **Motion 2 by T. Ansari, seconded by D. Sauer. The motion passed with unanimous approval**

5) WG Standard for DPV Transformers C57.159 H. Shertukde

- **P. Hopkinson presented a NEMA document on transformers connected to inverters and the effects on the transformer design to achieve reliable operation. The presentation and discussion used most of the meeting. The main points are a) for a Wye secondary avoid grounding the neutral, if possible, to avoid ground loops, b) if the neutral is grounded it is advised to install a shield between the core and LV winding to prevent core partial discharge and gassing. There are some configurations (Delta LV, some core types) where these precautions might not be necessary.**
- **Discussion if batteries connected to inverters and other new applications of inverters and new inverter types should be included in the Scope. Chair said that the PAR change this would require would take too much time. These other applications could be included in an informative annex.**

6) TF on PCS Continuous Revisions to Test Code C57.12.90 H. Sahin

- **Meeting started on time. 117 individuals attended the meeting. 42/59 members were present, quorum was achieved.**
- **The TF continued to work on clause 5.1, "Determination of cold temperature, under Clause 5: Resistance measurements" to improve the clause to define a better method/process and understanding rather than the current statement, which is " The cold temperature of the winding shall be determined as accurately as possible when measuring the cold Resistance". TF agreed to form a small group of experienced members to work on this off-line and come to the next meeting with the proposal. The group was formed.**
- **TF reviewed the new business request to re-look at the location of clause 10.5.1 within the standard. TF agreed that this belongs under the Di-electrics SC and the new business is handed over to the TF Cont. Revision to low frequency tests C57.12.90 – DiTests**
- **TF reviewed another possible new business which is related to the % current applied during load loss and impedance tests. Chair agreed to consider this as new business and will be discussed during the next meeting.**

6) WG Switching Transients Ind by Xfmr/Bkr Interaction PC57.142 J. McBride

- **Circulation of Attendance Sheets 35 of 44 Members were present, quorum was achieved.**
- **Approval of Agenda and Minutes from Fall 2024 Meeting**
- **C57.142 Ballot status and Comment Resolution**
- **Total Comments 306 (Editorial Required 107; Editorial Not Required 109**

- **Technical Required 67; Technical Not Required 22)**
- **Addressed Comments: 306; All Comments Addressed**
- **Draft 13 has been completed and incorporates all the 306 addressed comments.**
- **Recirculation will begin as soon as CRG approves. The CRG has members from both the Transformers and Switchgear Committees.**
- **Mitigation Methods Task Force Update The task force will be presenting a tutorial on mitigation methods at the Fall meeting**

7) WG Guide for Application of Tertiary & Stabilizing Windings C57.158 E. Betancourt

- **The TF achieved a quorum 11 Guests requested membership.**
- **TF1 "Editorial and technical corrections and enhancements to existing document" completed its work. Most changes already included in Draft 1A, already circulated among membership.**
- **TF2 "Further recommendations for transformers without a delta winding" also finished discussions, preparing final text to be included in Draft 2 of the Guide.**
- **TF3 "Enhanced topics: Loading of Multiwinding Trs. and Other", finished work and will send text for incorporation in Draft 2.**
- **TF4 "New special topics" with work still in progress.**
- **Motion 1, unanimously Approved: "The Chair will circulate Draft 2 of the Guide for a 'straw ballot' before the next, F'25 meeting of the Group".**
- **If comments could be resolved by the F'25 meeting, the document would be ready for MEC review early 2026.**

8) WG IEEE Neutral Grounding Devices PC57.32 S. Kennedy

- **Approval of Agenda and Approval of Minutes from previous Meeting**
- **Clause 4 completed all main body section draft work and SPAR Annex is complete.**
- **David Caverly presented the SPAR annex.**
- **Camilo will send a slightly revised document after the meeting.**
- **Clause 5 - Neutral Ground Fault Neutralizers, completed all main body work, "Failed Phase Grounding" Annex and "Residual Current Compensator" Annex is complete.**
- **Clause 6 - Neutral Grounding Transformers. all work is complete.**
- **Clause 7 - Neutral Grounding Resistors. All work is complete.**
- **Clause 8 - Combination Devices. Still need a method for calculating impedance of single phase transformers and/or zigzags. Sergio will add this to the main body draft and send shortly to the Chair.**
- **Working Group Survey will go out as soon as these couple items are finished**
- **An overall draft will be prepared and sent out to the working group before the next meeting for survey.**

9) WG Entity HVDC Neutral Grounding Devices PC57.32.10 Z. Hua

- **Approved by SA**

10) WG Entity Winding Deformation Guide PC57.141 X. Shao (P. Patel)

- **The Draft 7.0 of IEEE PC57.141 - Guide for Detection, Monitoring, and Evaluation of Winding Deformation in Liquid-Immersed Power Transformers, has been completed and the WG has reached a consensus on moving forward to the SA ballot**
- **P. Patel makes motion to take C57.141 - Guide for Detection, Monitoring, and Evaluation of Winding Deformation in Liquid-Immersed Power Transformers to initiate balloting. D. Sauer seconds. The motion passed with unanimous approval**

11) PAR Study Group C57.120 R. Verdolin (K.Ziebert)

- **Approved title, scope and purpose as well as a motion to move forward with a PAR for revision of the document**
- **K. Zibert made motion for PAR revision for C57.120. D. Sauers seconded. The motion passed with unanimous approval.**

J.6 Unfinished (Old) Business

There was no unfinished business.

J.7 New Business

- EPM **– P0161**
  - **Project Title: Recommended Practice for Testing the Impact of Harmonic Distortion on the Transformers of a nominal voltage of 10kV and less**
  - **Scope of the proposed standard: The scope of this guide is testing related to the impact of harmonic distortion on transformers with respect to energy consumption. It includes how to specify the testing procedures, how to standardize type tests, describes parameters and layout of testing equipment, clarifies how to conduct testing effectively, recommends testing processes, how to report test results, and specifies what content conclusions should be included in the testing report.**

S. Kennedy makes motion for committee to accept oversight on this proposal. Seconded by D. Sauer. The motion passed with unanimous approval

- **P. Hopkinson proposed creation of a task force for IEC/IEEE 60076-16 to open up a PAR. S. Debass was assigned chair for this TF to prepare the PAR.**
- **S. Som created task forces for C57.109 (Chair S. Hoffman) and C57.110 (Chair A. Narawane) to prepare the PAR.**

J.8 Adjournment

- **The meeting was adjourned at 4:04 PM**

J.9 Minutes of Meetings of Working Group (WG) and Task Force (TF) Reports (all unapproved)

J.9.1 WG Eval Guide Environ Impact of Trans & Reactors PC57.151 J. Kazmierczak

Technical Activity Reports
IEEE Guide for the Evaluation of the environmental impact & life cycle assessment of Transformers & Shunt Reactors
2025 Spring Meeting, Hyatt Regency Denver; Denver, Colorado, USA
Monday, March 24, 2025 – 11:00 AM to 12:15 PM Mountain Time

Chair	Vice Chair	Secretary
J. Kazmierczak	**Ismail Guner**	**Elise Arnold**
Hitachi Energy	**Hydro Quebec**	**SGB-SMIT Group**

- This is the second meeting of the guide
- A call to order was made at 11:00 AM
- The patent & copyright policy was reviewed. A call for any patents was made. There were two patents that were previously declared & clarified.
- Quorum was taken. There were 78 attendees total with 36 being members. Thirty seven members were needed to achieve quorum. Therefore, quorum was not achieved
- The Agenda was presented, but couldn't be approved due to lack of quorum.
- Approval of MoM's from St. Louis could not be approved due to lack of quorum.
- Mike Nolte with Kewitt presented section 3 outline, as this is the intial section that will drive the rest of the guide
- John Sen, Duke Energy, asked about low loss design aspects, suggested just listing losses.
- Luiz Chem, Hittachi Energy, suggested having additional focus of operation (loading) & maintenance. Also would consider the strategy to have spares, etc.
- Valentina Valori, Hittachi Energy, suggested to show/compare both concepts of cradle to gate vs. cradle to grave
- Sethi Kabir, Hitachi Energy, asked if we will include alternative liquids as well.
- Hitachi Energy if we consider in the LCA the loading profile
- Valentina Valori, Hitachi Energy, why is noise level included in the LCA?
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- John Sen, Duke Energy, how will this agenda be allocated to work on?

- Jonathon Tan, Northern Tx, the design aspects included are interesting & relevant. We neeed to make sure we can also look at heat & noise emissions, as the guide's title does reference environmental impacts as well as LCA.
- Paul Wench, Schneider Electric, happy to be included in scoping piece.
- Luka Kovacic, Koncar, regarding the losses & noise level it is not the LCA basis to look at heat or noise emissions, but to look at it from CO2 emissions.
- Hongzhi Zhang, Hitachi Energy, need to also mention the heating/cooling of the tx. (temp rise).
- Francis Mills, other aspects should be included in the design aspects (thermal capability, dielectric capability, losses, noise, etc.)
- Emil Kricic, Hitachi Energy, will it be realted only to Tx. & Reactor or will this be extended to other aspects, such as substations (i.e. alternative liquids allow for smaller substation footprint). Also, use sensitivity calculation for loading, evaluate the effect at different loading points
- Poorvi Patel, EPRI, the detailed discussions should be had in the task forces.
- John Sen, Duke Energy, use design optimization as a title, with the sections listed as losses, noise, etc. instead of using low.
- Jonathon Tan, Northern Tx., also volunteered to work on section 3.
- New business was covered, as per the agenda, no new business was offered.
- John Sen, Duke Energy, motioned to dismiss & Markus Schiessl (SGB) seconded.

IEEE/PES Transformers Committee

Roster

IEEE GUIDE FOR THE EVALUATION OF THE ENVIRONMENTAL IMPACT & LIFE CYCLE ASSESSMENT OF TRANSFORMERS & SHUNT REACTORS

MEEting Location: Fall 2024 – St. Louis, Missouri, USA 11 :00AM-12 :15AM CST
date: October 28, 2024

	Last Name	First Name	Company (Affiliation)	Role
1.	Giraldo	Orlando	The HJ Family of Companies	Member
2.	Munoz	Marta	Hitachi energy	Member

	Last Name	First Name	Company (Affiliation)	Role
3.	Tenyenhuis	Ed	Hitachi Energy	Member
4.	Matthews	Lee	Howard Industries	Member
5.	Tan	Jonathan	Northern Transformer	Member
6.	Greaves	Brad	Weidmann Electrical Technology	Member
7.	Hossain	Saif	Trench Canada	Member
8.	Rehkopf	Sebastian	Reinhausen Germany	Member
9.	Ploetner	Chris	Siemens Energy	Guest
10.	Foata	Marc	MR	Guest
11.	Boettger	William	Boettger Transformer Consulting LLC	Member
12.	Mahajan	Kushal	Sungrow	Member
13.	Schiessl	Markus	SGB	Member
14.	Dillon	Nikolaus	Dominion Energy	Member
15.	Sharp	Michael	Trench Limited	Member
16.	Bhardwaj	Naveen	Trench Group	Member
17.	Calil	Wilerson	Hitachi Energy	Member
18.	Kapka	Sergiusz	Hitachi Energy	Guest
19.	Kowalski	Rafal	Hitachi Energy	Member
20.	Casallas	Camilo	Trench	Member

	Last Name	First Name	Company (Affiliation)	Role
21.	Sen	John	Duke Energy	Member
22.	Garcia	Miguel	Hitachi Energy	Member
23.	Nolte	Michael	Kiewit	Member
24.	Dorpmanns	Luc	Royal SMIT Transformers	Member
25.	Schrammel	Alfons	Siemens Energy	Member
26.	Thomas	Scott	Hitachi Energy	Guest
27.	Patel	Rakesh	Hitachi Energy	Member
28.	Weyandt	Paul	Schneider Electric	Member
29.	Patel	Poorvi	EPRI	Member
30.	Gustavsson	Niklas	Hitachi Energy	Member
31.	Labh	Ashwini	Hitachi Energy	Member
32.	Cheim	Luiz	Hitachi Energy	Member
33.	Mills	Francis	Power Engineers Inc.	Member
34.	Luka	Kovacic	Koncar Instrument Transformers	Member
35.	Gamboa	Jose	The H-J Family of Companies	Guest
36.	Post	Nicholas	WEC Energy Group	Guest
37.	Vir	Dharam	Prolec GE Waukesha	Member
38.	Steele	Hampton (Allen)	TVA	Member

	Last Name	First Name	Company (Affiliation)	Role
39.	Bernesjo	Mats	Hitachi Energy	Guest (Requests Membership)
40.	Taylor	Marc	JFE Shoji Canada	Member
41.	Som	Sanjib	PTT, LLC	Member
42.	Cordova	Olivia	Bureau of Reclamation	Guest
43.	Robles	Antonia	Bureau of Reclamation	Guest
44.	Digby	Scott	Duke Energy	Guest
45.	Kennedy	Sheldon	Sheldon R. Kennedy Engineering	Guest
46.	Loiselle	Luc	Tetratech	Guest
47.	Hamoir	Didier	Transformer Protector Corporation	Guest
48.	Hrkac	Miljenko	HE	Guest
49.	Zhang	Hongzhi	Hitachi Energy	Guest (Requests Membership)
50.	Klempner	Dmitriy	Southern California Edison	Guest
51.	Chiang	Solomon	TGC	Guest
52.	Mai	Tim-Felix	Siemens Energy	Guest
53.	Lopez	Libando	Hitachi Energy	Guest
54.	Brzoznowski	Steven	BPA	Guest
55.	Ortiz	Juan	Reinhausen	Guest (Requests Membership)

	Last Name	First Name	Company (Affiliation)	Role
56.	Caverly	David	Trench Limited	Guest (Requests Membership)
57.	Blaszeayk	Piotr	Specialty Transformer Components	Guest (Requests Membership)
58.	Kulasek	Krzysztof	Delta Star Inc.	Guest
59.	Manzano	Moses	Hyosung HICO	Guest
60.	Urbirez	Orlando	JST Power	Guest (Requests Membership)
61.	Hampton	Kevin	Siemens Energy	Guest
62.	Faur	Florin	Prolec GE	Guest
63.	Rapelly	Layman	Georgia Transformer Corp.	Guest (Requests Membership)
64.	Da Silva	Roberto	MR	Guest
65.	Hipchen	John	Copper Development Association	Guest
66.	De Oliveira	Liuz	Hitachi Energy	Guest
67.	Sarkar	Amitabh	Virginia Transformer	Guest (Requests Membership)
68.	Martinez	Alberto	WEG	Guest (Requests Membership)
69.	Jones	Braxton	SD Myers	Guest
70.	Guinand	Benjamin	Power Magnetics	Guest
71.	Garner	Joshua	RESA Power	Guest
72.	Keels	Thomas	Keelectric Engineering	Guest

	Last Name	First Name	Company (Affiliation)	Role
73.	Montanha	Juliano	Siemens Energy	Guest
74.	Kriatushi	Mateuse	Hitachi Energy	Guest
75.	Sethi	Kabir	Hitachi Energy	Guest (Requests Membership)
76.	Valori	Valentina	Hitachi Energy	Guest
77.	Arnold	Elise	SGB SMIT	Officer - Secretary
78.	Kazmierczak	Jerzy	Hitachi Energy	Officer – Chair

J.9.2 TF Audible Sound Revision to Test Code **R. Girgis**

Unapproved Minutes of Spring 2025 TF "Audible Sound Revision to Test Code" Meeting The TF met at 1:45 PM, on Monday, March 24, 2025. Dr. Ramsis Girgis, Chairman of the TF, presided over the meeting, with Mats Bernesjo being the Secretary.
The Chairman & Secretary welcomed the audience to this meeting and reviewed the proposed agenda. The proposed agenda was unanimously approved as was the unapproved minutes of the Fall 2024 TF meeting in Saint Louis (Eduardo Garcia 1st, David Wallach 2nd).
The TF meeting was attended by 34 out of 68 members and a total meeting attendance of 89 . A quorum was not established. 19 attendees requested membership at this meeting (listed below) **.
First, the chairman gave a follow up to the 2 action items from the St. Louis TF meeting, namely:

1. Putting together a proposed addition to the IEEE Noise Guide that includes a procedure for determining the maximum allowed sound pressure of Preventive Autotransformers (PAs) in air to limit the impact of the PA noise on the Sound Pressure level of the main transformer to 1 dB. A draft of this proposed addition is completed, and the outline of this addition was presented later in this meeting.
2. An IEEE PES conference paper on this topic was submitted and was accepted for presentation at the upcoming IEEE PES general meeting in Austin, TX in July.

The chairman then presented cases previously presented on impact of PA noise on power transformers at FAT and on site. This is followed by a presentation by Mr. Scott Digby of Duke Energy gave presentation on some of the experience that Duke Energy have had with noisy PAs and how these required un-tanking of Power transformers and replacing the PAs.
The Chairman then presented a summary of present practice of different power Transformers manufacturers of defining their PA noise requirements. Some of these requirements indicated very conservative limits on PA sound levels and hence non-optimized designs.

Next, the Chairman presented the outline of the proposed addition to the IEEE Noise Guide which included:

1. The proposed procedure for determining the required Sound pressure level of PAs in air such that the PA noise does not increase the Sound Pressure Level of the main Transformer by more than 1 dB at the bridging Tap Positions.
2. A numerical example of this procedure
3. Suggested methodology to measure the Sound Pressure level of PAs in air.

Mr. Fernando Leal of Prolec – GE, Mexico, stated that his factory tested 94 PAs and that 90 % of the data deviated from sound levels calculated using the proposed formula for determining the maximum allowed sound pressure of Preventive Autotransformers (PAs) in air. Fernando requested that his data be presented to the Task Force for further discussion of the proposed procedure. The Chairman stated that he will try to get more clarification from Fernando on his data and will respond to him upon receiving this clarification and will share the response with all who attended the TF meeting. Also, he agreed to present the results of the analysis of Fernando's data at the fall meeting of the TF.

Mr. Dumitru Diaconu stated that, in some cases, the PA noise was thought to have been amplified by mechanical resonance of the tank. The Chairman responded that this could happen in some cases. The proposed addition would not cover such special incidents.

In response to a suggestion by Mr. Jason Varnell, the Chairman suggested that he will email a draft of the proposed text of the addition to the IEEE noise Guide to those who attended the TF meeting and will ask for feedback, with the plan to share the feedback with participants of the fall TF meeting and possibly vote for the inclusion of this addition to the IEEE noise Guide. A number of TF members agreed with that plan.

Finally, the chairman stated that the presentation given at the TF meeting will be shared with the attendees of this meeting along with the unapproved minutes of the meeting.

With no new additional business raised, the meeting was adjourned upon unanimous approval

Respectfully submitted,

Mats Bernesjo, TF Secretary

** Attendees requested membership

Alfredo Carrizales (Prolec), Steven Brzoznowski (BPA), Cuauhtemoc Ortiz (Niagara Power Transformer Corp), Dumitru Diaconu (Delta Star), Fei Yang (Hitachi Energy), Ion Radu (Hitachi Energy), Jason Varnell (Doble Engineering), Jesus Marcelino Perez (Prolec), Jesus Sanchez Rodriguez (Vertiv), John John (Virginia Transformer), Josh Bohrn (PacifiCorp), Kabir Sethi (Hitachi Energy Germany AG), Moses Manzano (Hyosung HICO), Naveen Bhardwaj (Trench group), Nihat Kosedagi (ERMCO), Nitesh Patel (Hyundai Power Transformers), Qasim Khan (Neetrac Georgia Tech), Vijay Gunja (Powertechlabs), Wilerson Calil (Hitachi Energy)

2025 Spring Meeting Attendance and Affiliation is as follows:

Name	Affiliation	Involvement Level
Ajith Varghese	Prolec GE Waukesha	Voting Member
Alberto Martinez	WEG	Observer
Alfredo Carrizales	Prolec	Request Membership

Andy Steineman	Delta Star, Inc.	Observer
Armindo santos	Prolec	Observer
Bilal Maksoud	Delta Star inc.	Voting Member
Brzoznowski Steven	BPA	Voting Member
Christopher Slattery	FirstEnergy	Voting Member
Cuauhtemoc Ortiz	Niagara Power Transformer Corp	Request Membership
Dal Ho Kim	Iljin electric	Observer
Daniel Sauer	Eaton	Voting Member
Darren Brown	Howard Industries	Observer
David Caverly	Trench Limited	Observer
David Wallach	Duke Energy	Observer
Diego Galvez	HICO America	Observer
Dinesh Sankarakurup	Duke Energy	Voting Member
Dumitru Diaconu	Delta Star	Request Membership
Duvier Bedoya	Hitachi Energy	Voting Member
Eduardo Garcia	Siemens Energy	Voting Member
Elise Arnold	SGB	Voting Member
Enrique Betancourt	Prolec GE	Voting Member
Fei Yang	Hitachi Energy	Request Membership
Fernando Leal	PROLEC GE	Voting Member
Francis	Mills	Voting Member
Frank Neder	Trench Group	Observer
Gilberto Garza	Prolec	Observer
Hakan Sahin	Virginia Transformer	Voting Member
Hugo Flores	Ermco	Voting Member
Hyounggon Ryu	HD Hyundai electric	Observer
Ion Radu	Hitachi Energy	Request Membership
Jaeyong Park	LS Electric	Observer
James Norton	Oncor	Observer
Janusz Szczechowski	Maschinenfabrik Reinhausen GmbH	Observer
Jason Varnell	Doble Engineering	Request Membership
Jeffrey Wright	Duquesne Light	Observer
Jerzy Kazmierczak	Hitachi Energy	Voting Member
Jesus Marcelino Perez	Prolec	Request Membership
Jesus Sanchez Rodriguez	Vertiv	Request Membership

Joe Nims	Allen & Hoshall	Observer
John John	Virginia Transformer	Request Membership
John Sen	Duke Energy	Voting Member
Josh Bohrn	PacifiCorp	Request Membership
Josipa Brekalo	Koncar D&ST	Observer
Juan Reyes Perez	Hitachi Energy	Observer
Juliano Montanha	Siemens Energy	Observer
Kabir Sethi	Hitachi Energy Germany AG	Request Membership
Kayland Adams	Prolec-GE Waukesha	Voting Member
Klaus Pointner	Trench Austria GmbH	Voting Member
Kris Zibert	Allgeier Martin	Voting Member
Kyungchan An	HYOSUNG	Observer
Marc Taylor	JFE Shoji Power Canada	Voting Member
Mark Lachman	Doble	Voting Member
Markus Schiessl	SGB	Voting Member
Marta Munoz	Hitachi Energy	Voting Member
Matija Koprivnjak	Končar D&ST	Observer
Mats Bernesjo	Hitachi Energy	Voting Member
Michael Botti	Hyosung HICO	Observer
Michael Sharp	Trench Limited	Voting Member
Moses Manzano	Hyosung HICO	Request Membership
Naveen Bhardwaj	Trench Group	Request Membership
Nicholas Koinis	CenterPoint Energy	Observer
Nick Jensen	Delta Star	Voting Member
Nihat Kosedagi	ERMCO	Request Membership
Nitesh Patel	Hyundai Power Transformers	Request membership
Onome Avanoma	MJ Consulting	Voting Member
Pedro Trujillo	Hyundai	Observer
Peter Dopplmair	Trench Group	Observer
Qasim Khan	Neetrac-Georgia Tech	Request Membership
Rafal Kowalski	Hitachi Energy	Voting Member
Ramsis Girgis	Hitachi Energy	Voting Member
Raymond Frazier	Ameren	Observer
Sanjib Som	Quantas Services	Voting Member
Sanjib Som	Pennsylvania Transformers	Voting Member

Scott	Dennis	Voting Member
Scott Digby	Duke Energy	Voting Member
Shawn Gossett	Ameren Illinois	Observer
Stefan Wirth	Coil Innovation GMBH	Observer
Steven Brzoznowski	BPA	Request Membership
Sukin Jang	ILJIN Electric	Observer
Troy Tanaka	Burns & McDonnell	Observer
Vijay Gunja	Powertechlabs	Observer
Vivian Chan	Hitachi energy	Observer
Wilerson Calil	Hitachi Energy	Request Membership
William Boettger	Boettger Transformer Consulting LLC	Voting Member
William Griesacker	WGA	Observer
Xose Lopez-Fernandez	Universidad de Vigo	Observer

J.9.3 TF PCS Continuous Revisions to C57.12.00 **T. Ansari**

PCS Task Force on General Requirements C57.12.00

Performance Characteristics Subcommittee

IEEE / PES Transformers Committee

March 24, 2025

Denver, Colorado

UNAPPROVED MINUTES

The PCS Task Force on General Requirements for C57.12.00 met at 3:15 PM on Monday, March 24, 2025. Chairman Tauhid Ansari presided over the meeting together with Vice Chair Enrique Betancourt and Mats Bernesjo being the secretary. The meeting was called to order and the Chairman reminded the group of the purpose and scope of this Task Force. The copyright and patent statements from IEEE were presented to the group; none of the members and guests present were aware of any issues related to this TF's activities.

The meeting was attended by **41** voting members (out of **65**), 63 observers, for a total meeting attendance of 106 people, including 22 requests for membership at this meeting. A quorum was established with 42 / 65 = 65 % attendance.
The agenda was unanimously approved (1st Hugo Flores, 2nd Dan Sauer). The unapproved minutes from the previous meeting (Fall meeting, Saint Louis, 2024) was unanimously approved (1st Hugo Flores, 2nd Amitabh Sarkar).

The following 22 guests requested membership:
Alfredo Carrizales (Prolec), Arvind Kumar (Delta star inc), Steven Brzoznowski (BPA), Cuauhtemoc Ortiz (Niagara Power Transformer Corp), Dumitru Diaconu (Delta Star inc), Duvier Bedoya (Hitachi Energy), Fernando Leal (Prolec GE), Jonathan Tan (Northern Transformer), Juan Velasquez (Magnetron sas), Juliano Montanha (Siemens Energy), Kannan Veeran (Virginia/ Georgia Transformer corp), Michael Botti (Hyosung HICO), Miguel Plascencia (Pacific Gas & Electric), Monil Patel (Pacific Gas and Electric), Nick Jensen (Delta Star), Nitesh Patel (Hyundai Power Transformers), Scott Dennis (Hitachi Energy), Waldemar Ziomek (PTI Transformers LP), Alberto Marinez (WEG), Fei Yang (Hitachi Energy), Alery Palhatija (Virginia Transformers), and John Tranum (Siemens Energy)

Next, the Chair briefly provided background and relevance of each item brought up for Group's discussion in the agenda. The Chair started Group's regular business.

WG Item 115, Adding Sec 4.1.10 on DC current injection limits – Andrew Larison

Mr. Larison brought back the discussion on adding DC current injection limits to C57.12.00. A question was brought up whether the Distribution Transformer Standards Committee would accept this request as it does not necessarily belong to C57.12.00. Again, it is not fully clear what the basis is for the 0.5 % current limit, whether it is of the Base KVA rating, the Top KVA rating, etc. It was decided / requested that this item is brought up with the Distribution Transformer Standards Committee for further action.

WG Item 116, Update of KVA Levels in Table 11 – Ryan Hogg

Mr. Hogg gave an update of the history of Table 11 after some additional findings. He proposed to add a note to C57.12.00 "Note: The kVA values for single-phase and three-phase transformers in the table intentionally do not adhere to a 1-to-3 ratio for all values. Notably, for values near 500 kVA, the table presents 500 or 501 kVA for both single-phase and three-phase. This is historically due to an old distribution transformer kVA limit."

A vote within the WG to add the above note resulted in 27 approve and 1 abstain. Hence, the proposed write up will be added as an INFORMAL note in the body of the text (not normative).

WG Item 119 – Load loss on Min and Max tap of Distribution transformers – Andrew Larison

Prior to the meeting, Mr. Larison sent a suggestion to the WG with a proposal to add additional tests to the table for Class II Power Transformers (excluding DTR and Class I transformers from these requirements). A short discussion leading up to a motion was held before the motion was tabled by Mr. Sauer. The following discussion focused on improving the terminology some to better clarify the intent. The bottom line that was agreed upon was to modify the text marked in yellow to start with "For Class II Power Transformers, followed by the remainder of the text ending with …KVA rating. A full stop and line break will follow this sentence. Dan Blaydon motioned to go with this text, seconded by Hugo Flores.

Impedance voltage and load loss at rated current and rated frequency on the rated voltage connection, and at the tap extremes of the first unit of a new design	*			*			*			These measurements shall be taken only at the rated voltage connection for a two-winding unit, and at all rated voltage connections for units with three or more windings. At least one test shall be performed at the minimum kVA rating and one test at the maximum kVA rating. The tested load loss of duplicate transformers shall be corrected to reference temperature by assuming the same stray and eddy loss as the design test transformer. For LTC units, see 8.3.2.

A vote was held whether to accept the new write up as proposed above was held. No objections nor abstain. Hence, the motion passed unanimously.

With a quiet floor, the Chairman asked for the meeting to be adjourned (1st Hugo Flores, 2nd by Sanjib Som).

Meeting was adjourned at 4:00 PM.

Respectfully submitted,

Tauhid Ansari	Enrique Betancourt	Mats Bernesjo
Chair	Vice-Chair	Secretary

Attendance Spring 2025 Meeting – PCS TF to Revision C57.12.00

Name	Affiliation	Involvement Level
Adriana Cisco Sullberg	Salt River Project	Observer
Ajith Varghese	Prolec GE Waukesha	Voting Member
Alain Bolliger	HV TECHNOLOGIES Inc	Observer
Alan Washburn	Burns & McDonnell	Observer
Alfredo Carrizales	Prolec	Request Membership
Amitabh Sarkar	Virginia Transformer Corporation	Voting Member
Andreas Thiede	HIGHVOLT Dresden	Observer

Andrew Larison	Hitachi Energy	Observer
Anton Koshel	Delta Star, Inc.	Observer
Aparna Vedantham	Virginia transformer corporation	Voting Member
Armindo Santos	Prolec	Observer
Arvind kumar	Delta star inc	Request Membership
Balaji	Virginia transformer	Observer
Bertrand Poulin	Hitachi Energy	Voting Member
Bilal Maksoud	Delta star inc	Observer
Brzoznowski Steven	BPA	Request Membership
Chanmin Jeong	HD Hyundai	Observer
Christopher Slattery	FirstEnergy	Voting Member
Cihangir Sen	Duke Energy	Voting Member
Cuauhtemoc Ortiz	Niagara Power Transformer Corp	Request Membership
Dal Ho Kim	Iljin electric	Observer
Daniel Blaydon	Baltimore Gas and Electric	Voting Member
Daniel Sauer	Eaton	Voting Member
Darren Brown	Howard Industries	Voting Member
David Calitz	Siemens Energy	Observer
David Wallach	Duke Energy	Voting Member
Dinesh Sankarakurup	Duke Energy	Voting Member
Dominique Bolliger	HV TECHNOLOGIES, Inc.	Observer
Dumitru Diaconu	Delta Star inc	Request Membership
Duvier Bedoya	Hitachi Energy	Request Membership
Elise Arnold	SGB	Voting Member
Enrique Betancourt	Prolec GE	Voting Member
Eric Davis	Consultant	Voting Member
Fedor	SGB-Smit Group	Observer
Fernando leal	Prolec ge	Request Membership
Francis Mills	Power Engineer Inc.	Voting Member
Hakan Sahin	Virginia transformer	Voting Member
Hampton Steele	TVA	Observer
Harry Pepe	Phenix Technologies	Observer
Hugo Flores	Ermco	Voting Member
Isaac Abdalla	HICO America	Observer
Jason Varnell	Doble Engineering	Voting Member
Jeffrey Britton	Doble Engineering	Observer
Jeffrey Gragert	Xcel Energy	Observer

Joe Nims	Allen & Hoshall	Voting Member
Jonathan Reimer	FortisBC	Observer
Jonathan Tan	Northern Transformer	Request Membership
José Luis Machain	Prolec GE	Observer
Joshua Watson	NPPD	Observer
Juan Reyes	Hitachi Energy	Observer
Juan Velasquez	Magnetron sas	Request Membership
Juliano Montanha	Siemens Energy	Request Membership
Kannan Veeran	Virginia/ Georgia Transformer corp	Request Membership
Kris Neild	Megger	Voting Member
Landen Kwan	NRC	Observer
Luc Dorpmanns	Royal SMIT Transformers	Observer
Marc Taylor	JFE Shoji Power Canada	Observer
Markus Schiessl	SGB	Voting Member
Marnie Roussell	Entergy	Voting Member
Mats Bernesjo	Hitachi Energy	Voting Member
Matija Koprivnjak	Končar D&ST	Observer
Michael Botti	Hyosung HICO	Request Membership
Miguel Plascencia	Pacific Gas & Electric	Request Membership
Monil Patel	Pacific Gas and Electric	Request Membership
Moses Manzano	Hyosung HICO	Observer
Nick Jensen	Delta Star	Request Membership
Nikolaus Dillon	Dominion Energy	Voting Member
Nitesh Patel	Hyundai Power Transformers	Request Membership
Pedro Trujillo	Hyundai	Observer
Peter Heinzig	Weidmann	Observer
Rafał Kowalski	Hitachi Energy	Observer
Ramsis Girgis	Hitachi Energy	Voting Member
Sheila Ray	US Nuclear Regulatory Commission	Observer
Raymond Frazier	Ameren	Voting Member
Reto Fausch	RF Solutions	Observer
Rudolf Ogajanov	Hitachi Energy	Observer
Ryan Hogg	Bureau of Reclamation	Voting Member
Sanjay Patel	Royal Smit Transformers	Voting Member
Scott Dennis	Hitachi Energy	Request Membership
Shawn Gossett	Ameren Illinois	Voting Member
Sheldon Kennedy	Sheldon P Kennedy Engineering PLLC	Voting Member

Sanjib Som	PTT	Voting Member
Stephen Antosz	Consultant	Voting Member
Steven Snyder	Hitachi Energy	Voting Member
Sukin Jang	ILJIN Electric	Observer
Tauhid Ansari	Hitachi Energy	Voting Member
Vijay Gunja	Powertechlabs	Observer
Vinay Patel	Con Edison	Observer
Zan Kiparizoski	Howard industries	Voting Member
Waldemar Ziomek	PTI Transformers LP	Request Membership
Eduardo Garcia Wild	Siemens Energy	Voting Member
Marc Lachman	Doble	Voting Member
Sanjib Som	Pennsylvania Transformers	Voting Member
Kris Zibert	Allgeier, Martin and associates	Voting Member
Waldemar Ziomek	PTI Transformers LP	Observer
Matt Weisensee	Pacificorp	Observer
Gabriel Mamede	Siemens Energy	Observer
Joska Brekalu	Končar D&ST	Observer
Matija Koprivnjak	Končar D&ST	Observer
Samragni Dutta Roy	Siemens Energy	Voting Member
Alberto Marinez	WEG	Request Membership
Ed teNyenhuis	Hitachi Energy	Voting Member
Fei Yang	Hitachi Energy	Request Membership
Laxman Rapelly	Georgia Transformer Corp	Observer
Ajay Palhatiya	Virginia Transformers	Request Membership
John Tranum	Siemens Energy	Request Membership

J.9.4 WG Standard for DPVTs C57.159 **H. Shertukde**

Performance Characteristics Subcommittee

Working Group C57.159: Standard for Distributed Photo-Voltaic Transformers (DPVTs)

Unapproved Meeting Minutes

Spring 2025 Meeting
March 24, 2025, 4:45pm

Hyatt Regency Denver Centennial DE
Denver, Colorado

The meeting was called to order at 4:51PM CDT by Vice-Chair, Phil Hopkinson. Chair Hem Shertukde was present, and David Walker as Secretary.
20 Members attended, and 38 guests. The WG has 29 total members, and ,thus, a quorum was achieved.

David Walker called for patents. None were mentioned.

Paul Weyandt moved to approve the agenda as written, Ed teNyenhuis seconded. Approval of Agenda unanimously passed.

Old Business:
Phil Hopkinson presented the document NEMA US 80042-2024, Product Guide for Transformers Connected to Inverters. This document has much detail about the considerations involved in successfully connecting transformers to inverters. The link to the NEMA site that allows purchasing this document is: https://store.accuristech.com/nema/searches/51735634

Phil showed a schematic of a transformer connected to an inverter. The schematic would be the same regardless of if the transformer was connected to batteries or solar panels. The inverters used IGBTs for switching. The transformer is 600V Wye LV and 34.5kV Delta HV. The measured Line to Line current has no significant harmonics. The transformer neutral does not have a ground connection and, thus, there is no neutral ground current. In a second example, the schematic is the same as the first example except that the transformer Wye neutral is grounded. This forms a ground current loop with the inverter ground connection. The inverter has line-line and line-neutral filtering of internal noise. But it has no neutral-ground filtering. In this case the measured line currents and ground current have large harmonic components. Also, large ground currents and increased line currents (compared to the first example) are measured. Often, this causes the neutral bushing to burn up. Also, the noisy neutral current creates noise in the LV winding. This also produces noisy HV winding voltages increased in voltage by the turn ratio when compared to the LV. This has caused failure of many transformers in a solar site. Joe Watson asked what, if anything, would be different if the LV was delta and the HV was grounded Wye. Phil replied that this would be ok since there is no ground current connection to the LV winding. Hem pointed out that the delta would also circulate any 3rd harmonic currents and they wouldn't be present in the HV. Sheldon Kennedy pointed out that in C57.18.10 NO LV circuits ever have grounded Wye windings. In fact, the neutral is never brought out in a rectifier transformer. NFPA 70 (National Electric Code) shows windings with grounded neutrals.

The Commutation frequency of IGBTs in inverters in solar systems can be as high as 100kHz. Solar and wind typically are in the range of 3 to 6 kHz. Commutation voltage spikes are then coupled via the ground connection to the LV winding and capacitively coupled to the core. Simple calculations gave the outside sheets of the core rising to about 900V due to the coupled noise. With about 1000 sheets in the

core and about 25 V/turn in the windings gives about 0.025V per sheet in the absence of noise. However, these solar transformers have gassing with H2, Acetylene, etc. being present. The 900V of noise gives about 0.9V per sheet which is about 2X the insulation strength of the core steel. So, this voltage breaks down the insulation on the core sheets and causes partial discharge within the core which causes gas generation. Experiments in conjunction with WEG added a grounded shield between the core and the LV winding. This stopped the core discharge because the shield prevents the noise voltage from reaching the core. Phil concluded that to make an inverter transformer that does not have gassing regardless of core type one should use a core shield. Luigi Vega from Hitachi tried to reproduce the experiment. He found that not only the capacitance to the core mattered but it also depends heavily on the conductivity of the core insulation. If the core insulation is poor (high conductivity) the noise will create core current but not voltage buildup and PD. Luigi found lower voltages than Phil's calculation. David Walker asked if in Luigi's case of high conductivity does a core shield help? Luigi feels that there are a lot of transformers that operate without gassing. Carlos Guytan said that stacked cores had more problems than wound cores due to better insulation in stacked cores and shields were not as necessary for wound cores. Phil said that the WEG units had stacked cores.

Alan Zhang said that floating the neutral on a unit with a three leg core versus a 4 or 5 leg core was more likely to heat the neutral. He did a test adding a voltage to the LV and saw discharge in the core. Only when the core insulation is > 1000 ohms.

New Business- Standard versus Guide

Sasha Levin said that this standard is the only photovoltaic standard. We have 2.5 years to complete the revision and that will last a long time. The technology is still evolving quickly and that we can address a lot of things, like battery energy storage, that weren't mentioned in the original document or the current PAR. We should consider including battery storage in the revision. Which would require change of title, scope, etc. of the PAR.

Hem said that we are now on Draft 4 which has contributed to this draft. Much remains to be completed. Maybe 60% of what was planned for the standard.

David Walker said that the document is still written like a guide and not a standard. That is more descriptive than prescriptive. Hem said that is would require a PAR change which is time consuming to keep the document a Guide instead of changing to a standard.

Paul Orr suggested that sections that are primarily guidance could be in an informative annex. Hem agreed that there can be normative and informative content in the document.

Sheldon Kennedy said that there was a potential entity PAR with China about measuring core voltages.

Ryan Hogg said that there will be units mentioned in this document will have effects on his document on reverse power flow,

Adjournment and Next Meeting:

The meeting was adjourned at 5:59 MDT.

The next meeting will be at the Transformers Committee Fall 2025 Meeting in Bonita Springs, Florida. If additional virtual meetings are scheduled before the Spring 2024 meeting all Working Group members and non-member attendees will be notified.

Attendees at the Spring 2025 Meeting

Full Name	Employer	Participation
Beaudoin, Jason	Weidmann Group	Member
Biggie, Kevin	Weidmann Group	Member
Boettger, William	Boettger Transformer Consulting	Guest
Britton, Jeffrey	Doble	Guest
Conneighton, Brian	Cleveland Cliffs	Guest
Cryer, Rich	Digitial Grig	Guest
Delgado Zamora, Gabriel	Invenergy	Member
de Olivera, Luiz	Hitachi Energy	Guest
Dinh, Huan	Hitachi Energy	Member
Flores, Hugo	Ermco	Guest
Gamboa, Jose	H-J Industries	Member
Garza, Gilberto	Prolec	Member
Gaytan, Carlos	Prolec	Member
Hernandez, Giovanni	Virginia Transformer	Guest
Hopkinson, Phil	Hvolt, Inc	Vice Chair
Iman,Mike	mgm Transformer	Guest
Kennedy, Sheldon	Sheldon P Kennedy Engineering	Member
Kotbagi,Sanju	MGM Transformer	Guest
Labean jr, Bernard	Consumers Energy	Guest
Larison, Andrew	Hitachi Energy	Member
Lee, Moonhee	Hammond Power Solutions	Guest
Levin, Aleksandr	Weidmann Group	Guest
Lewand, Lance	Doble Engineering	Guest
Lopes, Ricardo	Efacec	Guest
Lopez-Fernandez, Xose	Universidade de Vigo	Member
Mani, Kumar	Duke Energy	Member

Mantoan, Francis	Siemens Energy	Guest
Moore, Curtis	Digital Grid	Guest
Morgan, Tyler	Duke Energy	Guest
Murcia, Fredy	Siemens Energy	Guest
Murillo, Hugo	H-J Industries	Guest
Newbill, Mark	Hitachi Energy	Guest
Oakes, Stephen	WEG	Member
Orr, Paul	NEMA	Member
Parkinson, Dwight	Eaton	Member
Patel, Vinay	Commonwealth Edison	Guest
Pepe, Harry	Dobel	Guest
Peuc,Luca	Koncar Dst	Guest
Quinones, Manuel	GE Vernova	Guest
Rato, Nuno	Efacec	Guest
Rodriguez, Juan Carlos	Magnetron SAS	Guest
Schindler, Stefan	Reinhausen	Guest
Shalabi, Jaber	VanTran	Guest
Shertukde, Hemchandra	University of Hartford	Chair
som, sanjib	Pennsylvania Transformer	Guest
teNyenhuis, Ed	Hitachi Energy	Member
Tirado, Fernando	Prolec Energy	Guest
Torchia, Leonard	PSE&G	Guest
Velasquez, Juan David	Magnetron SAS	Guest
Villa, Hector	Ecuatran SA	Guest
Walker, David	MGM Transformers	Secretary
Webb, Bruce	Knoxville Utilities Board	Guest
Weiss, Zachery	WEG	Guest
Weyandt, Paul	Schneider Electric	Member
White, Joe	Power Engineers	Member
Yuan, Guang	Hitachi Energy	Guest
Zarnowski, Michael	Carte	Guest
Zhang, Alan	Hitachi Energi	Guest

J.9.5 PCS Task Force Continuous Revision to Test Code C57.12.90 **H. Sahin**

Chair: **Hakan Sahin** **Vice-Chair** **N/A**

Secretary	**Adam Sewell**	**Percent Complete**	**95%**

Current Draft Being Worked On: **N/A** **Dated:** **N/A**

PAR Expiration Date: **N/A**

Meeting Date: **25 March 2025** **Time:** **9:30am – 10:45am**

Location: **Denver, CO, USA**

Attendance:	Members	44 of 59
	Guests	80
	(Guests Requesting Membership)	(34)
	Total*	124

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

Meeting Minutes / Significant Issues / Comments:

Meeting was called to order at 9:30am, March 25, 2025 at Hyatt Regency Denver.

1. Administrative
    a. IEEE Patent Policy and Call for Patents and IEEE SA Copyright Policy
        i. No comments from group
    b. Review of Spring 2025 agenda
        i. No comments from group
    c. Introductions of the attendees
        i. Attendance was taken by QR Code sign-in…no paper attendance sheets were passed out. Due to time constraints, chair did not have each attendee announce their name/affiliation. Name/affiliation was announced as attendees spoke during the meeting.
    d. Updated membership review and count for quorum
        i. 59 members were listed and 40 were counted as present by hand count. Based on the hand count, the chair announced there was QUORUM for this meeting.
        ii. Attendance list after meeting completed showed 44 members attended.
        iii. **Members are expected to attend and stay in the meeting so business can be conducted.**
        iv. **Member requests should be sent to secretary – adamsewell@ieee.org**
    e. Approval Spring 2025 agenda

i. MOTION-S.Som, 2nd-J.John

ii. No opposition to unanimous approval – MOTION APPROVED

f. Approval of Fall 2024 unapproved minutes

i. MOTION-D.Wallach, 2nd-J.John

ii. No opposition to unanimous approval – MOTION APPROVED

2. Old Business

a. From Fall 2024 meeting, review of the recommended revision to Clause 5.1: Determination of cold temperature, under Clause 5: Resistance measurements

5.1 Determination of cold temperature

The cold temperature of the windings shall be determined ~~as accurately as possible when measuring the cold Resistance~~ *by using top liquid (What to do for conservator units?), top and bottom temperature probes or sensors, to determine top liquid and average liquid temperatures. If a temperature rise test is required on the subject transformer, same temperature probes shall be used to determine the liquid temperatures*. The precautions in 5.1.1, 5.1.2, and 5.1.3 shall be observed.

5.1.1 General

Cold-resistance measurements shall be made on a transformer only when the liquid or winding temperature is stable. The temperature is considered stable if the ~~top~~ *average* liquid temperature does not vary more than 2 ºC in a 1 h period. Define average??

5.1.2 Transformer windings immersed in insulating liquid

The temperature of the windings shall be assumed to be the same as the average temperature of the insulating liquid, provided the following occurs:

a) The windings have been under insulating liquid with no excitation and with no current in the windings for a minimum of 3 h for a transformer without pumps and for 1 h for transformer with pumps running before the cold resistance is measured.

b) The temperature of the insulating liquid has stabilized, and the difference between top and bottom temperature does not exceed 5 ºC.

b. J.Varnell proposed suggested wording for the TF discussion on the winding resistance:

i. The cold temperature of the windings for class II transformers shall be determined by a thermocouple or suitable thermometer immersed directly in oil.

c. Discussions were had about wording of cold temperature measurement and will be continued at Spring 2025 meeting –

i. MOTION to change 5.1 wording: For Class-I and distribution transformers, the temperature of the windings shall be measured as accurately as possible. The cold temperature of the windings for Class-II transformers shall be measured by a suitable temperature probe either directly immersed, or in a thermowell fully immersed in the transformer liquid.

1. MOTION by D.Sauer, 2nd – S.Som
2. After discussions, MOTION to table/kill made by D.Sauer, 2nd – H.Flores
3. No opposition to unanimous approval of MOTION to table/kill – MOTION APPROVED

3. New Business
    a. Form a small group to review wording for section 5.1 Determination of cold temperature offline/between meetings.
        i. Volunteers to propose/review Section 5.1 wording – T.Ansari, S.Antosz, H.Sahin, D.Sauer, A.Varghese, J.Varnell
    b. R.Musgrove brought up discussion about the location of clause 10.5.1 within the standard. TF agreed that this belongs under the Di-electrics SC and the new business is handed over to the TF Cont. Revision to low frequency tests C57.12.90 – DiTests
    c. TF reviewed another possible new business which is related to the % current applied during load loss and impedance tests. Chair agreed to consider this as new business and will be discussed during the next meeting.
4. Membership changes
    a. Officers will look at attendance and change TF membership status before next meeting.
5. Next meeting: October 21, 2025 at Fall 2025 Transformers Committee Meeting scheduled for October 19-23, 2025, Bonita Springs, FL, USA
6. Close of meeting
    a. Meeting adjourned at 10:45am

Submitted by: Hakan Sahin Date: 4/11/25

March 25, 2025 Meeting Attendance: (RM = Request Membership)

LAST NAME	FIRST NAME	COMPANY/AFFILIATION	Role
Adams	Kayland	Prolec-GE Waukesha	MEMBER
Alonso	Mario	Georgia Transformer	GUEST
Amin	Mihir	Eaton	GUEST-RM
Ansari	Tauhid	Hitachi Energy	MEMBER
Antosz	Stephen	Consultant	MEMBER
Arnold	Elise	SGB	MEMBER
Avanoma	Onome	MJ Consulting	GUEST-RM
Bargone	Gilles	FISO	MEMBER
Bedoya	Duvier	Hitachi	MEMBER
Blaydon	Daniel	Baltimore Gas and Electric	MEMBER
Boettger	William	Boettger Transformer Consulting LLC	MEMBER
Bolliger	Dominique	HV TECHNOLOGIES, Inc.	MEMBER
Bolliger	Alain	HV TECHNOLOGIES Inc	GUEST
Botti	Michael	Hyosung HICO	GUEST-RM
Bradshaw	Garrett	Howard Industries, Inc.	GUEST
Brekalo	Josipa	KONCAR D&ST	GUEST
Britton	Jeffrey	Doble Engineering	MEMBER
Brzoznowski	Steven	BPA	GUEST-RM
Calitz	David	Siemens Energy	GUEST-RM
Carrizales	Alfredo	Prolec GE	MEMBER
Cisco Sullberg	Adriana	Salt River Project	GUEST
Colopy	Craig	Retired from EATON	GUEST
Crockett	Janet	Fayettville PWC	GUEST
Dappen	Tim	Cargill	GUEST-RM
Dennis	Scott	Hitachi Energy	MEMBER
Diaconu	Dumitru	Delta Star inc	GUEST
Dillon	Nikolaus	Dominion Energy	GUEST
Dorpmanns	Luc	Royal SMIT Transformers	GUEST
Duffy	Jesse	Nashville Electric Service	GUEST
Dutta Roy	Samragni	Siemens Energy Inc	MEMBER
Espitia	Egui	Reinhausen Manufacturing Inc	GUEST
Fausch	Reto	RF Solutions	GUEST-RM
Flores	Hugo	Ermco	MEMBER
Frazier	Raymond	Ameren	MEMBER
García	Eduardo	Siemens Energy	GUEST
Girgis	Ramsis	Hitachi Energy	MEMBER
Gorzin	Alireza	Black & Veatch	MEMBER
Gossett	Shawn	Ameren	MEMBER
Griesacker	William	WGA	MEMBER
Heinzig	Peter	Weidmann	GUEST
Hernandez Decanini	Giovanni	Virginia Transformer Corp	MEMBER
Holifield	Thomas	Howard Industries	GUEST
Hrkac	Miljenko	Hitachi Energy	GUEST-RM
Iman	Mike	MGM Transformers	GUEST-RM
Jakob	Karl	Cargill	GUEST
Janakiraman	Balaji	Virginia Transformers	GUEST
Jang	Sukin	ILJIN Electric	GUEST
Jensen	Nick	Delta Star	GUEST-RM
John	John	Virginia Transformer Corp	MEMBER
Kadar	Laszlo	Laszlo & Associates	GUEST
Kennedy	Sheldon	Sheldon P Kennedy Engineering PLLC	GUEST
Khan	Qasim	NEETRAC Georgia tech	GUEST-RM
kim	dalho	iljin electric	GUEST
Kiparizoski	Zan	Howard Industries	GUEST
Koprivnjak	Matija	Končar D&ST	GUEST
Kosedagi	Nihat	ERMCO	GUEST-RM
Kumar	Arvind	Delta star inc	GUEST-RM
LaBean Jr	Bernard	Consumers Energy Company	GUEST
Lachman	Mark	Doble	MEMBER
Leal	Fernando	Prolec ge	MEMBER
Lee	Moonhee	Hammond Power Solutions	MEMBER
Levin	Aleksandr	Weidmann	GUEST

LAST NAME	FIRST NAME	COMPANY/AFFILIATION	ROLE
Mahajan	Kushal	Sungrow	GUEST
Mamede	Gabriel	Siemens Energy	GUEST-RM
Martínez Mares	Alberto	WEG	GUEST-RM
McBride	Brian	Cargill	GUEST
McBride	Jim	JMX High Voltage	GUEST
Melle	Tom	MELLE	GUEST-RM
Mills	Francis	POWER Engineers	MEMBER
Montanha	Juliano	Siemens Energy	GUEST
Munoz	Marta	Hitachi Energy	GUEST-RM
Naderian	Ali	Potencia Partners	GUEST
Narawane	Aniruddha	Eaton	GUEST
Neild	Kris	Megger	MEMBER
Ortiz	Cuauhtemoc	Niagara Power Transformer Corp	GUEST-RM
Palhatiya	Ajay	Virginia Transformer	GUEST-RM
Pandya	Manan	Siemens Energy	GUEST-RM
Panesar	Parminder	Virginia Transformer Corp	GUEST-RM
Patel	Monil	PG&E	GUEST
Patel	Nitesh	Hyundai Power Transformers	GUEST-RM
Patel	Sanjay	Royal Smit Transformers	MEMBER
Patel	Dipeshkumar	Hyper solutions	GUEST-RM
Pepe	Harry	Phenix Technologies	MEMBER
PEREZ	MARCELINO	PROLEC	GUEST-RM
Poulin	Bertrand	Hitachi Energy	GUEST
Reyes perez	Juan	Hitachi energy	GUEST
Ronchi	Rodrigo	WEG Transformers México	GUEST
Ryu	Hyounggon	HD hyundai electric	GUEST
Sahin	Hakan	Georgia transformer	MEMBER
Santos	Armindo	Prolec GE	GUEST
Sauer	Daniel	Eaton	MEMBER
Schiessl	Markus	SGB	MEMBER
Sethi	Kabir	Hitachi Energy Germany Ag	GUEST-RM
Sewell	Adam	Quality Switch	MEMBER
Shalabi	Jaber	Vantran Industries	GUEST-RM
Shannon	Michael	Rea Magnet Wire	GUEST-RM
Shertukde	Hemchandra	UHART-DDI	MEMBER
Slattery	Christopher	FirstEnergy	MEMBER
Smith	Jimmy	Howard Industries	GUEST
SOM	SANJIB	PTT, LLC	MEMBER
Stechschulte	Kyle	AEP	GUEST
Steele	Hampton	TVA	GUEST
Steineman	Andy	Delta Star, Inc.	GUEST
Tan	Jonathan	Northern Transformer	GUEST-RM
teNyenhuis	Ed	Hitachi Energy	MEMBER
Thiede	Andreas	HIGHVOLT Dresden	MEMBER
Thomas	Scott	Hitachi Energy	GUEST
Trujillo	Pedro	Hyundai	GUEST
Van Dreel	Cole	American Transmission Company	MEMBER
Varghese	Ajith	Prolec GE Waukesha	MEMBER
Varnell	Jason	Doble Engineering	MEMBER
Veeran	Kannan	Virginia/Georgia Transformer	GUEST-RM
Villa	Hector	Ecuatran SA	GUEST
Vyas	Pragnesh	Cleveland Cliffs	MEMBER
Wagner	John	AEP	GUEST-RM
Wallach	David	Duke Energy	MEMBER
Watson	Joshia	NPPD	GUEST
Weyandt	Paul	Schneider Electric	GUEST-RM
White	Leon	Hedrich North America	GUEST
Yang	Fei	Hitachi Energy	GUEST-RM
Yuan	Guang	Hitachi energy	GUEST-RM
Zhang	Hongzhi	Hitachi Energy	GUEST-RM
Zibert	Kris	Allgeier Martin	MEMBER
Ziomek	Waldemar	PTI Transformers LP	MEMBER

J.9.6 WG HV & EHV Breaker & Transformer Sw. Transients C57.142 **J. McBride**

MEETING MINUTES
IEEE / PES Transformers Committee
Performance Characteristics Subcommittee

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

Denver, Colorado USA
Tuesday, March 25th, 2025
11:00 AM – 12:15 PM
Hyatt Regency - Centennial DE

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

1) Welcome and Chair's Remarks (it was mentioned the WG paper can be found at https://ieeexplore.ieee.org/document/9161400)
2) Circulation of Attendance Sheets. Quorum was achieved with 36 of 44 Members present. Guest attendance was 77 for a total of 113 attendees.
3) IEEE Patent Policy Slides – no patent claims
4) Approval of Agenda and Minutes from Last Meeting: Fall 2024 Minutes (motion by Phil Hopkinson / 2nd by Eduardo Garcia Wild) and Spring 2025 Agenda (motion by Marnie Roussell / 2nd by Phil Hopkinson) unanimously approved.
5) Reminder that the WG PAR extension is through December 31, 2025.
6) C57.142 Ballot and Comment Resolution for Draft 13 – Jim McBride:

The Chair stated that all comments have been resolved and asked for a motion to recirculate the ballot (motion by Hemchandra Shertukde / 2nd by Amitabh Sarkar). Weijun Li mentioned that a vote was not mandatory; however, the motion was unanimously approved. The Chair showed the slide containing the members of the CRG.
During discussion a question from Phil Hopkinson, regarding resolution of the comment from Doug Edwards of the Switchgear Committee was asked: "Should we state the loading levels and chopping currents in the Guide?" The chair responded that this topic will be considered in future business.
Update from IEEE Switchgear Liaison Task Force to WG for Revision of C57.142 by David Caverly. The Switchgear Meeting will be held at the Wyndham Grand Orlando Resort Bonnet Creek (Orlando, Florida) from April 6 – 11, 2025. No Task Force work is planned for the meeting, as all comments are complete. Mr. Caverly mentioned the creation of CIGRE A3.42 (new brochure for transformer failures) that may be of interest to the WG for liaison opportunities.

7) Mitigation Methods Task Force Update – Jim McBride / Phil Hopkinson

The Chair presented the Mitigation Methods summary and a list of TF Members. A tutorial is scheduled for Fall 2025 TC Meetings.

The WG plans to have ongoing discussions regarding the challenges of high-magnitude, high-frequency transients. It should be noted there are few (if any) factory tests to simulate these occurrences.

8) New Business – the Chair mentioned many recent occurrences of failures of transformers connected to solar farms as a possible future topic for the guide.

9) Next Meeting (Bonita Springs, FL October 19-23, 2025)

10) Adjournment at 11:33 AM

Meeting Attendance:

Role	Last Name	First Name	Company
Chair	McBride	James	JMX High Voltage
Vice-Chair	Lopez-Fernandez	Xose	Universidade de Vigo
Secretary	Melle	Thomas	HIGHVOLT
Member	Betancourt	Enrique	Prolec GE
Member	Boettger	William	Boettger Transformer Consulting LLC
Member	Britton	Jeffrey	Phenix Technologies, Inc.
Member	Caverly	David	Trench Limited
Member	Espindola	Marco	Hitachi Energy
Member	Frazier	Raymond	Ameren
Member	Garcia Wild	Eduardo	Siemens Energy
Member	Heiden	Kyle	EATON Corporation
Member	**Hernandez**	**Giovanni**	Virginia Transfomrer Corp.
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	**Khan**	**Qasim**	Georgia Tech - NEETRAC
Member	Kirchenmayer	Egon	Siemens Energy
Member	Lee	Moonhee	Hammond Power Solutions
Member	Li	Weijun	Braintree Electric Light Dept.
Member	Mani	Kumar	Duke Energy
Member	Montanha	Juliano	Siemens Energy
Member	Pepe	Harry	Phenix Technologies, Inc.
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	Sharp	Michael	Trench Limited
Member	**Tolcachir**	**Eduardo**	TTE
Member	Varghese	Ajith	Prolec-GE-Waukesha
Member	Vir	Dharam	Prolec-GE Waukesha
Member	Yun	Joshua	Virginia Transformer Corp.

Member	Zhang	Shibao	PCORE Electric
Member	Ziomek	Waldemar	PTI Transformers
Guest	An	KYUNGCHAN	HYOSUNG
Guest	Arnold	Elise	SGB
Guest	Botti	Michael	Hyosung HICO
Guest	Bradshaw	Garrett	Howard Industries
Guest	Brodeur	Samuel	Hitachi
Guest	Calitz	David	Siemens Energy
Guest	Carrizales	Juan Alfredo	Prolec GE
Guest	Chan	Vivian	Hitachi Energy
Guest	Chorzepa	Jaroslaw	ABB Inc
Guest	Czernorucki	Marcos	Hitachi Energy
Guest	de Oliveira	Luiz	Hitachi Energy
Guest	Duffy	Jesse	Nashville Electric Service
Guest	Feaster	Kyle	Xcel Energy
Guest	Fernandez	Miguel	BELD
Guest	Fujimori	Alan	Romagnole
Guest	Griesacker	Bill	WGA
Guest	Gunja	Vijay	Powertechlabs
Guest	Heinzig	Peter	Weidmann Electrical Technology
Guest	Hollrah	Derek	Burns & McDonnell
Guest	Iman	Mike	MGM Transformer Company
Guest	Janakiraman	Balaji	Virginia Transformer
Guest	Jarosz	Patrycia	IEEE SA
Guest	Juchem	Kevin	ABB AG
Guest	Kim	Yeounsoo	MEPPI
Guest	Klempner	Dmitriy	Southern California Edison
Guest	Koshel	Anton	Delta Star Inc
Guest	Kotbagi	Shrinivas	MGM Transformers
Guest	Kumar	Arvind	Delta Star Inc.
Guest	Leal	Fernando	Prolec GE
Guest	Levin	Aleksandr	Weidmann Electrical Technology
Guest	Lopes	Ricardo	Efacec Energia, SA

Guest	Martinez Mares	Alberto	WEG
Guest	Masoud	Nader	Central Moloney
Guest	Mills	Francis	POWER Engineers
Guest	Munoz	Marta	Hitachi Energy
Guest	Nambi	Shankar	Bechtel
Guest	Natale	Anthony	HICO America
Guest	Nims	Joe	Allen & Hoshall, Inc.
Guest	Panetta	Sergio	I-GARD Corp
Guest	*Parkinson*	*Dwight*	EATON Corporation
Guest	Patel	Nitesh	Hyundai Power Transformers USA
Guest	Patel	Monil	PG&E
Guest	Perez	Marcelino	PROLEC-GE
Guest	*Ploetner*	*Christoph*	Siemens Energy
Guest	Prevost	Tom	Weidmann
Guest	Raymond	Tim	Inductive Reasoning
Guest	Reimer	Jonathan	Fortis BC
Guest	Rossini	Yuri	Siemens Energy
Guest	Rutledge	Gris	GeVernova
Guest	Santos	Armindo	Prolec GE
Guest	Saraf	Manish	Hammond Power Solutions
Guest	Sbravati	Alan	Hitachi Energy
Guest	Schiessl	Markus	SGB
Guest	Schleismann	Eric	Southern Company Services
Guest	Segovic	Dario	Koncar Power Transformers
Guest	Sethi	Kabir	Hitachi Energy
Guest	Shaikh	Salahuddin	Hitachi Energy
Guest	Shull	Stephen	BBC Electrical Service, Inc.
Guest	Snyder	Jason	FirstEnergy
Guest	Stechschulte	Kyle	American Electric Power
Guest	*Steele*	*Hampton*	Tennessee Valley Authority
Guest	*Steineman*	*Andrew*	Delta Star Inc.
Guest	Thiede	Andreas	HIGHVOLT Dresden
Guest	Torchia	Leonard	PSE&G
Guest	Trifunoski	Rusto	Trench

Guest	Trujillo	Pedro	Hyundai Power Transformers USA
Guest	Velasquez	Juan	Magnetron SAS
Guest	Wagner	John	AEP
Guest	Washburn	Alan	Burns & McDonnell
Guest	Watson	Joe	JD Watson & Associates
Guest	Watson	Joshua	Nebraska Public Power District
Guest	Weatherbee	Eric	PCORE Electric
Guest	Wong	Terry	Trench LTD
Guest	Xie	Jiahao	S&C Electric Company
Guest	Yeboah	Kwasi	GE Vernova
Guest	Yuan	Guang	Hitachi Energy
Guest	Zhou	Anna	JST Power

J.9.7 WG C57.158 Application Guide for Tertiary and Stabilizing Windings E. Betancourt

PCS Working Group Revision of Application Guide for Tertiary and Stabilizing Windings C57.158
Performance Characteristics Subcommittee IEEE / PES Transformers Committee
March 25, 2025 Denver, Colorado, US

UNAPPROVED MINUTES
This group met on Tuesday March 25, 2025, at 4:45 PM in Denver, CO, US. The attendance record showed **80** people attended the meeting with **25** out of the **41** Members present; a quorum to conduct business was established.

The following **14** Guests requested Membership (to be awarded after consecutive attendance at two WG meetings):

Alberto Martinez* WEG
Alireza Gorzin* Black and Veatch
Anton Koshel* Delta Star
Belaji Jonakiramm Virginia Transformers
Fei Yang* Hitachi Energy
Garret Bradshaw Howard Industries Geraldo Magela Junior Hitachi Energy Hongzhi Zhang* Hitachi Energy
Libardo Lopez Hitachi Energy
Marcelino Perez Prolec GE
Michael Botti* Hyosung HICO
Orlando Giraldo* The HJ Family of Companies
Pedro Trujillo HD Hyundai

Wilerson Calil Hitachi Energy (*) To become WG Members after this meeting.
The officers were introduced as Enrique Betancourt Chair, Xose Lope-Fernandez Vice Chair, and Kayland Adams Secretary.

IEEE Patent slides were covered, no issues were brought up.
IEEE Copyright Policy slides were discussed, no issues were brought up.
Attendance was conducted and quorum was achieved. Agenda was presented. Motion unanimously passed to approve the agenda (Amitabh Sarkar, John K. John). The Minutes from the last meeting were also unanimously approved (Eduardo García, Sanjib Som).

1. OLD BUSINESS

A. Draft 1A, including revision items from TF1 and TF2

Updates by each task force were presented.

2. Task Force 1: General editorial overview

Emilio Morales-Cruz presented the findings. 92 comments were assembled. As a result of this group's discussions, new text was proposed and further incorporated to Draft 1A of the Guide.

Jason Varnell proposed to add new subclause for protection and monitoring of stabilizing windings based on current measurements. The Chair explained that although protection and relaying fall out of the scope of current document, discussion of the subject could be incorporated as part of the scope of TF4.
Steve Antosz reviewed C57.12.70 for labeling of bushings with five windings. Two options were proposed, and the Group agreed that for the fourth and fifth windings, the "numeral, letter, numeral" designations could be more convenient (i.e. H, X, Y, 1Z, 2Z- terminals, each with three different phase tags: "1,2,3").

The Chair had shared Draft 1A with the Group before the meeting, and during the meeting he presented the several sections where additional wording was added, identifying new text in red colored font.

3. Task Force 2: Recommendations for Y-connected transformers without a delta connected winding.

Dr. Xose Lope-Fernandez presented work in this section. Text was added for monitoring techniques that will allow Y-Y transformers without a tertiary to operate with a certain level of unbalanced load.

Egon Kirchenmayer of Siemens Energy offered some discussion on this topic but was referring to text that was not under review by task force 2, as he was addressing a grounding situation that was outside the scope of the task force 2.

Anton Koshel of Delta Star also offered some discussion mentioning auto transformers and Y-Y connected transformers with both neutrals grounded. It was explained that the case fell outside the scope of task force 2.

A. Further Steps for TF3 and TF4

Task Force 3: Improvement and, or simplification of concepts in the Guide

Krzysztof Kulasek offered to finish his work in a few weeks after this WG's meeting; the Chair presented briefly the status of discussions within TF3. Topics that are under discussion within TF3 are simultaneous loading of LV and TV at different power factors, and recommendations to determine the load losses for these situations.

The topic of bushing placement of large transformers with tertiary windings and transformers with stabilizing windings that require temperature testing was not supported with sufficient experience data and would not be further pursued.

4. Task Force 4: New recommendations for TW or SW

No work has been done at this time but topics to be covered are

- Some experiences with collector transformers in Renewables Plants (solar, wind, batteries?). Tertiaries for axial-split, Y-connected LVs.
- Section of grounding of neutrals in Y-connected transformers. [Reference?]
- Caution for application of outermost Tertiaries: electrostatic voltage pick-up.
- Effects from Reverse Power Flow?
- Circulating currents in delta of single-phase banks.

The Chair offered to review the scope of this TF with WG Members knowledgeable on the subject, and in case no further interest could be confirmed, the proposal would be presented to the Group to exclude the subjects from this revision of the document.

A. Concepts on "Zero-Sequence" (Tutorial Part 2- just informative)

A short presentation was given by the Chair to further explain the topic of "Zero sequence currents and its effects on systems and transformers". A circuit model was presented, as well as the role of neutral grounding on transferring zero-sequence currents from one to other side of a Y-connected transformer. The purpose of this tutorial material is just to cover the fundamentals necessary to understand the Guide's concepts.

B. Next Steps

Draft 1A of the document is in circulation among the Group's Membership. After this session and before the meeting of Fall 2025 the following is planned to take place, add comments from this meeting to draft 1A and TF3 proposed improvements. With the new information prepare Draft 2 and perform a straw ballot.

Motion 1 (Hugo Flores, Eduardo Garcia) "The Chair will circulate Draft 2 of the Guide for a 'straw ballot' among WG's Membership before the next, F'25 meeting of the Group".
If comments could be resolved by the F'25 meeting, the new document would be released as Draft 3, potentially ready for MEC review by mid-2026.

5. NEW BUSINESS

No new business was brought up.

6. ADJOURN

Motion passed to adjourn. Sanjib Som made the motion, Eduardo Garcia seconded. The meeting was adjourned at 5:55 PM.

Respectfully submitted,

Enrique Betancourt	Dr. Xose Lopez-Fernandez	Kayland Adams
Chairman	Co-Chair	Secretary

Next Pages: Attendance List (Req. = Request):

Nr	Last Name	First Name	Affiliation	Status
1	Adams	Kayland	Prolec GE Waukesha	Member
2	An	KyungChan	HYOSUNG	Guest
3	Antosz	Stephen	Consultant	Member
4	Avanoma	Onome	MJ Consulting	Member
5	Betancourt	Enrique	Prolec GE	Member
6	Boettger	William	Boettger Transformer Consulting LLC	Member
7	Bohrn	Josh	PacifiCorp	Guest
8	Botti	Michael	Hyosung HICO	Req. Membership
9	Bradshaw	Garrett	Howard Industries, Inc.	Req. Membership
10	Brekalo	Josipa	Koncar D&ST	Guest
11	Brzoznowski	Steven	BPA	Guest
12	Calil	Wilerson	Hitachi Energy	Req. Membership
13	Calitz	David	Siemens-Energy	Guest
14	Chan	Vivian	Hitachi energy	Guest
15	Czernorucki	Marcos	Hitachi Energy	Guest
16	Diaconu	Dumitru	Delta Star Inc	Guest
17	Dillon	Nikolaus	Dominion Energy	Guest
18	Filip	Mikulecky	Koncar Power Transformers Ltd.	Guest

19	Frazier	Raymond	Ameren	Member
20	Fujimori	Alan	Romagnole	Guest
21	Garcia	Eduardo	Siemens Energy	Member
22	Giraldo	Orlando	The H-J Family of Companies	Req. Membership
23	Goglia	Slaven	Koncar Power Transformers Ltd.	Guest
24	Gorzin	Alireza	Black & Veatch	Req. Membership
25	Heinzig	Peter	Weidmann	Guest
26	Holifield	Thomas	Howard	Guest
27	Hollrah	Derek	Burns & McDonnell	Guest
28	Hrkac	Miljenko	Hitachi Energy	Guest
29	Janakiraman	Balaji	Virginia Transformer	Guest
30	Jang	Sukin	ILJIN Electric	Guest
31	Jensen	Nick	Delta Star	Guest
32	John	John	Virginia Transformer Corp	Member
33	Kadar	Laszlo	Laszlo & Associates	Guest
34	Kim	Dal-Ho	ILJIN Electric	Guest
35	Kirchenmayer	Egon	Siemens Energy	Member
36	Koprivnjak	Matija	Končar D&ST	Guest
37	Koshel	Anton	Delta Star Inc	Req. Membership
38	Kulasek	Krzysztof	Delta Star Inc.	Member
39	Lope-Fernandez	Xose	Universidade De Vigo	Member
40	Lopez	Libardo	Hitachi Energy	Req. Membership
41	Magela junior	Geraldo	Siemens-Energy	Req. Membership
42	Manzano	Moses	Hyosung HICO	Member
43	Martínez Mares	Alberto	WEG	Req. Membership
44	Matt	Chu	Shihlin Electric	Guest
45	Mendez	Omar	Prolec	Guest
46	Morales-Cruz	Emilio	Qualitrol	Member
47	Munoz	Marta	Hitachi Energy	Member
48	Murcia	Fredy	Siemens Energy	Guest
49	Nambi	Shankar	Bechtel Energy, Inc.	Member
50	Nims	Joe	Allen & Hoshall	Guest
51	Obregon	Daniel	TTE Transformers	Guest
52	Palhatiya	Ajay	Virginia Transformer Corp	Guest

53	Patel	Monil	Pacific Gas and Electric	Guest
54	Patel	Nitesh	Hyundai Power Transformers	Member
55	Patel	Sanjay	Royal Smit Transformers	Member
56	PEREZ	MARCELINO	PROLEC	Req. Membership
57	Reyes perez	Juan	Hitachi energy	Guest
58	Ronchi	Rodrigo	WEG Transformers México	Member
59	SALSWACH	BORIS	SIEMENS ENERGY	Guest
60	Sankarakurup	Dinesh	Duke Energy	Member
61	Sarkar	Amitabh	Virginia Transformer Corporation	Member
62	Schiessl	Markus	SGB	Member
63	Segovic	Dario	Koncar Power Transformers Ltd.	Guest
64	Sethi	Kabir	Hitachi Energy Germany Ag	Member
65	Som	Sanjib	Pennsylvania Trs.	Member
66	Steineman	Andy	Delta Star, Inc.	Guest
67	Swarna	Sunny	Virginia Transformer Corp	Guest
68	Torchia	Leonard	PSE&G	Guest
69	Trujillo	Pedro	Hyundai	Guest
70	Valori	Valentina	Hitachi Energy	Guest
71	Varnell	Jason	Doble Engineering	Member
72	Vullo	Stephen	GE Vernova	Guest
73	Wagner	John	AEP	Guest
74	Wallach	David	Duke Energy	Guest
75	Webb	Bruce	Knoxville Utilities Board	Guest
76	Weisensee	Matt	PacifiCorp	Guest
77	White	Joe	POWER Engineers	Member
78	Yang	Fei	Hitachi Energy	Req. Membership
79	Zhang	Hongzhi	Hitachi Energy	Req. Membership
80	Zhou	Anna	JST Power	Guest

J.9.8 WG PC57.32 Neutral Grounding Devices **S. Kennedy**

ANSI/IEEE PC57.32
IEEE Neutral Grounding Devices
Working Group Meeting

Hyatt Regency Denver

Denver, CO, USA

Tuesday, Mar 25, 2025
4:45 PM – 6:00 PM

Chair – Sheldon Kennedy
Vice Chair – Thomas Melle
Secretary – Ed teNyenhuis

1. Welcome and Chair's Remarks

2. Circulation of Attendance Sheets
(Quorum achieved – 14 of 26 Members; 18 Guests present)

3. Approval of Agenda
(Motion to approve by Sergio Panetta, second by Mike Sharp – motion passed without objection)

4. Patent Call - none

5. Copyright and IEEE Ethics Policies

6. Approval of Minutes from previous Meeting
(Motion to approve by Sergio Panetta, second by Camilo Casallas – motion passed without objection)

7. Reports from TF Leader Assignments

a. Clause 4 - Neutral Grounding Reactors – Camilo Casallas
All main body section draft work and SPAR Annex is complete.
David Caverly presented the SPAR annex.
Camilo will send a slightly revised document after the meeting.

b. Clause 5 - Neutral Ground Fault Neutralizers – Klaus Pointner
All main body work, "Failed Phase Grounding" Annex and "Residual Current Compensator" Annex is complete.

c. Clause 6 - Neutral Grounding Transformers – Don Ayers
All work is complete.

d. Clause 7 - Neutral Grounding Resistors – Ryan Hogg, Sergio Panetta
All work is complete.

e. Clause 8 - Combination Devices - Sergio Panetta

Still need a method for calculating impedance of single phase transformers and/or zigzags. Sergio will add this to the main body draft and send shortly to the Chair.

8. Working Group Survey
An overall draft will be prepared and sent out to the working group before the next meeting for survey.

9. Old Business
None

10. New Business
None

11. Next in-person meeting – Fall 2025 Meeting (IEEE TC – Bonita Springs, Florida USA, October 19-23, 2025)

12. Adjournment at 5.22PM local time

List of Attending Members and Guests

Last Name	First Name	Affiliation	Status
Kennedy	Sheldon	Sheldon P. Kennedy Engineering	Chair
Melle	Thomas	HIGHVOLT	Vice-Chair
teNyenhuis	Ed	Hitachi Energy	Secretary
Casallas	Camilo	Trench Ltd.	Member
Hossain	Saif	Trench Ltd.	Member
McBride	Jim	JMX High Voltage	Member
Sharp	Mike	Trench Ltd.	Member
Cruz Valdes	Juan Carlos	Prolec GE	Member
Hogg	Ryan	Bureau of Reclamation	Member
Panetta	Sergio	I-Gard Corp.	Member
Pointner	Klaus	Trench Austria	Member
Stechschulte	Kyle	AEP	Member
Thomas	Scott	Hitachi Energy	Member
Wong	Terry	Trench	Member
Bhardwaj	Naveen	Trench Group	Guest
Brooks	Jeffrey	Asplundh Engineering	Guest
David	Caverly	Trench	Guest
Dom	Corsi	Doble	Guest
Kaineder	Kurt	Trench Austria	Guest
Keels	Thomas	Keelectric Engineering PLLC	Guest

Klemper	Dmitriy	SCE	Guest
Wirth	Stefan	Coil Innovation	Guest
Xie	Giahao	SRCC Electric	Guest
Qasim	Khan	Neetrac-Georgia Tech	Guest
Luza	Peuc	Koncar	Guest
Stauffer	Jonathan	BOR	Guest
Rato	Nuno	Efacec	Guest
Pedro	Pedro	Efacec	Guest
Burke	David	Xcel Energy	Guest
Propts	Thomas	Dominion Energy	Guest
Gardner	James	Prolec GE	Guest
Guinard	Benjamin	Power Magnetics	Guest

J.9.9 TF Transformer Data Required for System Studies **J. Watson**

Performance Characteristics Subcommittee Task Force Mee1ng Minutes Transformer Data Required for System Studies

Hyatt Regency Denver at Colorado Convention Center 650
15th Street, Denver CO 80202

Mineral Hall A (3)

Chair: Joe Watson

Vice Chair: Rogerio Verdolin Secretary:
Alwyn Vanderwalt

The Task Force met for the first time at 9:30AM on Monday, 3/24/25 with 50 attendees, including 9 of the 17 members, to establish a quorum. Patent and Copyright requirements were covered. The Minutes from the Fall '24 mee1ng and the remote mee1ng that was held on 1/30/25

No motions or other official business were covered. The meeting hosted two presentations on System Studies programs and Transformer Modeling. The first presenta1on was a remote presentation by Dr. Rohitha Jayasinghe and Dr. Dharshana Muthumuni who work with

the Power Systems Technology Centre at Manitoba Hydro International. The second presentation was in-person by Yuefeng Liang who is a Principal Simula1on Engineer with RTDS Technologies in Winnipeg Manitoba.

Both presentations explained that there are many different types of System Studies that need to be performed and that most studies like load flow studies and fault studies can be performed with readily-available transformer data such as the MVA, kV and impedance ratings, but other studies that need to model the transformers' performance under overvoltage or system instability condi1ons require additional data such as air-core reactance, core saturation curves, winding and core dimensions or dimensional ratios that need to be calculated or estimated from design data that may not be readily available.

The slides from both presentations have been submitted to the webmaster to post on the TF's section of the Performance Characteristics SC's web page.

The TF plans to have a remote mee1ng in April or May to start work on the report.

The TF intends to meet in the fall 2025 meetings and should need a room for at least 60 attendees.

The meeting adjourned at 10:45.

Meeting Attendees: Note that "New Members" requested membership during the Spring 2025 meeting which was granted when the attendance was recorded.

First Name	Last Name	Affiliation	Status
Mats	Bernesjo	Hitachi Energy	Guest
Enrique	Betancourt	Prolec GE	Guest
Vivian	Chan	Hitachi Energy	Guest
Bhaumik	Choksi	Hitachi Energy	Guest
Olivia	Cordova	Bureau of Reclamation	Guest
Janet	Crockett	Fayetteville PWC	Member
Rich	Cryer	Digitalgrid	Guest
Gabriel	Delgado	Invenergy	Guest
Evgenii	Ermakov	Hitachi Energy	Guest
Ken	Fedor	SGB-Smit	Guest
Patrick	Foster	NextEra	Guest
Lorne	Gara	Shermco Industries	Guest
Ramsis	Girgis	Hitachi Energy	New Member
Donghyun	Jang	LS Electric	Guest

Sukin	Jang	Iljin Energy	Guest
Heun su	Kim	LS Electric	Guest
Ashwini	Labh	Hitachi Energy	New Member
Andrew	Larison	Hitachi Energy	Guest
Weijun	Liang	Braintree Electric Light Dept.	Guest
Ricardo	Lopes	EFACEC	New Member
Libardo	Lopez	Hitachi Energy	Guest
Xose	Lopez-Fernandez	University of Vigo	New Member
Omar	Mendez	Prolec GE	Guest
Juliano	Montanha	Siemens Energy	New Member
Curtis	Moore	Digitalgrid	Guest
Shankar	Nambi	Bechtel Energy, Inc.	Member
Joe yong	Park	LS Electric	Guest
Nitesh	Patel	Hyundai Power Transformers	Guest
Verena	Pellon	NextEra/FPL	Guest
Homer	Portillo	Advanced Power Technology	Guest
Marnie	Roussell	Entergy	Member
Dan	Sauer	Eaton	Guest
Hemchandra	Shertukde	University of Hartford/DDI	New Member
Sanjib	Som	Pennsylvania Transformer Tech	Guest
Hampton	Steele	TVA	Guest
Andy	Steineman	Delta Star	New Member
Maxathe	Swapnil	Megger	New Member
Janusz	Szczechowski	Machenfabrik Reinhausen	Guest
Alwyn	Vanderwalt	ECI	Secretary
Rogerio	Verdolin	Verdolin Solutions	Vice-Chair
Dharam	Vix	Prolec GE	New Member
Jolin	Wagner	AEP	Guest
Alan	Washburn	Burns and McConnell	Member
Joshua	Watson	Nebraska Public Power District	Member

Joe	Watson	JD Watson and Associates, Inc.	Chair
Trenton	Williams	Advanced Power Technologies	Guest
Jiahao	Xie	S&C Electric Company	New Member
Fei	Yang	Hitachi Energy	Guest
Joseph	Youn	Iljin Energy	Guest
Zachary	Yu	Sieyuan Toshiba	Guest

J.9.10 WG Entity Winding Deformation Guide PC57.141 **L. Zhao**

J.9.11 C57.120 – Loss Evaluation Guide **R. Verdolini**

TF PAR Study Group Loss Eval for Transformers & Reactors C57.120
Unapproved Meeting Minutes
Spring 2025 Meeting
Tuesday, March 25, 2025
Hyatt Regency Denver – Mineral Hall DEFG

- Meeting called to order at 8:00AM
- Attendance QR code
- K. Zibert, Vice Chair leading meeting
- No prior minutes
- Agenda approved unanimously
- Patent Notice
- IEEE Copyright policy
- Participant Behavior Expectations
- Document Expires 2027
- Title, Scope, and Purpose Discussion - seeking to establish these items, motion, and 2/3 majority to send to SC
- Title: Guide for Loss Evaluation of Distribution and Power Transformers and Reactors
    - M. Nolte - the 2 "and" in the title?
    - Title unanimously agreed to keep as written
- Scope: This guide covers the economic loss evaluation of liquid-filled distribution and power transformers, dry-type distribution and power transformers, and reactors.
    - Alexander Levin - Economic losses only? What about environmental impact? Is there possible overlap with C57.151 in development?
        - K. Zibert - intend to keep exclusively as economic loss, cost of ownership
    - D. Klempner - Clarify scope for liquid-filled and air-core reactors?
    - Move liquid-filled and dry-type distribution transformers
    - S. Som - please make font larger

    - Final: "This guide covers the economic loss evaluation of liquid-filled/immersed and dry-type distribution transformers, power transformers and reactors"
    - S. Som - should this be immersed or filled?
    - V. Valori - reference the current terminology guide?
- Levin - Make sure to clarify in SC for immersed vs. filled
    - Scope accepted - pending for immersed vs filled discussion in SC for PAR
- Purpose (too long to repeat here)
- Levin - some repeats
    - K. Kaineder - Suggest deleting after first few sentences?
    - David Caverly - Is there a risk of getting the PAR tied up with such a long purpose? This is too detailed.
    - K. Adams - Don't like that we're restating our scope.
- Levin - leave as just economic benefit of units of different designs (second sentence)
    - E. Espita - Equipment vs transformers and reactors, need to be cautious we don't unwittingly exclude reactors
    - J. Sneyder - perhaps should keep suggested deletions from a new/young engineer perspective
        - K. Kaineder - it makes more sense to detail this in the main body of the document
        - D. Klempner/A. Levin - too much and no need to include so much in the purpose
    - Deleting paragraph directly copied from introduction
    - Removal of additional paragraphs that aren't statement of purpose
    - Last paragraph - keep it
        - Add total losses as a better means for being inclusive of reactor losses
        - Rip off first sentence for first sentence of the purpose and wipe the last paragraph
    - Some items move for clarification
    - Purpose as marked up unanimously
- D. Klempner - moved to approve title/scope/purpose for unanimous consent to move to SC (Wed at 3pm)
- Meeting adjourned at 9:10AM.

First Name	Last Name	Your Affiliation	Role:
Kayland	Adams	Prolec-GE Waukesha	Member
Gilles	Bargone	FISO	Member
Naveen	Bhardwaj	Trench Group	Member
Josipa	Brekalo	Koncar D&ST	Member
Alfredo	Carrizales	Prolec GE	Member
David	Caverly	Trench Limited	Member
Nikolaus	Dillon	Dominion Energy	Member
Egui	Espitia	Reinhausen Manufacturing Inc	Member
Jean Carlos	Hernandez-Mejia	NEETRAC Georgia Tech	Member
Saif	Hossain	Trench Canada	Member

Kurt	Kaineder	TRENCH	Member
Dmitriy	Klempner	Southern California Edison	Member
Matija	Koprivnjak	Končar D&ST	Member
Krzysztof	Kulasek	Delta Star Inc.	Member
Aleksandr	Levin	Weidmann	Member
Parry	lively	Tempel	Member
Xose	LOPEZ-FERNADEZ	Universidade de Vigo	Member
Geraldo	Magela junior	Siemens-Energy	Member
Geraldo	Magela Júnior	Siemens-Energy	Member
Mike	Nolte	Kiewit	Member
Anastasia	OMalley	Consolidated Edison Co NY	Member
Klaus	Pointner	Trench Austria GmbH	Member
Kabir	Sethi	Hitachi Energy Germany Ag	Member
Jason	Snyder	FirstEnergy	Member
SANJIB	SOM	PTT, LLC	Member
Marc	Taylor	JFE Shoji Power Canada	Member
Valentina	Valori	Hitachi Energy	Member
Richard	VonGemmingen	Dominion Energy	Member
Alan	Washburn	Burns & McDonnell	Member
Joshua	Watson	NPPD	Member
Stefan	Wirth	Coil Innovation GmbH	Member
Terry	Wong	Trench Limited	Member
Kris	Zibert	Allgeier Martin	Vice Chair

J.10 Performance Characteristics Subcommittee Attendance List

First Name	Last Name	Affiliation	Role
Sanjib	Som	PTT	Chair
Kris	Zibert	Allgeier Martin	Vice Chair
John	Wagner	AEP	Secretary
Kayland	Adams	Prolec-GE Waukesha	Member
Tauhid	Ansari	Hitachi Energy	Member
Stephen	Antosz	Consultant	Member
Javier	Arteaga	Hitachi Energy	Member
Onome	Avanoma	MJ Consulting	Member

Robert Casey	Ballard	DuPont	Member
Gilles	Bargone	FISO	Member
Enrique	Betancourt	Prolec ge	Member
Daniel	Blaydon	Baltimore Gas & Electric	Member
Jeffrey	Britton	Doble Engineering	Member
Alfredo	Carrizales	Prolec GE	Member
Craig	Colopy	Retired from EATON	Member
Juan Carlos	Cruz Valdes	PROLEC GE	Member
Sami	Debass	EPRI	Member
J Arturo	Del Rio	HSP-US	Member
Nikolaus	Dillon	Dominion Energy	Member
Samragni	Dutta Roy	Siemens Energy Inc	Member
Evgenii	Ermakov	Hitachi Energy	Member
Reto	Fausch	RF Solutions	Member
Hugo	Flores	Ermco	Member
Jose	Gamboa	The H-J Family of Companies	Member
Eduardo	Garcia Wild	Siemens Energy	Member
Rob	Ghosh	GE Vernova	Member
Ramsis	Girgis	Hitachi Energy	Member
Bill	Griesacker	WGA	Member
Saramma	Hoffman	PPL	Member
Phil	Hopkinson	HVOLT Inc.	Member
Saif	Hossain	Trench Canada	Member
Nick	Jensen	Delta Star	Member
John	John	Virginia Transformer Corp.	Member
Sheldon	Kennedy	Sheldon P Kennedy Engineering	Member
Moonhee	Lee	Hammond Power Solutions	Member
Aleksandr	Levin	Weidmann	Member
Weijun	Li	Braintree Electric Light Department	Member
José Luis	Machain	Prolec GE	Member
Jim	McBride	JMX High Voltage	Member
Thomas	Melle	HIGHVOLT	Member
Francis	Mills	POWER Engineers	Member
Emilio	Morales-Cruz	QUALITROL	Member
David	Murray	TVA	Member

Ryan	Musgrove	Oklahoma Gas & Electric	Member
Aniruddha	Narawane	Eaton	Member
Kris	Neild	Megger	Member
Poorvi	Patel	EPRI	Member
Harry	Pepe	Phenix Technologies	Member
Klaus	Pointner	Trench Austria GmbH	Member
Ion	Radu	Hitachi Energy	Member
Rodrigo	Ronchi	WEG Transformers México	Member
Marnie	Roussell	Entergy	Member
Hakan	Sahin	Virginia transformer	Member
Amitabh	Sarkar	Virginia Transformer Corporation	Member
Daniel	Sauer	Eaton	Member
Markus	Schiessl	SGB	Member
ewald	schweiger	siemens energy	Member
Michael	Sharp	Trench Limited	Member
Christopher	Slattery	FirstEnergy	Member
Steven	Snyder	Hitachi Energy	Member
Kyle	Stechschulte	AEP	Member
Charles	Sweetser	Omicron	Member
Janusz	Szczechowski	Maschinenfabrik Reinhausen GmbH	Member
Ed	teNyenhuis	Hitachi Energy	Member
Ajith	Varghese	Prolec GE Waukesha	Member
Jason	Varnell	Doble Engineering	Member
Dharam	Vir	PROLEC GE	Member
Richard	VonGemmingen	Dominion Energy	Member
Pragnesh	Vyas	Cleveland Cliffs	Member
David	Wallach	Duke Energy	Member
Joe	Watson	JD Watson and Associates	Member
Bruce	Webb	Knoxville Utilities Board	Member
Jeffrey	Wright	Duquesne Light	Member
Joshua	Yun	Virginia Transformer Corp	Member
Peter	Zhao	Hydro one	Member
Waldemar	Ziomek	PTI Transformers LP	Member
Nabi	Almeida	Prolec GE	Guest
Mihirkumar	Amin	Eaton	Guest

Elise	Arnold	SGB	Guest
Prudhvi Anand	Bhattiprolu	AES	Guest
Michael	Botti	Hyosung HICO	Guest
Josipa	Brekalo	Koncar D&ST	Guest
Steven	Brzoznowski	BPA	Guest
Wilerson	Calil	Hitachi Energy	Guest
David	Caverly	Trench Limited	Guest
Michael	Craven	Qualus	Guest
Janet	Crockett	Fayettville PWC	Guest
Eric	Davis	Consultant	Guest
Luiz	de Oliveira	Hitachi Energy	Guest
Scott	Dennis	Hitachi Energy	Guest
Durnitru	Diaconu	Delta Star Inc.	Guest
Dumitru	Diaconu	Delta Star Inc	Guest
Scott	Digby	Duke Energy	Guest
Luc	Dorpmanns	Royal SMIT Transformers	Guest
Zachary	Draper	Delta-X Research	Guest
Will	Elliott	AEP SWEPCO	Guest
Eric	Elson	San Diego Gas and Electric	Guest
Egui	Espitia.	Reinhausen Manufacturing Inc	Guest
Miguel	Fernandez	Braintree Electric	Guest
Raymond	Frazier	Ameren	Guest
Alan	Fujimori	Romagnole	Guest
Shawn	Gossett	Ameren	Guest
Benjamin	Guinand	Power Magnetics Inc	Guest
Vijay	Gunja	Powertechlabs	Guest
Peter	Heinzig	Weidmann	Guest
Ryan	Hogg	Bureau of Reclamation	Guest
Miljenko	Hrkac	Hitachi Energy	Guest
Jose	Izquierdo	Siemens energy	Guest
Donghyun	Jang	LS ELECTRIC	Guest
Patrycja	Jarosz	IEEE SA	Guest
chanmin	Jeong	HD hyundai	Guest
Laszlo	Kadar	Laszlo & Associates	Guest
Kurt	Kaineder	Trench	Guest

Heonsu	Kim	LS Electric	Guest
Gary	King	Consultant	Guest
Egon	Kirchenmayer	Siemens Energy	Guest
Dmitriy	Klempner	SCE	Guest
Matija	Koprivnjak	Končar D&ST	Guest
Nihat	Kosedagi	ERMCO	Guest
Arvind	Kumar	Delta Star Inc.	Guest
Arvind	Kumar	Delta Star inc	Guest
Bernard	LaBean Jr	Consumers Energy	Guest
Andrew	Larison	Hitachi Energy	Guest
ANDREW	LAWLESS	Potencia Partners	Guest
Fernando	Leal	PROLEC GE	Guest
Ricardo	Lopes	Efacec	Guest
Libardo	Lopez	Hitachi Energy	Guest
XOSE	Lopez-Fernandez	UNIVERSIDADE DE VIGO	Guest
Geraldo	Magela junior	Siemens-energy	Guest
Moses	Manzano	Hyosung HICO	Guest
Alberto	Martinez	WEG Transformers USA	Guest
Omar	Mendez	Prolec	Guest
Juliano	Montanha	Siemens Energy	Guest
Marta	Munoz	Hitachi Energy	Guest
Fredy	Murcia	Siemens Energy	Guest
Ali	Naderian	Consultant	Guest
Shankar	Nambi	Bechtel Energy, Inc.	Guest
Nam Tran	Nguyen	TT Electronics	Guest
Rudolf	Ogajanov	Hitachi Energy	Guest
Juan	Ortiz	Reinhausen Manufacturing	Guest
Ashwin	Padmanaban Iyer	STP	Guest
Jaeyong	Park	LS Electric	Guest
Dean	Park	Hyosung Hico	Guest
Monil	Patel	Pacific Gas and Electric	Guest
Sanjay	Patel	Royal Smit Transformers	Guest
Pedro	Pedro	Efacec Energia	Guest
MARCELINO	PEREZ	PROLEC	Guest
Luka	Peuc	Končar D&ST	Guest

Christoph	Ploetner	Siemens Energy	Guest
Nocholas	Post	WEC Energy Group	Guest
Bertrand	Poulin	Hitachi Energy	Guest
Thomas	Propts	Dominion Energy	Guest
Jonathan	Reimer	FortisBC	Guest
David	Reyes	Oncor	Guest
Juan	Rodriguez	Magnetron	Guest
hyounggon	Ryu	HD Hyundai electric	Guest
Dinesh	Sankarakurup	Duke Energy	Guest
Alfons	Schrammel	Siemens Energy	Guest
Cihangir	Sen	Duke energy	Guest
Kabir	Sethi	Hitachi Energy Germany Ag	Guest
Stephen	Shull	BBC Electrical Services,LLC	Guest
Stefan	Siebert	BROCKHAUS	Guest
Amitkumar	Singh	Conedison	Guest
Jimmy	Smith	Howard Industries	Guest
Jason	Snyder	FirstEnergy	Guest
Markus	Stank	MR	Guest
Hampton	Steele	TVA	Guest
Andy	Steineman	Delta Star, Inc.	Guest
Janusz	Szczechowski	Maschinenfabrik Reinhausen GmbH	Guest
Jonathan	Tan	Northern Transformer	Guest
Troy	Tanaka	Burns & McDonnell	Guest
Erik	Tarango	Olsun electric	Guest
Val	Tatu	Powersmiths	Guest
Marc	Taylor	JFE Shoji Power Canada	Guest
Andreas	Thiede	HIGHVOLT Dresden	Guest
Scott	Thomas	Hitachi Energy	Guest
Fernando	Tirado	Prolec GE	Guest
Eduardo	Tolcachir	TTE transformers	Guest
Leonard	Torchia	PSE&G	Guest
Valentina	Valori	Hitachi Energy	Guest
Joshua	Verdell	ERMCO	Guest
Hector	Villa	Ecuatran SA	Guest
Matt	Weisensee	PacifiCorp	Guest

Paul	Weyandt	Schneider Electric	Guest
Joe	White	POWER Engineers	Guest
Kayla	Whitesel	Delta-X Research	Guest
Calil	Wilerson	Hitachi Energy	Guest
Terry	Wong	Trench Limited	Guest
Terry	Wong	Trench Limited	Guest
Jiahao	Xie	S&C Electric Company	Guest
Fei	Yang	Hitachi Energy	Guest
Hongzhi	Zhang	Hitachi Energy	Guest