Annex J Performance Characteristics Subcommittee (PCS)

October 25th, 2023, Westin Crown Center, Kansas City, MO

UNAPPROVED MINUTES

Chair: Rogerio Verdolin
Vice Chair: Sanjib Som
Secretary: Kris Zibert

J.1 Introduction / Attendance

Quorum was achieved with 81 members present (78% in attendance). In addition, 91 guests were present at the meeting. The total attendance at the meeting was 172. 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 Vancouver, British Columbia, Canada, March 10-14, 2024.

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.

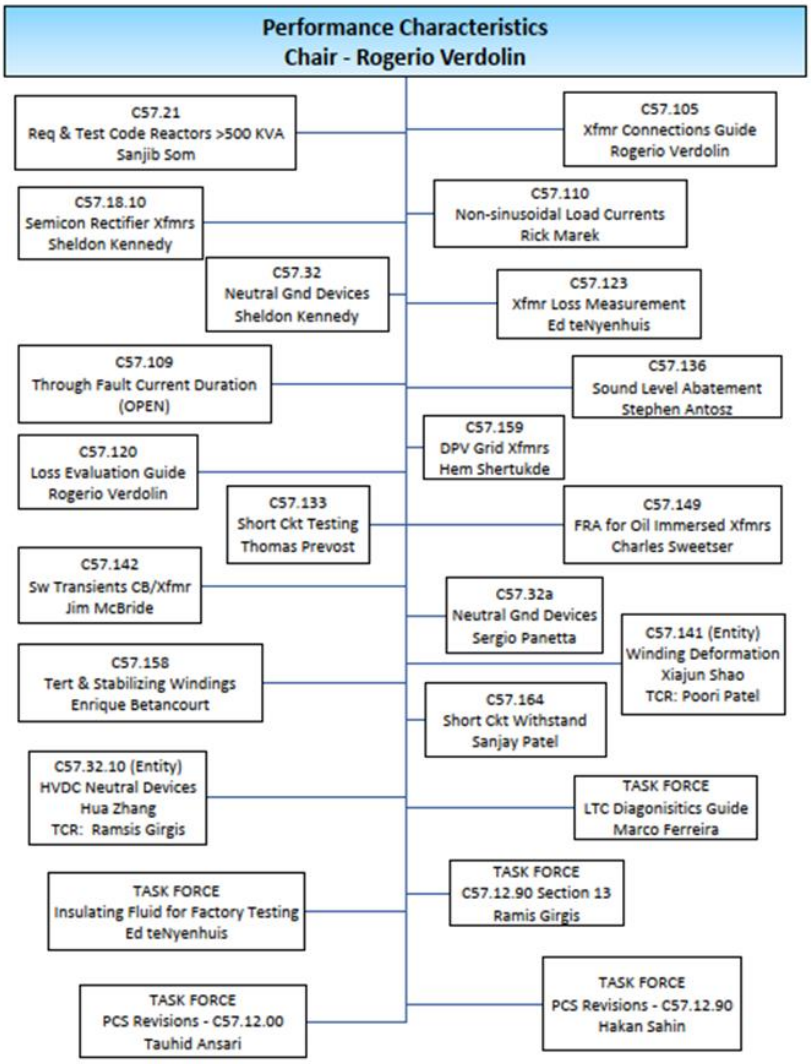
The Chair asked anyone with new business to submit said business in writing prior to the meeting.

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
- C57.12.90-2015 – 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
- C57.32a – Neutral grounding devices – S. Panetta
- C57.32.10 - new Entity PAR - 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

- C57.133-exp – Guide for Short Circuit Testing (Expired – now covered by C57.12.90) – T. Prevost
- 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 – New SFRA Guide (2022) – C. Sweetser
- C57.158 – Tertiary & Stabilizing Windings (2027) – E. Betancourt
- C57.159 – DPV Transformers (2026) – H. Shertukde
- C57.164 – Short Circuit Withstand (in development) – 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

Status of Active PAR's:

- 2023 PAR's
- 2024 PAR's
  - C57.32.10 Entity WG Guide for the Selection of Neutral-Grounding Devices for HVDC Converter Transformers (PAR Extension Requested)
  - C57.105-2019/Cor 1 (Submitted to RevCom)
  - C57.149 SFRA Guide (Comment Resolution)
- 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 (New WG)
  - C57.158 Application of Tertiary and Stabilizing Wdgs Guide (New WG)

Status of Standards without active PARs

- C57.159-2016 – DPV Transformers (2026)
- 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 – Xfrmr 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 – Audible Sound Guide (2033)

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 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

Performance Characteristics Subcommittee Meeting Minutes

- Name of the group, time, date, and location of meeting
- Officers' names, meeting participants, and member status
- 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 mover 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 8 Members missed more than 2 consecutive meetings and have been moved to "Guest" status:

- Bruce Forsyth
- Deepak Kumaria
- Rashid Minaz
- Afshin Rezaei-Zare
- Thomas Hartman
- Xose Lopez-Fernandez
- Rhea Montpool
- Shukdev Walia

Please contact Sanjib 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 Spring 2023 meeting and have attended 3 of the past 5 meetings:

- Juan Carlos Cruz Valdes
- Samson Debass
- Nicolas Jensen
- Richard vonGemmingen
- Pragnesh Vyas

Attendance / Membership – Quorum determination

- Current breakdown of the Subcommittee:
  - 103 Members
  - 52 are needed for a quorum
- Quorum was established with 81 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 D. Sauer and seconded by W. Binder. The motion passed by unanimous consent.

J.4 Approval of Last Meeting Minutes

The Chair presented the minutes of meeting held in March 2023 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 P. Hopkinson and seconded by H. Shertukde. 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).

- **TF CO2 Emissions in the Construction of Transformers** **J. Kazmierczak**
- **TF Audible Sound Rev to Test Code** **R. Girgis**
- **TF Continuous Revisions to C57.12.00** **T.Ansari**
- **TF Inverter Transf Precautions on Ground Shields 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**

Below are highlights that were discussed at the PCS meeting:

1) **TF CO2 Emissions in the Construction of Transformers** **J. Kazmierczak**
    - This was the first meeting of this TF.
    - The agenda was reviewed followed by review of the patent and copyright policy.
    - Introduction of officers was made.
    - Introduction of attendees was made with a total of 66 attendees present.
    - Request for membership was made. Fifty-three attendees requested membership.
    - Review of the motion from Spring Meeting 2023 was completed.
    - Presentation “Decarbonization & Government Oversight” was given by Elise Arnold.
    - Presentation “Environmental Life-Cycle Assessments of Transformers – Why and How?” was given by Ghazi Kablouti.
    - A proposed draft Title and scope for a possible guide was presented. However, in the discussion, it was mentioned that the focus of the meeting should be if the attendees recognized the need to from a working group on the topic.
    - A motion was made by E. teNyenhuis (Hitachi Energy) to proceed to make a recommendation to continue with the guide for the topic. L. Cheim (Hitachi Energy) seconded. A vote was taken: 46 for, 0 against, 2 abstentions.
    - E. teNyenhuis made a motion to create a PAR study group for a guide tentatively titled “Environmental impacts of Transformer Manufacturing”. Seconded by P. Patel. Passed by unanimous consent.

2) TF Audible Sound Code Revision **R. Girgis**

- Chair of the WG that developed the Noise Guide (C57.136), S. Antosz, reported that the Guide was approved for publication in April of 2023.
- Chair gave an overview of the changes and additions to the text of Clause 13 of C57.12.90 in response to 3 Technical Comments previously received when C57.12.90 was originally balloted.
    - Requirement to measure Core noise at highest noise-producing condition (s) – ***Replaced "upon request by customer" by "Shall"***
    - Measuring Load noise for ONAN – only Rated Transformers – **ONAN Contour**
    - Method of adding ambient Sound pressure level measurements – **Logarithmic**
- Motion by S. Antosz to accept as written the three items that Ramsis just presented and approve them to be moved to the WG for Continuous Revision of C57.12.90 in the Standards Subcommittee for inclusion in the next revision of C57.12.90, Clause 13. These items have already been thoroughly discussed in the Task Force and have been approved at the Task Force level.
- P. Hopkinson seconded. Clarification was made that the items would be forwarded to the WG for Continuous Revision of C57.12.90 for inclusion in the next publication. The motion passed by unanimous consent.
- Chairman presented data on Sound Level values of several Power transformers measured at 5 different factories using both the Sound Pressure method and the Sound Intensity method. The data showed that, when these two methods are used per the IEEE Standard C57.12.90 (Clause 13), the measured sound levels are within 0.5 dB or less.
- New Business
    - The chairman presented the need for measuring sound levels of Preventive Autos (PAs) prior to installing into the main transformer.
    - A great number of attendees expressed their opinion and gave feedback on a wide range of issues related to this subject.
    - The main objective of this TF will be to develop a methodology to measure the sound level of PAs, not to establish required sound levels of the PAs.
    - In the next meeting, data on PA noise will be presented by the chairman and by members of the TF.

3) TF Continuous Revisions to C57.12.00 **T. Ansari**

- Meeting Date/Time: October 23, 2023, 3:15 PM
- Co-Chair: Enrique Betancourt (Prolec GE). Secretary: Mats Bernesjo (Hitachi Grid)
- After scope and purpose of the Group, the Chair presented IEEE Copyright and Patent statements, with no issues raised by Members present.
- 106 total attendees, consisting of 42 (out of 58) Members and 64 Guests, so a quorum was achieved; 32 Guests requested membership. Agenda and Minutes from previous meeting were unanimously approved.

- Highlights
    - Old Business
        1. WG Item 112, Clarification on ±0.5% tolerance of ratio of three-phase transformers, originally submitted by Ryan Musgrove.
            - A TF was created to investigate the subject and propose response. The Group, led by Dan Sauer, provided report to the Group. The TF presented two proposals: 1) Keep the existing text in the Standard as is, 2) Change text to include that the individual phases should be the same for same design turns ratio.
            - From the two options, Option 1 (leave text in C57.12.00 "as is") was approved by the Group. In other words, no tolerance will be proposed for difference of turns ratio between individual phases.
        2. WG Item 113, Measurement of auxiliary loss, submitted by Ajith Varghese: "disconnect noticed between what different manufacturers are doing for measuring auxiliary and control losses – based on how 'integral parts of transformers' is interpreted."
            - A TF led by Ajith Varghese developed following proposed new text: ***If the device cannot be energized or not present at the time of auxiliary loss measurement, the power information from the data sheet of device shall be identified and included in the total auxiliary losses.***
            - Bottom line of the discussion: all losses consumed by the transformer (losses drawn by heaters, tap changer motor, fans, light, etc.) must be considered in the total losses of the transformer, and that the control cabinet must not trip when all accessories are loaded.
            - After a long debate, a motion to approve the new text did not pass. The Chair will review other options with Ajith.
    - New Business
        1. With no New Business, the meeting was adjourned at 4:30 PM.

4) TF on Inverter Transf Precautions on Ground Shields C57.159 H. Shertukde

- Vice Chair: Phil Hopkinson, Secretary: Rhea Montpool
- The first task force meeting for the revisions of this Guide
- The Guide currently expires 12/31/2026
- The TF met as schedule. The meeting was attended by 49 people. This was the first meeting of the TF; no quorum was required. The agenda was presented.
- Patent and Copyright slides were presented. No patent nor copyright concerns were communicated.
- Phil Hopkinson gave a presentation regarding Analysis and Integration of Yy padmount transformer heading in a solar PV farm.
- Discussion after the presentation indicated that a PAR study group was needed to revise or reaffirm the title and scope.
- PAR request will be submitted for approval prior to Spring 2024 meeting.

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

- Vice Chair: Pugazhenthi Selvaraj, Secretary: Adam Sewell
- Meeting started on time at 9:30 am on Tuesday, Oct 24, in the Century A Ballroom
- Total attendance = 103, Members: 35, Guests: 68, Guests Requesting Membership: 23
- Quorum: 35/53 members were present; quorum was achieved
- Approved all pending previous unapproved meeting minutes and the meeting agenda
- Discussions on the new business to revise Clause 5.1: Determination of cold **temperature**, under Clause 5: Resistance measurements continued
- TF members agreed by vote to form a TF and produce a proposal to revise this clause to introduce better methods to record cold temperature for resistance measurements, as this is a critical item for temperature rise test. Volunteers selected and TF formed.
- Meeting adjourned at 10:15 am

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

- Vice Chair: Xose Lopez-Fernandez; Secretary: Tom Melle
- Met Tuesday, October 24, at 11:00 AM CDT in Kansas City, MO
- Welcome and Chair's Remarks
- Circulation of Attendance Sheets (25 of 48 Members were present – quorum was achieved. 77 guests with 14 requesting membership)
- IEEE Patent Policy Slides (no patent claims)
- Meeting Agenda and Minutes from Spring 2023 Meeting (Approved)
- C57.142 Ballot status and Comment Resolution – Jim McBride
    - Total Comments: 305
    - Addressed Comments: 282; Need Resolution for Remaining
    - Comments: 23
    - All Figures have been redrawn
    - Draft 11 has been completed and incorporates all the 276 addressed comments
- CRG is reviewing all comments remaining. The group has members from both the Transformers and Switchgear Committees
- All comment resolution group documents will be posted on the WG website
- Switchgear Liaison TF – No Task Force meeting held as the Guide is in Ballot Resolution
- Mitigation Methods Task Force Update – the full list of proposed mitigation methods was presented as well as a lengthy discussion with key comments about testing and modeling of STLI and other special impulse tests
- Motion to develop a complete presentation including possible panel discussion for a future Transformers Committee tutorial session was approved
- Meeting adjourned at 12:15 PM CDT

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

- Co-Chair: Xose M. Lopez-Fernandez (Universidad de Vigo), Secretary: Kayland Adams (Prolec GE)
- Meeting Date/Time: October 24, 2023; 4:45 PM
- After scope and purpose of the Group, the Chair presented IEEE Copyright and Patent statements with no issues raised by Members present

- There were 62 Total Attendees, 37 of them requesting Membership. Being the first meeting of the Group, Membership was granted, and the Group started regular business. The Agenda for the meeting was accepted with no comments
    - Highlights
        1. The Chair introduced the Group background information about current document C57.158, first published in 2017. It was clarified that this is a Revision of the document, with intention to update references and harmonize the document with new published literature. Some new topics will also be considered by the Group for potential inclusion in the document.
        2. A presentation on the subject of "Y-Connected Transformers without a Tertiary Winding" was presented by Dr. Xose Lopez-Fernandez, explaining thermal effects on structural parts of the transformer during zero-sequence excitation events.
            - Meeting attendees stated questions regarding the type of analysis performed and shared experiences related to applications with and without tertiaries and stabilizing windings.
        3. The Chair presented a preliminary timetable to produce a Draft to be sent to IEEE SA RevCom before Dec 2027. Group's work will be organized through Task Forces that will identify and address proposed improvement areas to the document. The Chair will distribute by email statement of work for those TFs to give Members opportunity to sign up on them.
        4. It was recognized by the Group that access to some in IEEE published material will be required and the Chair will approach IEEE TC officers to get advice on the process. It was also recognized that it would be very valuable if utility participants could share more practical experiences.
- With no New Business, the meeting was adjourned at 5:45 PM

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

- Vice Chair: Tom Melle, Secretary: Ed teNyenhuis
- Met October 24, 4:45 PM – 6:00 PM
- Circulation of Attendance Sheets
    - Quorum achieved – 14 of 23 Members; 18 Guests present; 7 guests requesting membership
- Approval of Minutes from previous Meeting
    - Correction to 23 members and 2 guests instead of 25 members at the first meeting.
    - Motion to approve amended minutes by Sergio Panetta, Second by Mike Sharp – motion passed without objection
- Reports from TF Leader Assignments
    - Section 4 – Neutral Grounding Reactors – Camilo Casallas, Saif Hossain
        - The proposed sections to change were reviewed in the WG. These sections will be worked on by the TF.

    - Section 5 – Neutral Ground Fault Neutralizers – Klaus Pointner
        - It is planned to make this section consistent with IEC 60076-6 which is presently in the CD stage. These sections will now be worked on by the TF.
    - Section 6 – Neutral Grounding Transformers – Don Ayers, Jusuf Krvavac
        - This work has begun and will be completed before the next meeting.
    - Section 7 – Neutral Grounding Resistors – Ryan Hogg, Sergio Panetta
        - The TF has held 7 meetings so far and is processed 60% of the comments.
    - Section 8 – Combination Devices – Sergio Panetta, Jusuf Krvavac
        - No meetings have been held yet but the items to change have been noted.
- All task force chairs are to forward future remote meeting invitations to Ed teNyenhuis for circulation to the entire working group.
- We need more input from users or other device manufacturers.
- Old Business
    - Preliminary discussions of different test sections including impedance of zig-zag transformers (Sergio Panetta); relationship of HVDC and instrument transformers to NGT's and the possible inclusion of the effects of switching transients in the new Standard (Jim McBride and Tom Melle).
    - Brief discussion of the importance of the test sections of C57.12.00 and 12.90. Further discussion of whether it may be possible to create a single section for all tables containing test voltages; the Vice Chair and Chair commented that this was considered in the prior revision of the Standard and found to be difficult considering the variety of Neutral Grounding Devices.
- No New Business
- Next in-person meeting – Spring 2024 (IEEE TC March 10-14, 2024 in Vancouver, BC)
- Adjournment at 5:47 PM CDT (Motion by Ryan Hogg, Seconded by Tom Melle)

J.6 Unfinished (Old) Business

There was no unfinished business.

J.7 New Business

- S. Kennedy gave a brief overview of possible concerns regarding Power Transformers connected to Battery Energy Storage Systems (BESS). The Subcommittee is seeking input from manufacturers and users of BESS transformers to see if there is a need for material to be inserted into any standards that fall under PCS.
    - P. Zhao suggested from a user prospective that an application guide would be helpful and is needed.
    - J. Yun discussed that the application is very rare from his perspective as a manufacturer.
    - J. Watson mentioned in his experience issues are more with protection of the transformer and control of LTCs. He
    - K. Singh asked what the definition of a BESS transformer would be.
    - S. Kennedy stated that it would be a large transformer >125 MVA.
    - S. Som asked if a single line diagram would be available to determine where it is connected.

    - S. Kennedy stated he did not believe it was connected directly to an inverter so wouldn't fall under C57.18.10.
- K. Vijayan made a motion to refer the topic to the TF Reverse Power Flow Effects. Seconded by S. Kennedy.
    - K. Singh stated that he believes the application is not a reverse power flow. In his experience charging comes from the Bulk Electric System, but power is discharged directly into a feeder system, not back through the power transformer.
    - K. Vijayan stated it should be bi-directional power flow.
    - S. Som asked that users submit an SLD.
    - D. Blaydon stated that the TF Reverse Power Flow Effects has a narrow scope and is not set up to take on more work that is outside the scope. The TF is also under the Standards Subcommittee so PCS may not be able to assign the work.
    - D. Sauer made a motion to table the motion indefinitely. C. Slattery seconded.
        - W. Ziomek stated there are not standards for collector transformers.
        - Motion was approved by unanimous consent.

J.8 Adjournment

- The meeting was adjourned at 4:20PM**.**

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

J.9.1 TF CO2 Emissions in the Construction of Transformers

Meeting Date/Time: Monday, October 23, 2023, 9:30 AM to 10:45 AM CDT
Meeting Location: Kansas City, Missouri
Chairman: J. Kazmierczak (Hitachi Energy)
Vice Chair: Ismail Guner (Hydro Quebec)
Secretary: Elise Arnold (SGB SMIT)

- This was the first meeting of this task force.
- A call to order was made, the agenda was reviewed and followed by review of the patent and copyright policy. The agenda was approved.
- Introduction of officers was made.
- Introduction of attendees was made, with a total sixty-six attendees present
- Request for membership was made. Fifty-three attendees requested membership.
- Review of the motion from Spring Meeting 2023 was completed
- Presentation "Decarbonization & Government Oversight" was given by Elise Arnold
- Presentation "Environmental life-cycle Assessments of Transformers – Why and How?" was given by Ghazi Kablouti
- A proposed draft Title and scope for a possible guide was presented
- However, in the discussion, it was mentioned that the focus of the meeting should be if the attendees recognized the need to form a working group on the topic.

- A motion was made by Ed teNyenhuis (Hitachi Energy) to proceed to make a recommendation to continue with the guide for the topic. Luiz Cheim (Hitachi Energy) seconded.
- A vote was taken: 46 for, 0 against, 2 abstentions.
- After the vote was taken and the motion passed, the meeting was recessed at 10:45.
- The next meeting will take place in Vancouver, BC Canada during spring IEEE Transformer Committee Meeting scheduled for March 10-14, 2024.

List of Meeting Attendees from Fall 2023 meeting (including affiliation & member status).

Daniel	Aleksandrowicz	Hitachi Energy	Member
Tauhid Haque	Ansari	Hitachi Energy	Member
Elise	Arnold	SGB SMIT	Officer -Secretary
Mats	Bernesjo	Hitachi Energy	Member
William	Boettger	Boettger Transformer Consulting LLC	Member
Robert	Bracun	KPT	Member
Wilerson	Calil	Hitachi Energy	Guest
Camilo	Casallas	Trench Ltd.	Member
Luiz	Cheim	Hitachi Energy	Member
David	Coverly	Trench	Member
Roberto	Da Silva	Cargill	Member
Pooneh	Davoodi	Delta Star	Member
Scott	Digby	Duke Energy	Guest
Nikolaus	Dillon	Dominion Energy	Member
Luc	Dorpmanns	Royal Smit Transformers	Member
Raymond	Frazier	Ameren	Member
Miguel	Garcia	Hitachi Energy	Member
Alexander	Gaun	Coil Innovation	Member
Orlando	Geraldo	HJ Family of Companies	Member
Ramsis	Girgis	Hitachi Energy	Member
Jeff	Gragert	Xcel Energy	Guest
Ismail	Guner	Hydro Quebec	Officer - Vice Chair
Saif	Hossain	Trench Ltd.	Member
Avila	Hugo	Hitachi Energy	Member
Jeremy	Johnson	Burns & McDonnell	Member
Ghazi	Kablouti	Hitachi Energy	Member
Kurt	Kaineder	Trench Austria	Member
Sergiusz	Kapka	Hitachi Energy	Guest
Jerzy	Kazmierczak	Hitachi Energy	Officer - Chair
Zan	Kiparizoski	Howard Industries	Member
Egon	Kirchenmayer	Siemens Energy	Member
Krzysztof	Klasek	Delta Star	Member
Klaus	Koeck	Trench Austria	Guest
Ivan	Konta	Koncar Instrument Transformers	Member
Rafal	Kowalski	Hitachi Energy	Member
Mark	Lachman	Doble	Guest
Fernando	Leal	Prolec GE	Member
Stephanie	Mabrey (Denzer)	Weidmann Electrical Tech	Member
Not Legible	Makon	WEG USA	Member
Kalakrishnan	Mani	ITEC	Member

Brian	McBride	Cargill	Member
Justin	Minikel	Eaton	Guest
Emilio	Morales-Cruz	Qualitrol	Member
Masta	Munoz	Hitachi Energy Spain	Member
Paul	Mushill	Ameren	Guest
Anastasia	O'Malley	Consolidated Edison NY	Guest
Rakesh	Patel	Hitachi Energy	Member
Poorvi	Patel	EPRI	Member
Jay	Pidcock	Ameren	Guest
Klaus	Pointner	Trench Austria GmbH	Member
Bojan	Popovic	Koncar	Member
Michael	Richardson	Ameren	Member
Rodrigo	Ronchi	WEG Transformer	Member
Dinesh	Sankarakurup	Duke Energy	Member
Alan	Sbravati	Hitachi Energy	Guest
Markus	Schiessl	SGB	Member
Ewald	Schweiger	Siemens Energy	Member
John	Sen	Duke Energy	Member
Kabir	Sethi	Hitachi Energy	Member
Michael	Sharp	Trench LTD.	Member
Michael	Swiatkowski	Hitachi Energy	Member
Ed	Tenyenhuis	Hitachi Energy	Member
Rogerio	Verdolin	Verdolin Solution	Member
Dharam	Vir	Prolec GE	Member
Terry	Wong	Trench ltd.	Member
Evanne	Wong	Dupont	Member

J.9.2 TF "Audible Sound Revision to Test Code"

Unapproved Minutes of Fall 2023 TF "Audible Sound Revision to Test Code"

The TF met at 1:45 PM, on Monday, October 23, 2023. Dr. Ramsis Girgis, Chairman of the TF presided over the meeting, with Mats Bernesjo being the Secretary.

The Chairman welcomed the audience to this meeting and reviewed the agenda. The agenda was unanimously approved as was the unapproved minutes of the Spring 2023 TF meeting in Milwaukee (Steve Antosz 1st, Dan Sauer 2nd).

The TF meeting was attended by 23 out of 41 members and a total meeting attendance of 77. A quorum was established. 32 attendees requested membership at this meeting (listed below) **.

The Chairman asked the Chair of the WG that developed the Noise Guide (C57.136), Steve Antosz, to give an update on the status of the Guide. The Guide was approved for publication in April of 2023.

The Chairman then gave a short overview of the changes and additions to the text of Clause 13 of C57.12.90 in response to 3 Technical Comments previously received when C57.12.90 was originally balloted. These were approved in the spring meeting of this TF. Below is the approved proposed text in response to these 3 comments. Note that the text in red is the proposed updated / added text:

Item 1: Proposed modified text in response to comment on "Measuring no-load sound level at the highest sound producing tap position"

When a transformer is equipped with a tap changer, the transformer may, on certain tap changer positions, produce sound levels that are higher than the audible sound level at the rated tap position. For these transformers, the measurements shall be made with the transformer on the highest sound producing tap position.

Also, other excitation conditions may occur in service leading to lower, or higher, core noise. For example, transformers designed to operate with variable flux the core audible sound level is strongly impacted by the tapping position. The same is true for SVC transformers when connected to a Capacitive Load; Again, for these transformers, the measurements shall be made with the transformer operating at the highest sound producing condition.

Item 2: Proposed modified text – Clause 13.5.5.1 Measuring ambient sound pressure level

The ambient sound shall be measured at a minimum of four locations around the transformer immediately preceding and immediately following the sound measurements with the transformer energized. The ambient sound pressure level shall be established by calculating the Logarithmic average of measured values of the ambient sound pressure levels. The measuring instruments shall be in conformance with ….

Item 3: Proposed text for Clause 13.3.3.2: Load audible sound level

Proposed added text in red

Since load audible sound becomes a contributor to the total audible sound of the transformer at higher loads, the load audible sound level shall be measured at the ONAF measuring contour. For transformers with only an ONAN rating, load noise is to be measured at the ONAN Sound Measuring Contour.

As these are small changes / additions, it was agreed with the Chairman of the PCS, Mr. Rogerio Verdolin, to resent those at the PCS meeting to be formally surveyed at the upcoming meeting of this SC by show of hands to approve submitting these to the Standards SC.

The chairman then presented data on Sound Level values of a number of transformers measured at 5 different factories using both the Sound Pressure method and the Sound Intensity method. The data showed that, when these wo methods are used per the IEEE Standard C57.12.90 (Clause 13), the measured sound levels are within 0.5 dB or less. In response to a question on whether this data was for ONAN noise levels, the chairman promised to present such data for ONAF measurements at the Spring 2024 meeting in Vancouver, BC.

As a new business, the chairman presented the need for measuring the sound level of Preventive Autos (PAs)

prior to installing it into the main transformer. A great number of attendees expressed their opinion and gave feedback on this subject. The following are the results of the discussion that took place at the meeting:

1. The objective of this TF is to develop a methodology to measure the sound level of the PA, not to establish required sound levels of the PAs.

2. The chairman promised to present at the next meeting comprehensive data on this subject. The data will help appreciating the significance of the issue and will contribute to the method of measuring the sound level of PAs. He asked other manufacturers and customers who have data on measured sound levels of PAs before installing them into the main transformer to share this data with the chairman, so he can arrange for them to present this data at the next meeting of the TF.

3. Most of the attendees supported requiring measuring sound levels of PAs, but some objected on the basis that such tests are related to the quality of components of the transformer.

4. There is a need to determine what limit (s) can be used for Sound Levels of PA (s).

5. For transformer manufacturers who build their own PAs, the noise test would need to be perform just before installing the PA into the main transformer. For transformer manufacturers who buy PAs from PA manufacturers, the noise test would need to be performed both at the PA manufacturer as well as by the manufacturer of the main transformer just before the PA is installed into the main transformer.

6. Regarding where to include the text of such a test, the following was suggested:

- In Clause 13 of C57.12.90
- As an Informative Annex to C57.12.90

The final decision on this will be dealt with in future meetings of the TF after data is provided and discussed. With no new additional business raised, the meeting was adjourned upon unanimous approval.

Respectfully submitted,

Mats Bernesjo, TF Secretary

Fall 2023 TF Meeting Attendance and Affiliation is as follows:

Kayland	Adams	Prolec GE Waukesha	Guest
Alex	AlAhmed	Evergy Wolf Creek	RM
Daniel	Aleksanderowicz	Hitachi Energy	RM
Stephen	Antosz	Stephen Antosz & Associates, Inc	Member
Elmurdo	Arevalo	BPA	RM
Elise	Arnold	SGB	Member
Onome	Avanoma	MJ Consulting	Member
Hugo	Avila	Hitachi Energy	RM
Duvier	Bedoya	Hitachi Energy	RM
Mats	Bernesjo	Hitachi Energy	Secretary
Enrique	Betancourt	Prolec GE	Member
Edwin	Betancourt	Siemens Energy	RM
William	Boettger	Boettger Transformer Consulting LLC	Member
Robert	Bracun	KPT	Guest
Darren	Brown	Howard Industries	Guest
Wilerson	Calil	Hitachi Energy	RM
Alfredo	Carrizales	Prolec GE	RM
Marcos	Czernorucki	Hitachi Energy	RM
Everton	De Oliveira	Siemens-Energy	Member
Scott	Dennis	Hitachi Energy	Member
Scott	Digby	Duke Energy	Member
Paul	Dolloff	East Kentucky Power	Guest
Sean	Fitzgerald	ComEd	RM
Hugo	Flores	Hitachi Energy	Member
Richard	Frye	Eaton	RM
Eduardo	Garcia Wild	Siemens Energy	Member
Ramsis	Girgis	Hitachi Energy	Chair
Shawn	Gossett	Ameren Illinois	Guest
Derek	Hollrah	Burns & McDonnell	RM
Sergiusz	Kapka	Hitachi Energy	RM
Nathan	Katz	Pacificorp	Guest
Egon	Kirchenmayer	Siemens-Energy	Guest

Rafal	Kowalski	Hitachi Energy	Guest
Andrew	Lawless	Potencia Partners	RM
Junho	Lee	Hyundai Electric	RM
Jose	Machain	Prolec GE	Guest
Daniel	Martinez	JFE Canada	RM
Matthews	Lee	Howard Industries	Guest
Francis	Mills	Power Engineers Inc	RM
Marta	Munoz	Hitachi Energy	RM
Joe	Nims	Allen & Hoshall	Guest
George	Partyka	PTI Transformers	RM
Nitesh	Patel	Hyundai Power Transformers USA	Member
Sylvain	Plante	HQ	RM
Klaus	Pointner	Trench Austria GmbH	Member
Dominic	Pollaro	NASS	Guest
Bajaij	Popovic	KPT	Guest
Juan	Reyos Perez	Hitachi Energy	RM
Michael	Richardson	Ameren	RM
Tim	Rocque	Prolec GE Waukesha	Guest
Marnie	Roussell	Entergy	Guest
Vinicius	Rubio	Hitachi Energy	RM
Dinesh	Sankarakurup	Duke Energy	Member
Daniel	Sauer	EATON Corporation	Member
Markus	Schiessl	SGB	Member
Cihangir	Sen	Duke Energy	Member
Kabir	Sethi	Hitachi Energy	RM
Hakim	Shamaun	WEG Trans USA	Guest
Stefan	Siebert	Brockhaus Measurement	RM
Kushal	Singh	ComEd	RM
Christopher	Slattery	FirstEnergy Corp.	Guest
Jimmy	Smith	Howard Industries	RM
Yong Tae	Sohn	Hyosung HICO	RM
Sanjib	Som	Pennsylvania Transformer	Member
H Allen	Steele	TVA	Guest
Andy	Steineman	Delta Star Inc.	Guest
Michal	Swiatkowski	Hitachi Energy	RM
Troy	Tanaka	Burns & McDonnell	RM
Marc	Taylor	JFE Shoji Power Canada Inc.	Guest
Ryan	Thompson	Burns & McDonnell	Guest
Anar	Tleoukoulov	Qualitrol	Guest
Ajith	Varghese	SPX Transformer Solutions, Inc.	Member
Jason	Varnell	Doble Engineering Co	Member
Krishnamurthy	Vijayan	PTI Transformers	Member
David	Wallach	Duke Energy	Member
Jeffrey	Wright	Duquesne Light	Guest
Kris	Zibert	Allgeier Martin	Guest

J.9.3 TF PCS Continuous Revisions to C57.12.00

PCS Task Force on General Requirements C57.12.00

Performance Characteristics Subcommittee
IEEE / PES Transformers Committee

October 23, 2023
Kansas City, Missouri (USA)

UNAPPROVED MINUTES

The PCS Task Force on General Requirements for C57.12.00 met at 3:15 PM on Monday, October 23, 2022. Chairman Tauhid Ansari presided over the meeting with Enrique Betancourt being the Vice Chair, and Mats Bernesjo acted as 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 42 members (out of 58), 64 guests, for a total meeting attendance of 106 persons, including 32 requests for membership at this meeting. A quorum was established with 42 / 58 = 72 % attendance.
The agenda was unanimously approved (1st Hugo Flores, 2nd San Sauer) as was the unapproved minutes (1st Hugo Flores, 2nd ?? ??) from the previous meeting (Spring meeting, Milwaukee 2023).

The following 32 guests requested membership:
Kayland Adams (Prolec GE Waukesha), Alex AlAhmed (Every-Wolf Creek), Elise Arnold (SGB), Duvier Bedoya (Hitachi Energy), Michael Botto (Hyosung HICO), Scott Dennis (Hitachi Energy), Samragni Dutta Roy (Siemens Energy), Raymond Frazier (Ameren), Saramma Hoffham (PPL), Ryan Hogg (USBR), Mike Iman (MGM Transformer Company) , Nathan Katz (Pacificorp), Jerzy Kazmierczak (Hitachi Energy), Sheldon Kennedy (Sheldon Kennedy Engineering), Junho Lee (Hyundai Electric), Moses Manzano (Hyosung HICO), Swapnil Marathe (Megger), Francis Mills (Power Engineers), Ali Naderian (Metsco), Nitesh Patel (Hyundai Power Transformers USA), Rodrigo Ronci (WEG Transformers USA), Fernando Salinas (Power Partners), Dugal Selvaraj (Virginia Transformers), Kabir Sethi (Hitachi Energy), AbdulMajud Shaikh (Delta Star Inc.), Yong Tae Sohn (Hyosung HICO), Michal Swiatkowski (Hitachi Energy), Ali Syed (ComEd), Andreas Thiede (Highvolt Pruftechnik Dresden), Scott Thomas (Hitachi Energy), Cole Van Dreel (ATC), and Devora Wiesel (Consolidated Edison).

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 112, Clarification on ±0.5% tolerance of ratio of three phase transformer

Originally submitted by Ryan Musgrove.

"During the Spring 2022 meeting in Denver, the motion "Create a TF to review Section 9.1 of C57.12.00 and provide recommendation on phase-to-phase ratio tolerance to this task force by Fall 2022" was proposed by Dan Sauer and seconded by Phil Hopkinson. A short discussion preceded the vote: 14 agree, 9 oppose, and 5 abstain. With only 28 votes (out of 33 members), the validity of the vote to pass the motion was questioned (Sanjib Som) since "abstain" votes does not count towards # of votes. A second quorum check (by raised hands) showed that a quorum was no longer maintained within the TF and hence, the motion to create a TF did not pass. However, Ryan Musgrove will spearhead a group with the support of Sanjay Patel."

The TF group was able to meet in both June and July of this year spearheaded by Dan Sauer. The outcome of the TF was two proposals. 1) Keep the existing text in the Standard as is, 2) Change text to include that the individual phases should be the same for same design turns ratio.
A very extensive and informative discussion including Utilities, Manufacturers, and Consultants was held. After a lengthy debate, Dan Sauer called the question which was seconded by Steve Antosz. A vote was held to select any of the two alternatives above. 31 voted "Approve" alternative 1 (keep the existing text as is). 3 voted "Abstain". Hence, the motion passed

WG Item 113, Measurement of Auxiliary Loss

Submitted by Ajith Varghese:

"I see there is some disconnect between what different manufactures are doing for measuring control losses – based on how one interprets "integral parts of transformers".

We can't have each and every component listed in IEEE, but I think there need to be some additional clarity needed. Some of the disconnects:

- Heaters
- When dual temp heaters, many are taking only one stage
- Heaters in Cubicles/bus duct (supplied with transformer) are not included
- Heaters in LTC cubicles
- Breathers
- Power for LTC Motor
- Power consumed by N2 generator
- Power consumed by Oil Filters.

Also – Need clarity of inrush/starting power needed for cooling fans, etc."

Present wording from C57.12.00 Sec 5.9.

> For Class II transformers (see 5.10), control/auxiliary (cooling) losses shall be measured and recorded. All stages of cooling, pumps, heaters, and all associated control equipment shall be energized, provided these components are integral parts of the transformer.

A very interesting and informative discussion was held on this topic with input from both Manufacturers, Utilities, and Consultants. The bottom line of the discussion seemed to be that all losses consumed by the transformer cooling fans / pumps must be included. A vote was held among the TF whether to approve the revised wording proposed (see Tauhid presentation). 22 votes opposed, 5 approved, and 3 abstain. Hence, the motion to accept the changes to the writeup was rejected.

The participants in the meeting agreed upon that Ajith Varghese & Tauhid Ansari will go through the wording one more time before the TF can vote on this topic. Chris Slattery (FirstEnergy) asked to be included to work with the Chairman on this topic.

New business

No new business was proposed.

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

Meeting was adjourned at 4:30 PM

Respectfully submitted,

Tauhid Ansari	Enrique Betancourt	Mats Bernesjo
WG Chair	Vice Chair	Secretary

Attendance Fall 2023 Meeting – PCS TF to Revision C57.12.00

Kayland	Adams	Prolec GE Waukesha	RM
Alex	AlAhmed	Evergy-Wolf Creek	RM
Daniel	Aleksanderowicz	Hitachi Energy	Guest
Tauhid Haque	Ansari	Hitachi Energy	Chair
Stephen	Antosz	Stephen Antosz & Associates, Inc.	Member
Elise	Arnold	Starkstrom Geratebau GmbH	RM
Javier	Arteaga	Hitachi Energy	Member
Alejandro	Ayala	Power Partners	Guest
Donald	Ayers	Ayers Transformer Consultants	Guest
Christopher	Baumgartner	WE Energies	Member
Jason	Beaudoin	Weidmann	Guest
Duvier	Bedoya	Hitachi Energy	RM
Mats	Bernesjo	Hitachi Energy	Secretary
Enrique	Betancourt	Prolec GE	Vice Chair
Daniel	Blaydon	Baltimore Gas & Electric	Member
William	Boettger	Boettger Transformer Consulting LLC	Member

Michael	Botti	Hyosung HICO	RM
Robert	Bracun	LPT	Guest
Darren	Brown	Howard Industries	Member
Alfredo	Carrizales	Prolec GE	Guest
Eric	Davis	Consultant	Guest
Everton	De Oliveira	Siemens Ltda	Member
Scott	Dennis	Hitachi Energy	RM
Nikolaus	Dillon	Dominion Energy	Member
Luc	Dorpmanns	Royal SMIT Transformer	Guest
Samragni	Dutta Roy	Siemens Energy	RM
William	Elliott	AEP / SWEPCO	Member
Sean	Fitzgerald	ComEd	Guest
Hugo	Flores	Hitachi Energy	Member
Raymond	Frazier	Ameren	RM
Eduardo	Garcia Wild	Siemens Energy	Member
Dragana	Gasic	Koncar D & ST	Guest
Ramsis	Girgis	Hitachi Energy	Member
Shawn	Gossett	Ameren	Member
Ravi	Gupta	Megger	Guest
Shamaun	Hakim	WEG Transformers USA	Guest
Shertukde	Hemchandra	University of Hartford	RM
John	Herron	Raytech USA	Member
Saramma	Hoffman	PPL	RM
Ryan	Hogg	USBR	RM
Phil	Hopkinson	HVOLT Inc.	Member
Mike	Iman	MGM Transformer Company	RM
John	John	Virginia Transformer Corp.	Member
Christopher	Johnson	Oncor	RM
Sergiusz	Kapka	Hitachi Energy	Guest
Nathan	Katz	Pacificorp	RM
Jerzy	Kazmierczak	Hitachi Energy	RM
Sheldon	Kennedy	Sheldon Kennedy Engineering, PLLC	RM
Zan	Kiparizoski	Howard Industries	Member
Matija	Koprivnjak	Koncar D & ST	Guest
Anton	Koshel	Delta Star Inc.	Guest
Rafal	Kowalski	Hitachi Energy	Guest
Alexander	Kraetge	Omicron electronics Deutschland GmbH	Guest
Mark	Lachman	Doble	Member
Junho	Lee	Hyundai Electric	RM
Moses	Manzano	Hyosung HICO	RM
Swapnil	Marathe	Megger	RM
Tom	Melle	Highvolt	Guest
Fernando	Meza	Power Partners	Guest
Francis	Mills	Power Engineers	RM
David	Murray	TVA	Member
Ryan	Musgrove	OG&E	Member
Ali	Naderian	Metsco	RM
Shankar	Nambi	Bechtel Energy, Inc.	Member
Kristopher	Neild	Megger	Member
Joe	Nims	Allen & Hoshall	Member
George	Partyka	PTI Transformers	Member

Sanjay	Patel	SMIT Transformers	Member
Nitesh	Patel	Hyundai Power Transformers USA	RM
Jay	Pidcock	Ameren	Guest
Bojan	Popovic	KPT	Guest
Jarrod	Prince	ERMCO	Member
Jonathan	Reimer	Fortis BC	Guest
Michael	Richardson	Ameren	Guest
Rodrigo	Ronchi	WEG Transformers USA	RM
Marnie	Roussell	Entergy	Member
Hakan	Sahin	Virginia / Georgia Transformers	Member
Fernando	Salinas	Power Partners	RM
Dinesh	Sankarakurup	Duke Energy	Guest
Amitabh	Sarkar	Virginia Transformers	Member
Daniel	Sauer	Eaton Corporation	Member
Markus	Schiessl	SGB	Member
Dugal	Selvaraj	Virginia Transformers	RM
John	Sen	Duke Energy	Member
Kabir	Sethi	Hitachi Energy	RM
AbdulMajid	Shaikh	Delta Star Inc.	RM
Kushal	Singh	ComEd	Guest
Christopher	Slattery	FirstEnergy Corp.	Member
Steven	Snyder	Hitachi Energy	Member
Yong Tae	Sohn	Hyosung HICO	RM
Sanjib	Som	Pennsylvania Transformers	Member
Andrew	Steineman	Delta Star Inc.	Guest
Kerwin	Stretch	Siemens Energy	Guest
Michal	Swiatkowski	Hitachi Energy	RM
Ali	Syed	ComEd	RM
Marc	Taylor	JFE Shoji Power Canada Inc.	Guest
Ed	teNyenhuis	Hitachi Energy	Member
Andreas	Thiede	Highvolt Pruftechnik Dresden	RM
Scott	Thomas	Hitachi Energy	RM
Alan	Traut	Howard Industries	Guest
Cole	Van Dreel	ATC	RM
Ajith	Varghese	Prolec-GE	Member
Jason	Varnell	Doble Engineering Co.	Member
Krishnamurthy	Vijayan	PTI Transformers	Member
Dharam	Vir	Prolec-GE Waukesha	Member
David	Wallach	Duke Energy	Member
Shelby	Walters	Howard Industries	Guest
Devora	Wiesel	Consolidated Edison	RM
Kris	Zibert	Allgeier Martin	Member

J.9.4 TF Inverter Transformer Precautions on Ground Shields C57.159

TF Inverter Transformer Precautions on Ground Shields C57.159
Unapproved Meeting Minutes
Fall 2023 Meeting
Kansas City, MO
4:45 pm, Monday, October 23, 2023

The Task Force met at the Westin Hotel – Century C Conference Room. The meeting was called to order at 4:45 PM by Chair, Dr. Hemchandra Shertukde

Chair made opening comments.

49 attendees. This is the first meeting of this task force.

Introductions

Approval of Agenda: The Fall 2023 agenda was approved unanimously without discussion.
Motion: Don Ayers
Second: Vijay Tendulkar

Call For Patents: The Chair presented the information on Patent Disclosures and asked the group to report any relevant patent issues – None were communicated.

Copyright Notice: The Chair presented the IEEE_SA Copyright Policy. No discussion.

Chair presented Working Group Policies stating all attendees at first meeting today requesting membership are granted membership.

Chair presented previous of PAR scope published in 2016

Current document expiration December 31st, 2026

Presentation by Phil Hopkinson: Analysis and Integration of Yy padmount transformers heating in a solar PV farm

SUMMARY

- Standard Transformers newly installed connected to IGBT transformers were overheating and gassing
- Metering showed line-line voltage is devoid of harmonics and typical. Line-ground voltage has much higher harmonics up to the 200th.
- Inverters well filtered line to line and line to neutral but not line or neutral to ground
- DGA Analysis shows Hydrogen and Methane in oil indicating possible partial discharge
- Transformer passed all tests before teardown
- Teardown showed carbon evident in insulation materials between LV winding and coil, specifically at the laminations
- Shielding the core eliminates the high harmonics voltage line-ground.
- LV neutral should remain ungrounded because to prevent ground loop with IGBT ground

Discussion commenced regarding the presentation

Dan Sauer suggested to include "liquid immersed" terminology when PAR is created which is consistent with C57.12.80

Chair recommends creating PAR study group to take into consideration the new topics.

PAR study group to meeting virtually before Spring 2024 meeting to develop Title, Scope

Adjourned at 6:05

The Task Force will meet again at the Spring 2024 meeting,

Chair: Dr. Hemchandra Shertukde
Secretary: Rhea Montpool

Meeting Attendance:

Donald	Ayers	Ayers TX	RM
Jason	Beaudoin	Weidman	RM
Anthony	Coker	M&I Materials	RM
Brian	Conneighton	Cleveland Cliffs	RM
Gabriel	Delgado	Invenergy	RM
Raul	Dominguez	WEG	RM
Jeffrey	Door	HJ Family of Companies	RM
Morales-Crus	Emilio	Qualitrol	RM
Jose	Gamboa	HJ Family of Companies	RM
Miguel	Garcia	Hitachi	RM
James	Gardner	Prolec-GE	RM
Carlos	Gaytan	Prolec GE	RM
Shamaun	Hakim	WEG	Guest
Giovanni	Hernandez	Virginia Transformer	RM
John	Hipchen	Copper Development Assn	RM
John	John	Virginia Transformer	RM
Thrinadha	Katapalli	Virginia Transformer	RM
Sheldon	Kenndy	Sheldon P. Kennedy Eng	RM
Gary	King	Howard Ind	RM
Andrew	Larrison	Hitachi	RM
Moonhee	Lee	Hammond Power Sol	RM
Aleksandr	Levin	Weidman	RM
Xose	Lopez-Fernandez	Univrsidad De Vigo	Guest
Stephanie	Mabrey	Weidmann	RM
Jinesh	Malde	M&I Materials	RM
Bryan	Marquardt	Cleveland Cliffs	RM
Sharifi	Masoud	Siemens Gamesa R.E	RM
Lee	Matthews	Howard	RM
Toni	Mellin	Vaisala	RM
Ali	Naderian	BBA	RM
Mark	Newbill	Hitachi	RM
Shawn	Nunn	Hitachi	RM

Stephen	Oakes	WEG	RM
Paul	Orr	NEMA	RM
George	Partyka	PTI	Guest
Baptiste	Pousset	Transformer Protection Co	RM
Rodrigo	Ronchi	WEG Transformers	RM
Dan	Sauer	Eaton	RM
Steve	Snyder	Hitachi	Guest
Mike	Spurlock	Spurlock Eng Serv	RM
Brad	Staley	Leeward Energy	RM
Vijay	Tendulkar	Eaton	RM
Ed	TeNyenhuis	Hitachi	RM
David	Walker	MGM Transformers	RM
Joe	Watson	JD Watson & Assoc	RM
Zachery	Weiss	WEG	RM
Michael	Wheeler	Hitachi	RM
Joe	White	Power Engineers	RM
Samuel	Young	Hitachi	RM

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

Kansas City, MO
October 24, 2023
9:30 AM – 10:45 AM Central Time Zone – USA
Chair – Hakan Sahin
Vice Chair – Pugal Selvaraj
Secretary – Adam Sewell

Meeting Minutes / Significant Issues / Comments:

Meeting was called to order at 9:30am, October 24, 2023.

1. Administrative
    a. IEEE Patent Policy and Call for Patents and IEEE SA Copyright Policy
        i. No comments from group
    b. Review of Fall 2023 agenda
        i. No comments from group
    c. Introductions of the attendees
        i. 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.
        ii. Secretary asked all who wanted on email distribution for the C57.12.90 PCS Task Force to send him an email at: adamsewell@ieee.org
    d. Updated membership review and count for quorum
        i. 53 members were listed and 27 were counted as present by hand count. Based on the hand count, the chair announced there was QUORUM for this meeting.
        ii. Attendance sheets after meeting completed showing 35 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. Approvals needed from previous meeting minutes:
   i. Spring 2022 unapproved minutes
   ii. Fall 2022 unapproved minutes
   iii. Spring 2023 unapproved minutes
      1. Motion to approve all minutes listed – D.Sauer, 2nd-J.Herron
         a. No opposition to unanimous approval – MOTION APPROVED

f. Approval of Fall 2023 agenda
   i. Motion to approve agenda – J.John, 2nd-D.Saur
      a. No opposition to unanimous approval – MOTION APPROVED

2. Old Business
   a. All old business was completed in previous meeting.
3. New Business
   a. Chair reviewed a proposed revision to Clause 5.1: Determination of cold temperature, under Clause 5: Resistance measurements
      i. After discussions from members during the meeting, the chair asked for a vote if this proposal should be continued to be worked on
         1. 24-YES, 2-OBJECT, 0-ABSTAIN – will continue to work on this clause

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, top (outlet) and bottom (inlet) 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.

4. Membership changes
   a. Officers will look at attendance and change TF membership status before Spring 2024 meeting.
5. Next meeting: March 12, 2024 at Spring 2024 Transformer Committee Meeting scheduled for March 10-14, 2024, Vancouver, BC, CANADA.
6. Close of meeting
   a. Meeting adjourned at 10:45am – Motion-D.Sauer, 2nd-J.John
      i. No opposition to unanimous approval – MOTION APPROVED

Submitted by: Hakan Sahin

October 24, 2023 Meeting Attendance:

(RM3=Requested Membership 3 times, RM2=Requested Membership 2 times, RM1=Requested Membership 1st time)

Kayland	Adams	Prolec GE Waukesha	Guest-RM3
Alex	Alahmed	Evergy	Guest-RM1
Tauhid	Ansari	Hitachi Energy	Guest-RM1
Stephen	Antosz	Stephen Antosz & Associates, Inc.	Member
Elise	Arnold	SGB	Member
Hugo	Avila	Hitachi Energy	Guest-RM1
Donald	Ayers	Ayers Transformer Consulting	Member
Gilles	Bargone	FISO Technologies Inc.	Guest-RM3
Chris	Baumgartner	We Energies	Member
Duvier	Beoya	Hitachi Energy	Member
Mats	Bernesjo	Hitachi Energy	Member
Daniel	Blaydon	Baltimore Gas & Electric	Member
William	Boettger	Boettger Transformer Consulting LLC	Member
Sanket	Bolar	Oncor	Guest
Dominique	Bolliger	HV Technologies, Inc.	Guest-RM1
Elizabeth	Bray	Southern Company Services	Guest
Jeffrey	Britton	Phenix Technologies, Inc.	Member
Darren	Brown	Howard Industries	Guest
Juan Alfredo	Carrizales	Prolec GE	Guest
Thomas	Dauzat	AEP-SWEPCO	Guest-RM3
Everton	De Oliveira	Siemens Energy	Member
Scott	Dennis	Hitachi Energy	Member
Nikolaus	Dillon	Dominion Energy	Guest
Luc	Dorpmanns	SGB SMIT	Guest
Samragni	Dutta Roy	Siemens Energy	Member
Evgenii	Ermakov	Hitachi Energy	Guest
Florin	Faur	Prolec GE Waukesha	Guest
Sean	Fitzgerald	ComEd	Guest
Raymond	Frazier	Ameren	Member
Richard	Frye	EATON Corporation	Guest
Renjie	Fu	ERMCO	Guest
Ramsis	Girgis	Hitachi Energy	Member
Alireza	Gorzin	Black & Veatch	Guest-RM1
Shawn	Gossett	Ameren	Guest-RM2
Ravi	Gupta	Megger	Guest-RM2
Shamaun	Hakim	WEG Transformers USA Inc.	Guest
Giovanni	Hernandez	Virginia Transformer Corp.	Guest-RM1
Sergio	Hernandez Cano	Hammond Power Solutions	Guest
John	Herron	Raytech USA	Member
Martin	Himow	HIGHVOLT	Guest-RM1
Thomas	Holifield	Howard Industries	Guest
Mohammad	Iman	MGM Transformer Company	Guest
Nathan	Jacob	Camlin Energy	Guest-RM1
John	John	Virginia Transformer Corp.	Member
Jerzy	Kazmierczak	Hitachi Energy	Guest-RM1
Sheldon	Kennedy	Sheldon P. Kennedy Engineering, LLC	Guest
Stacey	Kessler	Ulteig Engineers	Guest-RM2
Gary	King	Howard Industries	Member
Evan	Knapp	Eaton	Guest
Mark	Lachman	Doble Engineering Co.	Member
Fernando	Leal	Prolec GE	Member
Moonhee	Lee	Hammond Power Solutions	Guest
Swapnil	Marathe	Megger	Guest

Tim	Menter	Lincoln Electric System	Guest
Francis	Mills	Power Engineers	Guest
Juliano	Montanha	Siemens Energy	Guest
Marta	Munoz	Hitachi Energy	Guest
David	Murray	TVA	Member
Ali	Naderian	METSCO Energy Solutions Inc.	Guest-RM1
Ismael	Naja	Eaton	Guest-RM2
Shankar	Nambi	Bechtel Energy	Guest
Kristopher	Neild	Megger	Member
Joe	Nims	Allen & Hoshall	Guest
George	Partyka	PTI Transformers	Guest
Sanjay	Patel	Smit Transformers	Member
Harry	Pepe	Phenix Technologies, Inc.	Member
Miguel	Plascencia	PG&E	Guest
Bertrand	Poulin	Hitachi Energy	Guest
Jarrod	Prince	ERMCO	Guest
Sebastian	Rehkopf	Maschinenfabrik Reinhausen	Guest
Juan	Reyes Perez	Hitachi Energy	Guest
Michael	Richardson	Ameren	Guest
Marnie	Roussell	Entergy	Guest
Hakan	Sahin	Virginia/Georgia Transfomer	Member-Chair
Dinesh	Sankarakurup	Duke Energy	Guest
Daniel	Sauer	EATON Corporation	Member
Markus	Schiessl	SGB	Member
Pugal	Selvaraj	Virginia Transformer Corp.	Member-Vice Chair
Kabir	Sethi	Hitachi Energy	Guest-RM1
Adam	Sewell	Quality Switch, Inc.	Member-Secretary
Hemchandra	Shertukde	University of Hartford	Member
Kushal	Singh	ComEd	Guest
Christopher	Slattery	FirstEnergy Corp.	Guest-RM3
Jason	Snyder	FirstEnergy Corp.	Guest
Sanjib	Som	Pennsylvania Transformer	Member
Mike	Spurlock	Spurlock Engineering Svcs	Member
Andrew	Steineman	Delta Star Inc.	Guest
Michael	Swiatkowski	Hitachi Energy	Guest-RM1
Ed	teNyenhuis	Hitachi Energy	Member
Andreas	Thiede	HIGHVOLT	Guest
Scott	Thomas	Hitachi Energy	Guest
Cole	Van Dreel	American Transmission Company	Guest-RM3
Ajith	Varghese	Prolec GE Waukesha	Member
Jason	Varnell	Doble Engineering Co.	Member
Rogerio	Verdolin	Verdolin Solutions Inc.	Guest-RM1
Krishnamurthy	Vijayan	PTI Transformers	Member
Pragnesh	Vyas	Sunbelt Solomon	Guest-RM3
David	Wallach	Duke Energy	Guest
Shelby	Walters	Howard Industries	Guest
Guang	Yuan	Hitachi Energy	Gust
Malia	Zaman	IEEE SA	Guest
Kris	Zibert	Allgeier, Martin & Associates	Guest
Waldemar	Ziomek	PTI Transformers	Guest-RM3

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

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

Kansas City, MO
Tuesday, October 24, 2023
11:00 AM – 12:15 PM CDT – USA
Century C (Ballroom Level)

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

1) Welcome and Chair's Remarks
2) Circulation of Attendance
    - Member count was 25 of 48 required for quorum; therefore, quorum was achieved; 77 Guests were present. Total Attendance was 102.
3) IEEE Patent Policy Slides presented. There were no conflicts or patent claims.
4) Presentation and approval of meeting agenda (motion by Waldemar Ziomek / second by Phil Hopkinson) and Minutes from Last Meeting (motion by Phil Hopkinson / seconded by Bertrand Poulin) – approved without opposition.
5) C57.142 Ballot and Comment Resolution status – Jim McBride: Summary of the status of open comments before the ballot resolution group as follows:

    - Total Comments – 305
    - Comments Incorporated – 282
    - Remaining Comments to Address – 23
    - All Figures – Completed and Included thanks to Dr. Xose Lopez-Fernandez
    - All of the latest BRG documents will be posted on WG website

6) Update on Switchgear Liaison TF – No Task Force meeting held as the Document is in Ballot Resolution.
7) Mitigation Methods Task Force Update – Jim McBride / Phil Hopkinson
    - Chair commended Pierre Riffon for his contributions and presented seven possible mitigation methods including Resistor-Capacitor Snubbers and Online Monitoring among others.
8) New Business
    - **STLI modeling and testing.** The chair discussed (but did not show) the following paper:
        i. IEEE Transactions on Power Delivery, Vol. 11, No. 1, January 1996 INVESTIGATIONS OF AN EHV AUTOTRANSFORMER TESTED WITH OPEN AND ARRESTER TERMINATED TERMINALS.
        ii. The paper features an example of a 500 MVA,765-345-34.5 kV single phase autotransformer used for modeling and testing. In summary, the STLI test introduced higher voltages to ground in the lower 80 % of the HW windings and even a failure.
        iii. The Chair introduced comments on the subject from Loren Wagenaar from recent emails. Bertrand Poulin and Phil Hopkinson personally delivered their own comments. The Chair presented comments from research by Jin Sim on

STLI testing as well. Dharam Vir commented that in the past modeling was not possible, but modern software can model and predict stresses of a simulated STLI test. Note: the content of most of the comments are contained in the meeting presentation slides.

- **Open discussion of possible additional mitigation methods:**
    i. Ajith Varghese asked whether there is any database with US grid failures due to transients. The Chair mentioned a CIGRE A2 study containing examples of worldwide interactions involving Switching Transients. That paper will be referenced and listed in the future.
    ii. Phil Hopkinson and the Chair discussed the feasibility of factory testing with special impulse tests, since the studied transformers that passed standard factory tests still failed under certain switching conditions. It was generally agreed that special impulse tests, including steep-front impulse testing could be beneficial for certain special-use cases (for example instrument transformers).
    iii. Discussion ensued about a tutorial, panel session, presentation and/or possibly a paper on the mitigation methods during an upcoming meeting. A motion was made by Hemchandra Shertukde / seconded by Bertrand Poulin to move ahead with a group presentation. The motion was approved with no opposition.

9) Next Meeting (Vancouver, BC, Canada, March 10-14, 2024)

10) Motion to Adjourn at 12:15 PM CDT made by Waldemar Ziomek / seconded by Phil Hopkinson with no opposition.

Fall 2023 WG Meeting Attendance and Affiliation (in process):

Robert	Arritt	EPRI	Guest
Jean-Noel	Berube	Rugged Monitoring	Guest
Enrique	Betancourt	Prolec GE	Member
William	Boettger	Boettger Transformer Consulting LLC	Member
Christopher	Borck	EATON Corporation	Guest
Jeffrey	Britton	Phenix Technologies, Inc.	Member
Cole	Casey	Invenergy	Guest
Vivian	Chan	Hitachi Energy	Guest
Alex	Cochran	U.S.E.	Guest
Michael	Craven	Qualus Corporation	Guest
Gabriel	Delgado Zamora	Invenergy	Guest
Scott	Digby	Duke Energy	Guest
Nikolaus	Dillon	Dominion Energy	Guest
Paul	Dolloff	East Kentucky Power	Guest
Evgenii	Ermakov	Hitachi Energy	Guest
Marco	Espindola	Hitachi Energy	Guest
Esseddik	FerdJallah	Trench Group	Guest
Raymond	Frazier	Ameren	Guest
Richard	Frye	EATON Corporation	Guest
Jose	Gamboa	H-J Family of Companies	Guest
Lorne	Gara	Shermco	Guest
Miguel	Garcia	Hitachi Energy	Guest
Eduardo	Garcia Wild	Siemens Energy	Member
Carlos	Gaytan	Prolec GE	Guest
Detlev	Gross	Power Diagnostix Consultant	Guest
John	Harley	FirstPower Group LLC	Guest
Kyle	Heiden	EATON Corporation	Member

JC	Hernandez	Georgia Tech - NEETRAC	Guest
Saramma	Hoffman	PPL Electric Utilities	Guest
Philip	Hopkinson	HVOLT Inc.	Member
Saif	Hossain	Trench Limited	Guest
Patrycia	Jarosz	IEEE SA	Guest
John	John	Virginia Transformer Corp.	Member
Akash	Joshi	Black & Veatch	Member
Thrinadha	Katapalli	Virginia Transformer	Guest
Stacey	Kessler	Ulteig Engineers	Guest
Qasim	Khan	Georgia Tech - NEETRAC	Guest
Egon	Kirchenmayer	Siemens Energy	Member
Dmitriy	Klempner	Southern California Edison	Guest
Evan	Knapp	EATON Corporation	Guest
Bernard	Labean, Jr.	Consumers Energy	Guest
Mark	Lachman	Doble Engineering Co.	Guest
Weijun	Li	Braintree Electric Light Dept.	Member
Xose	Lopez-Fernandez	Universidade de Vigo	Vice-Chair
Kumar	Mani	Duke Energy	Guest
James	McBride	JMX High Voltage	Chair
Thomas	Melle	HIGHVOLT	Secretary
Omar	Mendez	Prolec GE	Guest
Klaus	Pointner	Trench Austria GmbH	Member
Bertrand	Poulin	Hitachi Energy	Member
Marnie	Roussell	Entergy	Member
Amitabh	Sarkar	Virginia Transformer Corp.	Member
Cihangir	Sen	Duke Energy	Member
Michael	Sharp	Trench Limited	Member
Mike	Spurlock	Spurlock Engineering Services, LLC	Member
Ajith	Varghese	SPX Transformer Solutions, Inc.	Member
Dharam	Vir	Prolec-GE Waukesha	Member
Waldemar	Ziomek	PTI Transformers	Member

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

Performance Characteristics Subcommittee
IEEE / PES Transformers Committee

October 23, 2023
Kansas City, Missouri (USA)

UNAPPROVED MINUTES

The PCS Working Group on Guide for Application of Tertiary and Stabilizing Windings C57.158 met at 4:45 PM on Tuesday, October 24, 2023. Chairman Enrique Betancourt presided over the meeting with Dr. Xose M. Lopez-Fernandez being the Vice Chair, and Kayland Adams acted as Secretary. The meeting was called to order and the Chairman explained the group the purpose and scope of this Working Group. 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 WG's activities.

The meeting was attended by 62 interested individuals, 34 of them requesting membership to this Group. As this was the first meeting of the Group, Membership will be granted to following attendees:

Antosz , Stephen	Consultant
Avanoma, Onome	MJ Consulting
Boettger, William	Consultant
Davoudi, Pouneh	Delta Star
De Oliveira, Everton	Siemens-Energy
Frazier, Raymond	Ameren
Garcia, Eduardo	Siemens-Energy
John, John	Virginia Transformer
Kirchenmayer, Egon	Siemens-Energy
Kulasek, Krzysztof	Delta Star
Manzano, Moses	Hyosung HICO
Martinez, Daniel	JFE Canada
Morales-Cruz, Emilio	Qualitrol
Munoz Marta,	Hitachi Energy
Nambi, Shankar	Bechtel Energy
Patel, Sanjay	SMIT
Patel, Nitesh	Hyundai
Richardson, Michael	Ameren
Rocque, Tim	Prolec GE Waukesha
Ronchi, Rodrigo	WEG
Sankarakurup, Dinesh	Duke Energy
Sarkar, Amitabh	Virginia Transformer
Schiessl, Markus	SGB
Sethi, Kabiy	Hitachi Energy
Shertukde, Hemchandra	UHART
Snyder, Jason	First Energy
Sohn, Yong Tae	Hyosung HICO
Som, Sanjib	Pennsylvania Transformers
Speegle, Arthur	Entergy
Varghese, Ajith	Prolec GE Waukesha
Varnell, Jason	Doble
Vijayan, Krishnamurthy	PTI Transformers
Vyas, Pragnesh	Sunbelt Solomon

White, Joe Power Engineers

The agenda was presented by the Chair with no comments from the attendance. The Chair explained that the PAR application for this WG did not change Title and Scope from currently active C57.158, and mentioned that some items explained in first edition of the document included:

Distinction between stabilizing winding (SW) and tertiary winding (TW).

No need to design an SW, or a TW for 35% of main winding power.

No direct correlation between winding power and short-circuit current withstand.

In Y-Y transformers with three legged cores, the tank can act as a "virtual" SW.

The Chair explained also that our PAR is good till December 31, 2027; the intention is to plan to have our draft ready by 6/2025, expecting to deliver the approved document to REVCOM by 6/2026.

Next, the Chair covered more topics to revise or include in new revision of the Guide:

Harmonization with current version of other standards 12.00, 12.10, 12.90 …

Consideration of new published CIGRE documents

Extended discussion on Y-connected transformer or Auto without SW or TW

Considerations for "vectorial" (different power factor) loads for TWs

Transfer of transient voltages on TWs

Consideration of IEC 60071 Annex D SIL voltages transferred to delta windings

Some special cases of Renewables' Collector Transformers

Extended discussion on Grounding of neutrals

Cautions for application of TWs as the outermost windings (Sanjay Patel and Krishnamurthy Vijayan proposed clarifications about terminology)

Considerations about potential influence of Reverse Power Flow on SWs or TWs

As the next Agenda item, Vice Chair Dr. Xose Lopez-Fernandez gave a presentation on 3D FEA analysis of a Y-Y unit that had no tertiary winding, showing the heating effects of zero sequence flux on the internal structural parts. The idea was to monitor the current in the neutral circuit and make decisions for transformer operation based on previous calculations of component heating and time constants. The main idea is to remove the tertiary winding to reduce the complexity of the transformer and so reduce the chance of failure and/or field issues.

Amitabh Sarkar (Virginia Transformer) - Asked for clarification about the graph labels.

Marta Munoz (Hitachi Energy) - Asked if everyone would be able to conduct this type of analysis.

Sanjay Patel (SMIT) - Talked about monitoring structural part temperatures.

Sanjib Som (Pennsylvania Transformers)- Talked about developing a table to determine if an SW, or a TW is required or not.

Vijayan Krishnamurthy (PTI) - Clarified need to monitor current vs time.

Kushal (ConEd) – Mentioned a utility that removed or disconnected all of its Tertiaries.

Sanjay Patel (SMIT) - Suggested to make the Guide into a standard.

Vijayan Krishnamurthy PTI - Suggested that utilities share their experiences with eliminating Tertiary and Stabilizing windings.

Next Steps

The Chair will distribute by e-mail a Statement of Work for several Task Forces, intending to cover the first presented revision items to the Guide.

New business

No new business was proposed.

The meeting was adjourned on Tuesday October 24, 2023 at 5:45 PM

Respectfully submitted,

Enrique Betancourt	Dr. Xose M. Lopez-Fernandez	Kayland Adams
WG Chair	Vice Chair	Secretary

Attendance Fall 2023 Meeting – PCS WG Revision of C57.158
RM=Request Membership
G=Guest

Kayland	Adams	Prolec GE Waukesha	Secretary
Stephen	Antosz	Stephen Antosz & Asociates	RM
Onome	Avanoma	MJ Consulting	RM
Enrique	Betancourt	Prolec GE	Chair
William	Boettger	Boettger Transf. Consulting	RM
Michael	Craven	Qualus Power Services	G
Daniel	Crockett	Ameren	G
Pouneh	Davoudi	Delta Star	RM
Everton	De Oliveira	Siemens-Energy	RM
Paul	Dolloff	EKPC	G
Janko	Dzodan	Koncar D&ST	G
Jacob	Eshenroder	Burns & McDonnell	G
Raymond	Frazier	Ameren	RM
Eduardo	Garcia	Siemens-Energy	RM
Dragana	Gasic	Koncar D&ST	G

Thomas	Holifield	Howard	G
Derek	Hollrqh	Burns & McDonnell	G
John	John	Virginia Transformer	RM
Nathan	Katz	Pacificorp	G
Egon	Kirchenmayer	Siemens-Energy	RM
O. Koffi	Koffi Akakpo	Burns & McDonnell	G
Matija	Koprivnjak	Koncar D&ST	G
Anton	Koshel	Delta Star	G
Krzysztof	Kulasek	Delta Star	RM
Mark	Lachman	DOBLE	G
Xose	Lope-Fernandez	Universidade De Vigo	Vice Chair
Moses	Manzano	Hyosung HICO	RM
Daniel	Martinez	JFE Canada	RM
Emilio	Morales-Cruz	Qualitrol	RM
Marta	Munoz	Hitachi Energy	RM
Shankar	Nambi	Bechtel Energy	RM
Anthony	Natale	HICO America	G
Joe	Nims	Allen & Hoshall	G
Sanjay	Patel	SMIT	RM
Nitesh	Patel	Hyundai	RM
Jay	Pidcock	Ameren	G
Juan	Reyes Perez	Hitachi Energy	G
Michael	Richardson	Ameren	RM
Tim	Rocque	Prolec GE Waukesha	RM
Rodrigo	Ronchi	WEG	RM
Dinesh	Sankarakurup	Duke Energy	RM
Amitabh	Sarkar	Virginia Transformer	RM
Markus	Schiessl	SGB	RM
Kabiy	Sethi	Hitachi Energy	RM
Hemchandra	Shertukde	UHART	RM
Christopher	Slattery	First Energy	G
Jason	Snyder	First Energy	RM
Yong Tae	Sohn	Hyosung HICO	RM
Sanjib	Som	Pennsylvania Trs.	RM
Arthur	Speegle	Entergy	RM
H. Allen	Steele	TVA	G
Andrew	Steineman	Delta Star	G
Ajith	Varghese	Prolec GE Waukesha	RM
Jason	Varnell	Doble	RM
Krishnamurthy	Vijayan	PTI Transformers	RM
Pragnesh	Vyas	Sunbelt Solomon	RM
Joe	Watson	JD Watson & Assoc	G
Bruce	Webb	K.U.B	G
Joe	White	Power Engineers	RM
Kris	Zibert	Allgeier Martin	G

J.9.8 WG PC57.32 Neutral Grounding Devices

IEEE Neutral Grounding Devices Working Group Meeting

Meeting Date/Time: October 24, 2023 4:45 PM – 6:00 PM
Meeting Location: Kansas City, Missouri
Chairman: Sheldon P. Kennedy
Vice Chair: Thomas Melle
Secretary: Ed teNyenhuis

1. Welcome and Chair's Remarks

2. Circulation of attendance sheets. (Quorum achieved – 14 of 23 Members; 18 Guests present, 7 guests requesting membership)

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

4. Patent Call

5. Copyright and IEEE Ethics Policies

6. Approval of minutes from previous Meeting.
    - It was noted the membership should be corrected from 25 to 23 in the minutes – this was done. (Motion to approve by Sergio Panetta, Second by Mike Sharp – motion passed without objection)

7. Reports from TF Leader Assignments
    - **Section 4 – Neutral Grounding Reactors** – Camilo Casallas, Saif Hossain
        i. The proposed sections to change were reviewed in the WG. These sections will be worked on the by TF.
    - **Section 5 – Neutral Ground Gault Neutralizers** – Klaus Pointner, Sheldon Kennedy
        i. It is planned to make this section consistent with IEC 60076-6 which is presently in the CD stage. These sections will now be worked on by the TF.
    - **Section 6 – Neutral Grounding Transformers** – Don Ayers, Jusuf Krvavac
        i. This work has begun and will be completed before the next meeting.
        ii. It was discussed to lower the time limits to below 10 s with some devices suggesting 4 s or 5 s.
    - **Section 7 – Neutral Grounding Resistors** – Ryan Hogg, Sergio Panetta
        i. The TF has held 7 meetings so far and has processed 60% of the comments.
    - **Section 8 – Combinational Devices** – Sergio Panetta, Jusuf Krvavac
        i. No meetings have been held yet, but the items to change have been noted.

8. Old Business
    - Preliminary discussions of different test sections including impedance of zig-zag transformers (Sergio Panetta); relationship of HVDC and instrument transformers to

NGT's and the possible inclusion of the effects of switching transients in the new Standard (Jim McBride and Tom Melle).

- Brief discussion of the importance of the test sections of C57.12.00 and 12.90. Further discussion of whether it may be possible to create a single section for all tables containing test voltages; the Vice Chair and Chair commented that this was considered in the prior revision of the Standard and found to be difficult considering the variety of Neutral Grounding Devices.
- It was discussed that we will not reference the CSA grounding resistor standard

9. New Business
    - None

10. Next in-person meeting – Spring 2024 (IEEE TC March 10th-14th, 2024, in Vancouver, BC)

11. Adjournment at 5:47 PM CDT (motion by Ryan Hogg; Seconded by Tom Melle)

List of Meeting Attendees from Fall 2023 meeting (including affiliation & member status).

Robert	Allison	Dominion Energy	Guest
Donald	Ayers	Ayers Consulting	Member
Jason	Beaudain	Wiedmann	Guest
Rahul	Bharduoaj	Burns & McDonnell	Guest
Vivek	Bhatt	Prolec GE	Guest
Sankey	Bolar	ONCOR	Member
Camilo	Casallas	Trench Ltd.	Member
Juan Carlos	Cruz Valdes	Prolec GE	Member
Huan	Dinh	Hitachi Energy	Member
teNyenhuis	Ed	Hitachi Energy	Secretary
Will	Elliott	AEP/SWEPCO	Guest
Jeff	Grager	Xcel Energy	Guest
Ravi	Gupta	Megger	Guest
Roger	Hayes	GE	Guest RM
Ryan	Hogg	Bureau of Reclamation	Member
Saif	Hossain	Trench Ltd.	Member
Kevin	Juchem	ABB AG	Guest
Kurt	Kaineba	Trench Austria	Guest RM
Sheldon	Kennedy	Sheldon P. Kennedy Engineering PLLC	Chair
Klaus	Koeck	Trench Austria	Guest RM
Mark	Lowthor	Kruger	Guest RM
Thomas	Melle	HIGHVOLT	Vice Chair
Sergio	Panetta	I-Gard Corp.	Member
Klaus	Pointner	Trench Austria	Member
Daniel	Posadas	Prolec GE	Guest RM
Ulf	Radbrandt	Hitachi Energy	Member
Pugal	Selvaraj	Virginia Transformer Corp.	Guest
Mike	Sharp	Trench Ltd.	Member
Troy	Tanaka	Burns & McDonnell	Guest
Scott	Thomas	Hitachi Energy	Guest

Terry	Wong	Trench	Guest RM
Maria	Zaman	IEEE	Guest

J.10 Performance Characteristics Subcommittee Attendance List

First Name	Last Name	Affiliation	Status
Kayland	Adams	Prolec-GE	Guest
Alex	Alahmed	Evergy	Guest
Robert	Allison	Dominion Energy	Guest
Daniel	Aleksandrowicz	Hitachi Energy	Guest
Tauhid Haque	Ansari	Hitachi Energy	Member
Stephen	Antosz	Stephen Antosz & Associates, Inc	Member
Elise	Arnold	SGB	Guest
Javier	Arteaga	Hitachi Energy	Member
Onome	Avanoma	MJ Consulting	Member
Donald	Ayers	Ayers Transformer Consulting	Member
Robert	Ballard	DuPont	Member
Gilles	Bargone	FISO Technologies Inc.	Member
Christopher	Baumgartner	We Energies	Member
Jason	Beaudoin	Weidmann	Guest
Enrique	Betancourt	Prolec GE	Member
Vivek	Bhatt	Prolec-GE	Guest
Wallace	Binder	WBBinder Consultant	Member
Daniel	Blaydon	Baltimore Gas & Electric	Member
William	Boettger	Boettger Transformer Consulting LLC	Member
Sanket	Bolar	Oncor Electric Delivery	Member
Michael	Botti	Hyosung HICO	Guest
Jeffrey	Britton	Phenix Technologies, Inc./Doble Eng.	Member
Samuel	Brodeur	Hitachi Energy	Guest
Juan Alfredo	Carrizales	Prolec GE	Guest
Camilo	Casallas	TRENCH	Guest
Vivian	Chan	Hitachi Energy	Guest
Eunyoung	Cho	HICO-America	Guest
Craig	Colopy	Retired - EATON Corporation	Member
Michael	Craven	Qualus Power Services	Guest
Juan Carlos	Cruz Valdes	Prolec GE	Member
Marcos	Czernorucki	Hitachi Energy	Guest
Thomas	Dauzat	AEP-SWEP CO	Guest
Pouneh	Davoudi	Delta Star Inc.	Guest
Everton	De Oliveira	Siemens Energy	Member
J. Arturo	Del Rio	Siemens Energy	Member
Scott	Dennis	Hitachi Energy	Member

Scott	Digby	Duke Energy	Guest
Nikolaus	Dillon	Dominion Energy	Guest
Huan	Dinh	Hitachi Energy	Guest
Luc	Dorpmanns	Royal Smit Transformers	Guest
James	Dunn	UniFin	Guest
Samragni	Dutta Roy	Siemens Energy	Member
William	Ellis	Ameren	Guest
Evgenii	Ermakov	Hitachi Energy	Guest
Marco	Espindola	Hitachi Energy	Guest
Reto	Fausch	RF Solutions	Member
Sean	Fitzgerald	ComEd	Guest
Hugo	Flores	Hitachi Energy	Member
Raymond	Frazier	Ameren	Member
Jose	Gamboa	H-J Family of Companies	Member
Eduardo	Garcia Wild	Siemens Energy	Member
Rob	Ghosh	General Electric	Guest
Ramsis	Girgis	Hitachi Energy	Member
Shawn	Gossett	Ameren	Member
Ismail	Guner	Hydro-Quebec	Member
Ravi	Gupta	Megger	Guest
Sergio	Hernandez Cano	Hammond Power Solutions	Member
Jean	Hernandez-Myia	Georgia Tech	Guest
John	Herron	Raytech USA	Member
Saramma	Hoffman	PPL Electric Utilities	Member
Gary	Hoffman	Advanced Power Technologies	Guest
Ryan	Hogg	Bureau of Reclamation	Guest
Derek	Hollrah	Burns & McDonnell	Guest
Philip	Hopkinson	HVOLT Inc.	Member
Saif	Hossain	Trench Limited	Guest
John	John	Virginia Transformer Corp.	Member
Christopher	Johnson	Oncor Electric Delivery	Guest
Ghazi	Kablouti	Hitachi Energy	Guest
Nathan	Katz	Pacificorp	Guest
Jerzy	Kazmierczak	Hitachi Energy	Guest
Sheldon	Kennedy	Sheldon P. Kennedy Engineering, PLLC	Member
Gael	Kennedy	GR Kennedy & Associates LLC	Guest
Stacey	Kessler	Ulteig Engineers	Member
Gary	King	Howard Industries	Guest
Egon	Kirchenmayer	Siemens Energy	Member
Anton	Koshel	Delta Star Inc.	Guest
Rafal	Kowalski	Hitachi Energy	Guest

Alexander	Kraetge	OMICRON electronics Deutschland GmbH	Guest
Fernando	Leal		Guest
Moonhee	Lee	Hammond Power Solutions	Member
Junho	Lee	Hyundai Electric	Guest
Aleksandr	Levin	Weidmann Electrical Technology	Member
Weijun	Li	Braintree Electric Light Dept.	Member
Xose	Lopez-Fernandez	Universidade de Vigo	Guest
Colby	Lovins	Federal Pacific	Guest
Jose Luis	Machain	Prolec GE-Waukesha	Guest
Kushal	Mahajan	Eaton	Guest
Tim-Felix	Mai	Siemens Energy	Member
Swapnil	Marathe	Megger	Guest
Thomas	Melle	HIGHVOLT	Member
Francis	Mills	Power Engineers	Guest
Juliano	Montanha	Siemens Energy	Guest
Emilio	Morales-Cruz	Qualitrol Company LLC	Member
Marta	Munoz	Hitachi Energy	Guest
David	Murray	Tennessee Valley Authority	Member
Ryan	Musgrove	Oklahoma Gas & Electric	Member
Shankar	Nambi	Bechtel	Guest
Aniruddha	Narawane	EATON Corporation	Member
Kristopher	Neild	Megger	Member
Rudolf	Ogajanov	Hitachi Energy	Guest
Anastasia	O'Malley	Con Edison, NY	Guest
Orlando	Giraldo	The H-J Family of Companies	Guest
Poorvi	Patel	Electric Power Research Institute (EPRI)	Member
Harry	Pepe	Phenix Technologies, Inc.	Member
Donald "Jay"	Pidcock	Ameren	Guest
Sylvain	Plante	Hydro-Quebec	Member
Klaus	Pointner	Trench Austria GmbH	Member
Daniel	Posadas	Prolec-Celeco	Guest
Bertrand	Poulin	Hitachi Energy	Guest
Jarrod	Prince	ERMCO	Member
Ulf	Radbrandt	Hitachi Energy	Member
Ion	Radu	Hitachi Energy	Member
Jonathan	Reimer	FortisBC	Guest
Juan	Reyes	Hitachi Energy	Guest
Michael	Richardson	Ameren	Guest
Tim	Rocque	Prolec GE Waukesha	Member
Rodrigo	Ronchi	WEG-Voltran	Guest

Marnie	Roussell	Entergy	Member
Dinesh	Sankarakurup	Duke Energy	Guest
Amitabh	Sarkar	Virginia Transformer Corp.	Member
Daniel	Sauer	EATON Corporation	Member
Markus	Schiessl	SGB	Member
Eric	Schleismann	Southern Company	Guest
Alfons	Schrammel	Siemens Energy	Guest
Ewald	Schweiger	Siemens Energy	Guest
Cihangir	Sen	Duke Energy	Guest
Abdul Majid	Shaikh	Delta Star, Inc.	Guest
Michael	Sharp	Trench Limited	Member
Samuel	Sharpless	Rimkus Consulting Group	Member
Hemchandra	Shertukde	University of Hartford	Member
Stephen	Shull	BBC Electrical Services, Inc.	Guest
Kushal	Singh	Consolidated Edison Co. of NY	Guest
Christopher	Slattery	FirstEnergy Corp.	Member
Michal	Swiakowski	Hitachi Energy	Guest
Steven	Snyder	Hitachi Energy	Member
Jason	Snyder	First Energy	Guest
Yong Tae	Sohn	Hyosung Hico	Guest
Sanjib	Som	Pennsylvania Transformer	Vice Chair
Mike	Spurlock	Spurlock Engineering Services, LLC	Member
Charles	Sweetser	OMICRON electronics Corp USA	Member
Janusz	Szczechowski	Maschinenfabrik Reinhausen	Guest
Erik	Tarango	Olson Electrics	Guest
Valeriu	Tatu	Powersmiths	Guest
Marc	Taylor	JFE Shoji Power Canada Inc.	Guest
Vijay	Tendulkar	EATON Corporation	Member
Andreas	Thiede	Highvolt Dresden	Guest
Scott	Thomas	Hitachi Energy	Guest
Tim	Tillery	Howard Industries	Guest
Olivier	Uhlmann	Reinhausen Canada Inc.	Guest
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Rogerio	Verdolin	Verdolin Solutions Inc.	ZChair
Krishnamurthy	Vijayan	PTI Transformers	Member
Dharam	Vir	Prolec-GE	Member
Richard	vonGemmingen	Dominion Energy	Member
Pragnesh	Vyas	Sunbelt-Solomon	Member
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Joe	Watson	JD Watson and Associates Inc.	Member

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Matthew	Weisensee	PacifiCorp	Guest
Drew	Welton	Intellirent	Guest
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William	Whitehead	H2scan Corporation	Guest
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Terry	Wong	Trench Limited	Guest
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Malia	Zaman	IEEE	Guest
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