# Performance Characteristics Subcommittee (PCS)

**November 17th, 2021, In the Cloud**

**UNAPPROVED MINUTES**

**Chair: Rogerio Verdolin**

**Vice Chair: Sanjib Som**

**Secretary: Kris Zibert**

## Introduction / Attendance

There were 81 of the 114 PCS members in attendance so quorum was achieved (71% in attendance).  In addition, 90 guests were present at the meeting.  The total attendance at the meeting was 171. 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 Denver, Colorado, March 27-31, 2022.

## Chairman’s Remarks

The Chair introduced himself, the vice–chair and secretary and provided the below updates and comments.

The Chair asked everyone to mute their microphones unless speaking and reminded everyone to identify themselves and their affiliation when speaking. The Chair discussed that the meeting would be recorded for minutes purposes and then deleted.

The Chair asked everyone to state any affiliation changes since last meeting in the chat window.

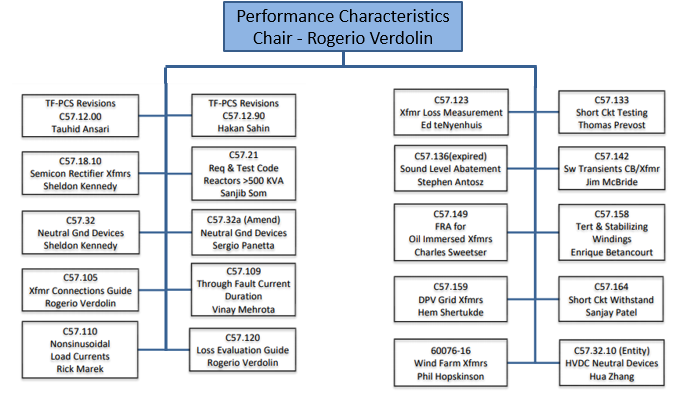
The Chair asked anyone with new business to submit in writing prior to the meeting.

**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
* C57.105 – Transformer connections guide – R. Verdolin
* C57.109 – Through Fault Current Duration – V. Mehrotra
* 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
* C57.142 – 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-new – Short Circuit Withstand (in development) – S. Patel
* 60076-16 – Wind Turbine Generator Transformers – P. Hopkinson

**Status of Active PAR’s:**

* **2021 PAR’s**
  + **C57.142 Transient Guide (in Ballot Group Creation)**
  + **C57.164 Short Circuit Withstand Guide (at Rev Com)**
* **2022 PAR’s**
  + **C57.32.10 Entity WG Guide for the Selection of Neutral-Grounding Devices for HVDC Converter Transformers (WG in draft development)**
  + **C57.149 SFRA Guide (WG in draft development)**
* **2024 PAR’s**
  + **C57.105-2019/Cor 1 (New WG)**
* **2025 PAR’s**
  + **C57.136 Audible Sound Guide (New WG)**

**Status of Standards without active PARs**

* C57.133 – Guide for Short Circuit Testing (Expired, now covered by C57.12.90)
* C57.136-2000 – Sound Abatement Guide (intentionally allowed to expire)
* C57.32-2015 – Neutral Grounding Devices (2025)
* C57.159-2016 – DPV Transformers (2026)
* C57.120-2017 – Loss Evaluation Guide (2027)
* C57.158-2017 – Application of Tertiary and Stabilizing Windings 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)

**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 Sue
* Must track attendance in AM System
* 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 1 Member missed the past 2 meetings and have been moved to “Guest” status:

|  |
| --- |
| * Roger Fenton |

Please contact Sanjib by sending him a message or see him after the meeting if you believe your membership status is not accurate.

**Attendance / Membership – New Members**

These 7 former Guests requested membership at the Fall 2019 meeting and have attended the past 2 of the last 3 meetings:

|  |  |
| --- | --- |
| * Raj Ahuja * Jose Gamboa * Sergio Hernandez Cano | * Rashed Minhaz * Afshin Rezaei-Zare * Kyle Stechschulte |

**Welcome the New Members: We look forward to your contributions to the Subcommittee**

**Attendance / Membership – Quorum determination**

* Current breakdown of the Subcommittee:
  + 114 Members
  + 58 are needed for a quorum
* Quorum was established.

## 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 passed by unanimous consent.

## Approval of Last Meeting Minutes

The Chair presented the minutes of meeting held in the Spring 2021 – April 28th, 2021 and entertained a motion to approve. The minutes had been sent to the members by email several weeks prior to the meeting. The motion passed by unanimous consent.

## Minutes from Working Groups and Task Force

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

* **WG Guide for FRA for Liquid Filled Transformers C57.149 C. Sweetser**
* **TF PCS Audible Sound Revision to Test Code R. Girgis**
* **TF PCS Continuous Revisions to C57.12.00 T. Ansari**
* **TF PCS Continuous Revisions to Test Code C57.12.90 H. Sahin**
* **WG HV & EHV Breaker & Transformer Sw. Transients C57.142 J. McBride**

Below are highlights that were discussed at the PCS meeting:

1. **WG Guide for FRA for Liquid Filled Transformers C57.149 C. Sweetser**

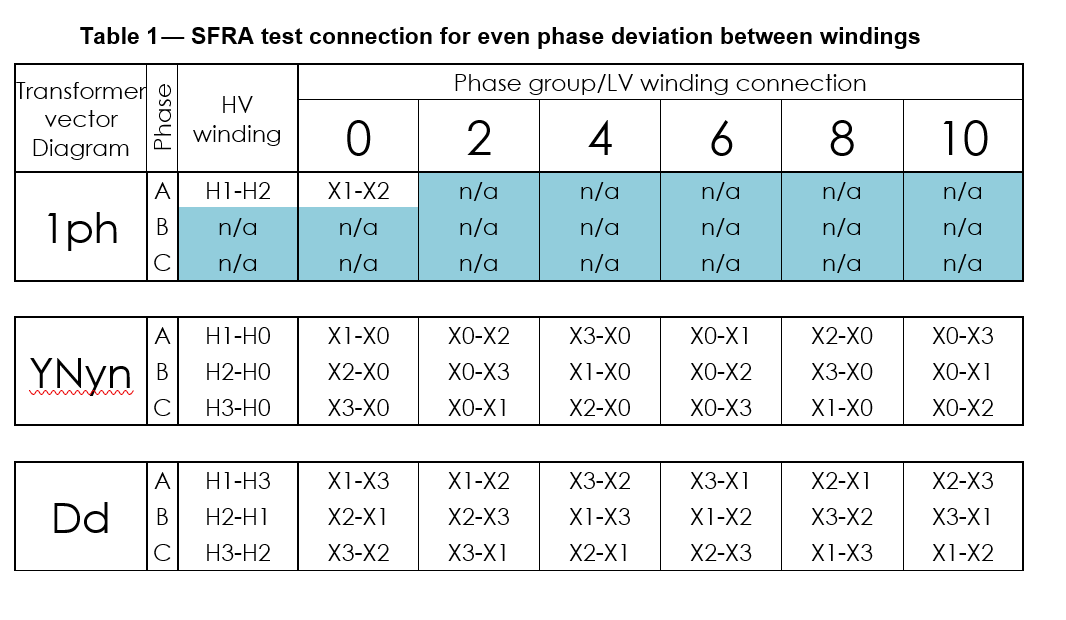
Meeting Date/Time: November 15, 2021 10:25 AM

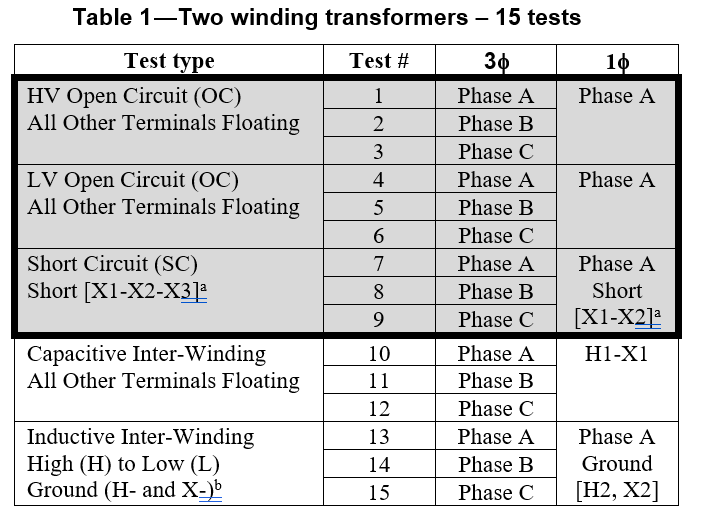
Vice-Chair: Poorvi Patel (EPRI)

Secretary: James Cross (Kinectrics)

80 total attendees, consisting of 17 members and 63 guests. The WG achieved a quorum. 17/32

**Highlights**:

* Consolidated failure mode considerations
* New Analysis Section for Radial Deformation
* Included 2 - Radial Deformation Cases
* Discussed frequency range identification
* Presented newly reformatted connection tables:



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* Connection tables are completed
* Test order lists will be added for 2W, 3W, and Auto

1. **TF on Audible Sound Revision to Test Code/C57.136 Guide for Audible Sound R. Girgis/S. Antosz**

* The TF met on Monday.
  + 25 members attended, out of a total of 61 total attendance.
  + The TF has 44 members now.
* First technical item on the Agenda :
  + Overview of the items discussed in detail at previous TF meetings with the resolution to address them in more detail in the new Noise Guide PC57.136
    - Impact of temperature on core noise
    - Impact of temperature on load noise
    - Impact of tap position on core noise
    - Impact of tap position on load noise
* Second technical item on the Agenda:
  + Overview of resolutions of comments received on ballots of the C57.12.00 and C57.12.90
    - Table C.1 of Annex C on No Load Sound levels was expanded to include sound levels of both Power & Distribution transformers
    - Add text in the Noise Guide explaining the relative levels of no load and load noise.
    - Requesting No-Load sound level measurements to be required to be made (and guaranteed) at the highest sound producing tap position combinations
      * This will require a change in C57.12.00 and therefore is planned to be discussed in a future TF meeting.
    - Requesting whether to add ambient sound pressure measurements arithmetically or logarithmically, to determine the average level.
      * Difference is <1 dB. Plan to be discussed and decided upon in a future TF meeting.
    - Requesting measuring load noise after the Heat-Run test
      * Already discussed in detail, impact is small, and is being discussed in Noise Guide.

1. **WG on Noise Guide C57.136 S. Antosz**

* WG held first meeting
* Chair presented background and status of the guide and an overview of the content of the guide.
* A solicitation of those in attendance was initiated to request membership. A total of 22 requests were received.
* Input to specific parts of the Guide was requested.
* The plan is to include these into the next draft of the Guide and send it back to the WG for comments and additional input.
* The updated draft of the Guide will be posted on the committee website in the C57.136 section under Performance Characteristics Subcommittee.

1. **TF on PCS Continuous Revisions to C57.12.00 T. Ansari**

* TF group met Nov 15, 14:20 hr with 40 out of 79 Members present.
* The Chair presented Copyright and Patents Disclosure documents from IEEE.
* Minutes from Spring 2021 Meeting were approved.
* Agenda Item discussed: Addition of transformer core information on Type C Nameplate.
  + Accepted to indicate Type of Core: “Shell” or “Core”.
  + Discussion not finished to define Specific type of construction: “D or Conventional”, for Shell type transformers, number of columns and how many of those wound, for “Core” type transformers.
* Meeting adjourned at 15:35 hr.

1. **TF on PCS Continuous Revisions to Test Code C57.12.90 H. Sahin**

* Meeting started at 9:25 am CST. Quorum was not achieved during the first poll. Meeting continued to share the information
* 30 minutes into the meeting, a second poll was conducted, and quorum was achieved with 37/69 members’ presence out of 79 total attendees
* Agenda and previous meeting minutes were officially approved
* Updated the TF that the revision to the “Ratio Test Methods” under section 7.3 was passed on to the PCS
* TF second revision survey results and comments for proposed changes to the “Ratio tests voltage and frequency” section 7.1.2 was reviewed. Members voted to pass the new version of the section to the PCS
* Meeting started at 9:25 am CST. Quorum was not achieved during the first poll. Meeting continued to share the information
* 30 minutes into the meeting, a second poll was conducted, and quorum was achieved with 37/69 members’ presence out of 79 total attendees
* Agenda and previous meeting minutes were officially approved
* Updated the TF that the revision to the “Ratio Test Methods” under section 7.3 was passed on to the PCS
* TF second revision survey results and comments for proposed changes to the “Ratio tests voltage and frequency” section 7.1.2 was reviewed. Members voted to pass the new version of the section to the PCS
* Discussion took place regarding surveying the recommendations of this TF to the PCS SC for approval.

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

* 58 total attendees, consisting of 25 members and 33 guests. The WG did not achieve a quorum. 25 / 56
* Agenda and Minutes were Approved via e-mail.
* IEEE Transactions Paper developed by those in the C57.142 WG has been published and is now available at <https://ieeexplore.ieee.org/document/9161400>.
* Transformers WG and Switchgear Committee Task Force have unanimously approved Draft 9B which has now been submitted to MEC for review.
* The ballot group formation has been initiated and those who wish to join the ballot group should join before December 10th, 2021.
* We have received a PAR extension to complete the balloting process. PAR now expires on December 31st, 2023.
* Switchgear Committee has requested that we help to provide dielectric transient withstand information on transformers and reactors. There was some discussion on this topic and a small TF was formed to help draft a response. Any response will be reviewed and approved prior to sending.
* We reviewed the Mitigation Methods which have been presented and discussed in our WG meetings. There was an open discussion to organization of these items for presentation to the Dielectric Tests subcommittee. Several participants offered to assist in future virtual meeting to help draft a completed response to Dielectric Test Subcommittee task.
* New Business – Deepak Kumaria - Requested inclusion of instrument transformers in our mitigation studies. This topic was postponed due to lack of time remaining in today’s meeting.
* Next Meeting: Spring 2022 – Denver, CO on March 29th, 2022.
* The meeting was Adjourned at 3:40pm Central Time.

## Unfinished (Old) Business

* **There was no old busines.**

## New Business

* **There was no new business.**

## Adjournment

* **The meeting adjourned at 3:21PM.**

## Minutes of Meetings of Working Group (WG) and Task Force (TF) Reports (all unapproved)

### WG Guide for FRA for Liquid Filled Transformers C57.149

**Working Group “Guide for FRA for Liquid-Filled Transformers” C57.149**

**(Performance Characteristics Sub-Committee)**

Meeting Date/Time: November 15, 2021 1010 H

Meeting Location: Virtual – On-Line

Chairman: Charles Sweetser [CS] (Omicron)

Vice-Chair: Poorvi Patel (EPRI)

Secretary: James Cross (Kinectrics)

Meeting was convened at 1010 H by Chairman Charles Sweetser with 70 total attendees, consisting of 18 members and 52 guests. A quorum was achieved.

AGENDA

1. Introduction and Member confirmation / Attendance poll
2. Meeting Guidelines and Patent information.
3. Review Agenda
4. Approval of Minutes from October 19, 2020 and April 26, 2021 Meetings (Virtual) Discussions
   1. Update/Presentation – Analysis and Interpretation (New Radial Format)
      1. Peter Werelius (Megger) - Lead
   2. Connection Table Discussion – Presentation of new tables
      1. Diego Robalino (Megger)
5. Old Business
6. New Business
7. Adjourn

CS reviewed the IEEE Working Group meeting guidelines and the standard patent disclosure info. (No response from attendees to request for patent info.)

CS showed a slide showing the WG membership in preparation for the electronic polling of attendance. Attendees of the virtual meeting were instructed to confirm whether or not their name was on the membership roster.

CS waited 5 minutes before triggering the attendance poll to allow people to sign into the meeting.

The membership list shows 32 WG members.

18 members were present at this meeting, so quorum was achieved.

The agendas and minutes were approved, both Fall 2020 and Spring 2021.

CS noted that there is a 1 year left on the PAR and so we need to get the draft prepared this year for balloting.

Discussions:

Revision tasks are wrapping up with the main focus on consolidated failure modes, connection tables, and analysis.

Latest work included:

1. Consolidated failure mode considerations

The consolidation is as follows:

* + Radial “Hoop Buckling” Deformation of Winding
  + Axial Winding Elongation “Telescoping”
  + Overall- Bulk & Localized Movement
  + Core Defects
  + Winding Turn-to-Turn Short Circuit
  + Winding Looseness due to Transportation
  + Residual Magnetization

1. New Analysis Section for Radial Deformation
   * Introduced newly formatted Radial Winding deformation section. Several new edits were discussed. Two new figures added along with two new case studies.
   * Discussions focused around identifying frequency ranges associated with Radial Winding deformation. The WG will keep the original ranges.
2. Presented newly reformatted connection tables:
   * Connection tables are completed and presented by Diego Robalino
   * Test order lists will be added for 2W, 3W, and Auto

* Section leadership assignments for final wrap-up
  + Grounding – Wes Schrom
  + Connection – Diego Robalino
  + Analysis – Mario Locarno

List of meeting participants with membership status at the end of the meeting:

Ali Naderian

Jonathan Reimer

Rogerio Verdolin Member

Amitabh Sarkar

Taylor Gray

Sergio Hernandez Cano

Sudip Chanda

Fernando Leal Member

Jeremiah Bradshaw

Mark Perkins

Drew Welton

Suresh Babanna

Eduardo Garcia

Eric Davis

Stacey Kessler

Luiz Cheim Member

Sanket Bolar

Philip Miller

George Frimpong

Diego Robalino Member

Alwyn VanderWalt

vinay mehrotra

Jeff Ray JLR Consulting

Loren Wagenaar

Rodrigo Ocon

Jason Varnell Member

Emilio Morales-Cruz

Charles Sweetser Member

Jonathan Sinclair Member

Waldemar Ziomek

Shibao Zhang Member

Pranav Ketharam Pattabi

Leopoldo Rodriguez

Mario Locarno Member

Rob Ghosh

Zack Draper

James Gardner

James Cross Member

Wes Schrom Member

Dwight Parkinson

Daniel Weyer Member

Paul Boman

Hakan Sahin

arturo nunez

Donnie Rackley

Kenn Skinger

David Murray

Jim McBride Member

Roger Hayes

Rakesh Patel Member

Balakrishnan Mani

Marco Espindola

Wayne Ellis

Scott Reed Member

Bill Whitehead

Shawn Gossett

Patrick Picher Member

Arup Chakraborty

Matthew Mcfadden

Larry Christodoulou

Gael R Kennedy

Brady Nesvold

Bertrand Poulin

Ed teNyenhuis

Chris Slattery

Mickel Saad Member

K.Vijayan

Steve Jordan

Peter Werelius Member

Evgenii Ermakov Member

Alexander Kraetge

Paul Jarman

Jos Veens

Matthew Pinard

Lorne Gara

Respectfully submitted,

James Cross

Secretary

C57.149 WG

### TF PCS Continuous Revisions to Test Code C57.12.90

Meeting was called to order at 9:25 AM CST, November 16, 2021.

1. **Administrative**
   1. IEEE Patent Policy and Call for Patents
      1. No comments from group
   2. IEEE SA Copyright Policy
      1. No comments from group
   3. Introduction of the new officers
      1. Chair: Hakan Sahin
      2. Vice-Chair: -
      3. Secretary: Pugal. Selvaraj
   4. Update on membership and Quorum
      1. First poll conducted at 9:30AM did not achieve quorum, second poll conducted at 11 AM, achieved quorum with 37/69 members’ presence
   5. Approval of Agenda
      1. No opposition to unanimous approval. APPROVED
   6. Approval of minutes from Fall 2020 and Sprint 2021 TF Meeting
      1. Minutes of both Fall 2020 meeting and Spring 2021 meetings were approved.
2. **Old Business – “Ratio Test Methods” clause 7.3**
   1. Chair provided update on the status of changes to “Ratio Test Methods” under section 7.3. This revision was already approved by poll during the Spring-21 meeting. However, Chair needed to confirm the poll submitters’ member status. Chair shared with the group that he had confirmed the poll member count, and the revision was passed on to PCS for survey. Revision as below:

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1. **Old Business - “Ratio tests voltage and frequency” under section 7.1.2**

Chair shared the proposed changes with the group, which was surveyed within the TF. The proposed revision was:

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Survey results within the Task Force was:

Table

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Chair commented to pass the revision to PCS to be surveyed since it has passed with majority approvals. However, Bruce Forsyth corrected the Chair that since the total responses were less than the half of the total members, it would not count as “pass” within the TF, hence recommended to survey during the meeting since we had the quorum. Peter Klaine made motion to accept the proposed revisions to the ratio voltages and test frequency under section 7.1,2 and pass on the survey results to PCS. Steve Antoz seconded the motion. Daniel Blaydon made objection for unanimous approval and the motion was set on floor for voting. Motion was accepted with 29 members for, 3 against and 3 abstain.

1. **Old Business – “Number of short circuit tests” under section 12.3.4**

Chair presented the proposed changes to the “Number of short circuit tests” under section 12.3.4along with the survey results which was done within the Task Force. The proposed revision and the survery results are as follows:

Text, letter

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Since we had the quorum, Chair asked if anyone had any objections to passing the presented revision. John John made motion to accept the proposed revisions to the number of short circuits under section 12.3.4 and forward survey results to PCS. Peter Klaine seconded the motion. Chair opened the floor for discussions comments and objections. Motion passed.

1. **Old Business - N*ew* proposed test sections 8.7 & 9.6 for OLTC tests**

Chair Presented the new proposed test sections for OLTC tests under section 8.7 and 9.6, along with the Task Force survey results, which are as follows:

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Text, letter

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Text

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Chair asked the group if anyone had any objections to approving to pass the new section to PCS for survey. Steve Antoz made motion to accept the proposed revisions to the LTC tests under section 8.7 and 9.6 as presented and forward the survey results to PCS. Hugo Flores seconded the motion. However, there was an objection to the approval, as:

Dr Alexander commented that some factories may not have needed power source to conduct the test per proposed revisions and sought permission to make a presentation on the impact of the changes. Due to lack of time, and the long history of the work performed on these new clauses, which was presented, Chair declined the request of Dr. Alexander for making presentation. Rainer Frotscher commented that the discussions regarding power source requirements were discussed in the past meetings and clarified. Dr. Alexander made objection for unanimous approval. The Motion was sent for poll voting. Motion passed with 34 approval, 2 opposed and 5 abstain. The group approved the new sections to be sent to PCS for survey.

Chair commented that since there is no definitive conclusion to either using “LTC” or “OLTC”, he will change the acronym to the most commonly known “LTC” and send the new clauses to PCS to be surveyed.

1. **New Business - Request by Jason Varnell to revise the subclauses 9.3.a and 9.3.b, “Tests for measuring load losses and impedance voltage” to bring better clarity, and Chair’s proposal for this revision**

Chair presented the new business requested by Jason Vernal’s to revise the subclauses 9.3.a and 9.3.b for better clarity. Chair presented the question and his answers to each, as follows:

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Raja Ahuja commented that the clarification is sufficient, and revision is not necessary. Steve Antoz recommended to Jason to make a proposal of the revision for review and Jason Vernal agreed to provide the proposed changes to Chair.

**Final Remark by the Chair:**

I will send all these revisions and new clauses to PCS and work closely with PCS Chair Rogerio and help during the PCS survey of these clauses. We will target to get these done in January 2022.

1. Next meeting: TBD at Spring 2022 Transformer Committee Meeting scheduled for March 27-31, 2022 in Denver, Colorado, USA
2. Close of meeting
   1. Meeting adjourned at 10:40 AM CST
3. Attendee’s list is provided in Annexure - A

Submitted by: Hakan Sahin Date:\_\_\_\_\_12/27/21\_\_\_\_\_\_\_

**Annexure – A Meeting Attendance:**

|  |  |
| --- | --- |
| Aaron Meyers | EATON Corporation |
| Ajith Varghese | SPX Transformer Solutions, Inc. |
| Alain Bolliger | HV TECHNOLOGIES, Inc. |
| Alexander Kraetge | OMICRON electronics Deutschland GmbH |
| Amitabh Sarkar | Virginia Transformer Corp. |
| Andy Steineman | Delta Star Inc. |
| Anthony Franchitti | PECO Energy Company |
| Antonio Ceballos | Georgia Transformer |
| Arup Chakraborty | Delta Star Inc. |
| Axel Kraemer | Maschinenfabrik Reinhausen |
| Barry Beaster | The H-J Family of Companies |
| Bertrand Poulin | Hitachi ABB Power Grids |
| Bill Griesacker | Boettger Transformer Consulting LLC |
| Brady Nesvold | Xcel Energy |
| Brandon Dent | Memphis Light, Gas & Water |
| Bruce Forsyth | Bruce Forsyth and Associates LLC |
| Charles Sweetser | OMICRON electronics Corp USA |
| Chris Baumgartner | We Energies |
| Chris Powell | Intermountain Electronics |
| Chris Slattery | FirstEnergy Corp. |
| Craig Colopy | EATON Corporation |
| Curtiss Frazier | Ameren |
| Daniel Blaydon | Baltimore Gas & Electric |
| Daniel Weyer | Nebraska Public Power District |
| DANIELA EMBER BACIU | Hydro-Quebec IREQ |
| Darren Brown | Howard Industries |
| David Murray | Tennessee Valley Authority |
| David Walker | MGM Transformer Company |
| Digby Scott H | Duke Energy |
| Don Dorris | Nashville Electric Service |
| Donald Ayers | Ayers Transformer Consulting |
| Alexander Winter | HIGHVOLT Pruftechnik Dresden |
| Duvier Bedoya | Hitachi ABB Power Grids |
| Dwight Parkinson | EATON Corporation |
| Eduardo Garcia | Siemens AG |
| Elise Arnold | SGB |
| enrique betancourt | Prolec GE |
| Eric Schleismann | Southern Company Services |
| Eric Weatherbee | PCORE Electric |
| Evgenii Ermakov | Hitachi Energy |
| Feras Fattal | Manitoba Hydro |
| Fernando Leal | Prolec GE |
| Gael Kennady | GR Kennedy & Associates LLC |
| Gary King | Howard Industries |
| Hakan Sahin | Virginia and Georgia Transformers |
| Harry Pepe | Phenix Technologies, Inc. |
| Hemchandra Shertukde | University of Hartford |
| Hugo Flores | Hitachi ABB Power Grids |
| J.Dennis Marlow | DenMar TDS Transformers |
| Jarrod Prince | ERMCO |
| Jason Varnell | Doble Engineering Co. |
| Javier Arteaga | Hitachi Energy |
| Jeff Britton | Phenix Technologies, Inc. |
| Jeff Door | H-J Family of Companies |
| Jeff Gragert | JLR Consulting, Inc. |
| Jeffrey Wright | Duquesne Light Co. |
| Joe Watson | JD Watson and Associates Inc. |
| John Crouse | Roswell Alliance |
| John Herron | Raytech USA |
| John K John | Virginia Transformer Corp. |
| John Lackey | PowerNex Associates Inc. |
| Jorge Cruz | PTI Transformers |
| Juan Carlos Cruz Valdes | Prolec GE |
| Krishnamurthy Vijayan | PTI Transformers |
| Kannan Veeran | Georgia Transformer |
| Kerwin Stretch | Siemens Energy |
| Kris Neild | Megger |
| Kris Zibert | Allgeier, Martin and Associates |
| KUSHAL SINGH | ComEd |
| Mahesh Sampat | EMS Consulting Inc. |
| Marc Taylor | Taylor |
| Markus Schiessl | SGB |
| Mats Bernesjo | Hitachi Energy |
| Mike Iman | MGM Transformer Company |
| Mike Warntjes | American Transmission Co. |
| Marnie Roussel | Entergy |
| Muhammad Ali | Northern Transformer |
| Nicholas Jensen | Delta Star Inc. |
| Norman Field | Stantec |
| Peter Kleine | US Army Corps of Engineers |
| Phil Hopkinson | HVOLT Inc. |
| Polo Rodríguez |  |
| Pugal Selvaraj | Virginia Transformer Corp. |
| Rainer Frotscher | Maschinenfabrik Reinhausen |
| Raj Ahuja | Raj Ahuja Consulting |
| Ramsis Girgis | Hitachi Energy |
| Reto Fausch | RF Solutions |
| Reza Torabi | SMIT Transformatoren B.V. |
| Rhea Montpool | Schneider Electric |
| Rhett Chrysler | ERMCO |
| Rod Sauls | Southern Company Services |
| Rogerio Verdolin | Verdolin Solutions Inc. |
| Samragni Dutta Roy | Siemens Energy |
| Sanjay Y. Patel | Smit Transformer |
| Sanjib Som | Pennsylvania Transformer |
| Sankarakurup, Dinesh | Duke Energy |
| Saramma Hoffman | PPL Electric Utilities |
| Sen, Cihangir John | Duke Energy |
| Shankar Subramany | KEMA Labs |
| Shawn Gossett | Ameren |
| Sheldon Kennedy | Niagara Transformer |
| Steve Antosz | Stephen Antosz & Associates, Inc |
| Steve Brzoznowski | Bonneville Power Administration |
| Sukhdev Walia | New Energy Power Co. |
| Suresh Babanna | SPX Transformer Solutions, Inc. |
| Susan McNelly | Xcel Energy |
| Terence J. Martin | Cleveland |
| Tiffany Lucas | SPX Transformer Solutions, Inc. |
| Toby Johnson | Hunt Electric |
| Troy Tanaka | Burns & McDonnell |
| Ulf Radbrandt | Hitachi ABB Power Grids |
| vinay mehrotra | SPX Transformer Solutions, Inc. |
| Wallace Binder | WBBinder Consultant |
| Weijun Li | Braintree Electric Light Dept. |
| William Boettger | Boettger Transformer Consulting LLC |

**Quorum Confirmation by the second poll:**

**Text, letter

Description automatically generated**

36 + from K.Vijayan to everyone: Krishnamurthy Vijayan- I voted first

time but could not vote the 2nd time. I am member and so include me for attendance

Total 37 members were present

### TF PCS Audible Sound Revision to Clause 13 of C57.12.90

**Unapproved Minutes of** **Fall 2021 TF PCS Audible Sound Revision to Clause 13 of C57.12.90**

The task force met at 12:55 PM, on Monday, November 15, 2021. Chairman, Dr. Ramsis Girgis, presided over the technical part of the meeting and Secretary, Barry Beaster, handled the administrative duties of the meeting.

After the Spring 2021 meeting, the membership was adjusted to 44 members. There was 25 of 44 members with a total of 61 persons in attendance. A quorum was established with 56.8 % of the membership. A call was made for any objections for a unanimous approval of the Spring 2021 TF minutes; no objections were raised so minutes are approved as written. A revised agenda was presented without objections for approval. Two requests for membership have been reviewed.

The first technical agenda item was a summary of items previously considered for inclusion in Clause 13 of C57.12.90. The following bullets describe these four subjects with the previously agreed upon action by the TF.

* Impact of temperature on Core Noise
* Impact of temperature on Load Noise
* Impact of Tap position on core noise
* Impact of Tap position on load noise

Previous decision: These items are to be addressed in more detail in the noise guide rather than in the C57.12.90 Standard. This is already addressed in Clauses 3.2.1.6, 3.2.2.6, 3.2.1.4, and 3.2.2.5 of the present draft of the new noise guide, C57.136.

The next agenda item was a review of resolutions previously agreed upon at earlier TF meetings on comments received from balloting of C57.12.00 and C57.12.90. These are:

1. Comment: Table C1 in C57.12.00 starts at 700 kVA and refers to “Power Transformers”, Table C2 refers to “Distribution Transformers”, covers up to 3 MVA, and C57.12.36 for distribution substation transformers has a scope of up to 10 MVA.

Resolution (already incorporated in the new revision of C57.12.00):

* No Load Sound levels for ratings below 700 kVA were added to Table C1.
* Original Tables C1 and C2 have been replaced by a revised Table C1.
* “Distribution transformers” were added to title of Annex C. The title now reads: “Audible sound pressure levels for No-Load and Load noise of liquid immersed power and distribution transformers”. Title of Table C1 was supposed to include Distribution transformers but it was missed. The chairman of C57.12.00 will try to correct this before publication but if not, then through a Corrigenda.

1. Comment: Table C.3 in C57.12.00 specifies audible sound levels of load noise without the consideration of BIL, and these levels are much lower than the no-load levels specified in Table C.1.

Resolution: Add such an explanation into the Noise Guide with a few clarifying sentences. It is being planned.

1. Comment: No-Load sound level measurements should be required to be made (and guaranteed) at the highest sound producing tap position combinations and not on the rated tap position.

Related text present in Clause 13.3.3.1 of C57.12.00 : Core noise is to be measured at rated tap position and only upon request by customer that the transformer is tested at highest noise producing tap position.

Issue: This will require changes in C57.12.00 and C57.12.90. The TF needs to decide whether the existing text is, or is not, sufficient.

Resolution: This is planned to be discussed in a future meeting of the TF. Also, the impact of Tap Position on Core noise is discussed in the noise guide

1. Comment: Related to whether to add ambient sound pressure measurements arithmetically, or logarithmically, to determine the average level

Issue: The difference is typically a fraction of 1 dB. Also, this will require changes in C57.12.90

Resolution: This is planned to be discussed in a future meeting of the TF

1. Comment: Related to whether to measure load noise after the Heat-Run test

Resolution: This item was discussed in great detail at previous TF meetings. Also, impact of temperature on Load noise is small and Text on this impact has already been incorporated in the Noise Guide (C57.136).

The next agenda item dealt with the new “*Guide for Audible Sound of Liquid-Immersed Power Transformers”,* IEEE PC57.136. The officers for this Guide WG are Stephen Antosz as Chair, Ramsis Girgis as Vice-Chair, and Mats Bernesjo as Secretary. Separate minutes of the WG meeting will be submitted to the PCS separately.

A discussion was raised about the continuous operation conditions of certain transformers operating in a step-up condition, e.g. GSUs, where the core flux density is typically higher than the rated flux density which, in turn, causes the core noise level to be higher than at rated. A request was made to review if factory testing might be able to address this condition. Joe Foldi asked how to incorporate in-service modes of operation to factory testing. Should the worst case tap position be used? The Chairman responded that the core flux density, under such loading conditions, can be calculated and the transformer can be tested for core noise in the factory at that flux density. Also, Joe requested that some text be added in the Guide about whether the guaranteed sound level should be based on the worst case tap position. Presently C57.12.90 has the guarantee based on the nominal tap position, unless otherwise specified by the User. The Chairman responded that text on this subject will be added to the Guide as part of “Impact of Load and Power Factor on Core noise”. However, requiring core noise to be tested at the worst case tap position will need to be discussed at another Audible Sound TF meeting.

A solicitation of those in attendance was initiated to request membership in the Noise Guide. A total of twenty-two requests were received. Names and affiliations of these new WG members are included in the minutes of the Guide WG meeting.

With no new business raised, the meeting was adjourned.

Respectfully submitted,

Barry Beaster, TF Secretary

Spring 2021 Task Force Meeting Attendance and Affiliation is as follows:

|  |  |  |
| --- | --- | --- |
| First Name | Last Name | Company |
| Kayland | Adams | SPX Transformer Solutions, Inc. |
| Raj | Ahuja | Raj Ahuja Consulting |
| Stephen | Antosz | Stephen Antosz & Associates, Inc |
| Edmundo | Arevalo | Bonneville Power Administration |
| Elise | Arnold | SGB |
| Donald | Ayers | Ayers Transformer Consulting |
| Suresh | Babanna | SPX Transformer Solutions, Inc. |
| Barry | Beaster | H-J Family of Companies |
| Mats | Bernesjo | Hitachi Energy |
| Enrique | Betancourt | Prolec GE |
| Thomas | Blackburn | Gene Blackburn Engineering |
| William | Boettger | Boettger Transformer Consulting LLC |
| Darren | Brown | Howard Industries |
| Steven | Brzoznowski | Bonneville Power Administration |
| Arup | Chakraborty | Delta Star Inc. |
| John | Crouse | Roswell Alliance |
| Everton | De Oliveira | Siemens Energy |
| Scott | Digby | Duke Energy |
| Thomas | Eagle | SPX Transformer Solutions, Inc. |
| Thomas | Falkenburger | Coil Innovation USA, Inc. |
| Hugo | Flores | Hitachi Energy |
| Joseph | Foldi | Foldi & Associates, Inc. |
| Eduardo | Garcia Wild | Siemens Energy |
| Mohammad | Gholami | Trench Limited |
| Ramsis | Girgis | Hitachi Energy |
| Ismail | Guner | Hydro-Quebec |
| Thomas | Hartmann | Pepco Holdings Inc. |
| Nicholas | Jensen | Delta Star Inc. |
| John | John | Virginia Transformer Corp. |
| Stephen | Jordan | Tennessee Valley Authority |
| Kurt | Kaineder | Siemens Energy |
| Xose | Lopez-Fernandez | Universidade de Vigo |
| Vinay | Mehrotra | SPX Transformer Solutions, Inc. |
| Aaron | Meyers | EATON Corporation |
| Rashed | Minhaz | Transformer Consulting Services Inc. |
| Paul | Morakinyo | PSEG |
| Joe | Nims | Allen & Hoshall, Inc. |
| Sanjay | Patel | Smit Transformer |
| Sylvain | Plante | Hydro-Quebec |
| Klaus | Pointner | Trench Austria GmbH |
| Pierre | Riffon | Pierre Riffon Consultant Inc. |
| Tim | Rocque | SPX Transformer Solutions, Inc. |
| Dinesh | Sankarakurup | Duke Energy |
| Amitabh | Sarkar | Virginia Transformer Corp. |
| Daniel | Sauer | EATON Corporation |
| Markus | Schiessl | SGB |
| Cihangir | Sen | Duke Energy |
| Michael | Sharp | Trench Limited |
| Christopher | Slattery | FirstEnergy Corp. |
| Sanjib | Som | Pennsylvania Transformer |
| Marc | Taylor | JFE Shoji Power Canada Inc. |
| Ryan | Thompson | Burns & McDonnell |
| Reza | Torabi Goodarzi | SMIT Transformatoren B.V. |
| Ajith | Varghese | SPX Transformer Solutions, Inc. |
| Jason | Varnell | Doble Engineering Co. |
| Kiran | Vedante | Ritz Instrument Transformers |
| Jos | Veens | SMIT Transformatoren B.V. |
| David | Wallach | Duke Energy |
| Terry | Wong | Trench Limited |
| Jeffrey | Wright | Duquesne Light Co. |

### WG PC57.136 Noise Guide

**Unapproved Minutes of Fall 2021 TF PCS IEEE PC57.136, “Guide for Audible Sound of Liquid-Immersed Power Transformers”**

The task force met at 12:55 PM, on Monday, November 15, 2021 as part of the TF PCS Audible Sound Revision to Clause 13 of C57.12.90 meeting. Chairman Steve Antosz presided over the meeting with Ramsis Girgis being the Vice-Chair, and Mats Bernesjo as Secretary.

The total membership of the WG is 47, including 22 requested membership at this meeting. The total attendance was 51.

First, the Chairman gave the following background for the new Guide:

* C57.136 was the “Sound Abatement Guide” and the document expired several years ago
* 2019/2020 was decided to resurrect/update it
* The PAR was approved in early 2021
* An early draft was circulated to TF participants in April 2021
* Some feedback was received and incorporated
* The draft was updated Summer/Fall 2021

The new guide has made significant progress and noise experts are asked to review the latest draft and provide more material where needed. The following list of technical chapters and sections of the Guide are summarized below:

**Chapter 3 Basics and Standards of Transformer Noise**

3.2 Sources and characteristics of transformer noise

3.2.1 Core noise

3.2.1.1 Impact of Core design & material

3.2.1.2 Frequency spectrum

3.2.1.3 Impact of Core and Tank resonances

3.2.1.4 Impact of Tap Changer position

3.2.1.5 Impact of load and load power factor

3.2.1.6 Impact of core temperature

3.2.2 Load noise

3.2.2.1 Sources of load noise

3.2.2.2 Design factors impacting load noise level

3.2.2.3 Impact of load

3.2.2.4 Frequency components

3.2.2.5 Impact of tap changer position

3.2.2.6 Impact of temperature

3.2.3 Cooling system noise

3.2.4 Contribution of components of transformer noise to the total noise level of transformers

3.3 Transformer industry standards related to noise

3.3.1 IEEE Standards

3.3.2 IEC Standards

3.3.3 Sound level information used in the IEEE & IEC Standards

**Chapter 4 Factors affecting sound levels in field operation**

4.1 Operating voltage and tap-changer settings

4.2 Noise of auxiliary transformers and reactors

4.3 Load noise

4.4 Load power factor

4.5 Voltage and load current harmonics

4.5.1 Load current harmonics

4.5.2 Harmonics in the excitation voltage

4.6 DC and GIC current

4.7 Contribution from vibrations of structures attached to the transformer

4.8 Contribution of sound build-up from surrounding sound / fire walls

4.9 Impact of transformer mounting

4.10 Other sources of noise on site

4.11 Operating temperature

**Chapter 5 Transformer noise reduction in the design stage and factory**

5.1 Methods to reduce core noise

5.1.1 Lower core flux density

5.1.2 Usage of high permeability grain-oriented core steel

5.1.3 Avoiding core resonance

5.1.4 Filling tank stiffeners with sand

5.1.5 Other means

5.2 Methods to reduce / eliminate cooling equipment noise

5.3 Methods to reduce load noise

5.4 Methods to reduce both core and load noise

5.4.1 Low noise tank design

5.4.2 Vibration isolation between active part and tank

5.4.3 Tank mounted external sound panels

5.4.4 Sound enclosures

5.5 Older methods of transformer noise reduction

**Chapter 6 Methods to reduce noise on site**

6.1 Sound enclosures

6.2 Sound barriers and walls

6.3 Other field installed techniques

**Chapter 7 Determination of required sound levels of power transformers on-site**

7.1 Simplified relationship between sound level of a transformer and sound level at specific receiver locations on the far field

7.2 Determination of appropriate noise level of a transformer on site

It was reported that input into Clauses 6.1 and 6.2 was solicited from Sanjay Patel and is expected to be received in the next week or two. Also, material of Clause 7.2 was requested from Chris Howell of Burns & McDonnel and was recently received. These will be added in the next draft of the Guide.

In relation to clause 7.2 regarding methods of determination of appropriate noise level of a transformer on site, one manufacturer noted that some specifications from the north-east region of the country specify the same low total noise level for transformers of a wide range of MVA ratings. This represents added expense to the customer to try to achieve such low noise levels for larger transformers. Several utility representatives commented on how they determine sound requirements for their transformer Specifications. The Vice Chair commented that he previously gave a presentation at a tutorial (Fall 2020 meeting) specifically on issues with some sound requirements in Specification. He promised to add this presentation to the website of the IEEE Standards.

A solicitation of those in attendance was initiated to request membership in the Noise Guide. A total of twenty-two requests were received. The following names are included in this following table.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Scott Digby | Hugo Flores | Ajith Varghese | Vinay Mehrotra | David Wallach |
| Chris Slattery | Klaus Pointer | Marc Taylor | Sanjib Som | William Boettger |
| John K. John | Eduardo Garcia | Enrique Betancourt | Elise Arnold | Markus Schiessl |
| Steve Brzoznowski | Kurt Kaineder | Everton De Oliveira | K. Vijayan | Thomas Hartmann |
| Kiran Vendante | Kayland Adams |  |  |  |

Finally, a request was made to members of the newly formed Guide WG to review the next draft of the Noise Guide and provide feedback, add text, as well as add their experience to Chapter 6 on methods on noise mitigation on site. The current Draft will be posted on the committee website in the C57.136 section under Performance Characteristics Sub Committee and it will be posted again after updates are made.

With no new business raised, the meeting was adjourned.

Respectfully submitted,

Mats Bernesjo, WG Secretary

### TF PCS Continuous Revisions to C57.12.00

*PCS Task Force on General Requirements C57.12.00*

*Performance Characteristics Subcommittee*

*IEEE / PES Transformers Committee*

*November 15, 2021 2:20 PM*

*On-Line Meeting; Virtual, CT Time Zone USA*

***UNAPPROVED MINUTES***

The PCS Task Force on General Requirements for C57.12.00 met on Monday, November 15, 2021. The Chair Tauhid Ansari called the Group to order at 2:20 PM and reminded purpose and scope of the TF. The copyright statement from IEEE was presented to the Group, as well as the essential patents claim; none of the members and guests present was aware of issues related to this TF’s activities. There were **46** Members and **66** Guests present. The quorum to conduct regular business was achieved, as **77** members are registered in the Task Force.

The following **8** guests requested membership:

Alexander Kraetge OMICRON

Dan Sauer Eaton

Deepak Kumaria Applied Materials

Mats Bernesjo Hitachi Energy

Ryan Hogg Bureau of Reclamation

Samragni Dutta Roy Siemens Energy

Suresh Babanna SPX Transformer Solutions

Vinay Mehrotra SPX Transformer Solutions

The Agenda proposed by the TF Chair was unanimously approved by the Group (Motion Raj Ahuja, Second Phil Hopkinson), and also were approved the minutes from the Spring 2021 meeting, with none opposed (Motion Sylvain Plante, Second Eduardo Garcia).

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

1. OLD BUSINESS
2. **Inclusion of Core information on Nameplate**

This request had originally been brought up by Bipin Patel, expecting to simplify GIC evaluation of power transformers (type C Nameplate). In course of discussion with subject matter experts, it turned out that much more information would be required for a proper evaluation. However, a second group of participants saw value on having core type information on nameplate and the topic came back within Group’s business agenda.

With support of a TF of WG Members, the Chair developed new proposed text to include on Table 6 of C5.12.00 standard. WG Member Ramsis Girgis provided detailed description of core type options currently applied in industry. The Chair opened the floor for discussion.

Group’s general opinion was in favor of including either “Shell” or “Core” on “Core Design” (new, line 25) of Table 6, but there was lengthy discussion as for “Core Type” options. Main arguments brought up by meeting participants follow:

* There are different types of Shell design cores which designations should be stated as possible inputs for Table 6. Option to include sketches as part C57.105 was mentioned but was not considered within TF’s scope.
* Recommendation was given to let manufacturers freely state “core type”, according to own definitions.
* Recommendation was given to address at least 80% of industry application, leaving special cases to manufacturer’s own definitions.

The Chair tried to lead the Group to agree on a new version of proposed Line 26 to Table 6, showing different options, but it was not possible to reach a consensus within the time of the meeting. The subject will remain within TF’s agenda.

Meeting was adjourned at 15:35 hr. (Motion Phil Hopkinson, Second Eduardo García).

Respectfully submitted,

Tauhid Ansari Enrique Betancourt

WG Chair Co-Chair and Acting Secretary

|  |  |  |
| --- | --- | --- |
| Name of attendees |  |  |
| Joe Foldi | Donald Ayers | Jim Graham |
| Ajith Varghese | Dr. Alexander Winter | John Crouse |
| Alexander Kraetge | Duvier Bedoya | John Herron |
| Ali Naderian | Ed teNyenhuis | John K John |
| Allan Bartek P.E. | Eduardo Garcia | John Lackey |
| Amitabh Sarkar | Elise Arnold | K.Vijayan |
| Anderson, Greg | Encore 12 | Kenneth Skinger |
| Andrew Larison | enrique betancourt | Kevin Biggie |
| Anthony Franchitti | Eric Schleismann | Kris Neild |
| Arup Chakraborty | Evan H.B. Knapp-Eaton | Kris Zibert |
| Bertrand Poulin | Everton De Oliveira | Larry Dix |
| Bruce Forsyth | Feras Fattal | Leopoldo Rodriguez |
| Bruce Webb KUB | Gary King | Marc Taylor |
| Chris Baumgartner | hachichi said | Mark Perkins |
| Chris Slattery FirstEnergy | Hakan Sahin | Markus Schiessl |
| Craig Colopy | Harry Pepe | Marnie Roussell |
| Dan Sauer - Eaton | HUAN DINH | Mats Bernesjo |
| Daniel Blaydon | J.Dennis Marlow | Michael Botti |
| DANIELA EMBER BACIU | Jarrod Prince - ERMCO | Michael Zarnowski - Carte |
| Darren Brown | Jason Varnell | Muhammad Ali Masood Cheema |
| deepak | Javier Arteaga | Nicholas Jensen - Delta Star |
| Don Dorris | Jeff Schneider | Olle Benzler |
|  |  |  |
| pedro | Shawn Gossett | Zachery Weiss |
| Philip Hopkinson | Sheldon Kennedy | Zan Kiparizoski |
| Polo Rodríguez | Stephen Oakes |  |
| Raj Ahuja | Steve Antosz |  |
| Ramsis Girgis | Steve Brzoznowski |  |
| Reza Torabi | Steve Jordan |  |
| Richard von Gemmingen | Steve Schroeder |  |
| Rod Sauls | Steve Snyder |  |
| Rodrigo Ocon | Sukhdev Walia |  |
| Rogerio Verdolin | Suresh Babanna |  |
| Ronnie Minhaz (Rashid) | Sylvain Plante Hydro-Quebec |  |
| Ross McTaggart | Tauhid Ansari |  |
| Rudolf Ogajanov | Terence J. Martin |  |
| Ryan Hogg | Thomas Tom Dauzat |  |
| Ryan Musgrove - OG&E | Tiffany Lucas - Prolec GE - Waukesha |  |
| Samragni Dutta Roy | Toby Johnson |  |
| Sanjay Patel | Tommy Eagle |  |
| Sankarakurup, Dinesh | Kent Miller |  |
| Sanket Bolar | vinay mehrotra |  |
| Saramma Hoffman | Waldemar Ziomek |  |
| Sen, Cihangir John | Will Elliott - Prolec-GE |  |
| Sergio Hernandez Cano | William Boettger |  |

### WG HV & EHV Breaker & Transformer Sw. Transients C57.142

**MEETING NOTES**

**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**

Virtual Meeting

Tuesday, April 27, 2021

2:30 PM – 3:35 PM Central Time Zone - USA

**Chairman – Jim McBride**

**Vice Chair – Xose Lopez-Fernandez**

**Secretary – Tom Melle**

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

Welcome and Chair’s Remarks

1. Two Attendance Poll were taken.

First at 2:25 PM 52Attendees were present (31 Guests) 21 of 56 Members present

Second 3:00 PM 58 Attendees were present (33 Guests) 25 of 56 Members present

Quorum was not achieve. Therefore, the Spring Minutes will be sent by e-mail for approving.

3) IEEE Patent Policy Slides and Copyrights slides (NO essential patent claims or copyright issues)

4) Approval of Agenda and Minutes from Last Meeting.

Quorum was not achieve. Therefore, the Spring Minutes will be sent by e-mail for approving.

5) Switchgear Liason Task Force Update – Dave Caverly

The Switchgear Task Force met on OCTOBER 21, 2021, but there is nothing new this time.

6) Status of Current Draft 9B and Comments – Jim McBride

Some editorial changes made to Draft 9B before submitting to MEC which corrected errors in the TOC and references.   The document from the Transformers website highlights in blue all changes to the C57.142-2010 Guide. And the focus now will be on Mitigation Methods for the upcoming meeting.

7) Request to Proceed to Ballot with Draft 9B – Jim McBride

The Formation of Ballot Group has been initiate and the invitation to join the ballot group for C57.142 logging into the myProject, Close Date is December 10, 2021. The track changes version of Draft 9B can download from the Transformers Committee Website.

8) Mitigation Methods

Jim made a summary about the mitigation methods discussed in previous meetings.

Switchgear Committee has requested that we help to provide dielectric transient withstand information on transformers and reactors. A short discussion was stablished among Phil Hopkinson, Pierre Riffon, Egon Kirchenmayer and Jim about switching reignitions and prestrikes due to circuit breakers operation with reactors and sometimes with transformers, which not always are covered by standard factory acceptance tests. Pierre Riffon quoted C57.21 IEEE Standard Requirements, Terminology, and Test Code for Shunt Reactors Rated Over 500 kVA, which stablishes limits of chopping waves in percent. A group was formed by Pierre Riffon, Bertrand Poulin and Jim McBride to work on a response to Switchgear Committee which may include references to Clause B.6 of Std C57.21

Mitigation methods discussion was open to brainstorming additional options. Discussion on use of of internal arresters was stablished as a mitigation method, which not always is well accepted by the users. A presentation will be expected to made on it in next meetings. Finally, discussion was focused to additional factory tests. In this respect volunteers were request to work on a recommendation of voltages classes and dielectric tests requirements. Initially offered Phil Hopkinson, K. Vjayan, Amitbh Sakar, Deepak kumaria. And all interest to join this group could email to Jim McBride.

9) New Business – Deepak Kumaria asked about possibly including the study of transients on instrument transformers in our WG. Due to the lack of remaining time for today’s meeting, this topic was postpone until our next meeting.

10) Next Meeting (Spring 2022 – Denver (Hyatt Regency, Conv. Center), Colorado USA, March 27 – 31, 2022)

11) Motion to Adjournment made by Phil Hopkinson / 2nd by Mike Spurlock

Meeting was adjourned at 3:38 PM without objection.

## Adjournment

The Chair entertained a motion to adjourn. D. Sauer made the motion, seconded by A. Joshi. The meeting was adjourned at 3:37PM

## Performance Characteristics Subcommittee Attendance List

|  |  |  |  |
| --- | --- | --- | --- |
| **Role** | **First Name** | **Last Name** | **Company** |
| Guest | Nabi | Almeida | Prolec GE |
| Member | Tauhid Haque | Ansari | Hitachi Energy |
| Member | Stephen | Antosz | Stephen Antosz & Associates, Inc |
| Guest | Edmundo | Arevalo | Bonneville Power Administration |
| Member | Javier | Arteaga | Hitachi Energy |
| Member | Donald | Ayers | Ayers Transformer Consulting |
| Guest | Suresh | Babanna | SPX Transformer Solutions, Inc. |
| Member | Robert | Ballard | DuPont |
| Member | Gilles | Bargone | FISO Technologies Inc. |
| Member | Christopher | Baumgartner | We Energies |
| Member | Barry | Beaster | H-J Family of Companies |
| Guest | Mats | Bernesjo | Hitachi Energy |
| Member | Enrique | Betancourt | Prolec GE |
| Member | Wallace | Binder | WBBinder Consultant |
| Member | Wallace | Binder | WBBinder Consultant |
| Guest | Thomas | Blackburn | Gene Blackburn Engineering |
| Member | Daniel | Blaydon | Baltimore Gas & Electric |
| Member | William | Boettger | Boettger Transformer Consulting LLC |
| Guest | Elizabeth | Bray | Southern Company Services |
| Member | Jeffrey | Britton | Phenix Technologies, Inc. |
| Guest | Darren | Brown | Howard Industries |
| Guest | Steven | Brzoznowski | Bonneville Power Administration |
| Guest | Jagdish | Burde | Virginia Transformer Corp |
| Guest | Juan Alfredo | Carrizales | Prolec GE |
| Guest | David | Caverly | Trench Limited |
| Guest | Rhett | Chrysler | ERMCO |
| Member | Craig | Colopy | EATON Corporation |
| Guest | Jorge | Cruz | PTI Transformers |
| Guest | Juan Carlos | Cruz Valdes | Prolec GE |
| Guest | Juan Carlos | Cruz Valdes | Prolec GE |
| Member | J. Arturo | Del Rio | Siemens Energy |
| Guest | Brandon | Dent | Memphis Light, Gas & Water |
| Guest | Huan | Dinh | Hitachi Energy |
| Guest | Samragni | Dutta Roy | Siemens Energy |
| Guest | Thomas | Eagle | SPX Transformer Solutions, Inc. |
| Guest | William | Elliott | Prolec GE |
| Guest | Daniela | Ember Baciu | Hydro-Quebec IREQ |
| Guest | Evgenii | Ermakov | Hitachi Energy |
| Guest | Marco | Espindola | Hitachi Energy |
| Guest | Feras | Fattal | Manitoba Hydro |
| Member | Reto | Fausch | RF Solutions |
| Member | Hugo | Flores | Hitachi Energy |
| Member | Joseph | Foldi | Foldi & Associates, Inc. |
| Member | Bruce | Forsyth | Bruce Forsyth and Associates PLLC |
| Guest | Anthony | Franchitti | PECO Energy Company |
| Guest | Raymond | Frazier | Ameren |
| Member | Jose | Gamboa | H-J Family of Companies |
| Member | Eduardo | Garcia Wild | Siemens Energy |
| Guest | Rob | Ghosh | General Electric |
| Member | Ramsis | Girgis | Hitachi Energy |
| Member | Shawn | Gossett | Ameren |
| Member | Bill | Griesacker | Duquesne Light Co. |
| Guest | Ismail | Guner | Hydro-Quebec |
| Member | Said | Hachichi | Hydro-Quebec |
| Member | Thomas | Hartmann | Pepco Holdings Inc. |
| Guest | Giovanni | Hernandez | Virginia Transformer Corp. |
| Member | Sergio | Hernandez Cano | Hammond Power Solutions |
| Member | John | Herron | Raytech USA |
| Guest | Saramma | Hoffman | PPL Electric Utilities |
| Guest | Ryan | Hogg | Bureau of Reclamation |
| Member | Philip | Hopkinson | HVOLT Inc. |
| Guest | Ramadan | Issack | American Electric Power |
| Guest | Nicholas | Jensen | Delta Star Inc. |
| Member | John | John | Virginia Transformer Corp. |
| Member | Stephen | Jordan | Tennessee Valley Authority |
| Guest | Laszlo | Kadar | Hatch |
| Member | Sheldon | Kennedy | Niagara Transformer |
| Guest | Gael | Kennedy | GR Kennedy & Associates LLC |
| Member | Stacey | Kessler | TC Energy |
| Guest | Gary | King | Howard Industries |
| Guest | Dmitriy | Klempner | Southern California Edison |
| Guest | Alexander | Kraetge | OMICRON electronics Deutschland GmbH |
| Guest | Krzysztof | Kulasek | Hitachi Energy |
| Member | Deepak | Kumaria | Applied Materials |
| Guest | Moonhee | Lee | Hammond Power Solutions |
| Member | Aleksandr | Levin | Weidmann Electrical Technology |
| Member | Weijun | Li | Braintree Electric Light Dept. |
| Guest | Mario | Locarno | Doble Engineering Co. |
| Member | Xose | Lopez-Fernandez | Universidade de Vigo |
| Guest | Colby | Lovins | Federal Pacific |
| Member | Tim-Felix | Mai | Siemens Energy |
| Member | Richard | Marek | Retired |
| Corresponding Member | Dennis | Marlow | DenMar TDS Transformers |
| Guest | Lee | Matthews | Howard Industries |
| Member | James | McBride | JMX Services, Inc. |
| Member | James | McBride | JMX Services, Inc. |
| Guest | Matthew | McFadden | Oncor Electric Delivery |
| Guest | Susan | McNelly | Xcel Energy |
| Member | Vinay | Mehrotra | SPX Transformer Solutions, Inc. |
| Member | Rashed | Minhaz | Transformer Consulting Services Inc. |
| Guest | Manoj Kumar | Mishra | ASAsoft (Canada) Inc |
| Member | Rhea | Montpool | Schneider Electric |
| Member | Emilio | Morales-Cruz | Qualitrol Company LLC |
| Member | David | Murray | Tennessee Valley Authority |
| Member | Ryan | Musgrove | Oklahoma Gas & Electric |
| Guest | Ali | Naderian | METSCO Energy Solutions Inc. |
| Member | Kristopher | Neild | Megger |
| Guest | Rodrigo | Ocon | Industrias IEM |
| Guest | Rudolf | Ogajanov | ABB Inc. |
| Member | Sanjay | Patel | Smit Transformer |
| Member | Sanjay | Patel | Smit Transformer |
| Corresponding Member | Paulette | Payne-Powell | Retired |
| Guest | Harry | Pepe | Phenix Technologies, Inc. |
| Guest | Caroline | Peterson | Xcel Energy |
| Guest | Matthew | Pinard | Weidmann Electrical Technology |
| Member | Sylvain | Plante | Hydro-Quebec |
| Guest | Cornelius | Plath | OMICRON Energy Solutions GmbH |
| Member | Klaus | Pointner | Trench Austria GmbH |
| Guest | Chris | Powell | Intermountain Electronics |
| Member | Jarrod | Prince | ERMCO |
| Member | Ulf | Radbrandt | Hitachi Energy |
| Member | Ion | Radu | Hitachi Energy |
| Member | Afshin | Rezaei-Zare | York University |
| Member | Pierre | Riffon | Pierre Riffon Consultant Inc. |
| Guest | Diego | Robalino | Megger |
| Member | Tim | Rocque | SPX Transformer Solutions, Inc. |
| Member | Marnie | Roussell | Entergy |
| Guest | Hakan | Sahin | Virginia/Georgia Transformer |
| Guest | Albert | Sanchez | Knoxville Utilities Board |
| Guest | Dinesh | Sankarakurup | Duke Energy |
| Guest | Amitabh | Sarkar | Virginia Transformer Corp. |
| Member | Daniel | Sauer | EATON Corporation |
| Guest | Roderick | Sauls | Southern Company Services |
| Member | Steven | Schappell | SPX Transformer Solutions, Inc. |
| Guest | Markus | Schiessl | SGB |
| Guest | Stephen | Schroeder | Hitachi Energy |
| Guest | Dan | Schwartz | Quality Switch, Inc. |
| Guest | Ewald | Schweiger | Siemens Energy |
| Guest | Pugal | Selvaraj | Virginia Transformer Corp. |
| Guest | Cihangir | Sen | Duke Energy |
| Guest | Devki | Sharma | Entergy |
| Guest | Michael | Sharp | Trench Limited |
| Member | Samuel | Sharpless | Rimkus Consulting Group |
| Member | Hemchandra | Shertukde | University of Hartford |
| Guest | Thomas | Sizemore | ABB Inc. |
| Member | Kenneth | Skinger | Scituate Consulting, Inc. |
| Member | Christopher | Slattery | FirstEnergy Corp. |
| Vice-Chair | Sanjib | Som | Pennsylvania Transformer |
| Member | Mike | Spurlock | Spurlock Engineering Services, LLC |
| Guest | Brad | Staley | Salt River Project |
| Member | Kyle | Stechschulte | American Electric Power |
| Guest | Andrew | Steineman | Delta Star Inc. |
| Guest | Neil | Strongosky | Memphis Light, Gas & Water |
| Member | Charles | Sweetser | OMICRON electronics Corp USA |
| Guest | Janusz | Szczechowski | Maschinenfabrik Reinhausen |
| Guest | Marc | Taylor | JFE Shoji Power Canada Inc. |
| Guest | Dervis | Tekin | Meramec Instrument Transformer Co. |
| Member | Ed | teNyenhuis | Hitachi Energy |
| Guest | Alan | Traut | Howard Industries |
| Member | Ajith | Varghese | SPX Transformer Solutions, Inc. |
| Guest | Joshua | Verdell | ERMCO |
| Chair | Rogerio | Verdolin | Verdolin Solutions Inc. |
| Member | Krishnamurthy | Vijayan | PTI Transformers |
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| Guest | Hugh | Waldrop | Memphis Light, Gas & Water |
| Member | Sukhdev | Walia | New Energy Power Co. |
| Guest | David | Wallach | Duke Energy |
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| Member | Bruce | Webb | Knoxville Utilities Board |
| Guest | Drew | Welton | Intellirent |
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| Guest | Daniel | Weyer | Nebraska Public Power District |
| Guest | William | Whitehead | H2scan Corporation |
| Guest | Helena | Wilhelm | Vegoor Tecnologia Aplicada |
| Member | Dr. Alexander | Winter | HIGHVOLT Pruftechnik Dresden |
| Member | Jeffrey | Wright | Duquesne Light Co. |
| Guest | Joshua | Yun | Virginia Transformer Corp. |
| Guest | Malia | Zaman | IEEE |
| Member | Peter | Zhao | Hydro One |
| Secretary | Kris | Zibert | Allgeier, Martin and Associates |
| Role | First Name | Last Name | Company |
| Guest | Nabi | Almeida | Prolec GE |
| Member | Tauhid Haque | Ansari | Hitachi Energy |
| Member | Stephen | Antosz | Stephen Antosz & Associates, Inc |
| Guest | Edmundo | Arevalo | Bonneville Power Administration |
| Member | Javier | Arteaga | Hitachi Energy |
| Member | Donald | Ayers | Ayers Transformer Consulting |
| Guest | Suresh | Babanna | SPX Transformer Solutions, Inc. |
| Member | Robert | Ballard | DuPont |
| Member | Gilles | Bargone | FISO Technologies Inc. |
| Member | Christopher | Baumgartner | We Energies |
| Member | Barry | Beaster | H-J Family of Companies |
| Guest | Mats | Bernesjo | Hitachi Energy |
| Member | Enrique | Betancourt | Prolec GE |