

# Power Transformers Subcommittee

## Working Group Report

Document #: C57.125  
Document Title: Guide for Failure Investigation, Documentation, Analysis and Reporting for Power Transformers and Shunt Reactors

|           |                    |                  |                     |
|-----------|--------------------|------------------|---------------------|
| Chair:    | <u>Hakan Sahin</u> | Vice-Chair       | <u>Thomas Melle</u> |
| Secretary | <u>Adam Sewell</u> | Percent Complete | <u>100%</u>         |

Current Draft Being Worked On: 1.0 Dated: February 2025  
PAR Expiration Date: December 31, 2025

Meeting Date: March 24, 2025 Time: 4:45pm – 6:00pm  
Location: Denver, CO, USA

|                                |                 |
|--------------------------------|-----------------|
| Attendance: Members            | <u>32 of 49</u> |
| Guests                         | <u>74</u>       |
| (Guests Requesting Membership) | <u>(20)**</u>   |
| Total*                         | <u>106</u>      |

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

\*\*Because WG approved to send draft to ballot, no new WG Members will be added. Member list as of Spring 2025 meeting is final WG list\*\*

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### Meeting Minutes / Significant Issues / Comments:

Meeting was called to order at 4:45pm, March 24, 2025 at Hyatt Regency Denver.

#### 1. Administrative

- a. IEEE Patent Policy and Call for Patents
  - i. No comments from group
- b. IEEE SA Copyright Policy
  - i. No comments from group
- c. Review of agenda
  - i. No comments from group
- d. Reminder on the purpose and the scope of the working group, and the timeline
  - i. The expectation from this WG is to review and update the document as it expires on 12/31/2025.
  - ii. Projected Completion Date for Submittal to RevCom: Dec 2025
- e. Introductions of the attendees
  - i. Attendance was taken by QR Code sign-in...no paper attendance sheets were passed out.
  - ii. Name/affiliation was announced as attendees spoke during the meeting.
- f. Updated membership review and count for quorum
  - i. 49 members and 29 were counted as present via hand count.
    1. QUORUM ACHIEVED
  - ii. *Attendance list after meeting completed showed 32 members attended.*

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- iii. Members are expected to attend and stay in the meeting so business can be conducted.
- iv. Because WG approved to send draft to ballot, no new WG Members will be added. Member list as of Spring 2025 meeting (with 49 members) is final member list
- g. Approvals of previous minutes and agenda:
  - i. Approval of the agenda for Spring 2025
    - 1. MOTION to approve Spring 2025 agenda – D.Murray, 2<sup>nd</sup> – F.Mills
    - 2. No objection to unanimous approval – MOTION APPROVED
  - ii. Approval of the Fall 2024 unapproved meeting minutes
    - 1. MOTION to approve Fall 2024 unapproved meeting minutes – A.Sarkar, 2<sup>nd</sup> – D.Schwartz
    - 2. No objection to unanimous approval – MOTION APPROVED
- 2. Old Business
  - a. Draft 1.0 was emailed to the 49 WG members before the Spring 2025 meeting and was voted on electronically.
    - i. 41 members responded (85% response)
    - ii. 35 approved with no comments
    - iii. 3 abstained
    - iv. 3 approved with comments, making it 38/41 approval (93%)
    - v. Zero disapproved
  - b. Member comments from the Draft 1.0 email vote were reviewed in the S25 meeting
    - i. Comment from Weijun Li: Definition of Compressive Force: If I remember correctly, the WG voted to use definition from C57.164 but it appears that it remains unchanged in the updated document. Could you please double check?
      - 1. Chair's response: Weijun is correct. The circulated document did not have the compressive force definition updated as it was approved during Spr\_24 meeting:

During the Spring 2024 meeting changes below were approved

a.

Definition for compressive force

- i. MOTION made by A.Sarkar, 2<sup>nd</sup> – M.Saad to use definition from C57.164
  - 1. Vote was unanimously approved with 1 abstention

Existing Definition: (A) The force that presses the inside coil toward the core. (B) The force attraction that presses coils wound in opposite directions together in a set of pancake coils.

- 2. Definition within C57.164 for compressive force will be put in the document by Chair before being sent to ballot:

**compressive stress:** Inward stresses on windings, spacers, conductor paper, insulation and pressure rings (or pressure plates) due to radial forces resulting in tangential compressive stress. Also applied to interphase wedges in shell form transformers.

- ii. Comments on Draft 1.0 from Anastasia O'Malley:

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1. In section 5.3.2.2 Other hazards, suggest adding an additional bullet point, - Chemical hazards: There are hazards associated with touching transformer oil and other dielectric liquids. Direct contact can cause skin irritation and potentially other health problems. Always wear appropriate PPE.
    2. In section 5.4.4 Internal inspection of main tank and LTC, in the 4th paragraph, on line 852, suggest adding a sentence before the last sentence: ... air at a safe positive pressure. Note that if the combustible gas content above the oil is excessive (> 0.5% by volume), an intermediary purge, where the displaced oil is followed by tested, dry nitrogen may be recommended. Appropriate precautions need to be taken regarding PCB contamination in....
  - iii. Comments on Draft 1.0 from Sanjib Som:
    1. Line 466 -468, page 6 – that a spiral winding has no key-spacer between turns should be mentioned. A helical winding is a spiral winding with key-spacers between turns.
    2. Lines 469-472 , page 6 – they can be connected in series as well (Siemens does). It is inaccurate to presume that it cannot be used for the higher side voltage. We can discuss more if there is a need.
    3. 21000 Annex E, page 79 – if this blank, please delete
3. New Business
  - a. The chair announced that since the PAR expires at the end of 2025, the WG will most likely not have enough time to resolve all comments and get the document approved before the PAR expires, a PAR extension should be requested.
    - i. MOTION – To have the chair make a motion at the PTSC to request a 1 year PAR extension to start the ballot process no later than Fall 2025 meeting - by B.Forsythe, 2<sup>nd</sup> – P.Panesar
    - ii. After some discussion of the MOTION, an amendment was made:
    - iii. AMMENDMENT - To have the chair make a motion at the PTSC to request a 2 year PAR extension to start the ballot process no later than Fall 2025 meeting – by S.Som, 2<sup>nd</sup> – F.Mills
      1. No objection to unanimous approval – AMENDMENT APPROVED
  - b. MOTION To have the chair request at the PTSC for the ballot process to start as soon as possible by June 2025 at the latest by A.Sarkar, 2<sup>nd</sup> – S.Som
    - i. No objection to unanimous approval – MOTION APPROVED
  - c. MOTION To form a comment resolution group and give them the authority to resolve editorial issues and comments where consensus is reached by the CRG. If any of the comments cannot be resolved to a consensus point, they will be brought back to the Working Group for Resolution by P.Panesar, 2<sup>nd</sup> – D.Schwartz
    - i. No objection to unanimous approval – MOTION APPROVED
    - ii. 11 CRG volunteers announced during the meeting:
      1. S.Debass, B.Forsyth, E.Garcia, W.Li, T.Melle, F.Mills, R.Musgrove, T.Raymond, H.Sahin, A.Sarkar, A.Sewell
      2. J.Yun volunteered to be part of CRG after meeting adjourned
4. Next meeting: October, 20, 2025 at the Fall 2025 Transformers Committee Meeting scheduled for October 19-23, 2025, Bonita Springs, FL, USA.
5. Close of meeting

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a. Meeting adjourned at 5:45pm

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

**March 24, 2025 Meeting Attendance (RM = Request Membership - Because WG voted to send draft to ballot, no new WG Members will be added. Member list as of Spring 2025 meeting is final WG list):**

| LAST NAME  | FIRST NAME   | COMPANY/AFFILIATION                 | Role     |
|------------|--------------|-------------------------------------|----------|
| Abbas      | Mubarak      | Virginia Transformer                | GUEST    |
| Adams      | Kayland      | Prolec-GE Waukesha                  | GUEST    |
| Betancourt | Enrique      | Prolec ge                           | MEMBER   |
| Boettger   | William      | Boettger Transformer Consulting LLC | MEMBER   |
| Botti      | Michael      | Hyosung HICO                        | GUEST-RM |
| Bradshaw   | Jeremiah     | Bureau of Reclamation               | GUEST    |
| Calil      | Wilerson     | Hitachi Energy/Member               | GUEST-RM |
| Chanda     | Sudip        | Delta Star Inc.                     | GUEST-RM |
| Chu        | Matt         | Shihlin Electric                    | GUEST    |
| Crockett   | Daniel       | Ameren                              | MEMBER   |
| Crockett   | Janet        | Fayetteville PWC                    | GUEST    |
| Cross      | James        | Kinectrics                          | GUEST-RM |
| Da Silva   | Roberto      | Maschinenfabrik Reinhausen          | GUEST    |
| Debass     | Sami         | EPRI                                | MEMBER   |
| Dillon     | Nikolaus     | Dominion Energy                     | MEMBER   |
| Draper     | Zachary      | Delta-X Research                    | MEMBER   |
| Dulac      | Hakim        | Advanced Power Technologies         | MEMBER   |
| Elson      | Eric         | San Diego Gas and Electric          | GUEST    |
| Fausch     | Reto         | RF Solutions                        | GUEST    |
| Fernandez  | Miguel       | Braintree Electric Light Dept.      | GUEST-RM |
| Foata      | Marc         | MR                                  | GUEST    |
| Forsyth    | Bruce        | Cargill                             | MEMBER   |
| Garcia     | Eduardo      | Siemens Energy                      | MEMBER   |
| Garner     | Joshua       | RESA Power                          | GUEST    |
| Garza      | Héctor       | Orto de México                      | GUEST    |
| Goglia     | Slaven       | Koncar Power Transformers Ltd.      | GUEST    |
| Gorzin     | Alireza      | Black & Veatch                      | MEMBER   |
| Greaves    | Brad         | Weidmann Electrical Technology, Inc | GUEST    |
| Hall       | Jesse        | VTC                                 | GUEST    |
| Hampton    | Kevin        | Siemens Energy                      | GUEST    |
| HOLLRAH    | DEREK        | Burns & McDonnell                   | GUEST    |
| Jang       | Donghyun     | LS ELECTRIC                         | GUEST    |
| Jones      | Braxton      | SD Myers                            | GUEST    |
| Keels      | Thomas       | kEElectric Engineering PLLC         | GUEST-RM |
| Kelemen    | Franjo       | Koncar Power Transformers Ltd.      | GUEST    |
| Khan       | Qasim        | Neetrac-Georgia Tech                | GUEST    |
| kim        | dalho        | iljin electric                      | GUEST    |
| Kim        | Yeounsoo     | JST Power Equipment                 | GUEST-RM |
| Klempner   | Dmitriy      | Southern California Edison          | GUEST-RM |
| Koshel     | Anton        | Delta Star Inc                      | GUEST    |
| Kurz       | Andreas      | Maschinenfabrik Reinhausen          | GUEST    |
| Kwai       | Yeboah       | GE Vernova                          | GUEST-RM |
| Labh       | Ashwini      | Hitachi Energy                      | GUEST-RM |
| Li         | Weijun       | Braintree Electric Light Department | MEMBER   |
| Loiselle   | Luc          | Tetra tech                          | GUEST    |
| Lopes      | Ricardo      | Efacec                              | GUEST    |
| Lugge      | Andrew       | Hitachi Energy                      | GUEST    |
| Machain    | Jose Luis    | Prolec GE                           | MEMBER   |
| Mamede     | Gabriel      | Siemens Energy                      | GUEST-RM |
| Mani       | Balakrishnan | Delta star Field service            | GUEST-RM |
| MELLE      | TOM          | HIGHVOLT                            | MEMBER   |
| Mellin     | Toni         | Vaisala                             | GUEST    |
| Merrill    | Logan        | OMICRON                             | GUEST    |

| LAST NAME         | FIRST NAME | COMPANY/AFFILIATION              | Role     |
|-------------------|------------|----------------------------------|----------|
| Mills             | Francis    | POWER Engineers                  | MEMBER   |
| Montanha          | Juliano    | Siemens Energy                   | MEMBER   |
| Morales-Cruz      | Emilio     | Qualitrol                        | MEMBER   |
| Munoz             | Martin     | Orto de México                   | GUEST    |
| Munoz             | Marta      | Hitachi Energy                   | GUEST-RM |
| Murray            | David      | TVA                              | MEMBER   |
| Musgrove          | Ryan       | Oklahoma Gas & Electric          | MEMBER   |
| Obregon           | Daniel     | TTE Transformers                 | GUEST    |
| O'Malley          | Anastasia  | consolidated Edison Co of NY     | MEMBER   |
| Orozco            | Eduardo    | GE Vernova Grid Solutions        | GUEST-RM |
| Ortiz             | Juan       | Reinhausen Manufacturing         | GUEST    |
| Pandya            | Manan      | Siemens Energy                   | GUEST-RM |
| Panesar           | Parminder  | Virginia Transformer Corp        | MEMBER   |
| Park              | Jaeyong    | LS Electric                      | GUEST    |
| Pedro             | Pedro      | Efacec Energia                   | GUEST-RM |
| Rato              | Nuno       | Efacec                           | GUEST    |
| Raymond           | Timothy    | Inductive Reasoning              | MEMBER   |
| Reyes perez       | Juan       | Hitachi energy                   | GUEST    |
| Ryu               | Hyounggon  | HD hyundai electric              | GUEST    |
| Saad              | Mickel     | Hitachi Energy                   | MEMBER   |
| SAHIN             | HAKAN      | GEORGIA TRANSFORMER              | MEMBER   |
| Sanchez rodriguez | Jesus      | Vertiv                           | GUEST-RM |
| Sarkar            | Amitabh    | Virginia Transformer Corporation | MEMBER   |
| Schaffer          | Marcus     | Meta                             | GUEST    |
| Schrammel         | Alfons     | Siemens Energy                   | GUEST    |
| Schwartz          | Dan        | Quality Switch                   | MEMBER   |
| Segovic           | Dario      | Koncar Power Transformers Ltd.   | GUEST    |
| Sethi             | Kabir      | Hitachi Energy Germany Ag        | GUEST-RM |
| Sewell            | Jeremy     | Quality Switch, Inc.             | GUEST    |
| SEWELL            | ADAM       | QUALITY SWITCH                   | MEMBER   |
| Sexton            | Aron       | Kinectrics                       | GUEST    |
| Shaikh            | Salahuddin | NRG Energy Inc                   | GUEST-RM |
| Sinclair          | Jonathan   | Black and Veatch                 | GUEST    |
| Singh             | Amitkumar  | Con Edison Company of New York   | GUEST-RM |
| Snyder            | Jason      | FirstEnergy                      | GUEST    |
| SOM               | SANJIB     | PTT, LLC                         | MEMBER   |
| steele            | Hampton    | TVA                              | GUEST    |
| Sweetser          | Charles    | OMICRON electronics Corp. USA    | GUEST    |
| Szczechowski      | Janusz     | Maschinenfabrik Reinhausen GmbH  | MEMBER   |
| Tan               | Jonathan   | Northern Transformer             | GUEST    |
| Vedantham         | Aparna     | Virginia transformer corporation | GUEST    |
| VonGemmigen       | richard    | Dominion Energy                  | MEMBER   |
| Vullo             | Stephen    | GE Vernova                       | GUEST    |
| Wagner            | John       | AEP                              | GUEST    |
| Wallace           | David      | Mississippi State University     | GUEST    |
| Washburn          | Alan       | Burns & McDonnell                | MEMBER   |
| Whitehead         | William    | Reinhausen                       | GUEST    |
| Woods             | Deanna     | PTT                              | MEMBER   |
| Wright            | Jeffrey    | Duquesne Light                   | GUEST    |
| Xie               | Jiahao     | S&C Electric Company             | GUEST    |
| YU                | ZACHARY    | SIEYUAN ELECTRIC COMPANY         | GUEST    |
| Yun               | Joshua     | Virginia Transformer Corp        | MEMBER   |
| Zibert            | Kris       | Allgeier Martin                  | GUEST    |