Tank Pressure Coordination Working Group

St. Louis, Missouri
3:15 – 4:30 PM, Oct. 29, 2024

Chair: Carlos Gaytan
Vice-Chair: Jeremy Van Horn

IEEE PES Power & Energy Society®

Agenda

1. Welcome, introductions and rosters
2. Essential Patent Claims & SA Copyright Policy
3. Membership Changes & quorum Check
4. Chair Report
5. Approval of Agenda
6. Approval of Spring 2024 Meeting Minutes
7. Old Business
   a) Task Force report – Negative Pressure requirements – Luke Grandbois
   b) Clarification of applicability of fault current capability test – Carlos Gaytan
   c) Review overall structure of the document for clarification – Carlos Gaytan
   d) Discussion on transformer fault current capability test scope – Jim Cai
8. New Business
9. Next Meeting – Denver, Colorado, USA, March 25, 2025
10. Adjourn

Welcome, introductions and rosters

- Roster circulating
- Scan QR code for electronic verification

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PARTICIPANTS HAVE A DUTY TO INFORM THE IEEE

- Participants shall inform the IEEE (or cause the IEEE to be informed) of the identity of each holder of any potential Essential Patent Claims of which they are personally aware if the claims are owned or controlled by the participant or the entity the participant is from, employed by, or otherwise represents

- Participants should inform the IEEE (or cause the IEEE to be informed) of the identity of any other holders of potential Essential Patent Claims

Early identification of holders of potential Essential Patent Claims is encouraged

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08 June 2021 – Slide 1

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WAYS TO INFORM IEEE

- **Cause an LOA to be submitted to the IEEE SA (patcom@ieee.org); or**
- **Provide the chair of this group with the identity of the holder(s) of any and all such claims as soon as possible; or**
- **Speak up now and respond to this Call for Potentially Essential Patents**

If anyone in this meeting is personally aware of the holder of any patent claims that are potentially essential to implementation of the proposed standard(s) under consideration by this group and that are not already the subject of an Accepted Letter of Assurance, please respond at this time by providing relevant information to the WG Chair

IEEE SA STANDARDS ASSOCIATION

08 June 2021 – Slide 2

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IEEE PES Transformers Committee

OTHER GUIDELINES FOR IEEE WORKING GROUP MEETINGS

- **All IEEE SA standards meetings shall be conducted in compliance with all applicable laws, including antitrust and competition laws.**
  - **Don't discuss the interpretation, validity, or essentiality of patents/patent claims.**
  - **Don't discuss specific license rates, terms, or conditions.**
    - Relative costs of different technical approaches that include relative costs of patent licensing terms may be discussed in standards development meetings.
      - **Technical considerations remain the primary focus.**
  - **Don't discuss or engage in the fixing of product prices, allocation of customers, or division of sales markets.**
  - **Don't discuss the status or substance of ongoing or threatened litigation.**
  - **Don't be silent if inappropriate topics are discussed. Formally object to the discussion immediately.**

For more details, see *IEEE SA Standards Board Operations Manual*, clause 5.3.10 and *Antitrust and Competition Policy: What You Need to Know* at http://standards.ieee.org/develop/policies/antitrust.pdf

PATENT-RELATED INFORMATION

The patent policy and the procedures used to execute that policy are documented in the:

- *IEEE SA Standards Board Bylaws*
  (http://standards.ieee.org/develop/policies/bylaws/sect6-7.html#6)
- *IEEE SA Standards Board Operations Manual*
  (http://standards.ieee.org/develop/policies/opman/sect6.html#6.3)

Material about the patent policy is available at
http://standards.ieee.org/about/sasb/patcom/materials.html

If you have questions, contact the IEEE SA Standards Board Patent Committee Administrator at patcom@ieee.org

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- Previously Published material (copyright assertion indicated) shall not be presented/submitted to the Working Group nor incorporated into a Working Group draft unless permission is granted.
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IEEE SA COPYRIGHT POLICY

- The IEEE SA Copyright Policy is described in the IEEE SA Standards Board Bylaws and IEEE SA Standards Board Operations Manual
  - IEEE SA Copyright Policy, see
    Clause 7 of the IEEE SA Standards Board Bylaws
    https://standards.ieee.org/about/policies/bylaws/sect6-7.html#7
    Clause 6.1 of the IEEE SA Standards Board Operations Manual
    https://standards.ieee.org/about/policies/opman/sect6.html
- IEEE SA Copyright Permission
  - https://standards.ieee.org/content/dam/ieee-standards/standards/web/documents/other/permissionltrs.zip
- IEEE SA Copyright FAQs
  - http://standards.ieee.org/faqs/copyrights.html/
- IEEE SA Best Practices for IEEE Standards Development
  - http://standards.ieee.org/develop/policies/best_practices_for_ieee_standards_development_051215.pdf
- Distribution of Draft Standards (see 6.1.3 of the SASB Operations Manual)
  - https://standards.ieee.org/about/policies/opman/sect6.html

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Membership and quorum check (19)

Nabi Almeida	Didier Hamoir	Robert Reepe
Javier Arteaga	Ramadan Issack	David Rohrer
Alejandro Ayala	Brian Klaponski	Mason Rush
Samuel Brodeur	Andrew Larison	Fernando Salinas
Jeffrey Brooks	Alejandro Macias	Stephen Shull
Darren Brown	Nicholas Manske	Audrey Siebert-Timmer
Jim Cai	Fernando Meza	David Stockton
Noah Chesser	Daniel Mulkey	Fernando Tirado
Ben Garcia	Molina Munoz	Alan Traut
Carlos Gaytan	Jerry Murphy	Jeremy Van Horn
Ali Ghafourian	Ismael Naja	Joshua Verdell
Michael Gonzales	Dwight Parkinson	Alan Wilks
Luke Grandbois	Daniel Posadas	

Membership Addition: Attend last 2 meetings
Membership Retention: Attend 3 of last 5 meetings

Member Count: 38

IEEE PES Transformers Committee

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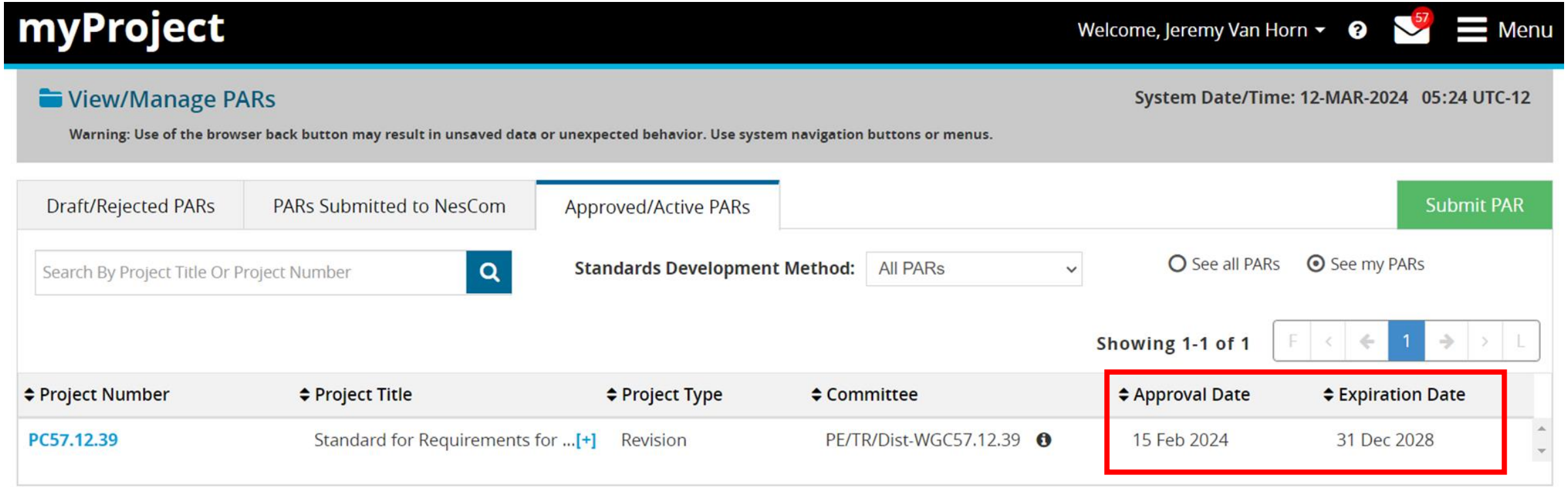
Chair Report

- PAR Approved by NesCom 2/15/2024
- Fall 2024 is WG's second meeting
- PAR Expires 12/31/2028



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Motion for Agenda approval?

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Approval of Spring 2024 Meeting Minutes

Distribution Transformer Subcommittee
Task force / Working Group Report

Document #:	C57.12.39
Document Title:	Tank Pressure Coordination
Chair:	Carlos Gaytan
Vice-Chair	Jeremy Van Horn
Secretary	
Current Draft Being Worked On:	1.0
Dated:	Mar 2024
Meeting Date:	March 12, 2024
Time:	3:15 PM PST
Attendance: Members	38
Guests	7
Total	45

List of Members:

Gaytan	Carlos	Grandbois	Luke	Posadas	Daniel
Van Horn	Jeremy	Hamoir	Didier	Reepe	Robert
Almeida	Nabi	Issack	Ramadan	Rohrer	David
Arteaga	Javier	Klaponski	Brian	Rush	Mason
Ayala	Alejandro	Larison	Andrew	Salinas	Fernando
Brodeur	Samuel	Macias	Alejandro	Shull	Stephen
Brooks	Jeffrey	Manske	Nicholas	Siebert-Timmer	Audrey
Brown	Darren	Meza	Fernando	Stockton	David
Cai	Jim	Mulkey	Daniel	Tirado	Fernando
Chesser	Noah	Munoz	Molina	Traut	Alan
Garcia	Ben	Murphy	Jerry	Verdell	Joshua
Ghafourian	Ali	Naja	Ismael	Wilks	Alan
Gonzales	Michael	Parkinson	Dwight		

List of Guests:

Ali	Rehan	Garza	Hector	Walters	Shelby
Crockett	Janet	Nunn	Tommy		
Dinh	Huan	Ortega	Agustin		

Meeting Minutes:

1. Carlos Gaytan called the meeting to order at 3:15 PM PST. Group introductions were made.
2. Carlos Gaytan reviewed IEEE SA Copyright Policy and Essential Patent Claims. No issues were raised.

The unapproved minutes of the March 12, 2024 meeting in Vancouver, BC were emailed to members and guests, and posted on the website.

Motion for Approval of the Minutes?

IEEE PES Transformers Committee

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Task Force A: Negative Pressure requirements

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Task Force B: Applicability of fault current capability test

comment received from Ben Garcia regarding the need for clarity regarding the applicability of the fault current capability test for rectangular tanks.

4.3 Rapid transient pressure

4.3.1 Requirements

Rapid transient pressures cause instantaneous, impact-type pressure forces. The rate of rise of the pressure can be as high as 103 kPa/cycle (15 psi/16.7 ms).

For overhead-type and submersible transformers utilizing round tank construction, the completely assembled transformer enclosure shall be capable of passing the fault current tests as defined in Clause 5 of this standard.

- Transformers with Rectangular or non-round construction are out of the scope of the fault current test.
- Performance of rectangular tanks being discussed in WG C57.12.23, single phase submersible trs.
- Task Force D charged to review scope of this test

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Task Force C: Document structure

Review overall structure of the sections of the document for clarification – Carlos introduced a comment relating to the differences between static and dynamic pressures for round and rectangular tanks.

Carlos and Jeremy will propose a change to the structure of the document to address the comment for review at the next working group meeting.

Task Force C: Document structure

Current structure

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IEEE PES Transformers Committee

Possible alternate structure

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6. Design tests for fault current capability of overhead distribution transformer enclosures 3
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   6.5 Test duty 2 – For enclosures with internal fusible elements 3
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1. Liquid preservation

Round Tank
Rectangular Tank
Both construction styles

4. Mechanical characteristics

4.1 Liquid preservation

Distribution transformers shall have a sealed-tank liquid-preservation system. Sealed-tank construction is a construction in which the interior of the tank is sealed from the atmosphere and the gas volume plus the liquid volume remains constant. The transformer shall remain effectively sealed for a top liquid temperature range of −5 °C to +105 °C for continuous operation at rated kilovolt-amperes and under the operating conditions as described in IEEE Std C57.91.[4]

The sealed-tank system shall be designed so that the internal gas pressure does not exceed 49 kPa (gauge) (7 psig), or −35 kPa (gauge) (−5 psig).

Applies to both round and rectangular construction, would be duplicated in alternate structure

2. Nominal pressure

Round Tank

Rectangular Tank

Both construction styles

4.2 Nominal pressure

Nominal pressure refers to pressure changes due to overloads, high ambient temperatures, external secondary faults, or internal incipient faults in the low-voltage or high-voltage windings. This excludes instantaneous, impact-type pressure change forces associated with rapid transient pressures.

4.2.1 Tank integrity

For overhead-type and submersible transformers utilizing round tank construction, the completely assembled transformer enclosure shall be of sufficient strength to withstand an internal pressure of 49 kPa (gauge) (7 psig) without permanent deformation to the enclosure. The enclosure shall also be of sufficient strength to withstand an internal pressure of 138 kPa (gauge) (20 psig) without rupturing or displacing components (excluding any gasket liquid leaks) of the transformer.

For all other distribution transformers, the tank shall be of sufficient strength to withstand a gauge pressure of 49 kPa (gauge) (7 psig) without permanent deformation and 103 kPa (gauge) (15 psig) without rupturing.

For pad-mounted type distribution transformers, the cabinet security as described in IEEE Std C57.12.28 or IEEE Std C57.12.29 shall not be affected.

4.2.2 Relief of excessive pressure

4.2.2.1 General

The criteria to define the relationship between the tank integrity and pressure relief requirements are given in Annex B.

4.2.2.2 Cover assembly for overhead transformers

A cover assembly designed to relieve excessive pressure in the transformer tank shall remain effectively sealed for overloads and external secondary short-circuits of the magnitude and duration allowed by industry standards and loading guides. The assembly shall relieve pressure at a minimum of 56 kPa (gauge) (8 psig) if designed to reseal, or at a minimum of 138 kPa (gauge) (20 psig) if designed for pressure relief without resealing. Such operation shall occur before other components of the tank are ruptured or displaced, and the cover shall remain in position. Manual means of venting the tank before removal of the cover shall be provided. The flow rate shall be at least equal to that of the pressure-relief valve specified in 4.2.2.3.

4.2.2.3 Pressure relief valve (PRV)

To provide automatic relief of pressures that build up slowly in excess of normal operating pressures, a replaceable PRV shall be provided on transformers 2500 kVA and below that do not have a cover assembly designed to relieve excessive pressure.

The PRV shall be designed and located to minimize liquid egress when relieving these excessive pressures. The PRV shall be located above the 140 °C top liquid level, by the manufacturer's calculation, and shall be located so as not to interfere with any other devices.

The inlet port shall be 1/4 in or larger National Pipe Taper (NPT), sized for a specified minimum flow rate. Exposed parts shall be of weather- and corrosion-resistant materials. Gaskets and O-rings shall withstand liquid vapor and a 105 °C temperature continuously under operating conditions as described in IEEE Std C57.91, without seizing or deteriorating for the life of the transformer.

The PRV shall have a pull ring for manually reducing pressure to the atmosphere using a standard hookstick, and shall be capable of withstanding a static pull force of 112 N (25 lbf) for 1 min without permanent deformation. The PRV shall withstand a static force of 445 N (100 lbf) for 1 min applied normally to its longitudinal axis at the outermost extremity of its body.

When specified, the venting port, on the outward side of the PRV head set, shall be protected to prevent entry of dust, moisture, and insects before and after the PRV has actuated; or, a weather-cap-type indicator shall be provided, which will remain attached to the PRV and provide positive indication to an observer that the PRV has operated.

Venting and sealing characteristics shall be as follows:

a) Cracking pressure: 69 kPa (gauge) ± 13 kPa (gauge) (10 psig ±2 psig).

b) Resealing pressure: 42 kPa (gauge) (6 psig) minimum.

c) Zero leakage from resealing pressure to −56 kPa (gauge) (−8 psig).

d) Flow at 103 kPa (gauge) (15 psig) = 16.5 L/s (35 SCFM) minimum, corrected for air pressure of 101 kPa (14.7 psi) (absolute) and air temperature of 21 °C.

4.2.2.4 Pressure relief device (PRD)

A PRD shall be provided on the cover for distribution substation transformers rated above 2500 kVA or having an insulation level above 200 kV BIL, and when specified for pad-mounted transformers. Alternative locations such as the tank sidewall may be specified. The minimum flow rate for cover-mounted PRDs should be of 142 m3/min (5000 SCFM), at an operating pressure of 69 kPa (gauge) (10 psig) when tested at 103 kPa (gauge) (15 psig).

If a PRD is required or specified, the tank shall also have a PRV to relieve the tank pressure manually, or a pressure-vacuum bleeder valve.

The use of the PRD on pad-mounted transformers shall not affect conformance with the enclosure security requirements of IEEE Std C57.12.28 or IEEE Std C57.12.29, as appropriate.

3. Rapid transient pressure

Round Tank
Rectangular Tank
Both construction styles

4.3 Rapid transient pressure

4.3.1 Requirements

Rapid transient pressures cause instantaneous, impact-type pressure forces. The rate of rise of the pressure can be as high as 103 kPa/cycle (15 psi/16.7 ms).

For overhead-type and submersible transformers utilizing round tank construction, the completely assembled transformer enclosure shall be capable of passing the fault current tests as defined in Clause 5 of this standard.

4.3.2 Sudden pressure relay

When specified for distribution substation transformers, a sudden pressure relay shall be provided for the indication of transformer faults, and to reduce damage to equipment. The relay shall not actuate under normal transformer operating pressures. The sudden pressure relay may be either a sudden-liquid-pressure relay, mounted on the tank below the lowest liquid level, or a sudden-gas-pressure relay, mounted in the region of the gas space. The sudden-liquid-pressure relay shall actuate under rapidly changing pressures of 10 kPa/s to 38 kPa/s (1.5 psi/s to 5.5 psi/s). The sudden-gas-pressure relay shall actuate with a pressure change of 3.5 kPa/s to 21 kPa/s (0.5 psi/s to 3.0 psi/s). The sudden pressure relay seal-in circuit shall actuate within 3 cycles of the rated power frequency after the pressure relay operation.

The sudden pressure relay shall be able to withstand both full vacuum and a positive pressure of 103 kPa (15 psi) without damage.

The seal-in circuit shall, as a minimum, be supplied with an alarm contact and a trip contact. Refer to IEEE Std C57.12.36 for minimum contact ratings.

Conclusion & recommendation

1. The current document structure is clear; it is easy to understand which requirements apply to which construction styles
2. Changing the structure to round & rectangular construction would result in duplication of 11 paragraphs (5 subclauses, either partially or completely)
3. The resulting document would not necessarily increase clarity for differing construction styles

- **Recommendation:** continue with the current document structure

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Task Force D: Discussion on transformer fault current capability test scope – Jim Cai

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