Insulation Life Subcommittee

March 26, 2025
Denver, Colorado

Chair: Sam Sharpless
Vice-Chair: Jinesh Malde
Secretary: Anastasia O'Malley

The Insulation Life Subcommittee (ILSC) was called to order by the Chair on March 26, 2025, at 8:00 am MDST. The list of subcommittee members was displayed and attendees scanned a QR code to record their attendance. The Chair reviewed the agenda and introduced the subcommittee officers. Due to the size of the group, general introductions were not made. The Chair requested that each person state their name and affiliation when addressing the subcommittee.

H.1 Chair's Report/Remarks

The Chair emphasized the timely completion, technical accuracy, and usefulness of quality projects through the participation of working group leaders, subject matter experts and the general membership.

The Chair reviewed the requirement for activity leaders to maintain updated documents on the subcommittee webpage. He also reviewed administrative requirements for task force and working group chairs. The Chair showed the essential patent claim notice and requested that any person with knowledge of an essential patent that meets the requirements of any subcommittee standard to bring the issue forward for discussion. No essential patent claims were raised.

The Chair reviewed guidelines for IEEE working group meetings reminding compliance with all applicable laws, including antitrust and competition laws.

The Chair displayed the copyright policy and advised the subcommittee that permission would be required from the authors or organizations for use of information.

The Chair discussed the membership requirements and welcomed new members:

Juan Alfredo Carrizales Baaldua
Miguel Garcia
Carlos Gaytan
Miljenko Hrkac
Nick Jensen
Qasim Khan
Yeounsoo Kim
Junho Lee
Gabriel Mamede
Cole Van Dreel
Bruce Webb
Joe White
Terry Wong
Fei Yang

And reviewed members moved to guest status:

George Frimpong
Kurt Kaineder
Chao Li
Jose Luis Machain
Kent Miller
Jaber Shalabi
YoungTae Sohn
Mauricio Soto
William Whitehead

H.2 Secretary's Report

For the Spring 2025 Denver meeting, a QR scan code was used for attendance polling and recording. The QR code scan indicated that a quorum had been achieved with 106 out of 131 members in attendance. The QR code scan indicated that 134 guests were also present. Participants requesting membership for the subcommittee were advised to reach out to the Chair, Vice-Chair or Secretary at the conference or through email, or to note it during the QR code scanning. Thirty-seven guests requested membership. A list of attendees is provided at the end of this report.

The Fall 2024 subcommittee meeting minutes had been provided to participants in advance of the meeting for review.

Sami Debass made a motion to approve the minutes. Eduardo Garcia Wild seconded the motion. After hearing no objection from the attendees, the Fall 2024 meeting minutes were approved by unanimous consent.

The agenda for the meeting had been provided to participants in advance of the meeting for review. An updated agenda with one order change highlighted was displayed.

Marcos Ferreira moved for approval of the agenda as shown. Amitabh Sarkar seconded the approval of the agenda. After hearing no objection from the attendees, the meeting agenda was approved by unanimous consent.

H.3 Technical Activity Reports

H.3.1 WG IEEE 1276a IEEE Guide for the Application of High-Temperature Insulation Materials in Liquid Immersed Distribution, Power and Regulating Transformers, Annex B and D revision – Kevin Biggie WG Chair presented update

This working group did not meet in person during the Spring meeting as the document is in the balloting process. On January 25, the document proceeded to the IEEE Standards Association to initiate ballot approval. The ballot pool was closed resolving 120 comments. The document is awaiting Mandatory Editorial Coordination review. The document will incorporate MEC changes and then proceed to final ballot.

H.3.2 C57.119 Study Group - Recommended Practice for Performing Temperature Rise Tests on Liquid-Immersed Power Transformers at Loads Beyond Nameplate Ratings – Ewald Schweiger Chair presented the update

The study group had developed a title, scope and purpose that was approved and submitted to NESCOM. The PAR is on this week's NESCOM meeting agenda and pending formal approval of the PAR. Members are currently reviewing the existing document in preparation of the Fall Committee meeting to provide feedback whether updates are needed. The unapproved meeting minutes from the Spring 2025 study group meeting are directly below. These minutes are followed by the approved Fall 2024 meeting minutes.

Recommended Practice for Performing Temperature Rise Tests on Liquid-Immersed Power Transformers at Loads Beyond Nameplate Ratings

1) Meeting took place at 9:30 AM (CDT) on Monday March 24th, 2025

2) In our todays in person meeting 72 attended our in person meeting.
   - Attendance: 72
   - Members: 9
   - Guests: 63

3) A brief overview about the previous meetings of C57.119 was presented:
   - F23 - Kansas City: Start Study Group for C57.119.
   - S24 – Vancouver: Recommendation to ILSC "Document needs revision" and received task to work on title / scope.
   - Sept 24 - Virtual: Voted on wording of title and scope.
   - F24 – St Louis: ILSC's approval to create a PAR to revise the document.
   - S25 – NesCOM Meeting March 26th 2025: Agenda 4.5.10.
     The current status on MyProject showed that 16 have pre-voted to accept our PAR – 2 votes are pending.
     → Need to wait for the official communication from NesCOM.
   - Purpose of this meeting is to work on the needs for revision, improvements and adaptions.

4) Call for patents, Copyright statement, Participant behavior

   a) The slides on essential patents from IEEE have been uploaded on the internet and were presented during the meeting. A call for essential patents was made.
      → No essential patents or issues were reported.

   b) The slides on IEEE copyright policy from IEEE have been uploaded on the internet and were presented during the meeting. A call for essential patents was made.
      → No issues were reported.

   c) The slides on "Participant behavior in IEEE-SA activities is guided by the IEEE Codes of Ethics & Conduct" have been presented.

5) Establish quorum
   - A quorum was achieved.
     Total number of members is 11, requiring 6 members for quorum.
     9 members have been present in the meeting.
     → Quorum achieved.

6) Approval of agenda

a) No comments from the group.

b) The agenda was unanimously approved (1st motion by Samuel Sharpless and 2nd Juan Castellanos).

7) Approval of meeting minutes of the previous in-person meeting from October 28th, 2024.

a) No comments from the group.

b) The meeting minutes were unanimously approved (1st motion by Juan Castellanos and 2nd Alfons Schrammel).

8) If NesCOM will approve our PAR, this was the last meeting as Study Group.
In order to be pro-active we continued the discussion based on feedback from review of C57.119 and next steps with the focus to work on the needs for revision, improvements and adaptions.

a) The actual Title, Scope, Need and Purpose submitted in the PAR was presented:

Title (for PAR 2024):

IEEE Recommended Practice for determining the thermal parameters of liquid immersed power transformers.

Scope (for PAR 2024):

This recommended practice covers test procedures for determining the thermal parameters of liquid immersed power transformers needed to appraise the transformer's load carrying capabilities.

Need (for PAR 2024):

This revision is needed to maintain and provide necessary updates and corrections to this recommended practice in order to reflect today's technology.

Purpose (for PAR 2024):

These recommended test procedures for performing temperature rise tests on power transformers are for the purpose of the following:

a) Determining the thermal characteristics of a transformer needed to appraise the thermal performance of a transformer at loads other than nameplate rating.

b) Verifying that a transformer can be loaded with a specified load profile without exceeding specified temperature rise.

c) Assessing a transformer's performance during transient loading, simulating a load cycle that includes loads in excess of nameplate rating.

b) The content of C57.119 – 2028 was shown and the group was asked to volunteer to review and work on suggestions about the needs for revision, improvements and adaptions.
Here is the list of the content and the individuals who took the task to review and present the outcome in the next meeting.

Last Name	First Name	Clause
Bhattiprolu	Prudhvi Anand	Annex A-D
Calil	Wilerson	3, 4
Castellanos	Juan	9,10, 11
Cisco Sullberg	Adriana	5, Annex A-D
Diaconu	Dumitru	9
Hoffman	Saramma	6, 7
Kumar	Arvind	10
Mamede	Gabriel	9, 10,11

Last Name	First Name	Clause
Ortiz	Cuauhtemoc	9
Palhatiya	Ajay	7
Patel	Monil	5, 6
Poulin	Bertrand	8, 9, 10, 11
Stechschulte	Kyle	3, 4, 6, 7
Tan	Jonathan	9
Vedantham	Aparna	5

Annex H

Volunteer	Clause	Content of C57.119 - 2018
	1	**Overview**
	1.1	Scope
	1.2	Purpose
	2	**Normative references**
Wilerson Calil Kyle Stechschulte	**3**	**Definitions, symbols, and subscripts**
	3.1	Definitions
	3.2	Symbols
	3.3	Subscripts
Wilerson Calil Kyle Stechschulte	**4**	**General**
	4.1	Preliminary evaluation
	4.2	Cooling equipment operation
Monil Patel Adriana Cisco Sullberg Aparna Vedantham	**5**	**Precautions**
	5.1	Thermal degradation
	5.2	Other factors limiting loading
	5.3	Monitoring of test results
	5.4	Maximum temperatures
Saramma Hoffman Monil Patel Kyle Stechschulte	**6**	**Monitored data**
	6.1	Ambient air temperature
	6.2	Insulating liquid temperatures
	6.3	Other temperatures
	6.4	Currents
Saramma Hoffman Ajay Palhatiya Kyle Stechschulte	**7**	**Recorded data**
	7.1	Losses
	7.2	Temperature indicator readings
	7.3	Tank surface and other temperatures
	7.4	Insulating liquid levels
Bertrand Poulin	**8**	**Insulating liquid samples**
Juan Castellanos Dumitru Diaconu Gabriel Mamede Cuauhtemoc Ortiz Bertrand Poulin Jonathan Tan	**9**	**Test procedure for determining the thermal characteristics of liquid-immersed power transformers**
	9.1	Tap position and connection
	9.2	Number of tests
	9.3	Applied test currents
	9.4	Discontinued tests
	9.5	Temperature rise test at rated load
	9.6	Temperature rise test at reduced load
	9.7	Temperature rise test at load beyond nameplate rating
	9.8	Evaluation of thermal data
	9.9	Evaluation of other data
Juan Castellanos Gabriel Mamede Arvind Kumar Bertrand Poulin	**10**	**Test procedure for performing load cycle temperature rise tests**
	10.1	Recommended prior tests
	10.2	Information specified by user
	10.3	Determination of load cycle
	10.4	Preparatory calculations
	10.5	Data recorded
	10.6	Test procedure
	10.7	Interrupted test
	10.8	Assessment of transformer performance
Juan Castellanos Gabriel Mamede Bertrand Poulin	**11**	**Integrated test procedures for determining thermal characteristics and for performing load cycle temperature rise tests**
	11.1	Load cycle simulation
	11.2	Preliminary evaluation
	11.3	Test procedure
	11.4	Initial test
	11.5	Conditioning load
	11.6	Beyond maximum nameplate test
	11.7	Final test
Prudhvi Anand Bhattiprolu Adriana Cisco Sullberg	**Annex A** (normative) Loading guide equations	
Prudhvi Anand Bhattiprolu Adriana Cisco Sullberg	**Annex B** (informative) Tutorial .	
Prudhvi Anand Bhattiprolu Adriana Cisco Sullberg	**Annex C** (informative) Hottest spot measurements using direct reading fiber optics temperature measurements	
Prudhvi Anand Bhattiprolu Adriana Cisco Sullberg	**Annex D** (informative) Bibliography .	

c) The meeting progressed with a deeper conversation to determine which supplementary topics should be considered and what are the cornerstones to follow.
- Sanjay Patel raised the issue of potentially incorporating Dissolved Gas Analysis (DGA) Limits into the revision. There is an apparent need for clarity on this matter, particularly in relation to avoiding redundancy with existing documentation, such as standard C57.130 and various CIGRE publications.

In response to this need, Sanjay Patel has kindly offered to prepare a detailed problem statement. This document will serve as a basis for more focused discussions in our upcoming meetings, allowing us to address this matter with the thoroughness it requires.

9) New business:
Joe Watson's insights on the **Overload Test** were shared on his behalf, as he was unable to attend due to a scheduling conflict with a session he was chairing.

Thoughts on Overload Test

Summary of input from Joe Watson

- **Overload Tests Overview**:
  - Specified as percentages of the nameplate rating.
  - Many users specify both Winter and Summer, short- & long-term overloads.
  - Include pre-overload loading conditions.
- **Overload Percentages**:
  - Short-term overloads: Higher percentage than long-term.
  - Winter overloads: Higher percentage than Summer.
- **Winter Overloads (short and long term)**:
  - Specified at lower ambient temperatures than manufacturers' test labs.
  - Testing Winter overloads at Summer ambient temperatures likely to be subjected to winding and top oil total (rise plus ambient) temperatures that are significantly greater than its specified or designed performance characteristics, and the transformer could be damaged (rise plus ambient)
- **Summer Overloads** :
  - Should be able to be tested with minimal loss of insulation life.
- **Best Practices**:
  - Perform overload temperature rise tests in Summer long-term conditions.
  - Measure hot resistance only on the hottest phase, as determined on the ONAF2 temperature rise tests.
  - Re-energize transformer if all required hot resistances cannot be measured during the first shutdown.
- **Challenges**:
  - Temperatures at the end of overloads are likely increasing and not stabilized.
  - Reheating transformer to stable pre-load temperature for long-term overload tests is impractical.
- **Future Considerations**:
  - Discuss best practices for addressing overload testing challenges.
  - Reheat time should bring top oil temperature back to the temperature at the first shutdown … but the group may have a better solution.
  - The whole reheating process for the 2nd or third shutdown can have more effect on the measured temperatures than the transformer's thermal performance.

10) The meeting was adjourned at 10:30 AM (MDT)

11) Next meetings (planned):

If NesCOM approves our PAR in their meeting on March 26th then we will meet the first time as a WG.

- Virtual meeting – might be scheduled before October 2025.
- In-person meeting F25 – October 19-23, 2025 in Bonita Springs, FL.

Respectfully submitted,
Ewald Schweiger
Study Group Chair

List of attendees for this meeting:

Last name	Given name	Affiliation	Status
Abdalla	Isaac	HICO America	G
Antosz	Stephen	Consultant	M
Avanoma	Onome	MJ Consulting	G
Berube	Jean-Noel	Rugged Monitoring Quebec Inc	G
Bhattiprolu	Prudhvi Anand	AES	G
Blaydon	Daniel	Baltimore Gas and Electric	G
Bradshaw	Garrett	Howard Industries, Inc.	G
Brekalo	Josipa	Koncar D&ST	G
Bule	John	DTE Energy	G
Calil	Wilerson	Member, Hitachi Energy	G
Carrizales	Alfredo	Prolec GE	G
Castellanos	Juan	Prolec GE	M
Cisco Sullberg	Adriana	Salt River Project	G
Diaconu	Dumitru	Delta Star Inc	G
Digby	Scott	Duke Energy	G
Dillon	Nikolaus	Dominion Energy	G
Elson	Eric	San Diego Gas and Electric	G
Espitia	Egui	Reinhausen Manufacturing Inc	G
Farmer	James	Bureau of Reclamation	G
Frazier	Raymond	Ameren	G
Greaves	Brad	Weidmann Electrical Technology, Inc	G
Hampton	Kevin	Siemens Energy	G
Heinzig	Peter	Weidmann Electrical	G
Hoffman	Saramma	PPL	M
Holifield	Thomas	Howard Industries Inc	G
Jensen	Nick	Delta Star	G
Jeong	Chanmin	HD Hyundai	G
Khan	Qasim	NEETRAC-Georgia Tech	G
Kim	Yeounsoo	JST power equipment	G
Kiparizoski	Zan	Howard Industries	G
Klempner	Dmitriy	Guest	G
Koprivnjak	Matija	Končar D&ST	G

Kumar	Arvind	Delta star inc	G
Leal	Fernando	PROLEC ge	G
Mamede	Gabriel	Siemens Energy	M
Markus	Schiessl	SGB	G
Martínez Mares	Alberto	WEG USA	G
McBride	Brian	Cargill	G
Munoz	Marta	Hitachi Energy	G
Natale	Anthony	HICO America	G
Norton	James	Oncor	G
OMalley	Anastasia	Consolidated Edison Co NY	G
Ortiz	Cuauhtemoc	Niagara Power Transformer Corp.	G
Palhatiya	Ajay	Virginia Transformer	G
Park	Dean	Hyosung Hico	G
Patel	Monil	Pacific Gas and Electric	G
Patel	Sanjay	Royal Smit Transformers	G
Pellon	Verena	FPL and NextEra	G
Perez	Marcelino	PROLEC	G
Poulin	Bertrand	Hitachi energy	M
Reyes perez	juan	Hitachi energy	G
Ronchi	Rodrigo	WEG Transformers México	M
Sanche Rodriguez	Jesus	Vertiv	G
Sankarakurup	Dinesh	Duke Energy	G
Santos	Armindo	PROLEC GE	G
Schrammel	Alfons	Siemens-Energy	M
Schweiger	Ewald	Siemens Energy	M / Chair
Sharpless	Samuel	Rimkus	M / Chair ILSC
Shawn	Gossett	Ameren Illinois	G
Skeik	Ahmad	Crosslink Technology Inc.	G
Stauffer	Jonathon	Bureau of Reclamation	G
Stechschulte	Kyle	AEP	G
Tan	Jonathan	Northern Transformer	G
Thomas	Scott	Hitachi Energy	G
Tolcachir	Eduardo	TTE transformers	G
Van Dreel	Cole	American Transmission Co.	G
Varghese	Ajith	Prolec GE Waukesha	G
Varnell	Jason	Doble Engineering	G
Vedantham	Aparna	Virginia Transformer	G
Weisensee	Matthew	PacifiCorp	G
White	Joe	POWER Engineers	G
Zibert	Kris	Allgeier Martin	G

Annex H

Approved C57.119 Study Group Fall 2024 Meeting Minutes
Chair: Ewald Schweiger

Recommended Practice for Performing Temperature Rise Tests on Liquid-Immersed Power Transformers at Loads Beyond Nameplate Ratings

1) Meeting took place at 9:30 AM (CDT) on Monday October 28th, 2024
2) After the virtual meeting on September 29th, 2024, this was the second in person meeting after Vancouver S24 In our todays in person meeting 81 attended our second in person meeting.
    - Attendance: 81
    - Members: 7
    - Guests: 74
3) A brief overview about the previous meetings of C57.119 was presented:
    - F23 - Kansas City: Start Study Group for C57.119
    - S24 – Vancouver: Recommendation to ILSC "Document needs revision" and received task to work on title / scope.
    - Sept 24 - Virtual: Voted on wording of title and scope
    - F24 – St Louis: Seek ILSC's approval to create a PAR to revise the document. Make motion on Wednesday
    - Purpose of this meeting is to work on the purpose with the objective to complete the content needed for the PAR
4) Call for patents & Copyright statement
   The slides on essential patents from IEEE have been uploaded on the internet and were presented during the meeting. A call for essential patents was made.
   → No essential patents or issues were reported.
    a) The slides on IEEE copyright policy from IEEE have been uploaded on the internet and were presented during the meeting. A call for essential patents was made.
       → No issues were reported.
5) Establish quorum
    - A quorum was achieved
      Total number of members is 11 requiring 6= members for quorum.
      7 members have been present in the meeting
6) Approval of agenda
    a) No comments from the group
    b) The agenda was unanimously approved (1st motion by Juan Castellanos and 2nd Bertrand Poulin)
7) Approval of meeting minutes of the previous virtual meeting from September 29th, 2024
    a) No comments from the group
    b) The meeting minutes were unanimously approved (1st motion by Bertrand Poulin and 2nd Juan Castellanos)
8) Discussion based on feedback from review of C57.119 and next steps needed for the new PAR

The main purpose of this meeting is to work on the purpose of C57.119 and continue to identify needs for improvements / changes

a) The discussions which took place, covered topics, like need to cover DGA, test procedure and overlapping with C57.12.90 and C57.12.91

b) Based on the discussions and decision from the previous meeting the following wording was presented:

Title (for PAR 2024):

IEEE Recommended Practice for determining the thermal parameters of liquid immersed power transformers

Scope (for PAR 2024):

This recommended practice covers test procedures for determining the thermal parameters of liquid immersed power transformers needed to appraise the transformer's load carrying capabilities.

Need (for PAR 2024):

This revision is needed to maintain and provide necessary updates and corrections to this recommended practice in order to reflect today's technology.

c) Per the decisions made in the last virtual meeting the SG chair will seek approval from the ILSC on Wednesday, October 30th, 2024 at the F24 meeting in St. Louis, MO to use the above mentioned (8b) wording of the title and scope for creation of the PAR to revise C57.119.

d) In regards to the question from the last virtual meeting about the a purpose statement in the document, it was recommended by IEEE to include in the purpose statement in the PAR in order to be included in the "standard document". Otherwise a PAR modification needs to be applied for.

Therefore the group decided to move forward to discuss the wording of the purpose statement

e) The current wording of the "purpose" in the PAR from 2014 were presented

Purpose (Old PAR 2014):

These recommended test procedures for performing temperature rise tests on power transformers are for the purpose of the following:

a) Determining the thermal characteristics of a transformer needed to appraise the thermal performance of a transformer at loads other than nameplate rating

b) Verifying that a transformer can be loaded with a specified load profile without exceeding specified temperature rise

c) Assessing a transformer's performance during transient loading, simulating a load cycle that includes loads in excess of nameplate rating

Tests performed in accordance with Clause 9 are for the purpose of determining transformer thermal characteristics in a consistent manner. Data may then be accumulated from a large number of transformers and used to evaluate the accuracy of the equations and the empirical constants used in the loading guides.

Tests performed in accordance with Clause 10 are for the purpose of demonstrating the thermal effects of loading a transformer with a specified sequence of loads, including loads beyond nameplate rating.

Tests performed in accordance with Clause 11 are for the combined purposes of determining the thermal characteristics of a transformer and demonstrating the thermal effects of loading with a designated load cycle. This is accomplished by performing temperature rise tests at three loads, similar to Clause 9, except the three loads are selected to simulate the thermal effects of a specific load cycle.
It is not intended that all of these procedures be performed on a transformer design. It is intended that only one of the following combinations of test procedures be specified:

- *Clause 9 only, when thermal characteristics are to be determined*
- *Clause 10 only, when only verification of complying with temperature limits when loaded to a specific load profile is needed*
- *Clause 9 plus Clause 10, when both thermal characteristics and verification of compliance with temperature limits when loaded to a specific load profile are needed*
- *Clause 11 when both thermal characteristics and verification of compliance with temperature limits when loaded to a specific load profile are required, and the load profile can be represented with three steady state loads*

The user should specify which of the test procedures are required at the time of specification.
A further purpose of these procedures is to obtain information with respect to possible loading limitations imposed on the transformer by liquid levels and ancillary equipment when the transformer is operated at loads beyond nameplate rating.

f) Extensive discussions for the wording of the purpose took place, like the content and the details needed and how possible changes in the numbering within the new document will impact the wording.

g) The final conclusion was to keep the wording simple and more general. With all further details then put into other sections, like introduction and others

h) Ryan Hogg suggested to shorten the wording and keep just the beginning and the delete the rest.
The proposal of the wording read as follows and was shown on the screen:
Purpose (for PAR 2024):
These recommended test procedures for performing temperature rise tests on power transformers are for the purpose of the following:

a) Determining the thermal characteristics of a transformer needed to appraise the thermal performance of a transformer at loads other than nameplate rating
b) Verifying that a transformer can be loaded with a specified load profile without exceeding specified temperature rise
c) Assessing a transformer's performance during transient loading, simulating a load cycle that includes loads in excess of nameplate rating

i) Bertrand Poulin made the motion to use this wording as stated above in e) and which was shown on the screen to use for the purpose statement for the application of the PAR if the ILSC will approve the creation of the PAR in SC meeting on the following Wednesday. Juan Castellanos provided second.

- Motion was carried unanimously with no objections or abstentions.

j) The ILSC Chair Samuel Sharpless took the opportunity to express his appreciation to the group to take this task forward and thanked for the established results.

9) Based on this, we will seek approval from the ILSC on Wednesday, October 30th, 2024 at the F24 meeting in St. Louis, MO to request a PAR to revise C57.119
10) The meeting was adjourned at 10:30 AM (CDT)
11) Next meetings (planned):
    - Virtual meeting – might be scheduled before March 2025
    - In-person meeting S25 – March 23-27, 2025 in Denver, CO

Respectfully submitted,
Ewald Schweiger
Study Group Chair

List of attendees for this meeting:

Last name	Given name	Affiliation	Status
Adams	Kayland	Prolec Ge Waukesha	G
Arnold	Elise	SGB	G
Bargone	Gilles	FISO	G
Blaydon	Daniel	Baltimore Gas and Electric	G
Bohrn	Josh	PacifiCorp	G
Bradshaw	Garrett	Howard Industries	G
Calil	Wilerson	Hitachi Energy	G
Carrizales	Alfredo	PROLEC	G
Castellanos	Juan	Prolec GE	M
Cisco Sullberg	Adriana	Salt River Project	G
Craven	Michael	Qualus	G
Crockett	Dan	Ameren	G
Dappen	Tim	CARGILL	G
Davoudi	Ponneh	Delta Star	G
Digby	Scott	Duke Energy	G
Dillon	Nikolaus	Dominion Energy	G
Dolloff	Paul	East Kentucky Power Cooperative	G
Dorpmanns	Luc	Royal SMIT Transformers	G
Dzodan	Janko	Končar D&ST	G
Eduardo	Tolcachir	TTE Transformers	G
Elson	Eric	San Diego Gas and Electric	G
Frazier	Raymond	Ameren	G
Frye	Richard	Eaton	G
Gasic	Dragana	KONCAR D&ST	G
Greaves	Brad	WEIDMANN Electrical Technology	G
Hoffman	Saramma	PPL	M
Hogg	Ryan	Bureau of Reclamation	G
Holifield	Thomas	Howard Industries	G
Hussain	MD Rashid	Mississippi State University	G

Jensen	Nick	Delta Star	G
Kaineder	Kurt	Trench Austria	G
Katapalli	Thrinadha	Virginia transformer corporation	G
Khan	clasim	NEETRAC - Georgia Tech	G
Kim	Yeounsoo	Meppi	G
Kiparizoski	Zan	Howard Industries	G
Kumar	Arvind	Delta Star Inc	G
Lachman	Mark	Foble	G
Lembacher	Stefan	Siemens Energy	G
Mamede	Gabriel	Siemens Energy	M
Martinez Mares	Alberto	WEG Transformers USA	G
McBride	Brian	Cargill	G
Munoz	Marta	Hitachi Energy	G
Natale	Anthony	HICO America	G
Newbill	Mark	Hitachi	G
Omalley	Anastasia	Con Edison NY	G
Orozco	Eduardo	GE Grid Solutions	G
Park	Dean	Hyosung Hico	G
Patel	Sanjay	SGB-Smit USA	G
Pavicic	Tomislav	Koncar Power Transformers Ltd	G
Poulin	Bertrand	Hitachi Energy	M
Reyes perez	Juan	Hitachi Energy	G
Richardson	Michael	Ameren	G
Ronchi	Rodrigo	WEG Transformer Mexico	G
Sahin	Hakan	Virginia transformer corp	G
Sankarakurup	Dinesh	Duke Energy	G
Sarkinen	Garret	Xcel Energy	G
Schiessl	Markus	SGB	G
Schrammel	Alfons	Siemens Energy	M
Schweiger	Ewald	Siemens Energy	M / Chair
Sen	Cihangir	Duke Energy	G
Shaikh	AbdulMajid	Delta Star Inc.	G
Sharpless	Samuel	Rimkus	M / Chair ILSC
Stechschulte	Kyle	American Electric Power	G
Steineman	Andrew	Delta Star, Inc.	G
Tan	Jonathan	Northern Transformer	G
Tanaka	Troy	Burns & McDonnell	G
Tekle	Samuel	WEG Transformers USA	G
Thomas	Scott	Hitachi Energy	G
Topol	Fran	Koncar Power Transformers Ltd.	G
Tostrud	Mark	Dynamic Ratings	G
Vanderwalt	Alwyn	Electrical Consultants Inc	G
Varghese	Ajith	Prolec Ge Waukesha	G
Varnell	Jason	Doble Engineering	G
Varnell	Jason	Doble Engineering	G
Viy	Dharam	Prolec Ge Waukesha	G

Wagner	John	American Electric Power	G
Watson	Joshua	NPPD	G
White	Joe	Power Engineers	G
ZHENQUAN	YU	Sieyuan Toshiba	G
Zibert	Kris	Allgeier Martin & Associates	G
Ziger	Igor	Končar - Instrument Transformers	G

H.3.3 WG C57.91 Guide for Loading Mineral-Oil-Immersed Transformers – David Wallach, WG Chair presented the update

Chair: David Wallach
Vice-Chair: Javier Arteaga
Secretary: Kumar Mani

The working group did not meet during the Denver Spring meeting. The ballot successfully closed on February 15, 2024, with 448 comments to be resolved. The comment resolution group completed resolving the comments and the document has been updated. The document will begin recirculating for balloting next week. The document is on track to be completed by the end of the year before the PAR expires on December 31, 2025.

H.3.4 C57.162 Guide for the Interpretation of Moisture Related Parameters in Liquid Immersed Transformers and Reactors – Tom Prevost, WG Chair presented the update

Chair: Tom Prevost
Secretary: Deanna Woods

No meeting was held in Denver. The comment resolution group resolved over 800 comments from the first recirculation. The second ballot recirculation yielded seven comments which have been resolved. The recirculation is scheduled to begin in the next month. The plan is to submit the document to IEEE SA Review Committee in June and the document should be approved by the fall. The PAR has been extended to December 31, 2025.

H.3.5 C57.165 IEEE Guide for Temperature Measurements for Liquid Immersed Transformers and Reactors – Mark Tostrud WG Chair presented the update

No meeting was held in Denver. The updated document was published at the end of February.

H.3.6 Task Force C57.12.90 Clause 11, Temperature Rise Tests – Dinesh Sankarakurup, TF Chair presented the meeting minutes from the March 25th meeting during which the addition of two sections was finalized.

ILFC TF Continuous Revisions to IEEE C57.12.90 Clause 11

Temperature-rise Tests

March 25th, 2025, Denver, CO

TF - Temperature-rise Tests		
Chair: Dinesh Sankarakurup	**Vice-Chair: Ajith M. Varghese**	**Secretary: Cihangir John Sen**
Room: Centennial F	Date: March 25th, 2025	Time: 3:15 pm to 4:30 pm
Total TF Members: 30	Members present at the Quorum: 19	Attendance Per Roster: 53
Guests present: 30 (Table-2)	Membership requested: 12	Granted membership: 4
Status changed to Guest: 5		Final TF Members: **29** (Table-1)

Chair's Remarks

The meeting was called to order at 3:15 PM on March 25, 2025. The Chair welcomed members and guests to the Spring 2025 meeting.

Attendance rosters were circulated. There were 52 participants present (including the Chair, Vice Chair, and the Secretary) and 12 participants requested voting membership. Six (4) of the 12 requests were granted according to their participation records. 5 members' statuses have changed to guest.

Per the Working Group Policies and Procedures, voting membership status will be effective as of the start of the next meeting in Fall 2025. Table 1 is the final list of the **29 members** of the TF. Table 2 lists the 31 guests present at the Fall 2024 meeting.

Table-1: Final Membership List (after F24 Meeting)

	First Name	Last Name		First Name	Last Name
1	Steve	Antosz (P)	**16**	Bertrand	Poulin (P)
2	Michael	Botti (New) (P)	**17**	Juan	Reyes Perez
3	Juan	Castellanos (P)	**18**	Dinesh	Sankarakurup (P)
4	Luc	Dorpmanns (P)	**19**	Garret	Sarkinen (New) (P)
5	Hakim	Dulac (New) (P)	**20**	Cihangir John	Sen (P)
6	Renjie	Fu	**21**	Abdulmajid	Shaikh
7	Saramma	Hoffman (P)	**22**	Michael	Shannon (P)
8	Qasim	Khan (P)	**23**	Sam	Sharpless (P)
9	Zan	Kiparizoski (P)	**24**	Sanjib	Som (P)
10	Egon	Kirchenmayer (P)	**25**	Valeriu	Tatu (P)
11	Arvind	Kumar (New) (P)	**26**	Ryan	Thomson
12	Fernando	Leal (P)	**27**	Ajith	Varghese (P)

13	Gabriel	Mamede (P)	**28**	Jason	Varnell (P)
14	Francis	Mills	**29**	David	Wallach (P)
15	Marta	Munoz			

(P) Members Present, (New) New Member

Table-2: Guests present during S25 WG Meeting

	First Name	Last Name		First Name	Last Name
1	Kayland	Adams	**16**	Kris	Neild
2	Mario	Alonzo	**17**	James	Norton
3	Elise	Arnold	**18**	Ajay	Palhatiya
4	Darren	Brown	**19**	Dwight	Parkinson
5	Vivian	Chan	**20**	Crystal	Qiao
6	Dimitri	Diaconu	**21**	Layman	Rapelly
7	Curtis	Frazier	**22**	Hyounggon	Ryu
8	Alireza	Gorzin	**23**	Armindo	Santos
9	Vijay	Gunja	**24**	Amitkumar	Singh
10	Chanmin	Jeong	**25**	Ahmad	Skeik
11	Lalchami	Komel	**26**	Andreas	Thiede
12	Nihat	Kosedag	**27**	Scott	Thomas
13	Luc	Loisellez	**28**	Pedro	Truillo
14	Moses	Manzano	**29**	Yves	Vermette
15	Alberto	Martinez Mares	**30**	Leon	White

Quorum, Approval of Minutes and Agenda

At the time of quorum 18 of the 30 members were present so quorum was achieved short after the meeting start. The Unapproved minutes from the Fall 2024 in St Louis meeting was presented by Chair and approved by the WG.

Below members' statuses have changed to Guest due to their attendances.

Members changed Guest Status	
First Name	**Last Name**
Gilles	Bargone
William	Boettger
Samragni	Dutta Roy
Jarrod	Prince
Ewald	Schweiger

The agenda for the Spring 2025 meeting minutes were unanimously approved.

Patents and Copyrights

Chair made the call for the patent and shared the IEEE SA slides on patent policy and copyright. The attendees were asked if there were any Patents and Copyrights relevant to the scope that the TF should be aware of. None were reported.

TF started to discuss about the old businesses since quorum was achieved.

Old/ Unfinished Businesses:

1) Hot spot rise calculation for OFAF /OFWF cooler transformer

Chair presented the survey results for the proposed changes by Bertrand Poulin regarding the section that was implemented from the C57.119-2018. This section is about the top oil temperature location for OFAF and OFWF compared to ONAN and ONAF cooling methods.

Chair suggested to survey the revised clause 11.3.2 within the Task Force after implementing the all the changes discussed during the Fall 2024.
This section has already been circulated within the TF to collect comments and was sent out for a final survey within the task force.
Survey results received with 91% approval (23 responded, 21 approved, 2 abstain). Two editorial comments were also review and accepted by the task force.
Chair shared the two comments from the participants. Both were editorial comments and already addressed in the revised version.
Chair asked for motion to Chair asked for motion to include two sections –

11.3.2.1 Basic transformer thermal model: This section brings relevant information from C57.119, updated with recommended edits based on TF surveys and discussions to explain basic transformer thermal model and differences between cooling modes.
and
11.3.4 Determination of winding hottest spot temperature-rise in the C57.12.90:
C57.12.00 specifies a limit for winding hot spot, but no method is suggested to calculate it. This section brings relevant information from C57.119, updated with recommended edits based on TF surveys and discussions.

The motion was unanimously approved and TF agreed to include the sections in the next C57.12.90 revision.
TF recommends ILSC the addition of above two sections 11.3.2.1 and 11.3.4 to C57.12.90 as finalized during the S25 TF meeting held on 3/25/2025.

2) Negative Altitude Correction (Transformers tested at factories located > 1000 m)

TF also reviewed the survey results for the reverse altitude correction formula under Sub clause 11.4.3, "**Correction of liquid temperature rises for differences in altitude" s**urvey results were received with 29 approved and 1 abstain from 30 responders.
Original version of the section 11.4.3 refers adjusting the oil rise when a transformer is tested at 1000 m or less and is to be operated at a higher altitude. However, it does not specify making adjustments when the opposite situation applies, such as when a transformer is tested above 1000 m and is to be operated at 1000 m or less

Chair shared the two comments, that were answered within the WG without any change in the surveyed document.

Chair asked for motion to move forward with the revised altitude correction calculation section (Zan Kiparizoski, Sanjib Som). Motion was unanimously approved and TF agreed to include that section as is in the upcoming C57.12.90.

TF recommends ILSC adoption of the revised section 11.4.3 to C57.12.90 as finalized during the S25 TF meeting held on 3/25/2025.

3) Tap Selection for Temp Rise Test:

This section was already surveyed but the TF didn't have the chance to review the survey results in the last two meetings Spring 24 and Fall 24.

Vice Chair presented the survey results for the sections 11.1.2.1 and 11.1.2.2 for the tap selection during the temperature rise test. According to the survey results, there were 49 approved and 2 disapproved votes received. There were 16 comments that have already been incorporated in the final revision of the document; however, the two comments remain disapproved. Vice Chair made a motion to resurvey the clean copy of the section including the comments & responses (Sanjib Som, Juan Castellanos).

4) Hotspot measurement using fiber optics as an alternate method

This subject was proposed by Egon Kirchenmayer as an alternative winding temperature rise calculation by using the direct hot spot measurement with fiber optic probes in the winding that allows a reverse calculation of the average winding temperature rise.
TF discussed about the proposed method
Bertrand Poulin asked "if the method was compared with the traditional measurement of the winding temperature rise with the conventional hot resistance measurement. It was requested from the subgroup to present the results from conventional vs direct measurement methods."
Ajith Varghese mentioned that "the fiber optic probe measurements could have 5-10degC differences based on the location and each manufacturer might have different results based on the different insulation, location or installation practices. Therefore, the industry is not ready to implement the method."

Motion is to collect the requested data for the comparison of the direct measurement and conventional measurements. Chair requested volunteers from the manufacturers to provide data before the next meeting. It was clarified that the data should include the raw measurements from each fiber optic probe, not just the highest temperature value.

No new business was identified.

Meeting was adjourned at 4:30pm.

Minutes respectfully submitted by

Cihangir John Sen
Secretary

Annex H

Dinesh Sankarup made a motion to add sections 11.3.2.1 and 11.3.4 to C57.12.90 as finalized during the Spring 2025 Task Force meeting that was held on March 25, 2025 and as shown below. Joe White seconded the motion. There was no objection to the unanimous approval of the motion.

11.3.2.1 Basic transformer thermal model
(This section brings relevant information from C57.119, updated with recommended edits based on TF surveys and discussions to explain basic transformer thermal model and differences between cooling modes.)

11.3.4 Determination of winding hottest spot temperature-rise
(C57.12.00 specifies a limit for winding hot spot, but no method is suggested to calculate it. This section brings relevant information from C57.119, updated with recommended edits based on TF surveys and discussions.)

Dinesh Sankarup made a motion to adopt the revised sections 11.4.3 to C57.12.90 as finalized during the Spring 2025 Task Force meeting that was held on March 25, 2025 and as shown below. John John seconded the motion. There was no objection to the unanimous approval of the motion.

11.4.3 Correction of liquid temperature rises for differences in altitude

(Original version says to make an adjustment to oil rise when a transformer is tested at 1000 m or less and is to be operated at a higher altitude. But it does not say to make an adjustment when the opposite situation applies, such as when a transformer is tested above 1000 m and is to be operated at 1000 m or less. The proposed changes provide an equation that can be used in both directions at specified altitudes.)

11.4.3 Correction of liquid temperature rise for differences in altitude

When factory tests are made at an altitude of 1000 m (3300 ft) or less, and the transformer is to be operated at an altitude of 1000 m (3300 ft) or less, then no altitude correction shall be applied to the liquid temperature rise.

When factory tests are made at one altitude and the transformer is to be operated at a different altitude, then it shall be assumed that the liquid temperature rise will change in accordance with Equation (32).

This equation applies in both directions, i.e.:

- When a transformer is tested at an altitude of 1000 m (3300 ft) or less, and it will operate at a site that is above 1000 m (3300 ft), then the correction will increase the tested (observed) liquid temperature rise.
- When a transformer is tested at an altitude above 1000 m (3300 ft), and it will operate at a site that is 1000 m (3300 ft) or less, then the correction will decrease the tested (observed) liquid temperature rise.

$$\Delta\theta_A = \Delta\theta_o \left(\frac{A_{site} - A_{test}}{A_o}\right) F \qquad (32)$$

where

$\Delta\theta_A$ is the correction of the liquid temperature rise (°C) from the altitude at test to the altitude at site, positive to increase or negative to decrease
$\Delta\theta_o$ is the observed (tested) liquid temperature rise (°C)
A_{site} is the altitude in meters (ft) of the operating site, minimum value is 1000 m (3300 ft)
A_{test} is the altitude in meters (ft) of the factory test, minimum value is 1000 m (3300 ft)
A_0 is 1000 m (3300 ft)
F is 0.04 for self-cooled mode or 0.06 for forced-air-cooled mode

Corrected liquid temperature rise = the tested liquid temperature rise + the correction = $\Delta\theta_o + \Delta\theta_A$

H.3.7 Study Group – Proposed IEEE Guide to Interpretation of Direct and Indirect Tests for the Degradation of Cellulosic Materials in Oil Immersed Transformers – Lance Lewand, Chair, presented the meeting minutes

The study group met and developed a proposed title, purpose and scope to submit a PAR for a new document.

Task Force
Tests Degradation of Cellulose in Liquid Type Transformers

- This task force met on Monday, March 24th, 2025 at 1:45PM at the Hyatt Regency in Denver, CO
- 78 people attended the meeting
- Meeting minutes and agenda were not approved as there is not yet an active PAR
- Reviewed guidelines for IEEE SA Meetings
- Reviewed IEEE Codes of Ethics and Conduct
- Reviewed Copyright and Patent Policies
- Goal of the meeting was to come to agreement on a Title, Scope and Propose so that a PAR could be applied for, and secondarily to get a start on assignments of task forces in anticipation that a PAR would be approved.
- This document will be published as a Guide not a standard
- Several titles, scope and purpose were prepared in advanced for discussion at this meeting. A lively discussion took place among those attending in rewording and editing the three items. A discussion of the terms "liquid-immersed" and "liquid-filled" took place and "liquid-filled" won out as the preferred term.
- Based on conversations and debates held in the meeting, the following title, scope and purpose were prepared with the full participation of the audience and are stated as:

TITLE:

IEEE Guide to the Interpretation of Tests for the Degradation of Cellulosic Materials in Liquid-Filled Transformers and Reactors

SCOPE:

This guide applies to liquid-filled transformers and reactors and addresses:

1. *Introduction and history of why cellulose is used, its inherent strengths and weaknesses, and aging mechanisms of cellulose in liquid-filled transformers and reactors containing either mineral oil, natural or synthetic esters, or silicone*
2. *Tests to evaluate degradation of cellulose and interpretation of those results*
3. *Impact of transformer and reactor design, construction and operation*
4. *Fate of cellulose aging markers due to liquid processing*
5. *Calculations, cellulose life estimation and risk assessment*
6. *Case studies and examples*

7. *A bibliography of related literature*

PURPOSE:

The purpose of this guide is to provide users with a reference concerning the cellulose aging processes in a liquid-filled transformer or reactor, what tests to use and when, and how to interpret those results. Additional information is provided to aid in determining the cellulose life estimation of the transformer or reactor.

A motion was made to accept the Title, Scope and Purpose listed above by Ed Casserly, seconded by Mike Bonn. No nays were recorded and the motion passed unanimously.
Suggested Officers for the official working group once the PAR is approved:
Chair: Lance Lewand, Doble Engineering
Vice Chair: Stuart Chambers, EPRI International
Secretary: Brad Greaves, Weidmann Electrical Technology

The rest of meeting consisted of requesting volunteers to participate for the following task forces that may implemented once a PAR is approved.
The anticipated task forces were listed as follows:

1. Structure of the Task Forces and those that volunteered
    1. Identify IEEE standards that overlap - Alan Sbravati and Yuri Rossini
    2. Introduction – Lance Lewand, Stuart Chambers
    3. Cellulose materials Inside the Transformers - Brad Greaves, Kevin Biggie
    4. Aging Mechanisms, stressors… Lance Lewand, Luis, James Cross, Kevin Biggie, Ed Casserly
    5. Tests – Lance Lewand, Stuart Chambers, Todd Felton, Stephanie Mabrey, Brad Greaves
    6. Impact of Transformer Construction… Alan Sbravati
    7. Impact of Liquid Processing – Lance Lewand, Stuart Chambers, Todd Felton
    8. Calculations – Luiz Cheim
    9. Case Studies – Lance Lewand, Anastasia O'Malley, James Cross
    10. Bibliography- ensure copyright releases - none

The next steps are to bring this to insulating life subcommittee with a motion and then if approved file PAR
Meeting adjourned at 2:48 PM

Last Name/Surname	First Name	Company
Lewand	Lance	Doble
Harper	Robert	Soltex Inc
Gagnon	Jean-philippe	qualitrol
Callsen	Thomas	Weldy Lamont Assoc
Bonn	Mike	Soltex

Tillery	Timothy	Howard Industries
Hershberger	Benjamin	Midwest Transformer
Kim	Yeounsoo	JST power Equipment
Casserly	Edward	Ergon
Valori	Valentina	Hitachi Energy
Vullo	Stephen	GE Vernova
Walters	Shelby	Howard Industries
Loiselle	Luc	Tetra tech
Cheim	Luiz	Hitachi
Arias-Garcia	Josh	Midwest Electric Transformer Services
Rossini	Yuri	Siemens Energy
Duarte	Fernando	Hitachi Energy
Masoud	Nader	Central Moloney
Britton	Jeffrey	Doble Engineering
Quinones	Manuel	GE Vernova
Quinones	Manuel	GE Vernova
Burk	Griffin	Ergon
Mantoan	Francis	Siemens Energy
Fujimori	Alan	
Sharpless	Samuel	Rimkus
Rutledge	Chris	GeVernova
Garner	Joshua	RESA Power
Biggie	Kevin	Weidmann Electrical Technology
Yeboah	Kwasi	GE Vernova
Da Silva	Roberto	Maschinenfabrik Reinhausen
Hermann	Florian	TRENCH FRANCE
Ray	Sheila	US Nuclear Regulatory Commission
Heinzig	Peter	Weidmann
Bule	John	DTE Energy
Shaikh	Salahuddin	NRG
Demes Jasso	Rolando	Arteche
Dappen	Tim	Cargill
Zhai	Yong	Sieyuan transformer bushing
Ramirez	Ernesto	Arteche
Pepe	Harry	Phenix Technologies
Yeh	Stanley	Shihlin Electric
Hsiao	YUTSO	Shihlin Electric
Matt	Chu	Shihlin Electric
Asam	Yu	Shihlin electric
Michael	Shannon	Rea Magnet Wire
Zhang	Hongzhi	Hitachi Energy
Hrkac	Miljenko	Hitachi Energy

Satheesh	Nithin	Trench Limited
Giraldo	Orlando	The H-J Family of Companies
Castellanos	Juan	Prolec
Trifunoski	Risto	Trench canada
Jean-Noel	Berube	Rugged Monitoring Quebec Inc
Perjanik	Nick	AVO Diagnostic Services
OMalley	Anastasia	Consolidated Edison Co NY
Mabrey	Stephanie	AVO diagnostics
Thomas	Holifield	Howard Industries Inc
Qiao	Crystal	Trench limited
Pandya	Manan	Siemens Energy
Kwan	Landen	NRV
Propts	Thomas	Dominion Energy
Felton	Todd	MVA Diagnostics, Inc.
Mellin	Toni	Vaisala
Greaves	Brad	Weidmann Electrical Technology, Inc
Almeida	Nabi	Prolec GE
Velasquez	Juan	Magnetron S.A.S.
Murcia	Fredy	Siemens Energy
Minikel	Justin	Eaton
Faur	Florin	Prolec GE
Hollra	Derek	Burns & McDonnell
Crockett	Daniel	Ameren
Rodriguez	Juan	Magnetron
Kurz	Andreas	Maschinenfabrik Reinhausen
Veeran	Kannan	Virginia/Georgia Transformer
Cross	James	Kinectrics
Gupta	Ravi	Megger
Blaszczyk	Piotr	Specialty Transformer Components
Bhattiprolu	Prudhvi Anand	AES

Lance Lewand made a motion to approve a PAR to create a new guide with the title, scope and purpose stated below. Ed Casserly seconded the motion. There was no objection to the unanimous approval of the motion.

TITLE:

IEEE Guide to the Interpretation of Tests for the Degradation of Cellulosic Materials in Liquid-Filled Transformers and Reactors

PURPOSE:

The purpose of this guide is to provide users with a reference concerning the cellulose aging processes in a liquid-filled transformer or reactor, what tests to use and when, and how to interpret those results. Additional information is provided to aid in determining the cellulose life estimation of the transformer or reactor.

SCOPE:

This guide applies to liquid-filled transformers and reactors and addresses:

1. **Introduction and history of why cellulose is used, its inherent strengths and weaknesses, and aging mechanisms of cellulose in liquid-filled transformers and reactors containing either mineral oil, natural or synthetic esters, or silicone**
2. **Tests to evaluate degradation of cellulose and interpretation of those results**
3. **Impact of transformer and reactor design, construction and operation**
4. **Fate of cellulose aging markers due to liquid processing**
5. **Calculations, cellulose life estimation and risk assessment**
6. **Case studies and examples**
7. **A bibliography of related literature**

H.3.8 Study Group – Non-C57.91 Loading Characteristics – Tim Raymond, Chair, presented minutes and update

Task Force Non-C57.91 Meeting
Spring 2025 Meeting
Mineral Hall (BC), Denver, CO
Monday, March 24th, 2025
11:00AM – 12:15 PM Mountain Time Zone
Chair: Tim Raymond Vice-Chair: Empty Secretary: Empty

UNAPPROVED MINUTES (provided by Jeremiah Bradshaw)

SUMMARY: This meeting is to discuss a need for end user guidance for loading transformers with non-conventional (ie. Not covered by C57.91) insulation systems. The goal of this group is to determine what gaps are present in current IEEE Transformers Committee documents and provide a recommendation to the ILSC on what revisions might need to be made or to recommend a new document altogether.

There were attendees. This being the first meeting of this task force, all 56 attendees requesting membership will be granted membership.

MINUTES: **Slide 1: There are other standards that touch on this topic a little:**

- C57.91: Guide for Loading of Mineral Oil Transformers
- C57.154: Temperatures above Conventional Limits Using High-Temp Insulation Systems
- 1276: Application of High Temp
- C57.12.00: General
- IEEE St 1: Temp Limits
- Maybe:
    - C57.100: Test Procedure for Thermal Eval
    - C57.162: Moisture Related

Comments:

Tom Prevost:

- There are some new documents that are being worked on in IEC 60076-1 (General), 60076-2 (Testing). IEC 60076-5 (Loading).
- They are also looking into a moisture related topic for accelerated aging.
    - C57.162 started this work.

Slide: Some Specific Concerns

- Loss-of-life is covered under 1276
- Temp Gradient
    - Included in C57.154
- Updated Thermal Models
- Temperature Limits
- Bubble Evolution
- C57.12.00: Allowable temp rise at nameplate

Comments:

Aleksandr Levin (Weidmann)

- We need something similar to C57.91 for all of the new cases.
- Cellulose should be discussed individually as well because it is different once mineral oil is added.

Jinesh Malde (Midel)

- We need to define what “non-C57.91” means. It sounds like it is anything different than a conventional system with a 65-degree C rise.

Aleksandr Levin:

- “even with a 65 rise unit, if you have a high temp insulation system does that affect the loading?”

Tom Prevost (Weidmann):

- we can’t completely go away from materials; example, bubble evolution will be impacted by the material.

David Wallach (Duke):

- we’ve seen failures in the leads that have cellulose while the windings have aramid. The designer and end user need to understand the temperature limits to prevent failures.

Aslendro:

- we can’t be completely agnostic of materials.

Tim Raymond:

- Where do we feel like this information should reside? (C57.91, C57.154, etc)

David Wallach:

- If you start with C57.91 as the template, and start to edit it, then look back at it and see if it can find a good home.

Adriana Cisco Sullberg (Salt River Project):

- No matter where we put this information, an end user will need to follow a decision tree to get to the right location information. So it should go into C57.91.

Anastasia O’Malley (ConEd):

- There is a need for a specific document dedicated to hybrid insulation systems.
[Unsure name]:
- There should be a separate guide that partners with C57.154.
Jinesh Malde:
- We do need a document, but we can treat the new document as a partner to C57.91.
Kevin Biggie (Weidmann):
- 1276 has an annex B that is a loading guide for this situation, but it shouldn't be the place for this information.
Tom Prevost:
- maybe we should start with looking at a title, scope, and purpose to help shape the direction of the new document.
[Unsure name]:
- if we open this to alternate liquids and solid insulation systems, it would take a long time to build these models.
David Wallach:
- we shouldn't jump straight into a title, scope, and purpose until we know what we want to write. We could run straight through a PAR and not achieve anything.
Bradshaw:
- should it be included as an annex in C57.91 with the key information we know that an end user should consider when they have a hybrid insulation system or anything different than the scope of C57.91.
Anastasia O'Malley:
Motion: "To present to the insulating life subcommittee, to create a study group for developing a PAR to create a title, scope, and purpose for a loading guide for alternate insulation systems."
Tom Prevost second.
No objections from the group [unanimous approval]
Aleksandr Levin:
- We need to define the term for high temperature operating conditions. We can do that at the next meeting.
Sam Sharpless (Rimkus):
- this group needs a secretary and vice chair as soon as possible since this discussion is rapidly moving.

Garrett Bradshaw volunteers as the secretary.
Sami Debass (EPRI) volunteers for vice chair.

Your name	Company/Affiliation
Adriana Cisco Sullberg	Salt River Project
Ajay Palhatiya	Virginia Transformers Corp
Alan H. Stuyven	Romagnole
Ali Naderian	Potencia Partners
Amitabh Sarkar	Virginia Transformer Corporation
Amitkumar Singh	Con Edison Company of New York
Anastasia OMalley	Consolidated Edison Co of NY
Andy Steineman	Delta Star, Inc.
Anna Zhou	JST Power
Anthony Natale	HICO America

Aparna Vedantham	Virginia Transformer Corporation
Arvind kumar	Delta star inc
Asam Yu	Shilling electric
Attila Gyore	MIDEL and MIVOLT Fluids Ltd
Balaji Janakiraman	Virginia Transformer
Bernard LaBean Jr	Consumers Energy Company
Brian McBride	Cargill
Bruce Forsyth	Cargill
Chris Powell	Intermountain Electronics
Cole Van Dreel	American Transmission Co.
Cuauhtemoc Ortiz	Niagara Power Transformer Corp.
dalho kim	iljin electric
Daniel Blaydon	Baltimore Gas and Electric
Daniel Obregón	TTE Transformers
Danny Schwartz	Quality Switch
Dario Segovic	Koncar Power Transformers Ltd.
David Wallach	Duke Energy
Derek Hollrah	Burns & McDonnell
Diaconu dumitru	Delta Star inc
Dinesh Sankarakurup	Duke Energy
Zach Draper	Delta-X
Dumitru Diaconu	Delta Star Inc
Eduardo Tolcachir	TTE Transformers
Eduardo Garcia	Siemens Energy
Egon Kirchenmayer	Siemens-Energy
Egui Espitia	
Emilio Morales-Cruz	Qualitrol
Eric Elson	San Diego Gas and Electric
Fei Yang	Hitachi Energy
Fidel Castro	SDGE
Filip Mikulecky	Siemens Energy
Florian Heurian	Trench France
Fredy Murcia	Siemens Energy
Gabriel Delgado	Invenergy
Gabriel Mamede	Siemens Energy
Garret sarkinen	Xcel energy
Garrett Bradshaw	Howard Industries, Inc.
Giovanni Hernandez Decanini	Virginia Transformer Corp
Grace Guang Yuan	Hitachi energy
Hakan Sahin	Virginia transformer
Isaac Abdalla	HICO America
Jaber shalabi	Vantran industries

James Farmer	Bureau of Reclamation
Jason snyder	FirstEnergy
Jason Varnell	Doble Engineering
Jean-Noel Berube	
Jean-philippe Gagnon	qualitrol
Jeremiah Bradshaw	Bureau of Reclamation
Jesus Sanchez rodriguez	Vertiv
Jiahao Xie	S&C Electric Company
Jinesh Malde	MIDEL & MIVOLT FLUIDS INC
Joe Nims	Allen & Hoshall
John Bule	DTE Energy
John K John	Virginia Transformer Corp
John Wagner	AEP
Jonathan Reimer	FortisBC
Jonathon Stauffer	Bureau of Reclamation
Josh Bohren	PacifiCorp
Josipa Brekalo	Koncar D&ST
Juan Castellanos	Prolec
Juan Reyes perez	Hitachi Energy
Juan Rodriguez	Magnetron
Kayland Adams	Prolec-GE Waukesha
Kevin Biggie	Weidmann Electrical Technology
Kyle Stechschulte	AEP
KYUNGCHAN,AN	HYOSUNG
Laszlo Kadar	Laszlo & Associates
Leonard Torchia	PSE&G
Manan Pandya	Siemens Energy
Marco Espindola	Hotachi Energy
Mark Lachman	Doble
Mark Tostrud	Dynamic Ratings
Matija Koprivnjak	Končar D&ST
Matt Chu	Shihlin Electric
Matt Weisensee	PacifiCorp
Mickel Saad	Hitachi Energy
Miguel Fernandez	Braintree Electric Light Dept.
Monil Patel	Pacific Gas and Electric
Moonhee Lee	Hammond Power Solutions
Nick Jensen	Delta Star
Nitesh Patel	Hyundai Power Transformers
Onome Avanoma	MJ Consulting
Patrick Foster	NextEra Energy
Peter Heinzig	Weidmann
Phil Hopkinson	HVOLT Inc.

Prudhvi Anand Bhattiprolu	AES
Qasim Khan	NEETRAC-Georgia Tech
Raymond Frazier	Ameren
Roger Hayes	GE Vernova
Sami Debass	EPRI
Samuel Sharpless	Rimkus
Saramma Hoffman	PPL
Stephen Antosz	Consultant
Sudip Chanda	Delta Star Inc
Sukin Jang	ILJIN Electric
Thomas Holifield	Howard Industries
Tom Prevost	Weidmann
Verena Pellon	FPL and NextEra
Will Elliott	AEP SWEPCO
William Boettger	Boettger Transformer Consulting LLC
William Griesacker	WGA
Zach's weiss	WEG transformers
Zan Kiparizoski	Howard Industries
Tim Raymond	Inductive Reasoning

Tim Raymond made a motion for the study group to proceed with development of a PAR title, scope and purpose for a new document that will be a loading guide for alternate insulation systems. Eduardo Garcia Wild seconded the motion. There was no objection to the unanimous approval of the motion.

H.3.9 EPMC 0197 – Entity Proposal Management Committee Project 0197 - Guide for Inversion Detection of Hot-Spot Temperature and Loading Capacity in Oil-Immersed Transformers from the State Grid Anhui Electric Power Co. LTD Research Institute –

Weijun Li, Liaison Representative presented the update

The liaison representative has been guiding the group to assist them to understand the IEEE process. They had held a virtual meeting and have been communicating via email. The group has drafted a white paper, "Technical Report for Inversion Detection of Oil-immersed Transformer Hot-spot Temperature" for peer review.

H.3.10 EPMC 0184 – Entity Proposal Management Committee Project 0184 - Guide for Measurement of the Polymerization Degree of Insulating Paper-Paperboard for Power Transformers Based on Terahertz Time Domain Spectroscopy from the State Grid Shanxi Electric Power Research Institute –

Sam Sharpless presented the status

During the Fall 2024 meeting, the ILSC had accepted sponsorship of this entity project. However, no volunteers came forward as a liaison representative to organize and guide the group through the IEEE process. Once completed, the document would be under Subcommittee supervision for future enhancement and revision. If rejected, the document will proceed without Transformer Committee supervision.

The chair again requested volunteers to serve as a liaison for this project.
Three volunteers came forward to act as liaison representatives for this project. It was agreed that these three volunteers would work together as ILSC liaison.

- Hemchandra Shertukde, University of Hartford
- Solomon Chiang, the Gund Company
- Mario Alonso, Georgia Transformer

H.4 Old Business

None.

H.5 New Business

None.

The meeting adjourned at 9:10am MDST.

Attendance:
106 Members
131 Guests

Membership	Last Name	First Name	Company
Guest	Abdalla	Isaac	HICO America
Member	Adams	Kayland	Prolec-GE Waukesha
Member	Almeida	Nabi	Prolec GE
Guest	Alonso	Mario	
Guest	An	KyungChan	HYOSUNG
Member	Antosz	Stephen	Consultant
Guest	Arnold	Elise	SGB
Member	Arteaga	Javier	Hitachi Energy
Member	Avanoma	Onome	MJ Consulting
Member	Ballard	Robert Casey	DuPont
Member	Bargone	Gilles	FISO
Guest	Bates	Jared	Oncor Electric Delivery
Guest	Beaudoin	Jason	Weidmann
Guest	Berube	Jean-Noel	Rugged Monitoring Quebec Inc
Guest	Bhattiprolu	Prudhvi Anand	AES
Member	Biggie	Kevin	Weidmann Electrical Technology
Member	Blaszczyk	Piotr	Specialty Transformer Components
Member	Boettger	William	Boettger Transformer Consulting LLC

Annex H

Guest	Bohrn	Josh	PacifiCorp
Guest	Bonn	Mike	Soltex
Member	Botti	Michael	Hyosung HICO
Guest	Bradshaw	Garrett	Howard Industries, Inc.
Guest	Bradshaw	Jeremiah	Bureau of Reclamation
Guest	Brekalo	Josipa	Koncar D&ST
Guest	Brzoznowski	Steven	BPA
Guest	Bule	John	DTE Energy
Guest	Burke	David	Xcel Energy
Guest	Calil	Wilerson	Hitachi Energy
Member	Calitz	David	Siemens Energy
Member	Carrizales	Alfredo	Prolec GE
Member	Casallas	Camilo	Trench
Member	Casserly	Edward	Ergon, Inc
Member	Castellanos	Juan	Prolec
Guest	Caverly	David	Trench Limited
Guest	Chanda	Sudip	Delta Star Inc
Member	Cheim	Luiz	Hitachi
Member	Chiang	Solomon	TGC
Guest	Colopy	Craig	Retired from EATON
Member	Da Silva	Roberto	Maschinenfabrik Reinhausen
Guest	Dappen	Tim	Cargill
Member	Debass	Sami	EPRI
Member	Delgado Zamora	Gabriel	Invenergy
Guest	Diaconu	Dumitru	
Member	Digby	Scott	Duke Energy
Guest	Dillon	Nikolaus	Dominion Energy
Guest	Duarte	Fernando	HitachiEnergy
Guest	Duffy	Jesse	Nashville Electric Service
Member	Dulac	Hakim	Advanced Power Technologies
Member	Dutta Roy	Samragni	Siemens Energy Inc
Guest	Elson	Eric	San Diego Gas and Electric
Member	Ermakov	Evgenii	Hitachi Energy
Member	Espindola	Marco	Hitachi Energy
Guest	Espitia	Egui	Reinhausen Manufacturing Inc
Guest	Felton	Todd	MVA Diagnosticd
Guest	Fernandez	Miguel	Braintree Electric
Member	Ferreira	Marcos	FEMA
Guest	Fujimori	Alan	Romagnole
Guest	Gagnon	Jean-philippe	Qualitrol
Guest	Gamboa	Jose	The H-J Family of Companies
Member	Garcia	Miguel	Hitachi Energy
Member	Garcia Wild	Eduardo	Siemens Energy
Member	Gardner	James	Prolec-GE Waukesha
Guest	Garner	Joshua	RESA Power
Guest	Garza	Gilberto	Prolec GE
Member	Gaytan	Carlos	Prolec GE
Member	Ghosh	Rob	GE Vernova
Member	Gorzin	Alireza	Black & Veatch

Annex H

Guest	Gossett	Shawn	Ameren
Guest	Greaves	Brad	Weidmann Electrical Technology, Inc.
Member	Griesacker	Bill	WGA
Guest	Guinand	Benjamin	Power Magnetics
Member	Gyore	Attila	MIDEL and MIVOLT Fluids Ltd
Guest	Hampton	Kevin	Siemens Energy
Member	Hayes	Roger	GE Vernova
Guest	Heinzig	Peter	Weidmann
Guest	Hernandez-mejia	Jean Carlos	NEETRAC GEORGIA TECH
Member	Hoffman	Saramma	PPL
Guest	Holifield	Thomas	Howard Industries Inc
Guest	Hollrah	Derek	Burns & McDonnell
Member	Hopkinson	Phil	
Member	Hossain	Saif	Trench Canada
Member	Hrkac	Miljenko	Hitachi Energy
Member	Issack	Ramadan	AEP
Guest	Janakiraman	Balaji	Virginia Transformer
Guest	Jang	Donghyun	LS ELECTRIC
Guest	Jarosz	Patrycja	IEEE SA
Member	Jensen	Nick	Delta Star
Guest	Jeong	chanmin	HD Hyundai
Member	John	John	Virginia Transformer Corp.
Guest	Kadar	Laszlo	Laszlo & Associates Inc.
Member	Kennedy	Sheldon	Sheldon P Kennedy Engineering PLLC
Member	Khan	Qasim	NEETRAC-Georgia Tech
Guest	kim	dalho	iljin electric
Guest	Kim	Heonsu	LS Electric
Member	Kim	Yeounsoo	JST Power Equipment
Member	King	Gary	Consultant
Member	Kiparizoski	Zan	Howard Industries
Member	Kirchenmayer	Egon	Siemens Energy
Guest	Koinis	Nicholas	CenterPoint energy
Guest	Koprivnjak	Matija	Končar D&ST
Guest	Kosedagi	Nihat	ERMCO
Guest	Kumar	Arvind	Delta star inc
Guest	Kurz	Andreas	Reinhausen Germany
Guest	Kwasi	Yeboah	GE Vernova
Guest	LaBean Jr	Bernard	Consumers Energy Company
Guest	Labh	Ashwini	Hitachi Energy
Guest	Lapointe	Sylvain	Rugged Monitoring
Guest	Larison	Andrew	Hitachi Energy
Guest	Leal	Fernando	Prolec ge
Member	Lee	Moonhee	Hammond Power Solutions
Member	Levin	Aleksandr	Weidmann
Guest	Lewand	Lance	Doble
Member	Li	Weijun	Braintree Electric Light Department
Guest	Loiselle	Luc	Tetra tech
Guest	Lopes	Ricardo	Efacec
Guest	Lopez	Libardo	Hitachi Energy

Member	Mabrey	Stephanie	Avo
Member	Malde	Jinesh	MIDEL & MIVOLT FLUIDS INC.
Member	Mamede	Gabriel	Siemens Energy
Member	Mani	Kumar	Duke Energy
Guest	Manzano	Moses	Hyosung HICO
Guest	Mellin	Toni	Vaisala
Guest	Mendez	Omar	Prolec
Guest	Merrill	Logan	OMICRON
Guest	Mikulecky	Filip	Koncar Power Transformers Ltd.
Member	Mills	Francis	POWER Engineers
Member	Montanha	Juliano	Siemens Energy
Member	Montanha	Juliano	Siemens Energy
Member	Morales-Cruz	Emilio	Qualitrol
Guest	Munoz	Marta	Hitachi Energy
Guest	Murcia	Fredy	Siemens Energy
Guest	Murillo	Hugo	The H-J Family of Companies
Member	Murray	David	TVA
Guest	Nader	Masoud	Central Moloney
Guest	Nambi	Shankar	Bechtel Energy, Inc.
Guest	Narawane	Aniruddha	Eaton
Guest	Natale	Anthony	HICO America
Guest	Neild	Kris	Megger
Member	Omalley	Anastasia	Con Edison NY
Guest	Ortiz	Juan	Reinhausen Manufacturing
Guest	Palhatiya	Ajay	Virginia transformer inc
Guest	Pandya	Manan	Siemens Energy
Member	Panesar	Parminder	Virginia Transformer Corp
Guest	Park	Dean	Hyosung Hico
Guest	Park	Jaeyong	LS Electric
Member	Parkinson	Dwight	Eaton Corp
Guest	Patel	Vinay	Con Edison
Guest	Patel	Sanjay	Royal Smit Transformers
Guest	Patel	Nitesh	Hyundai Power Transformers
Guest	Patel	Monil	Pacific Gas and Electric
Member	Patel	Poorvi	EPRI
Guest	Pedro	Pedro	Efacec Energia
Guest	Pepe	Harry	Phenix Technologies
Guest	PEREZ	MARCELINO	PROLEC
Guest	Peuc	Luka	Končar D&ST
Member	Pointner	Klaus	Trench Austria GmbH
Guest	Post	Nicholas	WEC Energy Group
Guest	Poulin	Bertrand	Hitachi Energy
Member	Prevost	Tom	Weidmann
Member	Radu	Ion	Hitachi Energy
Guest	Rapelly	Laxman	Georgia Transformer Corporation
Member	Raymond	Timothy	Inductive Reasoning
Guest	Reimer	Jonathan	FortisBC
Guest	Reiss	Tony	Custom Materials, Inc.
Guest	Rodriguez	Juan	Magnetron

Member	Ronchi	Rodrigo	WEG Transformers México
Guest	Rossini	Yuri	Siemens Energy
Guest	Rutledge	Chris	GeVernova
Guest	Ryu	Hyounggon	HD hyundai electric
Member	Saad	Mickel	Hitachi Energy
Member	Sahin	Hakan	Virginia Transformer Corp.
Guest	Samuel	Brodeur	Hitachi
Guest	Sanchez rodriguez	Jesus	Vertiv
Member	Sankarakurup	Dinesh	Duke Energy
Member	Sarkar	Amitabh	Virginia Transformer Corporation
Guest	Sarkinen	Garret	Xcel Energy
Member	Sbravati	Alan	Hitachi Energy
Guest	Schiessl	Markus	SGB
Guest	Schott	Cody	The H-J Family of Companies
Guest	Schrammel	Alfons	Siemens Energy
Guest	Schumack	Joseph	Ameren
Member	schweiger	ewald	siemens energy
Guest	Segovic	Dario	Koncar Power Transformers Ltd.
Member	SEN	CIHANGIR	Duke Energy
Guest	Sethi	Kabir	Hitachi Energy Germany Ag
Guest	Shaikh	Salahuddin	NRG Energy
Member	Sharp	Michael	Trench Limited
Member	Sharpless	Samuel	Rimkus
Member	Shertukde	Hemchandra	UHART/DDI
Guest	Shull	Stephen	BBC Electrical Services Inc
Member	Sinclair	Jonatha	Black and Veatch
Guest	Singh	Amitkumar	Consolidated Edison Company of New York
Guest	Snyder	Jason	FirstEnergy
Member	Som	Sanjib	PTT, LLC
Guest	Stankes	David	3M
Member	Stechschulte	Kyle	Aep
Guest	Steele	Hampton	hasteele@tva.gov
Guest	Sweetser	Charles	OMICRON electronics Corp. USA
Member	Szczechowski	Janusz	Maschinenfabrik Reinhausen GmbH
Member	Sze	Matthew	Omicron electronics
Guest	Tan	Jonathan	Northern Transformer
Member	Tanaka	Troy	Burns & McDonnell
Guest	Tatu	Val	Powersmiths
Member	Reed	Scott	MVA
Guest	Thiede	Andreas	HIGHVOLT Dresden
Member	Thomas	Scott	Hitachi Energy
Guest	Tillery	Timothy	Howard Industries
Guest	Tirado	Fernando	Prolec GE
Guest	Tolcachir	Tolcachir	TTE Transformers
Guest	Torchia	Leonard	PSE&G
Member	Tostrud	Mark	Dynamic Ratings
Member	Van Dreel	Cole	American Transmission Company
Member	Varghese	Ajith	Prolec GE Waukesha
Member	Varnell	Jason	Doble Engineering

Guest	Velasquez	Juan	Magnetron sas
Guest	Villa	Hector	Ecuatran SA
Member	Vir	Dharam	Prolec GE
Member	VonGemmingen	Richard	Dominion Energy
Member	Vyas	Pragnesh	Cleveland Cliffs
Guest	Wagner	John	AEP
Member	Wallach	David	Duke Energy
Member	Wang	Evanne	Dupont
Guest	Washburn	Alan	Burns & McDonnell
Guest	Watson	Joshua	NPPD
Member	Webb	Bruce	Knoxville Utilities Board
Member	Weisensee	Matt	PacifiCorp
Member	Weiss	Zachery	WEG transformers
Guest	Weyandt	Paul	Schneider Electric
Member	White	Joe	POWER Engineers
Member	Wong	Terry	Trench Limited
Guest	Wright	Jeffrey	Duquesne Light
Member	Yang	Fei	Hitachi Energy
Member	Yuan	Guang (Grace)	Hitachi Energy
Member	Yun	Joshua	Virginia Transformer Corp
Guest	Zhang	Hongzhi	Hitachi Energy
Guest	Zhou	Anna	JST Power
Member	Ziomek	Waldemar	PTI Transformers LP

37 Guests requested membership:

Last Name	First Name	Company
Alonso	Mario	
Bohrn	Josh	PacifiCorp
Bradshaw	Garrett	Howard Industries, Inc.
Bradshaw	Jeremiah	Bureau of Reclamation
Calil	Wilerson	Hitachi Energy
Chanda	Sudip	Delta Star Inc
Dappen	Tim	Cargill
Duarte	Fernando	HitachiEnergy
Elson	Eric	San Diego Gas and Electric
Garza	Gilberto	Prolec GE
Holifield	Thomas	Howard Industries Inc
Jeong	chanmin	HD Hyundai
Kosedagi	Nihat	ERMCO
Kumar	Arvind	Delta star inc
Kwasi	Yeboah	GE Vernova
Labh	Ashwini	Hitachi Energy
Leal	Fernando	Prolec ge
Murcia	Fredy	Siemens Energy
Murillo	Hugo	The H-J Family of Companies
Nader	Masoud	Central Moloney
Narawane	Aniruddha	Eaton

Pandya	Manan	Siemens Energy
Patel	Vinay	Con Edison
Patel	Nitesh	Hyundai Power Transformers
PEREZ	MARCELINO	PROLEC
Rapelly	Laxman	Georgia Transformer Corporation
Sanchez rodriguez	Jesus	Vertiv
Sarkinen	Garret	Xcel Energy
Sethi	Kabir	Hitachi Energy Germany Ag
Shaikh	Salahuddin	NRG Energy
Singh	Amitkumar	Consolidated Edison Company of New York
Tan	Jonathan	Northern Transformer
Tatu	Val	Powersmiths
Tirado	Fernando	Prolec GE
Velasquez	Juan	Magnetron sas
Weyandt	Paul	Schneider Electric
Zhang	Hongzhi	Hitachi Energy

Respectfully submitted,

Anastasia O'Malley
Secretary, Insulation Life Subcommittee