Insulation Life Subcommittee

October 19th, 2022
Charlotte, NC

Chair: Sam Sharpless (not present)
Vice-Chair: Jinesh Malde (acting Chair)
Secretary: Anastasia O'Malley

The Insulation Life Subcommittee (ILSC) was called to order by the Vice-Chair (acting Chair) on October 19th, 2022, at 8:00 am EDST. The Vice-Chair introduced the subcommittee officers. Due to the size of the group, general introductions were not made. The Vice-Chair requested that each person state their name and affiliation when addressing the subcommittee.

H.1 Chair's Report/Remarks

The Vice-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 Vice-Chair emphasized that the final document structure and goals should be established as soon as possible. Working groups and taskforces should avoid scope creep. If new information arrives late, it should be documented in the minutes for the next revision. If necessary, the standard/guide can be reopened for amendment.

The Vice-Chair encouraged working groups to conduct on-line meetings between the regular Transformer Committee Meetings to move projects along. Notice must be sent out to all members, attendance recorded, and minutes taken to be included within the subcommittee minutes. Any PAR extension requests need to be approved by the working group and documented in the minutes. The Vice-Chair reminded everyone that working groups must achieve a two-thirds majority to submit a document for Sponsor Ballot. The subcommittee must achieve a simple majority to submit a document for Sponsor Ballot.

The Vice-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 one responded to this request.

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

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

The Vice-Chair discussed that working group officer training is due to be completed by December 31, 2022. Any new officers are required to complete the training within sixty days.

The Chair discussed the membership requirements and stated that Kevin Rapp, Richard Marek and James Graham have been downgraded to guest status.

H.2 Secretary's Report

The attendance rosters reported that 82 out of 118 members were present in the meeting along with 109 guests. A quorum had been achieved. For the Fall 2022 Charlotte meeting, only a paper roster was used, supplemented by a hand count during the meeting. Participants requesting membership for the subcommittee were advised to reach out to the Chair, Vice-Chair or Secretary at the conference, through email or mention it on the paper roster. Twenty-three guests requested membership. A list of attendees is provided at the end of this report.

The agenda for the meeting had been provided to participants in advance of the meeting for review. Marcos Ferreira moved for approval of the agenda and it was seconded by Steve Shull. After hearing no objection from the attendees, the meeting agenda was approved by unanimous consent. The Spring 2022 subcommittee meeting minutes had been provided to participants in advance of the meeting for review. Ed Casserly made a motion to approve the minutes. Marcos Ferreira seconded the motion. After hearing no objection from the attendees, the Spring 2022 meeting minutes were approved by unanimous consent. There was a discussion on membership requirements and quorum protocol.

Meeting attendance:

Role	Last Name	First Name	Company
Vice-Chair	Malde	Jinesh	M&I Materials Inc.
Member	Arteaga	Javier	Hitachi Energy
Member	Avanoma	Onome	MJ Consulting
Member	Ayers	Donald	Ayers Transformer Consulting
Member	Ballard	Robert	DuPont
Member	Bargone	Gilles	FISO Technologies Inc.
Member	Beaster	Barry	H-J Family of Companies
Member	Biggie	Kevin	Weidmann Electrical Technology
Member	Boettger	William	Boettger Transformer Consulting LLC
Member	Calitz	David	Siemens Energy
Member	Casserly	Edward	Ergon
Member	Castellanos	Juan	Prolec GE
Member	Cheim	Luiz	Hitachi Energy
Member	Chambers	Stuart	Powertech Labs Inc.
Member	Chiang	Solomon	The Gund Company
Member	Denzer (Mabrey)	Stephanie	Weidmann Electrical Technology
Member	De Oliveira	Everton	Siemens Energy
Member	Digby	Scott	Duke Energy
Member	Dorris	Don	NES Power
Member	Dutta Roy	Samragni	Siemens Energy
Member	Ferreira	Marcos	Bridge View Resources
Member	Forsyth	Bruce	Bruce Forsyth and Associates PLLC
Member	Frimpong	George	Hitachi Energy
Member	Frotscher	Rainer	Maschinenfabrik Reinhausen

Member	Garcia Wild	Eduardo	Siemens Energy
Member	Griesacker	Bill	Duquesne Light Co.
Member	Guner	Ismail	
Member	Gyore	Attila	M&I Materials Inc.
Member	Hayes	Roger	
Member	Hoffman	Gary	Advanced Power Technologies
Member	Hoffman	Saramma	PPL Electric Utilities
Member	John	John	Virginia Transformer Corp.
Member	Jordan	Stephen	Tennessee Valley Authority
Member	Joshi	Akash	Black & Veatch
Member	Kaineder	Kurt	Siemens Energy
Member	Kennedy	Gael	
Member	Kennedy	Sheldon	Niagara Transformer
Member	King	Gary	Howard Industries
Member	Kiparizoski	Zan	Howard Industries
Member	Kirchenmayer	Egon	Siemens Energy
Member	Lee	Moonhee	Hammond Power Solutions
Member	Levin	Aleksandr	Weidmann Electrical Technology
Member	Li	Weijun	Braintree Electric Light Dept.
Member	Locarno	Mario	Doble Engineerng
Member	Mani	Kumar	Duke Energy
Member	Miller	Kent	T&R Electric Supply Co.
Member	Murray	David	Tennessee Valley Authority
Member	Mushill	Paul	
Secretary	O'Malley	Anastasia	Consolidated Edison Co. of NY
Member	Patel	Poorvi	Electric Power Research Institute (EPRI)
Member	Parkinson	Dwight	EATON Corporation
Member	Pointner	Klaus	Trench Austria GMBH
Member	Prevost	Thomas	Weidmann Electrical Technology
Member	Radu	Ion	Hitachi Energy
Member	Raymond	Timothy	Electric Power Research Institute (EPRI)
Member	Reed	Scott	MVA
Member	Saad	Mickel	Hitachi Energy
Member	Sankarakurup	Dinesh	Duke Energy
Member	Sarkar	Amitabh	Virginia Transformer Corp.
Member	Sbravati	Alan	Hitachi Energy
Member	Schneider	Jeffrey	Power Partners/Spire Power Solutions
Member	Schweiger	Ewald	Siemens Energy
Member	Shertukde	Hemchandra	
Member	Sinclair	Jonathan	
Member	Skinger	Kenneth	Scituate Consulting, Inc.

Member	Som	Sanjib	Pennsylvania Transformer
Member	Staley	Brad	Leeward Renewable Energy
Member	Szczechowski	Janusz	Maschinenfabrik Reinhausen
Member	Tanaka	Troy	Burns & McDonald
Member	Tostrud	Mark	Dynamic Ratings, Inc.
Member	Traut	Alan	Howard Industries
Member	Varghese	Ajith	Prolec GE
Member	Verdolin	Rogerio	
Member	Vir	Dharam	Prolec GE
Member	vonGemmingen	Richard	Dominion Energy
Member	Vyas	Pragnesh	Sunbelt-Solomon Solutions
Member	Waldrop	Hugh	
Member	Wallach	David	Duke Energy
Member	Wang	Evanne	DuPont
Member	Welton	Drew	
Member	Yang	Baitun	R E Uptegraff
Member	Ziomek	Waldemar	

H.3 Taskforce Reports

H.3.1 Task Force C57.12.90 Clause 11, Temperature Rise Tests – Dinesh Sankarakurup

Chair: Dinesh Sankarakurup
Vice Chair: Ajith Varghese
Secretary: Cihangir (John) Sen

Meeting was held of October 18, 2022 3:15pm EST
Attendance
57 Total Attendees
12 Members (27 member TF – 14 required for quorum)

1. Our meeting started at 3:17pm. After introductions of the TF Chair, Vice Chair and the new Secretary, 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.
2. No quorum was reached and hence no approvals of Agenda or previous Meeting Minutes were possible. TF plans to purge the membership again based on continued attendance.
3. Several Unfinished/Old Business items were revisited including a new formula to be added to Clause 11.4.3 to address how to apply altitude correction factor when the testing is done at over 1000m. Another proposal to add a clause referencing IEEE C57.119 to address OFAF (Non-directed flow) top oil temperature difference was discussed.
4. There are several old businesses that required further investigation by the TF so the Chair requested some volunteers from the Group to work on each item. Volunteers were successfully assigned to each item.

5. New business topic about standardizing the method for hot resistance extrapolation was discussed. Volunteers will work on different manufacturer's methodologies and come up with a suggestion until the next meeting.
6. New business topic about including the method of HS measurement with fiber optic probes under Clause 11 was discussed. This is suggested mainly because of safety concerns during measurement of resistances in a very short period after shut down.
7. Meeting was adjourned at 4:30pm.
8. Detailed minutes of the meeting will be submitted to SC and will be available to all who need to see more information.

H.4 Technical Activity Reports:

H.4.1 C57.91 IEEE Guide for Loading Mineral-Oil-Immersed Transformers – David Wallach

Working Group PC57.91 Loading Guide
Fall 2022 Meeting Minutes
October 18, 2022, 4:45 PM – 6:00 PM (EST)
Hotel Sheraton/Le Meridien, Charlotte, NC

1. Call to Order
2. The Chair presented the meeting agenda.
3. Chair reiterated the following IEEE-SA Policies:
   A. Call for Essential Patents
   B. Copyright
   C. Antitrust
4. Establishment of quorum: Members in Attendance-29; Total Members-47; Total Attendees-115. Quorum was established at 61.7%.
5. The chair asked for a unanimous approval of this meeting's agenda, and it was so approved, with no objections.
6. The chair asked for a unanimous approval of the March 29, 2022, Denver WG Meeting minutes, and it was so approved, with no objections.
7. The chair asked for a unanimous approval of the August 19, 2022, Virtual WG Meeting, and it was so approved, with no objections.
8. The chair remarked that we may miss the Dec 31, 2023, PAR deadline date for this guide's revision. He added that if we can get the technical details finalized by the Spring 2023 meeting, then there was hope that we might meet the target date,
9. Open-Source (OS) Code Development Activity & SA Support: The chair stated that this code now resides in the IEEE Open-Source vault in Zach Draper's account and people should send an email to Zach in case they wany access to this code. He added that Annex G provides a description of the OS code. The chair proposed the name of Zack D as the IEEE lead for this OS code. A motion proposing Zach's name was

moved by Michael S and was seconded by John J. The motion was passed unopposed. Mario L remarked that it is welcome that this WG has taken a lead on developing OS code.

10. Draft 5-Clause 7 Loading Capability and Ratings Methodology: Per Olig Roizman' suggestion, there is a plan to include NERC requirements to the purpose section of this guide for which a PAR revision may be required. The purpose will be revised in the Draft 6 version of the guide.

11. Other Discussions:

A. Anastasia O'Malley asked if this guide pertains to mineral oil only. The chair replied yes.
B. Sanjiv S suggested that separate guide be developed for other liquids. The chair replied that another PAR will be required to do that.
C. Vijayan K remarked that the new guide for other liquids could be used for the renewable market transformers.
D. Amitabh S stated we should also consider overload ratings for bushings, DETCs and OLTCs. Peter Zhao and Javier Artega remarked that the Bushing SC had already sent a note to this WG that bushings have no overloading capability and has been included in the draft Guide in Annex B.1.1. The chair wondered if need to mention something about the loss of life in the guide's purpose statement.
E. Jeffery W added that overload capability is not the same as name plate rating.
F. Ryan H mentioned that while calculating FAC-008 ratings for Bureau of Reclamation GSU transformers, C57.91 is used to derate name plate rating for high altitude applications.
G. Daniel B thought that end user loading capability is different than name plate rating. He felt that this draft revision is an improvement. He asked if a PAR extension is required to fit in with the existing status of the guide. The chair replied that he is hopeful we could meet the existing PAR completion date.
H. Luiz C asked if moisture and oxygen factors are going to be considered in this revision of the guide based upon IEC revisions. Tim R added that the C57.162 guide has called out moisture as a factor affecting overload capability and insulation life. The chair stated that these may have to wait for the next guide revision.
I. Tom C Stated their utility allows 150 % loading per their distribution experts.
J. Curtis F / Tim R/ Jeffery W / Matt W asked if we should add some explanations to Table 3 and the ambient vs rating graph. The chair agreed that we will form a small group (Peter Z/ Jeffery W/ Amitabh S / Curtis F / Michael S volunteered) to work adding text to 7.1.1, list of applications, add loss of life impact to the guide's purpose and notes for Table 3. This group will furnish their recommendation by Dec 31, 2022.
K. Sanjay P asked if the guide applies to phase shifters. Tim R remarked that it does not apply since they have a different thermal model.

12. The chair asked if any discussions were needed on Annex G and there were none.

13. Egon K provided an update to his work on validating the open-source code in association with Zach D. He remarked after tweaking the code, the newer models are more accurate. He commented that exponentials used in the calculations are design dependent and therefore suggested adding some cautionary words in Annex G for end

users. Details of his presentation and his recommendations can be found in the WG website. Tony F suggested that users may need to specify overload testing in their specification. Brian M suggested that we add a note about referring to IEEE 1276 for overloading transformers with other liquids. Tim R asked if the OSC has a loss of cooling factor (fans and pumps). The chair replied that this needs to be determined by the end user.

14. There was no new business.

15. Next Meeting: The chair announced that the next meeting is scheduled to be held on March 21, 2023, at Milwaukee, WI.

16. Adjournment

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

Attendee List:

First Name	Last Name	Role	Company	Requested Membership
Kayland	Adams	Guest	GE Prolec	
Elise	Arnold	Guest	SGB	
Javier	Arteaga	Vice-Chair	Hitachi Energy	
Gilles	Bargone	Member	FISO Technologies Inc.	
Jared	Bates	Guest	Oncor Electric Delivery	
Edwin	Betancourt	Guest	Not Known	
Wallace	Binder	Member	WBBinder Consultant	
Vinay	Bhatt	Guest	Prolec Energy	
Daniel	Blaydon	Member	Baltimore Gas & Electric	
William	Boettger	Guest	Boettger Transformer Consulting LLC	
Sanket	Bolar	Guest	Oncor	
Thomas	Callsen	Guest	Comm Edison	Y
Camilo	Casallas	Guest	Trench Group	
Juan	Castellanos	Member	Prolec GE	
Jose Antonio	Ceballa	Guest	Not known`	
Stuart	Chambers	Guest	Powertech Labs	Y
Luiz	Cheim	Guest	Hitachi Energy	Y
Juan Carlos	Cruz Valdes	Guest	Prolec GE	Y
Noan	Chesser	Guest	Oncor	
Jorge	Cruz	Guest`	Niagara Transformers	Y
Stuart	Chambers	Guest	Powertech Labs Inc.	
Domenico	Corsi	Guest	Doble	
Samson	Debass	Guest	EPRI	
Scott	Digby	Guest	Duke Energy	
Zachary	Draper	Member	Delta-X Research Inc.	

Marco	Espindola	Guest	Hitachi Energy	
Bruce	Forsyth	Member	Bruce Forsyth and Associates PLLC	Y
Anthony	Franchitti	Guest	Exelon Corp	Y
Raymond	Frazier	Guest	Ameren	Y
George	Frimpong	Member	Hitachi Energy	Y
Eduardo	Garcia Wild	Member	Siemens Energy	
Roger	Hayes	Member	GE	
Peter	Heineig	Guest	Weidmann Group	Y
Ronald	Hernandez	Guest	Doble Engg	
Saramma	Hoffman	Member	PPL Electric Utilities	
Ryan	Hogg	Guest	Bureau of Reclamation	
John	John	Member	Virginia Transformer Corp	
Christopher	Johnson	Guest	Oncor	
Stephen	Jordan	Guest	Tennessee Valley Authority	
Akash	Joshi	Guest	Black and Veatch	Y
Kurt	Kaineder	Guest	Siemens Energy	Y
Jerzy	Kazmierom	Guest	Hitachi Energy	
Sheldon	Kennedy	Guest	Niagara Transformers	
Gael	Kennedy	Guest	Not known	
First Name	Last Name	Role	Company	Requested Membership
Miller	Kent	Guest	Not Known	
Gary	King	Guest	Not Known	
Dimitry	Klempnet	Guest	SCE	Y
Egon	Kirchenmayer	Member	Siemens Energy	
Christoph	Kerschenbauer	Guest	Siemens Energy	
Anton	Koshel	Guest	Delta Star Inc.	
Aleksandr	Levin	Member	Weidmann Electrical Technology	
Weijun	Li	Member	Braintree Electric Light Dept.	
Mario	Locarno	Guest	Doble Engg	
Dan	Lowman	Guest	ConEd	
Kumar	Mani	Secretary	Duke Energy	
Balakrishnan	Mani	Guest	Virginia Transformer Corp.	Y
Jinesh	Malde	Guest		
Lee	Matthews	Member	Howard Industries	
Brian	McBride	Member	Cargill Ind.	
Emilio	Morales-Cruz	Member	Qualitrol Company LLC	
Joe	Nims	Guest	Allen & Hoshall, Inc.	
Ali	Naderian	Member	Not known	
Anastasia	O'Malley	Guest	ConEd	
Robert	Middleton	Guest	RHMINTL	
Parminder	Panesar	Guest	Virginia Transformer	Y
Dwight	Parkinson	Guest	EATON Corporation	

Sanjay	Patel	Guest	Royal SMIT Transformers	
Vinay	Patel	Guest	ConEd	
Verena	Pellon	Guest	FP&L	
Oscar	Pinon	Guest	OTE Services	
Ian	Radu	Guest	Hitachi Energy	Y
Timothy	Raymond	Member	EPRI	
Robert	Reepe	Guest	Southern Company	
Afshin	Rezai-Zare	Guest	Not Known	Y
Michael	Richardson	Guest	Ameren	
Tim	Rocque	Guest	GE	
Dale	Rogers	Guest	Duke Energy	
Mickel	Saad	Member	Hitachi Energy	
Albert	Sanchez	Guest	Knoxville Utilities Board	
Amitabh	Sarkar	Member	Virginia Transformer Corp.	
Anil	Sawant	Guest	Virginia Transformer Corp.	
Cihangir	Sen	Guest	Duke Energy	
Pugal	Selvaraj	Guest	Virginia Transformer Corp.	Y
Markus	Schiessl	Guest	SGB	
Eric	Schleisman	Guest	Southern Company	
Jeff	Schneider	Guest	Power Partners	Y
Alfons	Schrammel	Guest	Siemens Energy	
Masoud	Sharifi	Guest	Siemens	
First Name	Last Name	Role	Company	Requested Membership
Devaki	Sharma	Guest	Independent	
Hemant	Shertukde	Guest	Hartford University	Y
Kushal	Singh	Guest	ConEd	
Jason	Synder	Guest	First Energy	
Sanjib	Som	Guest	Pennsylvania Transformer	Y
Brad	Staley	Member	Salt River Project	Y
Andrew	Steineman	Guest	Delta Star	
Kyle	Stechschulte	Guest	American Electric Power	
Ryan	Thompson	Guest	Burns & McDonnell	
Alan	Traut	Guest	Howard Industries	Y
Alwyn	Van Der Walt	Guest	Electrical Consultants, Inc.	
Ajith	Varghese	Guest	Prolec Energy	
Jason	Varnell	Member	Doble Engineering Co.	
Rogerio	Verdolin	Guest		Y
Krishnamurthy	Vijayan	Guest	PTI Transformers	
Dharam	Vir	Guest	Prolec GE	Y
Mike	Waldrop	Guest	Not Known	
David	Wallach	Chair	Duke Energy	

Alan	Washburn	Guest	Burns & McDonnell	
Bruce	Webb	Member	Knoxville Utilities Board	
Mathew	Webb	Guest	GE	
Rene	Wind	Guest	Siemens Energy	
Matt	Weisensee	Guest	PacificCorp	
Zach	Weisss	Guest	WEG Transformers	
Jeffrey	Wright	Member	Duquesne Light Co.	
Malia	Zaman	Guest	IEEE	
Peter	Zhao	Member	Hydro One	

Working Group PC57.91 Loading Guide
August 19, 2022, Meeting Minutes

August 19, 2022, 10:00 AM – 11:30 AM (EDT)

Microsoft Teams Virtual Meeting hosted by David Wallach, WG Chair

1. The meeting was called to order. The chair, also meeting host, introduced himself. The IEEE Copyright, Anti-Trust and Patent policies were presented.
2. A slide was shared listing Working Group members. Two polls were launched to determine if a quorum was present for the meeting. Per the second poll, there were 24 members and 30 guests, and 11 guests requesting membership. 27 members were necessary to establish a quorum, so this meeting did not have a quorate.
3. The chair reviewed the agenda shared in the meeting notice and opened the floor for comments. There were no comments on the agenda, so the meeting continued.
4. Agenda with meeting summary
    A. Annex A
        a. Previously reviewed and approved updates are in Draft 4.
    B. Annex G
        a. Zack Draper has created draft text for Open-Source Code for Annex G. Draft 5 will have this update. Zack has been working with Josh Gay, IEEE Open-Source, to cover the necessary bases. One role we need to nominate and approve is the Open Source "Lead" for the Guide. The lead serves as the Working Group primary contact for the open-source code, leads the disposition of ballot comments for the code, etc. There is also a "maintainer" roll that the Lead can name and manage to create and maintain code. Since we do not have a quorum, we will defer this nomination and vote to the Fall 2022/October meeting in Charlotte.
    C. Definitions
        a. Oleg Roizman commented that Draft 4, Clause 3 has been updated with new definitions for the guide for review and comment. The document has the standard reference to the IEEE Standards Dictionary. The terms hottest-spot and hottest-spot temperature are defined.
        b. Oleg is suggesting an acronyms and abbreviations section be added and will be considered for Draft 5.
    D. Clause 7 update
        a. Oleg reviewed the current state of Clause 7 in Draft 4 reviewing what has been removed which now includes the text on developing the load cycle which no longer applies. Loading tables were part of the pre-1995 guide and this clause supported that but has been overlooked for removal until now. The open-source code will allow input of a load profile.
        b. The clause 7 equations now use governing equations with conservation of mass, momentum, and energy for a simplified thermal model. The mathematical model may not be the most interesting parts to review but must be presented as the basis of our thermal model moving forward.

a. Two definitions for an alternative method to determine top oil and hottest-spot temperatures are included and is basically a modification of the previous version of clause 7.

b. The updated mathematical model for thermal performance of a transformer including loading and life. Draft 5 will include a new table that will allow the user to select which model to use based on available information for the transformer.

B. Annex J

a. Annex J is informative and contains historical perspectives of thermal model progression.

C. Model Names

a. Historically, models have been named after the original developer. The updated model is clause 7 based on the old Annex G should be called the Pierce model. The updated alternative method should be called the Muzinger Cooney model. These model names are open for comment.

D. Annex K

a. Annex K has been added and shows the proof that the prior guide Clause 7 is a special case of the Pierce model.

E. Some questions and comments were made by attendees including

a. Luiz Cheim questioned if its time to update the model that has been in place since the 1940's based on the Arrhenius kinetic molecular combinations speed. We don't have time with this revision but perhaps the next? Oleg noted we have been focusing on the thermal models but had also suggested work on the aging portion. Now that we are getting the thermal portion updated, that could be our future next focus. The chair commented that after this PAR is complete, we may want to consider opening a new PAR to consider the aging model.

F. Annex G

a. Zack Draper updated the Working Group on his work with IEEE Open-Source and text drafted that will be part of Draft 5.

b. Zack Draper and the chair commented on the need to designate an Open-Source "Lead". The lead responds to questions, leads resolution of code ballot comments, addresses cyber-security concerns (if there were any), administers developer access to the code, addresses bug fixes, etc. Since we do not have a quorum, we will defer nomination. Zach has been leading this effort and is agreeable to be nominated.

c. There is a checklist of items that must be addressed before the code is moved out to be the "official code."

G. Bibliography

a. The chair noted that the Guide in current state has the Bibliography in various locations supporting different parts of the document. The style guide would have us correct this, but it will take much effort to move text and update all the references.

2. Unfinished business – none

1. New Business

   A. Egon Kirchmeyer, affiliated with Siemens Energy, has performed some Open-Source code testing using two factory transformers. The slide deck will be posted on the Working Group website.

2. The Fall 2022 will be held between Oct 16-20, 2022, at Charlotte.

3. The Chair asked if there were any open items for discussions, and hearing none, the meeting was concluded.

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

Attendance

Name	Affiliation	Requested Membership
Wallach, David	Duke Energy	
Rob Ghosh	GE	
Luiz V. Cheim	Hitachi Energy	
Lee Matthews	Howard Industries	
John K. John	VTC Retired	
Kevin Biggie	Weidmann Electrical Technology	
Jeff Schneider	Power Partners	
Michael Thibault	Pacific Gas & Electric	
Bruce Webb	Knoxville Utilities Board	
Ion C. Radu	Hitachi Energy	Y
Shibao Zhang	PCORE Electric	
Stephen H Jr Jordan	Tennessee Valley Authority	
Ryan S Hogg	Bureau of Reclamation	
Evgenii Ermakov	Hitachi Energy	
Aleksandr Levin	Weidmann Electrical Technology	
Yves Vermette	Electro Composites ULC	
Stacy Durand	Hitachi Energy	
Bertrand F. Poulin	Hitachi Energy	
Robert Harper	Soltex Inc.	
Eduardo Garcia Wild	Siemens Mexico	
Patrick Picher	Hydro-Quebec IREQ	
Anthony J Franchitti	PECO	
Anselm Viswasam	Hyperion	
Egon Kirchenmayer	Siemens Energy	
Albert Sanchez	Knoxville Utilities Board	Y
David Calitz	Siemens Energy	
Rick Marek	Independent	
Andy Steineman	Delta Star Inc.	
Weijun Li	Braintree Electric Light Dept.	
Curtiss C Frazier	Ameren	Y
Kurt Kaineder	Siemens Energy	

Juan Carlos Cruz Valdes	GE Renewable Energy	
Oleg Roizman	IntellPower Pty Ltd	
Balakrishnan Mani	VTC	Y
Brian McBride	Cargill, Inc.	
Ryan Musgrove	Oklahoma Gas & Electric	
Evanne Wang	Bureau of Reclamation	Y
Joe Watson	JD Watson and Associates Inc.	
Jeffrey Wright	Duquesne Light Co.	
Huan M. Dinh	Hitachi Energy	
Al Traut	Howard Industries	
Rodrigo Ocon	Industrias IEM	
14348450921	Name and Affln not known	
Mario Locarno	Doble Engineering	Y
Zack Draper	Delta X	
George K. Frimpong	Hitachi Energy	
Steven Schappell	GE Renewable Energy	
Jason Varnell	Doble Engineering	
Kent Miller	T&R Electric Supply Co.	Y
Peter Zhao	Hydro One	
Eric Davis	Burns & McDonnell	
Jose Gamboa	H-J Family of Companies	
Gael R Kennedy	GR Kennedy & Associates LLC	
16189749058	Name and Affln not known	
Zan Kiparizoski	Howard Industries	
Malia Zaman	IEEE	
Nicholas Kostich	Ameren	Y
Sanjib Som	Pennsylvania Transformer	
Mário Maia	Siemens Energy	
Suresh Babanna	GE Renewable Energy	Y
Anatoliy Mudryk	Camlin Power	Y
Stuart Chambers	Powertech Labs Inc.	
Florin Faur	GE Renewable Energy	Y
Alan Washburn	Burns & McDonnell	
Claude Beauchemin	TJH2b Analytical Services	
Emilio Morales Cruz	Qualitrol Inc	
R Cox	GE Renewable Energy	
Faye-Fei Yang	Hitachi Energy	
Josh Bohrn	PacifiCorp	
Edmundo Arevalo	Bonneville Power Administration	
Kumar Mani	Duke Energy	
Tony	Name and Affln not known	
Simonelli, Richard	GE Renewable Energy	

H.4.2 C57.100 IEEE Standard Test Procedure for Thermal Evaluation of Liquid-Immersed Distribution and Power Transformers – Roger Wicks

Chair: Roger Wicks
Secretary: Kevin Biggie

No meeting was held in Charlotte as the document has been submitted to Revcom for approval.

H.4.3 C57.162 Guide for the Interpretation of Moisture Related Parameters in Liquid Immersed Transformers and Reactors – Tom Prevost

Chair: Tom Prevost
Secretary: Deanna Woods

The document is currently in ballot which closes on October 21, 2022. A comment resolution group has been formed to resolve 340 comments.
The Comment Resolution Group will include the following individuals:
Tom Prevost, Valery Davydov, Deanna Woods, Stephanie Denzer, Oleg Roizman, George Frimpong, Poorvi Patel, Ron Hernandez, Bob Razor
A PAR extension has been requested.

H.4.4 C57.165 IEEE Guide for Temperature Measurements for Liquid Immersed Transformers and Reactors – Mark Tostrud

Chair: Mark Tostrud
Vice Chair/Secretary: Zan Kiparizoski

No working group meeting was held in Charlotte as the working group had approved sending the guide to the ILSC for ballot.

Mark Tostrud made a motion to approve the draft and submit the guide to sponsor ballot. Zan Kiparizoski seconded the motion. The motion was unanimously approved.

H.4.5 C57.169 Maximum Winding Temperature Rise in Liquid-Filled Transformers (PC57.169 replacing IEEE 1538) – Scott Digby

Chair: Scott Digby
Secretary: Cihangir John Sen

No meeting was held in Charlotte. The first round of balloting received a 94% approval rate. The comment resolution group addressed the comments and the document is going through the second round of balloting which closes on October 30, 2022. The PAR does not expire until December 2023.

H.4.6 Amendment of 1276 Guide for the Application of High Temperature Insulation Materials in Liquid-Immersed Power Transformers (Annex B & D) – Kevin Biggie

Working Group (WG) IEEE 1276, Amend Annexes B&D - Minutes

IEEE 1276 Guide for the Application of High-Temperature Insulation Materials in Liquid-Immersed Distribution, Power, and Regulating Transformers

Monday, 17 October 2022, 1:45pm – 3:00pm (EST) – Fall 2022 Meeting (in-person, Charlotte NC)

- Chairman: Kevin Biggie (Weidmann)
- Vice-chair: George Frimpong (Hitachi Energy)
- Secretary: Evanne Wang (DuPont)

The Chair called the meeting to order at 1:46pm. and welcomed attendees. A total of fifty-eight (58) attendees were present, with eighteen (18) of twenty five (25) members present including the Chair, Vice-Chair, and Secretary, thus a quorum was achieved. Fifteen (15) guests requested membership, however only one (1) request met the requirement of attending two of the last three meetings (or the first two meetings in this case, as this was only the second meeting as a WG), thus the WG welcomes new member: Zachery Weiss. Given this change, the new total number of members is twenty six (26).

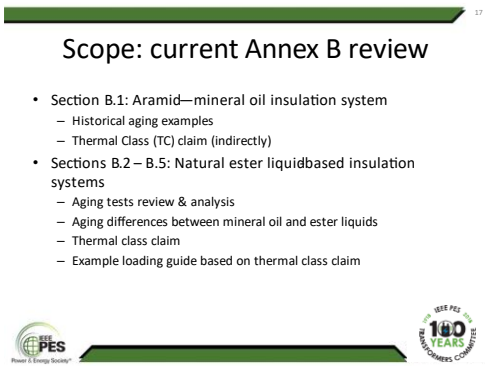
The Chair introduces the WG and notes that this work is to amend to the two annexes (B & D) from IEEE 1276. He explains that IEEE 1276 is a guide and that the purpose of this group is to amend the annexes and not revise the entire 1276 document.

The meeting agenda, Essential Patent Claims information, and copyright information were reviewed. No patent claims were noted. Phil Hopkinson (HVolt) makes a comment that if there is aging with a new material with material-related patents, then it should be noted during this section, but no one has commented. He points out that Weidmann has manufactured a material called “DPE” which should be called out during the patent claims section. The Chair (affiliated with Weidmann) points out that DPE is not a patented material and instead a trade-secret material and not required to report this under IEEE’s patent guidelines.

The minutes from the last meeting were reviewed and unanimously approved. The agenda from this meeting was reviewed and unanimously approved. Both documents were sent prior to the in-person meeting to the members and guests of this WG.

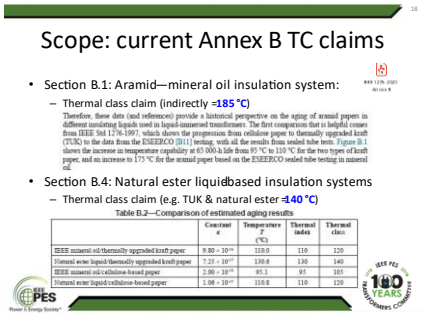
The Chair proceeds to follow the presented agenda. All comments received for each slide by title are noted below.

Scope: Current Annex B review



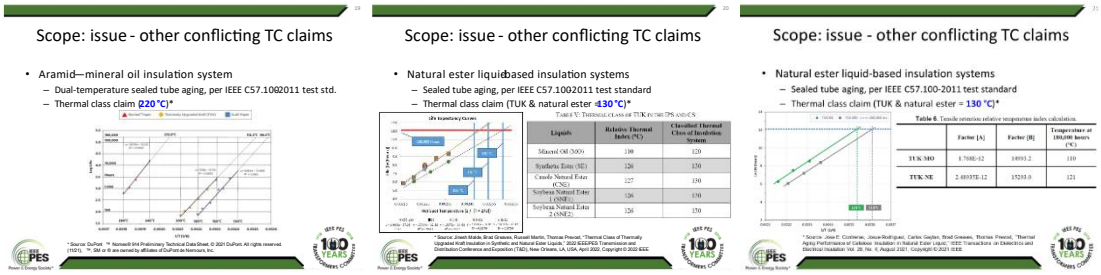
- In Section B.1 – Aramid-mineral oil insulation system: Lance Lewand (Doble) asks if the aramid material from this section refers to pure aramid or a material is that consists of blended aramid and cellulose. The Chair clarifies that this section is for pure aramid materials.

Scope: Current Annex B Thermal Class (TC) Claims



- TC claims: The current temperature class claims from Annex B are reviewed. Phil Hopkinson asks to clarify the terminology of why there is a 10°C thermal difference between Thermal Index and Thermal Class, and if the difference is related to average temperature vs. maximum ambient temperature. The Chair indicates that is the case, and notes that the beginning of IEEE C57.100 and C57.154 contain standards language that can be referred to on this topic.

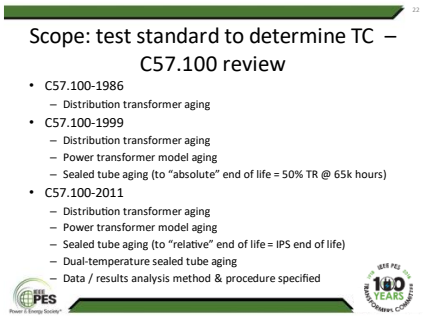
Scope: Issue - other conflicting TC claims



- The submission from DuPont (Roger Wicks) is reviewed for aramid-mineral oil aging in dual-temperature testing following IEEE C57.100-2011. Several comments were noted in this section:
  - Lance Lewand (Doble) asks if only tensile strength is being considered for testing for aramid paper. The Chair confirms that this is true. Lance then asks if the tensile strength is measured on impregnated paper material or degreased paper material. The Chair confirms that according to the recently balloted version of IEEE C57.100, the standard will specify impregnated but not degreased paper material. The previous versions of this standard do not specify the condition of the paper prior to tensile test.
  - Bruce Forsyth (Bruce Forsyth & Associates PLLC) then asks if this testing is for one specific aramid product and if there was another aramid product available on the market if it would be expected to follow the same test procedure. The Chair remarks there is an entire annex within the recently balloted version of IEEE C57.100 that specifies the boundaries of when a material requires a full test.
  - Juan Gonzalo Castellanos (Prolec GE) asks if the thermally upgraded kraft and the kraft paper from the dual-temperature submission graph was tested using dual-temperature method. The Chair confirms all curves on this graph were tested using the dual-temperature method.
- Natural ester-based liquid: Two submissions for aging in ester-based liquids were reviewed.

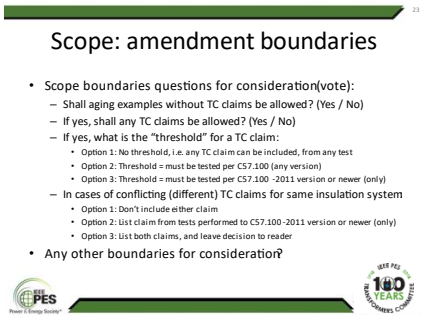
- Alan Sbravati (Hitachi Energy) reminded his previously submitted material shall be considered also, and the Chair agreed that it will be considered by the Task Force to be formed.

Scope: Test standard to determine TC – C57.100 review



- The Chair reviews historical versions of IEEE C57.100 and clarifies that each of these previous versions of this standard describe how one would perform an accelerated aging test but only the 2011 version provides clarity on how to conduct the data analysis.

The Chair then proceeds to discuss amendment boundaries by presenting scope boundary questions for consideration. These questions are shown below with the captured input.



1) Shall aging examples without TC claims be allowed? (Yes / No)
   - Mike Shannon (REA Magnet Wire) says he would not include aging examples without TC claims due to the older data. He brings up an example that from a NEMA perspective, round wire gets roll formed and when conducting this kind of aging test, the shape of the wire is overlooked and would cause confusion.
   - Jinesh Malde (M&I Materials) agrees with Mike but points out that there is really good information that has been generated over the course of the years. Jinesh suggests the inclusion of two tables: one for examples of how thermal class was calculated and the second is how to conduct aging analysis without thermal class. Additionally, TC is really important as DOE activities become prevalent.
   - Alan Sbravati (Hitachi Energy) clarifies with Mike that this is sealed-tube testing and has no testing on wire or varnishes.
   - Emilio Morales Cruz (Qualitrol) asks what the benefit of aging claims in the standard is. The Chair clarifies that it would be for references. Phil Hopkinson (HVolt) mentions that older examples would be good to include in the standard. Other comments from members chime in that inclusion of aging claims would be practical information and that it would be important to include in the amendment.
   - **The Chair then asks if anyone objects to this question. There were no objections to inclusion of aging examples without TC claims.**

2) If yes, shall any TC claims be allowed? (Yes / No)
   - **The Chair then asks if anyone objects to this question. There were no objections to inclusion of TC claims.**

1) If yes, what is the "threshold" for a TC claim: Option 1: No threshold, i.e. any TC claim can be included, from any test / Option 2: Threshold = must be tested per C57.100 (any version) / Option 3: Threshold = must be tested per C57.100-2011 version or newer (only)

2) In cases of conflicting (different) TC claims for same insulation system: Option 1: Don't include either claim / Option 2: List claim from tests performed to C57.100-2011 version or newer (only) / Option 3: List both claims, and leave decision to reader.

Jinesh Malde (M&I Materials) points out that answers for questions 3) and 4) should be a conversation for the TF. Stu Chambers (Powertech Labs) and Alan Sbravati (Hitachi Energy) agrees. Bruce Forsyth (Bruce Forsyth & Associates PLLC) says that a motion is required to form a task force.

A motion was made to form a task force to amend Annexes B & D given the agreed boundaries from these meeting minutes. This task force would deal with any conflicts for boundaries and would report their progress at the Spring 2023 meeting. This motion was made by Emilio Morales Cruz (Qualitrol) and seconded by Phil Hopkinson (HVolt). The motion passed unanimously.
Volunteers for this task force are as follows:

Name	**Affiliation**
Alan Sbravati	Hitachi Energy
Balakrishnan Mani	Virginia Transformer
Brian McBride	Cargill
Edward Casserly	Ergon Inc
Emilio Morales Cruz	Qualitrol
Evanne Wang	DuPont
James Cross	Kinectrics
Jinesh Malde	M&I Materials
Juan Gonzalo Castellanos	Prolec GE
Kevin Biggie	Weidmann
Michael Shannon	REA Magnet Wire
Nabi Almeida	Prolec GE
Parminder Panesar	Virginia Transformer
Roberto Ignacio	Cargill
Stephen Oakes	WEG Transformers
Timothy Charles Raymond	EPRI

Jinesh Malde (M&I Materials) notes prior to close of meeting that if there are new papers to be considered for submission to the amendment, a deadline for the publication dates of new papers should be established. The meeting then reached the allotted time limit.

Meeting adjourned at 3:00pm with a motion to adjourn initiated by Stu Chambers (Powertech Labs) and seconded by Lance Lewand (Doble), with unanimous approval.

Respectfully submitted,

Kevin Biggie, Chair
George Frimpong, Vice-Chair

Evanne Wang, Secretary

Attendance WG IEEE 1276 Annex B & D Meeting (10/17/2022):

- Attendees: 58
- Members present: 18
- Guests requesting membership: 15
- Guests granted membership: 1

The following attendees were present:

Last/Family/ Surname	First/Given Name	Affiliation / Company Name	Status / Role
Almeida	Nabi	Prolec GE	Member
Bhatt	Vivek	Prolec Energy	Guest
Biggie	Kevin	Weidmann Electrical Technology	Chair
Blaszczyk	Piotr	STC	Guest
Bubnjarkucko	Mateja	Siemens Energy, KPT	Guest
Casserly	Edward	Ergon	Guest
Castellanos	Juan	Prolec GE	Member
Chambers	Stuart	Powertech Labs	Member
Christodoulou	Larry	Electrical Power Service	Guest
Cross	James	Kinectrics	Guest
Da Silva (Ignacio)	Roberto	Cargill	Guest
Debass	Samson	EPRI	Guest
Dix	Larry	Quality Switch	Guest
Dolloff	Paul	East Kentucky Power	Guest
Faur	Florin	Prolec GE Waukesha	Guest
Felton	Todd	MVA	Guest
Foata	Marc	Reinhausen	Guest
Fong	Sanford	GA Power	Guest
Forsyth	Bruce	Bruce Forsyth & Associates PLLC	Guest
Frimpong	George	Hitachi Energy	Vice-Chair
Glasson	Scott	Siemens Energy	Guest
Gonzalez	Luis	Canduct Industries	Guest
Guerrero	Johnny	Consolidated Edison	Guest
Gyore	Attila	M&I Materials	Guest
Hopkinson	Philip	HVolt	Member
Kaineder	Kurt	Siemens Energy	Member
Kennedy	Sheldon	Niagara Transformer	Guest
Kiparizoski	Zan	Howard Industries	Member
Lewand	Lance	Doble	Member
Machain	Jose Luis	Prolec GE	Guest
Malde	Jinesh	M&I Materials	Member
Mani	Balakrishnan	Virginia Transformer	Member
Martinez	Alberto	WEG Transformers	Guest

Mayer	Robert	Siemens Energy	Guest
McBride	Brian	Cargill	Member
Mikulecky	Filip	Siemens Energy, KPT	Guest
Morales-Cruz	Emilio	Qualitrol	Guest
Oakes	Stephen	WEG Transformers	Member
O'Malley	Anastasia	Consolidated Edison	Guest
Panesar	Parminder	Virginia Transformer	Member
Plisic	Goran	Siemens Energy, KPT	Guest
Raymond	Tim	EPRI	Guest
Reiss	Tony	Custom Materials Inc.	Member
Sanchez	Oliverio	PG&E	Guest
Sankarakurup	Dinesh	Duke Energy	Guest
Sawant	Anil	Virginia Transformer	Guest
Sbravati	Alan	Hitachi Energy	Member
Schleismann	Eric	Southern Company	Guest
Shannon	Michael	REA Magnet Wire	Member
Sinclair	Jonathan	PPL Electric	Guest
Sohail	Muhammad	Trench Ltd	Guest
Spitzer	Tommy	City Transformer	Guest
Vanderzal	Gordon	EPRI	Guest
Walder	Nick	Eaton Corp	Guest
Wang	Evanne	DuPont	Secretary
Weiss	Zachery	WEG Transformers	Member
Whitehead	William	H2Scan Corp	Guest
Wind	Rene	Siemens Energy	Guest

H.5 Old Business

None.

H.6 New Business

C57.165 IEEE Guide for Temperature Measurements for Liquid Immersed Transformers and Reactors
Mark Tostrud made a motion to approve the draft and submit the guide to sponsor ballot. Zan Kiparizoski seconded the motion. The motion was unanimously approved.

C57.12.90 Clause 11
Egon Kirchenmeyer, Siemens Energy presented a request to include direct hot spot measurement of windings as an alternate method for Clause 11, Temperature Rise test of IEEE C57.12.90.

PC57.12.90
TF Continuous Rev Clause 11
Temp Rise Tests

Request for modifications of C57.12.90 to improve the health and safety of test personnel by applying state of the art technology

Egon Kirchenmayer and Ewald Schweiger
Siemens-Energy

IEEE/PES Transformers Committee
Transformers Subcommittee

October 16, 2022

New Business

Introduction

- Incident during **heat run test and the following resistance measurement**
- **Major contributing factor was the very short time required between the end of the heat run test and the measurement of the winding resistance.**
- Incident **could have been avoided with global rules and standards focusing on both: excellence of the products and health and safety of the people manufacturing them.**

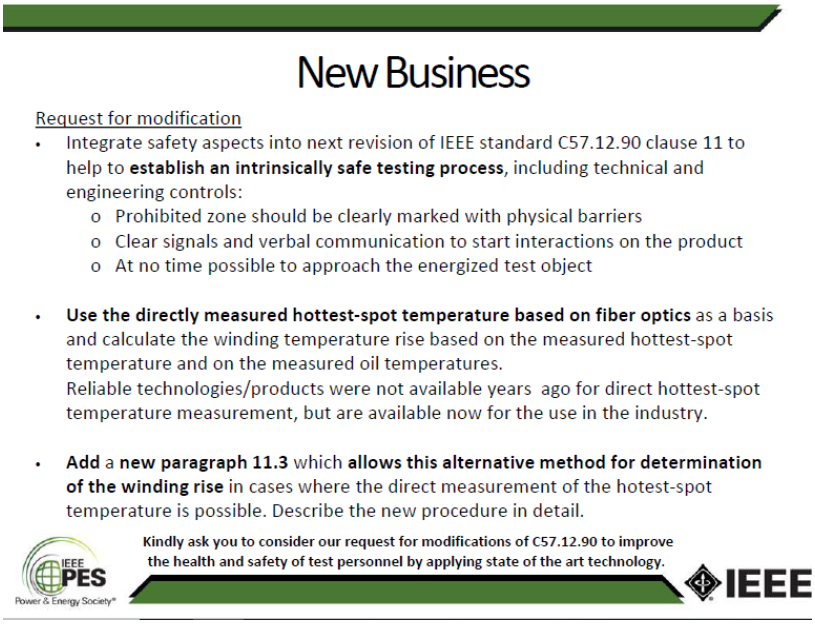
Problem statement

- C57.12.90 [clause 11] require achieving the as **quickly as possible** time between power shut-off at heat run end and installation of resistance measurement devices. **Limits the period** from finalization of heat run test to start of hot resistance **measurement to 4min.**
- Frequently are faced with **requests** to **achieve transition times** between both tests to **below 4 minutes** (supported by IEEE base "as quickly as possible" "short-time" requirement)

This has the following consequences

- test field engineers are under pressure to take additional risks in order to further reduce the transition time and might get exposed to high voltage
- the testing procedures could be reverted applying state-of-the-art technology including direct winding temperature measurement.

The health and safety of our people is our utmost priority!



New Business

Request for modification

- Integrate safety aspects into next revision of IEEE standard C57.12.90 clause 11 to help to **establish an intrinsically safe testing process**, including technical and engineering controls:
  - Prohibited zone should be clearly marked with physical barriers
  - Clear signals and verbal communication to start interactions on the product
  - At no time possible to approach the energized test object

- **Use the directly measured hottest-spot temperature based on fiber optics** as a basis and calculate the winding temperature rise based on the measured hottest-spot temperature and on the measured oil temperatures.
  Reliable technologies/products were not available years ago for direct hottest-spot temperature measurement, but are available now for the use in the industry.

- **Add** a **new paragraph 11.3** which **allows this alternative method for determination of the winding rise** in cases where the direct measurement of the hotest-spot temperature is possible. Describe the new procedure in detail.

Kindly ask you to consider our request for modifications of C57.12.90 to improve the health and safety of test personnel by applying state of the art technology.

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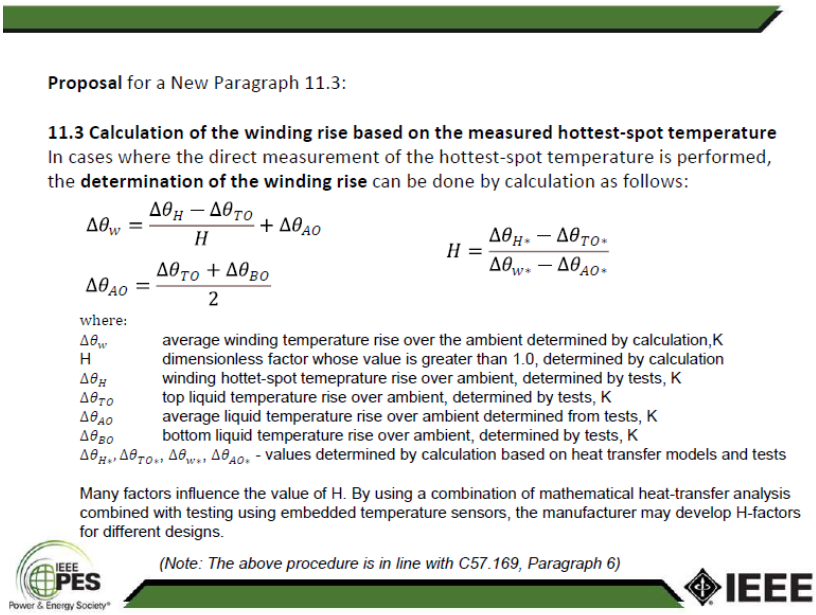

Proposal for a New Paragraph 11.3:

11.3 Calculation of the winding rise based on the measured hottest-spot temperature
In cases where the direct measurement of the hottest-spot temperature is performed, the **determination of the winding rise** can be done by calculation as follows:

$$\Delta\theta_W = \frac{\Delta\theta_H - \Delta\theta_{TO}}{H} + \Delta\theta_{AO} \qquad H = \frac{\Delta\theta_{H*} - \Delta\theta_{TO*}}{\Delta\theta_{W*} - \Delta\theta_{AO*}}$$

$$\Delta\theta_{AO} = \frac{\Delta\theta_{TO} + \Delta\theta_{BO}}{2}$$

where:

$\Delta\theta_W$	average winding temperature rise over the ambient determined by calculation,K
H	dimensionless factor whose value is greater than 1.0, determined by calculation
$\Delta\theta_H$	winding hottet-spot temeprature rise over ambient, determined by tests, K
$\Delta\theta_{TO}$	top liquid temperature rise over ambient, determined by tests, K
$\Delta\theta_{AO}$	average liquid temperature rise over ambient determined from tests, K
$\Delta\theta_{BO}$	bottom liquid temperature rise over ambient, determined by tests, K

$\Delta\theta_{H*}, \Delta\theta_{TO*}, \Delta\theta_{W*}, \Delta\theta_{AO*}$ - values determined by calculation based on heat transfer models and tests

Many factors influence the value of H. By using a combination of mathematical heat-transfer analysis combined with testing using embedded temperature sensors, the manufacturer may develop H-factors for different designs.

(Note: The above procedure is in line with C57.169, Paragraph 6)

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The Task Force for the continuous revision of C57.12.90 Clause 11 Temperature Rise Tests will address this request.

Tim Raymond, EPRI raised the need to provide guidance on how to load and operate transformers with alternative fluids and high temperature insulation systems. The 1276 Task Force will review the information available on the loading guide of elevated temperature transformers and address this request.

H.7 Adjournment

Motion was made by Marcos Ferreira to adjourn the meeting. The motion was seconded by Ed Casserly. With no objections, the meeting was adjourned at 9:15 AM EDST.

Attendance: Members (82) **Last Name**	**First Name**	**Company**
Malde	Jinesh	M&I Materials Inc.
Arteaga	Javier	Hitachi Energy
Avanoma	Onome	MJ Consulting
Ayers	Donald	Ayers Transformer Consulting
Ballard	Robert	DuPont
Bargone	Gilles	FISO Technologies Inc.
Beaster	Barry	H-J Family of Companies
Biggie	Kevin	Weidmann Electrical Technology
Boettger	William	Boettger Transformer Consulting LLC
Calitz	David	Siemens Energy
Casserly	Edward	Ergon
Castellanos	Juan	Prolec GE
Cheim	Luiz	Hitachi Energy
Chambers	Stuart	Powertech Labs Inc.
Chiang	Solomon	The Gund Company
Denzer (Mabrey)	Stephanie	Weidmann Electrical Technology
De Oliveira	Everton	Siemens Energy
Digby	Scott	Duke Energy
Dorris	Don	NES Power
Dutta Roy	Samragni	Siemens Energy
Ferreira	Marcos	Bridge View Resources
Forsyth	Bruce	Bruce Forsyth and Associates PLLC

Frimpong	George	Hitachi Energy
Frotscher	Rainer	Maschinenfabrik Reinhausen
Garcia Wild	Eduardo	Siemens Energy
Griesacker	Bill	Duquesne Light Co.
Guner	Ismail	
Gyore	Attila	M&I Materials Inc.
Hayes	Roger	
Hoffman	Gary	Advanced Power Technologies
Hoffman	Saramma	PPL Electric Utilities
John	John	Virginia Transformer Corp.
Jordan	Stephen	Tennessee Valley Authority
Joshi	Akash	Black & Veatch
Kaineder	Kurt	Siemens Energy
Kennedy	Gael	
Kennedy	Sheldon	Niagara Transformer
King	Gary	Howard Industries
Kiparizoski	Zan	Howard Industries
Kirchenmayer	Egon	Siemens Energy
Lee	Moonhee	Hammond Power Solutions
Levin	Aleksandr	Weidmann Electrical Technology
Li	Weijun	Braintree Electric Light Dept.
Locarno	Mario	Doble Engineerng
Mani	Kumar	Duke Energy
Miller	Kent	T&R Electric Supply Co.

Murray	David	Tennessee Valley Authority
Mushill	Paul	
O'Malley	Anastasia	Consolidated Edison Co. of NY
Patel	Poorvi	Electric Power Research Institute (EPRI)
Parkinson	Dwight	EATON Corporation
Pointner	Klaus	Trench Austria GMBH
Prevost	Thomas	Weidmann Electrical Technology
Radu	Ion	Hitachi Energy
Raymond	Timothy	Electric Power Research Institute (EPRI)
Reed	Scott	MVA
Saad	Mickel	Hitachi Energy
Sankarakurup	Dinesh	Duke Energy
Sarkar	Amitabh	Virginia Transformer Corp.
Sbravati	Alan	Hitachi Energy
Schneider	Jeffrey	Power Partners/Spire Power Solutions
Schweiger	Ewald	Siemens Energy
Shertukde	Hemchandra	
Sinclair	Jonathan	
Skinger	Kenneth	Scituate Consulting, Inc.
Som	Sanjib	Pennsylvania Transformer
Staley	Brad	Leeward Renewable Energy
Szczechowski	Janusz	Maschinenfabrik Reinhausen
Tanaka	Troy	Burns & McDonald
Tostrud	Mark	Dynamic Ratings, Inc.

Traut	Alan	Howard Industries
Varghese	Ajith	Prolec GE
Verdolin	Rogerio	
Vir	Dharam	Prolec GE
vonGemmingen	Richard	Dominion Energy
Vyas	Pragnesh	Sunbelt-Solomon Solutions
Waldrop	Hugh	
Wallach	David	Duke Energy
Wang	Evanne	DuPont
Welton	Drew	
Yang	Baitun	R E Uptegraff
Ziomek	Waldemar	

Attendance Guests (109):

Adams	Kayland	Prolec GE
Almeida	Nabi	Prolec GE
Anderson	Gregory	GW Anderson & Associates, Inc.
Ante	Gregory	Southern California Edison
Baumgartner	Christopher	WE Energies
Bedoya	Duvier	Hitachi Energy
Betancourt	Edwin	Siemens Energy
Bhatt	Vivek	Prolec GE
Blaszczyk	Piotr	STC
Botti	Michael	Hyosung HICO
Bradshaw	Jeremiah	Bureau of Reclamation
Carrizales	Juan Alfredo	Prolec GE
Casallas	Camilo	Trench Limited
Caverly	David	Trench Limited
Christodoulou	Larry	Electric Power Systems
Coker	Anthony	M&I Materials Inc.
Cook	Michael	Dominion Energy
Da Silva	Roberto	Cargill, Inc.
Debass	Samson	EPRI
Dillon	Nikolaus	Dominion Energy
Door	Jeffrey	The H-J Family of Companies
Duffy	Jesse	Nashville Electric Service
Dulak	Hakim	Advanced Power Technologies
Espindola	Marco	Hitachi Energy

Fang	Zhu	R E Uptegraff
Foldi	Joseph	F&A
Frye	Richard	EATON Corporation
Gonzalez	Jose Antonio	Georgia Transformers
Gonzalez	Luis	Canduct Industries
Gossott	Shaun	Ameron
Girlado	Orlando	H-J Family of Companies
Hampton	Kevin	Siemens Energy
Hayes	Ramon	Dominion Energy
Heiden	Kyle	EATON Corporation
Heinzig	Peter	Weidmann
Hernandez	Ronald	Doble Engineering
Hernandez-Cano	Sergio	Hammond Power Solutions
Hernandez-Myra	Jean	GT Neetrac
Hopkins	Traci	H2Scan
Issack	Ramadan	American Electric Power
Jhala	Anirudhdhsinh	Transformers & Rectifiers Ltd.
Johnson	Toby	Hunt Electric
Kazmierczak	Jerzy	Hitachi Energy
Kerschenbauer	Christoph	Siemens Energy
Kleine	Peter	US Army Corps fo Engineers
Klempner	Dmitriy	Southern California Edison
Larison	Andrew	Hitachi Energy

Lowman	Don	Dominion Energy
Mayer	Robert	Siemens Energy
Mbouombouo	Mama	Hitachi Energy
McBride	Brian	Cargill, Inc.
Mellin	Toni	Vaisala
Miller	Michael	Siemens Energy
Mills	Francis	Power Engineers Inc.
Minikel	Justin	EATON Corporation
Montanha	Juliano	Siemens Energy
Morales-Cruz	Emilio	Qualitrol Company LLC
Musgrove	Ryan	Oklahoma Gas & Electric
Neild	Kris	Megger
Nyanteh	Yaw	Hyosung Hico
Oakes	Stephen	WEG Transformers USA Inc.
Olsson	Tomas	Hitachi Energy
Patel	Rakesh	Hitachi Energy
Pinon	Oscar	OTC Services
Pollaro	Dominic	NASS
Posadas	Daniel	Prolec GE
Prince	Jarrod	ERMCO
Rehkopf	Sebastian	Reinhausen
Reiss	Tony	Custom Material Inc
Richardson	Michael	Ameren Corp.
Rocque	Tim	Prolec GE

Sahin	Hakan	Virginia/Georgia Transformer
Sanchez	Albert	Knoxville Utilities Board
Sanchez	Oliverio	PG&E
Schrammel	Alfons	Siemens Energy
Selvaraj	Pugal	Virginia Transformer Corp.
Sen	Cihangir	Duke Energy
Shannon	Mike	REA Magnet Wire
Shull	Stephen	BBC Electrical Services, Inc.
Sim	Jin	JSA
Simons	Andre	JFE Shoji Power Canada Inc.
Slattery	Chris	First Energy
Snyder	Jason	First Energy
Sparling	Brian	Dynamic Ratings, Inc.
Stankes	David	3M
Stechschulte	Kyle	American Electric Power
Steele	Hampton	TVA
Steeves	Gregory	Baron USA
Steineman	Andrew	Delta Star Inc.
Sweetser	Charles	OMICRON electronics Corp USA
Sze	Matthew	OMICRON electronics Canada
Taylor	Marc	JFE Shoji Power Canada Inc.
Tendulkar	Vijay	EATON Corporation
TeNyenhuis	Ed	Hitachi Energy
Thomas	Scott	Hitachi Energy

Tillery	Tim	Howard Industries
Tolcschir	Eduard	TTE
Vanderwelt	Alwyn	ECI
Varnell	Jason	Doble Engineering
Vijayan	Krish	PTI Canada
Vogel	Herman	TJH2b Analytical Services
Washburn	Alan	Burns & McDonnell
Webb	Bruce	Knoxville Utilities Board
Weisensee	Matt	Pacific Corp
Weiss	Zachery	WEG Transformers USA Inc.
Whitehead	William	H2Scan
Wind	Rene	Siemens Energy
Yeboah	Kwasi	GE
Yun	Joshua	Virginia Transformer Corp.

Guests requesting membership (23):

Almeida	Nabi	Prolec GE
Blaszczyk	Piotr	STC
Botti	Michael	Hyosung HICO
Da Silva	Roberto	Cargill, Inc.
Dulak	Hakim	Advanced Power Technologies
Foldi	Joseph	F&A
Girlado	Orlando	H-J Family of Companies
Issack	Ramadan	American Electric Power
Jhala	Anirudhdhsinh	Transformers & Rectifiers Ltd.
Kazmierczak	Jerzy	Hitachi Energy
Mbouombouo	Mama	Hitachi Energy
McBride	Brian	Cargill, Inc.
Nyanteh	Yaw	Hyosung Hico
Oakes	Stephen	WEG Transformers USA Inc.
Posadas	Daniel	Prolec GE
Prince	Jarrod	ERMCO
Sahin	Hakan	Virginia/Georgia Transformer
Selvaraj	Pugal	Virginia Transformer Corp.
Sen	Cihangir	Duke Energy
Shannon	Mike	REA Magnet Wire
Weiss	Zachery	WEG Transformers USA Inc.
Whitehead	William	H2Scan
Yun	Joshua	Virginia Transformer Corp.

Respectfully submitted,

Anastasia O'Malley
Secretary, Insulation Life Subcommittee