

# Annex H - Insulation Life Subcommittee

**October 30<sup>th</sup>, 2019**

**Hyatt Regency, Columbus, OH, USA**

**Chair: Sheldon Kennedy**

**Vice-Chair: Barry Beaster**

**Secretary: Jinesh Malde**

The Insulation Life Subcommittee (ILSC) was called to order by the Chair in Columbus, OH on October 30, 2019 at 8:02 AM. 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 provided the date of upcoming Transformer Committee meetings as follow;

2020 Spring Meeting; March 22-26, 2020, Charlotte, NC, USA

2020 Fall Meeting; October 18-22, 2020, Kansas City, MO, USA

The Chair requested that any person with knowledge of a patent essential to meet the requirements of any subcommittee standard to bring the issue forward for discussion. No one responded to this request.

The Chair showed the Copyright slides and advised to the subcommittee that permission would be required from the authors or organizations for use of information. If any information is presented in the meeting, it automatically provides IEEE license for use.

The Chair requested the following items be included in all activity group minutes;

- The name of the activity.
- The date and time of the meeting.
- The number of members and guests in attendance. Full attendance should be recorded in the AMS system.
- The presence or absence of a quorum.
- Any essential patent issues raised during the meeting.
- A summary of discussion. Intricate detail not required. Use a separate document to explain decisions that are made.
- A record of the decisions made in the meeting.
- If there will be another meeting. If so, state the time and place.
- Submit minutes as soon as possible, but no more than 15 days after the meeting.

The 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 Chair discussed the membership requirements and recognized the following new members: Mario Alonso, Robert Ballard, Edward Casserly, Jorge Cruz, Thomas Hartman, Jon Karas, Darrell Mangubat, Aniruddha Narawane, Ion Radu, Ewald Schweiger.

The Chair stated that the following members had been moved to guest status due to lack of attendance: Dick Amos, Dieter Dohnal, Paul Dolloff, Michael Franchek, Moonhee Lee, Rogelio Martinez, Oscar Pinon, Rodrigo Ronchi, Robert Stinson, Roy Su, Michael Veillette

Don Platts requested to be changed to guest from member.

The Chair also noted that no new guests were removed by request.

### **H.2 Secretary's Report**

The Chair reported that according to the electronic check-in system, 88 out of 115 members were present in the meeting and that a quorum had thus been achieved. For the Fall 2019 meeting, only electronic roster was used. Participants requesting membership for the subcommittee were advised to meet or email the Chair, Vice-Chair or Secretary.

The Spring 2019 subcommittee meeting minutes had been provided to participants in advance of the meeting for review. Kent Miller made a motion to approve the minutes and the motion was seconded by Sam Sharpless. Hearing no objections or abstentions, the motion carried by acclamation.

The Fall 2019 subcommittee meeting agenda was provided to participants in advance of the meeting for review and they were also presented on the screen at the meeting. Sam Sharpless made a motion to approve the agenda and the motion was seconded by Ed Casserly. Hearing no objections or abstentions, the motion carried by acclamation.

No participants requested membership.

### **H.3 Project Status Reports. The Chair reported the status of each project as follows;**

#### **H.3.1.1 C57.91 IEEE Guide for Loading Mineral-Oil-Immersed Transformers**

C57.91 is valid until December 31<sup>st</sup> 2021. The Working Group Chair is David Wallach.

#### **H.3.1.2 C57.100 IEEE Standard Test Procedure for Thermal Evaluation of Liquid-Immersed Distribution and Power Transformers**

C57.100 is valid until December 31<sup>st</sup> 2022. The Working Group Chair is Roger Wicks.

#### **H.3.1.3 C57.154 Design, Testing and Application of Liquid-Immersed Transformers with High-Temperature Insulation**

C57.154 is valid until December 31<sup>st</sup> 2022. The Working Group Chair is Richard Marek.

**H.3.1.4 C57.162 Guide for the Interpretation of Moisture Related Parameters in Dry, Gas Insulated and Liquid Immersed Transformers and Reactors**

C57.162 is a new document. The PAR for creating this document expires December 31, 2020. The working group Chair is Thomas Prevost.

**H.3.1.5 1276 Guide for the Application of High Temperature Insulation Materials in Liquid-Immersed Power Transformers**

1276 expires Dec 31, 2020. The working group Chair for this document is Roger C. Wicks.

**H.3.1.6 C57.165 IEEE Guide for Temperature Measurements for Liquid Immersed Transformers and Reactors**

C57.165 is a new standard and the PAR expires December 31, 2021. The working group Chair is Phil McClure.

**H.3.1.7 PC57.169 replacing 1538 - IEEE Guide for Determination of Maximum Winding Temperature Rise in Liquid-Immersed Transformer**

PAR valid till December 31<sup>st</sup> 2023. The working group Chair is Scott Digby

**H.3.1.8 C57.119 IEEE Recommended Practice for Performing Temperature Rise Tests on Oil-Immersed Power Transformers at Loads Beyond Nameplate Ratings**

New revised standard published on October 18<sup>th</sup> 2018. Standard valid until December 31<sup>st</sup>, 2026

**H.3.2 Working Group (WG) and Task Force (TF) Reports**

**H.3.2.1 Working Group on C57.162 Guide for the Interpretation of Moisture Related Parameters in Dry, Gas Insulated and Liquid Immersed Transformers and Reactors – Tom Prevost**

The meeting was called to order at 11:00 am by Chair Tom Prevost.

There were 144 people present. There were 110 guests and 34 members. Membership quorum was not achieved. It was discussed that membership would be evaluated by next meeting

Update on Task Force Activity

TF1: Terminology and definitions – completed

TF3: Measurement and evaluation of moisture-in-liquid insulation parameters – completed

TF4: Measurement of moisture in solid insulation using sample of insulation - completed

TF5: Evaluation of moisture in solid insulation using dielectric response methods - completed

TF6: Inferring of moisture in solid insulation from measurements conducted in liquid or gaseous medium - completed

TF7: Evaluation of aging and end of life of solid insulation parameters - completed

TF8: Factory/workshop application of knowledge on moisture; establishing baselines - completed

TF9: Field application of knowledge on moisture – Tom Prevost will be working with Bob Rasor to complete the work along with Jim Thompson TF leader.

TF10: Moisture migration, distribution and equilibrium charts – Oleg compiled, needs to be put into document.

Minutes:

A call for patents was completed and there were NO responses.

A quorum was not established, and agenda's and minutes were not approved. No comments or additions to agenda.

PAR extension will be expiring end of 2020. WG needs to start the balloting process by January 2020. Requiring editing to be completed by end of 2019. It will be a challenge to complete by 2020, WG has one more extension remaining, it is on its 7<sup>th</sup> year.

It was recommended to get a ballot resolution group together, to speed up the balloting process. Volunteers were accepted after the meeting.

Copyright slides were reviewed in the meeting with the new rules. There was a lot of discussion and questions about prior art. Any further questions were directed to the IEEE website.

New Business:

None

The meeting was adjourned at 12:15 pm.

ILSC Chair asked WG chair if there was plan to go to ballot. WG Chair mentioned that he has volunteers for ballot resolution group. WG Chair plan on sending document to ballot by end of January so as to complete ballot prior to Spring 2020 meeting.

**H.3.2.2 Working Group on Application of High-Temperature Materials IEEE P-1276 – Roger Wicks**

A. Welcome & Chairman's Remarks R. Wicks

Roger opened the meeting at 3:15 pm with a brief description of the status of the Working Group and main purpose of this meeting.

B. Circulation of Attendance Rosters J. Arteaga

Circulated

C. Attendance for Quorum J. Arteaga

23 members were in attendance meeting the quorum requirement of a minimum of 21 members. 50 guests were registered by the RFID check in, but only 41 signed the roster. Which do we use for the official attendance in the association management system?

D. Approval of Fall 2018 Meeting Minutes – Pittsburgh, PA J. Arteaga

Marion Jaroszewski made a motion to approve the minutes and Alan Sbravati seconds it. The group unanimously approved the minutes.

E. Approval of agenda

Marion Jaroszewski made the motion to approve the agenda and Kevin Biggie seconded it. The group unanimously approved the agenda.

F. Patent Disclosure

R. Wicks

There were not issues related to Patent Assurance brought up by attendees in the meeting.

G. Discussion

R. Wicks

In April 2018, a working group ballot was conducted to determine the suitability of draft 2.0 to go to IEEE-SA ballot. Our procedures require a super-majority (2/3 vote) at the working group level to allow the document to proceed to ballot. With this super-majority, the Insulation Life Subcommittee would then approve the vote (by a majority vote) confirming that the balloting process was conducted correctly.

The working group ballot was successful, with a 70% affirmative vote and a quorum was met. The Insulation Life Subcommittee approved the vote as well.

However, because it was agreed to resolve negatives at the working group level (in our fall and spring meeting minutes), a Ballot Resolution Group selected for the IEEE-SA ballot to help resolve technical comments related to this document. The members of the Ballot Resolution Group are Clair Claiborne, Marion Jaroszewski, Alan Sbravati and Roger Wicks.

The chair started work on the comments to the document by accepting, unless there were conflicts, all editorial comments proposed to the document.

The Ballot Resolution Group held numerous conference calls to confirm these editorial changes and to then deal with the technical recommendations in the document. Finally, a document was completed with the final changes for which a consensus was reached.

After these changes had been completed, the revised document was recirculated within the working group, and the supermajority approval was maintained.

Recirculation of ballot started October 30<sup>th</sup>. Plan is to complete by end of the year or prior to the next working group.

**H.3.2.3 Working group on C57.100 IEEE Standard Test Procedure for Thermal Evaluation of Liquid-Immersed Distribution Transformers – Roger Wicks**

Fall 2019 Meeting – 28 October 2019, 9:30 a.m., Columbus, OH  
Chairman: Roger Wicks, Secretary: Kevin Biggie

The Chair called the meeting to order at 9:30 a.m. and welcomed attendees. Pending the attendance count from the RFID system, the agenda was reviewed. The Chair provided information related to Essential Patent Claims, and none were noted. The new copyright information shared at the opening session was not reviewed due to the meeting beginning immediately afterwards, however it will be incorporated into future meetings. The Chair then reviewed the status of the PAR, which expires in December 2022.

The bulk of the meeting was then spent reviewing the work of the 4 task forces identified in the last meeting. The list (with TF leaders) is as follows:

1. Industry Proven System Listing – R. Wicks
2. Location of test methods in draft – A. Sbravati
3. Sealed Tube Method improvement – J. Malde
4. End of Life – L. Cheim

TF 1 report: Roger reviewed the current definition of “Industry Proven System - IPS” (existing clause 3.1 from 2011 version), and proposed changes to include “PVF coated magnet wire” and “inhibited” to clarify description of mineral oil.

TF 2 report: Alan discussed location of test methods in draft, and proposed 2 sections: ‘functional tests’ and ‘insulating materials test,’ with functional tests (e.g. Lockie tests) end of life defined by dielectric failure, and insulating materials test (sealed tube & dual temperature aging tests) end of life defined by thermal aging of materials with elevated temperature. He also proposed to bring all these into the main body of the standard. Alan also briefly discussed the proposed power transformer functional test from NcNutt in 1977.

TF 3 report: Jinesh reviewed the proposed improvements to the sealed tube aging test method as discussed by the members of TF 3. Topics for proposed changes include: material ratios, reduced aging equivalency for power material ratio, absolute tensile values, laminated materials, number of vessels & samples, pressure control, concurrent testing of different systems, trend line guidelines, nitrogen content of IPS, type of vessels, 100% values inclusion in curves (or not), correlation coefficient and curve fitting. Additional topics include: reconsideration of single point test, test temperatures in Table 1, and sample preparation details.

Joe Foldi commented that it should be considered to add crepe paper to the sealed tube test material ratio. He also questioned the importance of sealed tube pressure, with Kevin Biggie commenting that it is important, and Alan commenting that release of gasses is important and that his company has chosen not to use PRDs.

Amitabh Sarkar commented that 180°C from aging tests is not a realistic operating condition, and Kevin Rapp commented that elevated temperatures are needed for accelerated aging tests. Kevin also mentioned that Cargill has used both Lockie and sealed tube tests. Tom Prevost commented that aging tests should be both practical and economical.

At this point in the meeting, the RFID attendance was confirmed, and of the 59 WG members, 34 were present, achieving a quorum (57.6%) to conduct business. There were a total of 94 attendees at the meeting. Given the quorum, the meeting agenda and minutes from the Spring 2019 meeting in Anaheim were presented for approval. A motion was made to approve both by Luiz Cheim, seconded by Jinesh Malde, and both the agenda and Spring 2019 minutes were approved unanimously.

TF 4 report: Luiz reviewed several questions related to end of life, including: can absolute tensile be considered? Shouldn’t oxygen and moisture be considered? Are criteria correlated to probability of failure? Can the scope of TF 4 be clarified?

Roger shared tables of end of life criteria from IEEE 98 as well as IEC 62332-1 for reference. Regarding effect of water content, Roger commented that the indicated level in the standard (0.25 -0.5 %) may need to be expanded upon regarding how to confirm it.

Alan again indicated benefits of Lockie tests, and Jinesh commented again about importance of test practicality and affordability. Casey Ballard commented that the Lockie test is perhaps limited to small distribution transformers and is not scalable. Joe Foldi commented that the standard should not include the Lockie test because it is not realistic.

Roger mentioned for reference, and not for the standard, that IEC was in the process of updating the liquid compatibility standard. Jinesh said that ASTM was updating their compatibility standard also.

The meeting was adjourned at 10:45 pm.

### **H.3.2.4 Working group on C57.91 IEEE Guide for Loading Mineral-Oil-Immersed Transformers – David Wallach**

#### 1. Introductions

Establishment of quorum- Number of Members in Activity = 73; Number of Members Present = 32; Quorum Present = 44% and with Number of attendees = 94 at the meeting.

#### 2. Meeting Agenda Review- was proposed By Mickel Saad and seconded by Bruce Forsyth.

#### 3. Previous Meeting Minutes Approval Status

- a. Pittsburgh, 2018 Spring – could not be approved due to lack of quorum.
- b. Jacksonville, 2018 Fall – could not be approved due to lack of quorum.
- c. Anaheim, 2019 Spring- could not be approved due to lack of quorum.

Since we are unable to muster quorum either via email or by the in-person meetings, the Chair indicated that the membership roster may be trimmed based upon last 2 out of 3 meeting attendance.

#### 4. Call for Patents: A call for patents was made and there were none claimed.

#### 5. Copyright Policy: The IEEE copyright policy was read out.

#### 6. Discussions on Draft Document D2 (circulated before the meeting)

- A. The Chair indicated that the current PAR for this standard expires on Dec 21, 2021. The draft 3 is posted on the committee website and we hope to have the Rev 3 draft ready for review by the Spring 2020 meeting.
- B. Distribution Transformer loading: This topic was discussed at the Distribution Loading SC on Oct 28, 2019 and there will be no impact on our guide.
- C. Discussion on Table 8 (2008 Version) and Section 9.2:
  - The 200% maximum loading number has been firmly established in many end user documents and so it will be difficult to remove it from the standard.
  - The chair suggested adding a note "the duration of the load and additional factors listed in

Section 4.1 may limit the maximum loading to less than 200%".

- Daniel Blaydon felt that this may cause confusion among end users.
- Tim Raymond asked what the technical basis behind the 200% overload number and there seems to be many caveats in the foot notes.
- Jeff Wright remarked that the numbers are general maximum limits with a lot of conditional factors listed in Section 4.1. Using PT Load software, and starting from full load, the maximum 200% overload number (for 1/2 hr.) came back when the final winding hot spot temperature was limited to 180 Deg C.
- Michael Saad felt that the 200% number came from the C57.92 loading guide for distribution transformers. He stated that the maximum overloading depends upon the winding time constant.
- Kenneth remarked that 200% overloading number is possible under certain cold ambient conditions.
- Matt Weisensee stated that bushings are not suited for 200% 30 min loading, the bushing related factors are listed in Annex B.1.1.
- Daniel Blaydon - We should limit the overloading to 180% for 30 min once every 24-hour period. The 200% overloading number is incorporated in BG&E's operating strategy.
- Shibao Zhang remarked that the 200% overloading probably happens only 1-2 times in the life span of a transformer.
- Anastasia of Con Edison stated that CE's policy is 200% overloading during blackout conditions and their transformer bushing are accordingly rated.
- Mickel Saad commented that some customers specify C57.91 in their specifications. Shibao had the same opinion as Mickel.
- Tim Raymond felt that Table 8 can be worded better. He suggested limits should be in Table 9 and Table 8 should be deleted.
- Action Item: Tim Raymond agreed to draft verbiage for section 9.2.1 and work on Table 9 to indicate intent of limitations, overloading limits, temperature limits and time duration. Javier and Jeff Wright offered to work with Tim.
- Craig Colopy mentioned that the ambient temperature charts have been taken away from the C57.92 standard.
- Emilio Morales-Cruz pointed out that the transformer design will have an impact on the ambient curves.
- Matt Weisensee agreed that the ambient curves have been taken out but the curves were based upon old design methods and assumed certain typical transformer characteristics that applied to ratings < 100 MVA.
- Michel Saad commented that if we get new differential equations from Oleg R, then we should remove Annex. G.
- Tom Prevost stated that the errors in Annex. G has been corrected. We should add a new Annex. if Oleg comes up with new equations.
- Sheldon Kennedy felt that we should find out if the new equations from Oleg before we include them in the guide.
- Ali Naderian pointed out that the new IEC overloading document 60076-7-2018 document



considers both O<sub>2</sub> and H<sub>2</sub>O for service-aged transformers. Tim Raymond agreed with that point.

7. Differential Equation Presentation- Oleg Roizman was unable to attend the Columbus meeting and hence will now make this presentation at the Spring 2020 meeting. Brad Staley of SRR has provided Oleg with fiber optic temperature and load data.

Additional technical updates:

For the distribution loading, WG is monitoring work being done in the TF on transformer efficiency to see if any changes to make to the loading information on distribution transformers.

Table 8 is always discussed in every revision. Clarifying comments will be made.

Oleg will prepare information on differential equation that might impact Clause 7 Annex G. It may affect the timing for completion of the draft as par is expiring end of 2021.

### **H.3.2.5 Working group on C57.169 Maximum Winding Temperature Rise in Liquid-Filled Transformers (PC57.169 replacing IEEE 1538) – Scott Digby**

The Working Group for Determination of Maximum Winding Temperature Rise in Liquid-Immersed Transformers held its second WG meeting on Tuesday, October 29, 2019 at 1:45 pm. Agenda and minutes were approved. This revision process includes incorporation of a new document number to converting the existing IEEE Std. 1538, which will be expiring, into a C57 series document.

Two Draft versions of the document were circulated between the initial WG meeting in the spring and the fall meeting held on Tuesday, the first to a smaller group of volunteers and the second to the complete WG participants. The focus of the WG meeting was on the non-editorial comments received from that broad circulation of the draft. Among the notable items to be addressed are to update material associated with installation techniques for fiber optic sensors within transformer windings, with study groups formed and volunteers solicited to assist with addressing the comments. An action plan was developed for each comment that was unable to be resolved during the meeting.

The forthcoming input from the study groups and volunteers will be incorporated into a Draft D3 of the document for circulation for review in advance of the next meeting in the Spring in Charlotte.

### **H.3.2.6 Working group on C57.165 IEEE Guide for Temperature Measurements for Liquid Immersed Transformers and Reactors – Phil McClure**

1. Meeting Date and Time: 10/29/2019 at 9:30am

Meeting was called to order at 9:30am

2. Call for essential patents:

The patent slides were projected on screen and a request for any known patents that were essential to the work of the Working Group was made. There were no responses to the request.

3. Reviewed IEEE-SA Copyright Policy

The copyright policy slides were projected on screen and a request for any known copyright issues was made. There were no responses to the request.

4. Chairs remarks

Bob Thompson shared his reason for why he feels this guide is needed by the industry. He shared a story of an engineer running an OD transformer without the pumps operating for 45 minutes waiting for the

WHS gauge to change. The engineer did not understand the safety hazards involved with running an OD transformer without the pumps running and the excessive temperature the transformer could reach. He also shared his experience with temperature problems in transformers that were not apparent through standard temperature measurements.

### 5. Attendance

#### 5.1 Introduction of Members and Guests

#### 5.2 Quorum check

Email from RFID system hadn't been received after 30 minutes so a slide of the current members was presented

16 of 26 members were present

Shortly after manual verification of that we had a quorum, an email verification was received from the RFID system that we had a quorum.

RFID system numbers were as follows:

18 of 36 members were present

65 people were in attendance

Membership changes

The secretary changed the status of 10 Members in the AMS system to Guest status on 10/28/2019 to improve our odds of achieving a quorum.

Two were changed Guest status on their request

Eight were changed Guest status since they had not attended the last 3 meetings.

The roster was loaded in the RFID system prior to these changes being made.

### 6. Approval of the agenda and minutes

#### 6.1 The Chair requested a motion for approval of the meeting

Motion – Hakim Dulac

2<sup>nd</sup> – Stuart Chambers

Unanimous approval

#### 6.2 The Chair requested a motion for approval of the minutes from the spring 2019 meeting

Motion – Trent Williams

2<sup>nd</sup> – Brian Musgrove

Unanimous approval

### 7. Old Business

Section 3 - Definitions: Oleg Roizman - will provide this section once the document is further along to minimize the number of revisions required

Section 4.4 – Gil Bargone said his contribution to this section should be ready for the next meeting

Section 4.8 – Bushing temperature measurement – volunteers were received from the bushing committee shortly after the last meeting to draft the section on temperature measurement of bushings - Les Recksiedler, Sanjib Som, Ajith Varghese and Jim Thompson volunteered

Question was raised whether bushing temperature measurements should be limited to internal measurements or should external measurements be considered – no discussion

Section 4.9 – Tie plate measurement – volunteer was requested for section 4.9

Section 4.10 – Tap changer lead and contact temperature measurement – volunteer was requested – no volunteers but Zan Kiparizoski mentioned that Larry Dicks with Quality Switch has experience in this area and may be a possibility

- Tom Prevost - feels this is an R&D thing and is not something that is being done in production

- Florin Faur - cannot think of a location of what or where you would monitor something in the OLTC without conflicting with the OLTC operation. Standards require them to design the OLTC be able to handle 150% overload.

Hakim – Qualitrol volunteered to make a presentation on fiber temperature probes. He could do this himself or in conjunction with someone else

### 8. New Business

- Bob Thompson raised the issue about whether the guide should be limited to what is done continuously online or should we include what the OEM's may do during design testing?
  - Tom Prevost asked to review the scope of the guide
    - Attendees felt the scope is open and allows for almost anything
  - Since the Scope doesn't specify whether design measurements will be considered in the guide, a recommendation was made to add a Purpose statement to the document to clarify whether the guide should include R&D measurements and type test measurements
    - Tom Prevost and Homero Portillo offered to draft a Purpose statement for review at the next meeting
- Section 4.3 – winding temperature section – Chair feels parts of this section should be moved from the main document to an appendix. Chair requested the submitter to compare this section to what is in the appendix
- Upon request from the attendees, the temperature measurements listed in the table of contents was reviewed
  - Recommendation was made to clarify what is being measured in sections 4.5 through 4.10. There was concern that the titles were too vague
  - LTC temperature measurements should be changed to OLTC temperature measurements
- Following some general discussion of how OLTC temperature measurements could be made, a motion was made to remove sections 4.5 and 4.10 from the guide
  - Motion – Mark Shem-Tov
  - 2<sup>nd</sup> – Babanna Suresh
  - Discussion
    - There is no good way to do these measurements
    - It is not practical to measure tap changer leads or tap changer contacts on a production transformer. Measurements of this type are more of a design test that the manufacturer does during the design or development stage. Once the design is proven, there is no need to measure this going forward.
    - The guide should not include R&D projects
    - Original intent was to list all possible measurements
  - Vote
    - In favor – 11
    - Opposed – 1
    - Abstentions – 4
    - Motion was passed
- Section 4.6 LTC Temperature Measurements
  - Gary Hoffman and Greg Anderson informed the chair prior to the meeting that they would not be able to draft this section
  - A new volunteer was requested - Trent Williams volunteered
  - Discussion on this section
    - LTC Temperature Measurements should be changed to OLTC Temperature Measurements

- If the only method of measurement offered in this section is OLTC oil measurements, it should be included under 4.2 rather than discussed in its own section.
- Trent Williams will review available methods and make a recommendation to the group for the next meeting.
- Final decision was tabled until the next meeting
- Recommendation was made to consider changing the format of the document. Document is presently organized by component (leads, tap changer, etc.). Recommendation was made to organize the document by measurement type; thermocouple, fiber optic, etc. This issue was tabled until the next meeting since the chair was not present.

9. Motion to adjourn

- Motion – Mark Shem Tov
- Hakim Dulac – 2<sup>nd</sup>

**H.3.2.7 Working group on C57.154 Design, Testing and Application of Liquid-Immersed Transformers with High-Temperature Insulation – Richard Marek**

The meeting was called to order at 4:45PM by Chair Richard Marek. Vice-Chair Anastasia O'Malley and Secretary Ewald Schweiger (writer of Minutes) were also present.

This was the third meeting as a WG. There were **16** of the **total 113 attendees** that requested membership. There was a total of 105 people that signed in on the paper roster and 113 on the RFID list.

Data from the RFID system: (versus paper roster)

Number of Members in Activity = 89  
Number of Members Present = 45 (44)  
Quorum Present = 50.6%  
Number of attendees = 113 (105)

Introductions of the Chair, Vice Chair, and Secretary were made. Due to the large number of attendees no individual introductions were made. Attendees were asked to state their name and affiliations when making comments or asking questions.

The patent slides and the copyright policy were shown with no response.

The chair presented the agenda and a motion was made and seconded to approve the minutes of meetings (Phil Hopkinson, Kurt Kaineder). There were no objections.

The chair presented the minutes of meetings of the last meeting S19- Anaheim, CA. Roger Webb asked if the minutes from the TF can be posted on the web as well. The chair will work with Sue McNelly to set up the website. A motion was made and seconded to approve the minutes of the meeting (Kevin Biggie, Samuel Sharpless). There were no objections.

Alan Sbravati, who leads the TF to investigate the thermal class of liquids, presented the scope, reported on the status and showed preliminary test results. The aging tests are ongoing and additional results will be reported at the next meeting in Charlotte, NC. The presentation details will be posted.

Based on the feedback and input received the chair presented draft 1 of PC57.154 which is edited using the latest template. This first draft was submitted to the group before the meeting in Columbus. The chair explained the approach and reported that the sections are the same as in the previous document.

The chair discussed the changes in the document. For example, the section on accessories and all of the informative annexes have been taken out since these are part of P1276 (WG High-Temperature Insulation Materials). He also expressed his opinion that the winding diagrams no longer fit in the document and duplication should be avoided. The high temperature topic is handled in three different documents which are being developed in parallel (P1276, PC57.100 and PC57.154).

The floor was then opened for comments and discussions. Alan Sbravati and Kevin Rapp expressed the need for a red line version. Phil Hopkinson said he appreciated all the work that has been done and expressed the wish to establish a standard which considers the complete system of an application and is not limited to individual materials. Rainer Frotscher stated that he appreciates such a slim standard as draft 1 and agreed that informative annexes should have been moved to P1276 and duplications should be avoided.

The chair asked for volunteers to review definitions and check for completeness. Ed Casserly, Kevin Rapp and Paul Dolloff volunteered for this task.

The chair will prepare a red line version of the document and will send it out to the group. The group was asked to review the document and to volunteer for at least two sections. The chair will collect all the volunteer names and will assign the sections accordingly.

### **H.3.2.8 Taskforce on Temperature Rise Test Procedures (C57.12.90 Clause 11) – Ajith Varghese**

#### Meeting Attendance

- The TF met at 8:00 am.
- A total of 85 people attended the meeting, which included 22 of 41 total members. So quorum was made.

#### Discussions

- Meeting minutes of the Spring 2019 meeting were moved by Mr. Amitav Sarkar and seconded by Mr. John K John. The motion passed unanimously.
- Meeting agenda for Fall 2019 meeting has been moved by Mr. John K John and seconded by Mr. Raj Ahuja. The motion passed unanimously.
- Bertrand Poulin mentioned that he agrees to the proposal of reduced time constant based on his test experience – Typical Winding Time constants are less than 10minutes and half hour gradient is adequate. The overall winding Temp rise based on hot resistance measure have lot of error already and an error if at all added due to this is insignificant. He expects reduction to have positive effect reducing the measurement errors.
- Joe Foldi questioned about the way time constant was determined. He proposed to use fiber optic probes to establish time constant.
- Mr. Juan Castellanos mentioned that fiber optic measurement is local and should not be considered as this topic is related to average winding temperature.

- Chair supported Juan stating based on his experience drop in FO is depending on the duct oil temp at the very top of coil, so it's not accurate to use that for winding temp measurement using hot resistance
- Bertrand Poulin suggested that this topic should be well coordinated with C57.119
- Shamaun Hakim expressed to check the time constant for all 3 shutdowns at top MVA.
- Mr. Joe Foldi also suggested to mention whether the unit tested was ONAF, ODAF etc.
- Chair clarified that data presented was for ONAF and for ODAF, winding time constant should be lower.
- After some discussion , a motion was moved by Mr. Javier Arteaga and seconded by Mr. DharamVir.

The motion as moved :

### C57.12.90: 11.1.2.1 Short-circuit method

d) For the rated current run, reduce the current in the windings to the rated current (or reduced current according to 11.4.1) value for the connection and the loading used. Hold the current constant for 1h. Measure the liquid temperatures, immediately shut down, and measure the hot resistances in accordance with 11.2.2.

e) Repeat the rated current run (step d) for a minimum of 30 minutes, for hot-resistance measurements on additional terminal pairs, if needed, to meet the time limit criteria of 11.2.2.

- There was no additional discussion, and chair called for vote on the motion.
- Vote against the motion= 0, Supporting 13, abstain 9....motion passed.
- The chair stated will bring up the motion during ILSC to get approval to move the modified text to Standard SC to incorporate into the next revision of C57.12.90.
- Chair commented that this subjected to approval of motion in ILSC, this is likely to be the last meeting and thanked the TF for getting to a recommendation back to ILSC in just two sittings.
- Motion moved by DharamVir to adjourn the meeting and seconded by Raj Ahuja
- Meeting adjourned at 9:02 a.m.

After the meeting, Mario Alonso requested membership to TF.

Taskforce will be complete and will not start next time.

Bob Thompson will take on continuous work of the taskforce with temperature rise issues. If there are any particular issues related to temperature rise, contact ILSC Chair or Bob Thompson. If no particular issue is brought up Bob will start reviewing each clauses and update them as needed.

### **Liason Report**

Liason report for Volts/Hz provided by Jeff Ray- Taskforce reports to Power Subcommittee. TF is looking at the overheating caused by over excitation on units directly connected to generators. The areas being looked at are: structural steel, core steel, liquid and solid insulation. The TF is looking for volunteers from ILSC group to writing a couple paragraphs on thermal effects on insulation material due

to short time overload. Need help with solid and liquid insulation. If any members of ILSC are interested in participating, please email ILSC Chair or Jeff Ray.

### H.4 Old Business

There was no old business

### H.5 New Business

Jin Sim requested ILSC chair to present C57.12.00 Clause 5.11.1.4 Rises of metallic parts other than windings. The title for the clause says “Rises” but there is a “fixed” limit on the core hotspot.

ILSC Chair’s suggestion was to include the wording:

- The core hot spot temperature, *not rise*, shall be limited to 130 °C for the condition of highest core over-excitation, rated load, and the maximum average daily ambient temperature for transformers filled with mineral oil.

Gary Hoffman commented that rise will be in deg K. If it is fixed temperature, it is deg C.

Tom Prevost made motion to accept the wording as stated by the ILSC Chair. Akash Joshi seconded motion. Based on the count, 18 favored the motion, 42 reject and 5 abstain. Motion did not carry

Krishnamurthy Vijayan made the motion:

- The core hot spot temperature shall be ~~limited to 130 °C~~ 100°C rise for the condition of highest core over-excitation, rated load, and the maximum average daily ambient temperature for transformers filled with mineral oil.

Dharam Vir seconded motion. 34 favored the motion, 35 rejected and 8 abstain. Motion did not carry.

Sam Sharpless made the motion to form a taskforce to review the clause and provide recommendation on the wording. Motion was seconded by Ewald Schweiger. 47 favored the motion, 7 rejected it and 9 abstained. Motion carried. Taskforce will have 6 months to complete the work. ILSC Chair is looking for volunteer to lead the taskforce.

### H.6 Adjournment

The meeting was adjourned at 9:17 AM.

Respectfully submitted,

Jinesh Malde  
Secretary, Insulation Life Subcommittee