Annex G Insulating Fluids Subcommittee

October 25th, 2023 - 3:00 PM - 4:15 PM
Westin at Crown Center; Kansas City, MO -

Chair: Scott Reed
Vice-Chair: Jerry Murphy
Secretary: Alan Sbravati

1. **Introductions, Roll Call of Members for Quorum, Meeting Agenda Approval, S23 Minutes Correction and Approval, and Chair's Comments**

1.1 Chair's Opening Remarks:

a. Meeting started at 3:02 PM

b. Presentation of the Vice-Chair, Jerry Murphy, and the Secretary Alan Sbravati.

c. Reminded that the SC minutes are due Nov 15th, 2023 - WG and TF meeting minutes are due for submittal to the Insulating Fluids Subcommittee (IFSC) Secretary Alan Sbravati due within 15 days of their meetings.

d. IEEE Liaison Patrycja Jarosz reminded all chairs that:

i. Rosters are being collected to be uploaded in "myProject"

ii. Secretary must keep the excel sheet for controlling attendance

iii. Officers have a mandatory anti-trust training assigned with IEEE SA.

1.2 **Roll Call of SC members: (**Quorum requirement: 24 minimum)

a. 35 Members signed in, from a total of 48 members. Quorum was achieved.

b. Total of 104 attendees. A total of 69 guests, from which 18 requested membership, and two of them are eligible.

c. Registered Attendance:

First Name	Last Name	Role
Isaac	Abdalla	Guest
Jennie	Aldenlid	Guest
Edmundo	Arevalo	Guest
Kevin	Biggie	Member
Piotr	Blaszczyk	Guest
William	Boettger	Member
Paul	Boman	Member
Mike	Bonn	Member
David	Calitz	Member
Juan	Castellanos	Member
Marcelo	Catugas	Guest
Stuart	Chambers	Member
Jonathan	Cheatham	Guest
Paul	Cox	Guest
Janet	Crockett	Guest
Roberto	Da Silva	Guest
Michael	Dahlke	Guest
Tim	Dappen	Guest
Gabriel	Delgado	Guest
Larry	Dix	Guest
Zachary	Draper	Member
Samragni	Dutta Roy	Guest
Will	Elliotz	Guest

Joe	Fahert	Guest
Florin	Faur	Member
Marcos	Ferreira	Guest
Bruce	Forsyth	Member
Rainer	Frotscher	Member
Lorne	Gara	Guest
Miguel	Garcia	Guest
James	Gardner	Guest
Carlos	Gaytan	Guest
Rob	Ghosh	Guest
Luis	Gonzalez	Guest
Alireza	Gorzin	Guest
Niklas	Gustafsson	Guest
Attila	Gyore	Member
Robert	Harper	Member
Roger	Hayes	Member
Thomas	Holifield	Guest
Traci	Hopkins	Guest
Karl	Jakob	Guest
Patrycja	Jarosz	Guest
John	John	Member
Kurt	Kaineder	Member
Qasim	Khan	Guest
Zan	Kiparizoski	Member
Brian	Klaponski	Guest
Klaus	Koeck	Guest
Andrew	Larison	Guest
Chao	Li	Guest
Cesar	Lizcano	Guest
Luc	Loiselle	Guest
Tiffany	Lucas, P.E.	Member
Stephanie	Mabrey	Member
Jinesh	Malde	Member
Darrell	Mangubat	Guest
Kumar	Mani	Guest
Brian	McBRide	Guest
Toni	Mellin	Guest
Michael	Miller	Guest
Justin	Minikel	Guest
Jerry	Murphy	Vice-Chair
Ismael	Naja	Guest
Anthony	Natale	Guest
Mark	Newbill	Guest
Dwight	Parkinson	Member
Rakesh	Patel	Guest
Nicholas	Perjanik	Guest
Baptiste	Pousset	Guest
Thomas	Prevost	Member
John	Pruente	Member
Jimmy	Rasco	Guest
Timothy	Raymond	Member
Scott	Reed	Chair
Sebastian	Rehkopf	Guest
Clemens	Reiss IV	Guest
Diego	Robalino	Member
Patrick	Rock	Guest
Zoltan	Roman	Guest
Mickel	Saad	Member
Lina	Sandstein	Guest
Alan	Sbravati	Secretary
Alaor	Scardazzi	Guest
Kabir	Sethi	Guest
Igor	Simonov	Guest
Jonathan	Sinclair	Member
Mauricio	Soto	Guest
Fabian	Stacy	Member
Brad	Staley	Guest
Hampton	Steele	Guest
Gregory	Steeves	Member
Cris	Talbert	Guest
Ryan	Thompson	Member
Fernando	Tirado	Guest
Anar	Tleoukoulov	Guest
Mark	Tostrud	Guest
Alwyn	Van Der Walt	Member
Cole	Van Dreek	Guest
Evanne	Wang	Member
Zachery	Weiss	Guest
Daniel	Weyer	Guest
Christopher	Whitten	Guest
Kwasi	Yeboah	Guest

1.3 Agenda Approval:

a. A motion for approval of the agenda was presented by Stephanie Mabrey, second by Tim Raymond. Agenda was unanimously approved.

b. Scott presented some reminders:

   a. Deadline for the submission of minutes is Nov 15th.

   b. Emphasize the requirements for diversity and inclusion.

   c. Reinforce the mandatory training for WG officers.

   d. Discussion about replacing the term "liquid immersed" by "liquid type" transformers. Since the new C57.12.80 is not balloted yet, the groups should not start changing.

   e. Clarification on requirements for becoming and keeping membership of the SC is to attend at least 3 of the last 5 meetings.

   f. All DGA data to be submitted to c57data@ieee.org.

1.4 Approval of minutes from the S23 meetings:

a. A motion for approval of the S23 minutes was presented by Zan Kiparizoski, second by John John. Minutes were unanimously approved.
b. Chair presented a request to amend the minutes, adjusting the date and the information on the balloting process of C57.166. This amendment was unanimously approved.

1.5 Chair's review of key IFSC Standards:

a. The chair reviewed the status of each of the 10 guides under the Sub-Committee Insulating Fluids.

b. C57.166 PAR's was extended to December 2024. This will supersede C57.106, C57.111, C57.121, C57.147, so no activity is required at this point for these standards.

c. C57.155 will expire in 2024. C57.637, C57.130 and C57.139 will expire in 2025.

d. C57.104 no activities during last 2 meetings (active PAR).

e. C57.146, C57.155, C57.637 and C57.166 have active PAR's.

f. C57.146 PAR will expire in 2024. PAR for C57.155 and C57.637 will expire in 2025. PAR for C57.130 and C57.139 will expire in 2026.

2. WG & TF Reports Presented at the SC Meeting

2.1.1 IEEE C57.146 IEEE Guide for Interpretation of Gasses Generated in Silicone-Immersed Transformers

2.1.1.1 WG Chair: Paul Boman

a. Attendance total 28, members 6, and 1 requested membership. The required WG quorum of 6 was present and business could be conducted at this meeting.

b. Call for essential patents – none at this time

c. Agenda – no opposition to unanimous approval.

d. New guests introduced.

e. Minutes from previous meeting accepted as presented.

f. Group is working on the draft of the revised standard. They were able to collect DGA records, but only the results of the statistical analysis was shared. Questions around the 90th percentile were raised, but they may not be able to calculate that, because they don't have the full database.

g. Discussion around the online monitoring of hydrogen content in silicone liquid was raised by the chair. As the group confirmed the existence of such devices, the phrase will be adjusted.

See ***Appendix I*** for the F23 Minutes (unapproved) of C57.146 WG Meeting as submitted.

2.1.2 IEEE C57.166 Consolidation of Insulating Liquids Guides (PAR Expiration: Dec 2024)

2.1.2.1 WG Chair: Tom Prevost

2.1.2.2 Although the WG Meeting did not meet, an update was presented at the IFSC meeting by the chair:

a. PAR will expire in Dec 2024.

b. There was no meeting cause the group already approved starting the SA Ballot process.

c. Ballot pool is formed, Mandatory Editorial Coordination is completed.

d. Ballot expected to be started in November.

e. Comments Resolution Group was already defined. They will work on the comments after the ballot. Expected to be concluded prior to S24 meeting.

f. Chair presented a claim for people who joined the ballot to effectively vote.

See ***Appendix II*** reserved for the Meeting Minutes not submitted.

2.1.3 TF C57.104 IEEE Guide for the Interpretation of Gases Generated in Mineral Oil-Immersed Transformers

2.1.3.1 TF Chair:

a. The working group did not meet.

Appendix III has no minutes included.

2.1.4 C57.637 – Guide for the Reclamation of Mineral Insulating Oil and Criteria for Its Use

2.1.4.1 WG Chair: Stephanie Mabrey

a. The meeting was called to order at 10:58 am by Chair Stephanie Mabrey.

b. The Working Group (WG) was attended by 39 guests. The Working Group (WG) has 31 members and 19 were present so quorum was reached.

c. A straw ballot was triggered prior to the meeting. Comments should be sent due Dec 21st.

d. BRG was formed.

See ***Appendix IV*** for the F23 Minutes (unapproved) of C57.637 WG Meeting as submitted.

2.1.5 C57.155 – Guide for Interpretation of Gases Generated in Natural and Synthetic Ester Liquid Type Transformers

2.1.5.1 WG Chair: Alan Sbravati

a. There were 19 of 33 members present during the meeting. There were 81 guests, 11 membership requests. The quorum was achieved.

b. No patent claim nor copyright issue were presented.

c. Activities after S23 meeting was presented on data collection and NEI development.

d. Process of data collection was again presented and a request for data was reinforced. The group defined a deadline of Jan 31st, 2024 for the data collection.

e. Four task forces were created.

h. Meeting was adjourned at 15:01

See ***Appendix V*** for the S23 Minutes (unapproved) of C57.155 WG Meeting as submitted.

2.1.6 Working Group C57.139 – Guide for the Interpretation of Gases generated in Liquid Type Load Tap Changers

2.1.6.1 WG Chair: Rainer Frotscher

a. Total: 82, Members: 20, Guests: 62, with 22 requesting membership. Quorum was achieved.

b. S23 Meeting Minutes - unanimous approval

c. Essential patent claims: none stated; Copyright requirements were shown.

d. Task force leaders reported the progress.

e. TF1 received 120K records so far, representing 21 companies, providing DGA data from more than 6,000 LTCs, 80 different LTC models.

f. TF2, 3 and 4 presented the updates on the chapters of the document.

g. Chair then explained the database hosting by IEEE SA and the need to submit further data.

h. A motion was presented to expand the scope of the Guide to include voltage regulators (VR) to provide user with guidance on DGA, which passed in the WG.

i. Meeting adjourned 5:59 pm

See ***Appendix VI*** for the F23 Minutes (unapproved) of C57.139 WG Meeting as submitted.

2.1.7 Working Group C57.130 – Guide for the Use of Dissolved Gas Analysis Applied to Factory Temperature Rise Tests for the Evaluation of Mineral Oil-Immersed Transformers and Reactors

2.1.7.1 WG Chair: Bruce Forsyth

a. The WG met on Tuesday, Oct 24, 2023 but did not have a quorum
b. WG milestones were presented. Final submission of approved document is Fall 2025.
c. Lance Lewand (LL) presented on the "Data Request Form" to the WG and discussed.
d. DGA for overload condition discussed.
e. A request for DGA data will be sent out in December with a deadline to submit by the end of January.

See ***Appendix VII*** for the F23 Minutes (unapproved) of C57.130 WG Meeting as submitted.

2.1.8 Task Force – Development of a test method to determine the maximum continuous operating temperature of insulating liquids

2.1.8.1 TF Chair: Ahmed Gamil

a. Roberto Da Silva has accepted to be the secretary.
b. In the absence of Ahmed, Alan Sbravati presented the initial results of analysis did by Ahmed.
c. The group have requested to Ahmed set up a virtual meeting (maximum 1 moth after this meeting) to present (to the list members and previous virtual invitees) the initial analysis.
d. The group have requested to Ahmed to repeat the result curves separated by laboratory.
e. The group agreed to share the data.
f. Aleksandr Levin has presented a topic for discussion: "Practical Performance of Insulating Liquids". He has proposed a survey to understand real performance of insulating liquids, but the group concluded that we are not ready for that. Aleksandr will prepare a draft of the form.
g. Once Ahmed was not able to participate in the last 2 meetings, the group decided to keep him as the chair with the condition to his participation in the next meeting Spring 2024.

See ***Appendix VIII*** for the F23 Minutes (unapproved) of TF as submitted.

3. Old Business

a. No old business.

4. New Business

a. A request was presented to develop a new DGA Guide for transformers of Solar and Wind farms filled with mineral oil. The reasoning behind the request is that the values of C57.104 are not valid for such applications.
Chair suggested including this as a new task force, as a new revision of C57.104 is going to be started in S24 meeting.

b. A request was presented to develop a new Guide to understand corrosive sulfur issues by Stuart Chamber on behalf of Lance Lewand, who offered to be the chair of the group. Several discussions were endured, mostly around the reasoning of the request, which was understood by the group. A proposal to include this as an item on C57.637 was presented and declined, since that group is already starting the balloting process. Final recommendation was to form a study group to establish a Task Force to analyze the

interest in developing a guide. Tom Prevost presented a motion as previously stated, seconded by Mickel Saad. There was 22 approvals, 2 opposition and 2 abstentions. Motion passed.

5. **Next IFSC Meeting:**

   Mar 13th, 2024 – Vancouver, BC, Canada

6. **Adjournment**

   The meeting was adjourned at 3:30 p.m.

Respectively Submitted, Alan Sbravati, Secretary IFSC

Unapproved Minutes from the F23 IFSC WG and TF meetings

Appendix I

Working Group C57.146 IEEE Guide for DGA in Silicone

Monday, March 20, 2023
11:00 AM to 12:15 PM
Hyatt, Milwaukee, WI, USA
Minutes of Working Group Meeting

Chair Paul Boman
Vice Chair Lance Lewand
Secretary Tiffany Lucas of Prolec GE
Meeting start time 11:00AM 10/23/23.
Attendance total 28, members 6, and 1 requested membership. The required WG quorum of 6 was present and business could be conducted at this meeting.

F23 Attendance List

Membership Request	Role	First Name	Last Name
	Guest	Samuel	Brodeur
	Guest	Jeff	Benach
	Chair	Paul	Boman
	Guest	Marcelo	Catugas
	Guest	mark	Cheathan
	Guest	Randy	Cox
	Member	Zachary	Draper
	Guest	Marco	Espindola
	Member	Todd	Felton
	Guest	Rainer	Frotscher
	Guest	Robert	Harper
	Guest	Traci	Hopkins
	Vice-chair	Lance	Lewand
	Guest	Chao	Li
	Secretary	Tiffany	Lucas
	Guest	Nick	Perjanik
	Guest	Daniel	Posadas
	Member	John	Pruente
	Member	Scott	Reed
	Guest	Marilia	Ribecino
	Guest	Zoltan	Rottam
	Guest	Jim	Spaulding
	Guest	Mauricio	Soto
	Guest	Greg	Steeves
	Guest	Anar	Tleoukoulov
	Guest	Mary	Wheeler
	Guest	Milia	Zaman

1) Agenda – no opposition to unanimous approval as presented.
   a) Quorum – 6 members present – quorum achieved.
      i) Claude Beauchemin removed from WG membership, maintained as guest.
2) Essential patents claims – nobody notified on any essential patent claims.
3) Scott Reed – SC chair present – notes should be sent to Scott Reed after the meeting.
4) Paul Boman reviewed patent related business discussions and rules per IEEE. Formally object if necessary.
5) Paul Boman shared links to IEEE sites.
6) Introductions of new guests – Paul Boman created login sheet that is circulating

a) New guests include: Samuel Brodeur, Jim Spalding, Cesar Lizcano, Marilia Rubino, Zoltan Roman, Randy Cox, Mark Cheatham, Kwasi Yeboah, Mary Wheeler, Maria Zaman, Marcelo Catugas, Daniel Posadas and Anar Tleoukoulov. Todd Felton also listed as new, omitted from list when email was returned as undeliverable, but his email is the same as our records. Try re-sending email.

7) No corrections or additions to the meeting minutes – meeting minutes accepted as presented.

The Draft Guide

8) Rainer Frotscher – please send draft guide out earlier before the meeting for more time to review.
9) C57.104 is the document that many things are lifted from for this guide.
10) Table 1 – DGA concentrations compare to the thresholds set in 2005 (C57.146), matches pretty closely to the new table1 from the Claude Beauchemin database.
11) Scott Reed – question: what data was included in analysis – per Paul Boman a CIGRE group was left out because it had a small amount of data and was not in alignment with the other data sets. Per Lance Lewand some companies added more data.
12) Anar Tleoukoulov – what's our confidence level on this data? Statistical significance. Per Paul Boman each data set had statistical analysis, not statistical analysis of the whole group of data combined.
    a) Alan Sbravati – we are showing 90th percentile, it would be interesting to show the confidence level. Per Paul Boman it wasn't in the 104 guide, and it was in the 155 guide. We don't have that with this data because the diagnostic tool could not record that data. Paul Boman will ask Claude Beauchemin about the confidence intervals.
13) Randy Cox from GE - do we have a thermal chart in here? Lance Lewand will review Silicone guide at Doble.
14) Paul Boman – wording from 104 on Figure 1 n-octane curve, do we have anything similar that we can present for Silicone? We have key gasses for various fault types – very useful, WG approved. Per Lance Lewand, some experimentation may be necessary. Mass spectrometry used in 155 guide at various temperatures. Elena Wilhelm may have a study on natural esters, we could ask about Silicone. Also ask about cellulose vs aramid paper?

15) There is a device to monitor hydrogen in silicone – should we include online monitoring?
    a) Jeff Benach – Megger – we have been talking about that for different fluids, is there a need for silicone? Units are old, and smaller and it may not be cost effective. Most silicone transformers are not critical applications. Per Randy Cox – we can monitor headspace.
    b) WG did not see online monitoring as a business need.
    c) Traci Hopkins (H2 scan) – while not typical to have online DGA monitoring for silicone fluids, there are devices available if needed. Hydrogen monitoring in fluid and headspace by H2 scan.
    d) Scott Reed – on an xfmr old and small, is there value in an online monitoring?

16) Poll: all in favor of putting an online monitoring
    a) Traci Hopkins (H2 scan) : Motion that we have a statement stating that "Although online DGA monitoring is not typical for this liquid type, there are devices on the market that can monitor or detect gas in silicone liquid"
    b) Second - John Pruente
17) Alan Sbravati – ",there are devices on the market that can be used for this application"

a) Motion: Although online DGA monitoring is not typical for this liquid type, there are devices on the market that can be used for this application
    (1) Traci Hopkins– approved friendly amendment to motion
b) Second amendment to motion – John Pruente
c) No other comments

18) Poll: Put this statement in the online monitor prior to straw ballot – one opposed, many aye, no abstain

Question from Paul Boman: Silicone fluid vacuum processed before? Do we need a statement in the prep for service – see yellow in Paul Boman meeting presentation. From the original 2005 guide.

19) Paul Boman – strike "the saturation value for air dissolved in Si fluid " from mineral oil fluid, do we know what a typical saturation value for Si fluid is? Per Lance Lewand – we can't use the same values, we have to revisit this. Paul Boman wants to strike the sentence since we don't have a value for this threshold. Alan Sbravati – units having a threshold higher than 0.2, based on the data from Claude Beauchemin. Paul Boman will look into it and if he can't get a threshold value he will strike the sentence. Per Paul Boman and Lance Lewand we can work backward from the Oswald solubility data. Paul Boman is highlighting yellow in his notes to follow up on that.
20) Methanol ASTM test method not been examined in Si fluids. Per Lance Lewand – he doesn't know the stability in silicone liquids. ASTM defines for mineral oil, so Paul Boman will strike since ASTM does not reference Si fluids relating to methanol.
21) There is information on 2-furfural, per Lance Lewand it's pretty stable.

22) Claude Beauchemin accolades for his work on this data for this standard. Scott Reed recommended a comment of special thanks.
23) 146,000 DGA results used for the data set, Paul Boman will correct the appropriate number of results used in the data set.
24) Silicone triangle in the standard from Paul Boman, but an example or case study needed for the silicone triangle so that people have an example to apply the math. Mineral oil in now, Si one available, needs to be plotted with a case study example.
25) We have the rate of change. The first table has the concentrations from the 2005 guide, then the next table has the rates of change that Paul Boman calculated from the case study.
    a) WG verbally agree to keep the example from the case study. This case study is a thermal fault and arcing fault.
26) Second example from HSB, plotted, needs captions. Paul Boman will review numbers and plotted values.
    a) John Pruente – asked about extrapolated data suggests adding a line stating extrapolation with the chart, and suggested that we keep the titles/column labels all the same/consistent on the data tables.
    b) Alan Sbravati – double check the data in the data sets – Paul Boman will check.
27) Paul Boman will send as electronic ballot to ask permission to straw ballot.
    a) Anar Tleoukolulov – note on linear approximation on data? Paul Boman – maybe
    b) Paul Boman add some usage notes so that they're easier to follow.
28) Data from 1998 guide – to 2005 guide to current Oswald numbers – not sure on original source for data.

29) Nick Perjanik- AVO Dianostics– 0.2 threshold for breathing vs non-breathing, silicone sealed, 0.2 to be consistent with mineral oil? Or should we look at that?
    a) Lance Lewand – we will probably have to look at that again because the solubilities are different.
    b) Lance Lewand – calculate saturation and go back to Claude Beauchemin and see if that changes.
    c) Alan Sbravati – go one step further, the reason for increasing the content might be sampling process. Paul Boman wants to eliminate 0.2
30) Paul Boman – consider a PAR extension for this WG. PAR expires Dec 2024. Straw ballot would need WG member approval, WG members need an updated guide to approve straw ballot.
31) Paul Boman – please review revised document and reply.

Meeting adjourned because it was in the agenda.

Appendix II

Working Group for Acceptance and Maintenance of Insulting Liquids PC57.166

No meeting minutes.

Appendix III

TF Next Revision to C57.104: Guide for Interpretation of Gases Generated in Mineral Oil-Immersed

No meeting minutes

Appendix IV

Working Group C57.637 Guide for the Reclamation of Mineral Insulating Oil and Criteria for Its Use

Tuesday October 24, 2023
11:00 AM – 12:15 PM
Kansas City
Minutes of Working Group Meeting

The meeting was called to order at 10:58 am by Chair Stephanie Mabrey.

Attendees & Members:

The meeting was attended by 39 guests.

The Working Group (WG) has 31 members and 19 were present so quorum was reached.

1. Paul Boman
2. Mike Bonn
3. Stuart Chambers
4. James Cross
5. Samrani Dutta Roy
6. Todd Felton
7. Rainer Frotscher
8. Bob Harper
9. Andy Holden
10. Lance Lewand
11. Stephanie Mabrey
12. Jinesh Malde
13. Scott Reed
14. Mickel Saad
15. Alan Sbravati
16. Jonathan Sinclair
17. Greg Steeves
18. Ed teNyenhuis
19. Deanna Woods

Agenda

1) Introduction
2) Review Copyright IEEE SA Notification
3) Review Call for Patents
4) Introductions
5) Obtain Quorum
6) Approval of prior minutes
7) Introduction of Task Force leaders and updates

Chair's Remarks:

Chairwoman Mabrey (SM) made officer introductions.

Introductions were made by all in attendance.

The Chair then reviewed with the Task Force (TF) the IEEE's copyright policy, of which no comments were made.

Approval of Agenda & Minutes:

Quorum was confirmed by Secretary Andy Holden (AH). A motion to approve the meeting agenda and the Spring 2023 minutes by unanimous consent was made by Michael Saad and it was seconded by Bob Harper. The motion carried with no objections or abstentions.

Document Consolidation & Straw Ballot:

The document has been consolidated and distributed to all members prior to the meeting. Two members mentioned not receiving the email so AH will resend the document promptly and ask for confirmation from each recipient.

SM has asked that all comments be submitted no later than December 31, 2023.

Ballot Resolution Committee Formation:

SM asked for volunteers to form a Ballot Resolution group and eight volunteered.

1) Scott Reed (Vice-Chair)
2) Andy Holden (Secretary)
3) Jinesh Malde
4) Mike Bonn
5) Stuart Chambers
6) Alan Sbravati
7) Jonathan Sinclair
8) Gabriel Zamora

They will work to resolve any items in advance of the Spring 2024 meeting in Vancouver.

General Discussion:

Jinesh Malde (JM) asked for clarification about when the 637 document could go to ballot.

SR confirmed that the resolution work could be completed while C57.166 is still in ballot. Once that document is complete then 637 can proceed forward to ballot.

SM stated that our PAR expires at the end of 2025 and that we can make a decision at the spring meeting about the need to start the PAR Extension process.

Conclusion:

A motion to end the meeting was made by Deanna Wood and was seconded by Jonathan Sinclair. The motion carried with no objections or abstentions and the meeting concluded at 11:13am.

Appendix V

Working Group C57.155 – Guide for Interpretation of Gases Generated in Natural Ester and Synthetic Ester-Immersed Transformers

Tuesday, October 24, 2023
13:45 – 15:00, Kansas City, MO, USA
Minutes of Working Group Meeting

Chairman: Alan Sbravati
Vice Chair: Lance Lewand
Secretary: Attila Gyore

The meeting was called to order at 13:48 by the Chair.

There were 19 of 33 members present during the meeting. There were 81 guests, 11 membership requests. The quorum was achieved.

1. Attendance list:

1	Jennie	Aldenlid	Guest
2	Robert	Allison	Guest
3	Kush	Arora	Guest
4	Sean	Barker	Guest
5	Jeff	Benach	Guest
6	Edwin	Betancourt*	Guest
7	Vivek	Bhatt	Guest
8	**Paul**	**Boman**	Member
9	Griffin	Burk	Guest
10	Wilerson	Calil	Guest
11	Juan	Castellanos	Guest
12	Marcelo	Catugas	Guest
13	Jonathan Mark	Ceatham	Guest
14	**Stuart**	**Chambers**	Member
15	**Luiz**	**Cheim**	Member
16	Solomon	Chiang	Guest
17	Ennyoung	Cho	Guest
18	Anthony	Coker	Guest
19	Randy	Cox	Guest
20	Daniel	Crockett	Guest
21	Roberto	Da Silva*	Guest
22	Stephanie	Denzer	Guest
23	Luc	Dorpmanns	Guest
24	**Zack**	**Draper**	Member
25	Jacob	Eshenroder	Guest
26	Marco	Espindola	Guest
27	**Todd**	**Felton**	Member
28	Bruce	Forsyth	Guest
29	**Rainer**	**Frotscher**	Member
30	Miguel	Garcia*	Guest
31	James	Gardner	Guest
32	Luis	Gonzalez	Guest
33	Ismail	Guner	Guest
34	**Attila**	**Gyore**	Secretary
35	**Robert**	**Harper**	Member
36	Roger	Hayes	Guest
37	Carlos	Hernandez	Guest
38	Thang	Hochanh	Guest
39	**Traci**	**Hopkins**	Member
40	Logan	Howell	Guest
41	Karl	Jakob	Guest
42	John	John*	Guest
43	Jerzy	Kazmierczak*	Guest
44	Jim	Kay	Guest
45	Gael	Kennedy	Guest
46	Sheldon	Kennedy	Guest
47	Qasim	Khan	Guest
48	Egon	Kirchenmayer*	Guest
49	Klaus	Koeck	Guest
50	Rafal	Kowalski*	Guest
51	**Lance**	**Lewand**	Vice-Chair
52	**Chao**	**Li**	Member
53	Jacky	Lin	Guest
54	Caser	Lizcano	Guest
55	Luc	Loiselle	Guest
56	Mark	Lowther	Guest
57	**Jinesh**	**Malde**	Member
58	Brian	McBride	Guest
59	Toni	Mellin*	Guest
60	Filip	Mikulecky	Guest
61	Ali	Naderian	Guest
62	Markus	Newbin	Guest
63	Stephen	Oakes	Guest
64	Anastasia	O'Malley	Guest
65	Nick	Perjanik*	Guest
66	Rakesh	Rathi	Guest
67	Timothy	Raymond*	Guest
68	Scott	Reed*	Guest
69	Perry	Reeder	Guest
70	Diego	Robalino	Guest
71	Yuri	Rossini	Guest
72	Mickel	Saad	Guest

73	Lina	Sandsten	Guest
74	**Amitabh**	**Sarkar**	Member
75	**Alan**	**Sbravati**	Chair
76	Ewald	Schweiger	Guest
77	Kabir	Sethi	Guest
78	Jaber	Shalabi	Guest
79	Jonathan	Sinclair	Guest
80	Jimmy	Smith	Guest
81	**Mauricio**	**Soto**	Member
82	**Markus**	**Stank**	Member
83	Dave	Stankes	Guest
84	Greg	Steeves	Guest
85	Charles	Sweetser	Guest
86	Ali	Syed	Guest
87	Tim	Tillery	Guest

88	Anar	Tleoukoulov	Guest
89	Robert	Vary	Guest
90	Karsten	Viereck	Guest
91	**Evanne**	**Wang**	Member
92	Alan	Washburn	Guest
93	Matthew	Webb	Guest
94	**Zachery**	**Weiss**	Member
95	Christopher	Whitten	Guest
96	**Deanna**	**Woods**	Member
97	Jeffrey	Wright	Guest
98	Kwasi	Yeboah	Guest
99	Samuel	Young	Guest
100	Guang	Yuan	Guest

*membership requested

2. Agenda for approval

A. Welcome & Introduction
B. Attendance and Establishment of Quorum
C. Call for Patent Disclosure
D. IEEE Copyright Policy
E. Approval of Spring 2023 Minutes
F. Working Group Activities
    1. Task Force 1, IEEE database
    2. Task Force 2, Development of NEI parameters for Ester liquids
    3. Draft of the revised document, PC57.155/D1
G. Discussions:
H. Other Items for Discussion
I. Adjournment

3. Chair posted the Patent Claim. No claims were made.

4. Chair presented the copyright policy slides.

5. The agenda of the meeting was presented by the chair.

6. Agenda for Fall 2023 was approved, motion: Traci Hopkins, second: Luiz Chem

7. Spring 2023 Minutes was approved, motion: Evanne Wang, second: Traci Hopkins

8. Chair gave a short summary on activities from last meeting in March 2023
9.1 Discussion on data collection and data storage by IEEE
    IEEE created a platform to collect and store data.

    DGA data should be sent to IEEE data collection central email address: c57data@ieee.org
    The subject of the email should be like 'PC57.155 Revision'.

    IEEE anonymize the data and then forward them back to the working group.
    Dedicated people of the WG will fill the data into our spreadsheet and they will be processed
    DGA data should arrive by end of January 2024.
9.2 Four online TF meetings were held about Normalized Energy Index

9. Four Task Forces were created
    a) TF1 Statistical Analysis of Database,
        Leader: Lance Lewand, Doble,

8 members: Luiz Chem, Roberto Da Silva, Zack Draper, Todd Felton, Toni Mellin, Tim Raymond, Mauricio Soto, Charles Sweetser

b) TF2 Normalized Energy Index,
Leader: Alan Sbravati, Hitachi Energy,
7 members: Zack Draper, Todd Felton, Bruce Forsyth, Russell Martin (?), Charles Sweetser, Anar Tleoukoulov, Kevin Wirtz,

c) TF3 Revision of the Document
Leader: Stuart Chambers, SDC Consulting,
6 members: Attila Gyore, Robert Harper, Traci Hopkins, Lance Lewand, Jinesh Malde, Deanna Woods

d) TF4 Analyzing Diagnostic Methods
Leader: Jinesh Malde, M&I Materials,
7 members: Luiz Chem, Zack Draper, Egon Kirchenmayer, Lance Lewand, Toni Mellin, Ali Naderian, Anar Tleoukoulov

10. Timeline of the work discussed
    - DGA data collection by end of January 2024
    - Preliminary version of NEI and the Document by Meeting at Spring 2024

11. New Business/Other Items for Discussion: No new business.

12. Next meeting at Spring 2024, Vancouver, Canada

13. The meeting was adjourned at 15:01, on time, motion: Lance Lewand, second: Traci Hopkins

Attila Gyore, Secretary
Alan Sbravati, Chair

Appendix VI

WG C57.139 – Guide for Interpretation of Gases Generated in Liquid Type Load Tap Changers

Tuesday, Oct 24 2023
4:45 PM to 6:00 PM
Kansas City (MO)

Chair Rainer Frotscher
Vice Chair John Pruente
Secretary Paul Boman
Meeting: Milwaukee (WI), Tue Mar 21 2023, 4:45 – 6:00 PM
Attendance record: Total: 82, Members: 20, Guests: 62, with 22 requesting membership.
Attendees list: see end of these Minutes.

Attendees list:

First Name	Name	Status/ Membership Request
Jennie	Aldenlid	guest
Tauhid	Ansari	guest
Kush	Arora	guest *)
Jeff	Benach	guest
Paul	Boman	Secretary
David	Calitz	guest
Juan	Castellanos	guest
Marcelo	Catugas	guest *)
Stuart	Chambers	guest
Mark	Cheatham	guest
Luiz	Cheim	guest *)
Craig	Colopy	guest
Ranoy	Cox	guest
Roberto	da Silva	guest
Jeffrey	Door	guest
Thomas	Douzat	guest
Hakim	Dulac	guest *)
Samragni	Dutta Roy	member
Evgenii	Ermakov	guest
Marco	Espindola	guest *)
Florin	Faur	member
Todd	Felton	guest *)
Marcos	Ferreira	guest *)
Hugo	Flores	member
Rainer	Frotscher	Chair
James	Gardner	guest *)
Hector	Garza	guest
Niklas	Gustavsson	member
Attila	Gyore	member
Jean	Hernandez	guest
Traci	Hopkins	guest *)
Nathan	Jacob	guest *)
Christopher	Johnson	guest
Gasim	Khan	guest
Junho	Lee	guest
Chao	Li	guest
Cesar	Lizcano	guest
Luc	Loiselle	guest
Tiffany	Lucas	guest *)
Stephanie	Mabrey	member
Darrell	Mangubat	guest *)
Lee	Matthews	guest

Toni	Mellin	member
Mike	Miller	guest
Justin	Minikel	guest
Martin	Munoz	guest *)
Mark	Newbill	guest *)
Anastasia	O'Malley	guest
Poorvi	Patel	guest
Verena	Pellon	guest
Nick	Perjanik	member
John	Pruente	Vice-Chair
Tim	Raymond	guest *)
Scott	Reed	member
Perry	Reeder	member
Sebastian	Rehkopf	member
Jonathan	Reimer	guest
Mickel	Saad	guest *)
Lina	Sandsten	guest *)
Alan	Sbravati	guest
Alfons	Schrammel	guest
Steve	Shull	guest
Jonathan	Sinclair	member
Jimmy	Smith	guest
Mauricio	Soto	guest *)
Brad	Staley	guest *)
Tim	Tillery	guest
Anar	Tleoukoulov	guest *)
Olivier	Uhlmann	guest
Cole	Van Dreel	member
Alwyn	Vanderwalt	guest
David	Wallach	guest
Matthew	Webb	member
Daniel	Weyer	guest *)
Lesn	White	guest
Bill	Whitehead	member
Christopher	Whitten	member
Deanna	Woods	guest *)
Jeffrey	Wright	guest
Kwasi	Yeboah	guest *)
Joshua	Yun	member
Peter	Zhao	guest

*): requesting membership

Agenda

- Welcome
- Approval of Agenda
- Membership / Quorum
- Call for Patent Claims / IEEE SA Copyright Policy
- Approval of Meeting Minutes S23
- Report of Task Forces
- Database Hosting by IEEE SA
- New Business
- Adjourn Meeting

Minutes

- The WG met Tue, Oct 24, at 4:45 pm. Chair asked for approval of the agenda; motion by Deana Woods, 2nd by Hugo Flores => Agenda was unanimously approved.
- Chair showed membership list containing 31 members, with 20 attending => Quorum was achieved.
- Chair asked for Essential Patent Claims => none stated.
  IEEE Copyright Policy was shown.

- Spring 2023 Meeting Minutes: motion to approve by Deana Woods, 2nd by Hugo Flores
  => No corrections, unanimous approval.

- In the Spring meeting 2023, 4 Task Forces were set up and their Tasks were defined. All TFs met during the summer months to start the revision of the Guide and provided a report at the Work Group Meeting.
  Report of Task Forces:

  TF1: LTC Data Collection and Evaluation – led by Zachary Draper from DeltaX
  As a start, DeltaX encouraged selected TOA4 users to donate LTC DGA data:
  - 21 companies participated, providing DGA data from more than 6,000 LTCs,
  - representing 80 different LTC models.
  - 120K records were collected, categorized, anonymized, cleaned, and stored in a protected IEEE environment.

  Almost all data came without operational or application-specific data (TOA4 dump).
  35 documented fault cases were identified.
  TF1 did a first evaluation of the data to visualize the huge value range of gases. Zach Draper explained various charts to show the differences between arcing and vacuum type models, reactance vs. resistor types etc.
  Marcus Ferreira questioned the acetylene reported for vacuum type LTC. Chair explained that low concentrations of acetylene can be generated from commutation processes on by-pass or auxiliary contacts.
  The goal is to provide statistical evaluations as in C57.104. At present state it is not clear if 90 or 95 percentile gas concentrations will allow a detection of fault cases, as it is possible for transformers.
  Statistical evaluation of gas ratios might be more promising.

  TF2: Revision of Chapter 1 – 4 (General Section) – led by Florin Faur
  Florin gave an overview how to update this General Section of the document:
  - Chapters 1, 2, 3 will get formal edits on Scope, Purpose, Normative References, and Definitions.
  - Chapter 4 will be completely rewritten. Ideas were discussed how to improve structure, correct inconsistencies, develop the typical gas patterns of different LTC architectures, explain determining factors on the gassing behaviour (e.g. breathing, loading, no of ops/day), highlight the significance of gas ratios etc.
    A new section will be added with LTC faults that can be detected by DGA.

  TF3: Revision of Chapter 5 (Applied Norms and Basic Rules) – led by Deanna Woods
  Deanna reported:
  - The Classification scheme of LTC types (Annex A) will be revised, based on the findings of TF1.
    A 4th letter will be added to distinguish between in-tank and on-tank LTC models.
  - A new Annex containing a Table of LTC models worldwide and their classification will be added.
  - A method how to group data of comparable LTCs will be depicted.
  - Rules for use of Duval Triangle #2 (min. ppm gas levels required, etc.) to be added
  - The importance of additional data (e.g. op count, temperature, time since last oil change etc.) will be explained.

  Florin Faur made a statement about the need to define LTC conditions that would trigger an inspection. This may be suitable for being used with C57.152 LTC Field Testing Guide.

  TF4: Revision of Chapter 6 (Interpretation of LTC DGA Data) – led by William Solano (absent)
  Chris Whitten reported that the work on Chapter 6 has not started yet, as it is mainly based on the results from TF1.
  The main task is to describe how the interpretation methods, developed by TF1, can be applied:
  - Tables for 90/95% normal values for major LTC classes to be set up
  - Instructions how to use these Tables.
  - Evaluation flowchart, similar to C57.104.

  The work also includes maintenance of Annex C (Case Histories), Annex D (Duval Triangle), and maybe also parts of Annex B (examples for calculation of limits). A proposal was made to consider moving section 6.1 to Chapter 5 .

- Database Hosting by IEEE SA
  Chair then explained the database hosting by IEEE SA and the need to submit further data. So far, no new data have

been received. The problem is the extensive OLTC Data Template (EXCEL) which requests many additional data, which are either not available or difficult to access because they are stored in a different environment, apart from the DGA data. It causes a lot of work to compile the DGA data with LTC application and operational data.
Simplifying the Table was a Task from the Spring 2023 Meeting, but waiving of this additional information will hamper data evaluation and increase inaccuracy. This can be seen when processing the current data from TOA4 (TF1).
Further data providers are encouraged to deliver data to IEEE SA, as requested by Scott Reed by email from Sept 10, 2023. Scott Reed stated the need for a deadline to get data, which was defined to Dec 31, 2023. In case the data are generated by special conditions like heat run tests, this should be annotated.
Care must be taken when anonymizing the records: before replacing OLTC make and model by the classification, the LTC fluid volume and other model characteristics (e.g. number of phases, voltage class) should to be distilled from the LTC designation.

- New Business
  Samragni Dutta Roy (Siemens Energy) made a motion to expand the scope of the Guide to include voltage regulators (VR) to provide user with guidance on DGA. Motion 2nd by Craig Colopy.
  Users increasingly seek for guidance to interpret DGA from VRs, as it may represent its condition. The discussion revealed that there are significant differences between VRs and power transformers with LTC, concerning the amount of arcing, winding construction and insulating structure. Even if the interpretation method will be similar to a LTC, values of gases and ratios for failure detection may differ. Concerns were raised about the models with different mechanisms that may show differing gas patterns.
  It became clear that developing VR DGA interpretation rules is a complex task which would require a PAR extension. As this is not desirable, Chair proposed to set up a separate Task Force at the IF Subcommittee to explore voltage regulator DGA. This proposal was rejected. A new Annex should be set up instead which briefly describes the field of VR DGA.
  The WG voted: agree 9, disagree 6, abstain 2 => Motion passed. The decision will be brought up to the IF Subcommittee Meeting on Wed, Oct 25.
- Meeting was adjourned at 5:59 pm.

Appendix VII

Working Group C57.130 – Guide for the Use of Dissolved Gas Analysis Applied to Factory Temperature Rise Tests for the Evaluation of Mineral Oil-Immersed Transformers and Reactors

Tuesday, March 21, 2023
9:30 – 10:45 am
Hyatt Regency Hotel, Milwaukee, WI

Minutes of Working Group Meeting

Chair: Bruce Forsyth
Vice Chair: Jinesh Malde (Secretary)

Meeting Attendance:

Last Name	First Name	Status
Forsyth	Bruce	Chair
Malde	Jinesh	Vice-Chair
Alahmed	Alex	Member
Boettger	William	Member
Botti	Michael	Member
Calitz	David	Member
Castellanos	Juan	Member
Da Silva	Roberto	Member
Draper	Zachary	Member
Felton	Todd	Member
Garcia	Eduardo	Member
Kiparizoski	Zan	Member
Kirchenmayer	Egon	Member
Li	Chao	Member
Lucas	Tiffany	Member
Parenti	Tyler	Member
Patel	Nitesh	Member
Perjanik	Nick	Member
Sarkar	Amitabh	Member
Syed	Ali	Member
Thompson	Ryan	Member

Last Name	First Name	Status
Tolcachir	Eduardo	Member
Vir	Dharam	Member
Yuan	Guang	Member
Yun	Joshua	Member
Aleksandrowin	Daniel	Guest
Allison	Robert	Guest
Barker	Sean	Guest
Burk	Griffin	Guest
Chiang	Solomon	Guest
Chiem	Luiz	Guest
Dappen	Tim	Guest
Dominguez	Raul	Guest
Eshenroder	Jacob	Guest
Gardner	James	Guest
Hernandez	Ronald	Guest
Hopkins	Traci	Guest
Hopkinson	Phil	Guest
Johnson	Christopher	Guest
Khan	Qasim	Guest
Koeck	Klaus	Guest
Koualski	Rafal	Guest

Last Name	First Name	Status
Lambert	Jason	Guest
Mellin	Toni	Guest
Miller	Mike	Guest
Morales-Cruz	Emilio	Guest
Mushill	Paul	Guest
Nunn	Tommy	Guest
O'Malley	Anastasia	Guest
Poasset	Baptiste	Guest
Pouneh	Davoudi	Guest
Radbrandt	Ulf	Guest
Rainer	Frostcher	Guest
Shaikh	Abdul Majid	Guest
Steele	Hampton	Guest
Thompson	Jim	Guest
Tleokoulov	Anar	Guest
Vinicius	Rubio	Guest
Watson	Joe	Guest
Weiss	Zachory	Guest
White	Leon	Guest
Wilerson	Calil	Guest
Wright	Jeffrey	Guest

Quorum requirement was 33 of 65 members. 25 members were present, so quorum not met. 6 guests requested membership.
The Chair showed the IEEEE patent and copyright policies and asked the participants if there are any claims that should be reported regarding these policies. There were no claims brought up by attendees in the meeting.
The agenda and meeting minutes presented to the attendees was not approved as quorum was not met. Minutes of Fall 2022, Spring 2023 and Fall 2023 will be sent by email to the members for approval prior to Spring 2024 meeting. Minutes will be added to the IEEE C57.130 section on the website and they will be available in the subcommittee meeting minutes. The roster will be updated prior to Spring 2024 to improve the attendance requirement to meet quorum.
The scope and purpose were presented in the meeting and the Chair mentioned that the scope and purpose will include esters depending on the data collected and analyzed by the working group (WG).
WG milestones were presented. Substantive work needs to be completed by Fall 2024 so that the guide can be submitted to ballot in the Fall of 2024. Final submission of approved document is Fall 2025. The work of the WG was slowed down due to the mechanism to collect the data was not available. It is now available to the members and guests to upload the data to.
Lance Lewand (LL) presented on the "Data Request Form" to the WG. The following discussions took place:

- Data currently is being requested on mineral oil, natural ester (NE), and synthetic ester (SE) liquids.
- Jim Thompson (JT), previous Chair of C57.130-2015 analyzed the anonymous data collected for the standard and will upload the data in the new system.
- The Chair will provide the instructions on how to report the data. Additional request will be made to OEMs who manufacture transformers with NE and SE. Request will also be sent to them to provide guidance on limits currently used for esters.
- Serial number should be reported as same information may be reported by multiple entities (i.e. transformer OEMs, test labs, insulating liquid manufacturers). IEEE will anonymize the data so the serial number will not be available to the members.
- When submitting the data to IEEE, the subject line should state that the data is for IEEE C57.130.
- LL asked to the group why BIL rating is required and why some nameplates do not have that data but no responses received.
- DGA for overload condition discussed:
    - Egon Kirchenmayer (EK) mentioned that there can be different overload conditions based on current and temperature requirements. If the data is available, it should be added, especially data on the hotspot temperature.
    - Amitabh Sarkar (AS) mentioned that overload is not in the scope of the work however it is important information to collect.
    - Luiz Chem (LC) mentioned that top oil should be reported along with the time for the overload and per unit should be reported.
    - AS mentioned that the top oil is predefined and would not change.
    - LL proposed to the users to add information on the DGA test method as the different methods may have different gas levels. If data is reported in IEC method, a correction factor may be needed to change its equivalency to ASTM method.
    - LL added Propane, Propene, Butane and Butene to the list as there may be additional benefit to collect data as that may provide valuable information on ester liquids.

- The DGA data request will be sent to volunteers in December 2023. All DGA data will be requested to be submitted by January 2024. It will be anonymized and presented in the Spring 2024 meeting.
- LL will chair the taskforce (TF) to analyze at the data. 11 volunteers have agreed to be part of the TF.

Meeting adjourned at 10:45 am

Appendix VIII

Task Force – Development of a test method to determine the maximum continuous operating temperature of insulating liquids

Tuesday, Oct 24, 2023
3:15 PM – 4:30 PM
Kansas City, MO

Minutes of Task Force Meeting

Chair: Ahmed Gamil
Secretary: Roberto Ignacio da Silva

Attendees list:

First Name	Name	Role	Memb. Req.
Aleksander	Levin	guest	Y
Thomas	Prevost	guest	N
Kevin	Biggie	guest	Y
Tiffany	Lucas	guest	Y
Mike	Bonn	guest	N
Robert	Harper	guest	Y
Rob	Ghosh	guest	Y
Luke	Grandbois	guest	N
Zoltan	Roman	guest	Y
Marilia	Ribeiro	guest	Y
Nick	Perjanik	guest	Y
Tim	Tillery	guest	N
Jinesh	Malde	guest	N
Cesar	Liscano	guest	N
Attila	Giore	guest	Y
Brian	McBride	guest	Y
Roberto	Da Silva	guest	Y
Justin	Minikel	guest	Y
Zachary	Draper	guest	N
Edwin	Betancourt	guest	N
Kurt	Kaidener	guest	Y
Todd	Felton	guest	Y
Deniss	Carr	guest	N
Alan	Sbravati	guest	Y

Agenda

1) Introduction
2) Review Copyright IEEE SA Notification
3) Review Call for Patents
4) Introductions
5) Obtain Quorum
6) Approval of prior minutes
7) Introduction of Task Force leaders and updates

Minutes of Meeting

- Roberto Da Silva has accepted to be the secretary.
- In the absence of Ahmed, Alan Sbravati presented the initial results of analysis did by Ahmed.
- The group have requested to Ahmed set up a virtual meeting (maximum 1 moth after this meeting) to present (to the list members and previous virtual invitees) the initial analysis.
- The group have requested to Ahmed to repeat the result curves separated by laboratory.
- The group agreed to share the data.
- Aleksandr Levin has presented a topic for discussion: ”Practical Performance of Insulating Liquids”. He has proposed a survey to understand real performance of insulating liquids, but the group concluded that we are not ready for that. Aleksandr will prepare a draft of the form.
- Once Ahmed was not able to participate in the last 2 meetings, the group decided to keep him as the chair with the condition to his participation in the next meeting Spring 2024.