

# Annex G Insulating Fluids Subcommittee

November 17, 2021  
Virtual Meeting

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

## G.1 Introductions, Roll Call of Members for Quorum, Meeting Agenda Approval, S21 Minutes Correction and Approval, and Chair's Comments

### G.1.1 Chair's Opening Remarks:

- a. Presentation of the Vice-Chair, Jerry Murphy, and the Secretary Alan Sbravati.
- b. Reminded that the SC minutes are due December 30, 2021- 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 (Dec 7<sup>th</sup>, 2021).

### G.1.2 Roll Call of SC members: (Quorum requirement: 22 minimum)

- a. 32 Members signed in, from a total of 47 members. Quorum was achieved.
- b. Total of 105 attendees. 51 Guests and 22 new attendees, and 10 requested membership, whose eligibility will be verified.
- c. Registered Attendance:

Gregory Ante	Guest	Norman Field	Guest
Elise Arnold	Guest	George Frimpong	Guest
Claude Beauchemin	Member	Rainer Frotscher	Guest
Jeff Benach	Guest	James Gardner	Guest
Kevin Biggie	Guest	Rob Ghosh	Guest
William Boettger	Member	James Graham	Member
Dominique Bolliger,	Guest	Attila Gyore	Member
Paul Boman	Member	Robert Harper	Guest
Jeremiah Bradshaw	Guest	Roger Hayes	Member
Erich Buchgeher	Guest	Ronald Hernandez	Guest
David Calitz	Member	Andrew Holden	Member
Edward Casserly	Member	David Holland	Guest
Juan Castellanos	Member	Daniel Huenger	Guest
Sudip Chanda	Guest	John John	Member
Luiz Cheim	Member	Toby Johnson	Member
Larry Christodoulou	Member	Kurt Kainerder	Member
Michael Dahlke	Guest	Zan Kiparizoski	Member
Sami Debass	Guest	John Lackey	Guest
Stephanie Denzer	Member	Donald Lamontagne	Member
Larry Dix	Guest	Andrew Larison	Guest
Don Dorris	Member	Tiffany Lucas, P.E.	Guest
Zachary Draper	Guest	Alejandro Macias	Guest
James Dukarm	Member	Jinesh Malde	Member
Samraghi Dutta Roy	Guest	Darrell Mangubat	Guest
Marco Espindola	Guest	Balakrishnan Mani	Guest
Marcos Ferreira	Guest	Robert Mayer	Guest

Timothy Menter	Guest	Mickel Saad	Member
Aaron Meyers	Guest	Alan Sbravati	Secretary
Rashed Minhaz	Guest	Cihangir Sen	Guest
Hali Moleski	Guest	Peter Sheridan	Guest
Paul Morakinyo	Guest	Avijit Shingari	Guest
Anatoliy Mudryk	Guest	Stephen Shull	Guest
Jerry Murphy	Vice-Chair	Igor Simonov	Guest
Jayne Nunes, Jr	Guest	Jonathan Sinclair	Guest
Stephen Oakes	Guest	Fabian Stacy	Member
Anastasia O'Malley	Guest	Hampton Steele	Guest
Parminder Panesar	Member	Paul Su	Guest
Nicholas Perjanik	Member	David Sundin	Guest
John Poelma	Guest	James Thompson	Guest
Adam Polson	Guest	Ryan Thompson	Member
Alvaro Portillo	Guest	Timothy Tillery	Guest
John Prunte	Guest	Mark Tostrud	Guest
Donnell Rackley	Guest	Risto Trifunoski	Guest
Jimmy Rasco	Guest	Alwyn Van Der Walt	Guest
Timothy Raymond	Member	Dejan Vukovic	Guest
John Reagan	Guest	Dieter Wagner	Guest
Scott Reed	Chair	Daniel Weyer	Guest
Sebastian Rehkopf	Guest	William Whitehead	Guest
Jonathan Reimer	Guest	Christopher Whitten	Guest
Clemens Reiss IV	Guest	Helena Wilhelm	Guest
Afshin Rezaei-Zare	Member	Malia Zaman	Guest
Josue Rodriguez	Guest	Anand Zanwar	Guest
Zoltan Roman	Guest		

### **G.1.3 Agenda Approval:**

- a. A motion was made by Claude Beauchemin and seconded by David Sundin to approve the agenda. The agenda was approved unanimously without objection.

### **G.1.4 Approval of minutes from the S21 meeting (virtual):**

- a. A motion was made by Ed Casserly and seconded by Claude Beauchemin to approve the minutes. The minutes were approved unanimously without objection.

### **G.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 expires in December 2022, and the first balloting is expected to happen in Feb/22. 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. C57.637, C57.130, C57.139 will expire in 2025.
- d. The chair of C57.130 resigned. This will be discussed under new business topic.
- e. C57.104 will expire in 2029.
- f. C57.146, C57.155, C57.637 and C57.166 have active PAR's.

## **G.2 WG & TF Reports Presented at the SC Meeting**

### **G.2.1.1 IEEE C57.166 Consolidation of Insulating Liquids Guides (PAR Expiration: Dec 2022)**

WG Chair: Tom Prevost (interim Scott Reed)

**The report of the WG Meeting was presented at the IFSC meeting by Scott Reed:**

- a. The WG meeting had 30 of 40 members were present so a quorum was achieved.
- b. Call for patents was presented without any claim.
- c. Five Task Forces chairs each gave a status report of their respective sections.
- d. TF1, with Jinesh Malde, already completed their draft and shared with TF6.
- e. TF2 is with Scott Reed. Only pending topic was the in-service limits for synthetic ester liquids, and the presented values were accepted by the group. Draft is going to be shared with TF6 soon.
- f. TF3 is with Alan Sbravati. Work is completed, and already shared with TF6.
- g. TF5 is with Rainer Frotscher. The document was modified according to last meeting decisions. Some pending topics around the breakdown voltage limits, which need to be harmonized with the limits of the transformer. Testing per ASTM D877 will be removed. A table with values for energization after maintenance interventions is required. A suggestion for moving this to C57.637 was rejected.
- h. TF6 is now working on the merging of the individual drafts. A conference call will be scheduled in early January for ensuring compatibility and consistency across the guide. All members and guests will be informed of this meeting.
- i. The expectation is to have the guided balloted prior to the S22 meeting.

See *Appendix I* for the F21 Minutes (unapproved) of C57.166 WG Meeting as submitted.

### **G.2.1.2 IEEE C57.146 IEEE Guide for Interpretation of Gasses Generated in Silicone-Immersed Transformers (PAR Expiration extended to Dec 2024)**

WG Chair: Jon Karas

- a. Attendance total 39, members 8, guest 22 and 2 requested. Quorum was not achieved.
- b. No patent claim was presented.
- c. Scott Reed recommended an electronic poll of members for approval of Spring 2021 and Fall 2021 Meeting Minutes.
- d. Chair gave timeline of Guide progress with the Guide expiration at the end of 2021, a PAR extension was given to 2024
- e. Claude Beauchemin presented some statistics. They are preparing values for different levels, including 90<sup>th</sup> and 95<sup>th</sup> percentiles.

See *Appendix II* for the F21 Minutes (unapproved) of C57.146 WG Meeting as submitted.

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

TF Chair: Claude Beauchemin

- a. The working group had 110 attendees. Out of the 59 members, 31 attended the meeting, confirming quorum.
- b. One patent claim was presented by Don Lamontagne and it will be verified.

- c. Don Lamontagne presented very interesting case studies on the use of on-line monitoring in Arizona Public Services. Both short- and long-term trends were identified, and several failures were prevented. Several questions were presented and answered by the presenter.
- d. A publication of 2 papers which may be of interest of the SC was mentioned. The creation of a working group in Cigre for on-line DGA monitoring was mentioned and discussed.
- e. The IFSC chair reinforced the need of having the presentations posted in the transformer committee website. Claude will follow-up.
- f. Meeting was adjourned.

See *Appendix III* for the F21 Minutes (unapproved) of C57.104 TF Meeting as submitted.

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

WG Chair: Stephanie Denzer

- a. This is a new working group. PAR was approved.
- b. All attendees will be made members, excluding who expressed the intention of not becoming a member in the chat.
- c. Call for patents was presented, without claims. Copyright slides were presented.
- d. The standard was divided in four portions and task forces were created for analyzing each of them.
- e. The working group is requesting more volunteers for the task forces.

See *Appendix IV* for the F21 Minutes (unapproved) of C57.637 WG Meeting as submitted.

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

WG Chair: Alan Sbravati

- a. This is a new working group. PAR was approved.
- b. The attendees who requested membership during the TF meeting were made members. Attendees of this meeting who request membership in the chat will become members.
- c. No patent claims were presented. Copyright slides were presented.
- d. Next topic was the discussion of the Title, Scope and Purpose. Motions were presented and the three items were modified accordingly. During the PAR approval there were some edits in the proposed texts, which will be presented to the working group during S22 meeting.
- e. The main discussion was around the procedure for collecting data on historical values of dissolved gas content. The main proposal is to create a computational routine to be applied by each of the laboratories on their database, generating the statistical data to be used by this WG. A task force was created, and it will be led by Jon Karas.
- f. A second task force was created for starting to review the content of the standard, for avoiding duplications / conflicts with the current version of IEEE C57.104.
- g. Meeting was adjourned.

See *Appendix V* for the F21 Minutes (unapproved) of C57.155 WG Meeting as submitted.

#### **G.2.1.6 Task Force C57.139 – Guide for the Interpretation of Gases generated in Liquid Type Load Tap Changers**

TF Chair: Rainer Frotscher

- a. The task force had 43, with 11 attendees requesting membership.
- b. Call for patents showed none at this time.
- c. Copyright Policy was discussed.
- d. Title, scope and Purpose were discussed and changed during the meeting.
- e. Chair then showed possible improvements of the Guide, such as adding limit values for major LTC classes, which would need to set up a database with LTC DGA data, or to receive parametrics from DGA data sets.

- f. Chair asked for volunteers for the new Working Group: Active members, Vice Chair and Secretary are needed. Paul Boman volunteered to act as Secretary, Chair accepted and thanked

See *Appendix VI* for the F21 Minutes (unapproved) of C57.139 TF Meeting as submitted.

### **G.3 Old Business**

- a. No old business

### **G.4 New Business**

- a. The subcommittee needs a new volunteer for becoming the chair of the task force for the revision of C57.130, since John Foschia resigned from that position.
- b. Alan Sbravati presented a request for the Task Force he was coordinating within the WG PC57.154, which belongs to the Insulation Life Subcommittee to become a new Task Force in the Insulating Fluids Subcommittee. There were some discussions around what the correct procedure for such situation is. This will be verified by the chair and discussed with the chair of ILSC. A conclusion will be presented in the S22 meeting.

### **G.5 Next IFSC Meeting:**

March 30, 2022 – Denver, CO

### **G.6 Adjournment**

A motion for the meeting to be adjourned was presented by Claude Beauchemin and seconded by Ed Casserly.

The subcommittee adjourned at 3:32 p.m.

Respectively Submitted, Alan Sbravati, Secretary IFSC

*Unapproved Minutes from the F21 IFSC WG and TF meetings*

*Appendix I*

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

**Tuesday, November 16<sup>th</sup>, 2021  
12:55 – 2:10 PM (central time)  
Virtual Meeting**

**Minutes of Working Group Meeting**

Chairman Interim Scott Reed (temporarily replacing Tom Prevost)  
Vice Chair Scott Reed  
Secretary Alan Sbravati

The meeting was called to order at 12:55 pm by the Chair.

There were 30 of 40 members present. There were 72 guests. A membership quorum was achieved.

Attendance list:

Juan Acosta	Guest	Andrew Holden	Guest
Jennie Aldenlid	Guest	David Holland	Guest
Rehan Ali	Guest	Daniel Huenger	Guest
Barry Beaster	Guest	John John	Guest
Claude Beauchemin	Member	Toby Johnson	Member
Olle Benzler	Guest	Kurt Kaineder	Member
Enrique Betancourt	Guest	Jon Karas	Member
Kevin Biggie	Guest	Nathan Katz	Guest
William Boettger	Guest	Gael Kennedy	Guest
Dominique Bolliger,	Member	Zan Kiparizoski	Member
Jeremiah Bradshaw	Member	Dmitriy Klempner	Guest
Edward Casserly	Member	Michelle Kutzleb	Guest
Luiz Cheim	Member	Donald Lamontagne	Guest
Larry Christodoulou	Guest	Olivier Lejay	Guest
Brandon Dent	Guest	Aleksandr Levin	Guest
Stephanie Denzer	Member	Tiffany Lucas, P.E.	Guest
Eric Doak	Guest	Jinesh Malde	Member
Don Dorris	Member	Darrell Mangubat	Guest
James Dukarm	Guest	Terence Martin	Guest
George Frimpong	Guest	Robert Mayer	Guest
Rainer Frotscher	Member	James Mciver	Guest
Eduardo Garcia Wild	Member	Susan McNelly	Member
James Gardner	Member	Aaron Meyers	Guest
Ali Ghafourian	Guest	Hali Moleski	Guest
Rob Ghosh	Guest	Ali Naderian	Guest
Orlando Giraldo	Guest	Ashmita Niroula	Guest
James Graham	Member	Jayme Nunes, Jr	Guest
Ismail Guner	Guest	Anastasia O'Malley	Guest
Attila Gyore	Guest	Parminder Panesar	Guest
David Hanson	Guest	Rakesh Patel	Guest
Robert Harper	Guest	Pranav Patabi	Guest
Roger Hayes	Member	Nicholas Perjanik	Member
Ronald Hernandez	Guest	Alvaro Portillo	Guest

Donnell Rackley	Guest	Brian Sparling	Guest
Kevin Rapp	Member	Fabian Stacy	Guest
Jimmy Rasco	Guest	Gregory Steeves	Member
Robert Rasor	Member	Paul Su	Guest
Timothy Raymond	Member	David Sundin	Guest
Scott Reed	Vice-Chair	Troy Tanaka	Guest
Sebastian Rehkopf	Guest	James Thompson	Guest
Diego Robalino	Member	Ryan Thompson	Guest
Patrick Rock	Member	Timothy Tillery	Guest
Josue Rodriguez	Guest	Cole Van Dreel	Guest
Andre Rottenbacher	Guest	Dejan Vukovic	Guest
Mickel Saad	Member	David Wallach	Guest
Alan Sbravati	Secretary	Daniel Weyer	Guest
Pugal Selvaraj	Member	William Whitehead	Guest
Peter Sheridan	Guest	Christopher Whitten	Guest
Igor Simonov	Guest	Helena Wilhelm	Guest
Jonathan Sinclair	Member	Malia Zaman	Guest
Mauricio Soto	Guest	Peter Zhao	Guest

## Introductions

Approval of Agenda

Approval of Spring 2021 Minutes

Call for Patents ... Please read slides before meeting

Review of Copyright Policy.... Please read slides before meeting

Review of Scope and Purpose

Review of Document Structure and Task Forces

Task Force Reports

TF1 Types of Insulating Liquids—Jinesh Malde

TF2 In Service—Scott Reed

TF3 Mixture of Insulating Liquids—Alan Sbravati

TF5 Insulating Liquids for LTCs—Rainer Frotscher

TF6 Editorial—Toby Johnson

## New Business

Adjourn

The agenda of the meeting was presented by the chair. A motion for approval was presented by Don Dorris, and seconded by Eduardo Garcia. Without objections, the agenda was unanimously approved. A motion for approving the minutes of meeting from S21 was presented by Ed Casserly, seconded by David Sundin. No comments were presented, minutes from Spring 2021 were approved unanimously.

Chairman posted the Patent Claim. No claims were made.

Chairman presented the copyright policy slides.

The first discussed topic was the next steps for completing the work till the PAR expiration, which is due by Dec/22. Ideally, the proposed text should be balloted before the S22 meeting. Considering that Task Forces 1 to 5 completed most of their work, some additional effort on Task Force 6 for combining / harmonizing all the chapters may allow having a draft before next meeting.

Presentations of the task force activities

TF 1 – Jinesh Malde

- The draft was completed and shared with Toby Johnson. No pending topics.

TF 5 – Rainer Frotscher

- The draft was adjusted according to the decisions from S21 meeting, adopting the same voltage classes of TF1.
- The values of breakdown voltage were discussed, and it was agreed to remove the testing per ASTM D877 for both unused fluid and in-service conditions

- For in-service conditions, the requirement of visual inspection will be maintained, excluding a limit for fluid color.
- Values of breakdown voltage need to be harmonized with those applied for the transformer.
- Specifically for natural ester liquids, it was suggested to include in the text as assessment of the variation of viscosity, as the main indication of fluid oxidation.
- There is an additional table for the tap changers, with the required properties after maintenance prior to re-energization. These values are lower than the unused limits, and higher than the continuous service limits. The possibility of moving this table to the IEEE Std. 637 was discussed and rejected.

TF 3 – Alan Sbravati

- The draft was completed in May/21.
- Latest version will be shared with TF 6 (Toby).

TF 2 – Scott Reed

- Only open question was regarding the in-service limits for synthetic ester liquids.
- The suggestion was to adopt the same limits currently applied for natural ester liquids, adding a table note for the values of acidity in the case of free breathing transformers.

TF 6 – Toby Johnson

- Activities of this task force are starting now.
- Additional meetings will be scheduled in January / February for completing the first draft and harmonizing the values.
- All working group members and guests will be informed.

New Business: No new business.

The meeting was adjourned at 2:08 pm.

Alan Sbravati, Secretary  
Scott Reed, Vice Chair / Interim Chair



## *Appendix II*

### **Working Group C57.146 IEEE Guide for DGA in Silicone**

**Monday, November 15th, 2021  
10:50 PM to 11:51 AM (central time)  
Virtual Meeting**

#### **Minutes of Working Group Meeting**

Chair Jon Karas / Vice Chair Toby Johnson  
Secretary Paul Boman

Attendance total 39, members 8, guest 22 and 2 requested membership

F21 Meeting Attendance at end of meeting

Role	First Name	Last Name
Member	Claude	Beauchemin
Secretary	Paul	Boman
Member	Eric	Davis
Member	Dmitriy	Klempner
Guest	John	Lackey
Member	Scott	Reed
Guest	Jeff	Benach
Guest	Juan	Castellanos
Guest	Antonio	Ceballos
Guest	Luiz	Cheim
Guest	Larry	Christodoulou
Member	Zack	Draper
Guest	James	Dukarm
Guest	Bruce	Forsyth
Guest	George	Frimpong
Guest	Rainer	Frotscher
Guest	Lorne	Gara
Member	Jim	Graham
Guest	Robert	Harper
Guest	Ronald	Hernandez
Guest	David	Holland
Guest	Axel	Kraemer
Guest	deepak	Kumaria*
Guest	Michelle	Kutzleb
Guest	Hali	Moleski
Guest	Anatoliy	Mudryk
Guest	Martin	Muñoz
Guest	Arturo	Nunez
Guest	Harry	Pepe
Guest	Nick	Perjanik

Guest	Josue	Rodriguez*
Member	John	Prunte
Guest	Wes	Schrom
Guest	Jonathan	Sinclair
Guest	Mauricio	Soto
Guest	David	Sundin
Guest	Risto.	T
Guest	Bill	Whitehead
Guest	Helena	Wilhelm

\*Requested Membership

Call for patents – none at this time

Copyright discussed

Membership roll call where quorum was not met for this meeting

Scott Reed recommended an electronic poll of members for approval of Spring 2021 and Fall 2021 Meeting Minutes.

Chair gave timeline of Guide progress with the Guide expiration at the end of 2021, a PAR extension was given to 2024.

Claude Beauchemin presented the analysis for 4 sets of DGA data  
Data for combustible gas 90th percentile

Data categories for oxygen to nitrogen ratio for  $<0.2$  and  $\geq 0.2$  along with total mean values.  
Comparison was also provided to CIGRE TB433 and C57.146-2005 Edition data  
Transformer data set ages clustered between 1980 and 2010

Members asked for the 95th percentile and oxygen since silicon gassing dependent on oxygen concentration.

Claude Beauchemin explained the rules used for the C57.104 Guide development like rounding number for the various ranges of data.

Meeting adjourned

## *Appendix III*

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

**Monday, November 15<sup>th</sup>, 2021  
3:45 PM - 5:00 PM (central time)  
Virtual Meeting**

#### **Minutes of Task Force Meeting**

The virtual meeting was called to order by Chair Claude Beauchemin at 3:45 PM central time. Claude introduced himself, Norman Field (Vice Chair) and Hali Moleski (Secretary). There were 110 attendees at the start of the meeting. There are 59 members, with 23 attendees that requested membership last meeting (Spring 2021). Quorum was made with 31 of the 59 members according to the poll. Of those 23 that had requested membership, 13 were in attendance in this meeting (*italicized below*). These 72 members are listed below. There were 6 attendees that requested membership this meeting. If all membership requests were accepted, the new membership count would be 78 members.

Members (59 original and 13 new based on F21 meeting attendance):

- |                              |                               |
|------------------------------|-------------------------------|
| 1. Anand Zanwar              | 30. Juan Acosta               |
| 2. Anastasia O'Malley        | 31. Kris Zibert               |
| 3. Bill Whitehead            | 32. Mani Kumar                |
| 4. Bob Rasor                 | 33. Larry Christodoulou       |
| 5. Brad Staley               | 34. Lee Doyle                 |
| 6. Brady Nesvold             | 35. Luiz Cheim                |
| 7. Cihangir Sen John         | 36. Marco Espindola           |
| 8. Claude Beauchemin (Chair) | 37. Markus Schiessl           |
| 9. David Calitz              | 38. Michael Botti             |
| 10. David Murray             | 39. Mickel Saad               |
| 11. David Wallach            | 40. Monty Goulkhah            |
| 12. Diego Robalino           | 41. Nick Perjanik             |
| 13. Dmitriy Klempner         | 42. Nitesh Patel              |
| 14. Don Dorris               | 43. Norman Field (Vice Chair) |
| 15. Donald Lamontagne        | 44. Oleg Roizman              |
| 16. Dwight Parkinson         | 45. Paul Boman                |
| 17. Emilio Morales-Cruz      | 46. Roger Hayes               |
| 18. Eric Doak                | 47. Samraghi Dutta Roy        |
| 19. Erich Buchgeher          | 48. Scott Reed                |
| 20. Florin Faur              | 49. Shiva Rampersad           |
| 21. Hali Moleski (Secretary) | 50. Stacey Kessler            |
| 22. James Dukarm             | 51. Stephanie Denzer          |
| 23. Jayme Nunes              | 52. Stuart Chambers           |
| 24. Jerry Murphy             | 53. Sukhdev Walia             |
| 25. Jim Graham               | 54. Susan McNelly             |
| 26. John K John              | 55. Timothy Raymond           |
| 27. John Prunte              | 56. Ashmita Niroula           |
| 28. John Sinclair            | 57. William Boettger          |
| 29. Jon Karas                | 58. Zack Draper               |

59. Zan Kiparizoski

60. *Afshin Rezaei-Zare*  
61. *Amitahh Sarkar*  
62. *Anatoliy Mudryk*  
63. *Anthony Franchitti*  
64. *Balakrishnan Mani*  
65. *Brian Sparling*  
66. *George Frimpong*

67. *Ion Radu*  
68. *James Gardner*  
69. *Juan Castellanos*  
70. *Mike Waldrop*  
71. *Robert Harper*  
72. *Stephan Brauer*

#### Attendees Requesting Membership

1. Edmundo Arevalo
1. Elise Arnold
2. Ismail Guner
3. Arturo Nunez
4. Josue Rodriguez
5. Risto Trifunoski

The agenda was reviewed along with patent call and copyright policy. None were opposed to the Spring 2021 meeting minutes emailed prior to the conference. Motion to approve was by Jon Karas and seconded by Jon Sinclair.

Next, a presentation was given by Donald Lamontagne on online monitoring analytical techniques specific to transformer dissolved gas analysis. Don shared that this was also presented in C57.143 annex. And that a patent claim was submitted. After the presentation, discussion followed.

Phil Hopkins – Has Don been able to associate certain gasses based on causal events (example was given as to solar transformers and certain increased gassing traced back to phenomena in the core)? Don replied he did not look at transformers hooked up to solar inverters. He would expect the type of gasses unique to these units, and there would need to be specific changes made to algorithm used in TOAN.

Luiz Cheim asked if Don could explain what was patented. Claude stated we could not discuss the detail of the patent. Don said that when the letter of agreement is posted, it will show what is patented.

Luiz asked how the algorithm handles the fact that CO and CO<sub>2</sub> may not necessarily be from paper aging. Don shared that all their transformers are sealed.

Claude thanked Don for his presentation.

Claude reviewed the activities of the CIGRE WG D1/A2.77 “Liquid Tests for Electrical Equipment”. Proposal for a CIGRE/IEC centralised data repository of transformer related test and operating information. The slides were not all read, but Claude said they would be in the meeting minutes. See below in Italics.

*It had been observed by various members of the WG that obtaining the data required to develop improved diagnostic techniques, such as for example DGA interpretation or insulating liquids quality assessment, is often one of the main difficulties of the WG task.*

*CIGRE WG are per their nature temporary (2 – 3 years) and group typically a few dozen of world experts tasked to address specific questions about topics of interest to the general community of energy production.*

*In most cases, addressing those specific questions require large amount of data to be available for review and discussion to produce improvements in methods of analysis or in procedures of operation. Obtaining this data has proven to be quite difficult, requiring a large amount of time and efforts, taking a valuable part of the time and resources available to the WG. Unfortunately, when the WG conclude its task and is disbanded, the accumulated data is lost, as there is no "universal" permanent repository available where the WG could transfer the data it accumulated for the benefit of the next WG that will address a similar topic in the future.*

*A good example is data for Dissolved Gases Analysis (DGA). There have been several WG working on the topic of DGA interpretation in the past few decades and several Technical Brochures have been issued on this topic (In the last 15 years: TB 296, TB 409, TB 443, TB 771 and TB 783). Each time the WG convenor had to request various WG members to supply "had hoc" data in order to generate the interpretation method updates or new limits tables. After each of those WG had completed their work, the accumulated data was not retained.*

*We therefore propose the constitution of a central repository to collect and conserve data accumulated by the various WG. This repository could either be hosted by the CIGRE, the IEC or be a joint operation.*

*We recognise that such endeavor will have to address several possible roadblocks to be successful, but we consider the required effort to be worthwhile. Some of the items that will need to be addressed for success are as follow:*

*Protection of data supplier's anonymity with its associated NDA and other legal considerations (including "opting out" option from specific future WG).*

*Data security.*

*Universal transformer "Basic data set" containing the information of use for various tasks (e.g. Type, size, rating, insulating liquid, oil preservation system, loading....)*

*Uniformized data format (It will be different for each different type of data but need to be uniform withing a category, regardless of the data supplier).*

*Long term data storage and maintenance.*

*Control of data access to prevent missuses.*

*Clear usage protocols and user's obligations, including users NDA.*

*Some of the work already performed by various WG, specifically or partially, on data handling and integration (for example, TB 298, TB 630, TB 706 and TB 761) probably contain information useful in addressing some of the items mentioned above.*

Claude mentioned some publications of interest that are relevant to our TF.

"The Data Behind the Numbers: IEEE C57.104TM-2019 DGA Interpretation Guide" By C. Beauchemin, L. Cheim and N. Field. Transformer Technology Magazine, January 2022.

"Near-Term Failure of Transformers Using Reliability Statistics on Dissolved Gas Analysis". by Z.H. Draper and J. J. Dukarm. In 2021 CIGRE Canada Conference, number 408, Toronto ON, October 2021.

Then a list of IEEE Working Group and Task Forces were given that were relevant to our task force.

Monday 10H50: WG Guide for DGA in Silicone PC57.146, J Karas

Monday 14H20: WG Transformer Monitoring C57.143, M. Spurlock

Tuesday 10H50: TF Guide DGA for Factory Temp Rise Tests - C57.130, J. Foschia

Tuesday 14H20: WG Guide DGA in Ester-Immersed Transformers PC57.155, A. Sbravati

Tuesday 15H45: TF Revision of Guide for DGA in LTCs C57.139, R. Frotscher

Claude asked if there was any new business.

Mickel Saad asked if data was gathered on industrial transformers. Claude said that the data used in C57.104 does have a decent number of small transformers. It was also noted that some types such as windfarm transformers behave differently, and cautionary statements are given accordingly. Though that is one area of improvement that is not done yet. Another improvement to 104 would be to cover online DGA data.

Luiz Cheim noted that CIGRE had a proposal in consideration for a Working Group on online monitoring as well. It is not approved yet but may know in 6 months or so if approved.

No new business was brought forward. Meeting was adjourned unanimously a few minutes past five o'clock central time.

## *Appendix IV*

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

**Tuesday, November 16<sup>th</sup>, 2021  
9:25 AM – 10:40 AM (central time)  
Virtual Meeting**

#### **Minutes of Working Group Meeting**

The meeting was called to order at 9:25 am (c.s.t) by Chair Stephanie Denzer. Scott Reed (Vice-Chair) and Andy Holden (Secretary) were also present.

Attendees:

This was the first meeting of the Working Group so attendance today will trigger automatic membership. There were 54 attendees.

1. Alan Sbravati
2. Aleksandr Levin
3. Anand Zanwar
4. Andy Holden
5. Ashmita Niroula
6. Bob Rasor
7. Christopher Whitten
8. Colin Clark
9. Darrell Mangubat
10. David Holland
11. David Sundin
12. Dejan Vuković
13. Don Dorris
14. Donnie Rackley
15. Ed teNyenhuis
16. Edward Casserly
17. Eric Doak
18. George Frimpong
19. Greg Steeves
20. Hali Moleski
21. Helena Wilhelm
22. Igor Simonov
23. Ismail Guner
24. Jayme Nunes
25. Jeremiah Bradshaw
26. Jim Graham
27. Jimmy M Rasco
28. Jinesh Malde
29. John Poelma
30. John Prunte
31. Jon Karas
32. Jonathan Sinclair
33. Josue Rodriguez
34. Juan Acosta
35. Kevin Biggie
36. Larry Christodoulou
37. Lorne Gara
38. Marc Foata
39. Mickel Saad
40. Nick Perjanik
41. Paul Boman
42. Rajkumar Padmawar
43. Robert Harper
44. Roger Hayes
45. Ryan Thompson
46. Scott Reed
47. Sebastian Rehkopf
48. Shibao Zhang
49. Stacey Kessler
50. Stephanie Denzer
51. Thomas Hartmann
52. Tim Peterson
53. Timothy Raymond
54. Wes Schrom

Due to the time constraints, attendees did not introduce themselves.

#### Agenda

- 1) Introduction
- 2) Reviewed Call for Patents
- 3) Reviewed Copyright Notification.
- 4) Reviewed Title, Scope and Purpose
- 5) Reviewed the Guide C57.637-2015
- 6) Call for Task Force volunteers

#### Chair's Remarks:

Chairwoman Denzer requested a call for patents and no claims were made. Next, she reviewed with the Task Force the IEEE's copyright policy, of which no comments were made.

The Chair focused her time on reviewing the current guide and the creations of Task Forces to divide the work of including esters (natural & synthetic), silicone, and less flammable hydrocarbons (LFHs) to the guide. The following Task Forces were established:

- Task Force 1 – Overview, Normative References, & Definitions
- Task Force 2 – Classification of Service Aged Oils (Liquids) & Criteria for Reuse
- Task Force 3 – Types of Reconditioning & Reclamation Processes
- Task Force 4 – Oil (liquid) Tests & Their Significance
- Editor at Large

Volunteers were found to lead each Task Force and will be confirmed during the coming weeks.

The meeting was called to order at 11:20 am (c.s.t) by Chair Stephanie Denzer.



## *Appendix V*

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

**Tuesday, November 16<sup>th</sup>, 2021  
14:20 – 15:35 PM (central time)  
Virtual Meeting**

### **Minutes of Working Group Meeting**

The meeting was called to order at 14:20 am by the Chair.

There were 19 of 25 members present during the meeting, at time of the poll there were 16 members, however this was the first WG meeting after a TF meeting in Spring 2021. There were 62 guests, 13 membership requests which were granted after the meeting.

A “provisional” membership quorum was achieved, but as a first WG meeting, there is no meaning of it.

#### Attendance list:

1	Juan Acosta	Guest	42	Terence J. Martin	Guest
2	Elise Arnold	Member	43	Rogelio Martinez	Guest
3	Javier Arteaga	Guest	44	Robert Mayer	Guest
4	Barry Beaster	Guest	45	Matthew Mcfadden	Guest
5	Claude Beauchemin	Member	46	Tim Menter	Guest
6	Jeff Benach	Guest	47	Aaron Meyers	Guest
7	Paul Boman	Member	48	Ronnie Minhaz	Guest
8	Jeremiah Bradshaw	Member	49	Hali Moleski	Guest
9	David Calitz	Guest	50	Paul Morakinyo	Guest
10	Edward Casserly	Member	51	Anatoliy Mudryk	Guest
11	Juan Castellanos	Guest	52	Jerry Murphy	Guest
12	Luiz Cheim	Member	53	Kris Neild	Guest
13	Larry Christodoulou	Guest	54	Ashmita Niroula	Guest
14	Bhaba Das	Guest	55	Stephen Oakes	Guest
15	Eric Doak	Guest	56	Nick Perjanik	Member
16	Don Dorris	Guest	57	Donnie Rackley	Guest
17	Zack Draper	Guest	58	Kevin Rapp	Member
18	James Dukarm	Guest	59	Scott Reed	Guest
19	Tommy Eagle	Guest	60	Sebastian Rehkopf	Guest
20	Marco Espindola	Guest	61	Jonathan Reimer	Guest
21	Ed Feloni	Guest	62	Josue Rodriguez	Member
22	George Frimpong	Member	63	Alan Sbravati	Chair
23	Rainer Frotscher	Member	64	Peter Sheridan	Guest
24	Lorne Gara	Guest	65	Jonathan Sinclair	Guest
25	James Gardner	Guest	66	Muhammad A. Sohail	Guest
26	Rob Ghosh	Guest	67	Brian Sparling	Guest
27	Orlando Giraldo	Guest	68	Markus Stank	Guest
28	Jim Graham	Member	69	Hampton Allen Steele	Guest
29	Attila Gyore	Secretary	70	Paul Su	Guest
30	David Hanson	Member	71	Ryan Thompson	Guest
31	Robert Harper	Member	72	Tim Tillery	Guest
32	Roger Hayes	Guest	73	Risto Trifunoski	Guest
33	David Holland	Guest	74	Krishnamurthy Vijayan	Guest
34	Toby Johnson	Guest	75	Dejan Vuković	Guest
35	Jon Karas	Member	76	Pragnesh Vyas	Guest
36	Gary King	Guest	77	Bill Whitehead	Member
37	Michelle Kutzleb	Guest	78	Christopher Whitten	Guest
38	Aleksandr Levin	Guest	79	Helena Wilhelm	Guest
39	Tiffany Lucas	Guest	80	Mana Yazdani	Guest
40	Nigel Macdonald	Guest	81	Anand Zanwar	Guest
41	Jinesh Malde	Member			

Previously circulated agenda (which structure was slightly differed from the showed one as points 7/8 were combined)

1. Introductions
2. Approval of Agenda
3. Review of Spring 2021 Task Force Minutes
4. Call for Patents ... Please read slides before meeting
5. Review of Copyright Policy.... Please read slides before meeting
6. Review of Scope and Purpose
7. Review of Document Structure
8. Possible definition of Task Forces
9. New Business
10. Adjourn

The agenda of the meeting was presented by the chair.

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

5. Chair presented the copyright policy slides.

#### 6. Review of Scope and Purpose

The group has approved Scope and Purpose which were submitted in the PAR. Claude Beauchemin (CB) pointed that we did not need to change the scope and purpose beforehand, it is a good practice if we do small changes along the work and then before balloting a change in the PAR is requested.

The texts approved in the PAR request are:

Title:

Guide for the Interpretation of Gases Generated in Natural and Synthetic Ester Liquid Type Transformers

Scope:

The guide's application is for natural and synthetic ester-immersed transformers. This guide addresses the following:

- The theory of combustible gas generation in a natural and synthetic ester-filled transformer.
- Interpretation of the gas analysis.
- Suggested operating procedures.
- Various diagnostic techniques.
- Case studies and examples.
- Evaluation criteria and guidelines.
- A bibliography of related literature

Purpose:

The purpose of this guide is to assist the transformer operator in evaluating dissolved gas analysis (DGA) results obtained from natural and synthetic ester liquid type transformers.

#### 7/8 Review of Document Structure / Possible Improvements

Luiz Cheim (LC) questioned whether we want to collect data and it is the scope

Alan Sbravati (AS) replied we need data collection, and this is covered by the scope

Long discussion on the structure of the new C57.155 document which could follow the structure of C57.104 (IEEE Guide for the Interpretation of Gases Generated in Mineral Oil-Immersed Transformers), the main points were:

- If we want to create Table 1,2,3 similar to C57.104, we need a lot of data
- Kevin Rapp (KR) we should differentiate on free breathing and non-free breathing transformers. Discussion was on the interoperation of Table 1,2,3 and 4 in C57.104 with the ratio of O<sub>2</sub>/N<sub>2</sub> < or > 0.2. CD described that if the transformer is sealed the values for <0.2 should be used and for free breathing units the value for >0.2 should be used
- AS asked the contributors for the previous C57.155 how they gathered and processed the data

- James Dukarm (JD) confirmed that he'd done the statistical analysis and he also had the program code for that. JD can provide the original database
- AS has access to John Luksich's files but couldn't find any relevant data on this
- AS asked current laboratories whether they can provide data for the new/expanded database
  - Jon Karas (JS) from SD Myers said they'd done a similar summary statistic for silicone liquids where all sensitive information were removed
  - LC suggested to work out a standardized statistical procedure what all lab could use, however it is maybe beyond our capabilities
  - CB agreed that a "simple spreadsheet with macros" might not be enough as data filtering is a huge part of the task
- Jinesh Malde (JM) suggestions were
  - Reach out to labs and end users to know how much data they have to decide whether we have enough data to create Table 1, 2 and 3 for C57.155
  - Get data on transformers' types, like wind, renewable, traction, etc
- AS mentioned, there could be max 25 years old data on natural ester filled units. Attila Gyore (AG) comment, on synthetic ester filled unit there could be 30-35 years data, however collecting these data is really hard
- LC commented that IEC 60599 has ranges of values for the gases which could be a guide for the new C57.155 as in agreement with Michel Duval this is a practical approach of DGA
- Helena Wilhelm (HW) asked whether we only need the type of the natural esters. AS asked the participants to use brand names too as there are at least 4 soyabean natural esters on the market from different suppliers
- JD confirmed again that he had the original program code which has two parts
  - Cleanup the data
  - Statistical software to calculate the percentile values
- CB can provide the code what was used in C57.104, however the user needs a training to use it

Based on the aforementioned discussion AS suggested to form two task forces:

**Task Force 1** Developing a program code/system to analyze data and later build up a database

**Leader:** Jon Karas

Volunteered participants during the meeting:

- Claude Beauchemin
- Luiz Chem
- Jinesh Malde
- James Dukarm

**Task Force 2** Reviewing the content of the current C57.155

**Leader:** Alan Sbravati

Volunteered participants during the meeting:

- Attila Gyore
- Josue Rodriguez

We need more volunteers.

9. New Business: No new business.

The meeting was adjourned at 15:35, on time.

Attila Gyore, Secretary

Alan Sbravati, Chair

## *Appendix V*

### **Task Force C57.139 – Guide for Interpretation of Gases Generated in Liquid Type Load Tap Changers**

**Tuesday, November 16<sup>th</sup>, 2021  
3:45 PM to 4:58 PM (central time)  
Virtual Meeting**

#### **Minutes of Task Force Meeting**

Chair            Rainer Frotscher  
Vice Chair    <not nominated yet>  
Secretary     Paul Boman

Virtual Meeting took place on November 16, 2021, from 3:45 PM to 4:58 PM

Attendance record: 43, with 11 attendees requesting membership.

First Name	Name	eMail	Requesting Membership
Juan	Acosta	juan.acosta@ergon.com	
Claude	Beauchemin	beauchemin@tjh2b.com	
William	Boettger	weboettger@aol.com	
Paul Su	Boman	paul_boman@hsb.com	Secretary
Antonio	Ceballos	aceballos@gatransformer.com	
Larry	Christodoulou	l.christodoulou@epsii.com	
Don	Dorris	ddorris@nespower.com	x
James	Dukarm	j.dukarm@ieee.org	
Samraghi	Dutta Roy	samraghi.dutta_roy@siemens-energy.com	
Joe	Foldi	foldijoseph1@aol.com	
Rainer	Frotscher	r.frotscher@reinhausen.com	Chair
Jim	Graham	jimgraham@ieee.org	
Attila	Gyore	attilagore@mimaterials.com	x
David	Hanson	hanson@tjh2b.com	
Thomas	Hartmann	dr.thomas.hartmann@ieee.org	
Ronald	Hernandez	rhernandez@doble.com	
David	Holland	david.s.holland@exxonmobil.com	
Jon	Karas	jon.karas@sdmyers.com	
Zan	Kiparizoski	zkiparizoski@ieee.org	x
Michelle	Kutzleb	kutzleb@tjh2b.com	
Olivier	Lejay	o_lejay@hotmail.com	x
Matthew	McFadden	matthew.mcfadden@oncor.com	x
Susan	McNelly	susan.j.mcnelly@xcelenergy.com	
Kris	Neild	kris.neild@megger.com	
Brady	Nesvold	brady.a.nesvold@xcelenergy.com	
Nick	Perjanik	nick.perjanik@weidmann-group.com	x
Tim	Peterson	t.peterson@nassusa.com	
John	Pruente	john.pruente@spx.com	x
Scott	Reed	sreed@mvdiagnostics.com	
Patrick	Rock	patrock@ieee.org	
Josue	Rodriguez	josue.rodriguez@prolecge.com	x

Rod	Sauls	resauls@southernco.com	
Jonathan	Sinclair	jjsinclair@pplweb.com	
Kushal	Sing	kushal.singh@comed.com	
Brian	Sparling	sparlibr@gmail.com	
Paul	Su	pocheng.su@fmglobal.com	
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Mark	Tostrud	mark.tostrud@dynamicratings.com	
Cole	Van Dreel	cvandree@atcllc.com	x
Daniel	Weyer	dfweyer@nppd.com	
Bill	Whitehead	bwhitehead@h2scan.com	
Christopher	Whitten	christopher.l.whitten@hitachienergy.com	x
Kris	Zibert	kris.zibert@amce.com	

## Agenda

1. Welcome and Task
2. Call for Patent Claims / IEEE SA Copyright Policy
3. Revision activities:
  - Title
  - Scope
  - Purpose
  - Identify possible improvements
4. Setting up PAR
5. Formation of Working Group

## Minutes

- Chair welcomed the group, presented agenda and gave a short introduction on the task. Since the last revision in 2015, knowledge on tap-changer DGA did significantly improve, and new methods have been developed which are worth to be evaluated if they are suitable to be incorporated in the guide.
- Call for patents showed none at this time.
- Copyright Policy was discussed.
- Chair started Discussion on:
  - a) Title  
 Changed to: *“IEEE Guide for the Interpretation of Gases generated in Liquid-Immersed Load Tap Changers”*, with the objective to align with other DGA Guides, such as C57.104  
 Motion to accept the new title as written: 1<sup>st</sup> motion Claude Beauchemin, 2<sup>nd</sup> motion Scott Reed.  
 Poll to accept new title as written: For 23, Against 0, Abstained 6, No answer 11 ⇒ Motion passed.  
 Amendment made Nov 17, at SCIF Meeting: S.Reed proposed to change *“Liquid-Immersed”* to *“Liquid-Type”*, as this will be the future wording for all Gas Guides.  
 Motion to change the new title to *“IEEE Guide for the Interpretation of Gases generated in Liquid-Type Load Tap Changers”*: 1<sup>st</sup> motion Rainer Frotscher, 2<sup>nd</sup> motion Claude Beauchemin.  
 Approved by unanimous consent ⇒ Motion passed.
  - b) Scope  
 Changed to: *“This guide describes methods of evaluating dissolved gases in insulating liquids used with load tap changers (LTCs). General types of LTC mechanisms, breathing configurations, and electrical design will be included for evaluation criteria in determining when mechanical damage, deterioration or failure might have occurred.”*  
 Motion to accept the new Scope as written 1<sup>st</sup> motion Ed teNyenhuis, 2<sup>nd</sup> motion Don Dorris.  
 Poll to accept new scope as written: For 18, Against 0, Abstained 5, No answer 17 ⇒ Motion passed.
  - c) Purpose  
 Changed to: *“The purpose of this guide is to provide non-invasive methods for evaluating the condition of an LTC.”*

Motion to accept new purpose as written: 1<sup>st</sup> motion Don Dorris, 2<sup>nd</sup> motion Christopher Whitten  
Approved by unanimous consent ⇒ Motion passed.

- Chair then showed possible improvements of the Guide, such as adding limit values for major LTC classes, which would need to set up a database with LTC DGA data, or to receive parametrics from DGA data sets.  
Further possible topics to be worked on are:
  - how to apply online-DGA
  - discuss suitability of AI methods which could also handle exceptional LTC types (J.Dukarm)
  - revise gas ratios, define typical ranges for ratios and give a graphical representation of these.
- Finally, Chair asked for volunteers for the new Working Group: Active members, Vice Chair and Secretary are needed.  
Paul Boman volunteered to act as Secretary, Chair accepted and thanked.
- Having agreed on Title, Scope and Purpose, the Chair proposed the revision of the Guide C57.139 to the Insulating Fluid Subcommittee, to start the process for PAR approval.

Meeting adjourned.