

## MEETING MINUTES (UNAPPROVED)

**Activity** : WG PC57.130  
**Document Title** : Guide for the Use of Dissolved Gas Analysis Applied to Factory Temperature Rise Tests for the Evaluation of Mineral Oil-Immersed Transformers and Reactors  
**Meeting Date** : March 29, 2022, 11:00 AM – 12:15 PM MDT  
**Meeting Location** : Denver, Colorado  
**Chair** : Bruce Forsyth  
**Vice-Chair** : Jinesh Malde  
**Secretary** : Javier Arteaga (appointed after the meeting)

### 1 CALL TO ORDER

The meeting was called to order at 11:00 AM on March 29, 2022. The Chair announced that the meeting would be adjourned a few minutes before the regularly scheduled adjournment of 12:15 PM MDT because of a conflict with the next Committee activity.

### 2 CHAIR’S REMARKS

#### 2.1 Introduction and Attendance Sheets

Attendance rosters were circulated. There were 72 participants present and 50 participants requested voting membership. Since this was the first meeting of the Working Group, voting membership was automatically granted to those who checked the Membership Request box in the attendance roster. Per the Working Group Policies and Procedures, voting membership status will be effective as of the start of the next meeting. Table 1 lists the participants present and requesting voting membership at this meeting. Table 2 lists the guests present at this meeting.

**Table 1: Voting Membership\* Attendance**

Member Name	Affiliation	Role	Present?
Adams, Kayland	Prolec-GE Waukesha	Member*	X
Aikens, Tom	Virginia Transformer	Member*	X
Almeida, Nabi	Prolec-GE USA	Member*	X
Alonso, Mario	Georgia Transformer	Member*	X
Ansari, Tauhid	Hitachi Energy	Member*	X
Antosz, Stephen	Consultant	Member*	X
Arnold, Elise	SGB-Germany	Member*	X
Arteaga, Javier	Hitachi Energy	Member*	X
Beaudoin, Jason	Weidmann Electrical Technology	Member*	X
Boettger, William	Boettger Transformer Consulting LLC	Member*	X
Bohrn, Josh	Siemens Energy	Member*	X
Botti, Michael	Hyosung HICO	Member*	X
Bradshaw, Jeremiah	Bureau of Reclamation	Member*	X
Calitz, David	Siemens Energy	Member*	X
Castellanos, Juan	Prolec GE	Member*	X
Chakraborty, Arup	Delta Star Inc.	Member*	X
Clarke, Allen	Delta Star Inc.	Member*	X

<b>Member Name</b>	<b>Affiliation</b>	<b>Role</b>	<b>Present?</b>
Davis, Eric	Burns & McDonnell	Member*	X
Debass, Samson	EPRI	Member*	X
Draper, Zachary	Delta-X Research	Member*	X
Faur, Florin	Prolec GE Waukesha	Member*	X
Forsyth, Bruce	Bruce Forsyth and Associates PLLC	Chair	X
Garcia, Eduardo	Siemens Energy	Member*	X
Griesacker, Bill	Duquesne Light	Member*	X
Hollrah, Derek	Burns & McDonnell	Member*	X
Jensen, Nick	Delta Star Inc.	Member*	X
Joshi, Akash	Black & Veatch	Member*	X
Kazmierczak, Jerzy	Hitachi Energy	Member*	X
Kirchenmayer, Egon	Siemens Energy	Member*	X
Lewand, Lance	Doble Engineering	Member*	X
Malde, Jinesh	M&I Materials Inc.	Vice-Chair	
Murray, David	TVA	Member*	X
Musgrove, Ryan	Oklahoma Gas & Electric	Member*	X
Patel, Nitesh	Hyundai Power Transformer	Member*	X
Patel, Sanjay	Royal Smit Transformers	Member*	X
Reed, Scott	MVA	Member*	X
Sahin, Hakan	Virginia Transformer Corp	Member*	X
Sarkar, Amitabh	Virginia Transformer Corp	Member*	X
Schrammel, Alfons	Siemens Energy	Member*	X
Sinclair, Jonathan	PPL Electric	Member*	X
Skinger, Kenneth	Scituate Consulting, Inc.	Member*	X
Som, Sanjib	PTTI	Member*	X
Staley, Brad	Salt River Project	Member*	X
Thompson, Ryan	Burns & McDonnell	Member*	X
Tolcachir, Eduardo	Tubos Trans Electric	Member*	X
Varghese, Ajith	Prolec GE Waukesha	Member*	X
Varnell, Jason	Doble Engineering	Member*	X
Wallach, David	Duke Energy	Member*	X
Zemanovic, Kyle	Eaton	Member*	X
Zibert, Kris	Allgeier Martin	Member*	X
Ziparizoski, Zan	Howard Industries	Member*	X

\* Voting Membership will take effect at the beginning of the next meeting.

**Table 2: Guests Present**

<b>Guest Name</b>	<b>Affiliation</b>
Benach, Jeffrey	Megger
Byrnes, Ryan	HICO America
Carrizales, Juan Alfredo	Prolec GE
Christodoulou, Larry	Electric Power Systems
Downey, Andy	Prolec GE Waukesha
Faherty, Joe	OTC Services
Hakim, Shamaun	WEG Transformer USA

<b>Guest Name</b>	<b>Affiliation</b>
Havens-Spillers, Bridget	Ameren Missouri
Jakob, Karl	Cargill
Jordan, Steve	TVA
Nesvold, Brady	Xcel Energy
Nims, Joe	Allen & Hoshall
Pinard, Matt	Weidmann Electrical Technology
Powell, Chad	Hitachi Energy
Radbrandt, Ulf	Hitachi Energy
Rainer, Frostcher	Reinhausen Germany
Rehkopf, Sebastian	Maschinenfabrik Reinhausen
Sen, Cihangir	Duke Energy
Soto, Mauricio	Hitachi Energy
Steele, Hampton	TVA
Steineman, Andy	Delta Star
Wright, Jeffrey	Duquesne Light

## **2.2 Participant Behavior**

The Chair showed and briefly reviewed the IEEE SA slides related to participant behavior in the individual Working Group process. There were no comments.

## **2.3 Essential Patent Claims**

The Chair showed and briefly reviewed the IEEE SA slides related to Essential Patent Claims. The Chair provided an opportunity for participants to identify patent claim(s) or patent application claim(s) and/or the holder of patent claim(s) or patent application claim(s) of which the participant is personally aware and that may be essential for the use of this standard. No claims were made.

## **2.4 Copyright Policy**

The Chair showed and briefly reviewed the IEEE slides related to Copyright Policy. There were no comments.

## **3 REVIEW OF AGENDA**

The proposed agenda (see Figure 1) was shown. The Chair asked if there were any requested changes to the agenda. None were requested and as such the agenda was considered approved.

**PRELIMINARY MEETING AGENDA**  
IEEE PES Transformers Committee  
Insulating Fluids Subcommittee  
**Working Group PC57.130**  
Location: Denver, Colorado  
Tuesday, March 29, 2022 | 11:00 AM – 12:15 PM MDT

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**Chair:** Bruce Forsyth      **Vice Chair & Secretary:** Jinesh Malde

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1. Call to Order
2. Chair's Remarks
  - a. Introduction and Attendance Sheets
  - b. Participant Behavior
  - c. Essential Patent Claims
  - d. Copyright Policy
3. Review of Agenda
4. Review of PAR changes required by NesCom
5. Discussion of PC57.130 project milestones
6. Discussion of content...desired changes
7. New Business
8. Adjournment

**Figure 1: Proposed Agenda**

#### **4 REVIEW OF PAR CHANGES REQUIRED BY NESCOM**

The Chair reviewed the PAR that was originally submitted to NesCom as well as the final PAR that was approved by NesCom. Only a few changes were requested by NesCom.

The approved Scope is as follows:

*“This document defines evaluation procedures and guidelines for acceptable levels of gases generated in conventional mineral oil-filled transformers and reactors during factory temperature rise tests.”*

The approved Purpose is as follows:

*“The purpose of this Guide is to provide guidance in the application of dissolved gas analysis (DGA) to transformers and reactors subjected to factory temperature rise tests. This document consists of evaluation procedures and guidelines for acceptable levels of gases generated in conventional mineral-oil filled transformers and reactors during factory temperature rise tests.”*

## 5 DISCUSSION OF PC57.130 PROJECT MILESTONES

The Chair reviewed the basic milestones for the project as follows:

- Identify revision needs; form TF groups ..... March 2022 – Oct 2022
- Document development ..... Mid 2022 – Fall 2024
- Submit to SC for sponsor ballot approval ..... Fall 2024
- Begin Sponsor ballot process (several steps) ..... Late 2024
- Ballot resolution & re-ballot ..... Early 2025 – Mid 2025
- Submission of approved document ..... Fall 2025

It was noted that the PAR expires at the end of 2026, but since the current document expires at the end of 2025 it is necessary to accelerate the work and finish before the end of 2025.

## 6 CONTENT DISCUSSION

The Chair opened the floor to discussions related to improvements that should be considered by the Working Group to improve the Guide. The basic structure of the existing document was reviewed, with focus on Table 2 that provides gas generation rate limits for hydrogen (H<sub>2</sub>), carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), and the combined total of methane (CH<sub>4</sub>), ethane (C<sub>2</sub>H<sub>6</sub>), and ethylene (C<sub>2</sub>H<sub>4</sub>). The combine total of the latter three is referred to as the hydrocarbon component. The following bullets summarize the suggestions made.

- **Ester liquids.** Should the scope be expanded to include ester liquids? There was general agreement in favor of expanding the scope to include ester liquids. The Chair noted this would require a PAR revision. There was some question as to whether sufficient data exists to develop limits for ester liquids (both natural and synthetic). After some discussion it was agree that a Task Force will be formed to investigate the feasibility of expanding the scope of the document to include ester liquids. Lance Lewand agreed to chair the TF and to report back to the WG no later than the Fall 2022 meeting. Several people volunteered to participate in the TF, including Jeremiah Bradshaw, Javier Arteaga, Sanjay Patel, and Elise Arnold. Any other interested participants are asked to contact Lance Lewand directly.
- **Gassing during overload tests.** A participant asked whether any generation limits are included for overload tests, and if not, should the document be expanded to include such limits.
- **Gassing during other tests.** A participant asked if the document should be expanded to provide gas generation limits for other tests, such as dielectric tests. A comment was made that the current document focuses only on gasses generated during temperature rise tests performed in accordance with IEEE Std C57.12.90™.
- **Are the existing limits still valid?** A participant asked whether industry experience since the current document was published still supports the generation limits contained in Table 2.
- **Is the fundamental approach still valid?** A participant asked whether the basic approach of analyzing generation rates as described in the current document is still considered the best approach. There was general agreement that the approach is acceptable, and if the document is expanded to include ester liquids new tables similar to Table 2 should be introduced as necessary.

- **Does the document apply to full current and full voltage tests on load tap changers (LTC)?** A question was asked related to LTCs, but it was generally agreed the gas generation limits described in the current document are for temperature rise tests on the main transformer only and do not apply to special load current or voltage tests that focus on LTC operation.
- **Guidelines for reporting methods and duration of temperature rise test.** A participant recommended guidelines be introduced to document the specific procedure(s) followed during the temperature rise tests. Specifically, the participant recommended documenting whether any overloads or cooling restrictions were employed to shorten the duration of the temperature rise test.
- **Consideration for higher temperature transformers.** A discussion took place regarding the applicability of the Guide to transformers with non-standard temperature rise ratings (e.g., 75 °C rise). A participant mentioned it is the absolute temperature that we should discuss and not temperature rises since ambient temperature is frequently a consideration in the application of higher temperature rise designs. More specifically, he stated it is the absolute temperature within the transformer that is of concern, not necessarily the temperature rise rating.
- **Separation of gasses from hydrocarbon component.** A few comments were made suggesting there may be data supporting the separation of one or more gas from the hydrocarbon group (methane, ethane, ethylene). Specifically, it was suggested that methane should be separated for mineral oil and ethane may need to be separated for natural esters due to their relative concentrations with respect to the other gasses.
- **Data supporting the original values in Table 2.** There were a few comments about the data that was used to generate the existing limits in Table 2. Specifically, what was the source of the data and is it still available? The Chair stated he will reach out to the officers of the original documents to inquire about the original data.
- **Should columns be added to Table 2 with limits for various cooling modes (e.g., ONAN, ONAF, etc.).** A participant felt adding columns to Table 2 with separate limits for different cooling modes would be beneficial. Another participant stated it is not possible to determine during which cooling mode gasses are produced using the current temperature rise test methods. Specifically, current methods may run a temperature rise test at rated MVA, then immediately move to the maximum MVA. Unless separate tests are performed, perhaps with degassed oil for each, it is not possible to know when the gasses were generated.
- **Adding recommended actions.** The current Guide lists gas generation rate limits with three condition levels (Condition I - No problem detected; Condition II - Possible problem; Condition III - Likely problem). A participant stated it would be beneficial to expand the Guide to provide recommendations regarding investigative steps to take for conditions II and III.

## 7 UNFINISHED BUSINESS

No unfinished business topics were raised for discussion.

## 8 NEW BUSINESS

No new business topics were raised for discussion.

## **9 ADJOURNMENT**

Because of a scheduling conflict for the next Committee activity, the Chair adjourned the meeting at 12:10 PM MDT.

Prepared and submitted by,

Bruce Forsyth  
Chair

April 4, 2022