

WG C57.139 Guide for the Interpretation of Gases generated in Liquid-Type Load Tap Changers Spring 2025 Meeting Minutes Unapproved

Chair Rainer Frotscher (not present)

Vice Chair John Prunte

Secretary Paul Boman

Meeting: Denver CO USA Tue March 25, 2025 3:15 – 4:30 PM

Attendance record: Total: 50, Members: 20, Guests: 30, with 7 requesting membership.
Quorum was not achieved.

Attendees list: see end of these Minutes.

Agenda

- Welcome
- Membership / Quorum
- Approval of Agenda
- Call for Patent Claims / IEEE SA Copyright Policy
- Approval of Meeting Minutes F24
- Revision of C57.139 – Report of Task Forces TF1 - TF4
- Preparation of Final Document / Balloting
- New Business
- Closing Remarks / Adjourn Meeting

Minutes

1. The WG met Tue, March 25 2025, 3:15 pm. As the Chair was not present, the meeting was held by Vice Chair John Prunte.
2. Vice Chair showed membership list containing 42 members, with an initial count of 20 members attending
⇒ Quorum was not achieved.
3. Vice Chair asked for Essential Patent Claims ⇒ none stated.
4. Slides for Participant Behaviour and IEEE Copyright Policy were shown.
5. Fall 2024 Meeting Minutes were presented but could not be approved, as quorum was not met.
⇒ Approval postponed to F25 meeting.
6. Task Force Reports
- 6.1. TF1 LTC Data Collection and Evaluation – Zachary Draper reports:
 - Zach Draper presented the current status of TF1 and gave detailed information on the multi-stage process the data underwent.
 - After anonymization and cleansing of data, 167,252 records were available for further evaluations.
 - Statistical calculations have been performed on absolute values, incremental changes between successive samples, rates of changes for individual gases, 3- and 5-gas ratios and other relevant ratios.
 - For the 5 most popular LTC classes (showing the highest number of samples), characteristic values of the statistical distribution of data (percentiles) have been provided for significant gases and gas ratios; see 6.3. Additionally, advice on DGA interpretation will be provided for 7 further significant LTC classes.
 - To define the parameters which are the most useful to detect developing and imminent fault cases, several options were calculated, based on ROC (Receiver Operating Characteristic) analysis, which is a useful method for assessing the accuracy of model predictions. It has been found that the 90th, 95th and 99th percentiles are the most useful. They will be used for the Guide.
 - Annex B will be updated accordingly to represent the new approach and discuss the relevance of the current statistical method (quartiles, U1, U2 limits).

6.2. TF2 Revision of General Section (Chapters 1-4) – Florin Faur reports:

- Draft 4 was distributed in Sep 2024 and discussed within TF2. New proposals from the TF were discussed and implemented.
- Definitions and Bibliography were updated.
- Chapter 4.4 “LTC faults” has to be aligned with Chapter 6.2. “Identification of LTC faults”

6.3. TF3 Revision of Basic Rules for LTC DGA interpretation (Chapter 5) – Deanna Woods reports:

- Draft 3 was distributed within TF3 Feb 2025. TF3 met 3 times and discussed the new Tables showing characteristic values (limit values) for popular and important LTC classes.
- Tables providing the 75th, 90th, 95th and 95th percentiles for LTC classes OAXCB, OAXDB, OAXSB/S, OARCB, OARDB, OVXCB/S, OVXDB, IARDB, IARSB, IVRDB, and IVRCB were set up.
For IARDB, the huge spread of values renders the percentiles as ‘not useful’ to detect fault cases.
A meaningful advice needs to be worked on.
- Meaningful gases and gas ratios were identified based on the ROC analysis: C₂H₂, CH₄, C₂H₆, C₂H₄, CO, TDHG, TDHG/C₂H₂, C₂H₄/C₂H₂, C₂H₄/C₂H₆, C₂H₆/CH₄ will be used in the Guide.

6.4. TF4 Revision of Chapter 6: Interpretation of LTC DGA Data – William Solano reports:

- Draft 2 was distributed within TF4 Mar 2025. TF4 held 1 meeting to discuss open topics.
- A revised Result Code Table was set up, which now shows 4 stages and concatenates the percentiles from the Tables in Chapter 5 with the stages:

Percentiles Range	Stage	Code	Description	Recommended Action
<90	1	Normal	No irregularity of gas pattern detected	Continue regular sampling
≥90 .. <95	2	Caution	Weak indication of a fault	Resample 3 months
≥95 .. <99	3	Alert	Strong indication of a fault	Resample 1 month, consider LTC lockout
≥99	4	Alarm	Imminent fault	Stop operation; investigate

- Toni Mellin (Vaisala) asked about specific LTC faults that lead to stage 3 and 4.
⇒ This will be included. TF4 is currently working on a description of LTC faults and which gases / gas patterns they produce (lead: Chris Whitten).
- How to use the Result Code Table will be supplemented by a flowchart, similar to C57.104 ⇒ to be set up.
- Question from audience: Will the guide present any recommendation about the initial years of operation of the tap-changer until the first DGA is taken? Paul Boman (HSB) answered that TF4 is currently working on the right words for such recommendations. For new equipment (and re-energized equipment after maintenance), baseline samples should be drawn and the trend monitored during the 1st year of operation.
- Case studies have been updated with investigations into assignment of typical LTC faults.
- A call was made to collect additional case studies.
- Applicability and use of Triangle #2 will be updated. For exceptional LTC types, there is current activity to replace the additional N zones by density plots with data from popular LTC classes where we have sufficient data.

7. Preparation of final Document / Ballot Process

The timeline of the WG activities which are necessary until the Ballot process can be started was presented. A first Draft of the revised Guide is planned to be sent out to the WG in July 2025 as Straw Ballot, with feedback required. Patrycja Jarosz (IEEE) stated that a Straw Ballot is decided by the WG only. It is not required for submitting a Guide or Standard for a Ballot.

Comments on this Straw Ballot shall be resolved until the Fall 2025 WG Meeting, where a 2nd Draft will be presented. With this, the Ballot process is planned to be initiated.

8. New Business

- 8.1. Chris Whitten (Hitachi) requests a statement in the Guide about a combined fluid storage from different LTCs during a maintenance action, which will lead to cross-contamination that can disrupt DGA trending and diagnostic. ⇒ Task for Chris to write a proposal.
- 8.2. Toni Mellin (Vaisala) stated that CIGRÉ WG A2.69 is currently revising TB455 “Guide for Transformer Maintenance”, which includes some basic information on fluid diagnostic. The revised version is expected for 2025. Toni asks to study the Guide if it contains something relevant for C57.139.
⇒ Task for Toni to provide input.

9. Meeting was adjourned at 4:00 pm.

Attendees list:

First Name	Name	Affiliation	Status/ Membership Request
Anthony	Alexander	Hitachi Energy	Guest
Paul	Boman	The Hartford Steam Boiler	Secretary
John	Bule	DTE Energy	Guest
David	Burke	XCEL Energy	Guest
Edward	Casserly	Ergon	Member
Craig	Colopy	Retired from Eaton	Guest
Roberto	da Silva	MR	Guest ^{*)}
Dumitru	Diaconu	Delta Star Inn	Guest
Zachary	Draper	Delta-X Research	Member
Marco	Espindola	Hitachi Energy	Member
Florin	Faur	Prolec GE	Member
Kyle	Feaster	Xcel Energy	Guest
Todd	Felton	MVA Diagnostics	Member
Jean-Philippe	Gagnon	Qualitrol	Guest
Joshua	Garner	RESA Power	Guest
Niklas	Gustavsson	Hitachi Energy	Member
Attila	Gyore	MIDEL and MIVOLT Fluids Ltd	Member
Kevin	Hampton	Siemens Energy	Guest
Patrycja	Jarosz	IEEE SA	Guest
Chanmin	Jeong	HD Hyundai	Guest
Heonsu	Kim	LS Electric	Guest
Andreas	Kurz	MR	Guest ^{*)}
Ashwini	Labh	Hitachi Energy	Guest ^{*)}
Cesar	Lizcano	SHELL USA, Inc	Guest
Stephanie	Mabrey	AVO Diagnostics	Member
Francis	Mantoan	Siemens Energy	Guest
Tom	Matson	XCEL Energy	Guest ^{*)}
Lee	Matthews	Howard Ind.	Guest
Toni	Mellin	Vaisala	Member
Mark	Newbill	Hitachi Energy	Member
Anastasia	O'Malley	Consolidated Edison Co.	Guest
Verena	Pellon	FPL&NextEra	Guest ^{*)}
Nick	Perjanik	AVO Diagnostics	Member
John	Pruente	APC Construction llc	Vice Chair
Manuel	Quinones	GE Vernova	Guest
Sebastian	Rehkopf	MR	Member
Jonathan	Reimer	FortisBC	Guest
Chris	Rutledge	GE Vernova	Guest
Jesus	Sanchez Rodriguez	Vertiv	Guest ^{*)}

Alfons	Schrammel	Siemens Energy	Guest
Jonathan	Sinclair	Black and Veatch	Member
Jimmy	Smith	Howard Ind	Guest
William	Solano	Voltyx	Member
Cole	Van Dreef	ATC	Member
Kayla	Whitesel	DeltaX Research	Guest
Christopher	Whitten	Hitachi Energy	Member
Deanna	Woods	PTT	Member
Kwasi	Yeboah	GE Vernova	Guest ^{*)}
Samuel	Young	Hitachi Energy	Guest
Joshua	Yun	Virginia Transformer Corp.	Member

^{*)}: requesting membership