

## **Annex G Insulating Fluids Subcommittee**

**March 28, 2018  
Pittsburgh, PA**

**Chair: David Wallach  
Vice-Chair: Jerry Murphy  
Secretary: C. Patrick McShane**

### **G.1 Introductions, Roll Call of Members for Quorum, Meeting Agenda Approval, S13 Minutes Approval, and Chair's Comments**

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

- a. Reminded that the AMS must be used for Working Group and Task Force rosters.
- b. Reminded that the WG and TF meeting minutes are due for submittal to the SCIF Secretary within 15 days of their meetings. The target date for SCIF S18 Minutes is April 6, 2018.
- c. Announced that no recordings of the meeting is permitted.
- d. Called for patent disclosures. There were none disclosed.

#### **G.1.2 Roll Call of SC members: (Quorum requirement: 28 minimum)**

- a. 43 Members signed in. Quorum was achieved. Six new SCIF Members were present and welcomed to the SCIF: Stuart Chambers, John Foschia, Brian McBride, Dwight Parkinson, Mickel Saad, Michael Thibault.
- b. 55 Guests attended, of which 8 requested or re-requested membership: Jose Antonio Gonzalez Ceballos, Toby Johnson, Kurt Kaineder, Rakesh Rathi, Scott Reed, Diego Robalino, Pugazhenth Selvaraj, Jeff Valmus.

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

- a. The motion from Kent Mueller and seconded by Don Platts was approved unanimously, without objection.

#### **G.1.4 Approval of minutes from the F17 meeting in Louisville, KY:**

- a. The motion to approve was made by George Forrest and seconded by Stephanie Denzer. The motion was approved unanimously without objection.

#### **G.1.5 Chair's review of key SCIF Standards:**

- a. C57.104, Guide for DGA of mineral oil insulating liquid, PAR expires on December 31, 2019, but the current Guide will expire at the end of 2018.

- b. C57.146. Guide for DGA of Silicone insulating liquid will expire, and there is no active TF or WG working on its revision. The Chair requested if there is any interest in continuing the Guide. to let him know.

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

### **G.2.1.1 C57.104 – IEEE Guide for the Interpretation of Gases Generated in Oil – Immersed Transformer (PAR Expiration: 12/31/19)**

WG Chair - Claude Beauchemin

**The report of the WG Meeting was presented at the SCIF meeting by Claude Beauchemin.**

- a. The WG 120 attended 49 members had quorum. 12 requested membership. Discussed the current ballot process. The WG voted unanimously to accept the changes, to finish the remaining work and go to ballot process. 184 have entered formal ballot pool.
- b. No comments or questions were raised.

See *Appendix I* for the Minutes (unapproved) of C57.104 WG Meeting as Submitted.

### **G.2.1.2 IEEE C57.147 Guide for Acceptance and Maintenance of Natural Ester Fluids in Transformers (PAR Expiration: 12/31/18)**

WG Chair: Patrick McShane, Vice-Chair: Clair Claiborne, Secretary: Jim Graham

**The WG Report at the Sub-Committee Meeting: Presented by Patrick McShane:**

- a. No WG Meeting was held at S18. Immediately after the F17 meeting, the ballot resolution group completed the ballot comments resolution, resulting in Draft 5. The recirculation vote was very successful. Draft 5 was formally approved by REVCOM in February. The IEEE SA editorial staff is preparing the Standard Guide for publication in the near future.
- b. No comments or question were raised.

### **G.2.1.3 IEEE C57.166 Consolidation of Insulating Liquids Guides (PAR Expiration: Dec 2022)**

Chair: Tom Prevost, Vice Chair: Scott Reed

**The TF Report given at the Sub-Committee Meeting by Scott Reed:**

- a. The WG held its kick off meeting, with 91 attendees. The WG “grandfathered” the TF Members to WG Members. Six Task Forces were formed to help develop the 1st draft. Leaders were selected for each TF. Patrick McShane

asked for a clarification of “as received”, assuming it meant “as received *in new equipment*”. At F17, the Chair, Tom Prevost, confirmed that change and welcome additional input from the SC attendees. But the wording shown at the S18 meeting was unchanged. There was significant discussion, with the general consensus to have just two acceptance value tables: 1. As Received from the Supplier. 2. As Received in New Equipment or After Filling.

See *Appendix II* for the S18 Minutes (unapproved) of TF Consolidation of Insulating Liquid Guides as submitted.

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

None was presented.

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

- a. An issue involving insulating liquids for factory testing of transformers came up at the F17 Performance Characteristics Subcommittee meeting. The issue regarded factory transformer testing with a different insulating liquid type than what will be used in the field. PCS formed a TF, PSC Task Force on Filling with Alternate Fluids, to make a recommendation. The TF met on Tuesday morning.
- b. At the WG for consolidation of Guides for insulating liquids, the issue of the terms “new” vs. “unused” insulating liquid was raised by Patrick McShane. He noted that during the voting for the revision of C57.147, negative ballots were received regarding the use of the term “new”, which has been replaced by ASTM with the term “unused”. The BRC agreed and the change was accepted in the balloting of C57.147. Comment by [redacted] recommended to stay consistent with ASTM. Jim Thompson mentioned some prefer the term “new”. Jimmy Rasco stated that there is no ASTM definition for “new”, but there is an definition for “unused”. Luis Cheim stated that “unused” still has to meet minimum requirements. David Wallach stated that the SC officers will investigate the issue for discussion at the next SCIF meeting. They will look at C57.12.80.
- c. The Chair announced that Patrick McShane is “retiring” from the Transformer Committee, including the SCIF. Starting at the F18 meeting, Scott Reed will become the new SCIF Secretary.

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

October 17, 2018 – Jacksonville,

### **G.6 Adjournment**

The motion passed unanimously.

Respectively Submitted, Patrick McShane, Secretary SCIF

*Unapproved Minutes from the F17 SCIF WG and TF Meetings*

***Appendix I – WG C57.104 Minutes***

**IEEE Guide for the Interpretation of Gases Generated in Oil –  
Immersed Transformers**

**Tuesday, March 27, 2018**

**Pittsburgh, PA, USA**

**Minutes of WG Meeting**

**The meeting was called to order at 3:20pm by Chair Claude Beauchemin. Vice-Chairs Don Platts and Norm Field, and Secretary Susan McNelly (writer of Minutes) were also present.**

**There were 120 total in attendance. Of these 49 of 75 members were present. A membership quorum was achieved. There were 71 guests, and 12 of those requested membership. The WG plans to meet at the Fall 2018 Transformers Committee Meeting in Jacksonville, Florida.**

**The following is a list of the working group members. Those with an asterisk were in attendance at the meeting.**

Antosz, Stephen	Digby, Scott	Kirchenmayer, Egon
Antweiler, James	Dolloff, Paul	Kittrell, Brad
Attard, Jason	Dorris, Don *	Lau, Mike *
Banovic, Mladen	Dorsten, James	Livingston, Kerry
Bazemore, Brian	Doyle, Lee	Macias, Alejandro
Beauchemin, Claude *	Dukarm, James *	Mani, Kumar *
Blaszczyk, Piotr	Duval, Michel *	Martin, Terence *
Boettger, William *	Elliott, Joshua	McNelly, Susan *
Bolar, Sanket	Faherty, Joseph	Meton, Therence
Boman, Paul *	Fairris, James	Minhaz, Rashed
Brauer, Stephan*	Fallon, Donald	Minikel, Justin
Bray, Elizabeth	Fenton, Roger	Moleski, Hali *
Brett, John	Ferreira, Marcos *	Montpool, Rhea
Campbell, James	Field, Norman *	Morakinyo, Paul
Castellanos, Juan *	Forrest, George *	Morales-Cruz, Emilio *
Chakraborty, Arup	Frimpong, George *	Murray, David
Cheatham, Jonathan *	Garcia, Eduardo	Mushill, Paul *
Cheema, Muhammad Ali Masood	Gardner, James *	Nims, Joe *
Cheim, Luiz *	Gaytan, Carlos	Nunez, Arturo *
Christodoulou, Larry *	Graham, James	Parkinson, Dwight
Claiborne, C. Clair *	Hayes, Roger *	Patel, Poorvi *
Cox, Paul *	Ho, Calvin	Patel, Sanjay
Crotty, John	Hochanh, Thang	Pellon, Verena
Cyr, Marc	Jacob, Fredi	Perjanik, Nicholas *
Damico, Frank *	Jakob, Karl	Pinon, Oscar *
Davydov, Valery	John, John *	Plath, Cornelius
Denzer, Stephanie *	Johnson, Toby	Platts, Donald *
Diaz, Rodolfo	Kennedy, Gael	Rasco, Jimmy *
	Kiparizoski, Zan *	Rasor, Bob *

Reed, Scott *	Som, Sanjib	Vir, Dharam
Rhodes, Tom	Spiewak, Erin	Wallach, David *
Riordan, Kevin	Stem, Gregory	Wang, Evanne *
Robalino, Diego	Su, Roy	Webb, Matthew
Rosenstein, Adam	Sullivan, Kevin *	Welch, Lee
Saad, Mickel	Tanaka, Troy	Weyer, Daniel
Schaffer, Paul	Thompson, Jim *	Whitehead, William
Schrom, Wesley	Thompson, Robert *	Woods, Deanna *
Selvaraj, Pugazhenthii *	Thompson, Ryan	Wright, Jeffrey
Shem-Tov, Mark	Tostrud, Mark	Zhang, Jim
Simonelli, Richard *	VanderWalt, Alwyn *	
Simonov, Igor	Veillette, Michel *	

The following guests requested membership. Those with an asterisk will be accepted based on attendance to a minimum of two consecutive meetings:

Chakraborty, Arup  
 Cheema, Muhammad \*  
 Dolloff, Paul \*  
 Doyle, Lee \*  
 Fairris, James \*  
 Fenton, Roger \*  
 Hochanh, Thang \*  
 Murray, David \*  
 Saad, Mickel \*  
 Shem-Tov, Mark \*  
 Som, Sanjib \*  
 Weyer, Daniel \*

## Agenda

1. Welcome & Introductions
2. Patent Call
3. Quorum Check
4. Approval of Agenda
5. Approval of Minutes from Fall 2017 Louisville meeting.
6. Guide Status
7. Changes to Guide since last meeting
8. Example analysis using the Guide with real data
9. New Business
10. Adjourn

A call for essential patent claims was made. No patents were identified. It was mentioned that a patent response had been made at the previous meeting.

A motion to approve the Spring 2018 Pittsburgh Agenda was made by Deanna Woods and seconded by Kumar Mani. There were no objections or additions to the agenda.

A motion to approve the Fall 2017 Louisville Meeting Minutes was made by George Forrest and seconded by Clair Claiborne. There were no objections or additions to the minutes.

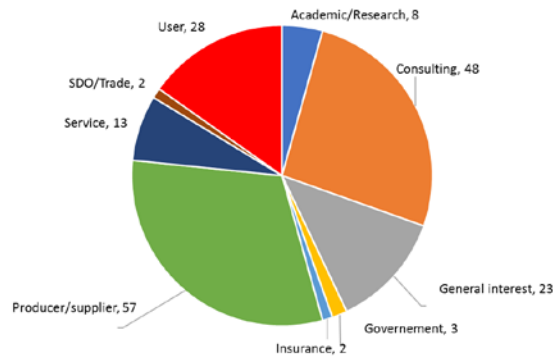
Introductions of the Chair Claude Beauchemin, Vice-Chair Don Platts, Vice-Chair Norm Field, and Secretary Susan McNelly were made.

### **Ballot Draft 4.3 – Revisions since Draft 4.1 approved at Fall 2017 WG meeting:**

#### **Guide Status**

- Ballot pool call issued in December and Ballot pool constituted (184 participants).
- Draft updated with fall meeting recommendations.
  - More draft clean-up and clarifications performed, as per mandate of fall meeting.
  - Modifications more extensive than expected
  - Draft 4.2 sent for Mandatory Editorial Review on February 6, 2018
  - More editing performed to meet IEEE template (e.g. black and white figures...).
  - Draft 4.3 distributed to working group on March 5, 2018
  - MER comments received on March 9, 2018

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- Next Steps
  - Ballot Process
    - Next step is to complete the draft including MER suggested changes and any changes approved today.
    - Send updated draft to all members of the ballot pool for ballot
    - Collect and consolidate ballot comments
    - The comment resolution group (CRG) will review every comment.
    - It will make appropriate changes to draft based on collected comments review and will recirculate updated draft, with comments, to Ballot pool for approval of changes (Re-ballot)
    - Claude reviewed the ballot process, methods of making comments and the requirements to address all comments.
  - Significant changes since Draft 4.1
    - Most significant changes are in clause 5 and 6
    - Essentially clarification of context and procedures and some content moved to streamline clause 6.
    - In clause 5.4 (p31):
      - Add a comment concerning the expected number of Status 2 and 3 for small DGA set:
        - “It should be noted that this will be true for a large set of DGA results having the same general characteristics as the set used to obtain the norms used in this guide. For smaller sets (for example from a single station), or for notably different DGA populations, a different proportion of selected DGA could be obtained.”
    - In clause 5.4 (p31):
      - Add a clarification on the influence of age and  $O_2/N_2$  on norms:
        - “One finding from the analysis of the DGA results is that certain parameters, most notably the ratio of  $O_2/N_2$  and the transformer age, have a large influence on the typical levels of gases, deltas and rates, while others did not. Consequently, Tables 1 to 4 included these sub categories as necessary.”



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### o New clause 6.1:

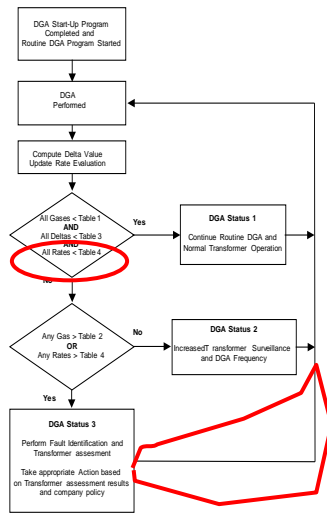
Clause was regrouped and emphasized warnings on DGA limitations and on definition of status. The new clause was reviewed.

### o Clause 6.1.1 (p33) and Figure 2 (p34-35)

The above have been updated to clarify the description of the process. Several rephrasing, relocation of text and additions made to avoid ambiguities.

Note: last 2 steps of 6.1.1 (p37) should have been marked in red in the redlined draft 4.3 as they have been added:

Updated Figure 2 (p35)



### o Page 37

Step 7: For DGA in status 3, gas evolution should be monitored for a significant period of time. If during that period of time there is no significant trend observed, then a lower DGA status could be considered, after consultation with a DGA expert, refer to 6.1.2.3.

Step 8: For extreme DGA results, consult a DGA expert (refer to 6.1.2.4)

### o 6.1.2.3 DGA Status 3 (p38)

“If after complete review of the available information, the transformer condition is deemed acceptable for continuous operation, then it is suggested to simply maintain surveillance typical of a lower DGA status. **An example of this would be a transformer having a DGA Status 3 due only to gas levels exceeding the values in Table 2 (especially if the only high levels are for carbon oxides) when several samples taken over a year or more indicate no sign of active gassing (all samples below Table 3 and Table 4).**”

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o Updated Table 4 (p41)

Gas/Period	Period between first and last point of the DGA series			
	$O_2/N_2 \leq 0.2$		$O_2/N_2 > 0.2$	
	4-9 Months	9-24 Months	4-9 Months	9-24 Months
H <sub>2</sub>	50	20	25	10
CH <sub>4</sub>	15	10	4	3
C <sub>2</sub> H <sub>6</sub>	15	9	3	2
C <sub>2</sub> H <sub>4</sub>	10	7	7	5
C <sub>2</sub> H <sub>2</sub>	Any increase		Any increase	
CO	200	100	100	80
CO <sub>2</sub>	1750	1000	1000	800

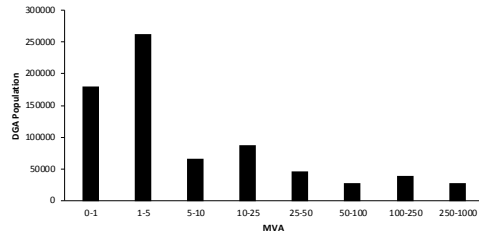
o 6.1.4 Impact of DGA limitations (p41)

Most of the clause content moved and integrated into Annex B.1 (p57-58), as it is more a tutorial than a procedure.

o 6.2.3 Duval Triangle 1 (p46-47)

Computation and Figure 4 moved to Annex D.4 (p67-68) as it is more part of a method description than an interpretation procedure.

o In Annex A (p51), new figure “Distribution of DGA in function of transformer rating



o Annex F (p85-86): Update and addition of  $NEI_{paper}$

$$NEI_{paper} = (101.4[CO] + 30.2[CO_2]) / 22400$$

“NEI” designated “NEI<sub>oil</sub>”

o Annex H Bibliography (p96-102)

References placed in alphabetical order by first author

Claude indicated that we need to approve the changes and hopefully move forward to ballot.

George Forrest made a motion to approve the new draft 4.3 and was seconded by Paul Boman.

Discussion:

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Jim Thompson asked if there were changes to Tables 1 & 2 and Table 3. He asked if there was a duration. Claude indicated that Table 3 is not based on a time period but strictly on the difference between two consecutive DGA results, which reflects normal DGA result variations between tests. He indicated that Table 4 is the table with a time factor and is based on several points over time, not just two samples.

Jim had a follow-up question about Table 3, if it is 40ppm for one day or for 100 days, that is a significant difference. He asked if there shouldn't be some ppm value over some time frame. Claude responded that this would be covered under Table 4.

The  $\mu\text{L}/\text{L}/\text{year}$  was inadvertently removed from the Table 4 headers and will be added back.

Jim indicated you would have to wait 4 to 5 months to get a discernable change using Table 4. Claude agreed that this was true. Claude indicated that if you sampled more frequently (e.g. once per month), you would need a minimum of 3-4 samples (including the ones already taken) to determine the slope. Claude encouraged Jim to look at Annex B1 for a complete explanation for the multi-point process.

Jim asked for whether there is guidance on troubleshooting in a much shorter time period. Claude indicated that the Guide does not provide an investigation procedure due to the many variations and possibilities (each case being unique) and refers users to seek expert opinions.

Claude indicated that the Guide does not say you have to wait 4 months to take another sample.

Response by Claude Beauchemin

The motion was unanimously approved.

Claude indicated the last minor editorial corrections would be made and it would be sent out for ballot.

Don indicated that we will need volunteers for a ballot resolution group. Technical resolutions determined by this group will be brought back to the WG for approval.

Don Dorris, Marcos Ferreira, Arturo Nunez, Kumar Mani, Muhammad Ali Masood Cheema, Paul Boman, and the WG officers will make up the ballot resolution group.

Discussion of examples did not occur due to lack of time, but will be posted for informational purposes.

Marco Ferreira made a motion to adjourn, which was seconded by Nick Perjanik. The motion was unanimous.

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The meeting was adjourned at 4:30PM

Claude Beauchemin  
WG Chair

Don Platts  
WG Vice-Chair

Norm Field  
WG Vice-Chair

Susan McNelly  
WG Secretary

*Unapproved Minutes from the S18 SCIF WG and TF meetings*

## ***Appendix II***

### **Working Group for Acceptance and Maintenance of Insulting Liquids**

**Monday, March 26, 2018**

9:30 – 10:45 AM

CL(A)

Pittsburgh, PA

Chairman Tom Prevost(absent)  
Vice Chair Scott Reed

The meeting was called to order at 9:35 am by Vice Chair Scott Reed.

There were 22 of 43 members present. There were 19 guests and 29 visitors. A membership quorum was achieved.

#### **Agenda**

- 1) Introductions
- 2) No Quorum Necessary
- 3) Approval of Agenda
- 4) No Approval of TF Fall 2017 Minutes Necessary
- 5) Call for Patents
- 6) Status of PAR
- 7) New Document:
  - a. Title
  - b. Scope
  - c. Purpose
- 8) Presentation and discussion of document format
- 9) Establishment of Task Forces
- 10) Task Force Objectives
- 11) New Business
- 12) Adjourn

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

There was unanimous approval of the Agenda.

Vice Chairman Reed posted the Patent Claim. No claims were made.

Since this was the first Working Group meeting, there were no previous meeting minutes to approve.

Vice Chair's Remarks:

Vice Chairman Reed announced the PAR was approved and expires December 31, 2022. Because it was the first meeting, Reed shared that active members from the Task Force were left as members and the guest who attended the last meeting were given membership status.

Next, the title, scope and purpose were reviewed. Jim Thompson asked if this guide would consolidate C57.637 and Vice Chair Reed said no. Next, the Vice Chair reviewed the six task forces that were created and which sections are covered by the task force. The Task Force Chairs that were present spoke about their respective Task Forces and identified who has already to volunteer:

TF1: Types of Insulating Liquids—led by Jinesh Malde with Attila Gyore, Jayme Nunes, Alan Sbravati, David Sundin, Suh Joon Han and Andy Holder

TF2: In Service—led by Scott Reed with James Gardner, Dominique Bolliger, Bob Rasor, Rick Cantrell and Stu Chambers

TF3: Mixture of Insulating Liquids—led by Clair Claiborne with Hali Moleski

TF4: Maintenance of Insulating Liquids—led by Rich Simonelli with Greg Steves and Scott Reed

TF5: Insulating Liquids for LTCs—led by Rainer Frotscher with Dave Hanson, Luiz Cheim, Paul Bowman and Mike Lau

TF6: Editorial—Not Assigned but Toby Johnson volunteered to contribute

Patrick McShane questioned whether De-Energized Tap Changers (DETC) should be included as part of LTC's. Luiz Cheim opined that a DETC is not its own compartment and therefore would not need to be covered. It was agreed that the focus is on the insulating liquid values and not application issues.

A question was asked where Voltage Regulators will be covered. It was mentioned perhaps under the LTC section.

Next, it was questioned by Patrick McShane why 'New' Liquids is broken into three sections: 1. As Supplied, 2. As received, 3. After Filling. After reviewing C57.106 and confirming that C57.147 mirrored C57.106, the group felt it would be better to have it divided in just two sections: New Insulating Liquids as Received from the Supplier and New Insulating Liquids Received in New Equipment or After Filling.

Patrick McShane questioned whether it should be worded as 'New' Insulating Liquids or 'Unused' Insulating Liquids. He referenced that ASTM D3487-16 had switch standard for mineral oil insulating liquid from 'New' to 'Unused.' **Claire Claiborne later clarified that a new ASTM standard used 'New.'** The working group was asked to consider how it should be phrased and we could review in Jacksonville.

Finally, the Vice Chair outlined the Task Force objectives for the next meeting:

- Organize Task Force Committees
- Define Scope and Content of each Task Force
- Establish a Work Schedule
- Assemble Applicable Content from other Standards
- Determine New Content that should be included as part of the Task Force (i.e. Use of Natural Esters at 800 kV)
- Have the Framework Ready and Present Update at the Jacksonville, FL Meeting

**Commented [PM1]:** Need to verify. Clair's email of 4-10 states: *I cannot find the natural ester document on my CD which was issued in 2017 because it was withdrawn.*

*The new ballot for synthetic esters uses the phrase less flammable to designate them.*

*So you see the source of my confusion. I remember that D 3487, used to say new and avoided the term unused.*

*I think that ASTM is moving toward unused in general.*

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No New Business was discussed and the meeting was adjourned at 10:38 am.