Annex G Insulating Fluids Subcommittee

October 17, 2018
Jacksonville, FL

Chair: David Wallach
Vice-Chair: Jerry Murphy
Secretary: Scott Reed

G.1 Introductions, Roll Call of Members for Quorum, Meeting Agenda Approval, S18 Minutes Approval, and Chair's Comments

G.1.1 Chair's Opening Remarks:

a. When balloting, the resulting document must be reviewed and approved after the Ballot Resolution is complete before recirculation.

b. Reminded that the WG and TF meeting minutes are due for submittal to the SCIF Secretary Scott Reed within 15 days of their meetings.

c. Called for patent disclosures. There were none disclosed.

G.1.2 Roll Call of SC members: (Quorum requirement: 31 minimum)

a. 35 Members signed in. Quorum was achieved.

b. 56 Guests attended, of which 3 requested or re-requested membership:.

G.1.3 Agenda Approval:

a. The agenda was approved unanimously without objection.

G.1.4 Approval of minutes from the S18 meeting in Pittsburgh, PA:

a. The minutes were approved unanimously without objection.

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

a. The chair reviewed the status of each guide of Sub-Committee Insulating Fluids and stated that while C57.111 ad C57.121 guides will expire December, 31, 2019, no new PARs will be initiated as these guides will be superseded by C57.166.

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 meeting had 130 attendees. Of these, 54 of 85 members were present so a quorum was achieved. One individual requested membership but since the document in a ballot, no new WG members will be accepted.

b. Draft 5.0 had a 91.8% return rate and an 88% affirmation rate. 409 comments were received and a Comment Resolution Group reviewed all of the comments. One comment was the scope did not match the PAR so the working group will correct. The recommendations of the comment resolution group were accepted in a vote of 47-1.

See ***Appendix I*** for the F18 Minutes (unapproved) of C57.104 WG Meeting as submitted.

G.2.1.2 IEEE C57.166 Consolidation of Insulating Liquids Guides (PAR Expiration: Dec 2022)

WG Chair: Tom Prevost

The report of the WG Meeting was presented at the SCIF meeting by Tom Prevost:

a. The WG meeting had 105 attendees. Of these, 27 of 35 members were present so a quorum was achieved.

b. Five Task Forces chairs each gave a status report of their respective sections. A common dilemma between the various task forces is the lack of voltage classes for various liquids so this will be an item of discussion at the next meeting.

See ***Appendix II*** for the F18 Minutes (unapproved) of C57.166 WG Meeting as submitted.

G.3 Old Business

Chairman Wallach raised the 'new' verses 'un-used' liquid distinction discussed at the SCIF S18 meeting. After review, the sub-committee decided not to take any action at this time as C57.166 will manage within the new guide.

G.4 New Business

a. Chairman Wallach announced that Clair Claborne would serve as the chair of the C57.12.80 working group to review all definition clauses in all transformer standards. The purpose is to identify terms which should be included in the terminology guide.

b. C57.12.80 met Monday, October 15, 2018 at 9:30 am in Jacksonville and needs volunteers from each of the technical subcommittees to help both review the documents under each subcommittee and offer recommendations to the terminology working group. Jimmy Rasco volunteered to assist. For those who would like to volunteer and have a meeting conflict, please contact Clair Claiborne or David Wallach to submit recommendations.

c. WG C57.104 Chair Claude Beauchemin shared his concern with the SCIF sub-committee that if the December, 2019 RevComm is cancelled, it could potentially impact the approval of the guide. C57.104 has already had PAR extensions and the PAR expires December 31, 2019. He noted that an exception may be warranted for C57.104 if the guide is not ready by September, 2019 and the December, 2019 RevComm meeting is cancelled.

G.5 Next SCIF Meeting:

March 27, 2019—Anaheim, CA

G.6 Adjournment

The motion passed unanimously.

Respectively Submitted, Scott Reed, Secretary SCIF

Unapproved Minutes from the F17 SCIF WG and TF Meetings

Appendix I – WG C57.104 Minutes

C57.104 – IEEE Guide for the Interpretation of Gases Generated in Oil – Immersed Transformers

Tuesday, October 16, 2018

Jacksonville, Florida, USA

Minutes of WG Meeting

The meeting was called to order at 3:15 pm by Chair Claude Beauchemin. Vice-Chair Don Platts and Secretary Susan McNelly (writer of Minutes) were also present. Vice-Chair Norm Field was not present.

There were 130 total in attendance. Of these 54 of 85 members were present. A membership quorum was achieved. There were 76 guests, and 1 of those requested membership. The WG plans to meet at the Spring 2018 Transformers Committee Meeting in Anaheim, California.

The list of meeting attendees will be maintained in the AMS system. The following guests requested membership.

Israel Barrientos, GE Prolec

Since the document is in ballot, no new WG members will be accepted.

Agenda

1. Welcome & Introductions
2. Patent Call
3. Quorum Check
4. Approval of Agenda
5. Approval of Minutes from Spring 2018 Pittsburgh
6. Ballot and Ballot Resolution Group status
7. New Business
8. Adjourn

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

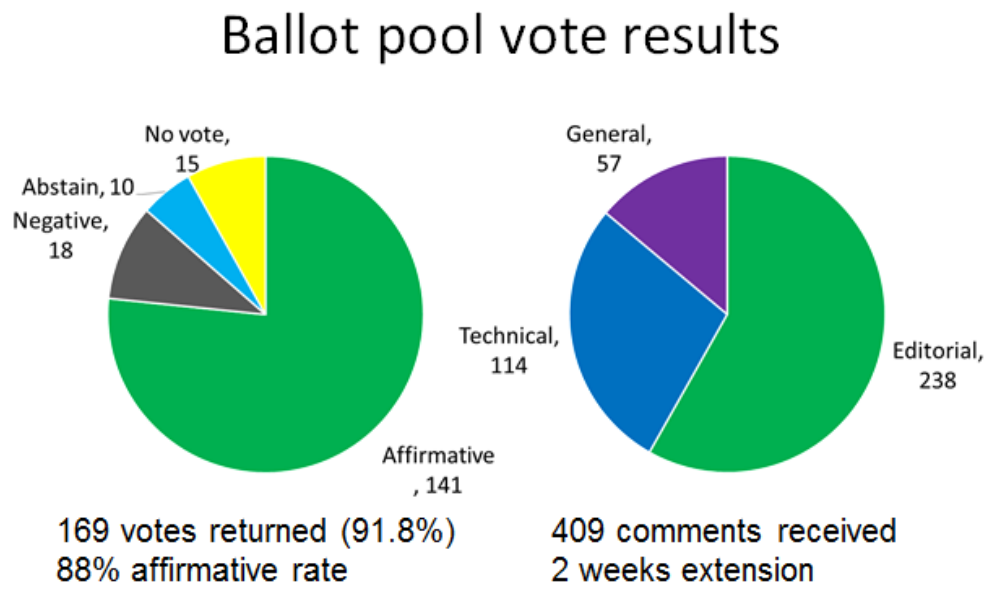
A call for essential patent claims was made. No patents were identified. It was mentioned that a patent response had been made at a previous meeting.

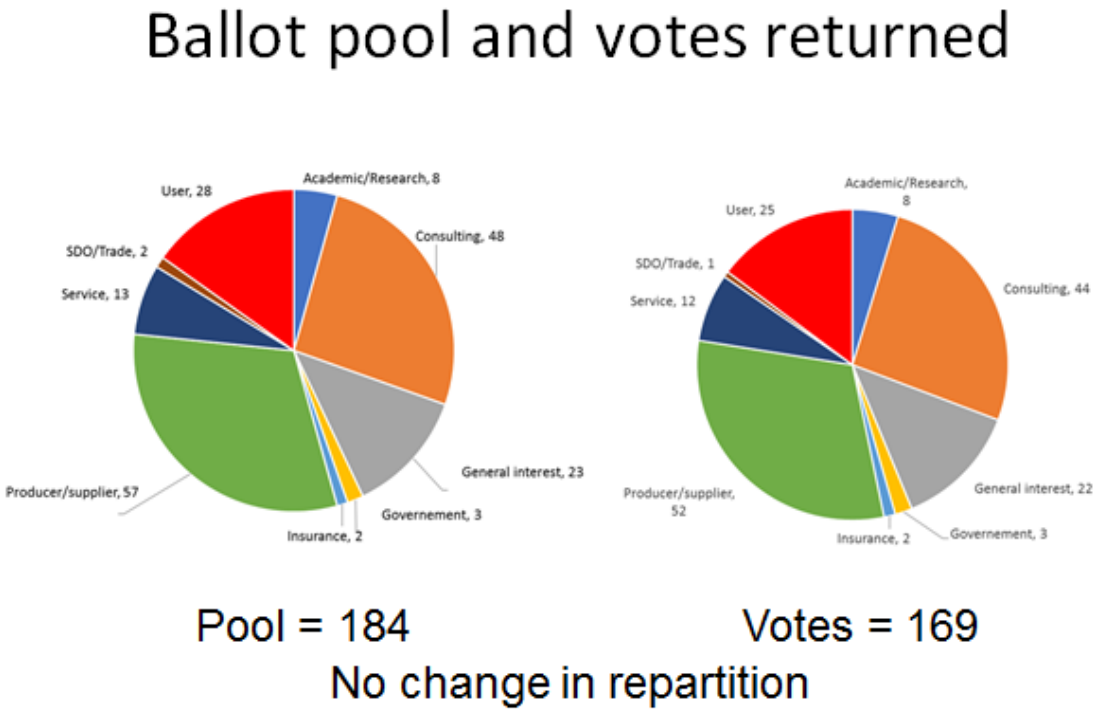
A motion to approve the Fall 2018 Jacksonville Meeting Agenda was made by Jerry Murphy and seconded by John John. There were no objections or additions to the agenda.

A motion to approve the Spring 2018 Pittsburgh Meeting Minutes was made by Jerry Murphy and seconded by Dave Wallach. There were no objections or additions to the minutes.

Ballot Draft 5.0 Status

- Ballot pool call issued in December 2017 and Ballot pool constituted (184 participants, including 32 members of the WG).
- At the spring 2018 meeting, draft 4.3 was approved unanimously and was issued to the ballot group, as draft 5.0, on April 13, 2018 for a two months ballot review





Context of ballot comments review

- The guide text and procedures have been developed over a 10 years period, with numerous presentations, WG discussions, votes and three straw ballots.

- The draft was accepted unanimously by the WG at the Spring 2018 meeting. (document considered "stable")
- Ballot affirmative rate is 88% (Consensus is defined as > 75%)
- 1 year before PAR expiration
- At this time major changes and rewriting should be passed to the next WG.

Comment Resolution Group

Don Platts	Jerry Murphy	Kumar Mani
Norm Field	Brian Sparling	Arturo Nunez
Sue McNelly	Marcos Ferreira	Tom Prevost
Dave Wallach	Jim Dukarm	Bob Rasor
Luiz Cheim	Michel Duval	Hali Moleski
Don Doris	Paul Boman	C. Beauchemin
Muhammad Ali Masood Cheema		

Comment resolution Protocol

- 60 % of comments resolved easily (essentially minor editorial and style corrections) by two reviewers.
- Ballot resolution group divided in four sub-groups (more adapted to work by conference call).
- Each remaining comments submitted independently to two sub-groups for resolution.
- Results consolidated. Contradictory results re-submitted to the other two sub-groups.
- A few residual one discussed among sub-group leaders on phone calls.

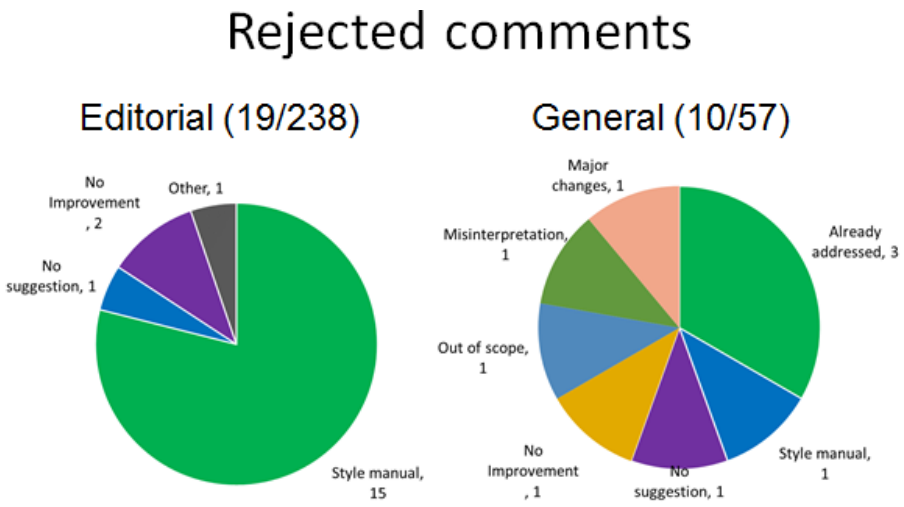
Comment resolution

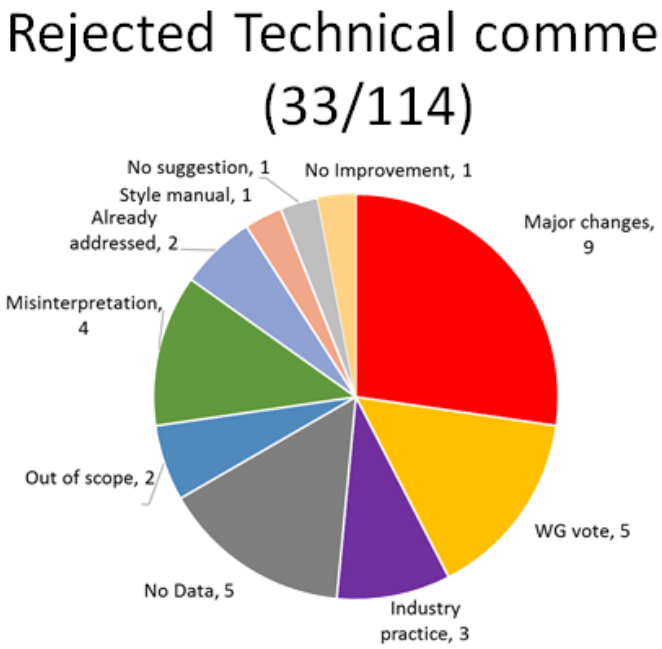
- Draft 5.1 has been created including all the Accepted and Modified comment resolutions
- A red lined and a clean version, as well as the comment resolutions spreadsheet, has been made available on the Fluid Subcommittee web page.
- All comment entries are highlighted in yellow with associated comment number in the margin.
- A notification email was send to all WG members on Friday September 28.
- Upon the close of a ballot, the BRG must present the result of the ballot and ballot review (vote count, comments received, and comment resolutions, including changes made to the draft) to the complete WG for approval.
- This is the purpose of todays meeting
- If approved by the WG, the same information will be send to the Sponsor balloting group for approval and further comments (recirculation).

Comment resolution group work

- Most comment (59%) have been accepted as suggested. The majority of the editorial comments fall in that category.
- Some comments have been accepted in principle, but with suggestions needing adjustment. 26% are in the modified category.
- Note from the chair: The exact ~~reparation~~ percentages could change following some editorial requests from IEEE committee.
- Some comments are rejected when they are unusable for draft revision. 15% have been rejected

- A suggestion could be rejected for one, or more, of the following reasons:
  - Incompatible with the IEEE Style manual
  - No suggestion or unsupported suggestion
  - Does not improve understanding
  - Against a WG vote or recommendation
  - Does not correspond to the industry practice
  - Already addressed in a different part of the document
  - Out of scope
  - Misinterpretation of the draft
  - Require major changes incompatible with the project status
    - extended modification of the text
    - modification of the methodology
    - could not be supported by available data





Review of main changes in Draft 5.1

Notable modifications

Purpose (1.2) (Revision)

The purpose of this document is to provide a guide for evaluating dissolved gases analysis results from mineral oil immersed transformers using statistical based analytical tools and fault interpretation methods.

Comment was made to change the wording from "statistic" to "statistical". A motion was made by Tom Prevost and seconded by Jim Graham to approve the Purpose as modified above. The motion passed.

The WG officers will request PAR changes to for the revised scope and purpose before the closing of the ballot.

Limitations (1.3) (Addition)

This guide is applicable to mineral oil immersed transformers and reactors of all type, size, voltage classes, construction, and usages, except those excluded in 1.3.

See text in draft concerning wind turbine application

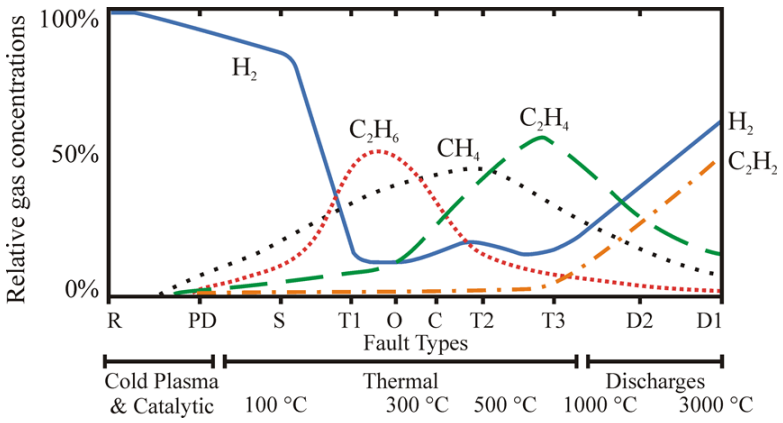
There was no objection to the proposed text.

Definition (3.1) (Addition)

Rate: Constant gas generation over a certain period, expressed in µL/L/year. In the context of this guide, rate is computed by linear best fit from 3 to 6 consecutive DGA covering a period of at least 4 months to a maximum of 24 months.

There was no objection to the proposed text.

Figure 1 (4.1) (Update)



NOTE—See 3.2 for faults acronym and Annex C for faults type definition

There was no objection to the proposed figure.

Warning box added (4.4) (Addition)

WARNING
Sampling from a transformer tank when negative pressure is known or suspected should never be done, as it will result in air ingress and possible immediate or future catastrophic failure of the transformer.

There was no objection to the proposed WARNING.

O_2/N_2 rationale (5.4) (Addition)

NOTE—The O_2/N_2 ratio was proposed for evaluation as a proxy for distinguishing sealed units from free breathing ones. This approach was used to evaluate the large database where this information was mostly absent, and the break point based on the data suggested the limit of <0.2, or >0.2. An O_2/N_2 ratio ≤0.2 is observed in most N_2-blanketed transformers and in about 60% of membrane-sealed one. An O_2/N_2 ratio > 0.2 is observed in all air-breathing transformers and in about 40% of membrane-sealed transformers. However, one should not infer from this approach that by looking at the O_2/N_2 ratio found in a specific sample that you can identify if the transformer is sealed or breathing, as other factors could influence this ratio.

Comment was made to start the above as "Although, the O_2/N_2 ratio was proposed…" The person that voted negative indicated he was OK with it as written, so there was no further discussion.

Clarification on rate computation (6.1.1) (Addition)

If more than 6 data points are available, use the six most recent data points to compute the rates, not exceeding two years.

There was no objection to the proposed text.

Clarification on yearly sampling (6.1.1) (Addition)

Note if only 1 sample per year is taken, there will not be enough samples to calculate the multipoint gas generation rates for comparison to Table 4, so only Table 3 would be used in such cases. If Table 3 is exceeded, a confirmation sample is required, which will allow the computation of the rates (e.g. 3 samples in 2 years).

There was no objection to the proposed amended text

Source of gas (6.2.1) (Addition)

Hydrogen, H_2, is created primarily from corona partial discharge and stray gassing of oil, also from sparking discharges and arcs, although C_2H_2 is a much better indicator in such cases. It can also be caused by chemical reaction with galvanized steel.

Methane, CH_4, Ethane, C_2H_6 and Ethylene, C_2H_4, are created from heating of oil or paper.

Acetylene, C_2H_2, is created from arcing in oil or paper at very high temperatures above 1000°C. Transformers without internal fuses, switches or other arcing devices that may have operated should not create any C_2H_2 under normal operating conditions. It is not uncommon to find increased levels of H_2 or C_2H_4 when C_2H_2 is detected.

The ranges of temperatures where these gases are mostly produced in oil can be seen in Figure 1. It can also be seen in Figure 1 that mixtures of these gases are always formed at any temperature. By looking at their relative proportions in oil, one can identify the faults which have produced them, using one of the methods described in 6.2 or Annex D.

Carbon Monoxide, CO, and Carbon Dioxide, CO_2, are created from heating of cellulose or oil insulation.

There was no objection to the proposed text.

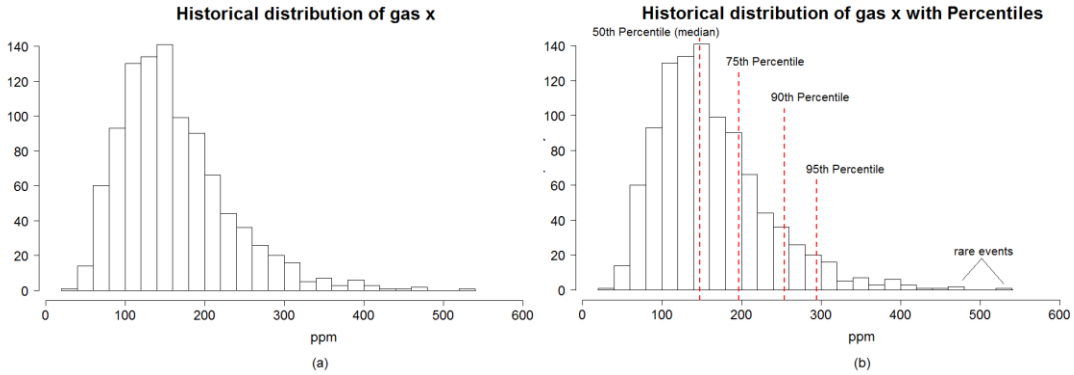
Link to Duval methods (6.2.3) (Addition)

Free algorithms for using the Duval Triangles Methods are available from the IEEE Transformer Committee web site at:

http://www.transformerscommittee.org/subcommittees/fluids/Duval/DuvalTriangles1_7-29Mar2016.xls

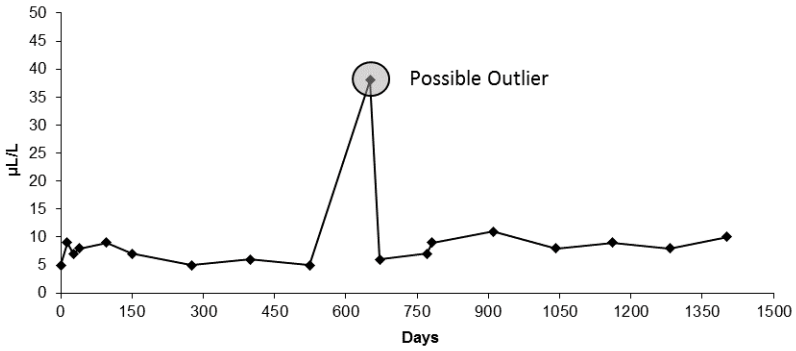
A quick discussion occurred concerning the impact of web server changes at the committee level. It was noted than the final guide publication will likely occur after these upcoming changes are implemented and that the hyperlink would be adjusted accordingly. There was no objection to the proposed link.

Concept of percentile (A.1) (Addition)



There was no objection to the proposed graphs and associated text.

Simpler example (B.2) (Addition)



Point Number	Days	µL/L	Delta µL/L	Table 3 Norms	µL/L/year	Period in Days	Table 4 Norms
1	0	5	N/A	N/A	N/A	0	N/A
2	17	9	4	20	N/A	17	N/A
3	68	11	2	20	N/A	68	N/A
4	80	14	3	20	N/A	80	N/A
5	122	34	20	20	75	121	7
6	150	30	-4	20	69	150	7
7	157	30	0	20	68	140	7
8	179	39	9	20	85	111	7
9	204	32	-7	20	53	124	7

There was no objection to the proposed example and associated table, figure and text.

Discussion:

Jim Thompson indicated a concern in the lack of guidance for sampling in less than a four month timeframe. He suggested this could go into an Annex. He also indicated that all 95th percentile values for six months or less will exceed Table 4 values.

Response was that Table 4 is only for use with multi-point trend analysis and its purpose is to detect low gassing rate when gas levels are low. Table 4 intent does not provide guidance on the sampling interval. The four month minimum of Table 4, and its associated 3 to 6 samples, is the minimum required to detect small continuous rates when gas concentrations are low and natural DGA variations are comparatively high in regards of gas levels. The observation was made to not confuse sampling frequency (sampling interval) with sampling period (time between first and last samples of a series). There are no recommendations in the guide concerning limiting sampling frequency to four months. On the contrary, the recommendation, when an ongoing gassing is suspected, is to install on-line monitoring that offers very high sampling frequency.

The commenter stated that two thirds of new transformers in the heat run data from the C57.130 working group meetings fail Table 4 in the current document for C57.104.The commenter is also using data out of its intended use, such as data from heat runs, which are specifically excluded from the present draft.

The WG Chair indicated that the u~~U~~se of any data out of context will inevitably cause issues. The commenter is also using data from F12 and F13 presentations coming from 2 point 'rates' computation in his argumentation concerning Table 4 limitations, contrary to the draft procedure recommendation of multi-points rates that are required for the use of this Table.

The Chair indicated that Jim's suggestion to go to an annex was not in line with the commenter submitted comments and suggested changes (i-350, i-351 and i-352), that were rather to revert to the 2008 version of the guide and to eliminate Table 3. As such, his recommendation could not be accepted, as it is a new comment, ineligible at this stage of the ballot resolution group (BRG) work review.

A motion was made by Stephanie Denzer and seconded by Brian Sparling to approve the work of the Ballot Resolution Group move the document forward for recirculation. There were 47 for and 1 against the motion. The motion carried.

The meeting was adjourned at 4:23PM

Claude Beauchemin
WG Chair

Don Platts
WG Vice-Chair

Norm Field
WG Vice-Chair

Susan McNelly
WG Secretary

Appendix II

Working Group for Acceptance and Maintenance of Insulting Liquids

Tuesday, October 16, 2018

1:45 – 3:00 PM

Jacksonville, FL USA

Minutes of WG Meeting

Chairman Tom Prevost
Vice Chair Scott Reed
Secretary (Open)

The meeting was called to order at 1:45 pm by Chair Tom Prevost.

There were 27 of 35 members present. There were 78 guests. A membership quorum was achieved.

Agenda
1) Introductions
2) Approval of Agenda
3) Approval of Spring 2018 Minutes
4) Call for Patents
5) New Document:
a. Title
b. Scope
c. Purpose
6) Review of Documents and Task Forces
7) Task Force Reports
8) New Business
9) Adjourn

The Spring 2018 minutes were unanimously approved. The Fall 2018 agenda was unanimously approved.

Chairman Prevost posted the Patent Claim. No claims were made.

Chair's Remarks:
Chairman Prevost reviewed the scope and purpose of the guide. Next, the chair asked each task force to speak about their respective sections.

TF1-Types of Insulating Liquids, Jinesh Malde
Jinesh announced his committee met October 14th and has 11 members. The task force will begin to consolidate information from the existing guides and is in the process of identifying background information for each fluid type. In addition, Jinesh will work to identify the appropriate liquid tests and their significance as well as evaluate new liquids to be included as part of this guide.

TF2- In Service, Scott Reed
Scott shared that his task force has meet and will consolidate information from existing guides that discuss in-service liquids. However, the task force has questions about voltage classes and thresholds for liquids that do not have any established values, as well as consideration for new liquid tests and new liquids. It was decided that TF2 will work with TF1 as they work to establish thresholds for as supplied, as received, and after filling as well as any new liquid tests that should be included. Chair Tom announced that voltage classes will be added to the Spring 2019 agenda.

TF3-Mixture of Insulating Liquids
Alan Sbravati has agreed to take over as task force chair for mixture of liquids. Alan questioned how retrofilling should be handled in this guide, It was decided to bring the question before the Insulating Liquids Sub-Committee of whether to make retrofilling it's own guide.

TF4- Maintenance of Insulating Liquids, Rich Simonelli
Rich reported that he is still looking for volunteers for his task force. Jim Thompson, Mike Lau, Jon Karas, Andrew Holden and Jimmy Rasco volunteered to assist. Rich also questioned whether re-refined oil is a maintenance classification to consider. It was decided it would not be considered as part of the task of maintenance since the oil is treated off site. It was further decided that more information is needed from ASTM to determine if this is a liquid for consideration under this guide.

T5- Insulating Liquids for LTC's, Rainer Frotscher
Rainer delivered a presentation that defined the parameters and the relevance for tap changers and the specific requirements of different liquids used in tap changers. The task force also identified the suitability of liquids for different tap changer types. The task force also identified potentially new liquid tests for both new and in-service liquids that should be considered for tap changer applications as well as developing thresholds for greater than 230 kV.

Old Business:
Chairman Prevost addressed 'New' Insulating Liquids or 'Unused' Insulating Liquid previously questioned.

As supplied by manufacturer: D3487
As received: C57.106 meet D3487 and Table 1.
After filling: C57.106 must conform to Table 2 (230 kV or > 230 kV).

The working group will continue the discussion of new liquids at the next meeting.

New Business:
Chairman Prevost stated that voltage levels within the acceptance tables will be discussed at the next meeting. Introductory material to facilitate this discussion will be distributed before the next meeting.

The meeting was adjourned at 3:00 pm.

Scott Reed, Vice Chair