

UNAPPROVED MINUTES
SC Insulating Fluids Meeting
April 22, 2009
Miami, Florida

7.3. Insulating Fluids Subcommittee (R.K. Ladroga, Chair; S.J. McNelly, Vice-Chair, C. Patrick McShane, Secretary)

7.3.1. Introduction/Attendance

The Insulating Fluids Subcommittee meeting in Miami, Florida was called to order by the Chair at 3 PM on Wednesday, April 22, 2009. All the officers of the SC were present. There were 22 members and 32 guests present. The following 2 guests requested membership: Claudette Beauchemin & Tiago Marchesan.

Meeting Agenda

1. Introductions
2. Call for patents disclosures as required by IEEE
3. Fall 2009 Minutes Approval
4. WG Reports
 - a. WG PC57.637 IEEE Guide for the Reclamation of Insulating Oil and Criteria for Its Use – Jim Thompson.
 - b. TF DGA in Natural Based Ester Fluids – Paul Boman
 - c. WG C57.139 – DGA in LTCs – Sue McNelly Secretary & Rick Ladroga
 - d. WG C57.104 – DGA in Oil Immersed Transformers – Sue McNelly
 - e. TF Guide for Retrofill of Natural Ester Fluids – Jim Graham
 - f. C57.130 - IEEE Trial-Use Guide for Dissolved Gas Analysis During Factory Temperature Rise Tests - Rick Ladroga
 - g. TF Particle Count Limits. No meeting held.
5. New business
6. Old Business
7. Adjournment

7.3.2. Introduction/Attendance, F08 Minutes Approval, & Patent Disclosure Request

As required the IEEE patent disclosure requirements were discussed and a request was made for disclosure of any patents that may be related to the work of the subcommittee. No new disclosures were forthcoming.

The Minutes of the Fall 2009 Oporto, Portugal meeting were approved as written.

7.3.3. WG & TF Reports Presented at the SC Meeting

7.3.3.1. WG PC57.637 Guide for the Reclamation of Insulating Oil and Criteria for Its Use

Chair: Jim Thomson; Co-Chair: TV Oommen

The WG report was presented by TV Oommen. Mr. Oommen gave a brief summary of the first WG meeting Meeting: April 21, 2009 beginning at 8 AM at the SC meeting. There were no questions or discussions. The unofficial minutes of the meeting follow.

Attendance: Total attendees 36, with no guests requesting membership.

Minutes of the WG meeting as submitted:

1. Introductions
 - a. Jim Thompson and TV Oommen conducted the meeting.
 - b. Background of the document was given. PC57.637 was reaffirmed in 2007 and the PAR for revision has been approved.
2. Patent Disclosures: None
3. Meeting Summary
 - a. The Chair presented the scope and title of the document. The discussion from the guests included corrosive sulfur information and a title revision in the future to reconcile the scope with the title regarding the term “mineral oil”. The Chair announced that email correspondence would be begin shortly between the Chair and persons selected as members from the meeting roster. The correspondence will include the pdf version of the current document IEEE Standard 637-1985.
 - b. The meeting then adjourned.
 - c. Respectively Submitted: Chair Jim A. Thompson, Co-Chair TV Oommen.

7.3.3.2. TF Natural Based Ester Fluids DGA Guide Development

Chairman: Paul Boman, Secretary: John Luksich

The TF report was presented by Paul Boman. He presented a summary of the TF meeting held on April 21 with 53 attendees. He expressed there is significant interest and expressed a need for a standard guide for DGA analysis of natural esters and the progress of data collection. He expressed the WG’s appreciation to EPRI and its natural ester DGA project sponsors for providing very valuable information. The TF voted to include synthetic esters into the same guide. Paul Boman requested approval to upgrade the activity status from a TF to WG level and draft a PAR. The approval was received.

Minutes of the TF meeting as submitted:

Task Force – DGA Natural Ester Fluids

Paul Boman – Chairman

John Luksich - Secretary

9:30 am Tuesday, April 21, 2009

3rd meeting of the group

Attendance

Attendance total attendees 53, Members 14 attendees were guests with 3 attendee requested membership

Patents

No patents disclosed

Porto Minutes

Motion to approve the meeting minutes from Porto made by Dave Sundin; second by Fredi Jacob.

Goal

The Task Force must decide if a separate guide or an addition to the mineral oil DGA guide is needed.

EPRI Project Status

Luke Van der Zel is not present – the status provided by Jim Graham. The data will be posted on the website.

Manufacturers of natural esters are present, as is Michel Duval (chairman of CIGRE TF15 D1 Task Force)

Call for field data.

EPRI thermal data as Excel spreadsheet

CHAIR: The natural ester shows high ethane content compared to mineral oil. Why?

COMMENT (Fred Jacob): We don't know if it's from the base oil or additives.

CHAIR: The oxygen goes down as temperature goes up.

COMMENT (Fred Jacob): The carbon oxides increase. The oxygen comes from either the ester molecule or from air as dissolved oxygen.

CHAIR: Two anomalies apparent. The carbon dioxide in mineral oil at 300C is an order of magnitude higher than the other two temperatures. Acetylene is seen in natural ester at 500C but not in mineral oil.

QUESTION: Could we compare EPRI data to those from the University of Manchester and DuPont CIGRE work?

COMMENT (Claude Beauchemin): At first glance it seems that there is enough difference between natural ester and mineral oil to warrant a separate guide.

EPRI thermal data as Duval triangle

QUESTION (Fred Jacob): The data does not seem to fall into the appropriate boundary areas.

COMMENT (Michel Duval): There is a good deal of uncertainty in the temperature. The T1/T2 and T2/T3 boundaries are moved for natural ester.

CHAIR notes that Michel Duval redefined his triangle for natural esters.

EPRI arcing data as Excel spreadsheet

CHAIR: Acetylene and hydrogen are higher for mineral oil.

QUESTION (Joe Cultrera): What was the level of arcing?

CHAIR: (shows arcing test slide) 50 arcs/min at 140 A

QUESTION (Joe Cultrera): What was the arc energy?

CHAIR: not available here

EPRI arcing data as Duval triangle

CHAIR: The triangle shows D1 for mineral oil and D1/D2 for natural ester.

COMMENT (Michel Duval): Need to shift the D1/D2 boundary for natural ester.

CHAIR requests and receives permission to post Michel Duval's article on the website.

Motion

Don Cherry moves to propose a separate natural ester gas guide to the Insulating Fluids subcommittee. Seconds by Michel Duval and Claude Beauchemin.

Discussion:

COMMENT (Michel Duval): We should be careful not to duplicate too much from the mineral oil guide.

CHAIR: suggests using the silicone gas guide as a model (shows draft scope).

CHAIR: How will a retrofill affect the gas interpretation, as 6-7% residual mineral oil has been seen in an inadequately drained retrofilled transformer?

COMMENT (Dave Sundin): Limit the scope to new transformers.

COMMENT (Claude Beauchemin): The scope should not limit in that way.

QUESTION (Claude Beauchemin): Should synthetic esters be included?

QUESTION: The mineral oil guide is a definitive document. Should we even try to put together a separate guide for natural esters considering the lack of field data?

COMMENT (CHAIR): A trial guide is an option.

COMMENT (Fred Jacob): Look at the practical alternative. Laboratories gather natural ester gas data and must interpret it for their customers. The interpretation is empirical and evolutionary.

COMMENT (Michel Duval): The guide should give a strong warning that it's based on laboratory data.

QUESTION (Don Chu): Synthetic esters are used in transformers. Should the guide include synthetic ester?

COMMENT (Claude Beauchemin): Synthetic and natural esters are more alike in their gassing behavior than synthetic esters and mineral oil.

COMMENT (Michel Duval): There is enough information available to warrant combining synthetic and natural esters in one guide.

QUESTION (Dave Sundin): Should we include synthetic esters if the main manufacturer does not participate in drafting the standard?

COMMENT (Don Chu): The manufacturer will definitely not participate if synthetic esters are not included.

COMMENT (Clair Claiborne): The manufacturer does not consider the US to be a significant market.

COMMENT (Michel Duval): The behavior of the synthetic ester is more like manufacturer A's natural ester than it is to manufacturer B's natural ester.

Amended Motion

Claude Beauchemin moves to amend the motion to include synthetic esters. Don Chu seconds. The amended motion accepted by Don Cherry.

Vote:

For: 14

Against: zero

Motion as amended passed.

Scope

COMMENT (Bill Bartley): The scope proposed by the Task Force can be different than the scope adopted for the guide.

QUESTION (Joe Cultrera): Do laboratory tests reflect what is actually happening inside the transformer?

COMMENT (Fred Jacob): Change “theory” to “interpretation”

COMMENT (Michel Duval): In the course of writing this guide we may conclude that it should be an addition to the mineral oil guide.

CHAIR: What is the difference between a trial use guide and a guide?

COMMENT (Bill Bartley): Trial use is intended for things new to the industry, so it might be appropriate for this guide.

COMMENT (George Reiter): An advantage of the trial use guide is that it makes users aware that this is new to the industry.

QUESTION: Would a trial use guide make life easier for customers working with their insurance company?

CHAIR: It would be unlikely that it would make a difference.

QUESTION (Patrick McShane): Did the silicone gas guide start as a trial use guide?

CHAIR: No.

QUESTION (Patrick McShane): Has the silicone gas guide been changed since it was issued?

CHAIR: No.

New Business

None

Call for Volunteers

Assuming that the Insulating Fluids subcommittee accepts the recommendation of the Task Force, Scope and Purpose statements are needed to obtain a PAR. Volunteers please contact the Task Force chairman.

QUESTION (Patrick McShane): Will the Task Force be abandoned if the Insulating Fluids subcommittee does not approve the Task Force recommendation?

CHAIR: The Task Force will become a Working Group if the Insulating Fluids subcommittee approves the recommendation.

QUESTION (Joe Cultrera): Is a Working Group possible for the next meeting?

CHAIR: We hope to have the Working Group in Chicago.

QUESTION: Can the silicone guide be made available on the website?

CHAIR: Yes.

Adjournment

Motion to adjourn is made by Joe Cultrera. Second by Claude Beauchemin

7.3.3.3. WG C57.139 – DGA in LTCs

Fredi Jacob-Chair, Sue McNelly – Secretary

Sue McNelly, WG Secretary, presented a background review, and Rick ran the discussion. The WG meeting had 47 attendees. The officers called for more data. Fred Jacob and Jack Harley are working on a warning statement for flammable gases in the LTC. More information is needed on where to include the warning in the guide.

Claude Beauchemin stated that the PAR is set to expire end of 2009. Matt Ceglia of IEEE stated may be risk of requiring new par. Matt stated should work on ballot group by June. Bill Bartley stated that

RevCon deadline date Oct. 19th. Jim Dukarm stated that the draft is ready and needs WG review for checking accuracy and for raising any issues before next meeting so it can be voted on for submittal at next meeting and immediate forwarding to IEEE SA.

Minutes of WG Meeting

Fredi Jakob called the WG meeting to order at 12:05 pm, Tuesday, October 7, 2008. WG Secretary Susan McNelly was also present. There were 17 members and 30 guests present with 4 guests requesting membership.

Guests requesting membership were:

1. Frank Damico
2. H. Jin Sim
3. Clair Claiborne
4. Karsten Viereck

Meeting Agenda:

1. Welcome
2. Introduction
3. Patent Disclosure
4. Approval of Minutes from Spring 2008 Meeting
5. Review of Draft 9.1 of the guide
6. New Business
7. Adjourn

Introductions of the participants were made.

The IEEE Patent disclosure requirements were discussed and a request was made for disclosure of any patents that may be related to the work of the WG. There were no responses to the request for disclosure.

Approval of minutes from the Spring 2008 meeting in Charlotte, North Carolina was requested. The minutes were approved as written.

Review of Draft 9.1 of the guide:

- a. Information from Jim Dukarm on the LTC DGA samples was presented by the Chair.
- b. The following commentary was provided by Jim:
 - i. For the gas concentration norms, the left one is the C0.95 norm as derived in Addendum A. The right one (enclosed in parentheses) is the corresponding outlier rejection limit U. See the text at the end of the gas concentration norm 'recipe' for some discussion of these.
 - ii. In Example 1, both the ethylene/acetylene and the hot-metal/acetylene ratios are normal right up to the last sample shown, where they have extreme values. In this example, the gas concentrations are so low in all but the last sample that the gas ratios would have been meaningless.
 - iii. In all samples, gas concentrations were well below their respective limits.
 - iv. In Example 2, the gas ratios remain low and relatively constant in all samples. The ethylene, total hot metal gas, and acetylene all become noticeably high in the last two samples. Here we notice the usefulness of the advice given in the statistical

Addendum where it is stated that if the percent-point limit $C_{0.95}$ for a combustible gas is drastically higher than the outlier rejection limit U , then U should be considered for use as the caution limit for that gas.

- c. The following comments from Jack Harley were discussed:
- i. Comment 1: The gas levels discussed at the last meeting were quite high. Explosion level for acetylene in air is 2.5% or 25,000 PPM. Should there be a safety warning about C_2H_2 and the hot metal gases when readings get this high?
 1. TV indicated that it would be good to have a statement in the guide. Tom Prevost indicated that if you do, that you would need to set limits. The guide is for diagnostics. Comment from Dave Hanson was that anytime you are handling the fluid you need to be aware of the concern.
 2. Fredi Jakob asked for a motion. TV Oommen proposed that a safety warning be included. There were inclusive results from the vote. Fredi explained that setting limits would be difficult as individual gas limits would be meaningless. Jack Harley asked the question of whether as the typical user would know that there was a risk of opening a unit with this type of concentration of acetylene. He was in favor of some type of warning.
 3. Fredi Jacob indicated that a reference to the sampling guide be made. Beauchemin indicated that he didn't feel this resolved the issue of the safety issue. Fredi asked Jack and Claude to propose some wording for the document. Jin Sim requested that they contact Paul Griffin from Doble for more information.

Note: After the meeting, Fredi Jacob made a draft of the proposed warning for the WG to consider:

Warning

“Oil from load tap changers (LTC) taken while flushing prior to sampling or during and after removal for LTC servicing may create a flammable gas mixture when exposed to air. Handling of this oil should only be attempted by those maintenance or test technicians and engineers trained in working on and knowledgeable of the risks associated with it.

Oil with gas levels exceeding 1500 ppm dissolved hydrogen or exceeding 10,000 ppm total dissolved combustible gases could create a flammable gas mixture when exposed to air.”

- ii. Comment 2: What is the effect of gas solubility in oil on the readings? For example, if a field chromatograph is being used in the gas space, will the readings be the same as in the oil? And is there a saturation level for C_2H_2 or the hot metal gases in oil?
 1. Fredi Jakob indicated that the answer to this is no. There won't be any agreement. The answer to the second part of Jack's question is yes, there is a saturation level, but it is very high and would never happen. Jack indicated that the new automated methods of taking samples may be in the head space. Fredi indicated that most look at the gas-in-oil. A total combustible would be the only

iii. Comment 3: A sample spread sheet showing the formulae in the cells would be very helpful.

1. Fredi Jacob will ask Jim Dukarm w provide the spreadsheet in the document.

iv. Comment 4: from Vijayakumaran Moorkath:

1. “This standard is applicable only for oltc operating in mineral oil. There are LTCs operating in silicone oil and also natural ester. Are we planning to have a separate standard for these applications? Further, it is mentioned in cl.1.1 Scope, that the evaluation criteria is for mechanical damage or failure. I think the DGA should indicate initiation of dielectric failure of insulation components in diverter switch.”

2. Response from Fredi Jacob: No, we will not be addressing silicone or natural ester fluids in this guide. It is too late to change the scope and they will have different values just as in the main tank. Regarding

d. The latest draft, 9.1, was reviewed section by section with additional changes identified to be included in the next draft 10. The following items need to still be addressed:

i. Clause 6.3.1 – Question on where did the code come from. Provide reference.

ii. Add THG and Hot Metal Gases to the list of definitions in clause 3.

e. Fredi reviewed the case histories document.

The meeting was adjourned at 1:15 pm.

Fredi Jacob
Chair
Susan McNelly
Secretary

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

Sue McNelly presented the TF task force meeting summary to the subcommittee based on the minutes below. Don Cherry asked what will be the name of the standard on the new PAR. The answer: IEEE Guide for the Interpretation of Gases Generated in Oil-Immersed Transformers.

WG Meeting minutes as received:

The meeting was called to order by Chair Rick Ladroga at 1:52 pm. Vice-Chair & Secretary Susan McNelly was also present. There were 41 of 95 members present, 42 guests, and 7 guests requesting membership.

Guests requesting membership were: Bill Boettger, John Crotty, Rick Dong, Jesse Inkpen, Hali Moleski, Brian Penny, Robert Rasor

Agenda

1. Welcome
2. Introductions/Roll Call
3. Patent Disclosure
4. Approval of Fall 2008 WG Minutes
5. Scope & Purpose for PAR submittal
6. Comments from Jack Harley and Paul Griffin

The IEEE Patent disclosure requirements were discussed and a request was made for disclosure of any patents that may be related to the work of the WG. There were no responses to the request for disclosure.

Approval of minutes from the Fall 2009 meeting in Miami, Florida was requested. The minutes were approved as written.

Due to a late start, introductions of attendees were not made.

New Guide:

A new PAR request will need to be filed to start over with an immediate revision to the guide to address the remaining issues that have been raised as soon as the ballot process with the existing document is complete.

Proposed Scope (Revision text indicates changes to present Guide Scope language):

“This guide applies to mineral-oil-immersed transformers and addresses:

1. The theory of combustible gas generation in a transformer;
2. The interpretation of gas analysis;
3. Suggested operating procedures;
4. Various diagnostic techniques, such as key gases, Dornenberg and Rogers ratios; Duval triangle; and other methods;
5. Instruments for detecting and determining the amount of combustible gases present;
6. Case studies;
7. Evaluation criteria and guidelines; and
8. A bibliography of related literature.”

A motion to adopt the scope as proposed was made and seconded. The floor was opened for discussion.

Mark Perkins asked if the Guide applies to high temperature transformers. If not, can it be expanded to include them. Tom Prevost indicated that his understanding is that it is for transformers containing only cellulose insulation. Then there is a question in what of windings not covered in cellulose or with nylon mesh instead of cellulose.

One comment is that the standard deals primarily with the oil, for specific areas dealing with cellulose, they could be individually addressed within the document.

Another comment was made that users with very small units will try to apply this Guide and it may or may not be appropriate.

A question regarding expanding the Guide to include Natural Ester fluids was asked. The amount of work that is expected just to get the Guide revised for mineral oil alone is considerable. If the guide was expanded, this may make it difficult to get the Guide

Don Platts requested an amendment to remove the word “and” from the end of item 7 in the Scope.

The motion as amended was approved.

Proposed Purpose:

“The purpose of this document is to provide the transformer owner and/or operator with a Guide for evaluating transformers using analytical tools and methods involving transformer mineral oil and associated developed gases.”

A motion was made and seconded to approve the proposed purpose.

A question was asked as to whether the intent is to include both operating and stored units. This is not the purpose of the guide, but would not now preclude it.

It was pointed out that the word “operating” is used in the Scope that was just approved.

Tom Prevost indicated that the wording of the Scope and Purpose is critical to moving forward with a PAR request, so it is necessary that we get this right.

An amendment was made to modify the wording by changing the word “transformers” to “transformer” and add the word “condition”.

The motion was made to accept the above changes and the motion was approved.

The meeting was adjourned at 3:00 pm.

Respectively Submitted:

Rick Ladroga
WG Chair

Susan McNelly
WG Vice-Chair and Secretary

7.3.3.5. TF Guide for Field Application of Natural Esters

Jim Graham – Chair, Jerry Murphy Vice-Chair

Jim Graham presented the TF task force meeting summary to the subcommittee based on the minutes below. There were 42 attendees. Jim requested reviewed the meeting highlights covered in the meeting minutes below. Most important, a consensus was reached to recommend a Guide be established. Jim asked for and received from the Chair approval to upgrade the activity status from a TF to WG level and draft a PAR. The approval was received.

TF meeting minutes as received:

Meeting Minutes / Significant Issues / Comments:

The meeting was called to order at 3:15 PM, introductions were made, and an attendance roster was circulated. Membership attendance was checked, and we did have a quorum. The chair asked the group if there were any patents that needed to be disclosed. None were announced to the group. The task force minutes from the Fall 2008 meeting were reviewed and approved.

The proposed scope and purpose were presented and reviewed for additional comments. Most of the comments centered on the words to be consistent with the subcommittee O&P manual. The group also decided to change the word fluid/fluids to liquid/liquids throughout the document.

The task force members gave a consensus decision to submit a recommendation to the subcommittee for establishing a working group. The intent is to submit a title, scope and purpose for subcommittee and main committee consideration.

A draft outline was discussed as a starting point should a working group be formed. Don Cherry and Patrick McShane offered to provide information for inclusion in the draft outline.

The meeting adjourned at 4:15.

7.3.3.6. IEEE C57.130 IEEE Trial-Use Guide for Dissolved Gas Analysis During Factory Temperature Rise Tests for the Evaluation of Oil-Immersed Transformers and Reactors.

No WG meeting was held in Miami. Rick Ladroga asked if anyone knew the current draft number. An attendee responded 17 is the most recent draft. No specific information was provided on the status from the ballot resolution committee. Further specific action was not determined. The PAR is set to expire by the end of 2009.

7.3.3.7. TF on Particle Count Limits

TF Chair: Mark Scarborough

This Task Force was established after the spring 2008 meeting to investigate the issue and determine if there is a need to develop a standard for particulate limits for new fluid, as received in new equipment, and continued use. No TF meeting was at the spring 2009 meeting.

7.3.4. Old Business

An Ad Hoc committee formed to review existing standards to determine the consistency of terms regarding dielectric coolant terms used in TC Standards. John Luksich did the first draft of listing the greater than 60 standards that make at least one reference to “oils”. More input sought and Bill Bentley suggested that the topic be presented to the Standards SC meeting later in the day. Patrick McShane agreed to make the presentation in order to get guidance from the TC Standards SC.

7.3.5. New Business;

The Chair of the TC Standards SC, William Bartley advised that IEEE C57.121 – Guide for Acceptance and Maintenance of Less Flammable Hydrocarbon Fluid in Transformers is set to expire. David Sundin offered to volunteer to work on getting the process on track.

It was requested that a new TF be developed to continue the work done by the TF that was started in the Insulation Life SC on moisture in insulation. It was determined by the ILSC that this more appropriately belonged within the IFSC. Bob Raser volunteered to chair this TF. Tom Prevost, Paul Boman, Matt Kennedy, Jim Thompson, Don Platts, Hali Moleski, and Rick Ladroga also volunteered to work on this TF.

Respectfully Submitted:

**Rick Ladroga
Fluids SC Chair**

**Susan McNelly
Fluids SC Vice-Chair**

**Patrick McShane
Fluids SC Secretary**