

Annex H Insulation Life Subcommittee

**March 23, 2016
Atlanta, Georgia**

**Chair: Sheldon Kennedy
Vice-Chair: Barry Beaster
Secretary: Sam Sharpless**

The Insulation Life Subcommittee met in Atlanta, Georgia on March 23, 2016 at 8:00 AM. Due to the size of the group, general introductions were not made. The chair requested that each person state their name and affiliation when addressing the subcommittee.

A hand count of the members at the beginning of the meeting revealed that 62 of 106 members were present. A quorum was declared.

The minutes for November 2015 Insulation Life Subcommittee meeting in Memphis Tennessee were presented. A motion to approve the minutes was made by Phil McClure and seconded by John John. Approval was unanimous.

The chair presented the proposed agenda for the meeting. A motion to approve the minutes was made by Tom Prevost and seconded by Bruce Forsyth. The minutes were unanimously approved without discussion.

A hand count of the attendance rosters after the meeting indicated a total attendances of 222 people, including 73 members. 14 guests requested membership. The complete attendance will be recorded in AMS.

H.1 Chair's Report

The Chair, Sheldon Kennedy, welcomed everyone to the meeting. He stated that the next meeting of the committee will occur during the 2016 Fall meeting in Vancouver, British Columbia, Canada, October 23-27, 2016. The final date and location of the Spring 2017 meeting has not been finalized. Those present were directed to the committee website for details as they become available.

The Chair reviewed the scope of the Insulation Life Subcommittee. A motion was made by Sanjib Som to change section "a" of the scope, replacing "...safe insulation temperatures..." with "...recommended insulation temperatures...". This change was seconded by Gary Hoffman. The motion carried unanimously.

The Chair thanked activity leaders for leading effective meetings and keeping activity documents up to date. He noted that the minutes for working groups should include the name of the activity, the date and time of the meeting, the number of members and guest present, the presence or absence of a quorum, a summary of the discussion, a record of the decisions made in the meeting, and the date/time/place of the next meeting. He requested that the minutes be submitted as soon as possible and no later than 30 days after the date of this meeting.

The chair reminded everyone that working groups need a 2/3 majority to submit a document for Sponsor Ballot. The subcommittee needs a simple majority to submit a document for Sponsor Ballot.

The following new members were welcomed and recognized; Michael Barnes, Josh Herz, Arvin Joshi, Sheldon Kennedy, Kenneth McNeish, Dhiru Patel, Álvaro Portillo, Eduardo Robles, Zoilo Roldan, Mathieu Sauzay, Jose Valencia, and Waldemar Ziomek.

The following members were moved to guest status; John Crouse, Van Nhi Nguyen, Michael Botti, Martin Hinow, and David Wood. Don Duckett was removed from the rolls at his request.

H.1.1 Project Status Reports

H.1.1.1 C57.91 IEEE Guide for Loading Mineral-Oil-Immersed Transformers

C57.91 is valid until 2021.

H.1.1.2 C57.100 IEEE Standard Test Procedure for Thermal Evaluation of Liquid-Immersed Distribution Transformers

C57.100 is valid until 2021.

H.1.1.3 C57.119 IEEE Recommended Practice for Performing Temperature Rise Tests on Oil-Immersed Power Transformers at Loads Beyond Nameplate Ratings

C57.119 is valid until 2018.

H.1.1.4 C57.154 Design, Testing and Application of Liquid-Immersed Transformers with High-Temperature Insulation

C57.154 is valid until 2022.

H.1.1.5 C57.162 - Guide for the Interpretation of Moisture Related Parameters in Dry, Gas Insulated and Liquid Immersed Transformers and Reactors

The C57.162 PAR expires December 31, 2017. The standard is valid until 2018.

H.1.1.6 1276 Guide for the Application of High Temperature Insulation Materials in Liquid-Immersed Power Transformers

The 1276 PAR expires December 31, 2016. The standard is valid until 2018.

H.1.1.7 1538 IEEE Guide for Determination of Maximum Winding Temperature Rise in Liquid-Filled Transformer

1538 is valid until 2021. The amendment was approved in September 2015.

H.1.2 Working Group and Task Force Reports

H.1.2.1 Working Group on PC57.162 - Guide for the Interpretation of Moisture Related Parameters in Dry, Gas Insulated and Liquid Immersed Transformers and Reactors – Tom Prevost

A meeting was held on March 21, 2016 for WG PC 57.162 Guide for the Interpretation of Moisture Related Parameters in Dry, Gas Insulated and Liquid Immersed Transformers and Reactors. (Moisture in insulation systems)

Attendance	Members	54 out of 86
	Guests	84
	Guests Requesting Membership	15

Meeting Minutes

Tom Prevost, chair, introduced himself and in the interest of saving time members and guests introduction was skipped.

A quorum of the working group members were present 54 out of 86.

The first meeting minutes approved with Sam Sharpless making a motion and Claude Beauchemin seconding the motion.

Tom Prevost also mentioned he sent out the agenda for the meeting today. Deanna Woods asked Tom Prevost to mention the criteria for membership to the group. Tom Prevost went over the Scope and Purpose of the working group.

Timeline, we are using up our 4 years allotted very quickly therefore the WG is close to deadline. Tom also mentioned that extensions for PARs are becoming difficult to obtain for the WG. So we need to get things moving along. We will be circulating out the compiled documents in the next couple of months.

Some Task Forces have made great progress and after the updates today we will know which task forces need to do more work.

Task Force 1 - Terminology and Definitions

Task Force Leader - Jeff Golarz jgolarz@lumasenseinc.com

This section will list and define the terminology for moisture related phenomena in solid, liquid and gaseous insulating materials used in transformers and reactors.

Tom Prevost asked Jeff Golarz to come forward and discuss his task force and go over the scope. Jeff sent out to TF leader and received 2 responses to date. There are 50 to 55 terms to date.

Task Force 2 - Measurement and evaluation of moisture-in-gas insulation parameters

Task Force Leader – Tom Melle tom.melle.us@ieee.org

This section describes existing measurement, evaluation and methods of moisture and other relevant parameters in a gaseous medium. Tom is looking for scientific people to help and

someone with field experience with dew point and moisture and finally someone with historical research.

Tom Melle gave a review of where the Task Force stands and is having a meeting for the Task Force on Tuesday.

Tom had Oleg Roman give a short presentation on dew point.

Task Force 3 - Measurement and evaluation of moisture-in-liquid insulation parameters

Task Force Leader - Claude Beauchemin beauchemin@tjh2b.com

This section describes the existing measurement and evaluation methods of moisture parameters and other relevant parameters in the liquid medium of a transformer or reactor for sequential or continuous on-line moisture assessments.

- -Karl Fisher Methodology
- -Consider effect of chemical solutions used for new aged and contaminated insulating liquids
- -Consider types of insulating liquid
- -Relative Saturation
- -Consider measurement method
- -Capacitive probe
- -Derived from Karl Fisher
- -Effect of aging (contamination) on water solubility

Claude reported that there was not much change from the last meeting. Claude did not endorse Karl Fisher for getting relative saturation.

Task Force 4 - Measurement of moisture in solid insulation

Task Force Leader - Paul Griffin pgriffin@doble.com / Ron Hernandez is taking lead

Ron went over the purpose that describes the methods of measurement of moisture in solid insulation using a balance, for un-oiled insulation and a Karl Fisher method using solvent extraction or vapor extraction for oiled insulation. Ron stated that they had a motion to change the scope and it was declined and left as is.

Task Force 5 - Estimation of moisture in solid insulation

Task Force Leader - George Frimpong george.k.frimpong@us.abb.com

The TF has changed the name to estimation of moisture in solid insulation. The TF is done with their section and waiting for comments.

Task Force 6 - Inferring of moisture in solid insulation from measurements conducted in liquid or gaseous medium

Task Force Leader - Valery Davydov valery.davydov@ieee.org

This section describes methods of inferring moisture in solid insulation from that measured in the liquid or gaseous medium for both sequential and continuous on-line measurements.

A presentation was sent to Tom Prevost and presented by Tom after everyone else has presented.

Task Force 7 - Evaluation of aging and end of life of solid insulation parameters

Task Force Leader- Roger Wicks roger.c.wicks@usa.dupont.com

This section describes approaches for evaluation of parameters of end of life of solid insulation affected by moisture.

The consideration of the effects of moisture, oxygen and aging byproducts in transformer aging tests is the purpose of this task force.

Clarification the focus is aging in liquid not gas or dry. TF will focus on liquids.

Task Force 8 - Factory/workshop application of knowledge on moisture; establishing baselines

Task Force Leader - Poorvi Patel poorvi.patel@us.abb.com

This section describes a factory/workshop approach to the establishment of a baseline for each important moisture related parameter.

Poorvi Patel reported that they have completed the work.

Task Force 9 - Field application of knowledge on moisture

Task Force Leader - Jim Thompson serve1@svtv.com

This section lists the risks associated with moisture

Jim has next step to get comments on the survey spreadsheet and has yet to have final outcome returned. Survey deals with the effect of moisture does to a transformer and sample data.

Task Force 10 - Table of contents pertaining to moisture migration and moisture distribution

Task Force Leader – Bruce Forsyth bruce.forsyth@ieee.com

Bruce is still looking for members. He got one person.

Tom Prevost presented Valery Davydov's presentation relative to Task Force 6's work.

Meeting adjourned.

H.1.2.2 Working Group for Application of High-Temperature Materials IEEE P-1276 – Roger Wicks

Sheraton Atlanta Hotel – Atlanta, Georgia USA

Room – Capital Center

March 22, 2016, 3:15 - 4:30pm

Roger Wicks – Chair Mike Franchek – Vice Chair Javier Arteaga - Secretary

A. Welcome & Chairman's Remarks

R. Wicks

Roger opened the meeting at 3:15pm with a brief description of the scope of the Working Group.

B. Circulation of Attendance Rosters
Circulated J. Arteaga

C. Attendance for Quorum J. Arteaga

16 members were in attendance meeting the quorum requirement of 16 members. From the rosters at the end of the meeting there were 18 members in attendance and 73 guests. Of these 55 guests, 11 requested membership. The attendance will be reviewed and new members will be added if they meet current attendance requirements. The attendance will be recorded in the AMS system. The automated attendance records (scanning system) recorded 17 members and 55 guests. Number of members in system (for quorum purposes of 31) differed from our printed roster (of 30 members).

D. Approval of Fall 2015 Meeting Minutes – Memphis, TN J. Arteaga

David Sundin made a motion to approve the minutes as written, John Luksich seconded it and these were unanimously approved without changes.

E. Approval of Meeting Agenda R. Wicks

The agenda was approved unanimously without changes.

F. Review of IEEE 1276 D1.3

All

Aleksandr Levin requested clarification of the need for more details on section 5.5, aging test procedure for hybrid high-temperature insulation-system qualification, indicating that the already provided details in standard C57.100 are sufficient and we only need to make reference to this standard.

John Luksich also indicated that he is satisfied with the content of C57.100 as related to section 5.5 and there is no need to duplicate the information. David Sundin also agreed with John's statements.

The Chair agreed with these comments, but pointed out that section 6, insulating materials, needs more information regarding ageing of enamels in conductors. Rick Marek indicated that for enamel, all test data available is at room temperature and in air and there is a need to describe its thermal qualification at higher temperatures and in the fluids considered, being a first step the determination of the thermal evaluation qualifiers.

Chair also mentioned that the section for insulating fluids is missing a test method to determine the thermal capability of these. Rick Marek commented that the fluids table in standard C57.154 contains information about various fluids, with reference values based only on consensus data, without the existence of formal qualification of their properties and he does not favor to repeat this table in our document. He suggested the need to add an Annex to describe the thermal qualification of the fluids.

Aleksandr Levin requested to reference standard C57.100 as much as possible, adding only new information to our document. New components added to this standard will have their description and the description of their applicability for use at higher temperatures.

John Luksich presented his contribution for Annex C, loading guide for natural esters. This annex provides a guide similar to standard C57.91, but referred to thermally upgraded cellulose insulation in natural ester fluids. The life curve is based on 130°C and 180,000 h for loss of life with data points generated by tests. Additional curves could be plotted for other temperatures following the same slope when the same insulation materials are used. However, if different insulating materials are used it is very possible that the slope of the curve may be different. Therefore its applicability is only for the materials used in the tests.

Joe Foldi indicated that in order to use this new curve it is necessary to determine the hot spot of the winding and the methods available in C57.91 are based in mineral oil. He indicated that with testing following the guidelines of standard C57.119 it would be possible to determine the exponents "m" and "n" applicable to natural ester fluids.

Chair requested manufacturers to provide these values if they are available. He also commented that in many cases the new insulation systems covered in the scope of this document are using temperatures well above standard, so knowledge of these exponents and the effects on hottest spot (and hence life prediction) would be critical.

Rainer Frotscher requested also that have data for other insulating materials like aramid paper or others. Chair mentioned that he has made tests with aramid paper at 240°C, but after 2 years he was still unable to generate the thermal curve for this materials per C57.100 (as the material was essentially unaffected). John Luksich commented that with cellulose insulation, the life of

the transformers is based on the cellulose properties, but with aramid paper the life of the transformer is more dependent of the fluid used.

Chair will send by e-mail the draft to working members and volunteers who are still listed as guests, but because of file size will upload the draft to our website (may need to work with Sue to develop a site). The file is too large to go out via the AMS system. Guests can access this on Transformers Committee website.

The PAR of this standard expires at the end of this year and it may be required to have a draft circulated at least within the working group, members and guests, in order to be able to request an extension. The standard expires at the end of 2018.

The assignments for the elaboration of the draft are as follows;

Section 5 – Insulation-system temperature ratings, test procedures, and material aging qualification: Chair - Roger Wicks

Volunteers – Mike Franchek, Ken McNeish, Tom Golner, David Stankes, Solomon Chiang, Joshua Verdell, Dave Sundin, Jinesh Malde, and Mohamed Diaby.

Section 6 – Insulating Materials.

Chair – Javier Arteaga

Volunteers – Clair Claiborne, Julio Caldeira, Patrick McShane, Dave Sundin, Attila Gyore, Chuck Stevens, Shane Goydich, Jinesh Malde, Dustin Davis, and Mike Shannon.

Section 7 – Description of high-temperature transformers.

Chair – Mike Franchek

Volunteers – Kurt Kaineder, Arup Chakraborty and Evan Langran.

Section 8 – Loading guidelines for high-temperature transformers.

Chair – John Luksich

Volunteers - Arup Chakraborty and Jinesh Malde

Section 10 – Heat run test and average winding temperature.

Chair – Juan Castellanos

Volunteers – Mike Franchek

The Chairman indicated that the working group will meet again in the Fall 2016 meeting.

No further discussion, so with this, John Luksich moved to adjourn, seconded by Kurt Kaineder. Meeting adjourned at 4:11 PM.

H.1.2.3 Working Group on C57-119 IEEE Recommended Practice for Performing Temperature Rise Tests on Oil-Immersed Power Transformers at Loads Beyond Nameplate Ratings – Gael Kennedy

The document is undergoing ballot resolution. It is still on track to be completed prior to the end of 2018. This working group did not meet during the Atlanta Conference.

Submitted by: Gael R Kennedy

H.2 Old Business

Gary Hoffman presented the findings of the study group formed to “establish a title, scope, and purpose for the proposed guide for temperature measurement”.

- Proposed Title - “IEEE Guide for Transformer Temperature Measurement”
- Proposed Scope - “This guide discusses and recommends methods of temperature measurements for liquid immersed transformers and reactors. Thermal well types as well as sensors for both indirect and direct temperature measurement are included. Temperature measurement applications including liquid, winding, LTC, other parts and ambient temperatures on transformers, reactors and accessories attached to the transformer or reactor are discussed.”
- Proposed Purpose – “This guide discusses and recommends methods of temperature measurements for liquid immersed transformers and reactors. Thermal well types as well as sensors for both indirect and direct temperature measurement are included. Temperature measurement applications including liquid, winding, LTC, other parts and ambient temperatures on transformers, reactors and accessories attached to the transformer or reactor are discussed.”

There was a question as to whether the guide could also cover dry-type transformers and this issue was discussed at length. There was also discussion as to whether this information should be included as a part of another existing standard or guide.

A motion was made by Jeff Golarz to publish the task force’s report, and this motion was seconded by Don Platts. The motion carried 62 yeas to one nay and one abstention.

A motion was made by Gary Hoffman to approve the Title, Scope, Purpose (as proposed) and submit a PAR to the Standards Association Standards Board for approval of a new project. The motion was seconded by Bruce Forsyth. Phil McClure made a friendly amendment to the motion for the title to be “IEEE Guide for Liquid Immersed Transformer Temperature Measurement”. A vote was taken and the motion carried with 57 yeas, 2 nays, and 5 abstentions.

A question was raised about applicability of the new guide to reactors as well as transformers. After much discussion, there was ultimately a proposal to amend the title to be “**IEEE Guide for Temperature Measurements for Liquid Immersed Transformers and Reactors**” and the scope to read “**This guide discusses and recommends methods of temperature measurements for liquid immersed transformers and reactors. Thermal well types as well as sensors for both indirect and direct temperature measurement are included. Temperature measurement applications including liquid, winding, LTC, other parts and ambient temperatures on transformers, reactors and accessories attached to the transformer or reactor are discussed.**” Gary Hoffman made a motion to accept these changes and it was seconded by Phil McClure. The motion was carried with 46 yeas, one nay, and one abstention.

Phil McClure agreed to be the chair for the new guide and was so appointed by the Chair.

H.3 New Business

The chair asked for volunteers address ballot comments for C57.12.00 by Mark Perkins wherein clause 4.3.1 makes reference to C57.91. Bruce Forsyth and Gary Hoffman were appointed to study the situation and provide a response.

H.4 Adjournment

Bruce Forsyth made a motion to adjourn. Gary Hoffman seconded this motion. The meeting was adjourned.

Respectfully submitted,

Samuel L. Sharpless
Secretary, Insulation Life Subcommittee