

## **Annex L Standards Subcommittee – Unapproved Minutes**

**March 28<sup>th</sup>, 2018**  
**Pittsburgh, PA**  
**USA**

**Chair: Jerry Murphy**  
**Vice Chair: Kipp Yule**  
**Secretary: Daniel Sauer**  
**Standards Coordinator: Jim Graham**

The Chair, Jerry Murphy opened the meeting calling for a show of members to establish quorum which was met.

### **L.1 Meeting Attendance**

The Standards Subcommittee met on Wednesday, March 28th, at 4:34 PM EDT. A show of hands indicated 25 of 44 members in attendance at the beginning of the meeting which met the quorum requirement. Overall the attendance roll showed there were 103 attendees, 32 members, 71 guests, including 13 that requested membership upon tabulation of the circulated rosters and will be reviewed for eligibility. Furthermore, three attendees signed the paper roster but did not use the RFID system, and eight attendees used only the RFID system and not the paper roster. Jim Graham moved to approve the agenda with second by Vinay Mehrota; motion was carried with unanimous consent. Jerry then requested a review of the Louisville minutes; motion was made by Ajith Varghese and seconded by Vinay Mehrota; motion was carried with unanimous consent.

### **L.2 Chair’s Remarks**

### **L.3 Working group reports**

#### **L.3.1 Continuous Revision of C57.12.00-2015 – Steve Snyder**

The purpose of this WG is to compile all the work being done in various TF/WG/SC’s for inclusion in the continuous revision of C57.12.00 in a consistent manner. This WG coordinates efforts with the companion Standard C57.12.90 so that they publish together.

The current standard was approved by the IEEE-SA Standards Board on December 5, 2015, with an official publication date of May 12, 2016. The standard is good for 10 years, but is under continuous revision and will be next balloted when sufficient new material is available. The PAR which covers the ongoing continuous work on the document is good through December 31, 2021.

As agreed at the Fall 2016 Standards Subcommittee meeting, any new material provide to me for inclusion in the next revision, will first be presented to this subcommittee for the “official” vote of approval. At this time no new material has been submitted to me since the Fall 2017 meeting.

Respectfully submitted by Steven L. Snyder, WG Chair, on March 28<sup>th</sup>, 2018.

### L.3.2 Continuous Revision of C57.12.90-2015 & Cor. corrections – Steve Antosz

#### INTRODUCTION

This is a working group by committee of task forces, for continuous revision of C57.12.90. The purpose of the WG is to keep track of the work being done in various TF/WG/SC's for inclusion in the continuous revision of C57.12.90 in a consistent manner.

#### SUMMARY

The revised document was published in March 2016 as IEEE Std C57.12.90-2015. Shortly after the document was published, one error and one omission was discovered, so a Corrigendum was done and published on March 23, 2017. It is *IEEE Std C57.12.90™-2015/Cor 1-2017 (Corrigendum to IEEE Std C57.12.90-2015) Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers Corrigendum 1: Editorial and Technical Corrections.*

#### STATUS

A new PAR was submitted by me in October 2017 and it is on the agenda for NESCOM's next meeting in December.

#### FUTURE REVISIONS AND PENDING WORK

As agreed at the Fall 2016 Standards Subcommittee meeting, any new material provided by the various Task Forces to this WG Chair for inclusion in the next revision, will first be approved by the responsible technical subcommittee (Diel Test, PCS, Dist, IL, etc) and then presented to the Standards Subcommittee for the "official" vote of approval.

Since this is a continuous revision document, there continues to be ongoing work in the various Task Forces.

Changes already approved for the next revision:

- Changes to 9.3.1 Wattmeter-voltmeter-ammeter method from Mark Perkins' PCS TF for Revision of C57.12.90. Final survey approved in Nov 2015 in both the TF and PCS. The following text is to be added just prior to Figure 18 for three-phase transformers:

An alternate method for either single phase or three phase transformers is to provide capacitive compensation for the transformer impedance at the terminals of the transformer so that the AC source need only supply the real power for the test. Figure 18 shows the apparatus and connections for a single phase transformer for this alternate method and the method can also be used in a three phase configuration. In this case, the wattmeter will measure the real power of the transformer under test plus the power of the capacitors, which will be very small compared to the power in the transformer. The load loss in the transformer is determined by subtracting the loss in the capacitors from the measured loss. For modern oil film capacitors, a loss of 0.2 watts per actual kVAR may be used unless a specific capacitor bank loss is known. This method requires a separate CT or set of CTs at the transformer for setting the current and measuring the transformer impedance. The advantage of this alternate method is that the phase angle between the voltage and current at the wattmeter is low (closer to zero degrees) due to the capacitor compensation, so any phase angle errors in the loss measurement circuit are much less significant.

- Add in subclause 10.3.1 and 10.3.1.1 Lightning Impulse, the following words in red; by Pierre Riffon's WG Revision to Impulse Test in Dielectric Test Subcommittee. Submitted on 11/4/2016.

These subjects have been surveyed within the Dielectric Tests SC and within the TF. The 4<sup>th</sup> survey got a 100% approval rate.

10.3.1 Impulse tests shall be made without excitation. The impulse waveshape parameters such as peak voltage, front time and tail time are determined on the test voltage curve which is obtained after having processed the recorded curve using the test voltage function method, as defined in IEEE Std. 4.

#### 10.3.1.1 Full-wave test

The test wave rises to crest in 1.2  $\mu\text{s}$  and decays to half of crest value in 50  $\mu\text{s}$  from the virtual time zero. The crest value shall be in accordance with the assigned basic impulse insulation level (BIL), subject to a tolerance of  $\pm 3\%$ ; and no flashover of the bushing or test gap shall occur. The tolerance on virtual front time should be  $\pm 30\%$ , and the tolerance on time to half of crest should be  $\pm 20\%$ . However, as a practical matter, once the manufacturer has proven that they have test equipment limitations, the following shall be considered:

a) If the standard impulse shape cannot reasonably be obtained because of low winding inductance or high capacitance to earth and the resulting impulse shape is oscillatory so that the relative overshoot magnitude exceeds 5 % then the front time may be increased to reduce the overshoot amplitude. In all cases, the front time shall not exceed 2.5  $\mu\text{s}$  regardless of the overshoot amplitude.

Note 1: The overshoot can be reduced by increasing the front resistor value of the impulse generator. The use of low inductance connections between the impulse generator and the tested transformer are also recommended.

- New wording in subclause 10.3.1.3 Chopped-wave test, approved following the Louisville meeting in Fall 2017.

#### 10.3.1.3 Chopped-wave test

A chopped wave is inherently a full lightning impulse wave, except that the crest value shall be at the required level and the voltage wave shall be chopped at or after the required time to flashover (time to chopping) but not later than 6  $\mu\text{s}$  after virtual origin. The virtual front time of the chopped wave may be different than the virtual front during a full-wave test because of the presence of the chopping gap. Nevertheless, the tolerance on the virtual front time for the chopped-wave test should remain as defined for full-wave test.

The gap or other equivalent chopping device shall be located as close as possible to the terminals of the transformer without disrupting its electrical field distribution. The distance between the chopping device and the test object shall not exceed a lead length greater than the total height of the transformer (tank + bushing). The impedance between the tested terminal and the grounded end of the chopping device shall be limited to that of the necessary leads. The voltage zero following the instant of chopping should occur within 1  $\mu\text{s}$ . However, for some winding and transformer designs (particularly low-voltage windings of high stray capacitance, layer windings, high capacitance windings, UHV transformers requiring large clearances, etc.), the circuit response after chopping may not be oscillatory it may be overdamped or may collapse to zero with a lower frequency (slower voltage collapse). For such cases, the time interval to the first voltage zero after the instant of chopping may be significantly greater than 1  $\mu\text{s}$  and this deviation shall be accepted if the chopping gap is located as described above.

In order to have a common procedure for the determination of the steepness of voltage collapse, the steepness of the voltage collapse shall be the time interval between the instant of the voltage chopping to the instant where the applied voltage is 20% of the voltage level at instant of chopping. This time interval should be equal to or less than 0.8  $\mu\text{s}$ .

Only for cases...*(this paragraph and the last paragraph remain as they are in the 2015 edition, including the three NOTES)*..."

pending work

- Possible future addition of a new clause for a Load Tap Changer Performance Test, from Hakan Sahid (formerly Mark Perkins) PCS TF for Revision of C57.12.90.

This TF also is considering to add a clause that a transformer be tested with the same insulation liquid that it will use in service. For example, a unit to be filled with ester liquid should (or shall?) not be tested with mineral oil in the factory.

- Future revision to subclause 10.8.2 from Bill Griesacker's (formerly Bertrand Poulin) TF regarding a limit of pressure applied inside a transformer tank during induced voltage test. Ongoing work continues and is nearing an end.
- Other possible revisions to subclauses 10.2 to 10.4 from Pierre Riffon's TF for revision of impulse tests. Ongoing work continues.
- Other possible revisions to subclauses 10.5 to 10.10 from Bill Griesacker's TF (formerly Bertrand Poulin) for revision of low frequency tests. Ongoing work continues. A TF has been formed to look at reducing the limit for PD level Failure Detection in 10.8.5.
- Possible additions from Phil Hopkinson to detect improper core grounding in 10.7.7 for Special Induced-Voltage partial discharge Test for distribution and class I power transformers with a wound core, L-H winding construction and HV >15 kV. PD is to be measured as apparent charge in pico-coulombs (pC). One reading shall be made at the end of each interval. Minimum test duration and application of voltage:
  1. Voltage shall be raised to 100% of rated volts for 30 seconds and PD shall be measured and recorded.
  2. Voltage shall be raised to 110% of rated volts for 30 seconds and PD shall be measured and recorded.
  3. Voltage shall be raised to 150% of rated volts, held for 1 minute and PD shall be measured and recorded.
  4. Voltage shall be lowered to 140% of rated volts, held for 1 minute and PD shall be measured and recorded.
  5. Voltage shall be lowered to 130% of rated volts, held for 1 minute and PD shall be measured and recorded.
  6. Voltage shall be lowered to 120% of rated volts, held for 1 minute and PD shall be measured and recorded.
  7. Voltage shall be lowered to 110% of rated volts, held for 10 minutes and PD shall be measured and recorded.

Respectfully submitted by Stephen Antosz, WG Chair, on March 28, 2018

**L.3.3 Corrigenda for C57.12.70 – Steve Shull**

1. Steve called the meeting to order and introductions were made.
2. Quorum with 8 of 11 members were present at first call.
3. Confirmation of the essential patent statement and no response.
4. Approval of agenda for this meeting. Lee Matthews motioned & Dan Mulkey seconded; motion carried with unanimous approval.
5. Approval of minutes of the previous meeting Lee Matthews motioned & Dan Mulkey seconded; motion carried with unanimous approval.
6. Old Business
  - a. Steve explained to the working group that a copy of the annex was sent out to members on March 13<sup>th</sup> and had received no comments. Steve asked all members and guests for consideration of approval to ballot on the dispersed copy.

- b. Tyler Morgan had some minor corrections to be made to the diagrams and titles of those diagrams. Jason Varnell had additional comments for more minor diagram title corrections. As the discussion continued, it was clear the document was not ready to ballot. After a lot of discussion it was decided that due to the need to revise the main standard document before 2021, the current corrigenda would not move quickly enough to allow for time to revise the current main standard document before it was withdrawn. This being the case Steve suggested that we withdraw the corrigenda PAR and resubmit a PAR for total document revision.
  - c. Dan Mulkey made a motion to withdraw the corrigenda PAR seconded by Jason Varnell and after extensive discussion the motion was approved. Due to other commitments, Steve Shull withdrew from the Working Group Chair position. Jerry Murphy as Sub-Committee Chair appointed Jason Varnell to assume the position of chair. Jason will submit a new PAR before the fall meeting.
7. New Business – none.
  8. Next meeting on October 14, 2018 in Jacksonville, Florida
  9. Steve adjourned the meeting at 4:15pm.

Respectfully submitted by Jerry Murphy, on March 27<sup>th</sup> 2018.

#### **L.3.4 WG Standard Transformer Terminology C57.12.80**

##### Chair's Remarks:

The Chair opened the meeting at 4:45 p.m. on Tuesday 27 March, 2018.

The chair noted the low attendance of this working group's meeting to date, possibly due to conflicting schedules with other working groups.

Attendance Roster Sign In / Quorum Check:

Quorum was achieved with four of six members present.

Approval of the Agenda

A motion to approve the agenda was made by Fredric Friend, seconded by Lee Matthews. The motion passed unanimously.

Call for Essential Patents

A call for essential patents was made. No essential patent issues were reported.

Approval of the minutes

A motion to approve the Fall 2017 minutes was made by Fredric Friend, seconded by Lee Matthews. The motion passed unanimously.

Unfinished Business

A definition for wind turbine GSU transformers has not been submitted

**Action Item:** Fredric Friend will contact Phil Hopkinson, to get a suggested wind farm GSU definition for working group consideration.

A task force to review of existing standards for new definitions was suggested.

It was proposed to check the IEEE dictionary for transformer related definitions and to ask Ms. Zaman for a word document. A volunteer to do this is needed.

New Business

It was suggested to make the current draft of the PC57.12.80 available to the working group for review to stimulate more comments.

**Action Item:** Secretary Jim Graham will arrange to post PC57.12.80 draft 1.0 on the website in the protected area.

A task force to conduct a review of existing standards for new definitions was discussed.

**Action Item:** A request to solicit liaisons from all technical subcommittees to review their standards/guides for definitions which could be added to the terminology standard will be submitted to the Standards subcommittee.

**Action Item:** Lee Matthews will review the definitions included in the regulator standard (C57.15) and recommend if any should be incorporated into the terminology standard. It was suggested the working group develop a policy regarding the location of definitions in individual standards vs in the terminology standard. No decisions were made. The meeting was adjourned at 5:15 p.m.  
Next meeting - October 15, 2018 at Jacksonville, FL  
Respectfully submitted by Jim Graham, March 27<sup>th</sup>, 2018.

**L.3.5 IEEE / IEC Cross Reference**

There was no meeting at Pittsburgh, but it is planned to meet in Jacksonville.

**L.4 Old Business**

There was no old business discussed.

**L.5 New Business**

**L.5.1 C57.144 IEEE Guide for Metric Conversion of Transformer Standards**

There was discussion about this document as it either needs to be worked on to be brought to a current revision or it can expire. Jim Graham explained the difference between a withdrawn standard which is actively removed from publishers and an expired standard which is still available from some publishers but it is noted that the information may be out of date. The members decided to let this document expire.

**L.5.2 Standards Sub-Committee Leadership**

Kipp Yule announced that he is stepping down from the Vice Chair position. The Chair: Jerry Murphy announced that the Secretary Dan Sauer would progress to Vice Chair. The secretary position was opened as a result. Following the meeting, Marcos Ferreira volunteered for the Secretary Position and was accepted by the Chair Jerry Murphy.

**L.5.3 C57.152 Field Test Guide**

The status of this document was questioned. It is OK for now, but a revision should be envisioned in the near term future. It was noted that Jane Verner has resigned as the chair of this document. Kipp Yule stated that this document was originally envisioned as a continuous revision document in the same fashion as C57.12.00 & C57.12.90. This document will be on the agenda for a new revision under new business at the next meeting.

**L.5.4 What goes where?**

Kipp Yule asked about the status of the What Goes Where study. The document will be circulated to all Sub-Committee chairs for comment and any necessary revisions will be presented at the next meeting in the fall.

**L.6 Adjournment**

The meeting and was adjourned at 5:14 PM EDT.

Respectfully submitted by Daniel M Sauer, Standards SC Secretary