# Annex L Standards Subcommittee – Unapproved Minutes

**March 27, 2019**
**Hilton Anaheim Hotel, Anaheim, CA, USA**

**Chair: Jerry Murphy**
**Vice Chair: Daniel Sauer**
**Secretary: Marcos Ferreira**
**Standards Coordinator: Jim Graham**

The Chair, Jerry Murphy opened the meeting calling for a show of members to establish quorum which was met based on RFID system verified by e-mail.

## L.1 Meeting Attendance

The Standards Subcommittee met on Wednesday, March 27, 2019 at 4:30 PM EDT. A show of hands indicated **38 of 48** members in attendance the beginning of the meeting which met the quorum requirement. Overall the attendance roll showed according to RFID system: there were **120** attendees, **39** members, **58** guests, and **23** new guests including **10** that requested membership upon tabulation of the circulated rosters and will be reviewed for eligibility. Furthermore, we have the numbers of presence confirmed by the paper rosters. Steve Shull moved to approve the agenda with second by Susan McNelly; motion was carried with unanimous consent. Jerry then requested a review of the Jacksonville minutes; motion was made by Steve Shull and seconded by Jim Graham; motion was carried with unanimous consent.

## L.2 Chair's Remarks

## L.3 Working Group and Task Force Reports

Standards Working Group on the Continuous Revision of C57.12.00

WG Chair: Steven L. Snyder

March 27, 2019

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. The following pages show **two** (2) new items that have been submitted to me for the next draft. Both have been fully vetted and approved by their respective subcommittees.

Based upon this and other work in process, I anticipate the next revision ballot to begin in 2020, with all the updates collected at the close of 2019.

Respectfully submitted,

Steven L. Snyder
WG Chair Standard C57.12.00
March 27, 2019

**6.8 Minimum external clearances of transformer live parts**

Table 10 describes the minimum external clearances between transformer live parts to ground and to different phases. In the establishment of these clearances, it was recognized that bushing ends normally have rounded electrode shapes. It is also assumed that conductor clamps would be suitably shaped so that they would not reduce the withstand strengths, and the arrangement of the incoming conductors would not reduce the effective clearances provided by the transformer bushing. In other words, the clearances were established based upon electrostatic fields that were usually not divergent.

Where adequate previous experience has indicated that smaller clearances are acceptable, the smaller clearances may be applied when agreed upon by both the user and the manufacturer. The clearances in this section are for in service conditions. Factory test conditions may require larger clearances than those defined here.
Minimum external clearances shall comply with Table 10 except where suitable grading of local stresses may allow smaller clearances. Any such reduction in clearances should be on the basis of agreement between user and manufacturer.
The nominal clearance values indicated are subject to normal manufacturing tolerances. Normal manufacturing tolerances should not significantly increase the likelihood of a flashover because the clearances listed in Table 10 are conservative.

**Table 10—Minimum external clearances of transformer live parts**

| Maximum System Voltage | Nominal System Voltage | Winding line-end BIL (kV Crest) (from Table 3 and 4) | BSL (kV Crest) (from Table 5) | Minimum Clearance between live parts of one phase and ground | Minimum Clearance between live parts of different phases of the same voltage |
|---|---|---|---|---|---|
| (kV rms) | (kV rms) | (kV Crest) | | mm (in) | mm (in) |
| Col 1 | Col 2 | Col 3 | Col 4 | Col 5 | Col 6 |
| 1.5 | 1.2 | 30 | | 25 (1) | 25 (1) |
| 1.5 | 1.2 | 45 | | 51 (2) | 51 (2) |
| 3.5 | 2.5 | 45 | | 51 (2) | 51 (2) |
| 3.5 | 2.5 | 60 | | 64 (2.5) | 64 (2.5) |
| 6.9 | 5.0 | 60 | | 64 (2.5) | 64 (2.5) |
| 6.9 | 5.0 | 75 | | 89 (3.5) | 102 (4) |
| 11.0 | 8.7 | 75 | | 89 (3.5) | 102 (4) |
| 11.0 | 8.7 | 95 | | 127 (5) | 140 (5.5) |

| | | | | | |
|---|---|---|---|---|---|
| 17.0 | 15.0 | 95 | | 127 (5) | 140 (5.5) |
| 17.0 | 15.0 | 110 | | 140 (5.5) | 152 (6) |
| 26.0 | 25.0 | 125 | | 165 (6.5)[b] | 178 (7)[b] |
| 26.0 | 25.0 | 150 | | 203 (8) | 229 (9) |
| 36.0 | 34.5 | 125 | | 165 (6.5) | 178 (7) |
| 36.0 | 34.5 | 150 | | 203 (8) | 229 (9) |
| 36.0 | 34.5 | 200 | | 305 (12) | 330 (13) |
| 48.0 | 46.0 | 200 | | 305 (12) | 330 (13) |
| 48.0 | 46.0 | 250 | | 381 (15) | 432 (17) |
| 72.5 | 69.0 | 250 | | 381 (15) | 432 (17) |
| 72.5 | 69.0 | 350 | | 584 (23) | 635 (25) |
| 121 | 115.0 | 350 | | 584 (23) | 635 (25) |
| 121 | 115.0 | 450 | | 762 (30) | 838 (33) |
| 121 | 115.0 | 550 | | 940 (37) | 1041 (41) |
| 145 | 138.0 | 450 | | 762 (30) | 838 (33) |
| 145 | 138.0 | 550 | | 940 (37) | 1041 (41) |
| 145 | 138.0 | 650 | | 1118 (44) | 1245 (49) |
| 169 | 161.0 | 550 | | 940 (37) | 1041 (41) |
| 169 | 161.0 | 650 | | 1118 (44) | 1245 (49) |
| 169 | 161.0 | 750 | | 1321 (52) | 1448 (57) |
| 169 | 161.0 | 825 | | 1448 (57) | 1600 (63) |
| 242 | 230.0 | 650 | | 1118 (44) | 1245 (49) |
| 242 | 230.0 | 750 | | 1321 (52) | 1448 (57) |
| 242 | 230.0 | 825 | | 1448 (57) | 1600 (63) |
| 242 | 230.0 | 900 | | 1600 (63) | 1778 (70) |
| 362 | 345.0 | 900 | 745 | 1829 (72)[c] | 2337 (92)[d] |
| 362 | 345.0 | 1050 | 870 | 2210 (87)[c] | 2870 (113)[d] |
| 362 | 345.0 | 1175 | 975 | 2565 (101)[c] | 3429 (135)[d] |
| 550 | 500.0 | 1425 | 1080 | 2946 (116)[c] | 3988 (157)[d] |
| 550 | 500.0 | 1550 | 1290 | 3785 (149)[c] | 5461 (215)[d] |
| 550 | 500.0 | 1675 | 1390 | 4216 (166)[c] | 6198 (244)[d] |
| 765 | 735.0 | 1950 | 1550 | 5004 (197)[c] | NOTE 2 |
| 765 | 735.0 | 1950 | 1620 | 5385 (212)[c] | NOTE 2 |
| 765 | 735.0 | 2050 | 1700 | 5842 (230)[c] | NOTE 2 |
| 800 | 765.0 | 1950 | 1620 | 5385 (212)[c] | NOTE 2 |
| 800 | 765.0 | 2050 | 1700 | 5842 (230)[c] | NOTE 2 |
| 1200 | 1100.0 | 2250 | 1870 | 6934 (273)[c] | NOTE 2 |
| | | | | | |

NOTE 1—The above clearances are the minimum recommended to ensure satisfactory operation in service considering only the effects of the electrical stress. Clearances at 230kV and below in the table are based on lightning impulse. Clearances above 230kV in the table are

| based on switching impulse. |
|---|
| NOTE 2 – Transformers at nominal system voltages of 735kV, 765kV, and 1100kV are normally single phase so that clearances between live parts of different phases is not an issue. |

[a] The external clearances given are for transformers intended for operation at altitudes of 1000 m (3300 ft) or less. Refer to Clause 4.3.2 for operation at altitudes in excess of 1000 m (3300 ft).

[b] Note that ANSI C57.12.34-2015 specifies a phase-to-ground clearance of 5.75 in (146 mm) and phase-to-phase clearance of 6.25 in (159 mm) for 125 kV BIL, 25kV nominal system voltage. ANSI C57.12.38-2014 specifies a phase-to-ground clearance of 5.75 in (146 mm) for 125 kV BIL, 25kV nominal system voltage. The smaller clearances are acceptable since the bushings are always located within a metal enclosure and are not subject to the same conditions that occur with bushings exposed to the elements.

[c]Phase-to-ground switching impulse clearances may be calculated using the following formulas. The values in this table were determined using a gap factor of 1.3, probability of withstand of 90%, and coefficient of variation of 7%. Refer to IEEE 1313.2 and IEEE 1427 for more information on these formulas.

$$S = \frac{8}{\frac{k_g \times 3400}{CFO} - 1} \qquad BIL = CFO \times \left(1 - 1.28 \times \frac{\sigma_f}{CFO}\right)$$

Where
S is the strike distance in meters
Kg is the gap factor
CFO is the critical flashover voltage in kV
σf / CFO is the coefficient of variation

[d] Phase-to-phase switching impulse clearances may be calculated using the following formula and the formulas in Note c. The values in this table were determined using a phase-to-phase gap factor of 1.4, probability of withstand of 90%, and coefficient of variation of 5%. Refer to IEEE 1427 for more information on these calculations.

$$CFO_{ph-ph} = 1.068 \times BSL_{ph-grd} \times R_{ph-ph}$$

Rph-ph is from IEEE 1427 Table 6

### L.3.1 WG Standard Terminal Markings and Connections for Transformers C57.12.70

**IEEE / PES Transformers Committee**
Anaheim, CA, USA
Tuesday, March, 26th - 3:15PM – 4:30PM
**Working Group of C57.12.70**

*Meeting Minutes*

Chair Jason Varnell presiding with Secretary Kris Zibert recording minutes.

Call to order – 3:15PM

The chair read the slides provided by IEEE-SA with regards to essential patent claims.

Introductions were made. The electronic roster was utilized to record attendance.

The Agenda was presented and approved. M: S. Schappell, S: D. Mulkey passed viva voce.

The minutes of the Fall 18 meeting were presented and approved. M: S. Antoz, S: S. Schappell – passed viva voce.

Reports:

a. Chair:
    - Reviewed dates in order to meet PAR schedule
    - Reviewed PAR Scope.

New Business:

a. Straw Ballot Comments
    - Discuss comments required to be resolved.
    - Comment 1
        - The group discussed whether or not to add a requirement to include the angular displacement designation on transformer nameplates. It was discussed if this requirement should be in 12.70 or in 12.00.
        - The chair appointed S. Antoz as the chair of a task force with the following scope:
            - Determine the language and location in C57.12.70 to require the angular displacement designation on transformer nameplates.
            - Members: S. Antoz (chair), R. Musgrove, W. Li, K. Zibert
    - Comment 2
        - The Chair discussed the reasoning for the draft language. The draft language was used follow closely with IEC.
        - The comment was withdrawn.
    - Comment 10
        - The group discussed the comments.
        - The chair appointed W. Li as chair of a task force with the following scope:
            - Create a revised figure for Figure 11
        - Members: W. Li (chair), J. Varnell, A. Macias.
    - Comment 11
        - Unanimous approval to use Option D presented to resolve the comment.
b. Proposed changes to definitions
    - The chair presented definitions from 12.80 and 12.70 for tap and terminal.
    - The chair presented a proposal for a definition for “tap terminal” to be added to the document.
    - Will be kept as old business.

A motion to adjourn was made and seconded.

The meeting was adjourned at 4:30PM.

The next meeting will be held in Columbus, OH during the Fall 2019 meeting of the IEEE Transformers Committee.

### L.3.2 WG Standard Transformer Terminology for Transformers C57.12.80

**Document #:** **C57.12.80**

**Document Title:** **Standard Terminology for Distribution and Power Transformers**

**Chair:** **Clair Claiborne** **Vice-Chair** **James Graham**

**Secretary** **Open**

**Current Draft Being Worked On:** **1.0** **Dated:** **NA**

**Meeting Date:** **2019-03-25** **Time:** **9:30 AM**

| **Attendance:** | | |
|---|---|---|
| | **Members** | **5** |
| | **Guests** | **15** |
| | **Total*** | **20** |

*** For details of attendance, please refer to AMS system of the Transformers Committee**

**Meeting Minutes / Significant Issues / Comments:**

1) Chair's Remarks:

   The Chair opened the meeting at 9:30 a.m. on Monday 25 March, 2019.
   The chair noted the continued low attendance of this working group's meeting to date,

2) Attendance Sign In sheet/ Quorum Check:

   Quorum was achieved with five of six members present. 18 non-voting participants also attended. Three guests requested membership.

3) Approval of the Agenda

   A motion to approve the agenda was passed unanimously.

4) Call for Essential Patents

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

5) Approval of the minutes

   A motion to approve the Fall 2018 minutes was made and passed unanimously.

6) Unfinished Business

   a) A definition for wind turbine GSU transformers has not been submitted

**Action Item:** Research on a wind farm GSU definition was completed. After some discussion the group decided not to include a definition for an application-specific GSU transformer. This action is closed.

b) 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:** Vice Chair/Secretary Jim Graham will arrange to post PC57.12.80 draft 1.0 on the website in the protected area.

c) Jeff Wright volunteered to review C57.105 and review the definitions of core-type and shell type transformers for working group consideration.

d) Several individuals volunteered to review definitions in existing standards.

Richard von Gemmingen – C57.116, and create a definition for a GSU transformer

Tim-Felix Mai – Dry Type standards review.

Shankar Nambi – Insulation Life standards review

7) New Business

a) Hali Moleski reviewed the standards under Insulating Fluids and submitted her recommendations. These will be sent to the WG members for review.

b) A task force to conduct a review of existing standards for new definitions was discussed. No action was taken, but members will be given assignments to review existing standards before the next meeting.

c) Dan Sauer gave a presentation on possible definition of AC low frequency tests. Dan will create a definition for working group consideration.

8) The meeting was adjourned at 10:45 a.m.

Next meeting – October 2019 at Columbus, OH

Submitted by: Jim Graham, Vice-chair

Date: 03/25/2019

### L.3.3 WG Standards Transformer on Continuous Revision for C57.12.90

Standards Subcommittee
IEEE/PES Transformers Committee
WG Chair: Stephen Antosz
March 27, 2019

***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.

Currently there are five Task Forces in three different Subcommittees, as follows:

1. PCS – Continuous Revision to Test Code C57.12.90 Clauses 5-9, & 12, TF Chair: Hakan Sahin
2. PCS – Audible Sound Revision Clause 13, TF Chair: Ramsis Girgis

3. Dielectric Test – Cont Rev to Impulse Tests in Clause 10, TF Chair: Pierre Riffon
4. Dielectric Test – Cont Rev to Low Frequency Tests in Clause 10, TF Chair: Bill Griesacker
5. Insulation Life – Cont Rev to Temperature Test Clause 11, TF Chair: Ajith Varghese/Bob Thompson

***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 were discovered, so a Corrigendum was done and published on March 23, 2017.

***STATUS***

A new PAR was approved by NESCOM in December 2017, and has a life of 4 years.

We are planning to shut down work for this Standard (and C57.12.00 concurrently) at the end of this year 2019, and then balloting in 2020. So all Task Forces have until the October meeting and shortly thereafter to finalize their work outputs.

***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 4th 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 μs and decays to half of crest value in 50 μs 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 ± 3%; and no flashover of the bushing or test gap shall occur. The tolerance on virtual front time should be ± 30%, and the tolerance on time to half of crest should be ± 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 μs 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 by the TF and SC 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 μs 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 μs. 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 μs 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 μs.

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

- Add the following text in red to subclause 10.8.2 Test Procedure (for Induced Test). This work was done in Bill Griesacker's (formerly Bertrand Poulin) Task Force. The work started in 2015 and after

several surveys was approved by the TF and SC in October 2018. It stipulates a limit of overpressure applied inside a transformer tank during induced voltage test.

**10.8.2 Test procedure**

The voltage shall first be raised to the 1 h level and held for a minimum of 1 min or until a stable partial discharge level is obtained to verify that there are no partial discharge problems. The level of partial discharges shall be recorded just before raising the voltage to the enhancement level. The voltage shall then be raised to the enhancement level and held for 7200 cycles. The voltage shall then be reduced directly to the 1 h level and held for 1 h.

During this 1 h period, partial discharge measurements shall be made at 5 min intervals. Partial discharge acceptance criteria shall be based on each line terminal rated 69 kV and above. These measurements shall be made in accordance with 10.9.

The pressure inside the transformer tank during induced test shall not be increased by artificial means for the purpose of reducing the PD level. The liquid level and pressure inside of the transformer tank and/or conservator tank shall be configured such that oil head pressure during the induced test does not exceed the pressure under usual service conditions. Any exceptions that increase tank pressure by more than 3.5 kPa (0.5 psi) over normal operating pressure, such as the use of an elevated test facility conservator tank, requires customer approval prior to test. A note shall be added to the certified test report confirming this approval.

Note: Increasing the pressure for diagnostic purposes, such as to identify and possibly reduce suspected bubbles in the liquid, may be done as a remedial step to diagnose a source of high PD. To be considered valid, the test shall be repeated with no added pressure as stated above.

- Other revisions to subclauses 10.2 to 10.4 from Pierre Riffon's TF for revision of impulse tests. Ongoing work continues.

This text was approved by the Task Force and SC in Spring 2019. Add the following text in red to subclause 10.3.2.1 Connection of tertiary bushings during impulse test

**10.3.2.1 Terminals not being tested**

Neutral terminals shall be solidly grounded. Line terminals, including those of autotransformers and regulating transformers, shall be either solidly grounded or grounded through a resistor with an ohmic value not in excess of the values given in Table 3.

Tertiary winding terminals shall be considered as line terminals.

When buried stabilizing winding terminals ~~which are buried and~~ have been temporarily brought out of the tank for testing purposes only, they shall be ~~kept~~ connected ~~in~~ the same way ~~condition~~ as they will be in service during impulse tests (grounded or in open circuit) ~~as foreseen for service~~.

When a stabilizing winding terminal is brought out of the tank for ~~the purpose of~~ grounding purposes ~~the winding~~, this terminal shall be grounded during ~~the entire~~ impulse tests ~~sequence~~.

When stabilizing winding terminals are brought out of the tank for the purpose of grounding the winding and ~~for~~ closing the delta, these terminals shall be ~~grounded and~~ connected as ~~required~~ intended for ~~use in~~ service ~~for~~ during ~~the~~ impulse tests ~~sequence~~.

***The rest of the clause remains as is.***

This text was approved by the Task Force and SC in Spring 2019. Add the following text in red to subclause 10.2.4 Tap positions during Switching Impulse Test

**10.2.4 Tap connection**

**The choice of the tap connection shall follow the following rules:**

- **The tap position shall be selected in order to induce, as close as possible (preferably within ±3%), the rated switching impulse withstand voltage value on the LV winding terminal;**
- **If the LV winding has no rated switching impulse level, the tap position shall be selected in order to induce, as close as possible (preferably within ±3%), 83% of the LV winding rated BIL value on LV winding terminal.**

**It should be noted that for some cases, the LV winding may receive a voltage which is less than its rated switching impulse level or 83% of its rated BIL and this shall be accepted.**

**It should be also noted that for some other cases, the LV winding may receive a voltage which is higher than its rated switching impulse level or 83%of its rated BIL, this shall be accepted and the transformer shall be designed for it.**

**For transformers having a preventive autotransformer, the tap changer shall be in a bridging positing if this operational mode is permitted for continuous operation."**

*pending work*

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

  This TF also is considering:

  a) to add a new clause 4.5 in General Section 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. Or this requirement may be put into C57.12.00 Clause 8.1 General Testing. This work was to be forwarded after Fall 2018 to Standards SC. However, I am not sure I saw it on that SC's agenda.

  b) Load Tap Changer performance 8.7 voltage test and 9.6 current test. Text seems to have been approved in Fall 2018, and moved up to the Perf Char SC. Spring 2019 this work was not on TF or SC agendas, so the result is not clear. Was it surveyed in TF and SC?

  c) Addition in 5.4.1 new wording for winding resistance test requirement on wye connected transformers with neutral bushing brought out. Fall 2018 meeting minutes not clear as to disposition of this issue. Spring 2019 this work was not on TF or SC agendas. Was it surveyed in TF and SC?

  d) Number of short circuit tests under clause 12.3.4. Spring 2019 this work is ongoing.

  e) Altitude correction under clause 11.4.2. Spring 2019 this work was not on TF or SC agendas. Note that clause 11 is out of scope of PCS.

  f) OLTC continuity tests. Spring 2019 this work was not on TF or SC agendas.

  g) Request to change frequency bandwith in 7.1.2. Spring 2019 New Business.

- 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, along with the PD test procedure. In Spring 2019 the TF approved lowering from 500 to 250

pC limit, and from 150 to 50 pC increase, both during the one-hour test. It will be moved to the SC.

- Text for venting bushings during PD test, Fall 2018. Dave Geibel Study Group

  "If partial discharge is observed during the induced testing of the transformer and appears to be generated within an OIP bushing(s), it is permissible to "vent" the bushing(s) to atmosphere using the bushing manufacturer's instructions to allow for the dissipation of gas bubbles in the oil. Gas bubbles sometimes form following a temperature rise test during cool down or may be present for other reasons. Reestablishment of the bushing gas space blanket and resealing of the bushing must also be performed in accordance with the bushing manufacturer's instructions following completion of the induced test."

- Clarification of measuring voltage during low frequency tests – Bertrand Poulin
- Class I transformer PD test revision to the test procedure – Don Ayers

- 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.

- Possible revisions to subclause 11 from Ajith Varghese's TF regarding reducing resistance measurement reheat time from 60 minutes to 30 minutes during Temperature Rise test. Ongoing work continues.

Respectfully submitted,
Stephen Antosz, WG Chair
March 27, 2019

### L.3.4 Task Force to create a PAR for Revision of C57.152, IEEE/PES Transformer Committee

The Task Force for revision of the C57.152 met on Monday, March 25th, 2019. The Chair, Marcos Ferreira called the Group to order at 9:30am and explained purpose and scope of the TF. There were 40 attendees and all automatically become members. The TF meeting was well attended. The Attendances were registered in a paper roster and listed at the end of this document.

The Agenda as proposed was approved.

The Chair presented the purpose of this task force to review the existing Title and Scope of current version for C57.152, in order to create a PAR. Therefore, a working group will be formed and approved by the Standards SC Officers to add a new revision.

**The original Title,**
"IEEE Guide for Diagnostic Field Test of Fluid-Filled Power Transformers, Regulators, and Reactors",

**The original Scope,**
"This guide describes diagnostic field tests and measurements that are performed on fluid-filled power transformers and regulators. Whenever possible, shunt reactors are treated in a similar manner to transformers. The tests are presented systematically in categories depending on the subsystem of the unit being examined. A diagnostic chart is included as an aid to identifying the various subsystems. Additional information is provided regarding specialized test and measuring techniques.

Interpretive discussions are also included in several areas to provide additional insight on the particular test or to provide guidance on acceptance criteria. These discussions are based on the authors' judgment of accepted practice. It should be noted that the results of several types of tests should be interpreted together to diagnose a problem. Manufacturers' acceptance criteria and other standards in the IEEE C57™ series take precedence over the content of this guide."

Brian Penny formulated a motion to approve the original title. Robert Thomson second it.

Discussion: Jerry Murphy informed that recent IEEE documents uses the terminology "Liquid Filled" instead of "Fluid-Filled". Mario Locarno said that the fluid/liquid means excluding dry type transformers that many of test methods in the guide are well suited for. Susan McNelly pointed out that remove Fluid will significantly extend the work revise/update the document. Craig Stiegemeier, Don Platts, Robert Thomson and Jeff Murphy also participated in the discussion.

Susan McNelly formulated a motion to delete "fluid-filled" in the original title. Craig Stiegemeier second it. Discussion: similar to above Susan McNelly withdraw the motion, Craig second the withdraw

Craig Stiegemeier formulate a motion to a title with fluid-filled replaced by "liquid filled". Seconded by Robert Thomson.

Vote: All vote in favor, except 1 abstain

**Decided Title:**
IEEE Guide for Diagnostic Field Testing of Liquid Filled Power Transformers, Regulators, and Reactors.

Motion was proposed by John Harley and seconded by Robert Thompson to delete the three bold sentences in the scope below.

**The original Scope,**
"This guide describes diagnostic field tests and measurements that are performed on fluid-filled power transformers and regulators. Whenever possible, shunt reactors are treated in a similar manner to transformers. The tests are presented systematically in categories depending on the subsystem of the unit being examined. A diagnostic chart is included as an aid to identifying the various subsystems. Additional information is provided regarding specialized test and measuring techniques.

**Interpretive discussions are also included in several areas to provide additional insight on the particular test or to provide guidance on acceptance criteria. These discussions are based on the authors' judgment of accepted practice. It should be noted that the results of several types of tests should be interpreted together to diagnose a problem.** Manufacturers' acceptance criteria and other standards in the IEEE C57™ series take precedence over the content of this guide."

Vote: All in favor, but except 1 abstain

Motion was proposed by Bernard Kurth and seconded by Robert Thompson to delete the last sentence of the scope (in bold).

**Remaining part of Original Scope,**

"This guide describes diagnostic field tests and measurements that are performed on fluid-filled power transformers and regulators. Whenever possible, shunt reactors are treated in a similar manner to transformers. The tests are presented systematically in categories depending on the subsystem of the unit being examined. A diagnostic chart is included as an aid to identifying the various subsystems. Additional information is provided regarding specialized test and measuring techniques.

**Manufacturers' acceptance criteria and other standards in the IEEE C57™ series take precedence over the content of this guide."**

Vote: 22 in favor, 3 against, 1 abstain

**The following text of the Scope was decided:**

This guide describes diagnostic field tests and measurements that are performed on liquid filled power transformers and regulators. Whenever possible, shunt reactors are treated in a similar manner to transformers. The tests are presented systematically in categories depending on the subsystem of the unit being examined. A diagnostic chart is included as an aid to identifying the various subsystems. Additional information is provided regarding specialized test and measuring techniques.

TF Chair, Marcos Ferreira, after reported the meeting minutes of his meeting took place on Monday, informed to the SC Standards that he will request to the group to initiate a PAR for a working group to do a revision of the IEEE Guide for Field Tests, C57.152. Therefore, Standards SC Chair approved the request and assigned Marcos Ferreira as a Chair for the new WG of C57.152.

Meeting adjourned at 10:45AM.
Respectfully submitted by

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|---|---|---|
| Marcos Ferreira | Raka Levi | Peter Werelius |
| Chair | Vice Chair | Secretary |

### L.3.5 IEEE / IEC Continuous Cross Reference

**Minutes of the Task Force Meeting Reported by Vinay Mehrotra, TF Chair wasn't reported this time because the members of the task force didn't meet.**

## L.4 Old Business

There was no old business discussed.

## L.5 New Business

Motion made by Don Platts: "I move that the Transformers Committee shall immediately stop using the phrase 'liquid immersed transformers' in all active and future PARs."
Second by Steve Antosz
Discussion was held on the motion.

Subsidiary motion to amend by Kris Zibert, "Amend the motion to refer the action to C57.12.80".
Second by possibly Bruce Forsyth

Request by Kris to accept the subsidiary motion to amend by unanimous consent – failed due to objection by Don.

Discussion on the subsidiary motion to amend.

Vote on the (first) subsidiary motion to amend. Result is successful, but the resulting motion is unclear.
New subsidiary motion to amend by Phil Hopkinson, amend the main motion to read as follows: "The Standards Sub-Committee of the Transformers Committee shall refer the stoppage of the use of the phrase "liquid immersed transformers" in all active and future PARs to the Working Group of C57.12.80.
Second by Bruce Forsyth

Discussion on the second amending motion. Craig Colopy mentions the potential conflict of changing terminology with IEC dual logo documents. Other discussion.

Vote on the subsidiary motion to amend: 25 for, 3 against, 5 abstained. Result – motion amended as above.

Discussion on the main motion as amended. Concern about what we are asking C57.12.80 to do. The chair stated and the C57.12.80 WG secretary confirmed that 12.80 would propose a course of action for the future if this work was assigned to them.

Vote on the amended main motion: 25 for, 5 against, 0 abstained. Result – motion carried. The matter will be sent to C57.12.80 for review. The chair directed that C57.12.80 review the matter and return with proposed definitions and a proposed action plan. The chair asked the C57.12.80 working group to review the white paper regarding Recommendations to the "IEEE Transformer Committee (TC) on Recommended Changes, Deletions, and Insertions Related to Normalizing the References of Insulating Liquids throughout the IEEE TC Standard Series" and include the usage of liquid or fluid in TC standards.

## L.6 Adjournment

The meeting was adjourned at 6 PM PST.

Respectfully submitted by Marcos Ferreira, Standards SC Secretary