Standards Subcommittee

March 13, 2024, Vancouver, BC, Canada.

Standards Subcommittee		
Chair: Daniel Sauer	**Vice-Chair: Marcos Ferreira**	**Secretary: Ajith Varghese**
Standards Coordinator: Steve Shull		
Room: Regency E/F	Date: March 13, 2024	Time: 4:30 PM to 05:15 pm
Total Members: 70	Present at time of quorum check: 36	Attended per Record: 45
Guests present: 75	Membership requested: 20	Membership accepted: 15

L.1 Meeting Attendance

The Standards Subcommittee met on Wednesday; Mar 13th, 2024, at 4:32 PM (CST).

36 members were in attendance at the beginning of the meeting, which met the quorum requirement.

Based on attendance roster and after correction to membership, it was confirmed that **45 of 70** members were present. 75 guests were also present of which **20** guests requested membership of which **15** met attendance requirement and will be granted membership.

L.2 Chair's Remarks

The Chair welcomed members and guests to the S24 meeting. Chair briefly highlighted the requirement that while introducing one need to state their affiliation.

The agenda was moved by Eric Davis and seconded by Francis Mills. The motion was carried with unanimous consent. The Minutes for Fall 2023 was moved by Sanjib Som and seconded by Jerry Murphy. The motion was carried with unanimous consent.

Chair presented the IEEE requirement for patent and copyrights. The Chair reminded WGs that call of the patent is required a during every WG meetings including on-line/Teleconference meeting. If there are any patent claim, it shall be noted but not discussed at the working group meetings.

The Chair reminded the WG and TF leaders to submit their minutes from the meetings within **15 days** to the SC secretary. The SC Secretary then must submit the SC minutes within 45 days of the SC meeting.

WG on C57.12.00, C57.12.90, C57.12.80, C57.152 and C57.163 and TF on IEEE/IEC and Reverse Power flow provided an update on status of their standards/TF. Detailed WG/TF reports are included as part of this report.

- **WG C57.12.00:** During S24, PCS approved two changes for addition to the next revision of C57.12.00 . These are related to changes to reporting of Auxiliary losses and addition of Vector group to Nameplate. Chair (Eric Davis) stated that cut off for next revision will be after Spring 2025 meeting.

- **WG C57.12.90 Test Code**: Dielectric SC approved two changes for addition to C57.12.90- Additional notes to switching surge test section to verify phase to phase voltage withstand of LTC and allowing venting of bushings during induce test, when bushing is suspected as the cause of PD.

Sanjib Som wanted clarity of functioning of WG C57.12.00 and C57.12.90 as these WG don't have meeting and there is no formal WG approval for addition/modification to standards. It was clarified that all changes to these standards are discussed and approved in respect and approved by the respective subcommittee. Chair agreed to review this further during next P&P revision.

- **WG C57.12.70 Terminal Markings:** Currently not active and did not meet.

- **WG C57.12.80 Terminology Guide**: Currently not active and did not meet.

- **WG C57.152 Field guide**: Ballot is currently open, and document is under copyright review. WG Passed a motion "to create a comment resolution group and agree to give them full authority to resolve comments without bringing them back to the WG.

- **WG C57.163 Guide for Establishing Power Transformer Capability while under Geomagnetic Disturbances:** WG did not meet. Balloting process is complete and approved, pending editorial approval before releasing the guide.

- **TF IEEE/IEC Cross Reference**: TF met and discussed the framework and scope of work to be carried out. TF plan to start with creating an index document to compare IEC and IEEE and plan to start populating that before Fall meeting.

- **TF of Reverse Flow:** TF Chair (Ryan Hogg) reported that members agreed to disband this Task Force and sought a motion to submit a PAR to create a new guide for Evaluating Transformer Performance under Reverse Power Flow. Motion was moved by Sanjib Som and seconded by Jason Vernall.

  Motion to proceed with PAR to create a new Guide for Evaluating Transformer Performance under Reverse Power Flow was approved 28 in favor and 1 against with 3 abstaining.

  Dan Blaydon pointed out that Reverse Flor TF was initially set with two specific objective and one of them " Provide recommendations to update "service conditions" of the base standards" will be left out with disbanding the TF. Sanjib Som requested a presentation or any additional information to be shared, so that SC can make an informed decision. SC chair requested Dan Blaydon to prepare a document to be shared/presented to the SC.

Subcommittee New business and SC attendees list are included at end of this minutes after WG/TF reports.

L.3 Working Group and Task Force Reports

L.3.1 Standards Working Group on the Continuous Revision of C57.12.00

Standards Working Group on the Continuous Revision of C57.12.00

Standards Subcommittee
IEEE/PES Transformers Committee
WG Chair: Eric Davis
Spring 2024 Vancouver, CA; March 13, 2024

INTRODUCTION

This is a working group by committee of task forces, for continuous revision of C57.12.00. 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. The WG exists administratively in the Standards Subcommittee, and the technical work is done in other subcommittees, based on expertise and scope. This WG coordinates efforts with the companion standard C57.12.90 so that they publish together.

SUMMARY

C57.12.00-2021 was approved by IEEE SA Standards Board on November 9, 2021. and published January 2022. A Project Authorization Request (PAR) for Revision of PC57.12.00 was approved May 13, 2022. It expires December 31, 2026.

Changes approved by the appropriate subcommittees by the end of the Spring 2025 meeting will be included in the next revision of C57.12.00. This will allow sufficient time to ballot and resolve any comments prior to the expiration of the existing PAR.

FUTURE REVISIONS AND PENDING WORK

Any new material provided by the various Task Forces to this WG for inclusion in the next revision, will first be approved by the responsible technical subcommittee (Dielectric Test, PCS, Distribution, IL, etc.) and then presented to the Standards Subcommittee for the "official" vote of approval to go to ballot.

The following groups are reviewing proposed changes that may impact this standard.

- TF Partial Discharge Tests for Class I Transformers (DiTest)
    - The SC authorized a survey of the subcommittee for the following proposals. Please refer to TF and SC meeting minutes for additional detail on the proposals.

        - Proposal 1: Change PD Class I criteria to 250 pC with a maximum 50 pC rise to match the Class II requirements. Approved.
        - Proposal 2: Keep the duration of the PD Test at 1 hour. Approved.
        - Proposal 3: Remove acceptance criteria for PD for units below 34.5-kV. Approved.
        - Proposal 4: All changes from the TF will be kept in Clause 10.7. Approved.
        - Proposal 5: Modify Table 3 so we have a section for Class I without PD and a section for Class I with PD. Approved.
        - Proposal 6: Modify Table 4. Not approved.
        - Proposal 7: Modify the Title of Table 3: Refer to Proposal 5
- TF PCS Continuous Revisions to C57.12.00 (PCS)
    - The TF approved the following items. Please refer to the TF and SC meeting minutes for additional details.
    - Item 113: Measurement of Auxiliary Losses. Approved.
    - Item 114: Section 5.7.2 Phasor Groups. Approved.
- TF Revision of Impulse Tests C57.12.00 & C57.12.90 (DiTest)
- TF Continous Revisions of Low Frequency Tests (DiTest)

Changes ***already approved*** for the next revision:

1. Changes to Low Frequency Tests from Ajith Varghese's RLFT TF in the Dielectric Test SC. Final survey approved by TF and SC in the Spring 2023 meeting. Text in black is existing, red is revised, blue is added.

5.10.5.5 Induced-voltage test for Class II power transformers

With the transformer connected and excited as it will be in service, an induced-voltage test shall be performed as indicated in Figure 2, at voltage levels indicated in Columns 6 and 7 and 1.05 times the line to ground voltage per column 2 of Table 4. Minimum line-to-ground induced test levels for Class II power transformers shall be a multiple of corresponding line-to-ground nominal system voltage as follows: 1.58 times for one-hour tests and 1.8 times for 7200 cycles enhancement level tests.

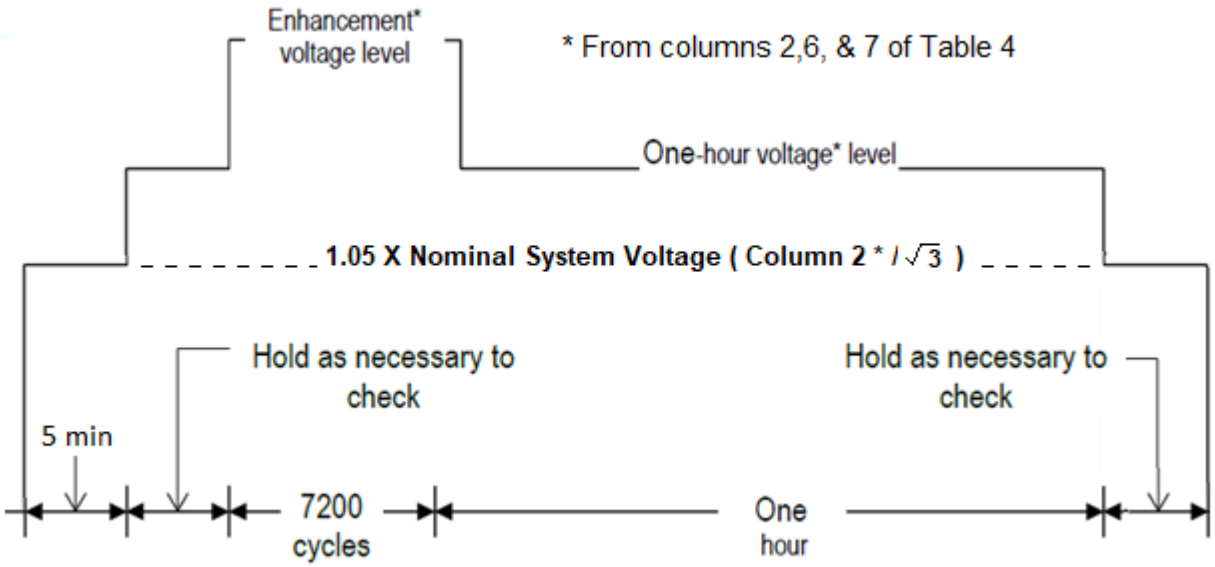

Figure 2 —Induced-voltage test for Class II power transformers

Respectfully submitted,
Eric Davis, WG Chair
March 24, 2024

L.3.4 WG Standards Transformer on Continuous Revision for C57.12.90

Standards Working Group on the Continuous Revision of C57.12.90
Standards Subcommittee
IEEE/PES Transformers Committee
WG Chair: Stephen Antosz
Vice-Chair/Secretary: Jason Varnell
Spring 2024 Vancouver; March 13, 2024 (changes in purple text)

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. The WG exists administratively in the Standards Subcommittee and has no live meetings. The technical work is done in other subcommittees based on expertise and scope. WG membership consists of the people actively working on revisions. These people are the TF Chairs, SC Chairs, and other significant contributors to the current version. WG Members are:

Hakan Sahin
Ramsis Girgis
Sylvain Plante
Ajith Varghese
Diego Robalino
Dinesh Sankarakurup
Daniel Sauer
Rogerio Verdolin
Poorvi Patel
Sam Sharpless
Bertrand Poulin guest
John Sen guest
Polo Rodriguez guest
Zan Kiparizoski guest

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

1. PCS – Cont Rev 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: Sylvain Plante
4. Dielectric Test – Cont Rev to LowFrequency Tests Clause 10, TF Chair: Ajith Varghese
5. Dielectric Test –Insulation Power Factor and Resistance, 10.10 and 10.11, TF Chair: Diego Robalino
6. Insulation Life – Cont Rev to Temperature Test Clause 11 and Resistance Clause 5, TF Chair: Dinesh Sankarakurup

SUMMARY

C57.12.90-2021 was approved as a revised standard by the IEEE-SA Standards Board on Nov 9, 2021. It was published on Feb 4, 2022. The WG Chair took out a new PAR on Feb 28, 2022, which was approved by the IEEE-SA Standards Board on May 13, 2022. The PAR expires on December 31, 2026.

We are looking to launch the next ballot by the end of 2025 or early 2026. Therefore, would close off pending work at the Spring 2025 meeting, for mid 2025 completion. This might be adjusted later.

FUTURE REVISIONS AND PENDING WORK

Any new material provided by the various Task Forces to this WG 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 to go to ballot.

Changes *already approved* for the next revision:

1. Hakan Sahin's PCS TF for Revision of C57.12.90.

    a. Changes to subclause 7.3, Ratio test methods to "modernize" it. Final survey approved in the Spring 2021 virtual meeting.

    Insert a new subclause 7.3.1 as follows:
    7.3.1 Electronic ratio and phase measurement meters
    An electronic meter that determines the transformer turns ratio, polarity and phase angle may be used for the measurement of these parameters.

    The existing 7.3.1 Voltmeter method should be renumbered to be 7.3.2, are no changes to the text.
    The existing 7.3.2 Comparison method should be renumbered to be 7.3.3, no changes to the text or figures 10 & 11.
    The existing 7.3.3 Ratio meter clause and figure 12 is to be deleted.

    b. Ratio test voltage and frequency under subclause 7.1.2. Request to change frequency bandwith. TF and SC approved in Spring 2022.

    7.0 Ratio test
    Current Version:
    7.1.2 Voltage and frequency
    The ratio test shall be made at rated or lower voltage and rated or higher frequency.
    Revised Version
    7.1.2 Voltage and frequency
    The ratio test shall be made at rated or lower voltage and be such that the ratio of test voltage to test frequency is less than or equal to the ratio of rated voltage to rated frequency.

    c. Number of short-circuit tests under subclause 12.3.4. TF and SC approved in Spring 2022.

    Current Version:
    12.3.4 Number of tests
    Each phase of the transformer shall be subjected to a total of six tests satisfying the symmetrical current requirement specified in 12.3.1 or 12.3.2, as applicable. Two of these tests on each phase shall also satisfy the asymmetrical current requirements specified in 12.3.3.

    Revised Version
    12.3.4 Number of tests

- When a three-phase transformer is tested in a three-phase test circuit or in a single-phase test circuit as given in Annex C, each phase of the transformer shall be subjected to three tests satisfying the asymmetrical current requirements specified in 12.3.3. The tests shall be performed on one of the outer phases with the tap-changer in the maximum position, on the other outer phase with the tap-changer in the minimum position and on the middle phase with the tap-changer in the principal position
- When a single-phase transformer is tested in a single-phase test circuit the transformer shall be subjected to three tests satisfying the asymmetrical current requirements specified in 12.3.3. The three tests shall be performed one each, with the tap-changer in the maximum, minimum and principal position.

d. Load Tap Changer performance test with rated voltage. New subclause 8.7. TF and SC approved in Spring 2022. It was re-discussed in Fall 2022 but no changes were made so still considered to be approved.

8.7 Load Tap Changer Voltage Test
8.7.1 General
In order to verify the performance of a transformer that has a load tap changer (LTC), the LTC shall be operated through one end-to-end-to-end sequence (from one tap extreme to the other tap extreme and back again) with the transformer energized at rated voltage.

8.7.2 Control voltage
Control voltage for the LTC motor during the test shall be as near to rated voltage as possible, with a minimum of 85%.

8.7.3 Preparation for the test
The LTC shall be fitted with all included equipment. It shall be connected as it will be in service, including protective devices.

8.7.4 Procedure
Either the high or low voltage winding of the transformer under test shall be energized at rated voltage and frequency, unless otherwise specified. The LTC shall be operated using the motor drive but not manual rotation. The LTC shall be operated through all tap positions twice, starting at one tap extreme and progressing to the other tap extreme, and then return back again to the original tap position. The test may be performed at intervals, if necessary, such as to adjust the test circuit for the applied voltage to be adjusted to the rated voltage of the tap position, but it is a requirement that the transformer be energized at no less than rated voltage corresponding to each tap to be changed.

8.7.5 Observations and Analysis
8.7.5.1 Audible Sound
The transformer shall be observed during this test and the operator shall identify that the sound during the tap changing operations was either normal or abnormal. With some types of tap changers, there will be abnormally loud sounds if components are not assembled properly. Note that during operation of the change-over selector (reversing switch or coarse-tap selector) the sound can be slightly different.

8.7.5.2 Supply Test Circuit
The test control system shall be monitored for any trip of the test circuit that automatically stops the circuit from keeping the transformer energized.

8.7.5.3 Dissolved Gas-in-Oil Analysis
Oil samples shall be taken from the LTC compartment of vacuum type tap-changers before and after the test and analyzed for dissolved gasses. Results of the analysis may show some increase of dissolved gases due to current commutation, resistor heating and / or stray-gassing of the oil.

8.7.6 Failure Detection and Acceptance Criteria
The transformer will have passed this LTC Voltage test if:

- The tap changer operates normally with no abnormal sound
- The transformer stays energized without a trip in the supply test circuit
- For mineral oil filled vacuum LTCs, the increase of the sum of H2, CH4, C2H6, C2H4 and C2H2 should not exceed 12 ppm for in-tank type LTCs and 6 ppm for compartment type LTCs.
- For non-vacuum type LTCs, or LTCs filled with a liquid other than mineral oil, the determination of acceptance criteria is through sound only and there is not a limit for increase in gases.

e. Load Tap Changer performance test with rated current. New subclause 9.6. TF and SC approved in Spring 2022. It was re-discussed in Fall 2022 but no changes were made so still considered to be approved.

9.6 Load Tap Changer Current Test
9.6.1 General
In order to verify the performance of a transformer that has a load tap changer (LTC), the LTC shall be operated through one end-to-end-to-end sequence (from one tap extreme to the other tap extreme and back again) with the transformer current flowing through the windings, corresponding to the top nameplate MVA rating.

9.6.2 Control voltage
Control voltage for the LTC motor during the test shall be as near to rated voltage as possible, with a minimum of 85%.

9.6.3 Preparation for the test
The LTC shall be fitted with all included equipment. It shall be connected as it will be in service, including protective devices.

9.6.4 Procedure
The test shall be performed by applying a short circuit either the high-voltage winding or the low-voltage winding and applying sufficient voltage across the other winding to cause a specific current to flow in the windings. The LTC shall be operated using the motor drive but not manual rotation. The LTC shall be operated through all tap positions twice, starting at one tap extreme and progressing to the other tap extreme, and then return back again to the original tap position. The test may be performed at intervals, if necessary, such as to adjust the test circuit for the applied voltage to be adjusted to the required current of the tap position, but it is a requirement that the transformer be energized at no less than 80% of the top MVA nameplate current value for each tap change.

9.6.5 Observations and Analysis

9.6.5.1 Audible Sound

The transformer shall be observed during this test and the operator shall identify that the sound during the tap changing operations was either normal or abnormal. With some types of tap changers, there will be abnormally loud sounds if components are not assembled properly. Note that during operation of the change-over selector (reversing switch or coarse-tap selector) the sound can be slightly different.

9.6.5.2 Supply Test Circuit

The test control system shall be monitored for any trip of the test circuit that automatically stops the circuit from keeping the transformer energized.

9.6.5.3 Dissolved Gas-in-Oil Analysis

Oil samples shall be taken from the LTC compartment of vacuum type tap-changers before and after the test and analyzed for dissolved gasses. Results of the analysis may show some increase of dissolved gases due to current commutation, resistor heating and / or stray-gassing of the oil.

9.6.6 Failure Detection and Acceptance Criteria

The transformer will have passed this LTC Voltage test if:

- The tap changer operates normally with no abnormal sound
- The transformer stays energized without a trip in the supply test circuit
- For mineral oil filled vacuum LTCs, the increase of the sum of H2, CH4, C2H6, C2H4 and C2H2 should not exceed 12 ppm for in-tank type LTCs and 6 ppm for compartment type LTCs.
- For non-vacuum type LTCs, or LTCs filled with a liquid other than mineral oil, the determination of acceptance criteria is through sound only and there is not a limit for increase in gases.

2. Changes to Insulation Power Factor test, from Diego Robalino's Diel Test SC TF for Winding Insulation Power Factor. Final survey approved in the Fall 2021 virtual meeting and by DielTest SC Jan 2022. Specifically with regards to Subclause 10.10.2 revising the accuracy requirements of instrumentation.

The existing text is:

10.10.2 Instrumentation

The insulation power factor may be measured by special bridge circuits or by the voltampere-watt method. The accuracy of measurement should be within ± 0.25% insulation power factor, and the measurement should be made at or near a frequency of 60 Hz.

The revised text to replace it will be:

10.10.2 Instrumentation

The insulation line-frequency power factor or dissipation factor may be measured by special bridge circuits or by the voltampere-watt method. The accuracy of the measurement instrumentation at or near rated frequency should be:

- for Insulation Power Factor Below 1%: +/-2% of reading +/-0.05% absolute

- for Insulation Power Factor Above 1%: +/-5% of reading +/-0.05% absolute

3. Changes to Clause 11 Temperature Test, from Dinesh Sankarakurup's TF in the Insulation Life SC.

   a. Changes to subclause 11.3.2, Liquid Temp Rise Determination. Final survey approved by TF and SC in the Spring 2023 meeting. In the first paragraph change the word "ultimate" to "stabilized", and add a sentence that the top oil rise shall not be averaged over time. Text in black is existing, red is revised, blue is deleted.

      Liquid temperature rise is the difference between liquid temperature and ambient temperature. The ~~ultimate~~ stabilized temperature rise above ambient shall be considered to be reached when the top liquid temperature rise does not vary more than 2.5% or 1 °C, whichever is greater, during a consecutive 3 h period. The stabilized liquid temperature rise determined at the end of the total loss run shall not be averaged over time.

4. Changes to Audible Sound from Ramsis Girgis' TF in the Perf Char SC. These changes were approved by the TF at Spring 2023. The Perf Char SC approved in-person at the Kansas City meeting. Text in black is existing, red is revised, blue is deleted.

   a. Changes to 13.3.3.1 No-load audible sound level.

      When a transformer is equipped with a tap changer, the transformer may, on certain tap changer positions, produce sound levels that are higher than the audible sound level at the rated tap position. For these transformers, the measurements shall ~~may, upon purchaser request, and as agreed upon,~~ be made with the transformer on the highest sound producing tap position.

      Also, other excitation conditions may occur in service leading to lower, or higher, core noise. For example, transformers designed to operate with variable flux the core audible sound level is strongly impacted by the tapping position. The same is true for SVC transformers when connected to a capacitive load; Again, for these transformers, the measurements shall ~~may, upon purchaser request, and as agreed upon,~~ be made with the transformer operating at the highest sound producing condition.

   b. Changes to 13.5.5.1 Measuring ambient sound pressure level.

      ~~The ambient sound pressure level shall be established by averaging the ambient sound pressure levels measured immediately preceding and immediately following the sound measurements with the transformer energized. The ambient sound shall be measured at a minimum of four locations, and the instruments shall be in conformance with 13.2.~~ The ambient sound pressure level shall be measured at a minimum of four locations around the transformer immediately preceding and immediately following the sound measurements with the transformer energized. The ambient sound pressure level shall be established by calculating the logarithmic average of measured values of the ambient sound pressure levels. The measuring instruments shall be in conformance with 13.2. However, additional measurements may be made if agreed to by the manufacturer and purchaser or if the ambient measurements vary by more than 3 dB around the transformer. …

   c. Changes to 13.3.3.2 Load audible sound level.

Since load audible sound becomes a contributor to the total audible sound of the transformer at higher loads, the load audible sound level shall be measured at the ONAF measuring contour. For transformers with only an ONAN rating, load noise is to be measured at the ONAN sound measuring contour.

5. Changes to Low Frequency Tests from Ajith Varghese's RLFT TF in the Diel Test SC. Final survey approved by TF and SC in the Spring 2023 meeting. Text in black is existing, red is revised, blue is deleted.

   a. Changes to Induced Test for Class II, Clause 10.8.2 PD Test Procedure

10.8.2 Test procedure

The voltage shall first be raised from zero to the 1.05 X line to ground value of the nominal system voltage (column 2, C57.12.00 Table 4) and held long enough to attain a stable partial discharge level and then record the level of partial discharge. The voltage shall then be raised to the one-hour level and held for a minimum of 5 min or until a stable partial discharge level is obtained to verify that there are no partial discharge problems. The partial discharge level shall be measured at the end of the 5 min period. If the 5 min. period at the 1 h voltage level is extended to obtain a stable partial discharge level the partial discharge shall be measured at the end of this period so that the level of partial discharges are 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 one-hour 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.

Immediately following the 1 h period, the voltage shall then be reduced to 1.05 X line to ground value of the nominal system voltage (column 2, C57.12.00 Table 4) and held until a stable partial discharge level is obtained and the partial discharge level measured.

   b. Changes to Induced Test for Class II, Clause 10.8.5 PD Failure Detection.

10.8.5 Failure detection

Failure may be indicated by the presence of smoke and bubbles rising in the insulating liquid, an audible sound such as a thump, or a sudden increase in the test current. Any such indication shall be carefully investigated by observation, by repeating the test, and by other diagnostic tests to determine whether a failure has occurred. In terms of interpretation of partial discharge measurements, the results shall be considered acceptable and no further partial discharge tests required under the following conditions:

a) The magnitude of the partial discharge level does not exceed 250 pC during the 1 h test period.
b) The increase in partial discharge levels during the 1 h period does not exceed 50 pC.
c) The partial discharge levels during the 1 h period do not exhibit any steadily rising trend, and no sudden sustained increase in the levels occurs during the last 20 min of the test.
d) The magnitude of partial discharge level at 1.05 X Nominal System Voltage following the 1 h test period does not exceed 100 pC.

PENDING WORK

Since this is a continuous revision document, there is ongoing work in Task Forces.

1. Possible revisions from Hakan Sahin's PCS TF for Revision of C57.12.90. As of March 12, 2024 there is only one item of business related to Clause 5 and determining the temperature used for measuring cold resistance. This item was

further discussed in Vancouver and it will be forwarded to Dinesh's TF on Temperature Test. However, some activity will remain.

2. Possible changes to Clause 13 sound test from Ramsis' TF. No open items. Measuring sound level of Preventive Autotransformers (PA) in air as a Quality Control check was presented and discussed. Possibly a Task Force Paper will be written.

3. Possible changes to Subclause 10.2 or 10.3 from Sylvain Plante's TF regarding switching and lightning impulse tests. The TF has the following items on its agenda and is working on possible revisions:
   - 10.3.2.2, 10.3.2.3, 10.4.4, 10.4.5 impulse tests on transformers with series-multiple and delta-wye connections. The following final wording was approved by the Dielectric Test SC during the S23 Milwaukee SC meeting:

     10.3.2.2 Windings for series, parallel or multiple connections. The windings shall be tested for all series, parallel and multiple connections. The test voltage for these conditions shall correspond to the BIL of the winding for that connection. 10.3.2.3 Windings for delta or wye connections. The three-phase transformer shall be tested on both delta and wye connections. The test voltage for each connection shall correspond to the BIL of the winding for that connection.

     10.4.4 Windings for series, parallel or multiple connections. For high-voltage windings with series, parallel or multiple connections above 15 kV, the routine impulse test shall be conducted on each connection at its assigned BIL. For nominal system voltages of 15 kV and below, only the series connections shall be tested, unless tests on all connections are specified.

     10.4.5 Windings for delta or wye connections. For high-voltage windings of three-phase transformers with delta or wye connection above 15 kV, the routine impulse test shall be conducted on each connection at its assigned BIL. For nominal system voltages of 15 kV and below, only the wye connection shall be tested, unless tests on all connections are specified.

   - Establishing guidelines about use of +/-3% tolerance on voltage peak. Draft wording was presented and discussed. Survey was done prior to Kansas City with high approval rate. The following final wording was approved by the Dielectric Test SC during the F23 Kansas City SC meeting:

     - Add as second paragraph to Subclause 10.2.2.2:
       The basic rule for application of the tolerance on voltage crest value is that testing laboratories shall aim for the test value specified. For any of the impulses of a test series, if the actual measured voltage is lower than the required voltage crest value but within the allowable tolerance of ±3%, the impulse crest shall be accepted as valid. For any required subsequent

impulse on the same terminal, adjustments shall be made to aim for the specified test value.

- Add as second paragraph to Subclause 10.3.1.1:
  The basic rule for application of the tolerance on voltage crest value is that testing laboratories shall aim for the test value specified. For any of the impulses of a test series, if the actual measured voltage is lower than the required voltage crest value but within the allowable tolerance of ±3%, the impulse crest shall be accepted as valid. For any required subsequent impulse on the same terminal, adjustments shall be made to aim for the specified test value.

- Proposal regarding tap for phase-to-phase switching impulse, 10.2.4. This work was approved in S23, TF Chair to do slight rewording based on feedback. The S24 Vancouver Dielectric Tests SC approved a motion to add the following to the end of Subclause 10.2.4

  While selecting the tap connection complying to above requirements, the phase-to-phase voltage withstand capability of the transformer active part including LTC, bushings and all accessories shall be reviewed.

  Testing on a non-compliant tap connection shall be discussed and agreed between manufacturer and purchaser."

4. Other possible revisions to subclauses 10.5 to 10.10 from Ajith Varghese's TF for revision of low frequency tests.

   - Class I transformer PD test revision to the test procedure by Don Ayer's sub Task Force. The sub-task force received approval from the S24 Vancouver RLFT TF to survey the Dielectric Tests SC for the sub-task force's final text. This work is nearing its end and seems like a final version is imminent.

   - Venting bushings during PD test, lots of discussion, this is a controversial topic, some proposed wording exists as a starting point and a small subgroup revised it again prior to Kansas City. Need collaboration with bushing manufacturers, transformer manufacturers, and users who all have different viewpoints. This work is nearing its end in F23 TF. It was approved at the F23 Dielectric Test Subcommittee meeting to go for survey of the DTSC. In Vancouver S24, the Dielectric Tests SC approved the following text to be added to the end of Subclause 10.8.5:

     If the partial discharge is measured during the Induced-voltage testing of the transformer and is suspected to be generated within an OIP (oil-impregnated-paper) bushing(s), it is permissible to "vent" the bushing(s) exhibiting partial discharge to the atmosphere using the bushing manufacturer's instructions.

Unless agreed between manufacturer & purchaser, bushings shall not be vented proactively prior to dielectric testing. The Induced-voltage test shall be entirely repeated after venting the bushing and a note shall be added to the certified test report indicating bushing(s) were vented during the induced-voltage test.

Notes:

1) Partial discharge intended to be addressed by venting the bushing, is a low energy discharge arising from partial vacuum (pressure below atmosphere) created in the expansion chamber and/or gas bubbles generated during the Temperature Rise test and the cooling down afterwards. Partial vacuum is created in the expansion chamber due to absorption of nitrogen or air into oil, and gas bubbles are formed due to saturation of nitrogen or air. Partial discharges from these cases may be resolved by venting the bushing. If continuous gas bubble generation or elevated partial discharge remains after the venting, additional investigations are required.

2) If there are concerns of gas generation from the temperature rise test causing bushing failure during impulse or applied voltage test, an induced-voltage test can be performed before impulse testing for diagnostic purposes. A complete induced-voltage test shall be performed as the last dielectric test, as specified in subclause 10.1.5.1 for dielectric test sequence.

3) Not all OIP bushings exhibit these conditions, so bushing design can be a factor.

4) The same condition of gas bubble formation or partial vacuum may occur in service during normal operation of load and overload cycles.
5) Re-establishment of the bushing gas space blanket and resealing of the bushing must also be performed in accordance with the bushing manufacturer's instructions. The internal integrity of the bushing may be compromised by venting, by allowing in oxygen and moisture or by not reestablishing proper conditions.

- A revision to add clarification to the overvoltage factor for Induced Test will be made in 12.00 and 12.90 as appropriate. Wording has been developed by Jason Varnell. It was agreed in Vancouver S24 by the RLFT TF to survey the TF for discussion at the F24 TF meeting and seems like a final version is imminent.

5. Possible changes to subclause 10.11 from Diego Robalino's TF regarding insulation resistance. This work is ongoing, the TF met in Vancouver. Nothing to do yet. Possible future changes to insulation resistance measurement procedures are being considered, as compared to conflicting procedures in other documents such as

C57.152. Also, possible future addition of core megger and clamp megger procedures since none currently exist in 12.90.

6. Changes to Clause 11 Temperature Test from Dinesh Sankarakurup's TF

- 11.4.3 Add text that reverse correction for altitude is also allowed; i.e., when factory is located above 1000 m and transformer rating is based on <1000m. This work is ongoing in a small subgroup and was almost complete in F23 Kansas City. This was further discussed at TF meeting in Vancouver S24; Steve Antosz will revise based on comments and send to TF Chair.
- Request for clarification for temp test of 3-winding transformers, injecting maximum losses, and correcting for maximum common winding current in autos. Prior to Kansas City a small sub group developed some wording, it was briefly discussed in Kansas City. It will be circulated to the whole TF for comments.
- Proposal by Bertrand Poulin OFAF Cooling and Top Duct Oil temperature and diagram in C57.119. Prior to Kansas City a small sub group developed some wording, it was briefly discussed in Kansas City. It was circulated to the Task Force for comments. This was further discussed at TF meeting in Vancouver S24, and more work will be done.
- Clarification to Hottest spot Rise calculation using Fiber Optics. Egon and Ewald Schweiger of Siemens advanced their proposal to add as an alternate method an option to measure hot spot temperature using direct measurement with fiber optic probes. A small sub task force will be formed to develop wording. This was further discussed at TF meeting in Vancouver S24, and more work will be done.
- Standardize Method for Hot resistance extrapolation not covered in Kansas City, but Bertrand Poulin submitted some info that should be circulated to the TF.

Respectfully submitted,
Stephen Antosz, WG Chair
Jason Varnell, WG Vice-Chair

L.3.5 WG Standards Transformer on Revision for C57.152, Guide of Field Tests

Standards Subcommittee,
WG – C57.152 Revision
IEEE / PES Transformers Committee

March 11, 2024, 4:45PM – 6:00PM
UNAPPROVED MINUTES

Welcome

The chair of the working group, Marcos Ferreira, opened the meeting at 4:45PM. Due to the absence of the secretary, Goran Milojevic, the notes of the meeting were kept by Evgenii Ermakov of Hitachi Energy.

1. Attendance and Attendance for Quorum

At the time of the meeting there were 38 Members, including Chair and Secretary. The chair counted the present members and established that the quorum was met. A total of 73 members and guests signed the circulating roster.

The list of attendees who signed into the paper roster is shown below:

Name	Affiliation	Status
Ferreira, Marcos	Quanta Technology	Chair
Bradshaw, Jeremiah	US Bureau of Reclamation	Member
Dutta Roy, Samragni	Siemens Energy	Member
Ermakov, Evgenii	Hitachi Energy	Member
Foata, Marc	Maschinenfabrik Reinhausen	Member
Gara, Lorne	Shermco	Member
Gardner, James	Prolec-GE Waukesha	Member
Harley, John	First Power Group	Member
Heiden, Kyle	EATON Corporation	Member
Locarno, Mario	Doble Engineering Company	Member
Mabrey, Stephanie	Weidmann Group	Member
Murray, David	TVA	Member
Reed, Scott	MVA	Member
Saad, Mickel	Hitachi ABB Power Grids	Member
Sauer, Dan	EATON Corporation	Member
Sweetser, Charles	OMICRON Electronics Corp USA	Member
teNyenhuis, Ed	IEEE	Member
Welton, Drew	Intellirent	Member
Woods, Deanna	ATC LLC	Member
Zhang, Shibao	PCORE Electric	Member

Boettger, William	Boettger Transformer Consulting LLC	Guest
Britton, Jeffrey	Phoenix Technologies	Guest
Castellanos, Juan	Prolec-GE Waukesha	Guest
Crockett, Janet	Fayetteville PWC	Guest
Cruz-Valdez, Juan Carlos	Prolec-GE Waukesha	Guest
Detlev, Gross	Power Diagnostix Consulting	Guest
Duffy, Jesse	Nashville Electric	Guest
Eun Young Cho	HICO America	Guest
Fazlic, Zlatan	Camlin Energy	Guest
Fu, Yao	BC Hydro	Guest
Gardner, James	Prolec-GE Waukesha	Guest
Gasperin, Eloy	Mistras	Guest
Hoffman, Sarama	PPL	Guest
Jonah, Ryan	PGE	Guest
Lachance, Matthew	OMICRON Electronics	Guest
Lagos, Fernando	GE Vernova	Guest
Leal, Fernando	Prolec-GE Waukesha	Guest
Lee, Junho	HD Hyundai	Guest
Lizcano, Cesar	Shell USA Inc	Guest
Martinez, Alberto	WEG USA	Guest
McBride, Brian	Cargill	Guest
McBride, Jim	JMX Services, Inc.	Guest
Melo, Yegor	BC Hydro	Guest
Murphy, Jerry	RCES	Guest
Natale, Anthony	HICO America	Guest
Neild, Kris	Megger	Guest
Nims, Joe	Allen & Hoshall	Guest
Nunez, Martin	Orto	Guest
Ortiz, Cuahtemoc	Niagara Transformer	Guest
Pruente, John	Prolec-GE Waukesha	Guest
Ravi, Gupta	Megger	Guest
Reepe, Robert	GA Power Co	Guest
Rehkopf, Sebastian	Maschinenfabrik Reinhausen	Guest
Reimer, Jonathan	Fortis BC	Guest
Richardson, Michael	Ameren	Guest
Salem, Sherif	Eversource Energy	Guest
Sar Kinen, Garrett	Xcel Energy	Guest
Shaikh, Abdul Majid	Delta Star	Guest
Soeller, Markus	Power Diagnostic Systems	Guest
Sparling, Brian	Kinetrics	Guest
Stechschulk, Kyle	AEP	Guest
Sze, Matthew	OMICRON Electronics	Guest
Tade, Sachin	PTI Transformers	Guest
Teofanovic, Marko	Ontario Power Generation	Guest
Thiede, Andreas	HIGHVOLT Prueftechnik Dresden	Guest
Tolcachir, Eduardo	TTE	Guest

Vandervalt, Alwyn	ECI	Guest
Vandermaar, John	BC Hydro	Guest
Vary, Robert	Reinhausen US	Guest
Vermette, Yves	Electro Composites	Guest
Washburn, Alan	Burns & McDonnell	Guest
Webb, Matthew	GE Vernova	Guest
Wright, Jeffrey	Duquesne Light	Guest

2. Approval of the Agenda

The motion to approve the agenda was made by Drew Welton, and seconded by Evgenii Ermakov. The motion was approved unanimously.

3. Approval of Minutes of Fall 2022 Meeting

The motion to approve the Minutes of Fall 2022 Meeting was made by Mickel Saad, and seconded by Evgenii Ermakov. The motion was approved unanimously.

4. Call for Patents

The chair presented slide 1-4, dated January 2, 2018 informing of the IEEE patent policy and participants duty to inform. There were no issues related to patent assurance brought up by attendees in the meeting.

5. IEEE Copyright Policy

The chair presented IEEE-SA Copyright Policy slides 1-2 informing the audience of the policy.

6. Chair's Remarks

The chair, Marcos Ferreira, gave the following remarks.

"After the Fall 2023 meeting, the draft accepted by the Working Group and the Standards Subcommittee was submitted to MEC (Mandatory Editorial Coordination). During the January meeting, MEC has submitted its response with 10 action items that must be completed prior to the beginning of the ballot (Section 1), and additional 7 action items that must be completed prior to the final recirculation. The WG officers have been working on addressing the MEC comments from Section 1, with the goal of submitting the draft for ballot by the end of March."

Stephanie Mabrey made a motion "to create a comment resolution group and agree to give them full authority to resolve comments without bringing back to the WG". Ed teNyenhuis seconded. The motion was approved unanimously.

7. New Business

No new business.

8. Meeting Adjournment

The motion to adjourn the meeting was made by Evgenii Ermakov, and seconded by Mickel Saad. The meeting was adjourned at 5:30PM.

Respectfully submitted,

Marcos Ferreira – Chair

Goran Milojevic – Secretary

L.3.6 TF - IEEE / IEC Continuous Cross Reference

S24 Meeting Minutes (Unapproved)

Standards Subcommittee Task Force
IEEE / IEC Cross Reference
Monday, March 11, 2024, 9:30am to 10:45am
Chair: Alan Washburn

1. Welcome Meeting came to order at 9:35am

2. Introduction of participants

    a. 13 attendees: Jaroslaw Chorzepa, Juan Carlos Cruz Valdes, Janko Dzodan, Anton Koshel, Marta Munoz, Monil Patel, Thomas Prevost, H. Allen Steele, Ryan Thompson, Steve Tsai, Ajith Varghese, Dharam Vir, Alan Washburn

3. IEEE SA patent policy and call for patents
4. IEEE SA copyright policy
5. Membership review
    a. 4 of 8 members present, quorum achieved.

6. Review/approval of agenda.
7. Review/approval of S23 meeting minutes.
8. Old business
        a. Scope of TF Continued discussion on index scope, format
            i. Look for opportunities to make recommendations to IEEE or IEC organizations.

    b. Creation of index document Involvement of other stakeholders/subcommittees, may help to collect information more quickly.
        i. Start with TC-14 and TC-10 List of documents Added TC10, 15, 38, SC36A, and TC113 For IEEE we'll focus initially on standards Use of Collaboratec for a shared file area and working document tool.
            1. Setup is complete, additional invites will be sent to new participants.
            ii. Document lists are uploaded.
            iii. Initial concept index spreadsheet created.
9. New business
    a. Presentation of index concept
        i. Discussion on how to best structure index
        ii. Several options suggested and to be considered.

10. Adjourn

L.4 Old Business

There was no old business to discuss.

L.5 New Business

Ryan Hogg brought up a new business of need for defining reverse power flow. It was pointed out that some WG like C57.153 is already working on creating own definition and it is important to have standard definition.

A motion was brough up by Francis Mill (seconded by Jeff Wright) to create a a new TF for creating a definition for Reverse Power Flow. Chris Zibert commented that definitions are covered by C57.12.80 and there is no need for another TF. After some discussion and **motion was amended to create a PAR study group to develop an addendum to C57.12.80 for defining Reverse Power Flow**. Motion was carried 24 in support, 2 against and 7 abstentions.

L.6 Attendance

Included as last two pages of this minutes.

L.7 Adjournment

The meeting was adjourned at 5:22 PM CST.

Respectfully submitted,
Ajith M. Varghese
Standards SC Secretary
04/06/2024

Standards SC S24 Attendance List

Role	First Name	Last Name	2024 Mar
Guest	Abdul Majid	Shaikh	X
Secretary	Ajith	Varghese	X
Member	Alan	Washburn	X
Guest	Alex	Ayala	X
Guest	Ali	Naderian	X
Guest	Alireza	Gorzin	X
Member	Alwyn	Van Der Walt	X
Member	Amitabh	Sarkar	X
Member	Andrew	Larison	X
Guest	Angela	Leigl	X
Guest	Anton	Koshel	X
Guest	Arash	Rezvan	X
Guest	Bertrand	Poulin	X
Member	Bruce	Webb	X
Member	Carlos	Gaytan	X
Guest	Chanmin	Jeong	X
Guest	Charles	Sweetser	X
Guest	Christopher	Johnson	X
Guest	Christopher	Whitten	X
Guest	Cole	Van Dreel	X
Member	Daniel	Blaydon	X
Chair	Daniel	Sauer	X
Guest	Daniel	Posadas	X
Member	David	Wallach	X
Member	Dharam	Vir	X
Guest	Didier	Hamoir	X
Guest	Dinesh	Sankarakurup	X
Member	Drew	Welton	X
Member	Dwight	Parkinson	X
Member	Ed	teNyenhuis	X
Member	Eduardo	Garcia Wild	X
Member	Egon	Kirchenmayer	X
Guest	Emilio	Morales-Cruz	X
Member	Eric	Davis	X
Guest	Evan	Knapp	X
Member	Evgenii	Ermakov	X
Guest	Fernando	Tirado	X
Guest	Fernando	Salinas	X
Member	Francis	Mills	X
Guest	Gabriel	Delgado	X
Guest	Garret	Sarkinen	X
Member	Gilles	Bargone	X
Guest	Grace	Guang Yuan	X
Guest	Harmanpreet	Shekon	X
Guest	Janet	Crockett	X
Member	Jarrod	Prince	X
Member	Jeffrey	Wright	X
Guest	Jeremiah	Bradshaw	X
Member	Jerry	Murphy	X
Guest	Jinming	Li	X
Guest	Joe	White	X
Member	John	John	X
Guest	john	Vandermaar	X
Guest	John	Wagner	X
Guest	Jonathan	Reimer	X
Guest	Jonathan	Tan	X
Guest	Jose Luiz	Machain	X
Member	Joseph	Tedesco	X
Guest	Joshua	Watson	X

Role	First Name	Last Name	2024 Mar
Guest	Joshua	Verdell	X
Member	Joshua	Yun	X
Guest	Juan	Acosta	X
Guest	Juan Alfredo	Carrizales	X
Member	Juan Carlos	Cruz Valdes	X
Guest	Juan	Reyes	X
Guest	Junho	Lee	X
Guest	Justin	Minikel	X
Member	kayland	Adams	X
Member	Kris	Zibert	X
Member	Kristopher	Neild	X
Guest	Kumar	Mani	X
Guest	Kyle	Helden	X
Guest	Kyle	Stechschulte	X
Guest	Luc	Loiselle	X
Guest	Malia	Zaman	X
Vice-Chair	Marcos	Ferreira	X
Guest	Mark	NewBill	X
Guest	Mark	Tostrud	X
Guest	Marko	Teofonic	X
Guest	Marnie	Roussell	X
Guest	Masta	Munoz	X
Guest	Matthew	Sze	X
Guest	Matthew	Weisensee	X
Guest	Michael	Richardson	X
Guest	Miguel	Fernandez	X
Guest	Miguel	Garcia	X
Guest	Miguel	Plascencia	X
Guest	Mihir	Amir	X
Guest	Monil	Patel	X
Guest	Omar	Mendez	X
Member	Onome	Avanoma	X
Guest	Orlando	Giraldo	X
Guest	Paul	Weyandt	X
Guest	Pouneh	Davoudi	X
Member	Pragnesh	Vyas	X
Member	Ramadin	Issack	X
Guest	Raymond	Frazier	X
Guest	Rhett	Chrysler	X
Member	Rob	Ghosh	X
Guest	Robert	Reepe	X
Guest	Ryan	Musgrove	X
Guest	Ryan	Hogg	X
Guest	Sherif	Salem	X
Guest	Samson	Debass	X
Member	Sanjib	Som	X
Member	Saramma	Hoffman	X
Member	Scott	Digby	X
Member	Scott	Reed	X
Guest	Scott	ThomAS	X
Member	Sergio	Hernandez Cano	X
Guest	Stacey	Kessler	X
Member	Stephen	Shull	X
Member	Steven	Snyder	X
Member	Thomas	Prevost	X
Guest	Tim	Rocque	X
Guest	Tim	Raymond	X
Member	Tim-Felix	Mai	X
Guest	Vijay	Tendulkar	X
Guest	Vivian	Chan	X
Member	Weijun	Li	X