

Standards Subcommittee

March 22, 2023, Milwaukee, WI

Standards Subcommittee		
Chair: Daniel Sauer	Vice-Chair: Marcos Ferreira	Secretary: Ajith Varghese
Standards Coordinator: Steve Shull		
Room: Regency C-D	Date: March 22, 2023	Time: 4:30 PM to 05:15 pm
Total Members: 71	Present at time of quorum check: 36	Attended per Record: 45
Guests present: 65	Membership requested: 7	Membership accepted: 3

L.1 Meeting Attendance

The Standards Subcommittee met on Wednesday; Mar 22nd, 2023, at 4:30 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 71** members were present. 65 guests were also present of which **7** guests requested membership of which **3** met attendance requirement and will be granted membership.

L.2 Chair's Remarks

The Chair welcomed members and guests to the S23 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 Jerry Murphy. The motion was carried with unanimous consent. The Minutes for Fall 2023 was moved by Evgenii Ermakov and seconded by Steve Shull. 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 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. The Chair welcomed members and guests to the virtual meeting.

Chair briefly highlighted the requirement that while introducing one need to state their affiliation. Chair informed that Shankar Nambi is appointed as new chair for WG C57.12.80 to take over from Jim Graham, who had stepped down/retired.

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:** Eric Davis reported PAR for next revision of C57.12.00 is approved by IEEE-SA and valid till 2026. WG is keeping a tab of activities in TF/WG for next revision. During S23, DTSC approved changes to Induce Test procedure and additional limits to Partial discharge. RLFT chair will forward approved text to WG
- **WG C57.12.90 Test Code:** Similar to C57.12.00, Test code was released in 2022 and PAR for next revision is also approved. During S23, in addition to changes to Induce/PD procedure (RLFT/DTSC), Temp rise TF (Insulation life SC) approved changes to changing wording ultimate to stabilized and added addition clarification how to report stabilized temperature.
- **WG C57.12.70 Terminal Markings:** Did not meet.
- **WG C57.12.80 Terminology Guide:** A motion was unanimously approved during F22 SC meeting to advance to IEEE SA for balloting. WG had discussion on definition of thermally upgraded paper
- **WG C57.152 Field guide:** During the Fall 2022 SC, a motion was unanimously approved to advance the guide to IEEE SA for balloting. However, a procedural error was made during the Fall 2022 WG meeting. During the meeting, the WG unanimously approved the work of the four WG Task Forces and approved the addition of their work to the draft. After that, a vote was taken to approve the draft of the standard and to send it to the Standards Subcommittee for approval. However, another email with the combined version of the draft should have been sent to the WG members for review prior to the approval vote, which made the vote to approve the draft of the standard invalid. The Chair and the Secretary thanked Mario for making the group aware of the error and promised to undertake the following actions to rectify it. The draft of the standard will be posted on the Committee website and sent by email to all members and guests.
- **WG C57.163 Guide for Establishing Power Transformer Capability while under Geomagnetic Disturbances:** Guide is in ballot resolution. Ballot got 81 % response rate and 97% approval. WG plan to recirculate and get the guide to IEEE before next meeting.
- **TF IEEE/IEC Cross Reference:** Allan Washburn, took over chair of this TF, which was inactive for some time and had their first meeting and discussed above creating a scoping document. Chair also reported previous work are not readily available and asked for support if any past documents are available. Ajith forwarded some work done in 2014 comparing C57.12.90 with IEC.
- **TF of Reverse Flow:** This was first meeting of this TF. Dan Blaydon and Ed made presentation and there was lot of interested. Some member noted that meeting time conflict with WG on paralleling guide and it will help to find time that work for both.

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 2023 Milwaukee; March 22, 2023

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. 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. 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.

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.

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.

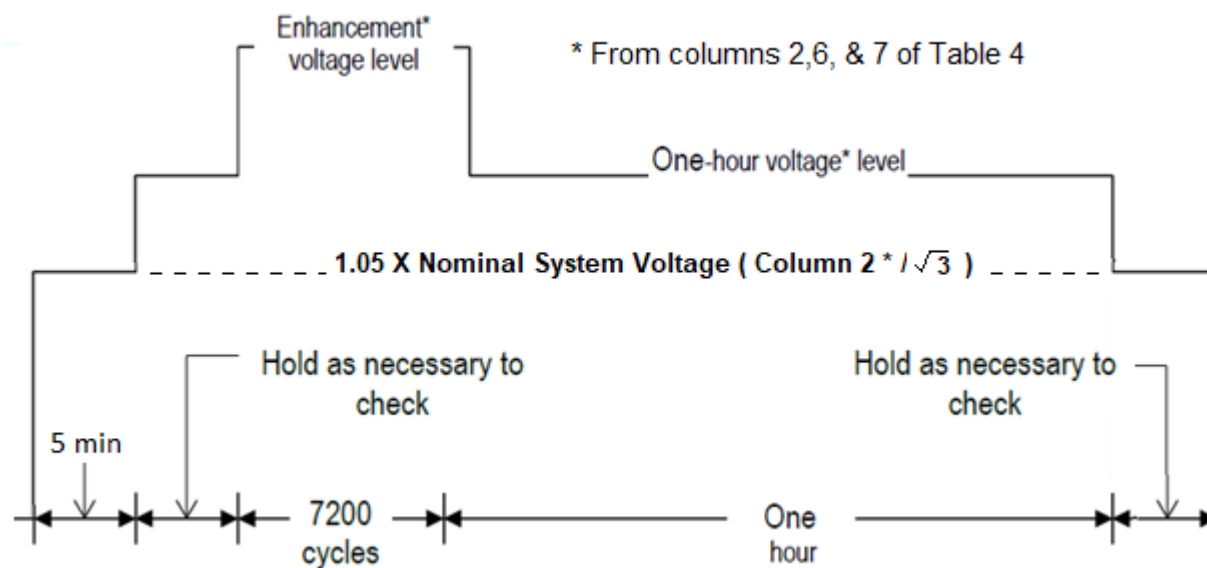


Figure 2 —Induced-voltage test for Class II power transformers

Respectfully submitted,
Eric Davis, WG Chair
March 26, 2023

L.3.2 WG Standard Terminal Markings and Connections for Transformers C57.12.70

WG on C57.12.70 did not meet during Spring 23 TC Meeting.

L.3.3 WG Standard Transformer Terminology for Transformers C57.12.80

WG on C57.12.80 did not meet during Fall 22 TC Meeting.

Document #: C57.12.80

Document Title:

Standard Terminology for Distribution and Power Transformers
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Chair: Shankar Nambi

Vice-Chair

Weijun Li

Prev Chair:	<u>James Graham</u>	Secretary	<u>Richard von Gemmingen</u>
Current Draft Being Worked On:	<u>1.4</u>	Dated:	<u>NA</u>
Meeting Date:	<u>3/20/2023</u>	Time:	<u>9:30 AM – 10:45 AM</u>
Attendance:	Members		<u>11</u>
	Guests:		<u>22</u>
	Total		<u>33</u>

Meeting Minutes / Significant Issues / Comments:

New Chair, Shankar Nambi opened the meeting at 9:31 a.m. on Monday 20 March, 2023.

- 1) Quorum Check
- 2) Quorum was achieved with 11 of 13 members present. 22 non-voting participants also attended. Two Guests requested membership, (Saramma Hoffman and Vir Dharam). Saramma Hoffman was granted membership based on participation in previous meetings.
- 3) Approval of the Agenda
Dan Sauer moved to approve Agenda, Weijun Li seconded, and motion was unanimously approved.
- 4) Approval of the Fall 2022 minutes
Kris Zibert moved to approve the fall 2022 minutes, Dan Sauer seconded, and motion was unanimously approved.
- 5) Call for Essential Patents
A call for essential patents was made. No essential patents or issues were reported.
- 6) Copyright policy
The IEEE copyright policy was displayed and quickly reviewed. No issues were reported.
- 7) Status of Latest draft of C57.12.80-review changes since last meeting before sending for ballot
 - At fall meeting in Charlotte, the membership approved moving the document to ballot.
 - As preparation for this, Dan Sauer submitted draft 1.2 to MEC (Mandatory Editorial Coordination).
 - Dan Sauer indicated document did not have proper # sequences. He requested IEEE Edit board to update to current template and this was done after 2nd request. The version after this is 1.3.
 - Comments from MEC were incorporated in draft 1.4 which was the version displayed in the meeting.
 - Document needs to go to ballot by Fall 2023 as PAR expires December 2023.
 - PAR has already been extended for 3 years.
 - Dan Sauer made motion to authorize request for a 2nd PAR extension, Jeff Wright seconded. After short discussion it was agreed that a 1-year extension should be needed, and Ballot needs to be out before October 16. Motion was approved by unanimous consent.

- Comments on discussion for draft 1.4 Thermally upgraded paper definition
 - Thermally upgraded paper definition was in 2021 but some of it appeared to have been dropped. Action is to go back to Tom Prevost / C57.100 for confirmation of final definition.
 - Use of word “Shall” not to be used in notes. Propose to make changes to remove word “Shall”. Discussion was the word was copied directly from reference C57.100. Suggest change Note to normative number.
- Draft 1.4 does not have items for introduction. This is to be drafted by Shankar Nambi and sent to membership for comments.
- Draft 1.4 discussion on thermal rating factor for current transformer
 - Replace word “shall” with “should” in the informative note.
If note is removed and the statement is made part of definition, then “shall” can be used. This was discussed by Kris Zibert, Weijun Li, Ryan Musgrove.
 - Conclusion was modification to keep note and change “shall” to “should”. Weijun made motion to change “shall” to “should”, Dan Sauer seconded. The motion carried
 - Discussion continued with Dan Blaydon indication this seems to be outside scope of definition dictionary; suggested to reach out to C57.12.00 to find out where it came from, etc.
 - Voting was held, 9 votes to pass, 1 objection, and zero abstentions. Motion passed to replace “shall” with “should”.
- Draft 1.4 discussion on Watertight definition
 - Replace word “Shall” with “will”.
 - Dan Blaydon wanted to understand where this definition came from.
 - Richard von Gemmingen proposed to change “shall be” to “is”.
 - Dan Sauer moved to strike “shall be” and replace with “is”, Kris Zibert seconded.
Vote was taken with 8 approve, 0 objections, and 2 abstentions.
- Draft 1.4 discussion on statement 5 revised to remove year reference to document. No comments or discussion.
- Draft 1.4 MEC comments needed to have metrification. That is being taken care of.
 - Draft 1.4 Shankar Nambi will send draft to membership. All in attendance agreed.

8) Unfinished business – There was no unfinished business.

9) New Business – Sanjib Som discussed decision to remove note. This was agreed to be something for consideration in the next revision of document.

10) Weijun Li agreed to take on role of vice chair for the working group.

11) Adjournment. Dan Sauer made motion to adjourn, Kris Zibert seconded. Motion carried unanimously. Meeting adjourned at 10:20 AM

12) Next meeting – October 2023 in Kansas City

Submitted by: Richard von Gemmingen, Secretary

Date: 3/20/2023

Meeting Attendance List 3/20/2023

Name	Affiliation	S2023 Milwaukee BEFORE Status
Betancourt Enrique	Prolec GE	M
Blaydon Daniel	Baltimore Gas & Electric	G
Craven Michael	Qualus Power Services	G
Debass Samson	EPRI	G
Demir Yasm	Prolec GE	G
Dolloff Paul	East Kentucky Power	G
Gonzalez Luis	Conduct Industries Limited	G
Hall Michael	Mid Central Electric	G
Heiden Kyle	EATON Corporation	M
Hoffman Saramma	PPL Electric Utilities	G
Hogg Ryan	Bureau of Reclamation	G
Hopkins Traci	H2Scan Corporation	G
Jarosz Patrycja	IEEE SA	G
Kapaka Sergiujz	Hitachi Energy	G
Kowalski Rafal	Hitachi Energy	G
Lambert Jason	JST Power	G
Li Weijun	Braintree Electric Light Dept	M
Lucas Tiffany	Prolec GE	G
Mai Tim-Felix	Siemens Energy	M
Matthews Lee	Howard Industries	M
Mills Francis	Power Engineers	G
Musgrove Ryan	Oklahoma Gas & Electric	M
Nambi Shankar	Bechtel Energy, Inc	M
Roussell Marnie	Entergy	G
Salahuddin Shatkh	Hitachi Energy	G
Sauer Daniel	Eaton Corporation	M
Som Sanjib	PTTI	G
Vir Dharam	Prolec-GE	G
vonGemmingen Richard	Dominion Energy	M

Name	Affiliation	S2023 Milwaukee BEFORE Status
Weyer Daniel	Monolith	G
Wright Jeffrey	Duquesne Light Co.	M
Zaman Malia	IEEE SA	G
Zibert Kris	Allgeier, Martin and Associates	M

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 2023 Milwaukee; March 22, 2023 (changes in red 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 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.**

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 bandwidth. 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 $\pm 0.25\%$ 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%: $\pm 2\%$ of reading $\pm 0.05\%$ absolute
- for Insulation Power Factor Above 1%: $\pm 5\%$ of reading $\pm 0.05\%$ 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, but not by the Perf Char SC. **The SC should review by email prior to or in-person at the next 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 22, 2023 there is only one item of business related to Clause 5 and determining the temperature used for measuring cold resistance.
- 2. Possible changes to Clause 13 sound test from Ramsis' TF. No open items.

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. This was discussed, survey done and slight changes made. **A final version is imminent.**
 - Establishing guidelines about use of +/-3% tolerance on voltage peak. Draft wording was presented and discussed. **A final version is imminent.**
 - Proposal regarding phase-to-phase switching impulse. **This work is ongoing.**
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. **This work is ongoing.**
 - Venting bushings during PD test, lots of discussion, this is a controversial topic, some proposed wording exists as a starting point but a small group will work to revise, need collaboration with bushing manufacturers, transformer manufacturers, and users who all have different viewpoints. **This work is ongoing.**
5. Possible changes to subclause 10.11 from Diego Robalino's TF regarding insulation resistance. **This work is ongoing.** 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 is almost complete.**
 - Request for clarification for temp test of 3-winding transformers, injecting maximum losses, and correcting for maximum common winding current in autos. **This work is ongoing.**
 - Proposal by Bertrand Poulin OFAF Cooling and Top Duct Oil temperature and diagram in C57.119. **This work is ongoing.**
 - Clarification to Hottest spot Rise calculation using Fiber Optics
 - Standardize Method for Hot resistance extrapolation

Respectfully submitted,
Stephen Antosz, WG Chair
Jason Varnell, WG Vice-Chair
~~March 23, 2023, Rev 0~~
March 26, 2023, Rev 1 Added final text
10.8.2 & 10.8.5 to Ajith's TF

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 20, 2023, 11:00AM – 12:15PM
UNAPPROVED MINUTES*

Welcome

The chair of the working group, Marcos Ferreira, and the secretary, Goran Milojevic, opened the meeting at 11:00AM.

1. Attendance and Attendance for Quorum

At the time of the meeting there were 42 Members, including Chair and Secretary. A total of 28 members were counted as present at the meeting. 71 members and guests signed into the circulating paper roster.

28 members present of 42 mean requirements for quorum were fulfilled. The list of attendees is shown below:

Name	Affiliation	Status
Ferreira, Marcos	Bridgeview LLC	Chair
Milojevic, Goran	DV Power	Secretary
Bradshaw, Jeremiah	US Bureau of Reclamation	Member
Colopy, Craig	Consultant	Member
Dutta Roy, Samraghi	Siemens Energy	Member
Ermakov, Evgenii	Hitachi Energy	Member
Foata, Marc	Maschinenfabrik Reinhausen	Member
Gara, Lorne	Shermco	Member
Guner, Ismail	Hydro Quebec	Member
Gustavsson, Niklas	Hitachi Energy	Member
Harley, John	First Power Group	Member
Hayes, Roger	General Electric	Member
Heiden, Kyle	EATON Corporation	Member
Herron, John	Raytech USA	Member
Lejay, Olivier	Huaming USA Corp.	Member
Locarno, Mario	Doble Engineering Company	Member
Mabrey, Stephanie	Weidmann	Member
Mayer, Robert	Siemens Energy	Member
Melle, Thomas	Highvolt	Member
Murray, David	TVA	Member
Parminder, Panesar	Virginia Transformer Corporation	Member
Poorvi, Patel	EPRI	Member
Robalino, Diego	Megger	Member
Saad, Mickel	Hitachi ABB Power Grids	Member
Sweetser, Charles	OMICRON Electronics Corp USA	Member
Tanaka, Troy	Burns & McDonnell	Member
teNyenhuys, Ed	IEEE	
Woods, Deanna	Alliant Energy	Member

Bernesjo, Mats	Hitachi Energy	Guest
Betancourt, Edwin	Siemens Energy	Guest
Boettger, William	Boettger Transformer Consulting	Guest
Canto, Jorge	Alliant Energy	Guest
Casey, Cole	Invenergy	Guest
Cross, James	Kinetrics	Guest
Delgado, Gabriel	Invenergy	Guest
Dillon, Nikolaus	Dominion Energy	Guest
Duffy, Jesse	Nashville Electric Service	Guest
Eun Young Cho	HICO America	Guest
Forsyth, Bruce	Bruce Forsyth and Associates	Guest
Gupta, Ravi	Megger	Guest
Gyore, Attila	M&I Materials	Guest
Kerschenbauer, Christoph	Siemens Energy	Guest
Knapek, Will	Omicron Electronics	Guest
LaBean, Bernard	Consumers Energy	Guest
Li, Chao	EATON	Guest
Lopes Mamede, Gabriel	Siemens Energy	Guest
McBride, Jim	JMX High Voltage	Guest
Mellin, Toni	Vaisala	Guest
Mills, Francis	Power Engineers	Guest
Natale, Anthony	HICO	Guest
Nims, Joe	Allen & Hoshall	Guest
Patel, Rakesh	Hitachi Energy	Guest
Plecevic, Uros	Invenergy	Guest
Pruente, John	Prolec GE	Guest
Powell, Chris	Intermountain Electric	Guest
Rehkopf, Sebastian	Maschinenfabrik Reinhausen	Guest
Rock, Patrick	American Transmission Company	Guest
Sahin, Hakan	Virginia Transformer Corporation	Guest
Scardazzi, Alaor	Siemens Energy	Guest
Shaikh, Abdulmajid	Delta Star	Guest
Shaikh, Salahuddin	Hitachi Energy	Guest
Snyder, Jason	First Energy	Guest
Speegle, Andy	Entergy	Guest
Spitzer, Tommy	City Transformer	Guest
Tolcachir, Eduardo	TTE	Guest
Uhlmann, Olivier	Reinhausen	Gues
Vir, Dharam	Prolec-GE	Guest
Washburn, Alan	Burns & McDonnell	Guest
White, Elliot	SD Myers	Guest
Whitten, Christopher	Hitachi Energy	Guest

2. Approval of the Agenda

The motion to approve the agenda was made by Wallace Binder, 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 Jeremiah Bradshaw, 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.

“Our vice chair, Mr. Peter Werelius, has informed us of his resignation from his position as Vice Chair of this Working Group. We want to thank Peter for his work and his contributions. Therefore, the remaining work to be done by the chair and secretary due to late stage of completion the current revision.

During the last meeting, the proposed draft of the standard was accepted unanimously by the present members of this Working Group. The work on obtaining copyright permissions from all copyright holders for new material that was added to the standard is currently ongoing, as part of preparation for submission of a clean version to the Mandatory Editorial Committee (MEC). Comment Resolution Board Members were formed between meetings.

Thank you.

Marcos Ferreira, Chair of WG.”

Discussion

During the show of the membership roster, Stephanie Mabrey pointed out that certain previous members have retired, and certain errors in the email list which was maintained manually. The Secretary took note and promised to rectify these errors.

During discussion after the Chair's Remarks, Mario Locarno pointed out that a procedural error that was made during the Fall 2022 meeting. During the meeting, the WG unanimously approved the work of the four WG Task Forces, and approved the addition of their work to the draft. After that, a vote was taken to approve the draft of the standard and to send it to the Standards Subcommittee for approval. However, another email with the combined version of the draft should have been sent to the WG members for review prior to the approval vote, which made the vote to approve the draft of the standard invalid.

The Chair and the Secretary thanked Mario for making the group aware of the error, and promised to undertake the following actions to rectify it.

- The draft of the standard will be posted on the Committee website and sent by email to all members and guests.
- Email balloting of WG members to approve the draft of the standard will be performed between meetings.
- If the draft is approved, it will be sent to the Standards Subcommittee for email balloting and approval between meetings.
- The Chair will apply for PAR extension to avoid potential issues with PAR expiration at the end of 2023.

7. New Business

No new business this time.

8. Meeting Adjournment

The meeting was adjourned at 11:40AM

Respectfully submitted,

Marcos Ferreira – Chair

Goran Milojevic – Secretary

L.3.6 WG PC57.163 IEEE Guide for Establishing Power Transformer Capability while under Geomagnetic Disturbances

PC57.163 - WG for the Revision of IEEE Guide for Establishing Power Transformer Capability while under Geomagnetic Disturbances

3:15 PM to 4:30 PM Eastern Time, March 21, 2023 (Milwaukee, WI)

Unapproved Meeting Minutes

The WG Chair Dan Blaydon presided over this meeting with both the Vice-Chair, Ramsis Girgis, and Secretary, Scott Digby, in attendance. Meeting attendance numbers as follows:

Total Attendance	72 (see listing at the end of this report)
Members in Attendance	21 (out of 37 members, quorum achieved)
Guests in Attendance	51
Guests Requesting Membership	0

Guests Requesting Membership (attendance at 2 out of 3 meetings required to qualify for membership): As the document had been previously approved by the Working Group for sponsor ballot, in accordance with clause 4.1 of the WG P&P manual new membership requests are not able to be accepted.

The requisite patent and IEEE-SA copyright policy slides were reviewed, with no items noted. The agenda was reviewed by the Chair and approved by unanimous consent. The minutes from the Fall-2023 meeting had been circulated along with the proposed agenda prior to the meeting. There were no changes to the Fall-2023 meeting minutes requested and they were approved by unanimous consent.

With the document currently going thru the Balloting process, the Chair provided a review of the project milestones, history, and status, noting that the PAR expires December-2024. The Chair reported that Balloting closed March 2, 2023, with an 81% return rate, 97% approve rate, and 65 comments. Of the comments 48 were editorial, 9 were technical, and 8 were general, with 17 being categorized as “Must Be Satisfied”. The Chair reported that the Comment Resolution Group (CRG) that had been formed as approved at the Fall-2022 WG meeting has been actively working on disposition for each comment received, will be incorporating the changes based on the comments into the Draft document as appropriate, and that once completed there will be a 10-day Ballot Recirculation of the updated Draft, likely in early April. In this Ballot recirculation, the full balloting group has the right to examine the revisions to the document resulting from the comments and determine whether they want to maintain / change their vote. The need for balloter to vote again is needed only in case of changing the original vote. The Public Review period had not yet closed, but no comments had been received from that process to date. The WG Officers will continue to move the document through the remaining IEEE processes toward publication.

There were no old business items to address.

There were no new business items raised.

Given the status of the ballot process for the revised document it is expected that this was the last meeting of this WG, so no WG meeting is planned during the Fall-2023 Transformers Committee meetings.

The meeting adjourned prior to the 4:30 pm end time of the designated meeting time slot.

Respectfully Submitted,

Scott Digby, WG Secretary

Role	First Name	Last Name	Affiliation
Chair	Daniel	Blaydon	Baltimore Gas & Electric
Vice-Chair	Ramsis	Girgis	Hitachi Energy
Secretary	Scott	Digby	Duke Energy
Member	Mats	Bernesjo	Hitachi Energy
Member	William	Boettger	Boettger Transformer Consulting LLC
Member	Hakim	Dulac	Advanced Power Technologies
Member	Bill	Griesacker	Duquesne Light Co.
Member	Saramma	Hoffman	PPL Electric Utilities
Member	Dmitriy	Klempner	Southern California Edison
Member	Martin	Munoz Molina	Orto de Mexico
Member	Sanjay	Patel	Smit Transformer
Member	Ion	Radu	Hitachi Energy
Member	Markus	Schiessl	SGB
Member	Eric	Schleismann	Southern Company Services
Member	Sanjib	Som	Pennsylvania Transformer
Member	Marc	Taylor	JFE Shoji Power Canada Inc.
Member	Mark	Tostrud	Dynamic Ratings, Inc.
Member	Alan	Washburn	Burns & McDonnell
Member	Joe	Watson	JD Watson and Associates Inc.
Member	Trenton	Williams	Advanced Power Technologies
Member	Waldemar	Ziomek	PTI Transformers
Guest	Kayland	Adams	SPX Transformer Solutions, Inc.
Guest	Thomas	Aikens	Virginia Transformer
Guest	Bob	Arritt	EPRI
Guest	Enrique	Betancourt	Prolec GE
Guest	Susan	Bonfiglio	Western Area Power Admin.
Guest	Elizabeth	Bray	Southern Company
Guest	Juan Alf..	Carrizabi	Prolec GE
Guest	Camilo	Casallas	Trench LTD
Guest	Arup	Chakraborty	Delta Star Inc.
Guest	Michael	Craven	Qualus Power Services
Guest	Daniel	Crockett	Ameren
Guest	Samson (Sami)	Debass	EPRI
Guest	Nikolaus	Dillon	Dominion Energy
Guest	Roger	Dugan	EPRI
Guest	Ken	Fedor	SMIT Transformatoren B.V.
Guest	Castro	Fidel	SDGE
Guest	Raymond	Frazier	Ameren
Guest	Hector	Garza	Orto deMexico
Guest	Jeffrey	Gragert	Xcel Energy
Guest	Corey	Hanson	Advanced Power Technologies
Guest	Akash	Joshi	Mott MacDonald
Guest	Viereck	Karsten	MR
Guest	Shelton	Kennedy	Niagara Transformer
Guest	Anton	Koshel	Delta Star Inc.
Guest	Krysztol	Kulasek	Delta Star Inc.
Guest	JOSE LUIS	MACHAIN	PROLEC GE
Guest	Lee	Matthews	Howard Industries
Guest	Omar	Mendez Zamora	Prolec GE
Guest	Emilio	Morales-Cruz	Qualitrol Company LLC
Guest	Marta	Munoz	Hitachi
Guest	David	Murray	Tennessee Valley Authority
Guest	Stephen	Oakes	WEG Transformers USA Inc.
Guest	Homero	Portillo	Advanced Power Technologies
Guest	Ulf	Radbrandt	Hitachi Energy
Guest	Sebastian	Renkopf	MR
Guest	Tim	Rocque	Prolec GE Waukesha

Guest	Rodrigo	Ronchi	WEG
Guest	Marnie	Roussell	Entergy
Guest	Amitabh	Sarkar	Virginia Transformer
Guest	Alfons	Schrammel	Siemens Energie
Guest	Jonathan	Snodgrass	Texas ABM University
Guest	Markus	Stank	Maschinenfabrik Reinhausen GmbH
Guest	Andy	Steineman	Delta Star Inc.
Guest	Scott	Thomas	Hitachi
Guest	Cole	Van Dreel	American Transmission Company
Guest	Jos	Veens	SMIT Transformatoren B.V.
Guest	Dharam	Vir	Prolec GE Waukesha Inc
Guest	Bruce	Webb	Knoxville Utilities Board
Guest	Joe	White	Power Engineers
Guest	Jeffrey	Wright	Duquesne Light Co.
Guest	Guang	Yuan	Hitachi

L.3.7 TF - IEEE / IEC Continuous Cross Reference

Standards Subcommittee Task Force
IEEE / IEC Cross Reference
Monday, March 20, 2023, 9:30am to 10:45am
Chair: Alan Washburn

1. Welcome
 - a. Meeting came to order at 9:35am
2. Introduction of participants
 - a. 12 attendees
3. IEEE SA patent policy and call for patents – none noted
4. IEEE SA copyright policy – no comments
5. Membership review
 - a. Meeting was approached as a new effort as it is being restarted
 - b. Anyone interested in membership was admitted
 - c. Quorum was achieved
6. Review /approval of agenda
 - a. Agenda was approved
7. Review of F19 Minutes
8. Old business
 - a. S20 presentation
9. New business
 - a. Presentation topics
 - i. Most recent previous meeting minutes focused on having regular presentations on detailed comparison topics. Attendees were requested to submit any future topic recommendations.
 - b. Index document
 - i. The majority of discussion was around determining the scope of the TF work, including putting some additional effort into finding previous documents or other information produced by the TF.
 - ii. Attendees recommended developing a written description of our scope and requesting feedback from the Subcommittee.

- iii. There was some discussion that a more formalized work product could be of interest, possibly shared in some way so that it could be publicly available.
 - iv. May start initially with an index that simply lists cross reference information by topic.
 - v. One attendee mentioned that adding cross reference information to CIGRE documents in the future may provide additional benefits.
 - c. Meeting frequency
 - i. TF will continue to meet at both spring and fall committee meetings.
10. Adjourn
- a. Meeting adjourned.

L.3.8 TF Reverse Power Flow

Minutes of Meeting Task Force – Reverse Power Flow Milwaukee, WI – Mar 21, 2023

- The Working Group met at 16.45 in the Executive Ballroom at the Hyatt Regency Hotel on Mar 21, 2023. This was the first meeting of the TF.
- The Chair, Dan Blaydon (Baltimore Gas & Electric), led the meeting; The Secretary, Ed teNyenhuys (Hitachi Energy), recorded the attendance and meeting minutes.
- There was 69 persons requesting membership and 52 guests for 121 total attendees.

First Name	Last Name	Affiliation	Member	Guest
Elise	Arnold	SGB	X	
Javier	Arteaga	Hitachi Energy	X	
Gilles	Bargone	FISO Technologies Inc.	X	
Mats	Bernesjo	Hitachi Energy	X	
Enrique	Betancourt	Prolec GE	X	
Daniel	Blaydon	Baltimore Gas & Electric	X	
William	Boettger	Boettger Transformer Consulting LLC	X	
David	Calitz	Siemens Energy	X	
Fidel	Castro	SDGE	X	
Thomas	Dauzat	AEP	X	
Nikolaus	Dillon	Dominion Energy	X	
Jose	Gamboa	H-J Family of Companies	X	
Eduardo	Garcia Wild	Siemens Energy	X	
James	Gardner	SPX Transformer Solutions, Inc.	X	
Carlos	Gaytan	Prolec GE	X	
Jeffrey	Gragert	Xcel Energy	X	
Bill	Griesacker	W. Griesacker and Associates	X	
Kenneth	Hampton	Baltimore Gas & Electric	X	
Corey	Hanson	Advanced Power Technologies	X	
Roger	Hayes	General Electric	X	
Carlos	Hernandez	Delta Star	X	
Jean	Hernandez	Neetrac - Georgia Tech	X	
Ronald	Hernandez	Doble Engineering Co.	X	
Saramma	Hoffman	PPL Electric Utilities	X	
Nicholas	Jensen	Delta Star Inc.	X	
John	John	Virginia Transformer Corp.	X	
Christopher	Johnson	Oncor	X	
Akash	Joshi	Black & Veatch	X	
Jerzy	Kazmierczak	Hitachi Energy	X	

Qasim	Khan	Neetrac - Georgia Tech	X	
Dmitriy	Klempner	Southern California Edison	X	
Mark	Lachman	Doble Engineering Co.	X	
Junho	Lee	Hyundai Electric	X	
Kumar	Mani	Duke Energy	X	
Daniel	Mulkey	Mulkey Engineering Inc.	X	
Dwight	Parkinson	EATON Corporation	X	
Monil	Patel	Pacific Gas & Electric	X	
Sanjay	Patel	Smit Transformer	X	
Vinay	Patel	Consolidated Edison Co. of NY	X	
Tim	Rocque	Prolec GE	X	
Dinesh	Sankarakurup	Duke Energy	X	
Amitabh	Sarkar	Virginia Transformer Corp.	X	
Anil	Sawant	Virginia Transformer Corp.	X	
Markus	Schiessl	SGB	X	
Eric	Schleismann	Southern Company Services	X	
Pugal	Selvaraj	Virginia Transformer Corp.	X	
Jaber	Shalabi	VanTran Industries, Inc.	X	
Hemchandra	Shertukde	University of Hartford	X	
Avijit	Shingari	Pepco Holdings Inc.	X	
Christopher	Slattery	FirstEnergy Corp.	X	
Sanjib	Som	Pennsylvania Transformer	X	
James	Spaulding	Fort Collins Utilities	X	
Arthur	Speegle	Entergy Services, Inc.	X	
Markus	Stank	Maschinenfabrik Reinhausen	X	
Ali	Syed	Comed	X	
Ed	teNyenhuis	Hitachi Energy	X	
Scott	Thomas	Hitachi Energy	X	
Eduardo	Tolcachir	Tubos Trans Electric S.A.	X	
Mark	Tostrud	Dynamic Ratings, Inc.	X	
Cole	Van Dreel	American Transmission Co.	X	
Jason	Varnell	Doble Engineering Co.	X	
Dharam	Vir	Prolec GE	X	
Pragnesh	Vyas	Sunbelt-Solomon Solutions	X	
Joe	Watson	JD Watson and Associates Inc.	X	
Joe	White	Power Engineers	X	
Fei	Yang	Hitachi Energy	X	
Guang	Yuan	Hitachi Energy	X	
Michael	Zarnowski	Carte International	X	
Peter	Zhao	Hydro One	X	
Shaikh	Abdulmajid	Delta Star		X
Stephen	Antosz	Stephen Antosz & Associates, Inc		X
Kush	Arora	Maschinenfabrik Reinhausen		X
Barry	Beaster	H-J Family of Companies		X
Jason	Beaudoin	Weidmann Electrical Technology		X
Duvier	Bedoya	Hitachi Energy		X
Kevin	Biggie	Weidmann Electrical Technology		X
Jeremiah	Bradshaw	Bureau of Reclamation		X
Chris	Brown	SDGE		X
Juan Alfredo	Carrizales	Prolec GE		X
Vivian	Chan	Hitachi Energy		X
Rhett	Chrysler	ERMCO		X
Craig	DeRouen	ERMCO		X
Scott	Digby	Duke Energy		X
Fernando	Duarte	EPRI		X
Roger	Dugan	EPRI		X
Qusai	Elnimri	Vantran		X
Sanford	Fong	Georgia Power Co.		X
Raymond	Frazier	Ameren		X
Lorne	Gara	Shermco		X
Miguel	Garcia	Hitachi Energy		X
John	Herron	Raytech USA		X
Nathan	Jacob	Camlin Energy		X
Gary	King	Howard Industries		X
Anton	Koshel	Delta Star Inc.		X
Krzysztof	Kulasek	Delta Star		X
Andrew	Larison	Hitachi Energy		X
So-young	Lee	Hyundai Electric		X
Aleksandr	Levin	Weidmann Electrical Technology		X
Lee	Matthews	Consultant		X
Omar	Mendez Zamora	Prolec GE		X

Timothy	Menter	Lincoln Electric System		X
Michael	Morgan	Duke Energy		X
Hugo	Murillo	H-J Family of Companies		X
Anthony	Natale	HICO America		X
Joe	Nims	Allen & Hoshall, Inc.		X
Bertrand	Poulin	Hitachi Energy		X
Thomas	Prevost	Weidmann Electrical Technology		X
Jarrod	Prince	ERMCO		X
Martin	Rave	ComEd		X
Robert	Reepe	Georgia Power Co.		X
Michael	Richardson	Ameren		X
Albert	Sanchez	Knoxville Utilities Board		X
Salahuddin	Shaikh	Hitachi Energy		X
Jason	Snyder	First Energy		X
Brad	Staley	Leenward Renewable Energy		X
Alan	Traut	Howard Industries		X
Reinaldo	Valentin	Duke Energy		X
Jos	Veens	SMIT Transformatoren B.V.		X
Joshua	Verdell	ERMCO		X
Bruce	Webb	Knoxville Utilities Board		X
Zachery	Weiss	WEG Transformers USA Inc.		X

- The Chair introduced the TF objectives which are to evaluate the effect of reverse power flow and identify which standards or WG's are likely to be impacted.
- Dan Blaydon presented a DER case with a solar farm connected to a 1950's step down transformer. There was flow in both directions due to: the solar farm feeding the system, the solar farm feeding the load or the grid feeding the load.
- Dan Blaydon presented specific sections of historical and current transformer standards which refer to step-up and step-down operation.
- Ed teNyenhuis presented various transformer winding arrangements (two winding, two winding with LTC, auto connected and multi winding) and the possible impacts due to reverse power flow. The main points for existing transformers are:
 - Power flow changes should be reviewed for all affected transformers
 - System study can predict the new reverse power flow loading scenarios
 - May need to be reviewed by the transformer OEM (they know the winding arrangement and can recalculate leakage flux)
 - Nameplate Loading might have to be decreased
 - Restrict power factor of the reverse power flow
 - In worst case, transformer life can be significantly reduced with reverse power flow
- The below comments were given by the TF:
 - Each case of reverse power flow is reviewed separately
 - New transformers are specified to be step up and step down
 - Common to have solar farm and battery together
 - DER load can be on or off in an instant
 - Sound level of the transformer could be increased (due to core over fluxing)
 - GSU's can also be in step down operation (VAR's can be coming from the system)

- Decommissioned power plants are often converted to battery storage with old GSU in step down operation
 - Transformers in reverse power flow experience many more LTC operations
 - User needs to specify what are the loading conditions for the manufacturer to consider
 - Need to consider the VAR's for reverse power flow as well
 - Will the TF consider both power and distribution transformers?
 - The 110% overvoltage required in IEEE standards should cover all cases of reverse power flow
 - The TF should outline what are the issues to consider for reverse power flow
- The Chair requested that the TF members each consider presenting cases of reverse power flow experiences for next meeting
- The meeting was adjourned at 18.00

L.4 Old Business

There was no old business to discuss.

L.5 New Business

No new business was brought up for discussion before or during the meeting.

L.6 Attendance

Included as last two pages of this minutes.

L.7 Adjournment

The meeting was adjourned at 5:15 PM CST.

Respectfully submitted,
Ajith M. Varghese
Standards SC Secretary
04/22/2023

Standards SC S23 Attendance List

Role	First Name	Last Name	Company	3/20/2023
Guest	Abdul Majid	Shaikh	Delta Star Inc.	X
Secretary	Ajith	Varghese	Prolec GE Waukesha	X
Member	Akash	Joshi	Black & Veatch	X
Guest	Alan	Washburn	Burns & McDonnell	X
Guest	Alex	Alahmed	Evergy	X
Member	Amitabh	Sarkar	Virginia Transformer Corp.	X
Guest	Anand	Zanwar	Siemens Energy	X
Guest	Anton	Koshel	Delta Star Inc.	X
Guest	Arup	Chakraborty	Delta Star Inc.	X
Guest	Bernard	Labean	Consumers Energy	X
Guest	Bertrand	Poulin	Hitachi ABB Power Grids	X
Member	Bill	Griesacker	Duquesne Light Co.	X
Member	Brad	Staley		X
Member	Bruce	Forsyth	Bruce Forsyth and Associates	X
Guest	Carlos	Gaytan	Prolec GE	X
Guest	Charles	Sweetser	OMICRON electronics Corp U	X
Guest	Christopher	Johnson	Oncor	X
Guest	Christopher	Slattery	FirstEnergy Corp.	X
Guest	Christopher	Whitten	Hitachi Energy	X
Guest	Cole	Van Dreel	American Transmission Co	X
Guest	Craig	Colopy		x
Member	Daniel	Blaydon	Baltimore Gas & Electric	x
Chair	Daniel	Sauer	EATON Corporation	X
Guest	Daniel	Posadas	Prolec SA	X
Guest	David	Wallach	Duke Energy	X
Guest	Derek	Hollrah	Burns & McDonnell	X
Member	Dharam	Vir	ProlecGE Waukesha	X
Guest	Dinesh	Sankarakurup	Duke Energy	X
Guest	Dmitriy	Klempner	SCE	X
Member	Drew	Welton	Intellirent	x
Member	Dwight	Parkinson	EATON Corporation	x
Member	Ed	teNyenhuis	Hitachi ABB Power Grids	x
Member	Eduardo	Garcia Wild	Siemens Energy	x
Member	Egon	Kirchenmayer	Siemens Energy	x
Guest	Emilio	Morales-Cruz	Qualitrol Company LLC	x
Guest	Enrique	Betancourt	Prolec GE	X
Member	Eric	Davis	Burns & McDonnell	x
Member	Evgenii	Ermakov	Hitachi ABB Power Grids	x
Guest	Fei	Yang	Hitachi ABB Power Grids	X
Guest	Francis	Mills	Power Engineers	x
Guest	Goran	Milojevic	DV Power	x
Guest	Grace	Guang Yuan	Hitachi	X
Member	Hemchandra	Shertukde	University of Hartford	X
Guest	Ion	Radu	Hitachi ABB Power Grids	x
Guest	Ismael	Naga	EATON Corporation	X
Guest	Jacob	Thielbar	WAPA	X
Member	Jarrold	Prince	ERMCO	X
Member	Jeffrey	Wright	Duquesne Light Co.	X
Guest	Jeremiah	Bradshaw	Bureau of Reclamation	x
Member	Jerry	Murphy	Reedy Creek Energy Services	x
Guest	Jesse	Duffy	Nashville Electric Service	X
Guest	Joe	White	Power Engineers	X
Member	John	Herron	Raytech USA	x
Member	John	John	Virginia Transformer Corp.	x

Role	First Name	Last Name	Company	3/20/2023
Member	Joseph	Tedesco	Hitachi ABB Power Grids	x
Member	Joshua	Yun	Virginia Transformer Corpora	x
Guest	Juan Alfredo	Carrizales	Prolec GE	x
Member	Juan Carlos	Cruz Valdes	Prolec GE	x
Guest	kayland	Adams	ProlecGE Waukesha	X
Guest	Kumar	Mani	Duke Energy	x
Member	Kurt	Kainerder	Siemens Energy	x
Guest	Lus	Gonzalex	Conduct	X
Vice-Chair	Marcos	Ferreira	Beale AFB	x
Guest	Mark	NewBill	Hitachi	X
Guest	Mark	Tostrud	Dynamic Ratings, Inc.	x
Member	Michael	Botti	Hyosung HICO	x
Guest	Michael	Richardson	Ameren	X
Guest	Miguel	Garcia	Hitachi Energy	X
Guest	Miguel	Plascencia	PGE	X
Guest	Monil	Patel	Pacific Gas & Electric Compan	x
Guest	Moonhee	Lee	Hammond Power Solutions	x
Guest	Nick	Jensen	Delta Star Inc.	x
Guest	Nikolaus	Dillon	Dominion Energy	x
Member	Philip	Hopkinson	HVOLT Inc.	X
Guest	Pragnesh	Vyas	Sunbelt-Solomon Solutions	X
Guest	Qasim	Khan		X
Member	Ramadan	Issack	American Electric Power	X
Guest	Raymond	Frazier	Ameren	x
Guest	Rehan	Ali	Siemens Energy	X
Guest	Richard	vonGemmingen	Dominion Energy	x
Member	Rob	Ghosh	General Electric	x
Member	Robert	Ballard	DuPont	x
Guest	Robert	Reepe	Georgia Power Co.	X
Guest	Roberto Ignacio	Da Silva	Cargill	X
Guest	Ryan	Musgrove	Oklahoma Gas & Electric	x
Guest	Ryan	Hogg	Bureau of Reclamation	x
Guest	Salahuddin	Shaikh	Hitachi ABB Power Grids	X
Guest	Samson	Debass	EPRI	x
Guest	Sanford	Fong	Georgia Power Co.	X
Member	Sanjib	Som	Pennsylvania Transformer	x
Member	Saramma	Hoffman	PPL Electric Utilities	x
Member	Scott	Digby	Duke Energy	x
Member	Scott	Reed	MVA	x
Guest	Scott	Thomas	Hitachi Energy	x
Member	Sergio	Hernandez Cano	Hammond Power Solutions	x
Guest	Stacey	Kessler	Ultieg Eng	X
Member	Stephen	Antosz	Stephen Antosz & Associates	x
Member	Stephen	Shull	BBC Electrical Services, Inc.	x
Member	Steven	Snyder	Hitachi ABB Power Grids	x
Guest	Susan	Bonfiglio	Western Area Power Admin.	x
Member	Tauhid Haque	Ansari	Hitachi ABB Power Grids	x
Member	Thomas	Dauzat		x
Guest	Tim	Rocque	ProlecGE Waukesha	X
Member	Tim-Felix	Mai	Siemens Energy	x
Guest	Vijay	Tendulkar	Eaton	x
Guest	Vivian	Chan	Hitachi	X
Guest	Vivek	Bhatt	ProlecGE Waukesha	x
Member	Weijun	Li	Braintree Electric Light Dept.	x
Guest	William	Boettger	Boettger Transformer Consu	x
Member	William	Whitehead	Siemens Energy	x