

## **Annex J Performance Characteristics Subcommittee**

**November 1<sup>st</sup>, 2017**  
**Louisville, KY, USA**

**Chair: Ed teNyenhuis**  
**Vice Chair: Craig Stiegemeier**  
**Secretary: Sanjib Som**

### **J.1 Introduction / Attendance**

There were 78 of the 97 PCS members in attendance so quorum was achieved (80% in attendance). In addition, 87 guests were present at the meeting, of which 32 were first time attendees. The total attendance at the meeting was 165. There were 21 guests who attended previous meetings that requested membership - they will be reviewed and added before the Spring 2018 meeting in Pittsburgh if they meet the membership requirements.

The Vice-Chair distributed rosters for the seating arrangement in the room.

### **J.2 Chairman's Remarks**

The Chair introduced himself, the vice-chair and secretary and provided the below updates and comments.

- 2018 PAR's
  - P60076-16 IEEE/IEC Wind Turbine Transformers
  - C57.158 Tertiary/Stabilization Windings
  - C57.110 Non-sinusoidal Load Currents
  - C57.21 Shunt Reactors
- 2019 PAR's
  - C57.105 3-ph Transf. Connections
  - C57.109 Through-Fault-Current Duration
- 2020 PAR's
  - C57.164 Short Circuit Withstand Guide
  - C57.18.10 Semiconductor Rectifier Transformers
- 2021 PAR's
  - C57.142 Transient Guide
  - C57.32A Neutral Grounding Devices amendment
  - C57.123 Loss measurement guide
- C57.120 Loss Evaluation Guide (is due in 2020)
- C57.133 Guide for Short Circuit Testing (Expired)
- C57.136 Sound Abatement Guide (2018 – will let expire)
- C57.149 SFRA Guide (2022)
- C57.159 DPV Transformers (2026)
- C57.32 Neutral Grounding Devices (2025)

- WG & TF Chairs should keep your web pages up to date – review regularly and send any files to post to Sue
- 9 “Corresponding Members” are counted as “Guests” in terms of attendance for a quorum
- Requests for membership will be granted after the meeting if you’ve made the past 2 or 3 of the last 5 meetings
- PCS now has 97 members after a review of the Spring 2017 meeting attendance, along with the 4 previous meetings
- A meeting quorum will be reached if 49 members are in attendance

The below 14 Guests requested membership at the Spring 2017 meeting and have attended the past 2 or 3 of the last 5 meetings. They have been added as Members for the Fall 2017 meeting:

- Bill Griesacker
- John K. John
- Stacey Kessler
- Egon Kirchenmayer
- Raka Levi
- Tim-Felix Mai
- Aniruddha Narawane
- Sanjay Patel
- Hakan Sahin
- Amitabh Sarkar
- Steven Schappell
- Jason Varnell
- Joe Watson
- Joshua Yun

The below 6 Guests requested membership but have not participated in the past 2 or 3 of the past 5 meetings. If present today and still request membership, these Guests will become Members at the Spring 2018 meeting

- Florin Faur
- Reto Fausch
- John Herron
- Mohammad Iman
- Alexander Kraetge
- Emilio Morales-Cruz

These 10 Corresponding Members are being counted as guest status to support reaching the meeting quorum. They continue to receive communications and their guidance for the working group is most welcome.

- Donald Chu
- Larry Coffeen
- Jerry Corkran
- Alan Darwin
- Richard Dudley
- John Lackey
- Tamyres Machado Junior
- Dennis Marlow
- Paulette Powell
- Loren Wagenar

- Current breakdown of the Subcommittee:
  - 97 Members
  - 10 Corresponding Members (counted as guests)
  - 97 total members; 49 are needed for a quorum

### J.3 Approval of Agenda

The Chair presented the agenda and requested if there was any objection to unanimous approval of the agenda - hearing none the agenda was unanimously approved. The agenda had been sent to the members by email several weeks prior to the meeting

### J.4 Approval of Last Meeting Minutes

The Chair presented the minutes of meeting held in New Orleans, Louisiana USA on April 5<sup>th</sup> 2017 and requested if there was any objection to unanimous approval of the agenda - hearing none the minutes was unanimously approved. The minutes had been sent to the members by email several weeks prior to the meeting

### J.5 Minutes from Working Groups and Task Force

The following WG and Task Force reports were received (the reports are appended later).

- |  |               |
|--|---------------|
| • WG on Tertiary/Stabilization Windings PC57.158             | E. Betancourt |
| • TF on LTC Field Tests                                      | M. Ferreira   |
| • TF on PCS Revisions to Test Code C57.12.90                 | H. Sahin      |
| • WG on C57.109 - Through-Fault-Current Duration             | V. Mehrotra   |
| • TF on Audible Sound Revision to Clause 13 of C57.12.90     | R. Girgis     |
| • WG on Non-sinusoidal Load Currents C57.110                 | R. Marek      |
| • TF on PCS Revisions to C57.12.00                           | T. Ansari     |
| • WG Shunt Reactors C57.21                                   | S. Som        |
| • IEEE/IEC WG Wind Turbine Generator Transformers, P60076-16 | P. Hopkinson  |
| • WG on C57.18.10 Semiconductor Rectifier Transformers       | S. Kennedy    |
| • WG 3-ph Transf. Connections C57.105                        | R. Verdolin   |
| • WG on HV & EHV Transients C57.142                          | J. McBride    |
| • WG Short Circuit Design Criteria C57.164                   | S. Patel      |
| • TF on Neutral Grounding Devices PC57.32                    | S. Panetta    |
| • WG on Loss Measurement C57.123                             | E. teNyenhuis |

Below are highlights that were discussed at the PCS meeting:

- 1) PC57.158 – document passed ballot with 88% return rate
- 2) During minutes for the TF on PCS Revisions to Test Code C57.12.90, the question “whether the fluid used for in service should be used for in factory test” was raised by Steve Antosz as to whether this should be dealt with in PCS. Craig Stiegemeier commented that in the past when he was the chair of a TF that identified an issue that had an impact on other SC’s, a message was prepared suggesting the sections in the standard that should be considered for modification. This approach may help with resolving the fluid filling issue identified in PCS C57.12.90 Test Code requirements. The Chair stated he will discuss with Power Transformer Subcommittee.
- 3) IEEE/IEC WG Wind Turbine Generator Transformers, P60076-16 Wind turbine – The guide was approved by IEEE balloting however there are now changes that IEC wants to make after it’s

balloting that are likely not agreeable to IEEE. Several participants commented including Phil Hopkinson, Paul Jarmin and Casey Ballard. The WG group will have to review at the next meeting what changes IEC wishes to make. It may be that IEEE and IEC each publish a separate guide.

- 4) WGPC57.164- The draft of the technical paper should in the website in a few weeks pending author details.
- 5) PC57.164- Sanjay stated that two major points come in the way for joint effort with IEEE; they are annexure A and auto- transformers.
- 6) PC57.123- Sheldon stated that the main point being discussed is the coefficient of resistance.

**J.6 Unfinished (Old) Business**

None

**J.7 New Business and Motions**

None

Ed teNyenhuis mentioned that this was his last meeting as PCS Chair. Craig Steigemeier will become Chairman of PCS starting at the next meeting.

Adjournment was proposed by Marcos Ferreira and seconded by Dan Sauer.

The meeting was adjourned at 4.15 pm.

**J.8 Minutes of Meetings of Working Group (WG) and Task Force (TF) Reports (all unapproved)****J.8.1 PCS Working Group on Guide for Application of Tertiary and Stabilizing Windings PC57.158***Performance Characteristics Subcommittee**IEEE / PES Transformers Committee**October 30, 2017 9:30 AM**Louisville Downtown Marriot Hotel, Room: Marriot 7-9**Louisville, KY, USA**UNAPPROVED MINUTES*

The WG PC57.158 met on Monday October 30<sup>th</sup> at 9:30 AM with **16** Members and **33** Guests present. The current Membership is 32 so we did have a quorum. The following **6** individuals requested membership to the WG.

Hamid Abdelkamel	Ameren
Markus Schiessl	Starkstrom-Geraetebau GmbH
Muhammad Ali M. Cheema	Northern Transformer
Raj Ahuja	Raj Ahuja Consulting
Rodrigo Ronchi	WEG-Voltran
Stephen Schroeder	ABB Inc.

## 1. Old Business

After introductions and approval of the New Orleans Minutes (H.Flores, Kushal Sing), the Chair explained to the group that the WG's document has already passed the balloting stage, and that no new members have been considered since the last WG meeting.

The Chair mentioned that the WG's PAR ends December 2018, and that the Guide for Application of Tertiary and Stabilizing Windings is already in the agenda for the next RevCom meeting, to take place by December 5<sup>th</sup>.

The Chair discussed the results from the of recirculation of Draft 7A which at an 88% return rate, included 107 affirmative votes and 12 abstaining votes; total eligible balloting members were 119.

Source files were requested for 12 of the 33 diagrams in the draft that were embedded as pictures. The Chair took note of members who offered support to complete the drawings.

Next agenda item was the discussion on the agenda and objectives for an upcoming tutorial, once the document is approved. Several WG members and guests volunteered to participate. A couple of new subjects were brought up to include in the Tutorial, as the so called "high impedance tertiaries"; it was clarified that all new subjects will only be mentioned at the final part of the tutorial, as opportunities for a future work.

With no new business, the meeting was adjourned at 10:20 AM.

Volunteers were requested to prepare material for a 1 hour and 15 minutes tutorial, according to following subjects:

- 1- Need of a Guide for Application of Tertiary and Stabilizing Windings (Raj Ahuja, Shankar Nambi)
- 2- Highlights of the approved Draft -Enrique

- 3- Function of stabilizing windings in Y-Y transformers and differences vs. Tertiary Windings (Sanjay Patel)
- 4- Systems Engineering – (Pending to confirm volunteer)
- 5- Recommendations for application of Stabilizing windings (S.Walia, K. Vijayan)
- 6- Further Work (High impedance tertiaries, protections, GIC, dielectric performance etc.) (Sanjay, Enrique, Kiran)

With no new business brought up by the Group, the meeting was adjourned at 10:20 AM with a motion from Sukhdev Walia and seconded by Hugo Flores.

Respectfully submitted,

**Enrique Betancourt**  
**WG Chair**

**Brian Penny, WG Vice-Chair**  
**WG Vice-Chair**

**Marnie Rousell**  
**WG Secretary**

**J.8.2**            ***PCS Task Force on OLTC Diagnostics / Testing***

*Performance Characteristics Subcommittee  
IEEE / PES Transformers Committee*

*Oct 30, 2017 9:30AM  
Louisville Marriott Downtown  
Louisville, KY, USA*

The PCS Task Force on OLTC testing / diagnostics met on Monday, April 3, 2016. The Chair Marcos Ferreira called the Group to order at 9:30am and explained the purpose and scope of the TF. This is the first meeting of the group so everyone present at the meeting was considered members for Quorum. There were total 68 individuals present, 38 requested membership. All that requested membership were accepted so the group has 38 members.

The motion to approve the agenda was initiated by Ed teNyenhuus and seconded by Dave Geibel. No discussion took place and agenda was approved unanimously with no comments or amendments.

The agenda Items were covered as follows:

Chair initiated the meeting with presentation

Joe Foldi requested to clarify if it is a test guide for transformer manufacturing and the field. The Chair stated that the subject test can be done in factory or in the field. These are diagnostics tests.

The Chair requested Vice Chair Raka Levi to present the principle of DR&M testing. Peter Zhao questioned the test method and application. The Chair explained that the test is very helpful in the field. The purpose of the Guide is to provide a tool to diagnose if there is any issue before opening the OLTC. The Vice Chair continued the presentation and covered a different method called Vibro Acoustics. After the presentation, Axel Kramer raised the concern about the title of the task force and suggested to change it to more relevant to topic covered in the meeting.

Charles Sweetener suggested focus on the general guide for testing and to harmonize it with the Field test guide C57.152. The Chair mentioned that the intent is not to restrict to field testing but for in general. Rich Simonell disagreed and suggested that the test is useful for the field but we cannot make it mandatory for factory test. So it is more related to field than the factory. Raka Levi mentioned that he felt there is a need for the guide but we need to agree on the title. Don Platts highlighted several technical points: the IEEE has never defined the new technology and we do not want the guide to endorse the new idea. So finalizing the guide without clearly understanding of Scope, purpose and process will be too early. There is confusion about the scope of the task force. Ali Naderian suggested to survey the scope and purpose of the task force and then to discuss the result in next meeting.

Raka Levi – mentioned that he felt there was a need for the guide, but we need to agree on the title. Also, we need a guide to standardize the method from many different are using as of today.

Apollonia Martinez - it is very helpful to have these type of guides available to filed engineers to refer to. Charles Sweetener – Let’s discuss the purpose and scope of the TF.

Roger Fenton agreed with the idea of having the guide and to keep it open to accept the new method in the future. It is necessary to take advantage of the experts and get the guide completed rather than waiting for another 10 years.

Raka initiated the Motion but Craig Stiegemeier mentioned motion has to come from floor not from an official.

Charles Sweetener initiated the motion “Define the scope, objective, and outcome of the task force with the road map, timeline and the summary of deliverables”. John Herron seconded it. Ed teNyenhuis confirmed the motion is in line with PCS direction. The Chair opened the floor for discussions. There was no further discussion. The motion passed unanimously.

Meeting adjourned at 10:45AM.

Respectfully submitted by  
Marcos Ferreira  
Chair

Raka Levi  
Vice Chair

Tauhid Ansari  
Secretary

J.8.3                                   **Task Force on PCS Revisions to C57.12.90**  
  October 30, 2017, 11:00am-12:15pm  
  Marriott VI Room, Marriott Hotel; Louisville, Kentucky USA  
  Hakan Sahin, Chairman; Craig Stiegemeier, Secretary

The TF Chair called the meeting to order at 11am.

The chair went through a review of the purpose of the task force and the proposed agenda for the meeting.

Fall 2017 Agenda

- 1. Administrative
  - A. Statement of Purpose
  - B. Introductions and attendance sheets
  - C. Approval of agenda

## D. Approval of minutes of meeting – Spring -2017

## 2. Old Business

## A. Changes to C57.12.90 on the Load Tap Changer performance voltage test and current test

## 3. New Business

## 4. Adjourn

The Chair asked if any changes to the agenda needed to be made or if anyone had new business. Stephen Schroeder requested time for two new business items.

The Chair confirmed a motion had been made and seconded to approve the agenda – there was unanimous approval.

Rodrigo Ronchi motioned, Kenneth Skinger second for approval of the minutes after the Chair covered a summary of the Minutes of the Spring 2017 New Orleans meeting were reviewed. The minutes were approved unanimously.

The task force moved on to old business, which is the LTC performance voltage test and current test to be included in future versions of C57.12.90.

There were 43 of the 61 TF members in attendance making this meeting “official” as a quorum of 70% was reached. In addition, 83 guests were present at the meeting, of which 27 were first time attendees. 21 of the guests who attended previous meetings requested membership on the Task Force. They will be added if they meet the membership requirements before the Spring 2017 meeting.

A proposal to sections 8.7 and 9.6 was developed and presented to the group at this meeting. They are:

## 8.7 On-Load Tap Changer End to End Voltage Test

*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 (from one extreme tap to the other extreme tap and back) with the transformer energized at rated voltage. The test may be performed in intervals if needed, but it is a requirement that the transformer be energized at no less than rated voltage for each tap change, and the applied voltage can be adjusted to the rated voltage of the tap position. 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. Note that with some types of tap changers, there will be an abnormally loud sound if components are not connected properly. The transformer will have passed this test if the tap changer operates normally, with no abnormal sound, and no abnormal observations in the test control system which may cause the test circuit to trip. Oil samples taken from the diverter compartment of vacuum type tap-changers, before and after the test, may show some increase of dissolved gases, which is due to current commutation, resistor heating and / or stray-gassing of the oil. The increase of the sum of H<sub>2</sub>, CH<sub>4</sub>, C<sub>2</sub>H<sub>6</sub>, C<sub>2</sub>H<sub>4</sub> and C<sub>2</sub>H<sub>2</sub> should not exceed 12 ppm for in-tank type LTCs and 6 ppm for compartment type LTCs.*

*Note: During the operation of the change-over selector (reversing switch or coarse-tap selector), the sound can be slightly different.*

The Chair gave 3 minutes for those attending to read the above text to enable a discussion. The Chair then showed the following test for section 9.6.

## 9.6 Load Tap Changer End to End Current Test

*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 (from one extreme tap to the other extreme tap) with the transformer current at the top nameplate MVA rating. The test may be performed in intervals if needed, but it is a*



*requirement that the transformer current be no less than 80% of the top MVA nameplate current for each tap change. 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. Note that with some types of tap changers, there will be an abnormally loud sound if components are not connected properly. The transformer will have passed this test if the tap changer operates normally, with no abnormal sound and no abnormal observations in the test control system may cause the test circuit to trip. Oil samples taken from the diverter compartment of vacuum type tap-changers, before and after the test, may show some increase of dissolved gases, which is due to current commutation, resistor heating and / or stray-gassing of the oil. The increase of the sum of H<sub>2</sub>, CH<sub>4</sub>, C<sub>2</sub>H<sub>6</sub>, C<sub>2</sub>H<sub>4</sub> and C<sub>2</sub>H<sub>2</sub> should not exceed 12 ppm for in-tank type LTCs and 6 ppm for compartment type LTCs.*

*Note: During the operation of the change-over selector (reversing switch or coarse-tap selector), the sound can be slightly different.*

The chair then opened up the meeting for discussion. The following members and guests came forward and made those comments:

Steven Brzoznowski of Bonneville Power – Wanted to confirm that these are proposed routine tests for class 2 transformers.

Steve Schroeder of ABB – thinks this should also apply to Class 1 transformers – basically any transformer with on on-load tap changer

Joe Foldi, consultant – This came about as issues on site were found for larger transformers.

Sam Mehta, consultant – this was a hot issue for voltage regulators, so a decision was made to just stop at Class 2.

Steve Antosz, consultant – The class requirement comes from 12.00. This should just be for a procedure to perform the test.

Krishnamurthy Vijayan of PTI Manitoba – Is this for both types of tap changers? Rainer Frotscher pointed out that this is for vacuum-type only LTCs. For non-vacuum determination of a problem is only the sound level.

Tony Franchetti or PECO – Control voltage at 8F% should be added to the procedure.

Someone from SPX – Questioned whether information is adequate for natural esters. Rainer noted that this is only for mineral oil.

Dan Blaydon – BG&E – Would like to see a tolerance on the 80% voltage. Joe Foldi noted that impedance is changing across the tap range, so that's why a minimum is specified.

Dave Geibel – ABB – Gas sampling should be performed on LTC's without a diverter compartment.

Rainer agreed and said that the oil from the LTC should be taken from all compartments. Sam Mehta noted that testing should be performed on all LTCs.

Pierre Riffon – would like a sentence for all oil type tap changers. He also wanted to understand the logic of the range of operation testing. Joe Foldi – since the tap changer could have a problem at any tap.

That's when it was agreed to test the complete operating range of the LTC.

Jeff Ray – Pointed out that a minimum of 80 or 85% allows going from one end to the other without having to adjust the test set up.

Don Ayres – We may want to align the current test here from the requirements of the heat run.

The Chair asked for 10-15 volunteers who would review the text and come up with something that can help move the tests forward.

Dave Geibel – Commented that he's not aware of a test that sounds significantly different at 95% than 80%.

#### New Business

Steve Schroeder – two items

1. We should address the fact that a transformer must be tested with in the same fluid that it will be filled with in service. This is due to the fact that natural ester and mineral oil have very different properties. This is most critical for temp run and dielectric tests. Ed teNyenhuis suggested that

by filling with regular oil may degrade the fire point of the final installation. Steve Antosz pointed out that from a practical/commercial/technical standpoint this is a good suggestion, but we need to make sure that this is the right TF for consideration.

2. For wye connected transformers with a neutral bushing brought out the winding resistance test currently is line to line. A bad neutral connection could be missed, and he suggests that line to neutral resistance should also be measured. The supplier needs to do something with winding resistance including the neutral.

There was agreement on both topics that they should become new business for the TF.

We need a secretary for the task force with Craig Stiegemeier moving on to the PCS Chair role.

Dan Sauer motioned and Ed teNyenhuis seconded to adjourn. All agreed and the meeting was adjourned at 11:56am.

J.8.4 **Working Group for Revision of C57.109  
IEEE Guide for Liquid-Immersed Transformer Through-Fault-Current Duration  
Louisville, KY, October, 30 2017**

**Minutes of the Working Group Meeting**

The meeting was held on Monday October 30, at 1.45 pm and five of the six members were present and therefore there was a quorum. There were a total of 39 people present which consisted of 5 members and 34 guests. Three guests were granted membership per request.

The meeting began with a patent call and there were none brought forward. After quorum was determined the Working Group unanimously approved the agenda for the current meeting as well as the meeting minutes from the Spring-New Orleans 2017 working group meeting.

The working group chair then discussed the current status of the draft and ballot results. The response rate of the ballot was was 78% with an approval rate of 94%. There were 31 comments from the ballot. They were largely editorial (17) but there were some technical issues that will need to be addressed. Due to the comments from the ballot a ballot resolution group was requested to be formed and volunteers were asked to come forward after the meeting. The following people volunteered for the ballot resolution group:

1. Chair \_\_\_\_\_ Vinay Mehrotra
2. Vice Chair \_\_\_ Hemchandra Shertukde
3. Secretary \_\_\_ Jason Varnell
4. Member \_\_\_\_\_ Kiran Vedante  
Member \_\_\_\_\_ Weijun Li
5. Member \_\_\_\_\_ Akash Joshi
6. Guest \_\_\_\_\_ Muhammad Ali Masood Cheema
7. Guest \_\_\_\_\_ Shankar Subramany

A motion was raised by Weijun Li to adjourn. Akash Joshi seconded the motion. The working group unanimously approved the adjournment. The meeting adjourned at 2:30pm.

Respectfully submitted  
Vinay Mehrotra  
WG Chair

J.8.5 **Unofficial Minutes of Fall 2017 Meeting of TF “Audible Sound Revision to Test Code C57.12.90”, in Louisville, Kentucky**

The TF met at 1:45 PM, on Monday, October 30, 2017. Chairman Dr. Ramsis Girgis presided over the meeting. Secretary Barry Beaster assisted with the administrative duties.

Prior to the meeting, a survey was issued to members of the TF for inclusion of the NEMA tables in Annex C of C57.12.00, providing Reference Sound Pressure levels for Load noise in Annex C2, and a proposed text for modifications in Table 17 of C57.12.00 regarding reference to Annex C. In another mailing, a proposed meeting agenda along with the unapproved spring 2017 minutes were circulated to all members and guests of the last meeting.

After the spring 2017 meeting, the membership had been adjusted to 49 members. The meeting was attended by 31 of the 49 members and 81 guests for a total of 112 persons. A quorum was established after the meeting via a paper sign-in count and confirmed by the RFID tag in system. The unapproved agenda was presented without change at the meeting. The spring 2017 meeting minutes had no requested changes or corrections and was considered approved. There were eighteen requests for TF membership; which will be reviewed based on previous meeting attendance.

Chairman Dr. Ramsis Girgis presided over the technical portion of the meeting.

The first technical Agenda item presented was the inclusion of NEMA TR1 tables, for no load sound levels, into Annex C of C57.12.00. As agreed upon in previous TF meetings, these values represent transformers designed with regular grain oriented steel, high design core flux density levels, and no means of sound mitigation. In the returns of the Survey, TF members had several constructive comments on both Tables C1 and C2. For Table C1, the following was suggested:

1. Simplify and improve presentation of the notes under the Table
2. Correct an incorrect sound level number in the NEMA Table
3. Remove reference to the 55 °C and add the word “rise”
4. Add a note the “BIL level is for the High Voltage winding of the transformer”
5. Include a statement on Sound levels of 1-phase transformers

For Table C2, it was suggested to change the title as follows:

- I. Remove “Step Voltage Regulators” from the title since they are not covered by IEEE Std. C57.12.00-2015
- II. Replace “network transformers” with “distribution transformers”

All above suggestions were implemented and agreed upon unanimously.

Another previously agreed upon action item was to replace the formulas presently included in Annex C for calculating reference load noise Sound Power levels, with tables of corresponding Sound Pressure levels. This is because:

1. NEMA levels of no load noise are in terms of Sound Pressure levels
2. IEEE Standards deal with Sound Pressure levels not Sound Power levels

The next technical agenda item discussed was whether to use the Full through MVA rating or the 2 – winding equivalent rating of an autotransformer as a reference for determining the Table sound pressure levels for no load noise and load noise. The chairman presented data that showed that very few measured No Load sound levels and Load sound levels were slightly higher than reference levels when using the full MVA as reference. This was not the case when using the 2 winding equivalent power rating for reference. A lively discussion with contribution from manufacturers, consultants, and end users presented

the pros and cons of having reference values either lower or higher than the tested values. To aid in the understanding, the Chairman explained the several factors that contribute to load noise. An unofficial hand vote agreed that the 2 – winding equivalent MVA would be more appropriate for No Load noise and the full MVA would be used for Load noise.

After above modifications are made to Annex C, a resurvey of the membership will be made to assure all are in agreement with the improvements implemented before presenting these to the Performance Characteristics Subcommittee.

During above discussion, the following items were raised:

- Mr. Joe Foldi stated that he expects that Load Sound levels would correlate with the reactive power of the transformer. The Chairman indicated that he would not expect such a relationship but promised to examine this relationship using available test data.
- Mr. K. Vijayan asked whether there is a difference in the final value of the total Sound level of a transformer if No load noise and Load noise are added in either of the following two ways:
  - Adding the corresponding total Sound levels
  - Adding the corresponding Frequency components and then adding the totals of the resulting frequency components.

The Chairman promised to examine above using available measured data. Mr. K. Vijayan promised to do the same

- A question was raised as to whether there is sufficient understanding in the industry of fan noise data and how to account for it in determining the total sound level of the transformer. The Chairman suggested that there might be a need to plan for a tutorial on that in a future Standards meeting.

The final agenda item was a report by Dr. Ploetner on the status of activities of the GIGRE WG: “Power Transformer audible sound requirements”. The purpose of this WG is to derive typical ranges of sound power levels of No load and load noise for specification purposes.

The meeting was adjourned at 3:00 PM.

Respectively submitted,

***Barry Beaster, TF Secretary***

J.8.6

**WG for Revision of C57.110**

**Fall 2017 Meeting, October 29 – November 2  
Louisville Downtown Marriott Hotel, Louisville, Kentucky, USA**

**Chair:** Rick Marek

**Secretary:** Sam Sharpless

**PC57.110D6:** Recommended Practice for Establishing Liquid-Immersed and Dry-Type Power and Distribution Transformer Capability When Supplying Nonsinusoidal Load Currents

No meeting was held this time since the document was just successfully balloted on October 19 with the following statistics:

- Ballot opened on September 19, 2017
- 92 comments with 53 that must be satisfied
- 101 of 123 ballot pool responded meeting the 75% requirement with 82%

- 5 negative votes
- 4 abstention votes
- 92 affirmative votes for a 95% approval

### J.8.7 *Task Force on General Requirements C57.12.00*

*Performance Characteristics Subcommittee  
IEEE / PES Transformers Committee*

*October 30, 2017 4:45 PM  
Louisville Downtown Marriot Hotel  
Louisville, Kentucky USA*

#### UNAPPROVED MINUTES

The PCS Task Force on General Requirements for C57.12.00 met on Monday, October 30, 2017. The Chair Tauhid Ansari called the Group to order at 16:45 and explained the purpose and scope of the TF. 52 Members and 82 guests were present, and as Task Force membership stands at 82 members, we did have a quorum and were able to conduct official business. The following 9 guests requested membership:

Akash Joshi	Black and Veatch
Babanna Suresh	Southwest Electric Co.
David Walker	MGM Transformer Company
Hamid Abdelkamel	Ameren
Liz Sullivan	ABB
Rhea Montpool	Schneider Electric
Rodrigo Ronchi	WEG-Voltran
Tim Felix-Mai	Siemens
Yong Tae Sohn	Hyosung/HICO

The Agenda was approved unanimously, and the minutes from the New Orleans meeting were corrected according to comments made from Sanjay Patel, then the minutes were approved (Raj Ahuja/Stephen Schroeder), with no further comments or amendments.

Agenda Items were covered as follows.

#### 1. OLD BUSINESS

##### **A. WG Item 104, Sec 6.1 – Discuss the P dimension that affects the interchangeability of bushings. (Keith Ellis)**

As Keith Ellis did not attend the meeting, the Chair asked for a motion (Raj Ahuja/Dahram Vir) to remove the topic from the agenda. The motion passed unanimously.

##### **B. WG Item 107, "Table 6 Row 9. Recommend all temperature rises be shown on NAMEPLATE, Top Oil rise, Average Winding Rise, and Hot Spot Rise" (Kipp Yule)**

The subject came from the ballot resolution of C57.12.00. The Chair introduced the subject and opened the floor for discussion. Following comments were brought up.

Joe Foldi: Considered requested temperature rise data as very important information, especially when applications deviate from standard conditions. Raj Ahuja: Requested data is already part of some users' specifications. Sanjay Patel: Special ambient temperature is nowadays more frequently specified; for instance, 50°C, and still 65°C rise, which is inconsistent with C57.12.00. Joe Foldi: As the Nameplate is also considered the "rating plate", it should say maximum temperature rises at the ambient temperature defined by standard C57.12.00. Sanjay Patel: Recommends working with

temperature rises. According to C57.12.00, maximum ambient of 40°C yields 120°C hot spot for 65°C rise.

The Chair clarified that the proposal was to add only temperature rises (independent on ambient temperature). Further comments came from the Group.

Shamaun Hakim: allowable rise can be dependent on ambient temperature. Babanna Suresh pointed out that the standard defines what is normal and abnormal. Juan Castellanos: Pointed add that C57.12.00 requires only compliance with 65°C average winding rise, therefore top oil rise and hot spot rise are not required. Rich von Gemmingen: Requested temperature rises can be obtained from test reports; no extra information is necessary, especially if C57.12.00 is applicable Std. Ryan Musgrove: Extra information can be a source of confusion. His utility uses IEEE standards for loading procedures. Scott Digby: His utility uses test reports and consider insulation classes for loading of transformers. Brian Penny: Has a special specification, provide little info for field application, use test reports. Daniel Blaydon: uses test reports.

A Motion (Craig Stiegemeier/ Babanna Suresh) was stated: not to add requested information about temperature rises to the nameplate. Motion passed with 41 votes in favor, none opposed.

**C. WG Item 108, Exclude Cabinet heater loss from the total cooling loss. (Mark Perkins)**

The chair presented current text in C57.12.00, where cabinet heater loss is added to ancillary equipment losses to calculate total cooling loss. The floor was opened to discussion.

Brian Penny: Where else that loss to be considered? Stephen Schroeder: Cooling fans, liquid pumps and other ancillary equipment. Stephen Schroeder: The proposal seems confusing as stated. Auxiliary losses to be redefined if include space heaters. Rich von Gemmingen.: Control cabinet energy not required as part of guaranteed MVA. Forsythe: it is suggested to remove space heaters from auxiliary losses. Ed teNyenhuis: Clearly stated, just take out space heater loss from auxiliary losses. Matt Weisensee: Some case of running control cabinet heaters all the time.

The Chair asked if further clarification was required from Mark Perkins, with no positive answer.

A Motion (Raj Ahuja/Akash Joshi) was stated: to leave text in standard as is. The motion passed unanimously.

**D. WG Item 109, Clause 7.1.1 on short circuit: Need to clarify if multi-winding transformers should have fault contribution from all un-faulted terminals, if not otherwise specified by customers (Sanjay Patel)**

Sanjay Patel explained that some users request all non-faulted terminals to be considered as sources for short circuit current calculations. In his view, only sources with more than 35% load should be considered.

The Chair requested comments from the Group.

Shamaun Hakim: It can be the case for line to ground faults. K. Vijayan: Bus in-feed should be considered only if there is generation. Shamaun Hakim: It should also be considered when there is stored energy. Anthony Franchitty: Brought up an example of transformer with synchronous motors connected to tertiary, where they can contribute.

The Chair asked for volunteers to rewrite the proposal, with response from Sanjay Patel, K.Vijayan and Babanna Suresh.

## 2. NEW BUSINESS

The Chair asked for new business.

With no new business brought up from the Group, the meeting was adjourned at 17:45 (Hugo Flores/Shamaun).

Respectfully submitted,

Tauhid Ansari

Enrique Betancourt

WG Chair

Secretary

**J.8.8 IEEE Standard Requirements, Terminology, and Test Code for**

Shunt Reactors Rated Over 500 kVA C57.21

**Louisville, KY  
Downtown Marriott Hotel Room 5  
Tuesday October 31, 2017**

The meeting was called to order at 9:30 AM by the Chairman Sanjib Som.

There were a total of 47 participants: 12 Members and 35 Guests out of which 6 Guests requested membership.

- The meeting was opened with the circulation of attendance rosters and call for potentially essential patents. No patent issues were raised.
- 12 of the current 15 WG Members were present and quorum was met.

**Meeting notes:**

■ **Meeting Agenda**

- Meeting agenda, which was circulated among members and guests on October 29, 2017 by email, was presented to the audience.
- There were no objections or comments and the agenda was approved unanimously.

■ **Minutes from previous meeting**

- The minutes from the S17 meeting in New Orleans, which were circulated on October 12, 2017 by email, were presented to the audience.
- There were no objections or comments and the S17 meeting minutes were approved.

■ **Old Business:**

The PAR expires December 2018. We need the document approved by SA before December 2018. Draft 1 is in circulation among members with comment submission date of 26<sup>th</sup> Nov. Members were requested to help in advancing the cause of the document. The goal is to get documentation submitted for SA ballot in Spring of 2018.

1. Draft 1 of the document was circulated among WG membership on October 27, 2017:
  - 1.1. Feedback and comments must be provided by November 26<sup>th</sup>.
  - 1.2. It is expected that a draft 2, including comments, be recirculated by December 26<sup>th</sup>, 2017.
2. Comments on Chris Ploetner were presented, Excel file summary:

- 2.1. Pages 55-63, clause 10.6, Audible Sound test Section is not in line with latest revision of IEEE C57.12.90:2015. Should be replaced by provided new write up.
- 2.2. Page 19, Dielectric test levels are partly different from such given in Table 6 of C57.12.00, Review content and bring it in line with dielectric test Table 6 of C57.12.00. Shamum Hakim to complete this task. Also add a note on the source of the table for future reference as changes on the source standard C57.12.00 may occur.
- 2.3. Page 86, section 12.5, the information is not precise enough, re-write section as provided in the write-up. It was pointed out by Enrique Betancourt that single-phase reactors in the field cannot be separated for sound evaluation. Enrique to provide comment to the Chairman.
3. A motion to remove Annex E on gapped-core reactors from the standard was made by Luc Dorpmanns and seconded by Raj Ahuja as it does not fit the standard. It was approved by 8 votes in favor and 4 against.
4. Vibration measurement section 10.7.5.3: the text had been changed to include only the maximum amplitude of 200 micrometers and align with IEC and CIGRE as per Luke Dorpmanns' presentation in a past meeting, removing the average consideration of 60 micrometers. A motion was presented by Dharam Vir and seconded by Raj Ahuja to re-insert and keep the 60 micrometers average as a requirement. This was approved by a vote of 8 in favor, 2 against and 2 abstentions.
5. The Chair proposed the creation of a comment resolution group (CRG) - Raj Ahuja and Hem Shertudke , Sanjib Som, Arturo Del Rio.
6. The group was encouraged to participate by providing comments as the deadline for the completion of the standard approaches.

No new businesses were presented and the meeting was adjourned at 10:45 am.

Next meeting: Spring 2018, Pittsburg, PA, March 27, 2018.

Respectfully submitted,  
Chairman: Sanjib Som (ssom@patransformer.com)  
Secretary: Arturo Del Rio (a.delrio@ieee.org)

**J.8.9 IEEE/IEC WG Wind Turbine Generator Transformers, P60076-16**

P. Hopkinson

Did not meet

**J8.8.10 Working Group on Semiconductor Power Transformers – C57.18.10**

**Unapproved Meeting Minutes**

Louisville Downtown Marriott Hotel, Louisville, KY  
Marriott 5 Room  
11:00 am, October 31, 2017



The Working Group met in the Marriott 5 meeting room

The Chair called the meeting to order at 11:06am

There were 19 members and 24 guests present. A quorum was present (19 of 27 members).

The patent call was given. Nobody replied with any patent issues.

The agenda was approved unanimously.

The minutes of the March, 2017 meeting in New Orleans were unanimously approved as written.

### Old Business

- The Chair pointed out changes to draft standard and asked for comments to the changes on non-traditional harmonics and breaker/transformer interactions.
- Showed section on non-traditional harmonics. Don Ayers asked if this belonged in the Standard or in an annex. The Chair felt that it belonged in the standard because this is where the discussion of harmonics was.
- Moved old section on separating eddy current and stray losses (Section 8.6.2.f/g) to an annex and added a section from Subhas Sarkar on FEA methods. Joe Foldi raised questions about eddy losses in bus bars being treated as eddy losses versus stray losses. Chuck Johnson pointed out difference between eddy and stray losses in bus bars. Simulation may be the only way to determine these losses and their thermal impact. Don Ayers commented that section was more about winding temperature changes due to strays and eddy currents than things external to the winding. Paul Buddingh also agreed along these same lines. The Chair said that electrical design focused on core/coil. Chuck Johnson mentioned that 3D simulation for bus bars needed to be 3D. David Walker talked about bus temperature affected winding temperature measurement and that 3D simulation is needed. Joe Foldi mentioned that heatrun is at 60Hz and that behavior at harmonic frequencies are different and hard to simulate in a 60H heatrun. Calculating current distribution in bus bars is complex and hard to capture in a standard. And that new harmonic distributions are more complex and you can't use previous experience as much as a guide for design. The Chair asked for volunteer to write up tutorial on this subject- David Walker, John John, Stefan Voss, and Sheldon Kennedy volunteered to help with writing a section on this. David Walker to compile and edit. Rick Marek suggested asking Hasse Nordman for input.
- The Chair asked if there were any comments about examples in Standard. No comments. On hold for now.
- Short Circuit on multi-phase winding. Nothing currently in standard. Should we add anything? In particular, drives are different in behavior. Jeremy Smith volunteered to work on this. And The Chair will also add input.
- Paul Buddingh previously asked about common mode voltage for high resistance grounded circuits. He commented that he isn't sure where it fits in. David Walker mentioned that a lot of drives have stacked secondary windings and high common mode voltages. Need to consider effect on hipot testing. Phil Hopkinson asked if inverter transformers are in scope. The Chair said that they are. Phil has seen failures in inverter transformers in solar with 3kHz clock frequency in a 380-34.5kV transformer. Looked at transients at 380V winding and seeing 150V spikes at zeroes of waveform and a 50V spike at each 3kHz edge. 5-15% voltage spikes are outside of IEEE 519. Is it legitimate? Also see 5% spikes at 9kHz (3<sup>rd</sup> harmonic of clock). Do we need to anticipate this in transformer designs or should transformer designers push the inverter designer to better filtering? Better filtering in the future might help. However, we need to deal with what is currently present in the design of the transformer. We need to get spike/noise information from the inverter supplier. Abe Shahrodi- used to be an inverter designer. He said that is a common phenomenon with IGBT switching. Some inverter designers add filters. IEEE519 was relating to rectifiers and not inverters and levels reflect that. 3kHz is a low switching frequency. Can be 5-10kHz these days. They produce voltage transients on transformer inputs. The Chair mentioned that IEEE519 is more about power line effects not about transformer itself. Abe and Phil to

submit comments. Phil thinks that transformers may need to be designed differently in the future to account for this. He feels that this should be mentioned in Standard. David W mentioned that drives also have similar spikes. Vijay Tendulkar- inverters and transformers have had problems with sine wave transients for a long time and they cause problems with motors being driven by the inverter. Switching spikes are seen on the sine wave outputs. Distance between inverter and motor (cable length) can exacerbate these problems. Phil H said filters are present but don't perform very well. Phil has wave shapes as examples. Vijay mentioned that transients are in the nanosecond range and not microsecond range and a lot of HV filter capacitors are not very good at these frequencies.

- The Chair brought up traction duty transformers and that we should add references to 1653.1. Bill Whitehead to add reference to draft.

**New Business:**

- Dinesh Sankarakurup- Standard refers to 12.90 and 12.91 for LV impulse testing. Should we mention LV impulse testing because rectifier transformers with multiple LV sections are often tested in non-standard ways? Should we cover how you test this type of LV winding? What about testing in cases where secondary impedance was too low to get a good impulse waveform? No answer to these questions at this time.

With no further business, the meeting was adjourned at 12:11.

The Working Group will meet again at the Spring 2018 meeting in Pittsburgh, PA

Chairman: Sheldon Kennedy

Vice Chairman: Bill Whitehead

Secretary: David Walker

**J.8.11 PC57.105 – IEEE Guide for Application of Transformer Connections in Three-Phase Electrical Systems**

**Tuesday, October 31st, 2017 - (1:45 PM – 3:00 PM)**

Chair: Rogerio Verdolin

Vice-Chair: Benjamin Garcia

**1. Attendance:**

a. Members:	10
b. Guests:	24
c. Guests requested membership	1
d. Total:	34
e. Quorum:	Yes

2. **Patents:** Call for patents were made by the Chair. No patents were claimed by guests/members.

3. **Meeting Called to Order:** 1:45 pm on Tuesday, October 31<sup>st</sup>, 2017.

4. **Spring 2017 Minutes Approval:** A motion was made by Phil Hopkinson, and seconded by Alejandro Macias, to approve the meeting minutes from the Spring 2017 meeting in New Orleans, LA. By unanimous vote, the minutes were approved.

5. **Fall 2017 Agenda Approval:** A motion was made by Phil Hopkinson, and seconded by Alejandro Macias, to approve the meeting agenda for Fall 2017 in Louisville, KY. By unanimous vote, the minutes were approved.
6. **PAR Status:** PAR expires December 31<sup>st</sup>, 2019, which represents 2 meetings before we have to conclude the guide. The PAR was approved March 2015. The draft has to go to ballot at the end of 2018. We have to conclude our draft by fall of 2018.
7. Review Comments from Latest Draft Standard (V6):
  - a. **Clause 2 Normative References:**
    - i. Email from Malia Zaman (October 25<sup>th</sup>, 2017): The editorial Group from the IEEE SA provided information regarding Clause 2. Normative References are any documents that must be understood to implement the standard. They do not have to be IEEE standards, nor do they even need to be standards (for example, sometimes manuals or other documents are listed and cited).
    - ii. Phil Hopkinson spoke to the team why IEEE references parent standards in the Normative Reference Clause. If a reference is made to another IEEE document within the body of the text, it should be included in the normative reference Clause. At a minimum, Phil believes that the parent documents (C57.12.00, C57.12.01) and test standards (C57.12.90, C57.12.91) should be included in Clause 2. The group also believes these documents should be listed as well.
    - iii. Sam Sharpless also believes that C57.12.10 and C57.70 should also be included since they were listed in the body of the text. Both of these documents will be added by the Vice-Chair.
    - iv. Phil Hopkinson has provided a list of IEEE standards that were included in Clause 3 and some references in the Bibliographic Clause as well.
  - b. **The Bibliography:**
    - i. All internal company documents need to be deleted from the document. The team believes that a documents needs to be readily available across the industry to be listed in this Clause. Internal company documents should not be included.
    - ii. Phil Hopkinson believes that the parent IEC standard should also be included in the biography. Phil will send to Ben the IEC standard number for inclusion into the standard.
  - c. **Draft Standard Comments:**
    - i. Use words for delta and wye, not symbols. All symbols will be replaced with words throughout the document.
  - d. **IEEE C57.105 Holes:**
    - i. This document is intended to address all three-phase power systems BUT does not include 3 winding transformers. Team said that this will have to be addressed after revision during the next PAR.
  - e. **Table 1:**
    - i. There are a few editorial errors in the revised changes; Ben Garcia and Giuseppe Termini will work together to correct after the meeting.
  - f. **Clause 4.5.1:**
    - i. Clear Cory Morgan's Note per RogerTV
  - g. **Clause 9.2:**
    - i. Ben will delete all highlighted Clause by Roger TV
  - h. **OTHER:**
    - i. The symbol for SQRT should be used instead of SQR T
    - ii. Add Phil Hopkinson as a working member; he has been a main contributor

**No Old Business:**

- None

**Next Steps:**

- Clean up last revision based on comments from today's meeting
- Send members the clean version for their review
- Send to editors the clean version concurrently for their review
- Respond to all comments at the same time
- Address all comments at the Spring 2018 meeting
- Go to ballot

8. Meeting Adjourned at 2:45pm
  - a. Motion: John John
  - b. 2<sup>nd</sup>: Sam Sharpless

Respectively submitted,  
Rogerio Verdolin, Chair  
Benjamin Garcia, Vice-Chair

J.8.12                      **Working Group for the revision of C57.142**  
   **Louisville, KY**  
   **Tuesday, October 31st, 2017 3:15**  
   **PM – 4:30 PM**  
   **Marriott VI**

Chairman – Jim McBride  
Vice Chair – Xose Lopez-Fernandez  
Secretary – Tom Melle

1. Meeting called to order at 3:15 PM
2. Welcome and Chair's Remarks
3. No essential patent claims made
4. Circulation of Attendance Sheets  
82 Attendees were present  
34 f 68 Members present (quorum was achieved)
5. No opposition to approval of Agenda and Minutes from Last WG Meeting.
6. Present working group status: PAR to move from TF to WG was approved in March 2017 and expires December 31, 2021. This work will be jointly sponsored by the Switchgear Committee.

Administrative work and main meetings will take place at Transformers committee meetings, but the Transformers committee WG will receive contributions from Switchgear Committee.

7. Presentation was made on Special Terminated Lightning Impulse Tests by Pierre Riffon. The Chair will request posting of Pierre's presentation on the WG website. The presentation was concluded and opened to questions:

Phil Hopkinson asked if increasing the series capacitance along the winding would help to reduced that existence of additional resonance frequencies during the STLI tests. Answer: yes

Will the papers detailing the AEP transient studies and conclusions be made available? Answer: These papers were reference in the TF paper and could be included in the revision of the guide

Roger Verdolin inquired regarding testing transformers with surge arresters attached. The details discussed are located within the presentation by Pierre Riffon.

Question: is a simulation calculation available for the stress on the transformer with the STLI?

Answer: yes, different probe locations within the winding were measured, which can be extrapolated to different areas of the winding.

Question: when is the STLI conducted and can the waveshapes be compared? Answer: STLI testing occurs after standard impulse testing and the waveshapes of the same level can be overlaid for comparison.

Question by Phil Hopkinson: how effective would modeling of the DUT circuit be? The Chair answered that the magnitudes of transients will generally be well modeled, however, different modeling scenarios will greatly affect the modeling result of the phasing of the transformer. Point to point measurements inside of the transformer and modeling are both extremely difficult, however, the end result is relatively easy to determine (flashover or not).

Pierre: A good starting point is during the design review of the service condition in order to best determine if the test factory conditions should be adapted. The Chair noted that monitoring the test current could help to determine is series resonances are occurring internally in the transformer windings.

Question: is there any data on core saturation or condition? No additional information is available at this time from any known CIGRE papers. The data from the study in the presentation is proprietary from the transformer manufacturer.

Question: Should surge arresters always be installed on transformers potentially exposed to these transients? Answer: testing open line terminals without surge arresters or surge impedance shall be avoided as the produced stress could be too high.

8. Presentation question session concluded at 4:12 PM
9. The chair discussed the activity on the terminals that do not see the breaker strike directly via coupling through the transformer to the "non-pulsed" terminals. The same phenomenon can occur with lightning impulses on a lightly loaded transformer. It was also noted that (breaker) closings can often occur at the peak voltage of the waveform.
10. Per the Chair, a few options for mitigation include: Increasing the BIL, Changing the Operating Sequences, Additional factory test requirements, and/or create additional simulations (models). The floor was opened up to comments:

Regarding no-load energization, generally for all transformers excepting distribution transformers, there is no other option to energize under load.

From Phil Hopkinson: regarding early failures from impulse and the AEP response: BIL was increased 14%, Special impulse tests were added, and steep front test were added. After these requirement changes, the frequency of failure was significantly reduced. Phil believes that transformers with high resonance should be considered for the Special Impulse test. Adding shielding which diminishes the capacitance to ground and increases the series capacitance should help, therefore, design change may be a good form of protection. The chair noted that these additional requirements most likely resulted in the manufacturers making design changes which resulted in better field performance.

11. The TF to study Mitigation Methods, Factory Testing, and Field Service Conditions was opened to the Attendees and had the following volunteers:

Phil Hopkinson – TF Chair  
 Pierre Riffon – TF Vice-Chair  
 Akash Joshi – TF Secretary  
 Mike Spurlock  
 Hamid Sharifnic  
 Shekhar Vora  
 Jim McBride  
 Waldemar Ziomek  
 Pugal Selvaraj  
 Dave Caverly  
 John Hall  
 Amitabh Sarkar  
 Changir Sen  
 Monty Goulkhah  
 Rogerio Verdolin

12. Discussion of initial changes to C57.142 Table of Contents includes Integration of Neutral Grounding Information, Integration of Reactor Switching Information, and Mitigation Methods

13. Status of TF Paper Submission: IEEE Transactions Paper must be resubmitted to IEEE with additional author biographies to be added for significant contributors (authors). Biographies must be submitted by the following members:

Larry Coffeen  
 Robert Degeneff  
 Xose Lopez-Fernandez  
 Philip Hopkinson  
 Bertrand Poulin  
 Pierre Riffon  
 Angelica Rocha  
 Michael Spurlock  
 Loren Wagenaar

14. Future Business: It was noted the next Meeting should feature a discussion among members with access to EMTP or other simulation/modeling software.

15. Adjournment at 4:35 PM

**J.8.13**

**WG PC57.164 (PCS)  
Short Circuit Withstand for Transformers**

**Meeting Minutes – October 31, 2017** F17 meeting at Louisville, Kentucky USA Sanjay Patel, Chair;  
Raj Ahuja, Vice-Chair; Joe Watson, Secretary

The WG met from 4:45 PM to 6:00 PM at Marriott (7-9) Conference Room

The minutes of the S17 New Orleans meeting were approved. The Agenda for the meeting was also approved.

There were a total of 62 in attendance - 18 members and 44 guests, out of which 11 guests requested membership. There were 18 of 32 members in attendance, so we had a quorum.

The attendance roster was circulated. The Chair opened the session, and asked Joe Watson to continue with the agenda. Following is the summary -

1. Kees Spoorenberg of Royal Smit, presented a brief technical presentation on Short circuit – describing the type of winding construction, specific points of concern/weak spots during manufacturing, different modes of failures, type of stresses and withstand. A few attendees asked if the presentation will be available to WG participants. Chair agreed to upload the presentation on the IEEE website, and password & log in name was provided to the attendees.
2. Joe Watson continued with the agenda and presented the current draft, and section 4 in detail, Fault current calculation method. Following comments were received at the meeting –
  - Javier and Steve Schrader suggested that for the pre-fault voltage assumed for fault current calculations, reference shall be made to IEEE C57.12.00, and example may be provided at 105% pre-fault voltage, which was agreed.
  - Enrique commented that one of the IEEE book also has the calculation method for the network model for fault current, and an effort to be made to ensure that there is no duplication, this was agreed.
  - Ramsis Girgis commented that in this guide we should focus on the method of calculation of fault current and short circuit stresses. The withstand criteria should be left to manufacturer, since each plant & manufacturer have different manufacturing practice and process which is also one of the criteria for deciding the withstand. This was agreed.
3. Raj Ahuja and the Chair presented the brief overview of the short circuit calculation method and philosophy, which was well received by the group.
4. All the members were requested to review the current draft and provide their input within 2 months (by 12/31). Based on the input received from the group, a follow up conference call to discuss these comments will be scheduled in Jan./Feb. 2018.
5. Request for volunteers was made, Javier agreed to help on the section for calculations of stresses of Core Form transformers, other volunteers will confirm participation by email.
6. The meeting adjourned at 6:02 pm

**J.8.14**

**IEEE C57.32 Amendment**

**Louisville, KY**  
**Tuesday, November 31, 2017**  
**1:45 PM – 3:00 PM**  
**Marriott 10 room**

**Chair – Sergio Panetta**  
**Vice Chair – Yann Ellassad**

1. Welcome and Chair’s Remarks. Objective: to determine the text of the amendment to the recently approved IEEE C57.32-2015
2. Attendance: 7 total. Sheldon Kennedy, Ed teNyenhuis, Sergio Panetta, Yann Ellassad, Tom Yingling, Sinan Balban, and 1 concerned individual, Frederico Turner.
3. Call to order motion by Yann, seconded by Tom.
4. Approval of Minutes motion by Yann, seconded by Tom. No Changes.
5. Motion to move paragraph 2. Normative references line 21 “CSA Std C22.2 No. 295-15 Neutral Grounding Devices” to Bibliography by Sinan, seconded by Sheldon. Motion passed.
6. Motion to add definition of Impedance Grounding to paragraph 3. Definitions by Sinan. Discussion was that IEEE C57.32-2015 Paragraph 3. “Definitions” is not within the scope of this amendment. Motion withdrawn.
7. Motion to change paragraph 4.1.3 Ten-minute rating line 19 from “routine test” to “type test” by Yann, seconded by Frederico (Approved by chair). Motion passed.
8. Discussion of proposed options A through E in paragraph 4.4 continued to the end of the meeting time. It was offered that interested parties could continue the discussion after the close of this meeting. It is desired by the members that the progress of this amendment could be continue and be resolved before the next spring 2018 meeting. A post meeting discussion was held with attendees Yann, Sinan, Tom and Frederico.
9. Motion to adjourn by Yann, seconded by Tom. Motion passed. Meeting was adjourned at 3:05 PM.
10. Next meeting Pittsburgh, PA March 25-29, 2018.

Respectfully Submitted,  
Tom Yingling  
11/3/2017  
Revised 11/7/17

J.8.15 **Working Group C57.123 Loss Measurement Guide**  
**Louisville KY – Oct 31, 2017**

Ed teNyenhuis, Oct 31, 2017, Rev 0

- The Working Group met at 9.30 AM in the Marriott Room 10 on Oct 31, 2017
- The Chair, Ed teNyenhuis, led the meeting.



- The following 7 persons were present and all accepted as members:
  - Sam Mehta
  - Anthony Franchitti
  - Tauhid Ansari
  - Andy Steineman
  - Ramsis Girgis
  - Ajith Varghese
  - Ed teNyenhuis
- This was the first meeting since receiving the PAR for revision of the guide
- This guide was first published in 2002, revised in 2010 and there is now a PAR for revision that expires in 2021.
- There are several items in the guide that can only be reviewed by test engineers or loss measurement equipment suppliers. The Chair will ask for input from this group (Mark Perkins, Eddy So, Measurement International, Reto Fausch)
- There is a new IEC guide on Loss Measurement that should be added as a reference in the revised guide,
- The present guide was reviewed during the meeting with the below comments / actions:
  - Sections 3.1 to 3.5.2 will be reviewed by Ramsis Girgis
  - Section 3.5.3 should be reviewed by Bertrand Poulin – may not apply anymore
  - Section 3.7.2 could be moved to the annex
  - Section 4.1 to 4.3 are OK as is
  - Should ask the industry if phase angle correction is used anymore (this part could then go to the annex). This will be done in a survey to PCS members.
  - Section 4.4.3.2.1 can be removed
  - Section 4.5.4 – Should ask the industry if anyone still uses this bridge method. This will be done in a survey to PCS members. Also ask Eddy So on this
  - Section 5 – Ask Eddy So to review and update
  - Section 6 – Ramsis Girgis will update this
  - Section 7 – Sam Mehta will update this
  - Section 8 – Tauhid Ansari and Andy Steineman will review this
  - Bibliography – Ask Eddy So and Bertrand Poulin to review this

Meeting was adjourned at 10.17 AM