

## **Annex C Distribution Subcommittee – Chair: Stephen Shull**

**October 26, 2016**

**Vancouver, BC, Canada**

**Chair: Stephen Shull**

**Vice-Chair: Jerry Murphy**

### **C.1 General Opening**

Steve opened the meeting welcoming everyone to the meeting. Jerry circulated the rosters. To establish a quorum, a list of members were displayed and a count of was made. We did have a quorum with 36 of the 63 members in attendance by count of those identified on a slide presented in the meeting. Recorded attendance gave 136 in attendance, 42 members and \_ requesting membership.

The agenda was reviewed and motion made by Dan Sauer, seconded by Martin Rave and approved by unanimous acclamation of the members in attendance.

The Spring 2016 meeting minutes were reviewed and motion made by Ron Stahara, seconded by Josh Verdell and approved by unanimous acclamation of the members in attendance.

### **C.2 Working Group and Task Force Reports**

#### **C.2.1 C57.15/IEC 60076-21 – Step-Voltage Regulators – Craig Colopy**

Craig presented the following minutes from the working group meeting on October 24, 2016 at 4:45 p.m. with 41 people in attendance.

Craig Colopy opened the meeting and introductions were made by the attendees. Rosters were distributed. The Essential Patent call was made by Craig Colopy with none received from attendees. Check for Quorum was made - 22 Members of 36 member were in attendance - Quorum achieved. Approval of agenda - Dan Sauer made Motion, Martin Rave seconded, no opposition to approval. Approval of minutes from Spring meeting in Atlanta - Motion for approval by Said Hachichi and second by Dan Sauer, no opposition to approval

IEEE ballot status and results Draft 2.0 ended Oct 23, 2016.

- 122 in ballot pool

- 99 returned ballots

- 81% return rate

- 94% affirmative rate

- 5 negative votes

- 101 comments

Chair discussed the IEC-TC Meeting that was held in Frankfort Germany Oct 11-12, 2016.

Craig reviewed the current status with the IEC WG for MT 60076-21 IEC 2CD (Draft 2.0).

- 1CD (IEEE D1.5) sent January 16

  - 6 Countries responded with comments

- IEEE Ballot issued on D2.0 (September 2016)

  - Expired Oct 23, 2016

2CD (IEEE D2.0) sent out September 16; expires end Nov 16

Original CDV - scheduled for Aug 16; reschedule planned for Dec 16; expires March 2017

IEEE Recirculation Ballot planned for March 2017

Craig reviewed key comments of ballot process from Friday meeting, Oct 21 discussions. See attachment 1.

Craig then reviewed some of the comments received that had not previously been discussed.

All 101 comments are noted on the Ballot Comment Resolution spreadsheet. Spreadsheet and next draft for CDV and recirculation will be posted to Distribution website. The next meetings will be held the spring 2017 in New Orleans, Louisiana

Motion made to adjourn by Lee Mathews, seconded by Scott Wilson, Motion carried.

Recorded and submitted by: Craig A Colopy/Gael R Kennedy

### **C.2.2 C57.12.20 – Overhead Distribution Transformers – Al Traut**

Al presented the following minutes from the working group meeting on October 24, 2016 at 11:00 a.m. with 59 in attendance.

The meeting was called to order at 11:05am on 10/24/2016 immediately followed by introductions and circulation of rosters. Electronic recording of attendance was not available at this meeting.

Chair made a call for Essential Patent Claims and none were brought forward

Based on the WG members listed on the roster and projected at the meeting a quorum was declared after a showing of hands (26 of 37 members present).

A motion was made (Stahara) and seconded (Pezin) for approval of the agenda. Unanimously approved

A motion was made (Stahara) and seconded (Hachichi) for approval of the S16 (Atlanta, GA) minutes. S16 Minutes were unanimously approved

Chair reported the results of the Sponsor Ballot. Closed 4/8/2016, 88% return, 100% Affirmative, 81 Comments.

Chair reported that our PAR expires 12-2016 and a 1 year PAR extension request was submitted 9/24/2016 and is on the Dec NESCOM agenda.

The remainder of the meeting was devoted to resolution of comments received from Draft 4 ballot.

#### 4.3 Minimum Impedance voltage

“For each transformer design, the manufacturer shall determine the nominal impedance. The impedance of individual transformers shall be within the tolerance on impedance as specified in IEEE Std C57.12.00. The minimum nominal impedance shall be per Table 12 which applies to all distribution transformers with low voltage ratings 600 V and below. Two winding distribution transformers with low voltage ratings above 600 V should be designed to withstand short circuits limited only by the impedance of the transformer. There is no requirement for ratings not shown in Table 12.” A motion was made by Marty Rave and Ron Stahara to the user may specify. Motion was unanimously approved.

Clause 5.1 Basic Lightning Impulse & 5.2 Dielectric Test. A suggestion was made on clause 5 that is more rating related to test levels and Clause 6 is related to the actual tests. AI Suggested that we change title of 5.1 to Basic Impulse Insulation Levels and 5.2 to Dielectric Test Levels. This distinguishes clause 5 which outline insulation level requirements from clause 6 which addresses tests. A motion was made by Ron Stahara and seconded by Steve Shull. The motion was approved unanimously

Clause 7.3 Polarity Terminal Markings. The title of the clause does not include all the content. AI suggested "The title and arrangement of this clause has been in use for many revisions of this standard. Expanding the title of 7.3 would result in a lengthy, confusing title". AI suggested that we consider reviewing in detail for the next standard revision. No vote was taken but everyone agreed.

Clause 8.2. The angle of tilt was discussed. AI Suggested that we reject the comment and stated "The existing clause sufficiently instructs users when an angle of tilt requirement may be needed. Users may further describe the angle of tilt from vertical or horizontal". No vote was taken but everyone was OK with AI's suggested comment

Clause 9.1. There were three parts of this comment the first part, AI stated that "The comment does not offer a clear proposal for the revision". The recommendation was to reject the with AI's justification. The second part of Clause 9.1 AI stated that "The present wording is sufficient and conveys that each transformer enclosure is limited to no more than two tests". The recommendation was to reject the with AI's justification. The third part of Clause 9.1, AI stated that "The proposal is not sufficiently different than the existing wording". The recommendation was to reject the with AI's justification. Again, AI was suggesting that we reject the comment for consideration for a future revision. There was no strong feeling or objection brought forward by the WG. No vote was taken but there was no objection to moving forward with AI's comment.

Clause 7.1.1 The comment was reviewed by AL with the WG . . . AI Suggested that we replace Low Voltage with ALL bushings shall be sidewall type . . . Also the shaded area "zone" of acceptability was not consistent with the 1 bushing and 2 bushing. Carlos Gaytan brought up a question ...Base on discussion AI suggested we accept the comment as written... No vote was taken at the time but the WG agreed

Clause 7.2.1 ...Tap Change ...The comment was this was awkwardly worded...It was suggested that we change it to "A written caution statement to de-energize the transformer before operating, shall be located on or adjacent to the operating mechanism." AI's suggestion was that we accept the comment. No vote was taken at the time but the WG agreed

Clause 7.2.2 ...The exact same thing... The comment was this was awkwardly worded. . . It was suggested that we change it to "A written caution statement to de-energize the transformer before operating, shall be located on or adjacent to the operating mechanism." AI's suggestion was that we accept the comment. No vote was taken at the time but the WG agreed

Clause 7.2.6.1 Excluding the cover gaskets and insulating fluids leaks of the component gaskets activation. There was considerable discussion on pressure and pressure relief device. Carlos Gaytan discussed what was being discussed in his working group. The comment was to re-word the following sentence (excluding the cover gasket and insulating liquid leaks of component gaskets). It was suggested that we change it to (excluding the cover gasket and insulating liquid leaks of component gaskets). AI asked if there were any objections with going with the statement and accepting the comment. No vote was taken at the time but the WG agreed

Clause 7.3.4. It was stated that “The location of the instruction nameplate is already given in detail per Clause 7.3.4.1.” It was suggested that the sentence be removed . . . Al stated that he agreed with the comment . . . No vote was taken at the time but the WG agreed. . .

Clause 7.3.4.1 ...The comment suggested we change “Instruction nameplates shall contain the information specified in IEEE Std C57.12.00 (see item 11 in Figure 7 through Figure 14) except that the BIL rating shall be shown for all single-phase ratings above 16 340 V. The instruction nameplate shall be in accordance with nameplate A as described in IEEE Std C57.12.00.” Al reviewed with the WG his cleaned up sentence rather than have two separate sentences, Al suggested, “The instruction nameplate type and information provided shall be in accordance with Nameplate A as described in IEEE Std C57.12.00 except that the BIL rating shall be shown for all single-phase ratings above 16 340 V”. No vote was taken at the time but the WG agreed. Al suggest that we go with this now and consider changes to future revisions.

It was agreed that we would pick up where we left off for the next meeting and vote on the recommendations all at one time.

The next meeting will be April 2017 in New Orleans.

The meeting was adjourned at 12:21pm, Ed Smith recording.

### **C.2.3 C57.12.28, .29, .30, .31 & C57.12.32 – Enclosure Integrity – Dan Mulkey**

Dan Mulkey presented the following minutes from the working group meeting on October 25, 2016 at 8:00 a.m. in with 57 in attendance.

1. Dan Mulkey called the meeting to order at 8:02 AM.
2. Introductions were performed
3. Quorum was verified. The working group consisted of 42 members, requiring 22 for Quorum. 25 members were confirmed at the time of counting. 35 members were confirmed afterwards through the roster.
4. A call for was made for essential patent statement and responses. None were raised.
5. A motion was made by Ron Stahara and seconded by Justin Pezzin to approve the minutes from the previous meeting in Atlanta. The motion passed unanimously.
6. A motion was made by Ron Stahara and seconded by Alan Wilks to approve the agenda for the meeting. The motion passed unanimously.
7. Status of Standards:
  - a. C57.12.28 Standard for Pad-Mounted Equipment – Enclosure Integrity, Published July15, 2014, Revision Due: 12/31/2024
  - b. C57.12.29 Standard for Pad-Mounted Equipment – Enclosure Integrity for Coastal Environments, Published August 8, 2014, Revision Due date 12/31/2024
  - c. C57.12.31 Standard for Pole Mounted Equipment – Enclosure Integrity, Published September 20, 2010, Revision Due: 6/17/2020, Corrigenda approved May16, 2014
  - d. C57.12.32 Standard for Submersible Equipment – Enclosure Integrity, Reaffirmed 3/7/2008, Revision Due: 12/31/2018, PAR expiration: 12/31/2019
8. Revision of C47.12.32 – Continuation of reports from Atlanta Meeting:
  - a. Darren Brown – comparison of FS-40 bulb versus UVB-313EL

Summary of discussion & conclusions:

Darren presented a Howard Industries test report comparing FS-40 bulbs with UVB-313EL bulbs. The test was performed using a UV accelerated weathering chamber and brand new bulbs.

The findings were that grey panels were more impacted with the UVB bulb than green panels. The green and grey panels acted differently between the two bulbs indicating that there is a difference between the two bulbs using this basic test. All test panels passed the test.

Dan Mulkey commented that we need a quick test which will pass good units and fail bad ones and is also reflective of real-world environments.

It was noted that a letter was received from one supplier of the FS-40 bulbs indicating that they were not being discontinued as indicated by a ballot comment.

It was also noted that if a change in lamps is made, new baselines will need to be established.

The question was asked if any testing had happened using samples with black paint. Darren mentioned it likely has been in the past but we don't have the results documented.

b. Tom Holifield – citation of paper on 409 stainless steel

Summary of discussion & conclusions:

Tom presented a historical paper which investigated suitable tank materials. The investigators looked at 3 types of stainless steel: SS304, SS316 and SS409. The paper concluded that SS409 was the best material to use. It discussed that SS316 performed better with respect to pitting corrosion from sea water, but was more susceptible to stress corrosion.

9. New Business

a. Maria Lamorey – PPG comparative QUV testing on FS40 bulbs

Summary of discussion & conclusions:

Scott Abbott of PPG presented a comparison study between the QUV-A and QUV-B lamps.

The study indicated that in tests using QUV-B testing, powder systems did not perform as well as liquid systems, but this does not necessarily correlate to real world test data based on tests performed in Florida. He explained that the QUV-A bulb mimics sunlight better than the QUV bulb.

The study made the following conclusions:

- QUV-B testing is too variable and depends very much on irradiance (power output) level of the bulbs
- Current QUV test is not irradiance controlled
- QUV-B testing may eliminate a system which is cost effective and suitable for IEEE end use
- QUV-A mimics real world (Florida) better than QUV-B and is more reliable if specification (gloss retention and test time) is set correctly
- QUV-A can still “weed out” poor performing systems in a short time period
- QUV-A bulbs would still use the current QUV cabinets used today

- Recommend the use of “irradiance control” on new QUV hardware moving forward
- Irradiance control cabinets are easier to run and can provide significant savings on bulb costs
- Payback from cost saving can often be within one year

Scott recommended the following settings for tests:

- 0.9 irradiance,
- 1000 – 1500 hours minimum,
- 80-90% glossary retention

After this presentation, a prolonged discussion took place:

The point was raised that the time required for QUV-A testing may be longer than current testing duration, which is a concern for manufacturers. Alan Wilks mentioned that QUV testing is not labor intensive since it can be left alone after the test is setup, so it can be used for “screening tests” of materials prior to running other types of tests.

Brian Klaponksi mentioned that the ozone layer changes over time and asked how that would influence the “Florida test” in the report. Scott replied that there is a lot of Florida data over the years and we may need to investigate if there has been a change in performance over the years.

The question was asked if the presented test data was sufficient to develop the standard, or if further testing was required. Ron Stahara suggested that if we feel that further testing would be of value, we ought to pursue it, even if we don’t use it for this version of the document.

Further testing using black paints may also be helpful, since this color is also used for underground transformers. Brian Klaponksi proposed that there is not currently an issue with black paint, so it is not worth spending further time testing it. It was asked if PPG could repeat the test using black. They indicated it would be best if samples were provided by manufacturers. Alan Traut mentioned that Power Partners could provide all three colors.

It was suggested that manufacturers should send samples to the lab for further testing, instead of paint manufacturers providing test samples to ensure the testing was done on the actual substrates.

It was also mentioned that a defined irradiance needs to be set for further testing moving forward.

There was a discussion about whether the impact of the coating effects performance or aesthetics. It was suggested that durability, not aesthetics, must be the purpose of this standard.

It was suggested that underground transformers may not need as long of a coating lifetime because they are installed below surface. However, they may wait in the yard for a long time prior to installation. In some cases they are also installed above ground.

There was further discussion about the impact of percent gloss. Brian Klaponksi asked if a higher percent gloss yielded higher durability. Scott Abbott responded that generally, a higher initial gloss tends to give higher durability or better gloss retention than a similar product at lower gloss. Tom Holifield mentioned that they have coatings with low gloss that are better than coatings that do have gloss. Scott clarified that

different families will behave differently, so one type of coating with a high percent gloss may not perform as well as a different type of coating with a lower percent gloss. If comparing similar types of coatings, generally a higher percent gloss results in higher durability.

It was noted that percent gloss impacts aesthetics, durability and thermal characteristics. It was asked if emissivity is a function of percent gloss. Al Traut mentioned that radiation heat transfer doesn't play a large impact in a vault. It was also noted that both percent gloss and irradiance should be specified in the standard.

On a pad-mount transformer, a higher gloss shows irregularities more, so lower gloss may be preferred by some manufacturers. Some manufacturers prefer high gloss.

It was noted that in C57.12.40, the specification simply states a "dark color", and suggested that this be more thoroughly defined in C57.12.32.

There was a discussion about how change in percent gloss should be described. Dan Mulkey suggested that since gloss is measured in percentage, the change in percent gloss should be a subtractive difference, not a divisive difference. For example, a change of 0.02 to 0.01% is a 0.01% change, not a 50% change.

Carlos Gaytan clarified the difference between percentage points and percentage:

- Percentage point loss: the subtracted difference between initial and final percentage
- Percentage loss: the divided percent between initial and final percentage

In the paint industry, percent change in gloss is usually based on percent gloss retention of the initial gloss (divisive, not subtractive). For example, the gloss must remain above 90% of the initial gloss.

Brian Klaponski stated that if a higher gloss provides better durability, we should specify a higher gloss.

It was noted that the response to the ballot comment stating "Working to see if we have an equivalent – potentially QUVA-303 with lower irradiance level" should state QUVA-340 instead of QUVA-303.

A motion was made by Mike Thibault and seconded by Alan Wilks to change the language in paragraph 4.5.6 from "Expose two test panels" to "Expose three test panels". The motion passed unanimously.

A motion was made by Ron Stahara and seconded by Mike Thibault to change from two to three test panels for all long-term tests. The motion passed unanimously.

A task force was formed to develop proposed final wording for paragraph 4.5.6 Ultraviolet accelerated weathering test (QUV). The following attendees joined the task force:

- Scott Abbot, PPG Industries
- Darren Brown, Howard Industries
- Martin Rave, ComEd
- Maria Lamorey, PPG Industries
- Rebecca Giang, Sherwin-Williams Co.
- Mike Thibault, PG&E

The following members agreed to provide coating samples for further testing.

- Alan Traut, Power Partners
- Dwight Parkinson, EATON Corporation
- Darren Brown, Howard Industries
- Josh Verdell, ERMCO

10. Next meeting—April 4, 2017 in New Orleans, Louisiana, USA

Copies of any handouts and/or subgroup reports will be made available as separate items but referenced by these minutes.

The following attendees were added to membership:

- Maria Lamorey, PPG Industries
- Scott Abbott, PPG Industries

The meeting adjourned at 9:15am, Jeremy Van Horn recording.

### **C57.12.34 – Three Phase Pad-Mount Transformers – Ron Stahara**

Ron Stahara presented the following minutes from the working group meeting on October 24, 2016 at 3:15 p.m. with 71 in attendance.

Ron Stahara called the meeting to order and introductions were made. The rosters were circulated. The names of those in attendance are recorded in the AM system. To establish a quorum, a members list was displayed on the screen and those who saw their names were asked to hold up their hand. From this count of hands, it was determined that a quorum was established. A motion was made by Gael Kennedy and seconded by Jerry Murphy to accept the agenda as shown. The motion passed unanimously. The Patent Slide statement calling for Essential Patent Claims was read and none were brought up at this point. A motion was made by Gael Kennedy to accept the minutes of the Spring 2016 meeting as written. This was seconded by Cory Morgan. The motion passed unanimously.

Ron Stahara stated that the PAR had been approved.

Ron went on to state that we had two items that we need to pursue on the new standard. The first is to review the exiting standard for any updates from other standards that have recently been published. These would include IEEE C57.12.00, IEEE 386, and others that are pending such IEEE C57.12.39. Ron suggested to the Working Group that a taskforce be created to do this. The Working Group agreed and Dan Mulkey was appointed as chair and the following individuals were added as members; Steve Snyder, Carlos Gaytan, Brett Chrysler, and Justin Pezzin. This Task Force would work on this during the next few months and report their progress at the spring 2017 meeting. The second item would be to review the figures for clarity and correctness. Again a Task Force was suggested to do this work. The Working Group agreed and Gary King was appointed chair and the following individuals were added as members; Dwight Parkinson, Scott Dahlke, and Alex Macias. This Task Force would work on this during the next few months and report their progress at the spring 2017 meeting.

The Working Group had discussed how to present various items that users purchase on these units. These could be classified as accessory items that are provided on or in the transformer and should not be considered a part of the standard. This document would be provided as informational for an unsophisticated user. This suggestion resulted in a rather lively discussion. Some of the comments were concerns about liability or attempting to provide a transformers 101 document. Other comments were that this was a good idea to help these unsophisticated users to understand the need for items like sight glasses, gauges, under-oil fuses, and their

applications, etc. This resulted in a motion by Brian Klaponski and seconded by Alex Macias to make an “Attempt to make an informative annex for application of accessories as they relate to this standard”. This motion passed unanimously. Steve Shull volunteered to gather these items into some type of outline to be presented at the next meeting. After this, Brian Klaponski, stated that he was not sure but with this addition we may have an Essential Patent Claim. He believed that the “third door” was a patent that was held by ComEd created by Martin Rave and Tom Callsen in 2004. Tom Callsen confirmed that this was true. Steve said he would send the LOA informational letter and form to Martin Rave since he was remaining person of the two working for ComEd.

The last comment of the day was made from Aniruddha Narawane concerning a couple of items that seem to be in error in the current document and should be reviewed for correctness in the next version. He stated that he would send this detail to Steve Shull so that he could include it correctly in the minutes. It is as follows:

Table 4—Electrical characteristics and minimum electrical clearances of high-voltage bushings and low-voltage terminals

Transformer voltage	BIL <sup>a</sup> (kV)	60-Hz dry-one-minute withstand <sup>b</sup> (kV)	Minimum clearance—live parts <sup>c</sup>		
			Phase to ground <sup>d</sup>	Phase to phase <sup>e</sup>	Phase to non-hygroscopic insulating barrier
208Y/120, 240	30	10	25 (1.0) <sup>f</sup>	25 (1.0)	
480Y/277, 480	30	10	25 (1.0)	25 (1.0)	
600Y/347, 600	30	10	25 (1.0)	25 (1.0)	
2400	45	15	51 (2.0)	51 (2.0)	
4160 to 4800	60	21	64 (2.5)	64 (2.5)	
7200	75	27	89 (3.5)	102 (4.0)	76 (3.0)
12 000 to 13 800	95	35	127 (5.0)	140 (5.5)	76 (3.0)
22 800 Grd Y to 24 940 Grd Y	125	42	146 (5.75)	159 (6.25)	76 (3.0)
34 500 Grd Y <sup>g</sup>	150	70	203 (8.0)	229 (9.0)	102 (4.0)

NOTE—These dimensions should be increased wherever possible to allow for ease in making connections by the user.<sup>2</sup>

<sup>a</sup>All dimensions are in millimeters (inches).<sup>3</sup>

<sup>b</sup>The use of barriers shall not reduce these electrical characteristics.

<sup>c</sup>Where clearances are less than those shown, an adequate non-hygroscopic insulating barrier shall be provided.

Table 5—Electrical characteristics and ratings of high-voltage connectors

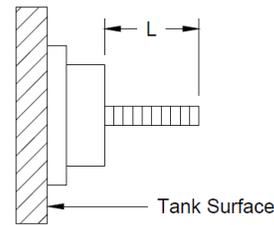
Transformer High-voltage ratings (V)	BIL (kV)	Electrical characteristics of completely assembled high-voltage connectors <sup>a</sup>			
		High-voltage ratings		BIL (kV)	60-Hz Dry-one-minute withstand (kV)
		Phase to ground (kV)	Phase to ground/Phase to phase (kV)		
2400	45	8.3	8.3/14.4	95	34
4160 to 4800	60	8.3	8.3/14.4	95	34
7200	75	8.3	8.3/14.4	95	34
12 000 to 13 800 <sup>b</sup>	95	8.3 or 15.2	8.3/14.4 or 15.2/26.3	95 or 125	34 or 40
22 800 Grd Y to 24 940 Grd Y	125	15.2	15.2/26.3	125	40
34 500 Grd Y <sup>c</sup>	150	21.1	21.1/36.6	150	50

<sup>a</sup>The required connector rating should be specified.

<sup>b</sup>When specifying 125 kV BIL, adequate grounding and surge protection studies should be made.

<sup>c</sup>IEEE Std 386 should be consulted for complete connector ratings.

IEEE Standard Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers, 10 MVA and Smaller, High-Voltage, 34.5 kV Nominal System Voltage and Below, Low-Voltage, 15 kV Nominal System Voltage and Below



kVA ratings	Low-voltage ratings (V)	Thread size <sup>a</sup>	L <sup>b</sup> minimum
45–150	240, 208Y/120	5/8–11 UNC-2A	32 (1.250)
45–300	480, 480Y/277, 600, 600Y/375	5/8–11 UNC-2A	32 (1.250)
225–300	240, 208Y/120	1–14 UNS-2A	44 (1.750)
500	480, 480Y/277, 600, 600Y/375	1–14 UNS-2A	44 (1.750)
500	240, 208Y/120	1–12 UNF-2A	67 (2.625)

NOTE 1—All dimensions are in millimeters (inches) and are minimums.

NOTE 2—Kilovolt-ampere ratings which are separated by a dash indicate that all ratings covered in this range as shown in 4.1 are included.

<sup>a</sup>If materials other than copper are used, larger thread size or length, or both, may be required.

Figure 20—600 V and below terminals

The yellow highlighted items enumerate the concerns.

With this, the meeting was adjourned, Stephen Shull recording.

### C.2.4 C57.12.36 – Distribution Substation Transformers – Jerry Murphy

Jerry reported the working group met Tuesday, October 25, 2016 at 1:45pm with 48 people in attendance.

Jerry Murphy called the meeting to order at 1:50 PM. Introductions were made. The names of the members were projected on the screen. By a show of hands the quorum was reached by having 12 out of the 21 members present. The approval of the agenda was moved by Terry Martin, seconded by Steve Schroeder. The motion was approved. Steve Shull made a motion to approve the minutes of the Spring 2016 meeting in Atlanta; Gael Kennedy seconded, and the motion was approved.

After Jerry asking the question, there were no patent claims brought up to the working group.

Jerry reviewed the comments from the latest ballot recirculation. The first was a general comment from Peter Balma, indicating that a number of changes approved by the WG were not reflected in the latest draft. Jerry proposed to accept this comment, and receive from Peter a list with the approved changes, in order to add them to the document. Three comments related to corrections to figures and metric conversions were accepted. Next a comment about figures in Annex A showing dimensions in inches was discussed. Gary Hoffman stated that since this was an informative annex, the use of dimensions in U.S. Customary units was allowed. The disposition of the comment was to accept it and include a note indicating that the dimensions were in inches.

Next the comment about the reference to PC57.12.39 was reviewed. It was agreed to keep the reference to Draft 4 of this project standard, since it had been balloted. The last comments related with editorial corrections were reviewed and accepted.

Gary Hoffman made a motion, seconded by Steve Shull, to permit the chair to incorporate the changes that should have been included in the document, and initiate a ballot recirculation process. The motion was approved unanimously.

The next WG meeting will be in April 2-6 in New Orleans, LA.

The meeting adjourned at 2:50 pm., Carlos Gaytan recording.

### **C.2.5 C57.12.38 – Single-Phase Pad-Mounted Transformers – Ali Ghafourian**

Mike Faulkenberry presented the following minutes from the working group meeting on October 25, 2016 at 1:45 p.m. with 59 in attendance.

The meeting was called to order at 1:45 p.m. by Ali Ghafourian.

A quorum was established with 22 of 27 working group members present.

The agenda for the meeting was presented and unanimously approved.

The minutes of the spring 2016 meeting in Atlanta have been posted on the web site since shortly after that meeting for the working group members to review. There were no suggested changes to the minutes and a motion was made by Justin Pezzin and seconded by Marty Rave that the meeting minutes be approved. The approval of the minutes was unanimous.

A call for essential patents was made as required using the statement provided in the general session. No essential patents were brought forward.

The status of the document was discussed. The ballot on Corrigenda 1 correcting an error in Figure 1 of the published standard has closed. 89% of the ballots were returned. 100% approved. The document is currently at RevCom. A PAR cannot be submitted until the corrigenda is published, and Ali announced his intentions are to file for a PAR when he is permitted to do so.

A discussion was begun of proposed changes to be considered for inclusion in the next revision of the document.

- Ali proposed that two new tables be added to the document. One for dual voltage ratings would be added as Table 4 and a potential table was presented for review. A question was raised as to why 34.5 kV dual voltage units were not included. Ali answered that the attempt was to match a similar table in C57.12.20, and it does not include 34.5 kV as that is not a common application.

- Another table for minimum percent impedances was proposed and would be added as Table 5. There were no objections to adding the table, but the consensus was that the table needed to match the table in C57.12.20. The proposed table, as presented for review, did not match C57.12.20 but will be changed to do so.
- Mike Faulkenberry stated that he had received an email from a user asking why there was no table with voltage ratings for live front transformers while there was a table (Table 3) for dead front transformers. The first two columns of Table 3 are actually voltage ratings for both live front and dead front transformers. The remaining columns of the table are ratings for dead front bushings. The working group was asked if we needed to consider separating out the transformer ratings into one table and the dead front bushing ratings into a separate table, similar to Table 2 for live front bushings. After some discussion, the decision was to leave the table as currently published.
- A question was raised as to why the Phase-to-Ground clearances in Table 2 were smaller than the Phase-to-nonhygroscopic insulating barrier clearances. It was noted that this was actually only true for the first three lines of the table. After comparing this table to the similar table in C57.12.34, it was determined that the first three lines should not have contained values. They should have been grayed out as in C57.12.34 to indicate that values are not applicable for these system voltages. This will be corrected in the next revision.
- Ali asked the working group to consider if we wanted to include in the next revision any of the transformer components. The current scope states that components are not covered. These could be included as an informative annex to the standard. A task group was selected to formulate a list of components for possible consideration and provide the reason why they should be addressed. The members of that task group are Giuseppe Termini, Wes Suddarth, and Craig DeRouen.
- A question was raised as to the potential for inclusion of phase-to-phase voltage ratings. Ali responded that the use of those voltage ratings is not common and is why they are not included in the standard.

Mike Faulkenberry, Vice-Chair, announced that he will be retiring in April of 2017 and will most likely not be attending future meetings. Therefore, the working group will need a new Vice-Chair, preferably a utility member, to take his place. The working group members were asked to consider volunteering for the position.

The meeting adjourned at 1:45 pm.

Submitted by Mike Faulkenberry.

Steve appointed Martin Rave as the new vice chair for the working group.

The Distribution Subcommittee recognized and applauded Mike Faulkenberry for his many years of dedicated service and wished him all the best as he retires.

#### **C.2.6 C57.12.39 – Tank Pressure Coordination – Carlos Gaytan**

Carlos reported the working group met Tuesday afternoon at 4:45 p.m. with 44 in attendance.

The meeting was called to order at 4:45 PM. Quorum was reached by having 22 of 30 members present. The approval of the agenda was moved by Al Traut, seconded by Ron Stahara, and the motion was approved unanimously. The approval of the minutes from the Spring 2016 meeting was moved by Dan Mulkey, seconded by Jerry Murphy, and the motion was approved

unanimously. No patents were declared. On chair remarks, Carlos informed that a PAR extension was requested, and it was expected to be approved at the Dec. 7 IEEE-SA Standards Board meeting. The question about essential patent claims was posed. The results of the ballot of Draft 4 were presented. They were successful, with a 95% approval rate, and a total of 32 comments.

The group then reviewed the comments and proposed resolutions. First question was a disapproval vote from Gary Hoffman. The concern was related with the clarity of the purpose of the document related to distribution transformers. After some discussion related with the risks associated with modifying scope and purpose on approved PARs that may invalidate the ballot, Gary agreed with the proposed disposition. Dan Mulkey suggested that any editorial changes we thought were required, should be made before submitting a new draft for ballot.

Next the group discussed a negative vote related with Sect. 3 definitions, proposing to simplify the text. After some discussion, Dan Mulkey moved to remove the Nominal Pressure definition from the document. Steve Shull seconded. Robert Stinson offered a friendly amendment to add to move the text from the current text of the definition into sect. 4.2. The amendment was accepted, and the motion was approved unanimously. The ballot disposition changed to Revised.

Next the comment to modify the definition of Rapid Transient Pressure was reviewed. It was accepted as Revised. Comment about definition of Pressure-vacuum bleeder was discussed. It was agreed to modify the text as per the comment, and changing to “air / gas” in last sentence.

Next comment was related with section 4.3.1, applicability of fault current capability test to overhead and submersible transformers with round tank construction. A comment was made that trying to incorporate test criteria for rectangular tanks should be left for a future revision. Group believed that the current language was acceptable.

Next the comment related with the use of words distortion vs. deformation. There was agreement that deformation was a more accurate term to use. Dan Mulkey made a motion to change distortion to deformation, only if we were able to change the purpose of the PAR and the document without invalidated the ballot. Ron Stahara seconded. The motion was approved unanimously. Steve Shull later identified that the purpose could be changed.

Next comment discussed was on PRV location in section 4.2.2.3. It was concluded that reference to tank wall was not needed in the first part of the statement. The text was changed to Draft 5.

Near the end of the meeting, a suggestion was made to create a ballot resolution task force in light of the need to move forward quickly to complete before the end of the 1 year PAR extension. Carlos will form the task force in order to complete the review and resolution of the comments prior to the next meeting.

The next WG meeting will be in April 2-6, 2017, in New Orleans, LA

The meeting adjourned at 5:55 pm, Justin Pezzin recording.

Carlos concluded his report saying he would be requesting a one year PAR extension.

### **C.2.7 Task Force on Transformer Efficiency and Loss Evaluation – Phil Hopkinson**

The Phil Hopkinson welcomed the members to the meeting and noted that the high attendance (129) indicted the level of interest in the topic.

This was the first meeting of the task group so there were no minutes to approve. The agenda was approved as submitted. Since this was the first meeting a quorum verification was not needed.

Presentations for the meeting from Mr. Hopkinson and Mr. Mulkey have been uploaded to the IEEE Transformer Committee Website under Distribution Transformers Subcommittee.

### **Background**

The DOE Energy Efficiency rules will be due for renewal or revision by January 1, 2022. The current loading is estimated at 50% of nameplate rating load for medium voltage transformers and 39% for low voltage transformers. There is a need for real data to replace these estimates. The quality and availability of data have benefited from the expanding use of smart meters. Utilities may be capable of providing data on transformer loading broken down into load types, geographic locations and other useful categories.

### **PG&E Data**

Dan Mulkey provided the perspective from PG&E who have extensive loading data that has been made public on their website. He presented data for the 2006 which was noted for a heat storm that caused a great number of transformer failures. His report has been uploaded and made available to members.

Mr. Mulkey reported that the loading RMS was very close to the 50% used by DOE.

Transformer capability was based on limits of the following:

- a) Thermal
  - Hot Spot  $\leq 190^{\circ}\text{C}$
  - Top Oil  $\leq 110^{\circ}\text{C}$
- b) Life loss
  - Total Aging  $\leq 13140$  hours
    - 5% of expected life / 1.5 years of aging in one year
- c) Voltage regulation
  - Voltage drop  $< 6.5$  volts for transformer secondary
  - Flicker drop  $< 8.0$  volts for transformer, secondary and service

He noted that typically distribution transformers are run to failure or run until a problem is encountered. He explained that the cost of a transformer is outweighed by the installation costs so replacement is preferred to relocation. PG&E's experience showed that most transformers have an average life of 40 years with 2.5% of total installed being returned each year. Distribution transformers are pulled from stock so there cannot be any optimization when picking the transformer for the application. This is in contrast to power transformers which are purchased for a specific location even though these can be redirected to other locations as urgent needs arise.

The chair asked members representing utilities if they thought the disclosure of data similar to that from PG&E could raise conflict of interest concerns for them. Only one individual said that it might be a concern. After some discussion, it was decided that a template should be developed to provide a method in which this information could be provided. The work group chair will create a task force to develop this by the spring 2017 meeting, which will be held in New Orleans.

The meeting was adjourned, Gerard Winstanley recording.

**C.3 Old Business**

- None

**C.4 New Business**

- Impulse Test Concepts – Phil Hopkinson

Phil gave a presentation (posted to website) on how it is time our factory impulse tests were upgraded. Phil gave examples of how factory tests are not achieving as much winding stress as field conditions with the troubling fact of failed windings from the field returned to the factory and passed the standard impulse test. BIL tests for dry type transformers are reduced compared to liquid filled with no basis today.

Phil concluded that impulse testing should add stress with higher BIL levels, faster front waves, higher chopped waves, longer switching waves and specific open terminals in addition to shorted terminals of non-tested windings.

- Hemchandra Shertukde commented to the subcommittee that solar transformers needed to be addressed for tank pressure issues.
- Brian Klaponski asked for clarification around patent claims requests in working group meetings. Gary Hoffman clarified that if a claim is made then a letter of assurance (LOA) must be requested and this should be recorded in the minutes. There is no need for discussion in the meetings as it is a matter for PatCom. There is a listing of all filed LOAs on the PatCom web page.

**C.5 Chairman’s Closing Remarks and Announcements**

Steve had no closing comments to the SC except to see them in New Orleans in spring of 2017.

**C.6 Adjournment**

Steve adjourned the meeting as provided in the meeting agenda at 10:47am.