# Underground Transformers & Network Protectors Subcommittee

**November 4, 2015**

**Memphis, Tennessee**

**Chair: Dan Mulkey**

**Vice Chair: George Payerle**

## Meeting Administration

**Introductions** – The meeting was called to order at 11:00 AM in the Grand Ballroom of the Peabody Memphis Hotel in Memphis, Tennessee. Introductions were made and sign-in sheets were routed.

**Quorum** – The members were listed on the screen and by a show of hands, it was determined that there was a quorum with 14 of the 18 members in attendance.

**Approval of Minutes** – The minutes from the Spring 2015 meeting in the San Antonio, Texas were approved with the changes noted in the working group reports below. They were motioned for approval by Brian Klaponski and seconded by Al Traut. The subcommittee approved these without opposition.

**Members and Guests** --There were 14 members and 19 guests in attendance. Their names can be found in the AM system.

The chairman, Dan Mulkey, asked that as reports are read that each group state where they are relative to completing work on their PARs.

The chair mentioned that Greg Anderson has reminded everyone to include details of the next meeting in the minutes of the current meeting.

We have also been asked to submit a second document along with the meeting minutes that summarizes why changes to the spec were made. For example, he said he would like to see subsurface transformers painted white instead of black. The reason which is enhanced visibility would be the reason and would be in a companion document. The thinking is that it will cut down on the comments in the ballots. Brian Klaponski stated that he feels it is an unnecessary burden and is not in the procedures. The chair stated that it is probably headed there.

## Working Group and Task Force Reports

### C57.12.23 Working Group Report – Single-Phase Submersible Transformer

Alan Traut, Chairman, Adam Bromley, vice-chair.

Revision due date: **3/19/2019**

PAR Approval Date: **8/21/2014**

PAR Expiration Date: **12/31/2018**

Introductions – The meeting was called to order and everyone was asked to introduce themselves. Rosters were sent around.

Quorum – We had 35 attendees, 19 members (out of 37), 16 guests with 1 of those requesting membership (we will check attendance records), which gave us enough members to establish a quorum.

Chair Report – Al talked about when the PAR expires and how long we have to complete our work. PAR expires December 31, 2018. 10-year life cycle of the standard is December 31, 2019. Al mentioned that we should be fine to meet that deadline. We would like to send to ballot in the fall meeting of 2017.

Approval of Agenda – Motion: Justin Pezzin, Second: Jermaine Clonts, unanimous

Approval of Minutes – Motion: Bill Wimmer, Second: Christopher Sullivan, unanimous

Old Business

Review draft changes from last meeting. Section 5.6 – We pulled in the table from 12.20 on minimum impedances.

Dimensions discussion – Jermaine stated that with regards to increases in efficiency per DOE that the maximum overall dimension should be 40”. Giuseppe stated that his company will still have to specify 36” due to existing space constraints of their manholes. Brian asked if there was a standard on manhole widths; general consensus is that all users have different sized manholes that they use. Giuseppe asked about dimension differences due to changes in BIL or voltage levels.

Motion made by Jermaine to change the overall dimension for 250 kVA from 36” to 40”. Seconded by Dan Mulkey. Giuseppe would like to see a breakdown in voltage class. Jermaine stated that his analysis was a worst case (i.e. 35 kV) scenario that led to the 40” overall diameter. Vote results: 5 yes, 6 no; does not pass.

Suggestion was made by Paul Chisholm and Brian Klaponski to perform a survey of the users of this size transformer and find out what limitations that they have for diameter and height for the different voltage classes. Do we need to have diameter and height dimensions in the spec? Al is going to take on the task of getting the survey to our user and manufacturer base for input. Make sure that the survey includes the question about what clearance between the overall diameter and manhole opening is needed by users.

We need to verify with Lee Mathews regarding the cable standard references and if they are up to date (ICEA).

Secondary terminal table updated with 250 kVA. Suggestion made by Giuseppe to update table with voltage class information. Task Force to help with this: Jermaine Clonts, Bill Wimmer, Giuseppe Termini.

Horizontal Transformers – Dan Mulkey discussed PG&E’s specification on horizontals. He explained the drivers behind PG&E going to these types of transformers. The main benefit is for operation of the elbow and secondary connections. Another benefit is that you won’t be on top of the tank trying to operate, which also helps with Arc Flash Hazards. Al – After reviewing Dan’s work, does the WG want to pursue including horizontals in this standard? We might want to include this work in an Annex so that it is not considered to be a minimum requirement. There was no vote but it seemed like there was general consensus regarding the inclusion of horizontal tank transformers.

New Business

A comment was made by Brian Klaponski that we may have to include requirements on specific tank materials like we have in C57.12.24 and C57.12.40.

Chris Sullivan stated that we need to discuss how we are going include pressure relief content that will be published in C57.12.39.

Adjourned at 10:45 am.

In addition to his minutes, Al mentioned that he had a hard time achieving quorum since there is a task force for bushings that meets at the same time and some of his members also want to go to that meeting. He will try to get his meting time changed

### C57.12.24 Working Group Report – Three-Phase Submersible Transformers

Giuseppe Termini, Chairman; George Payerle secretary

Revision due date: **6/17/2019**

PAR Approval Date: **11/9/2011**

PAR Expiration Date: **12/31/2015**

The meeting was called to order at 9:30 AM, November 2, 2015 in the Grand Ballroom D of the Peabody Memphis Hotel in Memphis, TN. Introductions were made and an agenda was presented. The meeting was attended by 17 members and 47 guests. Membership stands at 21, and with 17 members present, there was a quorum. Seven (7) guests requested membership. The Chairman stated that attendance at 3 consecutive meetings was necessary for membership. Any member missing 2 meetings in a row would be dropped unless the Chairman was notified with a valid justification for missing the meetings.

George Payerle acted as recording secretary. Minutes from the previous meeting in San Antonio, TX were presented. Justin Pezzin made a motion to approve the minutes, Dan Mulkey seconded it, and the motion was approved unanimously.

The Chairman stated that the PAR will expire on December 31, 2015. A request for a two year PAR extension has been submitted to NESCOM of the IEEE-SA for review and approval during their next meeting on December 7th.

The Chairman discussed the ballot status of Draft D5. There are 89 individuals registered to ballot the draft. As of November 1st, 30% of those individuals had voted. The approval rate so far is 96%. There is only one disapproval vote with 3 comments. 75% participation is required to successfully ballot the draft. Forty (40) additional responses are required to achieve the 75% threshold. The ballot will closes on November 21, 2015, and the Chairman encouraged those who registered should vote.

The Chairman stated that prior to submitting Draft D5 for ballot, the draft was sent to the Mandatory Editorial Coordination (MEC) staff for review. Two sets (Section I and II) of comments were received from MEC staff. Comments from Section I were incorporated in Draft D5 prior to ballot. Comments in Section II must be satisfied prior to standard recirculation.

The Chairman recommended the formation of a ballot resolution task force made up by 5 individuals to address comments received from the balloting process. The Chairman suggested that the task force would be made up by 2 end-users, 2 producers, and one interested individual. Cory Morgan from Erversource, who was not in attendance, agreed to be part of the task force, and along with the Chairman will represent the end-users. Cory also agreed to lead the task force. Brian Klaponski and Paul Chisolm agreed to represent the producers and Dan Mulkey agreed to be the fifth interested member. The purpose of the task force will be to resolve the comments received from balloting process. The task force will then report resolution of the comments to the WG members for final review and approval. Brian Klaponski made a motion that this task force be created, Mike Hardin seconded and the motion was approved unanimously.

Brian Klaponski stated that he did cast a vote on Draft D5 because of additional comments he had on several sections of the standard. The comments are listed below:

* Section 7.5.1.3, Material thickness - Table 6 contains inconsistency in the way inches and millimeters are expressed. This could be a possible rounding issue.
* Section 7.3.1, Tap Changer – The primary tap ratings referenced in Table 5 seems to be ambiguous.
* Section 7.4, Nameplate – The impedance statement in this section, along with the impedance description shown on the Note under Table 3 of Section 5.5, seems to be ambiguous.
* Section 7.5.4, Other Material - The wording ‘similar to bronze’ is in the wrong sentence.
* Section 7.5.10, Finish – The coating standard C57.12.32 refers to the 2002 revision of that standard. The year should not be included when referring to a standard.
* Section 7.6, Components for primary cable system - The words ‘1000 A’ should be 10 kA.
* Section 8.2, Installation – The “angle of tilt” is not well defined for the manufacturers. It was suggested that a minimum angle of tilt be listed.

The Chairman stated that the comments received by Brian Klaponski should be submitted as part of the ballot process and will be addressed by the ballot resolution task force.

The Chairman stated that he received comments from various individuals regarding difficulty to sign up into the PES system for the ballot invitation, and then to actually ballot. Erin Spiewak, from the IEEE-SA addressed the WG to explain how to sign up for the ballot invitation process and cast a ballot. Erin also stated that to ballot, one must be an SA member or pay a onetime fee but there is no requirement to belong to IEEE or attend meetings.

The meeting was adjourned with the next meetings scheduled for March 2016 in Atlanta. Bill Wimmer moved and Anil Dhawan seconded the motion to adjourn.

### C57.12.40 Working Group Report – Secondary Network Transformers

Brian Klaponski, Chairman; Giuseppe Termini, Secretary

Revision due date: **12/31/2021**

PAR Approval Date: **8/30/2012**

PAR Expiration Date: **12/31/2016**

The WG met on Tuesday, November 3, 2015 at 11:00 am with 12 members and 33 guests. Four guests requested membership.

An agenda was presented and approved then introductions were made.

The minutes of the April 14, 2015, meeting in San Antonio, TX were reviewed. George Payerle made a motion to approve the Meeting Minutes. Jeremy Sewell seconded the motion and the minutes were approved unanimously.

The Chair briefly summarized the items in the Meeting Minutes from San Antonio.

The Chair also presented the contents of the Annex: “Coordination of Bushing Selection and Application” proposed for inclusion in the standard.

Larry Dix expanded on the thermal calculation and explained the creation of the chart shown in the proposed Annex.

Jeremy Sewell made a motion to add a mathematical equation that derives the thermal graph shown in Figure 1 of the Annex. George Payerle seconded the motion and the motion was approved unanimously.

George Payerle made a motion to accept the Annex as amended and add it to the current draft of the standard. Tas Taousakis seconded the motion and the motion was approved unanimously.

Larry Dix explained the reasons to add the Annex to the standard. Primarily, the reason of the Annex is to address the separation of the elbows connection with bushings during a fault condition outside the transformer.

The Chair stated that the comments received from John Rossetti have been already handled in our standard except that John’s proposal on the protector height did not fit with many other users so it will not be incorporated.

Item 10 of the previous meeting in San Antonio recommended the inclusion of stainless steel requirement for tank material. The Chair made a proposal of a clause to do this. In the discussion Bob Kinner (material specialist) explained the basic difference of 304L versus 316L stainless steel. Bob volunteered to look into the specific benefits of 304L versus 316L in regards to weld stress cracking and will report out at the next WG meeting. Also the Chair explained that 316L had an advantage in a chlorine environment and Bob Kinner concurred.

Tas Taousakis gave a general discussion from an end-user point of view on corrosion effects on carbon steel tanks and its adverse effects. Tas asked if manufacturers had issues constructing a tank with stainless steel material and the response was no.

Mark Faulkner suggested that painting may be an issue with 316L stainless steel tanks. The Chair suggested that painting should not be addressed in the standard as network transformer manufacturers all had methods to properly paint stainless steel. The Chair also explained about emissivity issues associated with stainless steel tanks that are not painted and why from a cooling standpoint a painted stainless steel tank is preferred for cooling issues.

Tom Holifield asked if 316L stainless steel material applied to accessories such as flanges. The Chair stated that yes 316L stainless steel does apply and also that the material requirements for accessories are covered in Section 5.2.2.

Liz Sullivan made a motion to add “316L” between the words: austenitic and stainless steel in Section 5.2.2. The motion was amended by Liz to: “300 series” between the words: austenitic and stainless. Alex Macias seconded the motion and the motion was approved unanimously.

Dan Mulkey made a motion to include stainless steel material requirements when the transformer is installed in a corrosive environment, specifically Dan motioned to include the following statement follwing Table 5 of the standard. It would include a new Table 6.

As an alternate to using copper-bearing steel, some users may specify a stainless steel tank enclosure for applications where a transformer will experience an especially corrosive environment (such as frequent or continuous submersion in salt water). When stainless steel is specified, it shall be Type 316L with minimum material thickness as shown in Table 6.

**Table 6—Stainless Steel Minimum material thickness**

|  |  |
| --- | --- |
| **Transformer enclosure stainless steel** | **Subway type****mm (in)** |
| Tank wall | 6 (0.25) |
| Switch housing | 6 (0.25) |
| Cooling panels | 6 (0.25) |
| Cover | 9.5 (0.375) |
| Tank bottom | 9.5 (0.375) |

Mark Faulkner seconded the motion and the motion was unanimously approved.

The Chair asked the WG if a PAR extension should be submitted to continue working on the standard or take the standard to ballot. There was no response to his request, therefore the Chair made a decision to take the present draft as amended by this meeting to ballot on the basis that this specification is a living document and further improvements can be made to this standard in future revision.

The meeting was adjourned at 12:18 pm with the next meeting set for Atlanta, GA in March 2015.

### C57.12.44 Working Group Report – Secondary Network Protectors

Bill Wimmer, Chairman, Mark Faulkner, Secretary

Revision due date: **12/31/2024**

PAR Approval Date: **3/26/2015**

PAR Expiration Date: **12/31/2019**

The meeting was called to order at 1:45 PM, on Monday, November 2nd 2015 in the Grand Ballroom D of the Peabody Hotel in Memphis, Tennessee. Introductions were made. A short discussion on establishing membership in this new working group was made. A total of 17 individuals attended the meeting. Membership stands at 10 members and there was a quorum.

Bill Wimmer presented the meeting agenda to the WG for review and acceptance. Ed Bertolini motioned to approve the meeting agenda as presented, Dan Mulkey, Alex Macias seconded the motion, the motion was approved unanimously.

#### New Business

The WG discussed what changes should be considered in the next revision of C57.12.44.

The working group discussed the section 8.2 which describes details on network protector fuses. The location of which appears to be better suited to be included in Annex B. The section was re-located.

Dan Mulkey suggested change to average melting curve should be slower than network protector and to strike under no circumstances. The wording was fuses with a min. melt curve faster than the network protector relay tripping response, should not be used. Dan Mulkey motion, Ed Bertolini second the motion.

Comments by Lee Welch were received and review started.

##### Generation- changes made

Network Protector designed and tested in accordance with the standard, in particular with 5.2, are intended to be applied to a system with power normally flowing only from the high voltage side of the transformer that supplies a secondary network.

Special precautions must be taken with generation or energy storage on a secondary network that could result in reverse power flow as this will create an undesired and possibly unsafe condition.

Dan Mulkey motioned and Mark Faulkner seconded, carried unanimously.

Accepted IEEE STD. C57.12.00-2010 as normative reference.

##### Continuous current thermal test

Left temperature range 10C and 40C as stated versus 4.1.2 for realistic representation of thermal test conditions.

Table 1- Temperature rise- Motion by Mark Faulkner to add C to temperature class, second by Alex Macias., approved unanimously.

##### Test Conditions

Rejected Lee Welch Comment for conductor versus copper bus bar. Left copper bus bar in place.

Add thermal term to insulating panel per Lee Welch comment. Motion by Alex Macias, Dan Mulkey second. Motion carried.

Changed thermocouples to temperature sensors in multiple places.

The meeting was adjourned and the next meeting set for Memphis, TN in November 2015.

## Old Business

Brian stated that he thought 4 years was insufficient time for a PAR since the balloting process consumes a full year. In addition, there is now the issue of public comment on anything going to ballot after July 1 2015. This can potentially require even more time. Dan stated that a workaround is available. A study group can be assembled to work on a standard. Then when the work is well underway, a PAR can be requested. Brian made a motion to petition the transformers committee to request a change to 5 years for a PAR. George seconded. The motion passed unanimously.

## New Business

### Working group C57.12.57

The chair stated that a manufacturer had requested that working group C57.12.57 for dry type network transformers be resurrected. However, the person who asked was not at the meeting. A discussion followed and the following points were made: David Walker of ABB said that they have made a few ventilated dry type network transformers recently but they are not submersibles. Larry Dix commented that someone is making submersible dry types that are not ventilated. Brian suggested we could poll the users. Dan Mulkey said that PG&E has 1200 networks and only about 40 are dry type but their use is increasing. Mike Thibault said PG&E is using dry types in high rise buildings. Martin Navarro said that Siemens Brazil makes a cast coil submersible transformer. It is a patented product. He has 3 units in the network in Sao Paolo. In the end it was decided that this subcommittee would not take any action at this time.

### SC Scope

The chair stated that we have been requested to change the wording of the scope of our subcommittee. Currently it is ‘Underground Transformers and Network Protectors’. Various possibilities were discussed. Brian made a motion that a small task force of 3 people – Dan Mulkey, Larry Dix, and Jim Dorsten be formed. They will discuss and come to a conclusion on a new scope which they will then share with the rest of the committee, George seconded the motion and it passed unanimously.

There was discussion about whether the currently named underground transformer and network subcommittee be incorporated into the distribution transformer subcommittee. After some discussion by a show of hands it was unanimously decided to keep the underground group as a separate subcommittee.

### Misc

There was one person who suggested re-ordering the UTNP WG meetings so they would be more convenient for his schedule. After some discussion it was decided that making a change would make it impossible for other people to make all the meetings they needed to attend so we will leave the schedule as it is.

Due to personal reasons, Bill Wimmer is resigning as chair of the C57.12.44 Working Group. Mark Faulkner has agreed to accept the position. Alex Macias will be his secretary.

Brian wanted to publicly thank Bill Wimmer for all his work in C57.12.44. Bill will be at the spring meeting so he will be recognized at the awards luncheon at that time.

Brian also brought up the topic of safety. He said that in his visit to ABB Alamo he was very impressed by their safety procedures and thinks we should find a way to make it a strategic agenda in our standards.

## Adjournment

The meeting was adjourned at 12:30 PM with the next meeting set for Atlanta, Georgia on March 23, 2016.