

**Meeting Minutes**  
**Task Force on PCS Revisions to C57.12.90**  
March 26, 2018, 11:00am-12:15pm

*Omni William Penn Hotel*  
*Meeting Room “Urban (17)”*  
*Pittsburgh, Pennsylvania USA*

Chair: Hakan Sahin      Secretary: Hamid Abdelkamel

The TF Chair called the meeting to order at 11:00am

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

Spring 2018 Agenda

1. Administrative

- A. Statement of Purpose
- B. Introductions and attendance sheets
- C. Approval of agenda
- D. Approval of the minutes of the meeting – Fall -2017

2. Old Business

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

3. New Business

- A. Winding resistance test requirement on wye connected transformers with neutral bushing brought out

4. New Business

5. Adjourn

The chair commented that we would come back and approve the agenda if we have the quorum. In order to leave time at the end of the meeting, chair asked if anyone would have any new business. No new business was requested.

There were 39 of the 68 TF members in attendance making this meeting “official” as a quorum of 57.3% was reached.

The following 13 members were moved to guest status due to lack of attendance (missing 3 or more of the last 5 meetings): James Antweiler, Allan Bartek, Alain Bolliger, Elizabeth Bray, John John, Vladimir Khalin, Joseph Melanson, Amitav Mukerji, David Ostrander, Kirk Robbins, Rodrigo Ronchi, Mike Spurlock, and Sukhdev Walia.

Also 20 Guests requested membership last fall 2017 meeting, and they have attended the past 2 meetings or 3 of the last 5 meetings. They are our newest Members: Hamid Abdelkamel, Raj

Ahuja, Sanket Bolar, Eun Cho, Hugo Flores, John Foschia, Bill Griesacker, John Herron, Mohammad Iman, Peter Kleine, Fernando Leal, Ion Radu, Amitabh Sarkar, Markus Schiessl, Cihangir John Sen, William Solano, Liz Sullivan, Janusz Szczechowski, David Walker, and Matthew Weisensee.

There are 3 Corresponding Members counted as guests.

After approving the agenda and the minutes from the Fall 2017 meeting, 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.

The Chair gave about 5 minutes for those attending the meeting to read the below text in 8.7 to enable a discussion. Then he showed the text for section 9.6.

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

In order to verify the performance of a transformer that has an on-load tap changer (OLTC), the OLTC 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 with minimum control voltage of 85%. 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 OLTC 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. For mineral 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. For non vacuum type tap changers the determination is with abnormal sound only.

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

### **9.6 On-Load Tap Changer End to End Current Test**

In order to verify the performance of a transformer that has an on-load tap changer (OLTC), the OLTC 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 with minimum control voltage of 85%. 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 OLTC 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. For mineral 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. For non vacuum type tap changers the determination is with abnormal sound only.

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 the meeting to the floor for discussion.

Joe Foldi asked about the meaning of performing the test in intervals if needed. Joe Foldi suggested that the test be performed continuously and remove the “the test may be performed in intervals if needed”.

Due to the fact that there were similar comments for the last several years, The Chair asked by a showing of hands who agrees to keep the on load tap changer voltage and current functional test proposal in C57.12.90. The majority agreed to keep the voltage and current functional test proposal.

The Chair commented that he will email members and guests and ask for volunteers to work off site and have meetings via skype or other means, and finalize section 8.7 and 9.6 and send out for voting prior to next meeting (fall 2018).

The Chair then moved on to discuss new business from fall 2017 meeting, pertinent to winding resistance test requirement on wye connected transformers with neutral bushing brought out

Sections 5.4 and 5.4.1 below are taken from C57.12.90 – 2015.

#### **5.4 Resistance measurement connections and reporting**

The individual phase- or terminal-to-terminal resistance readings shall be reported along with the sum total winding resistance.

##### **5.4.1 Wye windings**

For wye windings, the reported resistance measurement may be from terminal to terminal or from terminal to neutral. For the reported total winding resistance, the resistance of the lead from the neutral connection to the neutral bushing may be excluded. For terminal-to-terminal measurements, the total resistance reported is the sum of the three measurements divided by two.

The Chair asked the following question: If the DC winding resistance test is performed terminal-to-terminal **only**, can we catch an issue with the neutral connection if the test is not performed terminal to neutral?

There was a discussion on why there is a need for an additional terminal to neutral resistance if terminal-to-terminal resistance is being performed, which is required for load loss calculation. Kushal Singh shared that they had instances where a transformer supplier connected the on load tap changer to the wrong neutral location. Since then they started requesting resistance measurement on all 3 phases: terminal to terminal and terminal to neutral.

Dan Sauer explained that by performing terminal to terminal resistance measurement, the connection will be proved terminal to terminal including windings. However, an additional test, terminal to neutral would be required to verify the connection from neutral point to the bushing.

Kris Neild made a motion to approve the proposed wording for 5.4.1 shown below. Dan Sauer seconded the motion.

Ajith Varghese requested a friendly amendment to add ‘at rated tap’ to the proposed wording.

Kris Neild accepted the friendly amendment.

#### 5.4.1 Wye windings

For the wye windings, the reported resistance measurement may be from terminal to terminal or from terminal to neutral. **When there is a neutral bushing brought out, at least one terminal-to-neutral measurement must be made and reported.** For the reported total winding resistance, the resistance of the lead from the neutral connection to the neutral bushing may be excluded. For the terminal-to-terminal measurements, the total resistance reported is the sum of the three measurements divided by two.

One of the meeting attendees recommended to change ‘For the wye windings, the reported resistance measurements may be from terminal to terminal. . .’ to ‘For the wye windings, the reported resistance measurements shall be from terminal to terminal. . .’

Jason Varnell suggested to add ‘in addition to’ to the existing statement in the current section and moving the statement to the end of the paragraph 5.4.1 when adding ‘**In addition, in order to verify neutral connection, when there is a neutral bushing brought out, at least one terminal-to-neutral measurement must be made and reported at the neutral position.**’

The group voted and agreed the changes as motion and friendly amendment agreed to.

The Chair then asked if there is any new business to be discussed during fall 2018 meeting. No new business was mentioned.

The meeting was adjourned at 12:10pm.