

**Meeting Minutes**  
**Task Force Core Gassing and Grounding**  
**August 22, 2014**

Chairman: David Buckmaster, Secretary: Donald Ayers

The fourth on-line meeting of the task force took place on August 22, 2014.

The meeting was called to order at 10:00 a.m. EST by Chairman David Buckmaster. A roll call was made and 12 of the 18 voting members were in attendance so a quorum was established. Four guests were also in attendance.

The minutes from the last meeting were reviewed. Two corrections were noted. The date of the meeting was corrected to show August 1, 2014. Jerry Corkran was the individual that commented on the 50 pC background requirement, not Jerry Schoen. Steve Shull moved and Tom Prevost seconded that the amended minutes be approved. The motion was approved by unanimous vote.

A proposed language adjustment to the C57.12.00 language was introduced by Aniruddha Narawane stating that cores are not the only potential source of partial discharge within a transformer. This led into a discussion of comments submitted by e-mail from Don Platts that suggested, based on Jeewan Puri's comment from last meeting, that partial discharge tests should be routine instead of design tests. Aniruddha Narawane said that routine PD tests for all transformers would adversely affect the production flow. He said that manufacturers should focus more on good processes that eliminate sources of partial discharge rather trying to test for PD. Jerry Corkran concurred that the test should be a design test not a routine test.

Aniruddha Narawane made a motion that his proposed language be inserted after the first paragraph in the proposed language on C57.12.00. Phil Hopkinson seconded the motion. The motion passed with no negative votes.

Jeewan Puri submitted a proposed language change to the C57.12.00 language. His change would better define the initiating factors that cause PD in wound cores. Jeewan Puri put his suggestions into a motion. There was no second to the motion so it died.

The discussion on C57.12.00 was closed at this point and the focus changed to C57.12.90 language.

Tom Prevost discussed his proposal for inserting the language into the test standard. He proposed a new Section 10.8. During a discussion of Tom's proposal minor adjustments were made. The second criterion for failure detection was eliminated as unnecessary and the first criterion was merged with the introduction sentence.

Steve Shull made a motion to accept the modified language from Tom Prevost's proposal. Wally Binder seconded the motion. The motion passed unanimously.

The title for Section 6.7.2, "Grounding of Core", was discussed but the decision was to leave the title as it was.

A motion was made by Phil Hopkinson to forward the new developed proposed language to Ed teNyenhuis, Chair of PCS, for sending the document for a survey vote of the PCS membership. Steve Shull seconded the motion.

During the discussion that followed, a suggestion was made to amend the main motion. The proposed amendment was to eliminate the final sentence in the C57.12.00 section as being unnecessary. Gary King made the suggestion into a motion with Aniruddha Narawane seconding it. The amended motion passed unanimously. The amended main motion then also passed unanimously.

A motion was made and seconded to adjourn the meeting. The vote was unanimous.

The meeting was adjourned at 11:20 a.m. EST.

Respectfully submitted,

Donald E. Ayers  
Secretary

Encl: Final proposed language for C567.12.00 and C57.12.90

Postscript to Minutes:

- The chairman of PCS, Ed teNyenhuis, was notified that the task force work was completed and that the scheduling of future meetings would depend on the feedback from the PCS subcommittee members.
- At the time of submittal, it was discovered that C57.12.00 Section 6.7.2 already existed with the title of "Grounding of Core". With agreement with the TF Chairman, the section number was changed to 6.7.2.1 and the title changed to "Grounding of Wound Cores" to avoid conflict with the existing document.

DEA

Accepted by

A handwritten signature in blue ink, appearing to be "A. King", written over a horizontal line.

Chairman Core Grounding and Gassing Task Force 8/23/2014

## **Proposed wording to insert into IEEE C57.12.00**

### **6.7.2.1 Grounding of Wound Cores**

In medium and high voltage applications of transformers with wound cores, the transformer core shall be properly grounded to the tank. One purpose is to prevent development of a voltage across the wound core loop that could result in the dielectric breakdown of the thin insulating fluid film between the core laminations and the initiation of PD and the generation of H<sub>2</sub> and other hydrocarbons.

It should however be noted that PD generation in transformers can possibly occur due to various other factors which may be internal and/or external to the transformer and the capacitive coupling described is one of these factors.

In order to validate that the core will not be susceptible to such discharges during normal operation, a design test, specific for this type of transformer is defined in C57.12.90, Section 10.8 with acceptance criteria in Section 10.8.4. Transformers which require this design test are those manufactured with a wound core and having a high voltage winding with nominal system voltage of 15 kV or greater.

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## **Proposed wording to insert into IEEE C57.12.90**

### **10.8 Special Induced-Voltage Test for distribution and class I power transformers with a wound core and having a high voltage winding with nominal system voltage of 15 kV or greater.**

#### **10.8.1 Test duration and application of voltage**

1. Voltage will be raised to 100% of rated volts for 30 seconds and PD will be measured and recorded.
2. Voltage will be raised to 110% of rated for 30 seconds and PD will be measured and recorded.
3. Voltage will be raised to 150% of rated and held for one minute and PD will be measured and recorded.
4. Voltage will be lowered to 140% of rated for 1 minute and PD will be measured and recorded.
5. Voltage will be lowered to 130% of rated for 1 minute and PD will be measured and recorded.
6. Voltage will be lowered to 120% of rated for 1 minute and PD will be measured and recorded.
7. Voltage will be lowered to 110% of rated for 10 minutes and PD will be measured and recorded.

PD can be measured as apparent charge in pico-coulomb (pC) or RIV in micro-volt (μV)

#### **10.8.2 Test Frequency**

As an induced-voltage test applies greater-than-rated volts per turn to the transformer, the frequency of the impressed voltage shall be high enough to limit the flux density in the core to that permitted by 4.1.6.1 of IEEE Std C57.12.00-2010. The minimum test frequency to meet this condition is given in Equation (27):

$$\text{Minimum test frequency} = \frac{E_t}{1.1 \times E_r} \times \text{rated frequency} \quad (27)$$

where

$E_t$  is the induced voltage across winding (V)

$E_r$  is the rated voltage across winding (V)

### 10.8.3 Grounding of Windings

When a transformer has one end of the high-voltage winding grounded, the other windings should be grounded during the induced-voltage test. This ground on each winding may be made at a selected point of the winding itself or of the winding of a step-up transformer that is used to supply the voltage or that is connected for the purpose of furnishing the ground.

### 10.8.4 Failure detection

The test is considered passed if PD recorded in step 7 of 10.8.1 does not exceed partial discharge level of 100 pC or RIV level of 100  $\mu$ V.