*IEEE/PES TRANSFORMERS COMMITTEE MEETING*

# POWER TRANSFORMERS SC

*April 12, 2001*

*Amsterdam, The Netherlands*

## 9.9 Power Transformers Subcommittee: Everett Hager – Chairman (presented by Joe Watson)

Tom Lundquist – Vice Chairman

Joe Watson – Secretary

The Power Transformers Subcommittee met at 11:00 AM Wednesday, April 11 with 33 members and 47 guests in attendance. 15 of the guests requested and were granted membership, bringing the total membership of this Subcommittee to an even 100.

After introductions, the minutes of the last meeting were approved.

The Working Group reports were presented as follows:

### 9.9.1 The working group on the revision of C57.12.10

Javier Arteaga - Chairman

The Group met at 8:00 AM on Tuesday with an attendance of 27 members.

Administrative Subcommittee members updated the Group on the existing situation between NEMA and IEEE regarding the copyrights of several NEMA standards including C57.12.10. After several discussions, the Working Group recommended to the Administrative Subcommittee to continue the work of this Working Group and request a PAR for either the revision of C57.12.10 or the creation of a new document to cover power transformers. The PAR will be issued for the next meeting.

At this time a draft will be prepared and distributed only within the Working Group members for review and comments.

Additional guidelines were provided for the sections of this draft as follows:

- LTC section to cover the application on delta or wye connections, to regulate either the HV or LV winding with or without variable core flux
- The draft will include preferred BIL ratings from C57.12.00
- New devices not widely used will be included in an annex

Sections of the draft will be sent to the Working Group chairman by June 15 for compilation, and the draft will be sent to the Working Group members by July 15 for comments and further discussion during the next meeting in Orlando.

The following members are preparing the following sections of the draft:

Ratings: John Rossetti, Rich von Gemmingen

Construction: Dennis Marlow, Roland James, Bob Hartgrove

LTC: Jim Harlow

The meeting adjourned at 9:15 AM.

### 9.9.2 The working group on ltc performance

William Henning - Chairman

The Working Group on LTC Performance met on Tuesday, April 10 at 11:00 AM with 10 members and 19 guests attending. Two guests requested membership after the meeting. Minutes of the previous meeting were approved.

This Working Group has been assigned responsibility for preparing a re-affirmation ballot for C57.131, "Standard Requirements for Load Tap Changers." The Working Group chair will submit a PAR for this activity.

The need for possible revisions of C57.131 was discussed. The Working Group will proceed with reaffirmation to keep the current document valid. Then we will look at additional information and some possible minor changes to C57.131 in a future revision, as discussed below.

Two considerations for revision of this standard after re-affirmation are as follows:

- The first consideration is that Phil Hopkinson chairs a Working Group that is proposing to add information on de-energized tapchangers, based on the IEC 214 clause on this subject. In addition, the Working Group proposes to add the requirements for a functional life test for de-energized tap changers.90-
- A second consideration is review of additional changes made by IEC WG26 on IEC 214 since C57.131 was prepared by IEEE.

The Working Group also discussed terminology used in the document. The distinction between auxiliary supply circuits and control circuits was discussed. It was decided to defer this small issue to a possible future revision.

A subject outline for the Load Tap Changer Application Guide, based on the corresponding IEC document was presented.

The final subject discussed was the need for a definition of Load Tap Changer Contact Life and a uniform and standard way of determining contact life. C57.131 states that (regarding the Service Duty Test) "The results of this test may be used by the manufacturers to demonstrate that the contacts used for making and breaking current are capable of performing, without replacement of the contacts, the number of tap change operations guaranteed by the manufacturers.

Jim Harlow agreed to draft a section of the Guide on this subject.

### 9.9.3 Working group on phase shifting transformers

Edgar Trummer/Tom Lundquist – Co-Chairmen

The Working Group met on Tuesday, April 10 at 4:30 PM. 9 members and 16 guests were

present.

A summary of a re-circulation ballot was presented as follows:

97 eligible people in the ballot group

77 affirmative votes

2 negative votes

7 abstentions

88% return with 97% affirmative

The two negative ballots were discussed. One negative ballot was on an item that was not revised or changed from the main ballot. Since the balloter did not vote negative on this item during the original ballot, the negative is not possible for consideration. The negative ballot was withdrawn

### 9.9.4 The working group on on-line monitoring of liquid immersed transformers

Andre Lux/Donald Chu – Co Chairmen

The Working Group met Tuesday, April 10, 2001. Approximately 70 members and guests were in attendance. The majority of the meeting was spent discussing Draft 9 of the Guide. Draft 9 was sent out in March to the Working Group membership in order to solicit comments on the Guide so the Guide can be finished and sent to ballot. Approximately 40 surveys were returned to the co-chairman and some of the comments were discussed. Volunteers to write some of the remaining sections were accepted. The Working Group plans to meet in Orlando the Sunday immediately before the next Transformers Committee meeting. The Guide will be reviewed in detail and edited during this one-day meeting.

A panel session on the statue of ON-Line Monitoring will be held during the Orlando meeting. The panel will consist of transformer manufacturers, utilities and monitoring system manufacturers and will discuss trends and the status of on-line monitoring of transformers applications. The presentations will be a purely technical (not marketing) nature. Two volunteers to join the panel came forward. One is from a utility and one is from a manufacturer. More volunteers will be requested. A panel session on this topic will also be conducted at the upcoming T&D Conference in Atlanta, Georgia.

### 9.9.5 The working group on transfofmer life extension

Rowland James – Chairman

The Working Group met at 3:00 PM on Tuesday, April 10 with approximately 35 members and guests in attendance.

After introductions a brief discussion of the latest draft's status was held. After a period of

relative inactivity, much progress has been made on the latest draft.

Joe Watson made a presentation on a statistical approach to transformer risk assessment and maintenance. The focus of the presentation was the proposal to create a reliability model similar to a fault tree that can accept inputs from condition assessments of all the transformer's components or systems. This model would take the assessed conditions and calculate the failure probability of each transformer.

Andre Lux also presented information on this Guide's Bibliography and references.

The meeting was adjourned at 4:15 PM.

### 9.9.6 The west coast transformer working group

Mike Lau - Chairman

The West Coast transformer Working Group met at 1:20 PM at the Arizona Public Service's Shure Building in Phoenix, Arizona on November 6th, 2000. There were four members and seven guests present.

| **Members:** | **Guests:** |
|---|---|
| Tom Lundquist | Stephen Allen |
| John Irvine | Bill Thompson |
| Bob Stewart | Hana Abdallau |
| Mike Lau | Charles Hoesel |
| | Jean-Bernard Dastous |
| | Sam Perkins |
| | Steve Brown |

After introductions, Mike Lau provided a brief report on the recent main transformer committee meeting in Niagara Falls, in mid-October, 2000. To attract more participation and attendance, more tutorials and technical presentations will be scheduled for future meetings. Future meeting dates and details were provided.

T.V. Oommen's paper "Bubble Evolution from Transformer Overload" was briefly reported followed by a discussion by the attendees on Bucholz Relay protection.

C57.93 – the Guide for Installation of Liquid-Immersed Power Transformers is due for re-affirmation at the end of this year. Invitations to be members of the balloting pool have already been sent. Mike Lau pointed out that there were issues (such as the acceptable leakage rate for vacuuming; the acceptable vacuum treatment in transformer dry-out; problems associated with re-energizing transformers under cold temperatures, etc.) that need to be re-visited. The Guide also makes reference to the D877 oil dielectric test that is no longer being used to test transformer oil (see the new C57.106 Oil Guide). Therefore, irrespective of the outcome of the

re-affirmation ballot, the guide will need to be revised. It is recommended that a Task Force/Working Group be set up to deal with the necessary revision. (See the additional report below on the Amsterdam meeting of this Working Group)

On Old Business, Tom Lundquist reported that the Guide on Phase Shifting Transformers has been successfully balloted with 90% affirmative and four negative votes. The Guide is expected to be completed by March 2001.

Under New Business, two items were brought up:

1. Mike Lau indicated that a method is required for drying out transformers with non-vacuum proof tanks. The hot air method may be used for such purposes. He also reported that an Australian transformer manufacturer apparently used a combination of a hot air and vacuum method and claimed that it is more effective than the traditional hot oil/vacuum method. Perhaps more studies are warranted.

2. Mike Lau indicated that the current Installation Guide does not provide any guidance with respect to the flow rate of dry air required for purging during transformer inspection. Other attendees felt that monitoring the oxygen content is necessary and cautioned that there could be a liability concern if a set flow-rate is provided.

There was no more business and the meeting adjourned at 3:00 PM.

**9.9.7 The working group on the installation of liquid-filled transformers C57.93**

Mike Lau - Chairman

The Working Group on the Installation of Liquid-filled Transformers was called to order at 1:35 PM on Tuesday April 10, 2001. There were 39 attendees present. The agenda for the meeting was distributed and introductions were made. The Chairman indicated this was an informational meeting to review the re-affirmation ballot of C57.93 and to initiate a Working Group to begin the process of revising this standard. An attendance list was circulated and all guests were asked to indicate if they would like to become members of the Working Group. 12 persons requested membership. In addition, Peter Balma volunteered to be secretary of the Working Group.

The reaffirmation ballot was sent out to 126 individuals and 99 were returned. This was a 78% return with 93 affirmative, 3 negative and 3 abstention responses. The three negative responders were contacted for clarification and agreed to withdraw their negative ballots. However, due to some wording problems on the submission to IEEE one of two actions can be taken. Either the ballot can be re-circulated with the negatives and can be approved with a 75% affirmative vote, or the comments can be re-worded and re-submitted to IEEE. The latter approach will be followed. In addition, a new PAR will be prepared to initiate the revision process for this standard.

The meeting continued with a discussion of the technical comments received during the ballot and outlined in this meeting's agenda.

a) Hold time for energization after fill

b) Start-up of transformers below –20°C

c) Hold time for transformers shipped oil-filled after processing

d) Oil test method

e) Level of vacuum for filling

f) Methods to heat windings be energization during vacuum processing

g) Acceptable shipping impact forces

h) Oxygen measurements and relationship to shipping integrity

i) Use of Metric versus English units

After discussion, it was decided that a survey of the majority of these items with both manufacturers and users would provide a starting point for revisions to the guide.

New items for discussion included the topics of confined space entry, dew point measurements at temperatures below freezing, and safety and cooling issues concerning oil-filled transformers installed indoors. Both will be discussed in additional detail as the Working Group moves forward.

The meeting adjourned at 2:45 PM.

**9.9.8 Old business:**

Report on TRV breaker-transformer switchgear/transformer project

The following report was presented by Tom Lundquist

- There will be a PAR developed and a High Voltage Subcommittee of the IEEE Switchgear Committee
- Previous volunteer list was lost between Mel Smith's computer crash and Tom Lundquist's computer change-out so we need to get the names and contact information for volunteers again
- Mel will send a letter to all volunteers from the PTSC
- Preliminary investigations support the idea that large transformer capacitance may be measured accurately using simple current injection or resonant techniques. The techniques use a low voltage circuit and are easily set up to conduct tests. These should be simple to use in a laboratory environment and during field measurements.
- Calculations of the capacitance values by transformer engineers seem to be a questionable approach to obtain accurate information.
- Derivation of capacitance values from FRA during factory impulse tests does not appear

to be possible because of the capacitance involved in the overall circuit. The impulse generator and measuring device have capacitance values so much larger (in the micro Farad range) than the transformer capacitance (in the Pico Farad range) that he transformer value is not possible to calculate.

### 9.9.9 New business:

Joe Watson reported on the tutorial held Wednesday at 9:00 AM on standardized control cabinet designs. Both ABB and Smit presented their approaches to a standard cabinet design. A new Working Group will start work on this subject at the next meeting in Orlando. A PAR will be requested when light can be seen at the end of the tunnel.

Florian Costa presented a brief video of a successful 1.0g seismic test of a 500 kV bushing.

The meeting was adjourned at 12:15 PM