9.6 POWER TRANSFORMERS

The Power Transformers Subcommittee met Wednesday afternoon at 1:30 pm with 45 members, 9 new members and 56 guests in attendance.

The minutes from the Vancouver meeting were approved before the various working groups and task forces reported.

9.6.1 WORKING GROUP AND TASK FORCE REPORTS

9.6.1.1 TASK FORCE FOR REVISION OF C57.17, ARC FURNACE TRANSFORMERS – Dom Corsi, Chairman

Bill Bartley reported for Dom Corsi and Robert Ganser. The meeting was called to order at 9:30 am. There were 20 members in attendance. Of these members, there were no Arc Furnace transformer users represented. The minutes from the Vancouver meeting were approved.

Prior to presenting the Agenda, a brief general discussion concerning the purpose of the Task Force and background information relating to AC Arc Furnace Transformers was held by the members. Frank Damico reported that there were no specific IEC standards addressing AC Arc Furnace Transformers. He references IEC 60599 for DGA analysis.

Dom Corsi then presented the Agenda, which included the following major sections:

- Greetings and introductions
- Proposed content page
- Proposed scope of the document
- PAR discussion
- Adjourn

Dom Corsi then presented the proposed content page, which included the following major sections:

- Scope
- Ratings
- Insulation Levels
- Impedance Voltage
- Connections
- Testing
- Construction
- Short Circuit Characteristics

The members recommended that the Scope, as presented, be changed to reflect the following:

- Retain the “Indoor” application description
- Change “oil” to “liquid immersed”
- List the voltage as 69kV maximum, but not the limit

- Remove the 2000kVA as a lower limit

The Ratings and Insulation Levels were accepted as proposed

Discussion concerning the Impedance Section resulted in the inclusion of the consideration and specification of impedance of the furnace transformer at the terminals of the transformer and at various reactor configurations, if so required. This discussion also emphasized the importance of the lead reactance in the ultimate performance of the transformer.

The Construction Section is to be opened to include Load Tap Changers, DETC switches and other switches that are specific to the AFT operation.

The members contributed readily to the items in the Agenda, which will form the basis for revision and study. The meeting adjourned at 10:45 am.

9.6.1.2 TASK FORCE ON A GUIDE FOR STANDARD CONTROL CABINET DESIGNS – Joe Watson, Chairman

Joe Watson reported that the task force met at 11:00 am on Monday, October 21, with 42 in attendance. There were 19 members and 23 guests. Three of the guests requested membership.

Initial discussions centered on the upcoming survey of users concerning their requirements for control cabinets. Joe had received two emails identifying several areas of concern: grounding the cabinet, thermal shields, circuit breaker ratings, protecting all devices, permanent labels, flex conduit problems, wire marking, and cooler control standards.

It was then brought up that a standard already exists for switchboard wiring, C37.21, and that the task force should look at the document and determine how best to use it for our needs. Joe will email the draft to members.

Several items were brought up as additions to the survey: non-GFI outlets, lifting provisions for heavy doors, and removable rear panels.

The group then discussed the survey feature list, including:

- NEMA 3R or 4 – Type 4 cannot have opening in the box
- Louvered openings – add other types of openings
- Conduit plates – add knockouts
- Lamp inside – add option for guard, and door-operated switch
- Heaters – add options for cover / shield
- Circuit Breakers – add options for voltage and interrupting current options
- Splicing – add option for no splices buried in conduit
- Wiring – remove “cross-linked polyethylene (SIS type)”

- Stranding – add
- Wire Terminals – add information concerning where ring-tongue terminals must be used. Also, add DIN rail mounting option.
- Wiring – add option for wiring in transformer braces
- Conduit – add option to run short piece of flex conduit to gauges

The survey will be emailed to task force members one more time for additions and corrections, and then Greg Anderson will send the survey out to users.

The meeting adjourned at 12:20 pm.

9.6.1.3 WORKING GROUP ON LOAD TAP CHANGER PERFORMANCE - William Henning, Chairman

William Henning reported that the Working Group on Load Tap Changer Performance met on Monday, October 21 at 1:45 pm with 13 members and 31 guests attending. The minutes of the April 15th meeting were approved.

The Working Group addressed the business of resolving three negative votes on the electronic ballot for the reaffirmation of C57.131-1995, "Standard Requirements for Load Tap Changers." The first negative vote concerned errors in the text of Sections 6.4.1 and 10.3.1 and the Tables A.2, B.2 and B.3 of C57.131-1995. These issues are clearly errors and will be corrected in the next revision of the Standard. A PAR for that work is being prepared.

A Working Group member who was not present at the meeting cast the second negative vote. He will be contacted after the meeting to discuss resolution of his concerns.

The third negative vote raised five separate technical issues, each of which will require more consideration by the Working Group than was possible in this meeting. A motion was passed to consider these changes in the next revision. The negative voter will be contacted regarding these issues.

The meeting was adjourned at 3:00 pm.

9.6.1.4 WORKING GROUP ON C57.140 "GUIDE FOR THE EVALUATION AND RECONDITIONING OF LIQUID IMMERSED POWER TRANSFORMERS" - Rowland James, Chairman.

Rowland James reported that the working group met at 3:15 PM on Monday, October 21, 2002 with 72 in attendance. There were 38 members and 34 guests-23 requested membership.

After introductions a brief discussion of the latest draft's status was held. The Chair reported that the efforts of the group so far have placed the draft ahead of schedule.

Discussion from the floor

- Phil McClure will add information in Oil & Winding temperature on calibration of gauges and also information on the new generation of digital and analog meters available.
- Stan Lindgren commented on vintage (Section 5 –Risk). He stated that thermally upgraded paper became available in the 60's not the 70's.
- Tom Bassett will add information in 4.1.4, 6.1.4 and 6.1.12 on molecular sponges (as an alternate to conventional drying techniques).
- Jeewan Puri posed a question on the direction/scope of section 4.1.16 "Noise and Vibration". He will work with Bill Chiu on a brief article.

Numerous Volunteers were obtained for incomplete sections:

- Radiators Fans & Pumps - Stephen Antosz (Mike Havener has already written this)
- Bushings - Bob Hartgrove (completed during meeting)
- LTC's - Van Nhi Nguyen and Carlo Arpino
- Infrared - Paulette Payne
- Conservators (COPS) - Mostafa Jafarnia and Robert Thompson
- Gas Blanketed Systems - Robert Thompson
- Noise and Vibration - Jeewan Puri
- Gaskets - John Matthews
- Internal assessment of Bushings - Carlo Arpino
- Oil & Winding Temperature Gauges-Phi McClure (expansion of existing article)
- Maintenance of Leads - Tommy Spitzer
- Molecular Sponge - Tom Bassett

The meeting was adjourned at 3:50 PM.

9.6.1.5 WEST COAST WORKING GROUP - Michael Lau, Chairman

Michael Lau reported that the West Coast Working Group met on Tuesday, October 22nd at 8:00 am with 5 members and 6 guests present.

After introductions, the Chairman pointed out that there is no active assignment for the Working Group at present. Discussion was carried out on two potential projects that were identified at the last meeting in Vancouver:
Development of a Users Guide on seismic considerations for transformer designs
Transformer shipping requirements and similar considerations

After much discussion, it was agreed that a supplementary Guide to the existing Substation Seismic Guide, IEEE 693 would be a worthwhile project for the Group.

The meeting adjourned at 9:15 am.

9.6.1.6 WORKING GROUP ON ON-LINE MONITORING OF LIQUID IMMERSED TRANSFORMERS - Donald Chu and Andre Lux, Co-Chairpersons

The Working Group on Transformer Monitoring met on Tuesday, October 22, 2002 at 9:30am. Approximately 14 members and 68 guests were in attendance. 19 Guests requested membership in the WG. There were also numerous requests for copies of the draft.

The meeting was presided over by William Bartley in the absence of the Co-Chair. Minutes of the previous meeting were not available.

Status of the Guide is 99% complete. Mr. Lux is in the midst of an arduous editing process to achieve a seamless and cohesive Guide.

Mr. Tom Prevost explained the On-Line editing tools available from the IEEE and the IEEE balloting process.

The floor was open for questions on the Guide; but there were none. The meeting adjourned at approximately 9:50am.

9.6.1.7 WORKING GROUP FOR THE REVISION OF C57.93, INSTALLATION OF LIQUID-FILLED TRANSFORMERS - Michael Lau, Chairman

Michael Lau reported that the Working Group on The Installation of Liquid-filled Transformers was called to order at 11:05 AM on Tuesday October 22, 2002. There were 59 attendees, 19 members, 8 requesting membership, and 34 guests. The agenda for the meeting was reviewed, followed by approval of the Minutes from the April 16, 2002, meeting in Vancouver, Canada. The minutes, a new draft of the guide, and copies of the overheads presented were distributed.

The PAR for revision of the guide was approved on June 13, 2002 as PC57.93, and the scope and purpose of the working group as submitted on the PAR were reviewed.

The present format of the document was reviewed, and a suggested alternative format was also presented for discussion. Alternatives considered changing the size of the transformers contained in the guide, and the clause structure of the guide itself. Various viewpoints were expressed, however, it appeared it was too early in the document review process to consider format changes. Salient points of the discussion were as follows: IEC considers three classes of transformers, which might provide assistance in this guides format.

- Requirements for a 500-kva unit versus a 1000 MVA unit are too diverse to be merged; several different clauses will be required to distinguish the two.
- Small transformer users are looking for guidance, as well as those utilizing the largest transformers manufactured.
- Installation requirements for transformers shipped oil filled have substantially different installation requirements from those that are shipped dry.
- Should the guide consider both old and new transformers; wouldn't the methodologies described in the guide be the same?

Another discussion developed during the meeting suggesting a change to the title of the guide to include maintenance, specifically since it was discussed within the present document. Various viewpoints were presented and considered whether maintenance should be in the document at all; implications to insurance companies and regulators if the guide was too prescriptive; and consideration that the majority of users have their own maintenance guidelines. Moreover, several indicated some guidance was needed as some users do not have maintenance practices, and that the current PAR does describe maintenance as part of the scope of this guide. A vote was held at the end of this discussion and the working group decided it should be included in the title and the document. A revised PAR will be submitted to reflect the title change.

- Review of the document was started with Clause 4.2, Shipping. Changes were reviewed and the following items were suggested.
- Impact recorders should be placed on rail cars in addition to those placed on the transformer.
- The need for a caution statement if a transformer is shipped nitrogen filled; how such a unit should be handled; and that vacuum may be need to remove the nitrogen.
- Consistency of the statements relative to shipping units filled with nitrogen, are needed in Clauses 3 and 4 of the document.
- Long distance and/or duration shipments of transformers may require external gas bottles and controls to insure positive pressure is maintained throughout the shipment.

Coordination of this working group with the working group on transformer life extension will be needed to avoid duplication of efforts.

Additional volunteers were requested to re-write several sections of the guide. New volunteers were as follows:

– Clause 1, & 2	Scope & Reference	Malcom Thaden
– Clause 3.9	Maintenance	Marcos Ferreira
– Clause 4.7	Assembly	Dan Perco
– Clause 4.8, 4.8.4	Vacuum treatment	Derek Baranowski
– Clause 4.9	Field drying of insulation	Derek Baranowski
– Clause 4.13	Maintenance	Paulette Payne

In addition Ron Daubert and Alan Peterson volunteered to provide general assistance.

Paulette Payne has been providing coordination between IEEE and Doble for this working group, and provided an update on Doble's progress on an oil-processing guide. Doble is working on a multi-section guide, and currently transformer filling is being discussed. Doble would like input from IEEE in this area. A discussion by the working group stressed the need to follow manufacturers directions when filling a transformer. Paulette indicated that would still leave a gap for older transformers without instruction books, especially if the manufacturer is no longer in the market.

There was no other old or new business, and the meeting adjourned at 12:15 PM.

9.6.1.8 WORKING GROUP FOR REVISION OF C57.12.10 - Javier Arteaga, Chairman

The Working Group met at 3:15 pm on Tuesday, October 22nd with 13 members and 27 guests present. 15 of the guests requested membership in the Group. The minutes from the Vancouver meeting were approved as written.

Since the Vancouver meeting, the PAR's for both C57.12.10 and C57.12.36 have been approved. The scope of C57.12.10 was modified to include ratings below 5 MVA to satisfy NESCOM concerns.

Regarding review of the specific sections of the current draft, the following items were discussed:
Ratings: The Scope of the PAR does not have an upper limit with respect to the ratings. Therefore, all of the existing tables need to be opened up to cover all possible sizes. There was much debate as to whether or not Tables should be used. One reason to keep the Tables is to provide users the ability to fall back on the limits provided in a Standard. After much debate it was decided to eliminate the rating Tables wherever possible and refer to C57.12.00. This decision also applies to the BIL Tables.
Impedance: For now, the impedance Table will remain in the Standard. Raj Ahuja volunteered to gather information and fill in the remainder of the Table. He will also contact Loren Wagenaar for input.

- Taps: A suggestion was made to clarify the de-energized tap switch application – "should be used for incoming line adjustment, not secondary regulation." This may belong in an Application Guide, instead, or possible included in C57.105.
- Taps for LTC Transformers: A suggestion was made to add information to regulate the high side along with the low side and use IEC 60606 as a guide. Since there weren't any volunteers to write this section, some statements will be circulated to the Working Group for review and comment. The addition of the information will impact the LTC section compiled by Jim Harlow.
- Top Liquid Temperature Range Limits: We will add a statement that the temperature range stated is for normal operating conditions. We will consider

removing the note that the pressure/vacuum bleeder may operate since a sealed tank should remain sealed.

- Construction (Section 5.0): Direct mounted devices will be limited to no higher than 96" and remote mounted devices will be used above 96". A suggestion was made to limit the distance the top liquid temperature well is below oil to 12". The statement that was previously added regarding locating the tap switch such that operators can change safely without a ladder will be removed.

Any additional feedback will be incorporated into the document and re-circulated.

The meeting adjourned at 4:30 pm.

9.6.2 OLD BUSINESS

Tom Lundquist reported that the Guide for Phase Shifting Transformers, C57.135 has been issued and is available for use.

9.6.3 NEW BUSINESS

Tom Ludquist also initiated a discussion on Section 4.1.6 of C57.12.00 that specifies that transformers shall be capable of operation at 105% of the kVA rating at a 0.8 power factor under full load and 110% of the kV rating under no-load. It was noted that there has been considerable discussion of this requirement recently and it was agreed that a tutorial on the subject would be beneficial. A Task Force, headed by Bipin Patel, was volunteered to put this tutorial together for presentation at the next Committee meeting in Raleigh.

Zalya Berler gave a presentation on methods to perform capacitance and power factor tests on bushings, current transformers, CCVT's and similar equipment on-line. The method is widely used in the Ukraine and Russia and similar systems have been installed in the past year in Canada and the US. The presentation will be posted on the website.

The meeting adjourned at 2:45 pm.