7.12 POWER TRANSFORMERS – E. G. HAGER, CHAIR

The Power Transformers Subcommittee met Wednesday afternoon at 1:30 pm with 43 members, 22 new members and 55 guests in attendance.

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

7.12.1 WORKING GROUP AND TASK FORCE REPORTS

7.12.1.1 TASK FORCE FOR REVISION OF C57.17, ARC FURNACE TRANSFORMERS – Dominic Corsi, Chairman

Dominic Corsi reported that the Task Force was called to order at 8:00 am on Monday, October 6th with 15 attendees. This was the group's 4th meeting since the start of the Task Force project.

The first order of business was to review and approve the minutes from the April meeting held in Raleigh, NC. The minutes were provided in electronic format prior to the meeting and were approved by the members present.

Dominic Corsi reviewed the status of the Task Force and progress to-date. It was noted that some of the members had not received correspondence from the Chair and it was re-emphasized that all members make sure that their e-mail addresses are accurate. It is the intention of the Chair that the majority of correspondence takes place via e-mail. Those members missing the latest mailings will be readdressed.

The Chair presented an open letter to the Task Force written by Giovanni Testin of ABB and Ugo Piovan of Weidmann. In the correspondence, Mr. Testin listed topics that he felt were both significant and generic to Arc Furnace Transformers. These topics were reviewed in detail by the Task Force to make sure that they were included in the contents of the current revision. It was agreed that the topics were covered but would serve also as a valuable basis for detailed writing under the particular subject content for each.

Under New Business, the Task Force was polled for participation and writing of the Contents. The following individuals volunteered.

- Appendix A: Dissolved Gas Analysis
    - Joe Kelley
    - Frank DiAmico
- Ratings:
    - Dominic Corsi
    - Bob Ganser
- Appendix B: DC Arc Ffurnace Transformers

    - Sheldon Kennedy (Contributor)
    - Ugo Piovan (tentative)
- Appendix C: Guide for Protection
    - Tom Slovik (tentative)

Volunteers are needed for the following:

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

A discussion on commissioning and field testing of arc furnace transformers followed. While arc furnace transformers do have sometimes special and unique requirements, it was decided that these were not sufficiently different to warrant a new Appendix on Commissioning and Field Testing in the revision.

The meeting adjourned at 9:00.

Rowland James commented that the IEEE Virtual Community could be utilized for data transmittal issues.

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

Michael Lau presented the minutes of the Working Group meeting.

The Working Group for the Installation of Liquid-filled Transformers was called to order at 9:35 am on Monday, October 6th. There were 45 attendees including 22 members, 4 new members and 19 guests. The agenda for the meeting was reviewed, followed by approval of the minutes from the March 17, 2003 meeting in Raleigh, NC. The agenda, minutes and a new draft of the Guide were distributed.

Draft 4 of the Guide has been placed on the Transformer Committee website for use by the Working Group.

Since the IEEE Standards Board has allowed dual dimensioning, the Working Group was asked whether we should utilize dual dimensioning in this Guide. The consensus of the group was to provide both dimensions, which will be included in the next revision.

It was proposed to the Working Group that all acceptance criteria from throughout the document be placed in a common informative annex. Further, as part of this discussion it was proposed that some of this information may be available in EPRI's life extension project and could possibly be utilized as an information source. Paulette Payne and David Wallach, Barry Ward and Michael Lau will review this information and provide feedback to the Working Group.

Currently there is some duplication of material between Clause 3 ("small transformers") and Clause 4 ("large transformers") in the Guide, and several suggestions were raised as to how to best include this material. First, to continue it as-is in both sections; second, to separate it out into a general clause; and third, to complete the document and determine then if separation is really necessary. The Group did not reach consensus as to the best approach, and further review of this area will be needed.

The subject of Clause 4.6, Preliminary Liquid Filling, was revisited. The Group previously agreed to remove this clause, but the issue was raised again. Due to the change in the state-of-the-art, the clause will not be returned to the document.

A question was raised relative to the extent of the time required by new Clause 4.8.3.2, Assembled Unit Vacuum Tests. Discussion indicated that it needed to be clearer as to when this procedure might be needed, and what other alternative methods might be applicable.

Clause 4.9.3, Hot Air Circulation for drying was discussed. Concerns for the effectiveness, potential hazards, costs and quantity of air needed for this process were all discussed. Consideration for the removal of this Clause from the document was presented, however a majority vote of the Group was to retain it in the Guide.

Paulette Payne provided an update of Doble's activities in this area and indicated there were no additional updates at this point in time. However, it was indicated that Doble's document is considering information relative to vacuum hold times relative to pressure and hold time after filling. After discussion, it was the Group's consensus that this Guide should provide guidance for vacuum times, which might be applied at various steps in the process.

Volunteers were requested to assist in further review of several aspects of the Guide and the following areas were assigned:

- General Format: Peter Balma
- Units and Conversion Factors: Susan McNelly
- Hot Oil Circulation: Donald Chu
- Annex of Acceptance Criteria: Mike Lau

- Insulation Dry-Out: Harold Moore
- Storage: Malcolm Thaden
- General Review: Greg Anderson, David Wallach

There was no other old or new business, and the meeting adjourned at 10:45 am.

7.12.1.3 WEST COAST WORKING GROUP - Michael Lau, Chairman

Michael Lau reported that the West Coast Working Group met on Tuesday, October 7th at 8:00 am with 10 members and 3 guests.

The Chair reported that this Working Group currently has no active projects. A few previously identified projects, such as documents on Wind Generation transformers and transformer shipping were discussed.

It was decided by the Group that work should proceed on a Guide for transformer shipping considerations. The Chair requested a collection of information and efforts to be made for the definition of a Scope of the project prior to the next meeting

The meeting adjourned at 9:20 am.

Joe Watson asked Michael Lau if the Wind Generation document was also moving forward. A brief discussion was held by the Subcommittee on the common practice of off-the-shelf padmount transformers being utilized for step-up applications at wind generation sites and the lack of understanding in this application's performance requirements. Following this discussion, it was agreed to also proceed with a document for wind generation and similar distributed generation step-up applications. Bippen Patel also suggested that we should search to see if IEC Standards exist for windfarm applications.

7.12.1.4 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 6, with 31 in attendance. There were 18 members and 13 guests. None of the guests requested membership.

The minutes from the Raleigh meeting were approved as submitted.

Copies of the Draft Guide for the Layout, Design and Construction of Control Cabinets for Power Transformers were handed out to those who did not have copies. The scope, purpose, references and definitions were briefly discussed.

Cabinet construction was discussed in great detail, beginning with the types of cabinets available, from NEMA 3R to NEMA 4X. The thickness of the cabinet and doors is listed as 3mm in the Draft. The group questioned this, and Steve Schappell volunteered to help with the material section. It was mentioned that there needs to be more information on exterior coatings, and C57.12.28 was mentioned as a reference that should be added. Also, a question was raised about the recommended type of stainless steel for control cabinet construction, and it was pointed out that the definition of NEMA 4X should be consulted. Tim Huff volunteered to find out what is available from European manufacturers.

The group discussed swing panels, specifically latches for the panels and covers for any "live" parts on the rear of the swing panel. The question was raised as to what voltage level should require protective covers. It was mentioned that the Draft may need a separate section detailing protection. Hurricane-proof doors were mentioned as a needed option, and that the Draft needs to define "sturdy" in Section 4.6.

Different environments were discussed, including coastal, normal, and explosion-proof. Joe Watson will address this in the next Draft. It was suggested that Section 4.7 specifically state that conduit shall not enter the top of the cabinet. Section 4.8 needs to list types of removable plates, including aluminum, mild steel, and stainless steel. Greg Anderson volunteered to work on Sections 4.7 and 4.8.

The need for Section 4.9 was questioned – is it a duplication of NEMA? Steve Schappell volunteered to help with Section 4.10 on mounting. The group discussed Section 4.12 concerning lights, specifically whether a manual switch should be required in addition to the door switch. It was decided that this should be an option. Steve Schappell volunteered to help with Section 5 on components, and Joe Watson volunteered to work on Section 6 concerning modular cabinet designs.

The meeting adjourned at 12:15 pm.

The Chair also reported that the PAR would be requested for this project and that since a key goal of this document is to produce a code for specifying the various options under standard control cabinet designs, a Guide may not be the appropriate type of document. In conversations with Committee officers following the Task Force meeting, it was determined that a Trial Use Standard would be more appropriate, and the PAR will be requested as such.

7.12.1.5 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 6th with 15 members and 26 guests attending.

It was announced at the meeting that IEC 60214-1 is published and is now available from IEC. It covers resistive and reactive load tap changers and de-energized tap changers. Since an IEEE Standard and an IEC Standard covering tap changers exist today, merging these two documents and obtaining a dual logo on one Standard will be difficult. Craig Colopy proposed to have IEEE focus on review of the IEC document with the intent to adopt the bulk of it. This agrees with the discussion held at the Spring 2003 meeting in Raleigh, NC.

Testing is covered in IEC 60214-1, while application is covered in IEC 60214-2, which is close to completion. Mr. Colopy recommended waiting for completion of 60214-2 before bringing it into IEEE with the purpose of creating its own document. It has been suggested that testing would be covered in IEEE C57.131.1 and the application covered in IEEE C57.131.2. The PAR would have to be revised to change from C57.131 to C57.131.1. A PAR was taken out for C57.141, which would have covered application. That PAR expires soon with action to be taken by November.

It was approved unanimously by the Working Group to have Draft 1 created by using a copy of the published IEC 60214-1 document. The Draft would be circulated among members along with a comment form to be used for suggested changes. There were no known issues with using the IEC document as a starting point. Dieter Dohnal will check IEC on this. Mike Culhane provided a summary of the direction that the de-energized tap-changer Task Force is taking, relative to combining the requirements if IEC 60214-1 with Phil Hopkinson's proposal for a functional life test.

Jim Harlow has asked the Group to revisit the power factor requirement for the breaking capacity test when work commences on the new Draft.

Red Hager nominated Craig Colopy as Vice-Chair and Mr, Colopy accepted. The meeting adjourned at 2:10 pm.

A lengthy discussion was held by the Subcommittee on the direction for the Working Group to take for this Standard. Jin Sim pointed out that IEEE would not support –1 and –2 suffixed documents, as is the practice of IEC. He also pointed out that the IEC can vote on and accept IEEE documents, but the IEEE does not normally vote on and accept IEC documents.

Jin Sim suggested that the Subcommittee should provide a clear direction to the Working Group on this issue. After discussion, Mr. Sim offered the following motion that was subsequently passed by the Subcommittee:

"motion to guide the working group to proceed with developing the guide, C57.141, with the following information as the basis.

- IEC 60214-2 draft
- Functional life test information available from Phil Hopkinson
  I also move to guide the working group to proceed with revising the standard, C57.131, with the increased scope to include the DETC and a new title "IEEE Standard Requirements for Tap Changers"
- The reason for this is that members of the IEC working group clearly indicated that they do not want to include the functional life test information in the standard or the guide. One other reason I stated is that the IEC document will not be finalized for another year or more and we do not want to hold up our process."

7.12.1.6 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 Tuesday, October 7, 2003 in Pittsburgh, PA with 71 in attendance. There were 38 members and 33 guests.

After introductions a brief discussion of the latest draft's status was held. The Chair reported that only two sections remain outstanding, Bushing CT's and Shell form transformers. Eric Davis of Burns & McDonnell volunteered to help with bushing CT's. Input on Shell form transformers should be submitted by Juan Therie shortly.

The current draft will be submitted to the Standards Editorial staff once clauses have been re-ordered in a more logical sequence.

Discussion from the floor:

- Don Platts noted that there are conflicts between what was written and quoted references. Contributors will be asked to reconcile these.
- Tom Lundquist suggested that chairman be sure the Working Group is part of Ballot Pool. This will be done.

The meeting was adjourned at 4:30 PM.

7.12.1.7 TASK FORCE FOR FUNCTIONAL LIFE TESTS OF DE-ENERGIZED TAP CHANGERS – Phil Hopkinson, Chairman

Phil Hopkinson discussed his Task Forces work during the Subcommittee's discussions following William Henning's report. The following written report was submitted:

The Task Force on Life Tests, De-energized Tap Changers was called to order at 9:30 am on October 7th. There were 52 attendees composed of 24 members, 8 new members and 20 guests. The agenda for the meeting was reviewed and the minutes from the March 18, 2003 meeting in Raleigh, NC were approved. This Task Force is now under the Power Transformers Subcommittee.

The Mission of the Task Force is to develop a functional life test and report for de-energized tap changers. The Chair presented a scope (as follows) for the functional life test and reviewed his testing results that were presented in a previous meeting.

Functional Life Tests:

A functional life test shall be performed as a Type Test to demonstrate the adequacy of the contact design to achieve long stable thermal life. The test consists of thermal cycling at accelerated current and temperature, with daily cool-down cycles. A successful test is completed if contact resistance remains within 25% of the original value and stability is achieved.

The test is conducted by passing twice rated current through the contacts for 8 hours per cycle at ambient temperatures of 130°C.

A total of 30 of the 8-hour on and 16-hour off cycles (days) are required to complete the functional life tests.

A report on testing by Cooper was presented by M. Culhane and Deiter Dohnal provided similar data from testing by Reinhausen. Results indicate that only silver-silver contact surfaces currently pass this test.

A report on Reinhausen's testing will be presented by Dieter Dohnal at the next meeting.

The meeting adjourned by the 10:45 scheduled time.

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

Javier Arteaga presented the report for the Working Group for revision of C57.12.10.

The meeting was called to order shortly after 2:00 pm on October 7th with 8 members, 5 new members and 10 guests present.

The minutes from the Raleigh meeting were approved.

The focus of this meeting was to review the accessory requirements in the construction section.

- The Tap Changer will be identified as a De-energized Tap Changer. A clarification will be made for the operating handle location requirements.
- It was noted that accessory requirements for conservator style tanks needs to be added to the Standard since there is no upper kVA limit identified in the Scope.
- The sizes of the various indicators will be identified as minimums. Scale ranges and contact settings need to be reviewed to reflect current technology.
- The winding temperature indicator section will be updated as progress is made in the separate Working Group focusing on winding temperature indicators.

Action Assignments

- Tom Lundquist will review the accessory sections with respect to conservator tank designs. Jin Sim will provide input to Mr. Lundquist.
- David Aho will provide a review of the remaining accessory items for sealed tank designs.
- Jane Verner will review current technologies of gauges and provide suggestions on rewriting specific sections.
- Javier Arteaga will e-mail the revised Draft to everyone in attendance for review.

The meeting adjourned at 3:00 pm.

7.12.1.9 WORKING GROUP ON THE APPLICATION OF ON-LINE MONITORING TO LIQUID IMMERSED TRANSFORMERS AND COMPONENTS- Donald Chu and Andre Lux, Co-Chairpersons

Donald Chu reported that the Working Group for the Application of Monitoring to Liquid-Immersed Transformers and Components met on Tuesday, October 7th with 47 attendees.

A brief discussion was held on the status of the Guide. All revisions have been made and the Guide is ready to be sent out to the Working Group membership to solicit comments, within one month. Comments will be discussed at the next meeting in San Diego.

Some discussions were held on what information the Users would like to see in the Guide. The following information was requested to be included:

- Status and discussion of present sensor and monitoring technology
- Measurement parameters and how they can be used in diagnostic algorithms

- Diagnostic algorithms and how they can be used to give a status to the health of the equipment
- Parameters which must be measured to implement algorithms
- Lessons learned from utilities who have implemented monitoring systems
- Minimum hardware specifications

The meeting adjourned at 3:45 pm.

7.12.2 OLD BUSINESS

Red Hager reported that the Working Group for IEEE 693 will be meeting in San Diego in the near future and he will attend the meetings.

Tom Lundquist reported that a Task Force will be recruited for revision of C57.135, the Phase Shifting Transformer Guide. Members of the previous Working Group and others submitting comments during balloting, as well as any users of the Guide since its' publication will be sought out to review the document to see if revisions are needed.

Wally Binder presented results on the reaffirmation of C57.117 and C57.125. Both were still open to ballot and in-progress at the time of this meeting. As of October 4th, both ballots are 25% complete.

7.12.3 NEW BUSINESS

Ernst Hanique gave a presentation on testing the natural frequency of power transformers. **(Ernst – Can you e-mail me a copy that we can post on the Transformer Committee website?)**

The meeting adjourned at 2:45 pm.