7.6 POWER TRANSFORMERS – TOM LUNDQUIST, CHAIRMAN

The Power Transformers Subcommittee met on Wednesday, April 13th 2011 at 1:30 p.m. A quorum was present with 56 members and 125 guests.

The minutes from the fall 2010 meeting in Toronto, Ontario, Canada were approved with no changes.

The chairman asked if anyone was aware of any patent conflicts, none were voiced.

7.6.1 WORKING GROUP AND TASK FORCE REPORTS

7.6.1.1 TASK FORCE FOR REVISION OF C57.17, REQUIREMENTS FOR ARC FURNACE TRANSFORMERS – Domenico Corsi, Chairman

Bob Ganser reported that the TF for this project did not meet.

7.6.1.2 WORKING GROUP FOR DEVELOPMENT OF PC57.143, GUIDE FOR APPLICATION OF MONITORING TO LIQUID IMMERSED TRANSFORMERS AND COMPONENTS – Donald Chu and Andre Lux, Co-Chairmen

Tony Pink reported that the WG did not meet. The Guide has been balloted and is currently in ballot resolution.

7.6.1.3 WORKING GROUP FOR DEVELOPMENT OF PC57.148, STANDARD FOR CONTROL CABINETS FOR TRANSFORMERS – Joe Watson, Chairman

Joe Watson reported that the WG did not meet. The document was balloted shortly before the Toronto meeting and one recirculation was issued and received. There are only a few issues that need further revision to address all of the comments and a 2nd recirculation should be issued for balloting on these changes in late April or early May

7.6.1.4 WORKING GROUP FOR DEVELOPMENT OF PC57.131, STANDARD REQUIREMENTS FOR TAP CHANGERS - William Henning, Chairman

William Henning reported that the Working Group on Tap Changer Performance met on Monday, April 11, 2011 at 1:45 pm with 12 members and 32 guests present. There were introductions and a call for patents. A quorum was present, and the minutes were approved.

The main subject for discussion was the recirculation of Draft 1.6 of C57.131. The recirculation opened on April 8 and closes on April 28. The working group chairman gave a report on the recirculation. Part of this was to read from a list of all the changes made since the initial ballot. This was done to give the entire working group, and the guests present, an idea of the nature of the changes.

At a time prior to the working group meeting, a balloter pointed out that the posted copy of the draft does not, itself, show the changes. The balloter requested that change tracking be added to the document to make it easier to know the changes.

This subject was discussed at the working group meeting. The possibility of posting a list of changes, instead of modifying the document, was also discussed. No strong conclusions were reached in these discussions.

The meeting was adjourned at 2:40 pm.

After the working group meeting, the chairman discussed this subject with the IEEE liaison for the project. She indicated that one option is to upload a red-lined copy of Draft 1.6 and extend the closing date.

On April 20, 2011, a red-lined copy was uploaded. At the same time, the closing date was extended to May 8, 2011.

7.6.1.5 WORKING GROUP FOR DEVELOPMENT OF PC57.150, GUIDE FOR THE TRANSPORTATION OF TRANSFORMERS AND REACTORS RATED 10,000 KVA OR LARGER –Greg Anderson, Chairman

Greg Anderson reported that the WG did not meet. The document is nearly complete and a straw ballot of the WG will be held before balloting.

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

Phil Hopkinson reported that the TF on Functional Life Tests of DETC's has completed its' work and it has been determined by the SC that they will request a PAR and become a WG for the development of a Guide. The WG should have its' first meeting in Boston.

7.6.1.7 WORKING GROUP FOR REVISION OF C57.135, GUIDE FOR THE APPLICATION, SPECIFICATION AND TESTING OF PHASE-SHIFTING TRANSFORMERS – Jin Sim, Chairman

Jin Sim reported that the WG for the revision of C57.135, the Guide for the Application, Specification and testing of Phase-Shifting Transformers did not meet. The revised Guide was balloted and a resolution committee has met twice to resolve the comments. A recirculation should be issued within the next couple of weeks.

7.6.1.8 WORKING GROUP FOR REVISION OF C57.12.10, STANDARD REQUIREMENTS FOR LIQUID IMMERSED POWER TRANSFORMERS – Gary Hoffman, Chairman

Gary Hoffman reported that no meeting was held. The document was published January 6, 2011.

An Errata is in-process to fix an error to Table 4 for the Item Terminal Blocks.

No further action is expected for three years to give the industry time to use the document.

7.6.1.9 WORKING GROUP FOR THE REVISION OF IEEE STD 638-1992, IEEE STANDARD FOR QUALIFICATION OF CLASS 1E TRANSFORMERS FOR NUCLEAR POWER GENERATING STATIONS – Craig Swinderman, Chairman

Craig Swinderman reported that the Working Group for revision of IEEE 638 did not meet during the San Diego session in April 2011.

The revision of the document has been completed, and the document will be issued for editorial review and balloting in the next few weeks.

Results of the ballot should be available before the next meeting in October 2011.

7.6.1.10 WORKING GROUP FOR DEVELOPMENT OF PC57.153, GUIDE FOR PARALLELING TRANSFOREMRS – Tom Jauch, Chairman

Tom Jauch reported that the WG met on 4/12/2011, at 3:15 p.m. with 47 attendees. 16 of 27 members were present with 31 Guests. 3 people requested membership (2 met the requirements of attending the last two meetings and were added)

Introductions
No Patent issues
Minutes were reviewed and approved
Prior to the meeting a draft of the guide containing the first 5 sections was sent out for review. The first 5 sections include:

1. Overview
    - Scope
    - Purpose
2. References

3. Definitions
    - Example system configurations being considered in the guide
4. Basic paralleling information
    - General applications – system configuration
        - Distribution
        - Network intertie
        - Distribution substations with generation
    - Reasons for parallel operation
    - Basic tap changer control - voltage control
    - Consequences of improper paralleling
    - Transformer requirements for parallel operation
5. Requirements of the Paralleling Control System
    - Basic responsibility of the control system
        - Maintain the same tap position (transformer turns ratio) of all paralleled transformers
        - Minimize the current difference between transformers
        - Minimize the reactive current difference between transformers
        - Equalize the paralleled transformers load power factors.
    - System configuration

Comments and proposed changes received in written format prior to the meeting were reviewed:

- The chair gave a brief presentation on circulating current using an example of two transformers with the low side breaker closed and the high side breaker in both the open and closed position.
- Proposal was made to add a definition of circulating current - Karsten Viereck (Reinhausen) to prepare
- Proposal was made to add a paragraph to the power factor method section – Karsten Viereck to provide this additional information in 3 weeks.
- Steven Anthony – Pepco Holdings volunteered to review and modify the drawings in the guide document to ensure all sections use a similar look
- Several members commented the document should reference C57.12.80 for definitions of the acronyms used in the document.
- The working group felt the language to describe the section on LDC-Z needed to be revised. Steve Averitt – Reinhausen Mfg volunteered to write an alternative paragraph
- Motion was made and accepted to change the following wording:

  Present text - This paralleling guide describes and compares control methods and operations of paralleled power transformers equipped with load tap changers (LTC) or series regulators.

Proposed text - This paralleling guide describes and compares control methods and operations of paralleled power transformers with load tap changers (LTC) or step voltage regulators.
Vote taken – motion passed.

- Group was reminded that our PAR expires in 2012 and we still have a lot of work to do.

A motion to adjourn was approved and the meeting adjourned at16:25 p.m.

7.6.1.11 TASK FORCE FOR TRANSFORMER TANK RUPTURE AND MITIGATION – Peter Zhao, Chairman

Meeting of the Task Force for Tank Rupture & Mitigation convened Monday morning at 11:00am. Chairman Peter Zhao presided.

The Patent policy was displayed and discussed. There were no acknowledgements of patents of concern.

Attendance was 102 (17 members, 85 guests, with 8 guests requesting membership). Chairman Zhao provided introductory remarks and previewed the agenda to be covered for the meeting.

The PAR for the guide has been approved by Ad Com and now will be sent to IEEE for final approval. The objective of the meeting was to make progress on the document in anticipation of PAR approval.

Sections 4.3.1 and 4.3.2 recent additions were reviewed. Don Chu questioned the basis for the numbers provided for arc voltage and arc energy, and stated that Owner should only be responsible for providing available fault levels and voltages. Martin Heathcoat stated a significant value of the guide will be as a tool by which design reviews can verify adequacy of manufactures design for withstanding internal faults without rupture. The fact that relevant numbers are hard to derive is all the more reason that the Guide is needed to provide a rational basis for assuring adequate design.

It was suggested that the Guide be segmented: Most of section 4.3, since it is tutorial in nature, should be moved to an annex, to be referenced in the main body of the guide. Don Chu predicted that a draft of the guide that includes such numbers as presently included in the main body of the document will draw strong negative opinion/ballots. Izyaslav Polishchuk of Hydro One expressed a need for retaining the numbers as charts referenced in an annex.

Several Users agreed that numbers should reflect an assumption that first level breaker protection/isolation fails, taking more time for secondary breakers to operate. Also that a method of deriving relevant numbers must be included in the guide.

Don Chu suggested issuing the document as a 'trial use guide', with methodology and equations for deriving results. Dependence should be on formulas, and not tables, which should remain as examples of what others have derived for particular cases. In regard to the new chart addition to 4.3.4, Martin Heathcoat explained that the unpopulated chart was included to hold the spot for numbers he expects to obtain before the next meeting.

Isy Polishchuk indicated that Hydro One derived a chart many years ago, and has recently revised the numbers. 40% margin included in section 4.3.9 was questioned. Bill Darovny indicated that margins should not be included in this document and that it is the business of manufacturers to add margins according to their own criteria. Practicality of manufacture's testing to validate the adequacy of design was discussed and the consensus was that destructive tests for a power transformer of any significant size would be impractical and cost prohibitive. Martin Heathcoat suggested that such a test on a larger transformer may be equated to short-circuit testing. Paulo Avelino of Siemens suggested that a model should be established - then verified by testing. Tom Lunquist inquired as to whether Hydro One has done such a test. The answer is that actual testing has been done only on distribution class transformers.

The meeting was adjourned at 12:15p.m.

7.6.1.12 TASK FORCE FOR DVP-GRID TRANSFORMERS – Hemchandra Shertukde, Chairman

Hemchandra Shertukde reported that the Task Force met in the Boardroom of the Catamaran Resort Hotel. The meeting was called to order at 11:00 a.m.

The meeting was convened with 12 members (out of current 23 members) and 23 guests present. The TF did have a quorum.

The IEEE patent recommendations were addressed, no patents or patent claims were identified in relation to the work of TF.

<u>Old Business</u>
Toronto's meeting minutes were approved.

<u>New business.</u>
TF discussed the draft of TF's Position Paper.

- Title of the position paper was revised and it is "Consideration for transformers applied in Distributed Photo-Voltaic (DPV) Grid application".
- Introduction
    - It was confirmed that the residential and industrial type photo-voltaic systems are covered with this Position Paper.
    - Position Paper covered single-phase and 3-phase units.

- Existing Standards and areas of differentiation of DPV-GT.
    - Position Paper summarizes the input of the TF members on the reviewed existing standards in order to identify how the problems, perceived for DPV GT, are covered with the exiting standards and identify areas of differentiation.

    - This summary was reviewed. Some DPV GT differentiation points were discussed:

    - LTC in case of an inverse power flow – additional note added to the Position Paper highlighting this aspect of the application.
    - Harmonics – the consensus of the TF was that, generally, the high harmonic level is not expected in this application, but this aspect shall be specifically reviewed at the specification stage.

    - Than TF moved to review the Power Subcommittee assignment to Task Force one more time.
        - The TF consensus was that the Position Paper shall be presented to the PT SC with proposal that work be continued and WG is formed.
        - The opinion split on whether the TF would recommend the proposed WG to work towards Standard or User's Guide.
        - After short discussion, the motion was proposed by D. Ayers and seconded to support establishing of the WG working on the Standard. The chairman conducted the vote to gauge the TF opinion and the motion passed.
        - Then TF returned to the discussion with PT SC chairman Tom Lundquist emphasized that TF shall yet to come up with the convincing evidence that the Standard on DPH GT is indeed necessary.
        - The arguments for the Standard included: the guide may contain the optional recommendations which, sometimes, confusing for the users; DPV GTs have special winding configurations; residential use PH GT may require addressing specific safety issues, etc.
        - The arguments for the Guide included: in contrast to the transformers for wind power generation, the solar generation farms are usually better protected and less accessible to public, which resulted in less specific protection requirements; the inverter between generation and step-up transformer may solve the protection and regulation issues; transformer may often be a part of the inverter package, etc.
        - TF decided that the Chairman will circulate the TF survey on whether a standard or a guide is the preferable direction to continue the work. After that the decision shall be taken on what recommendation TF provides to the PT SC. One more meeting of Task Force is planned in Fall 2011 in Boston.

With no further business, the meeting was adjourned at 12:15 am.

7.6.1.13 WG for Revision of C57.125 Guide for Failure Investigation, Documentation, Analysis and Reporting for Power Transformers and Shunt Reactors - Wallace Binder, Chairman

Wallace Binder reported that the WG held its' first meeting on Monday, April 11, 2011.

1. Introductions – As this was the first meeting of the Working Group all present were invited to be members or elect not to be members on the sign-in roster. 89 were present, of which 31 requested membership.
2. Patent Disclosure Announcement – The Patent Disclosure Slide Presentation was made by the Chair. No patent disclosures were made.
3. Chairman's Remarks – (Wallace Binder) Chair reviewed the history of C57.117 Guide for Reporting Failures and the subsequent document C57.125 Guide for Failure Investigation, Documentation, and Analysis for Power Transformers and Shunt Reactors
4. Approved PAR & Scope – Chair displayed and reviewed the PAR and the Scope contained in the PAR.
5. Ballot results from 2009 Reaffirmation Ballot were presented
    - Comments from Ballot of 2009 were reviewed and the Chair asked for volunteers to resolve those in the two groups previously designated "Requires Resolution" and "New Work" as well as coordination of "Changes to C57.117" which will merge the thoughts and philosophy of the 117 Guide into the C57.125 Guide.
6. Presentation of Draft 1 – (WG Secretary, John Roach) Chair indicated that John had volunteered to finish the clean-up of the old language into the latest IEEE format after which the draft will be posted on the Transformers Committee Web Page.
7. Under New Business there was discussion of "Statistical Analysis" and the need for it in the Guide. Discussion included NERC requirements and methodologies. There are thoughts that the Guide could be used to meet NERC methodology requirements. It was reported that NERC only requires that utilities have a methodology for reporting failures.
8. A Work Plan was listed and a request for contributions made to cover the following topics:
    - Bibliography/References
    - Proofread / Eliminate duplication between the two guides
    - Structure of combined work
    - Outline of New Guide
    - Comments outstanding from ballot of 2009
    - Drafting/photos of illustrations
    - NEW WORK

7.6.1.14 WG for Revision of C57.140, the IEEE Guide for the Evaluation and Reconditioning of Liquid Immersed Power Transformers - Rowland James Chairman

Rowland James reported that the WG met on April 12, 2011, at 1:45 p.m.

The IEEE Patent Disclosure policy was reviewed. No patents were disclosed.

Volunteer Assignment for C57-140 Revision by Section, attachment of volunteers

Assigned section revisions due August 2011.

Brian Sparling agreed to conduct CIGRE presentation at Fall 2011 meeting on Transformer Maintenance Brochure A2-WG34.

7.6.1.15 TF for Revision of C57.116, the Guide for Transformers Directly Connected to Generators – Timothy Raymond, Chairman

Tom Lundquist reported that the Guide was balloted for reaffirmation, but some comments raised substantial technical issues that may require the Guide to be revised and then re-balloted as a revision to the Guide rather than a reaffirmation. The Chair will review the options.

7.6.2 OLD BUSINESS

None

7.6.3 NEW BUSINESS

The Wind Farm TF Chaired by Dave Buckmaster was moved to the Performance Characteristics SC and will continue its' work under that SC

Phil Hopkinsons TF on the DETC will request a PAR to develop a Guide – The new WG should hold its' first meeting at the Boston meeting this fall.

The meeting adjourned at 2:30.