7.6 POWER TRANSFORMERS – TOM LUNDQUIST, CHAIRMAN

The Power Transformers Subcommittee met on Wednesday, March 10th, 2010 at 1:30 p.m. with attendance of 167; comprised of 59 members and 108 guests.

The minutes from the Fall 2009 meeting in Lombard, Illinois 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

The document was submitted to IEEE for editorial review. With the editorial review now complete, the document is ready to be sent out for ballot.

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

A meeting was not held.

Status of ballot resolution:

- Ballot resolution committee convened 16 times since the ballot closed in mid year 2009.
- At the present time we have resolved 414 of the 426 comments (97%).
- The outstanding issues to be resolved all reference the annex section on communications.

Next steps:

- Close out the existing ballot process.
- Open a new ballot pool.
- Complete resolution to the issues in the annex section.

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

The WG did not meet since the Standard was out for balloting during the meeting. Volunteers from the WG will be drafted to help resolve any negative ballots that may occur.

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

The Working Group on Tap Changer Performance met on Monday, March 8, 2010 at 1:45 pm with 5 members and 13 guests present.

The working group chairman asked if anyone in the room had information on patents that may be essential for the implementation of C57.131, *Standard Requirements for Tap Changers.* It was noted that no one present at the meeting expressed knowledge of essential patents.

The working group chairman asked if there were any additions or corrections to the meeting minutes of October 26, 2009. There being no corrections, the minutes were approved.

This brought the working group to the main subject of its agenda: ballot results and comment resolution of Draft 1.5 of the C57.131 revision, *Requirements for Tap Changers.*

The ballot tally was:

117	people in the ballot group
82	affirmative votes
7	negative votes
0	abstentions
89	votes returned (76% return rate)
82	approved (92% affirmative vote)

130 comments were received. Resolution of the comments will require changes to the document and will result in a recirculation ballot. Many of the comments were duplicate or covered different aspects of the same issue. These comments were combined to create a list of 68 issues, concerns, and corrections. Each of these needs to be addressed with a response.

A comment resolution committee was formed. It has five members at present. The working group chairman will contact a few working group members who were not present to see if we can add one or two more.

The 68 issues, concerns, and corrections ranged from simple corrections, like hyphens, quotation marks, and omissions, to fundamental disagreements about the numbers and quantities specified in the requirements. Many of the concerns address a need for clarification by adding words, phrases, and notes to the current text.

Most of the comments are straightforward, and the response should be straightforward. The remaining time allotted to the working group was spent in discussion of a few

comments selected for discussion because they are not straightforward. The meeting was adjourned at 3:00 pm.

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, Chair of the Working Group for Transportation Issues Guide, PC57.150, called the meeting to order at 3:21 pm. Also present was the Vice Chair Ewald Schweiger and Secretary Susan McNelly.

There were 18 of 32 members present with 57 guests and 9 guests requesting membership. Only guests requesting membership that actually participate in the effort to get the Guide to ballot at this point would be considered for membership. At this time, only one of the guests (Diego Robalino) requesting membership will be considered for addition to the WG pending follow-through on his volunteering to provide substantive review of the overall guide.

Agenda:

1. Introductions/Roll Call
2. Patent Issues
3. Approval of Fall 2009, Lombard, Illinois Minutes
4. Status and steps ahead
5. Review of Contributor List
6. Adjourn

Member Roll Call was done. Results are provided above.
The IEEE Patent disclosure requirements were discussed and a request was made for disclosure of any patents that may be related to the work of the WG. There were no responses to the request for disclosure. Sue McNelly indicated that Rickmers has indicated that they will provide an updated Figure of the six degrees of motion. They indicated that there is no copyright requirement for the figure.
Approval of minutes from the Fall 2009 Lombard, Illinois meeting was requested. A motion was made and seconded. The motion was approved.

Greg summarized the status of the Guide. The Guide is approximately 90-95% complete.
Greg introduced the following guests present to talk to the group on ocean and rail shipping logistics.

Peter van den Berg – Rickmers-Linie (ocean)
Steve Garifalos – Rickmers-Linie (ocean)
Jerry Collins – Kavanagh Logistics Managements (rail)
Glenn Kavanagh – Kavanagh Logistics Managements (rail)

Presentation by Rickmers-Linie – Peter van den Berg

Rickmers has nine ships that operate worldwide. The ships have 320T cranes and can combine these for a maximum of 640T lifting capability. A video showing the pitching and rolling that these ships can see was presented. He discussed the 6 degrees of motion that a ship can see.

The influence of a ship's size and speed in relation to length and speed and the associated acceleration values were presented.

Transformers to be transported over the ocean may need to be capable of shoring to prevent tipping of the equipment. This needs to be considered in the design of the equipment. Transformers with waffle type bases can be problematic in the event of tipping.

Presentation by Kavenagh Logistics – Jerry Collins and Glenn Kavanagh

Jerry Collins gave a presentation on the North American railroad consolidations that have resulted in only 7 remaining railroads (BNSF, Canadian National Railway, Canadian Pacific Railroad, CSX Transportation, Kansas City Southern Railway, Norfolk Southern Railway, and Union Pacific Railroad) as well as marketing and pricing changes that are being seen. The US railroads were deregulated in 1980 (Staggers Rail Act).

Glenn Kavanaugh gave a presentation on the rail clearances and clearance parameters. Safety margins have been increased and equipment that may have previously cleared may not today. More time is required to obtain clearances and some railroads are now charging for clearance requests. Critical items are width/height, width at top and bottom, offset centers of gravity, restrictions are very route specific, and each railroad has its own clearance criteria.

Optimizing Rail Operations is a priority with the railroads. Dimensional shipments are disruptive and transit times are unpredictable. Railroads hold hi-wide cars to consolidate them and special trains now are being required more often for multiple speed restrictions in the route. A current decline in volume has not helped.

He also indicated that special rail cars are in limited supply and need to be arranged for in advance.

A request for draft document reviewers to look at the document from start to finish looking for duplication of information and organization of the document was made. Martin Heathcoat, Dick Amos, and Diego Robalino volunteered to do a general review of the document.

Meeting was adjourned at 4:23 pm.

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

The Task Force on Life Tests, De-energized Tap Changers was called to order at 9:35 AM on March 9, 2010. There were 44 attendees, 21 members, and 23 guests with 1 requesting membership. A quorum was not present. This TF has been in existence for a number of years. According to the roster there are 113 members. Regular attendance at meetings has been much lower – approx 25 members and 25 guests. A message will be sent to the members using the listserv to confirm membership on the TF. There were no patents to disclose. Reviewed the Agenda for the meeting, and the Minutes from the October 27, 2009, meeting in Lombard, Illinois, were approved.

1. Presentation by Larry Dix on Functional Life Test

   Explored significant aspects important to each manufacturer when conducting the test.

2. Paper review of Comments by Bengt-Olof Stenestam

   General view of the functional life test
   Uncertainties
   Statistical variations
   Acceptance criteria
   Start resistance – difference between new contacts and old contacts

3. Comments by Reinhausen and others were not addressed due to time constraints.

4. Tentative paper

   Posted on the IEEE website. Members are requested to review the paper and to determine
   - Authors
   - Venue: Panel Session or Transaction
   - Timing

   It is intended for a reference in C57.131 to the paper. Could be published with a number as a trial-use guide, which would make it easier to find.

5. New Business: There was no new business.

The meeting adjourned at 10:45 AM.

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

The Working Group met on Tuesday, March 9th, 2010 with a total of 13 in attendance. The group's membership is 31 so a quorum was not reached. The latest draft had been distributed to the group for a straw ballot and to the IEEE for Mandatory Editorial Coordination and the comments from those reviews were discussed. The group discussed all of the IEEE recommendations and as many of the technical comments as possible during the meeting time and the consensus opinions of those discussions will be submitted to the full group via e-mail within the next couple of weeks for official resolution.

There were no objections to implementing all of the IEEE editorial review comments which covered standard formatting, the inclusion of an Abstract and Key Words, normative references and reference citations. All referenced citations will remain, but the reference to IEEE 100 will be deleted and the other references that are not cited in the body of the document will be moved from the Normative reference section to the Bibliography. The discussions also led to a recommendation to include dual IEEE/IEC standard references for all reference citations in the text and to include the IEC standards in the Normative reference section as well.

Several graphical formatting issues and some figure numbering errors were pointed out by the straw ballot review and the group recommended their corrections. The use of the terms "primary" and "secondary" were questioned in the comments from the review and the group recommended that the document be reviewed to be consistent in using "S" and "L" to describe the PST terminals and to only use "primary" or "secondary" where they do not refer to the PST terminals (such as "CT secondary wiring…").

The discussions of the technical comments from the straw ballot review focused on the need to include a requirement for the specifier to include any requirements that they may have for phase angle shift under load. Further discussions showed that the specification of phase shifting transformers has other criteria to consider as well, particularly if the phase shifter is required to match the operating properties of other PST's for applications like parallel operation or replacement of existing units. Mr. Sanjay Patel volunteered to draft a paragraph to include under Section 12.3 and as a brief tutorial under Section 4.8.1 to cover the details.

Jin Sim, Sanjay Patel, Joe Watson and Tom Lundquist will discuss the few remaining technical comments within the next week via conference call and include further recommendation for their resolution in the e-mail ballot.

The proposal to be put forward to the full group by e-mail will be:

- To accept the IEEE editorial review formatting and document style comments
- To add to the normative references
    - IEC 60076-1, 60076-3 and 60076-5 and include as dual references whenever C57.12.00 or C57.12.90 are cited
    - IEC 60076-7 and include as dual references whenever C57.91 is cited

    - IEC 60137 and include as dual references whenever C57.19.00, C57.19.01 or C57.19.100 are cited
    - No IEC standard will be dual-referenced for C57.12.10
- To keep the following standards in the Normative references
    - C57.12.00 w/o the date reference
    - C57.12.10 with the date reference (list in Clause 7)
    - C57.12.70 w/o the date reference (list in Clause 7)
    - C57.12.80 with the date reference
    - C57.12.90 w/o the date reference
    - C57.19.00 w/o the date reference(list in Clause 7)
    - IEEE 693 w/o the date reference
    - C37.90.1 with the date reference
    - C57.131 w/o the date reference (list in Clause 7)
- To move the following standards from the Normative references to the Bibliography
    - C92.1
    - C57.93
    - C57.19.100
    - C57.19.01
    - C57.91
- To delete IEEE 100 from the Normative references and do not include in the Bibliography
- To change the word “specifical” in the Abstract to “specific”
- To renumber Figure 4 on page 16– it should be Figure 5
- To reformat the figures and equations per Mathieu Sauzay comments
- To include the additional text under sections 4.8.1 and 12.3 (phase shift under load, impedance, control, etc). The revised document will be included with the proposal
- To move second sentence of 3.1 to end of 4.2
- To approve the revisions dealing with the terms “primary” and “secondary.”
- Bibliographic citations in the body of the document will be redone per the recommendation

Note that a revised draft will be attached with the e-mail proposal for review, and additional recommendations may be included following the review of the remaining technical comments.

Having no quorum, the meeting was unable to adjourn.

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

1. No meeting was held.

2. The Ballot Resolution Committee has completed their work and submitted their review and recommendations to the Chair.

3. Proposed Time Table for Re-Circulation is as follows:

    - The Chair will be getting in touch with negative balloters with regard to obtaining agreement with changes proposed which were different from their suggested change.

    - C57.12.10 Draft 5.0 will be edited in parallel and readied for re-circulation

    - Goal is to move the new draft to re-circulation in April

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

Date: Tuesday, March 9, 2010 – 11:00 am to 12:15 pm.

Attendees: 2 members + 5 guests

The meeting began at 11:00 am.

The meeting minutes from the October 2009 meeting were approved.

The IEEE patent policy slides were shown. An opportunity was provided for the attendees to identify or disclose patents that may be essential for the use of the standard. No responses were given by the attendees of the meeting.

Topics discussed:
The latest version of the P638 document is now Draft #6. This latest draft was reviewed during the meeting. The majority of the document is nearly complete, but a few remaining items need to be addressed.

In reviewing section 6.3 of the draft document that describes the Qualification Tests and test sequence, a suggestion was previously made to add Frequency Response Analysis to the list of tests. The latest draft #6 has a total of four points in the test sequence where FRA test is performed on a prototype transformer for qualification. The reason

for including the four separate FRA tests was to perform a baseline FRA test prior to any potentially destructive tests such as the short circuit test and seismic test, and then repeat the FRA test after the completion of both the short-circuit test and the seismic test in order to more accurately determine if any movement of the core or windings has occurred. Since there are not yet any published standards or guides on FRA testing, a note will be added to explain the reason for including the FRA testing in the test sequence, and that interpretation of the FRA testing results should be discussed between the user and the manufacturer.

The current planned schedule for the working group is to have the document finished within the next month. We will then send the document out to working group members for a vote to submit the document for Mandatory Editorial Review in June 2010. At this time we will also start developing a balloting pool for this document. The IEEE PES Nuclear Power Engineering Committee (NPEC) will be included in the list of committees to participate in the balloting pool.

The meeting adjourned at 12:15 pm.

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

Members: 16
Guests: 12
New Attendees Requesting Membership: 4
New attendees requesting guest status: 4
Introductions
No patent issues
Polled the audience to ensure we met quorum requirements
Minutes from fall, 2009 were discussed, motioned and approved
General discussion during the meeting included the following:

- Original par schedule required first ballot in January, 2010 so we need to get this back on track.
- Reviewed proposed outline and asked for comments. A proposal was made to move 2.6 (Reasons for Paralleling) after 2.1 (Definition of Paralleled Transformers). No negative comments so we will proceed with this.
- Under goals of paralleling – a proposal was made to add “Minimize Losses” – No objections so this will be added.
- Phase diagrams should be used as necessary when describing paralleling methods.
- The names and the number of paralleling methods. Presently, the following methods will be covered in this guide:

    4.1 Master / Follower Method
    4.2 Power Factor Method

4.3 Negative Reactance Method
4.4 Circulating Current Method
4.5 Circulating Reactive Current (var Balancing) Method

- The section prepared for Master/Follower was reviewed by the working group. Discussions during the presentation included the following:
    - Follower feedback methods
        - Discussed variations of cam switch inputs that could be used in place of odd/even
        - Other methods used will be considered
- The working group discussed the definition and operation of matched impedances
    - C57.12.10 defines matched impedances as +/-10%. Since our definition of matched impedances differs from what is defined in other standards, we will need to define matched impedances in the guide.
    - The guide needs to identify what base (rating) impedances should be matched at. Matched impedances should allow all transformers to carry their maximum load
    - The effect of manufacturing tolerances needs to be considered. The impedance of "identical" transformers will typically vary by 2-3% (i.e. 10% and 10.2 %). This is the normally acceptable manufacturing tolerance.
    - The version of C57.12.10 presently out for ballot includes examples of impedance matched transformers. Our guide should include the same examples. Dave Harris to follow up.
- The working group decided this guide would not cover the use of a single control to operate multiple phases such as regulators or single phase transformers. This operation, although a Master/Follower type of operation, does not constitute transformer paralleling.

Working group adjourned at 4:30pm.

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

The task force met Monday Mar 8, 2010 at 11:00 AM.

Attendance was 74 (16 members, 58 guests). We did not have a quorum.

Peter Zhao as Chairman presented the agenda.
Knowledge of patent disclosures was requested, none cited.
Peter briefly outlined the past work of this TF and the IEEE paper that was published.
He then explained that one of the next steps was to create a PAR.
He presented a draft of wording for Title, Scope and Purpose that would be used in a PAR. Since there was not a quorum, a vote could not be made. In lieu of this, suggestions as to content were solicited from the attendees.

Concerning the Title, the attendees voted 42 in favour of version 1 and 9 in favour of version 2. Roland James suggested that the words “mineral oil” be replaced by “liquid immersed” as he had to do the same when developing C57.140. Several others had similar suggestions.

Concerning the Scope, it was suggested to add reactors, add topics related to the consequence of rupture, add instrument transformers and add radiators and piping. Tom Lundquist advised that the scope must have content specific to the document and not contain definitions.

Concerning the Purpose, it was suggested to eliminate the first sentence and to simplify and reduce the content.

Tom Lundquist suggested that the TF members only work and agree on the wording for the PAR and resubmit for approval. He also suggested a review of the working group membership to ensure that only the active people are members.

Mark Fota summarized the work on CIGRE TF A2.33 entitled Transformer Fire Safety Practices. This is still in the development phase and includes topics such as fire walls, spill containment and fire suppression systems.

Peter outlined the status of the submissions to the application guide. As it stands, this is an unofficial document because a PAR has not been approved and as such can’t be circulated beyond the participating members. Arnold Carlos gave an overview of the section on acceptance evaluation that was drafted by Dan Perco. Arnold explained that one of the key problems is how to define testing of the final product.

Comments from the floor included how to evaluate whether the relief systems will function after years of service and that certification of the welding should be included.

Peter advised of the upcoming tank rupture tutorial Mar 9 at 4:45 PM

The meeting adjourned at 12:15

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

TF DPV Grid Transformers – Spring 2010 – Houston – Monday March 8

Patent disclosure: no problem raised

Rosters & Quorum:

13 members (out of 20 existing), 8 guests were present. 5 requested membership; 6 attended as observers.

We had a quorum.

Minutes of the previous meeting where approved.

Homework

6 members had done their home work (see completed table below), and 3 proposed to review unaffected standards for the next meeting (see completed table below for both subject coverage and homework). Std 1547.1.3 was corrected to Std 1547.4.
This table shows that, at this stage and unless we discover new subject to be addressed, no subject is totally uncovered.

The question was asked whether anyone had had problem with a transformer directly related to the solar panels. No one answered “yes”.

It was suggested we invite Experts from PV solar panel manufacturers and Inverter pack manufacturers to enlighten us of the technology available in the market.

Joe Watson moved a motion “that we start the drafting of a position paper to list the available standards that influence this application for photovoltaic sites and grid transformers.”

After a discussion about the difference between “position” and “technical” paper, and whether the TF should write one or the other, the motion was approved.

Among other subjects that came to discussions were:

- Do we just provide a list of standard?
- Is this a common issue of distributed generation, whatever the kind of sources?
- Are we at a system or equipment level? We must not forget that we are in the PES Transformers Committee

New business: none

Meeting adjourned at 9:0 am.

7.6.1.13 TASK FORCE FOR WIND GENERATOR STEP-UP TRANSFORMERS – David Buckmaster, Chairman

The Task Force on Wind Power Transformers was called to order at 8:05 AM on March 8. There were 110 attendees, 13 members, 97 guests with 25 requesting membership. A survey of members present was conducted and a quorum was present (13 of 21 official members, excluding 2 corresponding members). There were no patents to disclose. The minutes from the meeting held October 26-27, 2009 was accepted as written.

6. Arc Flash Findings Report

John Crotty reported that the survey circulated received only 1 response. The survey will be re-circulated to the manufacturers and users again to see if it gets more responses.

Switchgear documents may have information on arc flash that may be of interest. Marcel Fortin to identify Switchgear documents for arc flash. This list will be submitted to Phil Hopkinson, who will request the documents from Matt Ceglia for TF use.

7. IEC 60076-16 Progress Report

Paul Jarman, IEC TC14 Chairman, reported that the Committee Draft for Voting (CDV) was circulated and closed in January. It received a positive vote and comments received will be addressed by the IEC WG at a future meeting.

Most of the TF members have not seen this document. Jodi Haasz will request permission from IEC for use of the document. The document is not expected to be published until early 2011, so the CDV will be posted. It will be put on a password-protected area of the IEEE website.

8. Discussion on when this TF can become a WG and membership.

The TF will remain a TF until the IEC document is published.
Title/Scope/Purpose of document submitted to the Subcommittee for approval to become a WG. A PAR is then submitted.
TF can review IEC document and develop recommended comments when work begins on the future document. Topics may be:

- Corrosion for offshore
- Arc Flash
- Other topics

Attendance is required at 2 consecutive meetings to become a member. Would become a voting member at the 3rd meeting attended. Electronic meetings held between IEEE Transformer Committee meetings count for this requirement.

IEEE has individual memberships so one cannot designate someone else from their company to represent him in the committee. It is not clear if proxy votes are in the procedures for voting for a member who cannot attend a meeting.

Further discussion on converting this TF to a WG was tabled until the fall meeting. WG status will depend on the progress of the IEC document.

9. Review of 14/618/CDV - Proposed IEC 60076-16

Phil Hopkinson reviewed some highlights of the proposed IEC 60076-16
Table 1 Insulation levels
Clause 4.6 Transient overvoltage

10. New Business: There was no new business.

7.6.2 OLD BUSINESS

Fall 2009 - The following documents are up for balloting in the near future. The following members have volunteered to review the documents and determine if they need revisions or can be submitted on a re-approval ballot.

C57.16 – Tim Raymond
C57.125 – Wally Bender
C57.117 – Wally Bender
C57.140 – Roland James is undertaking the reaffirmation of this standard.

The Working Group for C57.93 was disbanded and will be reinstated when reapproval of the document comes due.

7.6.3 NEW BUSINESS

The TF on Tank Rupture will be changed to a WG starting in the Fall 2010 meeting in Toronto.

7.6.4 STATUS OF "INACTIVE" GROUPS

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

This group is not meeting; major work on this document is complete; waiting for publishing.

TASK FORCE FOR WIND FARM TRANSFORMERS – Joe Watson, Chairman

Work of this group is complete; the task force is inactive.

TASK FORCE FOR EVALUATING THE NEEDS OF TRANSFORMERS USED WITH SVC – Peter Zhao, Chairman

Fall 2009 - The work of this task force is concluded. A report was issued and it is being considered if an educational paper should be published.