

8.12 POWER TRANSFORMERS – TOM LUNDQUIST, CHAIRMAN

The Power Transformers Subcommittee met on Wednesday, October 25nd, 2006 with 48 members and 67 guests.

The minutes from the Memphis, TN meeting were approved with no changes or corrections.

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

8.12.1 WORKING GROUP AND TASK FORCE REPORTS

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

NO MEETING MINUTES RECEIVED.

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

Meeting Minutes for Working Group on PC57.143 Transformer monitoring. 8:00 AM October 23, 2006 Delta Centre-Ville Hotel; Montreal, Quebec

- 92 members and guests were in attendance.
- Patent issue was mentioned with no one presenting an issue.
- Review of work completed since the fall meeting:
 - Addition of Section 6.7, Installation Considerations – Tony Pink
 - Addition of Section 6.9, Control Function - Tony Pink
 - Complete re-write of Section 7, Benefits – Brian Sparling
 - Re-write of Section 5.6, Winding Temperatures – Terry Martin
 - Complete Re-Write of Section 5.4..2, Acoustic Methods – Jack Harley
 - Addition of Section 5.4..3, Types of Acoustic Methods – Jack Harley
 - Annex 2, Partial Discharge – Electrical and Acoustical Methods - complete re-write/update - Prodipto Sankar Ghosh. Replaces existing partial discharge material in the Annex
 - Annex 3 , Winding Temperatures – Complete re-write. Reduced in length from 12 pages to 6 – Richard Van Neste and Tom Lundquist
 - Annex 4 – Reference Tables (From CEA Report) – Deleted (8 – 9 pages)
- Review of issues resolved during the meeting:
 - Delete Table 4.3.7.5
 - Delete Table 7
 - Delete sections 6.13, 6.14, and 6.15
 - Delete section 6.16 starting with “Starting Point”

- Tasks remaining prior to straw ballot process:
 - o Section 5.4.1.1 Electrical PD – To be condensed: Claude Kane assigned
 - o Cross check definitions with the IEEE standard definitions in C57.12.80
 - o Convert the annex sections to the new format.
 - o Check reference list
 - o Add participant list
- Revised document with above revisions to be posted and participant list will be solicited for straw ballot process.
- The meeting adjourned at 8:45.

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

The working group met at 11:00 a.m. on Monday, October 24, 2006, with 25 in attendance. There were 8 members and 17 guests in attendance. Six of the guests requested membership.

Rosters were handed out. Joe discussed a conference call that took place the week of October 16th, concerning the drawings that will be a part of the Standard. The intent is to have a set of standard drawings for six types of transformer designs: 1) ONAN Non-LTC, 2) ONAN LTC, 3) Forced Air Non-LTC, 4) Forced Air LTC, 5) Non-LTC with oil pumps, 6) LTC with oil pumps. Joe stated that the intent is to have the Draft ready by the next meeting with all drawings. The drawings will be posted on the IEEE website, available for download.

Frank Wolfe presented information from the conference call in more detail. Revisions to the drawings will include removing references to vendor names and transformer manufacturers, showing schematics for the LTC and some other devices as a “black box” instead of specific details, as well as standardizing of gauges. A meeting was set up for Monday, January 8, 2007 to discuss the drawings once these changes are implemented, which was estimated to be the second week of December. All interested parties were asked to contact Frank.

A suggestion was made to send the current draft to the editorial staff for review. Joe stated that the document requires further changes before it will be ready.

A motion to adjourn was made, and the meeting was adjourned at 11:27 am.

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

The Working Group on LTC Performance met on Monday, October 23, 2006 with 14 members and 21 guests.

The working group chairman asked if anyone had information on patents related to the work of this working group. It was noted that no one present at the meeting expressed knowledge of patents related to our work.

Next, the minutes of the previous meeting in Costa Mesa were approved as written.

At our previous meeting in Costa Mesa, the WG discussed 24 comments received during a straw vote. Revisions were made to the draft in response to the 24 comments. This resulted in Draft 1.1 of the C57.131 revision, distributed to WG members.

At this meeting, the WG discussed the definition and use of the term *step voltage* as it relates to:

1. Resistance type load tap changers
2. Reactance type load tap changers
3. De-energized tap changers

This discussion was necessary because the scope of C57.131 was modified to include requirements for de-energized tap changers, and the latest draft lists “rated step voltage” as a required nameplate rating. It was therefore necessary to define just what “rated step voltage” means for a de-energized tap changer so that its rating can be determined.

After some discussion, it was concluded that the term *step voltage* does not apply to a de-energized tap changer. The term *step voltage* is defined as the maximum permissible voltage between tap changer terminals for a given value of rated through current. Although it is a maximum voltage, rated step voltage has nothing to do with dielectric withstand. Dielectric withstand is covered by the insulation level rating, which specifies dielectric withstand between adjacent contacts.

The term *rated step voltage* has a meaning similar to the voltage rating of a load break switch: It is the maximum voltage between tap changer terminals (for a given value of through current) at which the tap changer switching contacts can perform the required arc interruptions in order to change taps under load. Since a de-energized tap changer does not switch under load, the term *rated step voltage* does not apply.

This means we need to make the following changes to the draft:

1. The definition entry for step voltage will read, “rated step voltage of a load tap changer.”
2. A note will be added to the definition that, “The term *step voltage* does not apply to de-energized tap changers.”

3. The quantity, “Rated step voltage,” will be removed from the list of required ratings for de-energized tap changers.

It was also pointed out that the IEEE Dictionary (Standard 100) also has a definition of step voltage. That definition refers to the electrical safety issue of the voltage gradient that results from electric currents flowing in the earth, causing a step voltage between the feet of a worker standing on the earth. Change #1 in the above list removes the possible conflict with the IEEE dictionary because it refers specifically to the rated step voltage of a load tap changer.

These changes will be made, and the draft number changed to 1.2. This draft will be re-circulated in an informal straw vote among the WG members for comments on this issue.

The meeting adjourned at 2:55 pm.

8.12.1.5 WORKING GROUP FOR DEVELOPMENT OF PC57.140, GUIDE FOR THE EVALUATION AND RECONDITIONING OF LIQUID IMMERSSED POWER TRANSFORMERS - Rowland James, Chairman.

INACTIVE.

8.12.1.6 IEEE C57.120-1991, IEEE LOSS EVALUATION GUIDE FOR POWER TRANSFORMERS AND REACTORS REAFFIRMATION REPORT - Michael Lau

INACTIVE.

8.12.1.7 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 3:15 pm, Tuesday, October 24, 2006. Also present were the Vice-Chair, Ewald Schweiger and Secretary, Susan McNelly.

There were 21 members present with 35 guests and 5 guests requesting membership in the WG. Those requesting membership were:

Barry Beaster
Pierre Feghali
Joe Foldi
Alan Peterson

Steve Wolfer

Agenda:

- 1. Introductions**
- 2. Patent Issues**
- 3. Approval of Fall 2005 Minutes**
- 4. Submittals**

Submittals have been received from:

1. Dave Wallach
2. Craig Swinderman
3. Jane Verner
4. FPM (Siemens, Mexico)
5. Kipp Yule

5. Sections needing assignment

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.

Approval of minutes from the Spring 2006 Costa Mesa meeting was requested. Greg reviewed the purpose of the guide and thanked those that have already provided information that has been input into the guide to date.

Greg mentioned that he has been asked to provide a certificate that the transformer is in good condition on receipt. The certificate is limited to those things that can be readily determined, such as no visible damage, no impacts recorded, pressure maintained, etc.

Comment - this is a joint responsibility between the manufacturer or manufacturer's representative and the customer or customer's representative. This is often necessary due to progress payments or payment of all but a retainer.

Comment - If it is a transportation guide we are providing, then the hazards must be presented. There have been instances where there were no signs of damage, no impacts recorded, etc, but in reality, as further testing progressed, it was discovered that the units were damaged beyond repair. These pitfalls need to be identified. Mark Hammer agreed to help with this section.

The installation Guide, C57.93, is presently out for ballot and does provide some overlap to this guide. The plan was to not hold up this document, but that the information would be put into this guide as well and later removed from the Installation Guide on a future revision.

Bob Tillman and Marnie Roussell volunteered to help with Clause 4, regarding necessary information to be provided to a contractor.

Joe Kelly indicated that there are ASTM standards in regards to nitrogen or dry air filling, D 1933-2003 type 3 for nitrogen filling and D 3283-1998 for dry air filling that specify the properties of the air or nitrogen in addition to dew point values.

Assignments:

1. RFQ, Specification

Transportation relevant data:

	Assignment
UCC vs Incoterms (see Installation Guide)	Ewald Schweiger
Exact address, contacts, status of site (existing, under construction)	Users requested to send in spec requirements Dave Wallach – provided Bob Tillman & Marnie Roussell

2. Design

	Assignment
Vertical / Longitudinal / Lateral direction	It was determined that we should not try to tell the Manuf how to design the transformer.
We may want to have some minimal requirement that the unit needs to be designed for truck or rail shipment regardless of how it is initially shipped. This should be noted on the nameplate Should also make a comment that different locals, countries, and shipping providers take different care of transformer shipments.	
Add some criteria on bracing. Ron Barker will provide some wording on this.	

3. Shipping preparation (XFMR – Main Tank)

	Assignment
Gas Filling - Dry air supply, # of bottles; Pressure; Regulator	Bill Darovny

4. Shipping preparation (Accessories)

Crates / Boxes / Containers

	Assignment
Special requirements	Tom Lundquist will resend info he supplied previously
Material legal compliance (treatment of lumber, etc)	Open
Refer to §5.1 Paper "Heavy Hauling, transportation and Rigging Guidelines for PT" - TF for Truck Rigging&Crane	Open

5. Shipping

	Assignment
Forwarder – Selecting subcontractors, checklist	Open
Barge and ocean vessels - Age of equipment, Registration, Lashing	Phil Sherman, Kipp Yule, Dave Kirshner
Others - Airplanes	Ewald Schweiger
Oil	Open

6. Arrival (Receipt) Inspection

	Assignment
Electrical Tests - FRA (specify tests - transformer oil filled y/n, before after testing, with or without bushings)	Jane Ann Verner and Jerry Murphy
Mechanical Tests - Ratio, Winding resistance, dielectric Power Factor, Insulation Resistance, No load excitation at 60Hz and 110% rated voltage, Induced voltage test, and DGA	Jane Ann Verner and Jerry Murphy

In general, good progress is continuing to be made on the document. A draft will be sent out in the next several weeks for review.

Meeting was adjourned at 4:00 pm.

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

The Working Group for The Installation of Liquid-filled Transformers was called to order at 1:56 PM on Tuesday October 24, 2006. There were 32 attendees, 13 members, 1 requesting membership, and 18 guests. Minutes from the previous meeting were distributed, introductions were made, and the agenda for the meeting was reviewed. Minutes from the March 21, 2006, meeting in Costa Mesa, California, were reviewed and approved without comment.

- 1) IEEE patent policy was reviewed and the group was asked if there were any disclosures. There were none.
- 2) The request to form an official ballot pool was issued, and was closed on September 30, 2006. The ballot pool has a total membership of 154 individuals, with the following composition:
 - General 37.7%
 - Producers 13.6%
 - Users 48.7%
- 3) The official ballot opened October 4, 2006, and as of October 23 had 68 responses. An additional 48, or more, responses will be required to validate the ballot.
- 4) As an item of new business a discussion of the theft of copper from station grounds, transformer neutrals, and fence grounds was held.
 - a) Several pictures demonstrating examples of theft were shared with the group, and key concerns of the issue highlighted were:
 - The system neutral may end up floating and this condition may not be immediately detected.
 - Customers will see voltage fluctuations or low voltage.
 - System protection may not act as intended.
 - Concern for public safety.
 - b) A discussion of measures to deter this type of theft considered the following:
 - Use of Copperweld ground cables
 - Galvanized steel connections for fence grounds
 - Cable identifiers or microdots to identify the companies cable
 - Painting grounds to make them less visible
 - Enhanced fencing with razor wire
 - Installation of real and fake video cameras
 - 24 x 7 guard protection
 - c) A discussion of alternate methods of creating the neutral connection at a transformer tank considered, placing it in the ribs of the transformer; making the neutral connection internal to the transformer, but brought out in a manner to still permit isolation and testing, or to locate it within the ribs of the transformer tank.
- 5) A request for any other new or old business was made, however none was presented. Therefore the meeting was adjourned at 2:45 PM.

**8.12.1.9 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 9:30 AM on October 24, 2006. There were 37 attendees, 23 members, and 14 guests with 4 requesting membership. Reviewed the agenda for the meeting, and the IEEE patent policy. The Minutes from the March 21, 2006, meeting in Costa Mesa, California were approved.

1. Mission – Develop Functional Life Test and Supporting Technical Paper for De-energized Tap-changers. Reminder that the goal is to develop the test and have a paper that supports the test. Test will ultimately be included in C57.131.
2. Reports from Reinhausen, Central Moloney, Quality Switch/Cooper and others on test results. No new data to report. Reinhausen, Quality Switch and Central Moloney should have data to report for the next meeting.
3. 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 cycles (days) of the 8-hour on 16 hour off 2XN current are required to complete the functional life test.

2 Criteria of success:

1. Resistance change <25%
2. Stability reached

Testing has shown that the proposed test approximates 30 years of aging in a 30-day test.

4. Proposed paper “Electrical Contacts for Off-Circuit Tap Changers for Oil Immersed Transformers” Revised October 11, 2005
The paper is posted on the IEEE website for this working group (from the Transformer Committee home page, go to the Power Transformers subcommittee, and then the Functional Life Tests for DETC's TF). All are encouraged to review and comment on the paper. Intention is to publish as an industry paper.
5. New Business
A question was raised if short circuit currents produce same phenomenon as occurs with steady state current. It does not because short circuit currents produce repulsion forces which may separate the contacts, create arcing, and welding.

The meeting adjourned at 10:28 AM.

8.12.1.10 WORKING GROUP FOR REVISION OF C57.135, GUIDE FOR THE APPLICATION, SPECIFICATION AND TESTING OF PHASE-SHIFTING TRANSFORMERS – Jim McIver, Chairman

The meeting was held on Tuesday Oct. 24th at 11:00 am. After the usual introduction and display of IEEE's Patent policy, the minutes of the previous meeting were approved as written.

Due to job changes and work re-assignments, the group is once again without a secretary. The WG Chairman will solicit volunteers to assume responsibilities of secretary, as well as to assist in the revision of Section 4 figures.

- 8 members, 12 guests were in attendance.
- WG Chair still must submit PAR & officially initiate the revision process. This will be done immediately after this meeting. Once PAR is submitted, WG will obtain an editable version of the standard from IEEE and begin figure revision.
- WG has received few comments which request editorial revisions. Focus of the WG remains editorial revisions & clean-up of the original figures
 - o Discussion at the WG meeting focused on guidance provided for functional description of phase shifter applications. This interchange produced some new suggestions for possible additions; these will be documented & sent to chairman for consideration.
 - o TF members will continue to meet electronically to reformat & revise Section 4 figures.
- The meeting was adjourned at 12:15 PM.

8.12.1.11 WORKING GROUP FOR REVISION OF C57.12.10, STANDARD REQUIREMENTS FOR LIQUID IMMERSSED POWER TRANSFORMERS - Javier Arteaga, Chairman

NO MEETING MINUTES RECEIVED.

8.12.1.12 IEEE STD 638-1992, IEEE STANDARD FOR QUALIFICATION OF CLASS 1E TRANSFORMERS FOR NUCLEAR POWER GENERATING STATIONS REAFFIRMATION – Craig Swinderman, Chairman

Attendees: 2 members + 3 guests

The meeting began at 1:45 pm.

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.

Topics discussed:

The existing standard IEEE 638 has recently been reaffirmed, but has received some comments during the balloting, including both technical and editorial aspects. As such, this task force was formed to work on determining the necessity and extent of revising the existing 638 standard. The existing document covers transformers rated 601V up to 15,000 V for the high voltage winding, and up to 2,500 kVA self-cooled rating transformers for Class 1E applications.

This standard also ties in with the requirements of IEEE 323, which describe requirements for qualification of all types of electrical equipment used for “Class 1E” applications.

Members of the IEEE 323 working group have been contacted, and the latest version of the IEEE 323 standard will be reviewed to make sure the revisions of IEEE 638 are in agreement with IEEE 323.

Over the last few months, the task force contacted several people from the Nuclear Power industry to get an opinion for how a widening of the scope of IEEE 638 would be perceived and voted on by that industry.

After this investigation and recommendations from the Nuclear Power industry, it was determined that the scope of the IEEE 638 document should be kept to its present limit, as the 1E designation is a very serious requirement in the Nuclear Power industry, and there are several standards that deal directly with class 1E equipment.

An additional topic of discussion was the Annex A contained in the existing IEEE 638-1992 document. Annex A is used to demonstrate the thermal ageing of the transformer insulation materials. This annex A is now being compared to the latest version of C57.96-1999 to verify if a revision is needed for the annex. It was noted that the existing annex A does not take into account for the case of non-sinusoidal loads, and no reference to C57.110 is made in the existing document. Members from the C57.96 working group will be contacted to verify the extent that Annex A needs to be revised.

A guest at the meeting suggested that it may be a good idea to contact the Nuclear Power Engineering Committee (NPEC) SC-2 or SC-3 to see if a possible joint working group should be established for this revision of IEEE 638. We will follow up on this request and inform the results shortly.

Now that the scope of the IEEE 638 revision has been determined, we will issue a request for a PAR to revise the existing document.

The meeting adjourned at 3:00 pm.

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

The chair opened the meeting at 11:00AM, and welcomed the members and guests. There were 43 attendees in total and 13 guests requested the membership.

This is the 2nd meeting – general review and presentation session. Three presentations and review on a TF survey were scheduled.

Three presentations are;

- Sealed Tank Transformers by Javier Arteaga
- One Utility's Practice and Specification by Marco Foata and Van Nhi Nguyen
- C57 Series Standards Coverage on Transformer Tanks by Peter Zhao

The presentations will be posted on the Website.

Future actions were reviewed;

- The Recommendations to the Transformer Committee will be drafted based on the results from two general review and presentation sessions, and the draft will be prepared before next meeting. Homework on the recommendations was assigned to all the members.
- A Utility Survey – the content was discussed during the meeting, and the comments were made by the members. Once the survey is finalized, it will be released and the results will be reviewed in Dallas meeting.
- A technical paper is considered to be drafted based on the presentations. The chair is looking for a volunteer to work on the paper.

The meeting adjourned at 12:15 PM.

8.12.1.14 C57.116 Reaffirmation Report – Tim Raymond

INACTIVE.

8.12.1.15 TASK FORCE FOR WIND FARM TRANSFORMERS – Joe Watson, Chairman

The Windfarm Transformer Task Force met on at 8:00 am Tuesday, October 24, 2006 with 33 members and 21 guests.

The latest draft of the paper was reviewed and topics for additional discussion were added including:

- DGA and other testing on high temperature design units
- Maintenance and testing on regular designs
- Fuse and relay co-ordination issues
- The use of grounding transformers
- Various means to control the collection system voltage
- Soil resistivity considerations for underground cable loading
- Loading issues
- Delivery concerns with mountain roads and other possible rough handling
- Ferro-resonance issues

We will try to invite a wind turbine design engineer to our next meeting to discuss the turbine manufacturers' expectations of the transformer performance.

The meeting adjourned at 9:15.

8.12.2 OLD BUSINESS

None.

8.12.3 NEW BUSINESS

Tom Jauch of Bechwith has requested for a transformer paralleling guide. Will form a task force to evaluate this subject.

Peter Zaho requested a guide for a standard transformer used in an SVC application as a coupling transformer. Will form a task force to decide the issues and what sub committee this work falls under.