7.10 DRY TYPE TRANSFORMERS SC CHAIRMAN C. W. JOHNSON, JR.

7.10.1 Introductions and Approval of Minutes

The Dry Type Transformer Subcommittee met in Memphis, TN on Wednesday October 26, 2005 with 17 members and 7 guests present; 1 guest requested membership and 1 guest requested corresponding membership. Introductions were made and the attendance roster was circulated. Minutes from the March 16, 2005 Jackson MS meeting were reviewed and approved.

The chair reminded the attendees that the minutes posted after each meeting were unapproved and would not be approved until the next meeting.

7.10.2 Working Group/Task Force Reports

The next order of business was the presentation of the reports of the various working groups and task forces. See the following sections for the individual reports:

7.10.2.1 WG Dry Type Test Code C57.12.91 Chairman Derek Foster

1 The working group met at 3:15 pm with 14 members and 7 guests present.

2 There were no comments regarding the minutes from the March 15, 2005 meeting in Jackson.

3 The Chairman asked if anyone present had any information regarding patent issues which may affect the work of the group. No replies were received.

4 Old Business

The Chairman informed the Working Group that the PAR for amendment of the standard was approved in June 2005. The title of the standard will be extended to "IEEE Standard Test Code for Dry-Type Distribution and Power Transformers – Amendment 1.

Four sections of the standard are included in the PAR:

Section 5	Resistance measurements
Section 10	Dielectric tests
Section 11	Temperature test
Section 13	Audible sound level measurements

Three of these four sections were the subject of negative comments during the last ballot of the standard and these negative comments will be dealt with during the review process.

Section 5 of the liquid filled transformer test standard, on resistance measurements, is also being reviewed at this time and proposed revised wording for this standard has already been prepared. The Chairman will obtain a copy of the proposed wording for

circulation to all members of the working group. This may provide useful input during the review process.

The Chairman requested volunteers for task forces to review each of the four sections of the standard included in the PAR. Two volunteers came forward for each of the four sections, as follows:

Resistance measurements	Carl Bush, Chuck Johnson
Dielectric tests	Marcel Fortin, Arthur Molden
Temperature test	Tim Lewis, Martin Navarro
Audible sound level test	Tim Lewis, Dhiru Patel

It is intended that the proposed amendments to the four sections will be available for further discussion at the next meeting.

A discussion was held regarding clause 10.1.5.4. This clause states "The sequence of tests shall be impulse tests (when required) followed by the low-frequency voltage tests". One member of the working group had requested that a detailed test sequence for dielectric tests be provided to include induced voltage test and partial discharge test. It was agreed to extend clause 10.1.5.4 to include a statement regarding these tests and the extended clause will be included in the review of the section on dielectric tests.

5 There being no new business, the meeting was adjourned at 4:00 pm.

7.10.2.2 WG Dry Type Thermal Evaluation C57.12.56/60 Co-Chairman Roger Wicks

The working group met in Memphis, TN at the Peabody Hotel at 1:45 PM on Monday, October 24, 2005 with 11 members and 12 guests present. Attendees introduced themselves and signed a roster. One guest requested membership in the working group.

The Vice-Chair reviewed the minutes from the last meeting which were approved as read. The chair reviewed the patent documents for our meeting, and no patent related issues were noted for the work of this working group.

The chair reviewed the action items from the last meeting related to simplified definitions, aging models, and test methods. The vice-chair also expressed his apology for delay in issuing the working group meetings, though it was noted that they were incorporated in the subcommittee minutes which were issued a while back. It was agreed that going forward the minutes would be issued fairly quickly and then reissued prior to the meeting as a reminder.

Due to the late nature in issuing the meeting, little had been accomplished related to the action items from the last meeting. The working group did receive input from the Chair (Dick Provost) related to a new model configuration for cast resin units, which led to a very healthy exchange of information. Jeewan noted he had submitted input as well, but the vice-chair was not prepared to discuss it (not sure if he got it). Jeewan will resend to the vice-chair.

There was a significant amount of discussion related to Dick Provost's model presentation regarding cast resin transformers. Contributions were provided by many, including Jeewan Puri, Tony Jonnatti, Chuck Johnson, Rick Marek, Martin Navarro, and Carl Bush to name a few. In summary, some of the key points raised:

> How should the model be constructed? Do we need to have turn-to-turn testing and or do we need to have section-to-section testing as well? This lead to a discussion for this type of model (foil wound coil) whether all of the failures are one method or another (impulse or double induced; turn to turn or section to section). Comments suggested that the aging methodology should be able to test all potential modes of failure, since going into the aging program one cannot always assume where the weak link. This led to a discussion about the typical sequencing of the test, with a full coil being built first for electrical modeling (impulse and transient analysis) followed by models that takes into account the result of the modeling. Rick pointed out that you need to understand these electrical characteristics, since they set the limits for the future design rules for the family of units being tested.

Issues were raised regarding the aging of the coils (cracking, etc.) which may not happen at operating temperature, but occur during accelerated testing at high temperatures. Unfortunately, there isn't a lot that can be done related to this effect.

Tony raised the idea of using the initiation of PD as failure criteria, but the group agreed that this would be problematic, that the use of the electrical proof test as the failure criteria was a "real world" method.

Martin pointed out that customers are requesting transformers with "180°C insulation" and he is not sure how to meet this requirement. He noted that there is an IEC test method that calls out the end of life as the amount of time until the unit has suffered a 3% weight loss vs. the initial weight. Many need to obtain this standard to compare to ours. Martin further noted an issue with how the dielectric test voltage is calculated in the test method. This led to a discussion about impulse vs. simulated impulse. This all the more reinforces the need to look at our test methods for both the coils and the models to insure they are correct per our current needs. The chair pointed out that C57.12.60 was written prior to any test experience, and with a number of test programs completed vs. this protocol, that it would be natural that adjustments should be made. One issue is how this information can be shared, since much of this work is proprietary to the few OEMs who have completed the work.

No real action plan was set up after the end of the meeting, however the chair agreed to put together these notes from the meeting, circulate this minutes along with the past minutes, and solicit evaluations/ideas regarding the models and the aging. The chair also agreed to scan and send copies of a paper he received from Tony Jonnatti related to this work (in 1955) titled "Functional Life Evaluation of Group-2 Dry-Type Power Transformers". It appears to be very directly related to the work of our working group. The chair, by copy of this set of minutes, requests all copied to look to see if they have any other papers of similar value to

the working group. In specific there are some documents in the bibliography of the above paper which might be of value to the group.

Meeting adjourned at 3:05 PM.

7.10.2.3 Dry Type Reactor TF **Chairman Richard Dudley**

The Dry-Type Reactors T.F. met in the Venetian Meeting Room of the Peabody Hotel in Memphis, Tennessee on Oct. 24, 2005 at 8:00 a.m. There were 10 members and 1 guest present.

1. The minutes of the Dry-Type Reactors T.F. meeting in Jackson were approved.

   NOTE: The minutes of the Memphis meeting of the T.F. will not be approved until the meeting in Costa Mesa, California.

2. Due to an oversight of the Chairman, the IEEE patent policy was not reviewed. However current work of the T.F. is either preliminary in nature (possible revisions to IEEE C57.16) or supportive input to the W.G. for the Revision of C57.32.

3. The remainder of the meeting was devoted to a review and discussion of Draft #3 of a proposed Annex E, for inclusion in the next revision of IEEE C57.16 on circuit breaker TRV issues and the application of series reactors. The following are the highlights.

   (i) Co-ordination with the IEEE Switchgear Committee was discussed as their input/agreement on the content etc. will be important to the successful ballot of the revision of IEEE C57.16. Pierre Riffon pointed out that Dennis Dufournet of the IEC Switchgear Committee who reviewed Draft #2 and provided input that is included in Draft #3 is also very active in the IEEE Switchgear Committee. Dennis Dufournet is Chairman of WG 35 of IEC SC 17A.

   (ii) The focus of Annex E is on the switching of series reactors and possible associated CB TRV issues; application of series reactors and especially current limiting reactors. Therefore Annex E should compliment rather than duplicate material in IEEE Switchgear Committee documents. This will be made clear to the IEEE Switchgear Committee when they are asked to formally review Annex E.

   (iii) Pierre Riffon presented the clause from IEC 62271-100 which covers the application of reactors and comments on TRV. Basically, available TRV mitigation measures are good and therefore no special CBs are required; medium voltage CBs up to 72.5 kV. Amendment 2 of IEC 62271-100 is now approved.

   (iv) Annex E that is proposed for inclusion in the revision of C57.16 will be limited in scope; TRV issues associated with the application of series reactors. CB TRV issues are largely confined to the application of current limiting reactors and under fault conditions.

(v) The text of the introduction "E.1" will be modified to state that the Annex only covers CB's applied with CLRs under fault conditions; TRV can then become significant.

(vi) In "E.2" "time delay" will be defined by referencing the appropriate IEEE CB standard.

(vii) Much of the IEC revision work referenced in "E.2" will be complete by the time the revision of C57.16 is ready for ballot; text to be modified accordingly.

(viii) In Fig. "E.1" TRV envelope will be defined; RR and peak voltage.

(ix) "E.3", "E.4", "E.5" and "E.6" are okay as drafted.

(x) In "E.7" example calculations are presented. In Fig. "E.2" the CLR is located ahead of the CB to reduce the cost of the CB; lowest fault duty. If the CLR is located after the CB then a lower fault and duty rated CB cannot be used.

(xi) If cable is used to connect the reactor (CLR) to the CB the cable capacitance to ground could be sufficient so that there is no CB TRV problem. If capacitance mitigation is required, the best solution is a capacitor across the reactor.

(xii) RFD will work with P. Riffon to pass the next draft (Draft #4) of Annex E to the IEEE Switchgear Committee for formal comment/input.

(xiii) T.F. members are requested to provide input re other draft proposals for inclusion in the revision of IEEE C57.16.

(xiv) T.F. members were asked if there are other revision opportunities for IEEE C57.16. P. Riffon suggested that a drawing be included on the set up configuration for carrying out a short circuit test on 3 phase stacked reactors to be used.

The meeting adjourned at 9:15 a.m.

7.10.2.4 WG Dry Type General Requirements C57.12.01 Chairman John Sullivan

The working group met in the Hernando Desoto meeting room of The Peabody Memphis in Memphis, Tennessee.

Chairman John Sullivan called the meeting to order at 9:30 AM on Tuesday October 25, 2005.

The meeting was convened with ten (10) members and five (5) guests present. One (1) guest requested membership.

Introductions were made and the minutes of the Jackson, Mississippi meeting were approved.

The first order of business was to show the slides on patents and inappropriate topics and ask the members if they knew of any patents or pending patents that apply to the contents of the C57.12.01 standard. No one knew of any patents that pertained to C57.12.01.

PC57.12.01 has been submitted to RevCom.

The next order of business was to present balloting results for the revision of C57.12.01. Balloting took place with an initial ballot and two recirculation ballots. The second recirculation ballot is detailed below.

Response to the 2nd recirculation ballot:

- 129 eligible people in this ballot group
- 95 affirmative votes
- 7 negative votes with comments
- 1 negative votes without comments
- 6 abstention votes
- 6% abstention
- 109 votes received
- 84% returned
- 93% affirmative 102 votes

Ballot group breakdown – recirculation two

Classification		**Yes**	**No**	**Abs**	**UR**	**Total**
General Interest		48	1	4	10	63
Producer	16	3	0	3	22	
User	31	4	2	7	44	
Total	95	8	6	20	129	

The following is a summary of comments from the second recirculation.

Comments Recirculation 2

- 6 Editorial
- 1 General SCC14 Coordination
- 7 Technical associated with Un-resolvable negative ballots

Unresolved Technical Comments - R2

- Table 5 - 5
- Table 6 - Partial discharge 2

All comments from recirculation two were discussed. In addition comments from Marcel Fortin were discussed and as a result three task forces were formed. The negative ballots received involved three items: Table 5, the partial discharge clause and the short circuit clause. After discussions the working group decided to form three task forces to review these items. The task forces are as follows:

Task force to review Table 5:
Members are Carl Bush, Chuck Johnson, Dhiru Patel and John Sullivan

Task force to review partial discharge:
Members are Marcel Fortin, Carl Bush, Chuck Johnson, Anthony Jonnatti and John Sullivan

Task force to review the short circuit clause:
Members are Marcel Fortin, Dhiru Patel, Derek Foster and John Sullivan

The task forces are charged with the responsibility to review the comments and the respective clauses within the standard and present their recommendations to the working group. The working group chair is a member of the three task forces and will expedite organization and facilitate action by the task forces.

There being no old business or new business presented, the meeting was adjourned at 10:45 AM.

7.10.3 New Business

1 The chair discussed four (4) ANSI documents (C57.12.50, C57.12.51, C57.12.52, and C57.12.55) whose copyright was transferred from NEMA to the IEEE Transformers Committee. The status of the documents remains in flux as we have no information on how to have the documents approved as IEEE standards. The SC chairman will request support from the IEEE Staff and Bill Chiu on how we should proceed.

2 The chair announced that two standards were due for reaffirmation in 2005: C57.134 "IEEE Guide for Determination of Hottest Spot Temperature in Dry Type Transformers" and C57.94 "IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry Type General Purpose Distribution and Power Transformers. Tim Lewis agreed to serve as the ballot designee for C57.94, and Paulette Powell agreed to serve as the ballot designee for C57.134. The chair will serve as the alternate ballot designee for each document. The chair asked all interested members to sign up for the ballot pool for each document.

3 There being no further business, the subcommittee meeting adjourned at 2:45 PM.