

Dry Type Transformers Subcommittee – Unapproved Meeting Minutes
March 14, 2007 – Dallas, Texas

8.1 Dry Type Transformers SC

Chairman C. W. Johnson, Jr.

8.1.1 Introductions and Approval of Minutes

The Dry Type Transformer Subcommittee met in Dallas, Texas on Wednesday March 14, 2007 with 13 members and 10 guests present. Introductions were made and the attendance roster was circulated. Minutes from the October 25, 2006 Montreal, Canada 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.

8.1.2 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:

8.1.2.1 WG Dry Type Test Code C57.12.91

Chairman Derek Foster

1. The working group met at 3:15 pm with 13 members and 5 guests present.
2. There were no comments regarding the minutes from the October 23, 2006 meeting in Montreal. The minutes were approved as written.
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 revision of this standard has been approved until December 2010.

Section 11 of the Standard, relating to the Temperature Test, was reviewed during the meeting. Martin Navarro had provided comments on three clauses of this section, which were the subject of negative comments during the last ballot:

Clause 11.2 Regarding ambient temperature measurement. Martin proposed that the dimensions of 0.91-1.83m, for the distance of sensors from the transformer, be revised to 0.9-1.8m. This proposal was accepted by the working group.

Clause 11.3 Regarding surface temperature measurements of metal parts surrounding or adjacent to terminals carrying currents in excess of 4000 A. After some discussion, it was decided to propose revised wording, omitting the value of 4000 A and to simply state that measurements of surface temperature should be made. Dhiru Patel agreed to provide proposed wording.

Clause 11.5 Regarding hot resistance measurement and specifically, the use of the data from one phase to obtain cooling curves for the other two phases. Martin had proposed an additional statement in this clause suggesting that the data from the center phase be used to obtain cooling curves for the other two phases. This clause is also being revised in C57.12.90, and it was decided to obtain input from that working group, before proposing revised wording for this clause.

In addition to the above, clauses 11.6 and 11.7.1 contain a note to equations (22) and (23) referring to the value to be used for T_k for aluminum windings. This note differs from the note to equation (13) and it was decided to adopt the note to equation (13) for equations (22) and (23) also.

Dry Type Transformers Subcommittee – Unapproved Meeting Minutes
March 14, 2007 – Dallas, Texas

A copy of the proposed revised section 13 on audible sound-level measurements, prepared by Jeewan Puri, will be sent to members of the working group after this meeting and this section will be reviewed at the next meeting.

A discussion was held regarding the need to expand clause 10.10, relating to partial discharge tests. The Chairman will attempt to arrange for Professor Lemke to give a short tutorial at the next meeting, on the subject of partial discharge measurement, and the relevance of C57.113, The Partial Discharge Measurement Guide, to dry-type transformers.

5. There being no new business, the meeting was adjourned at 4:10 pm.

8.1.2.2 WG Dry Type Thermal Evaluation C57.12.56/60 Chairman Roger Wicks

The working group met in Dallas at the Hilton Dallas Lincoln Centre at 1:45 PM on Monday, March 12, 2007 with 9 members and 5 guests present. Attendees introduced themselves and signed a roster.

The 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 bulk of the meeting was spent discussing Clause 4.2 Test Models, and Clause 4.8 Dielectric Tests.

The following changes were discussed and agreed to during the meeting:

1. Replace the number of samples required for model testing from 12 samples to “four or more samples” to be the same number as those used in the full-sized coil tests.

The working group noted that the thermal stresses can be more of an issue with full size coils than with model coils.

2. It was agreed that the drawings present in the existing documents should be placed in the Annex and that new “simplified” drawings which outline each of six test areas should be incorporated into the document:

- a) Turn-to-turn;
- b) Layer-to-layer;
- c) Disk-to-disk;
- d) Section-to-section;
- e) Winding-to-winding;
- f) Winding-to-ground.

This way no one specific winding style would be pictured, but rather the components for a style which are used by all would be used as examples. The Chair will solicit drawings from members for this document.

3. Rick Marek noted that with today’s test equipment, this test method should require the standard 1.2 x 50µs positive impulse wave. It is recommended to move the “simulated impulse” testing using 50/60 Hz tests to an Informative Annex. It was agreed that Rick will work with the Chair to identify locations within the document where this change should be made. The Chair noted that a historical discussion of the simulated test (and the fact that most of the systems covered under this test protocol used this method) should be included in the Annex.

Dry Type Transformers Subcommittee – Unapproved Meeting Minutes
March 14, 2007 – Dallas, Texas

4. The group requested a statement be added to the dielectric failure discussion in Clause 4.8. A proposed statement says: Visual cracks which do not cause dielectric failures are acceptable.

Finally, it was discussed that these tests are really coil tests. For each winding (primary and secondary) there may be different thermal classes of materials in use. The document will likely need to address how testing for such “mixed” insulation systems will be addressed.

Upon identification of the locations of the simulated impulse test and receipt of new simplified drawings, the chair will circulate the draft to the working group for comment. The goal is to complete this by the end of April. After comments from the working group, the chair intends to submit this document to the dry-type subcommittee for a survey ballot in time to get results back prior to our next meeting in Minneapolis.

Meeting adjourned at 3:15 PM.

8.1.2.3 WG for Revision of IEEE C57.16: Dry Type Reactors Chairman Richard Dudley

The W.G. for the Revision of IEEE C57.16 met in the Adams Meeting Room of the Hilton Lincoln Centre Hotel in Dallas, Texas on Mar. 12, 2007 from 8:00 a.m. to 9:15 p.m. There were 10 members and 3 guests present. The following are the highlights.

1. Introductions were made.
2. The minutes of the W.G. meeting in Montreal were approved.

Note: The minutes of the Dallas meeting will not be formally approved until the next meeting in Minneapolis, Minnesota.

3. IEEE patent policy was reviewed and no patent issues were identified. A discussion took place re patents on products covered by IEEE C57.16 (not an issue) vs patents that might impact the implementation of the standard.

4. The remainder of the meeting was devoted to the revision of IEEE C57.16; including new material drafted by and sent out by the Chairman to W.G. members. The following are the highlights.

(i) The Chairman informed W.G. members that he had not yet received a WORD version of the existing version of IEEE C57.16 from IEEE. Once this is received the Chairman will correct the WORD version, OCR problem, and produce Draft #13 which will include already drafted material; Annex E on CB TRV, sound measurement of FRs, reactors in enclosures.

(ii) Annex E was discussed re co-ordination/issues with the IEEE Switchgear Committee. Again W.G. members, especially utility engineers such as Pierre Riffon and Peter Zhao, deemed this informative annex very necessary. Pierre Riffon noted that he is chairing a W.G. co-ordinating input from the IEEE Switchgear Committee on the document being prepared by Bob Degeneff’s W.G. and that he was having difficulty getting input from the IEEE Switchgear Committee; Circuit Breaker S.C. It was agreed that ANNEX E was also applicable to CB TRV

Dry Type Transformers Subcommittee – Unapproved Meeting Minutes
March 14, 2007 – Dallas, Texas

issues associated with the application of reactors to shunt capacitor banks; fault between the reactor and the capacitor bank. A note will be added in the annex on shunt capacitor reactors explaining the issue and referencing ANNEX E. The Chairman will prepare Draft #6 of ANNEX E with the objective of ensuring the annex is reactor application focused and thus acceptable to the IEEE Switchgear Committee. The Chairman requested input from W.G. members re this strategy.

(iii) The situation of shunt capacitor banks when no reactors are employed was discussed. In this case a situation could occur where there is high frequency restriking of the CB; high capacitance and low stray inductance (“dual” of the TRV problem). It was deemed by the W.G. that this is a CB problem and not part of the scope of the revision of IEEE C57.16.

(iv) Sound tests on FRs were discussed; RFD draft material.

- Christoph Ploetner suggested that the latest revision of the IEC reactor standard should be consulted re possible material for inclusion.

- The IEEE sound measurement guide under preparation (and the IEC sound measurement guide which is published) should be referenced.

- A note or text in Clause A.5.6.3.1 “General” should emphasize that it may not be possible to test FRs with full harmonic current; lower current test and calculation. It is also not possible to carry out sound tests with simultaneous harmonic current spectrum.

- The main purpose of sound measurement on FRs is to demonstrate the accuracy of the manufacturers sound modeling software. In practice the sound level at the “fence” is most important.

- Information should also be included on the acoustic basics re filter reactors; multiple harmonics and resulting forcing functions, directivity, etc. This could be included in the Clause A.5.6.3 “General” or a new clause on “background” information.

- The Chairman will produce a new draft of material on sound measurement of FRs with input from W.G. members; especially Klaus Papp and Christoph Ploetner.

(v) The draft material on “de-Q’ing” of FRs prepared by the Chairman, was discussed.

Les Reckseidler has prepared material on the subject and will send it to the Chairman as comments to the draft material.

- The impact of the various methods of “de-Q’ing” on the temperature rise type test will be presented in more detail; explanations. One issue is that a temperature rise test at an equivalent 60 Hz current that may be satisfactory re winding temperature may not reflect the operating temperature of a “de-Q’ing” methodology in service. The temperature rise test details on FRs “including de-Q’ing” should be a matter for agreement between the manufacturer and “end user”.

- The Chairman will produce a new draft of the material on de-Q’ing including the above “actions”/”inputs”.

Dry Type Transformers Subcommittee – Unapproved Meeting Minutes
March 14, 2007 – Dallas, Texas

(vi) The draft material on reactors in enclosures was discussed.

- The material should be included in an annex; normative.
- Per Pierre Riffon comments this annex should emphasize that type tests should be carried out with reactor(s) in the enclosure; S.C. test, temperature rise test, dielectric tests. Routine tests can be carried out on the reactor(s) only. A note will be added re the test cost issues associated with this strategy. However waiving tests on the reactors in enclosures will be a matter for agreement between manufacturers and purchaser.
- Suitable reference papers will be included in a bibliography; action Chairman.
- A note will be added that the material in the annex is not directly applicable to reactors installed in “cells” (enclosures) constructed by the “end user”. In this case there are cooling issues; magnetic clearance issues to be addressed. The reactor manufacturer may be able to provide guidance.
- The Chairman will produce a new draft of the annex. Input from W.G. members is requested.

(vii) RI filter reactors for HVDC were discussed. After discussion the Chairman deemed that these would be best covered in the ANSI LT standard. He would discuss this issue with one of his engineers who is on the LT standard W.G. However a note could be added in the FR annex of IEEE C57.16 re RI filter reactors; ANSI LT standard main reference document but that material in IEEE C57.16 is also applicable. The Chairman will draft the note.

The meeting adjourned at 9:15 a.m.

8.1.2.4 Dry Type General Requirements

Chairman John Sullivan

The working group met in the Washington room of The Hilton Dallas Lincoln Centre

The meeting was called to order at 11:00 AM by Chairman John Sullivan

The meeting was convened with eleven (11) members and four (4) guests present. One (1) guest requested membership.

Introductions were made and the minutes of the last meeting held in Montreal, Quebec Canada October 23, 2006 were approved.

Task force reports discussion and working group action:

Table 5 – John Sullivan

The discussion of table 5 concerned Footnote a and the standard and alternate test values allowed under the right side of the table. The working group also discussed using two times nominal voltage plus one thousand versus peak values in column two (2).

The working group consensus was to revise Table 5 to consist of four (4) columns. The first two columns for nominal system voltage and low-frequency voltage insulation levels would remain. Peak values will be used in column two (2). The right side of the table will be condensed to two (2) columns. The intent is to remove the conflict with Footnote a and to simplify table references to alternate test values.

Dry Type Transformers Subcommittee – Unapproved Meeting Minutes March 14, 2007 – Dallas, Texas

Suitable tutorial information regarding alternate test values will be developed and included within the standard. A footnote mentioning the availability of alternate test values as agreed to between the manufacturer and user will be included with the table.

Chuck Johnson will prepare a draft of the revised table. Rick Marek will assist. The draft will be circulated within the taskforce and then the working group for input.

Partial Discharge – Chen Xuaxiang

The consensus of the working group was that 100 pC requirements in Table 6 are too high. The working group also recognized that encapsulated cores were a special case to be addressed. The task force will revise Table 6 and supporting documentation to address these issues.

Short Circuit Clause – Dhiru Patel

The Working Group discussed changes to Table 16 at the spring 2005 meeting in Jackson, MS. The Working Group decided to leave the table unchanged in the D5 revision and revise it during the next revision. See the Jackson minutes for details.

The working group has discussed the following revisions to Table 16.

Temperature limits during short circuit must be limited:

1. So the conductor does not anneal. The limit for copper is 450° C and for aluminum 300° C
2. So the material used on conductor and interlayer insulation does not get damaged during short circuit that could result in an internal turn to turn or layer to layer fault.
3. For different temperature classes of insulation, different materials are used. Limiting temperatures must correspond to the material used for these insulation temperature classes.
4. Table 16, does not differentiate between Cu and Al.
5. Table 16 gives winding temperature rise instead of insulation temperature class.

An effort will be made to coordinate with liquid standard.

Dhiru Patel will send revision proposals to task force members in April or May.

Task force activity should be handled through e-mail. The working group chair will post appropriate documents to the Transformers Committee web site as progress warrants.

Next meeting: Fall 2007 October 14-18 -- Minneapolis, Minnesota

With no new or old business the meeting was adjourned at 12:15 PM.

8.1.2.5 IEEE PC57.12.51

Chairman Paulette Powell

The copyright has been transferred from NEMA to IEEE. Paulette Payne Powell is the Chairperson of the Working Group that will update the document and issue it as an IEEE publication. The PAR for this project is approved. Draft 1 was prepared and submitted to the subcommittee for review. Comments received from Carl Bush were incorporated and Draft 1.1 was electronically distributed for discussion at the subcommittee meeting. Several editorial and technical issues were brought up, the most significant being duplicity with C57.12.01 *Dry Type Transformer General Requirements*. Based upon the discussion, the draft will be revised resolving Rick Marek's and Martin Navarro's comments. Subcommittee members were encouraged to review the draft and forward any comments as the draft will be revised and submitted to IEEE for balloting. The outcome of balloting will

Dry Type Transformers Subcommittee – Unapproved Meeting Minutes
March 14, 2007 – Dallas, Texas

determine necessity for a formal WG meeting in Minneapolis; the WG Chairperson agreed to timely inform Greg Anderson for a meeting slot, if needed. The following individuals volunteered to be WG members: Rick Marek, Charles Johnson, Sheldon Kennedy and Derek Foster.

7.7.4 Chairman’s Remarks and Announcements

Charles Johnson

The SC Chair discussed a number of issues from the Administrative Subcommittee Meeting.

The SC was informed that the due date for C57.124, “IEEE Recommended Practice for the Detection of Partial Discharge and the Measurement of Apparent Charge in Dry-Type Transformers” was Dec 2007 and that he would submit the document to the IEEE for reaffirmation. Ray Bartnikas questioned that as the document had not been updated since 1991, it might be out of date. He volunteered to review the standard to assess the document against the present state of the technology. We will proceed with reaffirmation, but will consider future revision based on Mr. Bartnikas’ review.

7.7.5 New Business

Joe Foldi questioned the pass-fail criteria for the impulse test. Joe stated that he had seen dry units that under impulse had instances of arcing (flashing). As the flashing was at random locations, would this be considered as a dielectric failure? The consensus of the SC was that a flashover on the first test followed by no further flashovers of the same connection could be considered as acceptable, but the condition he described required further evaluation. It was suggested that he review the impulse test guide C57.98 for further information.

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