7.4 Dry Type Transformers SC — Chairman C. W. Johnson, Jr.

7.4.1 Introductions and Approval of Minutes

The Dry Type Transformer Subcommittee met in Montreal, Canada on Wednesday October 25, 2006 with 14 members and 6 guests present. Introductions were made and the attendance roster was circulated. Minutes from the March 22, 2006 Costa Mesa, CA 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.

7.4.2 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:

7.4.2.1 WG Dry Type Test Code C57.12.91 — Chairman Derek Foster

The Chairman informed the Working Group that the existing PAR for amendment of the standard is being modified to a PAR for revision. Due to the fact that the standard expires at the end of 2006, it was necessary to seek reaffirmation or revision. It is expected that the PAR for revision will be approved at the NESCOM meeting on December 6.

A draft for a revised section 5, on resistance measurements, was sent to members before the meeting and was reviewed during the meeting. A discussion was held regarding the proposed clause 5.6.2, relating to the terminals to be used during resistance measurements on wye connected windings. The clause currently permits terminal-to-terminal or terminal-to-neutral measurements, but a proposal was made to identify terminal-to-neutral measurements as the preferred measurements. After discussion, it was decided to leave this clause as written, at this time. A draft 2 of this section will be sent to members of the working group for review. Draft 2 will incorporate changes resulting from comments made regarding section 5 of C57.12.90 and which are equally applicable to C57.12.91.

A discussion was also held on whether to revise clause 10.1.5.4, Test sequence for dielectric tests, to include the sequence of tests when both impulse and partial discharge tests are required. Again, it was decided to leave this clause as written.

The Chairman requested volunteers for a task force to review section 11 of the standard on temperature rise tests. It is intended to prepare a draft of this section for review before the next meeting.

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

The goal of this working group is to merge C57.12.56 which is the thermal evaluation guide for dry open-wound transformers with C57.12.60 which is the guide for thermal evaluation of cast coil transformers.

Martin Navarro presented information on IEC 60216, thermal evaluation of electrical insulation materials, which references a weight loss method for determining life of a solid resin or varnish. This was as follow-up from a previous working group meeting.

The working group spent the rest of the meeting reviewing a draft version of the combined standard in preparation for a survey ballot by dry-type subcommittee. Sections of the document discussed, included screening, test cycles, thermal test and dielectric tests.

It was agreed that for the screening and aging cycles that cold shock should be used for all dry-type transformers, which previously had only been applied in the original C57.12.60 document (only for cast coils).

In clause 4.5.1 of the draft document the phrase "with high-to-low barriers" was added to the beginning of paragraph 7. The last sentence of paragraph 6 "For all designs, the temperature aging cycle shall commence only when the required hottest-spot temperature is established and shall terminate when the cool-down period starts." was moved to after paragraph 7 as well.

In clause 4.6 Cold Shock, the reference to cast coil designs only was removed.

In clause 4.8, it was agreed that the models should go through the same dielectric test cycles as the full size coils, and that order of dielectric tests was changed to:

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

In Clause 4.8.2, disk-to-disk dielectric test was added as a mode of potential failure to test.

The chair finished the meeting by pointing out that the members of the working group should evaluate the clause 4.2, Test Models, and offer any upgrades to this section by the end of November. The chair will circulate this current version of the combined draft for this purpose. Any additional comments should be provided at this time. Upon receipt of all of the comments, the chair will circulate a survey ballot to the dry-type subcommittee by end of the year.

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

The Dry-Type Reactors T.F. met in the Cartier A Meeting Room of the Delta Centre-Ville Hotel in Montreal, P.Q. on Oct. 23, 2006 from 8:00 a.m. to 9:15 a.m. There were 7 members and 3 guests present. Steve Wolter of Ameren requested membership. The following are the highlights.

1. Introductions were made.

2. The minutes of the Dry Type Reactors T.F. meeting in Costa Mesa were approved.

   Note: The minutes of the Montreal meeting of the T.F. will not be approved until the meeting in Dallas, Texas.

3. IEEE patent policy was reviewed and no patent issues were identified.

4. The remainder of the meeting was devoted to the revision of IEEE C57.16. The following are the key points.
   (i) The Chairman reported that he had applied for a PAR for the revision of IEEE C57.16 and expected it to be approved the week of Oct. 23, 2006.
   (ii) The Chairman, Richard Dudley, briefed the T.F. on his conversion with Jeff Nelson, the Chairman of the IEEE Switchgear Committee, re Annex E. Per Jeff Nelson the IEEE Switchgear Committee has concerns regarding the content of the annex and believes that the content falls within the jurisdiction of the IEEE Switchgear Committee. One proposal is for the T.F. to consider a joint paper with the CB S.C. The Chairman asked for input from T.F. members. The most significant comments are as follows.
      - A joint paper was deemed not adequate. The annex was felt to be a crucial addition to IEEE C57.16 as it would guarantee that the information re possible CB TRV issues associated with the application of current limiting reactors would be readily accessible to an "end user". This sentiment was expressed by a number of utility engineers present; Pierre Riffon of H.Q., Les Reckseidler of Manitoba Hydro, Steve Wolter of Ameren, etc.
      - If the IEEE Switchgear Committee produces a future document that adequately addresses the issues of circuit breaker TRV and the application of current limiting reactors it will be referenced.
      - The Chairman noted that comments to-date from the IEEE Switchgear Committee were primarily editorial and not technical.
      - It was decided to continue to refer to circuit breakers in the annex and not switching device but not to discuss specific types of circuit breakers.
      - Precedent re the inclusion of the annex on CB TRV issues associated with the application of current limiting reactors in IEEE C57.16 exists. The IEEE application guide for shunt capacitors (Power Apparatus S.C. of the IEEE Transmission and Distribution Committee) contains information on CB TRV issues.
      - Utility engineers, due to "downsizing", typically do not have time to research papers or ancillary document sources. All relevant information should be included in an equipment standard; including basic application related information: More detailed application information can be referenced.
      - The basic conclusion is that current limiting reactor application issues, such as CB TRV, should be addressed in the series reactor standard; IEEE C57.16.
   (iii) Reactors are used in conjunction with shunt capacitor banks for various reasons. CB TRV issues could arise depending on the location of the reactor; reactor before or after CB etc. The TRV problem could be related to CB reignition. This will be addressed as a NOTE in the annex covering reactors used in shunt

capacitor banks and will reference Annex E as appropriate. Steve Wolter agreed to provide a recent paper on the subject as background information. Once the annex is modified, NOTE etc., it will be sent to the IEEE Switchgear Committee for comment.

- The basic conclusion is that current limiting reactor application issues, such as CB TRV, should be addressed in the series reactor standard; IEEE C57.16.

(iv) Annex E will be modified to reference specific parts of CB standards and guides as appropriate.

(v) The Chairman requested input from T.F. members and agreed to produce a new draft of Annex E.

- Should an informed ballot of the IEEE Switchgear Committee or CB S.C. be conducted or should a final version of the revision of IEEE C57.16 be produced ASAP to allow adequate time after formal IEEE ballot to address possible negative ballots from IEEE Switchgear Committee members? The Chairman will take the above into consideration in a future conversation with Jeff Nelson.

(vi) The re-draft of clause A5.6.3 in Annex A, prepared by the Chairman, re audible sound tests on filter reactors was discussed. More input was requested from T.F. members. The specifics re sound measurement of filter reactors should be addressed but the IEEE sound measurement guide now under preparation should be referenced for more general aspects.

(vii) De-Q'ing of filter reactors and impact on test code will be addressed by Les Reckseidler. Impact on specification and temperature limits (compatibility with other filter reactor components) will be addressed.

(viii) Reactors in enclosures (current limiting reactor in steel or FG enclosures) will be addressed in an annex; specification issues can impact test code. Considerations include type tests, losses measurement, short circuit type tests, etc. filter reactors in sound enclosures and impact on test code will be addressed in Annex A which covers filter reactors. Areas for consideration are temperature rise, type tests, sound measurement. The Chairman will produce draft material before the next T.F. meeting.

The meeting adjourned at 9:15 a.m.

7.4.2.4 Dry Type General Requirements — Chairman John Sullivan

The first item in the agenda was to establish three (3) task force groups to review outstanding issues from the latest revision of this standard and to provide recommendations for a par to the next revision. The task force groups were formed and leaders selected.

It is suggested that the task force group's activity be handled through the transformer committee web site and e-mail. It is also suggested that the recommendation on action items be available for discussion at the next working group meeting in Dallas. It is also hoped that the recommendation at the Dallas meeting can be the basis for the request for a new par.

A proposal to place a graph in this standard to de-rate kVA ratings for high ambient conditions was suggested. The working group indicated that information on this subject can be found in other standards.

7.7.4 Chairman's Remarks and Announcements — Charles Johnson

The SC Chair announced that

The reaffirmations of C57.94, the "IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type General Purpose Distribution and Power Transformers" AND C57.12.59-2001, the "IEEE Guide for Dry-Type Transformer Through-Fault Current Duration" were approved and the reaffirmation packages submitted to RevCom pending review and approval at December, 06 meeting.

The PAR for PC57.12.51 the "Ventilated Dry-type Power Transformers, 501 kVA and Larger, Three-Phase, with High-Voltage 601 to 34500 Volts; Low-Voltage 208Y/120 to 4160 Volts - General Requirements" Recommendation: Approve new PAR until December 2010. This document is the first of four former NEMA dry-type documents transferred to the IEEE. PARS for the other 3 documents will soon be submitted with the goal of forming the working groups at the Dallas meeting. This will require four additional meeting slots for dry-type transformers.

The SC chair expressed the sincere thanks of the SC to Cecile Wicks, Roger Wick's wife, for converting the text of the former NEMA documents to electronic format. As engineers are world renown for their typing skills, we could have probably completed the task in 18 months or less, but Cecile's efforts are still greatly appreciated.

7.7.5 New Business

Roger Wicks noted that there was a meeting this week on IEEE 638, the "IEEE Standard for Qualification of Class 1E Transformers for Nuclear Power Generating Stations which includes both dry and liquid transformers. Roger noted there was information in the annex calculating insulation life per hour for dry transformers as well as referencing both C57.12.56/ C57.12.60 the thermal evaluation guidelines for open-wound and cast coil technologies and C57.96 the dry type loading guide. Roger stated that he believed the document had been reaffirmed several time and that perhaps we should review the document for coordination with our latest standards. The SC committee chairman suggested that the SC members attempt to attend the next meeting of this grouping Dallas and also review the document.

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