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

7.7.1 Introductions and Approval of Minutes

The Dry Type Transformer Subcommittee met at 1:45 PM on March 19, 2003 with 17 members and 10 guests present; 5 guests requested membership. Introductions were made and the attendance roster was circulated. Minutes from the April 17, 2002 meeting were reviewed and approved.

7.7.2 Working Group Reports

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

7.7.2.1 Dry Type Reactor TF Chairman Richard Dudley

1 The Dry Type Reactors T.F. met in the Capital Room of the Sheraton Capital Center Hotel in Raleigh, North Carolina on March 17, 2003 from 8:00 a.m. to 9:15 a.m. There were 7 members and 2 guests present. One guest requested membership. The following are the highlights of the meeting.

2 Since the work of the group is not covered by a specific PAR the appropriate descriptor is Task Force and not Working Group. The basic scope of the Dry Type Reactor T.F. is to provide expert input on dry type reactors to any standards development process involving reactors. The current effort is the addressing of negative ballots resulting from the reaffirmation process of C57.21 and associated proposed revisions. Other ongoing work associated with future proposed revisions to C57.21 is the development of annexes on TCRs and voltage stresses seen by SRs during switching.

3 The Chairman briefly reviewed the current status of the two proposed annexes for C57.21. The annex on TCRs is considered complete. The annex covering stresses seen by SRs during switching has been sent to Roy Alexander of the IEEE Switchgear Committee. Official comments in writing have been requested. No response has been received to date. The Chairman stated that he would follow up with Roy Alexander.

4 The status of the reaffirmation process of C57.21 was reviewed and discussed. Peter Balma, who is chairing the reaffirmation process, presented a summary report. The net result of the ballot was 91% affirmative with 5 negatives. Peter has succeeded in getting 4 of the negative balloters to withdraw their negative ballots on the basis that many of their concerns were related to OCR errors and that other concerns would be addressed in the upcoming revision of C57.21. The one remaining negative ballot was discussed. This same negative ballot was discussed at the Vancouver and Oklahoma meetings of the Dry Type Reactor T.F. and was rejected. The T.F. again unanimously rejected the negative ballot. The negative balloter felt that the switching impulse level for dry type shunt reactors should be 70-75% of the lightning impulse level and not 83% as is the case for oil-immersed shunt reactors and, currently, dry type shunt reactors. The same switching impulse levels should be required for dry type and oil-immersed shunt reactors as they are used interchangeably on the power system; function of LA protection practice and characteristics.

5 The Chairman's proposals to address comments associated with negative ballots resulting from the reaffirmation process of C57.21 were discussed. Input and comments to these proposals from T.F. members were discussed and taken into consideration. The following are the highlights.

(i) REFERENCES

References will be updated as applicable. Care must be taken to ensure that the technical basis for the reference continues to be valid. This may require that the original specific reference be kept. In other cases it may only require changing the referenced clause etc. in the text of C57.21. References will be reviewed at the end of the revision process for C57.21.

(ii) TEMPERATURE RISE TEST & AUDIBLE SOUND TEST

If a Temperature Rise Test is performed the Audible Sound Test should be carried out at the end of the test since it allows the determination of sound level at operating temperature. If no Temperature Rise Test is performed it is recommended that the Audible Sound Test be carried out at or near operating temperature. A note will also be added stating that the sound level for oil-immersed and dry-type shunt reactors may vary with temperature.

Two T.F. members noted that Audible Sound Tests for dry type transformers and power transformers are carried out with the transformer at ambient temperature (cold).

(iii) FOOTNOTE 15

Peter Heinzig submitted a correction to the formula in the footnote. It is now mathematically correct. However, Pierre Riffon and Peter Heinzig have carried out sample calculations using the formula and have determined that it only works, at best, for a limited range of data. The footnote containing the formula and the reference to it will be removed. The following sentence will be added to the end of Clause 10.4.3.4.3;

"Since the iron losses cannot be measured on an oil-immersed shunt reactor and since iron losses are typically a small percentage of the total losses, the iron losses based on manufacturer's calculations should be used."

(iv) LOW FREQUENCY OVERVOLTAGE TEST

A note will be added to Clause 9.1.3.1 stating that a three-phase supply should be used to perform the Low Frequency Overvoltage Test on three phase oil-immersed shunt reactors connected in delta. The chairman also agreed to contact Ramon Garcia for more background information behind his comment as no T.F. members had any experience re oil-immersed shunt reactors being supplied as a delta connected single unit.

(v) COOLING CLASSES FOR OIL-IMMERSED SHUNT REACTORS

Cooling classes should be identical to those described in C57.12.00 except for the exclusion of water-cooled descriptors.

(vi) PD MEASUREMENTS

Oil-immersed shunt reactors should be treated the same way as oil-immersed power transformers. For voltages > 69kV PD measurements should be taken during the Low Frequency One Hour Overvoltage Test. Levels should be < 500 pC. For voltages < 69kV the Applied Voltage Test is carried out at 2 PU for 7,200 cycles and no PD measurements are required.

Pierre Riffon agreed to prepare a draft of the appropriate clauses based on the criteria above.

(vii) POWER & VOLTAGE CAPABILITIES OF TEST LABORATORIES

Tests should be carried out as described and at levels specified in the standard. Deviations to this practice must be based on a pre-agreement between the purchaser and manufacturer. During the revision process the standard will be reviewed for consistent adherence to this philosophy.

(viii) TURN TO TURN OVERVOLTAGE TEST

From a technical point of view the Turn to Turn Test, currently only applied to dry-type shunt reactors, is also valid for oil-immersed shunt reactors applied at system voltages 34.5 kV and lower. C57.21 will be revised on the basis that the Lightning Impulse Test and Turn to Turn Test are equivalent options for oil-immersed shunt reactors installed at 34.5 kV and lower.

(ix) FREQUENCIES OTHER THAN 60 HZ

A note will be added to Clause 4.3 stating that the standard is applicable to shunt reactors installed on 50 Hz systems with appropriate correction/modification to formulas and test code.

(x) DIGITAL DATA ACQUISITION SYSTEM FOR THE TURN TO TURN TEST

Clause 10.3.3.2 will be modified to include a statement that digital data acquisition systems are recommended for the Turn-to-Turn Test.

(xi) APPARENT CHARGE

Apparent charge acceptance criteria will be added to the One Hour Low Frequency Overvoltage Test for oil-immersed shunt reactors. Pierre Riffon will address this in his draft of clauses covering PD measurements.

(xii) TABLES 5A & 5B

Tables 5A and 5B will be kept separate. However Table 5B will be reviewed to ensure that system related values are the same as in Table 5A; dry-type and oil-immersed shunt reactors are used interchangeably.

6 The Chairman stated that a PAR would be raised and the revision process for C57.21 started under the Performance Characteristics S.C. The Chairman (Richard Dudley) stated that he had volunteered to chair the W.G. and that he would prepare a revision of C57.21 based on the above action items plus correcting the OCR errors resulting from IEEE's scanning of the original document. The Dry Type Reactor T.F. will continue to provide input to the W.G. tasked with the revision of C57.21.

7 The meeting adjourned at 9:15 a.m.

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

1 The meeting of C57.12.01 WG Dry-Type General Requirements was held on Monday March 17th at 1:45 PM in the Willow Oak room of the Sheraton Capital Center, Raleigh, North Carolina.

2 The meeting started with the introduction of the members and guests. No meeting was held in Oklahoma City in October 2002. Twelve members and six guests were present. Three guests requested membership.

3 The chairman started the meeting with a summary of the standard that will be submitted to IEEE for printing. The chairman indicated that comments made during the Draft three ballot stage have been approved by the working group. Editorial comments were addressed and corrected. The phase diagrams were changed to reflect 120° phase separation. No change was made to the 50 Hz wording. No change was made to enclosure coatings in this revision. A comment was discussed on BIL requirements for 120 volt and 250 volt windings. An attempt to clarify the BIL issue will be made in the next revision. The cooling classes for IEEE and IEC were both listed in this revision so a transition from IEEE classification to IEC classifications can be understood in further revisions.

4 The conversion to metric units was discussed. Concern for possible safety problems on weight change may not be acceptable to a mature work force in the transformer industry.

5 After discussion and with no further old or new business the meeting was adjourned at 3:00 PM.

7.7.2.3 WG Dry Type Test Code C57.12.91 Chairman David Barnard

1 The working group met at 1:45 pm with 16 members and 8 guests present. Six guest requested membership. There are currently 46 members of the working group. It should be noted that many of these members have missed 2 or more consecutive meetings.

2 After introductions the chairman asked for comments and/or corrections to the minutes from the Oklahoma City meeting. There being no comments the minutes were approved as written.

3 Old Business

Jeewan Puri apologized for not providing a copy of the re-write of Clause 13 in C57.12.90 to include an option for the user to specify sound intensity measurements, as he had promised at the last meeting. There was a communication mix up between Jeewan and the chairman of the C57.12.90 working group. Jeewan will email a copy of the revised Clause to the WG Chair, who will intern send it to all the members for review. Each member is to read and comment on the proposal to include the same wording in the next revision of our standard.

Carl Bush reported on the cooling class designations, which will require revision before the standard is published again. Table 2 and Table 3 of Clause 11.7.3 and 11.8 will need to be modified to comply with the IEEE standard designations.

Mark Rivers proposed changing the last sentence of the note following Table 1 in Clause 10.8.4 concerning insulation power factor measurements, as follows:

"Due to the wide variety of insulating materials used in dry-type transformers, it has not been feasible to establish standard insulation power factor values. However, when field measurements indicate a significant increase over factory-measured values (greater then 2 times factory measurements), changes it the insulation system have occurred and the manufacture should be consulted."

The Working Group discussed this proposal and by show of hands voted to not change the existing note. It was noted that power factor testing is not a routine test on dry type transformers.

Max Cambre, who was unable to attend this meeting, did complete his task to review numerous clauses on Resistance Measurements, Dielectric Tests and Temperature testing, which Nigel McQuin objected to during the last ballot. Max presented his comments in written form and the Chair emailed them to all members before the meeting. A task force of volunteers was organized to review this subject and to provide wording for any proposed changes, which would be incorporated in the next revision. The members of the task force include but are not limited to the following: Nigel McQuin, Max Cambre, Derek Foster and Don Kline.

4 New Business

Don Kline informed the W.G. that a guide for making loss measurements, C57.123 is being developed. This guide, which is concerned with very low power factor transformers, includes dry type transformers in its scope

The chairman informed the Working Group that after 15 years as their chairman he would like to be relieved before a new PAR is submitted to IEEE.

5 A motion was made and seconded to adjourn, meeting adjourned at 3:00 pm.

7.7.3 Old Business

1 The negative ballots received on the reaffirmations of IEEE Stds. C57.12.58 "IEEE Guide for Conducting a Transient Voltage Analysis of a Dry-Type Transformer Coil" and C57.124 "IEEE Recommended Practice for the Detection of Partial Discharge and the Measurement of Apparent Charge in Dry-Type Transformers" were discussed. Paulette Payne stated she had contacted the negative balloters and they agreed to withdraw their negative ballots by agreeing to address their comments in the next revision.

2 Regarding C57.12.58, Max Cambre has provided correctly notated equations for the appendix on page 22. Max stated in his comments that the corrections addressed the use of the proper Greek letters. Max has also proposed updating the calculations used in determining the charging capacitance and tail resistance at 50 microseconds by applying modern computer techniques.

7.7.3 New Business

1 The chair gave a report on the activities of the Administrative Subcommittee meeting.

2 Sites for upcoming meetings were announced.

3 The chair stated that a resolution of the NEMA MOU had been reached and that this subcommittee would now administer the Dry Type standards formerly owned by NEMA. The chairman announced he was looking for working group chairs, vice chairs, and secretaries to administer the new documents. Sheldon Kennedy agreed to become the working group chair for C57.12.52, the product standard for Sealed-Dry Transformers.

4 The subcommittee was reminded that the working group members are required to participate and not just attend the meetings. A suggestion was made for working group chairs to consider removing inactive members from the group.

5 The chairman thanked Dave Barnard for his efforts as chairman of the working group of C57.12.91. Derek Foster, Olsun Electrics Corporation, has agreed to become the chairman of the working group.

6 The chairman also thanked Wes Patterson for his efforts as chairman of the Dry Type Subcommittee stating that Wes would be a “hard act to follow”. All gave Wes a round of applause.

7 There being no further business, the subcommittee meeting adjourned at 2:35 PM.