

# **Annex E HVDC Converter Transformers and Reactors Subcommittee**

**November 2, 2015, 3.15 pm**  
**Memphis, Tennessee**

**Chair: Michael Sharp**  
**Vice Chair: Les Recksiedler**  
**Secretary: Ulf Radbrandt**

## **E.1 Introduction / Attendance**

Introductions were made and the attendance list circulated.

There were 13 members and 15 guests present. None of the guests requested membership

The total membership of the SC is 17. We needed at least a total of 9 members to be present in order to have a quorum. This was achieved.

The agenda for this meeting was approved

## **E.2 Approval of the minutes of the October 20, 2014 meeting in Washington, DC**

The minutes from the San Antonio meeting (Spring 2015) were approved after a motion by Pierre Riffon and seconded by Rogerio Verdolin.

## **E.3 Brief report on the meeting of the Administrative SC**

Each WG shall create a justification document where it is documented why certain decisions have been taken during the revision of a standard. That document will be stored by the IEEE-SA for future understanding.

After the Ballot Resolution Group completes their work they must obtain confirmation from all members of the working group that any changes that they made are approved by all.

All working groups are responsible for assuring proper English grammar is used in their documents. The IEEE editorial staff do not check this.

## **E.4 Working Group Reports**

### **E.4.1 WG IEC/IEEE 60076-57-129 – Ulf Radbrandt (IEEE) and Anders Lindroth (IEC), Co-Chairs**

This joint workgroup has had one joint meeting since the last IEEE Transformers Committee Meeting (San Antonio, Spring 2015). That meeting was in Milan in September 10-11, 2015

#### **The Agreements and actions from the Milan meeting were the following:**

- Result from the Ballot within the IEEE SC were discussed and actions on each comment were decided.
- Chris Plötner had sent updated audible sound sections prior to the meeting. This was included to the document.
- Pierre Riffon had sent an updated clause of determination of hot-spot temperature prior to the meeting. This was included to the document.
- The over-excitation test, for which Pierre Riffon had prepared a proposal for text, was not included. The reason is that this standard should include requirements that are special for HVDC

transformers. The intent for including it in this standard was that HVDC transformers are often very important for the AC system and that motivates more stringent testing than for ordinary ac transformers. However, it was argued that there are AC transformers that also are that important to the AC system. Users can include this test in their specifications. Eventually, this test might be included in the general transformer standards.

- An extended polarity reversal test has been introduced to the document. This is a special test that can be used for applications where there will be frequent polarity reversals in operation. The time with PD criteria is extended to any sliding 30 min window within the 2 hours following the completion of each polarity reversal. The test is divided into Alternative 1 and Alternative 2.
  - Alternative 1 is extended to 6+8+2 hours. For units that are subjected to this test, the normal polarity reversal test is not necessary.
  - Alternative 2 is combined with the DC applied test. The test time is 3(2+1)+8+2 hours. For units that are subjected to this test, the normal polarity reversal and the DC withstand test are not necessary.
- Eric Davis will check if there is an IEEE document corresponding to IEC 60270
- Anders Lindroth will review the list of references and delete the ones which are not referred to in the document.
- Eric Davis to check the wording in the section on use of normative references.
- Ugo Piovan to send the Word version of Annex A in IEC 61378-1 and Anders Lindroth will include it in the document as Annex F. This is a more complex and more accurate alternative way of calculating eddy losses.
- Eric Davis to review Annex C (Design Review) to cover HVDC converter transformer specific items.
- Sheila Batey to arrange the references. All bibliographies should be collected to the end of the document.
- Our ambition is to have the first CD sent out for comments within IEC and IEEE before the end of this year. To be able to achieve this, all above tasks have to be completed and reported to me before the end of November.
- We are planning to ask IEC to limit the period for comments to two months. If that will be accepted, the comments will be available for discussion at the next IEEE HVDC Converter Transformers and Smoothing Reactors SC meeting in the spring of 2016.

#### **E.5 Discussions and agreements regarding the work for a Dual Logo standard for converter transformers**

Ulf Radbrandt made a presentation of the progress of the joint IEC/IEEE WG meetings (according to clause E.4 above). The discussions and agreements during and after the presentation were as follows:

- **Switching Impulse Level and Test**  
7.3.2.2 should be rephrased to be clear that there should be switching impulse levels and tests for the valve side windings even for voltage levels that are so low so switching impulse would not be applicable for normal a.c. transformers. The reason is that switching impulse levels normally are very close to the lightning impulse levels for HVDC transformers and that requires switching impulse tests for low voltage windings (e.g. for transformer for back-to-back schemes). The standard should not include requirements on, or references to, the insulation coordination.
- **Induced voltage including running of oil pumps with OD cooling.**  
The text should be changed so that two tests (with and without pumps running) would not be mandatory. It should be open for agreement between manufacturer and purchaser to agree if the

normal induced test can be performed with the pumps running. There was much discussion about whether or not pumps running or not is more onerous a test but no conclusions were reached

- Pierre Riffon will check if we can refer to general standards (IEC 60076-1, IEEE C57.12.00 and IEEE C57.12.10) for requirements on sections of the actual edition of C57.129 that have been excluded from the dual logo document (for example: sections dealing with oil and accessories).
- Over-excitation test  
The joint IEC/IEEE WG had decided not to include this test since it is not a test that specifically concerns HVDC transformers. Some people in the IEEE SC do still consider that it is good to include it in the dual logo document due to the much more severe consequences in losing one HVDC transformer compared to losing one a.c. transformer (in most cases).  
A voting took place among SC members and the result was 5 votes to include the test to the dual logo document and 4 votes to not include it. This question will go back to the joint WG.
- The introduced extended polarity reversal test (special test)  
We should include text about d.c. bushing test with the same amount of extended times. This means that if an extended test is selected then the bushings that will be mounted on the transformer, that will be subjected to this test, must be tested with polarity reversal test with the same duration as for the transformer test.
- Normal polarity reversal test  
The normal polarity reversal test is 90 + 90 + 45 minutes, with acceptance criteria on PD during the 30 minutes following on each polarity reversal. That means that the last 15 minutes are meaningless. Should we do anything about this? This question will go back to the joint WG.  
Discussed alternatives were:
  - Extend the acceptance criteria to 45 minutes with the number of allowed pulses ( $\geq 2000\text{pC}$ ) increased from 30 to 45.
  - Extend the acceptance criteria to 45 minutes with the number of allowed pulses ( $\geq 2000\text{pC}$ ) remaining at 30 but during any sliding 30 minute interval.
- Annex A “In service overloading of HVDC converter transformers”, Table A.1  
The table contains limits for the increase in concentration of dissolved gases in oil during overload testing. The limits are not the same as the limits in Annex D “Dissolved gases analysis for the detection of local overheating” of IEC 60076-2. Some limits are more stringent in the dual logo document even though it is related to overload there. N.B. This is unchanged from the IEEE document. The limits should be reviewed. This question will go back to the joint WG.

## **E.6 Old Business**

### **E.6.1 Revision of IEEE Std 1277**

The chair (Michael Sharp) asked again for volunteers to chair a working group to review and update IEEE Standard General Requirements and Test Code for Dry-Type and Oil-Immersed Smoothing Reactors for DC Power Transmission, IEEE Std 1277. Unfortunately there is still no volunteer for the chair.

## **E.7 New Business**

None.

## **E.8 Adjournment**

The meeting was adjourned at 4.30 pm.