

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

**October 24, 2016, 3.15 pm  
Vancouver, British Columbia, Canada**

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

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

Introductions were made and the attendance list circulated.

There were 14 members and 24 guests present. One guest 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 after a motion by Eric Davis, which was seconded by Paul Jarman. As an addition to the agenda, a presentation on Medium Voltage Direct Current (MVDC) Series Resonant Converters was added.

## **E.2 Approval of the minutes of the March 21, 2016 meeting in Atlanta**

The minutes from the Atlanta meeting (Spring 2016) were approved after a motion by Pierre Riffon, which was seconded by Klaus Pointner.

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

Clarification was made that a task force should develop the scope and purpose for a PAR and obtain a PAR before a working group is created and working group officers are appointed.

It was confirmed that a quorum is defined as having 50% or more members in attendance. (Not 50% plus one).

The word “safety” should be avoided in standards. We should e.g. use “recommended” instead.

A WG chair must always ask the members if they are aware of any essential patent claims that could affect the work by the WG. That should then be brought to the knowledge of all WG members and to the minutes of the meeting. The following suggested wording was provided, “If any individual believes that patent claims might be essential patent claims that fact should be made known to the entire working group and duly recorded in the minutes of the working group meeting” This is only required for working groups and not task forces, ad hocs etc.

Steve Antoz will be heading a task force to clarify the qualification requirements, benefits and duration of Emeritus Member classification.

There will be a 100<sup>th</sup> anniversary celebration at the spring 2018 meeting in Pittsburg. Please let Greg Anderson know if you would like to help with planning.

The minutes from the sub committees must be submitted before December 4<sup>th</sup> 2016.

## E.4 Working Group Reports

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

Ulf Radbrandt made a presentation regarding the work with the dual logo document since the Atlanta meeting. The highlights of that presentation are as follows:

- After the Atlanta meeting, the latest draft of the dual logo document was distributed within the IEEE SC
  - A voting, if we should go for ballot, took place via e-mail. The results were:
 

	WG	SC
- Number of members	7	17
- Voted	6 (85.7%)	11 (64.7%)
- Voted yes	6	11
- Voted no	0	0
  - For the WG, only IEEE members of the joint WG were considered.
  - The 2/3 majority of the WG and the 1/2 majority of the SC were thereby met.
  - The decision was then to go for ballot which took place between 23-Aug-2016 and 23-Sep-2016.
  - In parallel with the ballot a CDV (Committee Draft Voting) took place in IEC.
- Results of IEEE ballot of IEC/IEEE 60076-57-129
  - 66 eligible people in this ballot group.
  - 57 received = 86% returned
  - 53 votes
    - 51 affirmative votes, 96%
    - 2 negative votes with comments
    - 0 negative votes without comments
  - 4 abstention votes: (Lack of expertise: 1, Lack of time: 3)
  - The 75% affirmation requirement was met.
  - Comments: 45 4 technical, 31 editorial and 10 general
  - Must Be Satisfied Comments: 10 1 technical, 3 editorial and 6 general
- Results of IEC CDV of IEC/IEEE 60076-57-129

- Members (national committees) voting: 22
- Members in favour: 22 = 100%
- Number of comments: 7 2 technical, 3 editorial and 2 general
- Paul Jarman pointed out that it is possible that editorial comments will come after the IEC general meeting in Frankfurt, October 2016.
- Decision by Standardization Management Board (SMB)
  - SMB agreed that standards with many alternative requirements were an unsatisfactory response to the objectives of international standardization.
  - This affects the possibility to publish the dual logo standard for HVDC transformers. It affects also the other dual logo standards. This decision will be reviewed by SMB in February 2017.
- There has not been any meeting, with the joint WG, since (prior to) the Atlanta meeting. Mats Berglund, Anders Lindroth (former IEC chair) and Ulf Radbrandt met October 19<sup>th</sup> to propose actions to the comments from the Ballot (IEEE) and CDV (IEC). The comments and the proposed actions have been circulated within the joint WG for comments.
- Summary of the proposed actions (IEC and IEEE combined):
  - Totally 52 comments
  - 6 technical comments
    - 1 must be satisfied 1 rejected
    - 5 don't have to be satisfied 5 agreed
  - 34 editorial comments
    - 3 must be satisfied 3 agreed
    - 31 don't have to be satisfied 28 agreed, 1 partly agreed, 2 rejected
  - 12 general comments
    - 6 must be satisfied 5 agreed, 1 partly agreed
    - 6 don't have to be satisfied 1 agreed, 1 agreed/open (more info needed)  
1 partly agreed, 3 rejected
- The most critical comments and the actions were shown and discussed. The discussion were as follows:
  - It is too late to change the scope (regarding Line Current Commutated (LCC) technology or Voltage Source Converters (VSC) technology). This standard covers all HVDC transformers including VSC where applicable.
  - A comment to put safety aspects in caution boxes was partly agreed. This was related to remaining charge after DC voltage tests. The word "safety" was proposed to be removed from the wording "Appropriate safety precautions should be taken". The reason was that the use of "safety precautions" in the document does not refer to personnel safety or damage of equipment but rather to consequences for the test result.

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During the discussion regarding this, it was pointed out that it still can be a safety issue for testing personnel since there can be remaining voltage at terminals and that could lead to electric shock if touched. Maybe we should add caution boxes about caution to avoid electric shock. This will go back to the joint WG for review.

- A comment to include a reference to the report detailing various gasket materials by the Canadian Electrical Association (CEA) was proposed. It was agreed to include this if we can find that report. The report is mentioned in Annex C (Design review). The SC members are encouraged to search for that report and (if found) send an e-mail with the document number and title to Mike Sharp and Ulf Radbrandt. If the report is not found then the sentence “The Canadian Electrical Association (CEA) has produced a report detailing various gasket materials as compared to each other.” will be removed.
- Comments to add captions to the table and to the figure in the Annex was rejected. That might also be requested by the IEC editorial review. In that case we can add the captions.
- Planned coming work with this document
- Decide on action regarding the Canadian Electrical Association (CEA) report (detailing various gasket materials).
- Wait for the final decision by the Standardization Management Board (SMB), if we can have the dual references (IEC or IEEE).
- Based on the SMB decision, decide if we should continue with the dual logo standard or make two separate but identical standards where the alternative references are removed. E.g. if the document states today “according to IEC 60076-1 or IEEE C57.12.90”, then “to IEC 60076-1” will be removed from the IEEE standard and vice versa.
- Recirculation ballot within IEEE.
- FDIS within IEC. This might not be necessary due to the 100% approval rate.

### **E.5 Old Business**

#### **E.5.1 Revision of IEEE Std 1277**

The task force chair, Klaus Pointner, presented the draft PAR for revision of IEEE 1277.

- The proposed title is “Standard General Requirements and Test Code for Dry-Type and Oil-Immersed Smoothing Reactors and for Dry-Type Converter Reactors for DC Power Transmission”.
- The standard should also cover dry-type converter reactors for voltage source converters (VSC).
- A discussion followed regarding if the standard should cover converter reactors for all topologies or VSC converters.
- A conclusion was that the standard should cover converter reactors that are in series with the semiconductor valves where the reactors see both DC current (a third of the DC current at the DC side) and AC current (half of the AC current at the AC line). The stresses of those reactors are quite similar to stresses of smoothing reactors.

- Another conclusion was that the standard should not cover converter reactors e.g. for 2 or 3 level converters when those reactors are in series with the AC line where the reactors don't see DC currents.
- The final conclusion of this discussion was to include in the standard only those converter reactors that carry some DC current. It was also agreed that this should be included in the scope.
- There was also a discussion if the standard should cover oil immersed converter reactors. The conclusion was not to include these as it is too early. No one was aware of their application in service.
- The present standard does not include a "Purpose" but it includes a "Need". The "Need" should be transformed to a "Purpose" in the revised standard.
- The draft PAR will be circulated within the SC.
- The SC should agree about the title, scope and purpose of the standard and the PAR should be updated.
- We should have a definition of converter reactors for Statcoms (SVC),
- If the PAR is approved then we should try to arrange a first WG meeting in the next committee meeting (Spring 2017). That WG meeting should then precede the SC meeting. A discussion followed regarding if we could handle the revision of this standard directly in the SC (as we did for the last revision). In that case, no separate WG meetings would be needed. The decision was to perform the work in the SC after a motion by Christoph Plötner, which was seconded by Klaus Pointner.
- The present standard is in a good shape and most work will be regarding converter reactors.
- We should also follow, and perhaps harmonize the work with, the revision of IEC 60076-6 (Power transformers – Part 6: Reactors). That IEC standard covers smoothing reactors today and might cover converter reactors later.

## **E.6 New Business**

Les Recksiedler made a presentation regarding work with Medium Voltage Direct Current (MVDC) Series Resonant Converters with voltages up to 100kV.

A Cigré - WG (C6.31 Medium Voltage Direct Current (MVDC) Grid Feasibility Study) is started. The converters are e.g. intended for feeding remote villages and for military applications (e.g. marine). The converters should be small, compact and modular. They should also be of Plug and Play function. The conclusion, following a discussion, was that the transformers (for this applications) probably should be covered by the converter transformer standard (IEEE 60076-57-129) in the future but that it is too early to include them now.

## **E.7 Adjournment**

The meeting was adjourned at 4.20 pm after a motion by Eric Davis, which was seconded by Pierre Riffon.