

Annex E HVDC Converter Transformers and Smoothing Reactors Subcommittee

**March 25, 2019, 3.15 pm
Anaheim, California, USA**

**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 11 guests present. 1 new request for membership was received.

The total membership of the SC is 14. We needed at least a total of 8 members to be present in order to have a quorum. This was achieved.

The agenda for this meeting was unanimously approved.

Mike Sharp indicated that the minutes of the March 26, 2018 meeting in Pittsburgh were approved by e-mail after the Jacksonville meeting where quorum was not achieved.

E.2 Approval of the minutes of the October 15, 2018 meeting in Jacksonville

The minutes from the Jacksonville meeting were unanimously approved.

E.3 Brief report on the meeting of the Administrative SC by Mike Sharp

SC minutes must be submitted latest May 9.

There are new rules for quorum. There must be a majority, which means more than 50%, of the members present to obtain quorum.

Submission deadline for the last standards board meeting in 2019 is September 17.

The Policies and Procedures document for the Transformers Committee has been revised to include a section stipulating that a subcommittee chair will be appointed for three years with possible extension to maximum five years. Due to this new rule, Mike Sharp will step down as chair for this subcommittee and this was the last meeting for him as chair. Ulf Radbrandt will be the new chair and the official transition date is October 1 this year.

E.4 Reminder that IEEE 1277 will expire in 2020.

The standard for smoothing reactors, IEEE 1277, will expire in 2020.

E.5 Working Group Reports

E.5.1 WG IEEE P1277 - Dry-Type and Oil-Immersed Smoothing Reactors and Dry-Type Converter Reactors

Chair: Klaus Pointner (klaus.pointner@ieee.org)
Vice-Chair: -
Secretary: Ulf Radbrandt (temporary)

E.5.1.1 Introductions and Call for Patents

This WG meeting was conducted as part of the HVDC SC meeting.

The WG has different membership than the SC and different rosters. The WG rosters were distributed.

There were 14 members and 10 guests present. No new request for membership was received.

The total membership of the WG 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 unanimously approved.

We did not get quorum at the Fall 2018 meeting in Jacksonville, The minutes from the Spring 2018 meeting in Pittsburgh meeting were unanimously approved here.

The minutes as well as the agenda from the Fall 2018 meeting in Jacksonville meeting were unanimously approved.

E.5.1.2 Draft 6 and Input received for Draft 7.

A clean draft 6 has been distributed.

Comments have been received from Pierre Riffon, Chris Ploetner and Eric Davis.

The technical inputs are more or less done now and we should focus on review and corrections.

The chairman Klaus Pointner will send out draft 7 after this meeting together with the request to go forward to form the ballot pool via IEEE SA for balloting of the document.

Note: balloting prior the Fall 2019 meeting would allow 3 meetings for comment resolution an re-circulation. The document will become invalid by end of 2020. However, the PAR expires end of 2021 only.

E.5.1.3 AC power test

This is a very good test which can find e.g. short circuited loops of corona rings.

The voltage level for the AC power test is today defined as:

$$E_{AC} = 2.0 \sum I_h Z_h$$

This gives unreasonably high test levels, which requires very high power, which is often impossible to achieve by test labs.

A more reasonable test level is defined by the following equation:

$$E_{AC} = 1.5 \sqrt{\sum (I_h Z_h)^2}$$

The harmonic range is today 1 to 49. This is suitable for LCC reactors. It should be possible to extend the harmonic range to be suitable for VSC reactors – full range of harmonics shall be considered for VSC SMR's. As the converter reactors do have considerable AC current, the AC power test is not applicable if the heat-run test is performed with AC current.

E.5.1.4 Annex B - Construction of oil-immersed smoothing reactors

Eric Davis has reviewed this annex and considers that most of the information is covered by other standards, such as IEEE C57.12.10.

It was once decided to have this standard as free standing as possible and thereby limit the references to other standards. A problem with that concept is that the information might be old when other standards, with the same information, are updated.

Some parts as bushings are special for these reactors. Those parts should be kept but moved to the main text instead.

The decision was to delete the annex and move some parts, as bushings, to the main text and/or refer to the DC bushing standard which is available in the meantime.

Oil insulated smoothing reactors has for a long time been faded out from the market.

E.5.1.5 Further comments

Converter reactors for VSC are often placed indoors. It is then important that the purchaser specifies the ambient temperature, which normally is higher than the outdoor temperature. The minimum humidity should also be specified by the purchaser.

The rated DC voltage depends on the converter topology and must be specified by the purchaser.

References must be thoroughly reviewed. Pierre Riffon has sent a list of updated standards that should be updated in the next draft.

Extended polarity reversal test has been included in the same way as in the dual logo standard for converter transformers, IEC/IEEE 60076-57-129.

Clause 14.8.4 explains that short circuit test should only be conducted if the peak short circuit current is higher than ten times the DC current level. This does not work well for VSC converter reactor which normally conducts both AC current and a third of the DC current. We should add that the factor then is related to the r.m.s. value of the rated operating current for those reactors.

The sound section has been rewritten by Chris Ploetner and should be reviewed by others.

E.5.1.6 New Business

- There was no new business

E.5.1.7. Adjournment

The WG meeting was adjourned and the SC chair, Mike Sharp, took over with the SC meeting.

E.6 Old Business

- There was no old business

E.7 New Business

- A new secretary is requested for this subcommittee. Volunteers are welcome to report interest.
- Les Recksiedler will continue as vice chair.
- Should we do an HVDC tutorial in a future meeting? The general opinion was that it is a good idea. The tutorial should mostly be focused on VSC but can also include some comparisons between VSC and LCC. A tutorial could be divided into following parts:

- Different types of HVDC projects
- Different types of converter topologies
- Special stresses on converter transformers
- Special stresses on converter and smoothing reactors

E.8 Adjournment

The meeting was adjourned at 4:00 pm.