

**MINUTES OF THE MEETING OF THE HVDC CONVERTER
TRANSFORMERS & SMOOTHING REACTORS S.C. IN
OKLAHOMA CITY, OKLAHOMA, OCT. 21, 2002**

The S.C. met in Room 15 of the Cox Business Services Convention Center in Oklahoma City, Oklahoma on Oct. 21, 2002 from 1:45 p.m. - 3:00 p.m. There were 7 members and 7 guests present. One of the guests Raj Ahuga of Waukesha requested membership. The following are the highlights.

1. The minutes of the Vancouver meeting were approved.
2. There is no equivalent for IEEE 1277 (smoothing reactors for HVDC application) in IEC. It may qualify for publication as a joint IEC/IEEE standard. The chairman stated that he would follow up with Jin Sim.
3. A number of recent HVDC projects in the U.S. may provide the bases for feedback on IEEE C57.129 and IEEE 1277. Projects include the Rapid City Tie in North Dakota and the Sylmar upgrade.
4. In the next revision of IEEE C57.129 the scope should be expanded and a specific annex added to cover transformers used in voltage source converter based HVDC schemes. Much of the testing of such transformers will be consistent with that for AC power transformers.
5. Peter Heinzig gave a presentation on a proposed annex A.5 for C57.129 covering the use of impedance analyzers to determine the Loss Adjustment Factors. The use of electronic impedance analyzers to determine Loss Adjustment Factors used in the calculation of harmonic losses for converter transformers is an alternative to the use of a signal generator/power amplifier and electronic wattmeter to directly obtain the harmonic losses. (It should be noted that no voltage dividers or CTs should be used with wattmeters in order to achieve maximum accuracy). Per Peter's experience the impedance analyzer approach was straightforward and produced accurate results. It is proposed that the two methods be included in the proposed annex.

Peter presented the results of load loss measurements on a 282 MVA converter transformer for an HVDC project. The results obtained using IEEE C57.129 and Annex A.4 (IEC method) agreed within 2.52% (maximum difference) of those calculated according to IEEE 1158.

A copy of Peter's presentation will be sent to S.C. members with the minutes.

Input is requested from Allan Forrest as he has a great deal of experience on this subject.

6. The issue of overloading of converter transformers should be addressed in the next revision of IEEE C57.129; probably in an informative annex. The overloading of converter transformers vs AC power transformers should be presented and differences fully explained; harmonics and current waveshape. The annex should also include information on how to carry out overload tests in the lab. The main problem is the lab ambient temperature (usually high after a temperature rise test) vs actual overloading conditions (usually low ambient). Waldemar Ziomek will produce a first draft of an annex for the next meeting in Raleigh.
7. Potential projects for the S.C. are variable reactors for filters in HVDC schemes and commutation reactors for voltage source converters. When is the appropriate timing? Should they be covered as part of existing standards?
8. Fred Elliot requested feedback on the DC bushing standard from the HVDC Converter Transformer and Smoothing Reactors S.C. Per S.C. members impulse test levels for DC bushings on converter transformers is an issue. The DC bushing standard requires a 15% safety margin for the DC hipot but it is being applied to lightning and switching impulse. This is a serious issue per some S.C. members. S.C. members should provide direct input to Fred Elliot on this issue and others with copies to the chairman and other S.C. members.

The meeting adjourned at 3:00 p.m.

R. Dudley