

## Minutes of meeting

30. April. 2012

**WG: C37.010 Circuit breaker application Guide**  
**Chair: Helmut Heiermeier**  
**Location Orlando**

**Participants: 35 members**  
**23 guests**

- 1.) The chair started the meeting with the introduction of all participants.
- 2.) The committee chair had the IEEE patent slides to review but the patent slides are no longer required to review for each working group meeting.
- 3.) The committee approved the MOM (Minutes of Meeting) from previous meeting in (Nashville)
- 4.) The chair reviewed the agenda for the meeting.
- 5.) The chair reviewed the status of the PAR and expiration date.
- 6.) The committee discussed the work completed to date. A draft copy was provided by Helmut on 4-20-12 to listed members and guests. Some members or guests did not receive a copy. The chair will review the list and the reviewed list will be used to send the next document. For the draft that was provided on 4-20-12 (PC37.010 / D2), the standard was updated into a “usable” word document. Many graphs and tables needed rework and pulled into the document.
- 7.) Some discussion was given for TLF (Transformer Limited Faults) and associated TRV. Section 5.19 should make reference to the C37.011 standard. “IEEE PC C37.011 4.4.1” in the draft standard needs to be updated to reflect the correct reference in PC37.011. The chair also discussed section (5.10.2) asymmetrical requirements.
- 8.) The draft copy discussed in the meeting included changes in section 5.16 for shunt reactor switching.
- 9.) Some comments were made to include information for series reactors and series capacitors banks. Shunt or series reactor switching is covered in the TRV application guide C37.011 but switching for series capacitors is not addressed. Roy Alexander will provide comments or a statement for PC37.010 for switching issues for series capacitor banks (e.g. DC offset, trapped charge. etc...)
- 10.) The committee discussed the changed or amended section 5.13 capacitance switching. Some general explanations for C1 and C2 requirements and some explanations on statistical background were added or need to be added to the document. Helmut discussed the general comments provided by Anne Bosma for capacitance switching.
- 11.) The committee discussed the changed or amended chapters for controlled switching in section 5.18.

12.) Mike Skidmore discussed comments to be added to PC37.010 for limitation to the breaker rating due to closing resistor duty cycle and BCT (bushing current transformer) TRF concerns. Clarifying comments should be added for closing resistors energy limitations for out of phase closing vs. closing on a trapped line charge. An out of phase closing event is more severe. The BCT should make reference to C57.13 to match this standard for bushings current transformers. In addition to BCT information in C57.13 some information may overlap into C37.04. Some general comments were made to avoid discussing standards not assigned to the C37 working groups. Arben Bufi pointed out that breaker ratings are based on 40 degree C ambient temperature, while BCTs are based on 30 degree C ambient temperature per C57.13. Users need to caution the difference and take this into consideration for BCT TRF (thermal rating factor) selection.

13.) The committee discussed concerns for circuit breakers used on the high side of a GSU (Generator – Step – Up) transformer and the requirements for such equipment. The topic was marked a “Generator Circuit Breaker” and the committee said the name needed to be changed since this type of application (CB on the high side of a GSU) is not a true generator circuit breaker. Some discussed the use of the term “Synchronizing Circuit Breaker”. The chair will review and consider a better term for such equipment. It did not seem the committee concluded if this type of breaker should be discussed in PC37.010.

14.) At the very end of the meeting some discussion took place to remove all the old references in C37.010 that did not apply. The chair again discussed moving the old information to an annex. IEC

15.) The Chair discussed a comment received on rated interrupting time with regard to asymmetrical currents from ( E. Dullni ). Sushil Shinde of ABB will send information about Derating factors for contact parting time ( X/R).

16.) Several comments provided by Denis Dufournet for the draft copy provided on 4-20-12.

17.) In general, the committee suggested that PC37.010 be submitted for ballot. There is much work that needs to be done but if a ballot is issued then more formal comments can be obtained and revisions will follow.

18.) The committee discussed 300 ms reclosing time within the duty cycle. The draft information presented by Helmut for PC37.010 provided some rationale or clarification why 300ms reclosing time (5.9) is used.

19.) The working group committee agreed to adjourn meeting.

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### Agenda

- Introduction of members and guests
- Patent slides
- MOM meeting Nashville
- Performed work
- Discussion on the need to rework graphs
- Further work/open points

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### Status of working group

- PAR approved
- PAR expires end of 2014
- assumed document by than

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- Work done after Orlando
  - Complete document based on Word format
  - All equations made editable
  - All graphs reworked to be able to edit and change it
  - Some chapters changed or amended
  - Several editorial and typing errors identified

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- Changed or amended chapters
  - 5.10.2 Asymmetrical requirements
    - Some general explanations on occurrence of asym.
    - Interpretation of test results
    - Guide how to use test results obtained for different requirements

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## Changed or amended chapters

### 5.13 Capacitance switching

- Some general explanations C1 and C2 requirements
- Some explanations on statistical background

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## Proposals for added wording

IEEE C37.010 (Mike Skidmore)

### **Circuit Breakers – Limiting Factors for Associated Equipment**

Most circuit breakers are supplied with additional equipment such as; bushing current transformers (BCT), free standing current transformers, liner couplers, or bushing potential devices. Although a circuit breaker may have adequate continuous current, fault current, and voltage rating capability; the user should review the rating of the accessory equipment supplied with the circuit breaker. Typically devices such as, current transformer will have RF (rating factor) for associated primary and secondary taps. Depending on tap selection, the circuit breaker's current transformers may be underrated for the application and could possibly result in a failure of the device and/or breaker. The user should consider such equipment in the application and the circuit breaker manufacturer should be consulted for possible de-rating requirements. Normative Annex in C57.13 provides additional information for bushing current transformers along with standard SG-4.

### **Circuit Breakers – Resistor Energy Limitations (For Consideration)**

Circuit breakers with tripping and/or closing resistors may require a limited duty cycle. Factors such as resistance value (ohm), applied voltage, pre-strike conditions, out of phase voltage conditions, resistor insertion time, cooling interval of resistor, and circuit breaker operating duty cycle should be considered by the user and manufacturer. Several uncontrolled closing and/or opening events on a circuit breaker with an opening or closing resistor may exceed the resistor energy capability and result in a failure of the equipment. The manufacturer should be consulted for energy

and operating duty cycle limitations to the circuit breaker with such equipment.

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### Items to be discussed

Discussion on rated interrupting time with regard to asymmetrical currents ( E. Dullni )

•The rated interrupting time according to : is defined under rated conditions and for symmetrical fault currents . In the event of an asymmetrical current it is possible that the rated interrupting time is exceeded. The rationale behind is that either in case of asymmetrical currents the time between current zeros may be longer ( depending whether major or minor loop ). In addition to that, depending on the interruption technology used, the breaker may experience longer minimum arcing times than in symmetrical case .

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### Items to be discussed

Reference to unusual service conditions

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### Items to be discussed

How to address different temperature ranges

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### Items to be discussed

Use as generator circuit breaker

- The present standards for high voltage circuit breaker exclude don't specify special duties as they may occur when used as generator circuit breaker.
- However in some cases a standard high voltage circuit breaker may be used in such conditions.
- Special attention need to be drawn to the following conditions:
  - High number of load current switching
  - Special condition which may occur when synchronising a generator with a network
  - In rare cases missing current zero's may occur
- Since these cases need to be treated case by case only attention should be drawn

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## □ Items to be discussed

### Influence of circuit breaker behaviour to other devices

- A circuit breaker may influence the needed capabilities of user devices in the substation by its special behaviour.
- One example is a circuit breaker which has, by definition or by chance, a big spread of the closing time between the phases. In such a case higher asymmetries than the usual 2.6 or 2.7 P.U. may occur. The other devices in the substation will be stressed with these higher values and need to be of appropriate design.
- An other example is the overvoltage which may be created by a circuit breaker when switching reactors. Also the other devices need to have the ability to withstand the overvoltages created.