

**Minutes of Meeting**  
**WG: C37.010 - Circuit breaker application Guide**  
**Chair: Helmut Heiermeier**  
**Location: Galveston**

**29. April. 2013**

**Participants: 39 members**  
**18 guests**

- 1.) The chair started the meeting with the introduction of all participants.
- 2.) The chair reviewed the agenda for the meeting.
- 3.) The chair asked to approve the MOM (Minutes of Meeting) from the previous meeting in (Saint Pete Beach) and (San Diego). MOM from Saint Pete Beach had errors that were identified at the meeting in San Diego and corrected.

The chair asked for a motion to approve the minutes of the meeting from Saint Pete Beach  
Approver of first - Mike Skidmore  
Approver of second – John Webb  
All were in favor - the minutes from Saint Pete Beach meeting was approved

The chair asked for a motion to approve the minutes of the meeting from San Diego  
Approver first - Anne Bosma  
Approver second – Leslie Falkingham  
All were in favor - the minutes from the San Diego meeting was approved

- 4.) Helmut discussed the status of the PAR and the worked completed in San Diego. The PAR will expire on 12-31-14.

- 5.) The guide was submitted for ballot after the meeting in San Diego and the ballot closed on April 19, 2013 just before the meeting in Galveston. There were approximately 841 comments received( including 144 late comments ). The chairman reviewed several comments from the ballot per the attached slides. Because of the high amount of comments the chair asked whether some members would be willing and able to help on the resolution of comments. Several members expressed their willingness to help in this matter. After the meeting the chair sent out a mail asking for these memebers to respond

- 6.) The chairman said it was still unclear what old information should be included in the new guide. For example, are we allowed to refer to an older version of the same guide within the document or should the information be moved to an annex. After several discussions it was decided to keep the old information where applicable within the guide and also keep references to older standards. It was discussed that the introduction to C37.010 should include information about what the guide should include and why. For example, there should be a “guide to the guide” explaining why old information was taken out and that newer technology was the main focus. The example reviewed was the “K” factor in section 5.2 and if such information will remain.

7.) Sean (Xi) Zhu discussed a major section of 6.1 and basically annex A covers about 35 pages of fault calculations. The majority of the committee agreed this information should move out and C37.010 should maybe reference an IEC 60865-1 as well as IEC 60909-1 or an IEEE fault calculation guide. A small group was formed that included: Carl Schuetz, Joanne Hu, Steve Cary, Jim van de Ligt and Xi Zhu. This group will review the fault information and develop general wording for the application guide about fault calculations in general and reference another standard.

8.) There was a discussion about reclosing time in section 5.9 and a general comment about allowing time for ionized gas to clear from the faulted location in the circuit. There was confusion about “reclosing” time and maybe “dead” time after the breaker is opened and has cleared the fault should be used. The working group chair said he will review the comments and possibly re-label the title of section.

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

10.) The following slides were presented during the meeting

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### Agenda

- Introduction of members and guests
- MOM meeting San Pete
  - Correction of errors
- MOM meeting San Diego
- Status of working group
- Performed work
- Discussion of ballot results
- Further work/open points

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- Status of working group
  - PAR approved
  - PAR expires end of 2014
  - assumed document by than

May 1, 2013

2

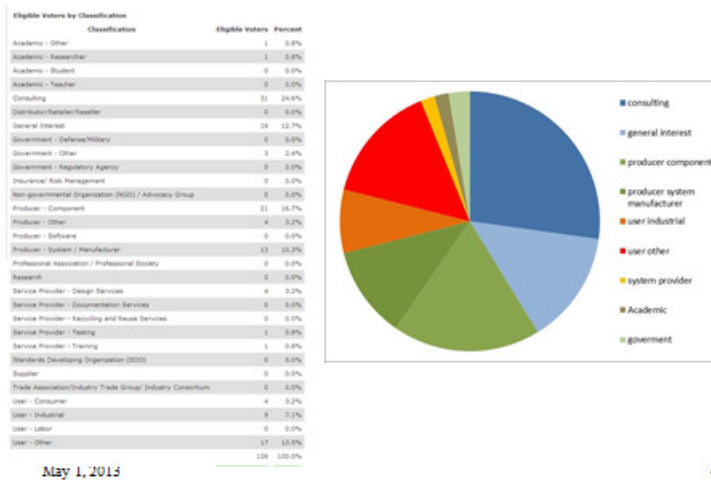
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- Work done after San Diego
  - Editorial work at the document
  - Finalisation of first draft for balloting
  - Initiation of ballot

May 1, 2013

3

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### Background for ballot:

Not the idea to really vote on the document

### Main idea to get:

Technical comments

General comments

Editorial comments

The documents has been sent out to the WG before the San Diego meeting with just a few responses

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- 126 Balloters
- Ballot closed 19 april
- Response rate 86%
- Abstain rate 7%
- Approval rate 86%
- Nr. of comments                      697 (144 late)
  - General comments                      128 (21 late)
  - Editorial comments                      335 (86 late )
  - Technical comments                      239 (37 late )

May 1, 2013

6

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- Additional information
  - Several comments related to poor english
  - Several comments related to references/footnotes
    - Partly problem of reformatting from PDF to word
  - A lot of comments related to mistyping
    - Partly problem of reformatting from PDF to word
  - These comments are even made to unchanged parts of the document

May 1, 2013

7

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- How to deal with old information
  - Reference to older standards/guides?
    - Even to the same guide
  - Include such information
  - Include such information in an annex
  - General note that standards and technologies changed and therefore for older technologies older guides are relevant

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8

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### Discussion of selected comments

- Comment I 48
- This sub clause defines voltage range factor K. For newer breakers the range factor is 1 and this application guide is applicable. For older breakers that are still in service the range factor may be other than 1 and this application guide does not apply to them. This sub clause gives the references where such guidance may be available. Since all of those reference standards are in different stages of individual revisions users will need to have on hand both old and new standards.

#### 32 **5.2 Voltage range factor**

33 The voltage range factor K defined in earlier standards has been changed to 1.0 for future circuit breakers,  
34 which allows simplification of the rating structure and circuit breaker application by eliminating the voltage  
35 range factor completely. However, it is recognized that circuit breakers rated in accordance with older  
36 standards and having voltage range factor K differing from 1.0 are still available and will be in service for  
37 many years. If there is a K factor, it should be noted on the circuit breaker nameplate. For circuit breakers  
38 that have a voltage range factor K differing from 1.0, the user should refer to IEEE Std C37.04-1979, IEEE  
39 Std C37.06-1987, IEEE Std C37.09-1979, and IEEE Std C37.010-1979 (or earlier editions of the same  
40 documents) for rating, application, and testing information.

Keep references to older standards?  
Put basic information in this guide?

May 1, 2013

9

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### •Discussion of selected comments

- Comment 96
- This says that the reclosing time is necessary to assure that there is sufficient dead time in the circuit breaker but this is not so. The dead time is needed in the circuit not in the circuit breaker. It is the ionized air in the circuit at the point of the fault that needs to be de-ionized. Therefore change "circuit breaker" to "circuit".

28 Several definitions of dead time for a circuit breaker are given in IEEE Std C37.100-1992. Before a circuit can be  
29 successfully re-energized, there must be sufficient dead time in the circuit breaker for the arc path at the fault to  
30 become deionized. On a radial line where the load includes a large motor component, arcing may be sustained after  
31 the breaker at the source is opened. Synchronous motors and static capacitors included in the load will tend to  
32 prolong the period of arcing. On tie lines, dead time on the circuit is the time interval between interruption of  
33 current by the last circuit breaker to clear and making of the contacts on the first breaker to reclose.

the meaning is that the time is needed at the fault location  
Can be reworded

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10

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### •Discussion of selected comments

- Comment 423
- The rated reclosing time of 300ms should not be shortened in service. The dead time with a reclosing time of 300ms will be 300ms - the interrupting time. For a 5 cycle breaker this yields a 216ms dead time. At most voltages this is about the minimum time to deionize a free burning air arc and allow a successful reclosure.

34 The rated reclosing time is 300ms. This time should not be shortened in service. The rationale behind the 300 ms is  
35 the time which is need to de-ionize the faulty position in air. This time depends also on the nominal voltage of the  
36 system, but the defined time of 300 ms is assumed to cover all cases. If the fault was not a permanent one a  
37 successful reclosing should be than highly probable. Special attention is needed if a probability of secondary arcs  
38 exists. These secondary arcs may occur if capacitive coupling between the healthy phases and the faulty phases  
39 exist. In such cases additional measures may be necessary to extinguish or to commutate the secondary arc.

Keep references to older standards?  
Put basic information in this guide?

May 1, 2013

11

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### •Discussion of selected comments

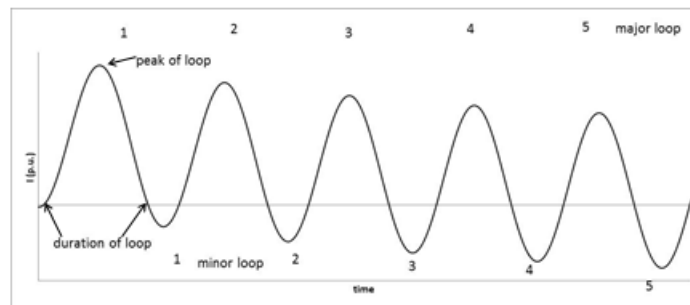
- Subclause 5.10.2 Asymmetrical requirements
- Several comments
- Figures 4-7 need improvement with regard to understandability
- A graphical representation of the asymmetrical current waveshape seems to be necessary
- A better description how to recalculate the tested values to the required values seems to be necessary

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12

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### •Discussion of selected comments



### Proposal for general graph related to asymmetrical currents

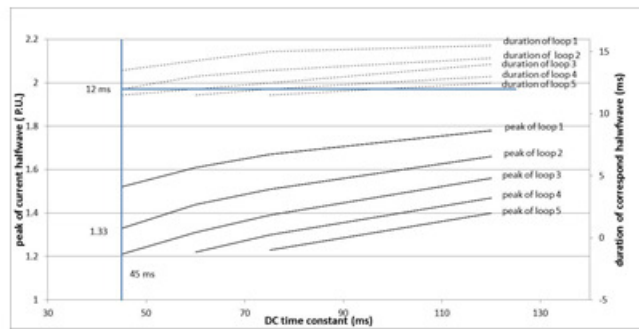
May 1, 2013

13



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### •Discussion of selected comments



May 1, 2013

14

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### •Discussion of selected comments

- Comment 542,544 dealing with delayed current zero's
- Extending the relay time can increase the total time of fault current duration.
  - Add a sentence which reads: "Care should be taken when intentionally delaying the moment of contact separation because this can increase the total time of fault current duration."
- The word "heavy" reminds of "high power" but this is not correct. Delayed current zeros may occur in power stations with units of any rating. The standard for generator circuit-breakers takes into account units from 10 MVA.

May 1, 2013

15

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### •Discussion of selected comments

Comment 266

""The 6th paragraph suggest that adding capacitors will lower the chopping overvoltage. This is not true. Adding capacitance will increase the chopping number and consequently the chopping overvoltage. This will in its turn increase the reignition overvoltages.""

32 The circuit breaker characteristic gained from this test procedure need to be used to calculate the expected  
33 overvoltages in the real application. The detailed description can be found in IEEE Std C37.015. Here the  
34 differences between chopping overvoltages and re-ignition overvoltages are distinguished. Basically the chopping  
35 overvoltages are related mainly to arcing time in a well-defined test circuit. These chopping overvoltages cannot be  
36 avoided.

37 However, system parameters could be influenced, for example by adding capacitors, in order to lower the natural  
38 frequency as well as the chopping overvoltages.

39 The re-ignition overvoltages will occur at short arcing times (below the minimum arcing time of the circuit  
40 breaker). During the re-ignition of the circuit breaker, the system will experience a fast voltage breakdown which  
41 may stress other system equipment.

This topic is complicated and may either need further explanation or, as suggested shortend

May 1, 2013

16

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### •Discussion of selected comments

Comment 649

I do not think the statement "These stresses are usual well within the voltage withstand capability of a circuit breaker" should be here. Shunt reactor switching duty is a severe duty that can cause significant wear to the breaker (e.g. nozzle wear/punctures) during frequent operation if proper care is not taken. I am afraid that some may take this statement as indicating that shunt reactor switching is an easy duty and mitigation such as synchronous-open control is not necessary when in fact for frequent operation it may be necessary."

21 **5.16 Shunt reactor current switching**

22 Tests for shunt reactor switching are defined in IEEE Std C37.015.

23 This switching duty is not considered to be critical for the circuit breaker with regard to the contact erosion.  
24 However, due to current chopping phenomena, it will be stressed frequently with higher voltage stress during  
25 opening. These stresses are usual well within the voltage withstand capability of a circuit breaker.

Rewording suggested

May 1, 2013

17

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## •Discussion of selected comments

- Comment 8,128
- ""ANSI Guide C37.06.1 does not describe tests but gives guidance on TRV parameters that could be used for testing. It should be noted that this document is under revision by the IEEE switchgear committee. The recent study by CIGRE WG A3.28 support the view that TRV values for 30% Isc are incorrect for EHV circuit breakers; so a note of caution should be added for those who will continue to use these TRV values in this case""
- ""This says that transformer limited fault tests are described in IEEE C37.06.1. Ignoring the fact that the IEEE document does not yet exist the tests were not discussed in ANSI C37.06.1. Therefore change ""Transformer limited fault tests are described in IEEE Std C37.06.1."" to ""Preferred TRV parameters for circuit breakers designated as ""definite purpose for fast transient recovery voltage rise times"" are listed in IEEE C37.06.1.

A hint should be given to this type of fault even if no released doc exists. How?

May 1, 2013

18

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## •Discussion of selected comments

PAR or Standard #	Style	Draft # -- <Filename>	Other Files	Stage	# of Balloters	Ballot Close Date	Response Rate %	Approval Rate %	Abstain Rate %	# Comments	A
7.010	PC37.010	Individual	7 -- <PC37.010_Draft_7_line_nr.pdf>	Comment Resolution	126	19-Apr-2013 11:59pm ET	86.0%	86.0%	7.0%	697	resolv reset termin

This topic is complicated and may either need further explanation or, as suggested shortend

May 1, 2013

19

## MEETING ROSTER FOR GALVESTON MEETING

First Name	Last Name	Company Name	City	State	Country	Role
Helmut	Heiermeier	ABB	Baden	Other	Switzerland	Chair
Michael	Skidmore	AEP	Pickerington	OH	USA	Secretary
Xi	Zhu	GE Energy Management	Atlanta	GA	USA	Vice-Chair
Ken	Edwards	Bonneville Power Administration	Vancouver	WA	USA	Member
Mauricio	Aristizabal	ABB	Pittsburgh	PA	USA	Member
Stan	Billings	Mitsubishi Electric PP	Warrendale	PA	USA	Member
Anne	Bosma	ABB AB	Ludvika	Other	Sweden	Member
Denis	Dufournet	Alstom Grid	Villeurbanne	Other	France	Member
Russell	Long	EATON Corp.	Pittsburgh	PA	USA	Member
Chih	Chow	PEPCO	Washington	DC	USA	Member
Arben	Bufl	HITACHI HVB INC.	Suwanee	GA	USA	Member
Anthony	Ricciuti	Eaton Corporation	Moon Township	PA	USA	Member
Mirko	Palazzo	ABB	Zurich	Other	Switzerland	Member
John	Webb	ABB	Florence	SC	USA	Member
Dave	Mitchell	Dominion	Richmond	VA	USA	Member
Leslie	Falkingham	Vacuum Interrupters Limited	Rugby	Other	UK	Member
Victor	Hermosillo	Alstom Grid	Charleroi	PA	USA	Member
Thomas	Pellerito	Detroit Edison	Detroit	MI	USA	Member
Richard	Jackson	Detroit Edison	Detroit	MI	USA	Member
Roderick	Sauls	Southern Company Services	Birmingham	AL	USA	Member

First Name	Last Name	Company Name	City	State	Country	Role
Li	Liu	Eaton	Moon Township	PA	USA	Member
James	van de Ligt	CANA High Voltage Ltd.	Calgary	AB	Canada	Member
Bjorn	Lofgren	Siemens Energy	Richland	MS	USA	Member
Jon	Rogers	Siemens Energy Inc	richland	MS	USA	Member
Gilbert	Carmona	Southern California Edison	Pomona	CA	USA	Member
Jiong	Zhang	MEPPI	West Covina	CA	USA	Member
Cody	Brehm	American Transmission Company	Milwaukee	WI	USA	Member
Steven	Chen	Chenhouse North America	MOON TOWNSHIP	PA	USA	Member
Sushil	Shinde	ABB Inc.	Mt Pleasant	PA	USA	Member
Don	Steigerwalt	Duke Energy	Charlotte	NC	USA	Member
Lise	Phan	Parcific Gas and Electric Company	Oakland	CA	USA	Member
Carl	Schuetz	American Transmission Company (ATC)	Waukesha	WI	USA	Member
Dean	Sigmon	Eaton corp.	Greenwood	SC	USA	Member
Ganesh	Balasurramanian	Eaton corp.	Greenwood	SC	USA	Member
Tom	Mulcahy	Dominion	glen Allen	VA	USA	Member
Toops	Vernon	Siemens	Jackson	ms	USA	Member
Michael	Crawford	Mitsubishi Electric	Warrendale	PA	USA	Guest
Jingxuan (Joanne)	Hu	RBJ Engineering Corporation	Winnipeg	MB	Canada	Guest
Todd	Irwin	Alstom Grid Inc	Smithville	MO	USA	Guest
Donald	Cantrelle	Georgia Power	Forest Park	GA	USA	Guest

First Name	Last Name	Company Name	City	State	Country	Role
Francis	Ricard	FirstPower Group LLC	Twinsburg	OH	USA	Guest
Vincent	Marshall	Southern Company Services	Forest Park	GA	USA	Guest
Lucas	Collette	Mitsubishi Electric	Warrendale	PA	USA	Guest
Dave	Collette	Mitsubishi Electric	Warrendale	PA	USA	Guest
Robert	Foster	Megger	Paradise	CA	USA	Guest
Charles	Hendrickson	Arizona Public Service Company	Phoenix	AZ	USA	Guest
Matthew	Lawrence	Doble Engineering	Baldwinsville	NY	USA	Guest
Stephen	Cary	Eaton Corporation	Moon Township	PA	USA	Guest
Donald	Swing	Southern States	Hampton	GA	USA	Guest
Julian	Profir	Rockwell Automation	Cambridge	ON	Canada	Guest
Doncus	Girano	Power Ind	Houston	Tx	USA	Guest
Sandeep	kulkarini	Crompton Greaves	Mumbai		India	Guest
Martinez	Ricardo	Lapem-GFE	Mexico		Mexico	Guest
Michael	Christian	ABB	lake Mary	FL	USA	Guest
		<b>36 Members</b>				
		<b>18 Guest</b>				