

Minutes of Meeting
Working Group C37.012 Application of Capacitive Current Switching for AC HV CB>1000 V

Location: Hilton Bonnet Creek, Orlando, FL
Date: Wednesday April 13th, 2022 (1:30-3:15 PM)
Participants: 31 Total in Attendance (7 Members –50% of total, 24 Guests)
4 of the 7 Members of the Comment Resolution Group in Attendance (57%)

WG Chair: Roy Alexander

WG Secretary & Vice Chair (Acting Chair): Luke Collette

Call to Order

Acting chair called the meeting to order.

Introduction of Members and Guests

Roster distributed and attendance recorded.

IEEE Copyright Policy and Call for Patents

Patent and copyright policy presented. No Patent claims identified.

Review of Minutes from October 11th, 2021

Acting chair reviewed minutes from the last meeting noting the following key items:

- WG vote to ballot C37.012 which was approved
- WG vote to form a Comment Resolution Group with authority to resolve comments and recirculate provided the ballot reaches 75% approval, which was approved

Agenda

Acting chair reviewed the agenda.

Review ballot results and comments from recirculation

Acting chair presented a summary of the ballot results for the initial ballot and the 1st recirculation. See the presentation attached to the end of these MOM.

The six (6) comments from the 1st recirculation were discussed among the WG and resolutions were agreed upon by the CRG. Table 1 shows a summary of the comments and agreed upon dispositions. Once the six (6) comments from the 1st recirculation are addressed, the document will be recirculated for ballot.

Adjournment

Meeting adjourned by the Acting chair at 2:30 PM.

Reported by:
Luke Collette

Table 1
Recirculation Comments and Dispositions

Category	Page	Subclause	Line	Comment	Must be Satisfied	Proposed Change	Disposition Status	Disposition Detail
Editorial	58	8.6.2	1678	The sentence in lines 1678 to 1680 is hardly readable.	No	Change to: This can be from inadvertent tripping of an unfaulted line immediately after energization or during unsuccessful three-phase auto reclosing into single or two-phase faults in the healthy phase(s).	REVISED	Sentence revised to: <i>"Delayed current zeros can be caused by events such as: - tripping of an unfaulted line immediately after energization - tripping all three poles after a re-close into a single or two-phase fault"</i>
Technical	83	C.2.1.1	2352	The clause talks about the different recovery voltages occurring under different grounding conditions. How does this clause relate to clause 4.5.2 "Test voltage and grounding, three-phase test" of C37.100.2, which says that both the supply and capacitor should never be isolated?	No	Check the relation to C37.100.2 cl. 4.5.2 and provide rationale of any differences.	REJECTED	The proposed change in the comment does not contain sufficient detail so that the CRG can understand the specific changes that satisfy the commenter. C.2.1.1 discusses the expected range for recovery voltage of capacitors banks in service which is expected to be between 2.0 p.u. and 4.05 p.u. depending on the capacitor bank grounding and pole opening sequence. C37.100.2 clause 4.5.2 discusses three-phase testing and does not give expected values for the recovery voltage.
Technical	4	3	508	The definition of "transient overvoltage factor" is difficult to understand and should be improved.	No	The transient overvoltage factor is defined as the ratio of the peak transient voltage appearing during opening between a circuit breaker disconnected terminal and the neutral of the disconnected capacitance to the phase to neutral crest voltage prior to opening.	REJECTED	The proposed change does not add sufficient improvement to the existing definition.
Editorial	3	3	373	According to the IEEE Style manual the defined term should not be in the definition.	No	Delete the introductory words, "Current chopping is" (I think the editors can do this as it does not introduce a change in meaning)	REVISED	Fixed all similar instances in the definitions clause.
Editorial	35	6.4.2.3	1227	Color graphs are difficult to incorporate into a standard and should only be used when essential. Since there is no legend for the various colors, can they be eliminated?	No	Remove blue and red colors from Fig. 13 or add legend showing the parameters represented.	REVISED	Removed blue and red colors from Figure 13.
Editorial	4	3	499	typographical grammer error "... to so that the ..."	No	... such that ...	ACCEPTED	

31 31 ATTENDEES
7 MEMBERS / 24 GUESTS

C37.012 Working Group Meeting Sign-In Sheet [2022-04-13]

By choosing to attend and sign in to this meeting, you acknowledge and agree that your personal data will be documented for IEEE standards development purposes to comply with policies and procedures, legal and accreditation requirements, and evaluation of patent claims by patent offices. IEEE must capture your personal data for these purposes, and will provide information about activities related to standards development groups in which you participate. IEEE standards development participation is documented through various methods, e.g., rosters, submission documents, email reflectors, records of meeting attendance, responses to ballots, publicly available participation lists, and declaration of affiliations. See the IEEE Privacy Policy at <https://www.ieee.org/security-privacy.html>.

[illegible]

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By choosing to attend and sign in to this meeting, you acknowledge and agree that your personal data will be documented for IEEE standards development purposes to comply with policies and procedures, legal and accreditation requirements, and evaluation of patent claims by patent offices. IEEE must capture your personal data for these purposes, and will provide information about activities related to standards development groups in which you participate. IEEE standards development participation is documented through various methods, e.g., rosters, submission documents, email reflectors, records of meeting attendance, responses to ballots, publicly available participation lists, and declaration of affiliations. See the IEEE Privacy Policy at <https://www.ieee.org/security-privacy.html>.

[illegible]

IEEE PES Switchgear Committee HVCB C37.012

**Hilton Orlando Bonnet Creek
April 13, 2022**

Agenda

1. Call to Order
2. Introduction of Members and Guests
3. Review of Copyright Policy and Patent slides
 - Call for Patents
 - If anyone is aware of any Patent Claims that might be Essential Patent Claims please make that known to the Working Group at this time.
4. Approval of Minutes from October 11th, 2021
5. Review and Approval of Agenda
6. Review ballot results and comments from recirculation
7. Adjournment

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IEEE SA COPYRIGHT POLICY

By participating in this activity, you agree to comply with the IEEE Code of Ethics, all applicable laws, and all IEEE policies and procedures including, but not limited to, the IEEE SA Copyright Policy.

- Previously Published material (copyright assertion indicated) shall not be presented/submitted to the Working Group nor incorporated into a Working Group draft unless permission is granted.
- Prior to presentation or submission, you shall notify the Working Group Chair of previously Published material and should assist the Chair in obtaining copyright permission acceptable to IEEE SA.
- For material that is not previously Published, IEEE is automatically granted a license to use any material that is presented or submitted.

IEEE SA COPYRIGHT POLICY

- The IEEE SA Copyright Policy is described in the IEEE SA Standards Board Bylaws and IEEE SA Standards Board Operations Manual
 - IEEE SA Copyright Policy, see
 - Clause 7 of the IEEE SA Standards Board Bylaws
<https://standards.ieee.org/about/policies/bylaws/sect6-7.html#7>
 - Clause 6.1 of the IEEE SA Standards Board Operations Manual
<https://standards.ieee.org/about/policies/opman/sect6.html>
- IEEE SA Copyright Permission
 - <https://standards.ieee.org/content/dam/ieee-standards/standards/web/documents/other/permissionltrs.zip>
- IEEE SA Copyright FAQs
 - <http://standards.ieee.org/faqs/copyrights.html/>
- IEEE SA Best Practices for IEEE Standards Development
 - http://standards.ieee.org/develop/policies/best_practices_for_ieee_standards_development_051215.pdf
- Distribution of Draft Standards (see 6.1.3 of the SASB Operations Manual)
 - <https://standards.ieee.org/about/policies/opman/sect6.html>

PARTICIPANTS HAVE A DUTY TO INFORM THE IEEE

- Participants shall inform the IEEE (or cause the IEEE to be informed) of the identity of each holder of any potential Essential Patent Claims of which they are personally aware if the claims are owned or controlled by the participant or the entity the participant is from, employed by, or otherwise represents
- Participants should inform the IEEE (or cause the IEEE to be informed) of the identity of any other holders of potential Essential Patent Claims

**Early identification of holders of potential
Essential Patent Claims is encouraged**

WAYS TO INFORM IEEE

- **Cause an LOA to be submitted to the IEEE SA (patcom@ieee.org); or**
- **Provide the chair of this group with the identity of the holder(s) of any and all such claims as soon as possible; or**
- **Speak up now and respond to this Call for Potentially Essential Patents**

If anyone in this meeting is personally aware of the holder of any patent claims that are potentially essential to implementation of the proposed standard(s) under consideration by this group and that are not already the subject of an Accepted Letter of Assurance, please respond at this time by providing relevant information to the WG Chair

OTHER GUIDELINES FOR IEEE WORKING GROUP MEETINGS

- All IEEE SA standards meetings shall be conducted in compliance with all applicable laws, including antitrust and competition laws.
 - Don't discuss the interpretation, validity, or essentiality of patents/patent claims.
 - Don't discuss specific license rates, terms, or conditions.
 - Relative costs of different technical approaches that include relative costs of patent licensing terms may be discussed in standards development meetings.
 - Technical considerations remain the primary focus.
 - Don't discuss or engage in the fixing of product prices, allocation of customers, or division of sales markets.
 - Don't discuss the status or substance of ongoing or threatened litigation.
 - Don't be silent if inappropriate topics are discussed. Formally object to the discussion immediately.

For more details, see *IEEE SA Standards Board Operations Manual*, clause 5.3.10 and
Antitrust and Competition Policy: What You Need to Know at
<http://standards.ieee.org/develop/policies/antitrust.pdf>

PATENT-RELATED INFORMATION

The patent policy and the procedures used to execute that policy are documented in the:

- ***IEEE SA Standards Board Bylaws***
(<http://standards.ieee.org/develop/policies/bylaws/sect6-7.html#6>)
- ***IEEE SA Standards Board Operations Manual***
(<http://standards.ieee.org/develop/policies/opman/sect6.html#6.3>)

Material about the patent policy is available at
<http://standards.ieee.org/about/sasb/patcom/materials.html>

**If you have questions, contact the IEEE SA
Standards Board Patent Committee
Administrator at patcom@ieee.org**

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Review Initial ballot results and comments

PC37.012, Draft 5

- Open date – 30 Nov 2021
- Close date – 30 Dec 2021
- Ballot Group
 - Members: 103
 - Return Ballots: 85 (82% meets minimum return rate of 75%)
 - Approve – 78
 - Disapprove with MBS (Must Be Satisfied) – 6
 - Abstentions – 1
 - Approval Rate: 92% (Meets minimum approval rate of 75%)
 - Total comments: 257

Type of Project: Revision to IEEE Standard C37.012-2014

Project Request Type: Modify / Revision

PAR Request Date: 20 Jan 2022

PAR Approval Date: 24 Mar 2022

PAR Expiration Date: 31 Dec 2024

Review Recirculation ballot results and comments

PC37.012, Draft 7

- Open date – 10 Mar 2022
- Close date – 25 Mar 2022
- Ballot Group
 - Members: 103
 - Return Ballots: 88 (85% meets minimum return rate of 75%)
 - Approve – 86
 - Disapprove with MBS (Must Be Satisfied) – 1
 - Abstentions – 1
 - Approval Rate: 98% (Meets minimum approval rate of 75%)
 - Total comments: 6

Type of Project: Revision to IEEE Standard C37.012-2014

Project Request Type: Modify / Revision

PAR Request Date: 20 Jan 2022

PAR Approval Date: 24 Mar 2022

PAR Expiration Date: 31 Dec 2024

Comment ID: 293473, Page 58, Subclause 8.6.2, Line 1678

When switching a line or cable whose charging current is more than 50% compensated with shunt reactors, and those shunt reactors are connected to the line or cable before it is energized, it needs to be understood that a rapid opening (within a few ten to thousand milliseconds) after a closing operation can result in delayed current zeros. This can be from inadvertent tripping of an unfaulted line immediately after energization or tripping all three poles after a re-close into a single or two-phase fault where the unfaulted phases could experience delayed current zeros. When an alternating-current (ac) circuit breaker opens a current zero must exist within a certain time after contact parting for successful current interruption to occur. The delayed current zeros associated with switching lines and reactors together can potentially lead to a failure for the circuit breaker to interrupt which can result in equipment damage or other system related concerns. Such a rapid opening after closing should be avoided by a tripping delay, or the shunt reactor should be disconnected before the line circuit breaker is opened. An appropriately sized preinsertion resistor or controlled closing may be another solution.

Comment:

The sentence in lines 1678 to 1680 is hardly readable.

Proposed Change:

This can be from inadvertent tripping of an unfaulted line immediately after energization or during unsuccessful three-phase auto reclosing into single or two-phase faults in the healthy phase(s).

Comment ID: 293418 Page 83, Subclause C2.1.1, Line 2352

Most capacitor banks are built either as single-phase, or three-phase wye. The grounding of the power system neutral and the capacitor bank neutral are key items in determining the required insulation level of the neutral connection and the recovery voltage that the switching device will need to withstand. An effectively grounded neutral system, and a grounded wye capacitor bank will impose the lowest possible recovery voltage on the switching device (2.0 p.u. maximum). The downside is that inrush current transients and harmonic currents will be conducted in the grounding system. An ungrounded capacitor bank can impose a recovery voltage from 2.50 p.u. to 4.05 p.u. depending on the opening sequence of the three poles of the switching device. Obviously since there is no ground connection neither inrush currents nor harmonic currents will be conducted in the grounding system. See IEEE Std 1036 for further guidance on the application of shunt capacitors.

Comment:

The clause talks about the different recovery voltages occurring under different grounding conditions. How does this clause relate to clause 4.5.2 "Test voltage and grounding, three-phase test" of C37.100.2, which says that both the supply and capacitor should never be isolated?

Proposed Change:

Check the relation to C37.100.2 cl. 4.5.2 and provide rationale of any differences.

Comment ID: 293418 Page 83, Subclause C2.1.1, Line 2352

Proposed Disposition Detail (Reject):

C.2.1.1 discusses the expected range for recovery voltage of capacitors banks in service which is expected to be between 2.0 p.u. and 4.05 p.u. depending on the capacitor bank grounding and pole opening sequence. C37.100.2 clause 4.5.2 discusses three-phase testing and does not give expected values for the recovery voltage. With respect to grounding in clause C37.100.2 clause 4.5.2, it says the following:

"For capacitor bank current switching tests, the capacitor bank neutral shall be grounded or isolated depending upon the capacitor bank neutral condition being tested. To test a capacitor with grounded neutral both the supply neutral and the capacitor neutral shall be grounded. To test a capacitor with ungrounded neutral, either the neutral of the supply or the neutral of the capacitor bank shall be grounded but not both."

Comment ID: 293417 Page 4, Subclause 3, Line 508

transient overvoltage factor: The transient overvoltage factor is defined as the ratio of the transient voltage appearing between a circuit breaker disconnected terminal and the neutral of the disconnected capacitance during opening to the operating line to neutral crest voltage prior to opening.

Comment:

The definition of "transient overvoltage factor" is difficult to understand and should be improved.

Proposed Change (also change where this appears in 5.9):

The transient overvoltage factor is defined as the ratio of the peak transient voltage appearing during opening between a circuit breaker disconnected terminal and the neutral of the disconnected capacitance to the phase to neutral crest voltage prior to opening.

Comment ID: 293399 Page 3, Subclause 3, Line 373

current chopping: Current chopping is an interruption prior to the natural power frequency current zero of the circuit connected to the circuit breaker.

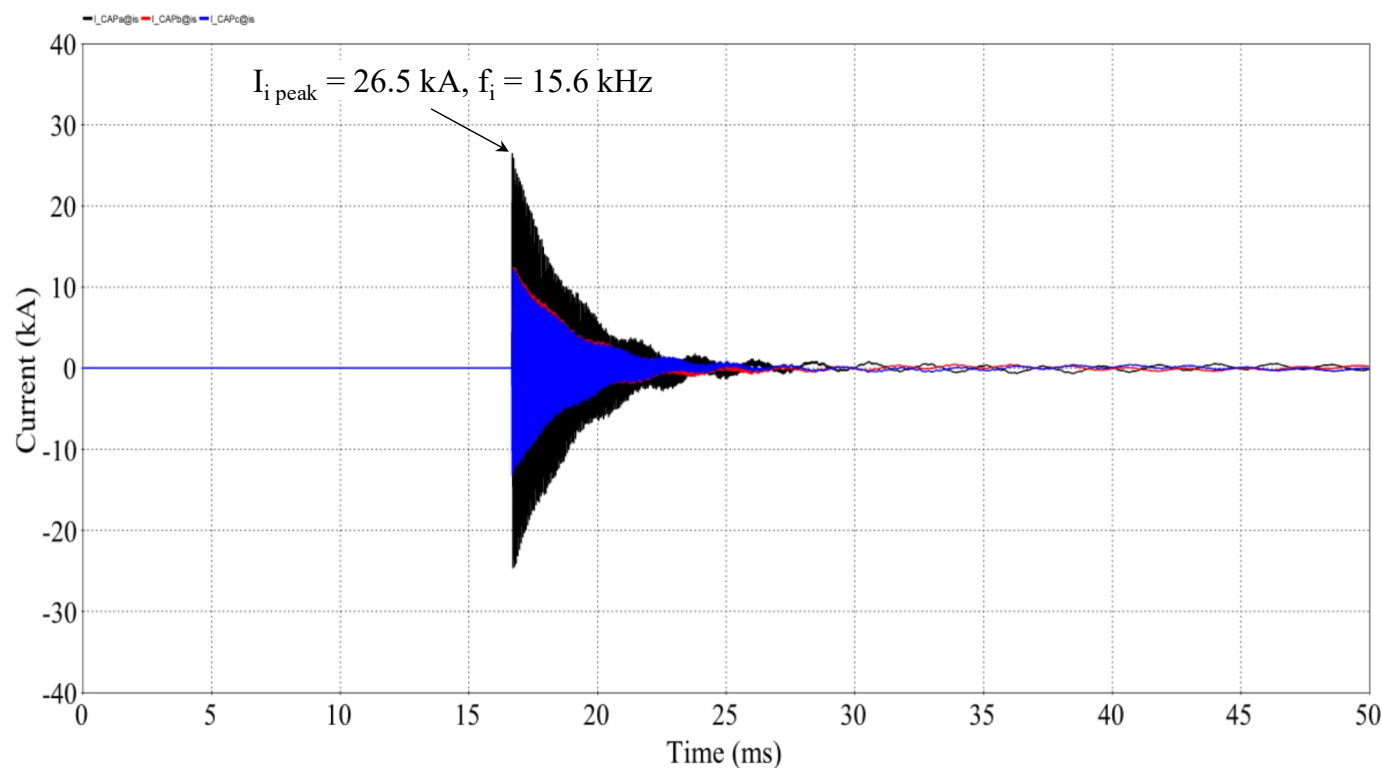
Comment:

Delete the introductory words, "Current chopping is" (I think the editors can do this as it does not introduce a change in meaning)

Proposed Change:

Fix along with other instances in the definitions

Comment ID: 293398 Page 35, Subclause 6.4.2.3, Line 1227



Comment:

Color graphs are difficult to incorporate into a standard and should only be used when essential. Since there is no legend for the various colors, can they be eliminated?

Proposed Change:

Remove blue and red colors from Fig. 13 or add legend showing the parameters represented.

Comment ID: 293397 Page 4, Subclause 3, Line 499

single capacitor bank switching: Switching of a capacitor bank whose inrush current is limited by the inductance of the source, buswork inductance, and its own capacitance. Other capacitor banks and cables are not sufficiently coupled to the bank **to so that the** inrush current magnitude is less than 20 x the steady state capacitor bank current.

Comment:

typographical grammer error "... to so that the ..."

Proposed Change:

... such that ...

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