

Minutes of Meeting

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

Location: Webex (Virtual Meeting)
Date: Monday October 11th, 2021 (8:00-9:45 PM CDT)
Participants: 40 Total in Attendance (10 Members –91% of total, 30 Guests)

Call to Order

Chair called the meeting to order.

Agenda

Chair presented the agenda.

Motion: Approve agenda: John Webb

2nd to the Motion: Marcus Young

Vote: Approved without objection/abstention

IEEE Copyright Policy and Call for Patents

Patent and copyright policy presented. No Patent claims identified.

Introduction of Members and Guests

Introductions and attendance gathered through Webex chat.

Acknowledgment of Contributions

The WG chair kicked off the meeting by giving acknowledgment of the contributions received to date.

Review Working Group Membership Requirements

Chair discussed obligations of Working Group members to actively participate in development and review of the document material.

Discussion on Comments Provided to Draft D3

Chair showed a presentation with a comment received for further description needed for outrush current. Proposal was to include a section 5.10 addressing overcurrent, including outrush current.

Question: Clarify the difference between inrush and outrush current.

Response: Difference is in which breaker sees it. Inrush, it is the breaker that is switching the capacitive device (e.g., cap bank, line, cable, etc.). Outrush is not the capacitive switching device, it is another device such as a line breaker closing into a short-circuit. The capacitor just happens to be on the source side, so the pre-charged capacitor discharges into the short-circuit. The concern is that it is possible no consideration was given to those breakers for a capacitive current rating.

Chair asked if there were any other comments that need addressed during this time?

Suggestion to add diagrams for inrush and outrush examples.

Comment that discussion on outrush current and impacts on nearby stations needs better clarification. One-line diagrams would help with this.

Vote to Ballot C37.012 D4 with Discussed Changes

Chair discussed the desired approach to send the next draft of the document to ballot.

Question: Is the suggested approach to add the outrush section/figures discussed here as well as include the additional comments received by e-mail on draft D3 to generate another draft (D4) and then send that to ballot?

Response: Yes, that would be the intention.

Motion: Incorporate the changes discussed during this meeting into the next draft to ballot, and then move the draft to ballot after the changes have been made.: John Webb

2nd to the Motion: Marcus Young

Vote: 10 Yes (100%), 0 No, 0 Abstentions

Vote to form a Comment Resolution Group

Motion: Working Group to form a Comment Resolution Group to act on behalf of the Working Group as a whole to resolve comments and recirculate the ballot as necessary following the initial ballot: John Webb

2nd to the Motion: Marcus Young

Clarification on the motion: The Comment Resolution Group has unlimited chances to resolve the comments and the Comment Resolution Group has the power to make all changes as it feels necessary to get the document approved with or without input from the Working Group.

Amended Motion: Comment Resolution Group has authority to resolve comments and recirculate provided the ballot reaches 75% approval and in the absence of 75% approval, the Working Group must vote in person or by electronic ballot on proposed changes.

Vote on Amended Motion: 10 Yes (100%), 0 No, 0 Abstentions

Comment Resolution Group:

- Roy Alexander
- Luke Collette
- Curtiss Frazier
- Hua Liu
- Craig Polchinski
- John Webb
- Jan Weisker

Question whether we can request ballot group formation and MER in parallel. Response that as long as HVCB approves going to ballot, both can be done at the same time.

Comment made that if you wish to be included in the ballot group, be sure you have the appropriate selections made in your IEEE-SA profile.

Adjournment

Meeting adjourned by the chair at 9:33 AM (CDT).

Reported by:

Luke Collette

**IEEE PES Switchgear Committee
HVCB C37.012 - Meeting Roster**

Place/Date of Meeting: Virtual / October 11th 2021

Ref. No.	First Name	Last Name	Company Name	Role	10/11/2021 Attendance
1	Roy	Alexander	RWA Engineering	Chair	X
2	Chris	Ambrose	Federal Pacific (Div. of Electro-Mechanical Corp.)	Guest	
3	Roy	Ayers	Nashville Electric Service	Guest	X
4	Steven	Brown	Allen & Hoshall	Guest	
5	David	Caverly	Trench Ltd.	Member	X
6	Andrew	Chovanec	GE Power	Member	X
7	Lucas	Collette	Duquesne Light	Secretary	X
8	Jason	Cunningham	Southern States, LLC	Guest	
9	Patrick	Di Lillo	Consolidated Edison Co. of NY, Inc.	Guest	
10	Raymond	Frazier	Ameren	Guest	X
11	John	Hall	Tennessee Valley Authority	Guest	
12	Jeremy	Hensberger	Mitsubishi Electric Power Products Inc.	Guest	X
13	Roy	Hutchins	Southern Company Services	Guest	
14	Christopher	Jarnigan	Southern Company Services	Guest	X
15	Thomas	Keels	DiGioia Gray & Associates	Guest	
16	Wangpei	Li	Eaton	Guest	
17	Yingjie	Ling	GE	Member	
18	Hua Ying	Liu	Southern California Edison	Member	X
19	Steven	May	Southern Company	Guest	X
20	Jeffrey	Nelson	Tennessee Valley Authority	Guest	
21	Andrew	Peterson	ABB	Guest	
22	Craig	Polchinski	MEPPI	Member	X
23	Carl	Schuetz	American Transmission Company (ATC)	Guest	X
24	Robert	Smith	Retired	Member	X
25	Donald	Swing	Powell Industries	Guest	
26	John	Webb	ABB	Member	X
27	Marcus	Young	Mitsubishi Electric Power Products, Inc.	Member	X
28	Wei	Zhang	Hitachi T&D Solutions, Inc.	Member	X
29	Devki	Sharma	Entergy	Guest	X
30	Carl	Kurinko	Hitachi-ABB Power Grids	Guest	
31	Arben	Bufi	Meiden America Switchgear, Inc.	Guest	X
32	Jan	Weisker	Siemens Energy	Guest	X
33	Jim	van de Ligt	Spark Power Corp.	Guest	X
34	Michael	Boulus	PSE&G	Guest	
35	Scott	Lanning	S&C Electric	Guest	X
36	Oleksandr	Sergeyenko	Tavrida Electric North America	Guest	
37	Damian	Perrin	Entergy	Guest	X
38	Anne	Bosma	Hitachi-ABB	Guest	X
39	Tony	Ricciuti	Eaton	Guest	X
40	Vincent	Marshall	Southern Company	Guest	X
41	Tom	Pellerito	DTE Energy	Guest	X
42	Rich	York	MEPPI	Guest	X
43	Samuel	Zaharko	MEPPI	Guest	X
44	Stephen	Cary	Innovative Switching Solutions Inc	Guest	X
45	Rey	Ramos	Southern Company	Guest	X
46	Brian	Roberts	Southern States, LLC	Guest	X
47	Don	Steigerwalt	Duke Energy	Guest	X
48	Mike	Skidmore	AEP	Guest	X
49	Michael	Christian	ABB	Guest	X
50	Victor	Hermosillo	GE Grid Solutions	Guest	X
51	Bill	Bergman	Bergman & Associates	Guest	X
52	Mike	Crawford	MEPPI	Guest	X
53	Michael	Wong	Entergy	Guest	X
54	Edgar	Dullni	Retired	Guest	X
55	Dragan	Tabakovic	Hubbell Power Systems	Guest	X

C37.012 Capacitor switching application guide

F21 virtual meeting

10/11/21 virtual C37.012 meeting Agenda

- Copyright slides
- Patent slides
- Acknowledge Task force contributions
- Review WG membership requirements.
- Discuss D3 remaining issues/ comments (note: D3 issued for comment 9/17/21)
- Vote to ballot C37.012 D4 with discussed changes
- Vote to form CRG for comment resolution and recirculations.

INSTRUCTIONS FOR CHAIRS OF STANDARDS DEVELOPMENT ACTIVITIES

At the beginning of each standards development meeting the chair or a designee is to:

- Show the following slides (or provide them beforehand)
- Advise the standards development group participants that:
 - IEEE SA's copyright policy is described in Clause 7 of the IEEE SA Standards Board Bylaws and Clause 6.1 of the IEEE SA Standards Board Operations Manual;
 - Any material submitted during standards development, whether verbal, recorded, or in written form, is a Contribution and shall comply with the IEEE SA Copyright Policy;
 - Instruct the Secretary to record in the minutes of the relevant meeting;
 - That the foregoing information was provided and that the copyright slides were shown (or provided beforehand).

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/permissions.ttrs.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**

Contribution Acknowledgements

- Definitions: Marcus Young, John Webb
- Capbanks: Andy Chovanek
- Overhead Lines: Jan Weisker (made many good additions)
- Switching through Transformers: Luke Collette, Craig Polchinski
- Esoteric stuff: Carl Schuetz. (Edgar Dullni – Kirk Smith – Leslie Falkingham)
- Everything else: Luke Collette, Me
- Special Kudos: To Dave Caverly– the only one to submit written comments on the entire D3 before the meeting!

Requirements to be a WG member and be listed as such in the front of the document

- It is expected the WG members contribute to the Writing of the Standard.
- The people mentioned on the previous slide have “paid their dues”
- One can Make significant comments on the document. (Some could be during the balloting process but better beforehand.)
- Just attending meetings is necessary, but not enough.

Known outstanding item

- Include a section 5.10 addressing overcurrents, in particular outrush concerns which involve non capacitive load switching breakers. Eg. Line breakers.
- What do we mean by outrush? Having capacitive loads on the source side and Closing into a pre-existing fault, as in closing into grounds, or a reclose into an uncleared fault. See proposed wording (Later)

Comments brought forward at this meeting

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5.10 "Inrush and outrush concerns"

Inrush speaks to the transient charging current which flows when energizing capacitive loads or elements. These transient charging currents stress the capacitive load switching device during the making operation. Outrush speaks to transient discharging currents which flow when charged capacitive loads or elements are discharged as a result of the high voltage capacitive element terminal being connected to neutral or ground. This may be as a consequence of a fault occurring, or as a result of a nearby station breaker closing into an existing fault. This could be a breaker in the same station, or in more unusual circumstances, even a breaker located in another nearby station. The key point here is that the breaker involved may be a station breaker that is not intended to be used for significant capacitive current making. And it may be an old oil General Purpose circuit breaker.

Clause 10.2.2 speaks of total capacitive discharge into a short circuit. When a fault occurs, capacitive elements will discharge into the fault but when the circuit breaker between the capacitor bank and the fault is fully closed the circuit breaker is usually not put in jeopardy.

The switching device Outrush Current issue occurs when a breaker closes into a fault with significant charged capacitance behind it (such as a reclose operation or a closing when safety grounds are left on by mistake.) This can occur on circuit breakers which are not intended to be used for significant capacitive current making. Oil circuit breakers in particular are sensitive not just to the peak current magnitude of the outrush transient but also to the di/dt . In such outrush cases, it may be necessary to limit the magnitude and/or the di/dt of the outrush current, depending on the capabilities of the circuit breaker which could potentially close into a fault. (see also 10.2.2) These requirements are reflected in past versions of IEEE Circuit Breaker Standards

Nevertheless, if oil circuit breakers are still present in the station, these factors and the limits in former versions of the standards should be considered when developing new applications that may also involve older circuit breakers.

It should also be stated that significant damaging outrush events are rare and in order to be serious, particularly at voltages below 170 kV, require that the involved fault be located quite near to the station. The higher the voltage, the further out from the station a fault could be and still result in a damaging outrush. Considering all of this, a risk analysis is an appropriate undertaking as part of a design application development. Such analysis should also take into account any requirements of the regulator – which may demand that certain limits be satisfied, regardless of risk/probability requirements.

TLIs can be used to limit outrush di/dt and magnitude and as such are often a good solution, but of course, they are not without additional cost and potential complications such as TRV on the circuit breaker. This too can be solved, but also with additional cost.

In summary, the limitations of old oil breakers, if present, need to be considered along with the particular application risks and associated mitigation costs to arrive at a good engineering solution.

A risk analysis needs to be done to compare the rare likelihood of a damaging outrush to the cost of mitigation with TLIs. Consideration needs to be given to unintended consequences of having TLIs in the circuit:

- 1) Increased voltage on the capacitors and possible shortened capacitor life
- 2) A shunt harmonic filter branch is being created which may cause harmonic overload of the capacitive load (particularly capacitor banks and long cables)
- 3) With a possible fault where the TLI is the majority of the fault impedance, a TLI can result in a fast TRV that SF6 breakers may not be able to handle.

These need to be considered in addition to the additional initial cost of installing TLIs.

Next

- Motion to approve to ballot including the proposed TLI section and any other items brought up at the meeting
- Form a CRG
- Initiate MER
- Initiate Invitation to ballot

Adjourn