Task Force Agenda

Low-Voltage Power Circuit Breakers for Emerging Technologies

Meeting Minutes

Meeting Date: 23 April 2018
Meeting Time: 8 AM – 9:45 AM EDT
Location: Disney's Contemporary Resort, Lake Buena Vista, FL

A. Call to order

The Task Force for Low-Voltage Power Circuit Breakers for Emerging Technologies teleconference was called to order at 8:05 AM EDT on April 23, 2018 by TF Chair, Keith Flowers.

B. Attendance

Introductions were made of all attendees. Attendees are listed below.

Nine Task Force members were present, with eighteen guests in attendance. Quorum was met. Attendance recorded in 123Signup.

Attendees:

Name	***Company***	***Member/Guest***
Keith Flowers	*Siemens Industry, Inc.*	*Chair*
Clint Carne	*Schneider Electric*	*Member*
David Dunne	*Schneider Electric*	*Member*
Lou Grahor	*Eaton Corporation*	*Member*
Tom Hawkins	*Siemens Industry, Inc.*	*Member*
Dan Hrncir	*Eaton*	*Member*
Jeff Mizener	*Siemens Industry, Inc.*	*Member*
Darryl Moser	*ABB*	*Member*
Danish Zia	*UL LLC*	*Member*
Jeffrey Andle	*Emerson*	*Guest*
Doug Edwards	*Siemens Industry, Inc.*	*Guest*
Michael Flack	*Southern Company Generation*	*Guest*
Paul Fox	*Schneider Electric*	*Guest*
John Harley	*FirstPower Group LLC*	*Guest*
Daniel Hook	*Western Electrical Services*	*Guest*
Chad Kennedy	*Schneider Electric*	*Guest*
Michael Lafond	*General Electric*	*Guest*
James Lagree	*Eaton*	*Guest*
Ted Olsen	*Retired, formerly with Siemens Industry, Inc.*	*Guest*
Owen Parks	*ABB*	*Guest*
Richard Rohr	*Powell Electrical Systems*	*Guest*
Jim Sharkey	*EPRI*	*Guest*
Kevin Sippel	*Eaton Electric*	*Guest*
Paul Sullivan	*DuPont*	*Guest*
Michael Titus	*Schneider Electric*	*Guest*
Bruce Venne	*Rockwell Automation*	*Guest*
Li Yu	*Eaton Corporation*	*Guest*

C. Approval of agenda

The meeting agenda was reviewed approved by consent.

D. Rules and guidelines for conducting working group meetings

The attendees were reminded of the IEEE Patent Policy and Business Conduct guidelines. The IEEE Patent Policy and Business Conduct slides may be reviewed at the following website:

http://standards.ieee.org/board/pat/pat-slideset.pdf

E. Working group P&Ps

Each Working Group must operate under a IEEE-SA approved Working Group Policies and Procedures protocol. The Task Force was reminded that the meeting would be conducted within these procedures. The approved template for the Switchgear Committee is:

http://www.ewh.ieee.org/soc/pes/switchgear/O-and-P/PES_WG_PP-Switchgear--approved-(2013-09-19).pdf

F. Document status report

Not applicable. No specific document was being considered at this juncture.

G. New business

See the slides appended to these meeting minutes, recapping previous discussions of the Task Force. The following discussions were held:

- **Are circuit breaker requirements for emerging technologies (for example, wind, solar, energy storage, etc) adequately covered by existing requirements within IEEE Std C37.13 and IEEE Std C37.14, or are modifications and/or additional standards required?**

  The consensus of the Task Force and guests was that “no,” there are readily identifiable gaps – particularly with IEEE Std C37.13.

- **Methodologies for incorporating emerging technology requirements into C37 standards.**

  The consensus of the Task Force was to follow the model of IEEE Std C37.20.7-2018, with common requirements detailed within the main body of the IEEE Std C37.13 document, and with unique requirements described within normative annexes.

  Discussions were held with regard to the importance of the Application Guide annex of the document, with giving users clear direction as how to apply the theoretical new requirements which would be detailed within the new normative annexes.

- **Discussion: Do we need an IEEE-SA PAR?**

  Darryl Moser motions to "request permission from the Low-Voltage Switchgear Devices Subcommittee (Sponsor) to request a PAR for the revision of IEEE Std C37.13 with no modifications to the Scope and Purpose clauses of C37.13."

  Jeff Mizener seconded the motion.

  The motion carried unanimously.

H. Conclusion

The Chair will present the motion to the LVSD Subcommittee at the April 25, 2018 meeting.

Anticipating approval of the PAR request, the Chair requested volunteers to assist with the construction of the initial draft of the new annexes.

With no further discussion, the meeting adjourned at 9:40 AM.

I. Upcoming Meetings

The face-to-face Working Group meetings are held in conjunction with the IEEE PES Switchgear Committee meetings. Additional teleconferences are scheduled as needed. The upcoming Switchgear Committee meetings are tentatively planned for:

Fall 2018 (14 Oct – 18 Oct), Kansas City Marriott Downtown, MO
Spring 2019 (28 Apr – 01 May), Hilton, Burlington, VT
Fall 2019 (06 Oct – 10 Oct), Catamaran Resort, San Diego, CA
Spring 2020 (04 May – 08 May), Peppermill Resort, Reno, NV
Fall 2020 (04 Oct – 08 Oct), Sheraton Sundance Square, Fort Worth, TX
Spring 2021 (18 April – 23 April), Hilton Charlotte University Place, Charlotte, NC

Specific date and locations are subject to change based on the overall Switchgear Committee schedule. IEEE PES Switchgear Committee meeting announcements and registration can be found at the following link:

http://www.ewh.ieee.org/soc/pes/switchgear/NextMeeting/Future_Meetings.html

Minutes submitted by:
Keith Flowers
Task Force Chair
April 23, 2018

Special-Purpose Circuit Breaker Applications for Emerging Technologies

Today's Agenda

A. Call to order

B. Introductions

C. Approval of agenda

D. Approval of March 27, 2018 Meeting Minutes

E. Rules and guidelines for conducting task force / working group meetings

The IEEE Patent Policy and Business Conduct slides may be reviewed at the following website:
http://standards.ieee.org/board/pat/pat-slideset.pdf

F. Working group P&Ps

Each Working Group must operate under a IEEE-SA approved Working Group Policies and Procedures protocol. The approved template for the Switchgear Committee is:
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G. Document status report

H. New business

- Discussion: Are circuit breaker requirements for emerging technologies (for example, wind, solar, energy storage, etc) adequately covered by existing requirements within IEEE Std C37.13 and IEEE Std C37.14, or are modifications and/or additional standards required?
- Discussion: Methodologies for incorporating emerging technology requirements into C37 standards.
- Discussion: Do we need an IEEE-SA PAR?

I. Conclusion

- Wrap-up and discussion of next steps.

Discussion:

Are circuit breaker requirements for emerging technologies (for example, wind, solar, energy storage, etc) adequately covered by existing requirements within IEEE Std C37.13 and IEEE Std C37.14, or are modifications and/or additional standards required?

Example #1: Drives/UPS Applications

- Problem: Loads with high harmonic content are commonly associated with:
  - ac drive applications
  - UPS applications / inverters
- Results: Harmonic content is destructive to iron core current sensors and energy transducers, resulting in component damage and fire.

Example #1: Drives/UPS Applications

- Solution:
  - Replace iron core current sensors with air core sensors
  - Replace energy transducers (providing power to the direct-acting trip unit) with external control power
- Conflict: In violation with IEEE Std C37.13 and IEEE C37.17 because the trip system is not direct-acting. Solution is non-compliant with industry standards.

Example #2: Wind Power Applications

- Problem: The Federal Energy Regulatory Commission (FERC) has expressed concern about system reliability due to low-current overloads. They have noted that circuit breakers and load-responsive protective relays associated with power generation facilities at a level to prevent unnecessary tripping of generators during a system disturbance for conditions that do not pose a risk of damage to the associated equipment.
- Results: FERC passed Reliability Standard PRC-025-1 for Generator Relay Loadability requires that the circuit breaker not trip at no less than 130% of the long-time trip pickup setting.

Example #2: Wind Power Applications

- Solution:
  - Adjust the long-time pickup point to 130% (or greater) of the setting.
  - Eliminate the long-time protective function within the direct-acting trip system.
- Conflict: In violation with IEEE Std C37.13 and IEEE C37.17 because the trip system:
  - does comply with long-time trip requirements, or
  - not include long-time trip functionality.

  Solution is non-compliant with industry standards.

Example #3: PV Applications

- Problem: Short-circuit currents are low-level in PV applications.
- Results: IEEE Std C37.13-2015 was approved with "preferred short-circuit ratings" of

  [continuous current rating] x 2

  This rating structure was controversial because it is inconsistent with the other requirements of IEEE Std C37.13, but allowed because there was no other home for these applications.

Example #3: PV Applications

- Conflict: Short-circuit ratings of [2 x (continuous current rating)] are inconsistent with the balance of the standard, where otherwise the lowest preferred short-circuit rating is 22 kA, and a maximum preferred rating of 200 kA.

Example #4: Corner-Grounded Delta Applications

- Problem: In a corner-grounded delta application, it is possible to have a short-circuit fault condition where the circuit breaker may be called upon to interrupt a fault of rated voltage / 87% rated current fault across a single pole of a three-pole circuit breaker. This is despite the fact that corner-grounded delta arrangements are extremely rare.
- Results: According to IEEE C37.13, all low-voltage ac power circuit breakers are subjected to a series of single-phase, single-pole short-circuit tests to validate performance in corner-grounded delta applications. This requirement stands for both 3-pole and 4-pole power circuit breakers.

Example #4: Corner-Grounded Delta Applications

- Solution:
  - Eliminate single-phase, single-pole testing requirements when not required by application, and with
  - Circuit breakers are marked “not suitable for corner-grounded delta applications.”
- Conflict: In violation with IEEE Std C37.13 and NEMA C37.50 because there are no exceptions for single-phase, single pole short-circuit testing.

Example #5: Service Conditions

- Problem: IEEE C37.13 and IEEE C37.14 only describe service conditions of -5°C - 40°C temperature conditions, and altitudes less than 2000 m.
- Results: No guidance is given for any service conditions outside of this narrow range. However, C37.20.1 gives some temperature de-rating and IEEE C37.100.1 gives guidance on altitude correction.

Example #5: Service Conditions

- Solution:
  - Add in rating and de-rating (calculation) information for additional service conditions
  - Evaluate what testing requirements are necessary

Comparison of LVSD Standards

- IEEE C37.13 only allows for general-purpose ac power circuit breaker applications.

- IEEE C37.14 allows for both general-purpose and definite purpose dc power circuit breaker applications.
  - General-purpose
  - Mining duty
  - Semi-high-speed
  - High-speed
  - Rectifier

Discussion:

Methodologies for incorporating emerging technology requirements into C37 standards.

Proposal: Body of C37.13

1 Overview

- 1.1 Scope
- 1.2 Purpose

3 Definitions

4 Service conditions

5 Ratings

6 Functional components

7 Temperature limits

Common Clauses

Proposal: Annexes

Annex A: Bibliography

Annex B: Application guide

Annex C: General purpose

Annex D: Unusual Service Conditions

Annex E: Definite-purpose 1

Annex F: Definite-purpose 2

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Annex X: Definite-purpose X

Unique Requirements

Proposal: Annex Layouts

X.1 Overview

X.1.1 General

X.1.2 Markings

X.2 Preferred ratings

X.3 Additional requirements

X.4 Test procedures

Discussion:

Do we need an IEEE-SA PAR?