C37.14 Working Group
MINUTES OF THE FALL 2021 MEETING
Signia by Hilton Orlando Bonnet Creek, Orlando, FL
Monday, April 11, 2022, 3:45-5:30 PM CDT

Attendance:

16 people were in attendance
There are no members since this is our first meeting as a Working Group, thus Quorum is met.

Attendance recorded below
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A. Call to order

Meeting was called to order by WG Chair, Lou Grahor, at 3:45 PM on Monday, April 11,2022.

B. Introduction of attendees

Complete

C. Approval of Revised Agenda

Agenda was reviewed by WG motion to accept by M. Lafond (1st) and C. Carne (2nd), motion was approved by unanimous consent

D. Verbal call for essential patents

A link to the IEEE patent policy slides was distributed in the agenda and displayed during the meeting, no patent issues were voiced by the meeting attendees

E. Approval of Minutes from previous meetings

Minutes were reviewed by WG and were approved by unanimous consent

F. Working group P&Ps and Copyright Policy

A link to the IEEE-SA WG Policies & Procedures and the IEEE copyright policy slides was distributed in the agenda, the slides were displayed online during the meeting

G. Document Status

Current document: C37.14-2015 due to expire 12-31-2025

C37.14 PAR approved 2-23-2022, expires 12-31-2026

H. New Business

Discussion followed for possible changes and additions to the document including:

Addition of UL 746B as a reference for establishing temperature limits for materials, possible inclusion of IEEE 98 as another reference

A comment about busbar current density of 1000A per sq. in. was discussed, it was noted that busbar size tables are not harmonized between C37.13 and C37.14. A method for interpolating busbar sizes will be established like what is in C37.13

Test labs are having a hard time setting the test circuit parameters correctly, D. Zia to check with STLNA group for recommendations. B. Gerzeny to get feedback from traction power group.

Discussed input from the traction power group, presented by B. Gerzeny.

Topic 1: Terms associated with Short-Circuit Current, Rated Peak Current must be clearly defined. Rated Short-Time Current is used to determine Rated Peak Current.

Topic 2: Terms associated with Breaker Types, breaker types can be defined by 3 main characteristics; tripping characteristics, direction of current flow, and use.

Ad Hoc group formed to make recommendations on "Rated Peak Current". Ad Hoc group led L. Grahor and includes M. Lafond, D. Zia, and B. Gerzeny.

I. Adjourn
Meeting adjourned at 5:18 PM.

Reported by: Darryl Moser – Secretary

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Attendance record:

First Name	Last Name	Company Name	Role	4/11/2022
Lou	Grahor	Eaton	Chair	✓
Darryl	Moser	ABB	Vice-Chair	✓
Clint	Carne	Schneider Electric	Member	✓
Dan	Delfino	ABB	Member	✓
Brian	Gerzeny	Powell Electrical Systems Inc.	Member	✓
Dan	Hrncir	Eaton	Member	✓
Mike	Lafond	ABB	Member	✓
Jeff	Mizener	Siemens	Member	✓
Michael	Christian	ABB	Member	✓
Owen	Parks	ABB	Member	✓
Albert	Livshitz	CE Power Engineered Services	Member	✓
Robert	Hanna	JST Power	Guest	✓
Kevin	Sippel	Eaton	Member	✓
Christo	Thomas	Schneider Electric	Member	✓
Randy	Blake	Schneider Electric	Guest	✓
Danish	Zia	UL LLC	Member	✓

C37.14-2025 WG Meeting Orlando

April 11, 2022

Draft 1 Discussion – Overview

Illustrate 2 general areas to consider for initial revisions. Both are related to terms used in the standard.

1. Terms associated with Short Circuit Current
2. Terms associated with Breaker Types

Consider these because their use in this standard is, at times, inconsistent, unclear & conflicting

Draft 1 Discussion – Rated Peak Current

Problem Definition:

1. The definition of ***"Rated Peak Current"*** in Clause 6.4 is not consistent with the use of the term throughout the standard.

6.4 Rated peak current

The rated peak current of a circuit breaker is the designated limit of non-repetitive available (prospective) peak current in amperes that it shall be required to close into and still be able to open. This rating shall apply to circuit breakers having direct-acting instantaneous trip devices active in the direction of the current flow. Ratings required for each circuit breaker type are shown in Table 1.

Draft 1 Discussion – Rated Peak Current

Discussion

1. …. “This rating shall apply to circuit breakers having direct-acting instantaneous trip devices in the direction of the current flow.”…
2. This statement in the definition implies the term *Rated Peak Current* does not apply to **breakers without direct-acting instantaneous trip devices** and does not describe **current flowing in a direction opposite the direct acting device detection**.

Draft 1 Discussion – Peak Current

Discussion

1. The definition in Clause 6.4 is reinforced in the description of the Peak Current Design Test Procedure in Clause 10.9.3

10.9.3 Test procedure

The circuit breaker shall be inserted in the test circuit of 10.9.2 and subjected to a single CO test. The circuit breaker shall be tripped by its direct-acting instantaneous trip element. The dielectric test shall be performed in accordance with item e) of 9.1.

Draft 1 Discussion – Peak Current

Discussion

1. The test procedure describes a single CO operation to establish the Rated Peak Current and that the breaker shall be tripped by its direct acting instantaneous trip element for a successful test.

Draft 1 Discussion – Peak Current

Discussion

1. The issue begins to get confusing in Clause 10.9.2 where the test circuit references the “Rated Short Time Current” as the basis for calculating the “Rated Peak Current”.

10.9.2 Test circuit

The current that verifies the peak current rating shall be determined by calibrating the test circuit with the circuit breaker short-circuited or omitted.

The test circuit shall produce a peak current no less than 1.65 times the value of the rated short-time current approximately 8 ms after the start of current flow.

Draft 1 Discussion – Peak Current

Discussion

1. Clause 6.5 indicates that Rated Short Time Current applies to breakers that do not have a direct-acting instantaneous trip device and to breakers with current flow in the non-active direction of polarized or unidirectional direct-acting trip devices. This explanation contradicts the definition of Rated Peak Current given in Clause 6.4.

6.5 Rated short-time current

The rated short-time current of a circuit breaker is the designated limit of available (prospective) sustained current in rms amperes that it shall be required to carry for a period of 250 ms without impairing its ability to operate and perform all other ratings. This rating shall apply not only to circuit breakers that do not have direct-acting instantaneous trip devices, but also to circuit breakers with current flow in the non-active direction of polarized or unidirectional direct-acting instantaneous trip devices. Ratings required for each circuit breaker type are shown in Table 1.

Draft 1 Discussion – Peak Current

Discussion

1. The term Rated Peak Current used in Table C.2 to describe the Peak Current rating for a “Rectifier or Other Breaker with delayed trip or in the non-trip direction” (see red circle).
2. This description contradicts the definition of Rated Peak Current in Clause 6.4 and is not consistent with the description of the Rated Peak Current Test in Clause 10.9.3
3. Delayed Trip does not equal Instantaneous Trip.
4. Non-Trip does not equal Instantaneous Trip.
5. Note the term Rated Peak Current is also used in Table C.2 to describe the Peak Current rating for a “Semi-High Speed Breaker”. Since a Semi-High Speed Breaker” typically has a direct-acting instantaneous trip device and does trip in the direction of current flow, this use of the term is consistent with the definition (see blue circle).

Draft 1 Discussion – Peak Current

Discussion

1. The term Rated Peak Current is used again in the Tables in Annex C

Table C.2—Preferred ratings and test circuit values for "heavy duty" high-speed, semi-high-speed, and rectifier dc power circuit breakers (based on transit systems with low frequency bonds)[b,c,e,f]

Circuit breaker frame size (amperes)	Test[d]	Rated maximum voltage (volts)	Semi-high-speed breaker rated peak or high-speed breaker short-circuit current (amperes)	Sustained current and semi-high-speed breaker rated short-circuit current (avg. amperes)	Rectifier or other breaker-ratings with delayed trip or in non-trip direction		Add to load circuit inductance (microhenries)	Approximate load circuit time constant (seconds)
					Rated peak current (amperes)	Rated short-circuit or short-time current (amperes)		
1200–10 000	a	300	140 000	85 000	70 000	42 500	0[a]	–
	b		–	46 200	–	–	2000	0.21
	c		–	13 300	–	–	4000	0.21
	d		–	7 300	–	–	8000	0.21

Draft 1 Discussion – Peak Current

- This highlights a few of the problems with the use of the term Rated Peak Current. There are other similar instances of problems that are not covered here due to time constraints.
- Additionally there are issues with the use of other terms related to short circuit current

Draft 1 Discussion – Breaker Types

There are 3 main **characteristics** to consider when defining a DC Circuit **Breaker Type** as it relates to breaker ratings (focus on transit applications – not general purpose)

1. Breaking Characteristic (semi high speed, high speed, delayed, none)
2. Use (rectifier, line, tie)
3. Current Interruption Direction (unidirectional, bidirectional)

NOTE: These characteristics are similar to European Standards.

Draft 1 Discussion – Breaker Types

Problem Definition:

1. C37.14 breaker types do not include all necessary **characteristics** to fully define breaker.
2. Undefined breaker types are introduced in ratings tables
3. Same ratings are applied to different breaker types with different uses.
4. Some **uses** of breakers are not defined or used in rating tables.
5. There is no mention of breaker interrupting direction as it pertains to breaker types
6. In total, these problems lead to confusion in standard interpretation and improper/unclear rating requirements on certain breaker types.

Draft 1 Discussion – Breaker Types

Breaker Types

Currently standard defines 5 breaker types

general-purpose dc power circuit breaker: A circuit breaker that, during interruption, does not limit the current peak of the available (prospective) fault current, and may not prevent the fault current from rising to its sustained value

Title/Definition describes breaker breaking characteristic

Draft 1 Discussion – Breaker Types

mining duty general-purpose dc power circuit breaker: A general-purpose dc power circuit breaker, with preferred ratings tailored to mining applications.

Title/Definition describes breaker breaking characteristic (general purpose) and use (mining duty)

Draft 1 Discussion – Breaker Types

semi-high-speed dc power circuit breaker: A circuit breaker that, during interruption, does not limit the current peak of the available (prospective) fault current on circuits with minimal inductance, but that does limit current to a value less than the sustained current available on higher inductance circuits.

Title/Definition describes breaker breaking characteristic

Draft 1 Discussion – Breaker Types

- **high-speed dc power circuit breaker:** A circuit breaker that, during interruption, limits the current peak to a value less than the available (prospective) fault current.

Title/Definition describes breaker breaking characteristic

Draft 1 Discussion – Breaker Types

rectifier dc power circuit breaker: A circuit breaker that carries the normal current output of one rectifier, and during fault conditions, functions to withstand and/or interrupt abnormal current as required.

Title/Definition describes breaker use (rectifier).

Draft 1 Discussion – Breaker Types

CB TYPE	Use	Breaking Characteristic	Interruption Direction
General Purpose	No	Yes	No
General Purpose-Mining	Yes	Yes	No
Semi High Speed	No	Yes	No
High Speed	No	Yes	No
Rectifier	Yes	No	No

Draft 1 Discussion – Breaker Types

Why is this considered a problem?

- Can lead to confusion
- Is a rectifier breaker a high speed breaker; semi-high speed breaker; general purpose breaker; none of the above? If none, why?
- Are high speed breakers unidirectional? Bidirectional? Should the ratings be dependent on current interruption direction?

Draft 1 Discussion – Breaker Types

Next problem: Undefined breaker type is introduced in ratings tables

- Tables in Annex C (transit system CB ratings tables) introduces another breaker type:
- “Other Breaker Ratings w/ delayed trip or in non-trip direction”
- This breaker type is combined with ratings for Rectifier Breakers
- This breaker type is not defined anywhere in the standard

Draft 1 Discussion – Breaker Types

Rectifier or other breaker-ratings with delayed trip or in non-trip direction	
Rated peak current (amperes)	**Rated short-circuit or short-time current (amperes)**
70 000	42 500
–	–
–	–
–	–
149 000	90 000
–	–
–	–
–	–
119 000	72 000
–	–
–	–
–	–
100 000	60 000
–	–
–	–
–	–
74 000	45 000
–	–
–	–
–	–
37 000	22 500
–	–
–	–
–	–

Draft 1 Discussion – Breaker Types

CB TYPE	Use	Breaking Characteristic	Interruption Direction	Defined in Std
General Purpose	No	Yes	No	Yes
General Purpose-Mining	Yes	Yes	No	Yes
Semi High Speed	No	Yes	No	Yes
High Speed	No	Yes	No	Yes
Rectifier	Yes	No	No	Yes
Other Breaker …	No	Implied	No	No

Draft 1 Discussion – Breaker Types

Next problem: Ratings in Annex C tables for Rectifier Breakers & Other … Breakers are lumped together.

- Rectifier breaker is defined in the standard as carrying short time current from its own rectifier yet the tables in Annex C indicate it carries short time current from 3 rectifiers. This may be a requirement for “Other Breakers …” but not for rectifier breakers.

Draft 1 Discussion – Breaker Types

Next problem: Some **uses** of breakers are not defined or used in rating tables

- What ratings apply to a tie breaker?
- Is a tie breaker unidirectional? Bidirectional? None? Both? How are ratings impacted?
- Is a bus tie breaker and a station tie breaker the same breaker type?

Draft 1 Discussion – Breaker Types

This highlights some of the issues with the standard concerning Breaker Types

Draft 1 Discussion – Conclusion

- This is a brief introduction of these 2 general areas for consideration related to terms.
- Requires studying the standard and determining if you feel improvement is necessary.
- Gain consensus on how to best proceed.