IEEE PC37.04 Working Group
Draft Meeting Minutes
April 7, 2025 – 1:30-5:30 EDT
Wyndham Grand Bonnet Creek, Orlando, FL

1. Call to Order

The meeting was called to order at 1:30 pm by the Working Group Chair, John Webb.

2. Establishment of Quorum

As this is the first meeting of the WG, there is no quorum requirement; anyone wishing to be part of the WG should indicate such on the attendance sheet. There were 113 individuals in attendance at the first session.

3. Roll call and Disclosure of Affiliation

Attendees present stated their name and affiliation. A list of attendees (name, affiliation, and voting membership status) is attached.

4. IEEE SA Patent Policy: Call for Patents

The chair reminded attendees that acknowledgement of the IEEE patent policy is part of the meeting registration and reviewed the patent policy slides. A call for knowledge of essential patents was made; no claims were raised.

5. IEEE SA Copyright Policy/IEEE Antitrust Policy

The IEEE SA Copyright Policy and Antitrust Policy slides were reviewed.

6. Approval of the Agenda

Motion to approve the meeting agenda. The agenda was unanimously approved as presented without objection.

7. Chair Remarks

A. iMeetCentral is to be used as a repository for WG materials.

B. PAR was requested in December 2024 and approved in February 2025. It is a 2028 document with a target of submitting to RevCom in October 2028.

C. Chair explained the WG voting membership requirements as well as provided a reminder to register interest in IEEE-SA MyProject to be notified of the eventual formation of the ballot group.

8. Technical Presentations or Discussions (Part 1)

Working group members discussed topics to be considered for inclusion in the current revision as had been previously forwarded to chair for consideration:

A. Incorporation of "Fast TRV" | TRVs for Transformer Limited Faults (TLFs) as optional rating (C37.06.1) | Calculated value (informative) vs. table value (normative) from C37.06.1 | RRRV.

   i. If calculations from the standard are used, then there are discrepancies when compared to the table due to rounding errors and typos. It was noted that these issues are going to be addressed in revision of C37.06.1.

B. Update of standard TRV tables: Alignment with IEC 62271-100 | Harmonization of T60 levels
    i. Address divergence between C37.04 and other standards (e.g., IEEE and IEC T60 TRV envelopes differ by 50%).
    ii. Including harmonization of times for out-of-phase conditions including potentially harmonizing of IEEE and IEC values.
    iii. It was stated there is a discrepancy with the source-side TRV for a short line fault.
C. Preferred ratings for capacitive current for cables: Class S2, and > 100 kV.
D. Consider including voltage > 800 kV (possibly adopting IEC values).
E. Transfer of E2 – Extended electrical endurance testing to C37.09.
F. Rated Interrupting Time: rating or related value? | "Cycles" or "ms" – 50/60 Hz Conversion | Move to R10 values?
G. Use of S1 ("indoor") circuit breakers in outdoor enclosures with line connections in substations (usually S2 application).
H. Use of S1 circuit breakers (kpp = 1.5 e.g., ungrounded) on grounded systems (kpp = 1.3) [this implicates 2nd pole to clear recovery voltage].
I. Replacement of single-phase fault at 100% I_{SC} vs. IEC single-earth-fault, double-earth-fault requirements.
J. Should an out-of-phase voltage withstand capability be added.
K. Should the chopped wave requirement for S2 and > 100 kV CB be retained? (TF in C37.100.1 determined it should be maintained but reasoning is needed).
L. Update clause 7.19 "Pressurized components" and 7.20 Pressure relief capabilities which refer to ASME standards.
    i. Suggestion that clause 7.19 should be updated to cover alternative gasses.
    ii. Will be presented in a virtual WG meeting.
M. Add tolerance tables [could fall under C37.09]. It was noted IEEE Std 1547 and P2800 indicate system voltage excursions of ±10% were tolerable.
    i. Suggestion that the standard should have tolerance tables for all parameters.
N. Revisit nameplate data.

<u>Additional items for consideration were suggested by WG members:</u>

O. The standard currently refers to SF6 but no other gases or mixed gases. Should the WG take on this topic?
P. Discussion on production test requirements

Coffee Break (3:15 – 3:45 PM EDT)

The working group meeting resumed with 93 attendees at 3:45 pm. New attendees were requested to introduce themselves to the group.

9. IEEE SA Patent Policy: Call for Patents

Following the break, the chair revisited the patent policy for individuals who joined the meeting after the break. The call for patents was re-issued; no claims were raised.

10. IEEE SA Copyright Policy/IEEE Antitrust Policy

Following the break, the chair revisited the IEEE SA Copyright Policy Antitrust Policy slides for individuals who joined the meeting after the break.

11. Technical Presentations or Discussions (Part 2)

Working group members continued discussion on topics from part:

A. Incorporation of "Fast TRV" | TRVs for Transformer Limited Faults (TLFs) as optional rating. Calculated value (informative) vs. table value (normative) from C37.06.1 | RRRV
   i. C37.06.1 is under revision for accreditation and well timed with C37.04.
   ii. TLF values in the table are rounded incorrectly as values have more significant figures than the parameters used in the calculation. It was noted that these issues are going to be addressed in C37.06.1
   iii. An annex that instructs how to perform the calculations was suggested.
      a) Luke Collette volunteered to chair a SG to draft a table for the annex.

B. TRV envelope clarification (resumption of discussion)
   i. An annex including an example figure showing the test TRV compared to a reference line along with an explanation was suggested.

C. Preferred ratings for capacitive current for cables: Table 15 for Class S2 breakers only covers capacitor bank or overhead line capacitive current switching, similarly Table 21 for circuit breakers above 100 kV only considers overhead lines.
   i. It was noted that there are long HV cables in service (>10 miles) between substations which hold trapped charge. These cables are often compensated.
   ii. Proposal to draft a survey to get more information from users.

D. It was stated that point on wave switching - (e.g. non-simultaneous pole operation) is becoming popular but there is no guidance in IEEE for this.
   i. The chair indicated considering point of wave switching may require amendment of the PAR and change of scope as C37.04 currently has

explicit limits on simultaneity of poles. If WG decides to include, this requires HVCB approval. Perhaps a separate guide rather than address in C37.04.

E. Consider including voltage > 800 kV (possibly adopting IEC values)
   i. 1000 kV or 1100 kV as rated maximum voltage?
   ii. Comment that the U.S. is just starting wide-spread adoption of 765 kV. Also, surge suppression equipment will need to be adopted too. Suggestion that there is no need to address this topic yet.
   iii. Similar work has also been performed in other countries so may only need to study, adapt, and consider for IEEE.

F. Transfer of E2 – Extended electrical endurance testing to C37.09.
   i. C37.04 Annex F uses a different abbreviation for "t" in the list of operating sequences as compared to the standard duty cycle.
   ii. Suggested updating the terminology within Annex F.
   iii. Also, a suggestion from WG to look at terminology for SLF testing for E2 in Annex F for SF6 alternatives. The test is a T60 test that uses the peak of L75 and the RRRV from T60. The attendees expressed concern that the test may not adequately stress the gap (interrupter) during the test. The issue is to be presented to the WG in more detail in a virtual meeting.
   iv. Should C37.04 define 'E2' extended electrical endurance differently based on application voltage and/or S1 or S2 or >100 kV ratings?

G. Rated Interrupting Time: rating or related value? | "Cycles" or "ms" – 50/60 Hz Conversion | Move to R10 values?
   i. It was discussed that interrupting times are expressed in milliseconds versus cycles between systems of different frequencies.
   ii. For the symmetrical test, the power system frequency is in practice generally not a concern although di/dt varies. However, the timings will be different and may lead to inconsistent interrupting time values if measured in milliseconds.
   iii. An attendee commented that there are no criteria currently to assess a 3-cycle breaker in a test. It was stated that the criteria formerly appeared in C37.09 but it was removed at some point.
   iv. WG suggested a survey of what is expected by protection engineers.

H. Use of S1 ("indoor") circuit breakers in outdoor enclosures with line connections in substations (usually S2 application).

I. Use of S1 circuit breakers (kpp = 1.5 e.g., ungrounded) on grounded systems (kpp = 1.3) [implicates 2nd pole to clear].
   i. Will be presented to WG at the F25 meeting in Reno, NV.

12. Future Working Group Meetings

The chair indicated that a virtual WG meeting will likely happen in the second half of May.

13. Adjourn

The chair adjourned the meeting at 5:30 PM EDT.

Meeting Minutes Recorded by: Marcus Young/Dan Benedict

Role	Full Name	Company Name	City	State	Country	4/9/2025
Chair	John Webb	ABB	Pawleys Island	South	USA	X
Secretary	Dan Benedict	PPL				X
VM	Mauricio Aristizabal	Hitachi Energy	Pittsburgh	Pennsylva	USA	X
VM	Hanan Attia					X
VM	Jesus Avila Escalante	ABB				X
VM	Ganesh Balasubramanian	Eaton				X
VM	Vincent Balvet	Vizimax				X
VM	Andreas Bartels	Powell				X
VM	George Becker	Power	Clover	South	USA	X
VM	Zachary Beecher	Power Grid				X
VM	Albane Bornuat	GE Vernova				X
VM	Arjan Bronsveld	Hitachi Energy			Swed	X
VM	Craig Bryant	Duke Energy	Greensboro	North	USA	X
VM	Arben Bufi	Meiden	Peachtree Corners	Georgia	USA	X
VM	Ted Burse	Powell	Friendswood	Texas	USA	X
VM	Sudarshan Byreddy	Burns and				X
VM	Jared Cantu	Omicron Energy				X
VM	Steven Chen	Eaton	Moon Township	Pennsylva	USA	X
VM	Andrew Chovanec	Power Grid	Chicago	Illinois	USA	X
VM	Michael Christian	ABB	Elon	North	USA	X
VM	Lucas Collette	Duquesne Light	Beaver Falls	Pennsylva	USA	X
VM	Michael Crawford	Mitsubishi	Cranberry Twp	Pennsylva	USA	X
VM	Jason Cunningham	Power Grid	Atlanta	Georgia	USA	X
VM	Matthew Cuppett	Hitachi Energy				X
VM	David Dart	Noja Power			Austr	X
VM	Federico Di Michele	CESI SPA	Milano	Milano	Italy	X
VM	Jeffrey Door	The H-J Family	High Ridge	Missouri	USA	X
VM	Maxwell Eastman	Black and	Olathe	Kansas		X
VM	Sergio Flores	Schneider	Smyrna	Tennessee	USA	X
VM	Sathish Govindarajan	Schneider				X
VM	Renaud Grenier-Poulin					X
VM	Robert Hanna	JST Power	Enterprise	Florida	USA	X
VM	John Harley	FirstPower	Peninsula	Ohio	USA	X
VM	Nadia Hasnaoui	GE Vernova				X
VM	Christian Heinrich	Siemens AG	Berlin		Germ	X
VM	Mark Heiny	ABB				X
VM	Eduardo Henriet Hernandez	Siemens Energy				X
VM	Victor Hermosillo	GE Grid				X
VM	Tyler Holp	EATON				X
VM	Derek Hughes	Georgia				X
VM	Jennifer Hunter	Mitsubishi	Harmony	Pennsylva	USA	X
VM	Todd Irwin	GE Grid	Smithville	Missouri	USA	X
VM	Kai Jacob	Siemens AG				X
VM	Christopher Jarnigan	Southern	Moody	Alabama	USA	X
VM	Thomas Keels	kEElectric	Mesa	Arizona	USA	X
VM	Vladimir Kirienko	Tavrida Electric				X
VM	Seth Kravetz	Qualus Services				X
VM	Carl Kurinko	Hitachi Energy	North Huntingdon	Pennsylva	USA	X
VM	Michael Lafond	National	Mebane	North	USA	X
VM	Brad Leccia	Eaton	Bethel Park	Pennsylva		X
VM	Yongwoo Lee	KERI				X
VM	Albert Livshitz	Qualus Services	Fairfield	Ohio	USA	X
VM	Soung Lyu	Federal Pacific				X

Role	Full Name	Company Name	City	State	Country	4/9/2025
VM	Chunming Ma	Burns and				X
VM	Peter Marzec	S&C Electric	Chicago	Illinois	USA	X
VM	Neil McCord	KEC Precision	Athens	Georgia	USA	X
VM	Kevin McGlown	JST Power	Winter Springs	Florida	USA	X
VM	Henning Milnikel	Siemens AG	Frankfurt		Germ	X
VM	Sergio Miranda	ABB Mexico			Mexi	X
VM	Michael Nolte	Kiewit				X
VM	Fernando Ordein	Dominion	Glen Allen	Virginia		X
VM	Mike Page	Eaton				X
VM	Sumitabha Pal	Schneider	Smyrna	Tennessee	USA	X
VM	Mirko Palazzo	Hitachi Energy				X
VM	Urmil Parikh	SwedenSwitzerl				X
VM	Lalit Patil	Eaton				X
VM	Craig Polchinski	Mitsubishi	Pittsburgh	Pennsylva	USA	X
VM	Isaac Pounders	Meiden				X
VM	Javier Ratmiroff	GE Vernova				X
VM	Justin Rebovich	GE Grid				X
VM	Samala Reddy					X
VM	Aaron Rexroad	Meiden	Mauldin	South		X
VM	Anthony Ricciuti	EATON	Bethel Park	Pennsylva	USA	X
VM	Sergey Rogozhkin	Tavrida Electric				X
VM	Leonel Santos	Schneider	Murfreesboro	Tennessee	USA	X
VM	Daniel Schiffbauer	Toshiba	Houston	Texas	USA	X
VM	Jeffrey Scott	Ameren	Bonne Terre	Missouri	USA	X
VM	Sanket Shetty	Oncor				X
VM	Michael Skidmore	AEP	Pickerington	Ohio	USA	X
VM	John Tarleton	Southern States,				X
VM	Timothy Terry	Meiden				X
VM	Jey Thayalan	Schneider				X
VM	Vernon Toups	Siemens Energy	Brandon	Mississipp	USA	X
VM	Jacob Walgenbach	Siemens	Wendell	North	USA	X
VM	Casey Weeks	Siemens	Richland	Mississipp	USA	X
VM	Jan Weisker	Siemens Energy	Berlin	Berlin	Germ	X
VM	Daniel Wolfe	Pennsylvania Swi	Canonsburg	Pennsylva	USA	X
VM	Terry Woodyard	Siemens	Wendell	North	USA	X
VM	Marcus Young	Mitsubishi	Knoxville	Tennessee	USA	X
VM	Mina Youssef	Eaton				X
VM	Samuel Zaharko	Mitsubishi	Warrendale	Pennsylva	USA	X
VM	Jim Zhong	ATC				X
VM	Danish Zia	UL LLC	Melville	New York	USA	X
NVM	Jeffrey Brogdon	Georgia	Tucker	GA	USA	X
NVM	Pedro Castillo	ABB Mexico			Mexi	X
NVM	Seung-Rae Jo	KERI			South	X
NVM	Seyoung Ju	HICO America				X
NVM	Dakota Leopard	Eaton	Greenwood	South	USA	X
NVM	Leo Lopez	WIKA	Lawrenceville	Georgia	USA	X
NVM	Paul Masterson	Meiden	Peachtree Corners	Georgia	USA	X
NVM	Mgunda McPharlen	HICO America				X
NVM	David Mitchell	Mitch &	Elizabeth	Colorado	USA	X
NVM	Martin Mucha	G&W Electric	Bolingbrook	Illinois	USA	X
NVM	Tad Myers	Salt River				X
NVM	Anthony Natale	HICO America	Pittsburgh	Pennsylva	USA	X
NVM	Miklos Orosz	Circuit Breaker	Murfreesboro	Tennessee	USA	X

Role	Full Name	Company Name	City	State	Country	4/9/2025
NVM	Fox Paul	Schneider				X
NVM	Conrad Pecile	Myers Power				X
NVM	Brian Roberts	Southern States	Hampton	Georgia		X
NVM	Ian Rokser	Eaton	South Milwaukee	Wisconsin	USA	X
NVM	Victor Savulyak	KEMA	Chalfont	Pennsylva	USA	X
NVM	Devki Sharma	Retired	Halifax	Nova	Cana	X
NVM	David Sheehan	HICO America				X
NVM	Josh Sizemore	WIKA				X
NVM	Timothy Tillery	HOWARD	Laurel	Mississipp	USA	X
NVM	Joseph Usner	AEP	Columbus	Ohio	USA	X
NVM	Marc Vittoz	GE Vernova				X
NVM	Jason Williams					X
NVM	Wei Zhang	Southern	Suwanee	Georgia	USA	X