C37.09a meeting minutes Fort Lauderdale, FL April 2, 2024

Welcome/Call to Order
Jan Weisker called the meeting to order at 10:15 am EDT.

Introductions & Membership
The attendees introduced themselves along with their affiliation.

40 members out of 47 voting members were present for the meeting which met the quorum requirements. There were 96 people present in the meeting.

Agenda
The agenda was reviewed.

Mandatory Information
IEEE Copyright slide was presented. The essential patent claim slide was presented. No essential patent claims were voiced during the call for essential claims during the meeting.

Approval of Minutes
The San Diego minutes were distributed by email and iMeet Central. A correction was presented to clarify that the previous meeting minutes were approved by unanimous consent.
Andy Keels made a motion to approve the minutes with the correction.
Michael Christian seconded the motion.
The motion was approved by unanimous consent.

The Virtual meeting minutes were distributed in iMeet Cental. Craig Bryant was erroneously not included in the attendance. He will be added.
Mike Crawford motioned to approve the minutes with the addition of Craig Bryant in attendance.
Carl Schuetz seconded the motion.
The motion was approved by unanimous consent.

Project Status
The project status was presented. There are only two items left to be addressed.

Review of the Item List and work done so far
Item #29
Service capability and circuit breaker conditions.

Line 329 needs to be corrected from “perfuming” to “performing”.

The draft of this section was presented during the meeting.

The formulas need to be improved as they are shown of low resolution in the draft.

Three phase synthetic testing is not being added due to the complexity. No comment against this approach.

A comment was made that (Andy Chovanec) improve wording for “average of the medium arcing times”.

Add “successful” to the required interruption test to be the last test chosen out of table 1.

There was discussion regarding if after performing six tests the average could be shorter than medium arcing time. It was made clear that the medium arcing time is a valid criterion. This is a common requirement within other international industry standards.

Method c) for the single-phase tests needs to be adjusted to make it comparable with method b) by mentioning the requirement to be equal or above medium arcing time.

New Item to be considered in #29
There was a question raised how the control voltage affects the testing as well as the whether the gas pressure being at rated or lockout affects testing.

A question was presented to the group whether rated condition or lockout condition should be used for the service capability testing condition.

A comment was made that testing at rated conditions is consistent with other electrical endurance testing. There is option to be given that other testing may be made under condition for the respective test duty. *Additional test to achieve the service capability criteria can be under rated conditions.*

Voltage check as condition check shall be made under min. functional pressure if applicable.

Item #26
How to address a gang operated circuit breaker that is tested single phase.

A proposal was presented to the working group.

There was a comment that Table 1 of C37.09 should include all of the tests required in the new proposal. Verification test shall be mentioned in a proper way.

Neil McCord will propose wording to add the two new tests to Table 1 and add it to C37.09a within the next 30 days.

Todd Irwin made a motion to ask the HVCB subcommittee to give the working group permission to go to ballot in July following review of the draft at the May virtual meeting.
Andy Keels seconded the motion.

37 voted in approval. There were no voiced nays or abstentions. The motion carried.

Time Schedule
A virtual meeting will be held in May to review the draft after the addition of information to Table 1.
Review draft in the May virtual meeting.
The working group will form a comment resolution group in the May virtual meeting.

Adjourn the Meeting
John Webb motioned that we adjourn the meeting.
Michael Christian seconded the motion.
The meeting was adjourned at 11:40 am CDT.

Attached:

Agenda
Attendance

PC37.09a Standard Test Procedure for AC High-Voltage Circuit Breakers with Rated Maximum Voltage above 1000V - Amendment 1

Chair: Jan Weisker
Secretary: Chris Jarnigan

IEEE Switchgear Committee Meeting, April 2, 2024 – Ft. Lauderdale/FL

Introduction & Membership

Chair: Jan Weisker

Secretary: Chris Jarnigan

Voting Members

Koustubh	Ashtekar
Herman Andreas	Bannink Bartels
Craig	Bryant
Arben	Bufi
Stephen	Cary
Steven Andrew	Chen Chovanec
Michael	Christian
Lucas	Collette
Michael Federico	Crawford Di Michele
Sergio	Flores
Robert	Hanna
Jeremy Victor	Hensberger Hermosillo
Jennifer	Hunter
Todd	Irwin
Thomas	Keels
Carl	Kurinko
Patil	Lalit
Chang Hoon Yong Woo	Lee Lee
Vincent	Marshall
Steven	May
Neil	Mc Cord
Sumitabha	Pal
Anthony	Ricciuti
Leonel	Santos
Victor	Savulyak
Carl	Schuetz
Jeffrey	Scott
Devki	Sharma
Michael	Skidmore
Donald	Steigerwalt
Vernon	Toups
Jacob	Walgenbach
John	Webb
Casey	Weeks
Terry	Woodyard
Richard	York
Marcus	Young
Li	Yu
Mina	Youssef
Samuel	Zaharko

45 Members (47 Votes → Quorum = 24)

Agenda

- Welcome/Call to Order
- Introductions & Membership
- Mandatory Information
- Approval of Minutes of last Meetings
- Review of the remaining Work items
- Review Draft D1.0
- Time Schedule
- Adjourn the Meeting

Mandatory Information

https://development.standards.ieee.org/myproject/Public/mytools/mob/slideset.pdf

https://standards.ieee.org/wp-content/uploads/2022/02/ieee-sa-copyright-policy.pdf

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  - 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
  - https://standards.ieee.org/faqs/copyrights/

- IEEE SA Best Practices for IEEE Standards Development

http://standards.ieee.org/content/dam/ieee-standards/standards/web/documents/other/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

Approval of MoM

San Diego Meeting

C37.09a meeting minutes **San Diego, CA** **October 10, 2023**

Welcome/Call to Order
Jan Weisker called the meeting to order at 2:00 pm

Introductions & Membership
The attendees introduced themselves along with their affiliation.

33 members out of 44 were present for the meeting which met the quorum requirements. There were 73 people present in the meeting.

Mandatory Information
IEEE Copyright slide was presented. The essential patent claim slide was presented. No essential patent claims were voiced during the call.

Approval of Minutes of last Meeting (Spring 2023 meeting)
Motion to approve – Andy Keels
2nd – Carl Schuetz

The minutes were approved by unanimous consent.

A project status update was given summarizing the previous meetings.

Approval of MoM

Virtual Meeting

C37.09a meeting minutes **Virtual meeting** **March 12, 2024**

Welcome/Call to Order
Jan Weisker called the meeting to order at 10:01 am CDT.

Introductions & Membership
The attendees introduced themselves along with their affiliation.

20 members out of 47 voting members were present for the meeting which did not meet the
requirements. There were 32 people present in the meeting.

Agenda
The agenda was reviewed.

Mandatory Information
IEEE Copyright slide was presented. The essential patent claim slide was presented. No essential patent claims were voiced during the call.

Project Status
Project status update was provided.

*Craig Bryant commented on **WG C37.09a Attendance VM 3-12-24.pdf***

Craig Bryant 2:41 pm April 2, 2024

I was in attendance on the viritual meeting on 3-12-24. Craig Bryant

Reply · View comment

Project Status PC37.09 Amd1

- First Meeting, April 12, 2022, Orlando/FL
- Second Meeting, October 18, 2022, Burlington/VT
- Third Meeting, April 18, 2023, Clearwater/FL
- Forth Meeting, October 10, 2023, San Diego/CA
- Fifth Meeting, March 12, 2024, Virtual

- Only two items left

Item List Review

No	Category	Page	Sub-clause	Comment	Proposed Change	Proposer	To be prepared by	Status	Remark F22	Remark S23	Remark F23	Remark VM	Spalte1
26	Technical		4.8.2.9	4.8.2.9 is a poorly worded section, regarding unit tests and tests of a single pole of a three.phase circuit-breaker	The word "If" in a standard leads to disagreements. > The tests required to prove the concept are not listed. > Is one opening test required? > I have been asked to perform a three phase closing test based on this. It is not clear in this language why closing is needed. I will say that with tulip contacts in SF6 this is not necessary. > Should those tests have a real TRV. > Are these test three separate and independent currents? > Or is this three interrupters in series with one current and voltage?	Neil McCord	Neil McCord, Victor Savuliak	in progress		Proposal from Neil and Victor	To be discussed		
29	Technical	54	4.8.5.4	As already discussed on the phone, I would like to bring in a topic regarding IEEE C37.09 subclause 4.8.5.4 Service capability and circuit breaker condition. It would be good to get a better clarification regarding procedure to demonstrate the service capability like I^2*t needs to be reached to successfully demonstrate the service capability.		Denis Baecker	Victor Savulyak, Harm Bannink, Jan Weisker	in progress		procedure to be agreed, clarifying which stresses may be combined to fulfill service capability	To be discussed		

Item List Review - #29

29	Technical	54	4.8.5.4	As already discussed on the phone, I would like to bring in a topic regarding IEEE C37.09 subclause 4.8.5.4 Service capability and circuit breaker condition. It would be good to get a better clarification regarding procedure to demonstrate the service capability like I^2*t needs to be reached to successfully demonstrate the service capability.		Denis Baecker	Victor Savulyak, Harm Bannink, Jan Weisker	in progress

Item List Review - #29

4.8.5.4 Service capability and circuit breaker condition

The service capability is demonstrated by performing short circuit breaking operations on the same pole in either single-phase tests or three-phase tests. The aim is to achieve an equivalent to:

a) Eight (8) times the rated short-circuit breaking current (*I*), for circuit breakers rated below 72.5 kV

b) Six (6) times the rated short-circuit breaking current (*I*) for circuit breakers rated 72.5 kV and above

For the verification of this requirement, it may be distinguished between direct three-phase and single-phase test
cap

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fulfil

a) Perfuming Terminal Fault duties as shown in Table1: combination of T10, T30, T60, T100s T100a and T100s 1ph or T100a 1ph on the same circuit-breaker according to 4.8.6.4, or
b) Eight breaking operations of T100s test current in steps of 40 degrees, or
c) T100s and additional tests in any order to achieve the total number of eight equivalent breaking operations. Last breaking operation shall be one operation of any terminal fault test duty from Table 1. Contribution of currents can be counted according to formulas (1) and (2)

For single-phase direct tests on circuit breakers rated below 72.5 kV the following procedures are considered to fulfill th[Kein Titel]pability requirement:

a) Eight breaking operations of T100s test circuit with medium arcing time as average, or
b) T100s and additional tests in any order to achieve the total number of eight equivalent breaking operations. Last breaking operation shall be one operation of any terminal fault test duty from Table 1. Contribution of currents can be counted according to formulas (1) and (2)

For single-phase synthetic tests on circuit breakers rated 72.5 kV and above the following procedures are considered to fulfill the service capability requirement:

a) Combination of T60 and T100s or T60 and T100a on the same pole of a circuit-breaker according to 4.8.6.4, or
b) Six breaking operations of T100s test circuit with medium arcing time as average, TRV shall be targeted for every test and shall be applied on the last test, or
c) T100s and additional tests in any order to achieve the total number of six equivalent breaking operations. Last breaking operation shall be one operation of any terminal fault test duty from Table 1. Contribution of currents can be counted according to formulas (1) and (2)

$\cdot\left(\frac{I_{test}}{I_{\square}}\right)^{1.7}$ → → for $I_{test} \geq 0.35 \cdot I$ ····· → (2)

where

I – the rated short-circuit breaking current

I_{test} – the actual current during breaking operation

Three-phase synthetic tests are not considered for service capability at this time.

Jump to Draft D1.0, Page 20

Item List Review - #26

26	Technical	4.8.2.9	4.8.2.9 is a poorly worded section, regarding unit tests and tests of a single pole of a three.phase circuit-breaker	The word "If" in a standard leads to disagreements. > The tests required to prove the concept are not listed. > Is one opening test required? > I have been asked to perform a three phase closing test based on this. It is not clear in this language why closing is needed. I will say that with tulip contacts in SF6 this is not necessary. > Should those tests have a real TRV. > Are these test three separate and independent currents? > Or is this three interrupters in series with one current and voltage?	Neil McCord	Neil McCord, Victor Savuliak	in progress

Item List Review - #26

4.8.2.9 Conditions during single-pole tests and unit tests¶

4.8.2.9.1 Single-pole testing on a three-pole circuit breaker¶

During single-pole tests of a three-pole circuit breaker, the closing speed/travel before contact touch, and the opening speed/travel after contact separation, shall be approximately the same as during a corresponding test on the complete circuit breaker. To verify that a three-phase circuit breaker can be tested single phase, verification tests shall be conducted in the following manner.¶

The verification tests shall consist of two closing operations and one opening operation with the maximum rated short-circuit current rating. One closing operation shall be performed with the circuit breaker closing

Jump to Draft D1.0, Page 17

requirements. For the closing on voltage peak maximum rated voltage shall be applied. Rated control voltage shall be used for all verification tests. The travel curves of the three-phase verification tests shall be recorded.¶

During single-phase testing, of the T100s, the contact travel curves shall be recorded and compared to the three-phase verification tests travel curves. Envelope curves shall be drawn with distance of ±5% from both sides of the three-phase travel curves. For the breaking operations, the singles-phase travel curve shall fall withing the envelope curve from the moment of contact separation to the point of damping. For the making operations, the travel curves shall fall within the envelope from the beginning of contact travel to moment of contact touch. The envelope curves can be adjusted in a vertical direction until one of the curves overlays an envelope curve to give a maximum tolerance of +0%, -10%, or +10%, -0%. However, this adjustment can only be done once through the entire comparison. If the single-phase tests fall within the envelope from the three-phase verification tests, then it is proven the single-phase tests are a valid representation of three-phase testing.¶

4.8.2.9.2 Unit testing¶

Unit testing is designed for circuit breakers that use identical making and breaking units in series.¶

The following designs and test methods should be considered:¶

a.)→Circuit breakers with an independent operating mechanism and independent arc extinguishing mediums for the making and breaking units on each pole.¶

Unit testing can be performed if the influence of electrodynamic forces of the current between the two units are considered. It is permitted that a conductor takes the place of the second making and breaking unit. The conductor shall be equivalent in size and shape to the making and breaking unit

uishing

valid.¶

c.)→Circuit breakers with a common operating mechanism.¶

Unit testing is only valid if the contact travel curves for unit testing are the same as the full-pole contact travel curves. The verification procedure in 4.8.2.8.2.1 shall be followed accordingly. However, the comparison of the contact travel curves is covered if there is arcing on the making and breaking units not under test. Circuit breakers with a common arc extinguishing medium is also covered as mentioned under item b) above.¶

d.)→Test performed at 60% or less of the short-circuit current rating, unit testing is accepted if the arc extinguishing medium volume is proportional between the single making and braking unit under test and the one part of the assembly of the making and breaking units consisting of the same arc extinguishing medium. The contact travel curves of a no-load operations shall be the same for the unit test and for full-pole assembly. The comparison of the contact travel curves shall be as described in 4.8.2.8.2.1 and used accordingly.¶

Draft Review

Jump to Draft D1.0

Motion to go to ballot

Ask for motion and vote

(MEC and comment response pending)

Schedule PC37.09 Amd1

- First meeting, April 12, 2022, Orlando/FL
- Second meeting, October 18, 2022, Burlington/VT
- Third Meeting, April 18, 2023, Clearwater/FL
- Forth Meeting, October 10, 2023, San Diego/CA
- Fifth Meeting, March 12, 2024, virtual
- Draft D1.0 prepared
- Sixth Meeting, April 2, 2024, Fort Lauderdale/FL
- Get permission to ballot by WG and HVCB
- Draft D1.0 circulation within the WG
- Form ballot group (validity 6 month) after Summer of 2024
- Initial Ballot before F'24 meeting
- Discuss Comments during F'24 meeting, form CRG
- Prepare D2
- 1st recirculation and comment resolution before S25
- Finalization in 2025

(PAR expires December 31, 2025)

Adjourn the Meeting

Thank you!!

Role	First Name	Last Name	Company Name	S22	F22	S23	F23	3/24	S24
Chair	Jan	Weisker	Siemens Energy	x	x	x	x	x	x
Secretary	Christopher	Jarnigan	Southern Company	x	x	x	x	x	x
Voting member	Koustubh	Ashtekar	JST POWER EQUIPMENT	x	x	x	x		
Voting member	Herman	Bannink	G&W Electric	x	x	x		x	x
Voting member	Andreas	Bartels	Powell Industries			x	x	x	x
Voting member	Craig	Bryant	Duke Energy		x	x		x	x
Voting member	Arben	Bufi	Meiden America	x	x	x	x		x
Voting member	Stephen	Cary	2 Phase Solutions	x		x	x		
Voting member	Steven	Chen	Eaton Corporation	x	x	x	x	x	x
Voting member	Andrew	Chovanec	Power Grid Components	x	x	x	x	x	x
Voting member	Michael	Christian	ABB	x	x	x	x		x
Voting member	Lucas	Collette	Duquesne Light Co.	x	x	x	x	x	x
Voting member	Michael	Crawford	Mitsubishi Electric	x	x	x	x		x
Voting member	Federico	Di Michele	CESI SpA		x	x		x	
Voting member	Sergio	Flores	Schneider Electric US, Inc.	x	x	x	x		x
Voting member	Robert	Hanna	JST Power Equipment	x	x		x		
Voting member	Jeremy	Hensberger	Mitsubishi Electric	x	x	x	x		x
Voting member	Victor	Hermosillo	GE Grid Solutions		x		x		x
Voting member	Jennifer	Hunter	MEPPI		x	x	x		x
Voting member	Todd	Irwin	GE Grid Solutions	x		x			x
Voting member	Thomas	Keels	kEElectric Engineering,	x	x		x		x
Voting member	Carl	Kurinko	Hitachi Energy	x	x	x	x	x	x
Voting member	Patil	Lalit	Eaton			x	x		x
Voting member	Chang Hoon	Lee	HYOSUNG	x	x	x	x		x
Voting member	Yong Woo	Lee	KERI			x	x		x
Voting member	Vincent	Marshall	Southern Company	x	x	x	x	x	x
Voting member	Steven	May	Southern Company		x	x	x	x	x
Voting member	Neil	Mc Cord	KEC Precision LLC	x	x	x	x		x
Voting member	Sumitabha	Pal	Schneider Electric	x	x	x	x	x	x
Voting member	Anthony	Ricciuti	EATON	x	x	x	x	x	x
Voting member	Leonel	Santos	Schneider Electric	x		x	x	x	x
Voting member	Victor	Savulyak	KEMA	x	x	x	x		
Voting member	Carl	Schuetz	ATC	x	x	x	x	x	x
Voting member	Jeffrey	Scott	Ameren	x	x	x	x		x
Voting member	Devki	Sharma	Self affiliated	x		x			x
Voting member	Michael	Skidmore	AEP	x	x	x			x
Voting member	Donald	Steigerwalt	Duke Energy		x	x	x	x	
Voting member	Vernon	Toups	Siemens Energy Inc	x	x	x	x	x	x
Voting member	Jacob	Walgenbach	Siemens	x	x	x	x	x	x
Voting member	John	Webb	ABB	x	x	x	x	x	x
Voting member	Casey	Weeks	Siemens Energy, Inc.	x	x	x	x		x
Voting member	Terry	Woodyard	Siemens Industry, Inc.	x	x	x	x	x	
Voting member	Richard	York	Mitsubishi Electric	x	x	x	x		x
Voting member	Marcus	Young	Mitsubishi Electric		x	x	x		x
Voting member	Mina	Youssef	Eaton Corporation		x		x		x
Voting member	Li	Yu	EATON		x	x			x
Voting member	Samuel	Zaharko	MEPPI	x	x	x			x
Non-voting member	Anatoly	Akhunov	HICO			x	x		x
Non-voting member	Samuel	Andris	KEMA Labs		x	x	x		
Non-voting member	Mauricio	Aristizabal	Hitachi Energy		x	x	x	x	
Non-voting member	Ganesh	Balasubramanian	Eaton			x		x	x

Non-voting member	Andy	Beckel	Xcel Energy			x	x		
Non-voting member	George	Becker	Power Engineers Inc.		x	x	x		
Non-voting member	Bob	Behl	JST POWER EQUIPMENT			x			x
Non-voting member	Dan	Benedict	PPL				x	x	x
Non-voting member	Brian	Berner	Power Grid				x	x	
Non-voting member	Sanket	Bolar	Oncor				x		x
Non-voting member	Elizabeth	Bray	Southern Company	x					
Non-voting member	Jeff	Brodgon	Georgia Transmssion			x			x
Non-voting member	Adam	Brooks	Duke Energy			x	x	x	
Non-voting member	John	Brunke	Power Engineers	x					
Non-voting member	Ted	Burse	Powell Industries, Inc.		x			x	
Non-voting member	Sudarshan	Byreddy	Burns & McDonell				x		
Non-voting member	Dave	Collette	Mitsubishi Electric			x			x
Non-voting member	Ivan	Contreras	ABB				x		
Non-voting member	Jason	Cunningham	Southern States, LLC	x	x	x			x
Non-voting member	Patrick	Di Lillo	Consolidated Edison Co.	x	x		x		
Non-voting member	Jeff	Door	H-J			x			x
Non-voting member	Max	Eastman	Black & Veatch			x			x
Non-voting member	Leslie	Falkingham	VIL			x			
Non-voting member	Bruce	Fennell	Nashville Electric Service	x					
Non-voting member	Andrew	Fernandes	Trayer				x		
Non-voting member	Peter	Glaesman	PCORE Electric Company		x				
Non-voting member	Mauricio	Gonzalez	Avangrid				x		
Non-voting member	Nadia	HASNAOUI	GE		x				
Non-voting member	Benjamin	Hohnstadt	DTE	x					
Non-voting member	Roy	Hutchins	Georgia Power Company	x	x				
Non-voting member	Bharatwaj	Jagadeesan	Southern States LLC	x					
Non-voting member	Darin	Jensen	Meiden American		x		x		
Non-voting member	Dave	Johnson	Self affiliated			x			
Non-voting member	Hyoungjin	Joo	Hyundai Electric & Energy		x				
Non-voting member	Jeff	Jordan	Southern States				x		
Non-voting member	SangTae	Kim	HICO America		x	x	x		
Non-voting member	Yun Seong	Kim	KERI			x			x
Non-voting member	Dwight	Krause	Black & Veatch			x			x
Non-voting member	Adrian	Lopez	Powell Industries		x				x
Non-voting member	Leo	Lopez	WIKA Instrument	x	x	x	x		x
Non-voting member	Chunming	Ma	Burns & McDonell				x		
Non-voting member	Peter	Marzec	S&C Electric	x					
Non-voting member	Paul	Masterson	Meiden America	x		x	x		x
Non-voting member	Kevin	McGlown	JST Power Equipment	x					
Non-voting member	Kenneth	McKinney	Underwriters		x				
Non-voting member	Henning	Milnikel	Siemens AG				x	x	x
Non-voting member	David	Mitchell	Southern States	x	x	x		x	x
Non-voting member	Andrew	Monroe	Southern Company	x					
Non-voting member	Stephanie	Montoya	MKI				x		
Non-voting member	Anthony	Natale	HICO				x		x

Non-voting member	Raj	Nayar	Siemens	x		x			
Non-voting member	Fernando	Ordein	Dominion Energy			x			x
Non-voting member	Miklos	Orosz	Circuit Breaker	x	x				x
Non-voting member	John	Owen	Powertech Labs			x			
Non-voting member	Mark	Pattison	H-J			x			x
Non-voting member	Conrad	Pecile	Myers Power Products				x		
Non-voting member	Thomas	Pellerito	DTE ENERGY	x					
Non-voting member	Mark	Peterson	Xcel Energy			x			
Non-voting member	Craig	Polchinski	Mitsubishi Electric Power	x					x
Non-voting member	Isaac	Pounders	Meiden			x	x		x
Non-voting member	Rakesh	Ranjan	Esgee Technologies Inc.	x					
Non-voting member	Aaron	Rexroad	Meiden			x	x		x
Non-voting member	Frank	Richter	50 Hz Transmission				x		
Non-voting member	Brian	Roberts	Southern States			x	x		x
Non-voting member	Jon	Rogers	Siemens Energy Inc				x		
Non-voting member	Ryan	Rowe	TCI			x			x
Non-voting member	Oscar	Salas	Duke Energy			x			
Non-voting member	Alex	Salinas	Doble/Vanguard			x			
Non-voting member	Jennifer	Santulli	IEEE-SA	x				x	
Non-voting member	Daniel	Schiffbauer	Toshiba International	x	x	x	x	x	x
Non-voting member	June	Seo	HD Hyundai Electric				x		
Non-voting member	Aleksandr	Sergeyenko	Tavrida			x		x	
Non-voting member	John	Sestito	Hyundai				x		x
Non-voting member	Matthew	Siena	Duke Energy	x					
Non-voting member	Hall	Sigmon	Siemens			x			
Non-voting member	R Kirkland	Smith	TCARA		x				x
Non-voting member	Ben	Sax	Nashville Electric Service			x			x
Non-voting member	Donnie	Swing	Powell			x			
Non-voting member	John	Tarleton	Southern States				x		x
Non-voting member	Truett	Thompson	Siemens		x				
Non-voting member	Joseph	Usner	AEP	x	x	x			x
Non-voting member	Jeffrey	Ward	Doble Engineering Co			x			x
Non-voting member	Dan	Wolfe	MEPPI		x	x	x	x	x
Non-voting member	Lukas	Zehnder	Hitachi Energy	x					
Non-voting member	Gigi	Zhang	HICO America			x			
Non-voting member	Xin	Zhou	Eaton		x				
Non-voting member	Danish	Zia	UL LLC	x					
Guest	Timothy	Terry	Meiden America						x
Guest	Lissy	Diaz	FPL						x
Guest	Sergiy	Rogozkhin	Tavrida Electric GmBH						x
Guest	Sharan	Parikh	Duke Energy						x
Guest	Matthew	Cuppett	Hitachi Energy						x
Guest	Bornuat	Albane	GE Grid Solutions						x
Guest	David	Dart	NOJA Power						x
Guest	Jerry	Wen	BC Hydro						x
Guest	Justin	Rebovich	GE Grid Solutions						x
Guest	Michael	Wong	Entergy						x
Guest	Gary	Meekins	Southern States						x
Guest	Brian	Alexander	S&C Electric						x
Guest	Arjan	Bronsveld	Hitachi Energy						x
Guest	Michelle	Antantis	Duquesne Light						x
Guest	Blair	Kerr	G&W Electric						x
Guest	Oliver	Klustmann							x
Guest	Jesus Manuel	Avila	ABB Mexico						x
Guest	Sergio	Miranda	ABB Mexico						x
Guest	Aniket	Shirode	ABB						x
Guest	Jeremy	Sneath	Electranix Corp						x
Guest	Linda	Liu	Sieyuan Electric						x
Guest	Zachary	Beecher	Southern States						x