Minutes of Meeting

WG: C37.09 Standard Test Procedure for AC High-Voltage Circuit Breakers with Rated Maximum Voltage above 1000V

Chair: Xi Zhu
Vice Chair: Victor Hermosillo (Victor not at meeting - Dan Schiffbauer assisted)
Secretary: Mike Skidmore

First Session (10:15 PM – noon) - April 25, 2017

Location: Charlotte, NC
Participants: 27 Members
47 Guests
(39 total members in WG - Quorum requirement met)

Greetings, Introductions, Members & Guests Sign in

All members and guests introduced themselves

Session #1 attendance list circulated and the chair asked all attendees to sign the roster and provide affiliation if not noted on the roster.

Chair presented the agenda (Document 156) in central desktop

MOM Approval

MOM (meeting of minutes) are posted and sent out via email after the fall meeting. ((Doc.150) Pittsburgh Meeting posted and emailed out 10/19/2016)

After the fall, meeting the WG chair and secretary received a few minor comments. The comments were accepted and the meeting minutes updated and posted into the IEEE PES switchgear website for members and guest to review.

John Webb commented on the meeting minutes from Pittsburgh. He questioned the wording and understanding on page #2. He objected that all “disposition” status was satisfactorily discussed during the meeting. The section in question on page #2 was duplicated below for clarification and discussion:

“Total comments = 492
Accepted 224
Revised 137
Rejected 105

TBD 26
No disposition 0”

The chair said the listing of “No disposition 0” on page #2 at the time addressed the agenda and status (at the beginning of the meeting). The main purpose for that particular line is to indicate that CRC had reviewed all comments before the meeting and had preliminary dispositions (including those 26 ‘TBD’ dispositions). The WG intention was not to avoid discussion of the topic and he was open to review any unresolved comments.

John Webb was satisfied with the response the chair provided as long as the unresolved “disposition” comments will be discussed at the meeting in Charlotte.

The chair agreed these would be discussed along with any other questions the WG wants to review.

The meeting minutes from Pittsburgh as posted in the IEEE PES switchgear website were unanimously approved.

When we go to recirculation, the chair suggested the balloters should provide very specific comments with a clear direction to update the document. If there is no suggested wording and the comment remains open-ended then the comment may be rejected.

Sushil – Even out of scope comments should be considered in updates to the standard.

Xi asked Erin for clarification

Erin – If the comments improve, the document then you can make an update but if it was, a successful ballot then it can be rejected, if out of scope. This is up to members of WG and Chair.

Xi said he would discuss important topics that were marked “out of scope”. If others want to discuss their rejected topic, please bring it to his attention.

<u>Xi Review of Project Status</u>

- Initial ballot completed (July 26-Aug. 25, 2016)
  - 88% returned (114 votes), 80% approved (84 affirmative votes),
  - 22 negative (1 without comment), 8 abstained. 492 comments
  - Public viewing (60 days) completed and no comments received.
  - CRC (Comment Resolution Committee) preliminary disposition sent to WG members and guests on 10/3/2016

    - Around 40 comments discussed in WG meeting

- 1st Recirculation completed (March 28 – April 12, 2017)
    - 91% returned (118 votes), 85% approved (94 affirmative votes),
    - 16 negative (5 without new comment), 8 abstained . 128 comments
    - CRC (Comment Resolution Committee) preliminary disposition sent to WG members and guests on 4/21/2017
    - Selected comments to be discussed in this meeting

Note: some people claimed they did not received the email the chair sent out on 4/21/17. After the meeting, Mauricio and Hua found that the email was put in the spam email folder in IEEE email server. WG members and guest should look in their spam folder. Chair will continue send email to both ballot and WG members/guest groups.

IEEE-SA CentralDesk Website:

- https://ieee-sa.imeetcentral.com/login?eid=&rurl=%252Fhome%252F
- 155+ documents archived in Central Desk. A few important ones:
    - Doc 000 - Master WG Document List
    - Doc 153 – Draft 2.6 sent out for 1st recirculation ballot
    - Doc 157c – 1st Recirculation Disposition (working document sent 4/21 to WG)

WG Member List review

The chair and secretary discussed requirements for Membership

1) Need to keep WG membership update for voting purpose
2) WG membership modified according to IEEE-SA policy below
3) In case of mistake, please contact WG chair/VC/Secretary

A PowerPoint slide shown for the WG policy and procedures document.

PAR expires December 2017

C37.09-1999 expired December 31, 2018

The Chair said he would skip some of the PAR discussion until Ted Burse is available.

Questions:

- Do we apply for PAR extension? (max. available time 1 year) – This will be discussed later
- Do we wait?

- C37.04 and C37.100.2 under development, C37.100.1 waiting on IEC copyright
- PAR says C37.09 development does not depend on other standards
- With both initial ballot and 1st recirculation exceed the approval threshold (75%) and changes can only be made to “changed portions”, limited changes can be made

Xi reviewed comments CRC (Comment Resolution Committee)
Total Comments Received = 128
CRC "Accepted" = 47
CRC "Revised" = 29
CRC "Rejected" = 42
CRC "TBD" = 10

About Disposition Status – Only three official categories:

- Accepted: meaning the exact proposal is adopted into the document. No changes to the original change proposal will be made.
- Rejected: The proposal is not accepted. No changes will be made;
- Revised: The proposal is accepted in principle, but modification from the proposed wording is changed.
- We used TBD for undetermined dispositions. But eventually it will be one of the three above.

NOTE:

- General comments lacking details of what is proposed for changes will be ended up being rejected.
- Comment proposing changes on the ‘unchanged’ part of a document after a successful ballot may be Rejected. 23 out of the above 42 comments belong to this category

The chair moved to discussed selected comments from ballot

Selected comments to be discussed (4/21/17 email):

r01-77	Aristizabal, Mauricio	Technical	781
r01-80	Aristizabal, Mauricio	Technical	2193
r01-24	Burse, Ted	Technical	2193
r01-101	Goodin, Robert	Technical	2358
r01-111	Behl, Robert	Technical	2374
r01-57	Dullni, Edgar	Technical	2375
r01-67	Chen, Steven	Technical	3564
r01-95	Edwards, Douglas J	Technical	4504
r01-26	Burse, Ted	Technical	4504
r01-116	Webb, John	General	4525

Comments Resolution Discussion

Line 3564, Steven Chen,

Stephen Chen – line 3564 – discussion of low voltage / high voltage control

Dan Schiffbauer reviewed table 13

Proposal to have some voltage range to match IEC

Stephen said this would require the control voltage to be changed every few operations. There seems to be some disconnect with MV to HV equipment.

Mauricio, Jan, and some others, said voltage change is not too difficult for them to achieve in the factory.

Todd – If it is changed to not match IEC then you may need to call it something different from an M2 test.

Roy – what is reasonable in the field (6 to 8% voltage due to battery float voltage)

Stephen – may not be difficult for some companies but maybe others may need to send someone in at midnight just to change control voltage for the test.

Dan – one more comment – rapid sequence on table is a little different from IEC – IEEE CO-30 sec – 20 operations – check – line #4. This requirement has been in C37.09 since 1979.

Anne – Number counts need to align with ratings and requirements in .04 – total number of counts.

Xi – we will coordinate with .04

John – Discussed temperature rise of motors and allowing fans for 1 min.

Anne – proposed to take it out of mechanism test table and move to another section.

Dan – will review options to preserve the rapid sequence operations while not causing a discrepancy in the definition of M2 from IEEE to IEC. Will do this with Anne and the CRC.

Conclusion: Discuss and agree to reject Stephen Chen original comment per line 3564

Line 897 – John Webb

Discussion of 2 and 3 pole test (symmetry). Should we test 3rd pole if it is symmetrical to the first pole?

John discussed dielectric test of breakers and probably of tests results – (36 time vs 54 times). One can reach a higher-level confidence if you test the 3rd pole. John gave a dice probability example.

Doug Edwards – dice analogy used by John may be skewed or weighted. Either you have a good pole (design) or you do not.

9 shots is sufficient

Xi – discuss example of flipping a coin. Since the sample numbers we are talking about are small, the set with large samples does not necessary give more accurate results. Accurate results can be guarantee only when test samples are very large. In addition, the difference between a type test breaker and a production breaker may be more significant than the statistic difference of concerns here. It makes sense to test two phases only if A and C phases are the same in terms of electric field mapping.

Doug Edwards – may help with 3%

Sushil – we are only talking on CBs on a common frame – agrees partly with Johns comments

Denis - 3X9 or 2X15 – To match IEC the test 3X9 is on ABC – not changed in last 15 or 20 years.

Dave Stone – 100.1 is the same – if you do 3X9

John Webb can do the math (probability comparison) and present findings to the WG

Roy – Is this that big of an issue?

Pat – take more life out of insulation each additional shot

Carl – curve approaches the 10% error – he referenced a Hileman book - 3X9 and 2X15 probabilities

Conclusion: John Webb to send out probability information to accept or reject test. The WG needs to understand the probability, benefit from the math, and make a decision.

Line 921 – John Webb

Discussion on negative tolerance (+/- 3%) - test value to be applied - .09 can take precedence over std 4.

Xi – clause P added two years ago. The purpose of clause is when you use correction factors. He gave example of other lines (line 871, 976, 987) in the document where 'on equal and greater to +/- 3%' is required in test voltages.

Hua Liu – prefers to keep existing requirements for C37.09-1999 "no negative tolerance" – experiences with 100.1 and std 4. She voted disapprove for IEEE Std 4 and C37.100.1 for this negative tolerance issue. The WG chairs for these two standards responded that the negative tolerances are general and specific equipment standard can set their own tolerance requirements.

Steve Chen and others - look at average of total shots and make sure the average is greater than or equal to the rating requirement in .04

Dave Stone – the recloser standard has a dual logo and takes the average of the rated value.

Stopped for Lunch

Second Session (2:00 PM – 3:45 PM) - April 25, 2017

Location: Charlotte, NC
Participants: 26 Members
40 Guests
(39 total members in WG - Quorum requirement met)

Chair asked if there were any introductions of new members or guests that were not present in Session #1

Session #2 attendance list circulated and the chair asked all attendees to sign the roster and provide affiliation if not noted on the roster.

The chair moved to continue discussion on selected comments:

The Chair asked the working group members to vote on the +/- 3% tolerance in test shot. (discussion before break)

Option #1 - The shots can be on the negative side as long as the average is equal to or above the rated value listed in .04 (.06). Also, the corrected is equal or greater.

Option #2 - Keep as C37.09-1999 “no negative tolerance”

The WG members voted on option #1

1 against
1 abstain
24 in favor
Conclusion: options #1 selected.

Line 1779, 1814 – Helmut Heiermeier

Helmut’s points are good but were rejected because there was no proposed change suggested

Line 2265 - John Webb

Can you count calibration shots? It is not clear.

Denis – must have condition if arcing time is within window of test.

Xi – will include revision and add notes. He will work with Denis.

Discussion on Dave Stone Topics

4.4 Continuous current-carrying tests

Subclause 7.5 of of IEEE Std C37.100.1-20xx is applicable with the following additions.

In subclause 7.5.1 of IEEE Std C37.100.1-20xx, add the following:

a) The circuit breaker shall be tested under all other usual service conditions, except as stated 4.4.1 for ambient air temperature range for the test.

b) Other accessories normally connected in series and closely associated with the circuit breaker, such as current transformers, primary disconnecting contacts, cell mounted auxiliary switches, buses, and connectors, shall be mounted in their regular position.

c) Circuit breakers normally equipped with current transformers shall be tested with transformers in place and connected to carry rated secondary current.

d) Indoor circuit breakers shall be tested in a minimum volume enclosure or in the actual switchgear vertical section compartment. Connections to the switchgear shall be made in accordance with IEEE Std C37.20.2.

In subclause 7.5.6 of IEEE Std C37.100.1-20xx, Table 14 is replaced by Table xx of IEEE C37.04.

Dave Discussed clause 4.4.1 to 4.4.7 – Dave reviewed and added omissions between 100.1 to .09

He highly recommends we keep the form of table of 100.1 which is similar to IEC

Remove the table is other option.

Conclusion: Xi recommended that 2 or 3 members review the table (Hua Liu, Dan Schiffbauer, John Webb to review the table)

Line 781 – Maurcio Aristizabal

Discussion on temperature rise test. What is the definition of “significant amount of heat”. 5 degree is in IEC and 100.1

Leslie - make sure connection does not change test. It is to do right measurement in the lab.

Conclusion: Xi said that 5 degree would be accepted per Mauricio comments. There was no other temperature value offered to prove or disprove the 5 degrees requirement.

Line 2193 – Mauricio Aristizabal

Discussion on 5 nF of a connection for SLF (directly connected with 5nF or less). Denis explained that 5nF would give at least a 2uS delay. This is similar to a comment made by Denis. Denis said this is related to class S2 comment he made.

Keep the first part of the statement and modify the 2nd part of sentence with a note. Note will say for S2 breakers only when less than 5nf

Line 2358 - Robert Goodwin

What is discussed in this section does not apply to vacuum breakers. There may be limits that may limit vacuum equipment.

Edgar - Total travel before 40mm the tolerance must be +/- 2%

John – believes most of these words came from Annex “N” in IEC. Maybe the +/- can be replaced with a different value.

Go to IEC and get all of annex “N”.

(Similar comments from Bob and Edgar)

Conclusion: John Webb, Bob Behl and Leslie to work on wording line 2358

Ted Burse - PAR Discussion

Xi - moved to discuss PAR (skipped over in first meeting session)

PAR expires in 2017. Can we wait?

Ted - The existing document withdrawing is actually Feb of 2019. We lose IEEE and ANSI recognition if it is withdrawn.

Dave – if IEEE .04 or .09. are withdrawn, what is the extra work?

Leslie – if we finish the standard now what is harm of releasing it? He believes it is ok to finish now.

Ted – There should be alignment of .04 and .09. There is no reason you have to submit .09 immediately to RevCom. Finish the document but do not release just yet and wait on .04. We should wait to align better with .04 and make sure there are not major discrepancies.

John – We should be done soon and all comments resolved. We should – finish this year (2017) to and align with .04 next year (2018).

Policy does not prevent WG from modifying the unchanged part of the standard even after successful ballots for the purpose of ‘coordination between standards’ to match .04 later.

Xi - 2 more meetings (Fall 2017 and Spring 2018) and then we will submit.

Conclusion: Xi will file for PAR extension. We will continue work on the document to make sure it aligns with .04 but by Fall 2017 we should know more on status of .04.

Line 4504 – Doug Edwards

Question to delete the test – 5.13 - sections deleted in previous discussion but now more information is needed
Must prove the duty cycle – keep it the way it is.

Conclusion: Ted and Doug comments rejected – agreed to by committee.

Line 4525 – John Webb

Clause 6 - notes are always informative
Conclusion: add a note to point people to C37.54

Meeting adjourned

Meeting Roster for Session #1 and #2 Charlotte, NC

First Name	Last Name	Role	Company	4/25/2017 Meeting #1 Charlotte, NC	4/25/2017 Meeting #2 Charlotte, NC
Syed Shahab Uddin	Ahmed	Guest	Siemens Energy Inc		
Roy	Alexander	Member	RWA Engineering	X	X
Natasha	Alvarado	Guest	IEEE Standards Association		
Mauricio	Aristizabal	Member	ABB	X	X
Brad	Armstrong	Guest	Meramec Instrument Transformer Co.	X	
Koustubh	Ashtekar	Guest	Eaton Corporation	X	X
Aasim	Atiq	Guest	Siemens Industry		
Roy	Ayers	Guest	Nashville Electric Service	X	X
Katrin	Baeuml	Guest	Schneider Electric		
Paul	Barnhart	Guest	Underwriters Laboratories		
Amildo	Barrio	Guest	Parsons		
George	Becker	Guest	POWER Engineers	X	X
Robert	Behl	Guest	ABB	X	X
Jean-Marc	Biasse	Guest	Schneider Electric		
J	Billings	Member	John S Billings Consulting		
Marcus	Bonner	Guest	GE	X	
Anne	Bosma	Member	ABB AB	X	X
Douglas	Brandt	Guest	Eaton Corporation		
Cody	Brehm	Guest			
Jeffrey	Britton	Guest	Phenix Technologies, Inc.		
Jeffrey	Brogdon	Guest	Georgia Transmission	X	X

Steven	Brown	Guest	Allen & Hoshall		
Raymond	Browning	Guest	FirstEnergy Corp.		
John	Brunke	Guest	Dr. John H. Brunke, P.E.		
Arben	Bufi	Member	Hitachi T&D Solutions, Inc.	X	X
Ted	Burse	Guest	Powell Industries, Inc		
Eldridge	Byron	Member	Schneider Electric	X	X
Donald	Cantrelle	Guest	Georgia Power		
Gilbert	Carmona	Guest	Southern California Edison		
Stephen	Cary	Member	GE Energy Management	X	X
Steven	Chen	Member	Eaton Corporation	X	
Wayne	Cheng	Guest	B C Hydro		
Vincent	Chiodo	Guest	HICO	X	
Jeonghwan	Cho	Guest	HICO America		
Chih	Chow	Member	PEPCO	X	X
Michael	Christian	Guest	ABB	X	
Roggero	Ciofani	Guest	Altalink		
Robert	Cohn	Guest	Powercon Corp.		
Lucas	Collette	Member	Mitsubishi Electric	X	X
Dave	Collette	Guest	Mitsubishi Electric		
Michael	Crawford	Member	Mitsubishi Electric		
Jason	Cunningham	Guest	Hitachi HVB, Inc.		X
David	Dart	Guest	NOJAPower		
Jerod	Day	Guest	Vacuum Interrupters, Inc.		
Patrick	Di Lillo	Member	Consolidated Edison Co. of NY, Inc.	X	X
Jeffrey	Door	Guest	H-J Family of Companies	X	
Denis	Dufournet	Member	Retired	X	X
Edgar	Dullni	Guest	ABB		X
Bernie	Dwyer	Guest	PECO		
John	Eastman	Guest	INCON		
Alexander	Ebbert	Guest	HICO America		
Ken	Edwards	Member	Bonneville Power Administration		
Doug	Edwards	Guest	Siemens Industry, Inc.	X	
Tanner	Esco	Guest	Eaton Corporation		
Leslie	Falkingham	Member	Vacuum Interrupters Limited		X
David	Feldmann	Guest	HICO America		
Howard	Fennell	Guest	Nashville Electric Service	X	X
Thomas	Field	Guest	Engergy		
Sergio	Flores	Guest	Schneider Electric Inc. USA	X	X
Robert	Foster	Guest	Megger	X	X
Paul	Fox	Guest	Schneider Electric	X	X
Raymond	Frazier	Guest	Ameren	X	X
Richard	Frye	Guest	Eaton		
Didier	Fulchiron	Guest	Schneider-Electric		

Sivakumar	Ganesh	Guest	ENMAX Corporation		
Douglas	Giraud	Member	Powell Electrical Systems		
Anne	Good	Guest	Netshape Technologies, Inc.		
Paul	Grein	Guest	Circuit Breaker Sales, Co, Inc, - GroupCBS		
Martin	Greschner	Guest	HIGHVOLT Prueftechnik Dresden GmbH		
John	Hall	Guest	Tennessee Valley Authority		
Jeffrey	Hanson	Guest	Schneider Electric	X	
Helmut	Heiermeier	Member	ABB	X	X
Christian	Heinrich	Guest	Siemens AG		
Charles	Hendrickson	Guest	Arizona Public Service Company		
Jeremy	Hensberger	Guest	Mitsubishi Electric Power Products Inc.	X	X
Victor	Hermosillo	Vice-Chair	GE Grid Solutions		
William	Higinbotham	Guest	EA Technology LLC		
Tyler	Holp	Guest	Eaton		
Alexander	Hoover	Guest	Siemens Industry	X	X
Jingxuan (Joanne)	Hu	Member	RBJ Engineering Corporation		
Carl	Hummel	Guest	HICO America		
Jennifer	Hunter	Guest	MEPPI	X	X
Roy	Hutchins	Member	Southern Company Services	X	X
Todd	Irwin	Member	GE Grid Solutions	X	X
Anton	Janssen	Guest	Liander		
Joseph	Jasinski	Guest	ITC Holdings Corp.		
David	Johnson	Guest	Self-Employed		
Jacob	Joseph	Guest	Toshiba International Corporation		
Wolfgang	Jung	Guest	Siemens AG		
Mangu	Kang	Guest	HICO America		
Jayamali	Kasige	Guest	Crown Technical Systems		
Thomas	Keels	Guest	Salt River Project		
Amir	Khosravi	Guest	BC Hydro	X	X
JaeHyun	Kim	Guest	HICO America/Hyosung		
Jinho	Kim	Guest	HICO America		
SangTae	Kim	Guest	HICO/HYOSUNG	X	X
Boris	Kogan	Guest	Schneider Electric	X	
Sandeep	Kulkarni	Guest	CG		
Carl	Kurinko	Guest	ABB Inc.		
James	Lagree	Guest	Eaton		
Stephen	Lambert	Guest	Shawnee Power Consulting, LLC		
Scott	Lanning	Guest	S&C Electric	X	X
Matthew	Lawrence	Guest	Doble Engineering		
Brad	Leccia	Guest	Eaton		X

HaeKyu	Lee	Guest	HICO America		
Shawn	Lee	Guest	HICO America		
David	Lemmerman	Guest	PECO/Exelon		
Werner	Lesse	Guest	Siemens AG		
Paul	Leufkens	Guest	Power Projects Leufkens		
Wangpei	Li	Guest	Eaton	X	
Qian	Li	Guest	Powertech Labs INC.		
Hua Ying	Liu	Member	Southern California Edison	X	X
Albert	Livshitz	Member	CE Power Solutions		
Russell	Long	Member	Retired		
Antonio	Mannarino	Guest	PSE&G		
Vincent	Marshall	Guest	Southern Company Services	X	X
Gary	Martin	Guest	Entergy		
Ricardo	Martinez	Guest	CFE-LAPEM		
Peter	Marzec	Guest	S&C Electric Co.		X
Joel	Mathewson	Guest	Siemens		
Frank	Mayle	Guest	Technibus, Inc.		
James	McBride	Guest	JMX Services, Inc.		
Neil	McCord	Guest	Southern States		
Timothy	McGee	Guest	Siemens Energy		
Steven	Meiners	Guest	GE		
Peter	Meyer	Guest	S&C Electric Company	X	
Dave	Mitchell	Guest	Dominion	X	X
Arthur	Molden	Guest	AMEESCO		
Terry	Monahan	Guest	Schneider Electric		
Tom	Mulcahy	Guest	Dominion Virginia Power		X
Raj	Nayar	Guest	Siemens Energy Inc.		
Jason	Neal	Guest	HICO America		
Jeffrey	Nelson	Guest	Tennessee Valley Authority		
Joachim	Oemisch	Guest	Siemens AG		
T	Olsen	Guest	Siemens Industry, Inc.		
Nicholas	Orlando	Guest	IEEE-SA	X	X
Miklos	Orosz	Guest	Schneider Electric		
Justin	Palmer	Guest	ELECTRONSYSTEM MD	X	
Molson	Parvin	Guest	CB&I		
Shawn	Patterson	Guest	US Bureau of Reclamation		
Thomas	Pellerito	Member	DTE Energy	X	X
Alan	Peterson	Guest	Utility Service Corporation		
Andrew	Peterson	Guest	ABB	X	X
Lise	Phan	Guest	Parcific Gas and Electric Company		
John	Phouminh	Guest	PEPCO HOLDINGS, INC.	X	X
Anton	Poeltl	Guest	ABB		
Iulian	Profir	Guest	Rockwell Automation		

Ahmad	Qasem	Guest	Bechtel	X	X
Syed	Rahman	Guest	The United Illuminating Company	X	X
Samala Santosh	Reddy	Guest	Powell Industries		
Frank	Ricard	Guest	FirstPower Group LLC		
Anthony	Ricciuti	Member	Eaton Corporation	X	X
Bobby	Rich	Guest	Dominion Virginia Power	X	X
Dave	Riffe	Guest	Westinghouse Electric Company		
Julian	Rizo	Guest	Xcel Energy		
Brian	Roberts	Guest	Southern States, LLC		X
Jon	Rogers	Guest	Siemens Energy, Inc		
Ben	Rosenkrans	Guest	Eaton Corporation		
Roderick	Sauls	Member	Southern Company Services		
Victor	Savulyak	Member	DNV GL KEMA Laboratory		
Robert	Sazanowicz	Guest	The United Illuminating Company		
Daniel	Schiffbauer	Member	Toshiba International Corporation	X	X
Carl	Schneider	Guest	Schneider Electric		
Carl	Schuetz	Member	American Transmission Company (ATC)	X	X
Jon	Schumann	Guest	American Transmission Company	X	
Devki	Sharma	Member	Consultant	X	X
Harish	Sharma	Guest	Southern Company	X	X
Sushil	Shinde	Member	ABB Inc.	X	X
Dean	Sigmon	Member	Eaton Corporation	X	
Sunita	Singh	Guest	Bechtel OG&C		
Michael	Skidmore	Secretary	AEP	X	X
Robert	Smith	Member	Retired		
Hongbiao	Song	Guest	GE		
Erin	Spiewak	Guest	IEEE	X	X
Kresimir	Starcevic	Guest	DNV GL KEMA Laboratories		
Don	Steigerwalt	Guest	Duke Energy		
David	Stone	Guest	DTS Technical Services	X	X
Donald	Swing	Guest	Hubbell Power Systems		
Dragan	Tabakovic	Guest	Meramec Instrument Transformer Co.	X	X
Humayun	Tariq	Guest	American Electric Power		
Jey	Thayalan	Guest	Schneider Electric		
Michael	Titus	Guest	Schneider Electric		
Jean-Marc	Torres	Guest	Eaton Corporation		
Vernon	Toups	Member	Siemens	X	X
Francois	Trichon	Guest	Schneider Electric		
Richard	Trussler	Guest	Schneider Electric		
James	van de Ligt	Member	CANA High Voltage Ltd.	X	X
Michael	Wactor	Guest	Powell Industries, Inc		
Jeffrey	Ward	Guest	Doble Engineering Company	X	X
Robert	Warren	Guest	DNV GL - KEMA Laboratories		

John	Webb	Member	ABB	X	X
Casey	Weeks	Guest	Siemens Energy	X	X
Jan	Weisker	Guest	Siemens AG	X	X
Jerry	Wen	Guest	BC Hydro		
William	Wilkie	Guest	Eaton		
Matthew	Williford	Guest	Schneider Electric		
Barnes	Wilson	Guest	Avista Utilities		
Joseph	Wisnewski	Guest	UL LLC	X	
Terry	Woodyard	Member	Siemens Industry Inc.		
Larry	Yonce	Guest	Eaton Corporation	X	X
Dong Sun	Yoon	Guest	HICO America		
Richard	York	Guest	Mitsubishi Electric Power Products Inc.	X	X
Li	Yu	Guest	Eaton Corporation		
Jiong	Zhang	Guest	MEPPI		
Wei	Zhang	Guest	Hitachi HVB, Inc.	X	X
Xi	Zhu	Chair	GE Energy Management	X	X

‘X’ - individual was at the meeting in Charlotte