Minutes of Meeting

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

April 25, 2016

Chair: Xi Zhu
Vice Chair: Victor Hermosillo
Secretary: Mike Skidmore

First Session (1:30 PM – 3:15 PM)

Location: Hilton Head, SC
Participants: 27 Members
39 Guests

Greetings and Introductions
All members and guests introduced themselves
The attendance list was circulated.

Chairman presented the following agenda (Doc 133) in central desktop.

Greetings, Introductions, Members & Guests Sign in
MOM (Doc 100) from San Diego posted and emailed out
Review of Project Status

- Many revisions since D2.2 reflecting comments and proposals since last meeting. Added 36 documents since the last meeting in San Diego, CA. Please see Doc 000, created 100 to 136.
- Complete revision history is documented in 30+ new documents added to C37.09 Central Desk. There is not enough time to review each comment and proposal during the meeting. Please notify the chair of any disagreements.
- 136 documents archived in Central Desk. A few important ones:
  - Doc 000 - Master WG Document List
  - Doc 100 – MOM from last meeting and notes on open item executions
  - Doc 096 – PDF version of D2.2
  - Doc 126 – Ted Olsen comments on D2.2 and dispositions
  - Doc 127 – PDF version of D2.3, e-mailed out about ten days ago
  - Doc 131 – Internal comments on D2.3 from Jan, Denis, Hua and dispositions
  - Doc 132 – Latest D2.3.1 reflecting all comments up to now

Most open items are closed; refer to minutes of last meeting. Notes are in red. Open items are highlighted in yellow.

After this meeting, in four weeks, all members and guests will receive updated document D2.4. This will be the last draft circulated before ballot.

The intent was to have a first ballot before this meeting. There were a few numbers of contributions that did not allow this to happen. The goal now is to go for a first ballot before the fall 2016 meeting.

Project outlook was presented:

- First Ballot done by Fall 2016 Meeting
- Recirculation by Fall 2017
- Submit to Revcom
- Revcom decision
- Completion by Dec. 2017

Open items from the last minutes of meeting (refer to Doc 100):

- 50Hz and 60Hz temperature rise test equivalence – Steve Cary
- Condition check after testing. 200% contact resistance limit and 10 degree temperature rise – John Webb
- M1, M2 endurance testing – Dan
- E2 test procedure – Jan
- 'Pressurized components' clause improvement – Dan, Sushil

Item #1. 50Hz and 60Hz temperature rise test equivalence – Steve Cary

D. Stone from common clause document was the source of the suggestion. Test at 50 Hz valid for 60 Hz if within 95% of temperature rise limit. Steve Cary said the difference is 2-3% in tests, depends on the conductor dimensions valid up to 0.5" busbar thickness. Dennis Dufournet concurred Alstom experience with a few tests they performed. Hua Liu asked what this proposal mean. Chairman explained. Carl Schuetz, wonder what the users think about this. If this is based on calculations are all factors considered besides current magnitude and frequency? Sushil Shinde this was proposed only to be valid for the same design tested at 50 Hz not to interpret a different design. Dan Schiffbauer, do you really want the standard to assume the risk of universal validity of this ratio of 95%.

Conclusion: Chairman proposes since there is no general agreement then this will be removed from the draft.

Item #2 Condition check after testing. 200% contact resistance limit and 10 degree temperature rise – John Webb

John Webb is not available so this will discussion will be postponed to the second session.

Item #3 M1, M2 endurance testing – Dan Schiffbauer

Dan Schiffbauer, worked with Sushil Shinde and V. Hermosillo integrating IEC requirements into mechanical endurance and environmental testing. Same basic procedure used, procedures presented in tabulated form.

Xi Zhu recommends to specifically describe M1 as 2000 and M2 as 10,000. Dan agreed to add the wording. The proposal from Dan will be added into the D2.4.

Item #4 E2 test procedure – Jan Weisker

Exchanges with John Webb via e-mail. Service capability rating. Procedure to depend on rated voltage <=72.5 kV and >72.5 kV. Specific E2 for high-voltage breakers according to IEC. Create definition of E1 and E2 and then talk about treatment of tests.

Jan to communicate with Steve Cary to coordinate with C37.04.

Xi if we want to refer to IEC procedure we should integrate the text in C37.09. Xi asked Jan to review Steve Cary and John Webb and provide wording for proposal.

Item #5 'Pressurized components' clause improvement – Dan Schiffbauer, Sushil Shinde

Distinguish between vessels that isolate voltage (porcelain/composite like bushings and live-tank circuit breakers) and those who are not insulating. For insulating vessels apply procedure in C37.017 max working pressure plus two times cantilever load. There are also reference IEC standards for porcelain and composite bushings.

Does the pressure vessel requirement belong in C37.09 U-stamp?

Richard York said that some of the wording came from (he thinks) NEMA SG4 for composite insulators.

Dan Schiffbauer to propose resolution and discuss with Richard York.

Pressure cycling testing for vessels that are exposed to temperature and current cycles, diurnal pressure cycles. This test is never done on tanks, requires 100,000 cycles. NEMA SG4 had this requirement for composite insulators, it was brought into C37.09. Dan Schiffbauer and Rich York will meet regarding this topic and inform about conclusions.

Xi wants information updated and back to him within 10 days.

Select subsets of comments received on Draft D2.2 were discussed:

Comment 1
Refer to Doc 126 and Doc 096.

Olsen	Technical	2531	The meaning of "lockout" is not defined, and how does one conduct this test if the circuit breaker has no function of lockout (as part of the circuit breaker)? It should say something like "recovery upon re-energization shall be verified".	See comment.	Yes	TBD

V. Hermosillo and D. Schiffbauer to reword in order to cover SF6, vacuum and other technologies that do not depend on recovery from lockout density of the insulating medium.

Comment 2
Refer to Doc 131 and Doc 127.
Break Time.

Dufournet - 4	Technical	1088	In the calculation of interrupting time it should be considered taht there is during tests a lack of precision in the determination of minimum/maximum arcing times. This is recognized in the current revision of IEC 62271-306 with the following wording: "The determined break time is reduced by 18º of the power frequency due to the precision in the determination of the minimum arcing time."	as proposed in the comment. Alternatively the full text on break time in IEC 62271-306 could be introduced (see 13.9).	Yes

Definition of break time, integration of definition from IEC 62271-306

D. Dufournet: some comments received stating that the definition is not clear. Definition of break time based on minimum arcing time and the window required depending on grounded/ungrounded network. This would replace the use of the maximum recorded arcing time during the test. Proposal is to take it from IEC and adopt it. For example, IEC uses T30, T60 and T100s, this could be adjusted in IEEE. Break time IEC definition is equivalent to interrupting time in IEEE. Correction is given for the opening time changes due to the control voltage at minimum or rated. A correction of 18 degrees is added since in testing accuracy may not find the exact minimum arcing time.

D. Dufournet suggested to include the IEC text and wait for comments during circulation. Chair agrees.

Comment 3
Refer to Doc 131 and Doc 127.
DC component text and Figures 1 and 2.

Jan Weisker - 1	Technical	1140	For the testing of T100a based on last loop of current the dc component at contact separation has no meaning anymore	remove line 1140 to 1173 and Figures 1 and 2	Yes

J. Weisker prepared presentation attached (Doc 137). He showed a comparison between asymmetrical currents with time constant of 45 ms and 120 ms. In testing the important is the magnitude and time between zero crossing of the major loop. Proposal is to move away from the definition of the DC component at the instant of contact separation. Time constants in laboratories are 80 to 120. Allows to test

with lab time constant different from the requirement, usually cannot be adjusted. Definition of last major loop is sufficient and allows meeting magnitude and duration.

A. Bufi asked what should be used in case of customer requirements above X/R=17? H. Heiermeier the application document C37.010 already provides a procedure to calculate X/R ratios above standardized values based on tested values. Basic principle is explained.

Ken Edwards reviewed the example provided with same DC component at contact separation. He is OK with graph. He wants to make sure that the standard is not being influenced by testing limitations.

D. Dufournet Figure 1 is still in C37.04.

Chairman summarized that the information in Figures 1 and 2 is not relevant. The relevant information is defined in Table 3.

Michael Wactor suggests to distribute information to all based on IEC or STL guides for asymmetrical testing to clarify the concepts.

Carl Schuetz, for users it would be valuable to maintain the information in the figures. Perhaps send to appendix and then move to C37.010 later on.

D. Dufournet keeping these figures will create confusion. H. Heiermeier keeping Figures may confuse users.

The rest of the topics will be discussed during the second session.

WG went to break

Second Session (3:45 PM – 6:00 PM)

Location: Hilton Head, SC
Participants: 31 Members
34 Guests

Chairman circulated attendance sheet

Comment 3 (continued)
Refer to Doc 131 and Doc 127.

DC component text and Figures 1 and 2.

Proposal is to move Figure 2 (which shows the DC component decay under different X/R ratios) currently under sub-clause 4.9.2.3 to C37.04 if Steve Cary is willing to take on work. Steve was at meeting and will review information to pull into C37.04. Information for Figure 1 and 2 and the related text in C37.09 will go away if pulled into C37.04. The plan it to remove wording and figures from body of C37.09 into .04 or move to an appendix within .04.

Comment 4
Refer to Doc 131 and Doc 127.
Condition check after which test duties?

Jan Weisker - 12	Technical	2257	Typically high-voltage circuit-breakers are maintained one or several times during a short-circuit test series. It should be clarified that this voltage test has to be performed only once. Typically after L90 or T100s or if performed after the service capability duty.	Add a sentence "For circuit-breakers equals and above 72,5 kV the proper condition after short-circuit interruption is proven if the voltage withstand test is performed once after the tests according 4.9.5.4.2.	Yes	Should be better defined. TBD. See clause 4.9.6

The WG agreed to add a description when voltage check tests are to be made. In IEC after L90, T100s.

Jan to propose a short paragraph defining after which type tests will these voltage checks be performed.

Comment 5
Refer to Doc 131 and Doc 127.
Cap switching making angle tolerance?

Jan Weisker - 15	Technical	2676	In STL and IEC it is commonly agreed to use a making angle of +- 25 degree for capacitance switching	use +- 25 degree	Yes	15 degree tolerance is from C37.09a. But STL and IEC is changing to 25 degrees due to practical testing reasons. TBD. See 4.11.9.1.1.2

Difficult to control within +/-15 degrees. Change to +/- 25 degrees. Still ~91% of voltage. STL suggests +/- 25 degrees.

Chair: OK with change, since voltage changes slowly in the vicinity of peak in a sinusoidal waveform.

Comment 6
Refer to Doc 131 and Doc 127.
Separate cap switching making test voltage clarification (applied to a few places)

Jan Weisker - 16	Technical	2695	For separate making operations the same conditions should apply as for three-phase making operations, therefore the voltage for making should be the line to ground voltage	Change indent to "-The test voltage shall be line-to-ground voltage…."	Yes	Changes made in D2.3.1. TBD.

Voltage during making in TD2 of LC, CC, BC. Voltage is line to ground during making.

Chairman: makes sense to specify making voltage as line to ground.

John Webb asked for specific definition of the making current. Change “appropriate” for “rated making current”.

Anne Bosma / John Webb suggests to take the proposal for C37.100.2.

Xi will take wording but reminded the WG it is needed within 10 days.

Comment 7
Refer to Doc 131 and Doc 127.
Out of phase switching operating duty

Jan Weisker - 22	Techical	3194	Table 9: The Test duty 2 requires a sequence O-O-CO. For ungrounded neutral testing it means that the making is on 2,5 times line to ground voltage. This far above real stresses.	Give option to move the C operation to the beginning of the sequence and to perform it separately with the correct making voltage	Yes	The making voltage could exceed the realistic condition for ungrounded systems. TBD. See IEC62271-100 Clause 6.110.3.

Jan prepared a presentation attached (Doc 137). Out of phase tested on a single phase, requirement is 2.0 or 2.5. For closing 1.25 has to be applied. Not possible to perform CO with two different voltage. Proposal is to make first all closing operations and demonstrate pre-strike and then perform the opening operations. Separate C only is pre-strike is less the ¼ cycle.

Jan to purpose wording and changes to Xi within 10 days.

Comment 8

Refer to Doc 131 and Doc 127.
Out of phase switching condition check test

Jan Weisker - 26	Techical	3297	Remove reference to 4.9.6.7 as the TRV is in many cases much higher than the voltage level required for the withstand test	change accordingly	Yes

Voltage test after OP test for high-voltage circuit breakers. Eliminate impulse voltage check requirement because magnitude is smaller than tested TRV.

Ken Edwards' condition check is an additional application of voltage to verify that the circuit breaker is in good condition after the test and has not been damaged.

Anne Bosma it is more useful to perform voltage check after L90 and T100s because there is more wear and pollution at these higher short-circuits levels.

Chair: revise for 72,5 kV and above because test TRV is higher than the condition check. Does not cover ratings that require AC 1-minute withstand tests which will be kept the same.

Item from the morning session was revisited
Item #2 Condition check after testing. 200% contact resistance limit and 10 degree temperature rise – John Webb

John Webb: Draw-out breakers, measurement is external, away from the contacts. Proposal is to remove the 10 degree temperature rise.

John Webb to revise paragraph and submit within 10 days.

Comment 9
Refer to Doc 131 and Doc 127.
Comments from Helmut on D2.2 (Doc 096)

Helmut Heiermeier - 1	Technical	445	do we have a definition for IL? For me it is a new abbreviation			This is the definition part
Helmut Heiermeier - 2	Technical	449	do we have a definition for IC? For me it is a new abbreviation			This is the definition part
Helmut Heiermeier - 3	Technical	453	do we have a definition for Isb? For me it is a new abbreviation			This is the definition part
Helmut Heiermeier - 4	Technical	458	do we have a definition for Ibb? For me it is a new abbreviation			This is the definition part
Helmut Heiermeier - 5	Technical	466	do we have a definition for Ilbi? For me it is a new abbreviation			This is the definition part
Helmut Heiermeier - 6	Technical	470	do we have a definition for fbi? For me it is a new abbreviation			This is the definition part

Helmut Heiermeier - 7	Technical	480	usually the scaling of the current should go with the power of 2 (I^2) is there a reason why it should scale linear?			TBD.
Helmut Heiermeier - 8	Technical	836/839	the figure 1 is expressed as time constant Tau, while figure 2 is expressed as X/R	should be similar x/r or Tau but equal		Figure 1 is for X/R=17. Figure 2 shows how DC components change with X/R values.
Helmut Heiermeier - 9	Technical	467	The whole T100a test duty should be revised somehow	proposal is to follow the IEC procedure for synthetic tests		It is revised in new draft D2.3.
Helmut Heiermeier - 10	Technical	1404	why is multipart testing restricted to certain voltages? Limitation in test stations can be observed for all voltage classes	open the possibility for all voltage classes		Apply to all voltage classes
Helmut Heiermeier - 11	Technical	1590	This is a topic for harmonisation with IEC why should a lightning impulse test instead of switching impuls test be done? Why should a test performed with T10 waveshape been tested with higher peak (90%) (lower rate of rise) than an original lightning impulse test (80%)	preferably a hamonised procedure and values should be used		May be 'impulse' instead of 'lightning impulse' should be used to avoid the confusions.

Tested back to back capacitor bank inrush current making frequency

H. Heiermeier use power of 1.8 to 2.2 to estimate the equivalence for variations of the inrush current, not linear summation. Propose to use an equation proposed by CIGRE working groups.

A. Bosma the entire paragraph should be removed from the test standard.

Chair: remove this section except the definition.

Chair: All rated voltages can use multi-part testing

H. Heiermeier: Harmonize with IEC for voltage check, use after T100s or L90.

Chair: Impulse waveform T10 is applied, delete “lightning”.

Comment 10
Refer to Doc 131 and Doc 127.
Any other comments missed?

No other comments were mentioned.

Conclusions

Based on discussions and resolutions made today a new draft document D2.4 will be prepared. There will be a period of 10 days to complete the tasks. Then the group would go to ballot.

Dates to remember:

- All open item comments, proposals due May 6
- Balloting preparation will start May 30
- Invitation of ballot
- Other ballot process to follow
- Finish ballot by Sept. 30
- Create a BRC to address comments
- Discuss resolution and revision in Fall 2016

Thank you for all contributions and participation.

Meeting adjourned by Chair.

Meeting Roster for Session #1, #2, Hilton Head, SC

First Name	Last Name	Company	Role	4/25/2016 Session #1	4/25/2016 Session #2
Mauricio	Aristizabal	ABB	Member	X	X
Syed Shahab Uddin	Ahmed	Siemens Energy Inc	Guest		
Roy	Alexander	RWA Engineering	Member		
Aasim	Atiq	Siemens Energy	Guest		
Roy	Ayers	Nashville Electric Service	Guest	X	X
Katrin	Baeuml	Schneider Electric	Guest		
Amildo	Barrio	Parsons	Guest		
George	Becker	POWER Engineers	Guest		
Robert	Behl	ABB	Guest		X
Jean-Marc	Biasse	Schneider Electric	Guest		X
Stan	Billings	Mitsubishi Electric PP	Member		
Anne	Bosma	ABB AB	Member		X
Cody	Brehm		Guest		
Jeffrey	Brogdon	Georgia Transmission	Guest	X	X
Steven	Brown	Allen & Hoshall	Guest	X	X
Raymond	Browning	FirstEnergy Corp.	Guest	X	X
John	Brunke	Dr. John H. Brunke, P.E.	Guest		
Arben	Bufi	Hitachi HVB, Inc.	Member	X	X
Eldridge	Byron	Schneider Electric	Member	X	X
Donald	Cantrelle	Georgia Power	Guest	X	X
Gilbert	Carmona	Southern California Edison	Member		
Stephen	Cary	GE Energy Management	Member	X	
Steven	Chen	Eaton Corporation	Member	X	X
Wayne	Cheng	B C Hydro	Member		
Vincent	Chiodo	HICO	Guest	X	
Jeonghwan	Cho	HICO America	Guest		
Chih	Chow	PEPCO	Member	X	X
Michael	Christian	ABB	Guest	X	
Roggero	Ciofani	Altalink	Guest		
Lucas	Collette	Mitsubishi Electric	Member	X	X
Dave	Collette	Mitsubishi Electric	Guest		
Lee	Cox, Jr.	Efacec	Guest		
Andrew	Crane	Consumers Energy	Guest		
Michael	Crawford	Mitsubishi Electric	Member	X	X
Jason	Cunningham	Hitachi HVB, Inc.	Guest	X	
David	Dart	NOJAPower	Guest		
Jerod	Day	Vacuum Interrupters, Inc.	Guest		

Patrick	Di Lillo	Consolidated Edison Co. of NY, Inc.	Member	X	X
Denis	Dufournet	Retired	Member	X	X
Bernie	Dwyer	PECO	Guest		
John	Eastman	INCON	Guest	X	
Doug	Edwards	Siemens Industry, Inc.	Guest		
Ken	Edwards	Bonneville Power Administration	Member	X	
Tanner	Esco	Eaton Corporation	Guest		X
Leslie	Falkingham	Vacuum Interrupters Limited	Member	X	
Howard	Fennell	Nashville Electric Service	Guest	X	X
Thomas	Field	Engergy	Member		
Sergio	Flores	Schneider Electric Inc. USA	Guest	X	X
Robert	Foster	Megger	Guest	X	X
Paul	Fox	Schneider Electric	Guest		
Didier	Fulchiron	Schneider-Electric	Guest		
Sivakumar	Ganesh	ENMAX Corporation	Member		
Douglas	Giraud	Powell Electrical Systems	Member		
Anne	Good	Netshape Technologies, Inc.	Guest		
Paul	Grein	Circuit Breaker Sales, Co, Inc, - GroupCBS	Member	X	X
John	Hall	Tennessee Valley Authority	Guest		
Jeffrey	Hanson	Schneider Electric	Guest		
Helmut	Heiermeier	ABB	Member		X
Christian	Heinrich	Siemens AG	Guest	X	X
Charles	Hendrickson	Arizona Public Service Company	Guest		X
Jeremy	Hensberger	Mitsubishi Electric Power Products Inc.	Guest	X	X
Victor	Hermosillo	Alstom Grid	Vice-Chair	X	X
William	Higinbotham	EA Technology LLC	Guest	X	
Jingxuan (Joanne)	Hu	RBJ Engineering Corporation	Member	X	X
Roy	Hutchins	Southern Company Services	Member		X
Todd	Irwin	GE Grid Solutions	Member	X	X
Carlos	Isaac	Oncor Electric Delivery	Guest		
Anton	Janssen	Liander	Guest		
Joseph	Jasinski	ITC Holdings Corp.	Guest	X	X
David	Johnson	Self-Employed	Guest		X
Jacob	Joseph	Toshiba International Corporation	Member		
Wolfgang	Jung	Siemens AG	Guest		
Mangu	Kang	HICO America	Guest		
Jayamali	Kasige	Crown Technical Systems	Guest		
Amir	Khosravi	BC Hydro	Guest	X	X
Sandeep	Kulkarni	CG	Guest		
Carl	Kurinko	ABB Inc.	Guest		

Stephen	Lambert	Shawnee Power Consulting, LLC	Guest		
Carl	LaPlace	GE Industrial Solutions	Guest		
Matthew	Lawrence	Doble Engineering	Guest		
HaeKyu	Lee	HICO America	Member		
Shawn	Lee	HICO America	Guest	X	
David	Lemmerman	PECO/Exelon	Guest		
Werner	Lesse	Siemens AG	Guest		
Paul	Leufkens	Power Projects Leufkens	Guest	X	X
Wangpei	Li	Eaton	Guest		
Qian	Li	Powertech Labs INC.	Guest		
Hua Ying	Liu	Southern California Edison	Member	X	X
Albert	Livshitz	CE Power Solutions	Member	X	X
Bjorn	Lofgren	Siemens Energy	Guest		
Russell	Long	Retired	Member		
Antonio	Mannarino	PSE&G	Guest		
Vincent	Marshall	Southern Company Services	Guest	X	X
Gary	Martin	Entergy	Member		X
Ricardo	Martinez	CFE-LAPEM	Member		
Peter	Marzec	S&C Electric Co.	Guest	X	X
Joel	Mathewson	Siemens	Guest		
Frank	Mayle	Technibus, Inc.	Guest		X
Neil	McCord	Southern States	Guest		
Timothy	McGee	Siemens Energy	Guest		
Dave	Mitchell	Dominion	Guest	X	X
Terry	Monahan	Schneider Electric	Guest		
Oscar	Montano	Salt River Project	Guest		
Tom	Mulcahy	Dominion Virginia Power	Guest	X	X
Volney	Naranjo	GERS USA	Guest		
Jeffrey	Nelson	Tennessee Valley Authority	Member		
Joachim	Oemisch	Siemens AG	Guest		
T	Olsen	Siemens Industry, Inc.	Guest		
Miklos	Orosz	Schneider Electric	Member		
Molson	Parvin	CB&I	Guest		
Amit	Patel	GE	Guest		
Shawn	Patterson	US Bureau of Reclamation	Guest	X	X
Thomas	Pellerito	DTE Energy	Member		
Alan	Peterson	Utility Service Corporation	Guest	X	
Andrew	Peterson	ABB	Guest	X	X
Lise	Phan	Parcific Gas and Electric Company	Member		
Iulian	Profir	Rockwell Automation	Member		
Ahmad	Qasem	Bechtel	Guest		
Syed	Rahman	The United Illuminating Company	Member	X	X
Samala Santosh	Reddy	Powell Industries	Guest		

Frank	Ricard	FirstPower Group LLC	Member		
Anthony	Ricciuti	Eaton Corporation	Member	X	X
Dave	Riffe	Westinghouse Electric Company	Guest	X	
Julian	Rizo	Xcel Energy	Guest		
Brian	Roberts	Southern States, LLC	Guest		
Jon	Rogers	Siemens Energy, Inc	Member		
Ben	Rosenkrans	Eaton Corporation	Guest		
Roderick	Sauls	Southern Company Services	Member	X	X
Victor	Savulyak	DNV GL KEMA Laboratory	Guest		X
Robert	Sazanowicz	The United Illuminating Company	Guest		
Daniel	Schiffbauer	Toshiba International Corporation	Guest	X	X
Carl	Schneider	Schneider Electric	Guest		
Carl	Schuetz	American Transmission Company (ATC)	Member	X	X
Jon	Schumann	American Transmission Company	Member	X	X
Devki	Sharma	Consultant	Member		X
Harish	Sharma	Southern Company	Guest		
Sushil	Shinde	ABB Inc.	Member	X	X
John	Shullaw	Retired	Guest		
Dean	Sigmon	Eaton Corporation	Member		X
Sunita	Singh	Bechtel OG&C	Guest		
Michael	Skidmore	AEP	Secretary	X	X
Robert	Smith	Eaton Corporation	Member		
Hongbiao	Song	GE	Guest		
Erin	Spiewak	IEEE	Guest		
Kresimir	Starcevic	DNV GL KEMA Laboratories	Guest		
Don	Steigerwalt	Duke Energy	Guest	X	
David	Stone	DTS Technical Services	Guest		
Donald	Swing	Powell Industries	Member		
Dragan	Tabakovic	Hitachi HVB, Inc.	Guest		
Humayun	Tariq	American Electric Power	Member		
Jey	Thayalan	Schneider Electric	Guest	X	
Michael	Titus	Schneider Electric	Guest	X	
Jean-Marc	Torres	Eaton Corporation	Guest	X	
Vernon	Toups	Siemens	Member	X	
Richard	Trussler	Schneider Electric	Guest		
James	van de Ligt	CANA High Voltage Ltd.	Member		
Michael	Wactor	Powell Industries, Inc	Guest	X	
Wes	Wadsworth	Hitachi HVB, Inc.	Member		
Robert	Warren	DNV GL - KEMA Laboratories	Guest		X
John	Webb	ABB	Member		X
Casey	Weeks	Siemens Energy	Guest	X	X
Jan	Weisker	Siemens AG	Guest	X	X
Jerry	Wen	BC Hydro	Guest	X	X

William	Wilkie	Eaton	Guest		
Matthew	Williford	Schneider Electric	Guest		
Barnes	Wilson	Avista Utilities	Guest	X	X
Terry	Woodyard	Siemens Industry Inc.	Member		X
Lisa	Yacone	IEEE-SA	Guest		
Larry	Yonce	Eaton Corporation	Guest		
Dong Sun	Yoon	HICO America	Guest	X	X
Richard	York	Mitsubishi Electric Power Products, Inc.	Guest	X	X
Jiong	Zhang	MEPPI	Member		
Wei	Zhang	Hitachi HVB, Inc.	Guest		
Xi	Zhu	GE Energy Management	Chair	X	X

"X" - individual was at the meeting in Hilton Head