

WG: C37.09 - IEEE Standard Test Procedure for AC High-Voltage Circuit Breakers
Rated on a Symmetrical Current Basis (Under Revision)

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

Session 1 – May 5, 2014 (10:15 AM to 12:00 PM)

Location: Orlando
Participants: 34 members
31 guests

- 1.) The meeting started with the chair introduction and introductions of the attendees. The chair asked all attendees to sign the roster and provide affiliation if not noted on the roster.
- 2.) The agenda for the meeting was shown on a projector and the chair reviewed the agenda for the meeting and the expected timeline. Refer to Doc. 040 for Agenda presented.
- 3.) The chairman reviewed the minutes of the meeting (MOM) from San Antonio. The MOM from San Antonio was distributed to all committee members and guests of C37.09 in October 2013 after the fall meeting with an e-mail from the secretary (Mike Skidmore). The draft MOM was also e-mailed by Mike Skidmore on 4-26-14, and the chairman Xi Zhu on 4-28-14 to all members and guests of C37.09. The minutes of the meeting from San Antonio, TX were shown again to the participants on the projector. The Chairman asked if anyone had questions.
- 4.) The chairman entertained a motion from Mike Crawford to approve the MOM from San Antonio. John Webb seconded the motion. The motion passed unanimously. Refer to Doc. 016 for MOM.
- 5.) The chairman discussed the structure of the meetings for C37.09. He said 3 sessions will be held on 5-5-14. Each session will be 1 hour and 30 minutes so topics will be about 15 min each. We will complete topics not covered in San Antonio in Session #1. He will ask for updates of previously assigned topics in San Antonio in Session #2 and the committee will review new topics as shown in the outline from: Eldridge Byron, Helmut Heiermeier, Denis Dufournet, and Jan Wisker (presented by Jon Rogers). The chairman said the sessions may overlap and certain topics may be shuffled around into different sessions if needed.
- 6.) The Project Timeline was reviewed
 - a.) The Chairman discussed the timeline and reconfirmed the target date for ballot should be by the fall of 2015.
 - b.) Additionally the document completion should be by December 2017
- 7.) The chairman said that a detailed discussion on individual topics will be presented in the meeting.

8.) The chair asked before the “discussion on topics” if there was any new business that should be included in the Agenda. Nothing was added by the working group committee.

9.) Discussion Topics (continued for San Antonio)

Topic #10 (Q007) Inclusion of ‘multi-part testing’ in C37.09. State the preference is to have full TRV whenever possible. Denis Dufournet

Denis presented information on “multi-part testing”. The presentation is attached in the MOM. (Doc.017 and 018).

In the case of higher voltage circuit breakers that require testing with four-parameter TRV there are sometimes test laboratory restrictions that require separate testing of the first (u1, t1) and second (uc, t2) reference points. The circuit breaker is subjected to double the number of shots. IEC experience with this method is more than 30 years. This is not the preferred method of testing but should be allowed since some four-parameter TRV cannot be replicated in the laboratory.

There were no objections to adding this alternative test procedure. Therefore, wording should be prepared and the location for this procedure should be found in the document.

The chair will send Denis the C37.09 document in WORD format to modify the relevant C37.09 clauses with specific recommendations for changes and prepare for presentation in the Fall meeting.

Topic #11(Q008) should we include inductive load switching test from IEC62271-110 Benefits for this test – Sushil Shinde

There was a proposal to add reference to IEC 62271-110 for inductive switching into C37.09. This standard includes a detailed test procedure consisting of four test duties. IEEE existing standards (C37.015) only include an application guide that does not specify a test procedure.

Anna Bosma said that Inductive switching is not considered a basic test for the circuit breaker. Therefore; it should not be added to the table of basic tests.

The committee discussed the possibility to include a reference to the IEC standard and associated explanatory notes.

Chairman requested guidance from IEEE representative regarding the addition of a reference that is currently not included in the PAR document. The committee reviewed the PAR and scope and with guidance from IEEE (Erin Spiewak) The standard can be added at the end of the PAR in the appropriate section but wasn't required. Therefore, there is nothing needed from the committee to adjust anything within the PAR and no action was necessary since the scope would not change.

The chair will send the sub-group chair C37.09 in WORD format to modify the relevant C37.09 clause(s) with specific recommendations for changes and prepare for a presentation in the Fall meeting.

Topic #12 (Q012) Cold temperature test method – IEC or IEEE or other? Indoor breaker with heaters should be included or excluded – Victor / John Webb

Victor Hermosillo presented information on cold temperature tests. The presentation is attached. (Doc. 019)

Presentation describing test procedure defined by IEC 62271-100 and by the existing version of C37.09. List of proposed improvements to C37.09:

- Define initial circuit breaker position throughout test (closed/open)
- Define location of temperature measurement in cold chamber, temperature difference along height of test object.
- Definition of “10 cycles”, including O, C, CO operations.
- Travel characteristics to be recorded during operation at the start, end and after the 24-hour soak period.
- Description of ramp-down, ramp up rate.
- Inclusion of graph defining the entire test.
- Possibility to perform tests at multiple low temperature values by performing additional subsequent test cycles.
- Addition of initial and final leak verification.
- Loss of power, clarification of characteristics that should be recorded.
- Include clarification regarding individual component testing.

Proposal for procedure will be written and submitted for comments before next meeting.

Existing version of C37.09 defines only one temperature equal to -30 deg C. This rating should be defined in C37.04 and C37.09 should only include the test procedure.

Discussion regarding consideration of indoor, outdoor temperature ranges referred to C37.04.

John Webb presenting information on cold temperature tests for C37.20.2. The presentation is attached. This presentation reviewed differences in standards for (-30C to +40C). The standard is for switchgear and there was discussion about differences in switchgear and outdoor breakers. Maybe the standard should address differences for an indoor vs outdoor rating because one could interpret ambient temperatures differently. The general feeling of the committee was to leave this part alone and not to distinguish a difference in indoor vs outdoor. It seems to be working so why change anything? Refer to Doc. 038.

The chair will send the sub-group chair C37.09 in WORD format to modify the relevant C37.09 clause(s) with specific recommendations for changes and prepare for presentation in the Fall meeting.

Topic #13 (Q013) IEEE std 693 Seismic Test standard – Xi

Seismic standard maintenance resides in the committee associated with IEEE 693. Xi presented an overview of IEEE std 693 and how it relates to HVCB seismic requirements. The presentation is included (Doc. 020)

Reference to the applicable standard could be added to C37.09.

Additional standards mentioned were C37.81. IEEE 323 for safety and C37.82 (specific to nuclear facilities). These standards should also be reviewed to maybe reference into C37.09.

Xi recommended that we add a section called 4.18. There were no objections and work will proceed to add references into C37.09.

Xi will present the specific recommendations for changes in the Fall meeting.

Topic #14 (Q019) Share documents for WG members. – progress update – Xi

Site for C37.09 is already available. Members to create a profile and login. Relevant documents to be uploaded. This will become important for sharing large documents and to review later.

The chair will upload WG documents and invite WG members to use the site.

Topic #15 (Q009) To incorporate C37.06.1 into C37.09 - ??

Sushil Shinde provided an update for the status of C37.06.1. The committee is still working on C37.06.1. Today we only have the present released version of the standard available and eventually they expect C37.06.1 to be pulled into .06 and then into .04. However, the timing of the release (or updates) for 04 will probably be complete before 06.1 so this may need to be added later. C37.06.1 is a working group not a (Task Force). Once C37.06.1 is done the working group will review how this will be pulled into C37.09.

C37.06 to be incorporated into C37.04 and hopefully C37.06.1 will be pulled into C37.06.

No action will be taken on C37.09 WG on C37.06.1 on-going changes since it will not alter the test procedures in C37.09.

Topic #16 (Q017) Test Duty Summary Table -- ?? (proposed by Ken)

Xi asked Ken Edwards for an update on the status of a summary table. Ken discussed that an annex will be added and is being worked on. A summary table was in the ANSI 1979 version and may be added back and look similar with improvements.

The chair will send the sub-group chair C37.09 in WORD format to modify the relevant C37.09 clause(s) with specific recommendations for changes and prepare for presentation in the Fall meeting.

Topic #17 (Q018) Measurement Tolerance Table -- ?? (proposed by Gilbert)
Refer to latest version of ieee std-4?

4 minutes remaining – Topic moved to session #2 (start)

3.) The working group committee agreed to adjourn the session.

Session 2 – May 5, 2014 (1:30 PM to 3:15 PM)

Location: Orlando
Participants: 31 members
25 guests

1.) The meeting started with the chair introduction and introductions of the attendees. The chair asked all attendees to sign the roster and provide affiliation if not noted on the roster.

2.) Discussion Topics

Topic #17 (Q018) Measurement Tolerance Table -- ?? (proposed by Gilbert)
Refer to latest version of ieee std-4? (continued topic from session #1)

Gilbert presented examples of “vague” information or statements within C37.09 in his opinion (see attachment Doc.021 and 022). Some committee guests and members did not believe some of the statements are vague and were sufficient. For example, some were satisfied with test levels as long as we “meet or exceed the rating”. Gilbert still thought there should be test tolerance limits. Some said that information is already in IEEE standard #4.

Allowance for “higher control voltage” during power tests

(V. Hermosillo) In cases where very precise timing is required from the circuit breaker during the opening operation in an interruption test, the voltage to the releases is set high in order to obtain a repeatable contact part time with respect to the fault current. Examples of this is during T100a tests in which a certain current loop is targeted to obtain certain peak current and loop duration to meet an asymmetrical requirement.

Comments were made that maybe “one sided” tolerances may be needed. That is, maybe sometimes the upper or lower limits are not needed but the opposite tolerance level is needed.

(K Edwards) These tight tolerances may impede testing in some laboratories since precision is required to fall within certain values, this is the reason why the standard specifies a lower limit and allows for values exceeding the requirement.

(E. Byron) This allows equipment rated at a higher voltage to be offered for lower voltages. If an upper tolerance limit is defined then this type of applications would require an additional test at a lower level. The standard should allow testing at higher values to cover lower requirements.

(L. Falkingham) Does the open-ended upper limit allow the laboratory to overstress the equipment during tests? There are cases in which the laboratory overshoots the value and damages the equipment. This is nevertheless covered by terms in the contractual documents signed between the equipment manufacturer and the laboratory. These terms limit the liability of the laboratory in these cases.

(B. Long) IEEE Standard 4 has a lot of centered tolerances with plus/minus range. C37.09 went to single sided tolerance and these documents took different directions.

Xi said that in his opinion, some tolerances aren't required such as "meeting or exceeding" some dielectric tests such as BIL and Switching but in some cases maybe there should be a tolerance for items where it makes good sense. For example, if we adopt the IEC procedure for alternative mechanism testing maybe there should be a tolerance for the travel curve trace (+ and - test levels).

In general, most committee members didn't think that any additional work was needed to C37.09. It was recommended to let the document alone and not add a "Measurement Tolerance Table". If it goes to Ballot, concerned members should ask that a tolerance be added specifically to the text, instead of adding a new table. Most of the committee and chairman agreed so no future work is needed to address this topic at this time.

Xi asked Gilbert to review the C37.09 text and suggest in each case what better tolerance wording to be used and prepare for presentation in the Fall meeting.

Topic #1(Q006): 'Piecewise testing' guidelines

Assigned to: Helmut Heiermeier, Ken Edwards, John Webb, Sushil Shinde, and Donnie Swing

Xi asked Ken Edwards for an update on this topic discussed in the Fall in San Antonio. No additional information was available but work continues. Xi asked Ken to try to have a specific list for the next meeting. "What is a minor change? , What is a Major change?"

(D. Dufournet) IEC 62271-100 procedure for alternative mechanisms to be considered, has been used for many years. Example is the use of testing performed on one mechanism type (v.g. hydraulic) and subsequent use of another type (v.g. spring). Travel curves are overlaid and compared, a tolerance is given with a width of 10% that can be centered (-5%/+5%) or one sided. No-load curves and curves obtained during power tests are compared after contact part and have to fall within the range. If they do, then T100s is repeated to qualify the alternative mechanism. Another example is when an IPO (Individual Pole Operation) breaker with one mechanism per pole is compared with a ganged breaker with one mechanism for three-poles. In general, a change in any component along the kinematic chain requires that this demonstration be made.

(J. Webb) For vacuum interrupters a demonstration that the alternative mechanism can break welds has to be made. Specific mention of contact welds during short-time withstand was made.

(D. Dufournet) The T100s test includes two parts, consisting of making and breaking operations.

Albert Livshitz suggested that we review C37.59 which is a standard that already addresses this topic and may have some good information we can use.

Xi asked for work to continue. In addition to the subgroup, Albert Livshitz and Neil McCord wanted to be involved with this committee and they were added to the group.

Xi asked for a specific list to be presented at the next meeting and he asked Ken to be the lead of the group.

The chair will send the sub-group chair C37.09 in WORD format to modify the relevant C37.09 clause(s) with specific recommendations for changes and prepare for presentation in the Fall meeting.

Topic #2(Q014): Incorporate C37.04 and C37.06 into C37.09

Assigned to: Mike Crawford

Xi asked Mike for an update on this topic discussed in the Fall in San Antonio. Mike said that work continue(s) to pull C37.06, NEMA SG4, etc. information into C37.04.

Xi said work will proceed on C37.09 assuming this information will be addressed in C37.04.

Ben Bufi prepared a nice presentation on review of C0 discussion history. Due to time constraint, this presentation was not made. But the presentation is attached (Doc. 023).

The chair will send the sub-group chair C37.09 in WORD format to modify the relevant C37.09 clause(s) with specific recommendations for changes and prepare for presentation in the Fall meeting.

Topic #3(Q015): Incorporate C37.09a and C37.09b into C37.09

Assigned to: Anne Bosma, Mauricio Aristizabal, Roy Alexander, Arben Bufi, Terrance Woodyard

Xi asked the group for an update on this topic discussed in the Fall in San Antonio. Anne Bosma missed the meeting in San Antonio and was not aware of his assignment. Some members suggested that 100.2 be reviewed in addition to looking at C37.09a and C37.09b.

The chair will send the sub-group chair C37.09 in WORD format to modify the relevant C37.09 clause(s) with specific recommendations for changes and prepare for presentation in the Fall meeting.

Topic #4 (Q016): Incorporate C37.017 into C37.09

Assigned to: Devki Sharma and Stan Billings

Xi asked Stan for an update on this topic discussed in the Fall in San Antonio. Stan said that specific information was presented and there was no additional update. Devki said that the IEC bushing standard 62271 is under revision and maybe additional updates are need for C37.017 if references are made.

Xi asked that Stan and Devki to take into account the discussions on San Antonio meetings and have those addressed in the revisions.

The chair will send the sub-group chair C37.09 in WORD format to modify the relevant C37.09 clause(s) with specific recommendations for changes and prepare for presentation in the Fall meeting.

Topic #5 (Q005): Incorporate C37.081, C37.081a and C37.083 into C37.09

Assigned to: Mauricio Aristizabal, Victor Hermosillo, Denis Dufournet and Steve Cary

Xi asked Mauricio for an update on this topic discussed in the Fall in San Antonio. Mauricio said the intention is not to use C37.081, C37.081a and C37.083 because the information is very outdated. The plan is to align information and testing with IEC. There was discussion that there needs to be changes and agreement for new test duties to align with IEC such as T100a. There is work that also needs to be completed in other standards before such information is accepted.

Denis presented information on suggested changes for test duties to align IEEE to IEC. The information will be sent to the committee for review. We need to also consider arcing times etc., for alignment. Refer to Doc. 024, 025 and 026.

The chair will send the sub-group chair C37.09 in WORD format to modify the relevant C37.09 clause(s) with specific recommendations for changes and prepare for presentation in the Fall meeting.

Topic #6 (Q011): Incorporate NEMA SG4 into C37.09

Assigned to: Gilbert Carmona and Mike Crawford

Xi asked Gilbert for an update on this topic discussed in the Fall in San Antonio. Gilbert presented information to incorporate NEMA SG4 into C37.09. Refer to Doc. 027 and 028. Mike Crawford also commented that NEMA SG4 is being pulled into C37.04.

Others said that we should include information for SF6 gas handling (62271-4, C37.122.3). Leslie Faulkinham also suggested we should review 62271-C37-082 for sound pressure levels and how this applies to C37.09.

Gilbert said that some utilities in California use 17.5kV rated equipment and should go into C37.09. This needs to be addressed in 04 and 06 first since it is being used in the USA.

The chair will send the sub-group chair C37.09 in WORD format to modify the relevant C37.09 clause(s) with specific recommendations for changes and prepare for presentation in the Fall meeting.

Topic #7(Q002): 'critical current'

No action required - Remove from list

Assigned to: Roy Alexander

Ran out of time, moved to session #3

Topic #8(Q003): Electrical endurance 800% cumulative fault current

Assigned to: Sushil Shinde, John Webb, Steve Cheng, Helmut Heiermeier, Terrance
Woodyard

Ran out of time, moved to session #3

Topic #9(Q004): Inclusion of 'test splitting' in C37.09

Assigned to: Denis Dufournet

Ran out of time moved to session #3

3.) The working group committee agreed to adjourn the session.

Session 3 – May 5, 2014 (3:45 PM to 5:30 PM)

Location: Orlando
Participants: 32 members
20 guests

1.) The meeting started with the chair introduction and introductions of the attendees. The chair asked all attendees to sign the roster and provide affiliation if not noted on the roster.

2.) Discussion Topics (continued from session #2)

Topic #7(Q002): 'critical current'

No action required - Remove from list

Assigned to: Roy Alexander

Xi said that no further action is required for this topic per meeting in San Antonio.

Topic #8(Q003): Electrical endurance 800% cumulative fault current

Assigned to: Sushil Shinde, John Webb, Steve Cheng, Helmut Heiermeier, Terrance
Woodyard

Sushi and John said there are not much open items for this topic. Xi asked that they reviewed the MOM from San Antonio meeting to address the concerns on having to disassemble a breaker to move it from power lab to dielectric lab for condition check. It would serve the purpose better to check the dielectric condition of the breaker after 800% current by using TRV circuit to generate a non-standard impulse wave.

John sent his proposal for changes after the meeting. Refer to Doc. 039.

The chair will send the sub-group chair C37.09 in WORD format to modify the relevant C37.09 clause(s) with specific recommendations for changes and prepare for presentation in the Fall meeting.

Topic #9(Q004): Inclusion of 'test splitting' in C37.09

Assigned to: Denis Dufournet

Denis presented information on Splitting test duties. Refer to Doc. 030 and 031. Xi said the method is a more closely representation of real system conditions in comparison with simplified test method. Roy Alexander expressed some concerns that some extra test “margins” may be tanking out of the equipment if this is used. Denis said we need to keep in mind test are run at SF6 and pressures lockouts and the breaker is also testing with addition margin(s) that you may not see typically on the equipment.

The chair will send the sub-group chair C37.09 in WORD format to modify the relevant C37.09 clause(s) with specific recommendations for changes and prepare for presentation in the Fall meeting.

3.) Discussion Topics (new)

Eldridge Byron - Consider changing the load current switching test to a similar concept as in IEC for critical currents. (Presentation)

Eldridge presented new information for “load current switching tests” (C37.09 page 29 section 4.9.1). Refer to Doc. 032 and 033. He wants to make “load current switching tests” conditional and not mandatory. The test will be reviewed or referenced in C37.20.9 which is a new standard he is chair. Most discussed that this test is meaningless and some never ran the test. The test is mostly resistive (with small TRV) and is very easy for the breaker to do. Some thought the test was in C37.09 for air magnetic breakers when low currents needed to be pulled up into the arc chute to extinguish and critical currents was possibly a concern for this type of breaker.

Neil McCord said that there are not many labs that can run this test and he wonders if it was being completed by most companies.

Denis said that the T60 test listed in the PowerPoint is not a very low current and should not be considered or removed.

Most agreed to make this a conditional test but others said we should maybe remove it from C37.09.

The chair will send the sub-group chair C37.09 in WORD format to modify the relevant C37.09 clause(s) with specific recommendations for changes and prepare for presentation in the Fall meeting.

Helmut Heiermeier – Critical Current Discussion and (Presentation)

Helmut did not present the information at the meeting since this was a “dead issue” for IEEE for C37.09. Helmut said we can reference his PowerPoint for more information if needed. (Doc. 029)

Denis Dufournet

- Update on status of IEC 62271-100 T100a (Presentation)
- Demonstration of arcing times
- Denis Dufournet - Cap switching preconditioning (12-11-13 e-mail)

Denis presented information for T100a and Cap switching preconditioning tests. Demonstration of arcing times was presented and discussed in other meetings. Denis provided an update on the status of IEC for T100a tests and new wording. This is wording (see PowerPoint) for direct tests but synthetic tests will eventually have similar wording. Refer to Doc. 034 and 035.

There was discussion that we need to review test duty 6 and 7.

The chair will send the sub-group chair C37.09 in WORD format to modify the relevant C37.09 clause(s) with specific recommendations for changes and prepare for presentation in the Fall meeting.

Jan Weisker – Out of Phase Switching Proposal

Jon Rogers presented information from Jan Weisker to modify “Out of phase” switching test duties. Please refer to PowerPoint for recommendations. (Doc. 036 and 037)

Ken Edwards said the out of phase conditions occur more often than we would think. Other utility members agreed with this comment. Also, Ken said that test duties (with lower currents) are used to find critical currents.

Most said they did not want to change this test duty.

No action will be taken for this item.

3.) The working group committee agreed to adjourn the meeting

Meeting Roster For Session #1, #2, #3 – Orlando

First Name	Last Name	Company	Role	Orlando Meeting Sessions 5/5/2014		
				#1	#2	#3
Syed Shahab Uddin	Ahmed	Siemens Energy Inc	Guest	X		X
Roy	Alexander	RWA Engineering	Member	X	X	X
Mauricio	Aristizabal	ABB	Member	X	X	X
Roy	Ayers	Nashville Electric Service	Guest	X	X	X
Katrin	Baeuml	Schneider Electric	Guest			
William	Bane	Nashville Electric Service	Guest			
Amildo	Barrio	Parsons	Guest			
Jerry	Baskin	Federal Pacific	Guest			
George	Becker	The United Illuminating Company	Guest	X		
Jean-Marc	Biasse	Schneider Electric	Guest			X
Stan	Billings	Mitsubishi Electric PP	Member	X	X	X
Anne	Bosma	ABB AB	Member	X	X	X
Cody	Brehm		Guest			
Steven	Brown	Allen & Hoshall	Guest			
Arben	Bufi	Hitachi HVB, Inc.	Member	X	X	X
Eldridge	Byron	Schneider Electric	Member	X	X	X
Donald	Cantrelle	Georgia Power	Guest	X	X	X
Gilbert	Carmona	Southern California Edison	Member	X	X	X
Stephen	Cary	Eaton Corporation	Member	X	X	X
Steven	Chen	Eaton Corporation	Member			
Wayne	Cheng	B C Hydro	Member			
Vincent	Chiodo	HICO	Guest	X		
Jeonghwan	Cho	HICO America	Guest	X		
Chih	Chow	PEPCO	Member	X	X	X
Michael	Christian	ABB	Guest	X	X	
Roggero	Ciofani	Altalink	Guest			
Lucas	Collette	Mitsubishi Electric	Member	X		X
Dave	Collette	Mitsubishi Electric	Guest	X		X
Lee	Cox, Jr.	Efacec	Guest			
Andrew	Crane	Consumers Energy	Guest			
Michael	Crawford	Mitsubishi Electric	Member	X	X	
David	Dart	NOJAPower	Guest			
Jerod	Day	Vacuum Interrupters, Inc.	Guest			
Patrick	Di Lillo	Consolidated Edison Co. of NY, Inc.	Member	X	X	X

Denis	Dufournet	Alstom Grid	Member	X	X	X
John	Eastman	INCON	Guest	X	X	
Ken	Edwards	Bonneville Power Administration	Member		X	X
Doug	Edwards	Siemens Industry, Inc.	Guest			
Tanner	Esco	Eaton Corporation	Guest	X	X	
Leslie	Falkingham	Vacuum Interrupters Limited	Member	X	X	X
Thomas	Field	Engergy	Member			
Sergio	Flores	Schneider Electric Inc. USA	Guest			X
Robert	Foster	Megger	Guest			
Paul	Fox	Schneider Electric	Guest	X	X	X
Sivakumar	Ganesh	ENMAX Corporation	Member			
Douglas	Giraud	Powell Electrical Systems	Member	X	X	X
Paul	Grein	Circuit Breaker Sales, Co, Inc, - GroupCBS	Member	X	X	
John	Hall	Tennessee Valley Authority	Guest	X		
Jeffrey	Hanson	Schneider Electric	Guest			
Helmut	Heiermeier	ABB	Member	X	X	X
Charles	Hendrickson	Arizona Public Service Company	Guest	X	X	X
Victor	Hermosillo	Alstom Grid	Vice- Chair	X	X	X
Jingxuan (Joanne)	Hu	RBJ Engineering Corporation	Member			
Roy	Hutchins	Southern Company Services	Member	X	X	X
Todd	Irwin	Alstom Grid Inc	Member	X	X	X
Carlos	Isaac	Oncor Electric Delivery	Guest			
Anton	Janssen	Liander	Guest			
Jacob	Joseph	Toshiba International Corporation	Guest	X	X	X
Mangu	Kang	HICO America	Guest	X		
Sandeep	Kulkarni	CG	Guest			
Carl	Kurinko	ABB Inc.	Guest	X	X	
Stephen	Lambert	Shawnee Power Consulting, LLC	Guest			
Matthew	Lawrence	Doble Engineering	Guest	X	X	X
David	Lemmerman	PECO/Exelon	Guest			
Wangpei	Li	Eaton	Guest		X	
Hua Ying	Liu	Southern California Edison	Member	X	X	X
Li	Liu	Eaton	Member			
Albert	Livshitz	Schneider Electric Services	Member	X	X	X
Bjorn	Lofgren	Siemens Energy	Member	X		X
Bill	Long		Member		X	
Antonio	Mannarino	PSE&G	Guest			
Vincent	Marshall	Southern Company Services	Guest	X	X	X
Gary	Martin	Entergy	Member	X		
Ricardo	Martinez	CFE-LAPEM	Member			
Peter	Marzec	S&C Electric Co.	Guest		X	X
Neil	McCord	Southern States	Guest	X	X	X

Timothy	McGee	Siemens Energy	Guest			X
Dave	Mitchell	Dominion	Guest	X	X	
Tom	Mulcahy	Dominion	Guest	X		
Volney	Naranjo	Megger	Guest	X	X	X
Jeffrey	Nelson	Tennessee Valley Authority	Member			
Joachim	Oemisch	Siemens AG	Guest			
Miklos	Orosz	Schneider Electric	Member			
Molson	Parvin	CB&I	Guest			
Shawn	Patterson	US Bureau of Reclamation	Guest			
Thomas	Pellerito	DTE Energy	Member	X		X
Lise	Phan	Parcific Gas and Electric Company	Member		X	
Iulian	Profir	Rockwell Automation	Member			
Syed	Rahman	The United Illuminating Company	Member			
Samala Santosh	Reddy	Powell Industries	Guest			
Frank	Ricard	FirstPower Group LLC	Member			
Anthony	Ricciuti	Eaton Corporation	Member	X	X	X
Dave	Riffe	Westinghouse Electric Company	Guest			
Brian	Roberts	Southern States, LLC	Guest	X	X	X
Jon	Rogers	Siemens Energy, Inc	Member		X	X
Ben	Rosenkrans	Eaton Corporation	Guest	X		
Roderick	Sauls	Southern Company Services	Member	X	X	X
Carl	Schuetz	American Transmission Company (ATC)	Member	X		X
Devki	Sharma	Consultant	Member			X
Sushil	Shinde	ABB Inc.	Member	X	X	X
John	Shullaw	GE Energy - Industrial Solutions	Guest			
Michael	Sigmon	Eaton Corporation	Member	X		
Sunita	Singh	Bechtel OG&C	Guest	X	X	X
Michael	Skidmore	AEP	Secretary	X	X	X
Robert	Smith	Eaton Corporation	Member			
Hongbiao	Song	GE	Guest	X	X	
Erin	Spiewak	IEEE	Guest	X		
Don	Steigerwalt	Duke Energy	Guest		X	
Donald	Swing	Powell Industries	Guest	X	X	X
Dragan	Tabakovic	Hitachi HVB	Guest	X	X	X
Vernon	Toups	Siemens	Guest		X	
James	van de Ligt	CANA High Voltage Ltd.	Member			
Wes	Wadsworth	Hitachi HVB, Inc.	Member			
John	Webb	ABB	Member	X		X
Casey	Weeks	Siemens Energy	Guest	X	X	X
Terrance	Woodyard	Siemens Industry Inc.	Member	X	X	X
Lisa	Yacone	IEEE-SA	Guest			
Dong Sun	Yoon	HICO America	Guest	X		
Richard	York	GE Gigital Energy	Guest			

Jiong	Zhang	MEPPI	Member			
Jiong	Zhang	MEPPI	Member			
Xi	Zhu	GE Energy Management	Chair	X	X	X

“X” - individual was at the meeting in Orlando