

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 – September 17, 2013

Location: San Antonio
Participants: 30 members
22 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 to be ready for ballot for C37.09.
- 3.) The chairman reviewed the minutes of the meeting (MOM) from Galveston. The MOM from Galveston was distributed to all committee members and guests of C37.09 on 9-3-13 with an e-mail from the secretary (Mike Skidmore). The draft MOM was also e-mailed by Mike Skidmore on 5-5-13 to all members and guests of C37.09. The minutes of the meeting from Galveston, TX were shown again to the participants on the projector. The Chairman asked if anyone had questions.
- 4.) The chairman entertained a motion from Mauricio Aristizabal to approve the MOM from Galveston. Denis Dufournet seconded the motion. The motion passed unanimously
- 5.) The PAR Status was reported. The PAR document submitted was shown on the projector and discussed at the meeting

The title on the PAR document was changed and confirmed to be:

~~IEEE Standard Test Procedure for AC High-Voltage Circuit Breakers~~ **with Rated on Maximum a Voltage Symmetrical above Current 1000V** ~~Basis~~

- 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

The chairman showed a list of topic to be discussed during the meeting. There will be a total of 210 minutes available in two sessions on September 17th and 18th 2013. Prior to the meeting and during the meeting the chair asked that the volunteers present or discuss their assigned topics given to them during the last meeting in Galveston and address what their plan is to incorporate the information into C37.09.

Topic #1 ‘Piecewise testing’ guideline? Should interrupter tested in GIS be acceptable in GCB? Volumes, supports, gas flow are different? – Ken Edward / Mike Crawford

Ken Edwards started a discussion on the topic; what is a major/minor change to a circuit breaker and when should you retest? For example, can the tests for a GIS interrupter be used to qualify the same chamber in a dead-tank circuit breaker? What constitutes a significant change? Should any tests be repeated? What tests can be completed with a live-tank vs. dead-tank. What changes in a mechanism are allowed before a complete retest?

Donald Swing provided his experience with using the same interrupter with two different mechanisms.

Ken discussed differences and change from a GIS to a dead tank breaker. There are additional insulators, exhaust changes, gas volume, and different tank designs and clearances.

Sushil Shinde said we should identify major components in the circuit breaker that need to be documented and a list of corresponding tests needed for each significant change.

C37.04 will address different mechanisms. There was discussion about the same interrupter in a different environment such as a tank. The committee needs to address what constitutes a change in C37.04 too (Ken). John Webb provided an example of a vacuum breaker change: such as, a change that affects the bellows, but prove that a travel curve is the same. What are the rules for common use of tests? Some tests are older and a series of minor changes may have been done.

The chairman said some may possibly use calculations to prove that the tank change, exhaust volume change leads to a more favorable condition.

Ken Edwards said IEC makes it clear it has to be worst case in the test in order to cover other variations in the product and maybe IEEE should adopt similar wording.

John Webb discussed retrofit breakers and conversions. C37.59 lists every single test and indicates if it has been performed or not and includes a justification of why it was or was not performed.

Chairman asked for volunteers to draft first ideas.

The following volunteered: Helmut Heiermeier, Ken Edwards, John Webb to cover vacuum, Sushil Shinde, and Donnie Swing.

Topic #2 To incorporate C37.04 and C37.06 into C37.09

Mike Crawford was not available at this time. Discussion will continue in second session tomorrow.

Topic #3 To incorporate C37.09a and C37.09b into C37.09 – Anne Bosma

- a) C37.09a to be incorporated into section 4.10 in C37.09-1999
- b) C37.09b to be incorporated into sections (4.7, 4.8, 4.12) in C37.09-1999

The chair discussed implementation of C37.09a and C37.09b into new C37.09. It looks fairly easy to replace indicated sections in 09 with 09a and 09b.

Roy Alexander: There is no test for C0. Some description is included in C37.100.2. and we should include this information into the C37.09 test description.

John Webb said we should be careful to not have unbalanced standards. He suggested, depending on timing and the release of other documents, we could maybe issue C37.04 with already an amendment to this standard to adjust for changes in C37.09.

We should look at the previous standard so that a breaker qualified by the old standard can be qualified as C0. There was some opposition to this. General purpose is not the same as C0. Mauricio said C0 is not defined in C37.04. Roy Alexander tried to provide some history and said that was only because another amendment such as “C37.04c” was not allowed at the time. The update could not be done since the maximum number of amendments was already met.

Denis commented that C0 was a backup for a C1 test such as C1 is a backup for C2. We can still get a test report with C0. In this structure one class is necessary so that the breaker can have a capacitive switching rating.

C37.04 will define if C0 class will remain. There was additional discussion for this working group that common clause (C37.100.2) may also cover the definition.

At the end of the meeting a decision was made to remove C0 class references when 09a and 09b was pulled into 09, since C37.04 is the master breaker document and we need to define C0 in 04 first. (Please note: this decision was later reversed (see session #2 – Topic #2))

Mauricio, Roy Alexander, Arben Bufi volunteered for C37.09a and 09b integration into C37.09. Terrance Woodyard also offered to help after the meeting. The Chair also assigned him to this topic.

Topic #4 To incorporate C37.017 into C37.09 – Stan Billings

Stan Billings talked about integration of C37.017 to C37.09. He presented information and gave some background of C37.017 (presentation). He provided a summary of what is in the document,

including test procedures and acceptance criteria. He cross-referenced information in C37.06 and C37.09 and gave some recommendations (see list in PowerPoint attachment):

We should retain text when applicable and wherever possible in C37.09.

A question was asked to please clarify that C37.017 is not being incorporated into C37.09 or will we only reference C37.017?

Sushil and Stan and the committee discussed to include or exclude RIV test procedure from NEMA into the document. The standard currently indicates that RIV test has to be discussed and requested by a customer as (optional).

In railway systems the bushings are free-standing and are incorporated in the breakers. The committee discussed to add a note stating that if the bushing is qualified separately from the circuit breaker then use C37.017. If the bushing is qualified together with the circuit breaker then C37.09 is applicable.

Gil Carmona asked what if a bushing is replaced in the field? Are separate tests for bushings required? Should we accept separate tests?

The committee discussed bushing tests in the breaker or mounted off the breaker. When an alternative bushing is used some suggested that we do not need to completely retest the breaker. Some bushings can be tested separately off the breaker but a support stand should be used to simulate how the bushing would be installed on the breakers. For example, simulated BCT protective covers, strike distance, creep distance, pressures, internal capacitance should be used if applicable.

Devki Sharma will collaborate with Stan Billings to coordinate items with C37.017 into C37.09.

Topic #5 To incorporate C37.081, C37.081a and C37.083 into C37.09 – Mauricio Aristizabal

- a) To be incorporated into section 4.8 of C37.09-1999 (Section 4.8.2.5?)
- b) Test duty difference for IEC 62271-101

Mauricio Aristizabal discussed the synthetic testing documents. First we need to address synthetic testing in C37.04 and C37.09 will define which tests should be performed then add reference to IEC 62271-101 for the test procedures. C37.081, C37.081a and C37.083 are good references for description of the test circuits but the IEEE documents do not have detailed information about tolerances and procedures that are to be used by the laboratory for testing. We should refer where possible to the IEC standard that is continuously updated and improved. IEC 62271-101 closely follows 62271-100 not the C37 series. The 62271-101 document is lengthy and difficult to incorporate as an annex into C37.09. The annex would be longer than the document. We should reference to the appropriate sub-clauses of the IEC standard.

Denis Dufournet proposed to align the test description of IEEE with the description of IEC 62271-100 if possible to avoid conflicts with references to IEC 62271-101.

The chair said we should review test duties and study possible alignment with IEC.

Denis said the first step was to harmonize the description and parameters of TRVs. The next possible step is to bring the test duties closer together.

The chair asked for a task force to compare the differences between power test requirements and draw up comparison tables.

Individuals assigned to this topic are Mauricio Aristizabal, Victor Hermosillo, Denis Dufournet, and Steve Cary.

Topic# 6 To incorporate NEMA SG4 into C37.09 – Gilbert Carmona / Mike Crawford

The Chair asked Gilbert Carmona to present his topic in session #2 due to lack of time.

Topic #7 How do we address 'critical current' issue? – Roy Alexander to lead the discussion

There are only anecdotal accounts of problems with critical currents with early generations of self-blast. The issues were maybe around 30% short line faults. IEC compares T10, T30, T60 and T100 and checks for changes in minimum arcing times ($>1/2$ cycle). Also, L90 and L75, if min arcing time changes more than $>1/4$ cycle then test L60. Recently there were no known reported needs for additional test duties such as L60.

Roy asked if there should be any concern for new manufacturers that may enter the breaker market. Should we wait until service trouble? Should we request for someone to continue work with this topic?

Helmut Heiermeier said the TRV is much lower for $<L60$ and he may be able to prepare a presentation.

No manufacturers are reporting having to test L60 or intermediate terminal fault duties with new designs. Roy does not want to proceed with this topic. It is an old issue and he believes most manufactures do not have this problem or it is resolved before design tests.

Denis Dufournet commented on the history of critical currents into IEC 62271-100. The committee was informed that there could be a critical current for some cases 10 years ago. Currently there have been no further reported incidents. He recommended we should not introduce a new test requirement.

The chairman asked the committee if there is no major disagreement then he believes the issue of "critical currents" should not be included with this revision of C37.09. No one objected. A decision was made not to introduce this topic into C37.09.

10.) The working group committee agreed to adjourn the meeting. A second session will be held on 9-18-13

Session 2 – September 18, 2013

Location: San Antonio
Participants: 29 members
26 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 #2 on agenda - To incorporate C37.04 and C37.06 into C37.09 – Mike Crawford

Mike Crawford said there are plans to define C0 in C37.04 and description of the test in C37.09. This rating is not included in IEC. It was introduced in C37.04a but not on C37.09.

Victor Hermosillo said C0 would have the same test procedure as C1 but allowing one restrike per breaking operation.

There was some additional discussion about class C0 for capacitance switching. If C37.04 defines C0 class, then we can plan to pull information from C37.09a and 09b directly into C37.09 and then go through a review process. This is a timing issue between the release and approval of 04 and 100.2 and 09. Which documents will be approved first?

A decision was made to directly pull in (09a and 09b) into 09 as written with C0 class. At the time of ballot or before ballot the committee will review the progress of other related documents such as C37.04 and C37.100.2 to better understand how the documents align. Depending on the timing and the release of other documents, some adjusted statements may be needed in 09 to address this issue such as references to C37.04 or “superseded” versions of C37.04. Depending on the timing, maybe we could start an amendment to C37.09 to add C0 back into the document after 04 is approved.

(Please note: this discussion reversed the decision under day #1 Topic #3)

Mike Crawford also said he is aware of information from NEMA SG4 that needs to be pulled in C37.04 and then into C37.09.

Topic# 6 To incorporate NEMA SG4 into C37.09 – Gilbert Carmona / Mike Crawford

Gilbert Carmona presented information to pull NEMA SG4 information into C37.09. He showed comparison between 2000 and 2013 versions. He said topics covered by this standard and not by C37.04 or C37.09. Information such as: mechanisms, bushing terminals, CT’s, RIV, noise level, arc furnace, etc... He understands that NEMA SG4 may stop publishing the 2009 revision once the requirements are incorporated into IEEE C37.04/.09. Gilbert showed some examples that are included in the PowerPoint attachments. He said the topics should be reviewed and a decision has to be made about where to include each of them.

Denis Dufournet said IEC 62271-4 is a new edition for the IEC document on Handling Procedures for SF6 and its mixtures and it is a revision of a Technical Report (IEC 62271-303).

A list of suggested topics from SG4 was provided by Ted Olson and is available to the committee. The list was quickly shown on the projector.

Gilbert Carmona was assigned to take the lead for comparison of SG4 into C37.09. Terrance Woodyard also offered to help after the meeting. The Chair assigned him to the working group.

Topic #8 Electrical endurance 800% cumulative fault current (IEC/IEEE differences) and dielectric test after 800% - Sushil Shinde / John Webb

a.) Section 4.8.5.6 of C37.09-1999

John Webb presented information on electrical endurance at 800% cumulative fault and service capability.

Section 5.8.5.5 has wording and reviews summation of currents, including calibration and low voltage shots.

He reviewed current information in the standard (see attached PowerPoint slides):

For dielectric withstand test: <72.5 kV 1 min. 80% AC dry withstand,

72.5kV to less 362kV - 80% of the peak withstand with T10 shape.

Equal or above 362 - 90% of peak SIL.

He reviewed options to use IEC 62271-100.

72.5 kV to less 245 kV test 60% of BIL

TRV waveform for >72.5 kV

In addition he discussed:

Same mechanical conditions

Primary circuit resistance <200%

Opening time <110% of pre-test value

Sushil Shinde said a voltage check is applicable to all power tests in current version of the standard. Should we allow for flexibility by permitting use of multiple voltage check alternatives including: AC withstand, % of SIL/BIL from impulse generator, or T10 wave shape from synthetic lab.

The Chair said we should simplify information in C37.09 and allow for options. We should keep the breaker in the same conditions for the tests with no disassembly. He asked how many shots we allow for the tests. There are differences in IEC and IEEE: 1 shot, 3 shots, IEC is 5 shots with no breakdown allowed.

Denis Dufournet explained reasons for values and specific tests in IEC. For lower voltage AC was considered the relevant stress. At intermediate voltages BIL is the most significant stress and at high voltages it is switching impulse. There are options to perform voltage check with 90% T10 from a synthetic circuit.

Roy Alexander said the reduction were due to alignment for equivalent field test levels on a used circuit breaker. 80% or 60% are reductions on SIL and BIL given the used condition. Is one shot enough? Roy did not think so. IEC requires 5 shots, but the behavior is statistical. Perhaps we should consider stating a probability. The reduction already considers this and he believes we should use more shots.

Helmut Heiermeier said the wording states after completion of all tests. Medium voltage breakers will use one test piece for all type tests. For higher voltage circuit breakers these tests are performed with separate prototypes. He proposed to select some tests for which the voltage check should be done. For example, IEC indicates voltage check for only some of the tests such as (L90).

Denis said E2 is a separate test program for MV circuit breakers, not covered in 62271-100.

The Chair recommends that this voltage check is associated with the test object that has seen 800% and not 800% divided by 3 to spread across the entire breaker.

Mike Skidmore stressed he mainly would like to see the tests done without disassembly of the breaker and moved to a different lab. If this is done, it defeats the purpose of the test. The IEC synthetic test (90% switching with T10 wave shape) for higher voltage class breakers is probably the best solution.

Sushil Shinde said the standard states that voltage withstand tests “performed at the end of power tests” Does this mean that each pole that completes 800% has to be tested?

Kirk Smith said the E2 series is more than 800% in medium voltage breakers. A voltage check is then made at the end.

Roy Alexander suggested a voltage check at the end of life of each pole.

Helmut Heiermeier said for high voltage circuit breakers it is not possible to run all tests during subsequent shifts. There is usually several weeks after completion of one or two duties.

John Webb also said there may be similar information in C37.54 conformance testing and this document should be reviewed.

The chair asked for volunteers and the follow individuals were selected:

John Webb, Steve Cheng, Sushil Shinde, and Helmut Heiermeier. Terrance Woodyard also offered to help after the meeting. The Chair assigned him to the working group. Helmut only wanted to be involved with the review of the high voltage equipment and not the C37.54 conformance testing document.

Topic #9 Inclusion of ‘test splitting’ in C37.09 for single phase testing to demonstrate three phase performance (Denis Dufournet)

Denis Dufournet presented information about splitting test duties. He discussed medium voltage three-phase direct tests. At intermediate (ex. 145 kV) direct tests are possible but only single phase. Also, at higher voltages usually synthetic tests are completed at single phase.

Cases for effectively grounded and non-effectively grounded systems have to be covered by single phase tests. Therefore, single phase tests should consider the first, second and third pole to clear. The first pole to clear sees the highest peak TRV, subsequent poles to clear see reduced peak TRVs.

A graph was shown with TRV peak as a function of arcing time to cover first, second, third pole to clear with different factors for each. He showed factors for the range of arcing times for each one.

He discussed two possibilities:

Umbrella tests with same factor for all arcing time. Include min, medium and maximum with the same factor. This leads to higher stress for the second and third pole to clear.

IEC addressed an alternative to umbrella tests allowing the test to be split to prove the performance of each pole with changing factors for first, second, and third poles to clear. Two arcing times are tested for each.

Choice is higher stress with umbrella tests (first pole to clear factor for all poles), but less tests (demonstrate min, medium, max arcing time).

The other alternative is splitting, then the factors are changed between first, second, third, but there are more shots, two for each with timing to cover each window.

The following topics were on the agenda but not discussed due to lack of time. The topics will be discussed next meeting

- Topic #10 Inclusion of 'multi-part testing' in C37.09. State the preference is to have full TRV whenever possible. (Denis Dufournet)
- Topic #11 should we include inductive load switching test from IEC62271-110 Benefits for this test – Sushil Shinde
- Topic #12 Cold temperature test method – IEC or IEEE or other? Indoor breaker with heaters should be included or excluded – Victor / John Webb
- Topic #13 IEEE std 693 Seismic Test standard – Xi
- Topic #14 Share documents for WG members. – progress update – Xi
- Topic #15 To incorporate C37.06.1 into C37.09 - ??
- Topic #16 Test Duty Summary Table -- ?? (proposed by Ken)
- Topic #17 Measurement Tolerance Table -- ?? (proposed by Gilbert)
- Refer to latest version of iee std-4?

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

4.) After the second session Terrance Woodyard volunteered to help with:

- a) Topic #3 – addition of C37.09a and C37.09b review
- b) Topic #6 - NEMA SG4 review
- c) Topic #8 - C37.54 review for conformance testing

He was added to the study groups by the chair.

Meeting Roster For Session #1 and #2 – San Antonio

First Name	Last Name	Company	Role	San Antonio Meeting Session #1 9/17/2013	San Antonio Meeting Session #2 9/18/2013
Syed Shahab Uddin	Ahmed	Siemens Energy Inc	Guest	X	X
Roy	Alexander	RWA Engineering	Member	X	X
Mauricio	Aristizabal	ABB	Member	X	
Roy	Ayers	Nashville Electric Service	Guest		
Katrin	Baeuml	Schneider Electric	Guest		
William	Bane	Nashville Electric Service	Guest		
Amildo	Barrio	Parsons	Guest	X	X
Jerry	Baskin	Federal Pacific	Guest		X
George	Becker	The United Illuminating Company	Guest	X	
Stan	Billings	Mitsubishi Electric PP	Member	X	X
Anne	Bosma	ABB AB	Member		
Cody	Brehm	American Transmission Company	Guest		
Steven	Brown	Allen & Hoshall	Guest	X	X
Arben	Bufi	Hitachi HVB, Inc.	Member	X	X
Eldridge	Byron	Schneider Electric	Member	X	
Donald	Cantrelle	Georgia Power	Guest	X	X
Gilbert	Carmona	Southern California Edison	Member	X	X
Stephen	Cary	Eaton Corporation	Member	X	X
Steven	Chen	Eaton Corporation	Member	X	X
Wayne	Cheng	B C Hydro	Member		
Vincent	Chiodo	HICO	Guest	X	X
Chih	Chow	PEPCO	Member	X	X
Michael	Christian	ABB	Guest	X	X
Roggero	Ciofani	Altalink	Guest	X	X
Lucas	Collette	Mitsubishi Electric	Member	X	X
Dave	Collette	Mitsubishi Electric	Guest	X	
Lee	Cox, Jr.	Efacec	Guest		
Andrew	Crane	Consumers Energy	Guest		
Michael	Crawford	Mitsubishi Electric	Member		X
David	Dart	NOJAPower	Guest		X
Jerod	Day	Vacuum Interrupters, Inc.	Guest	X	
Patrick	Di Lillo	Consolidated Edison Co. of NY, Inc.	Member	X	
Denis	Dufournet	Alstom Grid	Member	X	X
Ken	Edwards	Bonneville Power Administration	Member		

Doug	Edwards	Siemens Industries, Inc.	Guest		
Tanner	Esco	Eaton Corporation	Guest	X	
Thomas	Field	Energy	Member		
Sergio	Flores	Schneider Electric Inc. USA	Guest	X	X
Robert	Foster	Megger	Guest	X	X
Sivakumar	Ganesh	ENMAX Corporation	Member	X	
Douglas	Giraud	Powell Electrical Systems	Member		X
Paul	Grein	Circuit Breaker Sales, Co, Inc, - GroupCBS	Member		
John	Hall	Tennessee Valley Authority	Guest	X	X
Jeffrey	Hanson	Schneider Electric	Guest		
Helmut	Heiermeier	ABB	Member	X	X
Charles	Hendrickson	Arizona Public Service Company	Guest		
Victor	Hermosillo	Alstom Grid	Vice-Chair	X	X
Jingxuan (Joanne)	Hu	RBJ Engineering Corporation	Member		
Todd	Irwin	Alstom Grid Inc	Member	X	X
Carlos	Isaac	Oncor Electric Delivery	Guest		X
Anton	Janssen	Liander	Guest		
Jacob	Joseph	Toshiba International Corporation	Guest	X	
Sandeep	Kulkarni	CG	Guest		
Stephen	Lambert	Shawnee Power Consulting, LLC	Guest		
David	Lemmerman	PECO/Exelon	Guest		X
Wangpei	Li	Eaton	Guest		
Hua Ying	Liu	Southern California Edison	Member		
Li	Liu	Eaton	Member		
Albert	Livshitz	Schneider Electric Services	Member		
Bjorn	Lofgren	Siemens Energy	Member	X	X
Antonio	Mannarino	PSE&G	Guest		
Vincent	Marshall	Southern Company Services	Guest	X	X
Ricardo	Martinez	CFE-LAPEM	Member		X
Peter	Marzec	S&C Electric Co.	Guest	X	X
Neil	McCord	Southern States	Guest		
Dave	Mitchell	Dominion	Guest	X	
Tom	Mulcahy	Dominion	Guest		X
Jeffrey	Nelson	Tennessee Valley Authority	Member		
Joachim	Oemisch	Siemens AG	Guest		X
Miklos	Orosz	Schneider Electric	Member	X	X
Molson	Parvin	CB&I	Guest		X
Shawn	Patterson	US Bureau of Reclamation	Guest	X	
Thomas	Pellerito	DTE Energy	Member	X	X
Lise	Phan	Parcific Gas and Electric Company	Member		
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		
Dave	Riffe	Westinghouse Electric Company	Guest		
Brian	Roberts	Southern States, LLC	Guest		X
Jon	Rogers	Siemens Energy, Inc	Member	X	X
Ben	Rosenkrans	Eaton Corporation	Guest		X
Roderick	Sauls	Southern Company Services	Member	X	X
Carl	Schuetz	American Transmission Company (ATC)	Member	X	X
Devki	Sharma	Consultant	Member	X	X
Sushil	Shinde	ABB Inc.	Member	X	X
John	Shullaw	GE Energy - Industrial Solutions	Guest		X
Michael	Sigmon	Eaton Corporation	Member	X	X
Michael	Skidmore	AEP	Secretary	X	X
Robert	Smith	Eaton Corporation	Member		X
Hongbiao	Song	Bechtel	Guest		
Erin	Spiewak	IEEE	Guest		X
Don	Steigerwalt	Duke Energy	Guest		X
Donald	Swing	Powell Industries	Guest	X	
Vernon	Toups	Siemens	Guest	X	X
James	van de Ligt	CANA High Voltage Ltd.	Member	X	
Wes	Wadsworth	Hitachi HVB, Inc.	Member		
John	Webb	ABB	Member	X	X
Terrance	Woodyard	Siemens Industry Inc.	Member	X	X
Lisa	Yacone	IEEE-SA	Guest		
Dong Sun	Yoon	HICO America	Guest	X	X
Richard	York	GE Gigital Energy	Guest		
Jiong	Zhang	MEPPI	Member		
Xi	Zhu	GE Energy Management	Chair	X	X

“X” - individual was at the meeting in San Antonio