Standards Subcommittee

October 19, 2022, Charlotte, SC

Standards Subcommittee		
Chair: Daniel Sauer	**Vice-Chair: Marcos Ferreira**	**Secretary: Ajith Varghese**
Standards Coordinator: Steve Shull		
Room: Centennial F-G	Date: October 19, 2022	Time: 4:30 PM to 05:35 pm
Total Members: 74	Present at time of quorum check: 38	Attended per Record: 48
Guests present: 65	Membership requested: 7	Membership accepted: 6

L.1 Meeting Attendance

The Standards Subcommittee met on Wednesday; Oct 19th, 2022 at 4:30 PM (CST).

35 members were in attendance at the beginning of the meeting, which met the quorum requirement. Couple of the guests who were present reported that they believed they are members. Secretary reassured that their concern will be reviewed and status will be updated.

Based on attendance roster and after correction to membership, it was confirmed that **48 of 74**members were present. 36 guests were also present of which **6** guests requested membership of which **5** met attendance requirement and will be granted membership.

L.2 Chair's Remarks

The Chair welcomed members and guests to the F22 meeting. Chair briefly highlighted the requirement that while introducing one need to state their affiliation.

The Agenda was moved by Steve Shull and seconded by Tom Prevost. The motion was carried with unanimous consent. The Minutes for Spring 2022 was moved by Kris Zibert and seconded by Steve Shull. The motion was carried with unanimous consent

Chair presented the IEEE requirement for patent and copyrights. The Chair reminded WGs that call of the patent is required a during every WG meetings including on-line/Teleconference meeting. If there are any patent claim, it shall be noted but not discussed at the working group meetings

The Chair reminded the WG and TF leaders to submit their minutes from the meetings within **15 days** to the SC secretary. The SC Secretary then must submit the SC minutes within 45 days of the SC meeting. The Chair welcomed members and guests to the virtual meeting.

Chair briefly highlighted the requirement that while introducing one need to state their affiliation.

Chair informed Eric Davis is appointed as new chair for WG C57.12.00 to take over from Steve Snyder, who had stepped down.

Also, with the passing away of Vinay Mehrotra, Alan Washburn will take over as chair for IEEE/IEC Cross Reference TF

WG on C57.12.00, C57.12.90, C57.12.80, C57.152 and C57.163 provided an update on status of their standards. Detailed WG reports are included as part of this report.

- C57.12.00: 2021 standard was released in 2022. WG is keeping a tab of activities in TF/WG and have PAR for next revision approved.

- C57.12.90 Test Code: Similar to C57.12.00, Test code was released in 2022 and PAR for next revision is also approved.

- C57.12.70: Did not meet.

- C57.12.80 Terminology Guide: Dan Sauer provided an update that WG agreed on the definitions of Hottest spot temperature and stray gassing and approved motion to forward the guide to Sub Committee.

  A motion was unanimously approved during SC meeting to advance WG Approved draft of C57.12.80 to IEEE SA for balloting. Motion was moved by Kris Zibert and seconded by Jason Vernell.

- C57.152 Field guide: WG completed the revision of guide and approved a motion to advance the guide to SC.

  During the SC, a motion was unanimously approved to advance, WG Approved draft of guide C57.152 to IEEE SA for balloting. Motion was moved by Marcos Ferreira and seconded by Ajith Varghese.

- C57.163 Guide for Establishing Power Transformer Capability while under Geomagnetic Disturbances: WG met and approved a motion to forward the guide to SC and also approved establishing CAG.

  During the SC, a motion was unanimously passed to advance the guide to IEEE SA for balloting. Motion was moved by Dan Blaydon and seconded by Ramsis Girgis.

- IEEE/IEC Cross Reference TF - Did not meet.

L.3 Working Group and Task Force Reports

L.3.1 Standards Working Group on the Continuous Revision of C57.12.00

Standards Working Group on the Continuous Revision of C57.12.00

Standards Subcommittee
IEEE/PES Transformers Committee
WG Chair: Eric Davis
October 19, 2022

The purpose of this WG is to compile all the work being done in various TF/WG/SC's for inclusion in the continuous revision of C57.12.00 in a consistent manner. This WG coordinates efforts with the companion standard C57.12.90 so that they publish together.

Eric Davis replaced Steve Snyder as WG Chair. The WG thanks Steve for his service.

Standard C57.12.00 was approved by IEEE SA Standards Board on 11/9/2021 and published January 2022. It will be good for 10 years.

A Project Authorization Request (PAR) for Revision of PC57.12.00 was approved 5/13/2022. It expires 12/31/2026.

Respectfully submitted,
Eric Davis, WG Chair C57.12.00
October 19, 2022

L.3.2 WG Standard Terminal Markings and Connections for Transformers C57.12.70

Document #:	C57.12.80		
Document Title:	Standard Terminology for Distribution and Power Transformers		
Chair:	James Graham	Vice-Chair	Open
Secretary	Richard von Gemmingen		
Current Draft Being Worked On:	1.1	Dated:	NA
Meeting Date:	2022-10-17	Time:	9:30 AM – 10:45 AM

Attendance:		
	Members	13
	Guests:	20
	Total	33

Meeting Minutes / Significant Issues / Comments:

Chair James Graham could not be present for this meeting there for Dan Sauer filled in as Acting Chair and opened the meeting at 9:35 a.m. on Monday 17 October, 2022.

1) Quorum Check
Quorum was achieved with 13 of 14 members present. 20 non-voting participants also attended. No new members have been added.

2) Approval of the Agenda
Ryan Musgrove moved to approve Agenda, Jerry Murphy seconded the motion. Motion was unanimously approved.

3) Approval of the Spring 2022 minutes
Sankar Nambi moved to approve the spring 2022 minutes, Tim-Felix Mai seconded the motion. Motion was unanimously approved.

4) Call for Essential Patents
A call for essential patents was made. No essential patents or issues were reported.

5) Copyright policy
The IEEE copyright policy was displayed and quickly reviewed. No issues were reported.

6) Unfinished Business
   a) Stray Gassing definition – Proposed (only definition holding up ballot)

Spirited discussion surrounded the proposed definitions

Kris Zibert opened discussion with "no evidence of a" fault is present as talking point

Shankar Nambi asked is note adding value?

Dan Sauer added note is informative

Jerry Murphy indicated that C57.104 shows ratios of co/c02 as thermal evidence

Tom Prevost had issues with following:

a) "significant" as a subjective word
b) Evidence of a fault is problematic
    a. Paul Dolloff, Enrique Batencourt, Kris Zibert, Gary Hoffman and Tom Prevost discussed issues such as paint, zinc, rates of change, CIGRE view and other problems that can be related to stray gassing.
c) Jeff Wright added points from C57.104, 106 and 155 for consideration
d) Tom Prevost added latest Duval triangle, now a pentagon as example to include stray non fault related example

Motion from floor

Gary Hoffman moved to use sentence from C57.155 "Stray gassing refers to …"

Jerry Murphy Seconded the motion

a) Discussion from Jerry Murphy to reduce definition to simple and remove note
b) Tom Prevost supported the Motion as it covered his concerns
c) Dan Sauer asked it note should be left in?
d) Kris asked if reference to C57.155 can be included? Discussion indicated the reference to 155 can be included as a normative reference

Gary Hoffman called for Motion to be put to vote to accept final definition as follows:

stray gassing:. gases produced from the dielectric liquid under normal operating and overload conditions in the absence of a fault

NOTE—Neither carbon monoxide nor carbon dioxide production indicate stray gassing

Jerry Murphy seconded.

Motion was approved unanimously.

7) New Business
   a. Hottest Spot Definition

Proposed definition :

hottest spot: The location of the hottest-spot temperature of a component of a transformer that is in contact with insulation or insulating liquid. The term is frequently used in reference to the hottest location of a particular component, such as a winding or the core.
Note – the term hot spot is sometimes used colloquially as a synonym for hottest spot, but the preferred technical term is hottest spot when referring to the location with the highest temperature.

a. Floor was opened up for discussion on proposed definition, not discussion was initiated
b. Jerry Murphy motioned to accept definition as presented
c. Jeff Wright seconded motion
d. Discussion then proceeded between Tom Prevost, Dan Sauer, Gary Hoffman and Kris Zibert
e. Discussion concluded with vote to accept motion.
f. Motion was approved unanimously

b. As stray gassing and hottest spot were the last remaining definitions, the revised draft of the C57.12.80 is not ready to go to ballot:
    a. Jerry Murphy made a motion to go to ballot with the draft
    b. Gary Hoffman seconded the motion
    c. Motion was approved unanimously

c. Ballot resolution group
    a. Gary Hoffoman made a motion to create a ballot resolution group
    b. Jerry Murphy seconded motion
    c. Motion was approved unanimously
    d. Jerry Murphy and Saramma Hoffman volunteered for ballot resolution committee

d. Chairman James Graham in an email announced he was stepping down effective immediately
e. Shankar Nambi volunteered for the open position of vice chair.

8) The meeting was adjourned at 10:45 a.m. (MDT)

Next meeting – March 2023 Milwaukee Wisconsin

Submitted by: Rich von Gemmingen, Secretary

Date: 10/15/2022

Meeting Attendance List

Role	Last Name	First Name	Affiliation	10/17/2022
Chair	Graham	James	Weidmann Electrical Technology	
Secretary	vonGemmingen	Richard	Dominion Energy	X
Member	Betancourt	Enrique	Prolec GE	X
Member	Heiden	Kyle	EATON Corporation	X
Member	Hoffman	Gary	Advanced Power Technologies	X
Member	Li	Weijun	Braintree Electric Light Dept.	X
Member	Mai	Tim-Felix	Siemens Energy	X
Member	Matthews	Lee	Howard Industries	X
Member	Murphy	Jerry	Reedy Creek Energy Services	X
Member	Musgrove	Ryan	Oklahoma Gas & Electric	X
Member	Nambi	Shankar	Bechtel	X
Member	Sauer	Daniel	EATON Corporation	X
Member	Wright	Jeffrey	Duquesne Light Co.	X
Member	Zibert	Kris	Allgeier, Martin and Associates	X
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Role	Last Name	First Name	Company	
Guest	Abbas	Mubarak	Siemens Energy	
Guest	Alongia	Rachel	Entergy	
Guest	Amos	Richard	Retired	
Guest	Antosz Jr.	Stephen	Siemens Industry	
Guest	Antweiler	Irving	Retired Schneider Electric	
Guest	Bernesjo	Mats	Hitachi Energy	
Guest	Benech	Jeff	Megger	X
Guest	Biggie	Kevin	Weidmann Electrical Technology	
Guest	Boettger	William	Boettger Transformer Consulting LLC	
Guest	Brafa	John	Hub City Consulting Services	
Guest	Brannen	Randy	Southern Company Services	
Guest	Calitz	David	Siemens Energy	
Guest	Chorzepa	Jaroslaw	ABB Inc.	
Guest	Clift	Bobby	Xcel Energy	
Guest	Coffey	Lucas	Alabama Power	
Guest	Cryer	Richard	Digitalgrid, Inc	X
Guest	Cruz Valdes	Juan Carlos	Prolec GE	
Guest	Dauzat	Thomas	General Electric	
Guest	Doak	Eric	D4EnergySolutions LLC	
Guest	Dolloff	Paul	East Kentucky Power	X
Guest	Downey	Andy	Prolec-Waukesha	
Guest	Draper	Zachary	Delta-X Research	X
Guest	Dutta Roy	Samragni	Siemens Energy	
Guest	Eagle	Thomas	SPX Transformer Solutions, Inc.	
Guest	Eastman	John	ZTZ Services International	
Guest	Fattal	Feras	Manitoba Hydro	
Guest	Faur	Florin	SPX Transformer Solutions, Inc.	
Guest	Felton	Todd	MVA	X
Guest	Ferreira	Marcos	Beale AFB	
Guest	Ferreira	Marcos	Bridgeview Resources	X

Guest	Friend	Fredric	American Electric Power	
Guest	Frotscher	Rainer	Maschinenfabrik Reinhausen	
Guest	Gazivoda	Dora	KONCAR - Instrument Transformers	
Guest	Giraldo	Orlando	H-J Family of Companies	
Guest	Girgis	Ramsis	Hitachi Energy	
Guest	Glassou	Scott	Siemens Energy	X
Guest	Gonzalez	Luis	Canduct Industries Limited	
	Gonzalez	Jose		
Guest	Ceballos	Antonio	Georgia Transformer	
Guest	Herron	John	Raytech USA	
Guest	Hoffman	Saramma	PPL Electric Utilities	X
Guest	Hogg	Ryan	Bureau of Reclamation	X
Guest	Hopkins	Traci	H2scan Corporation	X
Guest	Holland	David	ExxonMobil	
Guest	Issack	Ramadan	American Electric Power	
Guest	Karas	Jon	SDMyers, LLC.	
Guest	Lambert	Jason	JST Power	X
Guest	Leal	Gustavo	Dominion Energy	X
Guest	Lee	Sungdae	Hyundai Power Transformers USA	
Guest	Lowman	Don	Dominion Energy SC	X
Guest	Lucas, P.E.	Tiffany	SPX Transformer Solutions, Inc.	
Guest	Macias	Alejandro	CenterPoint Energy	
Guest	Marek	Richard	Retired	
Guest	Martinez	Rogelio	Georgia Transformer	
Guest	Martinez	Joaquin	Siemens Energy	X
Guest	McNelly	Susan	Xcel Energy	
Guest	McTaggart	Ross	Trench Limited	
Guest	Miu	Aurel	FirstEnergy Corp.	
Guest	Moleski	Hali	SDMyers, LLC.	
Guest	Montpool	Rhea	Schneider Electric	
Guest	Moore	Curtis	Digitalgrid, Inc	X
Guest	Neder	Frank	Trench Germany GmbH	
Guest	Patel	Sanjay	Smit Transformer	
Guest	Peterson	Timothy	N. American Substation Services	
Guest	Polson	Adam	Arizona Public Service Co.	
Guest	Portillo	Homero	Advanced Power Technologies	
Guest	Prevost	Thomas	Weidmann Electrical Technology	X
Guest	Roizman	Oleg	IntellPower Pty Ltd	
Guest	Roussell	Marnie	Entergy	X
Guest	Sanchez	Albert	Knoxville Utilities Board	
Guest	Schweiger	Ewald	Siemens Energy	
Guest	Sen	Cihangir	Duke Energy	
Guest	Sewell	Nick	Alabama Power	
Guest	Shingari	Avijit	Pepco Holdings Inc.	
Guest	Shukla	Kunal	PECO Energy Company	
Guest	Silgardo	Adrian	IFD Corporation	
Guest	Sot	Msunab	Hitachi Energy	
Guest	Steele	Hampton	TVA	X
Guest	Steeves	Gregory	Baron USA, LLC	

Guest	Stem	Gregory	Cardinal Pumps & Exchangers	
Guest	Strongosky Swanson	Neil	Memphis Light, Gas & Water	
Guest	McLeod	Katrina	Southern Nuclear	
Guest	Thomas	Scott	Hitachi Energy	X
Guest	Torabi Goodarzi	Reza	SMIT Transformatoren B.V.	
Guest	Tournoux	Daniel	SPX Transformer Solutions, Inc.	
Guest	Varghese	Ajith	SPX Transformer Solutions, Inc.	
Guest	Vir	Dharam	Prolec-GE	X
Guest	Vo	Duy	Central Maine Power (AVANGRID)	
Guest	Walia	Sukhdev	New Energy Power Co.	
Guest	Washburn	Alan	Burns & McDonnell	
Guest	Webb	Matthew	SPX Transformer Solutions, Inc.	
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L.3.3 WG Standard Transformer Terminology for Transformers C57.12.80

WG on C57.12.80 did not meet during Fall 22 TC Meeting.

L.3.4 WG Standards Transformer on Continuous Revision for C57.12.90

Standards Working Group on the Continuous Revision of C57.12.90
Standards Subcommittee
IEEE/PES Transformers Committee
WG Chair: Stephen Antosz
Vice-Chair/Secretary: Jason Varnell
Fall 2022 Charlotte; October 19, 2022 (changes in purple text)

INTRODUCTION

This is a working group by committee of task forces, for continuous revision of C57.12.90. The purpose of the WG is to keep track of the work being done in various TF/WG/SC's for inclusion in the continuous revision of C57.12.90 in a consistent manner.

Currently there are five Task Forces in three different Subcommittees, as follows:

1. PCS – Cont Rev to Test Code C57.12.90 Clauses 5-9, & 12, TF Chair: Hakan Sahin
2. PCS – Audible Sound Revision Clause 13, TF Chair: Ramsis Girgis
3. Dielectric Test – Cont Rev to Impulse Tests in Clause 10, TF Chair: Pierre Riffon
4. Dielectric Test – Cont Rev to LowFrequency Tests Clause 10, TF Chair: Ajith Varghese
5. Dielectric Test –Insulation Power Factor and Resistance, 10.10 and 10.11, TF Chair: Diego Robalino
6. Insulation Life – Cont Rev to Temperature Test Clause 11 and Resistance Clause 5, TF Chair: Dinesh Sankarakurup

SUMMARY

C57.12.90-2021 was approved as a revised standard by the IEEE-SA Standards Board on Nov 9, 2021. It was published on Feb 4, 2022. The WG Chair took out a new PAR on Feb 28, 2022, which was approved by the IEEE-SA Standards Board on May 13, 2022.

FUTURE REVISIONS AND PENDING WORK

Any new material provided by the various Task Forces to this WG Chair for inclusion in the next revision, will first be approved by the responsible technical subcommittee (Diel Test, PCS, Dist, IL, etc.) and then presented to the Standards Subcommittee for the "official" vote of approval.

Changes *already approved* for the next revision:

1. Hakan Sahin's PCS TF for Revision of C57.12.90.

    a. Changes to subclause 7.3, Ratio test methods to "modernize" it,. Final survey approved in the Spring 2021 virtual meeting.

    Insert a new subclause 7.3.1 as follows:
    7.3.1 Electronic ratio and phase measurement meters
    An electronic meter that determines the transformer turns ratio, polarity and phase angle may be used for the measurement of these parameters.

The existing 7.3.1 Voltmeter method should be renumbered to be 7.3.2, and there are no changes to the text.

The existing 7.3.2 Comparison method should be renumbered to be 7.3.3, and there are no changes to the text or the figures 10 & 11.

The existing 7.3.3 Ratio meter clause and figure 12 is to be deleted.

b. Ratio test voltage and frequency under subclause 7.1.2. Request to change frequency bandwith.

7.0 Ratio test

Current Version:

7.1.2 Voltage and frequency

The ratio test shall be made at rated or lower voltage and rated or higher frequency.

Proposed Version

7.1.2 Voltage and frequency

The ratio test shall be made at rated or lower voltage and be such that the ratio of test voltage to test frequency is less than or equal to the ratio of rated voltage to rated frequency.

c. Load Tap Changer performance test with rated voltage. New subclause 8.7.

8.7 Load Tap Changer Voltage Test

8.7.1 General

In order to verify the performance of a transformer that has a load tap changer (LTC), the LTC shall be operated through one end-to-end-to-end sequence (from one tap extreme to the other tap extreme and back again) with the transformer energized at rated voltage.

8.7.2 Control voltage

Control voltage for the LTC motor during the test shall be as near to rated voltage as possible, with a minimum of 85%.

8.7.3 Preparation for the test

The LTC shall be fitted with all included equipment. It shall be connected as it will be in service, including protective devices.

8.7.4 Procedure

Either the high or low voltage winding of the transformer under test shall be energized at rated voltage and frequency, unless otherwise specified. The LTC shall be operated using the motor drive but not manual rotation. The LTC shall be operated through all tap positions twice, starting at one tap extreme and progressing to the other tap extreme, and then return back again to the original tap position. The test may be performed at intervals, if necessary, such as to adjust the test circuit for the applied voltage to be adjusted to the rated voltage of the tap position, but it is a requirement that the transformer be energized at no less than rated voltage corresponding to each tap to be changed.

8.7.5 Observations and Analysis

8.7.5.1 Audible Sound

The transformer shall be observed during this test and the operator shall identify that the sound during the tap changing operations was either normal or abnormal. With some types of tap changers, there will be abnormally loud sounds if components are not assembled properly. Note that during operation of the change-over selector (reversing switch or coarse-tap selector) the sound can be slightly different.

8.7.5.2 Supply Test Circuit
The test control system shall be monitored for any trip of the test circuit that automatically stops the circuit from keeping the transformer energized.

8.7.5.3 Dissolved Gas-in-Oil Analysis
Oil samples shall be taken from the LTC compartment of vacuum type tap-changers before and after the test and analyzed for dissolved gasses. Results of the analysis may show some increase of dissolved gases due to current commutation, resistor heating and / or stray-gassing of the oil.

8.7.6 Failure Detection and Acceptance Criteria
The transformer will have passed this LTC Voltage test if:

- The tap changer operates normally with no abnormal sound
- The transformer stays energized without a trip in the supply test circuit
- For mineral oil filled vacuum LTCs, the increase of the sum of H2, CH4, C2H6, C2H4 and C2H2 should not exceed 12 ppm for in-tank type LTCs and 6 ppm for compartment type LTCs.
- For non-vacuum type LTCs, or LTCs filled with a liquid other than mineral oil, the determination of acceptance criteria is through sound only and there is not a limit for increase in gases.

d. Load Tap Changer performance test with rated current. New subclause 9.6.

9.6 Load Tap Changer Current Test
9.6.1 General
In order to verify the performance of a transformer that has a load tap changer (LTC), the LTC shall be operated through one end-to-end-to-end sequence (from one tap extreme to the other tap extreme and back again) with the transformer current flowing through the windings, corresponding to the top nameplate MVA rating.

9.6.2 Control voltage
Control voltage for the LTC motor during the test shall be as near to rated voltage as possible, with a minimum of 85%.

9.6.3 Preparation for the test
The LTC shall be fitted with all included equipment. It shall be connected as it will be in service, including protective devices.

9.6.4 Procedure
The test shall be performed by applying a short circuit either the high-voltage winding or the low-voltage winding and applying sufficient voltage across the other winding to cause a specific current to flow in the windings. The LTC shall be operated using the motor drive but not manual rotation. The LTC shall be operated through all tap positions twice, starting at one tap extreme and progressing to the other tap extreme, and then return back again to the original tap position. The test may be performed at intervals, if necessary, such as to adjust the test circuit for the

applied voltage to be adjusted to the required current of the tap position, but it is a requirement that the transformer be energized at no less than 80% of the top MVA nameplate current value for each tap change.

9.6.5 Observations and Analysis

9.6.5.1 Audible Sound

The transformer shall be observed during this test and the operator shall identify that the sound during the tap changing operations was either normal or abnormal. With some types of tap changers, there will be abnormally loud sounds if components are not assembled properly. Note that during operation of the change-over selector (reversing switch or coarse-tap selector) the sound can be slightly different.

9.6.5.2 Supply Test Circuit

The test control system shall be monitored for any trip of the test circuit that automatically stops the circuit from keeping the transformer energized.

9.6.5.3 Dissolved Gas-in-Oil Analysis

Oil samples shall be taken from the LTC compartment of vacuum type tap-changers before and after the test and analyzed for dissolved gasses. Results of the analysis may show some increase of dissolved gases due to current commutation, resistor heating and / or stray-gassing of the oil.

9.6.6 Failure Detection and Acceptance Criteria

The transformer will have passed this LTC Voltage test if:

- The tap changer operates normally with no abnormal sound
- The transformer stays energized without a trip in the supply test circuit
- For mineral oil filled vacuum LTCs, the increase of the sum of H2, CH4, C2H6, C2H4 and C2H2 should not exceed 12 ppm for in-tank type LTCs and 6 ppm for compartment type LTCs.
- For non-vacuum type LTCs, or LTCs filled with a liquid other than mineral oil, the determination of acceptance criteria is through sound only and there is not a limit for increase in gases.

e. Number of short-circuit tests under subclause 12.3.4.

Current Version:

12.3.4 Number of tests

Each phase of the transformer shall be subjected to a total of six tests satisfying the symmetrical current requirement specified in 12.3.1 or 12.3.2, as applicable. Two of these tests on each phase shall also satisfy the asymmetrical current requirements specified in 12.3.3.

Proposed Version

12.3.4 Number of tests

- When a three-phase transformer is tested in a three-phase test circuit or in a single-phase test circuit as given in Annex C, each phase of the transformer shall be subjected to three tests satisfying the asymmetrical current requirements specified in 12.3.3. The tests shall be performed on one of the outer phases with the tap-changer in the maximum position, on the other outer phase with the tap-changer in the

minimum position and on the middle phase with the tap-changer in the principal position

- When a single-phase transformer is tested in a single-phase test circuit the transformer shall be subjected to three tests satisfying the asymmetrical current requirements specified in 12.3.3. The three tests shall be performed one each, with the tap-changer in the maximum, minimum and principal position.

All of these above items have been approved in Hakan's Task Force on Tues Nov 16, 2021. They have been passed up to the Performance Characteristics Subcommittee and await the subcommittee's survey and approval. Not sure of PCS status as of October 18, 2022

2. Changes to Insulation Power Factor test, from Diego Robalino's Diel Test SC TF for Winding Insulation Power Factor. Final survey approved in the Fall 2021 virtual meeting. Specifically with regards to Subclause 10.10.2 revising the accuracy requirements of instrumentation.

The existing text is:

10.10.2 Instrumentation

The insulation power factor may be measured by special bridge circuits or by the voltampere-watt method. The accuracy of measurement should be within ± 0.25% insulation power factor, and the measurement should be made at or near a frequency of 60 Hz.

The revised text will be:

10.10.2 Instrumentation

The insulation power factor may be measured by special bridge circuits or by the voltampere-watt method. The measurement should be ~~within ± 0.25% insulation power factor, and the measurement should be~~ made at or near a frequency of 60 Hz.

The accuracy of measurement should be as follows:

- for PF<1% , +/-2% of reading +/-0.05% absolute
- for PF>1% , +/-5% of reading +/-0.05% absolute

I AM NOT SURE OF THE EXACT TEXT NOR THE EXACT CHANGES. NEED TO GET IT FROM DIEGO ROBALINO. STEVE Nov 2021 as of Oct 18, 2022 still to do

PENDING WORK

Since is a continuous revision document, there is ongoing work in various Task Forces.

1. Possible other revisions from Hakan Sahin's PCS TF for Revision of C57.12.90. As of Oct 18, 2022 there are no open items of business.

2. Possible changes to Clause 13 sound test from Ramsis' TF. As of Oct 18, 2022 the TF has the following items on its agenda and is working on possible revisions:
    - Condition for measuring core noise
    - Method of adding ambient Sound Pressure level measurements
    - Ambient Sound Pressure level correction
    - Impact of Temperature on Core and Load noise
    - Measuring Load noise contour for ONAN rated only transformers
    - Near-field correction for pole mount transformers

3. Possible changes to Subclause 10.2 or 10.3 from Pierre Riffon's TF regarding switching and lightning impulse tests. As of Oct 18, 2022 the TF has the following items on its agenda and is working on possible revisions:
    - Proposal from Dan Sauer regarding 10.3.2.2, 10.3.2.3, 10.4.4, 10.4.5 impulse tests on transformers with series-multiple and delta-wye connections. This was discussed, a draft reviewed, and slight changes made.
    - Establishing guidelines about use of +/-3% tolerance on voltage peak. Pierre presented draft wording, much discussion, wording will be revised.
    - Proposal by Ajith Varghese regarding phase-to-phase switching impulse

4. Other possible revisions to subclauses 10.5 to 10.10 from Ajith Varghese's TF for revision of low frequency tests. Ongoing work continues. As of Oct 18, 2022…
    - Revision to PD test procedure for Class II revised procedure was presented and discussed, draft will be circulated
    - Class I transformer PD test revision to the test procedure survey results by Don Ayer's subTaskForce were presented. Still work to do.
    - Clarification of measuring voltage during low frequency tests status ???
    - Venting bushings during PD test, lots of discussion, this is a controversial topic, some proposed wording exists as a starting point but a small group will work to revise, need collaboration with bushing manufacturers, transformer manufacturers, and users who all have different viewpoints on this
    - Request to add 1100 kV to Table 4 of C57.12.00. This proposal was rejected.
    - Cover unresolved comments from C57.12.90-2021 ballot

5. Possible changes to subclause 10.11 from Diego Robalino's TF regarding insulation resistance. As of Oct 18, 2022 … Possible future changes to insulation resistance measurement procedures are being considered, as compared to conflicting procedures in other documents such as C57.152. Also, possible future addition of core megger and clamp megger procedures since none currently exist in 12.90.

6. Changes to Clause 11 Temperature Test from Dinesh Sankarakurup's TF
    - 11.4.3 Add text that reverse correction for altitude is also allowed; i.e., when factory is located above 1000 m and transformer rating is based on <1000m. This work is ongoing in a small subgroup. A draft already exists.

- 11.1.2.2.c and 11.3.2. Defining the top oil rise as the last reading at the end of the stabilization period of the total loss run, not an average. This work appears complete, but there was no quorum so no decisions made.
- Possible revision to 11.4.1 and 11.4.2, regarding K and L type insulating fluids for temperature rise test corrections. As of Oct 18, 2022 status unsure?
- Request for clarification for temp test of 3-winding transformers, injecting maximum losses, and correcting for maximum common winding current in autos. This topic has been sort of combined with the request for clarification of tap selection for temp test. Ajith has a first draft of proposed changes and will seek a small study group to review.
- Proposal by Bertrand Poulin OFAF Cooling and Top Duct Oil temperature
- Proposal by Ajith Varghese regarding Ambient Measurement distance of 1meter or 2meters.
- Clarification to Hottest spot Rise calculation using Fiber Optics
- Standardize Method for Hot resistance extrapolation

Respectfully submitted,
Stephen Antosz, WG Chair
Jason Varnell, WG Vice-Chair
October 19, 2022

L.3.5 WG Standards Transformer on Revision for C57.152, Guide of Field Tests

Standards Subcommittee,
WG – C57.152 Revision
IEEE / PES Transformers Committee

October 17, 2022, 11:00AM – 12:15PM
UNAPPROVED MINUTES

Welcome

The chair of the working group, Marcos Ferreira, and the secretary, Goran Milojevic, opened the meeting at 11:00AM.

1. Attendance and Attendance for Quorum

At the time of the meeting there are 43 Members, including Chair, Vice Chair and Secretary. The secretary counted 30 members as present at the meeting. 112 members and guests signed into the circulating paper roster.

30 members present of 43 mean requirements for quorum was fulfilled. The list of attendees is shown below:

Name	Affiliation	Status
Ferreira, Marcos	Bridgeview LLC	Chair
Milojevic, Goran	DV Power	Secretary
Binder, Wallace	WBBinder Consultant	Member
Bradshaw, Jeremiah	US Bureau of Reclamation	Member
Colopy, Craig	Consultant	Member
Christodoulou, Larry	EPSII	Member
Dorris, Don	Nashville Electric	Member
Dutta Roy, Samragni	Siemens Energy	Member
Foata, Marc	Maschinenfabrik Reinhausen	Member
Gara, Lorne	Shermco	Member
Guner, Ismail	Hydro Quebec	Member
Gustavsson, Niklas	Hitachi Energy	Member
Hayes, Roger	General Electric	Member
Heiden, Kyle	EATON Corporation	Member
Herron, John	Raytech USA	Member
Kraemer, Axel	Maschinenfabrik Reinhausen	Member
Lejay, Olivier	Huaming USA Corp.	Member
Locarno, Mario	Doble Engineering Company	Member
Mabrey, Stephanie	Weidmann	Member
Mayer, Robert	Siemens Energy	Member

Naderian, Ali	Metsco	Member
Parminder, Panesar	Virginia Transformer Corporation	Member
Poorvi, Patel	EPRI	Member
Reed, Scott	MVA	Member
Robalino, Diego	Megger	Member
Saad, Mickel	Hitachi ABB Power Grids	Member
Sweetser, Charles	OMICRON Electronics Corp USA	Member
Tanaka, Troy	Burns & McDonnell	Member
teNyenhuis, Ed	IEEE	Member
Welton, Drew	Intellirent	Member
Al Yousuf, Mohammed	PSEG	Guest
Aikens, Tom	Virginia Transformer Corporation	Guest
Aldenlid, Jennie	Hitachi Energy	Guest
Ansari, Tauhid	Hitachi Energy	Guest
Arnold, Elise	SGB	Guest
Babakrishran, Mani	Virginia Transformer Corporation	Guest
Boettger, William	Boettger Transformer Consulting	Guest
Bolar, Sanket	Oncor Electric	Guest
Chu, Donald		Guest
Craven, Mike	Qualus Corporation	Guest
Cross, James	Kinetrics	Guest
Cryer, Rich	Digitalgrid Inc.	Guest
Debass, Samson	EPRI	Guest
Digby, Scott	Duke Energy	Guest
Dillon, Nikolaus	Dominion Energy	Guest
Duffy, Jesse	Nashville Electric	Guest
Elliott, Will	Crescent Power Systems	Guest
Forsyth, Bruce	Bruce Forsyth and Associates	Guest
Garcia, Eduardo	Siemens Energy	Guest
Glasson, Scott	Siemens Energy	Guest
Gupta, Ravi	Megger	Guest
Gyore, Attila	M&I Materials	Guest
Heinzig, Peter	Weidmann	Guest
Hernandez, Angel	Artechi North	Guest
Hernandez, Giovanni	Virginia Transformer Corporation	Guest
Hernandez Mejia, Jean Charles	Georgia Transformers	Guest
Hoffman, Saramma	PPL	Guest
Johnson, Christopher	Oncor	Guest
Kained, Kurt	Siemens Energy	Guest
Klempner, Dmitriy	Southern California Edison	Guest
Leal, Fernando	Prolec GE	Guest
Lopes Mamede, Gabriel	Siemens Energy	Guest
Martinez, Rogelio	Georgia Transformers	Guest
Matthews, Lee	Howard Industries	Guest
Mbouombaro, Mama	Hitachi Energy	Guest
McCullough, Doug	Maxima	Guest

Melle, Tom	Highvolt	Guest
Miller, Mike	Siemens Energy	Guest
Mills, Francis	Power Engineers	Guest
Murphy, Jerry	RCES	Guest
Mushill, Paul	Ameren	Guest
Naranyo, Volney	Megger	Guest
Nield, Kris	Megger	Guest
Nims, Joe	Allen & Hoshall	Guest
Nunez, Arturo	MISTRAS	Guest
O'Malley, Anastasia	CONED NY	Guest
Patel, Rakesh	Hitachi Energy	Guest
Patel, Sanjay	Royal Smit Transformers	Guest
Pruente, John	Prolec GE	Guest
Radbrandt, Ulf	Hitachi Energy	Guest
Rathi, Rakesh	Virginia Transformer Corporation	Guest
Raymond, Tim	EPRI	Guest
Rehkopf, Sebastian	Maschinenfabrik Reinhausen	Guest
Richardson, Michael	Ameren Corporation	Guest
Rock, Patrick	American Transmission Company	Guest
Sahin, Hakan	Virginia Transformer Corporation	Guest
Schliessl, Markus	SGB	Guest
Schrom, Wes	Carolina Dielectric	Guest
Sextan, Aron	Kinetrics	Guest
Sen, Cihangir	Duke Energy	Guest
Sharifi, Masoud	Siemens	Guest
Sharp, Michael	Trench Ltd.	Guest
Sin, Jin	Jin Sin & Associates	Guest
Sinclair, Jonathan	PPL Electric	Guest
Solano, William	Reinhausen Manufacturing	Guest
Som, Sanjib	Pennsylvania Transformers	Guest
Sparling, Brian	Dynamic Ratings	Guest
Spitzer, Tommy	City Transformer	Guest
Tolcachir, Eduardo	TTE	Guest
Vanderwalt, Alwyn	ECI	Guest
Vedante, Kiran	Ritz Transformers	Guest
Vijayan, Krish	PTI Canada	Guest
Vir, Dharam	Prolec-GE	Guest
Walder, Nick	Eaton Corporation	Guest
Waldrop, Mike	Memphis Light, Gas and Water	Guest
Ward, David	ITEC	Guest
Weisensee, Matt	Pacificorp	Guest
Whitten, Christopher	Hitachi Energy	Guest
Woods, Deanna	Alliant Energy	Guest
Yaw, Nyan The	Hyosung HICO	Guest
Zhang, Shibao	Poore Electric	Guest
Zibert, Kris	AMCE	Guest

2. Approval of the Agenda

The motion to approve the agenda was made by Mario Locarno, and seconded by Jeremiah Bradshaw. The motion was approved.

3. Approval of Minutes of Fall 2021 Meeting

The Minutes of Fall 2021 Meeting were put for approval, since the Spring 2022 meeting lacked quorum to approve them. The motion was made by Robert Mayer, and seconded by Mario Locarno. The motion was approved.

4. Approval of Minutes of Spring 2022 Meeting

The Minutes of Spring 2022 Meeting were put for approval, since the previous meeting lacked quorum to approve them. The motion was made by Robert Mayer, and seconded by Jeremiah Bradshaw. The motion was approved.

5. Call for Patents

The chair presented slide 1-4, dated January 2, 2018 informing of the IEEE patent policy and participants duty to inform. There were no issues related to patent assurance brought up by attendees in the meeting.

6. IEEE Copyright Policy

The chair presented IEEE-SA Copyright Policy slides 1-2 informing the audience of the policy.

7. Chair's Remarks

The chair, Marcos Ferreira, gave the following remarks.

"On the behalf of Chair welcome all members of this working group to take this opportunity during this Fall meeting to finalize three task forces and two annexes by votes, so we can meet the deadline of the PAR without a need for extension.

Thank you."

8. Task Forces Working Progress Report

TF-1: Section 7.2 – Main Tank Volunteers
Charles Sweetser (team leader)

The final work of the Task Force 1 was sent to the working group members and guests in an email dated September 15th, 2022. No comments were received by the WG officers as a response.

Motion to discuss the work of the TF-1 and to vote on the approval was made by Robert Mayer, and seconded by David Murray. The motion was approved. There was no discussion of the work which was shown during the meeting. No objections, unanimously approved.

TF-2: Section 7.3 – Bushings Volunteers
Mario Locarno (team leader)

The final work of the Task Force 2 was sent to the working group members and guests in an email dated September 15th, 2022. No comments were received by the WG officers as a response.

Motion to discuss the work of the TF-2 and to vote on the approval was made by Mario Locarno, and seconded by Robert Mayer. The motion was approved. The team leader, Mario Locarno, briefly explained the formatting issues in the presented work, and suggested that the entire section 7.3 be considered new material due to significant changes in the text compared to the present text. No objections, unanimously approved.

TF-3: Section 7.4 – Tap Changers Volunteers
Marcos Ferreira (team leader)

The final work of the Task Force 3 was sent to the working group members and guests in an email dated September 15th, 2022. No comments were received by the WG officers as a response.

Motion to discuss the work of the TF-3 and to vote on the approval was made by Jeremiah Bradshaw, and seconded by Robert Mayer. The motion was approved. There was no discussion of the work which was shown during the meeting. No objections, unanimously approved.

TF-4: New Annexes: Dynamic Resistance and Vibroacoustic Measurements
Goran Milojevic

The final work of the Task Force 4 was sent to the working group members and guests in an email dated September 15th, 2022. No comments were received by the WG officers as a response.

Motion to discuss the work of the TF-3 and to vote on the approval was made by Drew Welton, and seconded by Mickel Saad. The motion was approved. The team leader, Goran Milojevic, briefly explained the subjects of the two annexes to the guests unfamiliar with the work of the task force. There was no discussion of the work which was shown during the meeting. No objections, unanimously approved.

After the working group ballot on the work of the individual task forces was completed, a motion was made to bring the approved draft of the revisions to the Standards Subcommittee. The motion was made by Jeremiah Bradshaw, and seconded by Diego Robalino. No objections, unanimously approved.

9. New Business

No new business this time.

10. Meeting Adjournment

The meeting was adjourned at 11:40AM

Respectfully submitted,

Marcos Ferreira – Chair

Goran Milojevic – Secretary

L.3.6 WG PC57.163 IEEE Guide for Establishing Power Transformer Capability while under Geomagnetic Disturbances

PC57.163 - WG for the Revision of IEEE Guide for Establishing Power Transformer Capability while under Geomagnetic Disturbances

3:15 PM to 4:30 PM Eastern Time, October 18, 2022 (Charlotte, NC)

Unapproved Meeting Minutes

The WG Chair Dan Blaydon presided over this meeting with both the Vice-Chair, Ramsis Girgis, and Secretary, Scott Digby, in attendance. Meeting attendance numbers as follows:

Total Attendance	83
Members in Attendance	33 (out of 47 members, **quorum achieved**)
Guests in Attendance	50
Guests Requesting Membership	8

Guests Requesting Membership (attendance at 2 out of 3 meetings required to qualify for membership): As during this meeting the document was approved by the Working Group for sponsor ballot, in accordance with clause 4.1 of the WG P&P manual new membership requests are not able to be accepted.

The requisite patent and IEEE-SA copyright policy slides were reviewed, with no items noted. The agenda was reviewed by the Chair and approved by unanimous consent. The minutes from the Spring-2022 meeting had been circulated along with the proposed agenda prior to the meeting. There were no changes to the Spring-2022 meeting minutes requested and they were approved by unanimous consent.
The Chair reviewed the project milestones and status, noting the PAR expiration date of December-2024 and the published document's expiration date of December-2025. The Chair noted that Drafts of the document had been circulated to the WG participants three (3) times since the Spring-22 WG meeting with comments received reviewed and incorporated as appropriate. With each circulation of the document there were fewer and fewer comments, and largely just editorial comments. There had been a tentative plan for a straw ballot of the document, but the general consensus seemed to be that the document has had adequate review at this point. The latest version, Draft -5B, had been transmitted to the WG participants prior to this meeting.
The Chair provided a very high-level review of the comments and changes to the document since the Spring-2022 WG meeting.
There were no old business items to address.
During new business a **Motion** was made by Sanjib Som and **seconded** by Gary Hoffman to approve Draft -5B of the document for sponsor ballot. The vote was unanimous in favor of the motion, meeting the 2/3 supermajority thus the motion carried.
The Chair indicated his intent to make a motion at the SC meeting to approve moving the document to sponsor ballot.
The Chair recognized that the WG Secretary, Scott Digby had represented the WG on two occasions since the Spring-2022 WG meeting, first at a panel session at the IEEE PES General Meeting in Denver, CO and again at a NERC/EPRI workshop at the EPRI offices in Charlotte, NC, to provide a brief presentation on the status of the document and work of the WG.
The Chair noted that the document was planned to be the subject of an IEEE PES Trending Tech bulletin in December-2022. The WG Officers will be working with IEEE toward compiling the content for the bulletin.
At this time a **Motion** was made by Bruce Forsyth and **seconded** by Joe Watson to form a Comment Resolution Group (CRG) with the authority to incorporate changes during the balloting process for subsequent recirculations thru the normal balloting process on behalf of the WG. This motion carried by unanimous consent.
The Chair made the request for those who would like to join the CRG to send him an email indicating so.
The next planned meeting of the WG will be during the Spring-2022 Transformers Committee meetings, scheduled to be held in Milwaukee, WI. The WG Officers will assess the status of the balloting process and to confirm if this planned meeting is necessary.
The meeting adjourned prior to the 4:30 pm end time of the designated meeting time slot.
Respectfully Submitted,
Scott Digby, WG Secretary

Role	First Name	Last Name	Affiliation
Chair	Daniel	Blaydon	Baltimore Gas & Electric
Vice-Chair	Ramsis	Girgis	Hitachi Energy
Secretary	Scott	Digby	Duke Energy
Member	Mats	Bernesjo	Hitachi Energy

Member	William	Boettger	Boettger Transformer Consulting LLC
Member	Hakim	Dulac	Advanced Power Technologies
Member	Bruce	Forsyth	Bruce Forsyth and Associates PLLC
Member	Anthony	Franchitti	PECO Energy Company
Member	Bill	Griesacker	Duquesne Light Co.
Member	Gary	Hoffman	Advanced Power Technologies
Member	Kurt	Kaineder	Siemens Energy
Member	Dmitriy	Klempner	Southern California Edison
Member	Balakrishnan	Mani	Virginia Transformer Corp.
Member	Kumar	Mani	Duke Energy
Member	Rogelio	Martinez	Georgia Transformer
Member	Martin	Munoz Molina	Orto de Mexico
Member	Anastasia	O'Malley	Consolidated Edison Co. of NY
Member	Sanjay	Patel	Smit Transformer
Member	Ion	Radu	Hitachi Energy
Member	Afshin	Rezaei-Zare	York University
Member	Markus	Schiessl	SGB
Member	Eric	Schleismann	Southern Company Services
Member	Sanjib	Som	Pennsylvania Transformer
Member	Marc	Taylor	JFE Shoji Power Canada Inc.
Member	Mark	Tostrud	Dynamic Ratings, Inc.
Member	Jason	Varnell	Doble Engineering Co.
Member	Kiran	Vedante	Ritz Instrument Transformers
Member	Rogerio	Verdolin	Verdolin Solutions Inc.
Member	David	Wallach	Duke Energy
Member	Alan	Washburn	Burns & McDonnell
Member	Joe	Watson	JD Watson and Associates Inc.
Member	Trenton	Williams	Advanced Power Technologies
Member	Waldemar	Ziomek	PTI Transformers
Guest	Kayland	Adams	SPX Transformer Solutions, Inc.
Guest	Thomas	Aikens	Virginia Transformer
Guest	Harry	Andrews	Bicron USA
Guest	Kush	Arora	Reinhausen
Guest	Gilles	Bargone	FISO Technologies Inc.
Guest	Enrique	Betancourt	Prolec GE
Guest	Piotr	Blaszczyk	Specialty Transformer Components
Guest	Juan Alf..	Carrizabi	Prolec GE
Guest	Douglas	Craig	Richards Mfg
Guest	Samson (Sami)	Debass	EPRI
Guest	Joseph	Foldi	Foldi & Associates, Inc.
Guest	Raymond	Frazier	Ameren
Guest	Hector	Garza	Orto deMexico
Guest	JOSE ANTONIO	GONZALEZ	Georgia Transformers
Guest	Jeffrey	Gragert	Xcel Energy
Guest	JAVIER	HERNANDEZ	ORTO DE MEXICO
Guest	Akash	Joshi	Black & Veatch
Guest	Anton	Koshel	Delta Star Inc.
Guest	Andrew	Lawless	POTENCIA PARTNERS
Guest	Gustavo	Leal	Dominion Energy
Guest	JOSE LUIS	MACHAIN	PROLEC GE
Guest	Alberto	Martinez Mares	WEG Transformers USA
Guest	Lee	Matthews	Howard Industries
Guest	Robert	Mayer	Siemens Energy
Guest	Mama	Mbouombouo	Hitachi Energy
Guest	Omar	Mendez Zamora	Prolec GE
Guest	Kent	Miller	T&R Electric Supply Co
Guest	Yaw	Nyanteh	Hyosung HICO
Guest	Tomas	Olsson	Hitachi Energy
Guest	Verena	Pellon	FPL

Guest	Oscar	Pinon	OTC Services
Guest	Ulf	Radbrandt	Hitachi Energy
Guest	William (Tommy)	Salmon	GE Grid Solutions
Guest	Amitabh	Sarkar	Virginia Transformer
Guest	Anil	Sawant	VIRGINIA TRANSFORMER
Guest	Hyeong	Sim	Jin Sim & Associates, PC
Guest	Andre	Simons	JFE Shoji
Guest	Kushal	Singh	ComEd
Guest	Mike	Spurlock	Spurlock Engineering Services
Guest	Fabian	Stacy	Hitachi Energy
Guest	Brad	Staley	Leeward Renewable Energy
Guest	Markus	Stank	Maschinenfabrik Reinhausen GmbH
Guest	Andy	Steineman	Delta Star Inc.
Guest	Cole	Van Dreel	American Transmission Company
Guest	Krishnamurthy	Vijayan	PTI Transformers LP
Guest	Dharam	Vir	Prolec GE Waukesha Inc
Guest	Jeffrey	Wright	Duquesne Light Co.
Guest	Baitun	Yang	R.E. Uptegraff
Guest	Kwasi	Yeboah	GE Grid Solution
Guest	Fang	Zhu	R.E. UPTEGRAFF MFG. CO

L.3.7 IEEE / IEC Continuous Cross Reference

TF did not meet during Fall 22 Transformer Committee.

L.4 Old Business

There was no old business to discuss.

L.5 New Business

Dan Blaydon brought up concern of **reverse power flow** seen in grid and its impact of transformers. Many members agreed that with increasing renewable power generation, concern is relevant and there are many unknown factors that need to be evaluated.

After some discussions, Chair agreed to setup a **Task force to evaluate effect of reverse power flow on transformers and identify which transformer standards/WG are likely to be impacted.** Dan Blaydon volunteered to lead this TF

A Second item was brought up to seeking SC sponsoring for tutorial. The topic will be "Monitoring Legacy Tap changers using PFC chemical Tracers. SC Chair will take the call on it after reviewing tutorial material and discussing with Tom Prevost on available tutorial slots.

L.6 Adjournment

The meeting was adjourned at 5:35 PM CST.

Respectfully submitted,
Ajith M. Varghese
Standards SC Secretary
11/15/2022

Standards SC F22 Attendance List

Role	First Name	Last Name	Company	F22
Chair	Daniel	Sauer	EATON Corporation	X
Vice-Chair	Marcos	Ferreira	Beale AFB	X
Secretary	Ajith	Varghese	Prolec GE Waukesha	X
Guest	Akash	Joshi	Black & Veatch	X
Guest	Alan	Washburn	Burns & McDonnell	X
Guest	Alfons	Schrammel	Siemens Energy	X
Guest	Alwyn	Van Der Walt	Electrical Consultants, Inc.	X
Member	Amitabh	Sarkar	Virginia Transformer Corp.	X
Member	Andrew	Larison	Hitachi ABB Power Grids	X
Guest	Anirudhdhsinh	Jhala	Transformers & Rectifiers (India) Ltd	X
Member	Baitun	Yang	R.E. Uptegraff	x
Member	Bill	Griesacker	Duquesne Light Co.	X
Member	Bruce	Forsyth	Bruce Forsyth and Associates PLLC	X
Member	Bruce	Webb	Knoxville Utilities Board	X
Guest	Carlos	Gaytan	Prolec GE	X
Guest	Charles	Sweetser	OMICRON electronics Corp USA	X
Guest	Christopher	Slattery	FirstEnergy Corp.	X
Member	Cihangir	Sen	Duke Energy	X
Member	Daniel	Blaydon	Baltimore Gas & Electric	X
Chair	Daniel	Sauer	EATON Corporation	X
Guest	Daniel	Posadas	Prolec SA	X
Guest	David	Wallach	Duke Energy	X
Member	Dharam	Vir	ProlecGE Waukesha	X
Guest	Dinesh	Sankarakurup	Duke Energy	X
Guest	Don	Dorris	Nashville Electric Service	X
Member	Drew	Welton	Intellirent	X
Guest	Dwight	Parkinson	EATON Corporation	X
Member	Ed	teNyenhuis	Hitachi ABB Power Grids	X
Member	Eduardo	Garcia Wild	Siemens Energy	X
Member	Egon	Kirchenmayer	Siemens Energy	X
Guest	Emilio	Morales-Cruz	Qualitrol Company LLC	X
Member	Eric	Davis	Burns & McDonnell	X
Member	Gary	Hoffman	Advanced Power Technologies	X
Guest	George	Frimpong	Hitachi Energy	X
Member	Gilles	Bargone	FISO Technologies Inc.	X
Guest	Goran	Milojevic	DV Power	X
Guest	H. Jin	Sim	Jin Sim & Associates, PC	X
Member	Hemchandra	Shertukde	University of Hartford	X
Guest	Mike	Waldrop	Memphis Light, Gas & Water	X
Guest	Ion	Radu	Hitachi ABB Power Grids	X
Guest	Janusz	Szczechowski	Maschinenfabrik Reinhausen	X
Member	Jarrod	Prince	ERMCO	X
Member	Jason	Varnell	Doble Engineering Co.	X
Member	Javier	Arteaga	Hitachi ABB Power Grids	X
Member	Jeffrey	Wright	Duquesne Light Co.	X
Guest	Jeremiah	Bradshaw	Bureau of Reclamation	X
Member	John	Herron	Raytech USA	X
Member	John	John	Virginia Transformer Corp.	X
Member	Jonathan	Sinclair	PPL Electric Utilities	X
Member	Joseph	Tedesco	Hitachi ABB Power Grids	X
Guest	Joshua	Verdell	ERMCO	X
Guest	Joshua	Yun	Virginia Transformer Corporation	X
Member	Juan Carlos	Cruz Valdes	Prolec GE	X
Member	Kris	Zibert	Allgeier, Martin and Associates	X
Guest	Krishnamurthy	Vijayan	PTI Transformers	X
Member	Kristopher	Neild	Megger	X
Guest	Kumar	Mani	Duke Energy	X
Member	Kurt	Kaineder	Siemens Energy	X
Guest	Kyle	Stechschulte	American Electric Power	X

Role	First Name	Last Name	Company	F22
Guest	Malia	Zaman	IEEE	X
Guest	Mark	Tostrud	Dynamic Ratings, Inc.	X
Guest	Matthew	Weisensee	PacifiCorp	X
Guest	Michael	Botti	Hyosung HICO	X
Guest	Moonhee	Lee	Hammond Power Solutions	X
Guest	Nabi	Almeida	Prolec GE	X
Guest	Orlando	Giraldo	H-J Family of Companies	X
Member	Poorvi	Patel	Electric Power Research Institute (EPRI)	X
Member	Ramadan	Issack	American Electric Power	X
Member	Ramsis	Girgis	Hitachi ABB Power Grids	X
Guest	Raymond	Frazier	Ameren	X
Guest	Rhett	Chrysler	ERMCO	X
Guest	Richard	vonGemmingen	Dominion Energy	X
Member	Robert	Ballard	DuPont	X
Guest	Ryan	Musgrove	Oklahoma Gas & Electric	X
Guest	Ryan	Hogg	Bureau of Reclamation	X
Member	Samragni	Dutta Roy	Siemens Energy	X
Member	Sanjib	Som	Pennsylvania Transformer	X
Member	Saramma	Hoffman	PPL Electric Utilities	X
Member	Scott	Digby	Duke Energy	X
Member	Scott	Reed	MVA	X
Member	Sergio	Hernandez Cano	Hammond Power Solutions	X
Member	Steven	Snyder	Hitachi ABB Power Grids	X
Member	Thomas	Dauzat	General Electric	X
Member	Thomas	Prevost	Weidmann Electrical Technology	X
Guest	Tim	Rocque	ProlecGE Waukesha	X
Member	Tim-Felix	Mai	Siemens Energy	X
Guest	Vijay	Tendulkar	Eaton	X
Guest	Vivek	Bhatt	ProlecGE Waukesha	X
Member	Weijun	Li	Braintree Electric Light Dept.	X
Guest	William	Boettger	Boettger Transformer Consulting LLC	X
Guest	William	Whitehead	Siemens Energy	X
Guest	Zachery	Weiss	WEG Transformers USA Inc.	X
Guest	Areeb	Wazir	Eaton	X
Guest	Jean Carlos	Hernandes Mejia	GT-NEETRAC	X
Guest	kayland	Adams	ProlecGE Waukesha	X
Guest	hERMAN	Parrales	ProlecGE Waukesha	X
Guest	Samson	Debass	EPRI	X
Guest	Dmitriy	Klempner	SCE	X
Guest	Abdul Majid	Shaikh	Delta Star Inc.	X
Guest	Mark	Foata	Reinhausen	X
Guest	Michael	Cook	Dominion Energy	X
Guest	Juan Alfredo	Carrizales	Prolec GE	X
Guest	Rich	Frye	Eaton	X
Guest	Fernando	Salinas	Power Partners, Inc.	X
Guest	Alex	ayova	Power Partners, Inc.	X
Guest	Cole	Van Dreel	American Transmission Co	X
Guest	Christoph	Kershenbouar	Seimens Energy	X
Guest	Scott	ThomAS	Hitachi Energy	X
Guest	Mama	Mboyombouo	Hitachi Energy	X
Guest	Dwvier	Bedoya	Hitachi Energy	X
Guest	Christopher	Whitten	Hitachi Energy	X
Guest	Francis	Mills	Power Engineers	X
Guest	Jesse	Duffy	Nashville Electric Service	X