

## ANNEX A Bushings Subcommittee

Denver, Colorado, USA  
March 30<sup>th</sup>, 2022, 09:30AM Mountain

Chair: Eric Weatherbee, Hubbell Power Systems / PCORE Electric  
Vice-Chair (presiding officer): Scott Digby, Duke Energy  
Secretary (Open): Open Role

(SC Member, Cihangir John Sen took notes and assisted in preparation of these minutes)

### A.1 Opening of the Meeting

#### A.1.1 Call to Order / Chairman's Opening Remarks

The SC Chair was not able to attend the Spring 2022 meeting, so the SC Vice Chair presided over the meeting.

The Vice Chair presented and reviewed the proposed agenda that was circulated to the SC members by the Chair prior to the meeting. There were no comments concerning the proposed agenda.

The Vice Chair requested that each person use the microphone, state their name and affiliation when addressing the subcommittee.

The Vice Chair reminded the WG chairs and secretaries that the meeting minutes need to be submitted to the Subcommittee officers no later than 15 days after their WG or TF meetings took place.

The Vice Chair advised that updates and/or documents that need to be posted to the website need to be transmitted to [tc-webmaster@ieee.org](mailto:tc-webmaster@ieee.org). It was noted that the transformer committee webmaster had recently retired so their previous work email is no longer valid.

The Vice Chair noted that some mandatory WG Chair training would be forthcoming. Implementation is expected to be in June-2022, with completion of the training required by December-2022. More information will be shared as it becomes available.

The Bushings SC currently has a vacant Secretary position, the Vice Chair asked that any interested individuals contact the SC Chair or Vice Chair by email or in-person after the meeting.

#### A.1.2 Reminders of IEEE policies

The Vice Chair presented 2 slides which included hyperlinks which details the IEEE SA Copyright Policy. Slides advised those present that by participating in this meeting they agree to comply with the IEEE code of ethics, all applicable laws, and all IEEE policies and procedures, including the IEEE SA Copyright Policy.

#### A.1.3 New Members

It was reported that 6 new members have been accepted into the Subcommittee, each of whom were recognized. These new members are Muhammad Ali Masood Cheema, Juan Carlos Cruz Valdes, Ismail Gruner, Parminder Panesar, Cihangir Sen, and Christopher Whitten.

#### A.1.4 Attendance

Participant rosters were circulated during the meeting for recording the meeting attendance. The Vice Chair presented a list of the 75 current voting members to perform a quorum check. Quorum was unable to be achieved. Per subsequent review of the rosters the meeting had 85 attendees, of which 33 were members and 52 guests, with 11 guests requesting membership. Refer to [Appendix A](#) for meeting participants, their affiliation, and voting member status.

Table 1 – Meeting Attendance

Total	85
Members	33
Guests	52
Guests Requesting Membership*	11

\*Review of the historical attendance records indicate that of the 11 guests requesting membership, 8 meet the eligibility requirements (Mubarak Abbas, Onome Avanoma, Barry Beaster, Evgenii Ermakov, Marco Espindola, Jose Gamboa, Emilio Morales-Cruz, and Diego Robalino) and will be added to the membership roster effective at the next SC meeting.

#### A.1.5 Agenda Approval

As a quorum was not achieved the proposed agenda could not be formally approved. Since there were no comments regarding the proposed agenda the meeting proceeded thru the agenda as proposed.

#### A.1.6 Previous Meeting's Minutes Approval

As a quorum was not achieved the previous meeting minutes could not be approved.

#### A.1.7 Status of Bushing Standards

The Vice Chair presented the Standards Status Report for standards and guides under the Bushing SC, see [Appendix B](#).

### A.2 Working Group and Taskforce reports

#### A.2.1 WG PC57.19.00-2004 – Peter Zhao, Chair; **VACANT, Vice-Chair**; Eric Weatherbee, Secretary

With the WG officers unable to attend and with their being no WG meeting held this week, the SC Vice Chair provided a brief report of the status of this WG based on an update received from the WG Chair. The current Draft is considered complete, after 11 meetings, with a recent unanimous vote (via email) of the WG approving all recent revisions. Draft D2 is posted on the website. The next step is for the WG to vote on approval of Draft D2 to send for Sponsor ballot, which is planned to be executed via email soon. Upon obtaining that approval the WG Chair would then seek approval from SC to send for sponsor ballot, which is also expected to take place via email. The WG Chair has developed a Comment Resolution Group with leads for specific sections of the document: Peter Zhao for Section 1, 2, & 4, Eric Weatherbee for Section 3, Scott Digby for Section 5, Art Del Rio for Section 6, and Shibao Zhang for Section 7.

Par expires at the end of 2022.

#### A.2.2 WG C57.19.01-2017 – Dr. Shibao Zhang, Chair; **VACANT, Vice-Chair**; **VACANT, Secretary**

No meeting held as the latest revision was recently published and is not due for revision again until closer to the document's 2027 expiration date.

#### A.2.3 WG PC57.19.02 Distribution Transformer Bushings – Steven Shull, Chair; Ed Smith, Vice-Chair, Rhett Chrysler, Secretary

See complete WG minutes in [Appendix C](#) of this report.

The WG Chair reported that they were not able to achieve quorum at their meeting. It was reported that the document is currently out for ballot, with a close date of April 4<sup>th</sup>. A Comment Resolution Group (CRG) was formed to manage the ballot comments that are received. Since quorum was not achieved, the WG Chair intends to schedule a virtual meeting to get the Fall-2021 and Spring-2022 minutes approved and to affirm the work of the CRG in support of the resolution and subsequent ballot recirculation process(es). The goal is to have the document submitted to RevCom this fall.

PAR expires at the end of 2022.

**A.2.4 IEC/IEEE 65700-19-03 Bushings for DC Application – Eric Weatherbee (IEEE Interim) and Lars Jonsson (IEC), Co-Chairs; VACANT, Vice-Chair; J. Arturo Del Rio, Secretary**

See complete WG minutes in [Appendix D](#) of this report.

WG Secretary Mr. Del Rio reported that there were 8 attendees at the WG meeting this week, noting that the low attendance could partially be due to another WG meeting scheduled during the same time slot that also deals with the topic of bushings. Joint IEC/IEEE WG virtual meetings had been held on February 15<sup>th</sup> and 16<sup>th</sup>, at which three task forces were formed to address certain areas. Two items of new business were introduced, one concerning how to proceed with updates to section 6 and the other on the need for nameplates for oil type bushings to include PCB content information.

The next joint IEC/IEEE WG meetings are scheduled for May 31<sup>st</sup> and June 1<sup>st</sup>. The WG also plans to meet during the F22 Transformer Committee meeting in Charlotte.

**A.2.5 WG C57.19.04-2018 – Scott Digby, Chair; VACANT, Vice-Chair; Rich vonGemmingen, Secretary**

No meeting held as the latest revision was recently published and is not due for revision again until closer to the document's 2028 expiration date.

**A.2.6 WG PC57.19.100-2012 – Tommy Spitzer, Chair; VACANT, Vice-Chair; VACANT, Secretary**

See complete WG minutes in [Appendix E](#) of this report.

The WG Chair reported that Draft 3 of the document is being re-circulated for comments and that comments received will be discussed at the F22 WG meeting. The existing PAR expires at the end of 2023.

### A.3 External Liaison Reports

**A.3.1 IEC Bushing Standards Activity – Bruno Mansuy, IEEE/IEC Liaison**

Mr. Mansuy was not in attendance but did submit a summary report, which was reviewed. This summary report is included in [Appendix F](#) of this report.

**A.3.2 WG PC57.160 Guide for PD Meas. in Bushings and Inst. Trans. – Thang Hochanh, Chair**

The WG Chair was not in attendance. No report was available during the SC meeting.

**A.3.3 PC57.12.200 Dielectric Frequency Response (DFR) Test for Bushings – TF Entity Ballot Oversight – Poorvi Patel**

Dr. Patel was not in attendance. No report was available during the SC meeting.

**A.3.4 Amendment to IEEE 693, Recommended Practice for the Seismic Design of Substations - Durand Stacy**

Mr. Stacy was not in attendance. SC Chair Eric Weatherbee had prepared a report in the form of a series of slides with audio voice-over, which was played during the meeting. The report slides are included in [Appendix G](#) of this report.

### A.4 Unfinished Business

**A.4.1 Venting/PD in OIP Bushings during FAT**

The VC advised that the topic concerning the practice of venting OIP bushings during transformer FAT in response PD activity is still active. The discussion currently resides under the Dielectric Test SC.

The Bushing SC Chair has been in discussions with the Dielectric Test SC Chair as next steps have been reviewed and will continue to monitor the status of the item.

**A.5 New Business**

**A.6 Adjournment**

**A.7 Next Meeting: Fall 2022, Charlotte, North Carolina - October 16 – 20, 2022**

First Name	Last Name	Affiliation	Role
William	Boettger	Boettger Transformer Consulting LLC	Member
David	Calitz	Siemens Energy	Member
Juan	Castellanos	Prolec GE	Member
Arup	Chakraborty	Delta Star Inc.	Member
Juan Carlos	Cruz Valdes	Prolec GE	Member
J. Arturo	Del Rio	Siemens Energy	Member
Scott	Digby	Duke Energy	Vice-Chair
Huan	Dinh	Hitachi Energy	Member
Eric	Euvrard	RHM International	Member
Hugo	Flores	Hitachi Energy	Member
Eduardo	Garcia Wild	Siemens Energy	Member
Niklas	Gustavsson	Hitachi Energy	Member
Kurt	Kaineder	Siemens Energy	Member
Egon	Kirchenmayer	Siemens Energy	Member
Marek	Kornowski	Polycast International	Member
Axel	Kraemer	Maschinenfabrik Reinhausen	Member
Kumar	Mani	Duke Energy	Member
Robert	Middleton	RHM International	Member
Poorvi	Patel	Electric Power Research Institute (EPRI)	Member
Ulf	Radbrandt	Hitachi Energy	Member
Scott	Reed	MVA	Member
Amitabh	Sarkar	Virginia Transformer Corp.	Member
Steven	Schappell	SPX Transformer Solutions, Inc.	Member
Ewald	Schweiger	Siemens Energy	Member
Cihangir John	Sen	Duke Energy	Member
Stephen	Shull	BBC Electrical Services, Inc.	Member
Sanjib	Som	Pennsylvania Transformer	Member
Thomas	Spitzer	City Transformer Service Co.	Member
Brad	Staley	Salt River Project	Member
Troy	Tanaka	Burns & McDonnell	Member
Alwyn	Van Der Walt	Electrical Consultants, Inc.	Member
Ajith	Varghese	SPX Transformer Solutions, Inc.	Member
David	Wallach	Duke Energy	Member
Mubarak	Abbas	Siemens Energy	Guest
Stephen	Antosz	Stephen Antosz & Associates, Inc	Guest
Elise	Arnold	SGB	Guest
Onome	Avanoma	MJ Consulting	Guest
Barry	Beaster	H-J Family of Companies	Guest
Jeremiah	Bradshaw	Bureau of Reclamation	Guest
Juan Alfredo	Carrizales	Prolec GE	Guest
Larry	Christodoulou	Electric Power Systems	Guest
Evgenii	Ermakov	Hitachi Energy	Guest

**Annex A, Appendix A**

Marco	Espindola	Hitachi Energy	Guest
Jose	Gamboa	H-J Family of Companies	Guest
Orlando	Giraldo	H-J Family of Companies	Guest
Shamaun	Hakim	WEG Transformers USA Inc.	Guest
Derek	Hollrah	Burns & McDonnell	Guest
Nicholas	Jensen	Delta Star Inc.	Guest
Stephen	Jordan	Tennessee Valley Authority	Guest
Akash	Joshi	Black & Veatch	Guest
Jerzy	Kazmierczak	Hitachi Energy	Guest
Emilio	Morales-Cruz	Qualitrol Company LLC	Guest
Ryan	Musgrove	Oklahoma Gas & Electric	Guest
Brady	Nesvold	Xcel Energy	Guest
Nitesh	Patel	Hyundai Power Transformers USA	Guest
Adnan	Rashid	Measurement Canada / ISED	Guest
Diego	Robalino	Megger	Guest
Zoltan	Roman	GE Grid Solutions	Guest
Hakan	Sahin	Virginia/Georgia Transformer	Guest
Markus	Schiessl	SGB	Guest
Alfons	Schrammel	Siemens Energy	Guest
Jonathan	Sinclair	PPL Electric Utilities	Guest
Brian	Sparling	Dynamic Ratings, Inc.	Guest
Kyle	Stechschulte	American Electric Power	Guest
Hampton	Steele	Tennessee Valley Authority	Guest
Andrew	Steineman	Delta Star Inc.	Guest
Charles	Sweetser	OMICRON electronics Corp USA	Guest
Mark	Tostrud	Dynamic Ratings, Inc.	Guest
Deniss	Villagran	GE Grid Solutions	Guest
Benjamin	Riggins	Xcel Energy	Guest
David	Burke	Xcel Energy	Guest
Mama	Mbouombouo	Hitachi Energy	Guest
Anthony	McGrail	Doble	Guest
Robert	Vantol	Commonwealth Assoc.	Guest
Erick	Sato	Siemens Energy	Guest
Daniel	Posadas	Prolec St de CV	Guest
Olivia	Cordova	Bureau of Recl.	Guest
Samson (Sami)	Debass	EPRI	Guest
Alex	Alahmed	Evergy - Wolf Creek	Guest
Jean-Nobel	Berube	Rugged Monitoring	Guest
Jennie	Aldenlid	Hitachi Energy	Guest
Alexander	Doutrelepont	Siemens Energy	Guest
Jonathan	Deverick	Dominion Energy	Guest
Phil	Swan	Resa Power	Guest
Sanjay	Patel	SGB SMIT	Guest

Standard Project	Title	WG Chair	Pub Year Rev. Due Date	PAR Issue Par Expiration	Comments
<a href="#">PC57.19.00</a>	IEEE Standard General Requirements and Test Procedure for Power Apparatus Bushings	P. Zhao	2004 12/2020	2018 12/2022	WG Draft Development Considered not active but is still available
C57.19.01	IEEE Standard Performance Characteristics and Dimensions for Outdoor Apparatus Bushings	S. Zhang	2017 12/2027		1st review meeting was held during S21 meeting. Evaluate again in ~2 years
<a href="#">PC57.19.02</a>	Standard for the Design and Performance Requirements of Bushings Applied to Liquid Immersed Distribution Transformers	S. Shull	New	2016 12/2022	WG Draft Development
<a href="#">P65700-19-03</a>	IEC/IEEE International Standard -- Bushings for DC application	Interim Eric Weatherbee	2014 12/2024	2021 12/2025	WG Draft Development
C57.19.04	Standard Performance Characteristics and Dimensions for High Current Power Transformer Bushings with Rated Continuous Current in Excess of 5000 A in Bus Enclosures	S. Digby	2018 12/2028		
<a href="#">PC57.19.100</a>	IEEE Guide for Application of Power Apparatus Bushings	T. Spitzer	2012 12/2022	2019 12/2023	WG Draft Development

## Distribution Transformer Subcommittee Task force / Working Group Report

Document #: PC57.19.02

Document Title: Standard for Design and Performance Requirements for Bushings Applied to Liquid Immersed Distribution Transformers

Chair: Steve Shull Vice-Chair: Ed Smith

Secretary: Rhett Chrysler Percent Complete: 90

Current Draft Being Worked On: D2.1 Dated: March 2022

Meeting Date: March 29, 2022 Time: 11:00 am – 12:15 pm

### Attendance:

NAME	Affiliation	M or G
Alan Wilks	Consultant	M
Albert Sanchez	Knoxville Utilities Board	G
Alex Alahmed	Evergy - Wolf Creek	G
Alex Doutrepeont	Siemens Energy	G
Ali Ghafourian	H-J Enterprises, Inc.	M
Angela Leigl	EATON Corporation	G
Barry Beaster	H-J Family of Companies	M
Christopher Witten	Hitachi Energy	G
Clemens Reiss IV	Custom Materials, Inc.	M
Craig DeRouen	ERMCO	M
Daniel Posados	Prolec SA de CV	G
Daniel Sauer	EATON Corporation	M
Darren Brown	Howard Industries	M
Gary King	Howard Industries	G
Hugo Flores	Hitachi Energy	M
James Spaulding	Fort Collins Utilities	M
Jared Bates	Oncor Electric Delivery	G
Jeffrey Door	H-J Family of Companies	G
Jennie Aldenlid	Hitachi Energy	G
Jonathan Deverick	Dominion Energy	G
Jose Gamboa	H-J Family of Companies	M
Joshua Verdell	ERMCO	M
Kendrick Hamilton	Power Partners, Inc.	M
Kyle Heiden	EATON Corporation	M

NAME	Affiliation	M or G
Lee Matthews	Howard Industries	G
Marek Kornowski	Polycast International	M
Michael Dahlke	Central Moloney, Inc.	M
Michael Hardin	H-J Enterprises, Inc.	M
Michael Morgan	Duke Energy	M
Mubarak Abbas	Siemens Energy	G
James Spaulding	Fort Collins Utilities	M
Stephen Shull	BBC Electrical Services, Inc.	CHR
Pam Edwards	Art Advertising, Inc.	G
Paminder Panesar	Virginia Transformer Corp.	G*
Ramadan Issack	American Electric Power	M
Reinaldo Valentin	Duke Energy	M
Rhett Chrysler	ERMCO	SEC
Rich Frye	Eaton	G
Robert Reepe	Georgia Power Co.	M*
Scott Digby	Duke Energy	G
Shelby Walters	Howard Industries	M
Som Sanjib	Pennsylvania Transformers	G
Stefan Schindler	Maschinenfabrik Reinhausen	G
Timothy Tillery	Howard Industries	M
Troy Tanaka	Burns & McDonnell	G
Weijun Li	Braintree Electric Light Dept.	M



## Distribution Transformer Subcommittee Working Group Report

### Meeting Minutes:

The chair called the meeting to order at 11:00 am.

Attendance is included in table above

- 47 total
- 25 members
- 22 guests
  - \*2 guests requested membership; requests were rejected to due document being in ballot status

Quorum was not established, 25/59 (42%) members participating.

The chair presented the agenda. The agenda could not be approved by the working group since quorum was not established.

The chair presented the minutes from the Fall 2022 meeting. The minutes could not be approved by the working group since quorum was not established.

The chair presented the IEEE SA slides for Essential Patent Claims.

The chair provided an opportunity for participants to identify patent claim(s)/patent application claim(s) and/or the holder of patent claim(s)/patent application claim(s) of which the participant is personally aware and that may be essential for the use of that standard. None were identified.

The chair presented the IEEE SA Copyright Policy.

### **Old Business**

Review status of the Ballot

- The Ballot is still in process and closes on April 02, 2022
- To date, 278 comments have been formally submitted, additional comments were submitted via an attached file resulting in 290 comments to date
  - 218 editorial
  - 15 general
  - 57 technical
- Of the 290 submitted comments, 225 were marked as much be satisfied

### **New Business**

Comment Resolution Group

The chair asked for 4 volunteers to form a ballot comment resolution group. Steve Shull, Rhett Chrysler, Barry Beaster, and James Spaulding volunteered to be members of the comment resolution group.

The chair will submit an email ballot to ask the working group members to give the comment resolution group the permission and authority to provide final resolution of all comments so that the working group can proceed to a recirculation ballot as soon as the group's work is completed. Any comments that the comment resolution group cannot address with a consensus will be brought back to the working group for resolution.

Barry Beaster expounded on his ballot comments regarding max current interrupt ratings to the working group by referencing IEC 60137 100 kA requirements vs. IEEE C57.12.00 63 kA (Distribution) and 80 kA (Power) requirements.

The chair clarified that any suggested additions that are not resolved via the comment resolution group would be considered for the next PAR cycle.

No other new business was brought forward.

Meeting was adjourned at 11:30 am.

Next meeting is scheduled for the Fall 2022 Transformer Committee meeting in Charlotte, NC.

Submitted by: Rhett Chrysler

Date: 03/29/2022

Page 2 of 2

## **IEC/IEEE 65700\_19\_03 DC Bushings WG**

Minutes of 2022 Spring Meeting  
Tuesday, March 29<sup>th</sup>, 2022- 4:45 – 6:00 PM  
Hyatt Regency – Denver, CO – Centennial D-E

Eric Weatherbee - Chair  
Vacant – Vice Chair  
J. Arturo Del Rio – Secretary

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### **Acting WG Meeting Chair: J. Arturo Del Rio**

The WG met on Tuesday, March 29<sup>th</sup>, 2022 at 4:45 pm.; with 8 participants.

#### **1. Welcoming and Call for Patents, Copyrights**

- The meeting was called to order at 4:45 PM by the Chair.
- The call for potentially essential patents and copyrights issues was made. None were reported.

#### **2. Quorum**

- 4 Members of the 10 WG Members were present therefore quorum was not met. Agenda and previous meeting minutes could not be approved.
- 3 active participants of the Joint Team (JMT) were attending the meeting
- The Chair requested participation from utility and user representatives

#### **3. Update on Join Team activity**

The first joint meetings (JMT) were held by teleconference on February 15 and 16, 2022, from 1:00pm to 3:00 pm (Central European Time).

**3.1.** Established three Task Forces (TF) to address subjects, requiring expertise in the respective area.

**a.** TF1 to review and suggest updates in case Voltage Source Converters (VSC) are included in the standard.

**b.** TF2 to review and suggest updates to the altitude corrections and pollution parameters.

**c.** TF3 to review and suggest updates to the special tests section, regarding even and uneven wetting.

**3.2.** Sections and parts of the document were highlighted red, yellow, or green according to importance, accordingly:

- a. Review and propose updates to Category Green, referring to the compilation of comments and setting up the structure for a Committee Draft (CD).
- b. Review and propose updates to the complete section 6 in IEC/IEEE 65700-19-03 since the purpose is unclear.
- c. A review of the yellow-marked sections in the compilation of comments started and comments from the delegates.

#### **4. New business:**

##### **4.1 How to proceed with section 6 General requirements?**

This part seems to be a legacy from an older IEEE DC bushing version and is not 100% aligned with C57.19.00.

In all new standards like C57.19.01 (see below) or C57.19.03 the part of General requirements is only referencing to the main standard

#### **3. General requirements**

Refer to IEEE Std C57.19.00 for general requirements, definitions, and methods of measurements or tests applying to detailed requirements given in [Clause 4](#).

It was mentioned the necessity of updating or deleting this section in the next revision of the standard. The question was the IEEE view on that?

In other joint standards a reference to both standard families were included. So, we can handle it in a similar way and reference to IEEE C57.19.00 and to IEC 60137 (Chapter 6: Ordering information and markings - which is more detailed).

Alternatively, an update to the existing C57.19.00 or IEC 60137 could be proposed.

**4.2** Meetings for other Joint standard development held the working group meeting partly as in person before or after IEEE Fall / Spring meetings, which brought an efficient collaboration. We can propose an in person Joint Team WG meeting before or after the Fall 2022 meeting in Charlotte.

**4.3** Nameplate markings for OIL type bushings should state PCB contents.

Meeting was adjourned at 5:15pm

#### **Next JMT JOINT Meeting**

To be held by Zoom teleconference service on two consecutive days.

Tuesday 31st of May 2022 from 13:00 to 15 00 (Central European Time).  
 Wednesday 1st of June 2022 from 13:00 to 15 00 (Central European Time).

**Next WG Meeting**

F22 - Charlotte, NC. October 16<sup>th</sup> – 20<sup>th</sup>, 2022

Respectfully submitted,  
 Secretary: Art Del Rio (a.delrio@ieee.org)

Attendance and status:

Last name	Name	Affiliation	Status
Cruz Valdes	Juan Carlos	Prolec GE	Member
Sen	Cihangir (John)	Duke Energy	Guest
Pointer	Klaus	Trench Austria	Guest
Kaineder	Kurt	Siemens Energy	Member
Euvarad	Eric	RHM International	Guest
Gazivoda	Dora	Konkar Inst. Transf.	Guest
Radbrandt	Ulf	Hitachi Energy	Member
Del Rio	Art	Siemens Energy	Secretary

C57.19.100 Unapproved Minutes Spring 2022, Denver Co.

We met on Monday March 28 at 3:15 PM. I called the meeting to order and did a roll call which resulted in having 5 members present so we did not have a quorum to proceed. Durand Stacy has agreed and gotten permission to serve as Secretary but was unable to be at this meeting. We had a total attendance of 30 with 5 members and 25 guests.

I had sent draft 3 out before the meeting but due to the attendance I will resend it and ask for an email vote on our progress. We had an open discussion about composite bushings and Art Del Rio, Johnathan Deverick, Alexander Doutrelepont, Eric Euvard, and Dominic Pollaro volunteered to send me information to be included in Draft 4.

Attendance:

Mubarack Abbas – Siemens Energy - Guest  
Barry Beaster - H-J Family of Companies – Guest  
Randy Branneb – Southern Company - Guest  
Samson Debass – EPRI – Guest  
Juan Carlos Cruz Valdes – Prolec GE - Guest  
Art Del Rio – Siemens Energy – Member  
Johnathan Deverck – Dominion Energy = Guest  
Scott Digby – Duke Energy – Member  
Huen Dihn – Hitachi Energy - Guest  
Larry Dix – Quality Switch – Guest  
Paul Dolloff – East Kentucky Power – Guest  
Jeffery Door – H-J Family of Companies - Guest  
Alex Doutrelepont – Siemens Energy - Guest  
Kurt Kaineder – Siemens Energy – Guest  
Egon Kirchenmayer – Siemens Energy – Member  
Chao Li – Eaton - Guest  
Mavek Kornoloski – Polycast – Guest  
Tom Matsen – Xcel Energy - Guest  
Robert Middleton – RHM International – Member  
Tihomir Pandza – Siemens Energy – Guest  
Goran Plisic – Siemens Eneergy - Guest  
Dominic Polarro – NASS – Guest  
Daniel Posadas – Prolec - Guest  
Clemens Reiss IV – Custom Materials – Guest  
Seremi Sewell – Quality Switch – Guest  
Russ Sewell – Quality Switch - Guest  
Tommy Spitzer – City Transformer - Chair  
Troy Tanaka – Burns & McDonald – Guest  
Malia Zaman – IEEE - Guest

We adjourned at 3:45

Tommy Spitzer P.E.

Chair

April 10, 2022

## SPRING 2022 MEETING OF IEEE TRANSFORMER BUSHINGS

**Location: DENVER**

**Date: March 27-31, 2022**

### BUSHINGS SUBCOMMITTEE WORKING GROUP AND TASK FORCE MEETINGS



Liaison Reports - IEC Bushing Standardization Activities

#### INTERNATIONAL ELECTROTECHNICAL COMMISSION TECHNICAL COMMITTEE No.36A: Insulated Bushing

<b>SC 36A Bushing dimensional standardization</b>	<p>A draft report has been finalized summarizing the possible standardization of LV (&lt; 1 kV) , MV (1 to 52 kV) and HV (72.5 to 500 kV) transformer bushings.</p> <p>It is covering OIP, RIP and RIS technology.</p> <p>A Preliminary Work Item (PWI 36A-1) has been opened: monthly meetings are planned in 2022 to issue a technical report.</p> <p>The document will be split in two parts: LV and MV, HV.</p>
<b>Guide of application for power apparatus bushings</b>	<p>A Preliminary Work Item (PWI 36A-2) has been opened.</p> <p>Meetings are on going.</p>
<b>Maintenance Team for revision of IEC 62199 Bushings for DC application</b>	<p>Revision of the standard IEC 62199 ed 1 on a dual logo procedure with IEC/IEEE, with a particular attention to keep the cross references to other IEC documents.</p> <p>The establishment of the JMT 9 DLMT (HVDC Bushings) in collaboration with IEEE has been approved, eight experts have been nominated by their NC.</p> <p>Mr Lars Jonsson (SE) has been approved as the convenor.</p>
<b>Maintenance Team for revision of IEC 60137 Bushings above 1kV.</b>	<p>Revision of the standard IEC 60137 with review of the contents and extension of tables to cover the new UHV voltage classes according to IEC60071-1</p> <p>Workplan to be defined</p>



model was found not to match the actual transformer system.

- The current amendment does not require a modeling guide nor model verification.

3



- Lack of a model verification requirement
  - Currently model verification is included as informative only. Suggesting it can be done to improve the techniques of modeling the transformer system but is not a requirement

4

### IEEE 693 Liaison Report



- IEEE Std 693™, IEEE Recommended Practice for Seismic Design of Substations.
  - Current version published 2018.
  - Amendment PAR was granted in 2020 to modify time-history and require dynamic modeling of the transformer and the specific bushing to be used.
- F21 Technical Presentation was given by Jon Bender. The amendment did not address replacement bushings.

1

### IEEE Std 693™



- Durand Stacy and Jon Bender established some additional modeling analysis that will be done to determine the impact of varying stiffness on the transformer system.
- Coupled with weight change restrictions and moment demands determined during the modeling, this may allow for some bushing replacement options that fall within specific ranges. This did take considerable effort by WG to include in the document.

2

### Area of Concern



- The 2018 WG voted against the dynamic modeling requirement.
- Some issues discussed in 2018 WG:
  - Lack of a modeling guide for consistency
  - Model verification, difficulties that may arise if the model was found not to match the actual transformer system.
- The current amendment does not require a modeling guide nor model verification.

3

### Area of Concern (cont.)

- Discussions during the WG meeting has included the lack of transformer features in some models that would impact the results as well as the modeling methodology used.
  - A modeling guide may help with consistency
- Lack of a model verification requirement
  - Currently model verification is included as informative only. Suggesting it can be done to improve the techniques of modeling the transformer system but is not a requirement

4

### Areas of Concern (cont.)

- Lack of model verification (cont.)
  - Without verification how can it be known if this is an improvement or detriment vs 2018 version.
  - Can a future failure analysis be completed if the transformer system does not perform as expected.
  - The verification process could be considered as an informational data for improving future models and not for acceptance or qualification criteria.



5

### Areas of Concern (cont.)

- Lack of model verification (cont.)
  - A minimum verification of the bushing installed frequency is suggested to take 10 min. Specific instruction on how to perform this test can be included in the Guide.
  - The verification requirement of the model can be eliminated in future revision if deemed appropriate.



6

### 693 Amendment

- Current timeline is to seek 2/3 majority vote of the WG this May and then proceed to requesting Substation Subcommittee approval to go to ballot.
- Could use more diversity as far as additional Transformer/Bushing OEMS and End Users
- Contact the WG Chair or Secretary
  - Michael Riley [mjiriley@bpa.gov](mailto:mjiriley@bpa.gov)
  - Brian Low [brian.low@pge.com](mailto:brian.low@pge.com)



7