ANNEX A Bushings Subcommittee

Denver Colorado USA
March 30, 2025, 09:30 AM

Chair:	Scott Digby, Duke Energy
Secretary:	Fabian (Durand) Stacy, Hitachi Energy

A.1 Opening of the Meeting

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

Attendees were informed that the meeting would be audio recorded for the purpose of creating meeting minutes with the intent to delete this recording once the minutes were approved.

The Chair covered the scope of the bushing Subcommittee by reading the scope from the transformer committee operation procedures manual 2016.

The Chair requested that each person use the microphone and to state their name and affiliation when addressing the Subcommittee.

The Chair reminded the WG chairs and secretaries that their meeting minutes need to be submitted to the Subcommittee officers no later than 15 days after their WG or TF meetings took place in this case they shall be submitted by April 10th, 2025 and the Subcommittee is to have its meeting minutes submitted by May 8th, 2025. Section 6.4 of the PandP manual covers what must be in these minutes.

The Chair discussed the membership management system and the remaining need to use a paper roster for attendance until we have an updated system.

A.1.2 New Members

It was reported that 4 new members have been accepted into the Subcommittee. (Edwin Betancourt, Junho Lee, Markus Schiessl, and Fei Yang).

A.1.3 Attendance

Participant rosters were circulated during the meeting to record the meeting attendance. The Chair presented a list of the 79 current voting members to perform a quorum check. A quorum was achieved. Per subsequent review of the rosters, the meeting had 132 attendees, of which 56 were members and 76 guests, with 8 guests requesting membership. Refer to Appendix A for meeting participants, their affiliation, and voting member status.

Table 1 – Meeting Attendance

Total	132
Members – **Quorum Achieved**	56
Guests	76
Guests Requesting membership*	8

*A review of the historical attendance records indicates that of the 8 guests requesting membership, 1 meet the eligibility requirements (Robert L Allison) and will be added to the membership roster effective at the next SC meeting.

A.1.4 Agenda Approval

As 56 of the 79 members were in attendance, a quorum was achieved. There were no comments on the proposed agenda. A motion was made by Sebastien Riopel Electro Composites ULC and seconded

by Samson (Sami) Debass EPRI to approve the agenda as proposed. This motion was carried by unanimous consent.

A.1.5 Previous Meeting's Minutes Approval

There were no comments on the minutes that had been posted. A motion was made by David Wallach, Duke Energy, and seconded by Samson (Sami) Debass EPRI to approve the minutes as posted. This motion was carried by unanimous consent.

A.2 Working Group and Taskforce reports

A.2.1 IEC/IEEE 65700-19-03 Bushings for DC Application – Eric Weatherbee (IEEE) and Lars Jonsson (IEC), Co-Chairs; Sami Debass, Vice-Chair; J. Arturo Del Rio, Secretary

See the complete WG minutes in Appendix C of this report.

The WG Chair reported that this was approved unanimously last November, and IEC just completed their process with 100% approval. It was determined that this could be sent directly to Revcom without additional action being taken.

A.2.2 WG C57.19.00-2023 – Peter Zhao, Chair; VACANT, Vice-Chair; Eric Weatherbee, Secretary

No meeting was held due to the publication of the new revision of the standard last year.

A.2.3 WG C57.19.02 Distribution Transformer Bushings – Steven Shull, Chair; Ed Smith, Vice-Chair, Rhett Chrysler, Secretary

No Meeting due to the status of the publication

A.2.4 WG PC57.19.01 – Dr. Shibao Zhang, Chair; VACANT, Vice-Chair; Dominic Pollaro, Secretary

See the complete WG minutes in Appendix C of this report

- Discussed Nominal System Voltages vs MAX Line to Ground Voltages for 115 kV & 138 kV discussion
- Discussed RIS bushing C1 power factor & % change limits
- Discussed "P" & "Q" dimensions on 46 kV 5000 amp in the standard does not provide enough sealing surface for gasket or O-ring and will be requesting information from bushing manufacturers on their stand practices for these bushings.

A.2.5 WG C57.19.02 Distribution Transformer Bushings – Steven Shull, Chair; Ed Smith, Vice-Chair, Rhett Chrysler, Secretary

No meeting due to the status of the publication.

A.2.6 WG C57.19.04-2018 – Scott Digby, Chair; Rich vonGemmingen, Vice-Chair; Anthony Natale , Secretary

See the complete WG minutes in Appendix D of this report.

The WG reviewed the comments that were generated from the circulated draft D1 of the document. Two comments were editorial, and the rest of the meeting was used to review the remaining comments.

A.2.7 WG PC57.19.100-2012 – Tommy Spitzer, Chair; VACANT, Vice-Chair; Fabian (Durand) Stacy, Secretary

See complete WG minutes in Appendix E of this report.

The WG is working through the balloting process with 92% approval and 153 comments, most of which are editorial, and remains on track to complete before the PAR expiration at the end of the year.

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A.3 External Liaison Reports

A.3.1 IEC Bushing Standards Activity – Kurt Kaineder, IEEE/IEC Liaison

See the complete report in Appendix F of this report.

Some of the key information included the following: 1) DC bushing standard is on track to be published in early 2025, 2) Tap adapter standardization for 550kV and above, IEEE will review their results as a similar subject is being addressed in 19.01. The approval was given to move forward, and work will start in March 2025. 2) Dimensional Standardization Part 1 will involve MV bushings only and is currently being considered as a non-mandatory specification but may become a standard/mandatory in the future. 3) The seismic standard will be reviewed with a call for experts. 4) The MT5 also has a call for experts.

A.3.2 Amendment to IEEE 693, Recommended Practice for the Seismic Design of Substations - Durand Stacy

Reported that the amendment was passed and is now published. The WG for IEEE 693 is in the process of PAR creation for the new revision, and the next meeting will be a Hybrid meeting in New Orleans, LA, on May 14th, 2025, and encourages all interested parties to attend.

A.4 Unfinished Business

Testing methods regarding determining if a bushing is prone to PD during FAT: Egon Kirchenmayer, Siemens Energy, stated that their company is still underway with its experimentation, with an expected completion date of sometime this summer. With that in mind, we will keep this on the radar.

A.5 New Business

1. Shibao Zhang, PCORE Electric, brought forth his belief that the bushing sub-committee should make its own standard for bushing seismic tests due to the IEEE 693 document growing to about 800 pages and stated the view that it had drifted from the original method for bushing qualification. He stated he has seen it change from the document providing certainty for the industry to uncertainty. "In the past, we had criteria where with high voltage bushing would be shake-table tested, and the low voltage bushing we would be tested with static pull testing, and there were clearly defined test methods with a clearly defined pass or fail criteria for these tests." He stated that it is clear to him that the bushings that passed these criteria are not failing in the field, and he believes that this is an indication that, in reality, these test methods are good. With the new amendment, it is his belief that everything has changed with the introduction of the requirement for modeling the bushing transformer system using unverified models. The new amendment requires dynamic analysis

of the bushing transformer system, and there is a need to redo this analysis every time a bushing is exchanged if it is not an exact duplicate of the bushing being replaced, and this will result in reduced interchangeability.

A suggestion was made to form a task force to consider the IEC seismic standard in this review.

Support was given to the creation of the task force by members and visitors attending the bushing subcommittee meeting for a simplified document that the bushing committee could maintain.

Shibao Zhang PCORE Electric made a motion to:

"To create a task force to check the feasibility of making the bushing seismic standard, potentially associated with IEC seismic standard, to determine what is required to create a harmonized standard for bushing qualification, and the deliverable from this task force is to report back to the bushing sub-committee with a recommendation on how to proceed based on the gathered information."

The motion was seconded by Sanjib Som of Pennsylvania Transformer

The motion carried with no opposition.

The Chair stated he would follow up with his appointment for the person to lead this task force.

2. Peter Zhao from Hydro One commented on the need to add new technologies to the standards to describe the differences between the legacy technologies, OIP, etc., compared to the dry-type bushings. Discussion were then had that these new technologies are being incorporated into the standard when they are being updated today. The Chair asked for examples of things not being considered today while pointing to C57.19.01 meeting minutes, where a table was being updated to include the dry offerings. This discussion did not result in a proposal. Peter ended the conversation by mentioning that younger engineers should be more active in creating standards.

A.6 Adjournment

A.7 Next Meeting: Fall 2025, BONITA SPRINGS, FLORIDA, USA OCTOBER 19 – 23.

Last Name	First Name	Role	Company
Abbas	Mubarak	M	Siemens Energy
Adams	Kayland	M	Prolec-GE Waukesha
Alexander	Anthony	G	Hitachi Energy
Allison	Robert	G	Dominion Energy
Alonso	Mario	G	Georgia Transformer
Antosz	Stephen	G	Stephen Antosz & Associates, Inc
Ashwini	Labh	G	Hitachi Energy
Avanoma	Onome	M	MJ Consulting
Beaudoin	Jason	G	Weidmann Electrical Technology
Bhardwaj	naveen	G	Trench Group
Boettger	William	M	Boettger Transformer Consulting LLC
Bradshaw	Jeremiah	G	Bureau of Reclamation
Calitz	David	M	Siemens Energy
Castellanos	Juan	M	Prolec GE
Cruz Valdes	Juan Carlos	M	Prolec GE
Debass	Samson (Sami)	M	EPRI
Del Rio	J. Arturo	M	HSP-US LLC
Delgado	Gabriel	M	Invenergy
Digby	Scott	M	Duke Energy
Duffy	Jesse	G	Nashville Electric Service
Elson	Eric	G	SDGE
Ermakov	Evgenii	M	Hitachi Energy
Euvrard	Eric	M	RHM International
Frazier	Raymond	M	Ameren
Gagnon	Jean-Philippe	G	Qualitrol
Gamboa	Jose	M	H-J Family of Companies
Garcia Wild	Eduardo	M	Siemens Energy
Giraldo	Orlando	G	H-J Family of Companies
Goglia	Slaven	G	Koncar Power Transformers
Griesacker	Bill	M	W. Griesacker & Associates Inc.
Gustavsson	Niklas	M	Hitachi Energy
Hampton	Kevin	G	Siemens Energy
Hayes	Roger	M	GE Verona
Hermann	Florian	G	Trench France
Hernandez	Ronald	M	Doble Engineering Co.
Hollrah	Derek	M	Burns & McDonnell
Hossain	Saif	G	Trench Limited
Jarosz	Patrycja	G	IEEE SA
Jeong	Chanmin	G	HD Hyundai
Johnson	Reeve	G	Hitachi Energy
Kadar	Laszlo	G	Laszlo & Associates
Kaineder	Kurt	M	Trench Austria

Kasonga	Mick	G	oncor
Kirchenmayer	Egon	M	Siemens Energy
LaBean	Bernard	G	Consumers Energy
Lakkaraju	Sai	G	Xcel Energy
Loiselle	Luc	G	Tetra Tech
Machain	Jose Luis	M	Prolec-GE
Mani	Kumar	M	Duke Energy
Manzano	Moses	G	Hyosung HICO
Martinez Mares	Alberto	G	WEG Transformers USA
Matson	Tomas	G	Xcel Energy
Middleton	Robert	M	RHM International
Millard	Zachary	G	Great River Energy
Mills	Francis	M	POWER Engineers Inc.
Munoz	Marta	G	Hitachi Energy
Murray	David	G	Tennessee Valley Authority
Musgrove	Ryan	G	Oklahoma Gas & Electric
Natale	Anthony	G	HICO America
Newbill	Mark	G	Hitachi Energy
Nolte	Mike	G	Kiewit
Ogajanov	Rudolf	G	ABB Inc.
O'Malley	Anastasia	G	Consolidated Edison Co. of NY
Pandya	Manan	G	siemens energy
Park	Dean	G	Hyosung HICO
Patel	Poorvi	M	Electric Power Research Institute (EPRI)
Patel	Monil	G	PG&E
Patel	Rakesh	G	Hitachi Energy
Patel	Sanjay	G	SGB SMIT
Pellon	Verena	G	Florida Power & Light
Perez	Marcelino	G	Prolec GE
Portillo	Homero	G	Advanced Power Technologies
Propts	Thomas	G	Dominion Energy
Raymond	Timothy	M	Inductive Reasoning
Reed	Scott	M	MVA
Reiss IV	Clemens	G	Custom Materials, Inc.
Reyes	David	G	Oncor
Riopel	Sebastien	M	Electro Composites ULC
Robalino	Diego	M	Megger
Roman	Zoltan	M	GE Grid Solutions
Rutledge	Chris	G	Dynamic Ratings
Ryu	Hyounggon	G	
Sanchez Rodrigez	Jesus	G	Voltyx/NASS
Sankarakurup	Dinesh	G	Duke Energy

Sarkar	Amitabh	M	Virginia Transformer Corp.
Sarkinen	Garret	G	Xcel Energy
Schiessl	Markus	M	SGB
Schleismann	Eric	M	Southern Company Services
Schrammel	Alfons	G	Siemens Energy
Schweiger	Ewald	M	Siemens Energy
Scott	Cosy	G	The H-J Family of Companies
Sen	Cihangir	M	Duke Energy
Shaikh	Salahuddin	G	NRG Energy
Shertukde	Hemchandra	G	Hartford.edu
Singh	Amikumar	G	Conedison
Skeik	Ahmad	G	Crosslink Technology
Snyder	Jason	G	FirstEnergy
Solano	William	M	Voltex
Som	Sanjib	M	Pennsylvania Transformer
Spitzer	Thomas	M	City Transformer Service Co.
Stacy	Fabian	M	Hitachi Energy
Stechschulte	Kyle	G	American Electric Power
Steele	Hampton	G	Tennessee Valley Authority
Steineman	Andrew	G	Delta Star Inc.
Szczechowski	Janusz	G	Maschinenfabrik Reinhausen
Tan	Jonathan	G	Northern Transformer
Tanaka	Troy	M	Burns & McDonnell
Thomas	Scott	G	Hitachi Energy
Torchia	Leonard	G	PSE&G
Varghese	Ajith	M	Prolec-GE Waukesha
Varnell	Jason	M	Doble Engineering Co.
Vermette	Yves	M	Electro Composites ULC
Vir	Dharam	M	Prolec GE Waukesha Inc
vonGemmingen	Richard	M	Dominion Energy
Vullo	Stephen	G	Konciar
Wagner	John	G	AEP
Wallach	David	M	Duke Energy
Weatherbee	Eric	M	PCORE Electric
Weisensee	Matthew	M	PacifiCorp
Werelius	Peter	M	Megger
Whitten	Christopher	M	Hitachi Energy
Wong	Terry	G	Trench Limited
Wright	Jeffrey	G	Duquesne Light Co.
Yang	Fei	M	Hitachi Energy
Young	Tim	G	Hitachi Energy
Yu	Zachary	G	Seiyuan Electric
Zambrano	Jose	G	HSP US

Zhang	Shibao	M	PCORE Electric
zhang	hongzhi	G	Hitachi energy
Zhao	Peter	M	Hydro One
Zhou	Anna	G	JST Power
Ziomek	Waldemar	G	PTI Transformers

F24 Unofficial Standards Status Report

Standard Project	Title	WG Chair	Pub Year Rev. Due Date	PAR Issue Par Expiration	Comments
C57.19.00	IEEE Standard General Requirements and Test Procedure for Power Apparatus Bushings	P. Zhao	**2023** 2033		Not Active
PC57.19.01	IEEE Standard Performance Characteristics and Dimensions for Outdoor Apparatus Bushings	S. Zhang	**2017** 12/2027	**2024** 12/2028	PAR has been approved, held first WG meeting
C57.19.02	Standard for the Design and Performance Requirements of Bushings Applied to Liquid Immersed Distribution Transformers	S. Shull	**2023** 2033		Not Active
P65700-19-03	IEC/IEEE International Standard -- Bushings for DC application	Eric Weatherbee	**2014** 12/2024	**2021** 12/2025	IEC Comments have been resolved. No IEEE comments received. Estimate recirculation Spring 2025
PC57.19.04	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	**2024** 12/2028	PAR has been approved, held first WG meeting
PC57.19.100	IEEE Guide for Application of Power Apparatus Bushings	T. Spitzer	**2012** 12/2022	**2019** 12/2025	WG voted to move forward to ballot, needs SubCom approval

WG PC57.19.01 – Meeting Minutes Performance Characteristics and Dimensions for Transformer and Reactor Bushings)

9:30 – 10:45 am, Mineral Hall BC (3)
Hyatt Regency Denver, Colorado
Tuesday, March 25th, 2025
Denver, Colorado USA
Chair: Shibao Zhang; Vice Chair: J. Arturo Del Rio: Secretary: Dominic Pollaro

ATTENDEES	MEMBER STATUS	ATTENDEES	MEMBER STATUS
J. Arturo Del Rio	Vice Chair	Terry Wong	N
Scott Digby	Y	Manuel Quinones	N
Jose Gamboa	Y	Fernando Tirado	N
Kurt Kaineder	Y	Daniel Obreqpm	N
Moses Manzano	Y	Jim Norton	N
Hugo Murillo	Y	Reeve Johnson	N
David Reyes	M	Niklas Gustavsson	N
Shibao Zhang	Chair	Patrick Foster	N
David Reyes	Y	Juan Carlos Cruz Valdez	Y
Cihangir John Sen	Y	Orlando Giraldo	Y
William Solano	Y	Ashwini Labh	Y
Matt Weisensee	Y	Mario Locarno	Y
Chris Witten	Y	Anthony Natale	Y
Tim Young	Y	Sebastian Riopel	Y
Anthony Alexander	N	Eric Schleismann	Y
Weijun Li	Y	Cody Schott	Y
Filip Mikulecky	N	Yves Vermette	Y
Eric Weatherbee	Y	Eric Euvrard	N
Florian Hermann	Y	Bob Middleton	N
Nirav Patel	N	Durand Stacy	N
Alfons Schrammel	N	Chanmin Jeong	N
Ahmad Skeik	N	Kevin Hampton	N
Leonard Torchia	N	Mike Nolte	N
Issac Abdalla	N	Homer Portillo	N
Jesus Sanchez Rodriguez	N	Geraldo Magela Jr.	N
Mo Agharahimi	N	Nidzar Turcinhodzic	N
Johnathon Reimer	N	Robert Allison	N
Josh Aries-Garcia	N	Ben Hershberger	N
Dominic Pollaro	Secretary	Marcus Scheffer	N

Meeting Overview

This was the second meeting of the Working Group (WG). There were 58 attendees.

Out of 37 TG members, 26 were present, achieving a quorum.

Agenda Approval

The agenda was unanimously approved (First by Scott Digby, Second by Kurt Kaineder). Attendees introduced themselves and reviewed the IEEE SA Copyright Policy, Participant Behavior, and Patent Policy. No issues or concerns were raised.

Previous Meeting Minutes

The minutes from the last TF meeting in St. Louis were sent to all TF members before this WG meeting. There were no concerns raised during the meeting. The previous meeting minutes were unanimously approved (First by Sebastian Riopel, Second by Matt Weisensee). No objections.

PAR & Timeline

The team reviewed the PAR approved by REVCOM on May 22nd, 2024, with an expiration date of December 31st, 2028. The Chair presented the revised timeline, extending the completion year to 2028 from the originally discussed 2027. No rejection last meeting, therefore, we will continue with previous timeline as defined below.

- F24 (WG meeting) – in person discussions
- S25 (WG meeting) – in person discussions
- F25 (WG meeting) – in person discussions
- S26 (WG meeting) – in person discussions
- F26 (WG meeting) – in person discussions
- S27 (WG meeting) – in person discussions
- F27 (WG meeting) – in person – Vote on the draft for ballot; submit for editing before ballot • January 1st – January 31st, 2028, 1st ballot
- S28 (WG meeting) – Review ballot results, form resolution group with visual meetings as needed;
- June 1st – June 30th, 2028, 2nd ballot if needed
- F28 (WG meeting) – Finalize all work • By end of 2028, submit to RevCom for approval as a standard

Discussed Topics

1. Nominal System Voltages vs MAX Line to Ground Voltages for 115 kV & 138 kV discussion

Currently, the 115 kV & 138 kV designs have 88 kV & 102 kV L-G voltages, respectively.

History:

The discussion is regarding bushing selection. The transformer table does not refer to Line to ground voltage at all; instead, system voltage and BIL.

There is confusion between the bushing standard C57.19.01 & the transformer standard C57.12.00. As transformer engineers select bushings , the selection criteria is less about line to ground voltage and more about BIL based on winding requirements. The transformer designer practice is to select a bushing one BIL larger than transformer winding BIL.

Bushing designers consider first one minute withstand based on BIL, irrespective of system voltage. Transformer designers consider first the BIL rating then make sure all other system requirements are met. i.e. L-G voltage.

The motion is to discuss the subject of L-G voltage for both 115 kV & 138 kV bushings and IF they need to be in line (changed) to those values listed within C57.12.00.

Motion to keep the table as listed C57.19.01 unchanged with respect to L-G Voltages.

First: Kurt Kaineder Second: Sebastian Riopel No Objections were posted.

2. "P" & "Q" dimensions on 46 kV 5000 amp in standard does not provide enough sealing surface for gasket or O-ring.

In the 2017 version, first time we put in the 46 kV/ 5000-amp design.

P =flange Max
Q=sealing surface.

248 mm =P
254 mm=Q
3mm sealing surface

The intent is to change the standard such that a proper sealing surface can be provided to transformer manufacturers.

Motion is to collect data from Transformer Manufacturers.

First: Sebastian Riopel Second: Scott Digby No Objections

Information for. all the dimensions (per table) for 46 kV/5000-amp bushing to be sent to : ZHANG/ARTURO/POLLARO accordingly such that information can be reviewed.

Sebastian will send info/ data on behalf of Electro Composites. Duran Stacy will send info on behalf of Hitachi. Robert Middleton for RHL, and Eric Weatherbee for PCORE.

3. TABLE 5: Partial Discharge Limits_ Discussion Points for RIS Bushings

Suggestions:

- ✓ Add Partial Discharge Limits for RIS Bushing
- ✓ Consider Partial Discharge_ 2x L-G Voltage for Other Dry Type
- ✓ Clearly specify in Note c that the 1 h duration is for bushing design test

Motion: To add RIS same as RIP @ 10 pC Level @ 1.5 x L-G Voltage for 1 hour and (specify Note c: of 1 h duration is for bushing Design Test)

First: Kurt Kaineder Second: Juan Carlos Cruz Valdez No Objections

4. RIS Bushing C1 Power Factor & % Change Limits add to (Table 6)

Suggestions:

- ✓ Add another line for RIS to Table 6 and specify the limits
- ✓ RIS PF limit to be 0.5%

Motion 1: Add RIS to Table and make limit 0.5% (similar to OIP) - Yes

First: L. Weijun Second: Kurt Kaineder No Objections

What is acceptable change? Copy OIP? Arturo

Motion 2: To keep variation of PF & Capacitance of RIS to copy OIP regarding acceptable range Yes.

First: J. Arturo Del Rio Second: Li Weijun No Objections

New Business – none
Next Meeting: F25_ October 19-23_ Hyatt Regency Coconut Point Resort
Meeting Adjourned: 10:39 am

Working Group C57.19.04
Standard Requirements for Bushings
above 5000A in Bus Enclosures
March 25th, 2025 1:45-3:00 PM
Denver, Colorado
UNAPPROVED MINUTES

1. **Introduction**
   - Meeting was called to order at 1:46PM by Chair Scott Digby.
   - Minutes recorded by Secretary Anthony Natale. Vice Chair is Rich von Gemmingen.

2. **Agenda Review**
   - Agenda was presented.

3. **Call for Essential Patents, IEEE Copyright Policy, Behavior Policy**
   - Slides were shown. No essential patents were identified.

4. **Membership**

The WG has 33 members. 33 people were in attendance including 24 members and 9 guests. 2 guests requested membership and their attendance will be reviewed to see if they meet the requirements. More than 50% of members are present so quorum is established.

5. **Agenda Approval**
   - Motion to approve the agenda was made by Kumar Mani and seconded by Durant Stacy.
   - Approved by unanimous consent.

6. **Minutes Approval**
   - Minutes Fall 2024 meeting were shown.
   - Motion to approve the minutes was made by Sebastian Riopel and seconded by Durant Stacy.
   - Approved by unanimous consent

7. **PAR Status Update / Timeline & Milestone Review**
   - PAR expires December 31st, 2028.
   - Active document was published in 2018 so will expire on December 31st, 2028
   - About 3 years or 6 Transformer Committee meetings to work including this one
   - Reserving the final year for balloting gives an objective to complete work and ready for Sponsor Ballot by end of 2027 or sooner

8. **Review of Comments from Circulation of Draft D1**
   a. 2 comments are editorial
      i. Shibao Zhang – Subclause 2: Title of C57.19.01 needs to be updated by changing "for outdoor apparatus bushings" to "for transformer and reactor bushings"
      ii. Shibao Zhang – Subclause 3.2: C57.19.00-2004 should be C57.19.00-2023
   b. Dry Switching Impulse
      i. Shibao Zhang – Table 1: Dry switching impulse is not directly tested in transformer or bushings. Impulse test is more critical than switching for low voltage bushings. Recommendation is to eliminate Column 10 and Note 3.
      ii. Comment from Sebastian Riopel: Since dry switching is not in 19.01 for these voltage classes, it makes sense to not have them here either.

iii. Comment from Kumar Mani: Agree also since they won't be tested in the transformer standard either.
iv. Consensus opinion seems to agree to remove dry switching

c. Figure 1
i. Shibao Zhang / PCore Electric offered a new Figure 1 that is a better pictorial description of the difference between bushings in bus duct per 19.04 and bushings in open air per 19.00 with a corresponding table.
ii. Comment from David Stockton: This is a great representation, but wonders if showing the "regular bushing" as well will confuse users.
iii. Comment from Eric Weatherbee: The "regular" bushing could be put in an appendix
iv. Comment from Shibao Zhang: The side-by-side comparison best highlights the differences
v. Comment from Durant Stacy: It would not uncommon to shown figures like this in standards. Shading the 19.00 figure with a note that it's for reference is a possibility.
vi. Comment from Tim Young: Comments regarding the language of "regular" and "high temperature" opened a debate on the language
vii. Comment from Sebastian Riopel: It's also possible to split these into two figures which refer to each other for clarify.
viii. Comment from Kumar Mani: Comments on if the oil level is necessary to be shown since most GSU are filled to the cover without air space. A response was that it was shown because the standard requires a 2" gap for testing.
ix. Comment from Nirav Patel: The shape of the terminals and tap is also not indicative of GSU bushings and could be cleaned up.
x. Action: The new figure and table will be embedded in the next draft and circulated for comments to be discussed at the next meeting.

d. General Comment
i. Barry Beaster made a general comment about new technologies allowing for refined condenser designs and how this affect future interchangeability.
ii. Comment from David Stockton: Condenser design is often not the driving design factor for these bushings, the conductor is.
iii. Comment from Sebastian Riopel: Smaller dimensions can be done as long as the transformer supplier maintains the minimum required dimensions for interchangeability.
iv. Comment from Kumar Mani: Agree, as long as the bolt holes and flange are maintained, the bushings can have some smaller dimensions.
v. Action: Clarification is needed from the commenter on what specific changes they feel are necessary.

9. **Old Business**
a. Update from Art Del Rio on tap extensions. This was a third party product and is not applicable for inclusion in the standard.
b. Comment from Kumar Mani: Are references to monitoring systems applicable? Response is that this would fall outside the scope of this document.
c. Comment from Chris Whitten: Are these extensions flexible? Art Del Rio replied no, they are rigid.

10. New Business
a. David Stockton inquired if any mention of overloadability of dry vs oil bushings needs to be mentioned since it was a big topic for C57.19.100 and how it may pertain to bushings in bus ducts.
b. Comment from Nirav Patel: This would be related to derating bushings in bus ducts but that is not the scope of this document but possible the application guide 19.100.
c. Comment from Eric Weatherbee: Bushing manufacturers do not do derating for bushings in bus ducts.

d. Comment from Durant Stacy: Agree, all the materials have to be rated for the full temperatures seen in the bus duct application.

11. Adjournment

- Meeting was adjourned at 2:34 pm.
- Next meeting will be at the Fall 2025 Transformers Committee meeting in Bonita Springs.

12. Attendance List

Mubaark	Abbas	Virginia Transformer	Member
Anthony	Alexander	Hitachi Energy	Member
John	Bule	DTE Energy	Guest
Juan Carlos	Cruz Valdes	PROLEC GE	Member
Scott	Digby	Duke Energy	Member
Florin	Faur	Prolec-GE	Guest
Jose	Gamboa	The H-J Family of Companies	Member
Orlando	Giraldo	The H-J family of companies	Member
Florian	HERMANN	Trench France	Member
Del Rio	J Arturo	HSP-US	Member
Reeve	Johnson	Hitachi Energy	Guest
Kurt	Kaineder	Trench Austria	Member
Mario	Locarno	Doble engineering	Member
Kumar	Mani	Duke Energy	Member
Filip	Mikulecky	Koncar Power Transformers Ltd.	Member
Anthony	Natale	HICO America	Member
Dean	Park	Hyosung Hico	Guest
Nirav	Patel	Yash Highvoltage Ltd	Member
MARCELINO	PEREZ	PROLEC	Requesting
David	Reyes	Oncor	Requesting
Sebastien	Riopel	Electro Composites	Member
Stefan	Schindler	Maschinenfabrik Reinhausen	Guest
Ahmad	Skeik	Crosslink Technology	Guest
Fabian	Stacy	Hitachi Energy	Member
David	Stockton	SBC	Member
Yves	Vermette	Electro Composites	Member
Richard	VonGemmingen	Dominion Energy	Member
Eric	Weatherbee	PCORE electric	Member
Matthew	Webb	GE VERNOVA	Member
Christopher	Whitten	Hitachi Energy	Member
Samuel	Young	Hitachi Energy	Member
Eva	Zarco	Yash	Guest
Shibao	Zhang	PCore	Member

IEEE PC57.19.100

Guide for Application of Power Apparatus Bushing WG

Minutes of 2025 Spring Meeting

Monday, March 24th, 2024- 3:15-4:30 PM

HYATT Regency – Denver, Colorado

Tommy Spitzer– Chair **Durand Stacy – Secretary**

The WG met on Monday, March. 24, 2024, at 3:15 PM in the Mineral Hall BC.

1. **Welcoming and Call for Patents, Copyrights**
   - The meeting was called to order at 3:15 PM by the WG Chair.
2. **Meeting**
   - An announcement was made that the meeting would be recorded to help with the creation of the meeting minutes, and the recording would deleted once the minutes were approved.
3. **Quorum**
   - Total of 51 participants: 12 members and 39 guests.
   - A quorum was reached
4. **Agenda was shown on screen**
   - Sami Debass Epri made a motion to approve the agenda
   - Juan Carlos Cruz Valdes Prolec GE seconded the motion.
   - No objections to the unanimous approval of the agenda.
5. **Patent and copyright slides were shown**
6. **Call to approve the meeting minutes for the last two meetings, Spring and Fall 2024**
   - **No objections to unamisous approval**
7. **Status of document**
   - The ballot occurred between the Fall 2024 and Spring 2025 meeting.
   - Meet 75% participation
   - The ballot received 92% approval with 153 comments. Of the 153 comments, only 26 are technical (many are duplicated). Three people have volunteered to be part of the comment resolution process. This team consists of Sebastien Riopel Electro Composites ULC, Eric Weatherbee PCORE Electric, and Peter Zhao Hydro One. A call was made for someone to help with the Word documents, but no one came forward.

8. **Call for new business**
   - None was brought forth

9. **Introduction**
   - Since we had time, the people present were asked to introduce themselves.

10. **Motion to adjourn**
    - Sami Debass Epri made a motion to adjourn
    - Juan Carlos Cruz Valdes Prolec GE seconded the motion.
    - Adjourned at 3:27 PM

Respectfully submitted,

Chair: Tommy Spitzer (t.spitzer@sbcglobal.net)

Secretary: Durand Stacy (durand.stacy@hitachienergy.com)

Attendance and status:

Last Name	First Name	Company	Status
Allison	Robert	Dominion Energy	Guest
Alexander	Anthony	Hitachi Energy	Guest
Arnold	Elise	SGB	Guest
Crockett	Daniel	Ameron	Guest
Cruz Valdes	Juan Carlos	Prolec GE	Guest
Debass	Sami	EPRI	Member
Del Rio	J. Arturo	HSP-US	Member
Dinh	Huan	Hitachi Energy	Guest
Euvrard	Eric	RHM International	Member
Faur	Florm	Prolec GE	Guest
Fong	Sanford	Georgia Power	Guest
Giraldo	Orlando	H-J Family of Companies	Guest
Hull	Jesse	VTC	Guest
Jarosz	Patrycja	IEEE	Guest
Johnson	Reeve	Hitachi Energy	Guest
Kasonga	Mick	Oncor	Guest
Kazmierczak	Terry	HE	Guest
Kirchenmayer	Egon	Siemens Energy	Member
LaBean Jr	Bernard	Consumers Energy	Guest
Magela Jr	Geraldo	Siemens Energy	Guest
Middleton	Robert	RHM International	Member
Mubark	Abbas	Va Transformer	Guest
Muikulecky	Filip	Koncar Power Transformers	Guest
Orlando	Giraldo	H-J Family of Companies	Guest

Last Name	First Name	Company	Status
Patel	Nirav	Yash Highvoltage	Guest
Patel	Poorvi	EPRI	Guest
Quinunes	Manuel	GE Vernova	Guest
Raymond	Tim	Inductive Reasoning	Guest
Reyes	David	Oncor	Guest
Riopel	Sebastien	Electro Composites ULC	Member
Rutledge	Chris	GE Vernova	Guest
Sarkinen	Garret	Xcel Energy	Guest
Schnider	Stefan	Reinhausen	Guest
Schott	Cody	H-J Family of Companies	Guest
Segovic	Dario	Koncar Power Transformers	guest
Skeik	Ahmad	Crosslink Technology	Guest
Spitzer	Thomas	City Transformer Service Co.	Chair

Last Name	First Name	Company	Status
Stacy	Fabian	Hitachi Energy	Secretary
Stockton	David	SBC	Guest
Szczechowski	Januaz	Reinhausen	Guest
Valentina	Valori	Hitachi Energy	Guest
Vermette	Yves	Electro Composites ULC	Member
Weatherbee	Eric	PCORE Electric	Member
Weisensee	Mathew	PacifiCorp	Guest
Whitton	Christopher	Hitachi Energy	Member
Yeboat	Kwnsi	GE Vernova	Guest
Young	Samuel	Hitachi Energy	Guest
Zambrano	Jose	Siemens	Guest
Zhaieng	Sbyuam	Siejuan Electric	Guest
Zhang	Shibao	PCORE Electric	Member

Zorco	Eva	Vash High Voltage	Guest

1

BUSHING SC MEETING

IEC Liaison Report - Spring 2025

IEEE PES TRANSFORMERS COMMITTEE
Location: Denver

Kurt Kaineder

2

SC 36A Team, Structure and Meetings

Role	Name	Term Of Office	NC
Chair	Mr Lars Jonsson	2026-12-31	SE
Secretary	Mrs Laura De Fina		IT

- Last General Meeting was held in Milan, Italy, on 15 June 2023
- **Next** General Meeting jointly with TC 36 in Beijing, China, on June 12, 2025.

Membership:

- 15 Participating Countries
- 24 Observer Countries

Experts:

- Total number of experts : 77 (11 IEEE, 1 US)
- Total number of records : 141

3

Working Groups

WG	Type	Description	Scope	Creation
JMT 9	Joint Maintenance Teams	DLMT: HVDC Bushings	To jointly revise the document IEC/IEEE 65700-19-03	2021-12-15
JWG 7	Joint Working Groups	Dimensional bushing standardization	To prepare the working draft of a Technical Report with the title LV-MV and HV Transformer bushings dimensional standardization.	2019-03-01
JWG 10	Joint Working Groups	Bushing Application Guide	To develop an International Standard on bushing application guide	2021-10-05
MT 5	Maintenance Teams	Maintenance Team for the revision of IEC 60137: Insulated bushings for alternating voltages above 1kV.	Revision of the standard IEC 60137 with review of the contents and extension of tables to cover new market technical requirements where necessary and possible.	2008-07-25
MT 6	Maintenance Teams	Bushings seismic qualification		2012-03-26
PT 63634	Project Team	General requirements for tap adapter of capacitance graded bushing	To generate general requirements for tap adapter of capacitance graded bushings	2025-02-18

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4

Working Groups and related activities

JMT 9 36A/255/FDIS, **IEC/IEEE 65700-19-03** ED2: Bushings for DC application
Circulation Feb. 7th, 2025, Closing March 21st, 2025

P-Members vote

P-Members Voting	P-Members In favour	In favour %	Criteria	Result
10	10	100	>=66.7%	APPROVED

All Votes

Total Votes Cast	Total Against	Against %	Criteria	Result
14	0	0	<=25%	APPROVED

Voting Result APPROVED

Document 36A/255/FDIS

Project : IEC/IEEE 65700-19-03 ED2

IEC/IEEE 65700-19-03 ED2: Bushings for DC application

Reference	Circulation date	Closing date	Downloads
36A/255/FDIS	2025-02-07	2025-03-21	
Compilation of Comments			
CC file			

- 1 editorial comment from Italy

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IEC/IEEE 65700-19-03 ED2: Bushings for DC application

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Compilation of Comments			
CC file			

- 1 editorial comment from Italy

Working Groups and related activities

JWG 7 Dimensional bushing standardization linked to TC 14
(F. Mauri – IT)

- **IEC TS 63493-1:** Transformer bushings dimensional standardization – Part 1: Medium voltage bushings with Um from 12 kV up to and including 52 kV and Ir from 630 A up to and including 3150 A
  - Related documents: **IEC 36A/248/Q, 36A/253/CD, 36A/258/CC**
    5 comments in total
  - A revised draft will be distributed as a DRAFT TECHNICAL SPECIFICATION (DTS) BY *2025-03-21*
  - Forecast Publication: *2025-10*
- The SC 36 A will agree how to proceed regarding the interchangeability criteria for the bushings removed from Part 1 during the next plenary meeting.

6

Working Groups and related activities

JWG 7 Dimensional bushing standardization linked to TC 14
(P. Cardano - IT)
Circulation January 24th, 2025, **Closing April 18th, 2025**

- **IEC TS 63493-2:** Transformer bushings dimensional standardization – Part 2: High voltage bushings
  - CD distributed Jan. 2025 document 36A/254/CD
  - Forecast Publication: *2026-03*

8

Working Groups and related activities

MT 6 **IEC TS 61463** Bushings seismic qualification
36A/259/AC Call for experts
Circulation March 18th, 2025, Closing **May 16th, 2025**

- Mr. Paolo Cardano (IT), convenor of MT6, has reviewed the document together with the experts who have identified the following proposals for revision (partly see below):
  - Ground acceleration levels (§6.1): discussion on the present ones and possible introduction of a performance level.
  - Vertical acceleration as percentage of the horizontal one: (now 50%, §6.1, other Standards with different values to be reviewed).
  - Superelevation K: calculation methods and values if unknown (§6.2): new possible increased value, dependency on the bushing rating or on other parameters.
  - Static calculation general review:
  - Natural frequencies and damping tables, got from experience, for bushings equipped with porcelain and composite insulators: general review, completion of the tables, thanks to the present wider understanding of bushing's behavior, especially with composite insulators (§7).
  - Modal analysis: superimposition method (§8.2 and §8.3): review and clearer definition.
  - Spectra definition (9.1.6) and possible plateau extension as a function of natural frequency.
  - Test methods (9.1.7): discussion of the present possibilities (static calculation, simulation and test for all the ratings).
  - Better specification of the simulation method: when it is valid and how to validate it.
  - Combination of stresses (§10.1):
  - Test evaluation -methods and acceptance criteria (§10): clearer definitions, evaluation methods (with bending tests, with stress comparison in the insulators or in the most critical parts, etc.).
  - Center clamped bushings (Annex E): clearer definition of acceptance criteria.
  - Direct molded bushings: test evaluation and acceptance criteria.

Working Groups and related activities

- **MT 5** Maintenance Team for the revision of **IEC 60137**: (Lars – SE)
  Insulated bushings for alternating voltages above 1kV.
  Start the revision work of IEC 60137 with Call of experts (36A/250/AC).
  The work will start 2025.
- **JWG 10** Bushing application guide (J-C Riboud - FR)
  WG is working on the document Part 1: Bushing selection and installation (**IEC 63548-1**)
  CD expected 2025-12