IEEE/PES TRANSFORMERS COMMITTEE

Bushings Subcommittee

TF Classification and Performance of Dry Type Bushings

Virtual

Monday, April 26, 2021

The Task Force group met virtually on WebEx on Monday April 26, 2021, at 3:45 PM session 2. This was the second meeting of this TF.

1. Welcome

2. Welcoming and Call for Patents

- The meeting was called to order at 3:45 PM by the TF Chair Art Del Rio.
- The TF Chair, Art Del Rio, did a call for potentially essential patents and copyrights issues. None were reported.

3. Verification of Quorum

- The TF Chair called for a quorum poll were 13 out of 20 members were present.
- In attendance was 12 guests and 7 requesting membership with 1 attendee not answering the poll.
- There was a total of 33 participants out of which were 13 members. Membership list and status attached in these minutes.

4. Approval of Agenda

- There were no objections to approving the agenda.

5. Approval of the minutes of the October 19, 2020 meeting

- There were no objections to approving the previous minutes.

6. Definitions in existing bushing standards.

- The Bushing SC has indicated that the TF should be looking at the definitions and the different standards. Previous discussions have taken place prior to this meeting, for instance, Peter Zhao's WG on C57.19.00. Some definitions as simply as "Composite Bushing" has implications to different users and manufacturers.
- Examples of "Terms and definitions" were presented and should be reviewed.
    - IEC/IEEE 65700-19-03:2014 (stated in section 3)
    - C57.19.04-2018 (the only definition found is in section 6)
    - C57.19.100-2012 (definitions in section 3 – all related to OIP technology)
    - C57.19.00-2004 (more extensive number of definitions in section 3)
- Art Del Rio (TF Chair) opened the floor to discussion on any particular definition. How do the users or manufacturers use or view the terms? Summary of the discussion below:

- Dry type/composite type bushings have not been addressed. Performance has not been addressed, particularly overloading capability. For example, under C57.19.00 and C57.19.100 we don't have a clear format of framework to start. We should review all documents to shape our work. Should there be two types, oil type and dry type? We need to develop something, since there is a need.
- The priorities for the TF were restated. For instance, C57.19.00-2004 has resin-bonded paper definitions (3.35), but no resin-impregnated synthetic definition. These definitions are going to be the basis if we decide to go ahead with a new document, guide, or extension of existing documents.
- We would like to avoid specific construction or materials. Use the performance levels to address issues if possible. There is a lot of new technology and we should invite the most appropriate experts into the discussions.
- A new dry type standard approach could be difficult to get through the SC. We should try to fit the work into the existing standards.
- There are some specific differences between Oil filled vs dry type bushings. Discussions of these differences should take place, specifically related to performance. PF correction and operational limits are some examples to be discussed and captured. Classification and performance are not captured anywhere.
- General PF temp correction is not available due to manufacturer's design and different materials used.
- Maybe listing the common dry type related industry questions can be the driving motivation behind this TF work.

7. Scope of TF. Discussion based on draft scope/purpose.

- Based on the last meetings, the chair came up with the following immediate scope and secondary draft TF scope. This was presented again here at the current meeting.
    - Immediate scope as per Bushing Subcommittee request: Review and revise as needed the definitions for "composite" transformer bushings (dry type) related to their use and applicability in the C57.19 series bushing standards, specifically C57.19.00 and C57.19.100 (application guide) currently under revision.
    - Draft TF Scope: Review existing IEEE power transformer and reactor bushing standards, guides and practices (based on C57.19 series) and determine the industry need for a new standard, guide or technical report for dry-type technologies used in liquid-filled transformer bushings. Such document should determine the classification and performance requirements for dry type transformer bushings and allow the transformer OEMs and end-users to select a dry-type bushing technology. The task force will report their findings to the Bushings Subcommittee with a recommendation on next steps.
- Are we aware of anything specifically in 19.01 that needs to be revised related to dry type bushings? Comparing the IEC with 19.01, RIS is not there. Users might appreciate insulator type information, in an annex for example.
- C57.12.00 has some performance characteristics for less than 34.5kV. These would include some dry type bushings and can be found in table 9 of the 2015 revision.

C57.19.01 currently starts from 25kV. In the past the lowest voltage was only 15kV. Table 9 specifies from 1.2kV to 34.5kV. Many of them fall together with the distribution transformers. We may need to consider C57.19.01 and C57.19.02.

- Table 9 of C57.12.00 mentions C57.19.01 in the table title. Previously the recommendation was made to add C57.19.04 to that table title.
- Maybe we should ask for volunteers from dry type bushing manufacturers and users to review 19.00 and 19.100. They will be the most familiar with the areas that need to be updated. It may or may not be possible to address areas before these go to ballot.
- During the C57.19.00 meeting this morning, a small group was put together to review the definitions in that documents, specifically talking about composite bushings. Should we reach out to this group and partner with them? As they do overlap and we should reach out to Dave Geibel to get some input from them. During the C57.19.00 meeting, there were several others topics related to definitions that where not addressed. They only made it to the Dave's comments on the definition of composite bushings.
- IEC already has the definition of RIS. Can we simply add the definition to IEEE? We need to reach a consensus if we need to move in this direction.
- Defining a dry bushing is a difficult task. The need for a functional comparison exists. The end user needs a list of functions of the RIP/RIS/etc and how they are applicable (different from OIP). From a user standpoint this information would be useful.
- As a standard, we cannot get into the detailed comparison of bushing technology performance. The standard sets the performance requirements that all bushings must meet. Setting performance characteristics for bushings is the goal of the standards, not to set different requirements for different manufactured bushings.
- The TF was established to determine classification and performance requirements for dry type bushings. IEC approach uses a simply table. We can take a look at IEC, CSA, existing tables. It would be good for manufacturers and users to look at the tables to see what we should do.
- Maybe we can have a meeting in June or July to look at C57.19.00 and C57.19.100 to see what could be added or updated. We should review the documentation. It may be that we respond to the SC and indicate there is no need for new documents, if that is the case. Is there any other information that users would like to see in the standards or guides?
- It would be useful to know the advantages of LSR vs HTV technology. Also, it would be good to go through the documents and look for gaps. Maybe dry type information could be added before C57.19.00 and C57.19.100 goes to ballot. The timeline for C57.19.100 is next year.

8. New Business

- Consensus was made to review the existing documents.
- Durand Stacy and Poorvi Patel volunteered to review C57.19.100
- Sebastien Riopel, Art Del Rio, and Eric Euvrard volunteered to look at C57.19.00

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9. Adjournment

- The Webex meeting was adjourned at 5:00 PM.

Next Meeting is planned to take place in Milwaukee, Wisconsin, on **October 17-21,** 2021.

Respectfully submitted,
Chair: Art Del Rio (a.delrio@ieee.org)
Secretary: Chris Whitten (christopher.l.whitten@hitachi-powergrids.com)

IEEE/PES TRANSFORMERS COMMITTEE

Bushings Subcommittee

Attendance and membership status

Role	First Name	Last Name	Company	City	State	Country
Guest	Javier	Arteaga	Hitachi ABB Power Grids	Raleigh	NC	USA
Guest	Suresh	Babanna	SPX Transformer Solutions, Inc.	Goldsboro	NC	USA
Guest	Jeremiah	Bradshaw	Bureau of Reclamation	Denver	CO	USA
Chair	J. Arturo	Del Rio	Siemens Energy	Raleigh	NC	USA
Member	Jonathan	Deverick	Dominion Energy	Richmond	VA	USA
Member	Scott	Digby	Duke Energy	Raleigh	NC	USA
Guest	Huan	Dinh	Hitachi ABB Power Grids	Lexington	KY	USA
Guest	Jeffrey	Door	H-J Family of Companies	High Ridge	MO	USA
Member	Eric	Euvrard	RHM International	Brookline	MA	USA
Guest	Reto	Fausch	RF Solutions	Monterey	CA	USA
Guest	Hugo	Flores	Hitachi ABB Power Grids	Alamo	TN	USA
Member	Raymond	Frazier	Ameren	Arnold	MO	USA
Guest	Jose	Gamboa	H-J Family of Companies	High Ridge	MO	USA
Guest	Ali	Ghafourian	H-J Enterprises, Inc.	Athens	GA	USA
Guest	Ryan	Hogg	Bureau of Reclamation	Denver	CO	USA
Guest	Stephen	Jordan	Tennessee Valley Authority	Chattanooga	TN	USA
Member	Kurt	Kaineder	Siemens Energy	Leonding	Other	Austria
Guest	Marek	Kornowski	Polycast International	Winnipeg	MB	Canada
Member	Mario	Locarno	Doble Engineering Co.	Marlborough	MA	USA
Member	Bruno	Mansuy	Trench France SAS	Saint Louis	Other	France
Guest	Vinay	Mehrotra	SPX Transformer Solutions, Inc.	Waukesha	WI	USA
Guest	Parminder	Panesar	Virginia Transformer Corp.	Roanoke	VA	USA
Guest	George	Partyka	PTI Transformers	Regina	SK	Canada
Guest	Poorvi	Patel	Electric Power Research Institute (EPRI)	Ballwin	MO	USA
Guest	Juan	Ramirez	CELECO	Apodaca	Other	Mexico
Guest	Jonathan	Reimer	FortisBC	Kelowna	BC	Canada
Member	Sebastien	Riopel	Electro Composites ULC	St-Jerome	QC	Canada
Guest	Eric	Schleismann	Southern Company Services	Forest Park	GA	USA
Guest	Stephen	Shull	BBC Electrical Services, Inc.	Joplin	MO	USA
Member	William	Solano	Instrument Transformer Equip Corp	Monroe	NC	USA
Guest	Fabian	Stacy	Hitachi ABB Power Grids	Alamo	TN	USA
Guest	Hampton	Steele	TVA	Hixson	TN	USA
Member	David	Stockton	Stockton Consulting	Arnold	MO	USA
Guest	Jacques	Vanier	Electro Composites (2008) ULC	St-Jerome	QC	Canada
Guest	Yves	Vermette	Electro Composites ULC	St-Jerome	QC	Canada
Guest	Loren	Wagenaar	WagenTrans Consulting	Marysville	OH	USA

Member	Eric	Weatherbee	PCORE Electric	LeRoy	NY	USA
Secretary	Christopher	Whitten	Hitachi ABB Power Grids	Alamo	TN	USA
Member	Shibao	Zhang	PCORE Electric	LeRoy	NY	USA
Member	Peter	Zhao	Hydro One	Toronto	ON	Canada