

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 Fred Friend Percent Complete 30

Current Draft Being Worked On: D1.3 Dated: November 2018

Meeting Date: March 26, 2019 Time: 11:00 am – 12:15 pm

Attendance:	Members	<u>32</u>
	Guests	<u>37</u>
	Total*	<u>69</u>

* For details of attendance, please refer to AMS system of the Transformers Committee

Meeting Minutes:

The meeting was called to order by the Steve Shull at 11:00am, the roster was circulated, followed by the introduction of members and guests.

The Chair made a call for any Essential Patent Claims and none were brought forward.

A check for quorum was made and achieved.

A motion was made by Dan Sauer and seconded by Jerry Murphy for approval of the agenda. The motion was unanimously approved.

A motion was made by Al Traut and seconded by Jerry Murphy for approval of the Fall 2018 meeting minutes. The motion was unanimously approved.

Old Business

Taskforce report – Section 5.3 Revisited – Steve Shull

Steve displayed the Task Force's modified document section on the screen and described the various changes and additions to this section. Steve asked for comments from the Working Group. Dan Sauer inquired about the capitalization of *failure* in Clause 5.3.3. A comment came from the group that this is part of a title used in Table 3. Jerry Murphy recommended changing 12h to 12hr in the text. Steve Shull will check for required editorial changes as required by the IEEE Style Manual. Jeff Door discussed cable cantilever loading at the temperature shown in Clause 5.3.4. It was pointed out that if this condition exists it would require the bushing to be supported. Tim Tillery asked if the gasket was included in these requirements. The answer was no, just the bushing, not the assembly. The chair will incorporate the task force's recommendations into the next draft of the standard.

Taskforce report – Stud Corrections/Additions – Al Traut

There were a number of dimensions added to Figure 1 and Figure 2. These were reviewed and no comments were brought forward by the Working Group. Steve would make these changes in the new draft.

New Business

One of the unresolved questions from the last meeting was the mounting orientation of the three stud bushing. Steve called for a Task Force to review and provide a recommendation on the orientation of the three stud bushing configuration in relation to the cantilever testing requirement.

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He asked the group to provide any clarifications that might be required as to the torque limits which would be applied to these orientations. The task force was formed consisting of Luis Osorio (Chair), Carlos Gaytan, Huan Dinh, and Jim Spaulding.

There were a number of questions brought to the Chair concerning Section 5.2.1.

- ❖ Even though the bushing stud can be rated for a nominal continuous current, it may not represent the continuous current rating of the bushing. This has to be determined by testing the combination of the stud, bushing material, and bushing configuration. If a table is shown, a novice user may try to imply that the bushing with this stud size should perform at this current level.
- ❖ The bushing current rating is based upon on its thermal performance at a continuous operating current. This must be determined by testing and not by a table listing.
- ❖ Some of our customers not only require the continuous current rating of the bushing but also a short circuit temperature rating. As a manufacturer, we can calculate the temperature of the bushing under short-circuit conditions. This could be given in an informative annex so consistency of this rating can be provided to the user.

A Task Force consisting of Barry Beaster (Chair), Weijun Li, and Lee Tyler was formed to address these issues. Their report would be provided at the next meeting.

Steve had received questions on Figure 7. There was some concern that the two holed pad was included in the “H” pad table. After some discussion, Josh Verdell made a motion, seconded by Al Traut, to remove the two holed pad reference from Figure 7 and create a new figure to address the two holed configuration. There were no negatives and one abstention. With this vote, the motion passed. It was decided that Al Traut’s task force would develop this figure and it’s dimensioning. Their work will be presented at the next working group meeting.

Steve presented Table 5, *Electrical characteristics of Distribution Bushings* which had some suggested additions from Lee Tyler and David Geibel.

Nominal	Maximum	Maximum	BIL	Minimum Creep		60 Hz Withstand		Lighting Impulse	
System Voltage	System Voltage	Line to Ground		Light Contamination	Heavy Contamination	1 min Dry	10s Wet	Full Wave	Chopped Wave Minimum Time to Flashover 3μs
(kV)	(kV)	(kV)	(kV)	mm (in)	mm (in)	(kV RMS)	(kV RMS)	(kV Peak)	(kV Peak)
1.2	1.5	1	30	20 (0.8)	30 (1.2)	10	6	30	--
2.5	3.5	2	45	40 (1.6)	64 (2.5)	15	13	45	--
5.0	6.9	4	60	81 (3.2)	127 (5.0)	21	20	60	--
8.7	11	7	75	140 (5.5)	220 (8.7)	27	24	75	--
15	17	10	95	254 (10)	381 (15)	35	30	95	110
18	26	16	125	305 (12)	457 (18)	42	36	125	145
25	26	16	125	305 (12)	457 (18)	42	36	125	145
34.5	36	22	150	560 (22)	880 (35)	70	60	150	175
15 ^a	17	10	110	280 (11)	381 (15)	50	45	110	126
25 ^a	26	16	150	405 (16)	635 (25)	60	50	150	175
34.5 ^a	36	22	200	560 (22)	880 (35)	80	75	200	230

NOTE 1—The Maximum System voltage levels were selected from Table 4 of IEEE Std C57.12.00-2000.

NOTE 2—The millimeter creepage values are based on 28 mm/kV (light) and 44 mm/kV (heavy) of nominal line-to-ground voltage. Nominal line-to-ground voltage is nominal system voltage divided by 1.732.

TABLE 5 – Electrical characteristics of Distribution Bushings

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Questions referring to the Red Text shown in the table

1. ^a Power Class. Should this be included in the table since this standard is only for Distribution Transformers?
2. 18kV nominal system voltage exists as a standard bushing in distribution class (IEEE C57.12.00-2000 Table 10). Should this be added? What shall we do with this rating which is being used on 24940GrdY/14400V 125kVBIL transformers?
3. The chopped wave peak level is not currently used for a distribution class bushing. In the table a rule of thumb was used for these values, Chopped = BIL x 1.15. Is this correct?
4. It is assumed that a chopped wave test for less than 15kV distribution class is not required. Is this a correct assumption?
5. The maximum L-G voltage rating was estimated by using the maximum system voltage / 1.732. Is this correct?
6. Minimum creep distance for 15kV power class 280mm (11") was taken from IEEE C57.19.01 - 1991 Table 1. Minimum and Maximum Creep distances for all others are based on 28mm or 44mm times the nominal line-to-ground voltage. Is this correct?

Steve formed a Task Force consisting of Lee Tyler (Chair), Dan Sauer, Jeff Door, and Israel Barrientos to review Table 5 as it now is and develop it further. Their report would be provided at the next meeting.

Steve stated that he would create a new draft of the standard and have it posted on the website for the working group to review. The meeting was adjourned at 11:45 am. The next meeting will be in October, 2019 in Columbus, OH.

Submitted by: Fred Friend

Date: 03/27/2019