

Review Section: 3. Definitions								
Comment	Name	Affiliation	Page	Sub clause	Line	Comment	Proposed Change	Disposition Status (accepted/rejected/revised)
1	David Geibel	ABB Inc., Alamo	2	3.1	25	Ambient should be clearly the temperature outside any bus duct or enclosurethe surrounding air in contact with the apparatus onto which the bushing is mounted, not inside bus duct or enclosure.	agreed
2	David Geibel	ABB Inc., Alamo	3	3.4	6	some bushings are horizontal and have no "bottom end"suitable connector at the inboard end of the bushings for the transfer of current.	agreed
3	David Geibel	ABB Inc., Alamo	3	3.6	11	We should clear up the notion that this requires a second capacitor to form a proper divider.	A connection to one of the capacitance layers which divides the layers into sections C1 and C2 such that the capacitance graded internal insulation forms a voltage divider.	
4	David Geibel	ABB Inc., Alamo	3	3.10	22	We need to distinguish between the high quality epoxy casting and, for example, the traditional polymer concrete, or bulk epoxy	Leave 3.10 alone and Add --> 3.10(+) cast insulation capacitance graded bushing: A bushing in which the internal insulation consists of a solid cast material with or without an inorganic filler and conductive grading layers.	
5	David Geibel	ABB Inc., Alamo	3	3.11	24	This is not the industries current understanding of a composite bushing. John Graham's study group indicates this needs new clarity.	... a bushing which does not contain any glass, porcelain, or liquid.	
6	David Geibel	ABB Inc., Alamo	4	3.17	1	Need to further clarify the bushing carries the current.	...such that the bushing carries the current and the rod does not.	
7	David Geibel	ABB Inc., Alamo	4	3.19	5	We have no definition for "ground layer"	add: ground layer: the outermost conductive layer of the internal insulation.	
7a	Sebastien Riopel	Electro Composites					In conjunction with DG comments include "normally connected to the bushings flange during operation"	
8	David Geibel	ABB Inc., Alamo	5	3.32	1	We should add a note that dissipation factor used by IEC is practically the same.	Note: Other standards exist which refer to "dissipation factor" which is mathematically different from power factor, but when used to evaluate bushings is virtually identical in value and meaning.	
8a	Sebastien Riopel	Electro Composites					<i>In conjunction with DG comments include up to what value they remain equal</i>	
8b	Eric Weatherbee	PCORE					<i>Theoretically not detectable until 2% where the last digit starts to vary X.XXXY and due to 3 place rounding may be different. Practically its 5%, X.XY may start to vary.</i>	
9	David Geibel	ABB Inc., Alamo	5	3.35	11	We need to add definition for RIS	add: resin impregnated synthetic insulated bushing: A bushing in which the internal insulation consists of a would core of untreated synthetic material and subsequently impregnated under vacuum with a filled or unfilled curable resin.	
10	David Geibel	ABB Inc., Alamo	5	3.38	19	Should we define as "C2" and include test taps?	The capacitance between the voltage tap or test tap and the flange and typically referred to as C2.	

Review Section: 4.Service Conditions

Comment	Name	Affiliation	Page	Sub clause	Line	Comment	Proposed Change	Disposition Status (accepted/rejected/revised)	Disposition Detail	additional note
1	Peter Zhao	Hydro One	5	4.1	30	add 105°C maxi temp limit	Add: and does not exceed 105°C maximum	Zhao to work w. transformer committee to get clarification	105C max oil temperature in contact with the bushing over 24 hours	top oil <> oil in turret
2	Peter Zhao	Hydro One	5	4.1	31	add temperature limit for bottom terminal connection, say, 105°C maxi temp	Add: - The bottom terminal and lead connections do not exceed a 105 °C.	TBD	TF formed - S19?	
3	Peter Zhao	Hydro One	6	4.2.2	14	add seismic conditions	Add: or seismic conditions	Accepted/Revised	Also to reference IEEE 693	
4	Ryan Musgrove	Oklahoma Gas & Electric	5	4.1	31	This line has the temperature measurement in K, while all other references are in °C.	For consistency, change this temperature to 30°C	To seek IEEE clarification		
5	Ryan Musgrove	Oklahoma Gas & Electric	5	4.1	32	The dash on the dashed list appears to have been accidentally deleted		Editorial issue?		

5. Rating									
Comment	Name	Affiliation	Page	Subclause	Line	Comment	Proposed Change	Disposition Status (accepted/rejected/revise)	Disposition Detail
1	Shibao Zhang	PCORE Electric Company Inc	8	5.4.1		Thermal base rating to reflect C57.19.04 in last sentence	To add "for the bushings used for enclosed bus duct or similar situation where the air temperature around the bushings exceeds the ambient temperature, reference to C57.19.04"	to further review	To work with C57.19.04 -to circulate 04 draft (already on website)
2	Shibao Zhang	PCORE Electric Company Inc	8	5.4.2		To be clearer about "draw-lead conductor"	To change "draw-lead conductor" to "draw-lead conductor (rod or cable)"	to revise	to "draw-lead conductor (solid or cable)
3	Scott Digby	Duke Energy	7	5.3		Add reference to C57.19.04.	Change the phrase in parenthesis at the end of this section to (shown in Table 1 of IEEE Std C57.19.01 and Table 1 of C57.19.04).	Accepted - S19	
4	Scott Digby	Duke Energy	7			Add section to cover "Rated dry switching-impulse voltage" since C57.19.04 will reference this test and not the "Wet..." version of the test that is already included. [Note: I'll also be submitting a suggestion to add an applicable sub-clause within section 7.2 to describe the test, similarly to the "wet" version]	Add the section noted	TBD - S19	
5	Scott Digby	Duke Energy	8	5.4.1		Add reference to C57.19.04 in the last paragraph of this section.	Suggest adding the text "For bushings located within bus enclosures refer to C57.19.04 for requirements." at the end of the last paragraph of this section.	Accepted - S19	

Review Section: 6. General Requirements										
Comment	Name	Affiliation	Page	Sub clause	Line	Comment	Proposed Change	Disposition Status (accepted/rejected/revised)	Disposition Detail	additional note
1	David Geibel	ABB Inc., Alamo	8	6.2	32	As a bushing manufacturer, I have no idea the pressure in the apparatus on which the bushing will be applied.	Open bushings shall be designed to withstand both full vacuum and two atmospheres of positive pressure.	Revise to 15PSIG, per DG following Bushing SubCom meeting F19	DG clarified 15PSIG is fine needs review	
2	Sebastien Riopel	Electro Composites	9	6.2	1 through 3	Should bushings above 350kV BIL continue to be required to have a voltage tap? Could it be optional? Very few Utilities still use the voltage tap for reasons other than testing the bushing.	Bushing voltage tap. Bushings above 350kV lightning-impulse insulatin level (BIL) can be fitted with either a voltage tap or a test tap. When a voltage tap is provided, it shall be the normally grounded type as shown in Figure 1 of IEEE C57.19.01.	Rejected by vote - S19		

7. Test Procedure

Comment	Name	Affiliation	Page	Subclause	Line	Comment	Proposed Change	Disposition Status (accepted/rejected/revise)	Disposition Detail
1	David Geibel	ABB Inc., Alamo	10	7.	1	Table 2 should include PD text for 7.2.1.5	Rated frequency dry withstand with partial discharge measurement		Accept - F19
2	David Geibel	ABB Inc., Alamo	10	7.	1	Table 2 is not consistent with text of 7.2.1.(1 & 4) we should use either BIL or voltage class as cut-off for wet test requirements in both places.	Change table to read ...(900 kV BIL and below) and ... (above 900 kV BIL)		Accept - F19
3	Shibao Zhang	PCORE Electric Company Inc	11	7.1.2	8	Mounting bushing for electrical tested in bushing factory could be different from real application; horizontally-mounted bushings may be also tested vertically for electrical purpose.	Change to "For electrical test, bushings shall be mounted on a supporting structure and with their ends in the media of the type in which the are intended to operate. The bushing may be mounted vertically for electrical tests regardless of bushing application being horizontal of verical"	Did not complete as time ran out - S19	TBD - resubmitted after F19 needs review
4	David Geibel	ABB Inc., Alamo	11	7.1.4	31	Std 4 has changed	...accordance to 13 of IEEE Std 4...	SZ/Durand to review include and standard 4 revisions - F19	
5	David Geibel	ABB Inc., Alamo	12	7.2	20	I think it is time to take RIV out or allow it only for 34kV class and below	...power factor, and apparent charge.	above 350BIL must be pC	Accept - F19
6	David Geibel	ABB Inc., Alamo	12	7.2.1.1	29	Std 4 has changed. We should update to agree.	...described in 11.2 ("Standard test procedure" in Table 5) of IEEE Std 4.	SZ/Durand to review include and standard 4 revisions - F19	
7	David Geibel	ABB Inc., Alamo	12	7.2.1.2	35	Chg reference to std 4	..shown under 8.4.2.2	SZ/Durand to review include and standard 4 revisions - F19	
8	David Geibel	ABB Inc., Alamo	13	7.2.1.3	3	I think we should get in line with IEC and type test for margin at 5% over (-) chopped waves	...minimum time to flashover. Crest voltage for positive polarity is per Table 1 in IEEE Std C57.19.01 and 5% higher for negative polarity.	DG to further check other standards - TBD - F19	
9	David Geibel	ABB Inc., Alamo	13	7.2.1.4		Std 4 has changed. We should update to agree.	...described in 11.2 ("Standard test procedure" in Table 5) of IEEE Std 4.	SZ/Durand to review include and standard 4 revisions - F19	
10	David Geibel	ABB Inc., Alamo	13	7.2.1.5	9 thru 14	I think it is time top drop RIV. Add an appendix for reference.	Remove ref to RIV		Withdrawn due to previous - F19
11	David Geibel	ABB Inc., Alamo	13	7.2.3	30	Since some bushings are horizontal mounted, ditch the reference to "bottom"	...shall apply to inboard end connected bushings where....		Accept - F19
12	David Geibel	ABB Inc., Alamo	13	7.2.3.a	34	"detected" is not just what we want; we want "determined and measured"	...in contact with the insulating materials can determined and measured.		Accept - F19

13	David Geibel	ABB Inc., Alamo	14	7.2.3.d	9	"300mm away" is vague	located at a distance 300mm plus 1/2 the "d" dimension from the bushing centerline (+/- 50 mm).		Accept - F19
14	David Geibel	ABB Inc., Alamo	14	7.2.3	23	Add a note ref C57.19.04	Note: For temperature rise test of bushings rated over 5000 Amps and operated within an enclosure, see C57.19.04		Accept - bus, applicable - F19
15	Shibao Zhang	PCORE Electric Company Inc	14	7.2.3	f)	change of ambient temperature affects the temperature	To change "1°C" to "1K rise"		Accept - F19
16	David Geibel	ABB Inc., Alamo	14	7.3.1	36	"300mm away" is vague	located at a distance 300mm plus 1/2 the "d" dimension from the bushing centerline (+/- 50 mm).		Accept - F19
17	David Geibel	ABB Inc., Alamo	14	7.3.1	38 thru 40	Self contradictory. It starts out saying to have load current throughout test, then next line says you can be simulated.	The conductor and main insulation must be raised to and maintained at the same temperature as that calculated for full rated load at the standard conditions specified in section 5.4.1 of this standard during all the following testing.		Accept - F20
18	David Geibel	ABB Inc., Alamo	14	7.3.1	41	"1.2 time" is an exact amount without a tolerance, not specific enough.	...equal to a minimum of 1.2 times....		Accept - F20
19	Shibao Zhang	PCORE Electric Company Inc	16	7.4.1	2nd paragraph	C2 test is normally at 2 kV for bushings with voltage tap	To change "10 kV" to "2 kV".		Accept - F20
20	Shibao Zhang	PCORE Electric Company Inc	16	7.4.2		bushing with no tap can be tested with UST as long as the flange is isolated	At the end of 2nd paragraph, to add" the bushing may be also tested by the UST method when the bushing flange is isolated from the ground".	After lengthy discussion Shibao said he would revise and resubmit based on discussions	TBD - resubmitted after F20 meeting See below
Resubmitted Comment 20 by SZ following F20 - needs review						If specified, bushings without taps that have a conductive ground shield (i.e. metallic flange, conductive glaze etc.) shall be tested using either the Ground Specimen Test (GST) method following the rated frequency withstand voltage test or alternatively using the Ungrounded Specimen Test (UST) method. If the UST method is to be used following the rated frequency withstand test the bushing shall be supported on a properly insulated mounting frame (to avoid leakage currents to ground) or the bushing may be suspended from one terminal with a suitable insulator; the test apparatus lead shall be connected to the metallic flange or bushing ground shield connection point. For alternative bushing constructions or if you are unsure of the proper test method to use, consult with the bushing manufacturer to establish the proper test procedure.			
21	Shibao Zhang	PCORE Electric Company Inc	17	7.4.3	Last paragraph	C57.12.90 still accept RIV test	To delete last paragraph		Withdrawn due to previous comment 5 agreement during F19

7. Incorporating 19.04

Comment	Name	Affiliation	Page	Subclause	Line	Comment	Proposed Change	Disposition Status (accepted/rejected/revise)	Disposition Detail
1	Scott Digby	Duke Energy	1	1.2		Add reference to C57.19.04 within this section.	Change the start of the 2nd sentence of this section to "See IEEE Std C57.19.01™ and C57.19.04™..."	Accept - F20, in general all references were agreed to by WG	
2	Scott Digby	Duke Energy	2	2		Add C57.19.04 as a normative reference (adding date once published).	As stated in comment		
3	Scott Digby	Duke Energy	6	4.2.2		Reword the 6th item in the list of examples to reference C57.19.04	Reword the 6th item as "Unusual temperature applications such as when located within bus enclosures (i.e., isophase or non-segmented bus duct, air terminal chamber). Refer to C57.19.04 for such service conditions.		
4	Scott Digby	Duke Energy	7	5.3		Add reference to C57.19.04.	Change the phrase in parenthesis at the end of this section to (shown in Table 1 of IEEE Std C57.19.01 and Table 1 of C57.19.04).		
5	Scott Digby	Duke Energy	7			Add section to cover "Rated dry switching-impulse voltage" since C57.19.04 will reference this test and not the "Wet..." version of the test that is already included. [Note: I'll also be submitting a suggestion to add an applicable sub-clause within section 7.2 to describe the test, similarly to the "wet" version]	Add the section noted	TBD - F20 Scott Digby to review and make suggestion	
6	Scott Digby	Duke Energy	7	5.4.1		Add reference to C57.19.04 in the last paragraph of this section.	Suggest adding the text "For bushings located within bus enclosures refer to C57.19.04 for requirements." at the end of the last paragraph of this section.	Accept - F20, in general all references were agreed to by WG	
7	Scott Digby	Duke Energy	8	6		Add reference to C57.19.04 within this section.	Change the applicable text of the 2nd sentence of this section to "...or in IEEE Std C57.19.01™ and C57.19.04™ under corresponding headings."		
8	Scott Digby	Duke Energy	10	7		Add Dry switching-impulse withstand voltage to Table 2, with reference to new clause describing the test.	As stated in comment	TBD - F20 Scott Digby to review and make suggestion	
9	Scott Digby	Duke Energy	13	7.2.1		Add section to describe "Dry switching-impulse withstand voltage" test.		TBD - F20 Scott Digby to review and make suggestion	