High Voltage Circuit Breaker WG Meeting Notes Hilton Head – April 26, 2016 (8 - 12 AM)

IEEE C37.04 revision to include IEEE C37.04 a, C37.04 b, C37.06-1999 ratings, and NEMA SG-4

Chair: Stephen Cary Vice Chair: Roy Alexander Secretary: Mike Crawford

- Introductions made (74 attendees – 28 members)
- MOM F15, posted on web site and no comments were received
- It was noted that the PAR 2 year extension was approved by IEEE to December 31, 2017
- Currently finalizing draft – For circulation
- Reference to "C37.100.1 applies with following modifications" leaves a huge set of preferred ratings, leave as referenced in C37.06 ratings to avoid creating unintentional ratings
- Will add optional E2 capabilities table, built from IEC table (5.5.2.5) to supplement 800% calculation proposed by D. Dufournet, W. Long, and Ted Burse
- Manual, mechanical release, not part of PAR/Scope of C37.04; discuss moving into C37.010 as an application item.
    - 37.04 limited to rating structure, preferred ratings and required capabilities - whether to open or close, remote or local is application decision
    - Could be risk for WG members to 'require' a manual release given arc flash rules issued after the 1999 revision. Revision will not require it, but it will require that if it is included that it is physically blocked to remind the operator to consider the risks associated with manual operations.
- Options for circuit mechanism and control protection:
    - Totally enclosed protection: (e.) protection against water ingress and dust (Work with Michael Christian for enclosure requirements on next draft)
    - Operating linkages shall be protected to limit exposure to accidental operation
    - g. will add an option for sound limits of 90bda at 3ft with door open with an optional 140db limit. (Work with Amir Khosravi)
- J. Webb, Jim V reference documents: **See Session 2 for more details
    - Plan is to move/remove items as stated on slide
- 7.3.1 Eldridge proposal for international mechanism symbols for spring energy as option not a requirement, (alternate preferred?) 7.3.6 Eldridge proposal for showing flag indicators to be considered for working group to be included as preferred (to review with common clauses)
-
- 7.4.4 Electromagnetic Controller were discussed. Field replaceable electronic controls; mechanical only, no programming required. Eldridge to work on improved wording after some objections to proposed wording
- Option wording for capacitor monitoring reviewed – and will be included
- S. Billings wording rated interrupting time to be used unless detail explanation is received from X. Zhu
- Figures 12-18 re-created by M. Crawford, as requested by T. Olsen, and S. Cary to format & insert into draft
- Alternative Mechanism; to be added per D. Dufournet with additional testing short time and momentary tests proposed by S. Chen, and S. Cary to add section for next draft.
- Definitions to be added were posted and will be reviewed with next draft

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- Silver plating joints or contacts, minimum thickness, make min 0.0002" (flash plating is typically 0.00004")
- Change manual operation on outside of enclosure on outdoor (as noted during previous meetings it will be option)
- Change pressure operation from 10% to minimum one operation (both stored energy and blast pressure)
- Definition t' to t_r for operating duty
    - C37.09 Figure 2 current asymmetry move into .04 (Gives TRV value as X/R, where the industry is using %DC and time constant (ms) now)
- Electro magnetic operators added with additional clarifications provided
- Undated references included
- References in 100.1 will be changing to be more in line with IEC/IEEE, Dave Stone working on now.
- Move TRV requirements into .04, all other text in .011 (about 50% has been moved at this point)
- Sound limit check, for factory will be written as noted in meeting. Currently indoor or enclosed circuit breakers have no sound test requirements.
- Tests have shown no risk of x ray for vacuum interrupters rated 15.5kV or less
    - Proposed to remove sticker requirement if field test voltages are less than 36kV power frequency withstand or 95kV impulse (and manufacturer complies with C3.85).
    - Leave as written, (covered in vacuum standard C37.85) for higher ratings
    - Add sticker that X-rays may be produced, no need for 'the forbidden radioactive hazard' sticker on front of circuit breaker if design or test results do not show risk

- Definitions brought in from C37.100 and retained by C37.04, as in slide
    - Add definition for 'Recovery Voltage'
    - Recommend the definitions to C37.100 and 100.5 after review that they are properly defined
        - Remove 'Actual TRV'
        - one minus cosine (1-cos) to be removed
        - Total (assymetrical) current to be renamed as Asymmetrical Current
        - 27 other definitions were identified by WG definition task members
- NEMA SG-4 position on Load Switching:
    - See slide for details, Eldridge proposal.
    - Highly inductive low current switching, magnetizing current (Refer to .015) See Anne B.
- Proposal for wording to make sure that circuit breaker can interrupt all currents up to the rated capabilities (in case obsolete technologies are re-introduced or new technologies) the following statement was provided to working group: "It is the manufacturer's responsibility to provide evidence of continuous current switching capabilities prior to C37.54 conformance tests. If no such data exists then C37.54 load testing must be part of the conformance test plan."

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- Tables in .04 still have coordination issues with 0.09. Xi and Cary to review.

Session 2:

- John Webb:
  - discussed bibliography: Plan is still to move/delete as slide proposal suggests
  - Reference to "C37.100.1 applies with following modifications" leaves a huge set of preferred voltage ratings, change to "…is replaced by the following" for the tables of C37.06 (Section 5). Add informative note stating these values are harmonized with_____.
- Draft 2.7 additions reviewed:
  - Forward Reviewer: Tony Riccuitti
  - Normative References Review by John C Webb
    - IEEE C37.06.1 is currently ANSI C37.06.1
    - Add C37.100.1 to Normative references
  - 5.9.1 Rated Interrupting Time: not a rating, so remove 'Rating' from wording and use only 'Interrupting Time'.
    - Proposals will be made on preferred time or 2,3,5 cycles
    - Add to nameplate
  - TRV to become rated first pole to clear factor (g.))
  - Remove formula for total current (I_t)
  - 5.6 Rated TRV, remove rated (Work on with Kirk and Dennis)
  - Tables 1 / 2 plan to stay in C37.09, but some uncertainty with WG as it does have some rating implications as it does not clearly fall into a test procedure.

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	Roster - and Attendance for WG meetings - April 26, 2016										
	First Name	Last Name	Company	City	State/Country	4/30/2013	9/17/2013	5/6/2014	4/28/2015	9/22/2015	**4/26/2016**
1	Syed Shahab Uddin	Ahmed	Siemens Energy Inc	Madison	MS		1		1		
2	Roy	Alexander	RWA Engineering	Cranberry Twp.	PA		1	1	1	1	**1**
3	Mauricio	Aristizabal	ABB	Pittsburgh	PA	1	1	1	1	1	**1**
4	Aasim	Atiq	Siemens Energy	Madison	MS				1	1	
5	Roy	Ayers	Nashville Electric Service	Nashville	TN			1			**1**
6	Ganesh	Balasubramanian	Eaton Corporation	Horseheads	NY						
7	Robert	Barnett	Tennessee Valley Authority	Chattanooga	TN						
8	George	Becker	Electric Power Research Institute	Guilford	CT		1	1		1	
9	W.J. (Bill)	Bergman	PowerNex Associates Inc.	Calgary	Canada						
10	Stan	Billings	Mitsubishi Electric PP	Warrendale	PA		1	1	1	1	**E**
11	Kofi	Boadi-Boateng	Pepco	Laurel	MD			1			
12	Mike	Boening	Plansee Powertech AG	Seon	Switzerland				1		
13	Antone	Bonner	Eaton	S. Milwaukee	WI						
14	Anne	Bosma	ABB AB	Ludvika	Sweden	1		1	1		**1**
15	Alessandro	Bottarelli	ABB	BERGAMO	Italy						
16	Cody	Brehm		Milwaukee	WI				1		
17	Jeffrey	Brogdon	Georgia Transmission	Suwanee	GA				1		**1**
18	Steven	Brown	Allen & Hoshall	Bartlett	TN		1		1		**1**
19	Raymond	Browning	FirstEnergy Corp.	Copley	OH			1		1	**1**
20	John	Brunke	Whidbey	Fuseland	WA					1	
21	Arben	Bufi	Hitachi HVB, Inc.	Suwanee	GA		1	1	1	1	**1**
22	Ted	Burse	Powell Industries, Inc	Houston	TX	1	1	1	1	1	**1**
23	Eldridge	Byron	Schneider Electric	Smyrna	TN		1	1	1	1	**1**
24	Glenn	Calhoon	Westinghouse	Monaca	PA						
25	Donald	Cantrelle	Georgia Power	Forest Park	GA		1	1	1	1	**1**
26	Gilbert	Carmona	Southern California Edison	Pomona	CA	1	1	1	1	1	**1**
27	Stephen	Cary	GE Energy Management	Chapel Hill	NC	1	1	1	1	1	**1**
28	Steven	Chen	Eaton Corporation	Moon Township	PA		1		1	1	**1**
29	Vincent	Chiodo	HICO	Pittsburgh	PA			1			
30	Chih	Chow	PEPCO	Washington	DC	1	1	1	1	1	**1**
31	Michael	Christian	ABB	Lake Mary	FL		1	1	1	1	**1**
32	Roggero	Ciofani	Altalink	Calgary	Canada		1				

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33	Lucas	Collette	Mitsubishi Electric	Warrendale	PA		1	1	1	1	1
34	Dave	Collette	Mitsubishi Electric	Warrendale	PA		1	1	1		
35	Michael	Crawford	Mitsubishi Electric	Cranberry Twp	PA	1	1	1		1	1
36	Jason	Cunningham	Hitachi HVB, Inc.	Suwanee	GA				1	1	1
37	Jerod	Day	Vacuum Interrupters, Inc.	Carrollton	TX	1	1				
38	Patrick	Di Lillo	Consolidated Edison Co. of NY, Inc.	New York	NY	1	1	1	1	1	1
39	Randall	Dotson	Lakeland Electric, City of Lakeland, FL	Lakeland	FL						
40	Denis	Dufournet	Retired	Sathonay-Camp	France	1	1	1	1	1	1
41	Bernie	Dwyer	PECO	Berwyn	PA				1		
42	John	Eastman	INCON	Saco	ME			1	1	1	
43	Ken	Edwards	Bonneville Power Administration	Vancouver	WA	1	1	1		1	1
44	Tanner	Esco	Eaton Corporation	Greenwood	SC				1		1
45	Leslie	Falkingham	Vacuum Interrupters Limited	Rugby	UK	1					1
46	Lawrence	Farr	Eaton Electrical	Arden	NC			1			
47	Howard	Fennel	Nashville Electric Service	Nashville	TN						
48	Thomas	Field	Entergy	Jackson	MS						
49	Marcel	Fortin	BPR Energy Inc	Sainte-Julie	Canada						
50	Robert	Foster	Megger	Paradise	CA		1		1	1	1
51	Paul	Fox	Schneider Electric	West Chester	OH			1			
52	Douglas	Giraud	Powell Electrical Systems	Houston	TX	1	1	1	1		
53	Anne	Good	Net Shape Technologies	Nashville	TX					1	1
54	Paul	Grein	Circuit Breaker Sales, Co, Inc, - GroupCBS	Gainesville	TX	1		1			1
55	John	Hall	Tennessee Valley Authority	Chattanooga	TN		1	1	1	1	1
56	Christian	Heinrich	Siemens	Berlin	Germany						1
57	Helmut	Heiermeier	ABB	Baden	Switzerland	1	1	1	1	1	1
58	Charles	Hendrickson	Arizona Public Service Co.	Phoenix	AZ	1		1	1	1	
59	Jeremy	Hensberger	Mitsbushi Electric		PA						1
60	Victor	Hermosillo	Alstom Grid	Charleroi	PA		1	1	1	1	1
61	Bill	Higinbothan	EA Technology	Denville	NJ						
62	Jingxuan (Joanne)	Hu	RBJ Engineering Corporation	Winnipeg	Canada				1		
63	Roy	Hutchins	Southern Company Services	Birmingham	AL			1	1	1	1
64	Todd	Irwin	Alstom Grid Inc	Smithville	MO		1	1	1	1	1
65	Carlos	Isaac	Oncor Electric Delivery	Fort Worth	TX		1				
66	Biasse	Jean-Marc	Schneider Electric	France	France						1
67	Richard	Jackson	Detroit Edison	Detroit	MI						
68	Joseph	Jasinski	ITC Transco	Novi	MI					1	1
69	David	Johnson	Consultant	Pittsburgh	PA						1
70	Jacob	Joseph	Toshiba International Corporation	Houston	TX		1				
71	Andy	Keels	Salt River Project	Phoenix	TX						1

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72	Amir	Khosravi	BC Hydro	Vancover	Canada					1	1
73	Sandeep	Kulkarni	CG	Mumbai	India						
74	Carl	Kurinko	ABB Inc.	N. Huntingdon	PA						
75	Stephen	Lambert	Shawnee Power Consulting	Williamsburg	VA						
76	Carl	LaPlace	GE	Raleigh	NC					1	
77	Matthew	Lawrence	Doble Engineering	Baldwinsville	NY			1			
78	Brad	Leccia	Eaton	Moon Township	PA				1		
79	Alex	Lee	HICO	LA	CA					1	
80	Paul	Leufkens	KEMA-Powertest	Chalfont	PA		1				
81	Hua Ying	Liu	Southern California Edison	Pomona	CA			1	1	1	1
82	Li	Liu	Eaton	Moon Township	PA	1					
83	Albert	Livshitz	CE Power Solutions	Loveland	OH			1	1	1	1
84	Bjorn	Lofgren	Siemens Energy	Richland	MS		1	1			
85	Russell	Long	Retired	Pittsburgh	PA		1	1	1		
86	Antonio	Mannarino	PSE&G	Springfield	NJ					1	
87	Vincent	Marshall	Southern Company Services	Forest Park	GA	1	1	1	1	1	1
88	Gary	Martin	Entergy	Kenner	LA	1		1	1		1
89	Ricardo	Martinez	CFE	Irapuato	Mexico					1	
90	Peter	Marzec	S&C Electric Co.	Chicago	IL	1	1	1	1	1	1
91	Joel	Mathewson	Siemens	Jackson	MS					1	
92	Neil	McCord	Southern States	Hampton	GA	1			1	1	1
93	Timothy	McGee	Siemens Energy	Richland	MS			1	1		
94	Peter	Meyer	S&C Electric Company	Chicago	IL	1					
95	Dave	Mitchell	Dominion	Richmond	VA	1	1	1	1	1	1
96	Oscar	Montano	Salt River Project	Canada	Canada					1	
97	Georges	Montillet	GFM Consulting LLC	Canonsburg	PA						
98	Tom	Mulcahy	Dominion Virginia Power	Richmond	VA	1	1	1	1	1	1
99	Volney	Naranjo	Megger	Mansfield	TX			1			
100	Jeffrey	Nelson	Tennessee Valley Authority	Chattanooga	TN						
101	Raj	Nayar	Siemens	Raleigh	NC						1
102	Joachim	Oemisch	Siemens AG	Berlin	Germany	1	1				
103	T	Olsen	Siemens Industry, Inc.	Wendell	NC						
104	Shawn	Patterson	US Bureau of Reclamation	Denver	CO		1		1		1
105	Thomas	Pellerito	DTE Energy	Detroit	MI	1	1	1	1	1	
106	Andrew	Peterson	ABB	Lake Mary	FL						1
107	Lise	Phan	Pacific Gas and Electric Company	Oakland	CA	1					
108	Zachary	Pintado	Entergy	New Orleans	LA						
109	Syed	Rahman	The United Illuminating Company	Orange	CT	1					1
110	Frank	Ricard	FirstPower Group LLC	Twinsburg	OH	1					

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111	Anthony	Ricciuti	Eaton Corporation	Moon Township	PA		1	1	1	1	1
112	Dave	Riffe	Westinghouse Electric Corporation	New Stanton	PA	1				1	
113	Brian	Roberts	Southern States, LLC	Hampton	GA		1	1	1	1	1
114	Jon	Rogers	Siemens Energy, Inc	richland	MS	1	1	1	1		
115	Roderick	Sauls	Southern Company Services	Birmingham	AL	1	1	1	1	1	1
116	Victor	Savulyak	DNV GL KEMA Laboratory	Chalfont	PA				1		1
117	Robert	Sazanowicz	The United Illuminating Co.	Wallingford	CT				1		
118	Daniel	Schiffbauer	Toshiba International Corp	Oliver	PA				1		1
119	Carl	Schneider	Schneider Electric	Smyrna	TN			1			
120	Carl	Schuetz	American Transmission Co.	Waukesha	WI	1	1		1	1	1
121	Jon	Schumann	American Transmission Co.	Waukesha	WI				1	1	1
122	Devki	Sharma	Consultant	Byram	MS		1	1	1	1	1
123	Harish	Sharma	Southern Company	Birmingham	AL				1	1	1
124	Sushil	Shinde	ABB Inc.	Mt Pleasant	PA	1	1	1	1	1	1
125	John	Shullaw	Retired -GE	Butlington	IA		1	1	1	1	1
126	Dean	Sigmon	Eaton Corporation	Greenwood	SC		1	1	1		1
127	Michael	Sigmon	Eaton	Greenwood	SC					1	1
128	Sunita	Singh	Bechtel OG&C	Houston	TX			1			
129	Michael	Skidmore	AEP	Pickerington	OH	1	1	1	1	1	1
130	Christopher	Slattery	FirstEnergy	Fairlawn	OH			1			
131	Robert	Smith	Eaton Corporation	Horseheads	NY		1				1
132	H.	Smith	Juno	Salem	VA						
133	Erin	Spiewak	IEEE	Piscataway	NJ		1	1		1	1
134	Don	Steigerwalt	Duke Energy	Charlotte	NC	1	1	1	1	1	1
135	David	Stone	DTS Technical Services	Reading	MA	1	1				
136	Donald	Swing	Powell Industries	Houston	TX	1	1		1		
137	Ahmad	Qasem	Bechtel	Houston	TX					1	
138	Humayun	Tariq	American Electric Power	Gahanna	OH				1	1	
139	Henk	te Paske	KEMA Netherlands	Arnhem	Netherlands	1		1			
140	Michael	Titus	Schneider Electric	West Chester	OH						
141	Jean-Marc	Torres	EATON	horseheads	NY				1		
142	Vernon	Toups	Siemens	Richland	MS	1	1	1	1	1	1
143	James	van de Ligt	CANA High Voltage Ltd.	Calgary	Canada	1	1	1		1	
144	John	Webb	ABB	Florence	SC	1	1	1	1	1	1
145	Casey	Weeks	Siemens Energy	Richland	MS			1	1	1	
146	Jan	Weisker	Siemens AG	Berlin	Germany				1	1	1
147	Jerry	Wen	BC Hydro	Burnaby	Canada				1		
148	Matt	Williford	Schneider Electric	Smyrma	TN					1	
149	Dong Sun	Yoon	HICO America	Greensburg	PA		1				

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150	Richard	York	Mitsbushi Electric	Atlanta	GA						**1**
151	Lukas	Zehnder	ABB Switzerland	Baden	Switzerland						
152	Jiong	Zhang	MEPPI	West Covina	CA				1	1	
153	Wei	Zhang	Hitachi HVB, Inc.	Suwanee	GA				1	1	
154	Xi	Zhu	GE Energy Management	Atlanta	GA	1	1	1	1	1	**1**
						43	61	67	76	72	**74**