Minutes of Meeting September 17, 2013

WG: C37.04 - Standard Ratings and Requirements for AC High Voltage Circuit Breakers with rated maximum voltage above 1000 V

Chair: Jeff Nelson
Vice Chair: Mike Crawford
Secretary: Stephen Cary

Location: San Antonio
Participants: 61
Members: 37
Guests: 24

1.) The meeting started with the chair introducing the attendees. The chair asked for all attendees to sign the roster and provided affiliation if not noted on the roster.

2.) The meeting minutes were shown by the projector and the chairman reviewed the MOM for the meeting in Galveston. Minutes of the meeting are posted on the committee web site http://www.ewh.ieee.org/soc/pes/switchgear under the "Minutes of Meeting (Archive)".

3.) The chair entertained a motion from John Webb. Kirk Smith seconded the motion. The motion passed unanimously.

4) Online webpage to assist member communications for C37.04 work was discussed. Ken Edwards to put on web site and then instructions will be provided to working group members

5.) Status of Working Group - It was noted the PAR expires December 2015. A one year extension was discussed.

6.) Preformed work:

References – Completed and will be added to next draft

Definitions – Tom Mulcahy, Carl Schuetz & Sushil Shinde agreed to address

Mechanical Loading -Topic was discussed and Victor Hermosillo agreed to provide table to include in the next draft. Pat Dillo will help out Victor.

C0 Capacitor switching -The definition was discussed.
-The draft will go out with general purpose test definition
-One restrike allowed per operation. 24 tests required

Ratings & Capabilities -The section was reviewed and changes will be issued in the draft

Critical Currents - It was decided that critical currents will not be a rating in C37.04

Duty Cycle	-Reclosing derating was discussed, it was decided that reclosing will only be addressed in C37.010
Mechanism Change	-Ken Edwards and others discussed the need to the define a mechanism change. Denis Dufournet brought forward the IEC definition for inclusion in the next draft revision. Section 3.5.126 and subclause 6.101.1.1 of IEC 62271 was shown on the screen (attached) IEC requires a T100s after alternate mechanism change. The alternate mechanism change is one having same characteristics as the original.
Endurance	-Operational endurance capability, table 17/19 vs IEC was discussed. The plan for the next draft to keep the same as the 1999 revision John Webb to make proposal for M1/M2 & E1/E2 to be considered at the next meeting
Arc Furnas Duty	-The plans to integrate SG-4 wording into the draft without revision
Current Transformers	-It was discussed and the plan is to make the revision after the October meeting of C57.13. Devki Sharma has agreed to lead this effort

6.) Further work/open points - Definitions, class C0, mechanical loading, mechanical endurance, arc furnas duty to be added the next draft.

7.) Preparation of the next draft – The plan is to have the draft circulation out before next meeting.

8.) A motion was made to adjourn and it was approved

9/17/2013 San Antonio - Meeting Roster:

First Name	Last Name	Company
Ken	Edwards	Bonneville Power Adminstration
Mauricio	Aristizabal	ABB
Robert	Smith	Eaton Corporation
Xi	Zhu	GE Energy Management
Devki	Sharma	Consultant
Roy	Alexander	RWA Engineering
Stan	Billings	Mitsubishi Electric PP
Steven	Brown	Allen & Hoshall
David	Stone	DTS Technical Services
Denis	Dufournet	Alstom Grid
Ted	Burse	Powell Industries, Inc
Russell	Long	Consultant for Eaton
Michael	Sigmon	Eaton Corporation
Chih	Chow	PEPCO

Michael	Crawford	Mitsubishi Electric
Arben	Bufi	Hitachi HVB, Inc.
George	Becker	The United Illuminating Company
Helmut	Heiermeier	ABB
Anthony	Ricciuti	Eaton Corporation
John	Webb	ABB
Eldridge	Byron	Schneider Electric
Dave	Mitchell	Dominion
Victor	Hermosillo	Alstom Grid
Thomas	Pellerito	DTE Energy
Patrick	Di Lillo	Consolidated Edison Co. of NY, Inc.
Roderick	Sauls	Southern Company Services
Todd	Irwin	Alstom Grid Inc
Donald	Cantrelle	Georgia Power
Douglas	Giraud	Powell Electrical Systems
Vincent	Marshall	Southern Company Services
Carlos	Isaac	Oncor Electric Delivery
James	van de Ligt	CANA High Voltage Ltd.
Michael	Skidmore	AEP
Lucas	Collette	Mitsubishi Electric
Bjorn	Lofgren	Siemens Energy
Jon	Rogers	Siemens Energy, Inc
Gilbert	Carmona	Southern California Edison
Paul	Leufkens	KEMA-Powertest
Steven	Chen	Eaton Corporation
Shawn	Patterson	US Bureau of Reclamation
John	Shullaw	GE Energy - Industrial Solutions
Joachim	Oemisch	Siemens AG
Sushil	Shinde	ABB Inc.
Dave	Collette	Mitsubishi Electric
Vernon	Toups	Siemens
Robert	Foster	Megger
John	Hall	Tennessee Valley Authority
Erin	Spiewak	IEEE
Don	Steigerwalt	Duke Energy
Stephen	Cary	Eaton Corporation
Tom	Mulcahy	Dominion
Donald	Swing	Powell Industries
Carl	Schuetz	American Transmission Company (ATC)
Jacob	Joseph	Toshiba International Corporation
Jerod	Day	Vacuum Interrupters, Inc.
Peter	Marzec	S&C Electric Co.

Michael	Christian	ABB
Syed Shahab Uddin	Ahmed	Siemens Energy Inc
Roggero	Ciofani	Altalink
Brian	Roberts	Southern States, LLC
Dong Sun	Yoon	HICO America

Attachments:

3.5.126

alternative operating mechanism

an alternative operating mechanism is obtained when a change in the power kinematic chain of the original operating mechanism or the use of an entirely different operating mechanism leads to the same mechanical characteristics.

NOTE 1 Mechanical characteristics are defined in 6.101.1.1. The use of mechanical characteristics and related requirements are described in Annex N.

NOTE 2 An alternative operating mechanism can utilise an operating principle different from the original one (for example the alternative mechanism can be spring-operated and the original hydraulic).

NOTE 3 A change in the secondary equipment does not lead to an alternative operating mechanism. However, it has to be checked that changes in the opening time/minimum clearing time does not entail different requirements for test-duty T100a (see 6.102.10).

6.102.7 Alternative operating mechanism	No-load test before the test	[a]	For equivalent alternative operating mechanisms
	Making and breaking operation based on T100s	[c]	

Table 17 —Schedule of operating endurance capabilities for circuit breakers[a] (1) (6) (7)

Line No.	Circuit-breaker ratings			Number of operations (each operation is comprised of one closing plus one opening) (3) (4) (5)			
	Rated maximum voltage kV, rms	Rated continuous current A, rms	Rated short-circuit current kA, rms	Between servicing (2)	No-load mechanical (8)	Rated continuous current switching (9)	Inrush current switching (10)
	Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7
	Class S1 circuit breakers						
1	4.76, 15	1200, 2000	20, 25, 31.5	2000	10 000	1000	750
2	4.76, 8.25, 15	1200, 2000, 3000, 4000	40, 50	1000	5000	500	400
3	15	1200, 2000, 3000, 4000	63	500	2000	500	400
4	27	1200, 2000, 4000	16, 25	500	2500	200	100
5	38	1200, 2000, 3000, 4000	16, 25, 31.5, 40	250	1500	100	100
	Class S2 circuit breakers (11)						
6	15.5 and above	All	All	500	2000	100	100
	Circuit breakers 100 kV and above (11)						
7	All	All	All	500	2000	100	100

[a] Numbers in parenthesis refer to the items in 9.1.

4.110 Number of mechanical operations

A circuit-breaker shall be able to perform the following number of operations taking into account the programme of maintenance specified by the manufacturer:

Standard circuit-breaker (normal mechanical endurance) **class M1**	2 000 operating sequences
Circuit-breaker for special service requirements (extended mechanical endurance) **class M2**	10 000 operating sequences

Table 13 – Number of operating sequences

Operating sequence	Supply voltage and operating pressure	Number of operating sequences	
		Circuit-breakers for auto-reclosing	Circuit-breakers not for auto-reclosing
$C - t_a - O - t_a$	Minimum	500	500
	Rated	500	500
	Maximum	500	500
$O - t - CO - t_a - C - t_a$	Rated	250	–
$CO - t_a$	Rated	–	500

O = opening;

C = closing;

CO = a closing operation followed immediately (i.e., without any intentional time-delay) by an opening operation;

t_a = time between two operations which is necessary to restore the initial conditions and/or to prevent undue heating of parts of the circuit-breaker (this time can be different according to the type of operation);

t = 0,3 s for circuit-breakers intended for rapid auto-reclosing, if not otherwise specified.

Table 33 – Operating sequence for electrical endurance test on class E2 circuit-breakers intended for auto-reclosing duty according to 6.112.2

Testing current (percentage of rated short-circuit breaking current) %	Operating sequences	Number of operating sequences (list 1) [a]	Number of operating sequences (list 2) [a]	Number of operating sequences (list 3) [a]
10	O	84	12	-
	O – 0,3 s – CO	14	6	-
	O – 0,3 s – CO – *t* – CO	6 [b]	4 [b]	1 [b]
30	O	84	12	-
	O – 0,3 s – CO	14	6	-
	O – 0,3 s – CO – *t* – CO	6 [b]	4 [b]	1 [b]
60	O	2	8	15
	O – 0,3 s – CO – *t* – CO	2 [b]	8 [b]	15 [b]
100 % (symmetrical)	O – 0,3 s – CO – *t* – CO	2 [b]	4 [b]	2 [b]

[a] List 1 is preferred. List 2 may be used as an alternative to list 1 for circuit-breakers used for effectively earthed neutral systems. Calculations have been carried out on the basis of publication [7]. These calculations are applicable for certain circuit-breaker types (single-pressure SF_6 and vacuum circuit-breakers). Calculation results may be different for other types of circuit-breakers. Using these calculations and setting the wear generated by list 1 at 100 %, list 2 results in 125 % and list 3 in 134 %. Therefore, list 3 may be used as an alternative to list 1 and to list 2 to reduce the number of different test circuits.

[b] When no reconditioning is made on the sample after the basic short-circuit test sequences in 6.106, the test already carried out may be taken into account in determining the number of additional operating sequences required to satisfy the requirements of Table 33. In practice, this means reducing these figures marked [b] by 1.