Meeting Minutes

C37.01 Standard for HVDC Circuit Breakers

Chair:	Steven Chen for Joanne Hu
Secretary:	Carl Schuetz for Steven Chen
Time:	8:00 am – 9:30 am, Oct. 9, 2023
Location:	San Diego, CA
Participants:	45 participants, including 13 members and 32 guests

1. Agenda and Topics

- Introduction of members and guests
- IEEE SA patent policy review
- IEEE SA copyright policy review
- Preliminary draft review and discussion

2. Introduction

Welcome and introduction by Steven Chen, Chair of the WG. The roster is attached in the end of this meeting minutes as Attachment 1.

3. Review of IEEE SA Patent and Copyright Policies

IEEE SA Patent and copyright policies were presented and reviewed in the first session. The chair asked if anyone knew of any essential patents or copyright claims.
No patents or copyright claims were identified.

4. Approval of meeting minutes from S23

Motion: Jeff Ward
Second: Jan Weisker

5. Working Group Review

The temporary chair asked for attendees that would volunteer for this WG leadership role. No attendees volunteered and the new WG leadership roles will be discussed and identified at the HVCB SC meeting.

6. Draft Update

The document outline was presented by the temporary chair. Several drafts that contain identified content have been started but not completed. Several clauses need completion before submission to the WG for review. Past work has discussed what type of power system this standard would apply to. In the S23 meeting it was agreed that the DC system considered would be applied to was multi-modular type, a system using VSC technology. Application for line current commutated technology will not be within the document scope.

Two types of DC circuit breaker will be within the scope of this standard: active current injection

and a mechanical-power electronic hybrid. Reviewed basic requirements to review is power loss, fast operating time, ability to reclose after a transient fault.

An attendee commented that CIGRE has recently finished, but not published, a Technical Brochure for medium voltage DC circuit breakers. Related to this research, IEC was considering development of HVDC CB at transmission voltage levels. The question was asked if the WG realized it would be the only standard in the world that included MV DC CB. The attendee recommended that the upcoming CIGRE TB (to be assigned at publishing date) be reviewed.

The next scheduled draft is 2.3. The WG has acknowledged that a limited number of references are available to draw from, ratings will need to be justified and discussed before inserting into the draft. WG members are investigating existing and planned HVDC systems to see what ratings would be logical. The existing systems requirements and reference standards are also being reviewed to gain data on which to base ratings/performance, etc.

DC circuit breaker overload current ratings will need to differ from AC systems. Discussion was had regarding the meaning of the term “Combined”. The point of view being discussed from an attendee was from the test laboratory. Combined may mean AC and DC sources in series whereas V_R may mean AC or DC applied to one side of a CIRCUIT BREAKER and DC or AC on the other. Further discussion ensued regarding the times needed to clear a DC side fault and how the AC side feeds a DC fault. Current interruption waveforms are different between AC and DC systems. In a DC circuit breaker,

the CB takes an active part in interruption by absorbing energy from the system after the conduction path changes state, producing a different waveform than expected by a constant DC voltage. An O-C-O duty cycle for a DC circuit breaker would be hard to perform since the energy absorbing elements must cool to their required values before absorbing further energy if the fault persists. The reclosing time will be critical, what would the required dead time be? It would depend on the system time constants. DC fault currents also may contain significant capacitance current discharges, especially if a VSC system is used.

Another comment from an attendee: possible learnings from system level to component level. It was proposed that the relevant IEEE Technical Committee for HVDC systems be contacted to discuss learnings and guidance overlap since both the system and circuit breaker parameters will affect one another. A challenge for the document will be to standardize on values. Unlike an AC circuit breaker, a DC circuit breaker will perform differently, if the system parameters are different, when placed in one system to another. There is a difference between TRV (AC concept) and TIV (DC concept). TIV as discussed, is termed Transient Interruption Voltage. A slide detailing current interruption events was presented.

Additional slides that concerned document structure and IEC document development were presented. In IEC documents are titled technical considerations, no standard yet. A standard is expected in the future, at the present time no date has been given. Several IEC HVDC documents are scheduled for publication at the end of 2023. An attendee suggested that IEEE request those published documents for WG reference.

7. Next Steps

- Determine the appropriate IEEE technical committee to discuss guidance on HVDC system parameters and equipment (circuit breaker) standardization.
- Request IEEE liaison to obtain relevant IEC documents and provide them to WG chair for posting as WG reference documents.
- Request a liaison from the appropriate IEEE technical committee.
- Schedule additional online meetings between F23 and S24 meetings

8. Adjourn

Motion: Nenad Uzelac

Attachment 1 - Attendance

First Name	Last Name	Affiliation	Role
Emmanuel	Ankvah	KEMA	Guest
Koustubh	Ashtekar	JST Power	Member
George	Becker	Power Engineers	Guest
Steven	Chen	Eaton Corporation	Vice Chair
Jason	Cunningham	Southern States	Guest
Thomas	Dawson	Merson	Guest
Boubacar	Diallo	Southern States	Guest
Patrick	Dihillo	Con Edison	Guest
Federico	Di Michele	CESI	Member
Sean	Guidry	Omicron Electronics	Guest
Sergio	Flores	Schneider Electric	Member
Chris	French	Beta Engineering	Guest
Victor	Hermosillo	GE Grid Solutions	Member
Danny	Hoss	Southern States	Guest
Joanne	Hu	RBJ Engineering	Chair (Excused)
Bill	Hurst	GE Renewable Energy	Guest
Shah	Jamal	AVANGRID	Guest
Christopher	Jarnigan	Southern Company	Guest
Mavilao	Javley	AVANGRID	Guest
Jeff	Jordan	Southern States	Guest
Dragan	Jovcic	University of Aberdeen UK	Member (Excused)
Riyad	Kechroud	GE Grid Solutions	Guest
Brad	Leccia	Eaton	Guest
YongWoo	Lee	KERI	Guest
Leo	Lopez	WIKA Instruments	Guest (R)
Chunming	Ma	Burns & McDonnel	Guest (R)
Vincent	Marchall	Southen Company	Member
Steve	May	Southern Company Service	Guest (R)
Fernando	Ordein	Dominion Energy	Guest
Sumitabha	Pal	Schneider Electric	Member
Damian	Podgorski	Sargent & Lundy	Guest (R)
Aaron	Rexrod	Meiden	Guest
Frank	Richbv	50Hertz Transmission	Guest
Brian	Robert	Southern States	Guest
Alex	Salinas	Doble/Vanguard	Guest

Leonel	Santos	Schneider Electric	Member
Victor	Savulyak	KEMA	Guest
Daniel	Schiffbauer	Toshiba International	Guest
Carl	Schuetz	American Transmission Company	Member
Jeff	Scott	Ameren	Guest
Dustin	Sullivan	Hubbell Power System	Member
Francois	Trichon	Schneider Electric	Guest
Nenad	Uzelac	G&W Electric	Guest
Jeff	Ward	Doble Engineering Company	Member
Jan	Weisker	Siemens Energy	Guest