

## **Air-Blast Ultrafast Disconnectors and Solid-State Medium Voltage DC Breaker: A Modified Version to Lower Losses and Higher Speed**

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**Abstract :** MVDC markets for green power generations, Navy, subsea oil and gas electrification, and transportation electrification are extending rapidly. The lack of fast and powerful DC circuit breakers (CB) is the most significant barrier to realizing the medium voltage DC (MVDC) networks. A concept of hybrid circuit breakers (HCBs) benefiting from ultrafast disconnectors (UFD) is proposed. A set of mechanical switches substitute the power electronic commutation switches to reduce the losses during normal operation in HCB. The success of current commutation in such breakers relies on the behaviour of elongated, wall constricted arcs during the opening across the contacts inside the UFD. The arc voltage dependencies on the contact speed of UFDs is discussed through multiphysics simulations contact opening speeds of 10, 20 and 40 m/s. The arc voltage at a given current increases exponentially with the contact opening velocity. An empirical equation for the dynamic arc characteristics is presented for the tested UFD, and the experimentally verified characteristics for voltage-current are utilized for the current commutation simulation prior to apply on a 14 kV experimental setup. Different failures scenarios due to the current commutation are investigated

**Keywords :** MVDC breakers, DC circuit breaker, fast operating breaker, ultra-fast elongated arc

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