

# Paris Session 2022



## Effectiveness of the unit testing and multi-part testing for an HVDC circuit breaker

SC A3  
PS1 / Q.2

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**Q2. HVDC switching equipment is on the way to become ‘standardized’ technology, while discussions are continuing based on the experiences in the field or laboratories as presented in 10545 and 10773.**

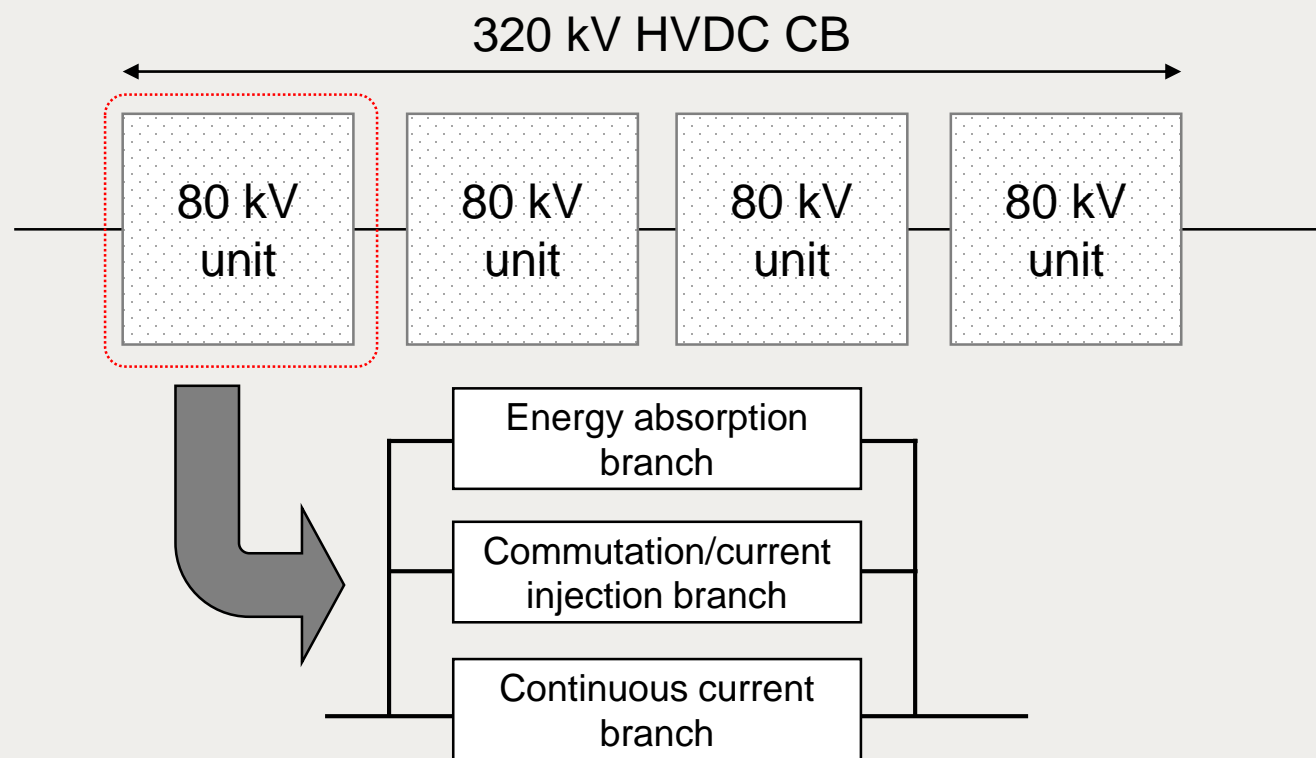
**Can experts provide relevant issues or proposals for the standardization of HVDC switchgear?**

**Answer**

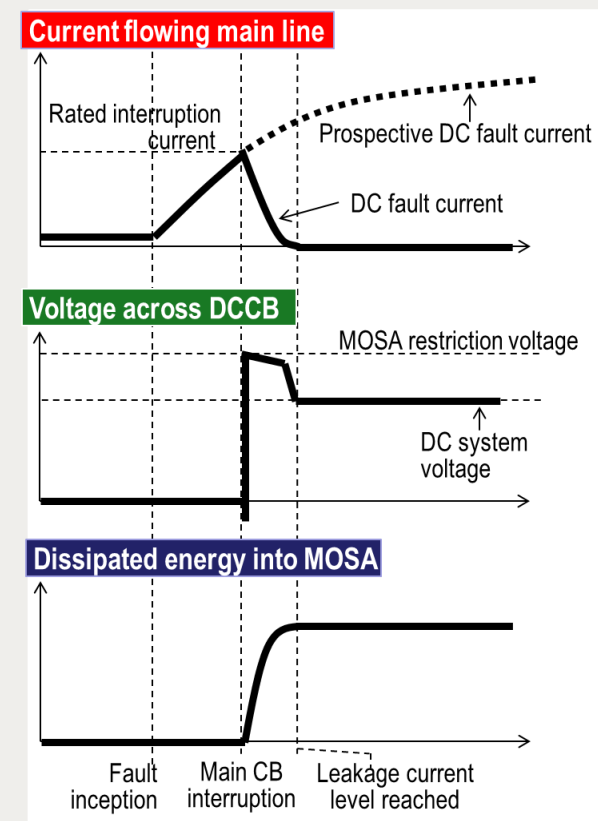
Unit testing, multi-unit testing and multi-part testing shall be allowed as far as these testing methods can provide the equivalent stresses expected in the practical HVDC systems to the HVDC CB. The idea has already been applied to a testing method of AC circuit breakers (IEC62271-100) and the similar testing procedure is proposed here.

# Testing of an HVDC CB

- In general, scaling up the voltage level of an HVDC CB such as 320 kV and higher involves series connection of modules and each module is composed of three main branches.
- Due to the limitation of the testing facility capabilities, direct test using the AC short-circuit generator would be difficult to impose the necessary stresses to the breaker that is equal to the real HVDC system.



<General HVDC CB configuration>

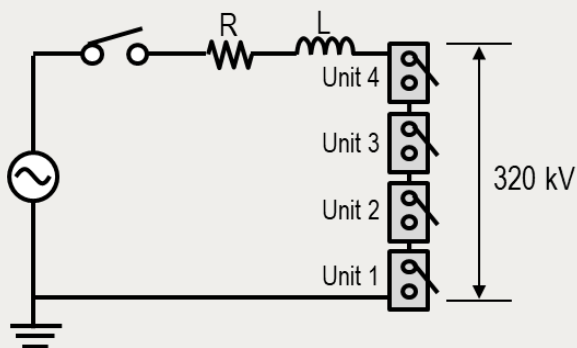


<HVDC CB main stresses>

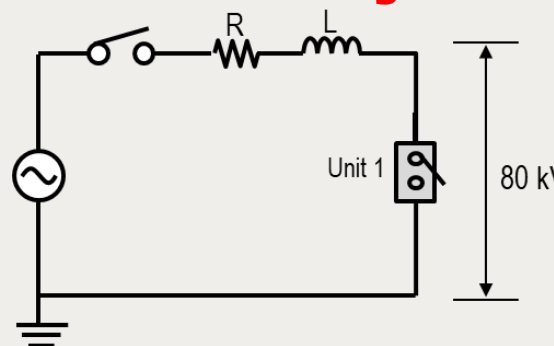
# Unit testing and multi-unit testing

- Unit testing or multi-unit testing is acceptable as long as the stresses are equivalent to those of corresponding unit of the HVDC CB in a real system.

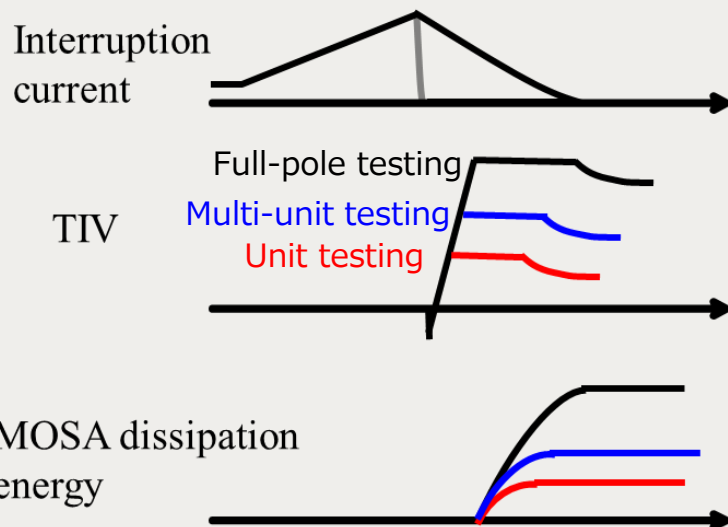
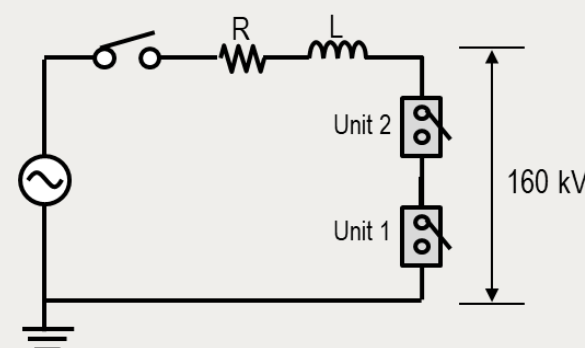
## ■ Full-pole testing



## ■ Unit testing



## ■ Multi-unit testing



### <Unit testing>

- Entire energy provided by the circuit can be imposed to only one module and high energy testing is possible.

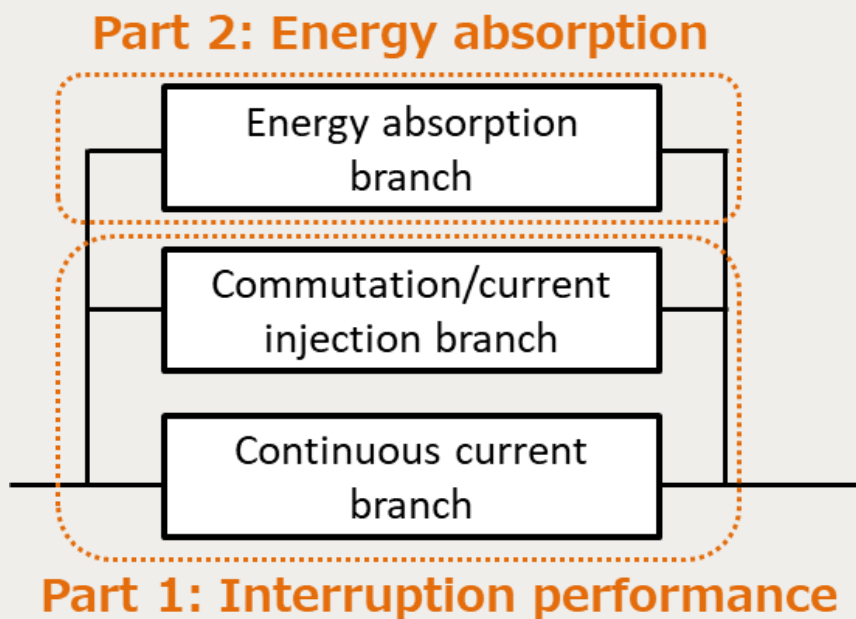
### <Multi-unit testing>

- Enable to verify the stress distribution among series connected breaker.

Different testing methods should be used depending on the stresses needed to be imposed on the breaker.

# Multi-part testing

- Even if the unit testing and multi-unit testing cannot supply the required stresses to the breaker, multi-part testing shall be allowed.
- 1<sup>st</sup> part and 2<sup>nd</sup> part pf the testing targets the different functionalities of an HVDC CB, since these two performance will not affect each other.



Part	Stresses for DCCB					
	Breaking current		TIV			MOSA energy
	Rate of rise	Peak	Rate of rise	Peak	Recovery Voltage <sup>(1)</sup>	
1	✓ Full	✓ Full	✓ Full	✓ Full	✓ Full	Small
2	None	None	None	None	None	Full

(1) Synthetic solution might be needed.

<Multi-part testing procedure for an HVDC CB evaluation>