

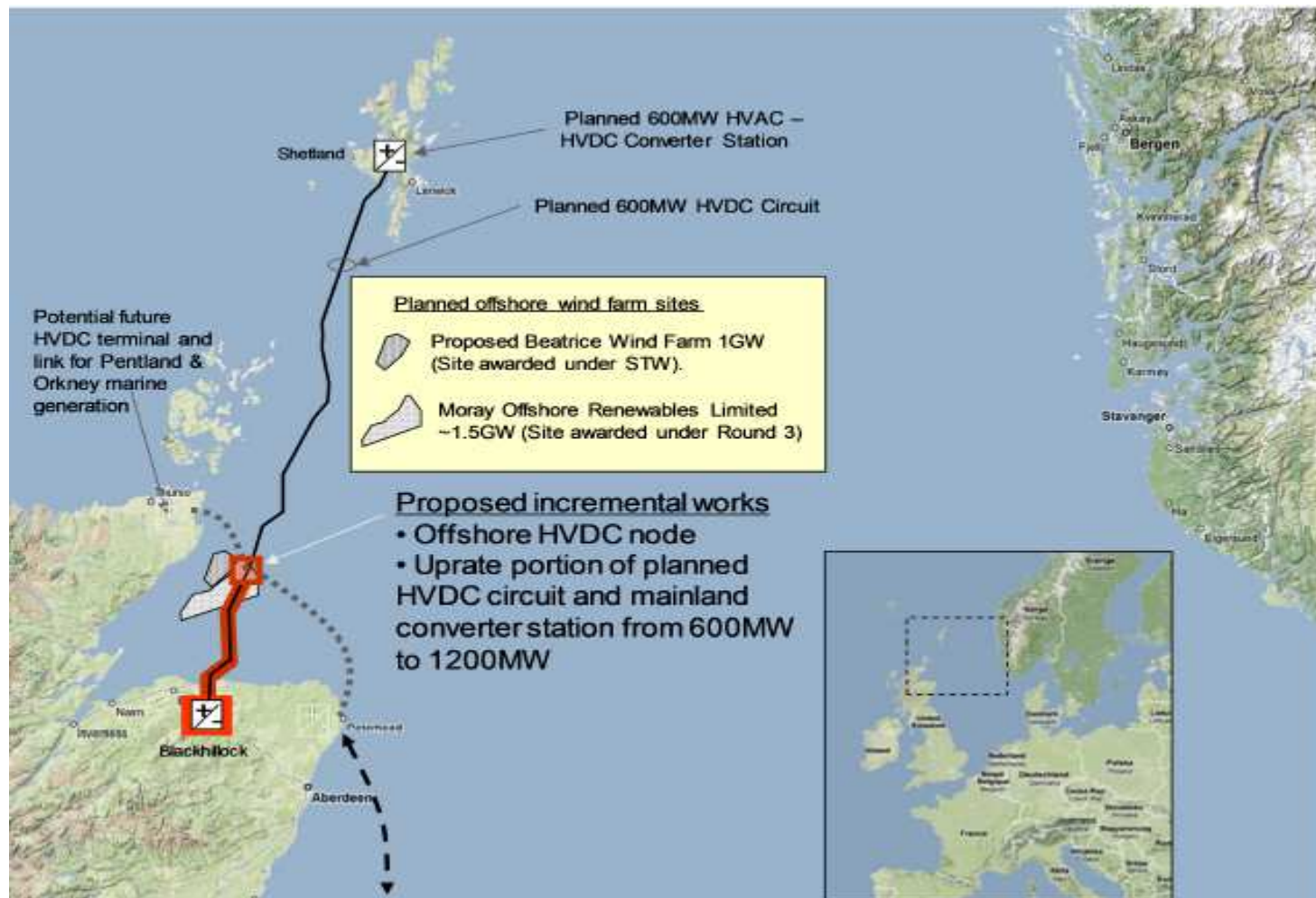
Recommendations for specifying Gas Insulated HVDC systems

Yash Audichya, 20/09/2018, Arnhem.

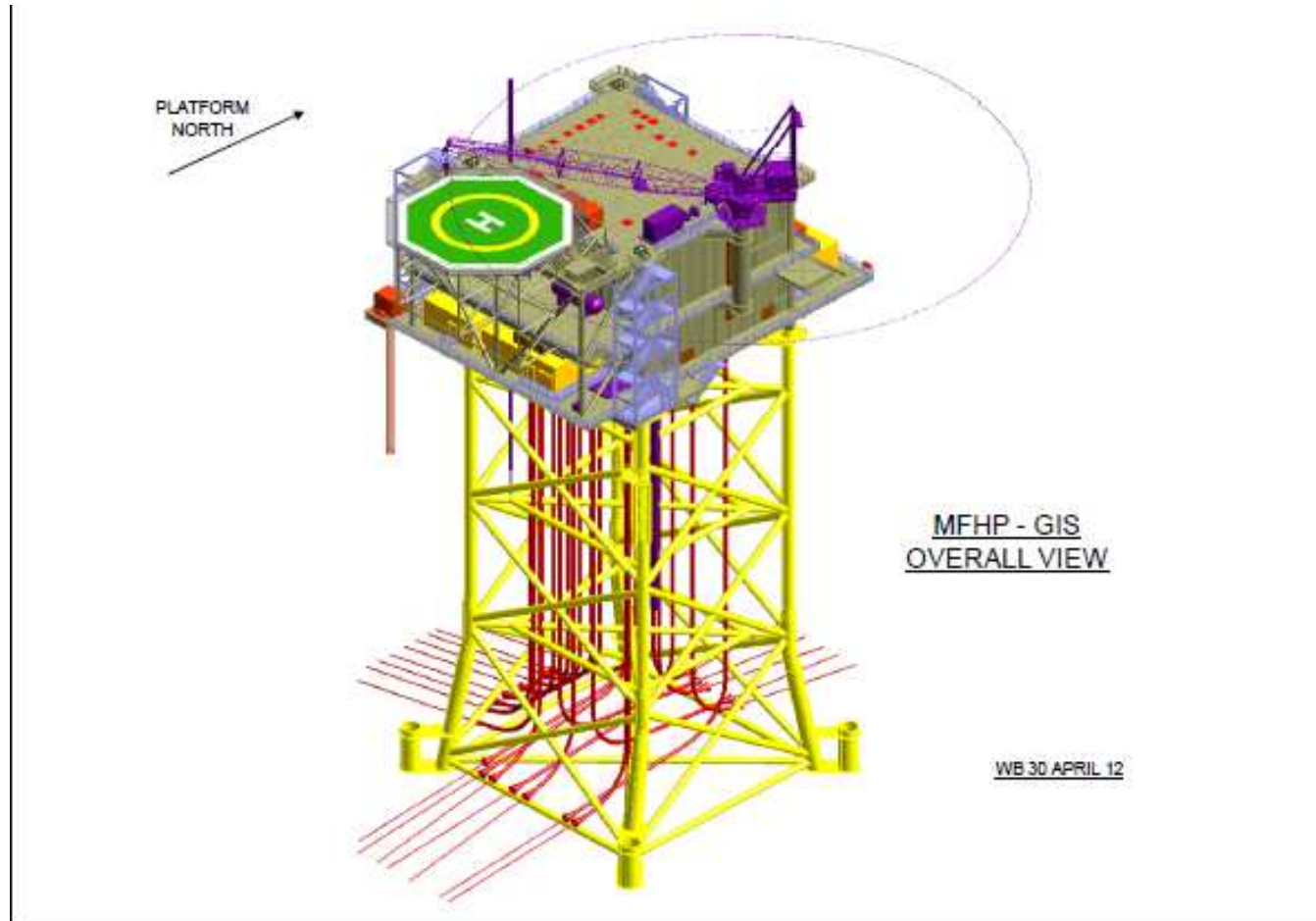


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DC Offshore Hub FEED study



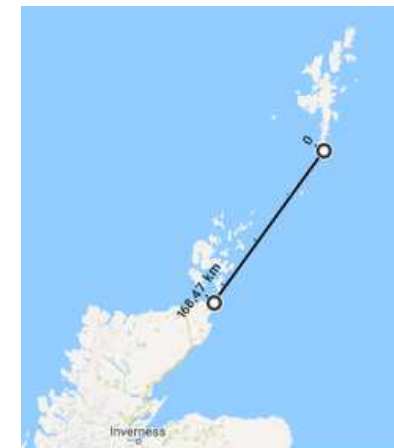
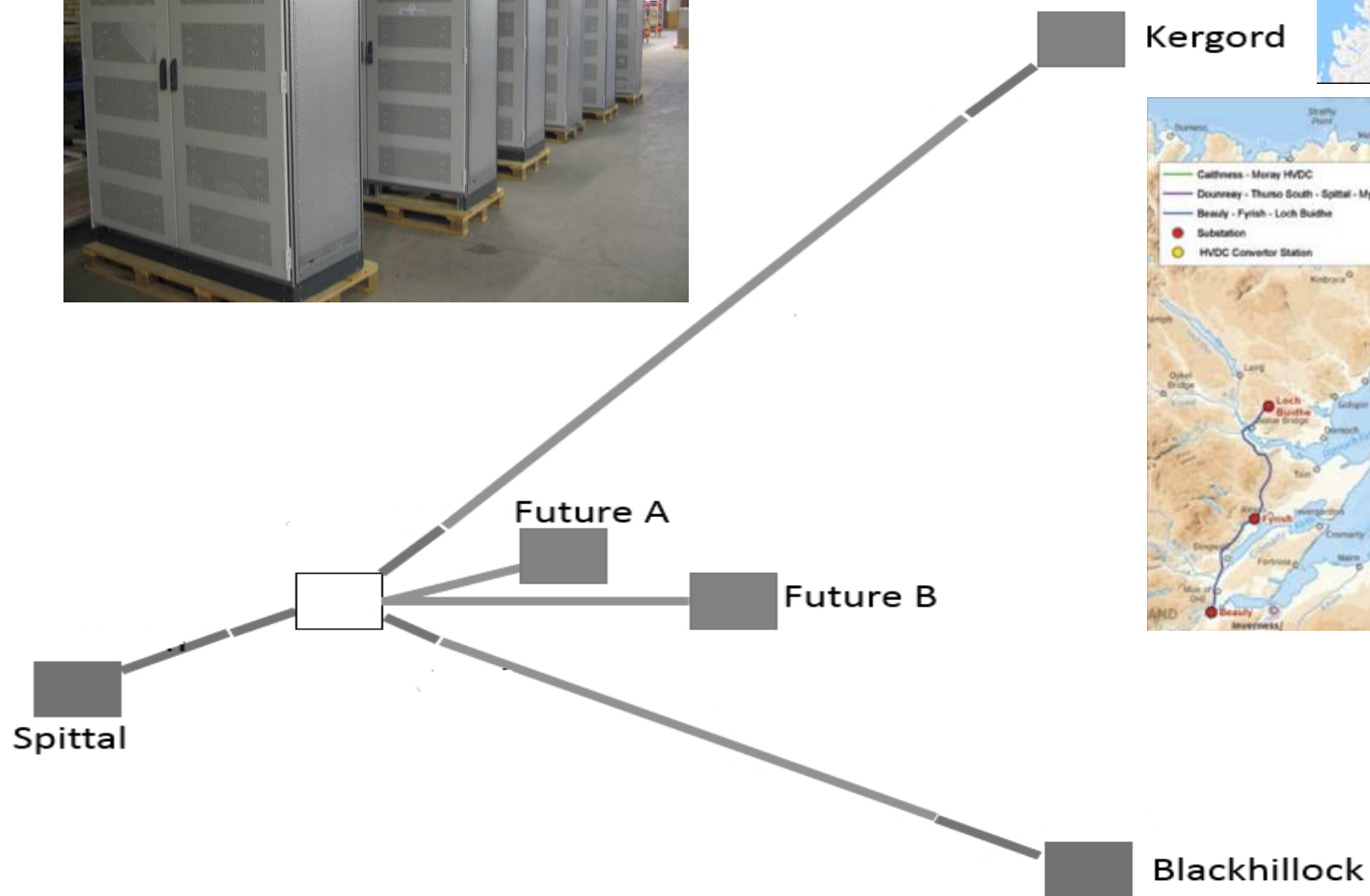
DC Offshore Hub FEED study



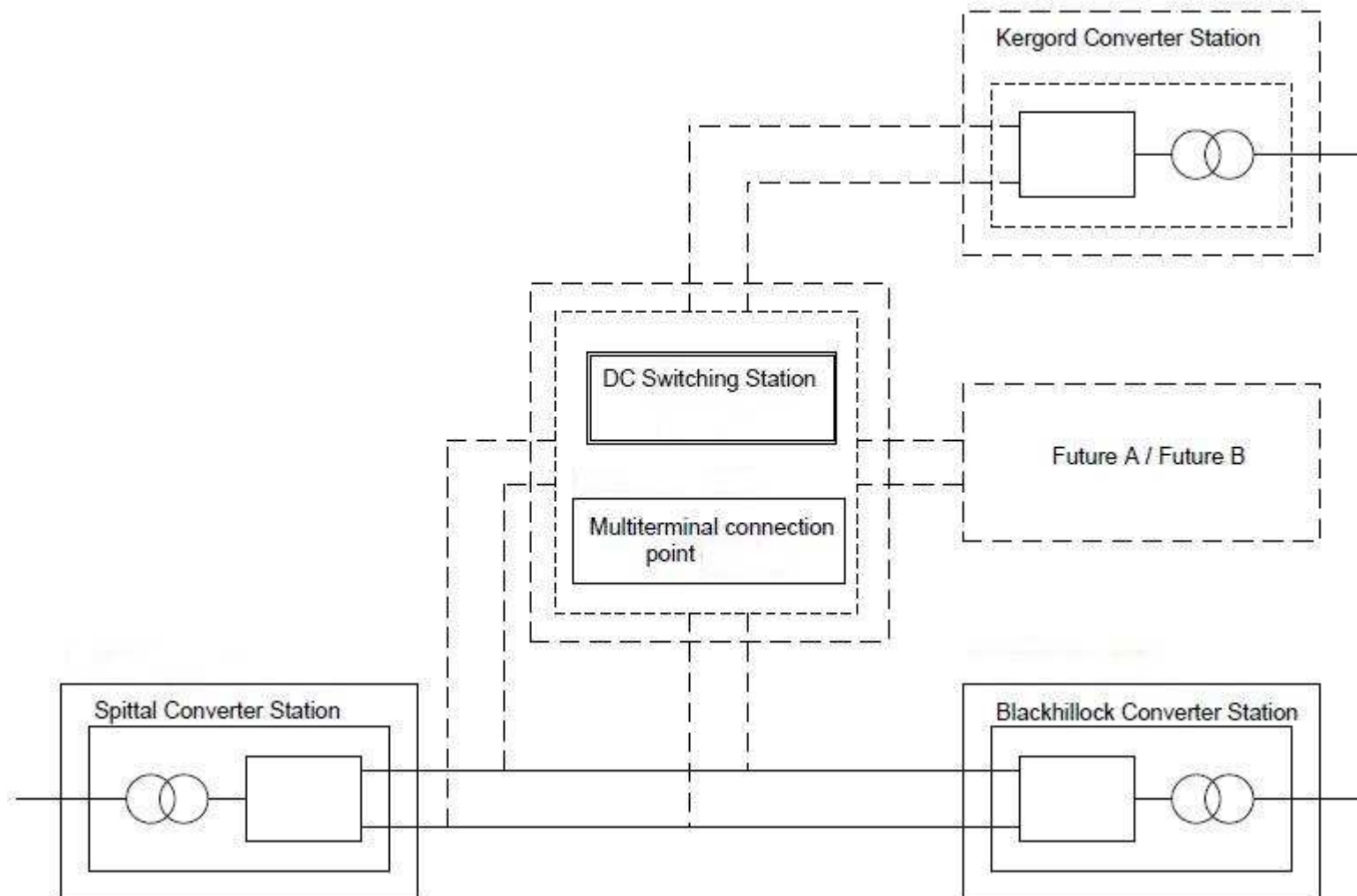
FEED overall view of jacket and topsides for Gas Insulated Switchgear *double* busbar substation (9 circuit connections)



5 terminal arrangement with provision for DCSS

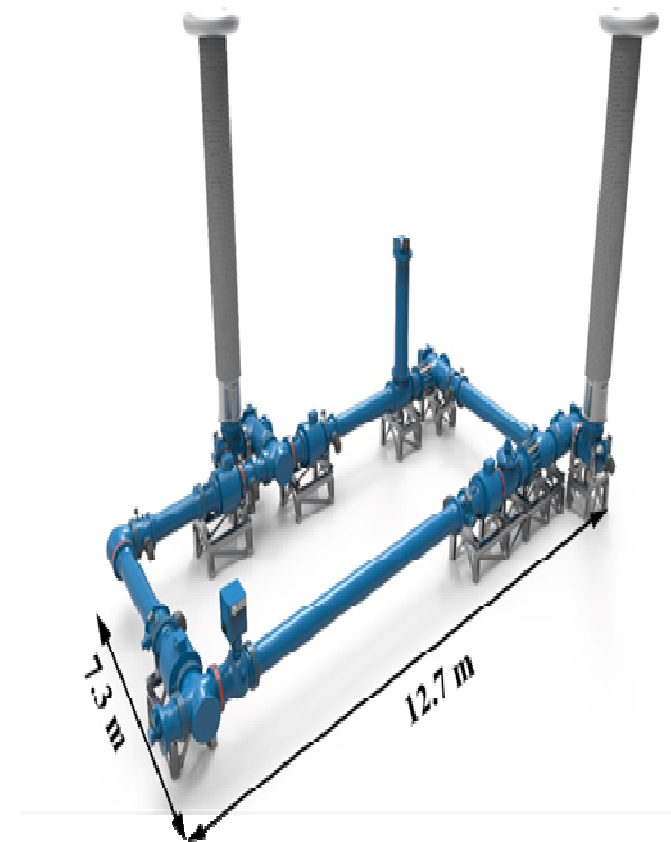


DC GIS Switching Station

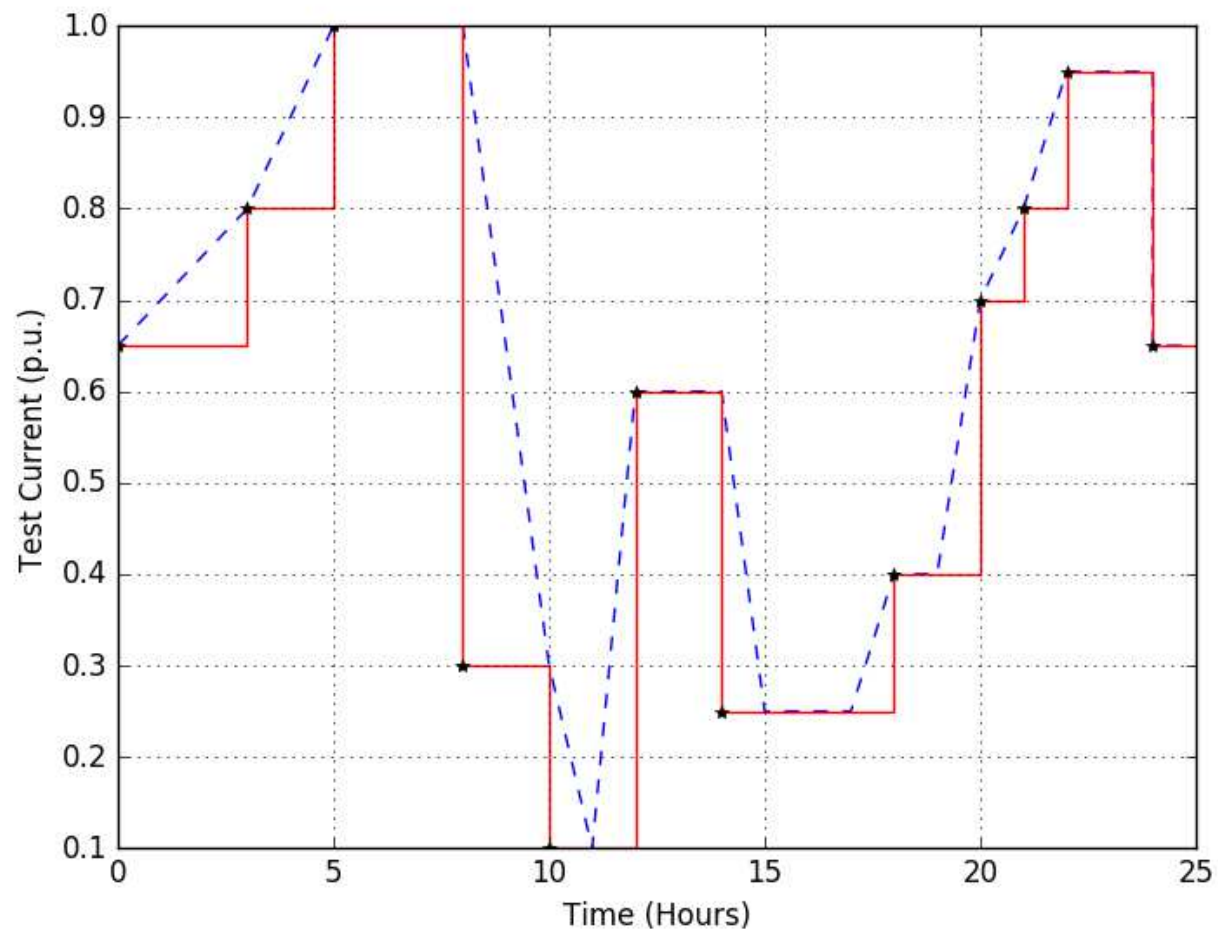


Components to be tested

- HVDC GIS bus-bars/bus-ducts
- Disconnectors
- Earthing Switches
- Bushings
- DC Current Transformers
- DC Voltage Transformers
- Insulation Medium and Enclosure



Load Cycle



Dielectric Tests with Pre-applied DC Stress

	Description	Test Voltage	Duration
Type tests Gas insulation	DC voltage withstand test	$1.5 \times U_n$	1 min
	Lightning impulse (LI) voltage test	IEC 60071-1/-5	15 impulses.
	Switching impulse (SI) voltage test	IEC 60071-1/-5	15 impulses
	Superimposed voltage test	$1.0 \times U_n + \text{rated LI/SI voltage}$	15 impulses
	Polarity reversal test* ¹	$1.25 \times U_n$	30 minutes
Insulator/gas interface	Insulation system test: DC voltage test	$1.0 \times U_n$	90% charging time
	Super imposed voltage tests (worst case conditions)	$U_r + \text{rated LI/SI voltage}$	3 impulses



PROMOTION Project DC GIS Rating Requirements

DC GIS Switchgear for PROMOTION Project	
U_n Nominal Voltage	±320 kV
U_r Rated dc operation voltage	±350 kV
U_p Rated lightning impulse withstand voltage	±1050 kV
U_s Rated switching impulse withstand voltage	±950 kV
I_r Rated normal current	4000A
I_{sc} Rated short-time withstand current, 1 second	50kA
Rated superimposed lightning impulse withstand voltage Lightning impulse voltage DC voltage	±1050 kV 350 kV
Rated superimposed switching impulse withstand voltage Switching impulse voltage DC voltage	±950 kV 350 kV
Leakage rate per year and gas compartment	≤ 0.5 % routine test; ≤ 0.1 % type test
Rated DC withstand voltage phase-to-earth	±480 kV
Ambient temperature range	-5 to 40 °C (indoor) -25 to 40 °C (outdoor)
Disconnectors	
Rated current	4000A
Rated short-time withstand current, 1 second	50kA
Closing time	≤ 6 s
Opening time	≤ 6 s
Preferred motor drive	DC Motor



APPENDIX

DISCLAIMER & PARTNERS

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