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Thu-Mo-Po4.06-03 [41]: Thermal and mechanical design of 10 MW class HTS wind power generator

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A 10 MW class HTS wind power generator is under development in Korea using REBCO wires for off-shore installation. NI (No-insulation) winding technique is applied to increase the electrical and mechanical stability of the rotor magnets using REBCO wires. The REBCO magnets, having operating temperature around 35 K, are designed to be cooled using forced circulation of cold helium gas. The cold helium gas would be cooled down through a heat exchanger in a rotating neon reservoir, which have been usually used in 'MW'class HTS rotational machine. Prior to the development of a cryogenic refrigeration system, thermal and structural design must be preceded to withstand the mechanical stress from large torque corresponding to 10 MW power. This paper describes the design of supporting structures and the thermal characteristics of the REBCO magnet. The supporting structures considered the Lorentz force in the REBCO magnet, fully coupled with an electromagnetic design result of 10 MW class generator, under load and no-load conditions. In a limited cryogenic space, thermal stress was also considered. Thermal loads are estimated for the conduction from supporting structures, thermal radiation and current leads. Then, thermal analysis, combined with cooling channels where the cold helium gas flows, was conducted to verify that the maximum temperature of coil met the design criteria. The analysis and design results will be used to develop a rotating refrigeration system for the 10 MW HTS wind power generator.

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