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Performance analysis and evaluation of a hundred-kW HTS dynamic synchronous condenser prototype

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The cryogenic and electrical tests of a hundred-kW HTS dynamic synchronous condenser (DSC) prototype were conducted in recent months. The performance of this prototype, which was developed to verify some key technical aspects for the future 10-Mvar HTS DSC, was evaluated based on the test results. The active power test results were nearly the same with design values, which indicated that the air-core stator has small synchronous reactance as the electromagnetic simulation predicting. The temperature data of HTS rotor during the running period, which were acquired from a rotating data acquisition device (rDAQ), showed that forced helium-gas circulating method + conduction cooling is sufficient for the cryogenic requirement. Also, in the fast-excitation process of the HTS rotor, the temperature of the HTS magnet almost unchanged. But in the long-time 1500-PRM running test, the temperature increment of the rotor bearings influenced the stability of the HTS rotor through the epoxy torque tubes. In both static cooling procedure and rotating tests, the helium cryogenic rotating coupling (CRC) performed well, which can be applied in the future 10-Mvar HTS DSC.

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