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Thermal characteristics of JT-60SA thermal shield

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JT-60SA is a superconducting tokamak constructed in a project being undertaken jointly by Japan and Europe. The thermal shield provides screening of the superconducting coils from the plasma vacuum vessel at elevated temperature and the tokamak cryostat at ambient temperatures. The thermal shield is made of stainless steel plates and is cooled by helium gas which flows in embedded pipes along the plates. The total surface area facing the warm components is 1150 square meters. Multi-layer insulator covers 40 percent out of total surface area. The coolant helium gas is typically supplied by 400 g/s at 80 K, and 1.4 MPa. The design heat loads for the whole thermal shield are 33 kW in nominal operation and 135 kW in baking operation, respectively. The first cool-down operation for the entire coil system including the thermal shield was conducted in 2020. The measured heat loads for the thermal shield are 30 kW in nominal operation and 100 kW in baking operation. In this work, a detailed operation method and measured data for JT-60SA thermal shield are revealed. The heat loads are analyzed in terms of difference between assumptions in design phase and measurements derived from the manufactured components.

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