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An update of dynamic thermal-hydraulic simulations of the JT-60SA Cryogenic system for preparing plasma operation

The JT-60SA cryogenic system will be operated at cryogenic temperature in 2019 in closed loop, without the cryogenic users (superconducting magnets, current leads, thermal shields). It will be another opportunity to verify the efficiency of the control strategies in order to handle plasma operation planned in 2020. This paper updates the heat load profiles to be extracted by the refrigerator and its thermal buffer. The heat load profiles are calculated through thermal-hydraulic simulations of the magnets and the associated cryo-distribution, also named as supercritical helium loops. This update was performed by taking into account new data from the magnets (measured pressure drops, updated heat loads coming from the plasma), as well as a more accurate thermal model of the magnet. This paper compares the simulation results with those previously obtained with the Vincenta code in 2012. The latter were obtained for the specification of the cryogenic system acceptance tests. The new thermal-hydraulic model is performed by using Simcryogenics, the modeling tool dedicated to refrigeration and cryo-distribution developed by CEA1. The differences between the two simulation results are highlighted and analyzed. These simulations also provide the transient heat load profiles of the magnet cooling loops, highlighting a first smoothing of the thermal loads at the interface with the cryogenic system.

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