MT 26
International Conference on Magnet Technology
Vancouver, Canada | 2019

Contribution ID: **1388** Type: **Poster Presentation**

Tue-Af-Po2.18-04 [36]: Design and performance of the quench protection heater for the HL-LHC beam separation dipole

Tuesday, 24 September 2019 14:00 (2 hours)

The LHC beam separation dipoles plans to be replaced for the high luminosity LHC (HL-LHC) upgrade. The new separation dipole, MBXF, is based on the Nb-Ti superconductor, and is designed to generate 35 Tm at the nominal operating conditions of 12.05 kA and 1.9 K. The magnet has a stored energy of 0.34 MJ/m, and all the energy needs to be extracted only by quench protection heaters before the hot spot temperature reaches its practical limit of 300 K.
The first heater is made of 25 um thick by 15 mm wide stainless steel (SUS), and its total length is adjusted to that of the MBXF model (2 m). An inrush current of ~150A is provided by the 7.05 mF capacitive power supply. The heater test was conducted with the first MBXF model and we found that the single strip-line heater was not capable of protecting the magnet for the nominal operation. Therefore, we conducted a design study for a new protection heater using our thermal simulation code.
The new heater is a composite of same materials as used in the first heater while the length and position of the SUS strip is optimized so that the normal propagation zone is developed effectively. The heaters were equipped with the second model magnet, and the full energy discharge was tested in order to check the performance. The result showed that the magnet current was successfully dumped and the new heater fulfills the protection requirements on the MBXF. In this paper, we summarize the results from the full energy dump test for the second model, and give prospect for the full-scale production magnet.

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Session Classification: Tue-Af-Po2.18 - NbTi Accelerator Magnets II