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

Contribution ID: **1600** Type: **Poster Presentation**

Tue-Af-Po2.14-02 [2]: Design and Performance Estimation of a 20 T No-Insulation all-REBCO User Magnet

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

This paper reports a design and performance estimation of a 20 T no-insulation (NI) high temperature superconductor (HTS) standalone user magnet currently being developed at the National High Magnetic Field Laboratory. It consists of a stack of 17 double pancake coils wound with tapes from two different vendors, SuNAM and SuperPower, in consideration of their complementary in-field critical current and mechanical properties. The inner and outer winding diameters and overall winding height of the magnet are 58 mm, 127.5 mm, and 149.2 mm, respectively. The magnet is designed to generate a center field of 20 T at its nominal operating current of 280 A in a bath of liquid helium at 4.2 K. The inductance and stored energy are 3.75 H and 147 kJ, respectively. First, we report key design parameters followed by numerical simulations on: (1) NI charging behavior and estimation of liquid helium consumption; (2) stress analysis, before and after quench, taking account of induced overcurrent during quench and the screening current distribution; (3) post-quench behavior including the local temperature rise.

ACKNOWLEDGMENTS
This work was performed at the National High Magnetic Field Laboratory, which is supported by National Science Foundation Cooperative Agreement No. DMR-1644779 and DMR-1839796, and the State of Florida. A part of analysis work by U. Bong and S. Hahn was supported by the National Research Foundation of Korea as a part of Mid-Career Research Program (No. 2018R1A2B3009249).

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Session Classification: Tue-Af-Po2.14 - No-Insulation Coil Technology