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Test Results for Prototypes of the Twin Aperture Dipoles for the LHC Insertion Region*

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Abstract—The Superconducting Magnet Division at Brookhaven National Laboratory (BNL) is building 26 insertion region dipoles of various types for the Large Hadron Collider (LHC) at CERN. These 9.45 m-long, 8 cm aperture magnets use the same coil design as the arc dipoles for the Relativistic Heavy Ion Collider (RHIC) at BNL. The required dipole field is up to 4.1 T (at 6.6 kA) for operation at 7.56 TeV. The most challenging of these dipoles are the twin aperture magnets. The two apertures are separated by 188 to 234 mm only, and the dipole fields in both the apertures point in the same direction. In order to test the design and determine various operating parameters of these magnets, two 3 m-long prototypes were built and tested at BNL in vertical test dewars filled with liquid helium at 1.12 atm and 4.35K. Tests were done to measure spontaneous quench performance, conductor temperature at quench, coil stress behavior during cooldowns, warm-ups and excitation ramps, and quench protection heater performance. Extensive magnetic field measurements were done with a 3.58-meter long integral coil, as well as a one-meter long coil at the axial center of the magnet. Dynamic effects, such as time decay and snapback at injection, and harmonics due to cable magnetization and eddy currents were also studied with a time resolution of 2 sec. This paper will present test results for the two prototypes.

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