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Wed-Af-Po3.15-12 [16]: Development of a 3-T conduction cooled MgB2 dipole magnet

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A 3-T MgB_2 dipole magnet has been designed aiming at applications of compact accelerators and rotating gantries for heavy-ion radiotherapy facilities. The dipole magnet contains two identical racetrack coils. Each coil is wound by 156-m long commercial MgB_2 wire, with the length of the straight side, the winding diameter of the round portion and the height of 60 mm, 40 mm and 23 mm, respectively. The central magnetic field of the dipole magnet is designed to be 3.0 T at the operating current of 125 A at 20 K. For verifying the feasibility of manufacture techniques, three identical scaled MgB_2 racetrack coil was designed, manufactured and tested in advance. All coils were wound by 5.1-m long MgB_2 wire, the same type as in the full-scale dipole magnet, and heat treated at different temperatures from 650 °C to 700 °C. All coils were cooled by solid nitrogen and tested at 20 K. The temperature evolutions at current lead and coil body positions were monitored. Two coils heat treated at 650 °C and 675 °C remained stable when charged up to 250 A. The one heat treated at 700 °C quenched at 225 A. It was proved that our manufacturing technique is reliable and can be used in the full-scale dipole magnet.

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