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Effect of current-sharing and heat capacity of metal core on quench protection of spiral coated conductors

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We experimentally studied the quench characteristics of coated conductors wound on metal cores spirally. The length of the metal core of each sample was 230 mm. A coated conductor was wound at the center 160 mm section of the core. Current terminals were attached over the coated conductor with 100 mm separation (effective section). Indium was filled in the gap between the current terminal and coated conductor in the sections under current terminals (terminal sections). We prepared the following four samples with four different insulation conditions.

Sample A: The entire core was completely insulated from both coated conductor and current terminals. Any current can flow in the core. The core is just a heat sink.

Sample B: The surface of the core was insulated from the coated conductor in the effective section. The current could be shared among the current terminals, the coated conductor and the core only in the terminal sections.

Sample C: The surface of the core was insulated from the coated conductor and the current terminals in the terminal sections. The current could be shared between the coated conductor and the core only in the effective section.

Sample D: No insulation was made on the core. The current could be shared anywhere.

Each sample was conduction-cooled at 55 K, and a normal zone was generated by a small heater. The normal voltages appeared in four samples were compared in order to examine the effect of the current sharing by the core as well as the effect of the heat capacity of the core on the normal voltages, which were related to the hot spot temperatures.

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