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Metal-as-Insulation HTS Insert for Very-High-Field Magnet: A Test Report after Repairment

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As a sequel to our previous report on in-field performance estimation of a 38 mm cold bore metal-as-insulation (MI) HTS insert after quench event of 32.5 T, this paper presents repairment process and test results of the insert. Although the insert had survived against insert quench and fault events of background magnet, the resistances of the insert increased because the inner as well as the outer junctions were kinked and the REBCO tapes of the last single pancake coil at the top and bottom of the stack were mechanically deformed. For this reason, 7 MI DP coils were re-wound with used REBCO tapes to just replace damaged HTS pieces by new ones for inner junctions. 2 DP coils were manufactured using new REBCO tapes as well as new inner junctions. During repairing process, a sapphire plate was used for electrical insulation between the SP coils to enhance the cooling condition inside each DP coil. The coils were tested in a bath of LN₂ at 77 K to compare critical current, coil constant and resistance values of original, damaged and repaired DP coils. After assembly of DP coils, the 9 DP stacked insert was installed in a newly made probe with a 34 mm bore size tube to access to the center of the coil allowing further in situ characterizations of the coil and future experiments by end users. The insert was tested under various background magnetic fields (B_{ext}) in a bath of LHe at 4.2 K. The key focuses of this paper are: 1) characteristics resistance change of the insert; 2) resistance value of each DP coil; 3) temperature change of the insert during operation; 4) the magnetic field induction rate of the insert under various B_{ext}; and 5) field homogeneity of the insert through field mapping.

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