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Lap joint resistivity and crossover resistance of REBCO conductors and coils

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During the NHMFL 32 T magnet project, a program to develop a reliable method for making soldered lap joints between REBCO tape conductors was initiated. Several combinations of solder, flux and process were tried and then tested in liquid nitrogen. A standard process was adopted from the findings of that study. For each unique REBCO conductor piece procured for the 32 T project, a lap solder joint was made using the standard process and tested for resistance in liquid nitrogen. A total of 211 lap joints were made and tested. For the NHMFL 40 T magnet project, a similar study was performed using the same standard process on conductors procured for test coils. A total of 22 lap joints were made and tested. Results from both data sets are reported, and compared with findings from the initial study and published findings by others.

In the stacked double-pancake construction adopted by the NHMFL for REBCO coils, each double-pancake is connected in series to adjacent modules with a crossover connection, made from an assembly of several REBCO tapes placed in parallel and soldered across the terminal ends of each adjacent module. Resistances of the crossovers in a 32 T test coil, from test articles and test coils made during the 40 T project, are reported here. The resistances of the crossovers do not scale inversely with area in the same manner as lap joints. A test of the current distribution in a crossover joint was performed in liquid nitrogen. Findings from this test are reported, and an improved predictive model for the resistance of a crossover connection is given.

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