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Influence of Reaction Heat Treatment Conditions on Interstrand Contact Resistances of Nb3Sn Rutherford Cables

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For the high luminosity upgrade of the large hadron collider (LHC) the US accelerator research program (LARP) is developing a magnet designated MQXF and its associated 40 strand Nb3Sn Rutherford cable designated QXF. To suppress interstrand coupling currents generated during field ramp 25 μm thick stainless steel cores may be included in the QXF cables. For the present study cables with cores of various widths were wound and interstrand contact resistances (ICR) were extracted from the results of AC-loss measurements obtained by way of pickup-coil magnetometry. The ICR so obtained is generally the combined result of crossover- and adjacent- strand contact resistances, Rc¬ and Ra, respectively. In preparation for AC-loss measurement each cable stack was reaction heat treated (RHT) in a closed fixture just large enough to contain it when expansions of 1.5% in width and 4.5% in thickness are expected to take place, a protocol that follows magnet fabrication specifications. In previous studies when RHT was performed under considerable uniaxial pressure the ICR was very low in uncored cable and increased with increasing core width. In the present case, in which RHT took place under ambient pressure, the crossover contact was found to be nonexistent. With Ra left as its sole contributor, ICR turned out to be relatively large, independent of core width, and unpredictable in value.

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