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Stacked tape HTS conductors for Fusion Magnets

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A prototype conductor for Fusion magnets rated for about 60 kA at 5K, 12 T has been fabricated. The conductor is composed by a flat cable in a steel conduit; the flat cable consists of twisted and soldered stack of tapes in round copper profiles which are cabled around a flat central former. Initially the performances of the coated conductor tapes used for the cable manufacturing were fully retained; during a long campaign cumulating about 2000 electromagnetic cycles and a warmup-cooldown cycle a progressive degradation of the performances was observed on both conductor legs. After the test the samples were dismantled and the jackets removed; the visual inspection of the strands revealed cracks in the soldering between the copper profiles; in three out of four cases the cracks were located at the cable edges. After disassembling the cables the critical current of the strands was measured at 77 K: a reduction was found not only in the loaded flat side of the cable, but also (and more evident) on the edges of the cable. Transverse pressure cycling test were performed at 77 K on various short test strands and it was confirmed that bent strands degrades more than straight ones; the hardness of the copper shell also affects the performances. Guidelines for the next prototypes have been suggested.

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