

Development Status of the HTS SECAS Conductor for a Full-Size Test Sample

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Abstract—The ENEA Superconductivity Laboratory, in collaboration with the industrial partner TRATOS Cavi, is continuing the development activity of the high-current / high-field SECAS Cable-in-Conduit conductor, based on stacked REBCO tapes and a segmented, sector-shaped Cu former. The test outcome of various prototypes, carried out at 77 K and self-field in the previous years, have clarified important aspects of the manufacturing process and cable performance, and identified the key aspects of the processing steps. The industrial manufacturing process is consequently being developed, and partly applied for the manufacture of full-size samples, to be tested in the SULTAN facility. The conductor is designed to operate at 4.5 K, with a current of 60 kA and at a field of 18 T (as required by the EUROfusion DEMO development plan). Different layouts have been probed, either based on 4 mm-wide, or on 12 mm-wide tapes, but maintaining the same total superconductor cross-section, in order to verify the impact on AC losses and on tape mechanics. Two of these layouts have been assembled into a single SULTAN sample, made of two legs connected by a bottom joint. The development of the joint/termination assembly technique for this full-size sample is discussed. The sample has been also equipped with fiber optic sensors, to demonstrate the transition detection capabilities: all the steps undertaken to define an appropriate layout to include systematically these sensors during cable manufacturing are discussed here, and have been verified during tests carried out at 4.2 K and at 10 T magnetic field, on representative sub-size samples. All results of these development activity are presented in this work, together with the foreseen test plan of the full-size conductor lengths.

Keywords (Index Terms)— Cable in Conduit, Center Solenoid, Fusion, HTS Cable

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