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Sun-Mo-Or1-05: DC and AC characterization of DTT superconducting cabled-in-conduit-conductor (CIC) samples

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The DTT magnetic system is mainly constituted by the following superconducting coil sets: 18 Toroidal Field (TF) magnets, 6 external Poloidal Field (PF) coils and a stack of 6 independently fed Central Solenoid (CS) modules. The PF coils system, characterized by a full top-down symmetry, is realized in Nb₃Sn (PF1 and PF6) and NbTi (PF2, PF3, PF4 and PF5). This work is focused on the SULTAN tests of the Nb₃Sn PF conductors, and of the TF production samples conductors. These tests are carried on to confirm the design choices and to deal with a crucial aspect concerning Nb₃Sn Cable-In-Conduit Conductors (CICCs), that is to manage the risk of the possible performance degradation with cyclic Electro-Magnetic (EM) and thermal loads.

The DTT PF16 SULTAN sample was made of two distinct Nb₃Sn CIC sections, namely 'PF16-A' and 'PF16-B', differing for the cabling twist pitch sequence and joined at the bottom. Both sections were made with ITER like strand wires produced by OST and were designed to work in DTT at 28.3 kA at 9.2 T peak field. The PF16 characterization comprised 6000 electro-magnetic (EM) cycles and two warm-up-cool-down (WUCD) steps, and in detail it included: pressure drop measurements as a function of the mass flow rate, AC measurements with and without background magnetic field and transport current on the virgin conductors, on cyclic loaded conductors and after WUCDs; DC tests at 8T/28.3 kA with intermediate EM cycles at 8 T/28.3 kA before and after WUCDs; DC tests at different Lorentz force loads to investigate the conductors' strain state, Trapezoidal pulsing and Minimum Quench Energy tests at 8 T/28.3 kA after cycles and WUCDs.

Concerning the TF production samples tests, the measurements aimed at confirming the excellent results of the qualification sample, including one WUCD cycle and 1000 EM cycles. Tests comprised pressure drop measurements as a function of the mass flow rate, AC measurements with and without background magnetic field and transport current on the virgin conductors, on cyclic loaded conductors and after WUCD, DC tests at 10.85T/42.5 kA with intermediate EM cycles at 10.85 T/45kA before and after WUCD; DC tests at different Lorentz force loads to investigate the conductors' strain state

In this work the results of the analysis of AC and DC tests both concerning PF16 and TF conductors will be presented and explored in depth.

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