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Wed-Mo-PL1-01: [Plenary] Qualification of the HTS Magnets for SPARC

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Commonwealth Fusion Systems (CFS) is building the SPARC tokamak in Devens, MA, USA, with first plasma planned in 2026. The initial objective of SPARC will be scientific demonstration of $Q>1$ (net fusion energy) in a tokamak, with experiments then shifting to the goal of exploring operating regimes for ARC, the first fusion power plant. SPARC utilizes a high field, compact, pulsed tokamak design enabled by superconducting Toroidal Field (TF), Poloidal Field (PF), and Central Solenoid (CS) coils. After the underlying technology for the SPARC HTS magnet systems was de-risked with the TFMC and CSMC programs, CFS constructed a manufacturing facility to build the SPARC magnets. As a part of this operation, CFS has constructed a set of test facilities to allow for the progressive testing of all magnet subcomponents through final tests of the full magnets themselves at SPARC operating conditions. At the component scale, facilities were built and qualified to allow for the testing of the input HTS tape at low temperature and high field as well as testing the structural material of the magnets at low temperature. At the magnet sub-unit scale, facilities were built and qualified to test the superconducting performance of every pancake/layer at 77 K to uncover any potential manufacturing defects before the pancakes/layers were integrated into full coils. Finally, two large cryogenic, high current test stands were built and qualified to enable the full testing of every single TF, PF, and CS coil before being sent to SPARC for installation. In addition to achieving the required operating conditions for each step of testing, the test facilities were designed and built to match the high throughput achieved by the manufacturing line, and will ensure high confidence that every magnet delivered to SPARC will work as designed. This talk will provide an overview of these test facilities and testing progress to date.

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