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Qualification Testing of SPARC's Poloidal Field Magnets

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***Abstract*—The SPARC tokamak relies on high temperature superconducting (HTS) magnets to achieve the magnetic fields required for a net energy plasma. SPARC has eight poloidal field (PF) magnets made with PIT VIPER cables that are pancake-wound. There are 10-14 pancakes within each magnet, and the performance of each individual pancake must be verified in liquid nitrogen before integration into SPARC. To this end we present the qualification process of the PF magnets, covering the tests, analysis methods, and models used to assess performance. Thermo-electric quench simulations of test current profiles ensured the entire pancake, including the low-field regions, could be safely transitioned above Ic, eliminating any risk of overheating the pancake. Pancake performance was assessed by comparing Ic measurements to predictions from a self-consistent Biot-Savart model. Test analysis and high-fidelity Ic predictions ultimately informed SPARC pancake acceptance decisions.**

***Keywords (Index Terms)*—Poloidal Field Coils, HTS magnet, Quench, and Tokamak**

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