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FTP/3-2: SST-1 Tokamak Integration & Commissioning

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Steady State Superconducting Tokamak (SST-1) commissioning attempted in 2006 was unsuccessful due to leaks being observed in magnet joints and isolators in the helium and nitrogen circuits. Additionally, 80 K thermal shields remained at higher temperature and leaks were observed in vacuum vessel baking channels. After a comprehensive review, the SST-1 refurbishment has been undertaken replacing all existing joints with sub nano-ohm leak-tight joints in superconducting magnet winding packs, installing single phase LN2 cooled bubble type thermal shields, developing and installing supercritical helium cooled 5 K thermal shields on Toroidal Field (TF) magnet cases, ensuring thermal and electrical isolations between various sub-systems of SST-1, testing all SST-1 TF magnets in cold with nominal currents. Furthermore, the task of testing each of the fully assembled modules and octants of SST-1 machine shell in representative experimentally simulated scenarios, experimentally establishing the operational reliability of the SST-1 vacuum vessel baking system, time synchronizing various heterogeneous subsystems of SST-1 through a dedicated GPS networking, ensuring reliable large data storage scenarios has also been started. Currently, SST-1 machine shell is getting fully assembled and an 'engineering validation'would commence with the objectives of establishing SST-1 as an appropriate calibrated UHV compatible thermo-mechanical and magnetic device prior to first plasma.
Design and engineering criticality in tokamak components that reduces functional risks, and important qualification measures thatreduce the leaks in the cold operational scenarios are some of the highlights of SST-1 refurbishment. Importance of testing superconducting magnets in cold with operational currents, flow imbalance and thermal run away elimination in thermal shields, consequences of the magnetic configurations with the machine assembly being done at room temperature are some of the major lessons learnt and are useful inputs to future devices.

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