

Pump Characterization of 80 K Liquid Nitrogen Booster System for SST-1

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The Steady state superconducting Tokamak (SST-1) is medium size tokamak, which requires liquid nitrogen (LN₂) cooled 80 K bubble shields for reducing direct static heat load from room temperature to superconducting magnets system (SCMS). Dedicated liquid nitrogen booster system has been installed and commissioned to cater 0.7 MPa / 80 K single phase flow for uniform temperature distribution among all the 80 K shields of the SST-1 machine. The boosting system has been driven by three centrifugal cold pumps at liquid nitrogen services. These pumps have been tested at steady state mode around 0.5 MPa / 80 K at the suction and 0.7 MPa / 80 K at discharge. This Pumps can handle the pressure head in the range of 1.3 - 3.5 bar (a) at the rated speed of 5500-7000 rpm respectively, over cryogenic stability. Each of three pumps was characterized at their rated speed by evaluating various differential pressure and mass flow rate. The active current, apparent current and the actual voltages have been measured onset from the frequency controller. Based on these measurements, the efficiency of each pump have been deduced using the rated parameters and the efficiencies were obtained to be in the range of 32 - 45%, which is found to be at satisfactory level as guaranteed.

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