Seminar

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Institute for Plasma Research

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Title: Recent Maintenance Experiences of Cryogenic Plant and Distribution System for SST-1

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Abstract

The Steady State Superconducting Tokamak (SST-1) has Toroidal Field (TF) and Poloidal field (PF) Superconducting Magnet Systems (SCMS). There are total sixteen TF coils and nine PF coils. IPR has dedicated Helium Refrigerator and Liquefier (HRL) system of 1.3 kW at 4.5K to cool the SCMS of SST-1 either in two-phase Helium cooling or single phase Helium cooling using a cold circulator. The HRL system is integrated with other subsystems such as Integrated Flow Distribution and Control System (IFDCS), Current Feeder System (CFS), Warm Gas Management (WGM) system and LN2 Management system with 80K Valve Box. Recently, we carried out dedicated SST-1 campaign for its cryogenic thermal load assessment. Detailed maintenance activities were planned for trouble-free operation of all cryogenic subsystems prior to carrying out a month long SST-1 campaign. The major activities were overhauling of Helium screw compressor for reliable long term operation, installation of new electrical motor for this overhauled compressor, upgradation of safety elements of Main Control Dewar (MCD), installation of additional temperature sensors on 4.5K and 80K surfaces of IFDCS/ CFS to understand thermal behaviour, in-house repairing of obsoleted IO modules of cold box PC3000 PLC and replacement of faulty positioner for electro-pneumatic control valves etc. Standard Operating Procedure (SOP) was implemented to remove impurities from Helium gas. The SOP covers a protocol of long regeneration of charcoal bed of Oil Removal System by dry nitrogen gas, extended regeneration of 80K heat exchanger and charcoal bed of on-line purifier and preconditioning activities of cold box and SST-1 SCMS. After above maintenance activities, we successfully operated all cryogenic subsystems for a month long SST-1 campaign. During the SST-1 campaign, TF SCMS was charged with its near nominal current and magnetic field for several hours. The paper describes the detail of maintenance activities with some technical challenges and engineering practices followed for such large cryogenic plant system and cryo distribution system. The maintenance activities and related technical experience discussed in this paper will be very helpful for cryogenics systems of future fusion devices.