

26th National Symposium on Cryogenics and Superconductivity

Contribution ID : 15

Thermal Performance Enhancement of Liquid Nitrogen Distribution System of SST-1

Content :

The cryogenic system of SST-1 Tokamak facilitate the liquid nitrogen system which consists of storage tanks and a distribution system; vacuum jacketed super insulated LN2 transfer lines connected to the 80 K thermal shields, current feeders system, integrated flow distribution and control system, pre-cooling heat exchanges and purifier of helium plant system via supply and return headers. The LN2 vapour out from the insulated vent outlet lines to atmosphere. Huge frosting, condensation and LN2 drips and vacuum level of order of 500 to 1000 mbar were observed on many sections of 80 K supply and return transfer line during evacuation process.

Investigations and causes were identified to rectify the problems. Previous installed mineral glass wool insulation have been replaced to cryogenic compatible Polyurethane insulation and Nitrile insulation in tubes forms for rigid section and flexible pipe sections respectively. The LN2 process lines were evacuated to 10^{-3} mbar and replaced all 'O' ring sealing by in-house developed puppet sealing valve and vacuum pumping test set up. The challenges were experienced in the task of vacuum pumping of process LN2 lines, installation and repairing task of cryo insulation on 80 K return lines at 13 meter height in complex LN2 piping network.

The thermal performance of insulation material has been validated during operational condition of 80 K system, no frosting and condensation was observed on the applied insulated vent lines and evaluated supply transfer lines. The physical and thermal properties tests also have been carried out for density, close cell content, water vapor permeability, thermal conductivity, thermal cycle test at LN2 temperature and dimensional stability with raw materials test certificates of Government approved National laboratory. In this paper, we report the details and selection of cryogenic insulation material, design calculation, insulation applying techniques and its repairing procedures, evacuation process, details of puppet valve set up, performances tests and its results.

Summary :

This tasks consists of mainly cryogenic insulation selection, installation and testing on return lines of 80 K distribution systems of SST-1 machine. The evacuation of all 80 K transfer supply lines evacuated up to $10E^{-3}$ mbar to improved the vacuum level. After this task, the thermal performance has been enhanced of 80 K

system, saving of huge quantity of LN2 fluid and no condensation and frosting was observed in any section of supply and return transfer lines. The challenges were experienced in the task of vacuum pumping of process LN2 lines, installation and repairing task of cryo insulation on 80 K return lines at 13 meter height in complex LN2 piping network.

Primary authors : Mr. SHARMA, Rajiv (Institute for Plasma Research)

Co-authors : Mr. GARG, Atul (Institute for Plasma Research) ; Mr. NIMAWAT, Hiren (Institute for Plasma Research) ; Mr. PURWAR, Gaurav (Institute for Plasma Research) ; Dr. TANNA, Vipul (Institute for Plasma Research)

Presenter : Mr. SHARMA, Rajiv (Institute for Plasma Research)

Session classification : Poster Session 1: Abstract ID

1,2,3,8,9,15,16,21,23,25,27,28,29,30,42,44,46,47,49,50,51,58,61,65,79,81,82,87,96,97,98,
106,126,130,189

Track classification : Cryogenics Storage and transfer lines / Space Research / Cryogenic Test & Test Facilities

Type : --not specified--