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# THERMO-HYDRAULIC ANALYSIS AND MECHANICAL DESIGN OF PURGE LINES CONNECTED WITH HELIUM COLD BOXES OF ITER CRYOGENIC SYSTEM

Content :

The ITER cryogenic system which is one of the largest cryogenic systems of the world consists of three main subsystems; the Cryoplant, the Cryo-distribution, and the Cryolines & Warmlines. The cryolines and warmlines are intended to transport cryogens from source (cryoplant and auxiliary cold boxes) to its users. The warmlines are network of piping system mainly used for transfer of room temperature cryogens, and Purge lines are part of ITER warmlines. The general purpose of Purge line is to discharge helium outside buildings that cannot be recirculated to Helium recovery system due to the possible impurities. These piping network will also be used as flow path of purging gases during conditioning.

Apart from the above, the Purge line connected with Helium Cold Box (HCB) is also intended to discharge helium from the process safety relief valves of HCB to atmosphere in case of Break of insulation vacuum (BIV) in HCB. During the case of BIV in HCB, the flow through SRV is much higher than in case of static heat in leak and the Relief lines [1] will not be able to collect all the gases released from safety valves. To cope with this condition gases will be diverted in purge lines and will be released to the atmosphere.

The process flow condition (Functional parameter) of working fluid (Gaseous Helium) at the inlet of purge line will depend upon the reliving condition (temperature, pressure and mass flow rate) of the process pipe/system on which the SRV has been installed.

Summary :

The paper describes the lowest possible temperature (~ 20 K) of pipe obtained through CFD analysis with very large flow rate of helium (~ 9 kg/s for 142 seconds) in purge lines connected with HCB. These functional inputs are used for thermo-hydraulic analysis. Based on the result obtained from above analysis thermo-mechanical design of Purge lines has been performed. This paper describes the thermo-hydraulic

analysis, physical constraints for the mechanical design of Purge lines, design steps, flexibility analysis, and results of thermo-hydraulic as well as thermo-mechanical design.

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