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Dynamic study of flow in quench lines for ITER

Content :

The cryogenic transfer lines are used to transfer the cold helium and nitrogen in order to fulfill the requirements of cryogenic process and its users considering various constraints. In general, cryogenic transfer line consists of process pipes and outer vacuum jacket along with their internal as well as external supporting systems. The process pipe transfers the low temperature cryogen to the end user and the outer vacuum jacket provide boundary for maintaining the vacuum.
Some cryogenic transfer lines are used to recover the cryogenic fluid from the equipment (end user) to the recovery system during off-normal operation such as quench of superconducting magnets. The Quench line is one of the cryolines which collect cold helium in the event of quench of superconducting magnets and transfer it to the storage tanks. The quench lines are routed from feeders of superconducting magnets in Tokamak complex to quench storage tank in cryoplant area with process pipe diameters varying from DN50 to DN 450 over length of more than 300 m and helium mass flow rates of upto 100 kg/s. The present paper describes the dynamic study for such quench line and it mainly includes the pressurization profiles across the line, temperature profile during different scenarios (e.g. quench in one or more of the magnets), impact of high mass flow rates on the supporting systems.

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