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Optimized filling of a 5000 liter liquid helium dewar

Content :

The ITER-India cryogenic test facility is established for test of pre-series cryolines of ITER which is able to deliver helium at 300K, 80K and 4.5 K temperature levels. The liquid helium (LHe) at 4.5K is fetched from a dedicated LHe dewar having the diameter of inner vessel as ~2.1m and height is ~1.8m with mass (which needs to be cooled down to 4.5K) of ~600 Kg having corresponding volumetric capacity of ~5000 liters. The LHe has been filled into LHe dewar through 40 feet mobile container by maintaining lowest pressure difference and minimizing flash. To optimize the consumption of LHe during cool-down/filling, pre-cooling of the LHe dewar through Liquid Nitrogen (LN_2) was performed through specially developed arrangement. The specially developed arrangement consists of supply link between existing LN_2 tank and LHe dewar using cryogenic long stem hand valves and necessary piping. This arrangement was utilized for a) cool-down of LHe dewar from 300K to ~100K and, b) recovery of GHe from LHe dewar to recovery channel at different point of time. Based on the past experiences and study, this procedure tremendously reduced the overall consumption of liquid helium during cool-down/filling by ~ 3 times. This paper describes about the comparison of theoretical estimation for quantity of cool-down/filling LHe with actual scenario, operational experiences gained, procedure followed for cool-down/filling, experimental data and proposed options for further optimization.

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