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## Approach of Fatigue Analysis of 6-100K Cryolines for ITER

### Content :

ITER cryolines are a complex network of transfer lines intended to transfer either helium or nitrogen to fulfill the requirements of ITER Cryogenic system users. Based on the specific purpose of the cryoline, each cryoline is intended to transfer helium or nitrogen at different levels of pressure, temperature and different mass-flow rates. The commissioning, cool-down, warm-up and decommissioning are transient states applicable to vacuum insulated ITER cryolines in which temperature and pressure are a function of time. The number of thermal, pressure cycles & external load cycles are specified for each vacuum insulated cryoline.

The 6-100K Cryolines, also called as Regeneration cryoline have length of around 700 m with pipe in pipe geometry and diameters of these process pipes ranging from DN 50 to DN 150 with outer vacuum jacket ranging from DN 100 to DN 250. The function of 6-100 K regeneration line is to collect the cold helium from cryopumps of neutral beam and Torus cryopumps in Tokamak Building and send it to Helium cold box. These cryolines shall undergo 490000 pressure & temperature cycles for main line and 75000 pressure & temperature cycles for branch line i.e. ~ 4000 full range cycles during machine life time (20 years). Since the number of fatigue cycles is more than 1000 cycles, a detailed fatigue analysis will have to be performed. Cyclic changes in pressure & temperature can cause damage by fatigue cracking. The cryoline is being designed for these fatigue cycles. The paper describes the major input data and approach of fatigue calculations for 6-100K regeneration cryoline.

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