DESIGN AND FABRICATION OF A TEST RIG TO DETERMINE HELIUM PERMEABILITY THROUGH FABRICS

Lovin Tanwar
Student
Department of Aerospace Engineering
Punjab Engineering College (PEC)
Chandigarh-160 012, Punjab, India
Email : lovintanwar@gmail.com

Rajkumar S. Pant
Professor
Department of Aerospace Engineering
Indian Institute of Technology Bombay (IITB)
Powai, Mumbai-400 076, India
Email : rkpant@aero.iitb.ac.in

Abstract

The fabric of a Lighter-Than-Air (LTA) system experiences permeation of Helium over a period of time. Due to the small size of the molecules of Helium, it permeates through the intermolecular spaces of the fabric. This leakage increases with time due to the degradation of the fabric. LTA systems need to be deployed for long durations. The loss of Helium due to permeation reduces the relative lift of the LTA system. The unknown permeation rates thus lead to uncertainties in the deployment time of the system. This paper describes the design and fabrication of a test rig to determine the permeability of Helium through different fabrics. This method involves a permeation cell divided into upper and lower chambers arranged to hold a specimen fabric between them, with the provision of a continuous supply of Helium in the lower chamber. A Phoenix L300i Helium Leak Detector (HLD) is connected to the upper chamber to detect Helium and measure its concentration. The further objective of this research is to study the variation of helium permeability through the fabrics at constant temperature and input pressure with time.

Keywords: Helium Permeability Tester, Hydrogen Leak Detector, Permeation, LTA Systems