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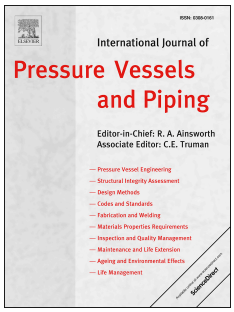

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A NOVEL BURST TEST APPROACH FOR THE QUALIFICATION OF HEAT PIPES DEVELOPED FOR SPACE APPLICATIONS

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Abstract

In this study, a reliable and novel testing methodology is presented for the burst test of heat pipes developed for space applications. The test set up enables heat pipe to be tested at flight configuration. The target internal pressure of the heat pipe is achieved by increasing the temperature of the heat pipe and consequently the ammonia inside. The setup uses microphones, oxygen sensors and thermocouples for the accurate determination of the burst instant and temperature. Burst temperature and specific volume are then used in conjunction for the determination of the burst pressure via thermodynamic data for ammonia.

Keywords: Heat pipe, ammonia, burst test, leak detection, structural integrity

1 Introduction

Burst test is one of the destructive testing methods in which the maximum pressure that a system or component can endure is demonstrated. This test is performed by applying the pressure increase in the system or component until a failure (in the form of a burst or a rapture) occurs. The burst test also reveals the type of failure such as leak, explosion, etc. and the failure location which can serve as a feedback for design activities. All of these information are essential to establish design safety margins especially in aerospace, nuclear, chemical applications where the failure of a component is might not be an option.

There are numerous studies in which different experimental setups were established for the burst test of different components and systems such as pipe fittings, flanges, line valves, expansion joints, filters, steam traps, measuring devices, pressure and strain gauges, pressure transmitters, pressure–relief devices, pressure vessels and pipes [1-6]. The testing approaches used for these components differ from each other in terms of the method used to apply pressure and measurement techniques employed. In one of these studies, Rajan et al. [1] investigated the pressure that leads to burst of thin-walled vessels by pressurizing vessels using a hydraulic pump. The vessel and the rest of the setup were separated from each other