

A Boiloff Calorimetry Test Configuration for the Characterization of Thermal Insulation Systems in Flammable Background Gasses

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In support of efforts related to the design of future industrial liquid hydrogen storage tanks, the Cryogenics Test Laboratory at NASA Kennedy Space Center has recently begun thermal performance characterization of various insulation systems in different gas background environments, including nitrogen, helium and hydrogen, using the Cryostat-100 (CS100) liquid nitrogen boiloff calorimeter. The CS100 is a vertical-cylindrical geometry, capable of measuring heat load and vacuum pressure ranges from 100 mW to 100 W, and 1e-8 torr to ambient pressure respectively, via the ASTM C1774, Annex A1 standard methodology. Flammable gas testing required numerous augmentations to the standard CS100 hardware configuration and controls software, and modifications to the Lab facility to ensure a safe test campaign. These included double-containment of the CS100 vacuum chamber and most supporting hardware, with continuous inert gas purging using nitrogen; remote control of valves and vacuum pumps; and hydrogen and oxygen detection systems. The design and implementation of these unique modifications led to safe and successful CS100 hydrogen testing, and is presented and discussed in-detail.

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