



Georgia Tech HPEPL Lab

Closed loop liquid nitrogen cooling for a space simulation chamber at the High Power Electrical Propulsion Lab at Georgia Tech, Atlanta GA, USA.

For testing these units they have several large Vacuum chambers (space simulation). In order to maintain the vacuum in these chambers they are equipped with (Cryogenic) Vacuum pumps that require liquid Nitrogen for pre-cooling and shielding. Significant amounts of liquid nitrogen can be consumed during these test.

In order to be more cost effective and more efficient it was decided to build a closed loop nitrogen system for the cooling of the VTF2 unit. During testing liquid nitrogen is pumped from a storage tank to the vacuum pumps of the chamber. At these pumps it will (partially) vaporize. The (still very cold) nitrogen gas (slush) is collected and fed back to the storage tank. On the storage tank 2 Stirling Cryogenics SPC-4 cryogenerators reliquefy the nitrogen gas and extract the energy that was put into the liquid by the vacuum pump. This way no nitrogen gas is wasted and a closed loop is formed. This eliminates the need of bulk supply of liquid nitrogen for testing, truck deliveries and logistic issues.

During times when there are no test, the cryocoolers keep the liquid cold, by operating in a minimum stand by mode.

The system has been in operation since 2009 and functions very well.

For more information and an economical evaluation, please check the following paper: Alexander Kieckhafer and Mitchell Walker of the High Power Electric Propulsion Laboratory of Georgia Tech Atlanta, discuss the application of Stirling SPC-4 cryocoolers in a closed loop liquid nitrogen recirculation system for their space simulation chamber.

More information

- Recirculating Liquid Nitrogen System for Operation of Cryogenic Pumps
- High power electrical propulsion