

Cryoquip Australia and CSIRO Create New Liquid Nitrogen Dewar Filling Station Designed To Safely Work In Confined Areas

Introduction

CSIRO (Commonwealth Scientific & Industrial Research Organisation) created a new Dewar Filling Station for use inside buildings. The new filling station includes automatic Liquid Nitrogen (LN₂) filling control, as well as monitoring and shutdown systems safety mechanisms.

LN₂ is commonly used in the microscopy laboratory environment, and can cause significant health and safety risks, such as asphyxiation, explosions, burns and/or frostbite from splashes and other injuries. Several workplace fatalities have resulted from nitrogen exposure.

One nitrogen exposure incident occurred CSIRO Livestock Industries' Australian Animal Health Laboratory (AAHL) in 2001. AAHL is a high security, bio-containment facility having a number of airtight laboratories. In airtight environments, the risks associated with handling LN₂ are significant. Even small spills or leaks can be life threatening as oxygen is rapidly displaced by the vaporizing LN₂. The CSIRO team worked closely with Cryoquip Australia, a supplier of cryogenic handling systems, on possible design solutions. The outcome was a practical and effective Liquid Nitrogen Dewar Filling Station.



Figure 5: Overall view of LN₂ Dewar Filling Station. The Dewar is placed on a metal tray, where the weight of the Dewar is monitored. The metal tray is also equipped with a temperature sensor (white arrow), which will cease the flow of LN₂ in the event of a spill.

Dewar Filling Station Safety Features –

- Weigh scale recessed into floor, eliminating trip hazards when moving Dewar in and out of the Filling Station.
- Dewars are labeled with a unique barcode and a barcode scanner identifies the individual size and weight. Filling commences when a Dewar is properly positioned and the station monitors and continues to fill until a pre-programmed weight is achieved.
- Programmable Logic Controller (PLC) provides safety instructions for filling, the status of the fill process, and alarms with actions to be taken in the event of an emergency.
- Alarmed automatic shutoff valves close supply when an overflow or spill of LN₂ is detected.
- Interlocks on filling hoses ensure correct filling hose is released for coded open or pressure Dewars.
- Station door interlocks, monitored by the PLC, prevent filling if open.
- O₂ monitors activate room lock out when O₂ concentration falls below 20%.
- Power failure protective shutdown.
- Emergency stop button allows staff to manually shut off the LN₂ filling process.

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Figure 1: Pressure Dewar filling, demonstrating LN₂ gas venting into ceiling duct. Photo shows filling valves (red tops), temperature sensor (silver), and gas vent valves (green).



Figure 2: Entry procedure to LN₂ filling room. Only trained personnel are permitted access during restricted hours. The room locks out when O₂ level fall below 20%.



Figure 3: Barcode scanner recognizes the individual Dewar and its pre-programmed fill weight.

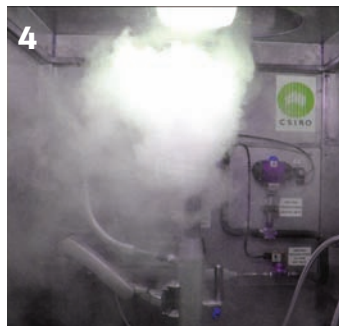


Figure 4: Open Dewar filling, demonstrates LN₂ gas venting into ceiling duct direct from cyclone filling head on a pivot swing arm.