|  |
| --- |
| **AUP Liquid Nitrogen Thermal Shock Procedure** |
| **Document Number:** | AUP-PR-LEAK-CMA-LN2 | **Approval Date:** | 4/26/2022 |
| **Revision Number:** | Rev 1 | **Periodic Review Date:** | 4/25/2024 |
| **Document Owner:** | Naeem Huque | **Department Owner:** | SRF Ops |
|  |

# Purpose and Scope

 The purpose of this document is to describe the safe practices for cold shocking components large and small for best results in determining quality and integrity of welds, feed through electrical connectors and other parts used in vacuum and cryogenics conditions. It will also cover PPE, training requirements, and tools.

 This document applies to any person or persons trained to use LN2 or the LN2 fill station in the Test Lab.

**Persons Must Have ODH SAF 103 Training**

# Terms and Definitions

* **Items – As referenced in this document are to be held to strict accordance to the safety guidelines for the health and safety to all concerned**
* **LN2 –Liquid Nitrogen referred to as either (liquid / Nitrogen)**
* **Cold Shock – procedure used to test materials use in cryogenic conditions.**
* **PPE – protective clothing and gear**
* **Portable Dewar – any approved vessel used to contain liquid nitrogen**
* **Dam – device or material used to contain LN2 from spillage during cold shock**

# Roles and Responsibilities

The following roles have responsibilities described in this document.

|  |  |
| --- | --- |
| **Role** | **Responsibility** |
| Supervisor | Quality Assurance/Safe work practices |
| Technician | Following the guidelines put forth in this document |

# Procedure

## Handling and Dispensing of Cryogens.

**All Persons Must Have ODH SAF 103 Training**

#### When preparing to handle cryogens all PPE must be available including.

#### Face Shield with Goggles

#### Cryogenic Gloves

#### Long Sleeve Shirt of full Arm Protection

#### Cuff-less long pants (no shorts) long enough to prevent LN2 from entering Boots

#### Cryogenic Apron.

\*\*\*Electrical safety: A GFIC must be used on all electrical outlets as this will become a wet location due to condensation\*\*\*

**Filling a portable Dewar:**

1. After donning all required PPE Set a portable Dewar next to the LN2 fill station and the remove cap.
2. Inspect the armored nitrogen line to be used, for cracks and separation down the length of hose. Ensure the connections are tight and that a diffuser (phase separator) is attached to the fill end, This will prevent splashing.
3. When satisfied that the hose is in good shape insert into the portable Dewar until it reaches the bottom.
4. Establish a “stay clear” boundary with signs and cones. Cold shocking must be done in an open area or outside and never in a confined space.
5. To begin, throttle the valve knob until you hear a hiss or whistle sound. Continue to open the valve slowly until a plume escapes the Dewar. (normal) Liquid will begin to collect in the bottom of Dewar as it cools. Fill until the desired amount is attained.

**Adding LN2 to an Approved Container for Cold Shocking**

All previous mentioned PPE must be worn

Persons Must Have ODH SAF 103 Training

**The container to be use in this process should be made of stainless steel or of cryogenic approved materials.**

* This process is called dunking and used for cold shocking small coupons or parts that require verification. Examples include items to be used in the transfer of cryogens, electrical feedthroughs, and welded joints testing their integrity.
* Establish a “stay clear” boundary with signs and cones. Cold shocking must be done in an open area or outside and never in a confined space.
* Prepare parts for submersion into the cryogen. Examples include a wire or mesh basket for small parts, or attaching a length of wire to a larger part.Never ever use your hands even gloved to insert or removed parts from Liquid Nitrogen.
* Pouring liquid from Dewar into container slowly prevents splashing and will pre-cool the bottom to prevent a quick boil off of liquid.
* Once desired depth is attained begin to insert parts to be cold shocked.
* The part must be held in the LN2 until the boiling stops or decreases to a steady rate. At this point, the part is considered cold and can be removed from the bath.
* Parts must be dunked five times, letting warm to room temperature after each dunk.
* When using dams to contain liquid try to have something fabricated to hold liquid long enough to get item cold, aluminum foil works in some instances.
* Parts are then visually inspected and vacuum leaked checked for integrity.

# **Release and Revision History**

|  |  |  |
| --- | --- | --- |
| Rev # | Revision or update: | Effective: |
| - | Initial version | 1/26/2022 |
| 1 | Added requirement to wait until LN2 boiling reduces to a steady rate before removing part | 4/20/2022 |

# **Approvals**

|  |  |  |
| --- | --- | --- |
| Approved by: | Signature: | Date: |
| **Document Owner** | Naeem Huque |  |
| **SRF Operations Quality Engineer**  | Jacob Harris |  |
| **SRF Operations Production Head**  | John Fischer |  |