



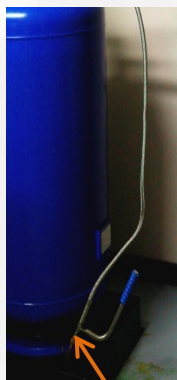
SOP: LIQUID NITROGEN (LN₂) PLANT

KEASER SX 4 NITROGEN PLANT



STEPS TO DECANTING LIQUID NITROGEN INTO DEWAR FLASKS/TANKS

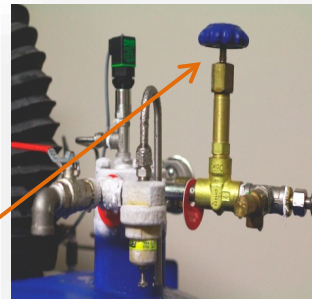
1. Each and every time complete all columns in the log book provided
2. Ensure proper PPE at all times
3. Place Dewar Flask on the ground
4. Insert the hose/nozzle into the Dewar Flask
5. Open the blue tap/valve slowly and gradually turn the blue tap/valve anti-clockwise for faster flow
6. Close the blue tap/valve after you have finished
7. **CAUTION:** Check & test regularly whilst decanting that you **DO NOT** overfill your flask.
8. **ONLY** 80% of flask size is recommended.
9. Report all **Emergencies** to Yaasien Ely (Room 5.19.8) (Ext: 2533/ **Mobile:** 082 889 2674)
10. Replace face shield and gloves in their positions. **DO NOT** take it with you.
11. Replace caps on your Dewar Flask/s to prevent LN in its gas form to escape.
- 12.



Hose/Nozzle



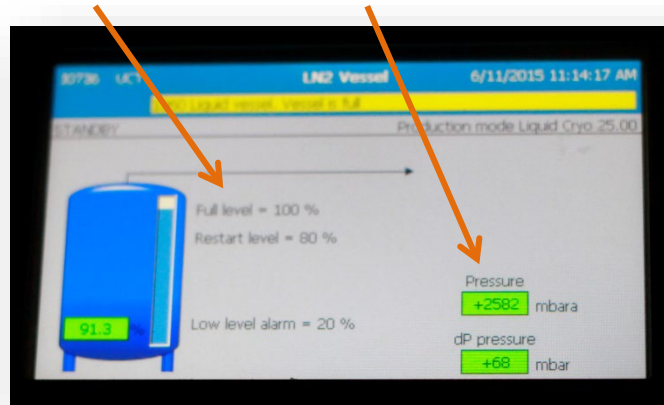
Blue Tap/Valve





1. Weekly Inspections:

- Cryogenic containers/tanks are equipped with pressure relief devices to control internal pressure. These must be in a leak free & correct working function.
- Ensure a proper ventilation & extraction system is in place & working properly.
- Ensure that relieve valves are not obstructed or covered.
- Ensure pressure relieve valves are still intact.
- The tank's content level in % and pressure is indicated on the Siemens LCD monitor.



- The secondary pressure relieves valve need to be in a good order to ensure gas is vented in case of pressure build up and primary relieve valve fails.
- If tanks are dented, it must be inspected by a professional.
- Test oxygen deficient/depletion sensor/monitor alarms installed.
- Check LN cylinders hose, pressure and pressure relief valves.

OTHER IMPORTANT ISSUES

- If the tank continuously vents loudly through the relieve valve, it is cold to the touch or has frost build-up around the pressure relieve valves - leave the room and contact **YAASIEN ELY** at **X2533 OR 082 889 2674** immediately.
- Materials exposed to cryogenic temperatures for long periods or which have undergone periodic warming and freezing should be examined for cracks and crazing.
- ONLY** use Goods Lift for transporting liquid nitrogen to labs. **NEVER** use lift with a liquid nitrogen container/Dewar flask inside if transporting more than 0.5 litre LN. **NEVER** transport in a publicly used lift.
- All containers & Dewar flasks shall be handled and stored in an upright position.
- DO NOT** plug, remove, or tamper with pressure relief devices on LN tank.
- Never allow any unprotected part of your body to touch un-insulated pipes or vessels which contain cryogenic fluids. The extremely cold metal will cause the flesh to stick fast and tear when one attempts to withdraw from it.
- DO NOT** plug, remove, or tamper with pressure relief devices.
- Fill your Dewar flask slowly to minimize spillages and splashes and to prevent thermal shock/stress to container.
- Never reach into liquid nitrogen to retrieve items (even with proper gloves on), always use a proper relevant mechanical devices or tongs to do so.
- Do not place Liquid Nitrogen containers in closed vehicles where the nitrogen gas that is continuously vented can accumulate.



HEALTH & SAFETY ISSUES

HAZARDS:

1. Liquid nitrogen is a colourless, odourless, extremely cold liquid and gas under pressure. It can cause rapid suffocation/asphyxiation when concentrations are sufficient to reduce oxygen levels below 19.5%.
2. Liquid nitrogen when spilled will vaporize rapidly forming an oxygen deficient vapour cloud.
3. A minor temperature increase produces a large volume of gas. Pressure relief valves on containers are very important to relief or prevent pressure build-up.
4. Do not stop or cork LN containers outlets.
5. Where ice is likely to form at the pressure valve additional pressure relief devices should be installed and ensure there is no water close to the location of the pressure release devices to minimize freezing risks.
6. Oxygen concentrations must be monitored in the release area. All cryogenic liquids produce large volumes of gas when they vaporize. One volume of liquid nitrogen will expand to produce 696.5 equivalent volumes of gas. Thus 1 litre liquid nitrogen produces 696 litres of nitrogen gas.
7. Pressure in a LN container can build up due to heat and it may rupture if pressure relief devices should fail to function causing an explosive damaging incident.
8. There should be good ventilation where LN is stored or used.
9. A sensor should also be installed.
10. Contact with liquid or cold vapours or pipes can cause severe frostbite.
11. Cold vapours in the air will appear as a white fog due to condensation of moisture. Visibility may be obscured in this vapour cloud.
12. While the vapour cloud may indicate the presence of the gas it should not be used to determine its concentration in the atmosphere.
13. Systems which are open to air should NEVER be cooled with liquid nitrogen as oxygen from the air will condense in system and cause a serious explosion either through evaporation causing build-up of pressure in the closed system or through interaction with oxidisable e.g. organic substances.
14. Care must be taken that grease used with taps & joints do not come into contact with LN.
15. NEVER work alone with cryogenic liquids such as LN.
16. DO NOT mount dewars with LN above eye level.
17. If you find that any of the equipment is cracked, dented or damaged please report this to **Yaasien Ely at Room 5.19.8 (x2533)**.
18. Never overfill Dewars. Great care should be exercised to ensure that space is left to replace lids/tops on Dewars especially those that insert a considerable distance into the vessel.
19. Spills and splashes can set off oxygen monitors. Moving Dewars away from the sensors on oxygen monitors before topping up and taking care to minimise splashing as suggested will avoid alarms being set off unnecessarily.
20. Do not cover or plug the entrance opening of any Dewar with any stopper or other device that would interfere with venting of gas. Inadequate venting can result in excessive gas pressure which could damage or burst the container. Check the unit periodically to be sure that venting is not restricted by accumulated ice or frost.
21. To check for filling height only use wooden or solid metal dipsticks.



MAINTENANCE

1. All large Dewars (25 litres or larger) need to be inspected annual.
2. Smaller Dewars should be visually inspected each time they are refilled and any defects must be reported to the appropriate person in your department.
3. Condensed moisture or frost on the outer shell of a Dewar and abnormally rapid evaporation of the liquid nitrogen are indications of vacuum loss.
4. If vacuum loss is evident or suspected, transfer the materials stored in the unit to another unit as soon as possible and remove the defective unit from service & Tag it with an **OUT OF ORDER** Tag.
5. The extraction fan must be serviced once every 3 months to ensure proper ventilation.

LOADSHEDDING

After load shedding the plant will need to be a reset and an alarm will be sounding loudly.



Following the following steps to reset plant:

1. Silence alarm by pressing the flashing sound symbol button.
2. Turn the ON/OFF button to the OFF position.
3. Push the green tick button
4. Turn the ON/OFF button back to the ON position.

CRYOTUBES used to contain samples stored under LN may explode without warning.

Tube explosions are thought to be caused by LN entering the tube through minute cracks and then expanding rapidly as the tube thaws. When thawing Cryotubes take the following precautions.

IN CASE OF SPILLAGE:

1. Evacuate area immediately.
2. Put on a Self-Contained Breathing Apparatus (SCBA) when a person needs to be rescued from suffocation. Respirators will not function.
3. Open all windows to area.
4. Only lines designed for cryogenic liquids shall be used. Some metals such as carbon steel may become brittle at low temperatures, will easily fracture and should not be used with cryogenic liquids.



SAFETY MEASURES

PERSONAL PROTECTION:

- Face shield OR Safety glasses closed at sides of eyes
- Loose fitting half arm thermal insulated (cryogenic) or leather gloves
- Cryogenic apron large enough with buckle to facilitate quick removal
- Safety shoes
- Trousers over shoes.

NITROGEN GAS EXPOSURE SYMPTOMS:

1. Exposure to an oxygen deficient atmosphere (<19.5%) may cause dizziness, drowsiness, nausea, vomiting, excess salivation, diminished mental alertness, loss of consciousness and death. Exposure to atmospheres containing 8-10% or less oxygen will quickly bring about unconsciousness without warning, leaving individuals unable to help or protect themselves. Lack of sufficient oxygen can cause serious injury or death.
2. Skin contact with liquid nitrogen can cause tissue freezing, resulting in severe burns. The burns are caused by the extremely low temperature of the cryogenic liquid and not the result of chemical action. Skin may appear red with the formation of blisters. In cases that involve prolonged or severe exposure, tissue may freeze and have a waxy or yellow appearance.

FIRST AID

Skin/Eye Contact

1. Immediately flush thoroughly with copious quantities of tepid water (the water must not be hotter than 44°C). In case of frostbite spray with water.
2. **DO NOT** apply any form of direct heat.
3. **DO NOT** rub affected parts either before or after warming.
4. Move the patient to a warm place (22°C).
5. Arrange for the casualty to be transported to hospital without delay.
6. While waiting for transport :
 - a. Remove or loosen restrictive clothing.
 - b. Continue to flush the affected area with copious quantities of tepid water.
 - c. Protect any frozen parts with bulky, dry, sterile dressings. **DO NOT** apply to tightly.
 - d. Keep patient warm and at rest.
 - e. Ensure ambulance crew/hospital is advised of details of accident and first aid treatment already administered.
 - f. The patient should neither smoke, nor drink alcohol.

Anoxia

1. However, attempts to rescue affected persons from confined spaces or where oxygen deficient atmospheres may be present should only be made by those trained in the use of breathing apparatus and confined space entry procedures. The Fire Brigade should be called in all instances where a trapped person requires rescue.
2. If a person seems to become dizzy or loses consciousness while working with liquid nitrogen, move to a well-ventilated area immediately.
3. If breathing has stopped, apply artificial respiration or where needed CPR.
4. Keep patient warm and at rest.
5. The patient should neither smoke, nor drink alcohol.