

# Beaumont

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 Area **Laboratory-Blood Bank**  
 Applicability **Royal Oak**

## Liquid Nitrogen Alarm Function Test-Royal Oak

Document Type: Procedure

### I. PURPOSE AND OBJECTIVE:

The purpose of this document is to provide the Blood Bank staff with a procedure to perform the Alarm Function test for the Custom Biogenic Series 2300 Controller. The Alarm Function Test is performed as a part of the bi-annual cleaning and maintenance of the Liquid Nitrogen Dewar Isothermal V-1500 Series.

### II. CLINICAL SIGNIFICANCE:

Cardiovascular tissue is in the custody of the Blood Bank for purposes of transplantation. These grafts are stored in a cryogenic Dewar, the Isothermal V-1500 Series. The refrigerant used in this Dewar is liquid nitrogen. The stored tissue may be compromised if not kept at a constant temperature, therefore it is essential that the Dewar is functioning properly. Bi-annual verification of temperature and liquid nitrogen levels is performed in order to evaluate the function of the Custom Biogenic Series 2300 Controller.

### III. HAZARDS OF HANDLING LIQUID NITROGEN:

- A. **Liquid nitrogen burns and frostbite hazards:** Liquid nitrogen is an extremely cold liquid, -196°C. Liquid nitrogen that is allowed to come in contact with human skin can cause severe damage to living tissue, including cold burns and frostbite. Damage can occur very quickly with only brief contact, longer than only a few seconds. Liquid nitrogen has a very low boiling point. The gases released can produce frostbite and permanently damage delicate tissues, i.e. eyes.
- B. **Flammability:** Liquid nitrogen is associated with explosion hazards, and care must be taken to avoid such hazards. Liquid nitrogen, a liquefied inert gas, may condense oxygen from the

atmosphere causing oxygen entrapment in unsuspected areas. In addition, extremely cold surfaces are also capable of condensing oxygen from the atmosphere. Liquid nitrogen storage and usage should occur in a wide open space.

- C. **High-pressure gas:** Working with or storing liquid nitrogen presents hazards from high-pressure gas. Liquid nitrogen is stored at or near its boiling point. Therefore there is always some gas present in the container. Due to the large expansion ratio from liquid to gas, a build up of high pressure can occur when the liquid evaporates. The evaporation rate will depend on the fluid, storage container design and environmental conditions. The container capacity must include an allowance for the evaporation of the liquid into the gaseous state. To prevent hazards associated with high-pressure gas, it is important to ensure that pressure relief devices are used appropriately. These devices should be maintained and checked regularly for leaks or damage. Pressure relief devices must be sized for maximum possible back pressure. These checks are done by the supplier.
- D. **Displacement of Oxygen/Asphyxiation:** Liquid nitrogen is capable of causing asphyxiation by displacing breathable air. To avoid such conditions, natural ventilation should be used.

## IV. PROCEDURE:

### A. Low Level Alarm

1. Using the manual valve labeled *liquid* on the liquid nitrogen supply tank, turn off the liquid supply.
2. Create a low alarm condition. This is done by adjusting the level set points above the actual liquid level.
  - a. Example: the liquid level is 6 inches. Adjust the high level setpoint to 10 and the low level setpoint to 8. This will cause the controller to go into an auto fill. In 7 to 10 minutes a low alarm should occur and the Blood Bank pager should sound with a message saying "Freezer Blood Bank-LN2 Level Alarm".
3. Return set points to the desired settings.
  - a. High level set point: 20 inches
  - b. Low level set point: 12 inches
4. Open manual valve on the supply tank to resume normal operation.
5. Place a check mark, initials, and date under the Low Alarm Function Test confirming that there was an alarm and the LCD display shows "low alarm". Also place a check mark, initials, and date under the Remote Alarm Check confirming that the Blood Bank pager alarmed with the proper message.

### B. High Level Alarm

1. Create a high level alarm condition. This is done by adjusting the high level set point at least one inch below the actual liquid level.
  - a. Example: The liquid level is 6 inches. Adjust the low setpoint to 2 and the high setpoint to 4. In 3 to 5 minutes a high alarm should occur and the Blood Bank pager should sound with a message saying "Freezer Blood

Bank-LN2 Level Alarm".

2. Return set points to desired settings to resume normal operation.
  - a. High level set point: 20 inches
  - b. Low level set point: 12 inches
3. Place a check mark, initials, and date under the High Alarm Function Test confirming that there was an alarm and the LCD display shows "High alarm". Also place a check mark, initials, and date under the Remote Alarm Check confirming that the Blood Bank pager alarmed with the proper message.

#### C. Temperature Display Verification

1. Open storage unit lid and locate temperature sensing probe.
2. Lower the One Type K Thermometer -200°C to 1370°C National Institute of Standards and Technology (NIST) to the same depth as the temperature probe.
3. Compare the reading of the One Type K Thermometer -200°C to 1370°C to the digital reading on the Dewar. The acceptable LCD digital read out should be within  $\pm 2^{\circ}$  Celsius of the One Type K Thermometer -200°C to 1370°C (NIST).
4. Remove thermometer from the Dewar.
5. Return probe into its protective sleeve at the desired depth.
6. Close the storage unit lid and resume normal operation.

## V. INTERPRETATION:

- A. If High Level and Low Level Alarm functions are not alarming as expected, repeat the verification procedure. If one or both of the alarms are still not functioning properly, refer to the troubleshooting guide in the Custom Biogenic Systems: 2300 LN<sup>2</sup> Storage Unit Set-Up & Technical Manual
- B. If the temperature display does not operate as described, there may be a problem with the probe or probe connections. Refer to Custom Biogenic Systems: 2300 LN<sup>2</sup> Storage Unit Set-Up & Technical Manual for more information if a problem is detected.

## VI. WARNINGS:

- A. Exposure of skin or eyes: If skin or eyes come in contact with liquid nitrogen, flood the exposed area with large quantities of unheated water. Protect frozen areas with loose, bulky, dry, and sterile dressings
- B. Asphyxiation: If a person is overcome by loss of oxygen while working with liquid nitrogen, move that individual to a well-ventilated area immediately. Artificial respiration should be applied if breathing has stopped.
- C. In all cases, seek medical help immediately

## VII. REFERENCES:

1. Custom Biogenic Systems: 2300 LN<sup>2</sup> Storage Unit Set-Up & Technical Manual

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### Attachments

[Cleaning and System Check of Liquid Nitrogen Isothermal V-1500 Series & 2300 Controller](#)

### Approval Signatures

Step Description	Approver	Date
Policy and Forms Steering Committee (if needed)	Ann Marie Blenc: System Med Dir, Hematopath	1/27/2023
	Kristina Davis: Staff Physician	1/26/2023
	Emily Kwasnik: Medical Technologist	12/22/2022
	Gail Juleff: Project Mgr Policy	12/22/2022
	Rebecca Thompson: Medical Technologist Lead	12/22/2022
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