# CRYOMETRIX® B-90 Blast Freezer

## Novel New Cryometrix Liquid Nitrogen (LN2) Cooled Plasma Flash Freezer

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## Background

Choices of plasma freezing methods have included blast freezers with heavy duty compressors, walk-in freezers and use of dry ice.

Freezers may have remote mounted or smaller on-board compressors and utilize single or two-stage refrigeration systems.

These mechanically complex systems use compressors, evaporator / condenser coils, expensive and possibly environmentally harmful refrigerant gases, fans, etc.

Mechanical systems, with many more moving parts, increase maintenance costs. As they age, they experience failures requiring service and requalification.

This study compares a modern traditional mechanical freezer to an LN2 cooled freezer.

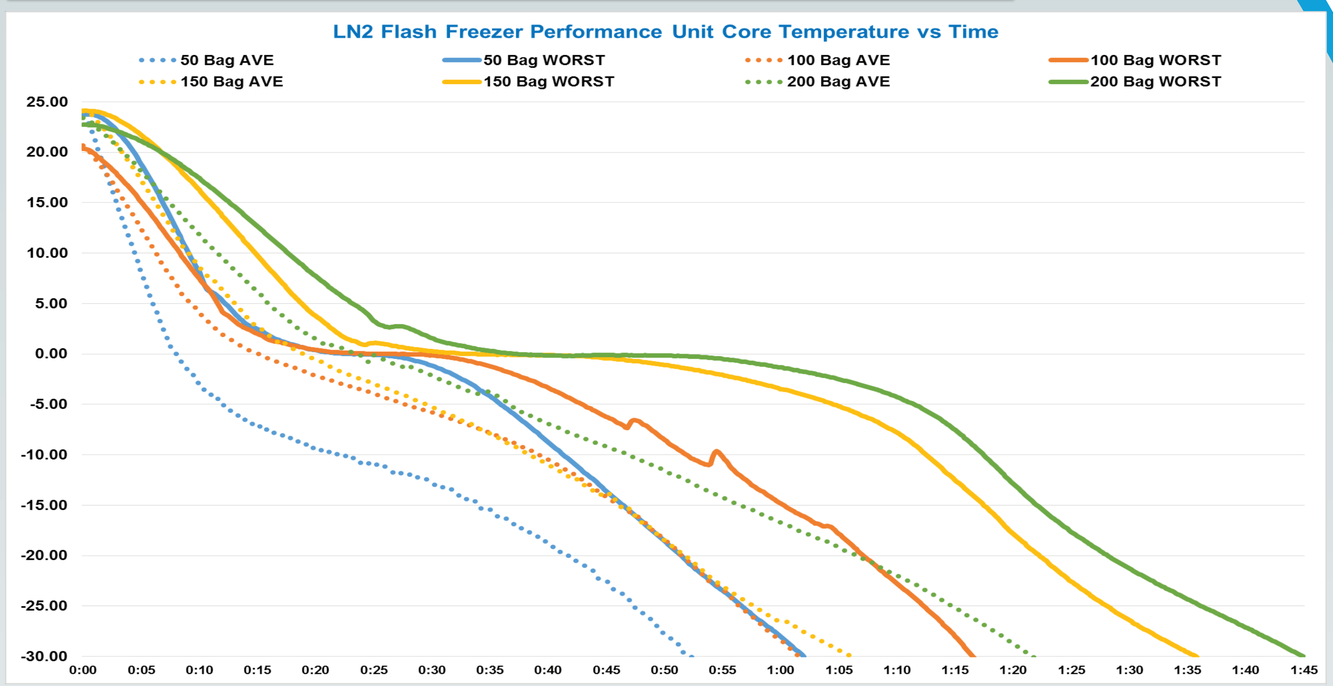
The LN2 freezer is a novel approach that is expected to increase freezer load capacity / throughput, reduce cost of operation, including maintenance / repair costs, and be more environmentally friendly.

## Study Design

Study design included:

- Evaluation of Return-On-Investment (ROI)
- Comparison of load capacity & throughput
- A validation including:
  - Installation Qualification (IQ)
  - Operational Qualification (OQ)
  - Product Qualification (PQ)
- The OQ consisted of:
  - A 10 point temperature mapping of the LN2 freezer
  - Validation of freeze cycle times for selected load sizes
  - Achieving a core plasma unit temperature of ≤ -30℃

## Results




| ROI | | | Traditional | LN2 |
|---|---|---|---|---|
| Freezer Cost | Note: Freezer ratio = 4:1 for equivalent throughput | # Units = | 4 | 1 |
| | | Price per Unit = | $36,000 | $60,000 |
| | | Total Price = | $144,000 | $60,000 |
| Annual Operating Cost | | Electrical Power Consumption @ $0.160/KW-Hr = | $9,377 | $131 |
| | | Liquid Nitrogen Consumption @ $1.62/Gallon = | $0 | $20,937 |
| | | Maintenance & Repairs = | $19,040 | $850 |
| | | Lab Floor Space @ $27/Yr/SqFt = | $1,728 | $540 |
| | | Replacement Cost @ Service Life 7 Yrs = | $20,571 | - |
| | | Replacement Cost @ Service Life 20 Yrs = | - | $3,000 |
| | | Total Annual Operating Expenses = | $50,716 | $25,458 |
| | | | ROI = | 28.5 Months |

| Capacity & Throughput | Load Capacity | Cycle Time | Throughput |
|---|---|---|---|
| Modern Traditional Mechanical Freezer = | 36 Units Max | 90 Minutes | 24 Units/Hour |
| New LN2 Cooled Flash Freezer = | 200 Units Max | 120 Minutes | 100 Units/Hour |

## Findings

Validated freeze cycle times by load size (*Ave. bag volume = 330mL*):

| # Units | Cycle Time (Minutes) |
|---|---|
| 50 | 75 |
| 100 | 90 |
| 150 | 105 |
| 200 | 120 |

All units with probes placed in the core of the bag, showed a temperature of ≤ -30˚C.

All plasma units were physically and visually inspected to confirm freezing.

## Conclusions

The LN2 freezer:

- ✓ Reduces costs by eliminating traditional refrigeration related mechanical systems
- ✓ Replaces most of the electrical power usage with LN2 cooling
- ✓ Eliminates use of refrigerants that are harmful to the environment
- ✓ Demonstrates a return on investment (ROI = 28.5 months)
- ✓ Offers increased load capacity (456%) and throughput (317%) in freezer-to-freezer comparisons at maximum load

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