AZENTA
LIFE SCIENCES

Automated Cryogenic Freezer Training

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Session Topics

01 Cryo-preservation principles and importance
02 Industry Cryo Personas
03 Automated Cryo Portfolio overview
04 Key product features and benefits
05 Summary

CRYO-THEORY REFRESHER

01

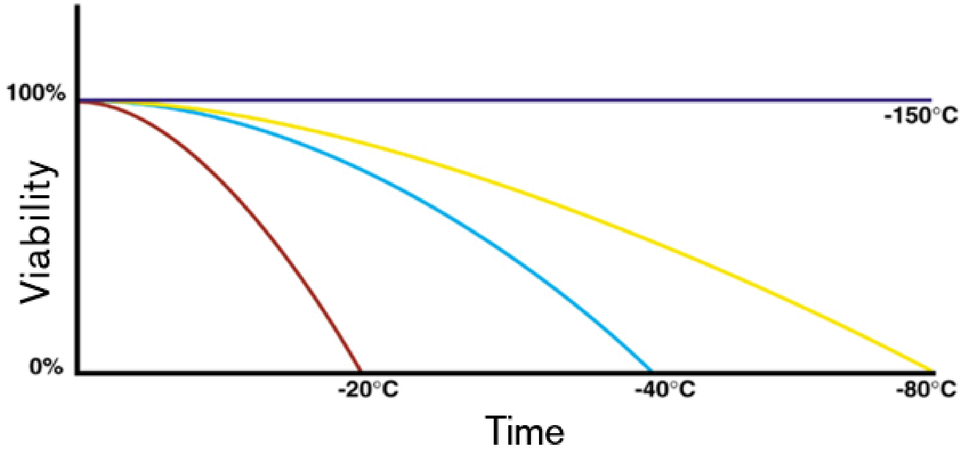
Cryo-preservation principles and importance

Cryo-preservation

Principles and importance

PRESERVATION OF LIVING CELLS AND TISSUES AT VERY LOW TEMPERATURES FOR AN EXTENDED DURATION OF TIME.

- Glass Transition temperature (Tg) = -135 °C
- Liquid nitrogen (LN2) provides cooling to -196 °C
  - Cryo-preservatives (CPAs) used for sample protection at low temperatures.
- Typical samples: Blood cells, stem cells, oocytes, sperm, embryos, forms of medication



Significance

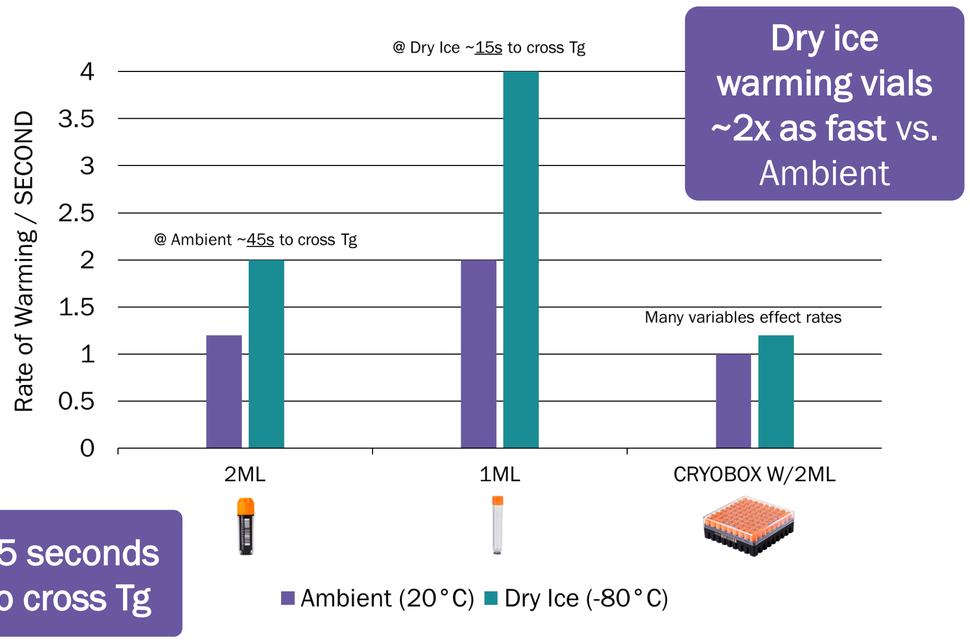
- Sample quality for pharmaceutical research, biotechnological industries or in medical transplantation
- **Sample recovery and viability is imperative**

Transient warming and Sample Viability

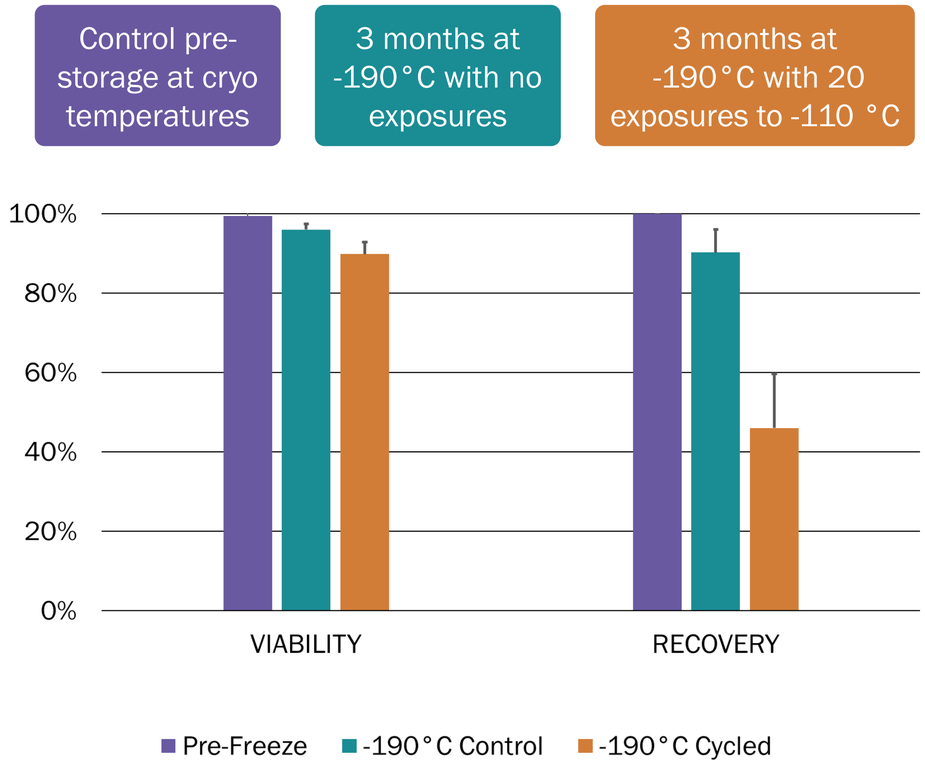
A BREIF EXPOSURE OF CRYOPRESERVED PRODUCT TO TEMPERATURES ABOVE THE CRITICAL STORAGE TEMPERATURE.

How quick do samples warm? How long is ‘Transient’?

- **Conduction and Convection**



Viability and recovery of mesenchymal stem cells pre-freeze and post-thaw



AZENTA CRYOGENIC STORAGE

02

Automated Portfolio

Automated Cryo Product Industry Personas

	Biobank	Discovery Lab	Cell Line Distribution	Manufacturer	Hospital/Clinic
Typical Location	• Research Hospitals • Government supported research centres • Large Pharmaceutical research biobank	• BioPharma Discovery Research environment	• Laboratory functioning as a stand-alone business or integrated within a research organisation.	• Large Biopharma • Contract development and manufacturing organisations (CDMOs)	• Cell lab facility supported by a Hospital or Clinic.
Primary Responsibility	• Support the collection, annotation, storage, retrieval and distribution of research specimens	• Discovery and research into new cellular therapies and treatments	• Maintain inventory of high-quality cell lines used for research	• Receive cells, manufacture autologous therapies or manufacturing allogeneic therapies from multiple cell sources.	• Commercial products received from manufacturer which will be maintained by staff until handover for patient infusion
Challenges	• Supporting a wide range of labware • Documentation requirements • Upkeep and maintenance cost • Academia – Budget constrictions • Pharma – Untrained scientists unnecessary interaction with cryo storage	• Training requirements • Multiple users within a common infrastructure with shared freezers • Inventory management	• Sample tracking capability • Cell viability during processing • Consistent and delicate handling of cells to maximise viability and quality	• Scaling the system to meet future demands • Manual paper inventory records • Documentation and reporting challenges	• Co-ordination of multiple staff members to ensure highest quality sample delivery to patients • Maintaining cold chain of custody, condition and identity
Automated Cryogenic Storage Value Proposition	• Capability to store a wide labware variety • Assurance of sample quality • Regulatory compliance for documentation requirements. Reporting option which is 21-CFR-Part 11 compliant	• User friendly user interface • Permission and user access capability • Easy access to live inventory through system controller	• Reporting option (21-CFR-Part 11 compliant) to track a samples journey in/out of store • Cryo critical features to ensure samples remain as safe and secure as possible • More consistent processing with less human interaction	• Expansion larger inventory tracking can provide with FreezerPro LIMS • Reporting option (21-CFR-Part 11 compliant) to track a samples journey in/out of store • Easy access to live inventory through system controller	• Diverse automation and supporting portfolio designed to provide optimal cold chain management • Tracking of samples in and out of freezer with reporting option (21-CFR-Part 11 compliant)

SAMPLE QUALITY | REGULATORY COMPLIANCE | USER SAFETY

Automated Cryogenic Storage Portfolio

CryoStore **PICO (A32)**

Optimised storage: Cryobox

Storage temperature: Down to -196°C

Capacity: 8,800 2ml Cryovials

Hold time: 10 days

CryoStore **M42 (A45)**

Optimised storage: Cryobox, SBS

Storage temperature: Down to -196°C

Capacity: 26,600 2ml Cryovials

Hold time: 15 days

CryoStore **M60**

Optimised storage: Cryobox, SBS, Cassettes

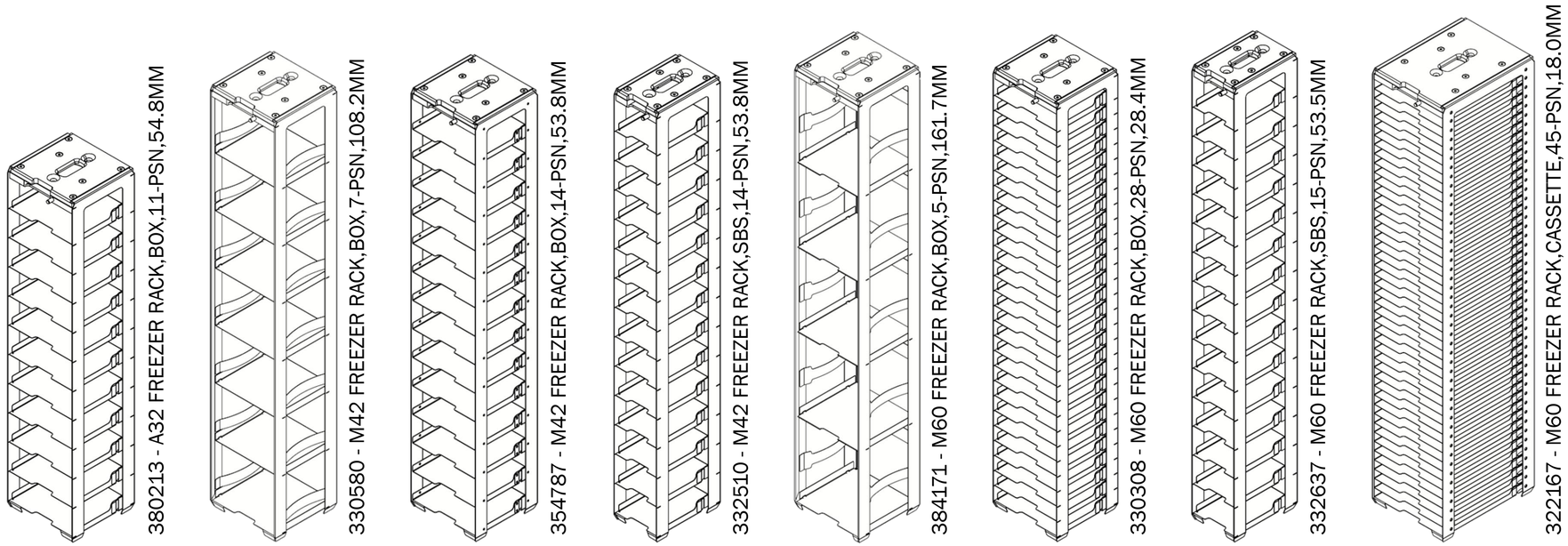
Storage temperature: -20°C -> -150°C and down to -196°C

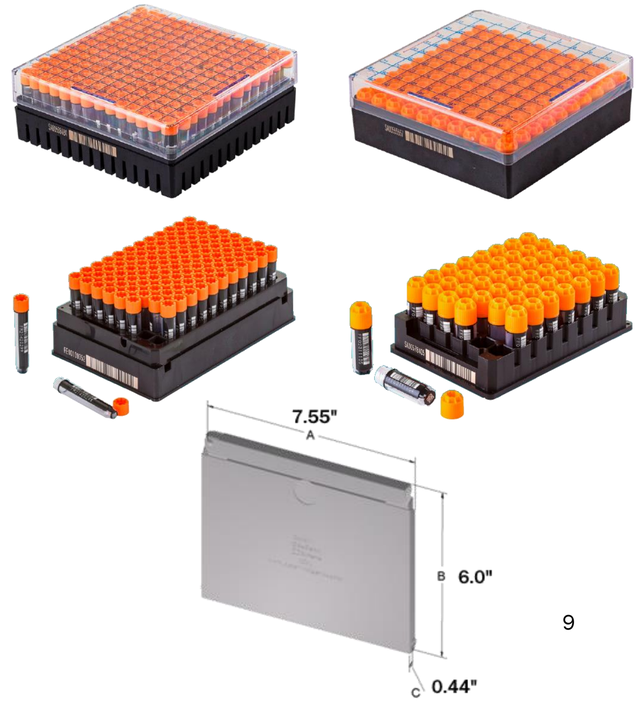
Capacity: 63,000 2ml Cryovials

Hold time: 17.5 days

Automated Cryogenic Storage Labware & Capacities

BioStore Cryo Type	Freezer Rack Type	Total Boxes	1ml FluidX Tubes	2ml FluidX Tubes	Typical Use
PICO (A32) Box	11-Pos, 2” CryoBox Racks	88	12,672	8,800	C&GT, Clinic, Cell Line Distribution
CryoStore A42 Box	14-Pos, 2” CryoBox Racks	252	36,288	25,200	BioBank, Discovery Lab, C&GT
CryoStore A42 SBS	14-Pos, 2” SBS Racks	280	26,800	13,440	HTS Lab, BioBank, Discovery Lab
CryoStore A45 Box	14-Pos, 2” CryoBox Racks	266	38,304	26,600	BioBank, Discovery Lab, C&GT
CryoStore M60 Box	11-Pos, 2” CryoBox Racks	630	90,720	63,000	Large Pharma, CDMOs, Dist. Hubs
CryoStore M60 SBS	11-Pos, 2” SBS Racks	915	87,840	91,500	Large Pharma, CDMOs, Dist. Hubs
CryoStore M60 Cassette	45-Pos, ¾” Cassette Racks	990			C&GT, CDMOs, Dist. Hubs

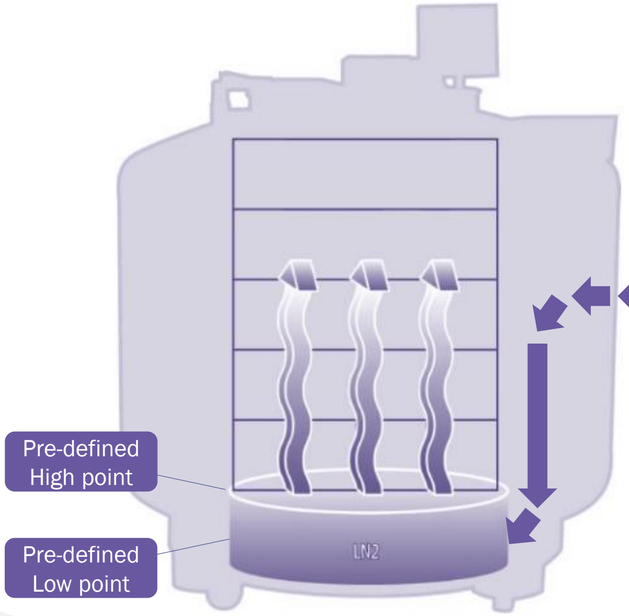




Freezer function at different temperatures – What's the difference?

CryoStore PICO (A32) /M42 (A45)/M60

-196°C LN2 cooled storage



LN2 LINE 22-35 psi supply pressure

RTD Temperature Sensors

- Accuracy and stability

Temperature gradient of ±3°C

M60 Ultralow Series

-20 to -150°C LN2 cooled storage

LN2 LINE 22-35 psi supply pressure

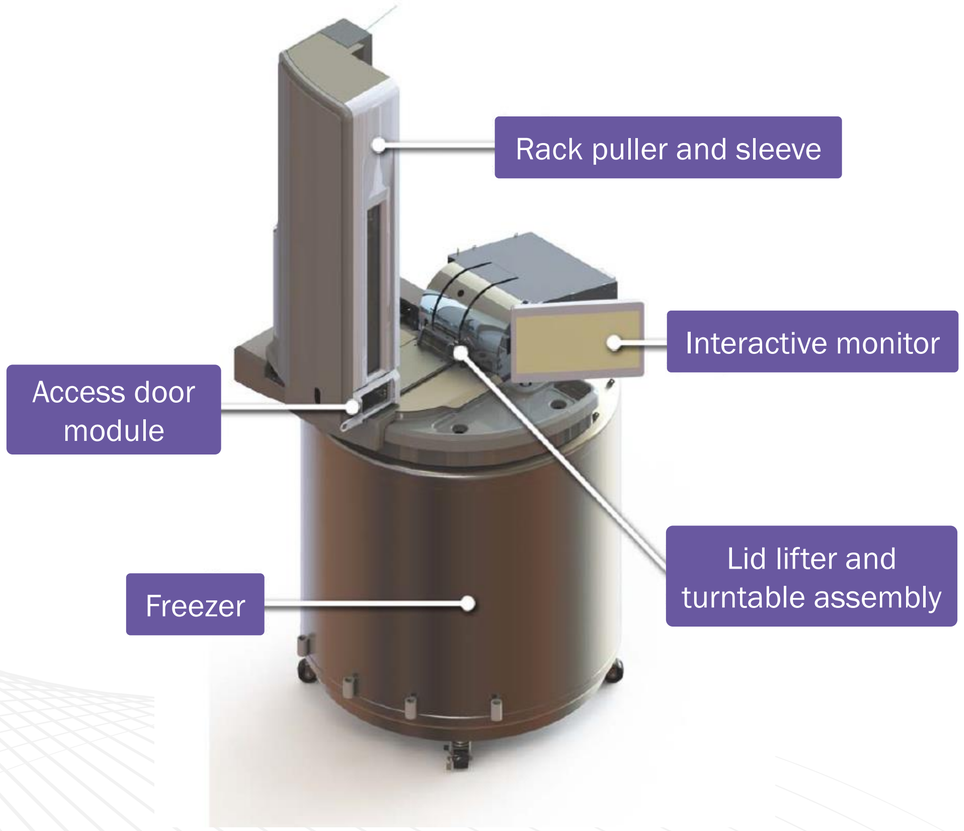
RTD Temperature Sensors

- Accuracy and stability

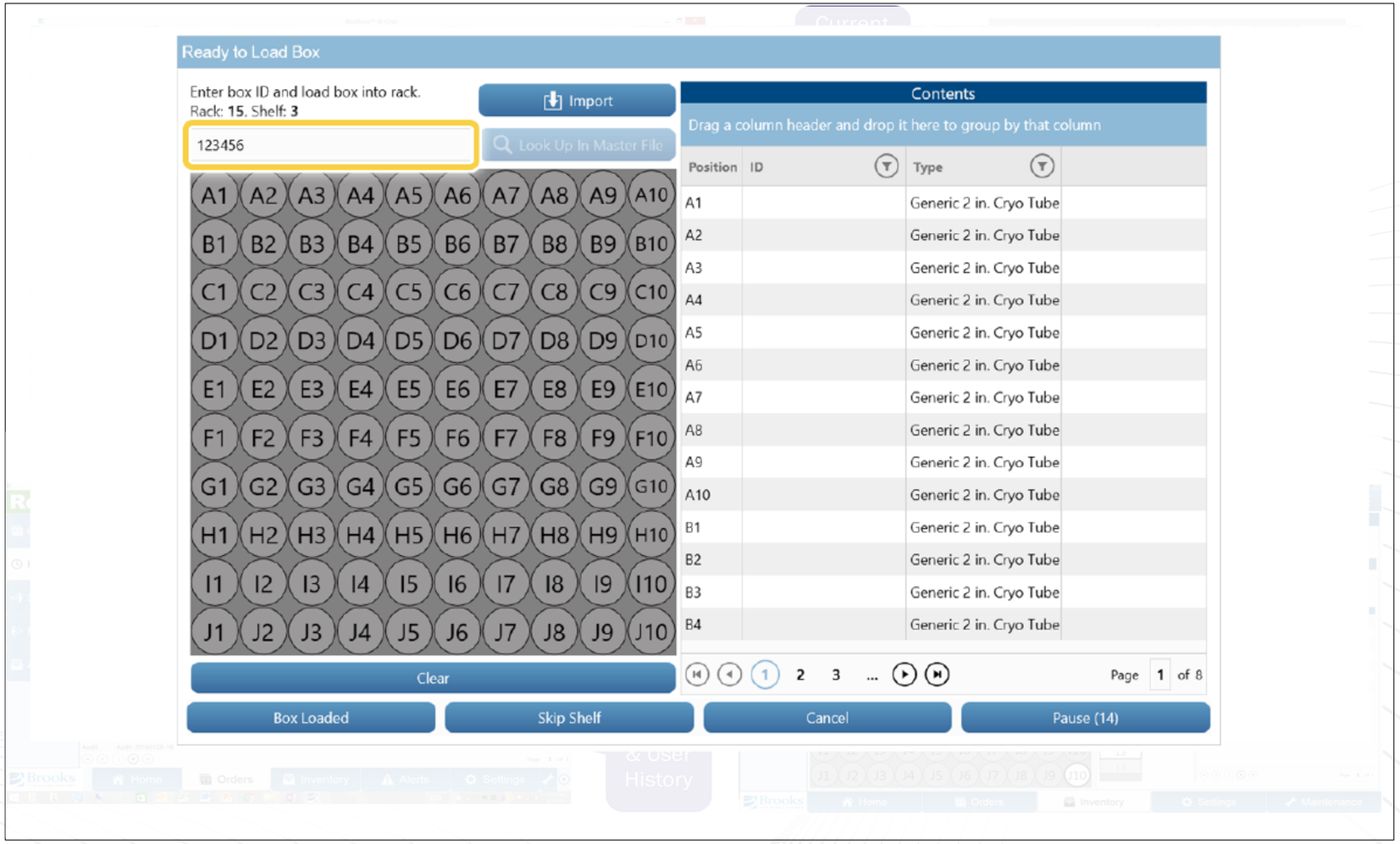
Temperature gradient of ±5°C

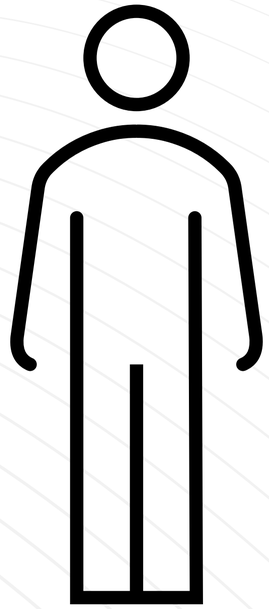
Architecture and operation

FUNDAMENTAL SYSTEM STRUCTURE



Controller Software UI



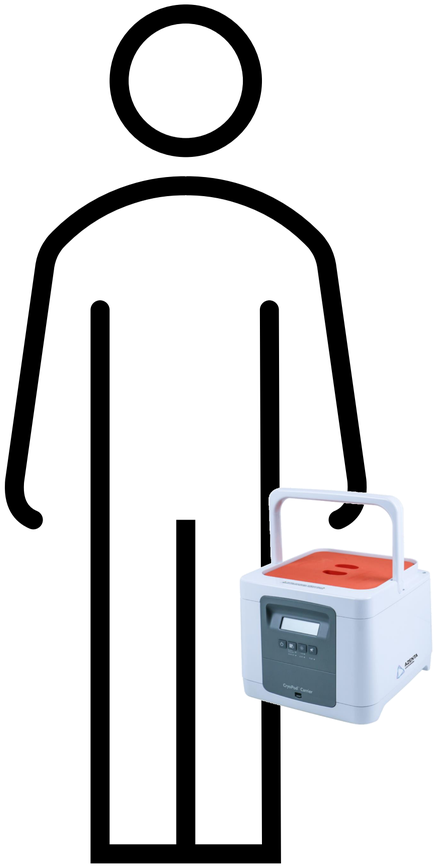


CryoStore Automation in action

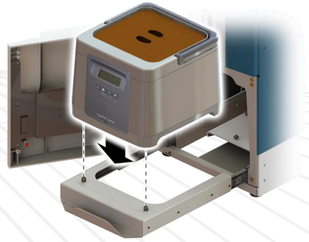
Azenta
CryoPod Carrier

- LN2 Cooled sample transportation
- Optimal size portable sample transfer
- Live and exportable data

Capacity:
- 1x 2” tall Cryobox
- 2x SBS Microplates
- Small cassettes



CryoPod and Filling Station



Azenta **CryoPod Carrier**

Azenta **CryoPod Filling Station**

- 5-10 minutes to fill
- Safe – No user contact with LN2 or cold surfaces
- Consistent – Exact fill every time
- On demand – Recharge anytime, even with samples in basket
- Integrate – Connects to portable or house LN2 supply
- Dimensions (W x D x H) 17” x 23” x 29”

FEATURES AND BENEFITS

Key highlights for the Automated Cryogenic storage portfolio

03

CryoStore -190°C LN2-Based Automated Storage

SAFER AND MORE SECURE SAMPLE STORAGE

Benefits of high-efficiency LN2 freezer

- Sample protection
- Safety
- Accessibility

Advanced Automation features

- Real-time inventory control
- Cold chain management
- Superior user experience

CryoStore -190°C LN2-Based Automated Storage

ULTIMATE SAMPLE PROTECTION WITH INVENTORY CONTROL

Consistent -190°C temperatures from top to bottom using LN2 vapor

Samples protected from excessive warming during retrieval

- Minimized warming of innocent samples
- Insulating tower for temperature stability

Up to 23 days of emergency hold time

Integrated software controls

- Full vial or cassette level inventory tracking
- 19 readily available reports to track temperature data and LN2 levels
- Optional reporting module is 21 CFR Part 11 Compliant

CryoStore -190°C LN2-Based Automated Storage

SIMPLIFIED OPERATION WITH FLEXBILITY

Superior User Experience

- Intuitive touchscreen control
- Ergonomic design for reduced injury risk
- Minimized PPE requirements

Compatible with a range of labware

- Cryoboxes
- SBS Racks
- Cryo Cassettes

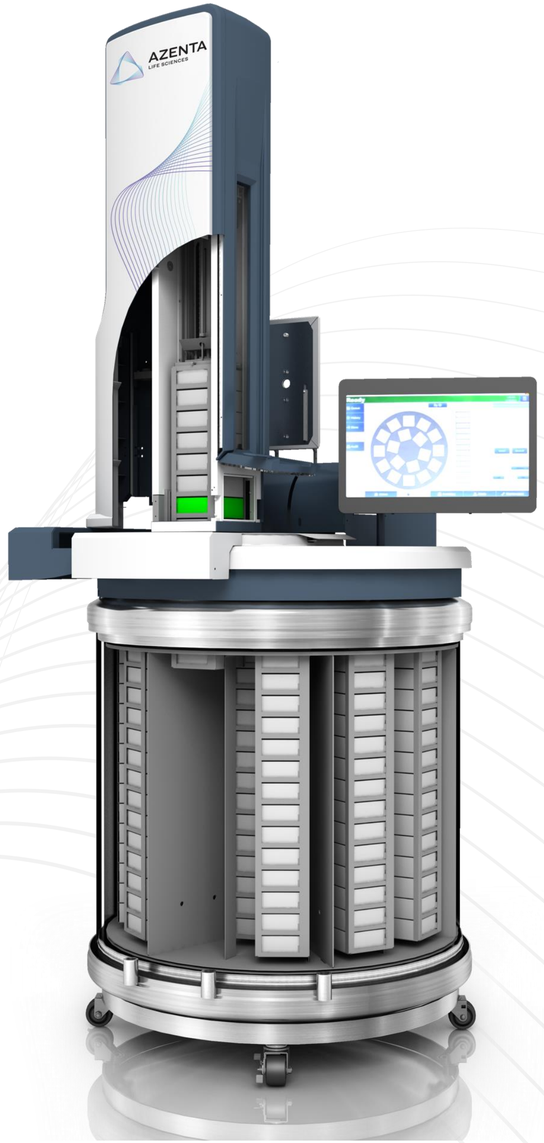
<15L consumption of LN2 per day

Fast sample retrieval <60 seconds

CryoStore -190°C LN2-Based Automated Storage
‘Cryo-Critical’ for GxP Environments

FEATURES TO INCREASE SAMPLE INTEGRITY & RESCUE

- UPS with software detection (and cleanup)
- Light tower and audible alarm with software management
- Absolute encoders on axes
  - Fast recovery from user accidentally bumping the tower, software crash or power outage
- Tower-side door for quick access to the rack and samples
- User-assisted lowering and raising of freezer rack in the tower automatically after electrical or software issues
- Enhanced tools to assist with sample rescue



CryoStore Software – Licensed Features

LIBRARY MANAGEMENT

- Capability to define logical libraries within the system
- Access rights to specific racks, boxes or cassettes
  - Limited user visibility
  - Samples Security

WEBAPI MODULE

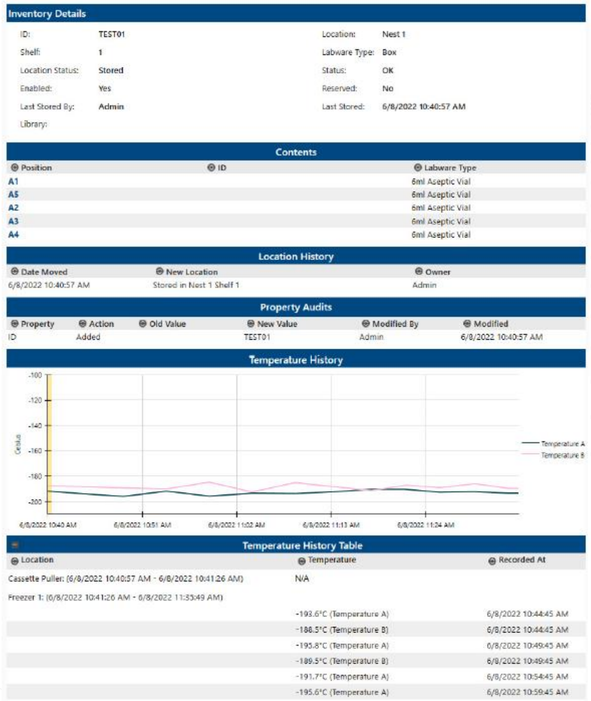
- Third party LIMS and application integration with RESTful WEB Service API
- AZENTA Freezer Pro LIMS

Includes

- Run time license for single-instance use
- Biostore III Cryo Web service API reference guide
- SOAP UI Function testing interface to assist with API testing

REPORTS

- Efficient, documented, 21-CFR-Part 11 Compliant
- List of report categories and types
  - Alarms, Inventory, Monitoring, Orders, Security, System



ALERT MANAGEMENT

- Onboard monitoring with configurable SMS/email notifications and alerts
- Database backup
- Inventory Empty Capacity Low
- Monitoring Item LN2 level
- Monitoring Item LN2 Usage
- Monitoring Item Temperature
- Order Execution
- Preference Settings Modified
- System State
- User Security

- **Alarms** – All, active, history
- **Inventory** – Lifetime, Statistics, Libraries, Partitions
- **Monitoring** – Items, Temperatures, LN2 Usage, LN2 levels, Manual LN2
- **Orders** – All, queued, history
- **Security** – Users, User sessions, User roles
- **System** – Settings, Errors, Traces, Activities

Service Products and Support

IOPQ Validation Service

Installation Qualification

Operational Qualification

Performance Qualification

RTD Calibration Service

Resistance temperature detector re-calibration service

Service Packages

	Standard Warranty Year 1	Warranty Blue Year 1	Performance Blue Year 2
Technical Support Office Hours	W	W	√
Max Response Time in Hours		4	4
Max Time for On-Site in Hours		72	72
No. of Preventative Maintenance		1	1
On-Site Repair Labour	W	W	√
Repair - Travel Time and Expenses	W	W	√
Replacement Parts	W	W	√
Software Maintenance Cat 'A'	W	W	√
Discounted Labour Rates			√
Discounted Upgrades			√

Notes:

1. Any column with a tick or W means that the feature is included in the contract cover
2. In Warranty Blue contracts, items marked with 'W' are covered by Azenta Standard Warranty

SUMMARY

Closing information and conclusion

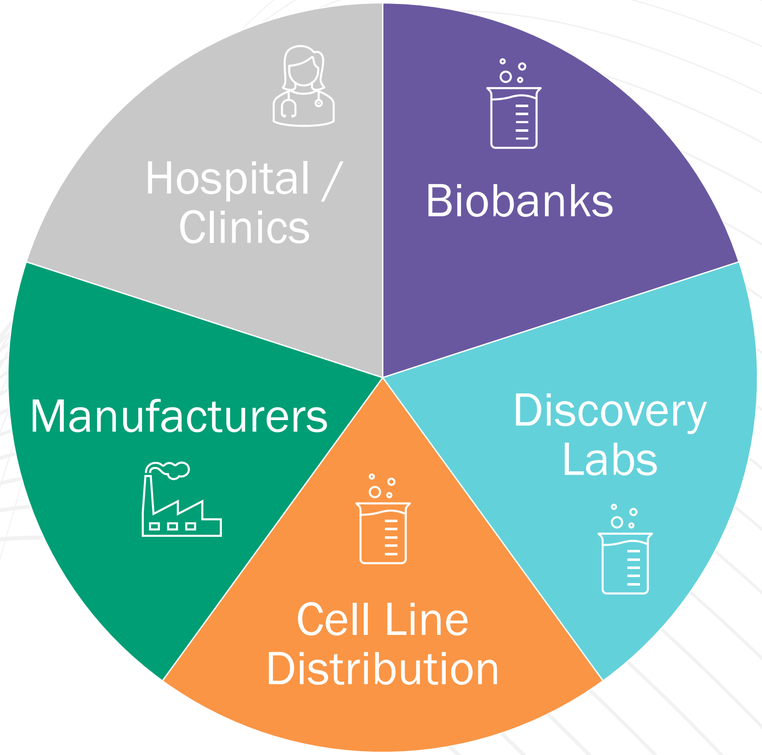
04

Summary

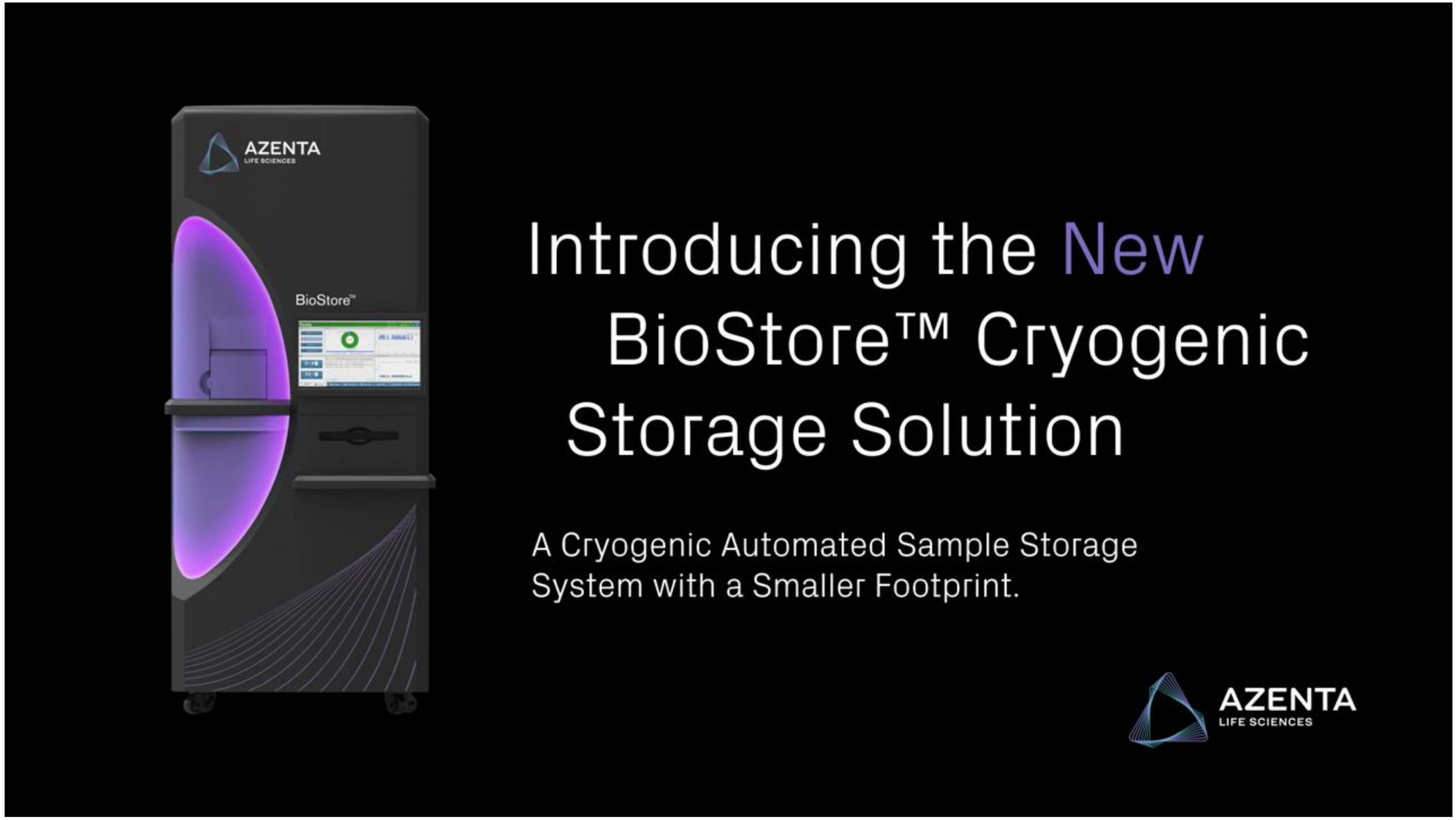
SAMPLE QUALITY | REGULATORY COMPLIANCE | USER SAFETY

Key value proposition

Azenta life sciences produces best-in-class cryogenic automation to streamline sample management so our customers can focus on bringing therapies to market faster. We secure **critical quality attributes**, substantially increase **regulatory compliance**, and deliver the **safest user access** to samples, in an automated and scalable manner. Available in expertly-curated bundles to offer a quick start setup for a seamless and efficient implementation.



Azenta CryoStore PICO (1:34 min)



Azenta /Kaon 3D Demo Tools (1:29 min)

Thank you

Do you have any questions?

Charlie Knowles

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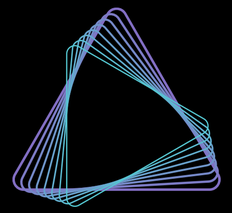

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APPENDIX

05

References

1. John Fink et al, “The Effects of Common Transient Warming Events on Post Thaw Recovery and Viability: Of Human Mesenchymal Stem Cells Stored in -190°C & -80°C Environments,” 2017, https://www.azenta.com/resources/effects-common-transient-warming-events-post-thaw-recovery-and-viability-human.
2. European Medicines Agency Inspection, “Good Manufacturing Practice: An analysis of regulatory inspection findings in the centralised procedure,” January 18, 2007, https://www.ema.europa.eu/en/documents/other/good-manufacturing-practice-analysis-regulatory-inspection-findings-centralised-procedure_en.pdf.
3. “Estimated Costs of Occupational Injuries and Illnesses and Estimated Impact on a Company’s Profitability Worksheet,” Occupational Safety and Health Administration, accessed December 6, 2023, https://www.osha.gov/safetypays/estimator.

Automated Cryogenic Storage Portfolio

	PICO (A32)	Cryostore A45		Cryostore M60						
Product Version	Cryobox	Cryo-critical Cryobox	Tall door Cryo-critical Cryobox	Cryobox	SBS	Cryo-critical Cryobox	Cryo-critical cassette	Ultralow – Cryobox	Ultralow - SBS	Ultralow- Cryo-critical Cryobox
Width	42.7 in (108.5 cm)	46 in (117 cm)	46 in (117 cm)	72 in (182.9 cm)	72 in (182.9 cm)	72 in (182.9 cm)	72 in (182.9 cm)	72 in (182.9 cm)	72 in (182.9 cm)	72 in (182.9 cm)
Depth	56.8 in (144.3 cm)	58.9 in (150 cm)	58.9 in (150 cm)	87 in (221 cm)	87 in (221 cm)	87 in (221 cm)	87 in (221 cm)	87 in (221 cm)	87 in (221 cm)	87 in (221 cm)
Height	95.5 in (242.6 cm)	107.9 in (274 cm)	107.9 in (274 cm)	126 in (320 cm)	126 in (320 cm)	126 in (320 cm)	126 in (320 cm)	126 in (320 cm)	126 in (320 cm)	126 in (320 cm)
Weight (fully loaded)	1433 lbs (650 kg)	2155 lbs (978kg)	2155 lbs (978kg)	3721 lbs (1691 kg)	Approx. 3721 lbs (1691 kg)	3721 lbs (1691 kg)	3548 lbs (1612 kg)	3721 lbs (1691 kg)	Approx. 3721 lbs (1691 kg)	3721 lbs (1691 kg)
Rack capacity	8	19	19	42	61	42	22	42	61	42
Sample capacity	8800 2ml Cryo Vials	26,600 2ml Cryo Vials	26,600 2ml Cryo Vials	63,000 2ml Cryo Vials	43,920 2ml Cryo Vials	63,000 2ml Cryo Vials	990 250 ml Blood bags	63,000 2ml Cryo Vials	43,920 2ml Cryo Vials	63,000 2ml Cryo Vials
LN2 capacity	93L	196L	196L	302 L	302 L	302 L	302 L	295 L	295 L	295 L
Temperature	-196°C	-196 °C	-196 °C	-196 °C	-196 °C	-196 °C	-196 °C	-20 to -150 °C	-20 to -150 °C	-20 to -150 °C
Hold time	10 days	15 days	15 days	16.5 Days	16.5 Days	16.5 Days	16.5 Days	From -80 °C to -60 is 4 days	From -80 °C to -60 is 4 days	From -80 °C to -60 is 4 days

Manual Freezer Solutions

HIGH EFFICIENCY (HE) FREEZER PRODUCT LINE

Improved ergonomics

- Cryo LED and Auto Fog Clear
- Full Sample Visibility
- Low lift over height

Increased capacity

- Highest Storage density
- Optimized footprint
- Lowest LN2 usage per sample

Stay connected

- Touchscreen with WiFi/ LAN
- Text & Email alerts
- Remote Monitoring

Sample exposure to harmful transient warming events

- 1,000+ innocent samples per rack
- Searching for sample increases time out of freezer

Less efficient operation

Variability in documentation and tracking

Risk of injury

Product Pricing

CryoStore **PICO (A32)**

Cryobox format pricing:
$150,000.00

CryoStore **A45**

Cryo-critical Cryobox format pricing:
$167,000.00

Tall door Cryo-Critical Cryobox format pricing:
$177,000.00

CryoStore **M60**

Cryobox format pricing:
$184,500.00

SBS format pricing:
$208,000.00

Cryo-critical Cryobox format pricing:
$205,000.00

Cryo-critical cassette format pricing:
$251,000.00

Ultralow Cryobox format pricing:
$210,500.00

Ultralow SBS format pricing:
$237,500.00

Cryo-critical Ultralow Cryobox format pricing:
$231,000.00

Appendix - FreezerPro

FreezerPro is a scalable, fast, reliable and secure Laboratory Information Management Software solution which enables users to know precisely where a laboratory sample is located even before opening the freezer door.

- Track all sample movement and sample information
- Create virtual freezers, customize to emulate the configuration of physical freezers down to box and vial level
- Quick and easy setup with intuitive user interface
- Dedicated menu for reports, providing tracking of all activities and a comprehensive audit trail
- Sample type customization with functionality to store specific metadata
- Easy search feature based on sample data by word or keyword
- Web-based solution providing access to sample information from anywhere in the world

Appendix - Cryoexchange