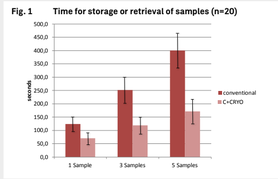
Results of scientific study concerning comparison C+CRYO with conventional rack-storage system

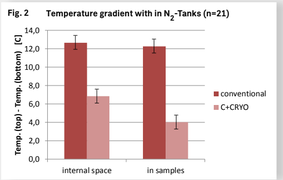
For 20 days three experiments were performed daily to store or retrieve 1, 3 and 5 samples respectively. Handling times were significantly shorter with the new system ($p < 0.00001$; Fig. 1).

Fig. 1 Time for storage or retrieval of samples (n=20)



In steady state conditions the C+CRYO system showed a significantly smaller temperature gradient and more homogenous temperature distribution than the conventional system ($p < 0.00001$; Fig. 2). We determined the intervall between N_2 filling cycles as a surrogate marker of N_2-consumption. Despite generally lower and more evenly distributed temperatures the N_2 consumption of the two systems was equal.

Fig. 2 Temperature gradient with in N_2-Tanks (n=21)



During and upon storage or retrieval of samples, the C+CRYO system is able to maintain a much more constant temperature as measured in moved samples, close-by stored and unmoved samples. (Fig. 3 and Fig. 4; $p < 0.00001$).

Fig. 3 Temperature increase induced by storage and retrieval processes in close-by stored, unmoved samples

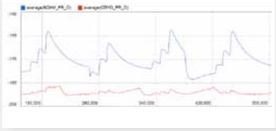


Fig. 4 Temperature increase induced by storage and retrieval processes in close-by stored, unmoved samples

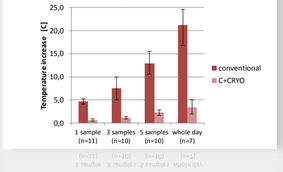


Fig. 5 and Fig.6 show the course of temperature in samples stored in conventional racks or C+CRYO chains removed in order to store or retrieve samples. The C+CRYO system shows a much better temperature stability, samples in the conventional system come even with fast operation and optimal sample handling close to -150°C or above.

Fig. 5 Temperature increase induced by storage and retrieval processes in samples in the removed rack/chain.

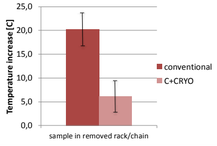
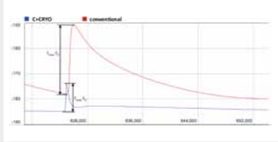
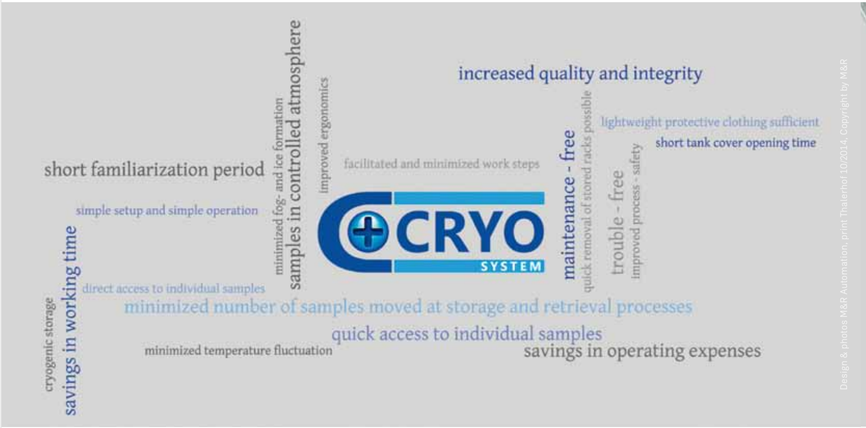


Fig. 6 Temperature increase induced by storage and retrieval processes in samples in the removed rack/chain.



Contact

C+CRYO SYSTEM



INNOVATIVE STORAGE SYSTEM FOR BIOLOGICAL SAMPLES IN CRYOGENIC STORAGE CONTAINERS

A product of: M&R AUTOMATION

In cooperation with:

INNOVATIVE STORAGE SYSTEM FOR BIOLOGICAL SAMPLES IN CRYOGENIC STORAGE CONTAINERS

Successful medical and natural scientific research demands highest quality of stored samples. Constant storage conditions and optimized sample handling processes are the premise to be able to measure sensitive biomarkers reliably. Exactly at this point starts the innovation of the C+CRYO System.

In cooperation with the scientific partner, the Medical University of Graz, which has built up one of the largest Biobanks in Europe with approximately 5 million biological samples, M&R Automation GmbH developed as specialist in the field of custom machine builder the C+CRYO System and registered it as a patent.

In comparison to conventional storage and manipulation systems, the C+CRYO SYSTEM has the following advantages:

SCIENTIFIC BENEFITS OF THE C+CRYO SYSTEM:

- > minimizes amount of moved samples up to factor 100 during storage and retrieval processes
- > minimizes temperature fluctuation in manipulated and non-manipulated samples
- > minimizes the storage artifacts at sensitive Biomarkers
- > better temperature homogeneity in the storage tank
- > reduces massive ice building inside the storage tank
- > improves process safety

OPERATIONAL BENEFITS OF THE C+CRYO SYSTEM:

- > Much faster completion of storage and retrieval processes (=savings in labour costs)
- > fast return on investment in comparison to commercially available rack-systems due to faster working processes
- > improvement of operating safety
- > simplifies and minimizes work steps for the laboratory workers
- > improvement of ergonomics
- > compatibility with conventional storage systems

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COMPARISON EXPENDITURE OF TIME FOR STORAGE AND RETRIEVAL OF SAMPLES

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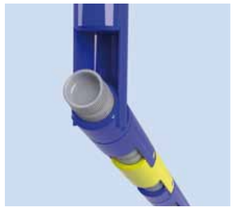
SYSTEM OLD

C+CRYO SYSTEM



C+CRYO CHAIN

The main component of the C+CRYO SYSTEM is the C+CRYO CHAIN. Direct access to any specific vial is possible with the C+CRYO CHAIN by only moving a minimal number of surrounding vials (on average, a maximum of 11 samples are moved). Therefore fewer samples are exposed to temperature fluctuation. Also the risk of damaging samples due to agitation is minimized due to a smooth and easy motion.Each link of the chain safely and securely captures one vial. The chains are positioned vertically in the C+CHAIN RACK and are guided by the C+CHAIN RACK during storage and retrieval processes. Every third chain link has a different colour and thus enables easy and quick identification of the desired storage location. The chains will be pulled out of the C+CHAIN RACK to the required height and then pivoted at the first link about the rack to enable access to the desired vial storage location. A C+CRYO HOOK makes the manipulation of the chain easier. The topmost chain link is marked with an individual alphanumeric code.

Type:	11-2
Material:	plastic
Capacity:	11 vials (2ml)
Dimension:	LxD= 578 mm x 17 mm
Weight:	0,061 kg
Configuration:	different number of chain links possible

C+CRYO RACK

C+CRYO RACKs position and guide C+CRYO CHAINs during storage and retrieval processes. C+CRYO RACKs are compatible with commercially available sample storage towers and can therefore be an option for extending an existing system. Another advantage of C+CRYO RACK is that it does not have to be removed from storage tanks for retrieval and storage processes. Thus the retrieval and storage process is more ergonomic and easier because there are no issues with finding storage positions of racks in the tank due to bad visibility. In addition, ice build-up on racks and loss of cold is significantly reduced. In case of emergency a quick removal of stored racks is enabled by the C+CRYO Handle on the upper side of the racks. Individual C+CRYO RACKs will be marked with engraved tags.

Type:	**52-11-2**
Material:	eloxadized Aluminum
Capacity:	52 pcs. C+CRYO CHAINs 572 Vials (2ml)
Dimension:	LxWxH=146 x 140 x 581mm (591mm incl. CHAINS)
Weight:	2,7 kg
Configuration:	different heights depending on type of storage tank possible

Type:	**18-11-2**
Material:	eloxadized Aluminum
Capacity:	18 pcs. C+CRYO CHAINs 198 Vials (2ml)
Dimension:	LxWxH= 87 x 87 x 581mm (591mm incl. CHAINS)
Weight:	1,16 kg
Configuration:	different heights depeding on type of storage tank possible

C+CRYO HOOK

A C+CRYO HOOK facilitates the manipulation of C+CRYO CHAINs. Thin cotton gloves are sufficient for the operation in comparison to the typically thick safety gloves needed when working with commercially available systems.

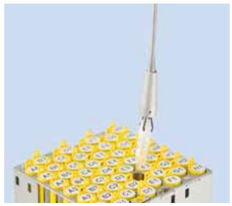
Material:	chrome-plated steel
Weight:	0,053 kg

C+CRYO HANDLE

The C+CRYO HANDLE allows quick evacuation of an entire C+CRYO Rack 52-11-2 from the cryo-tank. The handle is also used for loading a storage tank with C+CRYO Racks 52-11-2. The handle consists of a manual handle with hooks that are inserted into the C+CRYO RACK. Due to their compact build, there is no handle for small racks (18-11-2 racks). This racks have a grip opening on the side of the rack used for removing the rack from the tank and inserting it.

Type:	52
Material:	stainless steel
Weight:	0,2 kg

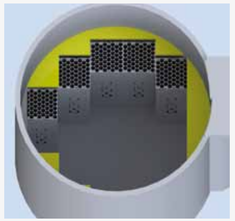
C+CRYO SYSTEM ACCESSORIES



C+CRYO RESCUE

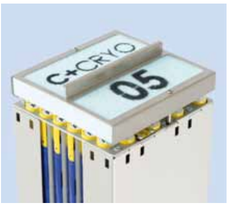
The C+CRYO RESCUE is used for quick and ergonomic recovery of vials or other components that have fallen into a rack, e.g. due to mishandling. It is thus possible to undertake a recovery without having to remove the rack from the cooled atmosphere inside the nitrogen tank. The Rescue consists of a flexible hose with a 4-finger gripper at the bottom end and a gripper trigger mechanism at the top end. It is suitable for vials of various sizes as well as other items.

Material:	Steel / plastic
Dimension:	LxD= 778 mm x 17 mm
Weight:	0,117 kg



C+CRYO CLEARANCE COVER

The C+CRYO CLEARNACE COVER insulates the remaining intermediary spaces between C+CRYO RACKS and the inside wall of the tank. It is positioned on the Clearance Cover Brackets. The Clearance Cover improves temperature homogeneity inside the storage tank. Combined with the C+CRYO RACK



C+CRYO RACK COVER

The C+CRYO RACK COVER comprises of an stainless steel frame with inserted insulation material with affixed positioning pins and labelling. It effects improved thermo-homogeneity inside the storage tank from bottom to top, meaning almost as low temperatures in the topmost samples as in the bottom ones, and it also reduces icing over of the C+CRYO CHAINS (improved chain identification). The RACK COVER is positioned on the upper end of the rack and aligned and stabilized with the positioning pins. The Cover is available for various rack sizes.

Type:	**52-11-2**
Material:	stainless steel / rigid foam
Dimension:	LxWxH= 146 x 140 x 34mm
Weight:	0,19 kg

Type:	**18-11-2**
Material:	stainless steel / rigid foam
Dimension	LxWxH= 87 x 87 x 34mm
Weight:	0,10 kg

COVER, a closed and insulated surface is created inside the tank. Thus vials slid of the tweezers can't fall into the tank like at conventional systems. Due to its insulating properties, the Clearance Cover also minimizes fogging in the tank, and therefore operators have an improved view. Further, the insulating effect of the Clearance Cover reduces icing inside the tank. The Clearance Cover is available for several different tank systems.

Material:	rigid foam
Dimension:	individual
Weight:	individual

C+CRYO TRAY

The C+CRYO TRAY is an auxiliary tool for storage and retrieval processes. It increases the process reliability and ensures that the samples are cold at all times. The C+CRYO TRAY is comparable to a toolbox for laboratory workers. It contains an isolated container for individual vials to be stored or retrieved as well as holders for pens, the C+CRYO HOOK and tweezers.

Material:	eloxadized Aluminum
Dimension:	LxWxH=300x220x190mm
Weight:	0,9 kg

C+CRYO BRACKET SET

The C+CRYO BRACKET SET is a beveled plate that secures the Clearance Covers in various tank systems and racks. It is simply hanged inside the rack, is self-clamping and available in different sizes.

Material:	stainless steel
Dimension:	LxW= 20/40/60/80 mm x 23,5 mm
Weight:	0,010 kg