

LIQUID NITROGEN TECHNOLOGY FOR STORAGE OF FRESH-FROZEN PLASMA AND LOGISTIC FEATURES -EXPERIENCE OF THE HEINRICH HEINE UNIVERSITY MEDICAL CENTER-

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Background:

Compressor technology is being used for cooling purposes and storage of blood components. However, this technology has several significant disadvantages, including many mechanical parts, space requirements and high electric energy consumption.

Aims:

Therefore a reliable, robust and user friendly technology without these drawbacks had to be designed.

Methods:

We have implemented a BOS-S/040 storage system (NSC Medical Cooling Systems, Hamburg, Germany) for any kind of biological materials (temperature range +10 to -86°C) which meets all requirements including a computer-based storage management system connected to our production system. The installation of 34 systems, each comprising 2.592 standard units of fresh frozen plasma (FFP) in a cube of approximately 2 x 2 x 2 meters was completed in 2008.

Results:

In operational use of this technology, the following significant benefits were experienced:

- (1) The operating costs per stored plasma unit are much lower than before due to
 - (a) a significant decrease by 26% in cooling energy costs (electrical energy vs. liquid nitrogen) corresponding to 910 € per 1000 FFP units per year
 - (b) a decrease in the net space by 31% requiring 1.5 square meters per 1.000 FFP units
 - (c) a reduction in manpower requirement for handling by more than 50%
 - (d) a reduction in maintenance cost by more than 50%.
- (2) The stability of the stored products, as evaluated by hemostasis profiling including coagulation factor activities including FVIII:C following freezing and thawing is superior, as compared to the European Guidelines. This result is related to constant temperatures inside the BOS-S/040 system which are warranted specifically during handling procedures due to minimized opened areas and appropriate cooling input.
- (3) In case of complete charging, the cooling capacity is guaranteed by the manufacturer and, as evaluated, provided indeed.
- (4) Handling of the stored products by the staff is easy to perform due to usage of pocket computer devices.
- (5) A detailed visualization of all relevant system data is available including alarm situations.
- (6) There is a complete documentation of the cooling chain implemented in the data management system.
- (7) Service operations are reduced to less than 50% due to the robust technical concept of the system.
- (8) Occupational health and safety are considerably increased because handling is performed at room temperature without ice-covered floors.

Summary/Conclusions:

The investment into the liquid nitrogen technology pays off shortly because of significant advantages over conventional compressor technology. Drawbacks cannot be seen. Moreover, occupational aspects for staff are evident because handling of FFP can be performed at room temperature instead of working in frosty environment. The complete loading/unloading process is performed and recorded automatically without hard copies and paper work. Most of all, the precise and computer-controlled management of the plasma units guarantees a significantly higher degree of safety for patients and staff. Based on this reliable and robust technology and our experience reported here, a follow-up system is being developed to preserve biological products at temperatures below -150°C, e.g. for red blood cells, hematopoietic progenitor or stem cells.

Fig. 1 Storage temperature documentation

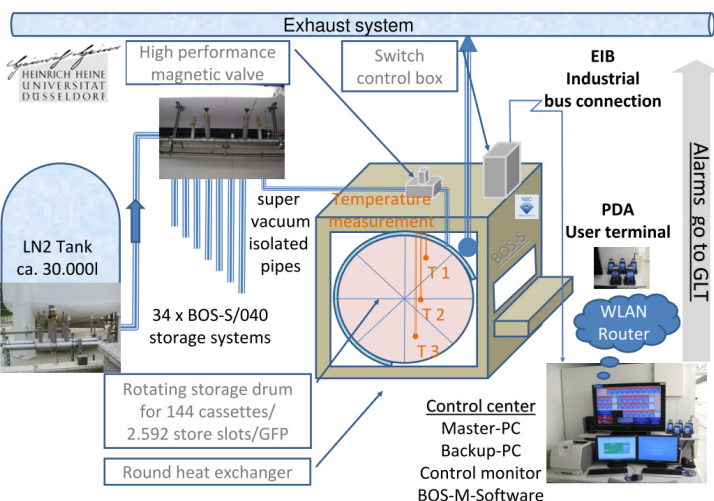
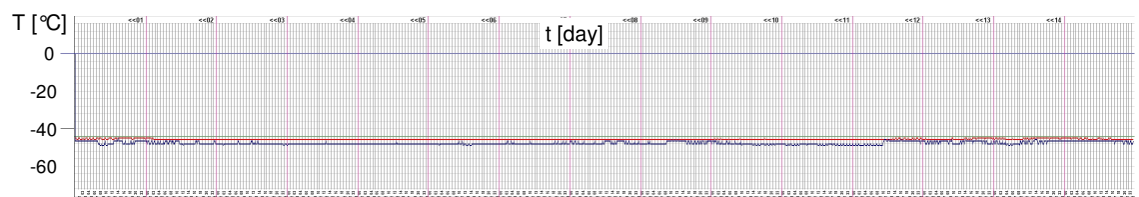


Fig. 2 Liquid nitrogen technology

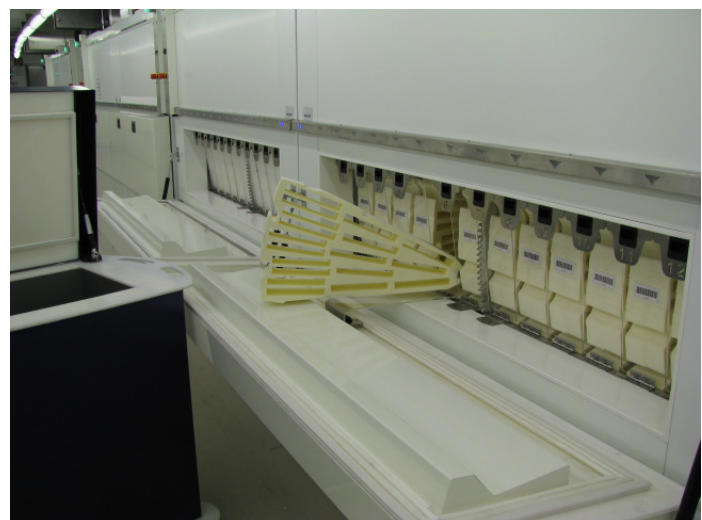


Fig. 3 Storage system for Fresh Frozen Plasma (FFP)