ENGINEERING PACKAGED

LSSU Freezers & Blast freezer

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Rev	Date	Purpose	Prepared	Reviewed	Approved

1. Project Purpose and Objective

This Engineering package is to define a simple and standard design of a Large Scale Storage Unit (LSSU) freezer plant from both a technical and commercial point of view. The document includes estimates on some of the technical parameters which is defined in the document.

The LSSU freezer and the Blast freezer is a standard unit which is fabricated at LOWENCOs production facility and transport to site to for a simple and fast installation conducted by LOWENCO team.

There is the following supporting documentation to inform in dept how the installation of a LSSU and Blast is to be installed. The documents below will be exposed to continually updated and therefore some information can be outdated.

In this simplification structure we have defined a LSSU and Blast freezer for standard refrigerants and for a -70C solution. Each project can be designed according to site specifications.

Documents include in this engineering packaged. Documents stated as "Released upon request" is not a part of the packaged due to the size of the file.

Document name	Definition	Note
LSSU freezer	SRS - Supplier Requirement Specifications LSSU - Rev.0.4 SRS - Supplier Requirement Specifications LSSU - US	Include in packaged Released upon request
	FDS - Functional Design Specification LSSU - Rev. 1.0	Include in packaged
	FAT – Factory acceptance test	Released upon request
	SAT – Site acceptance test	Released upon request
Blast freezer	SRS - Supplier Requirement Specifications LSSU - Rev.0.4 SRS - Supplier Requirement Specifications LSSU - US	Include in packaged Released upon request
	FDS - Functional Design Specification Blast - Rev. 1.0	Include in packaged
	FAT – Factory acceptance test	Released upon request
	SAT – Site acceptance test	Released upon request
LSSU storage (Trolley)	Trolley for bottles 2 liters	Released upon request
	Trolley for bottles 5 liters	Trolley 5L Bottle_100017015
	Trolley for bottles 10 liters	Released upon request
	Trolley for bags	Released upon request
	Trolley for Meissner	Trolley CryVault 20 l.
	Pallets	Released upon request
Documentation	Vendor Document List (VDL)	Released upon request
Standard	Standard list	Released upon request

2. LSSU scope and Price level

LOWENCO standard scope of delivery:

LOWENCO delivers a complete turnkey solution installed at our customers' site by the LOWENCO installation team. LOWENCOs standard solution includes normally following items:

Item	Definition	Pcs
Equipment	LSSU 4 doors freezer shells with a holding capacity of up to 4200 kg liquid medicine	
	Compressor skid for LSSU -70°C water-cooled Cascade Compressor Plants for redundant freezing	
	Corridor section including 1 pc sliding freezer door and 1 pc emergency escape door	
	Compressor skid for Corridor -25°C water-cooled Compressor Plants for maintaining Corridor room temperature	
	Anteroom 2/8°C 3 x app. 7 meters. Will be served from Corridor compressor skid	
	Blast 2 doors freezer shells	Option
	Compressor skid for Blast -70°C water-cooled Cascade Compressor Plants	
	Electrical boards for trace heating-, door switch- and emergency stop signals	
	Control boards including Siemens 19" touch panels for operating systems	
	Low-noise dry-coolers including pumps, filters, valves, and expansion tanks including maximum 10-meter piping	
	Standard trollies	
FAT	Fully operational Factory Acceptance Test of one freezer at LOWENCO production site Kolding, Denmark	
Installation and commissioning	Installation and commissioning of equipment mentioned above	
	X days Site Acceptance Test (SAT)	
	X days onsite training for Customer operators	

LOWENCOs standard price level installed at site. Price is only an estimate and can variate depending on different parameters.

Product	Definition	Storage capacity max in liters	Price estimate in EUR
LSSU freezer	2x LSSU and 1x Corridor 16 trollies	8.400	1.610.000
	4x LSSU and 1x Corridor 32 trollies	16.400	3.085.000
	6x LSSU and 1x Corridor 48 trollies	25.200	4.560.000
	8x LSSU and 1x Corridor 64 trollies	32.800	6.035.000
Blast freezer	1x Blast 4 trollies		465.000

LOWENCOs product and drawings

Product	Drawing
2x LSSU and 1x Corridor	LSSU 2 pcs w Anteroom120000002
4x LSSU and 1x Corridor	Released upon request
6x LSSU and 1x Corridor	Released upon request
8x LSSU and 1x Corridor	LSSU 8 pcs. w Anteroom 15-087-005
1x Blast	Blast freezer 2 doors

3. LSSU Solution Technical Specification

LSSU – Large Scale Storage Unit

The LSSU Freezer has a storage capacity of up to 4200 kg liquid medicine at a temperature setpoint of

20 to -80°C. The LSSU Freezer is fully redundant and can operate in lead mode, lack mode or assist mode. The system automatically chooses the needed mode depending on the operation scenario.

The LSSU Freezer is designed to meet requirements for minimum maintenance interruption. All major parts can be replaced from outside the LSSU Freezer while it is in operation.

The LSSU Freezer is fitted with the LOWENCO invented Double Duct Evaporator System, capable of maintaining an accurate and stabile temperature at all operation conditions.

The LSSU Freezer is designed with an assistance program to ease logistics for the end-user and to ensure a short pulldown time. When placing new products, the LSSU Freezer automatically goes into assist mode to reach temperature set point as fast as possible. In assist mode the two evaporator fans are circulating air corresponding to air circulation inside the freezer more than 200 times per hour.

The LSSU Freezer is designed and manufactured according to the European Machinery Directive EN60204-1 and the refrigeration system is built according to Refrigeration Standard EN 378.

LSSU Corridor

The Corridors includes 1 pc FR60 sliding entry door and 1 pc FR60 emergency escape door.

The Corridor consists of floor sections and ceiling sections that are designed as prefabricated bolt-on sections fitted between LSSU freezer front ends.

With this design the LSSU freezer front ends will act as walls in the Corridor, minimizing size of overall installation and reducing installation time on-site. Joints will be covered with pre-painted (RAL9010) aluminum plates for equal overall appearance.

The Corridor floor is made as a non-skid type of quintet pattern aluminum checker plates as top layer screwed/bonded onto an 8mm aluminum plate for pressure equalization. The Corridor floor is designed to a total simultaneous load of 2500 kg and a point load of 500 kg on 4 rubber wheels.

The Corridor ceiling also acts as floor of the above technical area, called Tech Space.

The Corridor ceiling sections have a 250mm built-in void duct between Corridor ceiling and Tech Space floor, for hiding cabling and piping.

The Tech Space floor has a removable non-skid aluminum checker plate 5/7mm and is designed for a total load of 1000 kg and a point load of 250 kg.

On the freezer side of the entry door a Polar Grade strip curtain is fitted as air escape barrier.

LSSU Anteroom

The Anteroom is built on-site as an extension to the LSSU Freezers. The Anteroom is built with 150mm FM approved Quad Core panels to maintain the FR60 fire rating.

The Anteroom floor is made of a non-skid aluminum checker plate type 5/7 mm screwed/bonded onto an 8 mm aluminum plate and designed to a total simultaneous load of 2500 kg and a point load of 500 kg on four rubber wheels.

Storage Freezer LSSU data

The LSSU Freezers are delivered as prefabricated 4 door units to minimize installation time on-site.

General

Structural Steel:	5mm stainless steel AISI 304 (1.4301/2B)
Insulation Material:	200mm FM approved Quad Core panels
Floor construction:	8mm aluminum plates as foundation for pressure equalization with nature anodized plates as top layer
Adhesive and Sealing:	All adhesive and sealing material provided by supplier
Doors:	4 pcs freezer doors.

Compressor Selection

According to room load calculation, maximum required freezing power is defined in watt in normal storage mode and will be specifically calculated for each project.

A project includes 2 pcs water cooled Cascade Compressor Plants per LSSU freezer.

The Compressor Plants have a total freezing capacity of approx. 7000 watts at room temperature -80C and 32°C ambient temperature, when compressors are running in assist mode.

Below refrigerant can be used in combination based on the designed temperature in the LSSU

HT Compressor:	R449 or R744 (CO2)
LT Compressor:	R473A or R508B

The defrost is designed as hot gas defrost giving a short defrost period with minimum heat transfer to surroundings and minimizing electrical installations inside the negative temperature area.

Corridor -25°C data

The Corridor is delivered as prefabricated modules to minimize installation time on-site.

General

Structural Steel Floor:	5mm stainless steel AISI 304 (1.4301/2B)
Structural Steel Ceiling:	5mm stainless steel AISI 304 (1.4301/2B)
Insulation Material:	200mm FM approved Quad Core panels
Floor construction:	8mm aluminum plates as foundation for pressure equalization with non-skid aluminum quintet pattern plates as top layer
Adhesive and Sealing:	All adhesive and sealing material provided by supplier
Doors:	1 pc entry sliding door 1 pc emergency escape door

Electrical Control Boards

Each compressor skid is controlled by a dedicated Scada Control System based on Siemens S7-1500 PLC. The software program is made in TIA 16 professional portal. All communication will be connected to and displayed on 2 similar 19" touch screens located respectively in Tech Space and inside the anteroom, for easy operation. A schematic view of the installation, freezer details, all vital components on each system, alarm log, temperature set points and trend curves are some of the items accessible from the touch screens.

Access control will be at distinct levels as described in the already shared LOWENCO Functional Design Specification (FDS).

4. Blast Freezer Technical Specification

Blast Freezer chamber data

The freezers are delivered as prefabricated 4 doors units to minimize installation time on-site.

General

Structural Steel:	5mm stainless steel AISI 304 (1.4301/2B)
Insulation Material:	200mm FM approved Quad Core panels
Floor construction:	8mm aluminum plates as foundation for pressure equalization with nature anodized plates as top layer
Adhesive and Sealing:	All adhesive and sealing material provided by supplier
Doors:	1 pc freezer doors with an opening of 1200mm

Blast Freezer

The dedicated Blast Freezer is designed for blast capacity of up to 300 kg liquid medicine. The Blast Freezer is designed to meet requirements for minimum maintenance interruption.
The -70°C Blast Freezer is fitted with the LOWENCO invented Double Duct Evaporator System.
The LSSU Freezer is designed and manufactured according to the European Machinery Directive EN60204-1 and the refrigeration system is built according to Refrigeration Standard EN 378.
This quotation includes 1 pc water cooled Cascade Compressor Plant for the Blast Freezer. Removal of heat will be conducted by dry cooler.
The Compressor Plant has a total freezing -70°C at 20°C ambient temperature. The defrost is designed as hot gas defrost giving a short defrost period with a minimum heat transfer to the surroundings and reducing electrical installations inside the -70°C area to a minimum.

Electrical Control Boards

Each compressor skid is controlled by a dedicated Scada Control System based on Siemens S7-1500 PLC. The software program is made in TIA 16 professional portal. All communication will be connected to and displayed on 2 similar 19" touch screens located respectively in Tech Space and inside the anteroom, for easy operation.

A schematic view of the installation, freezer details, all vital components on each system, alarm log, temperature set points and trend curves are some of the items accessible from the touch screens.

Access control will be at distinct levels as described in the already shared LOWENCO Functional Design Specification (FDS).

5. Services in Scope of Supply

Below definition describes the specific service to ensure complete installation.

Project Management

LOWENCO will appoint a dedicated Project Manager (PM) to have full responsibility for the overall planning, execution and reporting to the Customer. This will be a single point of contact for the individual contract. This relates to coordination between LOWENCO and the Customer, planning manpower, lead the daily coordination call with employer (PM and Site) and weekly/bi-weekly installation reports.

Site Requirements and Installation

LOWENCO site crew can always perform installation unobstructed without any Union as supervisors.

The site must be available for LOWENCO site crew daily from 7AM to 10 PM including weekends and holidays.

LOWENCO will bring their own office/workshop and 20 ft. storage containers and will require space to place those as close as possible to the installation site during the entire installation period.

To ensure correct installation a forklift is required. LOWENCO site crew members have forklift driver's license and can operate forklifts if allowed. If not allowed LOWENCO will need a contractor crew to operate the forklift. Forklift requirement:

- Approved for lifting 2000 kg
- Lifting height 4000mm
- Fork length 2400mm

A crane with minimum lifting capacity 6000 kg is required for unloading office/workshop and 20 ft. storage containers at installation start and loading office/workshop and 20 ft. storage containers after installation is completed.

Concrete slap, steel frame (or similar) and dry coolers placed next to the building, or on building roof will be arranged by customers contractor well in time before LOWENCO site crew arrives for installation. Customer to advise. Dimensions of dry coolers will be provided by LOWENCO after receiving signed purchase order (PO).

Electrical power supply and main distribution panel(s) will be supplied by the customer and will be ready according to the agreed time schedule and before LOWENCOs site crew arrives on-site. Needed fuses and electrical load are specified in Supplier Requirement Specifications (SRS) and will be confirmed by LOWENCO after receiving signed purchase order (PO). Electrical connection to each LOWENCO main distribution panel will be provided by customer internal electricians or contractors in collaboration with LOWENCO Site Manager or Electrician.

For further details please see Appendix X Supplier Requirement Specifications (SRS).

6. Quotation Options

Item	Definition	Pcs	Price (EUR)
UL certificate	Upon request		N/A
Transportation	Transportation from production facility in Denmark to site DAP		N/A
Site equipment	Stairway / other access to Tech Space		N/A
	Refrigerant piping from compressor skid to dry cooler	1 meter	500

7. Service Level Agreement

Preventative maintenance by LOWENCO Engineering will ensure maximum system uptime and optimal safety for stored products. At the same time it minimizes product handling during storage. Below items are covered under the Service Level Agreement (SLA). See separated quotation.

Item	Definition	Pcs	Price (EUR)
Service Level Agreement (SLA)	1 year standard warranty	1	N/A
	Remote access	1	N/A
Total Price / year	Monthly Fee (separate contract to be signed)		TBD

8. Warranty

12-month product warranty on equipment under this scope of supply. The warranty period will be effective upon handover.

9. Delivery Schedule

Below table determines program for equipment delivery, installation, and Site Acceptance Test (SAT).

Normal delivery from the production site in Denmark is 6-8 month depending on the production flow. The exact delivery time must be coordinated on each project.

Event	Date
Time of delivery (EX Works Kolding, Denmark)	6-8 month
Time of installation start	TBD
Time of installation completion	TBD
Time of commissioning completion	TBD
Site Acceptance Test (SAT) completion	TBD

10. Conditions in General

T&C:	Orgalime SI-14
Delivery:	Incoterms 2010 EXW
Delivery time:	According to presented time schedule or Appendix
Certificates:	LOWENCO A/S is ISO 9001:2015, ISO 14001 and ISO 45001, certified refrigeration contractors
Validity:	3 months from issue. Above the 3 months the quotation will be exposed to indexation Danish Producer Price Index (PPI)