LOWENCO - SRS

Supplier Requirement Specifications

1 Contents

Content

LOWENCO's SRS (Supplier Requirement Specification) is intended for the Client who wants to purchase a LSSU Freezer from LOWENCO.

This SRS is a technical description of what is expected of the Client regarding power supply, site requirements, concrete construction etc.

In this document you will also find LOWENCO's standard Trolleys which is included in the quotation without extra cost.

If the customer wants to differ from any of these standard requirements/information's LOWENCO will need to know as soon as possible and no later than receiving the PO.

In case the Client doesn't meet LOWENCO's site requirements, LOWENCO can at any time invoice the Client for delays relating to the project without any further notice.

1. Tag. Numbers

In the chart below you will see LOWENCO's Standard TAG. NO which is included in a potential quote.

If the Client want to differ from these, it will come with an extra price and LOWENCO will need these TAG. NO. when signing the P.O at the latest. The TAG. No. can't be any longer than 15 signs/symbols.

1.1 Freezer Tag numbers:

The Standard LOWENCO Tag numbers are based on the following:

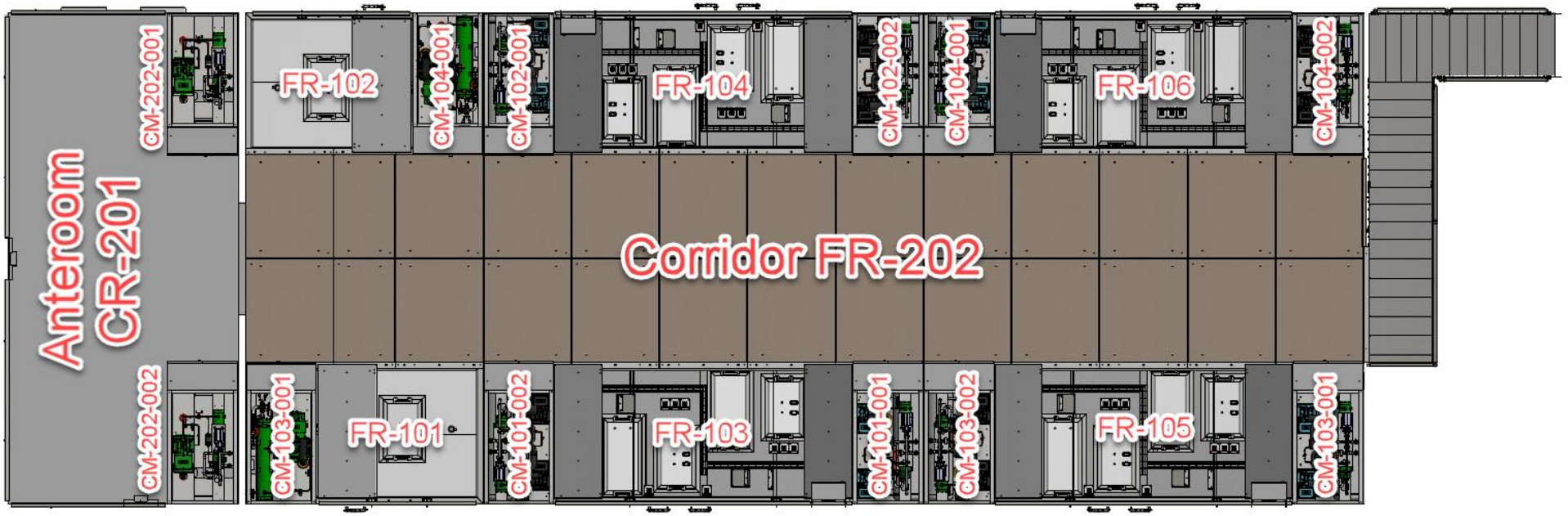
- CR = Cold Room
- CM = Cold Machine
- CP = Control Panel
- FR = Freezer

Common HMI Panel	
Common HMI Panel	HMI-301-TS
Common HMI Panel	HMI-302-AR
Anteroom 2-8°C	
Anteroom	**CR-201**
Compressor-Skid	CM-201-001
Control Panel	=CP-201-001+A1
Corridor -25°C	
Corridor	**FR-202**
Compressor-Skid Sys 1	CM-202-001
Compressor-Skid Sys 2	CM-202-002
Control Panel Sys 1	=CP-202-001+A1
Control Panel Sys 2	=CP-202-002+B1
Common Panel	=CP-202-003+C1

Freezer -70°C/-40°C	
Blast Freezer 1	**FR-101**
Compressor-Skid Sys 1	CM-101-001
Control Panel Sys 1	=CP-101-001+A1
Blast Freezer 2	**FR-102**
Compressor-Skid Sys 1	CM-102-001
Control Panel Sys 1	=CP-102-001+A1

Freezer -70°C/-40°C	
Freezer 3	**FR-103**
Compressor-Skid Sys 1	CM-103-001
Compressor-Skid Sys 2	CM-103-002
Control Panel Sys 1	=CP-103-001+A1
Control Panel Sys 2	=CP-103-002+B1
Common Panel	=CP-103-003+C1
Freezer 4	**FR-104**
Compressor-Skid Sys 1	CM-104-001
Compressor-Skid Sys 2	CM-104-002
Control Panel Sys 1	=CP-104-001+A1
Control Panel Sys 2	=CP-104-002+B1
Common Panel	=CP-104-003+C1
Freezer 5	**FR-105**
Compressor-Skid Sys 1	CM-105-001
Compressor-Skid Sys 2	CM-105-002
Control Panel Sys 1	=CP-105-001+A1
Control Panel Sys 2	=CP-105-002+B1
Common Panel	=CP-105-003+C1
Freezer 6	**FR-106**
Compressor-Skid Sys 1	CM-106-001
Compressor-Skid Sys 2	CM-106-002
Control Panel Sys 1	=CP-106-001+A1
Control Panel Sys 2	=CP-106-002+B1
Common Panel	=CP-106-003+C1

1.2 Freezer Placement



1.3 PI&D TAG NO:

Description	Tags	Bookmark
LT Compressor	COM01	Compressor1
HT Compressor	COM02	Compressor2
Crankcase Heater 1	CH01	Crankcaseheater1
Crankcase Heater 2	CH02	Crankcaseheater2
Condenser	CON01	Condenser1
Check Valve	CV01	Checkvalve1
Check Valve	CV02	Checkvalve2
Check Valve	CV03	Checkvalve3
Check Valve	CV04	Checkvalve4
Check Valve	CV05	Checkvalve5
Check Valve	CV06	Checkvalve6
Start Pressure Regulator	CVP01	Pressureregulator1
Deaerator	DA01	Deaerator1
Deaerator	DA02	Deaerator2
Deaerator	DA03	Deaerator3
Deaerator	DA04	Deaerator4
Dry Cooler + Fan	DC01	Drycooler1
Dual Changeover Valve 925	DCV01	DualValve1
Dual Changeover Valve 925	DCV02	DualValve2
Dual Changeover Valve 925	DCV03	DualValve3
Dual Changeover Valve 925	DCV04	DualValve4
Electronic Expansion Valve	EEV01	Electronicexpansionvalve1
Evaporator	EV01	Evaporator1
Evaporator Fan	EF01	Evaporatorfan1
Expansion Tank	ET01	Expansiontank1
Expansion Tank	ET02	Expansiontank2
Filter Drier	FD01	Filterdrier1
Filter Drier	FD02	Filterdrier2
LT Liquid Receiver	LR01	LTLiquidreciver1
Oil Return Solenoid Valve	MV01	Solenoidvalve1
Discharge Line Shut Off Solenoid Valve	MV02	Solenoidvalve2
LT Hot Gas Defrost Solenoid Valve	MV03	Solenoidvalve3
Expansion Tank Oil Return Solenoid Valve	MV04	Solenoidvalve4
Expansion Tank Solenoid Valve	MV05	Solenoidvalve5
HT Liquid Line Solenoid	MV06	Solenoidvalve6
Expansion Tank Startup Solenoid Valve	MV07	Solenoidvalve7
Expansion Tank Solenoid Valve 5/8”	MV08	Solenoidvalve8
Cascade Exchanger	HEX01	Cascadeexchanger1
Oil Strainer	OF01	Oilstrainer1
Oil Separator	OS01	Oilseperator1
Circulation Pump	PUM01	Circulationpump1
LT Suction Pressure Safety Switch	PS01	Pressuresafetyswitch1
LT Discharge Pressure Safety Switch	PS02	Pressuresafetyswitch2
HT Suction Pressure Safety Switch	PS03	Pressuresafetyswitch3
HT Discharge Pressure Safety Switch	PS04	Pressuresafetyswitch4
Pressure Safety Valve	PSV01	Pressuresafetyvalve1
Pressure Safety Valve	PSV02	Pressuresafetyvalve2

Pressure Safety Valve	PSV03	Pressuresafetyvalve3
Pressure Safety Valve	PSV04	Pressuresafetyvalve4
Pressure Safety Valve	PSV05	Pressuresafetyvalve5
Pressure Safety Valve	PSV06	Pressuresafetyvalve6
Pressure Safety Valve	PSV07	Pressuresafetyvalve7
Pressure Safety Valve	PSV08	Pressuresafetyvalve8
Pressure Safety Valve	PSV09	Pressuresafetyvalve9
LT Suction Press.	PT01	Pressuretransmitter1
LT Discharge Press.	PT02	Pressuretransmitter2
Exchanger Press.	PT03	Pressuretransmitter3
HT Suction Press.	PT04	Pressuretransmitter4
HT Discharge Press.	PT05	Pressuretransmitter5
Expansion Tank Press.	PT06	Pressuretransmitter6
Glycol Pressure Transmitter	PT07	Pressuretransmitter7
Expansion Tank Press.	PT08	Pressuretransmitter8
Suction Accumulator	SA01	Suctionaccumulator1
Suction Accumulator	SA02	Suctionaccumulator2
Water Cooled Superheat Remover	SC01	Superheatremover1
Refrigerant Valve	SFV01	Refrigerationvalve1
Refrigerant Valve	SFV02	Refrigerationvalve2
Refrigerant Valve	SFV03	Refrigerationvalve3
Refrigerant Valve	SFV04	Refrigerationvalve4
Refrigerant Valve	SFV05	Refrigerationvalve5
Refrigerant Valve	SFV06	Refrigerationvalve6
Refrigerant Valve	SFV07	Refrigerationvalve7
Refrigerant Valve	SFV08	Refrigerationvalve8
Refrigerant Valve	SFV09	Refrigerationvalve9
Refrigerant Valve	SFV10	Refrigerationvalve10
Refrigerant Valve	SFV11	Refrigerationvalve11
Refrigerant Valve	SFV12	Refrigerationvalve12
Refrigerant Valve	SFV13	Refrigerationvalve13
Sight Glass	SG01	Sightglass1
Sight Glass	SG02	Sightglass2
Sight Glass	SG03	Sightglass3
Thermostatic Expansion Valve	TEV01	Thermostaticexpansionvalve1
Evaporator Air In Temp.	TT01	Temperaturetransmitter1
Evaporator Air Out Temp.	TT02	Temperaturetransmitter2
Coil Temp.	TT03	Temperaturetransmitter3
Exchanger Temp.	TT04	Temperaturetransmitter4
Glycol Temp.	TT05	Temperaturetransmitter5
LT Discharge Temp.	TT06	Temperaturetransmitter6
Ambient Temp.	TT07	Temperaturetransmitter7
3-WAY Flow Reg. Valve + Controller	VS01	3-wayvalve1
Manual Isolating Water Valve	WV01	Watervalve1
Manual Isolating Water Valve	WV02	Watervalve2
Manual Isolating Water Valve	WV03	Watervalve3
Manual Isolating Water Valve	WV04	Watervalve4
Manual Isolating Water Valve	WV05	Watervalve5
Manual Isolating Water Valve	WV06	Watervalve6

2 Concrete Construction underneath the Freezer

As standard it is the Client's responsibility to construct the preferred concrete plinths including the dimensions underneath the Freezers.

- The concrete floor needs to be level $\pm 1mm$ on each Plinth, without any variations from Plinth to Plinth. This is essential for the Freezer airflow and the Trolleys/Drawers to operate correct.
- It is the Client's responsibility to assure the concrete floor are level $\pm 1mm$ from Plinth to Plinth.
- If the floor is not level $\pm 1mm$ on the Plinths, LOWENCO will not take any responsibility regarding the functionality of the system and the drain system for the Freezers.
- There is no need for a drain system underneath the freezer, If LOWENCO's plan regarding the placement of the LSSU's is followed. If the Client wish to install the freezers in a concrete pit below ground level, a sufficient drainage system needs to be installed prior to the installation.
- The Freezer will be placed on top of 100mm fiber blocks or on minimum 100mm concrete Plinths several places underneath the Freezer. This is to ensure airflow/circulation under the Freezer. (Preferred solution: Concrete Plinths of 600mm)
- If the Freezer are to be placed on concrete Plinths, it is the Client's responsibility to assure the Plinths are level $\pm 1mm$

2.1 Dimensions of The Plinths or Fiber Blocks:

Concrete Plinths:

Note: Preferred height: 700mm

Length (A) = 700mm $\pm$ 5mm

Width (B) = 350mm $\pm$ 5mm

Height (C) = 700mm $\geq$ 300mm

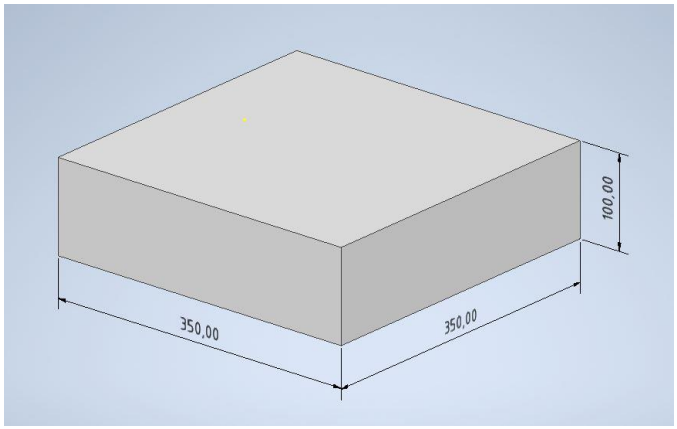
Fiber Blocks:

Note: Preferred height: 100mm

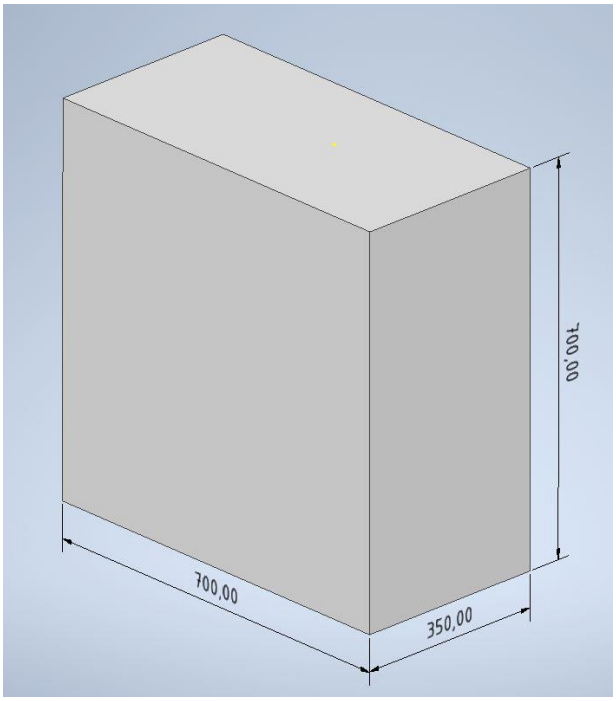
Length (A) = 350mm $\pm$ 5mm

Width (B) = 350mm $\pm$ 5mm

Height (C) = 200mm $\geq$ 100mm



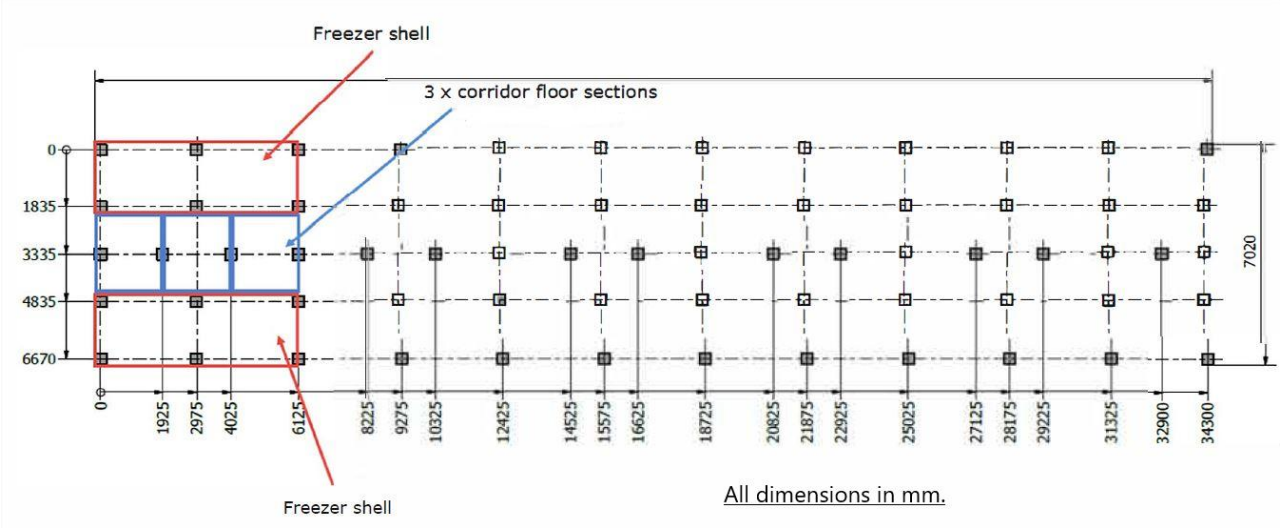
Above is a 3D picture of a potential Fiber Block with the dimensions of 350x350x100 (L*W*H)



Above is a 3D picture of a potential Concrete Plint with the preferred dimensions of 700x350x700mm (L*W*H)

2.2 Placement of the Plinths or Fiber Blocks:

For every 2 pcs. of Freezers there are 3 corridor floor sections and 5 roof sections as shown below.



When additional Freezers are added, the 2 Freezers which are placed up against each other is sharing 2 Plinths as shown below.

2.3 Plinth Load

Item	Dry weight [kg]	Extenal load [kg]	Misch. Load [kg]	Total load	No. Of plints	Load per plint [kg] incl. 50% safety	Comments
1 x Freezer shell	4000	3200	1600	8800	6	2200	Uniformly distrubuted load, trolleys (800 kg) and personnel (400 kg) included in misch. Load.
2 x compressor skids	1600	800	250	2650	6	663	Compressor skids incl. Supporting pipeworks and equipment
5 x Corridor roof section incl. Loads and equipment	1025	1000	0	2025	6	506	Including steel, checker plate and kingspan panel. Load added to freezer load (1/2 of total per freezer)
3 x Corridor floor section incl. Personnel and trolleys	1200	2500	0	3700	6	925	Incl. Steel checker plate and kingpan panel
					Total	4294	

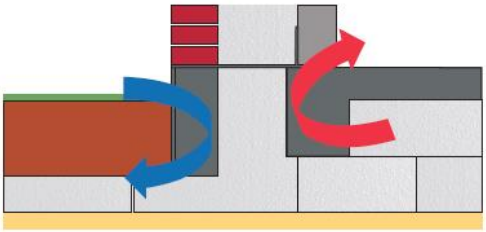
Worst case load are where 2 freezers share 1 plinth.
Installation works does not introduce significant horizontal load conditions (10-15%)

Worst case load	8588	Kg

3 Cable Penetration -70°C Panels

There can under NO circumstance be any cable penetration through the -70°C panels. This is very important to ensure an airtight and efficient chamber. If cables are penetrating the panels, it will be a lot more difficult to assure the right temperature inside the Freezer, together with assuring the temperature of the products. This is because a thermal bridging will occur and therefore the insulation level is a lot worse at the penetration, which will make the overall conditions for the Compressor Skids worse, and the Compressors therefore needs to have a higher cooling capacity.

An example of a good thermal bridging, where the cold air is kept inside and the warm air stays outside because of a solid insulation wall.



4 Weight of Equipment

Approximately weight sheet for LOWENCO's equipment regarding different products (LSSU) and the equipment for each Freezer together with heavy replaceable equipment.

It is always the Client´s responsibility to assure the right equipment for unloading, loading, craning and moving the equipment of the trailers and lifting the equipment onto the freezers and onto the roof.

Equipment	**Approx. Weight**
Complete LSSU	*4,0 Tons*
Total Weight per. LSSU	***4.0 Tons***
Compressor-Skid A *Compressor-Skid B*	*800 Kg pr. Compressor Skid* *800 Kg pr. Compressor Skid*
Total Compressor-Skids per Freezer	***1.6 Tons***
Dry Cooler A *Dry Cooler B*	*260 Kg pr. Dry Cooler* *260 Kg pr. Dry Cooler*
Total Dry Cooler per Freezer	***520 Kg without Glycol***
Required Space Outside During Installation	
Workshop Container 20 ft. *Storage Container 20 ft.* *Office Container 20 ft.*	*6,0 Tons* *5.5 Tons* *3,5 Tons*
Heavy Replaceable Equipment	
Evaporator *Evaporator Fan* *LT Compressor* *HT Compressor* *Condenser*	*65 Kg* *35 Kg* *90 Kg* *90 Kg* *35 Kg*

5 Interface with LOWENCO Equipment

All communication from the LOWENCO System to the BMS is through a switch and an ethernet cable behind the HMI or through Modbus TCP-IP.

You will therefore be able to monitor and see everything that goes on, on the HMI in your BMS system.

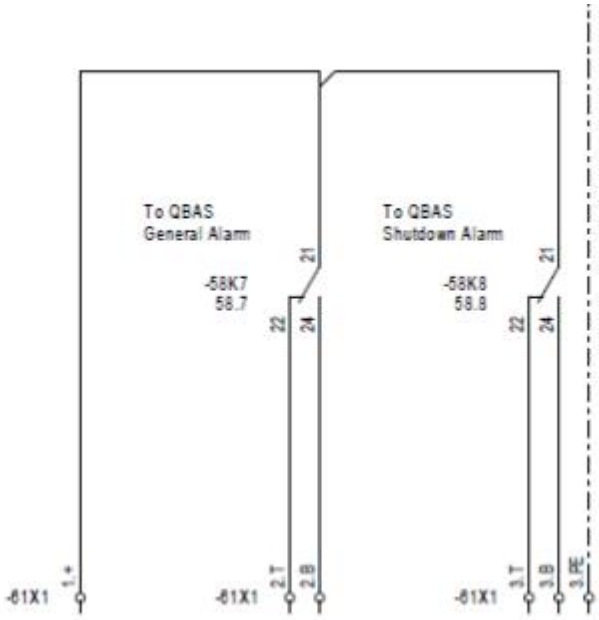
Please see addendum 2 for “Modbus TCP-IP List” for 1 system on 1 Freezer.

Other Hard Wire Signal:

On top of the ethernet cable and the MODBUS LOWENCO also have two output signals from each main panels. One urgent and one non-urgent output for the 2 relays shown below. Please see the picture below for illustration.

The urgent signal refers to the “failures” mentioned in the alarm list/FAT/SAT. Failures are always marked with the color red on the HMI. The urgent signal is critical failures for the compressor-skids, which will stop the compressor-skid.

The non-urgent signal refers to the “Alarms” mentioned in the alarm list/FAT/SAT. Alarms are always marked with the color yellow on the HMI. The non-urgent signal is not critical for the Compressor-Skids and they Compressor-Skids will continue to run.



6 Power Supply

All the fuses are based on the fuses in the Client's distribution panels. LOWENCO need these fuses in front of each main panel and equipment to ensure the selectivity of the equipment.

The Client is responsible for delivering the distribution panels and connecting all panels, HMI, sliding door etc. to their power supply. LOWENCO is following the machine directive EN60204-1 and LOWENCO can therefore not install any equipment to the Client's power supply and/or distribution panels.

In order to secure the redundancy and therefore the safety of the products inside the Freezers, it is strongly recommended that all Main Panels 1 is supplied from distribution supply "A" and all main panels 2 are supplied from distribution supply "B". This is to secure if one power source is experiencing a power failure, the Freezers are still able to maintain the designated setpoint inside the Freezer.

LOWENCO recommend a UPS supply to all main panels and HMI panels as shown in the table below. This is to ensure the temperature trend logging etc. can always be monitored.

For further information and a visualization of the power feed please see "**SRS – Addendum 1, Main feed single line**"

6.1 Storage Freezer

Storage Freezer:

Main Panel 1	40A @ 3x400V +N +PE **+ UPS 230V 10A**
Main Panel 2	40A @ 3x400V +N +PE **+ UPS 230V 10A**
Common Panel	16A @ 3x400V +N +PE

Add further Freezers. They all have the same power requirements

6.2 Blast Freezer

Blast Freezer:

Main Panel 1	63A @ 3x400V +N +PE **+ UPS 230V 10A**

Add further Freezers. They all have the same power requirements

6.3 Corridor

Corridor -25°C:

Main Panel 1	40A @ 3x400V +N +PE **+ UPS 230V 10A**
Main Panel 2	40A @ 3x400V +N +PE **+ UPS 230V 10A**
Common	16A @ 3x400V +N +PE

6.4 Anteroom

Anteroom 2-8°C:

Compressor Unit	10A @ 3x400V +N +PE
Control Unit	10A @ 3x400V +N +PE

6.5 Common

Common:

HMI 1	**UPS 230V 10A**
HMI 2	**UPS 230V 10A**

7 Automation Requirement

The IP Address in the table below is to be filled out by the end Client.

The table below is a complete IP Address list for 2 Freezer Units and 1 Corridor and the 2 HMI

The control system consists of three control boards as listed:

- Panel A1 Main Control Board– System 1
- Panel B1 Main Control Board– System 2
- Panel C1 Room Control Board – Common for System 1 & 2

7.1 IP addresses for 2-pack Freezer installation

System	IP Address	Mac Address
IPC in +HMI =CP-301-001+HMI-		
IPC in +HMI =CP-302-001+HMI-		
ModBus TCP - Gateway		

7.2 HMI Screen and Access Levels

Each Compressor-Skid are controlled by a dedicated Siemens S7-1500 series PLC. The PLC program is made in in TIA portal. All communication will be connected to and displayed on a Siemens 19" HMI Touch Screen located in the Technical Space as well on a similar Siemens 19" HMI Touch Screen located outside the Corridor / Inside the Anteroom, for easy operation.

A Schematic view of the installation, Freezer details, all vital components on each system, alarm log, set points and trend curves are some of the items accessible from the HMI Touch Screen.

The HMI Touch Screen have 4 different standard access levels and in order to make changes to the set points and control the system, the user needs to log in. Please see the picture below for the 4 different standard access levels.

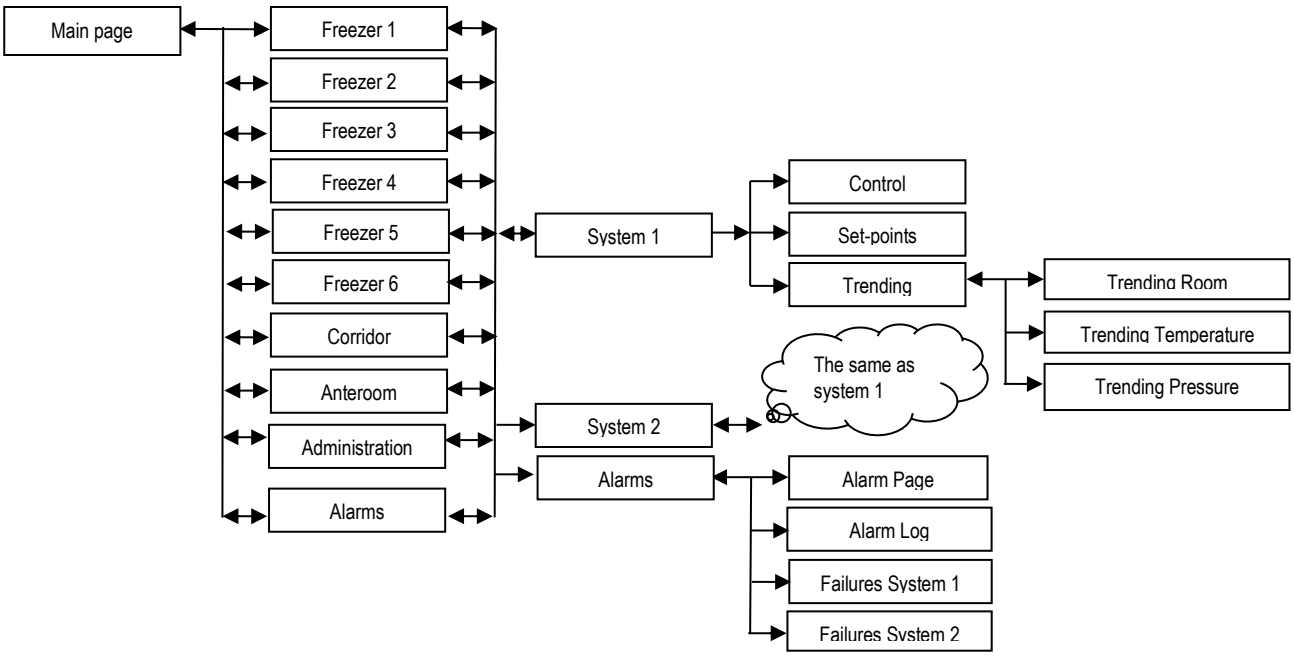
If the Client want to differ from these security access levels it will come with an extra price and LOWENCO will need these access levels when signing the P.O the latest.

Function	Operator	Supervisor	Administrator	Lowenco
View & Acknowledge Alarms	X	X	X	X
Lead, Start and Stop	X	X	X	X
Navigating HMI	X	X	X	X
Navigate Trends	X	X	X	X
Manual Defrost Control	-	X	X	X
Settings	-	-	X	X
Administration	-	-	X	X
Service Access, Manual Control	-	-	-	X

Table of security access levels X = allowed

7.3 Page Tree

In the below diagram you can see the Page Tree of the HMI Touch Screens. Both HMI´s have the same Page Tree layout, are a duplicate of each other with the capability of working on both HMI´s at the same time.



8 Material and Design Requirements

All components used for production is based on high end worldwide suppliers, so the Client can get spare parts on a Day-to-Day basis.

LOWENCO is the key manufacturer for some of the important and essential parts for the Freezer. These parts can of course only be ordered at LOWENCO.

8.1 Supplier List / Manufacturer

- *LOWENCO*
- *Siemens*
- *Bitzer*
- *Gunther*
- *OCS Cold*
- *Cool-it*
- *Danfoss*
- *Grundfoss*
- *Herose*
- *Schneider*
- *WVN Hansa*
- *Kingspan*
- *Swep*
- *ESKA*
- *JEVI*
- *Fermod*
- *EBM Pabst*
- *VEM*
- *Armaflex*

8.2 RSPL – Recommended Spare Parts List

Please see **"SRS – Addendum 3, Recommended Spare Part List"** for the full recommended spare part list.

9 Trolley Designs for LSSU

All LSSU Freezers are based on having 2 Trolleys per door. In total there will be 8 Trolleys per Freezer.

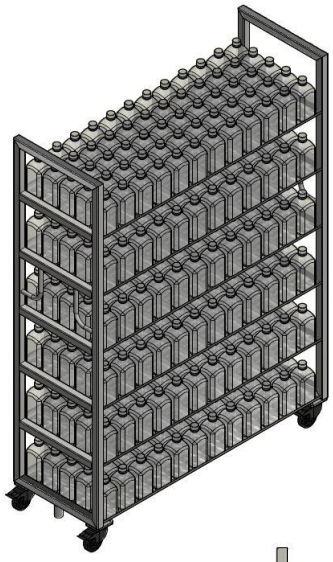
All Trolleys are universal for the LSSU Freezer. The smaller bottles will have 6 shelfs and the larger bottles will have 5 shelfs per Trolley. Each Trolley has a maximum weight capacity of 400kg. The LSSU Freezer have a maximum cooling capacity of 3200kg.

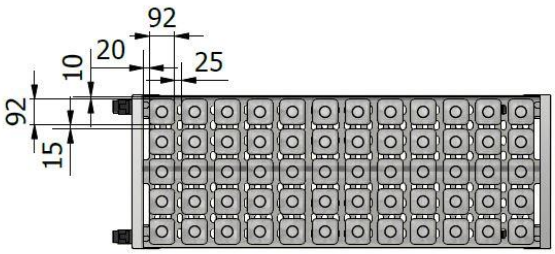
All these Trolleys can be available for the Client to choose from if the Trolleys are included in the quote.

If the Client wants LOWENCO to produce these Trolleys and wants to differ from these mentioned in this section, it will come with an extra price and LOWENCO will need these Trolley dimensions when signing the P.O the latest.

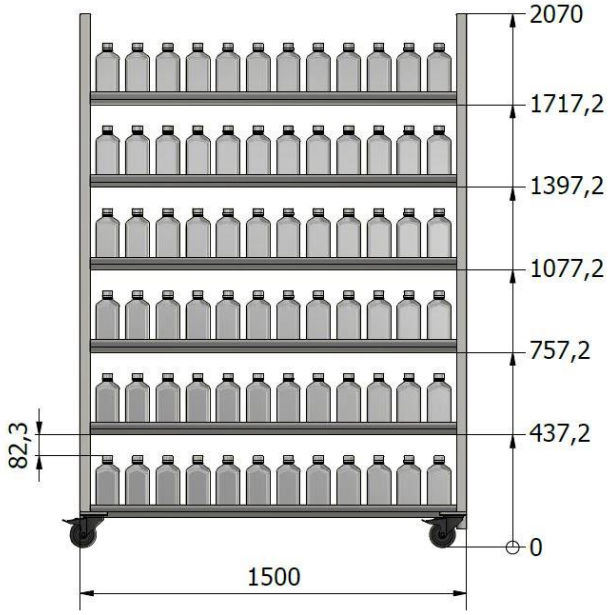
9.1 Universal Trolley - 1 Liter Bottle

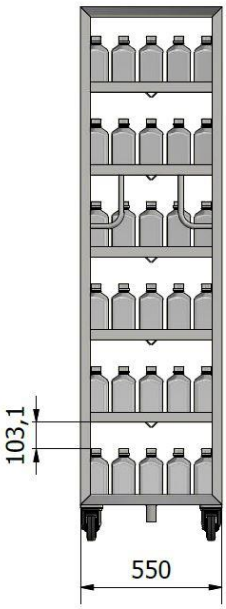
Trolley with 360 x 1-liter bottles.





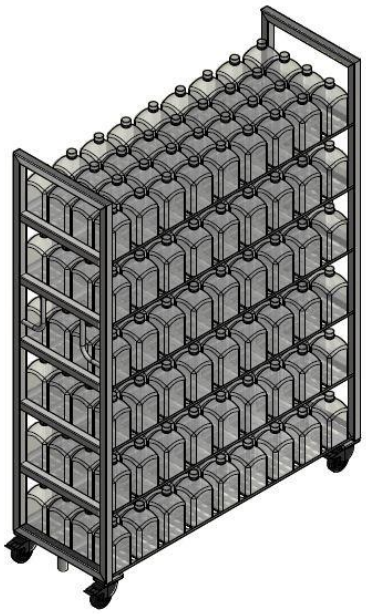
Shelf pcs: 6
Units per shelf: 60
Total Units: 360

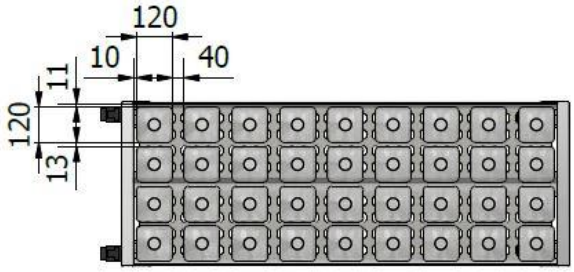




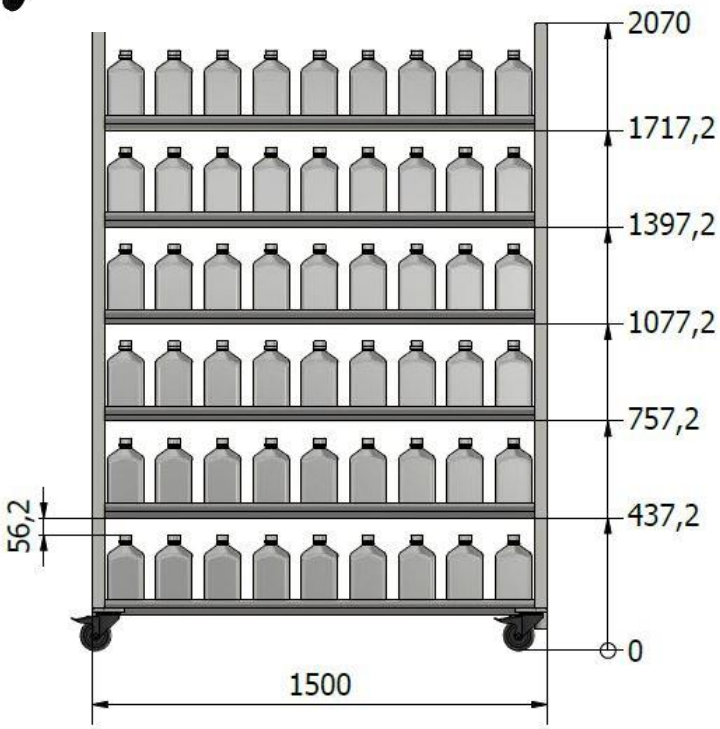
9.2 Universal Trolley - 2 Liter Bottle

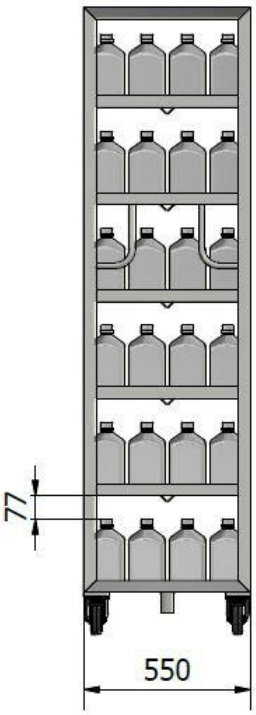
Trolley with 216 x 2-liter bottles.





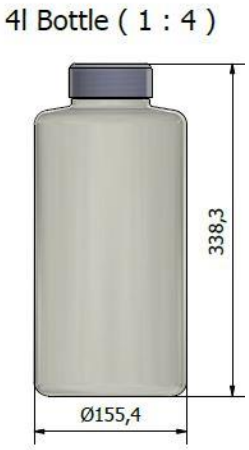
Shelf pcs: 6
Units per shelf: 36
Total Units: 216

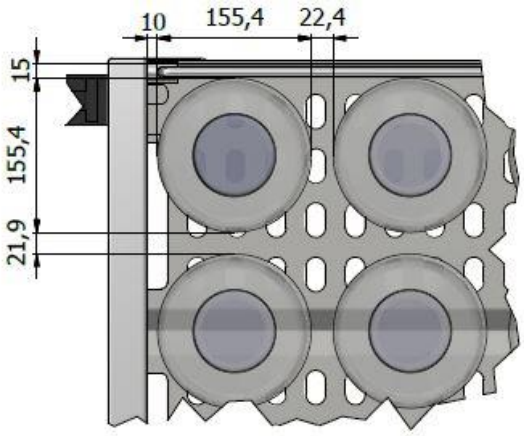


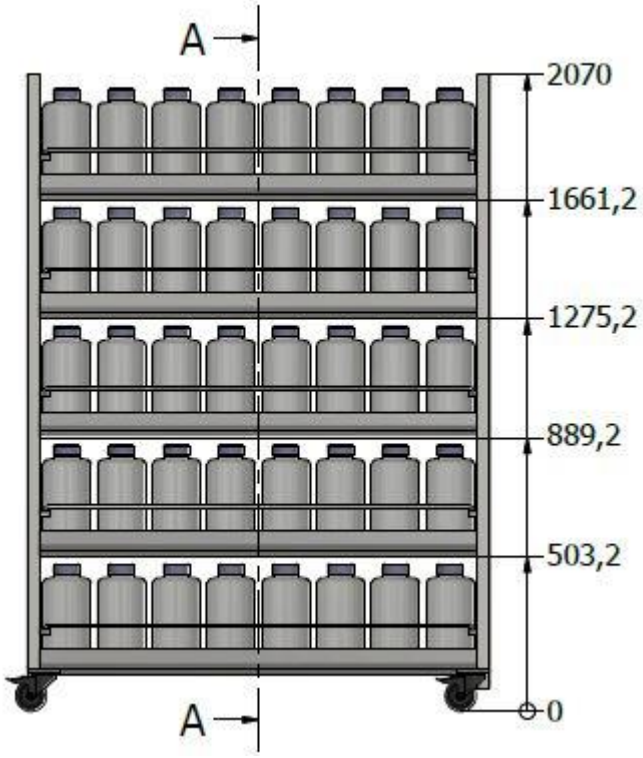


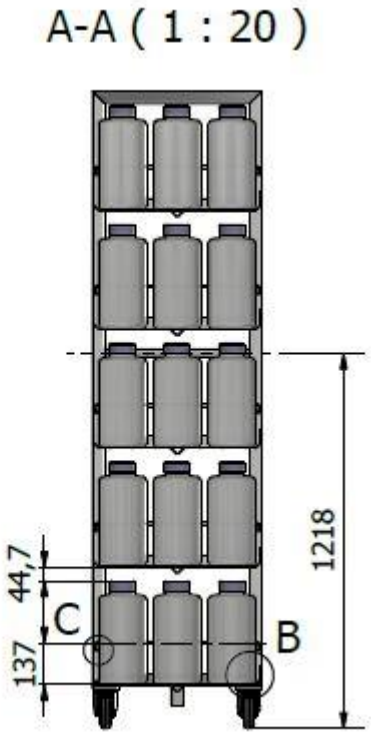
9.3 Universal Trolley – 4 Liter Bottle

Trolley with 120 x 4-liter bottles.



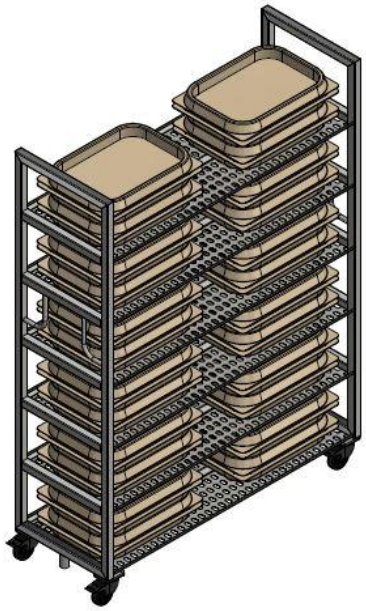


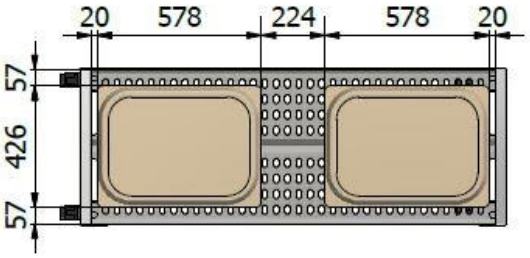




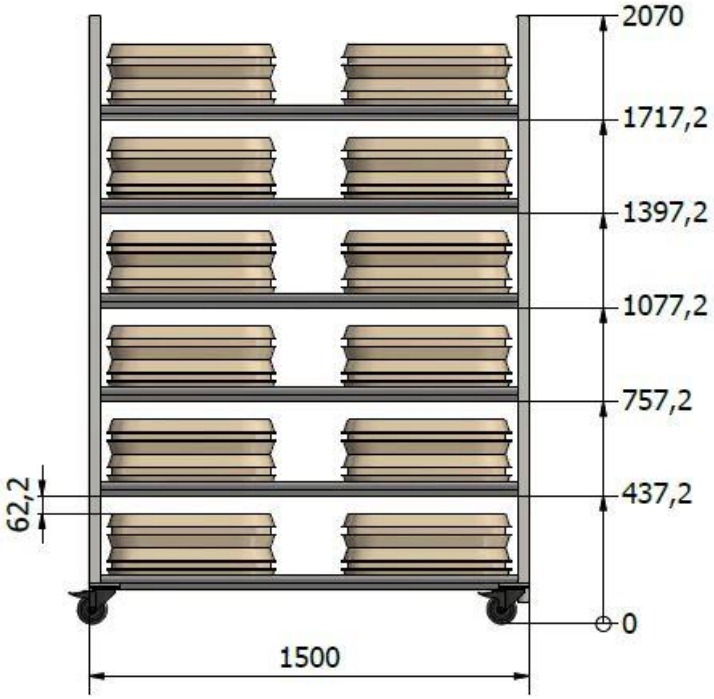
9.4 Universal Trolley – 6 Liter Bags

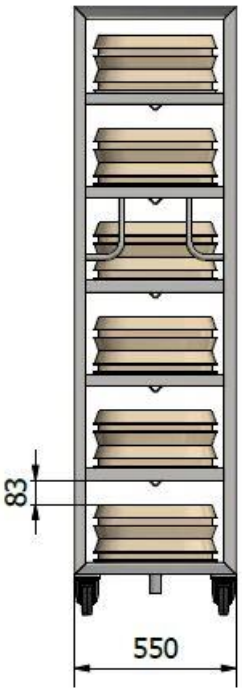
Trolley with 24 x 6-liter bags.





Shelf pcs: 6
Units per shelf: 4
Total Units: 24





10 Condensate Drain

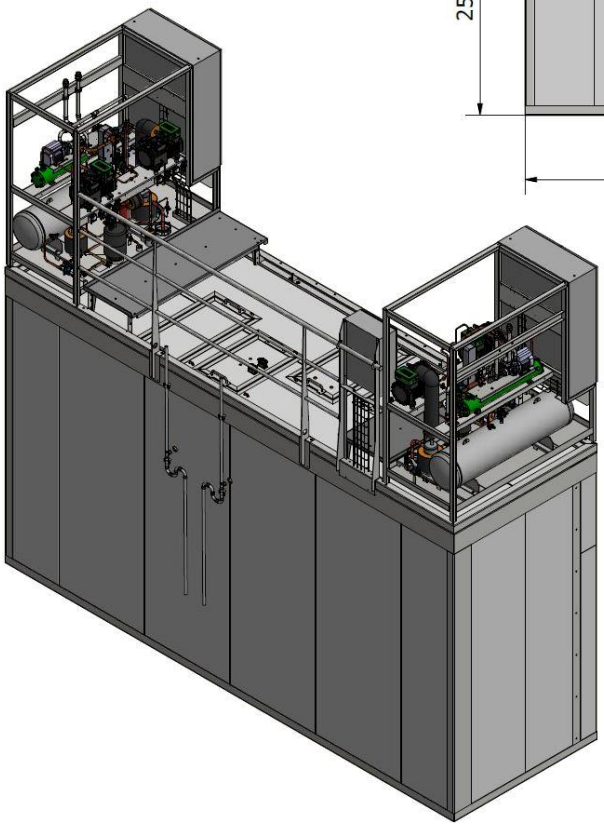
Every Freezer has 2 condensate drainpipes each. The condensate drainpipe from each Freezer is located in the back of the Freezer unit.

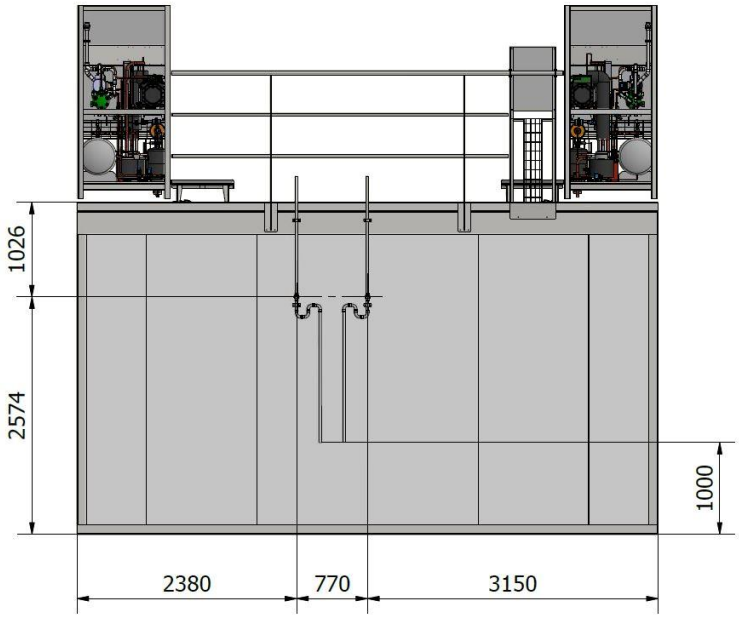
Each drain has a flow of approx. 5-8 liters every 14 days, when the Freezer and Compressor-Skids are running in normal operation mode. It only drains when a system (Compressor-Skid) is doing a defrost, while the other system (Compressor-Skid) is in operation.

The drain piping will as standard be left 1 meter above the bottom frame on the backside of the Freezer. The Client will then make sure to connect to this stainless-steel piping to collect the water from the condensate drain.

The sizes for the drainpipes are Ø28mm from Geberit prepared for stainless steel press-fittings.

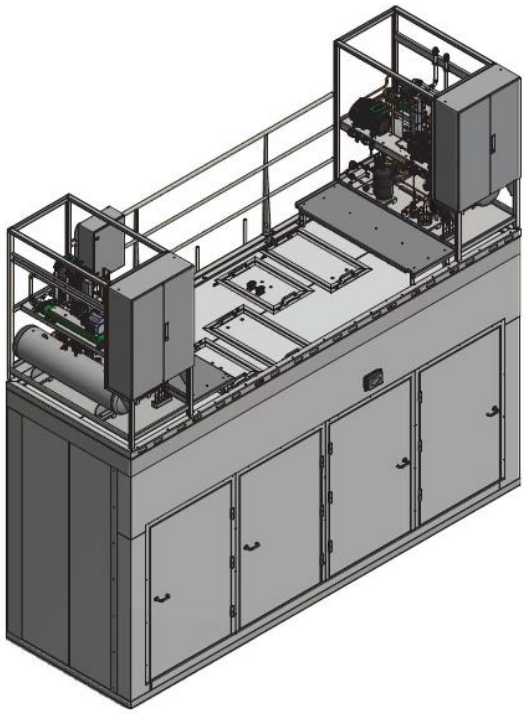
10.1 Drain placement

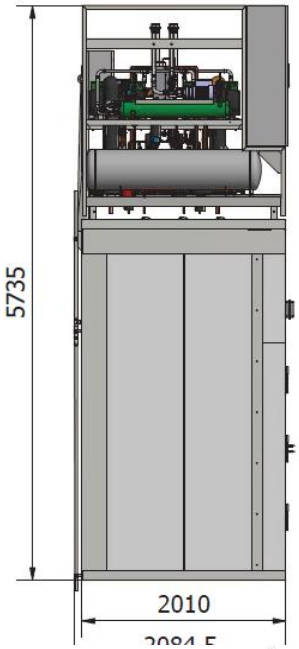


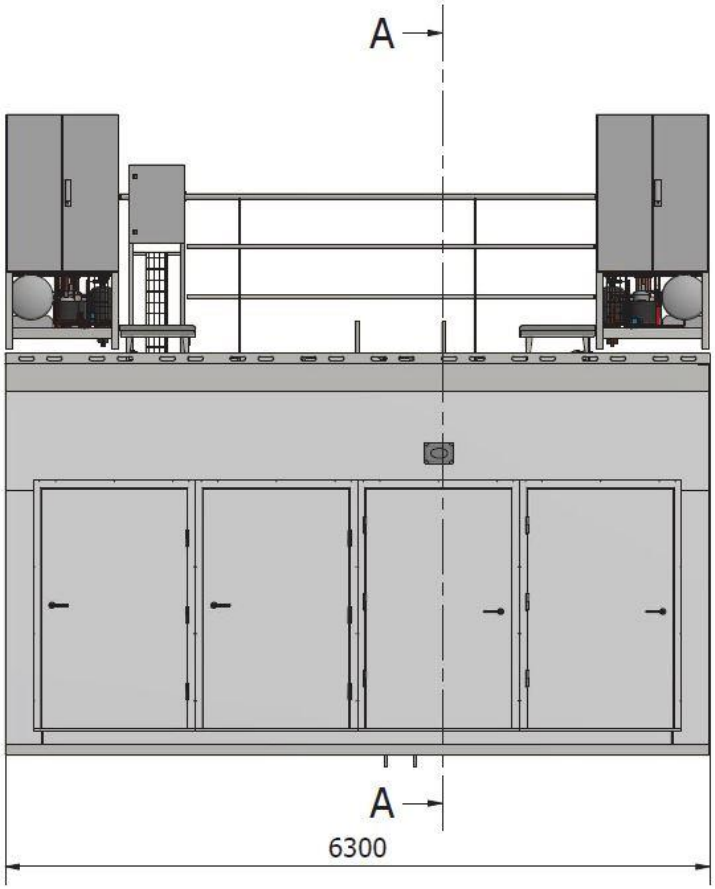


11 Dimensions

11.1 LSSU







12 Documentation Package (SDI)

SDI = Standard Documentation Index

LOWENCO's SDI shown in the table below is standard delivered right after handover of the project.

All documentation is delivered on one USB-Stick for each Freezer (Softcopy).

If the Client want to differ from this documentation package it will come with an extra price and LOWENCO will need a specified documentation package agreement when signing the P.O the latest.

SDI – Standard Documentation Index		
Sections	Name of Section	Sub Sections
1	Equipment List	N/A
2	P&ID Index	N/A
3	Equipment Specifications	P&ID Components Datasheet
4	Purchase Order Index	N/A
5	Instruments	N/A
6	Operating, Installation & Maintenance Manual	N/A
7	Material Specification & Certificates Index	Containers and Pressure Safety Valve Certificates.
8	Electrical Documentation	N/A
9	Computerized Systems	N/A
10	Spare Parts List	N/A
11	Addendum	01 – Calculations 02 – Declaration of Conformity 03 – FAT Protocol 04 – FAT Protocol (Result 05 – Pressure Test (Result) 06 – PED Certificates 07 – SAT Protocol 08 – SAT Protocol (Result)

13 Performance Testing

A temperature mapping is performed during SAT to make sure all Freezers and Compressor-Skids are performing successful and equally.

The temperature studies that are taking place during the SAT are:

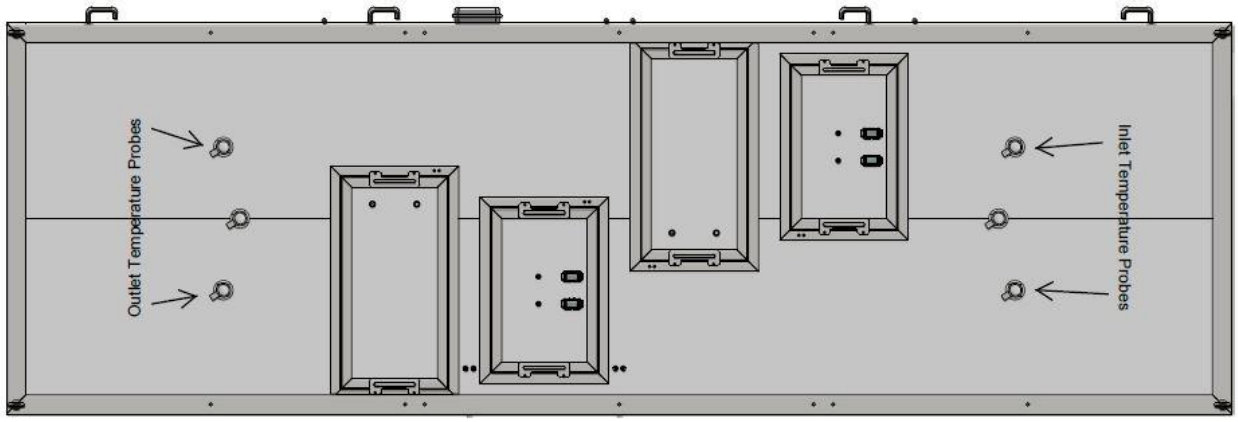
- Pull Down
- Defrost

The mapping is performed with “Empty Chamber” and the 2 temperature probes in the inlet and outlet of the Evaporator duct. The mapping will afterward be documented by using screen dumps, from the HMI on each Compressor-Skid, on each Freezer to make sure all the Freezers are performing equally.

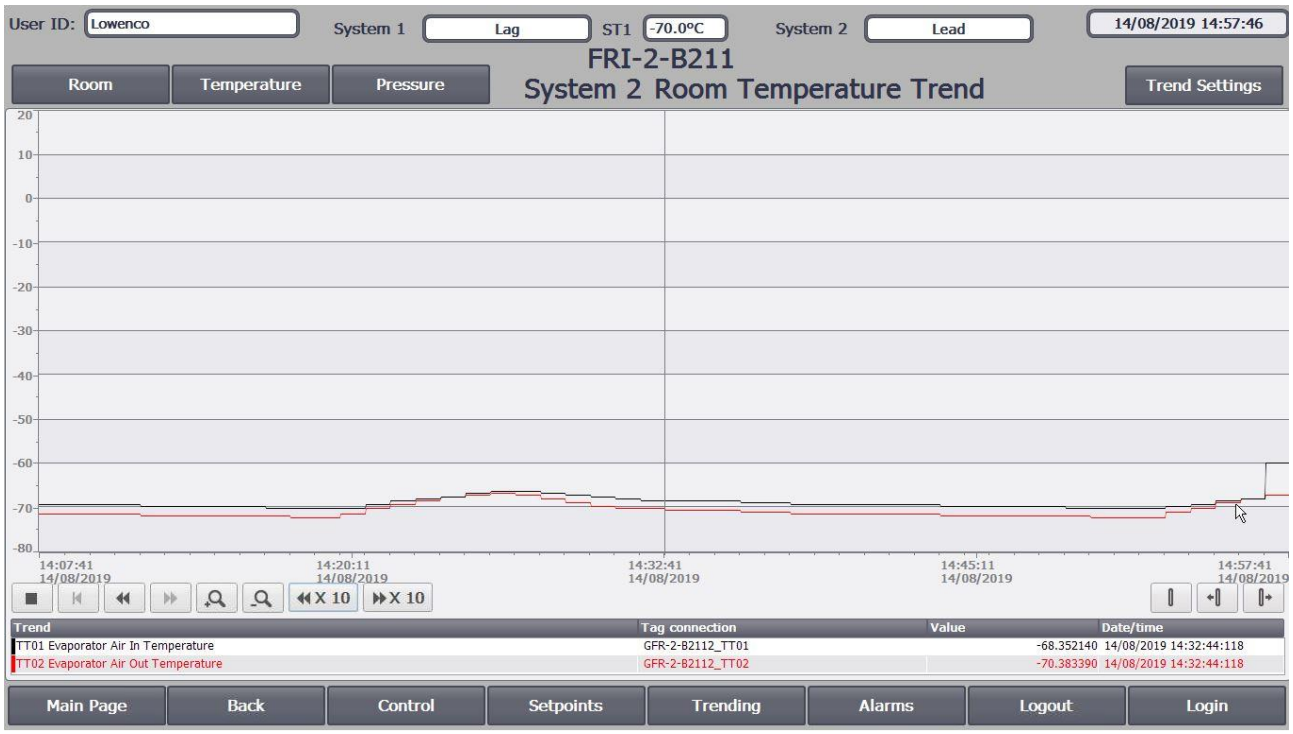
By accepting this section in LOWENCO´s SRS, the Client agrees on LOWENCO to receive the approved temperature validation tests including excel data and curves after completion for all tests.

Please note: LOWENCO is as standard not a part of the Client’s validation. Clients have previously been operating the Freezers incorrect. LOWENCO is therefore now offering a 2-day training at the Handover and assistance during the Clients validation upon request.

13.1 Temperature Probe Location



13.2 HMI Inlet and Outlet Temperature Curve



14 Pipe Labelling

The pipe labelling LOWENCO are using, for the Refrigerant and Glycol pipes are:

1) PML-P100 (D50)R CUS – 1014227 (DO NOT STEP)

2) PML-T105 (26X280)R CUS – 1014257 Caution Hot gas Line R23
3) PML-T105 (26X280)R CUS – 1014257 Caution Suction Line R23
4) PML-T105 (26X280)R CUS – 1014257 Caution Liquide Line R23

5) PML-T103 (26X280)R CUS – 1014253 Air Flow

6) PML-T109 (26X280)R CUS – 1014265 Propylene Glycol

14.1 Design

15 Electrical Requirements

15.1 Cable Labeling

The cable labeling used for all internal cable labeling are a black on yellow Phoenix labeling.

Specification:

- Cable Diameter: > 6mm
- Lettering Field Size: 55 x 15 mm
- Ambient Temperature: -25°C …. 80°C
- Component: Halogen-Free
- Flammability Rating According to UL 94: V0
- Material: PUR
- Wibe Resistance: DIN EN 61010-1 (VDE 0411-1)

15.2 Cable Type

The cables used is all halogen free.

Digital signals and power cables is type H-JZ.

Analog signals cables are type CH-JZ.

EMC power cables is type ROZ1-K.

15.3 Cable Color Codes

The cable color codes below are the standard LOWENCO color codes, and they will be used on all electrical panels.

15.3.1 Control Panels

Main Supply	
L1	Brown
L2	Black
L3	Grey
N	Light Blue
PE	Yellow / Green

230V Control Voltage	
230V	Red
0V	Red with White Stripe

24V Control Voltage	
24V	Dark Blue
0V	Dark Blue with White Stripe

Interlock
Orange

15.3.2 Installation

Main Supply	
L1	Brown
L2	Black
L3	Grey
N	Light Blue
PE	Yellow / Green

Control Wires
Black Cores with White Numbers

16 Pipe Size

The piping size are only based on the piping which leaves the Compressor-Skid and goes to the Freezer and the Dry Coolers.

16.1 Freezer Piping

Freezer Piping				
Pipe Size	Total Size with Insolation	Pipe Materiel	Function	Insolation Type
3/8”	Ø90 mm	Copper	Liquid Pipe / Inlet pipe	Armaflex
½”	Ø45 mm	Copper	Hot Gas / Defrost	Armaflex
1 1/8”	Ø170 mm	Copper	Suction / Return	Armaflex

The above-mentioned Freezer piping sizes are for EACH Compressor-Skids and for 1 Freezer there are 2 Compressor-Skids.

16.2 Dry Cooler

Dry Cooler Piping		
Size	Materiel	Function
Ø35mm	Stainless Steel	Inlet Pipe
Ø35mm	Stainless Steel	Return Pipe

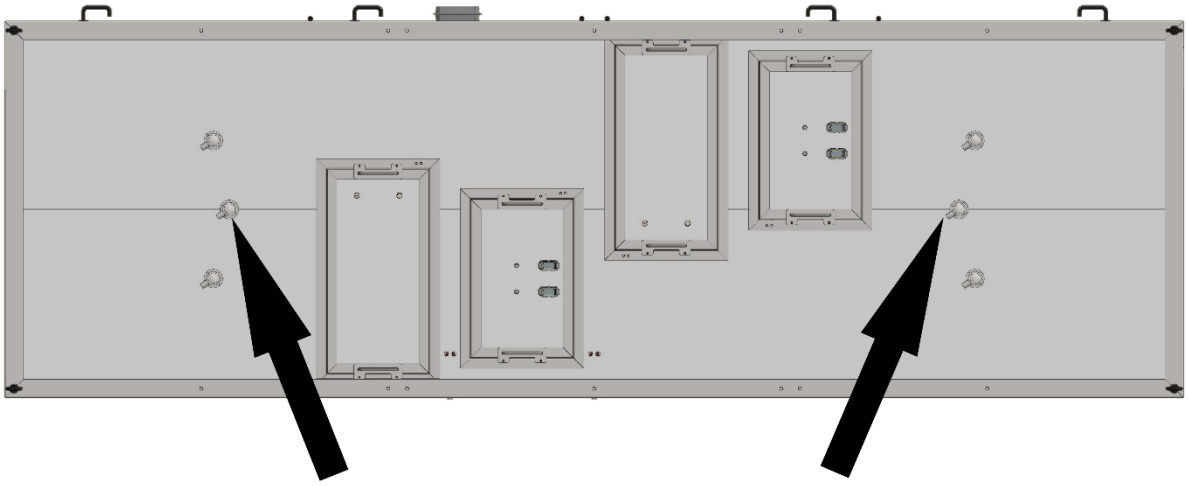
The above-mentioned Dry Cooler piping sizes are for EACH Compressor-Skids and for 1 Freezer there are 2 Compressor-Skids.

There is no insolation on the Dry Cooler pipes, due to their relatively low surface temperature of approx. 25°C to 35°C.

17 Thermo-Well

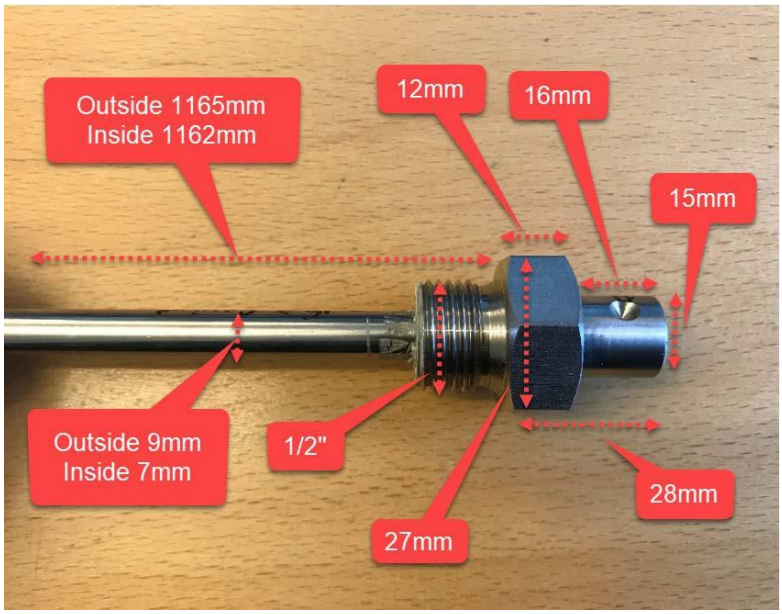
Thermo-Well Information	
Protective Tube:	9mm OD. 1mm wall
Neck Length:	25mm
Insertion Length:	1165mm
Process Connection:	½" BSP
Connection Head:	B: Degree of protection IP 65

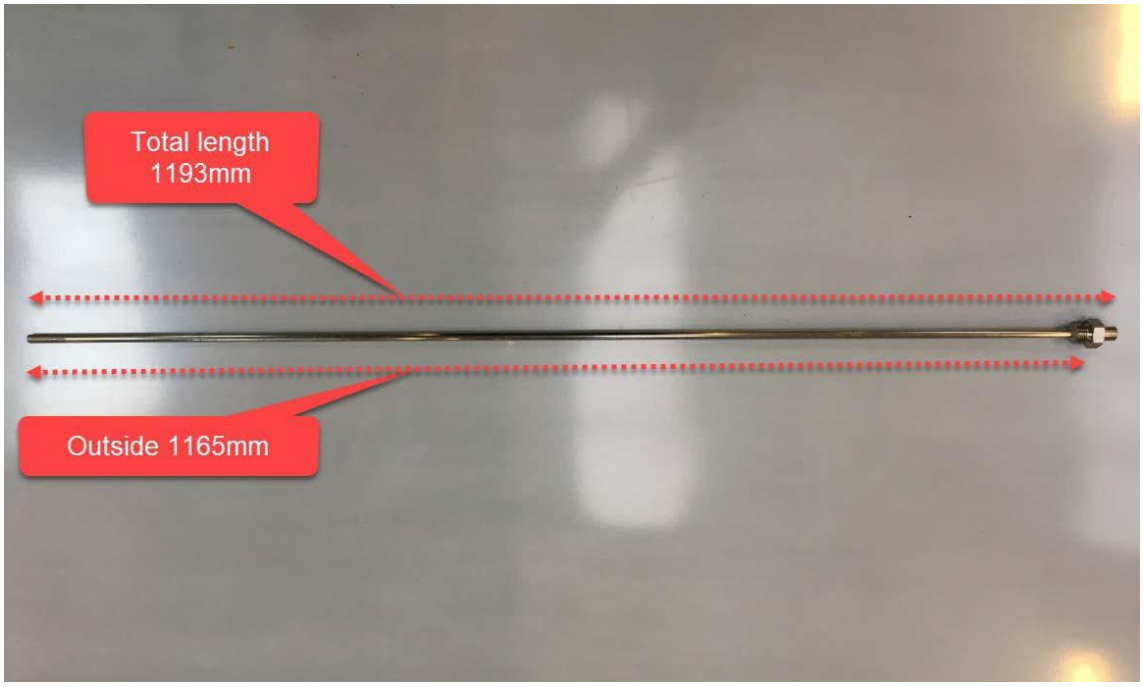
17.1 Location



Thermo-well Location No. 1 Thermo-well Location No. 2

17.2 Design


Outside 1165mm
Inside 1162mm
12mm
16mm
15mm
Outside 9mm
Inside 7mm
1/2"
27mm
28mm


Total length
1193mm
Outside 1165mm

18 Cooling of Compressor Skid

There are two ways the cooling of the Compressor-Skids can take place.

The first option is to have the Compressor-Skids to be cooled by the Client´s already existing chilled water plant by Heat Exchangers. If the Client wants this solution, LOWENCO will not be delivering any Dry Coolers and/or Heat exchangers to support the cooling of the Compressor-Skids. It is entirely the Client's responsibility to deliver and mount the Heat Exchanger if the chilled water plant is chosen.

The second option is to choose the Dry Cooler to cool the Compressor-Skids. The Dry Coolers will then be delivered and installed by LOWENCO. Each Dry Cooler belongs to its own Compressor-Skid, meaning if there are 10 Compressor-Skids, there will be 10 Dry Coolers, one for each Compressor-Skid to keep the full redundancy.

18.1 Dry Cooler

Each Compressor-Skid does as standard have its own Dry Cooler in order to have the 100% redundancy no matter what happens.

Each Dry Cooler has a dry weight of approx. 260kg

Tube volume for each Dry Cooler are 22,3 liters.

Medium used in the Dry Cooler are Propylene Glycol.

The casing is of Galvanized Steel, RAL 7035

The noise level at 10 meters from the Dry Coolers are 52 dB(A).

The Dry Coolers does as standard include a maximum of 10-meter piping, meaning the Dry Coolers can as standard not be placed longer than 10 meters away from the Compressor-Skids. Longer piping distance than 10 meter is as standard not included in the quotation.

18.2 Dry Cooler Construction Design

As standard, each Compressor-Skid have its own Dry Cooler.

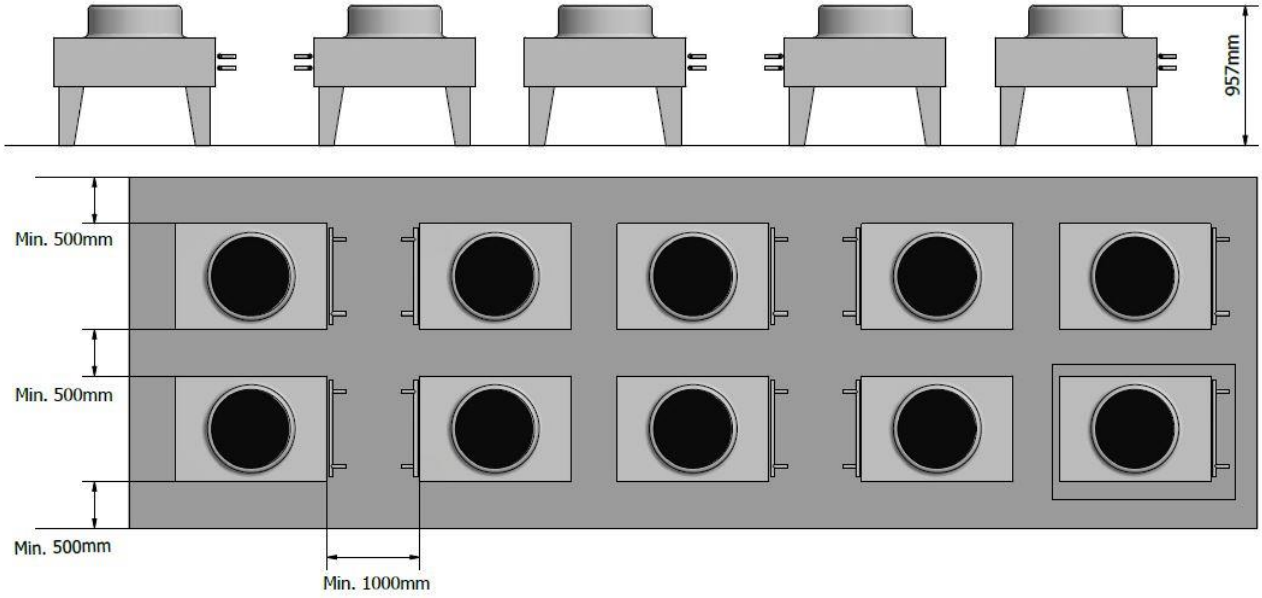
One freezer has 2 compressor-skids and therefore also 2 Dry Coolers. The Corridor also consists of 2 Compressor-Skids and therefore also 2 Dry Coolers.

The Dry Coolers can either be placed in a single line, or next to each other, or with a walk-path between 2 lines of Dry Coolers.

The Dry Coolers can either be placed on a concrete or steel construction on the ground level or on the roof.

The Dry Coolers needs to be placed as close to the Compressor-Skids as possible to secure the correct inlet and outlet temperature and a successful defrost sequence.

When building the construction underneath the Dry Coolers, it is important to keep in mind that the Dry Coolers need a minimum of 500mm between each other, and a minimum of 1000mm in front of each other as shown below, to secure the functionality of the Dry Coolers and the Dry Coolers not to interrupt each other.

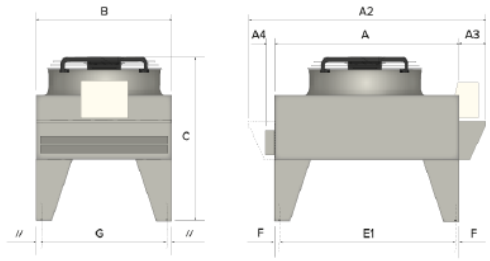


On the left, is a picture of an installation where the Dry Coolers are placed in one single line and placed on a concrete construction at ground level.

On the right is a picture of an installation where the Dry Coolers are placed in 2 single lines on each side of the walk-path due to a larger installation. This installation is placed on a steel construction on the roof above the Compressor-Skids.

18.3 Dry Cooler Design & Dimensions

In the below picture you can see the dimensions of the Dry Coolers which are used for the Freezers.



A 1503 mm	B 1130 mm	C 1333 mm	A2 1893 mm
A3 195 mm	A4 70 mm	G 1044 mm	E_1 1423 mm
F 40 mm			

19 Parameters List -70°C

Below is LOWENCO´s Standard Parameter List for -70°C freezers. Changes will come with an extra cost.

Parameter List -70°C	P&ID tag	parameter	Units	Min.	Max.	Default Value	Parameter Type	Password level			
								Operator	Supervisor	Administrator	Lowenco
Room Set-Point											
Room Set-Point		ST1	°C	-80	-40	-70	Parameter	-	-	x	x
Main Difference		P1	K	1	10	3	Parameter	-	-	x	x
Assist Difference		P2	K	1	10	3	Parameter	-	-	x	x
Alarm Set-Points											x
Room Temperature. High		AH1	°C	-80	40	-60	Alarm	-	-	x	x
Delay Room Temperature. High		AD1	Min	0	60	60	Alarm	-	-	x	x
Room Temperature. Hi Hi		AH2	°C	-80	40	-55	Alarm	-	-	x	x
Delay Room Temperature. Hi Hi		AD2	Min	0	60	60	Alarm	-	-	x	x
Room Temperature. Low		AL1	°C	-80	40	-75	Alarm	-	-	x	x
Delay Room Temperature. Low		AD3	Min	0	60	5	Alarm	-	-	x	x
Room Temperature. Lo Lo		AL2	°C	-80	40	-80	Alarm	-	-	x	x
Delay Room Temperature. Lo Lo		AD4	Min	0	60	5	Alarm	-	-	x	x
Door Open Temperature Alarm		DA	°C	-80	40	-51	Alarm	-	-	x	x
Delay High/Hi Hi Alarm Disable		AD5	Hour	1	99	36	Alarm	-	-	x	x
Evaporator Set-Point											x
Fan Release Temperature		FT	°C	-50	-30	-40	Parameter	-	-	x	x
Evaporator Superheat		ST6	K	4	20	8	Parameter	-	-	x	x
Defrost Set-Points											x
Defrost Time Interval		D1	Days	0	99	10	Parameter	-	-	x	x
Defrost Control Temperature		DC	°C	0	10	5	Parameter	-	-	x	x
Defrost Control Difference		P6	°C	0	10	3	Parameter	-	-	x	x
Drip Time		DD	Min	0	30	15	Parameter	-	-	x	x
Defrost Timeout		DT	Min	0	90	60	Parameter	-	-	x	x
LT Compressor Set-Point											x
LT Compressor Pressure Set-Point	PT01	ST2	Bar	-1	10	0,2	Parameter	-	-	x	x
LT Compressor Difference		P3	Bar	-1	10	0,5	Parameter	-	-	x	x
HT compressor Set-Point											x
HT Exchanger Set-Point	PT03	ST3	Bar	0	10	2	Parameter	-	-	x	x
HT Exchanger Difference		P4	Bar	0	5	2	Parameter	-	-	x	x
HT Compressor Pressure SetPoint	PT04	ST4	Bar	-1	10	0,4	Parameter	-	-	x	x
HT Compressor Difference	PT04	P5	Bar	-1	10	0,5	Parameter	-	-	x	x
Compressor Set-Point (LT/HT)											x
Comp. min. On Time		CD1	Sec	0	999	120	Parameter	-	-	x	x
Comp. min. Off Time		CD2	Sec	0	999	240	Parameter	-	-	x	x
Delay Suction Press. Alarm at start		CD3	Sec	0	60	30	Parameter	-	-	x	x
Condenser Set-Point											x
Condenser Pressure Set-Point	PT05	ST5	Bar	10	20	14	Parameter	-	-	x	x
Dry Cooler Outlet Temperature		ST7	°C	20	35	25	Parameter	-	-	x	x

20 Airflow / Circulation

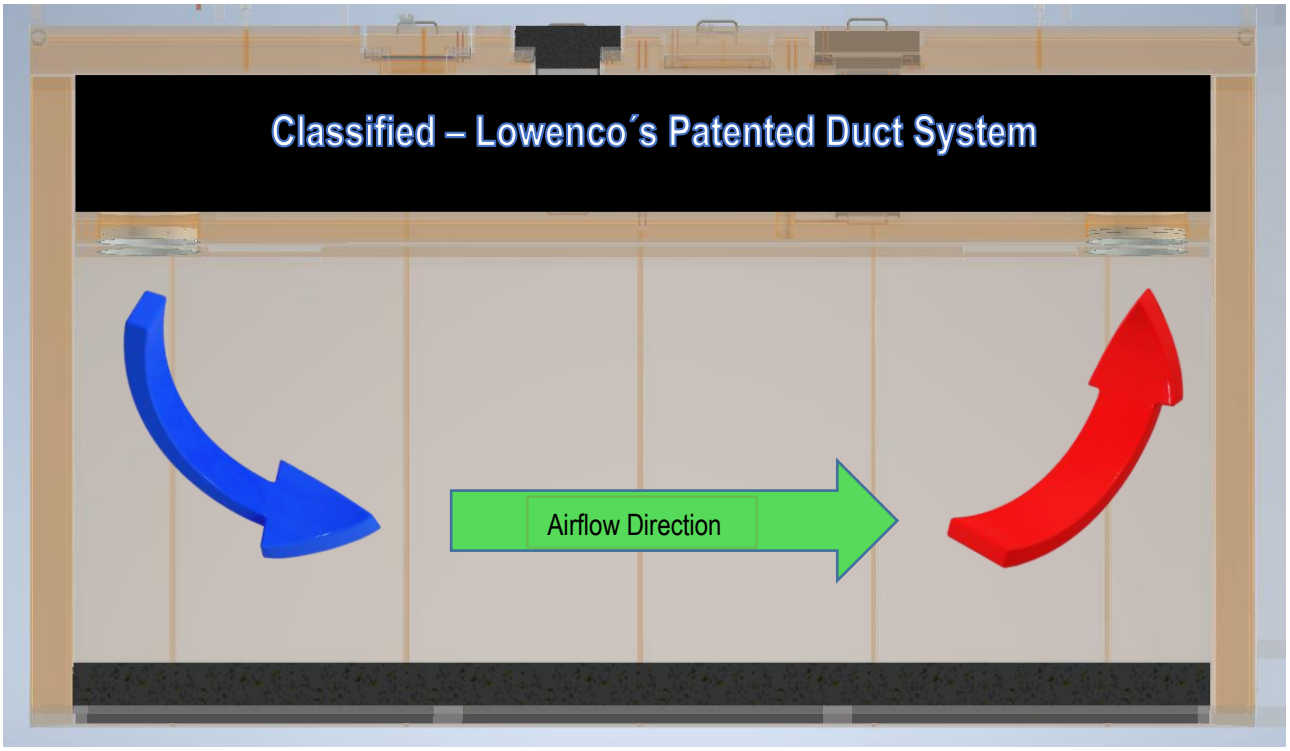
LOWENCO´s Freezer designs are based upon cold airflow inside the Freezer chamber and not cold walls like many upright Freezers. This means the airflow inlet and outlet inside the Freezer must under no circumstances be blocked by bags, wraps etc.

LOWENCO´s freezers are as standard made for cold storage of bottles and a few bags with room in between and above each bottle and bag to secure the airflow around the whole bottle/bag.

The Freezer has an airflow of approx. 3000 m^3/h when running assist mode as describes in LOWENCO´s FDS – Functional Design Specification. When the Freezers are running at the airflow of approx. 3000 m^3/h it is very important not to "wrap" any Bottles, Trolleys, Bags because this will make the air resistance very high, and the Freezer will therefore not operate correct. Therefore, LOWENCO is offering LOWENCO´s standard Trolleys.

If other Bags and Bottles than shown above is wanted, LOWENCO can and will assist in the design approval for the Trolleys to secure airflow and the operation of the Freezers. If different Trolley designs and/or different Bottles/Bags are going to be used, LOWENCO will need to be informed to assure the functionality of the Freezer.

20.1 Freezer Airflow Directions



21 Required Temperature for Tech-Space

It is important for the Client when planning the building for the Freezers to take the temperatures in the Tech Space into consideration. This is very essential according to the electrical panel building and the defrost sequence for the Compressor-Skids.

The temperatures in the Tech-Space are required to be between 15°C and 30°C.

If the temperature range is not followed in the Tech-Space, LOWENCO can't take the responsibility for unsuccessful defrost sequences and electrical failures and other temperature caused alarms and failures.

It is always the Client's responsibility to assure the ventilation in the Tech-Space. LOWENCO can and will assist with the heat load from the Compressor-Skids, Panels, and Glycol-Piping.

22 Site Requirements

LOWENCO's Technicians can always work unobstructed without any Union as Supervisors.

The site will need to be available for our staff daily from 7 am to 10 pm – All days a week including weekends and bank-holidays.

We will bring our own Workshop, Office and Storage- 20 ft. containers and we will need space as close as possible to the installation, for placing the 20 ft. containers during the entire installation period.

LOWENCO will need access to a Pallet Truck, Mobile Elevating Work Platform, and a Forklift with extension forks. It is crucial that these machines are available, from the first day LOWENCO starts commencing work on site. The Technicians from LOWENCO have valid licenses for Forklifts and Mobile Elevating Work Platforms and they can operate these machines at all times by themselves.

LOWENCO will during the installation discard a lot of waste from our building materials. Therefore, we will need waste bins at our disposal throughout the whole installation period.

A Crane needs to be available for unloading the equipment as well for loading on-site workshop- and storage- containers after the installation is finished.

Client signature:	Date:	LOWENCO signature:	Date:
_____		_____	