VACUACTIVUS MEDSTARCOM | World Leading Manufacturer

vacuactivus.com

VACUACTIVUS MEDSTARCOM | World Leading Manufacturer

USER MANUAL

CryoStar INFINITY OF RECOVERY
ANTARCTICA

vacuactivus.com

Thank you so much for purchasing our CryoStar Antarctica cryotherapy chamber.

VACUACTIVUS MEDSTARCOM | World Leading Manufacturer

VACUACTIVUS MEDSTARCOM | World Leading Manufacturer

CONTENT

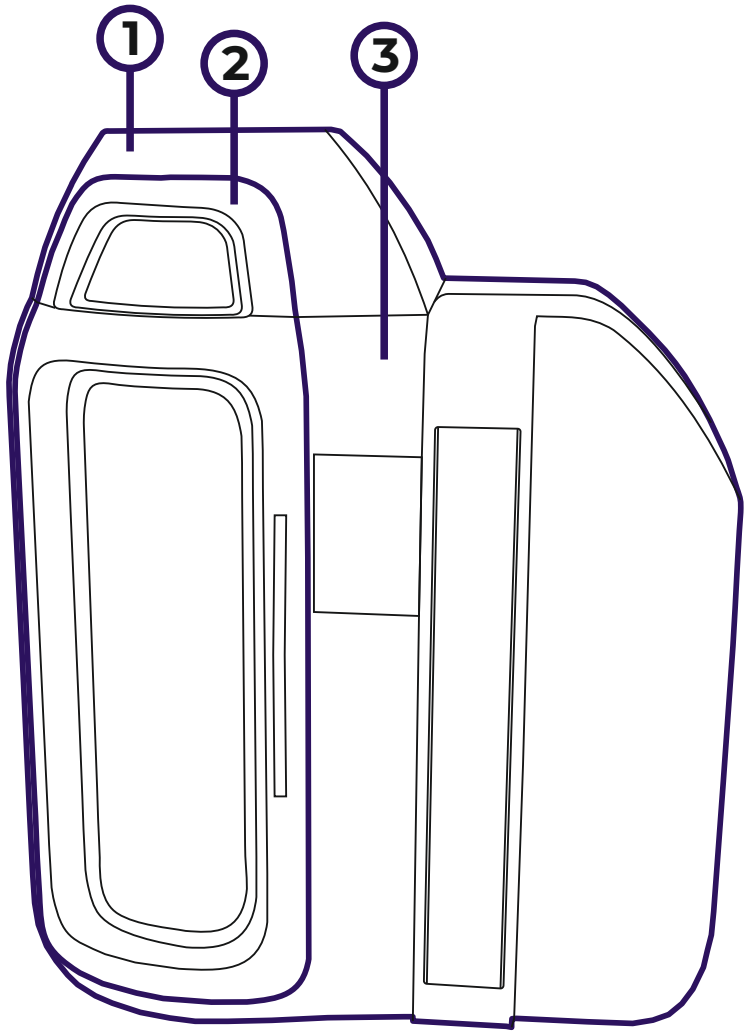
1. General information

1.1 INTRODUCTION

CryoStar Antarctica produced by VACUACTIVUS is a cryochamber designed to carry out whole-body cryotherapy by exposing one's body to low emperatures for a short time (2 – 3 min). Therapy is performed in pleasant and safe atmosphere of cold air.

CryoStar Antarctica consists of 3 main modules which combine to form a complete unit:

1. Chamber
2. Door
3. Machinery room



Remaining parts and features of CryoStar Antarctica:

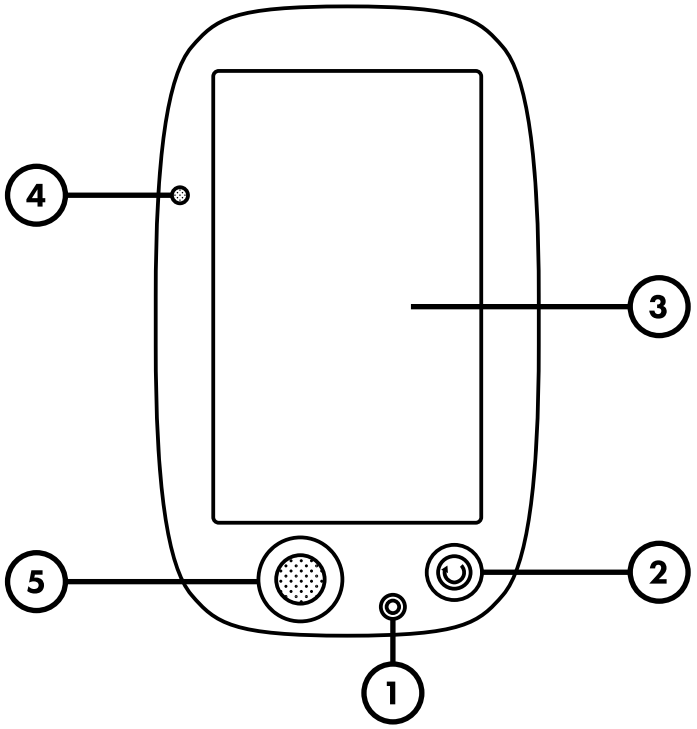
1. ON/OFF button

2. EMERGENCY/STOP button – it must be pushed in case of emergency. It cuts off the power from the fan, valves and the sliding window. When it's pressed, the fan, valves and window won't preform any operation.

3. Control panel – to operate the machine.

4. Microhpone for convenient communication between the patient and the operator.

5. Speaker system



1.2 TECHNICAL SPECIFICATION

Dimensions of appliance 2	
Height	2292mm
Depth with door	1870 mm
Width	1170 mm
Total weight	390 kg
Total weight with packaging	500 kg
Electric parameters	
Maximum power of current needed by equipment	10 amp 230 VAC 20 amp 110 VAC
Standard power supply	110/230 VAC
Time parameters	
Cooling down time (with short (2m) supplying hose and short (2m) exhausting pipe)	3-5 min
time of treatment	1-3 min
Time parameters	
temperature of treatment	to -140 °C (-220 °F)

Liquid Nitrogen consumption parameters:

1. Consumption for 10 to 20 treatment per day:

Calculation were performed for INTERMEDIATE treatment. Additionally, there was assumed:

- First cooling of the chamber from warm state
- There is one drying process during day
- The interval between treatments are average 30 minutes
- During intervals the doors are closed
- Chamber is supplied using 2 m long vacuum insulated hose

It gives an average nitrogen consumption at level of 15 liter/treatment.

2. Consumption for more than 20 treatment per day:

Calculation were performed for INTERMEDIATE treatment. Additionally, there was assumed:

- First cooling of the chamber from warm state
- There is no drying process during day
- The interval between treatments are average 15 minutes
- During intervals the doors are closed
- Chamber is supplied using 2 m long vacuum insulated hose

It gives an average nitrogen consumption at level of 14 liter/treatment.

VACUACTIVUS MEDSTARCOM | World Leading Manufacturer

VACUACTIVUS MEDSTARCOM | World Leading Manufacturer

2. General safety rules for CryoSrat Antarctica

1. Before assembling the product read all operating instructions.

2. The device comes divided into 3 modules. After unpacking check if the supplied product is complete.

3. The unit should be assembled based on drawings and descriptions contained in the manual. After connecting liquid nitrogen and its exhaust as well as power supply, please check if all the devices are working properly.

4. After mounting, electrical installation should be connected to a mains voltage of 230 V, 50 Hz Available 110V/60Hz version by a qualified electrician.

5. In accordance with the requirements of standards, electrical equipment must be protected by RCD devices with the rated amperage not exceeding 30 mA. These circuits should include protective PE wire, especially when using sockets for appliances in wet areas.

6. To avoid the risk of electric shock or burns caused by liquid nitrogen or hypoxia during use of the devices mentioned above follow basic safety rules and perform the required actions specified in the User Manual.

7. Keep the User Manual for the device.

8. To avoid the risk of electric shock, device must be plugged into a grounded socket.

9. In case of danger or emergency, immediately turn off the power or use emergency stop button by pushing it.

10. Disconnect the device from the electrical power when not in use for a long time (longer than 1 day).

11. Before thorough cleaning, disconnect the unit from the electrical power.

12. Throwing elements inside lower and upper air ducts is forbidden.

13. Putting hands or any other part of body inside lower and upper air ducts is forbidden.

14. Crouching or sitting inside chamber during operation is forbidden. Treatment is fully safe only when patient is standing.

15. Do not put hands on the edges of chamber laminates during closing the door.

16. Do not put hands or head on the upper edge of glass during operation of chamber.

17. Do not put any object on the upper edge of glass during operation of chamber.

18. Patient cannot stay inside chamber for a longer time than defined by operator.

19. Operation of cryochamber when there is a leakage on liquid nitrogen supply line or gaseous nitrogen discharge line is forbidden. If any leakage was noticed please contact the service of the device.

20. In case of damage of fan or in case of lack of oxygen inside room cryochamber cannot be used.

21. Patients always have to use proper safety equipment during treatment.

22. Patients always have to follow rules of safe behavior inside chamber.

23. Damaged device cannot be operated.

24. Making any changes to the device without consulting it with the manufacturer is forbidden.

VACUACTIVUS MEDSTARCOM | World Leading Manufacturer

VACUACTIVUS MEDSTARCOM | World Leading Manufacturer

3. First run of CryoStar Antarctica_

Before first run of CryoStar Antarctica please make sure that:

- all electrical connections are connected correctly;
- liquid nitrogen supply line and gaseous nitrogen discharge line are sealed (to avoid any leakage);
- drain in the bottom part of chamber is clean;
- interior of the chamber is fully dry;
- there is no element on the edge of the window – if so remove it;
- position of sealing on the door is correct;
- the door is closing correctly;
- there is a steel tray to catch water below the chamber;
- the liquid valve on the nitrogen vessel is open;
- oxygen level sensor is working.

When everything is prepared to first run, follow the steps below:

1. Connect the device to the power source using the included cable.

2. Check the EMERGENCY/STOP button . If it's pressed, turn it gently to the right side with carefull pulling it while turning to unlock the device.

3. Press the blue/silver round power button placed on the front of the device.
Wait for the fully load device operating system.

4. To prepare the chamber for session choose the PREFREEZING for the 10 minutes. Program automatically will be ended and subcooling will automatically turn on.

4. Operation procedures

4.1 MAIN MENU

After application start-up the screen with main menu will be displayed.

4.2 MAIN MENU SCREEN

Operator of the device can choose serveral options:

TREATMENT
Operator can open next menu with selection of treatment type and prepare chamber for treatment

PREFREEZING
Cooling the capsule for the optimal temperature before starting the treatments.

FULL DRYING
Operator starts drying of chamber after end of the treatments or before turning off the CryoStar Antarctica

POWER OFF
The device turns off immediately when clicked

- **Opening the door will interrupt the process of prefreezing**
- **During prefreezing window can't be opened**

4.3 MAIN SCREEN - SUBCOOLING

PRECOOLING BUTTON
Maintaining the set temperature inside the cabin between treatments

TIP
Keep the cabin temperature cool between treatments by using PRECOOLING feature to use less liquid nitrogen for session

The temperature value for PRECOOLING is set on the right sidebar panel

4.4 SETTINGS

Check button shows temperature range on temperature sensors located inside chamber and on exit of fan

Settings button allow to customize chamber settings

info button shows technical information regarding chamber

language button allows to change language.

back button forwards to previous screen menu

drying button starts drying program

precooling button starts precooling program

VACUACTIVUS MEDSTARCOM | World Leading Manufacturer

VACUACTIVUS MEDSTARCOM | World Leading Manufacturer

4.5 DRYING PROGRAM

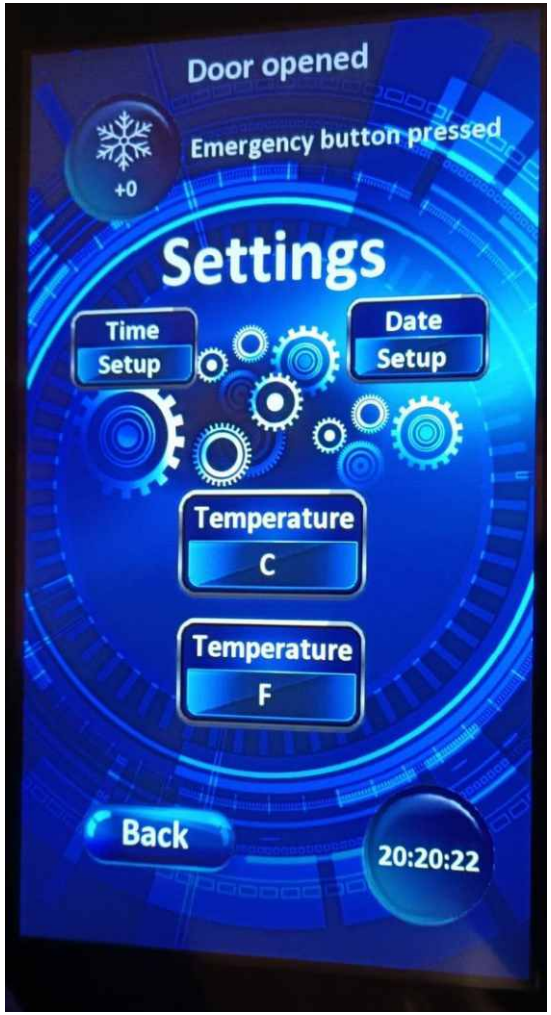
button Up to increase time of drying

button Down to reduce time of drying

Exit to preview menu

4.6 CHECK MENU

Shows technical information regarding temperature sensors located inside chamber



4.7 SETTING MENU

button Up to increase time of drying

button Down to reduce time of drying

Exit to preview menu

4.6 TREATMENT MODE - preparation for treatment

After the selection of preferred program of treatment, on the operator panel will appear screen with treatment parameters. Temperature and air flow is set on suggest level but it can be modified. Time of treatment is suggested for each program, but there is a possibility of change it. Parameters of BEGINNER, INTERMEDIATE and ADVANCED programs is presented in the table below:

	BEGINNER	INTERMEDIATE	ADVANCED
Time	1:00 min	2:00 min	3:00 min
Temperature	-100°C (-148°F)	-120 °C (-184°F)	-140°C (-220°F)
Window	Set by the operator	Set by the operator	Set by the operator

TEMPERATURE

The program automatically determines the temperature depending on the selected training level. You can change it as needed before training, but it will affect the amount of nitrogen you use. The current temperature in the chamber can be displayed in degrees Celsius or Fahrenheit.

4.9 COOLING DOWN

Before starting the cooling down process the door should be closed. After this the chamber will start to cool down. During this process do not open the door. At this moment displayer shows screen with prefreezing program. The chamber will cool for 10 minutes.

When the prefreezing time is end, chamber is ready for the treatment.

Important!
Remember to do not open the door or during the prefreezing.

VACUACTIVUS MEDSTARCOM | World Leading Manufacturer

VACUACTIVUS MEDSTARCOM | World Leading Manufacturer

4.10 GENERAL SECTION

The general section consists of three stages. The operator must confirm each stage with the check button. Operator has to check and confirm if patient has dry skin and all jewellery is removed. What is more, there must be confirmation that only one patient is going inside chamber. Click button to move forward.

CONTRAINDICATIONS SECTION

Operator has to make sure that there no contraindications for patient to go inside chamber. By clicking ✓ button operator confirms that patient is well-prepared for treatment.

VACUACTIVUS MEDSTARCOM | World Leading Manufacturer

CLOTH

Operator has to check if patient has proper clothes on his body and protective mask on the face.
Click ✓ button to move forward.

If all mentioned confirmations were not done, treatment cannot be started.

5 CHAMBER READY FOR TREATMENT

After finishing of safety control procedure, treatment can be performed. Actual temperature of air inside chamber (TEMPERATURE INSIDE) can be observed on the screen.

The current temperature inside the cabin

The SUBCOOLING should be activated when the operator waits too long before letting the person to go inside, when the temperature inside chamber is lower by 10 degrees from the temperature of treatment. To have a proper temperature inside the chamber – not to high – click on SUBCOOLING. The chamber will cool down again a little bit to temperature of treatment.

Enabling the SUBCOOLING option will maintain the set temperature inside the capsule.

5.1 TREATMENT MAIN SCREEN

To conduct the treatment - open the door of chamber and invite patient to go inside the chamber and close the door. Door should stay open for the shortest possible time to keep the proper level of temperature inside chamber.

Once the person is inside press the "START" button. During the treatment the only setting that is active is window level - you can manually adjust the window level with the arrows visible on the left side of the screen. During the treatment there is also a possibility to stop the treatment. Click "STOP" on the screen, the treatment will be discontinued and program will come back to main menu.

When treatment is finished screen will automatically reutrn to the main menu.

Now therapist can open a door of a chamber and patient can go outside. The door should be closed right after patient left.

If the SUBCOOLING was turned on before the session, it automatically starts after the session ends.

5.2 FULL DRYING

Full drying mode is a mode which is used to remove water and moisture from interior of chamber after operation. This mode should be selected every time when the amount of accumulated frost/snow is not allowing for normal chamber operation. Cryochamber cannot start cooling down from the room temperature if it is wet inside because of the risk of ice formation and increased wear of the whole device. When the gap between treatments is longer than one hour always start the FULL DRYING cycle to avoid forming of ice inside the chamber.

Remark for operators: cryochamber always has to be fully dried before start of cooling down! To keep interior of amber in good condition ice formation has to be avoided.

At this point operator has to decide if drying can be started. Click “START” to confirm start of process. Remember to open the door and do not close them during this process. Full drying takes up to 2 hour. During this time treatments cannot be performed. Drying can be cancelled at any time. During process operator can take a look how much time is needed to the end of operation. After drying control panel will go back to main menu. Please remember to put the tray before starting the drying process.

Important!
Remember to open the door and do not close them during the full drying process.

After pressing in main menu icon “FULL DRYING” pop up window will display on the following screen:

Pop up window with control panel of Full Drying with starting button, temperature information and drying time.

Pop up window with control panel of Full Drying with starting button, temperature information and drying time.

5.3 POWER OFF

After pressing “POWER OFF” button, shutting down process will start. Before switching off the device, make sure that it does not require FULL DRYING. Full drying process is used to fully dry chamber after operation. It can be cancelled at any time. Remember after time there should be already a water inside the chamber and after cooling down it again the ice can be formed in a chamber. This can have a bad impact on the material of components. What is more the frost inside the air duct can be blown during the treatment and can cause the serious frostbite on skin of patient.

During the process of drying there is an indicator on the screen which shows how much time is left until the end of process. After long drying remember to turn off CryoStar Antarctica

Please remember to put the tray below chamber and to open the door. Full drying of the chamber protects it against fungi and bacteria growth.

5.4 SETTINGS

Acces to the settings menu. Click and hold (2sec) Option is only available from **HOME SCREEN**

In the settings menu, the user can check the basic functions and change the units of the displayed temperature. By default, the temperature is set to °C, which can be changed to °F.
The tab with the GENERAL settings allows you to change the “access pin” to the device menu, and view device parameters, such as device ID, IP address, temperature units, version of application or version PC system.
In USER tab section operator can change the language of the device interface and also change the units of the displayed temperature (°C or °F).
The SERVICE tab contains the status of hourly counters of the device, the states of peripheral devices and information about temperature sensors monitoring the temperature distribution in the cryochamber.

5.5 Maintanance - cleaning, disinfection, sterilization

5.1 CLEANING

Cleaning of CryoStar Antarctica main compounds can be done as follows:
• External laminates and door – all laminates can be cleaned with usage of agents for washing of plastics. Wash the surface with soft cloth until it is glossy again. Take care about the surface – avoid making scratches. Do not use any dyeing substance.
• Glass – to clean glass close it fully, then apply some agent dedicated for cleaning of glass and use soft cloth and perform a circular motion. Than dry the surface with dry cloth to avoid blurs. Glass cannot be closed if it is wet!
• Sealing of door – sealing of door is mounted with bur and it can be easily removed and washed with usage of standard agents for washing of materials like soap . Replace this sealing with new one from time to time to avoid bacteria growth. Clean the surface with usage of agents for cleaning the leatherette.
• Threshold sealing (on the floor) – clean this sealing with usage of warm water and standard agents for cleaning of laminates.
• Internal laminate – the same situation as in case of external laminates, do not wash it when it is cold.
• Upholstery – clan surface of upholstery with usage of agents dedicated for cleaning the leatherette and cloth. Soap can be used as well. Do not use any dyeing substance.

VACUACTIVUS MEDSTARCOM | World Leading Manufacturer

In case of any other part, use standard agents and cloths, remember to do not damage the surface of elements. From time to time clean the water outlet in the floor of chamber and dry it to avoid any bacteria growth.

In very special cases there is possibility of removing of upholstery. It is mounted with bur. Slowly pull upholstery starting from the left wall and remove next parts. Clean the surfaces of chamber walls very carefully. Remember to dry it fully before mounting of upholstery! After finishing of all cleaning works remember to set drying mode for chamber. Chamber cannot start cooling when it is wet.

5.6 DISINFECTION

From time to time cryochamber and its air ducts should be disinfected to remove all bacteria which can growth because of wet atmosphere.

Disinfection can be done with spraying of chemical substances dedicated for removal of fungus and bacteria for air conditioning systems. Disinfection should be done **once per three months.**

VACUACTIVUS MEDSTARCOM | World Leading Manufacturer

VACUACTIVUS MEDSTARCOM | World Leading Manufacturer

6. Basic troubleshooting

OBSERVATION	REASON	SOLUTION
Fan does not work (it can't be heard during treatment) -100°C (-148°F)	An application error	Shut down device, plug off electrical connection, plug in again and start device again. If there is no reaction – contact with producer.
	Blockage of fan	Do not allow to get some solid elements to get inside fan. In case of this problem contact with producer.
Lack of nitrogen dosing – cryochamber is not cooling down	Closed liquid valve on the nitrogen vessel	Check if liquid valve on the nitrogen vessel is opened.
	Blockage of electromagnetic valves	Try to restart device, if it not helps contact with manufacturer.
	Lack of liquid nitrogen	Contact with supplier of nitrogen to order new delivery of nitrogen.
Leakage of cold air through door of chamber	Displacement of door sealing	Correct the position of sealing material – it is mounted with bur.
	Damage of door	Contact with manufacturer.
Light inside chamber is not working	Damage of electrical supplying system of light	Contact with manufacturer.

6. Basic troubleshooting

OBSERVATION	REASON	SOLUTION
High water level on the floor of chamber after drying	Clogged drain	Try to purge drain carefully.
Screen does not react to touch	Application error	Try to restart system. If it does not help, contact with manufacturer.
Glass is not moving during operation	Damage of electrical motor	Contact with manufacturer.
	Application error	Apply drying mode. Try to restart application after this. When glass is warm try to move it. If it does not help, contact with manufacturer.
	Blockage of glass	Apply drying mode and do not move glass until it is warm. Try to move glass after drying. If it does not help, contact with manufacturer.
Decreasing oxygen content in operating room	Leakage of nitrogen pipeline and connections	Check connections of nitrogen pipeline and remove leakages. Contact with manufacturer.

7. Safety and operational rules - how to properly and economically use a CRYOSTAR ANTARCTICA

7.1 SAFETY RULES AND PREPARATION OF PATIENT FOR TREATMENT

Main safety rules for safe CryoStar Antarctica usage are as follows:

- **skin of patient must be fully dried** before application of cryotherapy,
- **all jewellery (rings, earrings, bracelets, etc.) has to be removed** before application of cryotherapy,
- **only one patient** can stay inside CryoStar Antarctica during treatment,
- **during session operator** always has to control operation of CryoStar Antarctica stay outside chamber. Operator cannot perform session for himself.

Additionally the therapist responsible for treatment should prepare patients for the treatment to provide safety and satisfaction. Patient should be equipped in:

- knee socks or thin leggings with taking into account their minimal height,
- clogs/warm slippers, e.g. North Face Mule,
- cotton gym shorts and crop top (for ladies),
- headband,
- wool or cotton gloves,
- **protective mask to cover lips and nose.**

Dressing-gown or other type of coat should be removed right before treatment in order to provide contact of skin with cold air inside chamber

Therapist should inform patients that in case they feel bad they can push door of chamber and go out anytime.

Contraindications which completely prohibit usage of CryoStar Antarctica are as follows:

· **kids aged under 12,**

• **persons with heart problems and heart disease,**

• **persons with respiratory diseases,**

• **persons which has open wounds,**

• **women which are pregnant.**

7.2 CONDITIONS INSIDE TREATMENT ROOM

To make operation of CryoStar Antarctica safe and the most effective, temperature and humidity of air inside treatment room should be maintained at proper level. Those levels are defined as follows:

• Humidity of air should be maintained below 40 %,

• Temperature of air should be maintained below 22 °C.

Both those parameters can be controlled with usage of standard dehumidifiers applied for airconditioning.

Results of too high humidity level in treatment room (above 40%):

• Increased risk of frostbites,

• Increased risk of supply installation failure,

• Higher liquid nitrogen consumption per session,

• Larger condensation rate of water on the walls of CryoStar Antarctica.

7.3 DURING TREATMENT

Before the treatment operator should also inform the patient how to behave inside the chamber.

During treatment patient should follow the rules:

- wear the appropriate outfit and do not carry any metal components,
- breathe at a normal rate,
- do not touch the walls,
- do not jump in the chamber,
- do not put head or hand on the edge of glass, do not touch air ducts.

When treatment started, operator should:

- keep an eye on the patient who is inside the chamber – in case of any alarming behavior stop the treatment and react as fast as it possible. Door of chamber can be easily opened during treatment.
- guide patient with voice communication system through a microphone.
- stop operation of chamber in case of any danger by pushing emergency button (marked with red circle in the photo on the right) situated on the front wall of machinery room, near control panel. Open the door and remove the patient immediately

VACUACTIVUS MEDSTARCOM | World Leading Manufacturer

Remark for operators: in order to limit nitrogen consumption and to provide satisfactory and effective treatment for patient avoid to leave the door open at any time. Open the door directly before entering the patient to the chamber, when patient is fully ready for treatment.

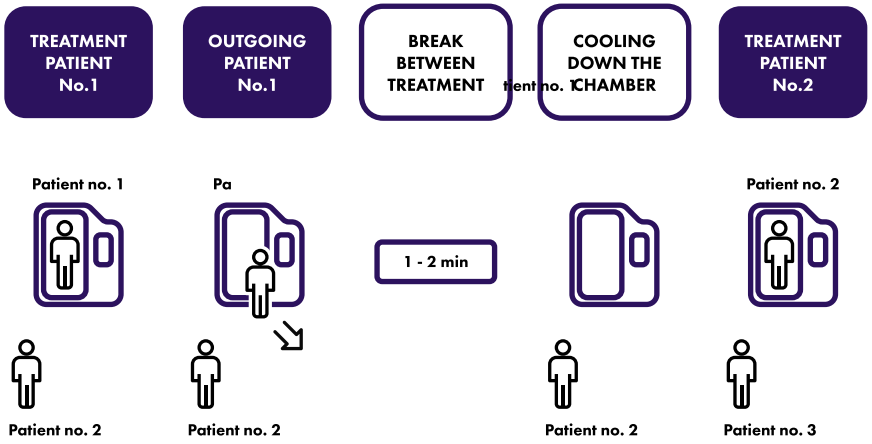
After opening the door a part of the cold air will get out of the chamber so the temperatureinside the chamber will always rise a little bit. At the beginning of treatment it always should be a little bit higher than the one that was set, because the patient body has to get used to a law temperature.

- First minute of treatment the body of patient will be adjusting to cold;
- Second minute – the patient bod will be reacting to the cold;
- Third minute – the patient body will be reaping the benefits of the cold.

7.4 INTERVALS BETWEEN TREATMENTS

Interval between treatments should be as short as possible. Prepare the schedule of treatments so that time between each of them will be about 1-2 minutes if it is possible. Thanks to that device does not have to maintain treatment temperature for long time, what significantly reduce liquid nitrogen consumption. Optimal interval between treatments ensuring low nitrogen consumption should be 4-5 minutes maximum. It is the most economical when the interval is as shortest as possible. After 7 minutes of break chamber will use a half of nominal quantity of liquid nitrogen that is needed to full cooling. When the interval between the treatment is longer than 20 minutes, the work is uneconomical. The machine will consume as much as during full cooling down.

Schematic explenation is shown below. When first patient (1) is inside chamber the next one should be prepared for treatment already. When first treatment is finished, the colling down for next treatment should start in 1-2 minutes. Next person should get inside the chamber right after reaching proper temperature value, signlized with communicate that chamber is ready for treatment.



7.5 CLOSING THE DOOR

Remember that CryoStar Antarctica **door should be closed during operation.** Opening of door during cooling of chamber holding the temperature causes significant temperature rise, what causes increase in liquid nitrogen consumption. The only exception is opening of door for patient ingoing or during drying process.

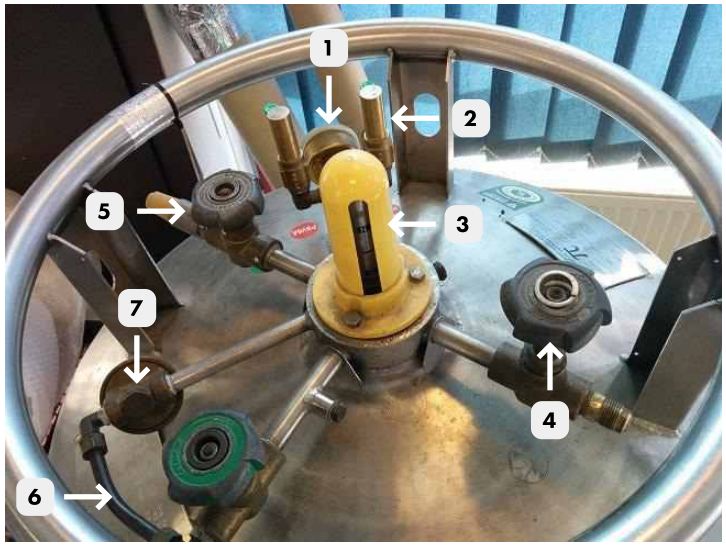
When chamber is ready for treatment patient should go inside quickly. Always **close the door right after patient incoming.** Do not keep them open for long time when patient is inside chamber. The result of keeping door open when session starts will be too high temperature of treatment and additional increase in nitrogen consumption.

Do not keep them open for long time when patient is inside chamber. The result of keeping door open when session starts will be too high temperature of treatment and additional increase in nitrogen consumption.

7.6 LIQUID NITROGEN VESSEL HANDLING

The head of the 230 liters tank in standard applications is equipped with the following elements:

1. Manometer indicating the pressure in the tank
2. 2 x safety valve
3. Float-type level indicator allowing the current control of the iquid nitrogen level
4. Dispensing / liquid use valve
5. Venting valve to gas exhaust and reduce pressure in the tank
6. Nitrogen vaporizer allows to increase the pressure in the tank
7. Pressure build-up regulator



Equipment installed on pressurized liquid nitrogen storage tank

VACUACTIVUS MEDSTARCOM World Leading Manufacturer

Basic rules regarding to liquid nitrogen storage tank handling which have to be respected are as follows:

· **Control the pressure value which is indicated by manometer 1 during CryoStar Antarctica operation.** Pressure value should be maintained at constant level (in normal conditions 1,5 bar, in some cases it can be higher due to manufacturer recommendation).
Pressure is maintained with usage of nitrogen vaporizer **6**. Authorized gas supplier which delivers liquid nitrogen should set pressure regulator **7** to value which is dedicated for CryoStar Antarctica(normal conditions 1,5 bar).

To maintain constant pressure inside cryogenic tank, open the vaporizer valve 4 right after opening of liquid valve 6 . Vaporizer automatically keeps constant pressure inside tank to maintain stable operating conditions of CRYO TOTAL.

· If the pressure inside vessel is higher than set value, use venting valve (5) to decrease it. Always use personal oxygen sensor and safety measures (google, shoes, gloves, apron) during this operation and do not breathe nitrogen which is being removed from vessel.

· Control level of liquid nitrogen with liquid level indicator . If the level of liquid is too low, maintenance of proper pressure value is not possible.

· Always remember to close supplying valve on the liquid nitrogen vessel when operation of chamber ends for long time e.g. for the night. Such action will decrease amount of wasted nitrogen which is constantly evaporating inside vessel and if valve is open, inside the dosing hose.

· If it is possible, store the liquid nitrogen vessel inside the room which is characterized by low temperature. Additionally place the vessel in a shady spot. This will reduce the evaporation rate inside vessel. Equipment installed on pressurized liquid nitrogen storage tank

· For more information contact with liquid nitrogen storage tank supplier.

Remember that the length of a connection between vessel and cryochamber (pipeline or dosing hose) has significant impact on consumption of liquid nitrogen. Try to keep liquid nitrogen vessel close to the chamber and use short supplying line to reduce nitrogen consumption.
Do not remove insulation from supplying line. If it is damaged it has to be repaired.

7.7 ADDITIONAL INFORMATION

If operator followed the rules mentioned above and problem with high nitrogen consumption still occurs, please:

a) check if liquid nitrogen vessel is working properly, especially:

· check if there is no leakage from liquid nitrogen supply valve,

· check the pressure level on the manometer – it should be 2,2 – 3,2 bar (35 – 50 psi),

· check if there is no leakage on the connection between dosing hose and liquid nitrogen vessel,

· check if the door seal is properly situated and there is no leakage of cold air from the gap between door and the chamber,

VACUACTIVUS MEDSTARCOM | World Leading Manufacturer

8. Liquid nitrogen usage risks

Operation with cryogenic medium such as liquid nitrogen is related several serious risks. Operators has to be aware of those risks to safely use liquid nitrogen.

8.1 LIQUID NITROGEN TEMPERATURE RISKS

Due to temperature of liquid nitrogen, the body should always be properly secured. Eyes should be protected by goggles, because even minimal contact with such low temperatures can damage delicate tissue of eye. Skin is slightly less sensitive, but prolonged contact with liquid nitrogen can cause frostbite. Users of LN should also avoid contact with objects immersed in liquid nitrogen. For example, frozen metal in contact with skin adheres to it, each trial to peel of can cause serious tissue damage.

When working with liquid nitrogen users must be careful. The following requirements must be respected:

· each work with liquid nitrogen should take place in the presence of another person.

· operators working with liquid nitrogen should have the appropriate personal equipment:

- goggles;
- protective gloves;
- waterproof apron.

· all work related to the installation of the equipment should also be carried out in protective gloves.

8.2 OXYGEN DEPLATION RISKS

In case of any failure of liquid nitrogen vessel, CryoStar Antarctica supply pipeline or exhaust pipeline, liquid nitrogen and nitrogen vapors will escape to the interior of room. Such cold vapors are heavier than air and they cause pushing off air from room and as a result also oxygen will be removed from room. Such situation makes serious danger. That's why it is needed to **always use oxygen level sensors.**

Oxygen level sensors are the most important safety equipment which personnel have to use in treatment room and in the rooms where liquid nitrogen vessels are stored if such rooms exist.

REMEMBER ABOUT OXYGEN LEVEL SENSORS IT'S FOR YOUR OWN SAFETY! It has to measure O2 (oxygen) level.

There should be at least 1 oxygen level sensor for treatment room and at least 1 sensor per each room with liquid nitrogen vessels. They have to be installed before CryoStar Antarctica installation.

Normal oxygen content in atmospheric air is equal to 20,9 %. Leakage from CryoStar Antarctica liquid nitrogen supply pipe, gaseous nitrogen outlet pipe or nitrogen removal from liquid nitrogen vessel will cause oxygen depletion because cold nitrogen vapors are heavier than air and they push air outside of room. When oxygen content will reach level of 19%, sensor should alarm staff about it by emission of very loud sound. If alarm starts, staff should leave room as fast as it is possible to avoid risk. Alarm can be stopped after some time and proper ventilation of room, only when oxygen content raise again to level above 19% by clicking on the sensor button to confirm that staff know about proper

Asphyxiation due to lack of oxygen often occurs quickly and without warning symptoms prior to the victim. The table below shows the major symptoms that can occur if the air does not have the right amount of oxygen. Instead, we must remember that the reactions may be different for different people and symptoms may differ from those listed in the table

OXYGEN CONTENT	EFFECTS AND SYMPTOMS
15-19%	Reducing the ability to perform tasks; the possibility of the onset of symptoms associated with problems with the heart, lungs and blood circulatory system
12-15%	Deep breathing, fast pulse, poor coordination
10-12%	Dizziness, mouth slightly sine
8-10%	Nausea, vomiting, unconsciousness, ashen face, fainting
6-8%	Death in 8 minutes, possible immediate resuscitation
0-4%	Coma in 40 seconds, convulsions, respiration ceases, death, irreversible brain damage

If any of these symptoms - rapid and labored breathing, sudden fatigue, nausea, vomiting, collapse or lack of movement or unusual behavior takes place you should react as fast as it is possible and alarm medical rescuers. When it is not possible to use special equipment, such a person should be immediately led out into the fresh air. Any attempt to pull the victim should be carried out by qualified persons trained in the use of medical breathing apparatus and entering a confined space with a small amount of oxygen inside.

8.3 COLD NITROGEN VAPOR RISKS

Because of the low temperature of liquid nitrogen, its vapor can damage the skin like heat burns. Unsecured parts of body in contact with uninsulated cold parts may stick to each other and tissue can be torn off when you try to separate this part off the skin.

Cold vapor as well as liquid nitrogen itself may lead to frost-bites when the unprotected parts of the body are exposed for low temperature for a long time. Attempt of warming up of body part may cause intense pain and shock. In order to carry out first aid, clothing that can impede the proper flow of blood should be loosened and the injured person should be immediately taken to hospital, with the exception of completely superficial wounds. Damaged parts of the body should not be exposed to high temperatures and if it is possible, they should be immersed in lukewarm water. Persons who have suffered such burns should not smoke cigarettes or drink alcohol.

Short-term exposure to very cold gas results in breathing problems and can trigger an asthma attack for those who are susceptible to it. Prolonged inhalation of cold gas normally causes no damage to lungs. If fumes are very cold frostbite can occur in the mouth or nose.

Hypothermia can occur in various conditions where the temperature is lower than 10 °C, but susceptibility to it depends on time spend in such conditions, air temperature, age of the person (older persons are more susceptible) and type of clothes. There are symptoms such as:

- physical and mental reactions are much slower,

- unusual behavior or hyperactivity,
- problems with speech and vision,

- spasms and shivering.

A person with a visible symptoms of hypothermia should be covered with a warm blanket and taken away to the warm place. Immediate medical attention should be given to such a person. Methods of direct heating should not be used unless qualified person tells otherwise.

8.4 PREVENTIVE MEASURES

Everyone who works with liquid nitrogen or systems which uses liquid nitrogen should be instructed about the risks in relation to damages, injuries caused by cold, frostbites or hypothermia. Particular attention should be paid to the deceitful nature of risks associated with this that the operator may be completely unaware of the dangers that occur. Practical trainings about the methods of risk reduction and the actions which have to be taken in case of danger must be performed.

Protective clothing is only used to protect the operator who works with a cold equipment from contact with liquid gas or components remaining in contact with it. Protective leather gloves should always be worn when servicing parts which have contact with liquid nitrogen. Gloves should fit loosely so that they can be easily removed when liquid is spilled on it or get into the interior. Goggles or face mask should be worn to protect eyes and face in places where liquid nitrogen can splatter. Used clothes should not have any open pockets and cuffs, where the liquid can be closed. For the same reason you should wear pants recessed into shoes. If your clothes are covered with liquid nitrogen it can lead to frostbite. In this case use clean water to clean clothes that need to be changed.

VACUACTIVUS MEDSTARCOM | World Leading Manufacturer

American sales department:

9595 Wilshire BLVD Beverly Hills CA 90212 USA
T +1-310-467-9723

European sales department:

Ostrow 338, Przemysl, Poland 37-700 European Union
WhatApp +48-884-191520 / Direct phone line +48 58 731 0931
UK/Ireland +44 20 32891959
Australia +61 73 103 3833
Ukraine +380 67 3117770
Russia +7 495 128 3922

www.vacuactivus.com

VACUACTIVUS MEDSTARCOM | World Leading Manufacturer
VACUACTIVUS MEDSTARCOM | World Leading Manufacturer