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Information and Operating Instructions for Dewar Vessels Type 21 to 24 AL

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1 Structure of an LN2 Container Type 21 to 24 AL

1.1 Description

The container comprises two parts:

a) **The inner container made of borosilicate glass 3.3 for the storage of LN2 or other coolants or liquids ranging from +150℃ to -196℃**

b) **The protective outer container made of aluminum with a handle and lid.**

1.2 Inner glass container with technical data

The inner container is made of borosilicate glass 3.3 in accordance with DIN/ISO 3585 (DURAN).
The glass has the following characteristics:

Chemical characteristics	**Water resistance: in accordance with DIN - ISO 719 (98℃)** **Water resistance: in accordance with DIN-ISO 720 (121℃)** **Acid resistance: in accordance with DIN - ISO 1776** **Alkali resistance: in accordance with ISO 695 - A2**
Optical characteristics	**Spectral range: 310 - 200 nm in which the absorption is negligible.**
Physical characteristics	**Linear coefficient of expansion:** **3.3×10^{-6} 1/K (at 20-300℃)** **Density: 2.23 g/cm^3** **Specific heat capacity: 910 J/kg K** **Transformation temperature: 525 ℃**

Permissible operating conditions for the inner glass container with no lid

Dewar temperature range	**- 196 to + 150 ℃**
Pressure range	**Pressure-less**

Standard Dewar vessels are not suitable for using with liquid and gaseous helium.

Standards and guidelines

The standard glass Dewar vessels, manufactured by KGW-ISOTHERM, are produced in compliance with the "Pressure Equipment Directive," Directive 97/23 EC (N4 with Annex 1) and in accordance with DIN 12492 "Equipment with Vacuum Insulation."

1.3 Aluminum protective shell (outer container) with technical data

The outer aluminum container is purely a protective container that protects the inner glass container from mechanical influences.

It comprises a lower section in which the spherical glass Dewar vessel is inserted. The glass Dewar vessel sits on a flexible buffer that should absorb any knocks that may have an impact on the glass Dewar.

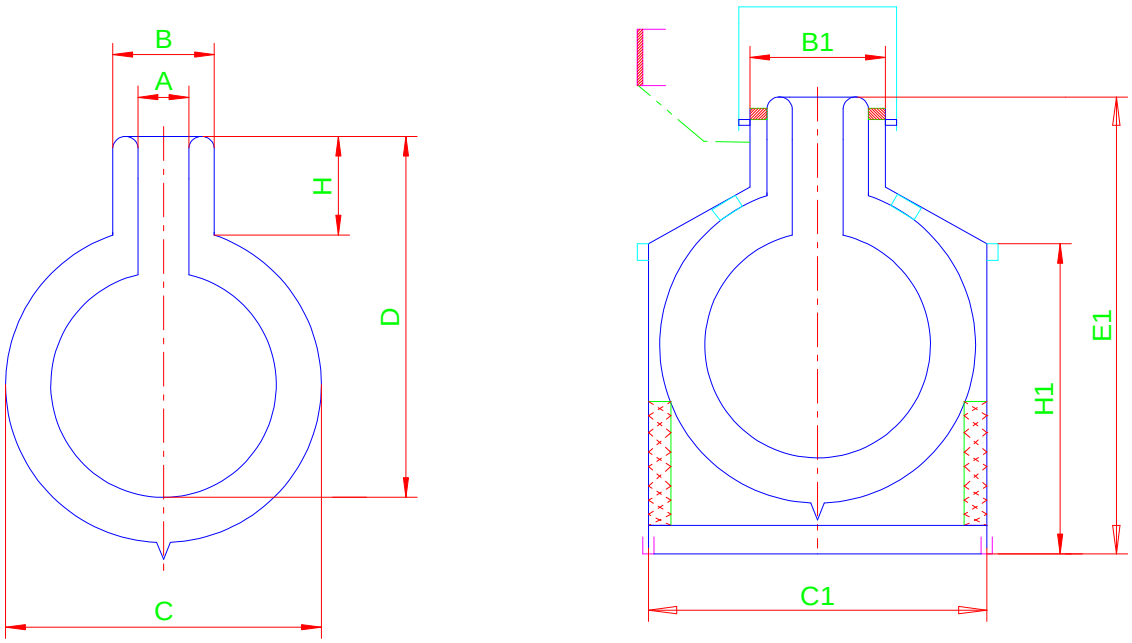
The upper aluminum section seals the protective shell (lower section) and thus secures the inner glass container in the protective shell. The upper section has a handle to transport and empty it as well as an insulated lid.

Permissible operating conditions for the aluminum protective shell with lid

Operating temperature of the aluminum protective shell: 0 to + 80 ℃

Operating temperature of the insulated lid (inner section PU): -196 to + 60 ℃

1.4 Dimensions and consumption data of spherical Dewar vessel



Technical Data

Type	max. content. ca. [L]	A mm	B mm	C mm	D mm	H mm
21 AL	1	30	50	165	235	70
22 AL	3	60	85	205	305	110
23 AL	5	60	85	250	350	110
24 AL	10	65	95	310	380	85

Type	max. content ca. [L]	B1 mm	C1 mm	H1 mm	E1 mm
21 AL	1	60	175	150	300
22 AL	3	105	225	210	380
23 AL	5	105	260	275	450
24 AL	10	105	330	310	480

Type	max. content ca. [L]	weight ca. [kg]	holding time LN2 ca. [d]	evaporation rate ca. [L / d]
21 AL	1	1,6	5	0,2
22 AL	3	3,1	7	0,4
23 AL	5	4,4	12	0,4
24 AL	10	6,6	16	0,6

Type	Art. No.
21 AL	1291
22 AL	1292
23 AL	1293
24 AL	1294

2 Set up Instructions

2.1 Safety precautions when setting up the container.

Before setting up or first using the container, read through and apply the safety regulations listed in point 7.

The following important points in particular should be noted:

a) Wear appropriate protective equipment.

b) Nitrogen is neither toxic nor flammable but can lead to a lack of oxygen in closed rooms.

It is therefore recommended that containers filled with liquid gas (especially when the liquefied gas is decanted into another container) are only used in an area with sufficient ventilation.

Always seal containers with the loose fitting lid that is provided with its insulated inner section (PU).

Always place the container securely onto a work table. Ensure that it is not put too close to the edge of table. Avoid carrying the vessels by hand when transporting them via stairways as stairways always present a trip hazard and therefore liquid could escape should you stumble. Therefore, always use a lift for safety reasons.

Always carry the container using the handle and avoid the container swinging when transporting it as LN2 could spurt out as a result.

We recommend using a transport trolley with larger vessels (23 and 24 AL).

3. Operating Instructions

3.1 Transport

The spherical Dewar vessels should only be used for in-house transportation. There is no ADR approval for road transportation.

Wear protective gloves, goggles and clothing if necessary when transporting the vessels. Furthermore, the internal in-house safety information or guidelines of the Employers' Liability Insurance Association should be observed.

3.2 Handling

The containers were designed in such a way that the glass insert is not damaged by minor knocks that cannot be avoided during handling. However, we strongly recommend the following in order to keep the LN2 evaporation low and ensure that the glass container has a long service life:

a) Avoid any hard knocks.

b) Always transport the container in an upright position.

c) Transport the container in such a way that any serious mechanical influences are avoided.

A mobile roller base or transport trolley can be used to make it easier to transport containers within a laboratory.

3.3 Filling and emptying

Protective gloves, clothing and goggles should generally be worn when handling liquid gases.

3.3.1 Filling

LN2 containers are filled using the following:

a) A filling hose with a phase separator that is inserted into the neck of the container. Ensure that the filling pressure in the hose does not exceed 1.5 bars so that the hose is stable and secure in the neck of the container during the filling process. The hose should not damage the glass wall. Secure the hose if necessary.

b) A filling funnel that is placed on the neck of the vessel. A filling hose is inserted into this filling funnel and secured if necessary so that the filling hose or phase separator cannot touch the glass vessel.

3.3.2 Emptying the LN2

Remove the lid from the container and raise the container using the handle of the protective shell. A gripping edge on the base of the protective shell can be used to tip the container so that it is possible to safely handle and decant the LN2 or another liquid.

4. Maintenance

The containers are generally maintenance-free. If the aluminum protective shell is damaged, check the connecting screws that connect the upper and lower section to each other. If the screws are damaged, the container must not be used until a repair is carried out.

5. Checking the Evaporation Rate

The evaporation rate of LN2 is checked by weighing the container with its liquid nitrogen content. This requires scales with a reading area that corresponds to the weight of the filled container and that provide sufficient accuracy when weighing.

Procedure:

Seal the container with its lid. (The evaporation rate is checked under atmospheric pressure).

Weigh the empty container (M1).

Fill the container with liquid nitrogen and wait 3 to 4 hours until the temperature of the container has stabilised. Then fill it completely.

Weigh the full container (M2).

Read off the weight every hour. Deduct the weight of the empty container (M1) from the weighing result and log the data. This generates a stream of data from which the average weight loss in grams per hour can be determined for the period of time measured. If this value is converted with the specific weight of LN2 at approx. 800 grams = 1 litre, this gives the average evaporation rate per hour.

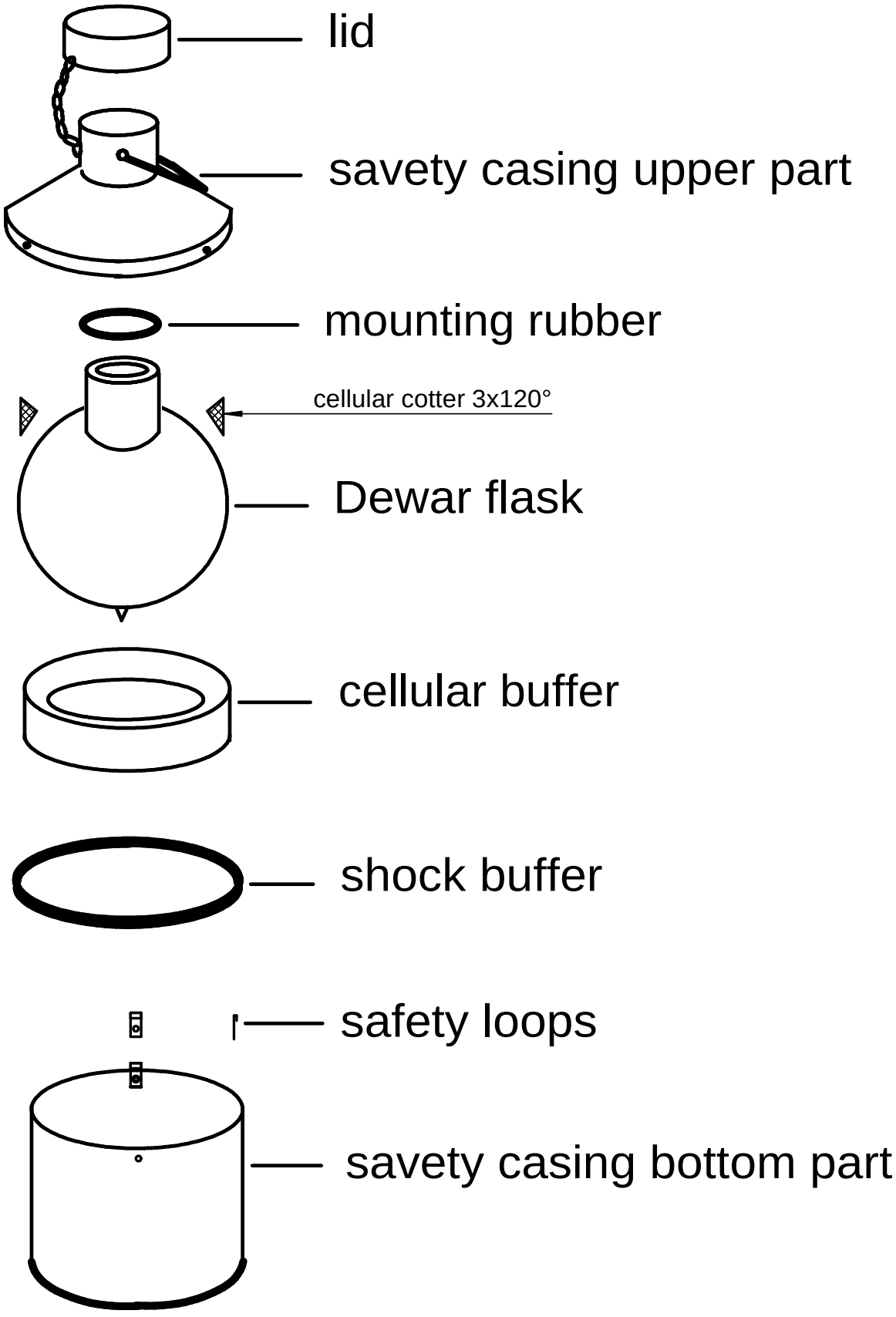
Note:

The room must remain at a constant temperature of 20℃ and the atmospheric pressure must be held at 1,013 mbar during the measuring interval so that the measurement can be reproduced. The condition and age of the container obviously have a significant effect on the evaporation rate.

6 Spare Parts and Accessories

Type	cellular buffer	lid	edge protection
	Art. No.	Art. No.	Art. No.
21	1994	1960	1971
22	1995	1961	1972
23	1996	1961	1973
24	1997	1970	1974

Type	impact rubber	handle	mounting rubber
	Art. No.	Art. No.	Art. No.
21	1964	1945	1968-21
22	1965	1946	1968-22
23	1966	1946	1968-23
24	1967	1946	1968-24


lid
savety casing upper part
mounting rubber
cellular cotter 3x120°
Dewar flask
cellular buffer
shock buffer
safety loops
savety casing bottom part

General Safety Regulations with Liquid Gases

This document contains general safety instructions in general, when using with liquid nitrogen.

The following instructions shall be respected while working with liquid nitrogen. To minimise the risk of accident and their consequences a few precautions should be taken, particularly related to:

- Oxygen deficiency
- Cryogenic burns
- Risks of explosion
- Oxygen enrichment

Once the users have been informed of risks and environmental conditions, all of them must be able to use liquid nitrogen in a safe way.

7 SAFETY INSTRUCTIONS

7.1 OXYGEN DEFICIENCY

The approximate composition of air by volume is as follows for its main components:

Oxygen O_2 21 %
Nitrogen N_2 78 %
Argon Ar 1 %

This gases are not toxic, but changes in their relative constituents, and particularly oxygen, have an effect on life and combustion processes. Therefore it is essential that the
air we breathe should contain sufficient oxygen (> 19 %).

Our senses are incapable of detecting changes in the concentration of the constituents of air
sufficiently quickly, since they are odourless and colourless.

7.1.1 Dangers

The risk of suffocation is high due to normal evaporation of liquid nitrogen to nitrogen gas that displaces oxygen in the inhaled air. For example, under standard temperature and
pressure conditions (20°C; 1013 mbar), 1 litre of liquid nitrogen evaporates to 680 litres of nitrogen gas. The critical limit of oxygen can be easily reached.
Oxygen deficiency is dangerous and can cause death from suffocation.
The reaction of the organism to oxygen deficiency is different from one person to another. It is impossible to give any valid information in general about symptoms of a starting oxygen deficiency.

7.1.2 Causes

To protect yourself from risks of oxygen deficiency pay attention to following points:

- usage of liquid or gaseous nitrogen
- natural evaporation of liquid nitrogen
- refilling of liquid nitrogen
- leaks in storage tanks for liquid or gaseous nitrogen
- defective vent pipes or exhaust pipes
- tipping over the vessel

This list is not complete.

7.1.3 Recommendation

Proceed as follows to prevent the risks of oxygen deficiency:

- keep always the vessel in the vertical position
- close the vessel with an suitable lid
- do not put the vessel in bright sunshine or close to a heat source
- do not transport the vessel by car
- premises must always be well ventilated
- prevent strokes, avoid shocks and sudden movements
- wear always individual protective equipment (suitable gloves, safety goggles or protection
visors and closed shoes)
- check the oxygen content continuously
- carry an oxygen meter
- train personnel

This list is not complete.

7.1.4 General behaviour to be followed in case of accident

Proceed as follows:

- mark the environment to prevent secondary accidents
- take action quickly: the rescuer must have taken individual protective measures (independent breathing protection apparatus)
- move the victim(s) away as quickly as possible
- pay attention to internal first aid rules of your plant
- ventilate the room sufficiently
- find out the reason of accident

This list is not complete.

7.2 CRYOGENIC BURNS

Liquid nitrogen is extremely cold (-196°C)

Parts of vessel that have been in contact with liquid nitrogen (especially while refilling) can burn the skin in case of contact.

7.2.1 Danger

Cryogenic fluids can:

- cause burns on the human body
- make materials (metallic or plastic) brittle in case they are not suitable for low temperatures
- cause strong nebulosity, depending on the air humidity of premise

7.2.2 Causes

There are two kinds of cryogenic burns:

7.2.2.1 Burns by splashes

It is important to protect yourself against the risk of splashes while using liquid nitrogen, especially when handling with samples. Splashes can cause cryogenic burns that can have serious consequences, especially when hitting eyes or face.

7.2.2.2 Contact burns

Contact between skin and cold materials causes frostbites or cryogenic burns. Never touch or
grip the inner side of vessel or samples with a bare hand.

7.2.3 Recommendation

Proceed as follows to prevent the risks of burns:

- prevent skin contact with cryogenic liquids
- never touch the cold walls of vessel, or un-insulated or frosted equipment
- wear individual protection equipment (suitable gloves, safety goggles or protective visors and closed shoes)
- always hold the vessel in the vertical position
- use only suitable equipment (metal or PTFE hose) for refilling the container
- train personnel

This list is not complete.

7.2.4 General behaviour to be followed if liquid nitrogen is splashed

7.2.4.1 In the eyes

- wash the eye with a generous supply of water for at least 15 minutes
- pay attention to internal first aid rules of your plant
- consult a doctor

7.2.4.2 On the skin

- do not rub
- if possible, remove or loosen your cloths
- defrost affected parts by moderate and progressive heating
- do not apply anything on the burned area
- pay attention to internal first aid rules of your plant
- consult a doctor

Both lists are not complete.

7.3 THE RISK OF EXPLOSION

7.3.1 Dangers

The evaporation of liquid nitrogen can causes an overpressure inside of the vessels.

7.3.2 Causes

The increase of pressure in the vessel may happen due to:

- poor maintenance of the container
- accumulation of ice on the neck and the lid

This list is not complete.

7.3.3 Recommendation

Proceed as follows to prevent the risk of explosion:

- always use a suitable lid (pay attention to an exhaust gas opening)
- respect filling levels to prevent the formation of ice on the lid
- use the vessel only in dry and sheltered locations
- control the humidity of the room
- check vessel periodically with regards to accumulations of condensation water
- check vessel periodically with regards to surface defects and material damages

This list is not complete.

7.3.4 General behaviour to be followed in case of accidents

Please see above under 2.1.4, oxygen deficiency.

7.4 OXYGEN ENRICHMENT

7.4.1 Dangers

Oxygen enrichment can enlarge the risk of explosion or fire.

7.4.2 Causes

Oxygen enrichment, as a result of liquefaction of ambient air, can occur, because the boiling point of oxygen is high (-183° C) than the boiling point of liquid nitrogen (-196° C).

7.4.3 Recommendation

Proceed as follows to prevent the risk of explosion in case of oxygen enrichment:

- do not smoke
- eliminate easily inflammable products from the area of vessel, if possible
- eliminate all sources of fire (flames, sparks, matches, lighters, etc.)
- premise of vessel must be continuously and adequate ventilated
- clean the floor regularly
- train personnel
- wear individual protection equipment
- check the oxygen content continuously
- always wear an oxygen meter

This list is not complete.

7.5 ENVIRONMENT OF VESSEL

7.5.1 The premise

The premise of vessel shall:

- enable safe operation for participants
- enable a safe refilling of vessel
- be continuously and adequate ventilated
- have a flat and non-porous floor, capable of resisting the maximum load of vessel
- include posters (safety data sheets) mentioning the dangerous properties of liquid nitrogen
- prevent access to unauthorised persons
- enable a good accessibility of vessel for inspection, cleaning and maintenance

This list is not complete.