Self-pressurized liquid nitrogen container

Instruction Manual

CONTENTS

GENERAL

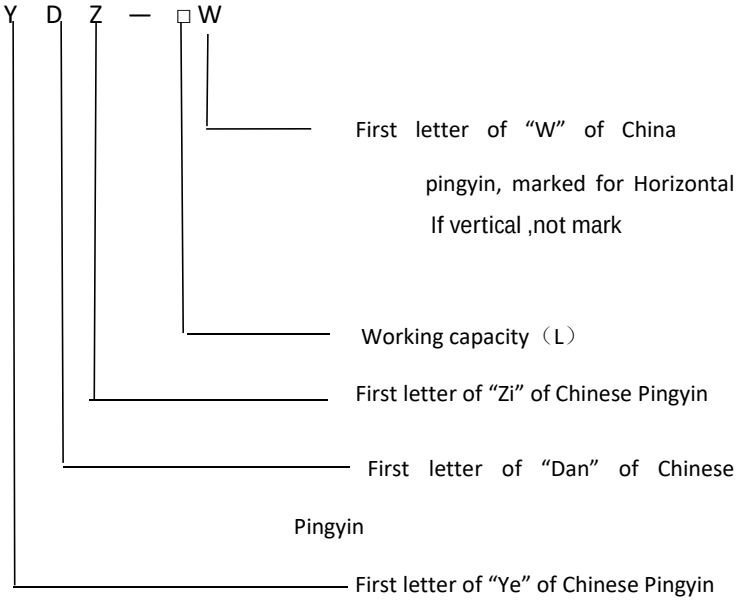
The series of self-pressurized liquid nitrogen container products produced by our company are widely used in animal husbandry, medical, scientific research, industrial and other departments, providing a good loading tool for the storage, transportation and supplement of liquid nitrogen.

Our company is a professional enterprise producing self-pressurized liquid nitrogen container. The company's products are produced in strict accordance with GB 16774-1997 "Self-pressurized Liquid Nitrogen Container" standard.

We warmly welcome customers to choose our company's products, and can undertake the design and manufacture of non-standard and special products. Our company has been adhering to the business philosophy of "quality first, technology leadership, honest service, innovative development", and do a good job in pre-sale and after-sale services.

THE PRODUCT MODEL COMPLIATION METHOD

Excerpt from GB 16774-1997 "Self-Pressure Liquid Nitrogen Container"



Example 1： YDZ-5 means 5L vertical self-pressurizing liquid nitrogen container with effective volume.

Example 2： YDZ-200W represents an effective volume of 200L horizontal self-pressurized liquid nitrogen container。

Schematic diagram of product structure and principle of self-pressurization

The container is mainly composed of the outer shell, the inner tank,

the transport vehicle, the drain pipe, various valves, pressure gauges, vacuum sealing joints, etc. (see Figure 1, Figure 2):

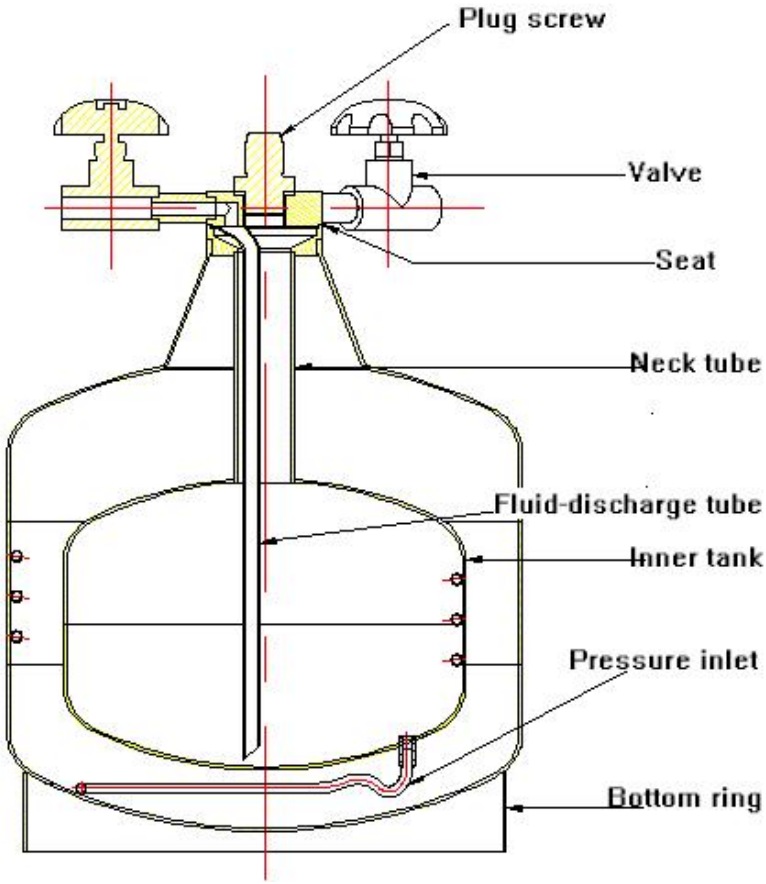


Figure **1** Product structure diagram

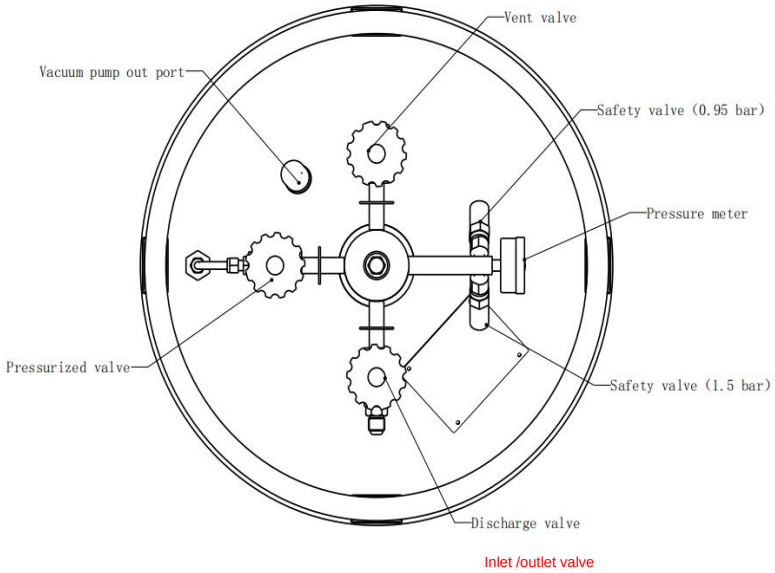


Figure 2 Valve diagram

The principle of self-pressurization:

When the tank is filled with liquid nitrogen, the drain valve, drain valve and booster valve are closed, and the screw plug of the liquid nitrogen injection port is tightened.

In the absence of any of the above, due to the heat transfer of the container shell to the booster tube, part of the liquid nitrogen that enters the tube by itself is endothermic and vaporized. When the pressure-increasing valve is opened, the vaporized nitrogen immediately enters the upper space of the liquid surface of the liner through the valve, and at the same time, the liquid nitrogen of the liner in the container continuously enters the pressure-increasing tube to absorb heat and vaporize. Since the volume of the vaporized

nitrogen is more than 600 times that of liquid nitrogen, a large amount of nitrogen source obtained after a small amount of liquid nitrogen is continuously passed through the opened pressure-increasing valve into the liner. With the increase of nitrogen intake, the nitrogen collected in the upper space of the inner gallbladder gradually began to generate pressure on the inner gallbladder wall and liquid surface. When the pressure gauge value reached 0.02 MPa, the drain valve was opened, and the liquid nitrogen would pass through the drain. The liquid pipe is discharged.

The main features of the product and the main role of the parts

1)The main features of the product are as follows:

1. Easy filling with liquid nitrogen：Just unscrew the screw plug of the liquid nitrogen injection port, you can use the liquid nitrogen machine fractionation tower discharge port or pipe perfusion.

2. The container adopts a pressurization method to pressurize the inner tank after a small amount of liquid nitrogen gasification. The operation is convenient, the pressurization is fast, and the purity of liquid nitrogen is ensured.

3. The container has high strength and is suitable for short distance transportation.

4. The discharge pressure of the container is extremely low, and a pressure gauge, safety valve and vacuum sealing joint are installed. Therefore, the container is safe and highly reliable in use.

5. The shell, liner and main parts are made of austenitic stainless steel, which has good vacuum and low temperature performance.

2) **The main functions of each part are as follows:**

1.Inner tank: Used to hold liquid nitrogen.

2. Screw plug: the seal of the liquid nitrogen injection port is connected by a thread and equipped with a low temperature resistant PTFE sealing ring to prevent nitrogen leakage and decompression.

3.Vent valve: deflate and reduce pressure as needed. When the screw plug of the liquid nitrogen injection port is unscrewed, the drain valve must be opened first to deflate the pressure. This valve should be opened when the container is not in use.

4. Booster valve: When opened, it can increase the pressure of the liner, and should be closed tightly when not in use.

5. Pressure gauge: used to indicate the pressure of the inner tank.

6. Safety valve: Control the liner pressure below the maximum working pressure. once the liner pressure exceeds the maximum working pressure, it will automatically open and exhaust pressure will be released.

7. Vacuum sealing joint: It is the suction port of the vacuum interlayer in the manufacture of containers. It has the effect of evacuation. and once the inner liner leaks and the interlayer produces internal pressure, it protects the inner liner and the outer shell from pressure.

Usage of products and others

(1) Instructions for product use

1. Before using the product, the user should open the box to check whether the appearance quality and accessories are complete. If the appearance of the container is defective or the accessories are not uniform, return this information to our company within 5

working days after receiving the product. Agents and distributors will be subject to the relevant provisions of the agent and distributor agreement.

2. The product belongs to a high-vacuum and low-temperature container. It is recommended that the user implement the operation by dedicated personnel, and read this instruction manual thoroughly and operate according to the instructions.

3. Due to the extremely low temperature of liquid nitrogen (-195.8 ℃), please wear leather gloves when operating, and do not wear long boots to prevent the liquid nitrogen from falling into the shoe and freezing the foot.

4. The container should be protected from direct sunlight and stored in a cool and ventilated place. During operation, doors and windows should be opened in the room to ventilate and ventilate to avoid suffocation due to lack of oxygen in the room.

5. The vacuum sealing joint is sealed before the product leaves the factory, and is protected with a vacuum sealing joint cover. It is strictly forbidden for the user to remove the vacuum sealing joint cover.

6. The container is equipped with a safety valve. The setting pressure of the safety valve has been adjusted before leaving the factory. The safety valve is sealed with lead. The user must not disassemble it when using it. If it is disassembled, our company will not guarantee it.

7. In order for the pressure gauge to indicate the accuracy of the pressure, its accuracy must be checked regularly, and at the same time, please do not hit the dial to avoid deformation and cause error

in the displayed value.

8. The pressure-increasing valve and emptying valve can control the pressure inside the container, and the discharging valve can control the flow rate of discharged liquid nitrogen. When using, do not turn the handle too tight to avoid damaging the valve. At the same time, please pay attention to the rotation direction of the valve handle: counterclockwise rotation is open, and clockwise rotation is closed. When not using the container, be sure to close the boost valve and open the drain valve at the same time.

9. When the pressure gauge indicates that there is internal pressure in the liner, the screw plug of the liquid nitrogen injection port cannot be unscrewed. The drain valve should be opened first to release the pressure on the liner.

10. The screw plug of the liquid nitrogen injection port is a sealing part during pressurization. After the liquid is drained, the thread is easily frozen and not easily twisted. At this time, waiting for the ice thawing naturally or heat it by warm wind.

11. The screw plug does not allow foreign objects to enter. If the screw plug is lost, please contact our company to buy it. It cannot be replaced by other parts.

12. When the drain metal hose is in use, if the bending radius is too small, it will be damaged.

13. Welding is not allowed on the surface of the container.

14. Since this product involves multiple professional technologies, the container can only be returned to our company for inspection and maintenance after a failure.

(2) Operation and use of products

1.Liquid nitrogen filling :First open the drain valve, close the boost

valve and drain valve to reduce the pressure gauge of the container to zero, and then use a wrench to remove the liquid nitrogen injection port plug.

Fill the container with liquid nitrogen through pipes. Or use a liquid nitrogen machine to fill the container with liquid nitrogen. Note: When filling the container with liquid nitrogen, for safety reasons, it cannot be completely filled, and a certain gas phase space must be left, which is about 10% of the geometric volume of the container.

2. Boost

When discharging liquid nitrogen, the pressure of the liner needs to be increased. When pressurizing, the drain valve and drain valve should be closed, open the boost valve, and observe that the pressure will gradually increase.

The maximum working pressure gauge value of the container is 0.09 MPa, but in order to reduce the loss of liquid nitrogen as much as possible, it is generally sufficient to increase to 0.05 MPa, which is more economical.

When the pressure increases to 0.02 MPa, the liquid can be discharged. If only a small amount of liquid nitrogen is needed, it is not necessary to open the booster valve. when continuous discharge is required, the booster valve should be opened at the same time.

After opening the booster valve, there are several frosts in the lower part of the casing. This is not a malfunction, but a normal phenomenon of the container working. When the liquid nitrogen in the container is full (but still has 10% of the geometric volume of the container

Gas phase space), the time required to pressurize to 0.05 MPa is about 20 seconds. when the storage capacity of liquid nitrogen is 3/4, the time required to pressurize to 0.05 MPa is about 1 minute. when the storage capacity of liquid nitrogen is 1 / 4 hours, the time required to pressurize to 0.05 MPa is about 8 minutes. As the liquid nitrogen in the container decreases, the time required for pressurization will increase.

3. Discharge(inlet or outlet)

First screw the metal hose (accessory) into the drain valve interface, close the drain valve, and open the booster valve. When the pressure in the liner rises to a pressure gauge value of 0.05 MPa, open the drain valve and the liquid nitrogen will Discharge. when the pressure of the pressure gauge is 0.05 MPa, the discharge is more economical. if the pressure gauge of the liner pressure is greater than 0.05 MPa, the discharge of liquid nitrogen will increase accordingly.

4. Pressure relief

After the discharge of liquid nitrogen is completed, the booster valve and the drain valve should be closed, and then the drain valve should be opened to release the pressure in the container.

5. The container is stored at rest

In order to prevent moist air from entering the container, forming ice particles, and blocking the booster tube, the liquid nitrogen injection port plug, booster valve, and drain valve can be closed and the drain valve can be opened.6. Container moving

a) Move indoors. The container is equipped with four high-strength universal casters, which can be easily moved indoors.

Because the product is a high vacuum, it should be slow to avoid impact or collision when moving. Otherwise, it will not only sag the container shell and reduce performance, but also cause damage to the internal structure of the container.

b) Lifting. The product is a high-vacuum container. Before lifting, wrap the wire rope on the support ring. when lifting, it should be vertical and stable.

During the operation of the product, the opening and closing status of each valve is shown in Table 1:

Table 1 State of the valve

Operation	**Valve**		
	Discharge valve	**Vent valve**	**Pressurized valve**
Liquid nitrogen filling	Open	Open	Close
Pressure improving	Close/open	Close	Open
Discharge	Open	Close	Close/Open
Pressure discharge	Close	Open	Close
Container statics stored	Close	Close	Close
Middle and far transport	Close	Close	Close
No liquid nitrogen stored	Close	Close	Close

(3) Other

1. Technical operation of melting ice and thawing

During the long-term use of the container, the inner tank will slowly accumulate humid air, and the moisture in the humid air will form tiny ice particles at a low temperature. Such tiny ice particles attached to the wall of the tube will block the booster tube and the

discharge tube. If the corresponding ice melting measures are not taken at this time, the following adverse consequences will result:

a) The supercharging is very slow or not at all.

b） Despite the internal pressure, the liquid discharge is slow or no liquid nitrogen can be discharged at all.

In order to extend the time between melting ice, the following must be noted:

a) During the filling process, the filling time should be shortened as much as possible to reduce the accumulation of humid air into the container.

b) The container must close all valves without storing liquid nitrogen to prevent moisture from entering the container。

Once the booster tube is blocked by ice particles and cannot be boosted, the following ice melting measures can be taken:

a) First remove the residual liquid nitrogen in the container by air pressure method. The method is: tighten the screw plug of the liquid nitrogen injection port, close the booster valve, open the drain valve and the drain valve, and pressurize the container with nitrogen or dry gas (forbidden oxygen or other flammable gas) from the drain valve to the container So that the residual liquid nitrogen in the container is drained through the drain valve. If it is found that the drain valve is blocked, you can remove the drain valve and observe whether there is ice blockage at the corner of the valve seat screw hole and the drain valve body. If there is a blockage, use a hard wire to remove the ice particles, or use an electric blower Or after the hot blast dryer melts the ice (temperature is not greater than 40 ℃), then drain.

b) In the case of draining the liquid nitrogen in the container,

close the drain valve, remove the external pipe of the booster valve (dotted line in Figure 5), and use normal temperature or hot air not more than 40 ℃ with a pressure of about 0.05 MPa Continuously injecting from the evacuation valve for several hours, when it was observed that the water-free bead gas sprayed from A gradually increased, indicating that the pressurizing tube was unblocked, and the ice melting and dewatering work was completed.

Note: Due to the differences in humidity, frequency of use of containers, and filling methods of liquid nitrogen, the interval of ice melting measures can be handled by the user at his discretion.

2. The method of measuring the amount of liquid nitrogen in the liner

a) Liquid level ruler estimation method. When in use, insert the liquid level gauge into the container until the liquid level gauge comes into contact with the bottom of the liner, let it stand for 15 seconds and then take it out to expose the liquid level gauge to the air. Since the part of the liquid level gauge soaked with liquid nitrogen will form a layer of white frost in the air, from the boundary of the white frost, the storage capacity of liquid nitrogen can be roughly estimated.

b) Weighing method. Using a weighing instrument, measure the mass of the liquid nitrogen in the container, and subtract the empty weight of the container in Table 1 of this specification to know the mass of liquid nitrogen in the container, from which the volume of liquid nitrogen can be calculated (liquid nitrogen density is about 0.825 kg / L). The accuracy of this method is higher than that of the liquid level ruler estimation method.

Faults and troubleshooting methods (see Table 3)

Table 3 Product faults and troubleshooting methods

N/M	malfunction	the reason	elimination method
1	The handles of booster valve, emptying valve and drain valve are too tight.	There is moisture or ice particles in the valve.	If it is in use, the valve can be heated with a hair dryer as a temporary measure. After the liquid nitrogen in the container is drained, the valve is opened to remove moisture or ice particles.
2	Leakage at the connection between the drain valve, drain valve and valve seat.	The valve stem and valve body are leaking at the joint, and the gasket or sealing material is damaged.	Replace the PTFE sealing ring or thread sealing material at the joint.
3	Although the booster valve is closed, the pressure in the container still rises slowly.	The booster valve is leaking or not tight.	1. Re-close the valve. 2. Replace the PTFE sealing ring or thread sealing material of the connection part.
4	The pressurization time is long or cannot be pressurized at all.	1. The booster tube or booster valve freezes. 2. Air leak.	1. Perform ice melting and dewatering operations. 2. Mix the soap with water, check the suspected air leak, and eliminate the leak.
5	Despite the internal pressure, the discharge rate is slow, or the liquid cannot be discharged at all.	1. The drain pipe or drain valve freezes. 2. There is no liquid nitrogen in the container.	Perform ice melting and dewatering operations or filling liquid nitrogen.

6	The internal pressure of the container has reached 0.09MPa or more, once The safety valve still does not open.	1. Safety valve freezes. 2. The setting pressure of the safety valve is shifted.	1. Melt ice to remove water. 2. Remove foreign objects on the sealing surface. 3. Send the manufacturer to readjust the constant pressure.
7	After the safety valve is opened, the pressure in the container drops below the set pressure, the spring cannot be reset, and the valve continues to spray gas.	1. Safety valve freezes. 2. There are foreign objects on the sealing surface of the safety valve. 3. The setting pressure of the safety valve is shifted.	1. Melt ice to remove water. 2. Remove foreign objects on the sealing surface. 3. Send the manufacturer to readjust the constant pressure.

Product quality assurance scope

The self-pressurized liquid nitrogen container products produced by our company under normal use，

Within twelve months from the date of shipment (that is, the three-guarantee period), if it is found that the use of the product is indeed affected by the use of the product, it shall be implemented as follows:

1. When the container is tested before the first use, if the daily evaporation rate of the container liquid nitrogen is greater than the national standard, our company is responsible for free maintenance or replacement.

2. The product is determined to be a quality problem in our

company's manufacturing, and our company is responsible for inspecting or repairing the product.

3. If repairs or replacements are required, the container with complete accessories, as well as the product certificate with matching serial number and a copy of the shopping voucher must be sent back to the company for inspection.

If one of the following situations occurs, our company will not implement guarantees:

1. Over the warrant.

2. Any one of the spool seal and the safety valve lead seal is damaged.

3. If the user does not have complete accessories for shipping the container, or the container is shipped without a copy of the product certificate or shopping certificate.

4. Failure to use the product in accordance with the instructions for use of the product and the requirements of the relevant regulations, causing damage to the product, such as depressions in the outer shell of the container, corrosion of the liner, deformation due to internal pressure, etc.

For the products out of the warranty, we'll do our best to repair it for our customers, and just ask for the cost。

Test and calculation method of product daily evaporation rate

1. The daily evaporation rate of the product is tested by weighing method.

2. The test needs to be conducted at an ambient temperature of 20 ℃ ± 3 ℃ and normal pressure. At the same time, the test cannot

be conducted in a directly ventilated site.

3. The test should be carried out under the condition that the liquid nitrogen filling rate of the container is not less than 50% and the static pre-cooling time is 48 h. The test time is 3 days.

4. The maximum weight of the weighing instrument used in the weighing method should not exceed 5 times the total mass of the product when it is filled with liquid nitrogen, and its accuracy should be better than or equal to one third of 3,000.

5. The daily evaporation rate α of the product is calculated by the following formula:

$$\alpha = \frac{q_m}{m - m_e} \times 100$$

α — Daily evaporation rate，%；

q_m — The average daily evaporation calculated using the total mass of liquid nitrogen lost within 3 days，kg；

m — The total mass of the product after being filled with liquid,kg；

m_e — Product empty weight，kg。

Note: The test and calculation of the daily evaporation rate of the product are carried out in accordance with the GB 16774-1997 standard. When the test is not performed according to the above-mentioned ambient temperature and atmospheric pressure, or the minimum division value of the measuring instrument is different from the standard requirements, the calculated value may deviate from the actual daily evaporation rate of the product.