Liquid Nitrogen Filling Machine

Tin containers are being gradually replaced by ring-pull aluminum containers and plastic containers, and should be pressurized to avoid container body deformation. An ideal scheme is to fill liquid nitrogen, and when the liquid nitrogen is gasified therein to expand the volume thereof by 700 times, the air therein is expelled to not only produce vacuum, but also increase the internal pressure of the container body, thus prolonging the guarantee period of the container body and meanwhile keeping the round complete appearance for convenient transportation and storage. After referring to and imitating the advanced equipment at home and abroad, our company has developed the product to fill the industrial vacancy.

With the container-free non-nitrogen filling capability, the product can accurately control the liquid nitrogen quantity and is provided with the control system composed of Siemens PLC and touch screen. With the features of simple, convenient and easy setting, small appearance and convenient installation, the product can support any production line and is provided with vacuum liquid nitrogen heat-insulated pipes to maximally ensure the minimum liquid nitrogen consumption and the condensation-free environment.

Specification

Rated input voltage: 110VAC-60Hz/220VAC-50Hz +/-10%

Current: <=5A

Humidity: relative humidity 0%-100%

Operating elevation: the product can work at the elevation of about

3050m (10000FT).

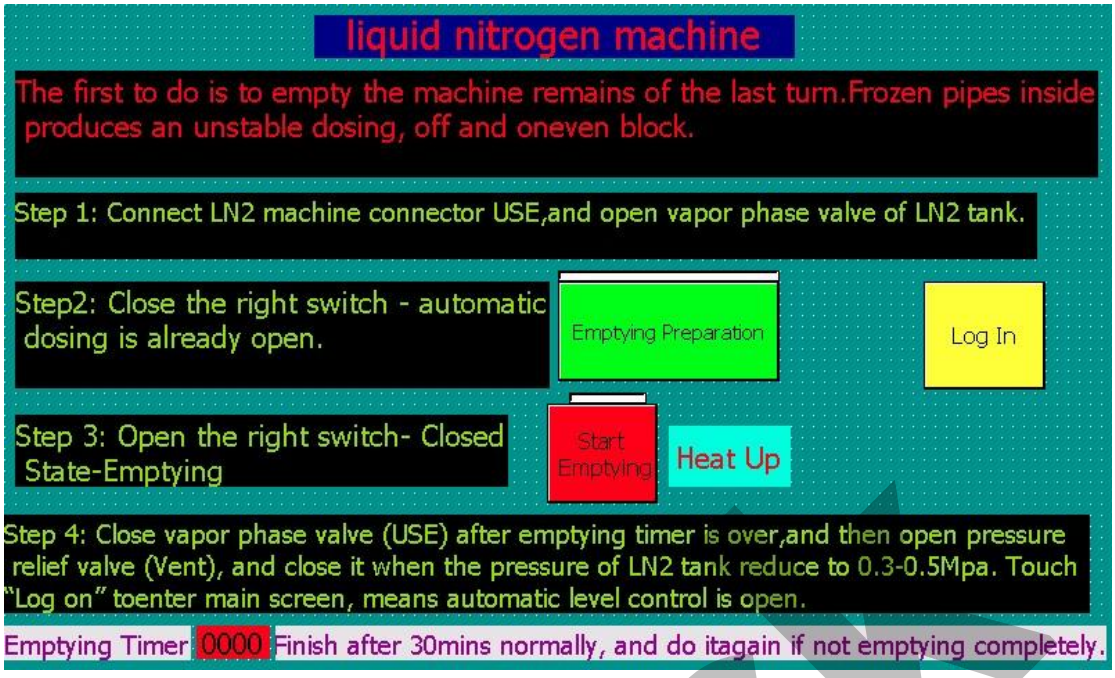
Noise: continuous noise <=78dB(A)

Total weight: 32KG

Capability: the filling speed is 50~2000 containers/min, and the starting speed for continuous filling is settable.

Operating conditions:

1. Liquid nitrogen supply: adjust to **15 (0.1MPa)** and connect to the liquid nitrogen port.
2. Compressed air or nitrogen: it is supplied to the filling valve. The pipeline with the diameter of **¼"** and the pressure range of **50-100 psig (3.4-6.9 bar)** should be provided. The pressure should be set as **50 psig (0.35MPa)**, and high pressure may cause large impact, thus unfavorable for the service life of the filling valve element and the internal vacuum pipeline.



Picture I

Starting up and Preparation:

1. Connect to AC 220V power supply and turn on the main power switch on the panel to display Picture I after half a minute.
2. If the sealing measure for moisture prevention is not provided on the previous day after production, the temperature must be returned for water removal for 30min for the production on the next day; or else, the icing of the internal pipeline can easily cause such hidden dangers as instable filling and even cause discontinuous liquid nitrogen supply or liquid nitrogen blockage under severe conditions.
3. Step 1: Connect LN2 machine connector USE,and open vapor phase valve of LN2 tank.

4. Step2: Close the right switch - automatic dosing is already open 

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5. Step 3: Open the right switch- Closed State-Emptying 

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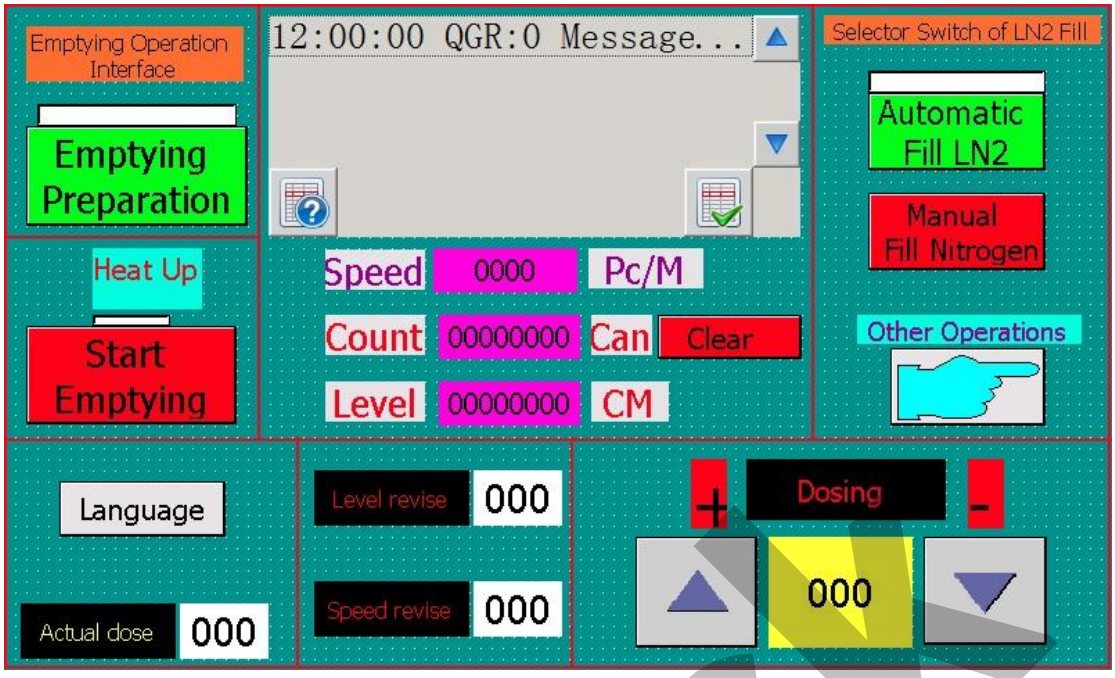
6. Step 4: Close vapor phase valve (USE) after emptying timer is over,and then open pressure relief valve (Vent), and close it when the pressure of LN2 tank reduce to 0.3-0.5Mpa. Touch “Log on” toenter main screen, means automatic level control is open.

Step 4: Close vapor phase valve (USE) after emptying timer is over,and then open pressure relief valve (Vent), and close it when the pressure of LN2 tank reduce to 0.3-0.5Mpa. Touch “Log on” toenter main screen, means automatic level control is open.

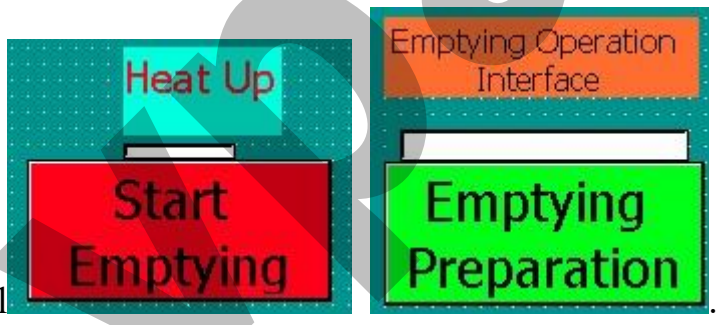
4. 

Click to enter Operating Picture II.

Operating Picture:



Picture II

1. Interruption of temperature return for water removal: the automatic set time of the system is 30mins. Click any one of the following buttons to interrupt the process of temperature return for water removal 

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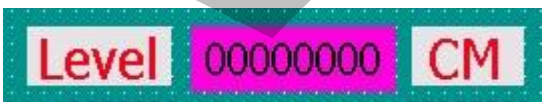
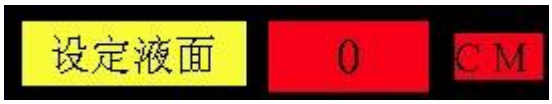
2. 

refers to the height of the liquid inside the liquid nitrogen machine, unit: cm.

3. 

is used for controlling the liquid height, namely setting the liquid level height.

4. 

is used for displaying the

present speed.

5. 

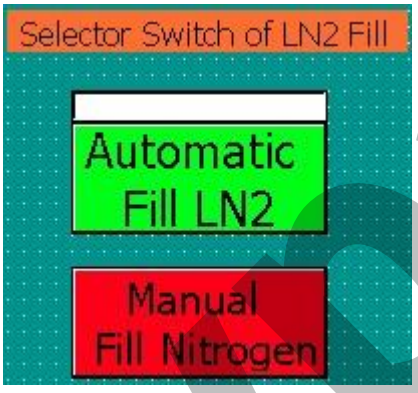
is used for displaying the present output.

6. 

is used for clearing the present output.

7. 

is used for setting the dosing, unit: ms.

8. 

refers to the external liquid level control switch. In actual application condition, the liquid nitrogen machine is internally provided with floating ball for automatic liquid level control, so this switch is normally opened.

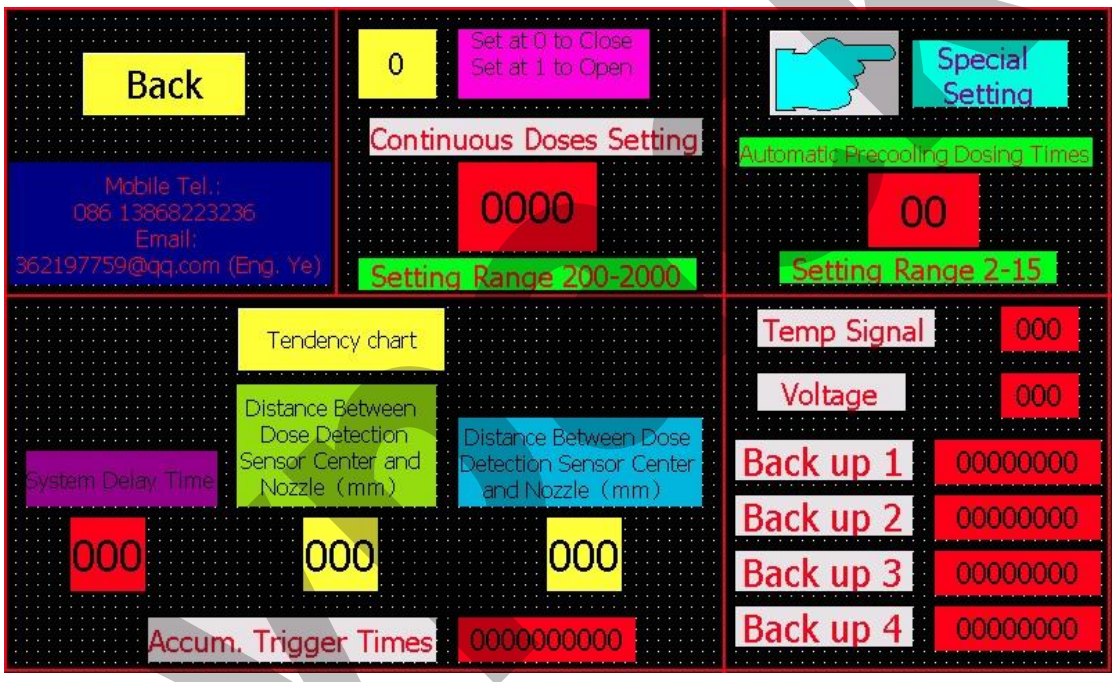
9. 

is used for setting the next menu.

10. 

refers to the alarm display bar.

Basic Parameter Setting:



Picture III

1. 

refers to the accumulative output count, and the output cannot be cleared.

2. 

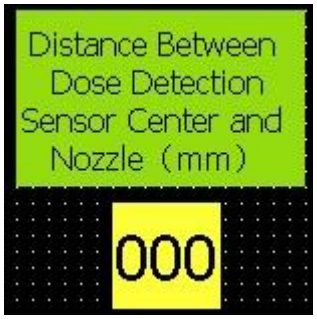
: when the filling speed is above the set speed for 5s, the system will automatically switch to the continuous filling state and the air cylinder for controlling the liquid nitrogen filling operation will be under the opened state all the time till the filling speed is kept at the set speed for 5s; afterwards, the system will recover to the single filling state.

3. 

is used for setting the automatic precooling dosing times.

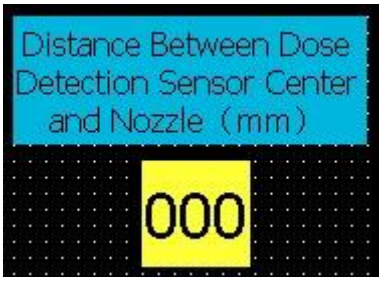
4. 

refers to the system delay time ---- fixed time between 10ms and 40ms.

5. 

refers to the distance between two adjacent

containers before entering the filling head, unit: mm.

6. 

refers to the distance between the dose detection sensor center and the filling head center, unit: mm.

7. 

is used for special setting.

1. The setting is mainly used for the non-uniform filling caused by the unchanged dosing under the changed production speed. Specifically, when the production speed is accelerated, the consumed time is shorter, the consumption is smaller and the sealed pressure is fairly higher; when the production speed is reduced, exposure can result in more consumption and the sealed pressure is correspondingly reduced. Therefore, in case of speed reduction, the liquid nitrogen dosing should be properly and necessarily increased for consumption supplementation.
2. As shown in the above figure, from higher speed to lower speed, the dosing should be properly increased according to the actual production in order to ensure that the pressure of the sealed container is basically balanced under different speeds after liquid nitrogen supplementation.

1. Maintenance

Daily maintenance steps:

Periodic detection: check whether the valve rod is worn and whether the sealing ring and the rubber mat are aged, and replace the parts as needed; check the sealing property of the external pipeline, timely replace the abnormal parts discovered thereby, and check whether the magnetic valve for filling control and the air cylinder have air leakage or slow action and whether the magnetic valve for liquid filling is unobstructed.

Troubleshoot and solution:

Operation failure of automatic filling valve:

1. The filling switch on the power distribution cabinet is turned off, so it is necessary to clockwise turn on the filling switch.
2. The filling suspension switch on the touch screen is activated, so it is necessary to press this button again to switch to the automatic filling state.
3. The speed tracking proximity switch is not effectively detected or is

damaged; the filling frequency is based on speed feedback and tracking; when the proximity switch fails to obtain a detection signal, the speed is determined according to the last shutdown feedback, and the detected speed is probably very low, and the container is detected to be not timely and accurately filled.

4. Check whether the pressure of the gas source reaches 0.35MPa---0.7MPa.
5. Check the magnetic valve and the pneumatic connection thereof, and if necessary, replace the corresponding parts.
6. Check whether the valve rod and the original pneumatic parts are worn or polluted by water vapor, because water vapor can be iced to block the normal movement of the valve rod.

Unsmooth or failed operation of filling valve:

1. The valve of DURA container at the front is not opened, or the magnetic valve for liquid filling is not opened or damaged.
2. DURA container has too low pressure, so it is necessary to check whether the liquid nitrogen is sufficient or the pressurization setting is too low.
3. Check whether the delivery pipeline has ice blockage.
4. Check whether the nozzle has ice blockage.
5. Check whether the magnetic valve for liquid filling is abnormal.

Filling port icing:

1. The heater at exit is under idle state, so it is necessary to check whether the plug is correctly connected and whether the plug indicator light is normally turned on: if the indicator light is turned on, then the heater damage is indicated and the heater should be replaced.
2. The nozzle is loosened, and the nozzle thread should be completely and correctly locked to 11.3N/M, wherein insufficient torsion may cause liquid leakage and excessive torsion may break the nozzle.
3. Check whether the nozzle seal is damaged and has liquid leakage, and if necessary, replace it by a new nozzle.
4. Observe whether the liquid nitrogen from the nozzle has severe furcation or flows to the heating device at the external edge.

Exhaust port icing:

1. At the moment of the main machine entering the cold state, the exhaust port has very high flow and the heat exchange cannot follow the exhaust cooling speed to cause icing phenomenon; along with the increase of the liquid level, the ice at the exhaust port will be gradually melted after sufficient precooling.
2. Check whether the plug indicator light of the exhaust port is turned on, and replace the heater as needed.

Filling valve leakage:

1. The exit end of the filling valve is iced or polluted to influence the

normal movement of the valve rod and cause the gas leakage, so it is necessary to take down the valve rod, check whether it has surface damage, replace the valve rod as needed, completely remove the pollutants on the valve rod and the nozzle and dry them, and install the valve rod again.

2. The nozzle is loosened, and the nozzle thread should be completely and correctly locked to 11.3N/M, wherein insufficient torsion may cause liquid leakage and excessive torsion may break the nozzle.
3. Check whether the nozzle seal is damaged and has liquid leakage, and if necessary, replace it by a new nozzle.

Liquid level fault:

Dissatisfied liquid level:

1. Please check whether DURA container has sufficient pressure, and replace it by DURA container with sufficient liquid nitrogen as needed.
2. Check whether the liquid delivery pipeline has ice blockage and adopt the gas phase of DURA container for the temperature return and drying treatment of the liquid delivery pipeline till the internal water vapor is completely drained, wherein this process takes a long time. Note: the pressure increasing valve must be adjusted to the pressure above 0.3MPa in order to make the gas phase temperature

of DURA container approximate to normal temperature, and the low gas phase temperature is unfavorable for temperature return and drying.

3. Check whether the valve element and the floating ball for liquid level control are normal, because they may have ice blockage; adopt the gas phase for drainage and drying treatment as mentioned in above item.

Overflow of liquid nitrogen from exhaust port:

1. Check whether the floating ball has ice blockage and implement the drying and drainage treatment as needed.
2. Check whether the liquid level control valve element is damaged or has ice blockage, and implement the temperature return and drying treatment as needed.

The filled container has too low pressure:

1. Observe the synchronicity of the filling valve to judge whether it is synchronous.
2. In case of synchronization failure, install the synchronizer and adjust the steps and the time delay.
3. In case of normal synchronization, increase the filling time delay.
4. If the synchronization is not improved through time delay increase,

please adopt the nozzle with larger diameter.

The filled container has too high pressure:

1. Reduce the filling time;
2. If the filling time is less than 15ms but the pressure is still too high, please adopt the nozzle with smaller diameter.

Large pressure difference among the filled containers:

1. Check the liquid levels of the containers, wherein the large liquid level difference may cause large internal pressure difference.
2. Check whether the filled liquid nitrogen flowing to the front cover is more or less taken away from the container due to the large waggle, wherein the inconsistency of the liquid nitrogen taken away can directly cause large pressure difference among the containers.

Notice:

1. **All pipelines used for the first installation of the complete machine must be dried and drained for more than 2h; or else, ice blockage may appear to cause filling fault.**
2. **Implement periodic inspection and drying & drainage treatment as needed**

in order to ensure filling accuracy and stability.

3. **As a common phenomenon for the filling machine, the severe ice blockage can influence the normal operation of the filling machine, so it is necessary to ensure the cleanliness of the filling machine. Since the water vapor can easily cause ice blockage during shutdown state, please do not cut off the power supply for short-time shutdown and continuously heat the filling port to prevent water vapor from entering.**
4. **When cleaning the complete machine and carrying out the drainage work, it is necessary to ensure the complete drainage of the liquid nitrogen in the filling machine.**