河北润丰
HEBEIRUNFENG

Microbulk Tank Instruction Manual

Manufacturer:

Hebei Runfeng Low Temperature Equipment Co., Ltd

Catalogue

Statement: the attached table and the text are of equal importance.

Please read them carefully

Part I. Foreword

1. General situation

This manual of microbulk tank is applicable to all conventional cryogenic microbulk tank provided by Hebei Runfeng Low Temperature Equipment Co., Ltd, which includes information about safe operation and the treatment of liquid nitrogen (LN2), liquid argon(LAR), liquid oxygen (LO2) and liquid natural gas (LNG) by microbulk tank. Anyone operating this equipment must thoroughly read and understand the contents of this manual. If you have any questions about the operation of microbulk tank, please contact the customer service department of Hebei Runfeng. The address is:

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The purpose of this manual is to provide users with all necessary information related to the installation, operation and maintenance of microbulk tanks.

Throughout the manual, reference codes are used when explaining the function, operation or maintenance of components, so as to attract special attention to components.

See the third part for the safety regulations on the operation and handling of microbulk tank and the transportation of cryogenic medium. This part can be used as a "safety checklist" for each use of the equipment.

2. Note

For the products of Hebei Runfeng, the customer changes the relevant accessories on the equipment without the consent of Hebei Runfeng. If there are related technical or safety problems, the company will not bear any responsibility. The pressure gauges and safety accessories configured by microbulk tank must be used within the validity period of calibration.

3. Terminology

The terms of safety precautions in this manual are expressed as follows:

Warning: It means that under certain conditions, it can cause personal injury or death.

Note: It means that under certain conditions, the equipment or components will be damaged.

Remark: It indicates that the content is important and needs to be emphasized or repeated.

Part II. Security

1. Prompt

Microbulk tank is composed of a carbon steel (or stainless steel) vacuum shell and a pressure vessel placed inside it. Microbulk tank can operate at low to medium pressure according to actual design requirements. The explosion-proof disc and double safety valve can protect microbulk tank in the case of excess pressure. The safety pressure relief device is used to protect the built-in pressure vessel and vacuum shell. Its use and model are determined in accordance with GB150 and the "Solid Capacity Regulations". It includes a double safety relief valve used to protect the built-in pressure vessel and The bursting disc device, microbulk tank is designed and manufactured according to safety, reliable operation and strong durability (can operate without trouble for many years). When operating microbulk tank, correct safety and operating regulations must be strictly observed. We recommend that our customers emphasize safety and safe operating regulations to their own employees and users, and that everyone who operates the microbulk tank carefully read all "Warnings" and "Cautions" listed in this safety section and manual. It is very important to read the relevant content in the Oxygen and Inert Gas Safety Manual. It is recommended to review these safety points regularly.

Warning: In an environment full of oxygen, flammable materials will burn violently and may explode. Excessive accumulation of oxygen will make the surrounding area full of oxygen. By definition, an oxygen accumulation amount exceeding 23% indicates that the surrounding area is full of oxygen. Some parts are considered not to be toxic in the air. Burns, but may burst into flames immediately in the presence of oxygen. All organic matter and other combustible materials should be removed so that they do not come into contact with oxygen. In particular, do not allow oil, grease, kerosene, cloth, wood, paint, asphalt, coal, dust or dirt that may have oil or grease to come into contact with oxygen. No smoking or open flames are allowed in any area where oxygen is stored, transported or used. Failure to observe this warning may result in serious personal injury.

Warning: The volatile gases of nitrogen and argon in the air will reduce the oxygen concentration required to sustain life. In this oxygen-deficient environment, it can lead to unconsciousness, serious injury, and even death.

Warning: Before disassembling any part or loosening a joint, first observe where the part is located and whether the liquid it contains must be drained or whether the pressure of the volatile gases simply needs to

be released in a safe manner. External valves and connections can become very cold and can cause frostbites if not properly protected. Protective gloves and eye protection must be worn at any time when disassembling components or loosening connectors. Failure to comply with this requirement can result in personal injury due to extreme cold and internal pressure within the microbulk tank.

Warning: Be careful not to splash or spill liquids when handling them. If liquefied gas comes into contact with skin or eyes accidentally, it can cause frostbite similar to burns. Protect eyes, skin and other places that are likely to come into contact with liquids, refrigeration pipes and refrigeration equipment or refrigeration gas. If there will be liquid spray or splash, or freezing gas will be ejected strongly from the equipment, wear protective goggles or face mask. It is recommended to wear easy-to-take off protective gloves and long sleeves to protect your arms. Wear no hoops. Wear long pants with the legs covering your shoes to block spilled liquids.

Warning: If liquid oxygen is splashed on your clothes, you must blow dry or take off your clothes immediately. Leaving liquid oxygen on clothes can easily ignite the clothes and catch fire. Clothing with liquid oxygen on it is not safe for at least 30 minutes.

Note: Only use replacement parts that are compatible with liquid oxygen. The parts must be cleaned. Do not use regulators, connectors, hoses, etc. that have been used in a compressed air environment. Likewise, do not handle compressed air with oxygen equipment. Failure to comply with these regulations can cause serious damage to the tank.

Note: Know all local safety standards before installing oxygen equipment.

Note: To prevent overturning, don't make microbulk tank stand upright before fixing it on the base (fixing it on the base with footbolts). The transportation and erection of microbulk tank should be carried out in accordance with the existing hoisting regulations of Hebei Runfeng. Failure to comply with these regulations may lead to serious damage to the tank and even overall failure.

2. Security manual

Cryogenic vessels must always meet the requirements of various unpredictable environmental conditions. This security manual is intended to remind you that security regulations must be strictly followed whenever an accident occurs in a cryogenic vessels due to damage to the vessel or its safety device. This also applies if at any time there is doubt about the integrity or functioning of the vessels.

Strictly abide by the regulations. Once the vessel is damaged or suspected to have problems, the liquid in the vessel should be carefully discharged as soon as possible. Under no circumstances should the liquid

remain in the damaged vessel. Moreover, damaged or suspicious vessels shall not be refilled before repair and inspection.

Accidents that need to comply with this regulation include: accidents in transit, immersion in water, exposure to overheating or fire, and bad weather conditions (earthquake, typhoon, etc.). As a rule, whenever a vessel is suspected of having problems or actually damaged, it must strictly abide by the safety regulations.

If you know or suspect that there is a vacuum problem in the vessel (even if the above-mentioned situation does not appear), please do not continue to use the device. If you continue to use the cryogenic vessel with vacuum problems, the vessel will be brittle and broken. Moreover, if the device is under excessive pressure due to internal liquid leakage, the carbon steel shell may be broken.

Before reusing the damaged vessel, the whole device must be tested, identified and repaired. It is suggested that the damaged vessel be returned to Runfeng for maintenance and identification.

3. Insufficient oxygen

The normal content of oxygen in the air is about 21%, which is potentially harmful whether it is due to combustion or inert gas. Operators should take appropriate protective measures.

One of the possible hazards is that the content of oxygen in the air is only 8-12%, which affects people. In this environment, people will faint immediately without any signs.

If the oxygen content in the air drops to 15-16%, the common combustible substances (including those commonly used as fuel for heating or lighting) will be extinguished. When the oxygen content is slightly lower than this concentration, individuals can't make a clear judgment on the condition of the air they breathe, because symptoms such as drowsiness, fatigue, listlessness, loss of coordination ability, misjudgment and confusion may be covered up by a state of "abnormal excitement", which makes the victims mistakenly think that they are in a safe and good state. Being in the air with oxygen content of 12% or lower will cause people to be in a coma immediately. Because of the sudden occurrence of coma, the operators are basically unable to help themselves. This may happen if the environmental conditions suddenly change or the oxygen gradually decreases.

People working in an oxygen-deficient environment should form an "assistance group". Obviously, if the "assistant" enters the scene to help the comatose colleagues, they will also be suffocated if they are not equipped with portable air transport facilities. The best protective measure is to equip all operators with portable breathing facilities, and only when the scene is basically unobstructed and the operators can easily

help each other can they use lifeline.

If it is suspected or known that oxygen in the air is decreasing.

1. An "assistance team" should be formed, with at least two "assistance personnel", so that the operators in distress can be separated from the scene of the accident when necessary.

2. Both operators and "assistants" must be equipped with portable or pipeline air breathing equipment.

Cleaning to meet the requirements of oxygen operation

If replacing parts, only parts that are compatible with liquid oxygen and have been cleaned accurately and can be used for oxygen operation should be used. Regulators, joints or hoses that have been used in compressed air environment should not be used on these "Aztec". Only oxygen-compatible sealants and Teflon tapes can be used for threaded joints, and Teflon tapes can only be used for aluminum threaded joints. All new pipe joints should be tested for leakage with oxygen-compatible leakage testing agents. If degreasing is needed, compatible solvents should be used.

3. Excess oxygen

Once the content of oxygen in the air rises to more than 23%, there will be excess oxygen (oxygen-enriched environment). Although oxygen is a non-combustible gas, combustible substances are easier to be ignited in the environment of excess oxygen than in the general air environment, and even if the total heat does not increase, the combustion speed will be accelerated.

It is important to place the oxygen operating device in a well-ventilated area. This is because during the operation of the safety pressure relief device or during the leakage of the operating device, oxygen will gather in a certain limited area, forming a temporary oxygen surplus environment.

The parts and components of oxygen operating device include (but are not limited to) vessels, valves, valve seats, lubricating oil, joints, gaskets and internal connection facilities. These parts and components should be fully compatible with oxygen under the conditions of temperature and pressure, because the parts and components under such conditions may be placed in oxygen-containing vessels and in the environment where oxygen is used. Besides the materials that are allowed, listed, tested and proved by past experience, flammable materials should be avoided.

Compatibility includes flammability and flammability. Under normal pressure, substances burn more violently in pure oxygen environment than in air, and will explode in pressurized oxygen environment. In addition, many substances that will not burn in the air will burn in pure oxygen, especially under pressure. The metals used to make vessels and pipes must be carefully selected according to their service conditions.

All kinds of steel can be used for many purposes, but some service conditions require other materials (usually copper or aluminum alloy) because of their high flame retardancy and low flammability.

Similarly, materials that can be ignited in air have a low ignition point in oxygen, and many of these materials may be ignited due to friction at the valve seat or valve stem gasket, or due to adiabatic compression when hyperbaric oxygen is rapidly introduced into a device with low initial pressure.

4. Nitrogen and argon

Nitrogen and argon (inert gas) are asphyxiating gases, and if these two gases replace oxygen, they will immediately produce dangerous situations and make life impossible to sustain. Under high pressure, even if the oxygen content is enough to sustain life, these gases may still make people anesthetized.

The volatile gases of nitrogen and argon in the air will reduce the concentration of oxygen necessary to maintain life. Inhaling high concentrations of these gases can cause hypoxia, leading to dizziness, nausea, vomiting, coma and even death. Personnel are prohibited from entering places where the oxygen content is lower than 19%, otherwise they must wear a portable respirator. If the oxygen concentration is less than about 8%, it may cause coma and death without any signs. Exposure to frozen nitrogen, argon, liquid nitrogen and liquid argon can cause hypothermic (extremely low temperature) burns and frostbite to human cell tissues.

Personnel injured by lack of oxygen should be immediately sent to an environment with normal air. Rescuers should wear breathing apparatus to prevent suffocation. If the person in distress stops breathing, artificial respiration or oxygen delivery should be given to him. If cryogenic liquid or frozen volatile gas comes into contact with the skin or eyes of the operator, warm water (105－115F; 41-46℃) rinse or soak the contact parts, do not use hot water, and ask a doctor for treatment immediately for blisters or deep frostbite caused by cryogenic burns.

5. Natural gas

Please strictly abide by the relevant safety precautions and operating procedures in this manual. Operators who come into contact with LNG must be familiar with the laws and regulations related to LNG and master the physical characteristics of LNG, the use of safety facilities and safety precautions.

Warning: The operator of microbulk tank shall establish a technical file card for each product, and keep track of the repair of valves and instruments.

Warning: The user must formulate a feasible emergency plan in accordance with the Rules for Safe Use of Cryogenic Liquid Storage and Transportation Equipment and this instruction manual, and report it to the

local fire safety authority for approval and filing.

The main components of this microbulk tank are in the state of LNG under pressure and cryogenic storage state. The working pressure of LNG vessel is low, and the operating temperature is very low. Although the system itself is designed with safety measures, the operators should at least observe the following safety regulations during operation.

Note: The recovered and vented natural gas enters the fuel system. If the vented natural gas cannot be recovered, it must be discharged centrally through a flame arrester, and the natural gas cannot be vented directly.

Pay attention to pressure relief and LNG emptying. Microbulk tank is a pressure storage and transportation system, and LNG can be vaporized to increase the pressure of the system. Before loosening the maintenance parts, the involved equipment and pipelines must be depressurized and isolated, and the LNG in them should be depressurized and vented in a safe way.

Warning: If LNG is started without safe pressure relief and emptying, it is likely to cause casualties. The temperature of external valves and flanges may be extremely low, so personnel should pay attention to wearing corresponding protective articles when operating. When a part of the system needs to be loosened or opened for maintenance, the LNG inside it must be depressurized and vented.

Never form a "dead zone" of LNG in the pipeline, such as the pipeline between two valves. The LNG enclosed in the "dead zone" vaporizes due to heat absorption, resulting in overpressure and rupture.

Pay attention to fire prevention, explosion prevention and antistatic. Natural gas is easy to burn, so smoking, naked flame and the use of non-explosion-proof electrical equipment are prohibited in the installation area of LNG storage, transportation and production. LNG is generally stored and transported under pressure to prevent air or other gases from entering. Ensure that LNG equipment is away from open flames and static electricity. Smoking is absolutely prohibited in LNG storage and transportation areas and maintenance areas.

Avoid using non-explosion-proof tools that will generate heat and sparks during use. When it is really necessary to use them, portable combustible gas should be used to ensure safety.

6. Differences between LNG cryogenic liquid storage tanks and conventional liquid oxygen, liquid nitrogen and liquid argon storage tanks

LNG (liquid natural gas) liquefied natural gas, the main component of which is methane. LNG is colorless, odorless, non-toxic and non-corrosive, and its volume is about 1/600 of that of the same amount

of gaseous natural gas. It is a flammable and explosive medium. It cannot be discharged directly into the air. All pipelines in contact with the outside air need to be discharged centrally, and a flame arrester needs to be installed at the discharge port. Oxygen, nitrogen, and argon are non-flammable gases that are produced by air separation and can be directly discharged into the air.

Similarities: The inner vessel and sandwich structure are the same.

Differences: 1. The working pressure and design pressure of LNG cryogenic liquid storage tank are relatively low, and the design pressure is usually between 0.8 MPA and 1.0 MPA; The working pressure and design pressure ofLO2 LN2 LAR cryogenic tank can be higher than 1.0 MPA.

2. LNG cryogenic liquid storage tank has no bursting disc, only safety valve; A flame arrester should be installed at the gas outlet of the LNG microbulk tank.

Part III.Overview

Microbulk tank is a small skid-mounted liquefied gas storage equipment with storage, self-pressurization, vaporization and other functions, and is equipped with pressure liquid level remote transmission, measurement and other equipment. This equipment is designed, manufactured, inspected and accepted in accordance with GB/T150-2011 "Pressure Vessel" and GB/T18442-2011 "Fixed Vacuum Insulated Cryogenic Pressure Vessel", and accepts TSG 21-2016 "Fixed Pressure Vessel Safety Technical Supervision Regulations" supervision. If you have any questions, you should ask them before going through the legal purchase procedures or confirming the purchase.

Part IV. Structure Introduction

Microbulk tank consists of three parts: skid-mounted equipment, cryogenic liquid storage tank and pipeline system.

- Working pressure: Under normal operating conditions, the highest pressure (gauge pressure) that may be reached at the top of the vessel.
- Design pressure: The set maximum pressure at the top of the vessel, together with the corresponding design temperature, is used as the basic design load condition of the vessel, and its value is not lower than the working pressure.
- Design Temperature: The set metal temperature of a component under normal operating conditions.

  Inner vessel: -196/+20℃ Outer shell: -20/+50℃
- Operating temperature: The actual operating temperature of metal components under normal operating

conditions. It is related to the filling medium. The current working temperature is -196/-135 ℃ (liquid oxygen -183.1 ℃, liquid nitrogen -195.6 ℃, liquid argon -185.7 ℃, liquefied natural gas: -162 ℃, liquid carbon dioxide: -40 ℃), so The container design temperature is derived from the temperature of liquid nitrogen. The design temperature of the shell is derived from GB150.

- Thermal insulation method: Place thermal insulation material in the mezzanine space to prevent heat conduction. Currently there are two ways:

  1. Glass fiber & aluminum foil insulation paper: high cost, small size and good thermal insulation effect.
  2. Perlite sand: low cost, large volume, poor heat insulation effect.

- Safety valve and bursting disc:

  Safety valves and bursting discs are overpressure relief devices that prevent the gas phase space pressure of the inner vessel from exceeding the design pressure and causing the tank to fail and cease to be used.

  Safety valve jump: The main reason for the safety valve tripping is that the liquid stored in the tank has not been used for a long time and the valves in the various pipelines are closed, causing the gas phase space pressure to reach the set pressure of the safety valve.

- Bursting of bursting disc: The vessel is in a fire or the interlayer is damaged, etc., causing the interlayer to lose its insulation function, causing the pressure in the gas phase space of the container to rise rapidly. The discharge of the safety valve still causes the top pressure to rise, and the bursting disc opens to achieve rapid pressure relief and protect the tank. and avoid safety accidents. The bursting of bursting discs is a safe discharge under abnormal working conditions.

- Design service life: The "solid capacity gauge" calls it the expected service life, that is, the design life. The design service life of this drawing is 20 years.

- Sealing vacuum degree (vacuum degree): The vacuum degree of the interlayer when sealing at normal temperature, the unit is Pa. The standard recommendation requirement is ≤0.01pa. The production of this enterprise must meet the standard requirements. The degree of vacuum directly affects the insulation effect of the interlayer, and its value is evaluated through the static evaporation rate.

- Static evaporation rate: After the pressure vessel is left standing to reach thermal equilibrium at the rated filling rate, the liquid mass lost by natural evaporation in 24 hours is the percentage of the mass of the low-temperature liquid in the effective volume of the inner container, converted into the evaporation rate value under standard conditions, the unit is (% /d) Static evaporation rate is an important indicator to measure the thermal insulation effect of storage tanks. There are many influencing factors, including diameter pipes, insulation materials, interlayer internal steel pipes, etc.

- Maintenance time: The storage tank is filled with liquid to the specified rated filling volume. Starting from the specified starting conditions, all pipelines in the storage tank are closed and timing is started until the pressure rises and reaches the set pressure of the limiting device. The time, the unit is "day". Maintenance is also an indicator of the thermal insulation performance of the tank.

Part V. Microbulk Tank

5.1 Microbulk tank structure

The microbulk tank consists of inner vessel, outer shell, internal pipeline and supporting structure. The material of microbulk tank inner vessel is S30408, and the wall thickness is designed and checked according to GB/T150-2011 "Pressure Vessel". Because the medium does not corrode the material, the corrosion allowance is 0.

The outer shell material is generally Q345R. The outer wall of the outer vessel is wrapped with dozens of layers of glass fiber and aluminum foil paper with high thermal insulation performance, and the high vacuum treatment technology is carried out between the interlayers, so that the storage tank can achieve better thermal insulation performance.

The internal pipeline includes gas phase pipe, liquid phase pipe, overflow pipe, top liquid inlet pipe, gas phase pipe, bottom liquid inlet pipe, liquid outlet pipe and pressurized liquid inlet pipe. The pipeline material is S30408.

The inner vessel and the outer shell adopt a composite support structure with radial combined support, so as to ensure that the relative displacement and structural deformation between the inner vessel and the outer shell will not occur due to the impact load during the operation of the microbulk tank, and the inner vessel will break the support, pipelines and phenomena due to the cold shrinkage after being filled with cryogenic liquid.

5.2 Pipeline system

The pipeline system mainly includes liquid filling pipeline, pressurization pipeline, level gauge pipeline, gas pipeline, liquid pipeline, auxiliary gas pipeline and LNG pipeline.

5.2.1 Liquid filling pipeline: The system is mainly composed of top liquid inlet pipeline and bottom filling pipeline, including top liquid inlet stop valve (A-2), bottom liquid inlet stop valve (A-1), purge valve (A-7) and liquid filling connecting device.

5.2.2 Pressurized pipeline: This system is a process in which low-temperature liquid is stored in the

external pipeline of microbulk tank through the pressurized liquid inlet pipe, and then the supercharger turns into gas and returns to the inside of microbulk tank through the supercharger input valve, filter and booster pressure regulating valve, so that microbulk tank can be self-pressurized.

5.2.3 Liquid level gauge pipeline: it is composed of differential pressure liquid level gauge and pressure gauge, which can monitor the liquid level and pressure in the tank.

5.2.4 Gas pipeline: communicate with the liquid outlet pipe. When the gas consumption is large, open the gas valve (A-6). The pressure in the tank will make the liquid enter the vaporizer from the vessel and quickly vaporize into gas for customers.

5.2.5 Liquid pipeline: Open the liquid outlet valve (A-13) to directly use cryogenic liquid.

5.2.6 Auxiliary gas pipeline: it communicates with the gas phase space in the tank. When the gas consumption is not large, the auxiliary gas valve (A-19) can be used directly.

5.2.7 Gas discharge pipeline: this pipeline is connected with the gas phase space at the top of the inner vessel, including vent pipeline and safety relief pipeline.

- Vent pipeline: reduce the pressure in gas phase space and gauge pressure. When the tank is filled, the pressure at the top of the inner vessel is high. At this time, open the vent valve to reduce the gas space pressure at the top of the inner vessel.
- Safety relief pipeline: overpressure relief device, including safety valve and bursting disc, to protect the inner vessel.

Part VI. LNG Safety File

6.1 Component

Natural gas is mainly composed of C1-C4 hydrocarbon gases, in which methane (C1) and ethane (C2) are the leading components, and additives can be added in proportion (typical additive is tetrahydrothiophene).

Danger!

Natural gas belongs to flammable gas, which can cause alkene explosion and explosion when its content in the air reaches a certain level!

When the content of natural gas in the air is high, it can replace oxygen, thus causing dizziness and suffocation.

Contact with LNG liquid and gas can cause frostbite.

6.2 Risk analysis

Main contact routes between people and LNG

6.2.1 Eyes: no contact

Natural gas itself has no irritating effect on eyes, but it can directly contact with LNG liquid and cryogenic gas under pressure, causing frostbite on eyes and leaving permanent scars.

6.2.2 Skin: no contact

Natural gas itself has no irritation to skin, but direct contact with LNG liquid and low-temperature gas can cause skin frostbite. The phenomenon of skin frostbite can be that the skin turns gray and white, accompanied by blistering, and the skin is inflammatory and painful.

6.2.3 Take food: prohibit

Ingesting LNG is impossible. Contact with LNG liquid will cause frostbite.

6.2.4 Breathe: ok

LNG itself is non-toxic, but the high content in the air can cause harm to people's nervous system, such as dizziness, drowsiness, headache, or similar to anesthesia, but it does not have a long-term impact. In the reports about the influence of high natural gas content in the air on people, the main things are numbness, "drunkenness" and vomiting. If LNG contains other substances such as benzene, it may be harmful to human body.

LNG is similar to CO2 gas fire extinguisher, and the air content is too high, especially in a closed space, which can replace the oxygen in the air. When the oxygen content in the air is below 16%, people's maladjustment symptoms can be divided into several stages. Rapid breathing and pulse, headache, dizziness, visual impairment, disorientation, sudden mood change, limb weakness, convulsion, cyanosis, coma or several complications. Low oxygen content in the air will make people unconscious, suffocate and die of financial and trade consciousness, which will lead to nervous system disorder and death.

Warning: Without ventilation, the combustion of any hydrocarbon can produce combustion products including carbon monoxide, which can cause unconsciousness, suffocation and death.

Chronic diseases, carcinogenicity：Not found, see article 10.

Can aggravate the condition：People with heart disease, lung disease and blood disease are very sensitive to oxygen-deficient air, and breathing oxygen-deficient air for a long time can make their condition worse.

6.3 Emergency rescue plan

6.3.1 Eye

If the eyes are frostbitten, usually rinse them with cold water first, and then rinse them with slightly warmer warm water. Never use hot water for washing (for example, the temperature is higher than 40℃(105℉)). Keep your eyes open and let the LNG liquid evaporate. If the eyes can't see the light, wrap them up with a handkerchief. Without the doctor's prompt, you must never use ointment. Send the injured person to the hospital immediately and ask the doctor for treatment.

6.3.2 Skin

If the skin is frostbitten, immediately take off the clothes at the frostbitten area, rinse with cold water first, and then rinse with slightly warm water. It is allowed to warm the frostbitten area, but hot water must not be used. If the frostbite is blistered and the tissue of the injured part is frozen, please call a doctor immediately.

6.3.3 Take food

Once you ingest LNG, you must never persuade the eater to vomit, because LNG can be sucked into the lungs when vomiting, so please ask a doctor for treatment immediately. Rinse your mouth with water and drink 1-2 glasses of water or milk. It is forbidden to let unconscious eaters drink water.

6.3.4 Breathe

Lift the injured person to a place with fresh air. If the injured person can't breathe, give artificial respiration immediately. If breathing is difficult, give oxygen immediately. If breathing starts again after artificial respiration, supplementary oxygen should be considered if necessary. And immediately sent to the hospital for medical treatment.

6.4 Fire precautions

- Combustion characteristics

  Flash point classification: extremely flammable

  Autoignition point: 482-632℃ (900-1170℉)

- Explosive

  Lower explosive limit (%): 3.8-6.5

  Upper explosive limit (%): 13-17

- Danger of fire and explosion

Warning: LNG is a low-temperature liquefied gas with methane (CH4) as the main component, and a small amount of ethane (C2H6), propane (C3H8), nitrogen (N2) and other components. Methane is a kind of hydrocarbon, which is a colorless and odorless gas. Its severity to air is 0.554. If it leaks, it will easily

drift upward. When it is mixed with air or oxygen, it can form explosive gas, which will burn in case of fire. In addition, if people inhale this gas in large quantities, they will be seriously injured or even suffocated due to lack of oxygen.

- Extinguisher

Dry powder fire extinguisher, carbon dioxide fire extinguisher, halide fire extinguisher or fire water: Class C, B or A fire fighting equipment shall be adopted accordingly. Only when the gas source and leakage source are cut off quickly can the fire be extinguished.

- Fire extinguishing guidance

Only when the gas source and leakage source are cut off quickly can the fire be extinguished. Therefore, the gas source is quickly turned off and vaporized with it. If the spilled or leaked LNG is not ignited, it is decided whether to spray water to disperse the natural gas according to the situation, so as to protect the personnel who try to stop the leakage.

The function of water is limited to cooling the fire-baked LNG microbulk tank and vessel, and reducing its surface temperature. In the case of a big fire, the use of hand-held fire water system is a kind of protection for personnel. Try to isolate the fire area, especially around LNG microbulk tank. If the leakage can't stop, only let LNG microbulk tank, LNG vehicle bottles and other vessels keep burning. When the safety device of LNG microbulk tank is started, all personnel should evacuate to a safe place immediately. When putting out extra-large fires, firefighters should wear fully protected fire clothes that meet the requirements and can withstand pressure.

6.5 Leakage measures

Formulate emergency prevention measures

Evacuate all non-operating personnel and extinguish all ignition sources. When LNG is dumped on the ground or leaked in large quantities, it will boil and evaporate violently at first, and its evaporation rate will rapidly decay to a fixed value. Evaporation gas forms a laminar flow along the ground, absorbs heat from the environment, gradually rises and diffuses, and at the same time cools the surrounding air below the dew point, forming a visible cloud, which can be used as a guide to the moving direction of evaporation gas and an indicator of the flammability of evaporation gas-air mixture. Judging the wind direction: stand at the upper air outlet and high place to judge the flowing direction of LNG liquid after leakage. The gas formed after LNG vaporization should be white, and when the gas dissipates, the white color will also disappear, but there is still the danger of fire and explosion! ! !

Under safe conditions, plug the leak. It is absolutely forbidden to flush LNG into drainage system. Do not touch the leaked LNG.

Judge whether to spray fire water to disperse vaporized gas. Isolate the entire leakage area until all LNG vaporizes and dissipates. Before personnel enter the area, they should be forced to ventilate and the combustible gas content should be detected.

6.6 LNG storage, transportation and production

- Safety precautions for LNG storage, transportation and production

The LNG storage and transportation production area should be kept free of open flames and fire sources, and avoid high temperature. LNG microbulk tank shall have the certification certificate and adopt the fixed ground type microbulk tank. The storage and transportation production area should be well ventilated.

6.7 Explosion control and personnel protection

- Engineering control

Good ventilation in the equipment area is an effective measure to control the concentration of combustible gas formed by LNG vaporization below the limits of combustion and explosion, especially for closed spaces. The equipment area shall adopt explosion-proof electrical appliances and explosion-proof lamps with corresponding classification.

- Eye/face protection

Protective glasses and masks should be provided where LNG liquid may be spilled.

- Skin protection

Wear apron, mask and low-temperature gloves where LNG liquid may be spilled.

- Respiratory protection

When working in an oxygen-deficient environment, or in an environment where it is uncertain whether it is safe, the certified portable oxygen cylinder should be used for positive pressure gas supply.

Caution: When working with oxygen cylinders, it should be considered that the combustible gas content may reach the combustion limit (if there is explosion danger).

6.8 Physical and chemical properties

- Exterior

Colorless gas. Cold air can form white air mass, but the absence of white air mass does not mean that there is no LNG vaporized gas. The liquid stored under pressure is colorless.

- Smell

  Pure gas is odorless, general additive (tetrahydrothiophene), so it has the smell of natural gas.

- Basic physical characteristics

  -Boiling point: -162℃ (-259°F)

  -Critical temperature: -87℃ (-187°F）

  -Relative gas phase density (air density is 1): 0.5544.

  -Solubility (H_2O): 3.5%

Note: The density of LNG depends on its composition, usually between 430 kg/m3 and 470 kg/m^3, but it can reach 520kg/m^3 in some cases. Density is also a function of liquid temperature, and its gradient is about 1.35 kg/m^3 ℃. Density can be measured directly, but it is usually obtained by calculation with components analyzed by gas chromatography.

The boiling temperature of LNG depends on its composition, and it is usually between-166℃ and-157℃ at one atmosphere. The gradient of boiling temperature with steam pressure is about 1.25x10-4℃/Pa. The temperature of LNG is usually measured by copper/copper-nickel thermocouple or platinum resistance thermometer.

6.9 Stability

- Stability: stable
- Conditions to be avoided

  Always avoid ignition sources, high temperature, open flames, electric sparks, welding sparks, cigarette butts, static electricity or other ignition sources and contacts.

- Inactive substance: avoid contact with strong oxidants.
- Danger of decomposition products

  Carbon monoxide, carbon dioxide and nonflammable hydrocarbons (smoke).

- Danger of polymers: It can't happen.

6.10 Deleteriousness

Carcinogenic effect

-International Agency for Cancer Research: No Carcinogenicity;

-American Occupational Safety Administration: No Carcinogenicity.

-Standard temperature and pressure: no carcinogenicity

-ACGIH: no carcinogenicity.

6.11 Impact on the ecological environment

The leaked LNG only causes local short-term damage to the environment, such as freezing. LNG can produce biodegradation in soil and water. In air, LNG can be completely vaporized and dissipated.

6.12 Emission requirements

Consult local exhaust emission regulations to determine appropriate emission conditions.

6.13cTransport requirements

-Name：LNG

-Danger level: 2.1

-Labeling required by the Department of Transportation: Flammable gases

Part VII. Procedures and Technical Treatment before Putting Into Use

7.1 Things to note when picking up the goods

When picking up the goods, please make sure whether the products you purchased are in conformity with your order contract.

In addition, when picking up the goods, we should also make appropriate observation or inspection of the product in kind, and check whether the nameplate, signboard and coloring mark of the product are consistent with the information of the corresponding model.

7.2 Procedures and precautions to be handled

Before this equipment is put into use, it must apply to the local special equipment safety supervision department for acceptance, filing, registration and obtaining the use certificate.

Equipment files shall be established for this equipment.

7.3 Technical inspection and treatment to be made

- Accept the reexamination and acceptance by the labor department as required.
- This product is sealed with nitrogen when leaving the factory. before use, the user must make necessary replacement to confirm whether the replacement medium is in line with the medium to be transported and whether the replacement accuracy (medium purity and pressure) meets the requirements.
- Check whether the state of safety accessories, instruments and valves is correct.
- Confirm that the stop valve before the pressure gauge is fully open. Confirm that the stop valve before

the safety relief device is fully open. Make sure that the above two valves are fully open and normally open during the use of the equipment. It is best to put it in a fully open state and seal it with lead.

- Check the pipeline.

Warning: The operator of microbulk tank shall establish a technical file card for each product and keep track of the repair of valves and instruments.

Warning: The user must formulate a feasible emergency plan in accordance with the Rules for Safe Use of Cryogenic Liquid Storage and Transportation Equipment and this instruction manual, and report it to the local fire safety authority for approval and filing, and put the emergency treatment plan in the emergency treatment plan file box of the refueling vehicle.

Warning: The user of microbulk tank shall formulate safety operation regulations for this product and record all operations.

Part VIII. Safety Precautions for Use and Maintenance

8.1 Equipment use

- After the equipment is put into use, the three-way valve (or cut-off valve) set in front of the pressure gauge and the safety deflation device must be kept fully open and normally open, and it is best to seal it with lead after putting it in the fully open position.
- The pressure gauge should be monitored when the microbulk tank is placed for a period of time.
- The place where microbulk tank is placed should be well ventilated, and attention should be paid to avoiding sun exposure and rain.
- During charging and discharging operations, the operator cannot leave the site.
- All combustible materials shall be removed within 5m around the filling and discharging workplace, and the site shall be kept clean, and no fire source is allowed in this area.
- Attention should be paid to leaving access roads for fire engines during charging and discharging operations.
- If the charging and discharging operation is interrupted for too long, the infusion hose should be released during the interruption period.
- When microbulk tank discovers minor leakage, it shall timely repair and stop the leakage, start the emergency cut-off valve, and strictly monitor it;
- It must be noted that during infusion, the liquid in the vessel cannot be exhausted, and generally 5% of the rated total liquid volume should be left as the residual amount. The internal pressure in the vessel

should be maintained above 0.1Mpa.

- Before microbulk tank is put into use again after being stopped for a period of time, the whole vehicle, vessels, safety accessories, valves, instruments, superchargers and connecting devices must be thoroughly inspected.
- Operators should read this manual carefully before operation, and be familiar with the performance and operation points of valves, instruments and safety accessories, equipment flow, operation steps and safety precautions.

8.2 Equipment maintenance

- Microbulk tank instruments, safety relief devices, valve accessories, etc. shall be regularly inspected and inspected according to the Regulation on Safety and Technical Supervision of Fixed Pressure Vessels.
- When a large area of frost appears on the vessel shell or the daily evaporation rate is abnormal, it shall be inspected and repaired in time. Major repairs should be carried out by relevant professional units.

8.3 Safety protection of operators

- Operators of cryogenic liquid equipment should wear clean and easy-to-take-off leather or asbestos rubber gloves, goggles or masks to prevent spraying and splashing. When dealing with a large number of cryogenic liquids or serious leakage accidents of cryogenic liquids, they must wear leather boots without nails, and their trouser legs should be covered outside the boots.
- When the operator's skin is frostbitten due to contact with low-temperature medium, the injured part should be immersed in warm water for washing in time (the water temperature is 20℃~40℃).
- When the person concerned loses consciousness due to gas suffocation, he should immediately move the person to an open and airy place.
- In case of an accident endangering personal safety, an ambulance should be called in time at the same time of emergency rescue at the scene, or sent to the hospital for emergency treatment quickly.

Part IX. Operating Instructions

9.1 Preparation before operation

Warning: When operating under the condition that there is cryogenic liquid in the microbulk tank and the external pipeline or valve is cold, the operator must wear leather cotton protective gloves and goggles or

protective masks to avoid freezing injury to personnel.

Warning: If the skin or eyes are accidentally exposed to low-temperature liquid, it will cause cold burns similar to burns. Be careful not to spill or overflow the liquid when handling it. Protect the eyes, skin and other parts that are easy to contact with liquid. If liquid is sprayed, splashed or frozen gas will be strongly ejected from the equipment, wear protective glasses or face covers. It is recommended to wear protective gloves and long sleeves that are easy to take off to protect your arms. To put on trousers without cuffs, trouser legs should cover his shoes to stop the spilled liquid. In addition: the operator's clothes should be made of cotton. It is forbidden to wear chemical fiber clothes that may cause static electricity, and shoes without nails should be worn on the feet.

Warning: When the microbulk tank is in fire, it is forbidden to spray water directly on the liquid leakage. It is recommended to use a dry powder (preferably potassium carbonate) fire extinguisher. Personnel related to handling liquefied natural gas should be trained in using dry powder fire extinguishers for fires caused by liquefied natural gas.

Warning: Just after the operation of accepting LNG, it is forbidden to smoke or get close to a fire place immediately after the operation because the clothes are likely to be soaked with LNG.

Operators must read this manual carefully and make the following preparations before operation: (natural gas)

9.1.1 Carefully check the loading and unloading site to make sure there is no open fire nearby.

9.1.2 When a new tank is used for the first time after overhaul, the inner vessel must be evacuated or replaced with nitrogen, and the oxygen content must be analyzed, and the oxygen content must be ≤0.3%, otherwise, it is never allowed to be filled.

Warning: If there is air in the inner vessel, the mixed explosion limit of natural gas and air may occur during filling, so clause 1.2 must be strictly implemented.

9.1.3 Check whether the connections of pipelines and valves are good, whether the joints are loose, and whether the instructions of pressure gauge and liquid level gauge are correct;

9.1.4 The system instrument valves have been set in the use state when they leave the factory, but users should still check whether all valves are in the correct state before use;

9.1.5 Liquid level gauge valve and gas level gauge valve should be fully open; Level gauge balance valve should be closed; When the valve state of the level gauge is unknown, the balance valve should be opened first, then the liquid and gas valves of the level gauge should be opened, and finally the balance valve should be closed, so that the level gauge will be put into use.

Note: It is forbidden to open only the gas phase valve or only the liquid phase valve when the balance valve is closed, otherwise the instrument will be damaged!

9.1.6 Make it clear that the medium contained in the microbulk tank in the liquid supply field is the liquefied natural gas to be transported;

9.1.7 Connect the liquid phase of the liquid storage tank in the liquid filling field or the liquid unloading field with the liquid phase interface of microbulk tank with a metal hose.

Warning: microbulk tank products are strictly prohibited from being overloaded (the filling coefficient of this product is ≤0.92). Failure to follow this warning may lead to serious personal injury and major safety accidents.

9.2 Filling

The operating instructions in this section are suitable for experienced operators. Before operation, be familiar with the safety protection measures in this manual and reference materials. Study the general layout and flow chart of microbulk tank, and find out the functional descriptions of each component, the operating instructions of each system attached to this manual, and the positions and functions of all components in the coefficient equipment.

Remark: In order to prevent moisture from entering, the microbulk tank is sealed with low-concentration nitrogen before the shipment of microbulk tank, so the product must be purged and replaced before it is officially used.

9.2.1 Purge replacement procedure

Remark: In order to prevent atmospheric impurities from returning to the "Anstar" inner vessel, the gas pressure in the inner vessel should be at least 0.35MPa during the purging process.

- Connect the supply source liquid or gas to the filling port;
- Fully open the bottom liquid inlet valve to let the liquid enter the cryogenic storage tank, so that the liquid flows into the cryogenic storage tank through the bottom filling pipe, and the gradual flow rate makes the liquid evaporate in the pipeline, gradually increasing the pressure in the tank;
- When the pressure in the tank reaches the maximum purging pressure, close the supply valve of the liquid delivery source;
- Open the balance valve of the level gauge, and close the liquid valve and gas valve of the level gauge. Loosen the connectors at both ends of the level gauge. Both high and low liquid level valves should be fully opened. If no moisture is found, both valves should be closed. If moisture is found in the airflow, the gas should be removed until all moisture is removed.

Remark: Carefully observe whether there is moisture in the phase tube to ensure that the liquid level meter will not fail during operation. Because the diameter of the surface tube is very small, it is easy to be

blocked by ice.

- Open the pressurized liquid inlet valve and gas phase valve, rinse for two minutes, close the pressurized liquid inlet valve, and then close the gas phase valve;
- Open the overflow valve, rinse for two minutes, and close the overflow valve;
- Repeat steps 2 to 9 for less than three times until the purity of the operating substance reaches the required pre-cooling and filling procedure;
- Reinstall the level gauge, open the liquid and gas valves of the level gauge, and close the balance valve.

9.2.2 Pre-cooling and Filling Procedure

Pre-filling is usually designed for "warm storage tanks". The so-called "warm storage tank" means that it has not been used before filling, and it must be purged to ensure the purity of the operating substances.

- Purge the microbulk tank low-temperature storage tank to ensure the purity of operating substances.
- Identify the substances contained in the conveying device.
- Make it clear that all valves are closed except the liquid valve of the level gauge, the gas valve of the level gauge and the pressure gauge valve after the pump.
- Connect the infusion hose with the liquid inlet of the storage tank. When the pressure of the liquid source is 0.2MPa higher than that of the microbulk tank, the filling effect is the best. When the pressure changes, it can be controlled by adjusting the gas phase valve or the liquid inlet valve.

Remark: Natural gas should be equipped with electrostatic grounding device.

- Slowly open the top liquid inlet valve.
- Observe the pressure of the storage tank during filling. If the pressure rises above the delivery pressure, or approaches the pressure of the microbulk tank safety valve, (A-12) must be used to relieve the pressure of the storage tank. If the pressure continues to rise, it may be necessary to interrupt the filling to reduce the pressure.
- Observe the liquid level gauge When the liquid level gauge shows about three quarters of the liquid level, open the overflow valve.
- If there is frost on the surface of the overflow pipe, stop filling the conveying source and close the overflow valve.
- Close the liquid inlet valve at the top and the liquid outlet valve of the liquid supply tank, and open the purge valve to discharge the residual liquid in the hose.

- When there is no pressure in the hose, loosen the hose on the filling joint, release the pressure in the filling hose, and then remove the hose. It is recommended to defrost the filling hose.
- Put away the filling hose.

Remark: When the microbulk tank is formally filled, it must be precooled because the inner vessel is in the state of "warm storage tank" at room temperature. Therefore, pre-cooling and filling will consume a certain amount of liquid, and the gas phase pressure will rise rapidly, which is normal.

Microbulk tank is equipped with bottom and top liquid inlet pipes. If the pressure in the liquid supply tank is higher than that in the filling car, bottom filling is adopted. If the saturation pressure of the liquid supply tank is less than the internal pressure of "Anstar", top filling is adopted. This operation will minimize the risk of pressure increase and the discharge operation due to the control pressure.

Prompt: The feed liquid of microbulk tank can be transported by pressure or by pump.
Warning: When discharging LNG liquid into the air, it should be carried out after it is confirmed in advance that there are no open flames and flammable materials nearby and no pedestrians pass by.
Note: During loading and unloading, the operators are not allowed to leave the site.
Remark: Due to the structure of microbulk tank, the inner vessel must always be in a low temperature environment and the need of medium purity, etc., and a small amount of liquid must still be kept when unloading, and all valves should be closed to prevent water from freezing in the storage tank or pipe valve.

Part X. Maintenance

Generally, the required maintenance should be inspected before the filling procedure, observed during and during the filling, and the faulty parts should be properly maintained. Personnel who maintain pipelines, valves and instruments must be familiar with the cleanliness requirements of parts used for LNG operation. If replacing parts, only parts that have been cleaned correctly should be used, and used joints or hoses should not be used on the storage tank.

10.1 Matters needing attention in valve operation

The valve must be opened slowly and closed slowly, and it is forbidden to use the "F" wrench to operate. If the valve is found frozen, it should be thawed with clean and oil-free warm water or hot nitrogen before operation.

Remark: Any part of the microbulk tank shall not be struck by a hammer or other objects, and must be kept in the ex-factory state of the manufacturer.

The explosion-proof cover on the upper side of the front end of the microbulk tank shell is an automatic safety device, and it is absolutely not allowed to be disassembled or pried open.

The top and bottom filling valves, booster inlet valves and full-measuring valves on the microbulk

tank are valves that are often opened and closed during normal liquid loading and unloading. Attention should be paid to their sealing performance. If there is any slight leakage, the gasket should be replaced in time.

The gas and liquid valves and safety relief selector valves of liquid level gauge are frequently used in normal operation, so the sensitivity of their switches should be checked frequently. When repairing the differential pressure level gauge, the gas and liquid valves of the differential pressure level gauge should be closed to avoid accidental overflow of gas and liquid. The safety relief selector valve can be closed when the safety valve is replaced or repaired. But in normal use, the valve must be opened.

Manual vent valves and valves that are normally closed during normal operation should also be regularly checked for their switch sensitivity. When the pressure of the microbulk tank exceeds or approaches the maximum working pressure, the manual vent valve can be opened to reduce the pressure to ensure the safe use of the microbulk tank.

Note: Before the microbulk tank is maintained or parts are replaced, the pressure of the cryogenic storage tank should be lowered to a safe state. To replace some parts in contact with liquefied natural gas, it is necessary to completely empty the liquefied natural gas contained in the storage tank and replace it with nitrogen.

10.2 Regular inspect

In order to make microbulk tank in good working condition, the following parts of the device must be inspected regularly and applied for inspection. If the microbulk tank has been working in a particularly hot or cold temperature environment, the inspection period should be shortened.

Inspection item	Period
Valves and joints	3 months
Appearance	1 year (subject to verification by the national metrology department)
Safety valve (YA)	According to the "Safety Technical Supervision Regulations for Stationary Pressure Vessels"
Cryogenic liquid storage tank	According to the "Safety Technical Supervision Regulations for Stationary Pressure Vessels"

10.3 Vacuum integrity check

As the microbulk tank is vacuum insulated, any decrease or loss of vacuum degree will cause abnormal rapid pressure increase of the microbulk tank. Therefore, the operation of the device should be stopped in time, and the company should truthfully report it and consult how to test and repair the vacuum degree of the storage tank. If there are other abnormal conditions (such as signs of frozen particles, frosting or condensation), they should also be truthfully reported to our company in time to determine the integrity

of vacuum degree.

10.4 Inspection and adjustment of pressure gauge and level gauge

Because the maintenance of instruments generally needs special maintenance personnel, it is suggested to replace the faulty instruments with new ones. Some inspection work should be done before replacing the instrument.

Instrument failure is generally caused by leakage of instrument pipeline. Therefore, first of all, check whether the pipeline is tight and leaking. Other checks include:

- Check whether the pipeline is blocked;
- Check whether the liquid valve and gas valve of the level gauge are leaking;
- Make sure that the liquid level gauge is correctly set to zero. The liquid level gauge is a differential pressure gauge used to display the total amount of liquid in the microbulk tank. This gauge sometimes needs to be adjusted. Check the zero setting value of this gauge. To open the balance valve of the liquid level gauge, close the liquid level valve and the gas level valve of the liquid level gauge. If the pointer is not at zero, adjust the gauge according to the instruction manual of the liquid level gauge until it reaches the zero setting value. After the adjustment, slowly open the liquid valve and gas valve of the level gauge, and close the balance valve of the level gauge. If these inspections and adjustments fail to solve the problem, remove and replace the meter. When returning the faulty meter to our company for maintenance, explain the situation encountered in handling this meter in the letter at any time.

10.5 Fault check

The failure checklist is divided in the format of "failure, assumed causes and countermeasures", and the assumed causes of a special problem are listed in descending order of importance.

10.6 Repair

It is recommended to replace the damaged parts with the parts allowed by our company, but if it is necessary to repair the damaged parts, the following provisions should be observed.

Trouble check table

Breakdown	Hypothetical reason	Countermeasure
Microbulk tank pressure is too high	Microbulk tank is not filled at low temperature, and the pressure display is high	Open the gas discharge valve to reduce the pressure and make it reach a lower pressure again

	The microbulk tank pressure gauge is faulty	Use the calibrated test table to determine the microbulk tank pressure. Replace the pressure gauge if it is faulty
	Vacuum degree is not high	See "Vacuum loss" Fault column.
Microbulk tank pressure cannot be maintained	Leakage or frost crack of safety valve	Replace with a new and verified safety valve.
	Internal pipeline leakage	Soap water testing and maintenance
	Low liquid level	Recharge
	Pressure relief rate (speed) is too high	Consult our company
Vacuum loss	Interlayer explosion-proof cover opened	If the liner or internal pipeline leaks, all the operating objects in the filling car will be discharged, and contact our customer service to obtain technology
	Corrosion and leakage of interlayer explosion-proof cover	For all the operating objects of microbulk tank, contact our customer service to obtain technology
	Serious water drops or frosting appear in the outer tank.	Test the normal evaporation rate of the storage tank. If it is unqualified, please contact our customer service to obtain the technology
The liquid level meter reading is unstable or has errors	Surface pipe leakage	Soap test and repair the leak
	The pointer does not move	Tap the pointer lightly. If this does not solve the problem, check the pointer according to the situation and bend it slightly
	The pointer has not been zeroed	Refer to level gauge adjustment
	The table is faulty or damaged	Replace
Safety valve leakage	There is dust or ice under the valve core	Reinstall or replace the valve as appropriate.
	The valve is not installed correctly	
	Damaged valve seat	Replace valve

Note: Before maintenance, the liquefied natural gas in the storage tank must be completely discharged and replaced with nitrogen, and the temperature of the storage tank should meet the ambient temperature.

If it is necessary to disassemble the components of the microbulk tank, the disassembled components should be numbered for reinstallation, and the components should always be installed in the reverse order of disassembly. In the process of disassembly, the disassembled components should be prevented from being damaged. If they cannot be reinstalled immediately, they should be thoroughly cleaned, put in polyethylene protective bags, and clean all metal components with good industrial cleaning agents. All rubber components should be cleaned in detergent and hot water. Blow-dry all cleaned parts with clean and low-pressure nitrogen. Before installation, ensure that all parts have been thoroughly cleaned and degreased. Cleaning can prevent the valve from freezing during operation and prevent liquefied natural gas from being polluted.

When removing parts from the microbulk tank, always remember to plug the exposed nozzle as soon as possible.

10.7 Maintenance of valves

Remark: There should always be enough microbulk tank spare parts in stock.

Remark: If the valve parts are in stock, replace the faulty valve with a new valve of the same model, which must have a certificate of approval and be re-inspected. The re-inspection report and the certificate of conformity shall be placed together with the data or documents of this product and kept properly.

If a valve is suspected to be faulty, disassemble and repair it as follows. If there is leakage at the valve seal, tighten the sealing nut first to see if the leakage stops, and then remove the valve.

- If the valve is repaired, all the liquid in the storage tank should be discharged and replaced with nitrogen;
- Open the vent valve to release all the pressure until the discharge stops. At this time, the gas phase pipeline pressure gauge reads 0;
- Remove the valve cover from the faulty valve;
- Remove the valve seat;
- Disassemble the valve and check all individual components;
- Clean all metal parts with suitable industrial cleaning agents, and rinse other parts thoroughly with hot water;
- Blow dry all parts with clean and dry nitrogen;
- Replace all worn-out, deformed or damaged parts;
- Re-seal the valve. Teflon filaments can be padded in it or wound and sealed. If sealed by winding, only a single Teflon filament can be wound reversely to tightly wrap Teflon. Otherwise, when the valve gets cold, moisture will enter the valve and freeze;

- Reinstall the valve to ensure that the mating surface is clean and placed correctly. If the repaired valve is not reinstalled immediately, put it in a PTFE protective bag for protection, and put the label "Clean the valve-do not open the bag unless reinstalled" on the bag.

10.8 Maintenance of microbulk tank safety valve

The safety valve cannot be repaired by itself. If the safety valve shows signs of leakage or failure, please use the sealing elements or materials recommended by the original valve manufacturer and carry out maintenance and debugging by qualified local departments.

10.9 Post-maintenance test

After removing or replacing parts and other related maintenance, all removed and reinstalled valves and pipe joints shall be tested for leakage. Do not return the storage tank to operation until all leaks are repaired and the storage tank is retested.

10.10 Return of faulty parts

If the faulty parts or components are to be returned to the factory for maintenance, they should be carefully packaged and put in vessels with cardboard outside to prevent further damage during transportation. In the letter you sent, explain the fault, whether it has been inspected, whether it has been repaired, etc. These data will enable most maintenance work to be carried out as soon as possible and economically.

Warning: During maintenance, when hot work is needed, it should be checked and confirmed that the residual LNG has been discharged from the pipeline at the hot work place. After purging with nitrogen, the gas in the pipeline should be sampled and analyzed and confirmed by the safety department before construction.

Part XI. Quality Assurance

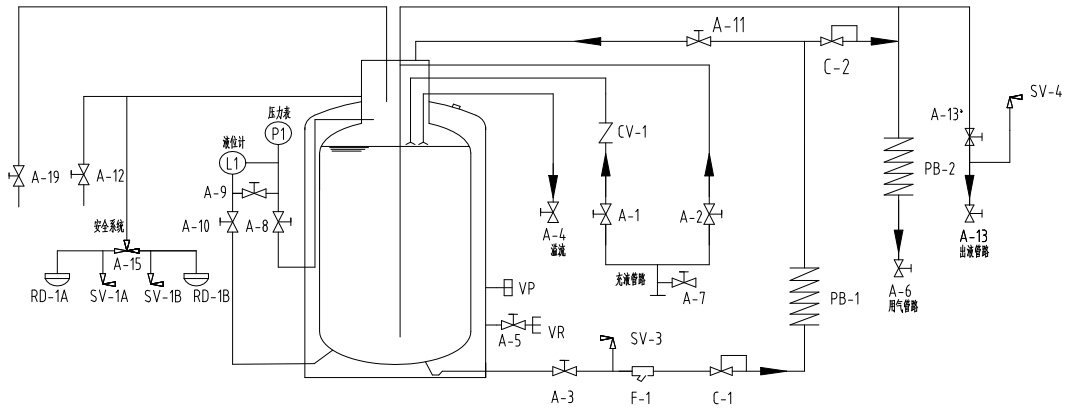
11.1 Product quality assurance

- The quality guarantee period of the company's ex-factory products:according to the contract.
- Vacuum degree of microbulk tank: according to the contract.
- Control system piping: according to the contract.

11.2 The guarantee in the above article 1.1.1 is based on the quality of the product itself, excluding the damage caused by force majeure or operational factors after delivery.

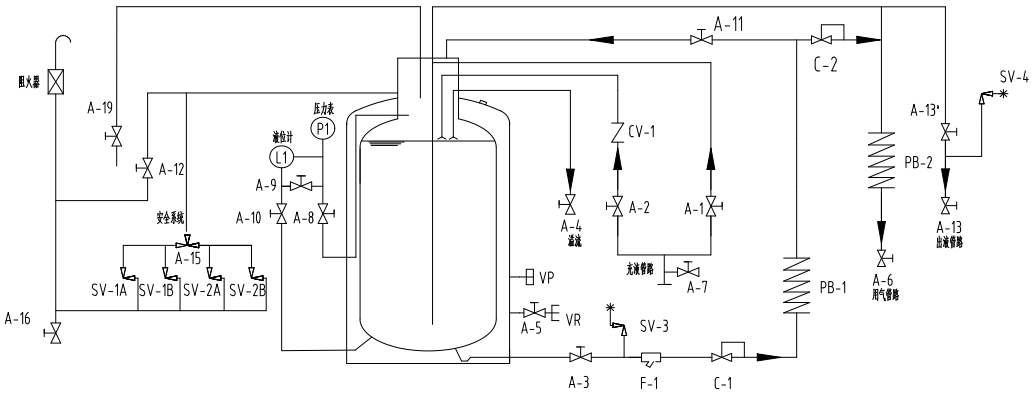
Attachment 1: Flowchart

LO2 & LN2 & LAR Microbulk Tank



A-1	底部充装阀	A-8	液位显示气相阀	A-15	三通阀	SV-3	安全阀	C-2	降压调压阀
A-2	顶部充装阀	A-9	液位显示均衡阀	A-16	排污阀	SV-4	安全阀	F1	过滤器
A-3	增压器输入阀	A-10	液位显示液相阀	A-19	辅助气相阀	P1	压力表	L1	液位计
A-4	溢流阀	A-11	增压器输出阀	SV-1A	安全阀	VP	抽空装置	CV-1	止回阀
A-5	真空规管阀	A-12	气体排放阀	SV-1B	安全阀	PB-1	增压器	VR	真空规管
A-6	用气阀	A-13'	出液阀	RD-1A	爆破片	PB-2	汽化器		
A-7	吹扫阀	A-13	出液阀	RD-1B	爆破片	C-1	升压调压阀		

LNG Microbulk Tank



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A-5	真空规管阀	A-12	气体排放阀	SV-1B	安全阀	PB-1	增压器	VR	真空规管
A-6	用气阀	A-13'	出液阀	SV-2A	安全阀	PB-2	汽化器		
A-7	吹扫阀	A-13	出液阀	SV-2B	安全阀	C-1	升压调压阀		