Operating Instructions for
CHD Series Liquid Distribution Systems

Introduction
The container consists of an inner stainless steel cylinder securely supported in an outer jacket shell. The space between the inner and outer vessels contains a highly efficient insulation material and is evacuated.

Safety Devices
The inner liquid reservoir is protected by a relief valve (RV-1) and a rupture disc (RD-1) on the vent manifold.

A combination evacuation valve and relief device is provided to service the vacuum space. This protects the container in the event of a leak in the inner reservoir. If this device vents, contact Cryofab; do not attempt to use the container or re-evacuate the insulation space.

Gauges
A pressure gauge is provided indicating inner vessel pressure. A liquid level gauge is provided to indicate approximate container contents. A liquid level gauge isolation valve (V-6) is located behind the gauge panel. This valve allows the liquid level gauge to be serviced even if there is still liquid remaining in the tank; it should be open during normal operation.

Pressure Control
The pressure control for this container is achieved via the road relief regulator (PCV-2) and the road relief isolation valve (V-4), arranged in series on the vent manifold. The road relief regulator functions as an adjustable relief valve to limit the working pressure of the vessel. This regulator is preset at the factory but can be adjusted in the field, according to different needs. To lower the setting, turn the adjusting screw counterclockwise. To raise the setting, turn clockwise.

Pressure Building System
This container is equipped with an integral pressure building system to aid in liquid withdrawal. The pressure-building system consists of the pressure- building coil (PBC-1), the pressure-building valve (V-3, located at the bottom right) and the pressure-building regulator (PCV-1, located at the bottom of the vent manifold) all connected in series.

The pressure-building regulator maintains a preset vessel pressure during liquid withdrawal, as long as a sufficient liquid supply is in the container and the pressure-building valve is open. If a different pressure setting is required, the pressure-building regulator can be adjusted. To lower the setting turn clockwise. To avoid wasting liquid, the pressure-building regulator should be set approximately 5 PSI lower than the road relief regulator.

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Filling

These containers can be filled from a pressurized liquid source using the following procedure: Attach an extension to the full trycock valve (V-1, located top right) and orient it so that the discharge is directed away from personnel and out of van compartment. Connect the liquid source to the fill/withdrawal valve, (V-2, labeled liquid) using a suitable transfer line. Be sure the vent valve (V-5) and the road relief isolation valve (V-4), both located on the vent manifold, are closed. Open the full trycock valve and the fill/withdrawal valve. To begin the transfer, open the liquid source valve.

Warning

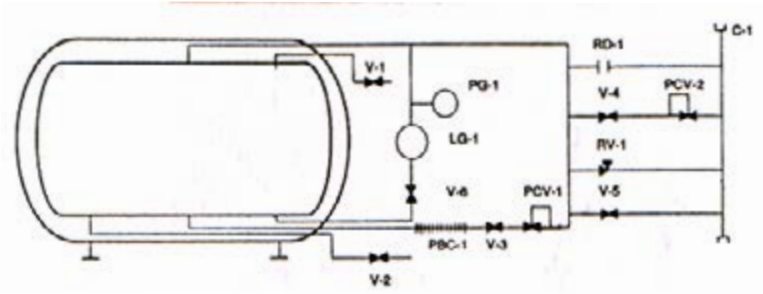
A cold stream of gas or liquid will exit from the full trycock extension. Keep clear of exiting stream.

When the container is filled to maximum capacity, liquid will start to exit from the full trycock. At that point, shut off the liquid source valve. (Consult DOT regulations or your local liquid supplier for the maximum allowable liquid load consistent with your working pressure). Shut off the fill/withdrawal valve and the full trycock valve. Disconnect the transfer line and the full trycock extension (if necessary). Open the road relief isolation valve (V-4) to limit the operating pressure of the vessel to the desired setting.

Withdrawal

Transferring liquid from the container is accomplished by the following procedure. Be sure the vent valve (V-4, located on the vent manifold) is closed and check the pressure gauge to see that the vessel pressure is adequate for the intended application. If additional pressurization is required, open the pressure-building valve (V-3) to operate the integral pressure-building coil (PBC-1). With the pressure-building system functioning the preset pressure will be maintained throughout the withdrawal, as long as a sufficient liquid supply is present.

Attach a suitable transfer line to the fill/withdrawal valve (V-2). Open the fill/withdrawal valve as far as necessary to obtain the desired flow rate. When the transfer is complete, close the fill/withdrawal valve and disconnect the transfer line. The pressure-building valve may be left open, if desired. This may, to a limited extent, determine the operating pressure of the vessel until the liquid is saturated. After that point, the road relief regulator becomes the limiting device for the operating pressure.



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WARNING

Do not operate this vessel in a closed compartment or confined area unless the vent stack is ducted to the outside. Do not open the fill/withdrawal or the full trycock valve if in a confined area.

WARNING

All transfer lines used with this vessel should be equipped with a relief valve.

Changing Service

CHD series are suitable for carrying liquid oxygen, nitrogen or argon, however, if changing service, purge according to DOT regulations. Minor component changes may be necessary.

Caution

Before operating this vessel, please read thoroughly, PRECAUTIONS FOR THE SAFE HANDLING AND STORAGE OF LIQUEFIED GASES included with these instructions, for additional precautions and good practice regarding cryogenics.

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Liquified Gas Safety
Precautions for Handling and Storage of Liquified gases

WARNING

Read and completely familiarize all personnel with handling procedures.

Introduction

The category of substances known as liquified gases includes liquid nitrogen, oxygen, argon, helium and carbon dioxide but those are only a few of the most common ones. There are many others. Liquified gases are extremely cold liquid. For example, at atmospheric pressures liquid oxygen exists at -297.3°F. Liquified gases, because of their peculiar nature, require special attention. The following paragraphs outline properties, precautions and safe handling for liquified gases.

Liquified Gas Safety Precautions: General Information

To insure safe control of liquified gases in laboratories, test stations or wherever these liquids are used, all orders for these materials should be cleared through a responsible person. This individual will insure that the potential user is aware of the danger involved and will follow recommended procedures.

Liquified gases should never be used in combination with other substances without knowing what the result may be. When in doubt, consult a competent authority.

Liquified Gas Safety Precautions: Purity

Liquid nitrogen, when placed in the container at the manufacturer's plant is of a definite purity but this purity is subject to change since the nitrogen evaporates in preference to the very small oxygen impurity. If liquid nitrogen remains in the container until a large portion of the liquid is evaporated, an analysis of the remaining liquid should be made before it is used for any purpose where a high oxygen impurity or a high oxygen content would be dangerous.

Liquified Gas Safety Precautions: Toxicity

Oxygen is nontoxic. Nitrogen, helium and argon are also nontoxic, but if allowed to accumulate in sufficient quantities they may act as asphyxiates. This is because these gases lower the concentration of oxygen that is normally present in the air. (For this reason, liquid nitrogen, helium and argon should never be stored or used in small closed compartments, rooms or excavations without added ventilation. Well-ventilated storage and working space should be provided.)

Liquified Gas Safety Precautions: Combustibility

While oxygen itself does not burn, it does provide an atmosphere that sustains combustion. Oxygen in liquid form can promote intense combustion of explosive violence. For this reason, liquid oxygen must never be stored or used in containers contaminated with oil, grease or carbonaceous materials of any kind. A serious fire may result from disregarding these guidelines.

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In the presence of an appreciable oxygen concentration, a spark on certain materials may cause them to burst into flame, whereas in air, fire would not result. (For this reason, liquid oxygen should never be stored or used in small closed compartments, rooms or excavations without added ventilation. Well ventilated storage and working space should be provided.) Materials that should be of special concern in this respect are wood, plastic, powdered metals, combustible rags and clothing. Anyone working with liquid oxygen should never allow one's clothing to become saturated with liquid or gaseous oxygen, as a spark may cause the clothing to burst into flames.

Liquified Gas Safety Precautions: Pressure Buildup

The heats of vaporization of most liquified gases are low. In addition, a small quantity of liquid produces a large volume of gas at atmospheric pressure. One cubic foot of oxygen, for example, will produce 860 cubic feet of oxygen gas. Small heat flow from the atmosphere into the liquid, therefore, will produce an appreciable volume of gas. For this reason, all storage vessels should be provided with pressure relief devices unless the container is vented properly to provide escape of evaporating gases. All lines and vessels in which the liquid may be trapped between closed valves should be equipped with pressure relief valves. If there is any likelihood that the relief valve may freeze, as for instance, from ice formed from dripping water or condensed moisture, such vessels and lines should be equipped with rupture discs. Both pressure relief valves and rupture discs should be placed and protected so that water cannot splash or condense upon them. In addition, it is desirable and sometimes necessary, to vent relief valves and rupture discs to the outside atmosphere.

Liquified gases should be transported only in suitable insulated containers that provide means for the escape of gas as liquid evaporates. Never cork or plug the outlet to such containers.

The use of liquified gases may require other precautions to be taken. It is imperative that all persons using that material be made aware of these precautions.

Liquified Gas Safety Precautions: Handling

Personnel handling liquified gases should be thoroughly instructed as to the nature of the materials. Training is essential to minimize accidental spilling. This is to prevent damage from the coldness of the liquid or from the fire hazard of the oxygen enriched air.

Small amounts of liquified gases are frequently handled in glass dewar flasks which occasionally collapse, particularly if the liquid oxygen is splashed on the joint at the neck. These flasks should always be kept behind protective shields while in use.

Liquified gases, because of their extremely low temperature, will "burn" the skin like hot liquids. Never permit liquified gases to come into contact with the skin or allow liquid oxygen or liquid nitrogen to soak clothing. Serious burns may result from careless handling.

When personnel are handling liquified gases, they are advised to protect themselves by wearing goggles or face shields and leather gloves large enough to allow quick removal. Rubber aprons and high-topped shoes worn with trouser legs outside the tops are also desirable.

Liquid oxygen must never be poured upon clothing, fabrics, rags, waste or other readily combustible materials, nor the gaseous oxygen arising from liquid oxygen be allowed to penetrate clothing. Combus-

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tible substances in the presence of oxygen are highly flammable. A spark can start a serious fire and may cause serious personal injury.

Liquid oxygen should never be poured or demonstrated in close proximity to a source of ignition. A spark coming into contact with a combustible material in an oxygen-enriched atmosphere can burst into flames and immediately cover the surface of the combustible material.

When pouring liquified gases from one container to another, the receiving container should be cooled gradually to prevent thermal shock. The liquid should be poured slowly to avoid spattering. The receiving vessel should always be vented to the atmosphere and high concentrations of gaseous oxygen and/or nitrogen should not be allowed to collect.

Introduction of a substance that is at normal room temperature into a liquified gas is always somewhat hazardous. There is a violent evolution of gas, and there is likely to be considerable splashing of the liquid. Personnel doing this work should be instructed of the hazard and should always wear full-face shield and protective clothing.

In the event a person is burned by liquified gas, the following first aid treatment should be given pending the arrival and care of a physician:

1. If any liquid gas contacts the skin or eyes, immediately flood that area of the body with large amounts of unheated water and then protect frozen parts with loose, bulky, dry, sterile dressings.
2. If the skin is blistered or there is any chance that the eyes have been affected, get the patient immediately to a physician for treatment.

Liquified Gas Safety Precautions: Material Limitations

The physical properties of many materials at extremely low temperatures may be quite different from the properties of the same materials at normal temperatures. Therefore, materials that have been cooled to the temperatures of liquid oxygen or liquid nitrogen should be carefully handled until their properties, under these conditions, are known.

Metals to be used for equipment in liquid oxygen or liquid nitrogen, must possess satisfactory physical properties at the low operating temperatures. Since ordinary carbon steels, and to a lesser extent most alloy steels, lose their ductility when subjected to the low temperatures of liquid oxygen or liquid nitrogen, they are considered unsatisfactory for such service. The austenitic nickel-chromium alloys have good ductility at the low service temperatures under consideration, and the most widely known is 18-8 stainless steel. Copper, monel, brass and aluminum are also considered satisfactory materials for low temperature use.

Each new use for these liquids should be carefully considered before it is instituted and liquified gas safety precautions should be completely outlined.

WARNING

Inert gases released in a confined space can displace sufficient air to make the atmosphere incapable of sustaining life. Entering an oxygen deficient atmosphere may cause unconsciousness without warning. Purge the space completely with air and test before entry. Wear an air respirator and have a helper stand by also equipped with an air respirator.