Operating Instructions

CH Series

Liquid Helium Storage Containers

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1 - GENERAL SAFETY & PRODUCT INFORMATION

Liquid Helium is light (S.G. = 0.125), colourless, and inert; it is found in the atmosphere at a concentration of approximately 5 parts per million.

Most helium gas is recovered by extraction from natural gas in the USA or Poland.

The boiling point of Liquid Helium is -269°C (4K).

Liquid Helium has a very low latent heat of vaporisation and can therefore evaporate very rapidly with an expansion ratio from liquid at -269°C to gas at 20°C of 750:1.

These properties give rise to various potentially hazardous situations against which precautions should be taken.

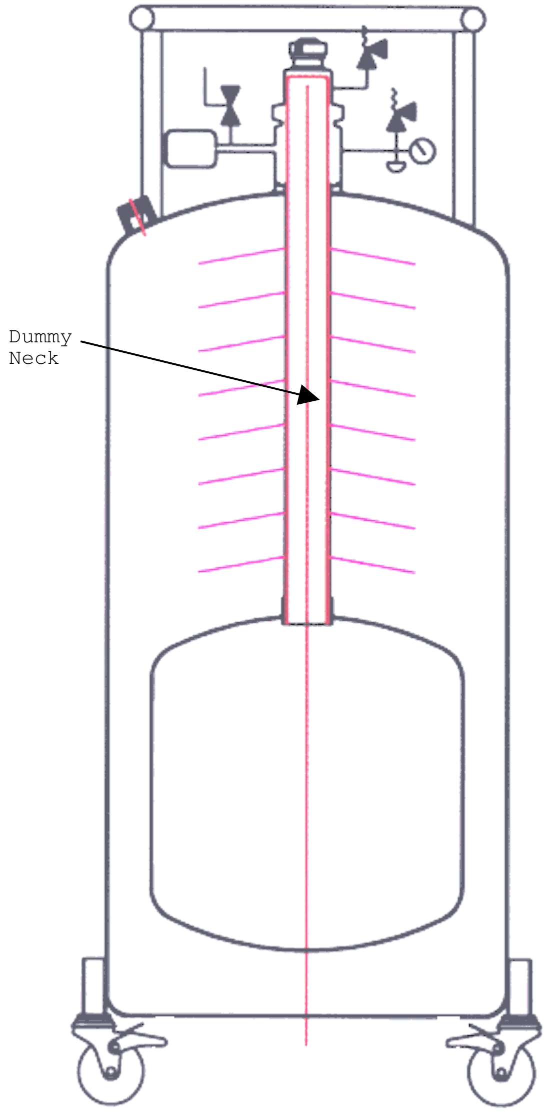
DANGERS	***PRECAUTIONS***
Intensely cold liquid and vapour can cause severe cold burns.	*Wear warm, dry gloves, eye protection goggles or face shield.*
Inert gas is asphyxiating and is especially dangerous in enclosed spaces.	*Avoid confined spaces and ensure adequate ventilation.*
At low temperatures, air and atmospheric moisture can condense and freeze onto cold vent valves, safeties etc and cause potential danger.	*Warm up and dry valves and fittings after transferring cold liquid and vapour.*
Atmospheric air may be drawn into the vessel if vents are left open. This can cause ice or solid air blockages in the vessel.	*Ensure the vessel is connected to a recovery system or a slight over-pressure is maintained in the dewar by means of a low pressure ballast valve.*
Liquid Helium evaporates very rapidly. The vapour being lighter than air displaces air from the top downwards in any enclosed space.	*Lower transfer tubes or experimental equipment SLOWLY into the dewar to avoid rapid evaporation.*

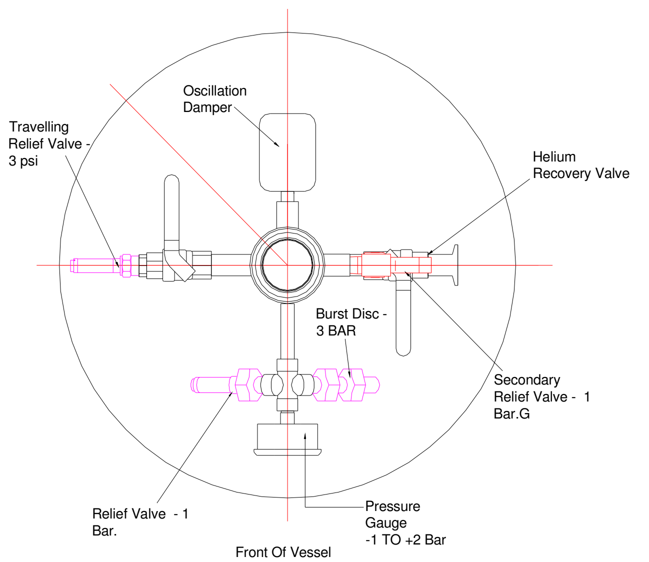
WARNING!

Due to the extremely rapid rates of evaporation which can occur under conditions of vacuum damage or other forms of high heat input and the large liquid / gas expansion ratio, it is essential that adequate vents and safeties are maintained in good order and that all precautions are taken to prevent ice or solid air blockages of the neck.

Helium dewars, although quite robust under normal conditions, must not be handled carelessly - **LIFT ONLY BY THE HANDLES OR LIFTING LUGS PROVIDED.** Use the wheels, trolley or fork-lift facilities provided with the vessel for the transportation of the dewar.

DESCRIPTION OF THE VESSEL





The vessel is a double walled, vacuum superinsulated stainless steel container as shown in fig. 1.

The **Primary Relief Valve, Primary Vent Valve, Primary Pressure Gauge** and **Oscillation Damper** are attached to the top head of the vessel as shown in fig.1., with the safety head removed.

The safety head incorporates an inner neck tube made of low thermal conductive non-metallic material and incorporates the **Secondary Relief Valve**, **Travelling Vent Valve**, **Isolation Ball**

Valve and **Siphon Entry Port**.
The purpose of the secondary head is two fold: -

a) The inner neck tube creates a narrow annulus through which venting of Helium gas, due to normal evaporation, takes place and improves the thermal efficiency of heat transfer between the cold vent gas and the floating radiation shields.

b) It provides two separate vent paths for safety. In the event that air is allowed to enter the dewar through one of the **Vent Valves** or the **Siphon Gland**, ice or solid air blockage of the neck might occur. By creating two separate vent paths, a second safety valve will always be available to relieve any unnecessary excess pressure in the dewar.

2 - DESCRIPTION OF THE VALVES AND SAFETIES

1)	**Oscillation Damper**	Very severe and rapid thermal oscillation can occur in small in small bore tubes which connect between the cold Liquid Helium and the warm atmospheric head of Helium Dewars. The narrow annulus created by the twin neck can behave very similarly to a small bore tube and the oscillation damper is installed to prevent this.
2)	**Primary Relief Valve**	This is a low pressure safety relief valve installed in the primary vent path to relieve excess pressure during normal operation.
3)	**Primary Vent Valve**	This is a ball valve installed in the primary vent path to ensure that under normal operation, the natural evaporation rate of Helium gas is through the narrow annulus, close to the wall of the vessel neck tube, to give the best thermal efficiency to the insulation and floating radiation shields. This is the valve which should be connected to a Helium recovery system during normal operation.
4)	**Pressure Gauge**	This indicates the pressure in the inner vessel.
5)	**Burst Disc**	This is a rupture device which is connected to the large bore inner neck and gives overall protection in the event of gross failure in the vessel.
6)	**Secondary Relief Valve**	This is a low pressure safety relief valve connected to the inner neck of the safety head to provide a second relief in the event of overload of the primary relief valve or primary vent path blockage.

7) **Travelling Vent Valve**

This is a ball valve installed in the secondary (inner) vent path to allow de-pressurising of the vessel if the primary path was blocked.

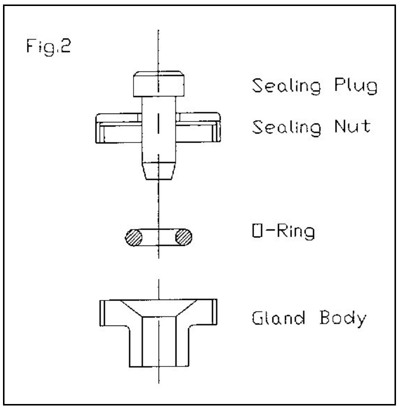
At the outlet of this valve is a safety relief valve (set typically at 3 psi). When the full vessel is being transported, it is recommended that the Travelling Valve is in the open position.

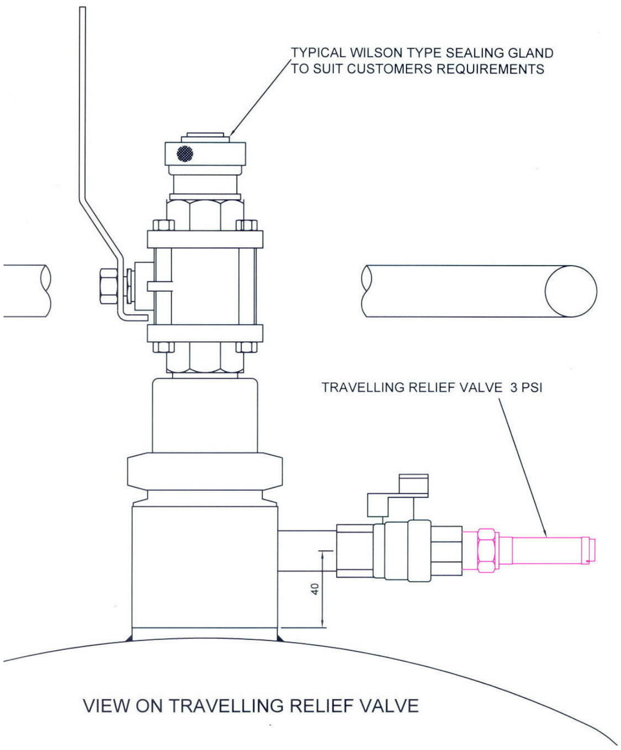
8) **Isolation Ball Valve**

Installed in the secondary (inner) vent path to allow insertion of the helium siphon with minimum loss of pressure / ingress of air.

9) **Syphon Entry Port**

Syphon entry ports are provided. These will be bored out to suit the size of syphon the customer intends to use. We can supply from 10mm to 16mm Dia or NW25KF flange.





In some instances more than one is provided, and also reducing glands which cater for two size are installed depending on the application.

Whatever the size or configuration, they all conform generally to the typical arrangement shown in fig. 2.

10)	**Castors**	Castors are fitted as standard on the CH Range of helium dewars. Two castors are fitted with a footbrake to prevent the vessel from moving when required.
11)	**Dummy Neck**	The dummy neck tube is manufactured from a non-metallic material which has low thermal conductivity properties. The function of the dummy neck, detailed previously, is to improve the efficiency of the vessel due to the cooling of the neck & radiation shields utilising the daily evaporation of helium in the vessel and to improve the safety of the vessel by having two, separate safety relief paths.
12)	**Tubular Handring**	The tubular handring is used for both manoeuvrability of the vessel, and to provide protection of the valves and safeties.

3 - PUTTING A NEW DEWAR INTO SERVICE

NOTE! Because of the low latent heat of vaporisation of Liquid Helium it would be grossly wasteful to attempt to fill a warm dewar without pre-cooling it.

a) Pre-Cooling With Liquid Nitrogen

Part fill with Liquid Nitrogen (approximately 20% to 30% of rated contents) and allow the vessel to cool down to -196^{o}C. Note! This can take several days on the first cooldown of a new, warm dewar.

Pump out the remaining Liquid Nitrogen by pressure dispensing until the vessel is virtually empty.

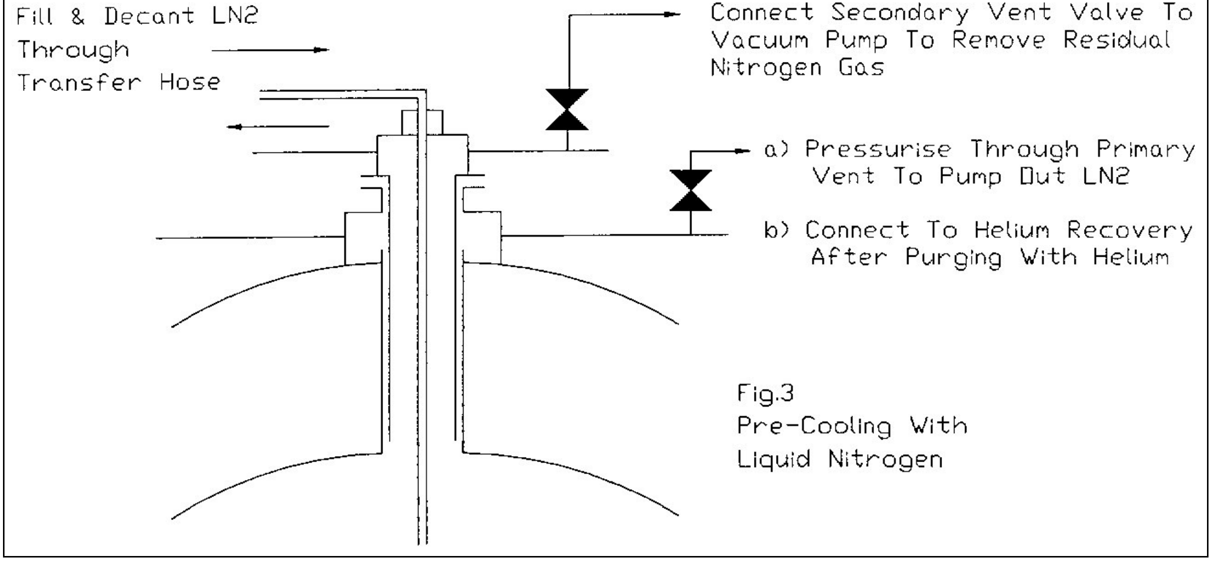


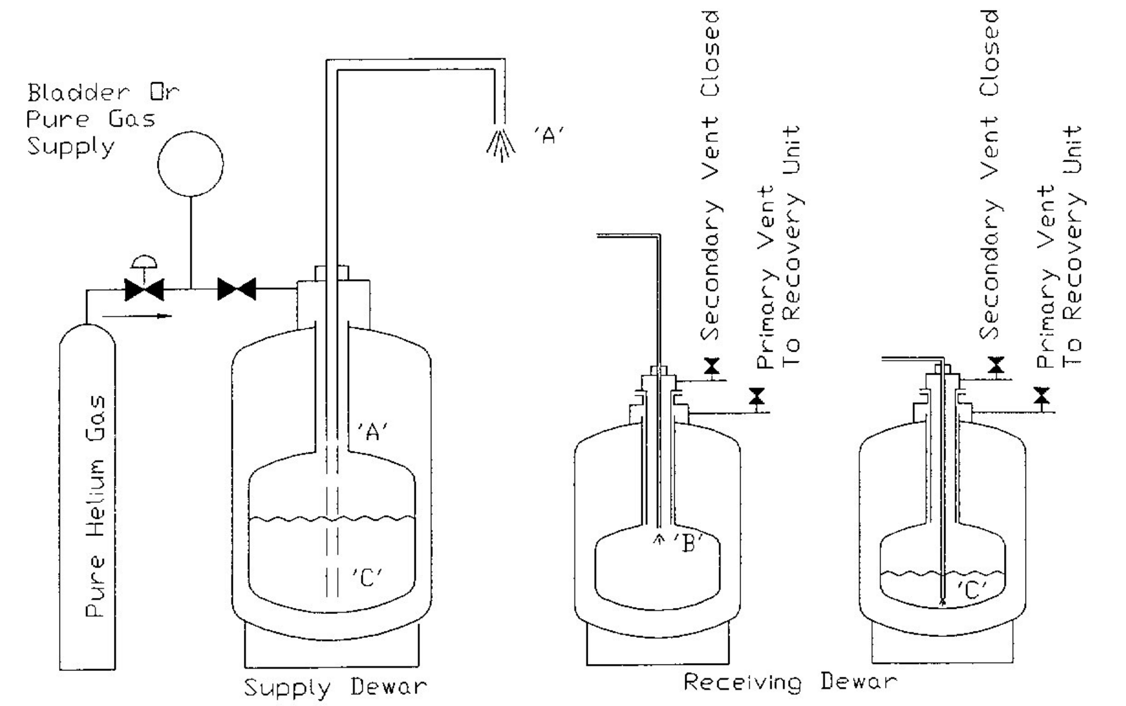
Fig.3
Pre-Cooling With
Liquid Nitrogen

Remove all final traces of Nitrogen from the vessel by connecting to a vacuum pump as shown in fig. 3.

b) Purging With Cold Helium Gas

After removing all Nitrogen gas from the dewar, purge the interior with cold Helium gas from the supply tank. The use of cold gas will help to lower the temperature of the dewar further and help in reducing liquid transfer losses when it is eventually filled.

Fig.4



Arrange the supply tank, receiving dewar, and vacuum insulated tube as shown in fig. 4.

Provide a means of pressurising the supply tank (either a low pressure helium gas supply or a bladder as shown).

Remove the syphon gland seal from the supply tank and insert the longer leg of the transfer tube - Helium gas will flow through and purge the transfer tube (Position 'A').

Remove the syphon gland seal from the receiving dewar and slowly lower the transfer tube into both supply tank and receiving dewar (Position 'B'). Cold gas from the supply tank will help to further pre-cool the receiving dewar.

Lower the transfer tube slowly to Position 'C' - in some instances it may be easier to raise the receiving dewar on a trolley jack to attain this final position.

At this final Position 'C', the intense cold concentrated at the base of the dewar will cool it sufficiently to allow liquid to begin to collect in the receiving dewar.

Visual indication of the state of the inside of the receiving dewar is evident during cooling down and filling.

Whilst the dewar is still cooling down there will be a heavy discharge of gas through the vent valve to the recovery system together with quite high pressure fluctuations in the system due to the rapid expansion of evaporating liquid and cold gas.

If persistent pressure fluctuations continue, gradually raising or lowering the position of the transfer tube in the receiving dewar can help to solve the problem.

4 - DISPENSING LIQUID HELIUM

This process is exactly the same as the arrangement for filling except that the dewar now becomes the supply tank and the transfer tube is routed from the dewar to the cryostat or experimental apparatus which is to receive the helium.

GENERAL INSTRUCTIONS

This is a double walled, vacuum insulated container designed and constructed to store liquefied gas. It has been constructed from materials suitable for cryogenic service to ensure a high performance specification. Every care has been taken in it's design, construction, and testing to ensure it is safe and fit for the purpose it is sold.

WARRANTY

If, within 24 months of the date of supply, this product fails due to faulty workmanship we will, at our option, either repair or replace the faulty product (or part of the product) provided the purchaser returns the product (or part) carriage paid to our factory, and provided we are satisfied that the said defect is not due to negligent handling or misuse by the purchaser.

Wessington will return the repaired or replaced product (or part) to the purchaser. These return carriage costs will be pre-paid by Wessington Cryogenics.

This warranty does not reduce your statutory rights under English Law and is only valid in the UK.