

# Use of Cryogenic Liquid Containers.

Safe handling of cryogenic containers is important for proper operation in your application.



Cryogenic liquid containers are commonly used to store and deliver liquefied gases colder than  $-130^{\circ}\text{F}$ . Such liquefied gases may include nitrogen, oxygen, argon, carbon dioxide, nitrous oxide, and helium. Most of these are sold to laboratories under the name Alphagaz 1000.

These containers may also be referred to as Dewars or VGLs (vent, gas or liquid use valves). The users of these containers should be aware of their construction and how they operate.

Cryogenic containers are portable storage devices that are well insulated due to the large differences in temperature between the outside atmosphere and the liquefied product inside. Most consist of two containers with a vacuum between them for optimum insulation. They are well engineered to prevent vaporization of the stored contents and typically have a loss rate of 1 to 2 % per day. Safety systems are built in that vent off any pressure build-up periodically to prevent rupture. That is why one will often hear gas venting from the safeties on these

containers particularly during warm weather. The gas losses one hears is actually very small in comparison to the total gas volume of the container though since one liter of liquid can produce approximately 700 to 850 liters of gas.

## Operation of a Cryogenic Container

Cryogenic containers are designed for supplying either gas or liquid product. At the top of the vessel is a manifold system with multiple valves that can easily confuse an inexperienced operator. Most containers have four valves that are labeled for their intended use. There are two valves with the appropriate CGA fitting for the product, one for gas withdrawal and one for liquid withdrawal. There is one valve normally labeled vent which will vent off the headspace gases during filling of the container. The fourth valve is labeled pressure building valve and is opened when one needs to remove larger quantities of product particularly for gas withdrawal. This valve allows a small amount of liquid to pass through a

vaporizing coil between the inner and outer jacket of the container to increase the pressure in the headspace. The pressure build up in the head space is limited by the pressure building regulator and the safety relief device on the container.

Gas phase withdrawal is normally not from the headspace of the container. When the gas withdrawal valve is opened, liquid product goes through a coil between the jackets and is vaporized. Some containers may also have an economizer that will allow excess pressure that builds up in the headspace to discharge through the gas phase outlet when it is open.

Selection of the right pressure relief device is critical for most applications where cryogenic containers are used. These relief devices control the rate at which both gas and liquid products are delivered as well as their delivery pressure. Normally, cryogenic containers are available with three different pressure relief devices or safeties- 22 psig, 230 psig, or 350 psig. Other pressures are available for special applications but they cannot exceed the rated

pressure of the container. For many applications, a 22 psig safety is ideal particularly when a large volume of low pressure product is needed. Many users make the mistake of thinking that the lower pressure safety will result in increased product loss which is not entirely true. Product loss during storage is due primarily to heat leaking through the jackets and insulated container and that heat transfer is not dependent on the safety.

### Safe Handling and Use

Cryogenic containers are much heavier than most gas cylinders. Empty cryogenic containers typically weigh over 200 lbs and full containers can weigh up to 500 lbs. Because of the increased weight and the design of the containers themselves, there are several safety recommendations that should be followed:

- Never try to tilt and roll the container using the top hand ring if the container does not have casters. Use only the specially designed handling carts to move these cylinders.
- Always use proper protective equipment when using cryogenic products. This should include thermally protective gloves, face shields and clothing that are designed to protect personnel from extremely cold gases and liquids.
- Do not tamper with or alter outlet fittings or safeties.
- Store oxidizing products like liquid oxygen and nitrous oxide away from flammable materials
- Remember that all cryogenic containers periodically release gases and that they should not be stored or used in enclosed spaces without proper ventilation.
- Outlet lines for both liquid and gas delivery must be designed to withstand extremely low temperatures. Pressure relief devices on these lines should be considered when there is a possibility of pressure build up inside.
- Do not use the pressure building valve when withdrawing liquid product under 25 psig. Slowly open the liquid withdrawal valve when transferring product to open containers since the liquid may splatter.
- Turn the pressure building device off when not withdrawing product.
- Report any containers that you suspect that the safety may be opening excessively. Either the safety may have failed or the vacuum between the jackets may have been lost resulting in excessive heat transfer
- Never transfer cryogenic liquids to totally enclosed vessels. Make sure any enclosed vessels have properly designed safeties that can handle rapid pressure build up.
- Store cryogenic vessels in cool well ventilated areas away from direct sunlight or heat.
- Never drop cryogenic containers or try to roll them on their sides. Rough handling of these containers can cause serious damage.

Cryogenic containers are an economical way to provide both gases and liquids for many different applications. Misuse of these containers can result in serious injury to operators.