



Safety and Warnings

This manual is designed to familiarize experienced operators with the safety precautions, operational parameters, operational features and maintenance requirements of the Transport Trailer.

The information provided in this manual provides guidance to the owner and should be used to enhance the owner's already in practice, Safety and Maintenance programs.

For more information on the safe handling of cryogenic liquids refer to CGA P-12 from the Compressed Gas Association (www.cganet.com or 703-788-2700).

It is imperative that all persons having contact with this equipment become thoroughly familiar with the safety precautions, procedures, schematics and operating sequences contained in this operation manual.

If for any reason this manual becomes confusing or the information provided is not completely understood contact a Technical Service Representative at Applied Cryo Technologies (ACT) at (281) 888-3884 before proceeding.

WARNING: The trailer is designed for cryogenic service. Many of the components and materials are regulated and are designed for cryogenic service. Design modifications to this piece of equipment could result in catastrophic failure resulting in severe bodily injury or death.

Hazards resulting from Cryogenic Temperatures

All cryogenic liquids are extremely cold. Cryogenic liquids and their vapors can rapidly freeze human tissue. Unprotected skin can stick to metal that is cooled by cryogenic liquids. The skin can then tear when pulled away.

WARNING: Contact with cryogenic liquid, its boil-off gases, or components cooled to these low temperatures can readily cause frostbite, cryogenic burns and severe bodily injury. All operators of the trailer should be well trained regarding characteristics and the handling of cryogenics. In the event of bodily contact with a cryogen immediately take the patient to the hospital to re-warm skin.

WARNING: To avoid a potential splash hazard when filling or offloading using a transfer hose, always blow down hose bleeds or drain valves slowly.

WARNING: Personnel, including rescue workers, should not enter areas where the oxygen concentration is below 19.5%, unless provided with a self-contained breathing apparatus or air-line respirator.

As a minimum, operators who handle cryogenic liquids should be equipped with the following Personal Protective Equipment (PPE):

- **Face Shield:** The eyes and face are best protected from splashing liquid by a full-face shield.

- **Gloves:** At the very least always wear loose-fitting leather gloves. The gloves should fit loosely, so they can easily be removed if liquid nitrogen spills or splashes into them. Thermal protective gloves specifically designed for cryogenic use with close fitting ribbed cuffs will prevent this from happening.
- **Shirt:** Arms should not be exposed - wear long-sleeved shirt with no cuffs (pure cotton or flame-retardant materials are preferred).
- **Trousers:** These are to be worn outside the shoes to prevent the possibility of liquid spilling into shoes and have no cuffs (pure cotton or flame-retardant materials are preferred)
- **Shoes:** Enclosed footwear, preferably safety shoes/boots, must be worn whilst handling liquid nitrogen. Take caution not to allow liquid nitrogen to be trapped in clothing near the skin.
- **No metal jewelry:** Rings, watches, etc. should not be worn while transferring cryogenic liquids.

WARNING: When the trailer contains LIN, always operate and store the trailer in well ventilated areas only. Failure to do so could result in severe bodily injury or even death.

Cryogenic fluids should only be used and stored in well ventilated areas. All cryogenic liquids produce large volumes of gas when they vaporize. Air is normally 21% oxygen by volume. When this is reduced to 15-16% oxygen, symptoms of asphyxia will develop. At 12% oxygen, the individual will lose consciousness without warning and may be unaware of any danger. When there is not enough oxygen, asphyxiation and death can occur very quickly. When cryogenic liquids form a gas, that gas is very cold and usually heavier than air. This cold, heavy gas does not disperse very well and can accumulate near the floor. Even if the gas is non-toxic, it displaces the air. Oxygen deficiency is a serious hazard in enclosed or confined spaces.

Table 1. Effects of Hypoxia⁸
(Reduced Oxygen)

Oxygen Percentage Available	Symptoms
21	Normal conditions, no effect.
19.5	OSHA oxygen-deficient atmosphere.
17	Muscular impairment, rapid breaths.
12	Dizziness, headache, rapid fatigue.
9	Unconsciousness.
7 to 6	Death within a few minutes.

<http://www.fireengineering.com/articles/2010/07/survivability-profiling-how-long-can-victims-survive-in-a-fire.html>



Additional Warnings

WARNING: Loss of Vacuum - If a loss of vacuum occurs it will be evident by cold spots or frost on the outer shell and/or abnormally rapid pressure build up (main safeties going off continually). The cause could possibly be a jacket breach or an inner vessel leak. Accelerated product vaporization can result in a fire and/or explosion and could result in severe bodily injury or even death. If these conditions are evident contact Applied Cryo Technologies (ACT) at (281) 888-3884 immediately.

Early morning condensation or dew on the tank is normal and may be irregularly distributed on the outer shell.

WARNING: Sources of fire - Keep equipment away from open flames or sparks.