ARGON MAXIMIZER

LIQUID CYLINDER FILLING SYSTEM

Manual Number 1.0
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Technical Service
1-800-400-4683 (United States)
1-952-758-4484 (Worldwide)
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Introduction

The Argon Maximizer is an efficient cryogenic heat exchanger designed to reduce filling losses in argon liquid cylinders. It operates with a simple heat transfer principle that consumes inexpensive liquid nitrogen to sub-cool the argon during the liquid cylinder filling process. The results are lower liquid cylinder filling losses and colder liquid for longer holding times – giving you better handling logistics at you fill plant and at your customer's site. The Argon Maximizer can also be used with Lo-Loss to further optimize the filling process.

Product Highlights

- Reduce argon liquid cylinder filling costs by as much as 73%
- Increase customer satisfaction with longer hold times (40 hours on average)
- Reduce liquid cylinder fill time labor
- Eliminate just-in-time liquid cylinder filling

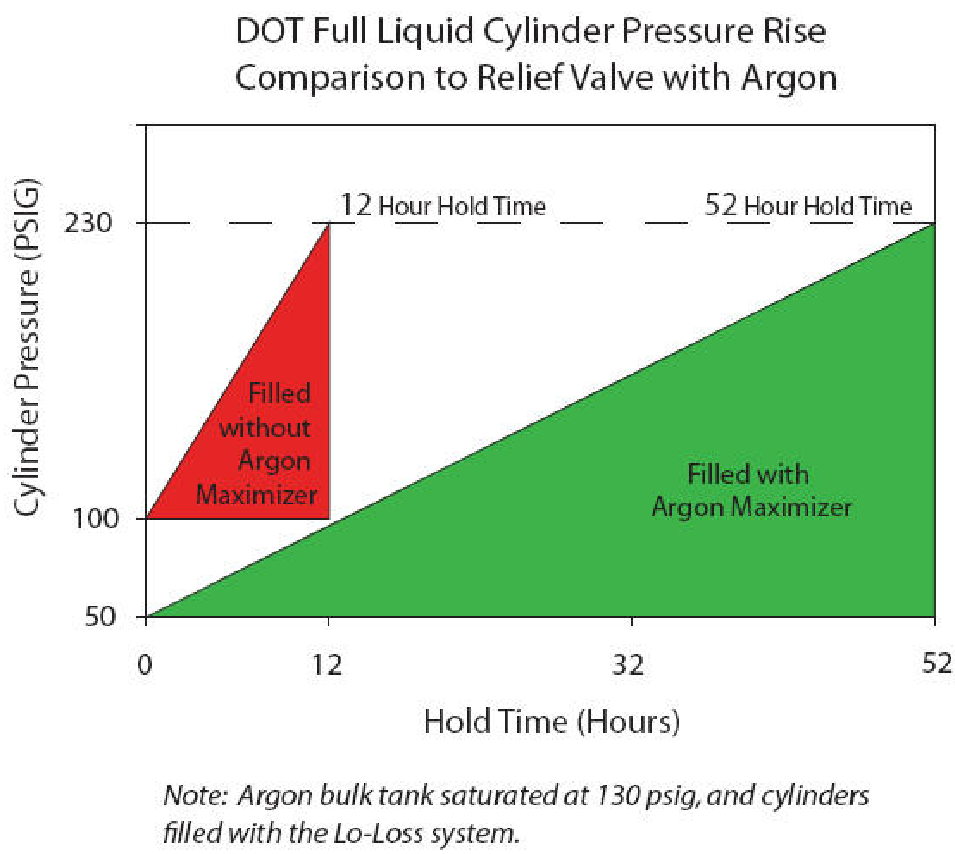


Figure 1: Improved Holding Time

SYSTEM SPECIFICATIONS

DIMENSIONS

Diameter	20 in	50.8 cm
Height	69 in	176 cm
Empty Weight	263 lbs	120 kg
Full Weight	515 lbs	234 kg

DESIGN CRITERIA

Code	ASME Section VIII, Div.1
MAWP	300 psig (20.7 bar)
Insulation Type	Super Insulation

CAPACITY

Net Volume (LN2@ 25-40 psig)	32 gal	123 liter
Coil Storage (Argon)	2 gal	7 liter

PERFORMANCE

Evaporation Rate % per Day	2.0
Flow Rate (Argon)	50 liter/min

COMPONENTS

Nominal Operating Pressure	25 psig – 40 psig	1.7 bar – 2.8 bar
Nominal Operating Level	100%-30%	
MAWP	300 psig	20.7 bar
Secondary RV Setting	375 psig	25.9 bar

CONSTRUCTION

Inner Vessel Material	Stainless Steel
Outer Vessel Material	Stainless Steel
Liquid Level Gauge	Cyl-Tel

System Requirements

Power: 110 VAC power for Cyl-Tel	
Bulk storage tanks: Nitrogen and Argon	
Summary of piping connections	
Liquid Nitrogen (IN)	⅜” fpt
Bulk Nitrogen Pressure	¼” mpt
Argon Liquid (IN)	½” fpt
Argon Liquid (OUT)	½” fpt
Bulk Argon Pressure (IN)	¼” fpt
Bulk Argon Pressure (OUT – Use with LO-Loss	¼” mpt

Typical Layout

Ideal layouts will vary from site to site. Layout shown in figure 2 is ideal for fill stations with the LAR scale on the end (if there floor space next to the scale). It is recommended to keep the Maximizer as close to the scale as possible. Locating directly behind the scale is another option. Access to the Maximizer is only really before and after the fill (if attached fill manifold with a control valve).

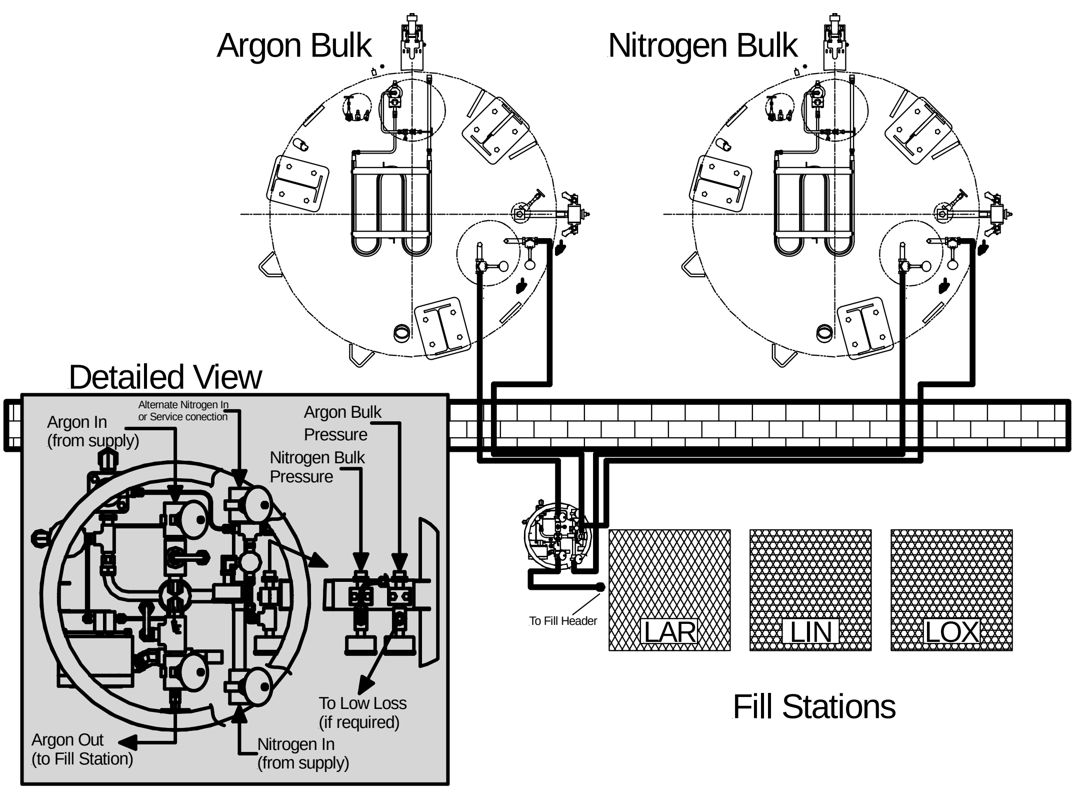
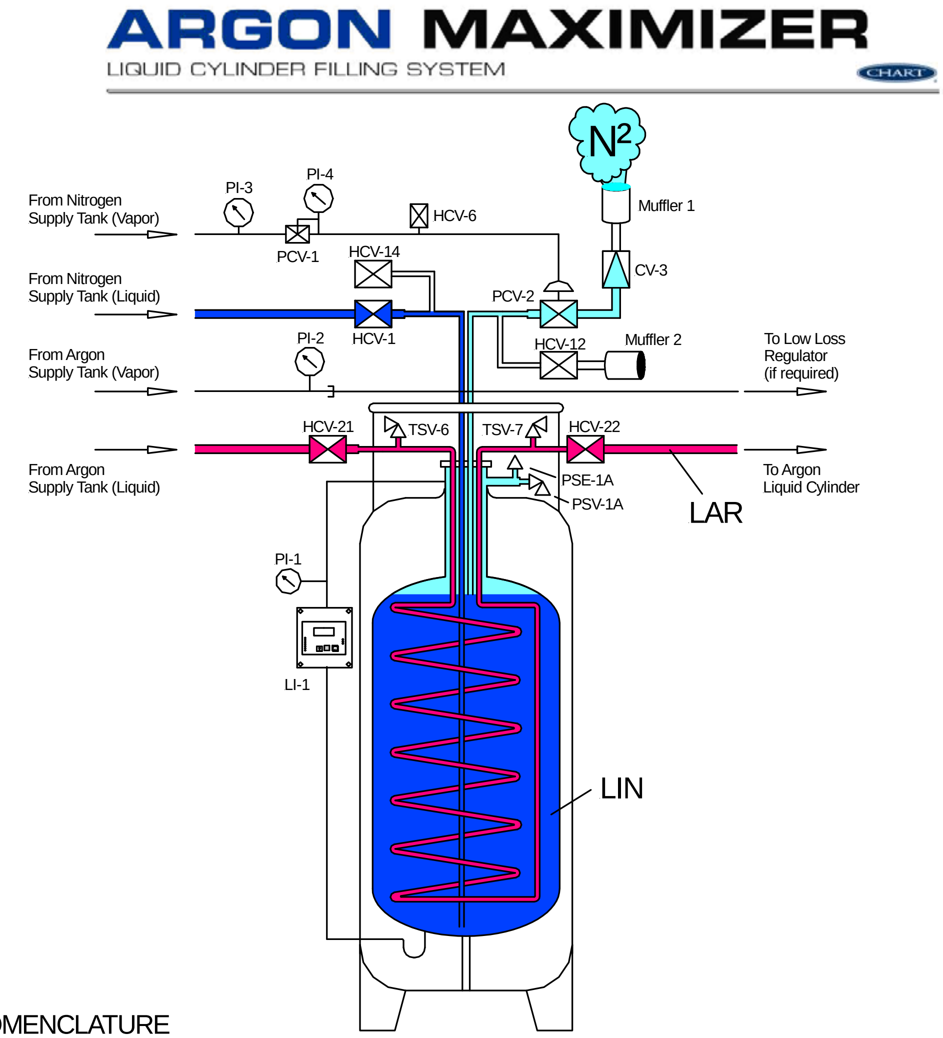


Figure 2: Typical Layout

Schematic



NOMENCLATURE

TAG#	DESCRIPTION	FUNCTION	Chart Part Number
CV-3	CHECK VALVE	Prevents moisture from entering PCV-2	13100094
HCV-1	BOTTOM FILL	Start and Stop bottom filling	1713202
HCV-12	VAPOR VENT	Allows manual venting of cylinder vapor space	1713202
HCV-14	SECONDARY BTM FILL/PURGE	Empty trycock and gas purge access	1713202
HCV-21	ARGON IN, ISOLATION	Argon liquid from bulk (Maximizer in)	10502848
HCV-22	ARGON OUT, ISOLATION	Argon liquid out of Maximizer (to cylinder)	10502848
LI-1	LEVEL INDICATOR	Maximizer liquid level indication	13141662
PCV-1	PRESSURE CONTROL VALVE	Controls PCV-2 open/close set point	11768373
PCV-2	PRESSURE CONTROL VALVE	Open/close to maintain Maximizer pressure	11081723
PI-1	PRESSURE INDICATOR	Maximizer pressure indication	2015179
PI-2	PRESSURE INDICATOR BULK LAR	Argon bulk tank pressure indication	2015179
PI-3	PRESSURE INDICATOR BULK LIN	Nitrogen bulk tank pressure indication	2015179
PI-4	PRESSURE INDICATOR PCV-1	PCV-1 pressure set point indication	2015179
PSE-1A	PRESSURE SAFETY ELEMENT	Safety (Burst Disc) for fire condition	11671281
PSV-1A	PRESSURE SAFETY VAVLE	Safety (relief valve) set at MAWP (@ 300psig)	1811252
TSV-6	LINE SAFETY ARGON IN	Argon inlet line safety (@ 450 psig)	1811472
TSV-7	LINE SAFETY ARGON OUT	Argon outlet line safety (@ 450 psig)	1811472

Figure 3: Argon Maximizer Schematic

Theory of Operation

Safety Statement

All operators should have full and complete understanding of the content of this manual before operating the equipment described. The manual is intended to describe the operation of the equipment, supplement any additional site specific training and not intended to supersede any site specific standards.

Warranty Statement

*Vacuum integrity as measured by conformance to Chart NER (**N**ormal **E**vaporation **R**ate) specifications is warranted for 3 years from the date of invoice.*

Piping components are warranted for a period of 90 days from the date of invoice. Authorization to replace piping components can be given by the product manager, regional sales person or customer service representative.

*All replacements under warranty with a component price less than $75.00 will be replaced at no charge. The **R**eturn **M**aterial **A**uthorization (RMA) process must be initiated prior to replacements being sent out. All components exceeding $75.00 that are replaced under warranty will be invoiced to the customer. Upon return of the components the customer will be issued a credit based on our component evaluation.*

Chart Storage Systems Division will not be liable for product losses, component replacement labor exceeding 2 hours for actual replacement and 2 hours travel time (4 hours @ $65.00/hour), or any other costs not related to replacement of components covered by warranty.

Safety

As with any cryogenic system, it should be observed that any non-insulated piping can get extremely cold and should not be touched by exposed skin. If the system requires maintenance, it should be shutdown and allowed to warm-up.

If maintenance is to be done on the system, such as changing valve seats, it is extremely important that the pressure be relieved from the system through the vent valves. The five transmitters can monitor the system pressures and liquid levels.

When doing maintenance on the system, it is recommended that the manual isolation valve to the bulk tank be closed.

Safety Summary

Strict compliance with proper safety and handling practices is necessary when using a cryogenic system. We recommend that all our customers re-emphasize safety and safe handling practices to all their employees and customers. While every possible safety feature has been designed into the unit and safe operations are anticipated, it is essential that the user of the cryogenic system carefully read to fully understand all WARNINGS and CAUTION notes listed in this safety summary and enumerated below. Also read the information provided in the Safety Bulletin for Oxygen and Inert Gases following this Safety Summary. Periodic review of the Safety Summary is recommended.

☞ **WARNING:**
In oxygen enriched atmosphere, flammable items burn vigorously and could explode.

Excess accumulation of oxygen creates an oxygen-enriched atmosphere (defined by the Compressed Gas Association as an oxygen concentration above 23%). Certain items considered non-combustible in air may burn rapidly in such an environment. Keep all organic materials and other flammable substances away from possible contact with oxygen; particularly oil, grease, kerosene, cloth, wood, paint, tar, coal, dust, and dirt which may contain oil or grease. Do not permit smoking or open flame in any area where oxygen is stored, handled, or used. Failure to comply with this warning may result in serious personal injury.

☞ **WARNING:**
Nitrogen and argon vapors in air may dilute the concentration of oxygen necessary to support or sustain life.

Exposure to such an oxygen deficient atmosphere can lead to unconsciousness and serious injury, including death.

➢ **CAUTION:**
Before removing and parts or loosening fittings, empty the cryogenic container of liquid contents and release any vapor pressure in a safe manner.

External valves and fittings can become extremely cold and may cause painful burns to personnel unless properly protected. Personnel must wear protective gloves and eye protection whenever removing parts or loosening fittings. Failure to do so may result in personal injury due to the extreme cold and pressure in the tank.

☞ **WARNING:**
Accidental contact of liquid gases with skin or eyes may cause a freezing injury similar to a burn.

Handle liquid so that it will not splash or spill. Protect your eyes and cover skin where the possibility of contact with liquid, cold pipes and equipment, or cold gas exists. Safety goggles or a face shield should be worn if liquid ejection or splashing may occur or cold gas may issue forcefully from equipment. Clean, insulated gloves that can be easily removed and long sleeves are recommended for arm protection. Cuffless trousers should be worn over the shoes to shed spilled liquid.

☞ **WARNING:**
If clothing should be splashed with liquid oxygen it will become highly flammable and easily ignited while concentrated oxygen remains.

Such clothing must be aired out immediately, removing the clothing if possible, and should not be considered safe for at least 30 minutes.

☞ **WARNING:**
Use only replacement parts that are compatible with liquid oxygen and have been cleaned for oxygen use.

Do not use regulators, fittings, hoses, etc., which have been previously used in a compressed air environment. Similarly, do not use oxygen equipment for compressed air. Failure to comply with these instructions may result in serious damage to the container.

> **CAUTION:**
> Before locating oxygen equipment, become familiar with the relevant EU Directives or National Fire Protection Assosiation (NFPA) standards for "Bulk Oxygen Systems at Customer Sites", and with all local safety codes.

The NFPA standard covers general principles recommended for installing bulk oxygen systems on industrial and institutional consumer premises.

> **CAUTION:**
> To prevent possible tip over, do not leave tank standing upright unless it is secured to its foundation (bolted down).

Transporting and erection of the tank should be performed in accordance with rigging instructions available from CHART. Failure to comply with these instructions may result in serious damage to the container.

Safety Bulletin

A portion of the following information is extracted from Safety Bulletin SB-2 from the Compressed Gas Association, Inc. (CGA). Additional information on nitrogen and argon and liquid cylinders is available in CGA Pamphlet P-9. Write to the Compressed Gas Association, Inc., 1235 Jefferson Davis Highway, Arlington, VA 22202.

From CGA Safety Bulletin

Cryogenic containers, stationary or portable are from time-to-time subjected to assorted environmental conditions of an unforeseen nature. This safety bulletin is intended to call attention to the fact that whenever a cryogenic container is involved in any incident whereby the container or its safety devices are damaged, good safety practices must be followed. The same holds true whenever the integrity or function of a container is suspected of abnormal operation.

Good safety practices dictate that the contents of a damaged or suspect container be carefully emptied as soon as possible. Under no circumstances should a damaged container be left with product in it for an extended period of time. Further, a damaged or suspect container should not be refilled unless the unit has been repaired and re-certified.

Incidents, which require that such practices, be followed, include highway accidents, immersion in water, exposure to extreme heat or fire, and exposure to most adverse weather conditions (earthquakes, tornadoes, etc.). As a rule of thumb, whenever a container is suspected of abnormal operation, or has sustained actual damage, good safety practices must be followed.

In the event of known or suspected container vacuum problems (even if an extraordinary circumstance such as those noted above has not occurred), do not continue to use the unit. Continued use of a cryogenic container that has a vacuum problem can lead to embrittlement and cracking. Further, the carbon steel jacket could possibly rupture if the unit is exposed to inordinate stress conditions caused by an internal liquid leak.

Prior to reusing a damaged container, the unit must be tested, evaluated, and repaired as necessary. It is highly recommended that any damaged container be returned to CHART for repair and re-certification.

The remainder of this safety bulletin addresses those adverse environments that may be encountered when a cryogenic container has been severely damaged. These are oxygen deficient atmospheres, oxygen-enriched atmospheres, and exposure to inert gases.

Oxygen Deficient Atmospheres

The normal oxygen content of air is approximately 21%. Depletion of oxygen content in air, either by combustion or by displacement with inert gas, is a potential hazard and users should exercise suitable precautions.

One aspect of this possible hazard is the response of humans when exposed to an atmosphere containing only 8 to 12% oxygen. In this environment, unconsciousness can be immediate with virtually no warning.

When the oxygen content of air is reduced to about 15 or 16%, the flame of ordinary combustible materials, including those commonly used as fuel for heat or light, may be extinguished. Somewhat below this concentration, an individual breathing the air is mentally incapable of diagnosing the situation. The onset of symptoms such as sleepiness, fatigue, lassitude, loss of coordination, errors in judgment and confusion can be masked by a state of "euphoria," leaving the victim with a false sense of security and well being.

Human exposure to atmosphere containing 12% or less oxygen leads to rapid unconsciousness. Unconsciousness can occur so rapidly that the user is rendered essentially helpless. This can occur if the condition is reached by immediate change of environment, or through the gradual depletion of oxygen.

Most individuals working in or around oxygen deficient atmospheres rely on the "buddy system" for protection - obviously, the "buddy" is equally susceptible to asphyxiation if he or she enters the area to assist an unconscious partner unless equipped with a portable air supply. Best protection is obtainable by equipping all individuals with a portable supply of respiratory air. Lifelines are acceptable only if the area is essentially free of obstructions and individuals can assist one another without constraint.

If oxygen deficient atmosphere is suspected or known to exist:

1. Use the "buddy system." Use more than one "buddy" if necessary to move a fellow worker in an emergency.
2. Both the worker and "buddy" should be equipped with self-contained or airline breathing equipment.

Oxygen Enriched Atmospheres

An oxygen-enriched atmosphere occurs whenever the normal oxygen content of air is allowed to rise above 23%. While oxygen is non-flammable, ignition of combustible materials can occur more readily in an oxygen-rich atmosphere than in air; and combustion proceeds at a faster rate although no more total heat is released.

It is important to locate an oxygen system in a well-ventilated location since oxygen-rich atmospheres may collect temporarily in confined areas during the functioning of a safety relief device or leakage from the system.

Oxygen system components, including but not limited to, containers, valves, valve seats, lubricants, fittings, gaskets and interconnecting equipment including hoses, shall have adequate compatibility with oxygen under the conditions of temperature and pressure to which the components may be exposed in the containment and use of oxygen. Easily ignitable materials shall be avoided unless they are parts of equipment or systems that are approved, listed, or proved suitable by tests or by past experience.

Compatibility involves both combustibility and ease of ignition. Materials that burn in air may burn violently in pure oxygen at normal pressure, and explosively in pressurized oxygen. In addition, many materials that do not burn in air may do so in pure oxygen, particularly when under pressure. Metals for containers and piping must be carefully selected, depending on service conditions. The various steels are acceptable for many applications, but some service conditions may call for other materials (usually copper or its alloys) because of their greater resistance to ignition and lower rate of combustion.

Similarly, materials that can be ignited in air have lower ignition energies in oxygen. Many such materials may be ignited by friction at a valve seat or stem packing, or by adiabatic compression produced when oxygen at high pressure is rapidly introduced into a system initially at low pressure.

Nitrogen and Argon

Nitrogen and argon (inert gases) are simple asphyxiants. Neither gas will support or sustain life and can produce immediate hazardous conditions through the displacement of oxygen. Under high pressure these gases may produce narcosis even though an adequate oxygen supply, sufficient for life, is present.

Nitrogen and argon vapors in air dilute the concentration of oxygen necessary to support or sustain life. Inhalation of high concentrations of these gases can cause anoxia, resulting in dizziness, nausea, vomiting, or unconsciousness and possibly death. Individuals should be prohibited from entering areas where the oxygen content is below 19% unless equipped with a self-contained breathing apparatus. Unconsciousness and death may occur with virtually no warning if the oxygen concentration is below approximately 8%. Contact with cold nitrogen or argon gas or liquid can cause cryogenic (extreme low temperature) burns and freeze body tissue.

Persons suffering from lack of oxygen should be immediately moved to areas with normal atmospheres. SELF CONTAINED BREATHING APPARATUS MAY BE REQUIRED TO PREVENT ASPHYXIATION OF RESCUE WORKERS. Assisted respiration and supplemental oxygen should be given if the victim is not breathing. If cryogenic liquid or cold boil-off gas contacts a worker's skin or eyes, the affected tissues should be promptly flooded or soaked with tepid water (105-115^oF; 41-46^oC). DO NOT USE HOT WATER. Cryogenic burns, which result in blistering or deeper tissue freezing, should be examined promptly by a physician.

CHART customer stations are safely designed with the following features:

1. A vacuum maintenance system specifically designed to provide long life and all possible safety provisions.
2. Safety relief devices to protect the pressure vessel and vacuum casing sized and selected in accordance with ASME standards to include a dual relief valve. While CHART equipment is designed and built to the most rigid standards, no piece of mechanical equipment can ever be 100% foolproof.

Installation

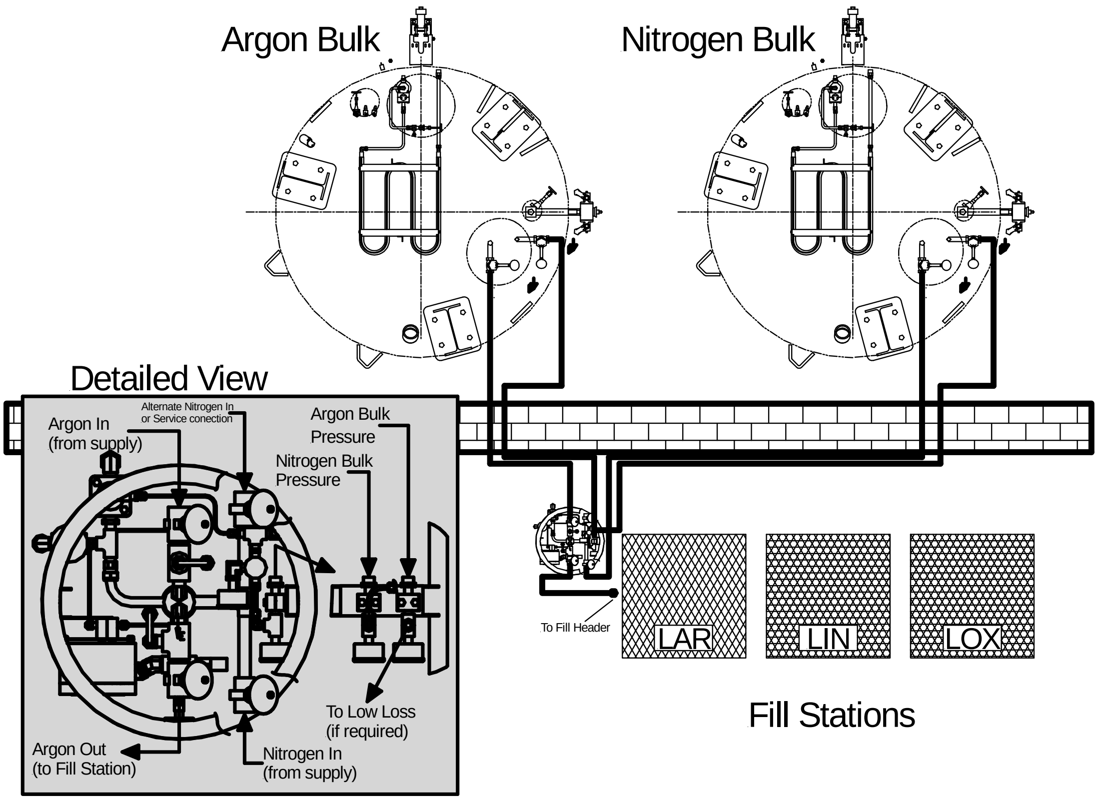


Figure 4: Typical Installation

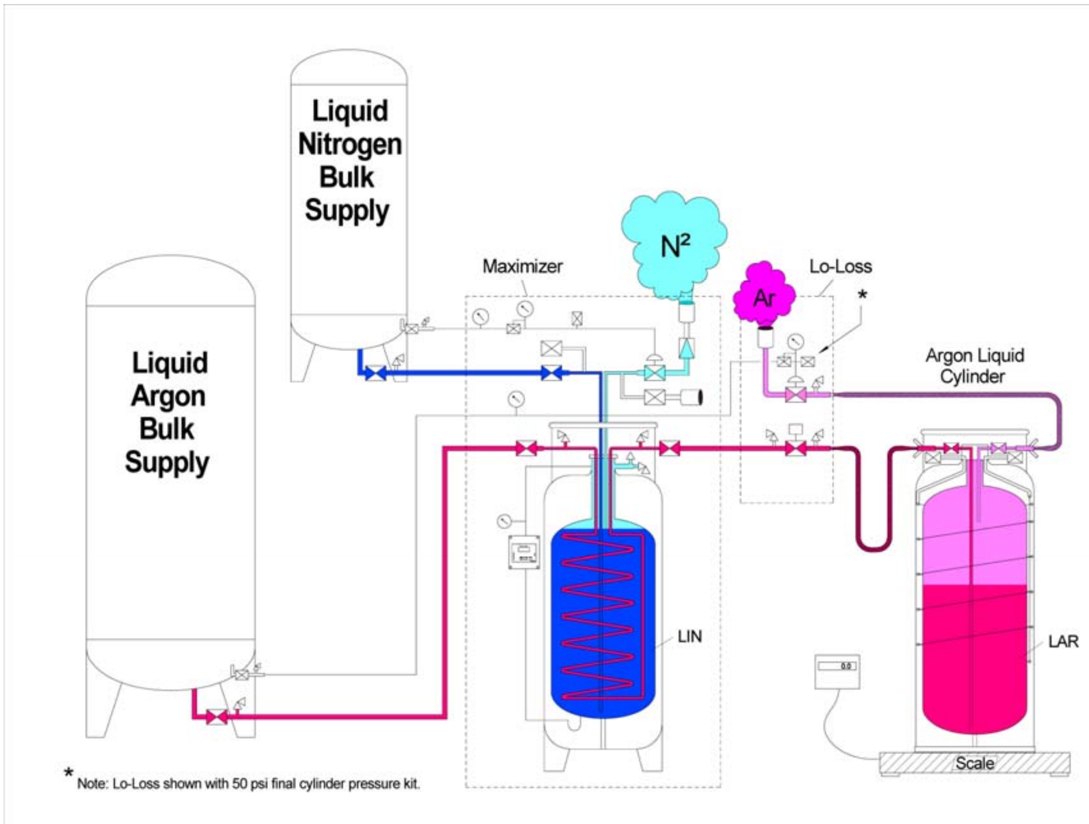


Figure 5: Liquid argon and nitrogen bulk supplies, Argon Maximizer, Lo-Loss, and argon liquid cylinder fill station set up.

Installation Procedure

Each of the following steps is discussed in further detail in subsequent sections.

1. Locate and position Argon Maximizer
2. Plumb Argon Liquid in from supply (Bulk Storage)
3. Plumb Argon Liquid out to Fill Manifold
4. Plumb Argon Bulk Tank Pressure Line (from Bulk vapor)
5. Plumb Nitrogen Liquid in from supply (Bulk Storage)
6. Plumb Nitrogen Bulk Tank Pressure Line (from Bulk vapor)
7. Commissioning

Placement of Argon Maximizer

Placement of the Argon Maximizer is important for best performance. When deciding upon placement, there are two main factors to consider.

1. How the location will increase or decrease the performance of the Argon Maximizer unit itself.
2. How the location will increase or decrease the safety, production, and usability for the operator.

For the safety and performance of both the Argon Maximizer and the operator, do not locate the unit near equipment that produces excessive moisture (i.e. cooling towers, drains, etc.). Excessive moisture can create an unsafe environment for the user that may result in injury.

> ❖ **Note:**
> Do not locate the Argon Maximizer near equipment that produces excessive moisture (i.e. cooling towers, drains, etc.).

Placement Considerations for the Argon Maximizer Unit

The typical layout prescribed at the beginning of this section (Installation) in Figures 4 and 5 shows Chart's recommended placement for maximum performance of the unit. Please note the addition of the Low Loss system included in Figure 5. This is an additional unit that is sold separately and used to help minimize losses while filling cylinders. Please consult Chart for further information. If the Low Loss is used now, or will be included in the future, it is good practice to leave room between the Argon Maximizer and the fill station.

The key consideration for the unit's performance would be the placement of the filling manifold. Keep the filling manifold as close as possible to the liquid fill station to minimize heat introduction to the system. This is accomplished by placing the unit as close as possible to the fill station.

> ❖ **Note:**
> Each site may have unique requirements; however, it is recommended to follow the basic layout located in the Installation section of this manual.

There are additional considerations for placing the equipment such as maintenance access. In order to accomplish this, the equipment should be oriented such that it allows easy access to all sides of the unit. This will ease maintenance or repair procedures that might need to access the individual cylinder gauges, control box, solenoid valves, or transmitters at any time.

The Argon Maximizer should be placed where it may receive a maximum amount of sunlight and airflow. Consideration should also be made for managing any condensation generated during the filling operation. Contact with excess moisture can hinder the performance of the Maximizer. In installations which require the Argon Maximizer to be located indoors, special arrangements must be made to safely exhaust nitrogen and argon vapors outside.

❖ **Note:**

It is important that the sun and wind contact both the external vaporizer and pressure build coils inside the skid to insure optimal operation of the unit and unusual build up of ice.

Placement Considerations for the Operator

It is beneficial to both the Maximizer unit and the operator to place the fill station as close as possible to each other. This is due to the fact that the operator will need to be able to access the Argon Maximizer and the liquid cylinder that is being filled simultaneously during filling operations. This will reduce operator fatigue and improve safety by decreasing the area that the operator will be involved in. You might have noticed in Figure 4 that the Maximizer and Argon fill station are located next to the Oxygen and Nitrogen fill stations. This will reduce the space needed in your facility by allowing all of the filling stations to be grouped together rather than having three separate areas. It also allows the bulk tanks to be located closely to all of the fill stations. Operators will not need to walk around the entire facility to visit all three bulk tanks.

Unpacking and Placement Best Practices

When the Argon Maximizer arrives, it is supply attached to a pallet, see Figure 5 below. Position the palleted Argon Maximizer near its final location by using a fork truck or a pallet jack. Remove the anchor bolts by hand (using the handling ring) and move the Argon Maximizer to the edge of the pallet. Slowly shift the Argon Maximizer until 6-8 inches overhang the pallet. Tip the Argon Maximizer and allow to slide off the pallet. Make sure the anchoring tabs located at the bottom of the tank don't make contact with the floor. The Argon Maximizer weighs 263 lbs and has a low center of gravity. This process should be only attempted using proper lift techniques and by personnel capable of lifting this weight.

Figure 6: Argon Maximizer Temporary Base

> ❖ **Note:**
> The Argon Maximizer assembly weighs approximately 263 lbs (120 kg) empty.

Liquid Argon Supply

The liquid argon supply is connected from the liquid argon bulk supply to the Argon Maximizer at the HCV-21 valve. The plumbing choices are listed below.

1. ½" ODT copper or stainless steel tubing
2. ½" Inert non-vacuum jacketed flex hose with ½" ODT flare fittings
3. ½" Inert vacuum jacketed flex hose with ½" ODT flare fittings

Chart recommends some form of insulation to reduce the heat flow into the argon. An inexpensive pipe wrap or pre-slit foam insulation is recommended. If the length of this line exceeds 30 feet, it may be necessary to use a more effective type of insulation. Please consider Chart's vacuum insulated pipe.

Argon Liquid Outlet

The recommendations for the argon liquid outlet are similar to those of the argon liquid inlet in regards to insulation and length. The main difference is in the plumbing material used. The argon liquid outlet requires ½" NPS or larger stainless steel or copper pipe. This section will connect to the Argon Maximizer on one end, and flow to either the Lo-Loss (If Equipped) or the liquid use valve on the argon liquid cylinder to be filled.

Argon Bulk Pressure Line

The argon bulk pressure line is only necessary for installations with the Lo-Loss installed and optional for all other installations. It is necessary on installations with the Lo-Loss because the argon bulk pressure line will be attached to the Lo-Loss regulator after it is installed on PI-2 (Pressure Indicator Bulk LAR). Without this line installed, the Lo-Loss will not operate correctly.

The reason it is optional on all other installations is because PI-2 is not necessary for the Argon Maximizer to function. However, Chart recommends taking the extra time and installing the line to PI-2. It will allow the user to quickly and easily monitor the bulk argon supply pressure by viewing PI-2 on the Argon Maximizer. If the argon bulk pressure line is not connected to PI-2, the gauge will not work and the operator will have to look at the argon bulk supply tank itself for a pressure reading. Use the following plumbing materials to install the argon bulk pressure line.

1. ⅛" ODT copper or stainless steel tubing
2. ¼" ODT copper or stainless steel tubing

Connect one end of the argon bulk pressure line to a vapor supply valve on the argon bulk tank. Then, connect the other end to PI-2 (Pressure Indicator Bulk LAR). In the situation where the Lo-Loss is also installed, tee the line from the argon bulk supply at PI-2 and run one side to PI-2 and the other to the Lo-Loss.

Liquid Nitrogen Supply

The liquid nitrogen supply has the same plumbing size, type, material, and insulation requirements as the liquid argon supply. Please refer to the liquid argon supply sections for these specific details.

Connect on end of the liquid nitrogen bulk supply line to a liquid use valve on the liquid nitrogen bulk tank. Connect the other end to HCV-1 (Bottom Fill). This will supply the Argon Maximizer with liquid nitrogen.

Nitrogen Bulk Pressure Line

The nitrogen bulk pressure line is necessary on all installations. The plumbing requirements are the same as those listed above for the argon bulk pressure line. Please review the argon bulk pressure line section for these specifications.

Connect one end of the nitrogen bulk pressure line to a vapor supply valve on the nitrogen bulk supply. Then, connect the other end to PI-3 (Pressure Indicator Bulk LIN).

Electrical Power

Will there be a batter option since the alerts don't function correctly?

The Argon Maximizer may require 120 VAC power depending upon the user's Cyl-Tel operation choices. The Cyl-Tel can be operated from 120 VAC power through the use of a 12 Volt transformer, or by battery. Electric power is only necessary when using 120 VAC power. Route the power to the Argon Maximizer through water tight conduit.

Commissioning

With all the lines connected it is time to commission the system. The commissioning is simple; purge, leak check and safety check.

☞ **WARNING:**

It is important to purge the entire Bulk Fill Station with warm, dry gas (gas of service before running the system with liquid). Water vapor can cause ice crystals for form that may cause the solenoid valves to operate improperly.

Purge, Pre-Charge, and Leak check of the Argon Maximizer

When all connections to the Argon Maximizer are made, pressure the complete system using low pressure gas. With all the lines connected, complete the following procedure.

1. Begin with the argon. Open HCV-21 (Argon In Isolation) and HCV-22 Argon Out Isolation) for about two minutes (a). Once the time has expired, close the valves.
    a. If liquid comes out before the two minutes have expired, close both valves immediately.

2. Leak check all of the new fittings used for the argon bulk supply and argon bulk pressure. This is accomplished by spraying a liquid soap mixture onto the joints of the new fittings installed. If you see any bubbles, there is a leak. Disassemble, clean, re-tape using teflon tape, and reinstall.
3. The remaining steps deal with the nitrogen side. Open HCV-1, (bulk nitrogen supply valve). Allow the nitrogen to flow until PI-1 (Pressure Indicator of the Argon Maximizer) reads 30 psi. Once it does, close HCV-1. Check for leaks by spraying a liquid soap mixture onto the joints. If you see any bubbles, there is a leak. Disassemble, clean, re-tape using teflon tape, and reinstall.
4. If there are no leaks, the Argon Maximizer should be ready to work.

Inspect Safety Circuits

Check all fittings, lines and relief valves to assure that they did not incur damage during shipment. If damage has occurred, repair the system with proper procedures and components.

First Operation

As you fill the Argon Maximizer with liquid nitrogen for the first time, the pressure will probably rise quickly. This is because a lot of liquid is boiling into gas. Once the Maximizer cools down, this will be minimal.

Operation

Operation of the Argon Maximizer is semi-automatic and involves two main procedures.

1. Filling the Nitrogen tank.
2. Filling the Argon tank.

Each of these procedures will be necessary in the proper use of the Argon Maximizer.

Argon Transfer

Argon transfer is completed with four main steps. These steps are listed below.

1. Assure the Nitrogen cylinder is full (Refer to the following section "Re-Fill Nitrogen cylinder" if required)
2. Ensure that Argon In (HCV-21) and Argon Out (HCV-22) are open.
   - *For filling systems with automated shut-off, Argon In (HCV-21) and Argon Out (HCV-22) remain open.*
3. Use standard Liquid Cylinder Filling Procedures.
4. At the end of the transfer, Re-Fill the Nitrogen Cylinder.

Re-Fill the Nitrogen Cylinder

Refilling the Nitrogen cylinder is necessary to operate the Argon Maximizer. It involves three steps which are listed below.

1. Open the Bottom Fill Valve (HCV-1). The Pressure Control Valve (PCV-2) will open when the pressure rises above the high set point (45 psig).
2. Monitor the liquid level using the Liquid Level Indicator (LI-1).
3. Close the Bottom Fill Valve (HCV-1) at the Indicated levels between 95-100% or at the first sign of liquid out Muffler 1.

Inspect Safety Circuits

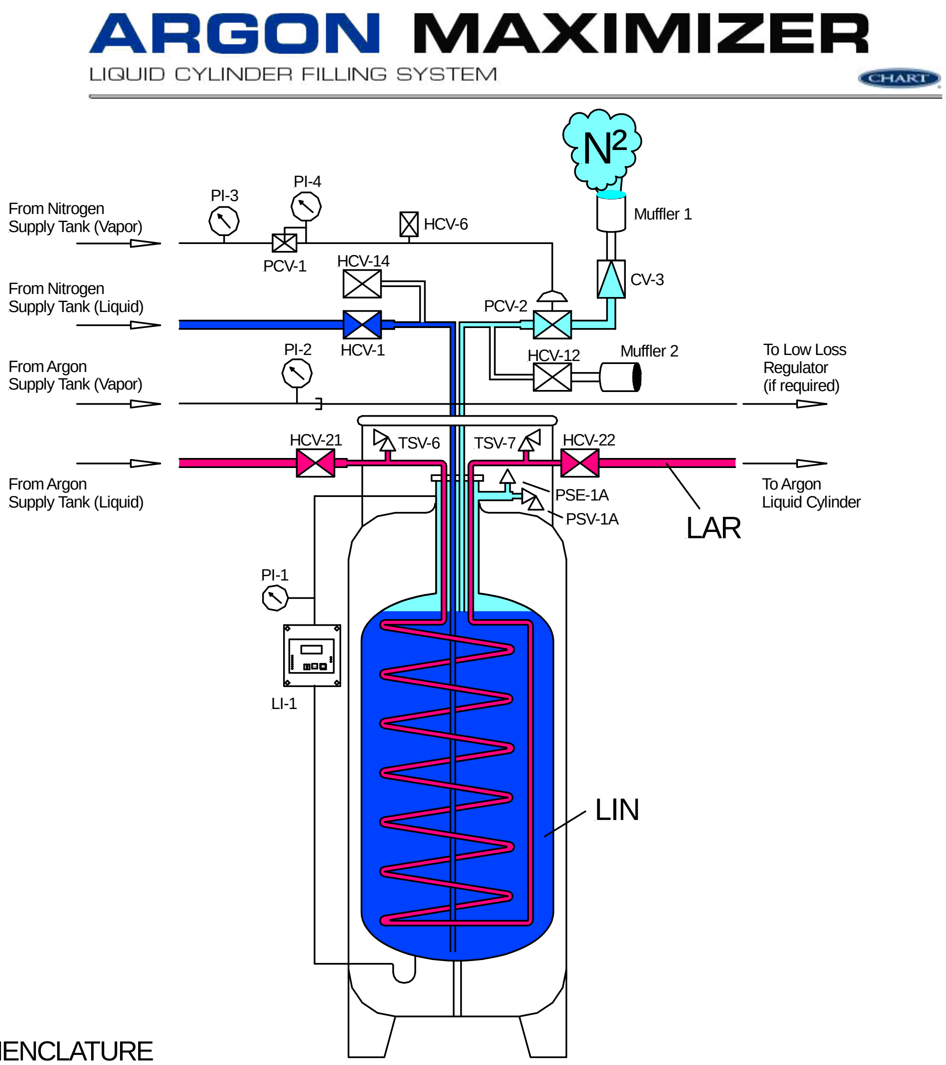
Once again, check all fittings, lines and relief valves to assure that they did not incur damage during shipment or assembly. If damage has occurred, repair the system with proper procedures and components.

Service/Replacement Parts

Contact Chart for more information about service and replacement part(s) by the following ways.

1. Phone:
    a. United States: 1-800-400-4683
    b. Worldwide: 1-952-758-4484
2. Online: www.chartparts.com

Use the following schematics and nomenclature below to identify your parts for replacement.



NOMENCLATURE

TAG#	DESCRIPTION	FUNCTION	Chart Part Number
CV-3	CHECK VALVE	Prevents moisture from entering PCV-2	13100094
HCV-1	BOTTOM FILL	Start and Stop bottom filling	1713202
HCV-12	VAPOR VENT	Allows manual venting of cylinder vapor space	1713202
HCV-14	SECONDARY BTM FILL/PURGE	Empty trycock and gas purge access	1713202
HCV-21	ARGON IN, ISOLATION	Argon liquid from bulk (Maximizer in)	10502848
HCV-22	ARGON OUT, ISOLATION	Argon liquid out of Maximizer (to cylinder)	10502848
LI-1	LEVEL INDICATOR	Maximizer liquid level indication	13141662
PCV-1	PRESSURE CONTROL VALVE	Controls PCV-2 open/close set point	11768373
PCV-2	PRESSURE CONTROL VALVE	Open/close to maintain Maximizer pressure	11081723
PI-1	PRESSURE INDICATOR	Maximizer pressure indication	2015179
PI-2	PRESSURE INDICATOR BULK LAR	Argon bulk tank pressure indication	2015179
PI-3	PRESSURE INDICATOR BULK LIN	Nitrogen bulk tank pressure indication	2015179
PI-4	PRESSURE INDICATOR PCV-1	PCV-1 pressure set point indication	2015179
PSE-1A	PRESSURE SAFETY ELEMENT	Safety (Burst Disc) for fire condition	11671281
PSV-1A	PRESSURE SAFETY VAVLE	Safety (relief valve) set at MAWP (@ 300psig)	1811252
TSV-6	LINE SAFETY ARGON IN	Argon inlet line safety (@ 450 psig)	1811472
TSV-7	LINE SAFETY ARGON OUT	Argon outlet line safety (@ 450 psig)	1811472

Figure 7: Argon Maximizer Schematic with Chart Part Numbers and descriptions.