



## ETHYLENE OXIDE VALVE GUIDE



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## **ATTENTION**

Due to its hazardous nature, all users and handlers of ethylene oxide must be made aware of the OSHA Ethylene Oxide Standard (29 CFR 1910.1047). Users should also be familiar with ARC's current SDS and Handling Guide.

Only properly trained operators should handle ethylene oxide and operate ethylene oxide valves.

Ethylene Oxide is a toxic and flammable compressed gas. This chemical is highly regulated. Users must be aware of and comply with all local, municipal, state, and national laws, regulations, and codes concerning this chemical.

All facilities that handle ethylene oxide must have a written emergency response plan.

24 Hour Emergency Telephone: CHEMTRIC - 800-424-9300

This guide is intended to address brass constructed Type CGA Valves. The information in this guide is not necessarily applicable to other style valves.

This is only a guide.

The data in this guide is furnished for the use and investigation of ARC customers and potential customers. While the information is believed to be correct, ARC makes no representation as to the accuracy of the information contained herein. ARC shall in no event be responsible for any damages of whatsoever nature directly or indirectly resulting from publication or use of, or reliance upon data contained herein. No warranty (either expressed or implied) of merchantability or of fitness for any purpose with respect to the product or to the data herein is made hereunder.

## **INTRODUCTION:**

ARC Specialty Products supplies Ethylene Oxide in 400 pound UN1A1 Drums. These drums are outfitted with two valves that meet the specifications of the Compressed Gas Association (CGA). These valves are used to connect and disconnect from end-user processes, to pressurize (inert) the headspace, and to deliver the ethylene oxide to its end-use. These valves constitute the only moving parts of the Ethylene Oxide Drum. Therefore, valves receive the most questions and scrutiny. This guide is intended to provide a detailed explanation of the operation of these valves. If you have specific questions, please contact your ARC Representative. You may also call the ARC Customer Service department at 845-326-5641.

## **DESCRIPTION AND OVERVIEW:**

An Ethylene Oxide drum is outfitted with two valves. These valves are placed opposite one another. The valves are of two types: Liquid Valve and Vent Valve (see Figure 1).

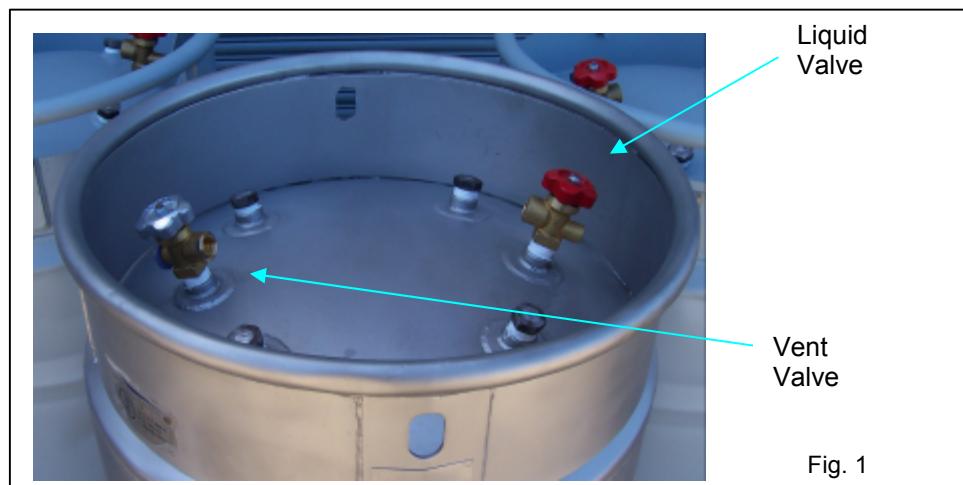


Fig. 1

The Liquid Valve is a CGA 510 connection and is outfitted with a Red Handwheel. This valve is connected to a dip-tube that delivers liquid ethylene oxide from the bottom of the drum. The threads on the valve outlet are designed to connect only to a CGA-510 Connector. **These are Left-Handed threads.**

The Vent Valve (also known as the Nitrogen Valve) is a CGA-580 connection and is outfitted with a silver handwheel. This valve connects to the headspace of the drum. It is used to pressurize (inert) the headspace with dry nitrogen (See ARC's Handling Guide). The threads on the vent valve are designed to connect only to a CGA-580 connection, a typical compressed nitrogen connection. **These are Right-Handed threads.**

The Vent Valve is outfitted with a pressure relief device that is set at 75 psig. This device is a CG-7 Type Pressure Relief Valve that is designed to re-seat when the pressure drops below 75 psig. The pressure relief valve is not exposed to the contents of the drum when the valve is closed, and is intended to prevent the inadvertent nitrogen over-pressurization of the drum. The plastic disc that is visible on the outside of the relief valve is intended to keep dust and particles out of the device. Please do not remove this plastic cover.

On the top of the drum are four fusible relief plugs (also known as melt plugs or fuse plugs). These are CG-2 Type relief devices. The fusible metal in these plugs is designed to melt between 157° - 165° F. In the event of a fire, these plugs will melt, releasing the contents of the drum. This will prevent an explosive rupture of the drum. These plugs are outside the scope of this guide, so if you have specific questions regarding fusible relief plugs please contact your ARC Representative.

Both the Vent and the Liquid Valve are diaphragm-style valves. This means that they are sealed with and operate by means of a metal diaphragm inside the valve. The diaphragm is composed

of several metal discs. This is in contrast to a packed-style valve, which is sealed by and operated by means of a packing material. Figure 2 illustrates the internal components of a diaphragm valve.

A nut secures the handwheel to the upper spindle, the upper portion of which extends above the gland.

When the valve is closed, the bottom of the lower spindle (the seat) forms a seal against the inside of the Body, preventing the flow of product.

The gland is threaded into the body, on top of the diaphragms, causing a seal between the diaphragms and the body (see Figure 3). This seal prevents leakage around the gland or upper spindle when the valve is open. Because of this, it is important that operators not attempt to tighten or move the Gland. This could damage the diaphragms and cause a leak.

As an operator turns the handwheel counterclockwise to open the valve, the upper spindle begins to rise. This allows the spring to push up on the lower spindle, which opens the valve. As these parts move, the diaphragm will change position, which may cause a 'pop' or 'snap' sound. Only a few turns (approximately 2 to 3 complete rotations) will allow the valve to open completely. Do not continue to turn the handwheel when increased resistance is encountered. Since the diaphragm limits the movement of the lower spindle, continuing to turn the handwheel will not provide for additional flow, and can damage the valve.



Fig. 2

When the handwheel is turned clockwise, the Upper Spindle pushes downward on the diaphragm, thereby causing the lower spindle to seat against the valve body. The 'pop' or 'snap' sound of the diaphragm changing position may be heard when closing the valve as well. Please note: operators should avoid over-tightening when closing the valve.

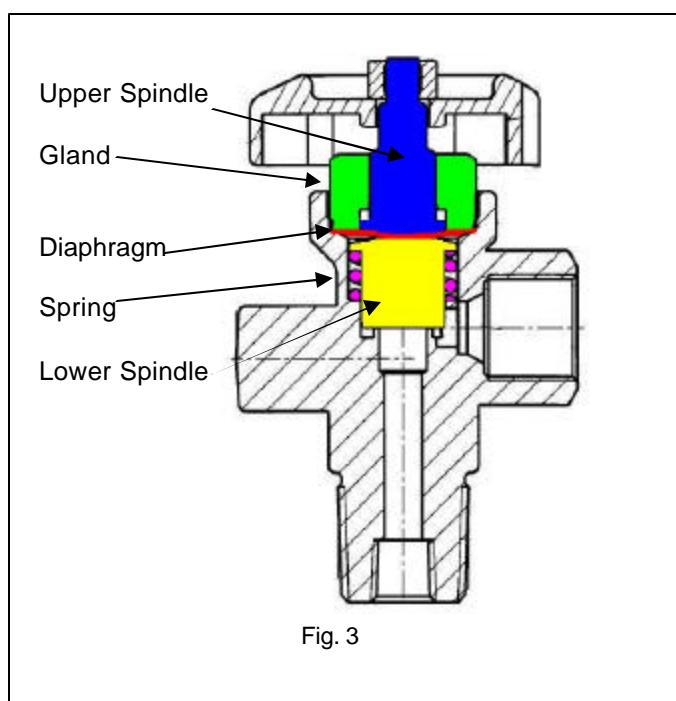


Fig. 3

These valves are designed to be operated by hand only. (The maximum recommended torque is 5 foot pounds). The valves should be able to be opened and closed with moderate effort. If extreme effort is required, please contact ARC. Never use any tools (strap wrenches, bars, etc.) on these valves.

Again, only a few turns (approximately 2 to 3 complete rotations) are necessary to open the valve. When the valve is open, the expected flow-rate is approximately 8.5 gallons of Ethylene Oxide per minute. Note that this value can change due to environmental factors, such as temperature, nitrogen pressure, and amount of material in the drum.



Fig. 4

Note that all ethylene oxide valves are outfitted with valve plugs (see Figure 4). Valve Plugs are made of brass, and have CGA threads that correspond to their matching valve outlet (CGA 510 and CGA 580). Valve Plugs are also equipped with an EPDM o-ring. Valve plugs serve two purposes. First, when drums are not in use, they prevent dirt and foreign objects from contaminating the outlet threads and outlet seat. Second, they form a gas tight seal that will prevent a release in the event that the valve is inadvertently opened. It is important to note that valve plugs are required to be installed in all valves that are not in service. Valve plugs should only be removed when the valve is connected. Figure 5 illustrates a valve plug that has been installed in the outlet of a liquid valve.

The outside end of a valve plug is designed to fit a 5/16" hex-wrench. Only non-sparking hex-wrenches, such as beryllium-copper should be used. Valve Plugs should always be installed using hex-wrenches, because hand-tightening the valve plug will not form a leak-proof seal. Do not use pliers or other wrenches to remove or install valve plugs, since they may cause damage.

The remainder of this guide is designed to provide the basic precautions and instructions, as well as technical data. If you have additional questions about ARC's ethylene oxide valves, please contact your ARC Representative.



Fig. 5



Fig. 6 – Typical Connections

## **PRECAUTIONS & INSTRUCTIONS**

Note: The general subject of ethylene oxide storage and handling is outside the scope of this guide. This guide is focused specifically on ethylene oxide valves. Please review ARC's SDS, ARC's Product Label, ARC's Handling guide, OSHA's Ethylene Oxide Standard (29 CFR 1910.1047), NFPA 560, and your local codes and regulations for storage and handling information.

- Only Properly Trained Operators should operate ethylene oxide valves and handle ethylene oxide drums.
- Facilities should maintain written operating procedures that address the connection, operation, and disconnection of ethylene oxide drums.
- Ethylene Oxide valves should be leak checked upon receipt of drums.
- Prior to use, inspect the visual appearance of valves. Do not connect valves that show any sign of damage. Possible damage may include lose or broken handwheels, cross-threaded valve plugs, or misalignment of the body of the valve. Note that such instances are extremely rare, but a careful visual inspection should not be overlooked.
- Use 5/16" non-sparking hex-wrenches to remove the valve plugs.
- Prior to removing the valve plug, inspect the nut, nipple, and pigtail (whip-line) of your valve connections. Dirt, burrs, nicks, or other damage on the connection can prevent a leak-free connection. Valve connectors should be inspected prior to every drum connection. They should also be replaced on a periodic schedule or if any damage is noted.
- Insure that valves are closed prior to removing valve plugs.
- When valve plugs are removed, carefully inspect the plug and the valve outlet for debris or damage. Do not attempt to connect drums if damage is suspected.
- Store valve plugs in a manner that allows for identification of the thread-type (CGA 510 or CGA 580). Attempting to place a valve plug in the incorrect valve can damage valve threads.
- Use care when inserting and threading connectors into valves. Ensure that the appropriate connector is inserted in the correct valve. Note the proper thread direction Liquid Valve = Left Handed; Vent Valve = Right Handed.
- Do not use Teflon® tape when connecting an ethylene oxide valve.
- Use only Spark-Proof tools.
- Ensure connections are snug.
- Leak check all connections using Snoop® or a similar soap solution. Do not use drums until a leak free connection is established. If a leak-free connection cannot be established, contact your ARC representative.
- It is recommended that nitrogen pressure should be used to test for leaks prior to opening ethylene oxide valves.
- Open and close valves only by hand. Do not use tools of any kind.
- The recommended torque for operating valves is 5 foot-pounds. Do not over-open or over-tighten valves.
- When opening, do not continue to turn the valve handwheel after encountering increased resistance. Approximately 2 to 3 complete rotations should be sufficient to open a valve.
- A 'popping' sound may be heard when the valve is opened and closed. This is the diaphragm changing position.



- If a leak is detected, close the valve. Do not use the drum. Contact your ARC representative.
- If the anticipated flow is not achieved, contact your ARC representative.
- Drums should always be inerted with nitrogen prior to disconnection.
- When inerting or pressurizing the drum, note that only Dry Nitrogen should be used.
- Do not pressurize the drum with excessive pressure. Refer to ARC's inerting guide (see ARC's valve tag or ARC's handling guide). Note that the pressure relief device on the Vent Valve is set to relieve at 75 psig.
- Use care when closing the valves. Do not over-tighten. Use hands only, do not use tools.
- Carefully replace valve plugs. Take care not to cross-thread the plugs. Use 5/16" non-sparking hex-wrenches to tightly install the plug.
- After use, leak check valves using Snoop® or a similar soap solution.
- Prior to return of drums, ensure that all valves are closed and valve plugs are snuggly installed in each valve. Every drum must be checked to ensure that they are not leaking prior to transportation.
- At any time, if you have any questions regarding ethylene oxide drums or valves, please contact your ARC Representative.
  - You may also contact ARC Customer Service:  
Phone: 845-326-5641  
e-mail: [ARCCustomerService@balchem.com](mailto:ARCCustomerService@balchem.com)  
website: [www.balchem.com](http://www.balchem.com)



### **CAUSES OF POTENTIAL PROBLEMS:**

Problems with valves are extremely rare. When operated properly, valves should not exhibit any of the problems discussed below. However, like all pieces of mechanical equipment, valves can experience issues with performance. We believe that an understanding of possible valve problems, however unlikely, is important information for all of our customers. Remember that Ethylene Oxide is a toxic and flammable gas. All problems should be treated as potential emergency situations. Do not attempt to use a drum if the valve exhibits problems.

Problem	Probable Cause	Recommendation
Difficulty making leak-free connections	Dirt or particulates on valve threads, damaged connector, or damaged valve threads	Safety plugs should be inserted at all times while not connected to prevent dirt or particulates on the valve threads.
Inability to remove plugs or connectors	Cross-threaded connection or damaged threads	Ensure operators training to connect/disconnect to prevent cross-threaded and/or damaged threads
Stuck Spindle, inability to operate valve	Excessive torque applied to valve	Ensure torque valve specifications/trainings are developed at customer sites
Leak through gland	Excessive torque applied to valve, damaging diaphragm	Ensure torque valve specifications/trainings are developed at customer sites

- If you experience any of the above problems, please report them to ARC immediately. When reporting a problem, please identify the drum number. The drum number is the serial number that is indicated on the barcode stickers that are affixed to our drums.

#### **REMEMBER**

ETHYLENE OXIDE IS A TOXIC AND FLAMMABLE GAS

TREAT EVERY PROBLEM AS A POTENTIAL EMERGENCY

ALWAYS FOLLOW WRITTEN PROCEDURES

USE CARE AND THINK BEFORE YOU ACT

## TECHNICAL DATA

### Liquid Valve – CGA 510

Ethylene Oxide Valve, Diaphragm Seal  
 Outlet Connection: CGA-510 Specification  
 0.885" – 14 NGO-RH-INT  
 Ref. CGA Pamphlets V-1 and V-9

Outfitted with Red Handwheel

Materials of Construction:

Body:	Brass
Seat:	Delrin
Spring:	Stainless Steel

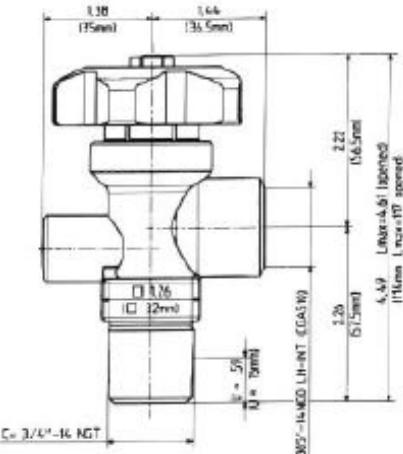
Valve Weight: 720 grams

Operating Temperature Range: -20° C to +60 ° C

Valve Manufacturer: Ceodeux Technology SA

Overall Valve Height (opened): 4.61"

Valve Width: 2.82" (Outlet cross-section)



### Vent Valve – CGA 580

Ethylene Oxide Valve, Diaphragm Seal  
 Outlet Connection: CGA-580 Specification  
 0.965" – 14 NGO-LH-INT  
 Ref. CGA Pamphlets V-1 and V-9  
 Relief Device: CG-7 Type Pressure Relief Valve  
 Spring-type reseating relief  
 Relief Pressure: 75 psig (+/- 5 psig)  
 Relief Capacity: 38.3 CFM  
 Isolated when main valve is closed

Outfitted with Silver Handwheel

Materials of Construction:

Body:	Brass
Seat:	Delrin
Spring:	Stainless Steel

Valve Weight: 700 grams

Operating Temperature Range: -20° C to +60 ° C

Valve Manufacturer: Ceodeux Technology SA

Overall Valve Height (opened): 4.61"

Valve Width: 2.76" (Outlet cross-section)

