

Product Safety Assessment

Acetylene

General

Acetylene is colorless, flammable gas, and is lighter than air. Acetylene at 100% purity is an odorless gas however acetylene of normal purity has distinctive garlic like odor. Acetylene burns with an intensely hot, luminous and smoky flame. Temperatures of Acetylene & Air and/or Acetylene & Oxygen mixtures can burn as high as 6000 °F.

Acetylene can be liquefied and solidified, however, in both liquid and solid states acetylene is shock sensitive and explodes violently. For this reason acetylene is only sold and distributed in cylinders with a porous mass as a dissolved gas in a solvent, primarily acetone. The normal flammable range for acetylene in air/oxygen mixtures is a lower flammable limit (LFL) of 2.5% and an upper flammable limit (UFL) of about 80%. Under certain pressure and conditions the upper limit can go to 100% where acetylene may violently decompose into carbon black and hydrogen.

Normal cylinder pressure is kept to 250 psig and delivery pressure of less than 15 psig (usually 7 psig). For more information please refer to the Compress Gas Association publication "CGA G-1, *Acetylene*"

Applications

Acetylene has many commercial and technical applications. The most known application for acetylene is for oxyacetylene welding, cutting and heat treating. The majority of acetylene is use in the chemical synthesis process for the manufacturing of many organic compounds such as acetaldehyde and acetic acid.

When using acetylene for welding or cutting comply with ANSI Z49.1, *Safety in Welding and Cutting*. Also refer to CGA SB-8, *Use of Oxy-Fuel Gas Welding and Cutting Apparatus*.

Health Effects

Acetylene acts as a narcotic and has been used as an anesthesia and other medical applications. Acetylene is a simple asphyxiant by diluting oxygen in the air. Pure Acetylene no known chronic effects, however depending on how it is manufactured and purified there may be toxic impurities within the acetylene. Prior to reaching levels needed for asphyxiation the lower flammable limit will have been reach which is far more of a serious hazard.

Rescue personnel should be equipped with self-contained breathing apparatus. Victims should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area, and if breathing has stopped, administer artificial resuscitation and supplemental oxygen. Further treatment should be symptomatic and supportive. A doctor should be consulted for more information.

Table 1 Acetylene Physical and Chemical Properties

Chemical Formula	C ₂ H ₂
Molecular Weight	26.04 g/mole
Vapor Pressure @ 70° F	635 psig
Boiling Point (BP) @ 10 psig	-103°F (-75°C)
Melting Point @ 10 psig	-116°F (-82.2°C)
Critical Temperature	96.8°F (36°C)
Critical Pressure	907 psia (61.7 atm)
Density, Liquid, @ 70° F	24.0 lb/scf
Density, Gas @ 68°F (20°C), 1 atm	0.073 lb/scf
Specific Gravity, Gas (Air=1) @ 68°F (20°C), 1 atm	0.906
Specific Volume @ 68°F (20°C), 1 atm	14.7 scf/lb
Latent Heat of Vaporization @ triple point	264 Btu/lb
Flammable Limits @ 1 atm.	2.5% to 100%
Flash Point (Closed Cup)	0° F (-18° C)
Solubility in Acetone @ 59° F & 1 atm.	20 scf./scf acetone.
Solubility in Acetone @ 59° F & 12 atm.	240 scf./scf acetone.

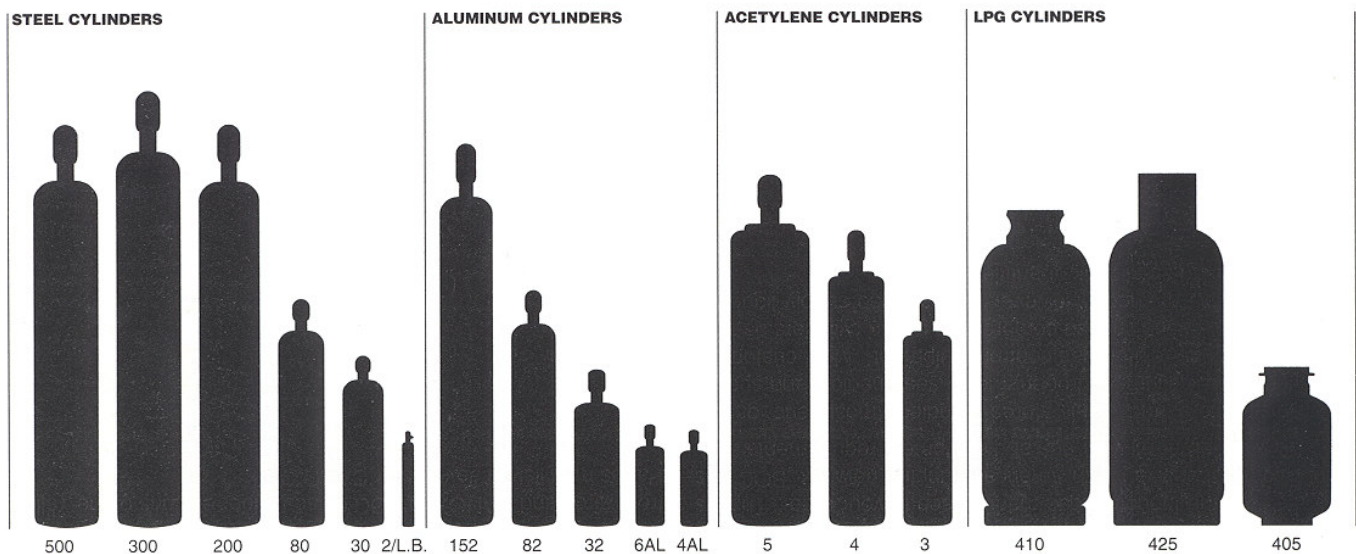
Containers

Acetylene is shipped and stored cylinders that are designed and manufactured according to applicable codes and specifications. The shell of the cylinder is manufactured to DOT-8, DOT-8AL or UN specification. These vessels are manufactured according to Department of Transportation (DOT) regulations, which specify the material of construction, method of manufacture and testing. Guidelines for testing and inspection of acetylene cylinders can be found in CGA C-13, *Guidelines for Periodic Visual Inspection and Requalification of Acetylene Cylinders*.

Each cylinder is completely filled with a porous mass filler material containing diatomaceous earth or a ceramic (silica lime) material. Older cylinders may contain charcoal, asbestos and/or cement. The filler is highly porous a light in weight that acts like a sponge for the solvent that in turns the acetylene is dissolved into.

The most common solvent used is Acetone, however DimethylFormaldehyde (DMF) is also used in some applications.

Cylinders



Valve Connections

The Compressed Gas Association (CGA) and American National Standards Institute recommend different connections for acetylene, depending on the cylinder size or type of service. Most common valves are packed valves with stems. The following table shows these different connections (for detailed drawings of these connections, consult CGA Pamphlet V-1).

Table	Acetylene Service Connections
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	<u>CGA Connection</u>
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	510 (0.885 in I.D. – 14 threads/in. internal) left handed bullet-shaped nipple
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	300 (0.825-14 NG) – right handed external
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WARNING: Do NOT use adapters to make cylinder connections!

Pressure-Relief Devices

Acetylene cylinders are equipped with fusible metal relief devices (plugs) to relieve cylinder pressure when temperature greater than 212 ° F are reached. This protects the cylinder from over pressurization and possible rupture.

Never attempt to stop a fusible plug leak by any means. Notify supplier immediately.

Manufacturing

Acetylene is manufacture via two primary methods; the first is the reaction of calcium carbide and water that produces acetylene and lime (calcium hydroxide). The lime is separated as a co-product in the reactor and the acetylene is then dried, purified and compressed into cylinders.

The second method is by thermal cracking of hydrocarbons or partial combustion of methane with oxygen.

Acetylene cylinder filling plants should comply with NFPA 51A, *Standard of Acetylene Cylinder Charging Plants*.

Container Stampings

Each cylinder is identified by stampings in the metal of the shoulder. These markings refer to its service pressure rating, date of manufacture, and testing.



Key to Cylinder Stampings

1. Cylinder Specification

- DOT—Department of Transportation, which is the regulatory body that governs the use of cylinders.
- Specification of the cylinder type of material of construction (e.g., DOT-8 or DOT-8AL).
- Service or working pressure in pounds per square inch (e.g., 2,015 psi).

2. Cylinder Serial Number

3. Registered Owner Symbol

- Symbol used to indicate the original owner of the cylinders.
- ARCO or AGA is a Registered Owner Symbol for Linde.

4. Date of Manufacture

- This date (month-year) also indicates the original hydrostatic test.

5. Neck Ring Identification

- The cylinder neck ring displays the name of the current owner of the cylinder.

6. Retest Markings

- The format for a retest marking is: Month–Facility–Year–Plus Rating– Star Stamp.

7. Cylinder Manufacturer's Inspection Marking

Shipment of Acetylene

All shipments of Acetylene, dissolved must comply with DOT regulations. This applies to motor freight, rail, air, and water shipments. For air shipments all packages must not only comply with DOT regulations but also comply with International Air Transport Association/International Civil Air Organization (IATA/ICAO) Dangerous Goods regulations. Water vessel shipments must also be prepared in accordance with the International Maritime Organization (IMO) regulations. All packaging used to transport argon must be either "UN/DOT Specification" or "UN/DOT Authorized" and in proper condition for transport. DOT Code of Federal Regulations, Title 49, also specifies the following labeling and identification requirements:

DOT Shipping Name: Acetylene, dissolved

DOT Hazard Class: 2.1

DOT Shipping Label: Flammable Gas



Identification Number: UN1001

Cylinders must be shipped, stored and transported in the up right position to prevent lost of solvent that may lead to a very dangerous situation of free acetylene in head space of the cylinder.

Safety Considerations

Acetylene users should have a knowledge and understanding of the cylinders and the properties of acetylene. The following is a guide for storage, handling, and use of acetylene cylinders.

1. Store and use acetylene cylinders in an upright position to prevent the loss of acetone.
2. Do not handle cylinders roughly or carelessly to prevent damage to the cylinder or the filler. Dropping cylinders can cause leaks to develop at fuse plugs. Sharp dents in the cylinder can break up the filler in the area of the dent and cause voids where free acetylene can accumulate and decompose at cylinder pressures.
3. Keep cylinders away from external sources of heat. Cylinders are not designed for temperatures in excess of 125°F (52°C).
4. Protect the bottom heads of acetylene cylinders from damp ground.
5. Separate flammable gas cylinders from oxygen and other oxidizing gas cylinders during storage. Separate full acetylene cylinders from empty cylinders. Provide a means of preventing cylinders from falling if accidentally bumped.
6. Use regulators and pressure relief devices designed specifically for acetylene.
7. Leak check with a leak test solution (soap & water) all regulators, torch, hose, and cylinder connections before placing acetylene equipment in service.
8. Do not use acetylene at pressures above 15 psig, the pressure where decomposition can begin, to avoid explosion and fire hazard.
9. Remove leaking acetylene cylinders to an open area and tag them indicating the danger. Never attempt to stop a fuse plug leak. Notify your supplier immediately.
10. Keep valves closed when cylinders are not in service or empty.
11. Always close the cylinder valve and bleed the pressure from the regulator slowly when work is completed.
12. If an acetylene cylinder receives a sharp or deep dent, the metal is gouged, or any other mechanical defect, circle the defect with a marking pen to alert the supplier of the defect. Federal Law prohibits persons, other than cylinder manufacturers, from repairing acetylene cylinders. Disposal of unserviceable cylinders should only be attempted by experienced personnel.
13. To lessen the loss of acetone withdrawn of acetylene should be limited to 10% of cylinder capacity per hour.
14. If a cylinder protective cap is extremely difficult to remove, do not apply excessive force or pry the cap loose. Attach a label or tag to the cylinder identifying the problem and return the cylinder to the supplier.
15. Wrenches should not be used on valves equipped with a hand wheel. If the valve is faulty, attach a label or tag to the cylinder identifying the problem and return the cylinder to the supplier.
16. Compressed gas cylinders should not be refilled except by qualified producers of compressed gases.
17. Refilling of any compressed gas cylinder without the consent of the owner is a violation of DOT.

Personnel Equipment

Personnel must be thoroughly familiar with properties and safety considerations before being allowed to handle acetylene and its associated equipment. Safety glasses, safety shoes, and leather work gloves are recommended when handling cylinders. Welder gloves, goggles and fire protective garments (such as leather) should be worn when using acetylene during welding or cutting operations

Only trained and certified emergency responders should respond to emergency situations.

First Aid

Persons who have become incapacitated or comatose through the anesthetic action of acetylene or oxygen deprivation should be moved promptly to fresh air. If breathing has stopped or is ineffective, assisted respiration is essential. Give oxygen if available. Seek medical assistance.

Fire Fighting

Since acetylene is a highly flammable gas and may burn with explosive force, caution should be taken to prevent acetylene leakage. Leak testing of all connections, valves and fuse plugs are critical to maintain a safe system.

If acetylene leaks from around the valve stem when the cylinder is open close the valve and contact the supplier of assistance. Never attempt to tighten the bonnet or O-ring packless valve. Do not in extinguishing the fire until the source of acetylene gas can be stopped. It is important to prevent acetylene gas from collecting in a confined area because the gas may reignite and explode.

In all cases of acetylene cylinder fires, the area should be evacuated as quickly as possible. Someone knowledgeable in handling acetylene fires should be left in charge. If possible, first stop the flow of acetylene gas by closing the valve and then cool all materials in the area below the ignition temperature.

The fusible metal plugs at the top and bottom of the cylinder will melt at 212°F. If the fusible metal plugs relieve, flames can be projected approximately 15 feet from the top and bottom of the cylinder. Dry powder or carbon dioxide fire extinguishers can be used to extinguish small acetylene flames. If an acetylene cylinder fire could involve additional acetylene cylinders, it is very important to spray a large quantity of water on adjacent cylinders to cool the cylinder and prevent the fusible metal plugs on the adjacent cylinders from becoming heated, melting, and discharging additional acetylene.

Disposal

Disposal of acetylene should be conducted by knowledge individual. Acetylene should be reclaimed only by the manufacture by venting it back to the manufacturing system or if necessary to the atmosphere is properly designed vent systems that are grounded and bonded.

Emergency Response System

Product Safety Information

- Call: 1-800-424-9300 (Continental U.S. and Puerto Rico)
- Call: 1-703-527-3887 (other locations)
- 24 hours a day, 7 days a week

For assistance involving Linde, Inc. products

For MSDS, Product Safety Assessment, and Product Safety Information,
www.linde.com

Information Sources

- www.us.lindegas.com
- Compressed Gas Association (CGA)
www.cganet.com

For More Information

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