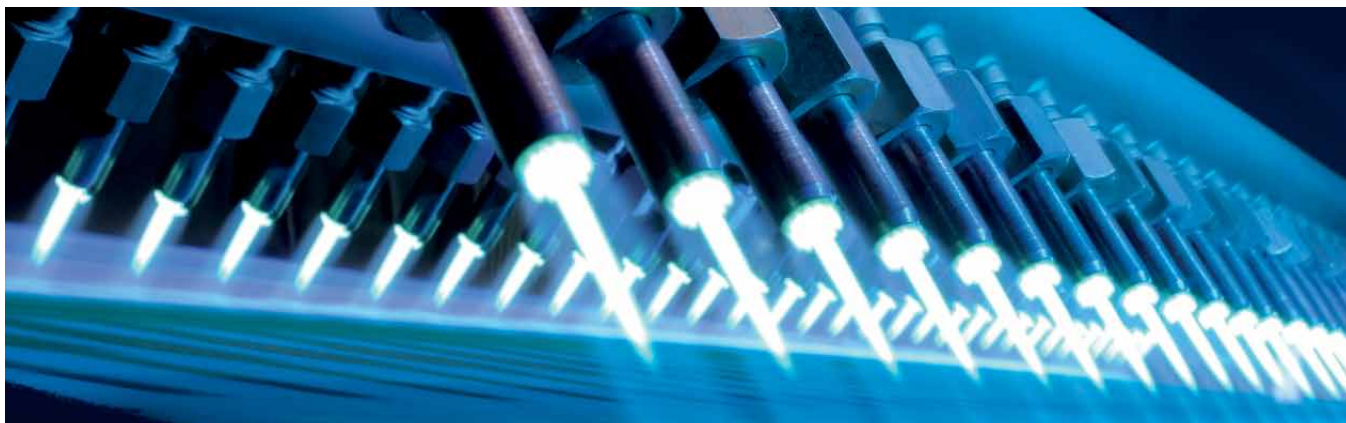


Safety Advice.

10 – Handling of Acetylene.



1. Preliminary remarks

Acetylene has particular properties which make this gas practically irreplaceable for oxyfuel gas welding and cutting. These properties are also significant in terms of safety, and must be taken into account when working with acetylene in order to prevent accidents.

This Safety Advice describes the properties of acetylene that are relevant to safety, and provide practical hints for working safely with this gas.

These instructions supplement, but do not replace, mandatory stipulations such as the Acetylene Code and relevant Technical Rules for Acetylene Equipment (TRAC).

2. Chemical Properties

Explosion hazard:

Do not allow uncontrolled mixing of acetylene and air or oxygen

Acetylene combines with air or oxygen to form an explosive mixture that can be ignited by a spark or the like, and can cause a serious Explosion.

To eliminate this hazard, take the following safety precautions:



Flammable substance warning

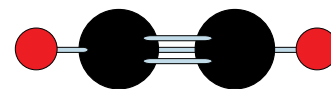
- To prevent significant quantities of acetylene from leaking into ambient air, acetylene systems must be leak-proof from the cylinder connection to the torch. Any leaks that occur must be repaired immediately. Acetylene hoses must meet the requirements of DIN EN 559. Connections meeting DIN EN 560 must be used to connect hoses to one another and to equipment. Protect the hoses from damage, and replace them at appropriate intervals. Close acetylene cylinder valves during work breaks.
- Before lighting a torch, any air present in the acetylene hose must be purged with acetylene to prevent the formation and ignition of an acetylene / air mixture in the hose.
- With a few exceptions, single-cylinder acetylene systems must be equipped with a hose check valve fitted to the torch, which blocks the flow of oxygen into the acetylene hose and thus prevents the formation of an acetylene / oxygen mixture in the hose. Also a flashback arrestor should be installed directly on the acetylene cylinder regulator, preventing flame propagation into the acetylene cylinder.
- A single-cylinder oxygen arrestor should be installed in the oxygen hose just before the torch, to prevent acetylene from entering the oxygen hose at low oxygen pressure.

Decomposes easily

**Protect acetylene cylinders from fire
Do not transfer acetylene**

Each acetylene molecule is held together by a "triple bond" that can break under the action of heat or extreme pressure. This causes the acetylene molecules to decompose into their components: carbon (soot)

and water. This decomposition reaction can occur explosively and can have a considerable destructive effect.



C₂H₂ molecule

The higher the pressure and temperature of the gas, the more readily acetylene decomposes. Acetylene decomposition is unlikely to occur, however, within an acetylene cylinder, since its volume is completely filled with a solid porous mass whose pores contain the acetylene, dissolved in acetone. This safety system is effective only if the quantitative ratio between the dissolved acetylene and the acetone solvent does not exceed certain limits. Acetylene cylinders should therefore be filled with gas only after the acetone content has been checked and topped up if necessary. Transferring acetylene from one cylinder to another is therefore prohibited.

Despite the presence of this safety system, under unfavourable conditions a decomposition reaction can occur inside the cylinder. To eliminate this hazard, acetylene cylinders must be protected from excessive heat. Although acetylene cylinders can withstand long periods of exposure to intense sunlight, direct contact with a flame can be hazardous. Welding, and use of any other kind of flame, are therefore prohibited within 1 meter of a single-cylinder acetylene system. For acetylene cylinder batteries containing up to six acetylene cylinders (called "small systems") this radius is 3 meters; for batteries with more than six acetylene cylinder it is 5 meters. Welding torches and hoses must not be hung on the acetylene cylinders. Stationary battery systems with more than six acetylene



cylinders must not be installed in the room in which welding is taking place. If a fire breaks out in the immediate vicinity of acetylene cylinders, remove them from the threatened area if possible, or cool them intensively with water.

Acetylene utilisation devices are not protected against acetylene decomposition in the same way as the cylinder. Acetylene must therefore be withdrawn from the cylinder only through an acetylene cylinder regulator, which limits pressure in the hose to a maximum of 1,5 bar above atmospheric. Regulators for acetylene cylinders must be approved by model, and bear an approval label (such as 01D – D 52172).

Formation of acetylides Use steel for acetylene systems

Under certain conditions, acetylene can combine with copper or silver to form acetylides. These compounds have explosive characteristics, and can explode if exposed to heat or mechanical energy. The explosive reaction of these acetylides can of course trigger acetylene decomposition. Therefore, copper or copper alloys containing more than 70% copper, and silver or silver alloys, must not be used for acetylene systems. Exceptions are made for precisely defined silver solders. The preferred material for acetylene systems is steel.

3. Physical Characteristics

Physical state Use acetylene cylinders in the vertical position

As already mentioned, acetylene is dissolved in acetone inside the cylinder. When the cylinder valve is opened, acetylene in gaseous form flows out, just like carbon dioxide when a bottle of carbonated water is opened. To prevent flammable acetone from emerging from the cylinder, acety-

lene cylinders must be vertical while gas is flowing, or must be placed with the cylinder valve at least 40 cm higher than the cylinder base. This precaution can be ignored for cylinders having a "high-porosity" mass, indicated by a red ring around the cylinder neck.

Relative density Provide high-level vent openings

Acetylene has a relative density of about 0.9, meaning that it is about 10% lighter than air. When unconfined, acetylene therefore migrates upward. Working areas in which acetylene is being used must be vented at the upper part of the space to prevent a dangerous build-up of acetylene in the ambient air in the event of leaks. However, this provision is effective only if a forced air flow is not moving the acetylene in the other direction. Instead of relying solely on this natural ventilation, everything possible should therefore be done to prevent leaks in the acetylene system.

Heat of compression Follow operating instructions for the acetylene cylinder bundle

Like almost all gases, acetylene heats up when it is compressed. If compression occurs as a "pressure surge", i.e. very quickly, the heat that is released cannot be immediately dispersed to the environment, but remains in the compressed gas. Acetylene that is suddenly compressed from 1 to 20 bar can reach temperatures of 250 – 300°C, which under unfavourable conditions can trigger acetylene decomposition.



Acetylene cylinder bundles require particular attention in this regard. Acetylene cylinder bundles with 6 or 16 acetylene cylinders (model 46 or 61) use a ball valve as the central shutoff device. This valve must always be actuated slowly; sudden opening can cause hazardous heating due to the pressure surge. In addition, before

the supply hose is connected, the safety bundle connector must be purged with acetylene by briefly opening the ball valve, to eliminate any air in the hose. If this is not done, an acetylene / air mixture can be produced in the supply hose; this mixture is even more sensitive to impact than pure acetylene.

Acetylene cylinder bundles with 13 cylinders (model 59) do not have a central shutoff device. With these acetylene cylinder bundles, purge the collector line inside the bundle before making connections, to remove the air inside.

Carefully follow the operating instructions provided on every Linde acetylene cylinder bundle and on the regulator station. Note the sequence in which the specific operating steps are to be performed.

4. Physiological Properties

Do not inhale acetylene in concentrated form

Acetylene is nontoxic, i.e. inhalation of acetylene does not damage the human body. Nevertheless, acetylene should not be inhaled in concentrated form since the gas has a narcotic effect. (Pure acetylene – known as "narcylene" – was once used in medicine as a narcotic agent.) Acetylene has a suffocating effect on humans. If more than 20 vol% acetylene is present in the lungs, the mixture then contains less than 17 vol.% oxygen and insufficient oxygen is present, creating the possibility of suffocation.

5. Asbestos Hazards?

Safety measures are not required

The high-porosity mass in acetylene cylinders contains a small proportion of asbestos, which is permanently enclosed and remains in the cylinder even gas is withdrawn. Measurements of the supply flow from acetylene cylinders have indicated unequivocally that the emerging acetylene is completely asbestos-free. Using acetylene cylinders with asbestos containing porous fillings does not constitute an asbestos hazard.

6. Conclusions

Ask Linde Service

Acetylene has specific properties that are neither good nor bad. The only important thing is to understand those properties and utilise them safely. Our gas applications engineers can tell you how to do that.

Linde AG

Linde Gas Division, Linde Gas Germany, Seitnerstraße 70, 82049 Pullach
Phone 018 03.85 000-0*, Fax 018 03.85 000-1, www.linde-gas.com