



COMPRESSED GAS ASSOCIATION, Inc.

SAFETY BULLETIN

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HANDLING ACETYLENE CYLINDERS IN FIRES

Introduction

This bulletin is one of a series of publications written by the Compressed Gas Association, Inc. to satisfy the demand for information relative to the transportation, handling, and storage of compressed gases, cryogenic liquids, and related products.

The purpose of this bulletin is to give guidance on how to handle acetylene cylinders in fires to individuals knowledgeable and experienced with the properties, safe handling, and use of acetylene and acetylene cylinders. As with any instructions of this nature, it is impossible to cover every situation that might arise, and it is for this reason that the following information is general and intended to give a basic understanding upon which one can build. Each situation will require a careful consideration of the circumstances before an intelligent decision can be made on how to best handle a fire.

If acetylene leaking from a cylinder should ignite, do not panic. Take precautions as outlined in this bulletin, evacuate the area, and call the fire department.

Take every precaution to prevent fires that involve or might involve acetylene cylinders. For additional information on the prevention of fires, refer to NFPA 51, NFPA 51A, NFPA 51B, ANSI Z49.1, and *National Fire Code of Canada* [1, 2, 3, 4, 5].

Construction of acetylene cylinders

Acetylene cylinders differ from other compressed gas cylinders because their interiors are packed with a porous filler material. Liquid solvent in a carefully determined amount saturates this filler. The acetylene gas is dissolved in the solvent. The acetylene cylinder contains a solution of acetylene and solvent dispersed throughout the porous filler. When the valve on a charged cylinder is opened, the acetylene comes out of solution and flows out in gaseous form.

All acetylene cylinders are equipped with one or more fusible metal pressure relief devices (fusible metal plugs). These devices are designed to function at a temperature between 208 °F and 220 °F (97.8 °C and 104 °C), or about the boiling point of water. On large cylinders, pressure relief devices can be easily identified because they are usually in the form of aluminum, brass, or steel threaded plugs in the tops of the cylinders. In addition, they are fitted, quite frequently, in protected places on the bottoms of the same cylinders. Smaller cylinders are not necessarily equipped with threaded plugs because the pressure relief device can be a special, machined passage in the valve body that is filled with fusible metal.

Parts of an acetylene cylinder that might catch fire

When a fire occurs on an acetylene cylinder, it is most frequently located at the valve outlet where the cylinder is connected to a pressure regulator or at the regulator outlet where the hose is connected. Failure to tighten these connections properly may cause leakage when the cylinder valve is opened and this leaking acetylene gas can ignite.

A fusible metal pressure relief device may function if:

- a cylinder is located too close to a heat source such as a furnace;

- a flame from a torch is carelessly or inadvertently directed on it; or
- hot metal or slag is dropped on it from operations being carried on above it, e.g., welding or cutting operations.

If fire or another heat source comes in contact with or near an acetylene cylinder, the pressure relief device will function only when the fusible metal reaches a temperature of approximately 212 °F (100 °C). The escaping acetylene may be ignited. This relief action is intended to prevent pressure from developing inside the cylinder, which can rupture the cylinder.

Companies that fill acetylene cylinders take very strict precautions to make sure that the cylinders are in good condition and that they have no leaks when they are shipped. Rough handling may damage fusible metal pressure relief devices or valves and cause them to leak. Abuse or tampering may loosen the packing in a cylinder valve and cause leakage around the valve stem. If the leaking gas is ignited, a cylinder fire can result.

It is unusual, but not impossible, for the shell of an acetylene cylinder to be punctured, which can occur if a sharp object strikes a cylinder or if a cylinder is dropped from a height. A fire can start in such cases.

If a cylinder becomes hot, acetylene decomposition may be occurring inside the cylinder. It is advisable to cool the cylinder to avoid a fire situation.

Acetylene release and burning characteristics

The manner in which acetylene from a cylinder will burn depends on the location and size of the leak and the pressure within the cylinder. Small leaks from gas escaping through the packing gland on a valve or around fusible metal pressure relief devices may continue to burn if ignited but may not grow in size if the heat of the flame is insufficient to melt the fusible metal in the relief device. A leak from a cylinder valve at a regulator connection may ignite and create sufficient heat to cause the fusible metal pressure relief devices to function. In any case, a small acetylene leak needs an ignition source to cause a fire; acetylene does not spontaneously ignite.

If sufficient heat is generated to melt the fusible metal in a pressure relief device, a rather loud report may be heard when the gas is released. Most bystanders tend to exaggerate the magnitude of this sound and often mistakenly refer to it as an “explosion.”

When a fusible metal pressure relief device releases, a large volume of acetylene will rush out and may be ignited by any nearby source of ignition. This will probably give a sustained “roaring” sound. Acetylene escaping from a fusible metal pressure relief device of a full cylinder may be traveling at such a speed that the flame will not burn back to the opening but actually may begin burning a short distance from the cylinder. However, as the pressure decreases, the flame will work back toward the pressure relief device opening and then burn from there outward.

A flame from a full cylinder will be larger than from a partially full one, and the sound will be proportionately louder. At first the flame will be brightly luminescent; acetylene is noted for the brightness of its flame. As the cylinder discharges and the flame becomes shorter in length, the degree of brightness is reduced, gradually tending towards a yellowish tinge and the flame will give off carbon smoke.

In some cases of burning acetylene cylinders where the gas is released at a high rate, a portion of the cylinder may acquire a coating of frost. The rate of gas withdrawal is so high that the normal amount of heat traveling through the cylinder walls to affect the release of the acetylene from its solvent is insufficient for the demand. Consequently, the acetylene-solvent solution inside the cylinder refrigerates itself. This cooling effect is transmitted to the cylinder wall and is sufficient to condense atmospheric moisture and freeze it.

Handling fire situations involving acetylene cylinders

If acetylene issuing from a single cylinder is ignited, follow the steps detailed in this section. When a group of cylinders are involved and/or there is a structural fire, evacuate all personnel from the area and notify the fire department.

As soon as possible, determine whether the acetylene is escaping from the cylinder or the attachments. If it is a small flame, put it out as quickly as possible and close the cylinder valve. A properly rated fire extinguisher will