NEW SOUTH WALES FIRE BRIGADES

OPERATIONS BULLETIN 2007/02

Acetylene cylinders exposed to fire or mechanical shock

This Operations Bulletin rescinds In Orders 1987/24 Acetylene cylinders and acetylene manifold packs.

The following information is provided for dealing with acetylene cylinders and/or acetylene cylinder manifold packs which are subjected to fire, heat or mechanical shock.

Examples of fire, heat or mechanical shock include:

- a fire in the immediate vicinity
- fire involving the safety device or hoses of the cylinder
- flashback into the cylinder from the hose
- a cylinder dropped several metres or damaged e.g. involved in a serious MVA.

Acetylene gas has explosive limits from 2.5% to 85%, with a vapour density of 0.9, which is slightly lighter than air.

The gas is stored in maroon coloured steel cylinders with one or more fusible plugs which will melt at 100° C to vent the gas. The cylinder is packed with a porous lime-silica matrix soaked in acetone, to avoid the gas collecting in pockets and exploding.

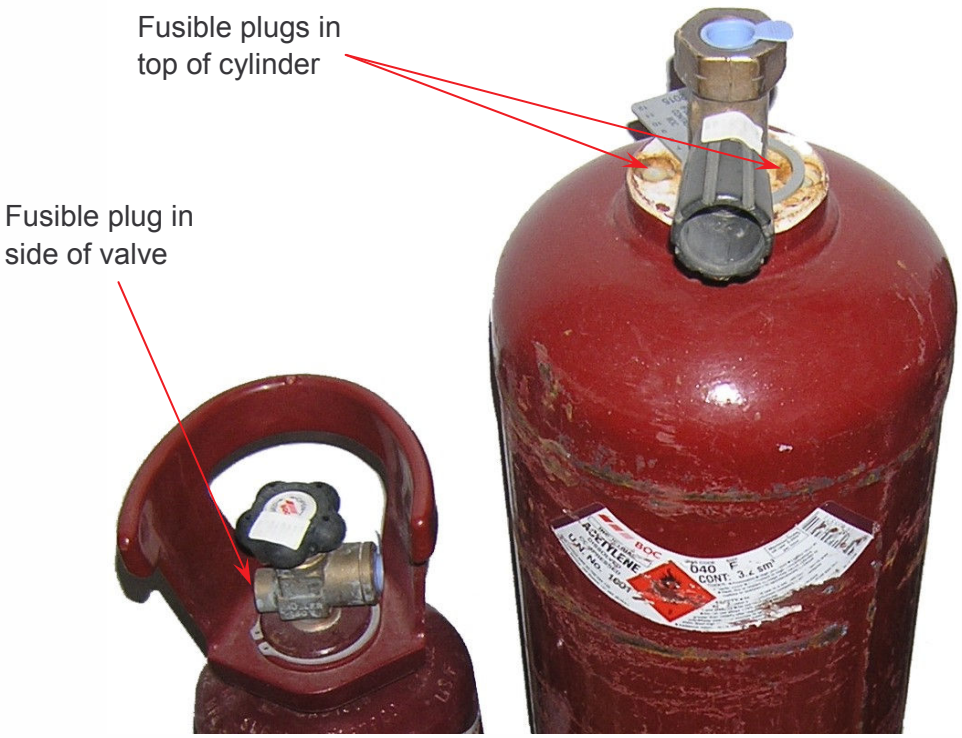

Figure 1 Typical acetylene cylinders showing fusible plugs

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Acetylene is more dangerous than other flammable gases

When an acetylene cylinder is subjected to fire, heat, or mechanical shock, gas decomposition can occur. This may result in an explosion where the cylinder could rupture and penetrate a double brick wall or metal freight container and land up to 200 m away. This can occur up to 24 hours after the cylinder was heated or damaged. See Figure 2.

1. Cylinders are most likely to explode before effective cooling can commence.
2. Due to the gas dissolved in acetone at atmospheric pressure, a cylinder could still contain acetylene gas when the gauge reads zero and the cylinder is considered empty.
3. An acetylene cylinder that has internal decomposition and is leaking gas presents the greatest danger of rupture. This is due to fresh acetylene moving through the damaged area and increasing the risk of explosion. Therefore, a venting fusible plug cannot be taken to indicate that the cylinder is safe.
4. Any movement of a cylinder could cause internal collapse of the porous matrix and allow the gas to accumulate and spontaneously explode.
5. The porous matrix in the cylinder is a good thermal insulator and may shield initial signs of heat build-up. Consequently, there is no reliable way of detecting decomposition in a cylinder unless it is occurring near a cylinder wall. See Figure 3.

Figure 2 Ruptured acetylene cylinder found 200 m from source

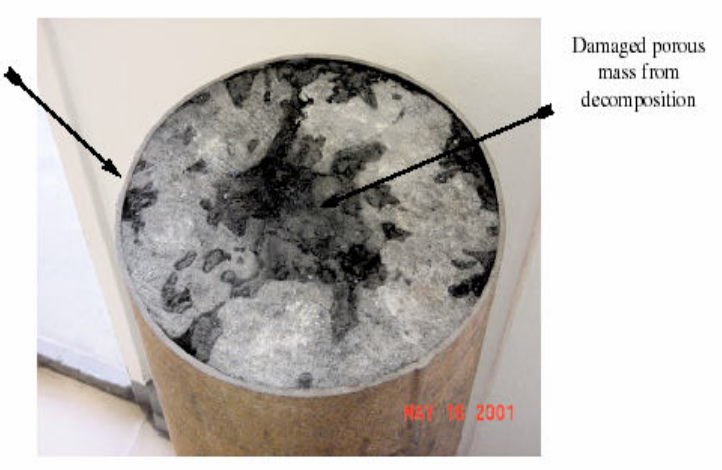

Figure 3 Acetylene cylinder cooled during cylinder decomposition

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Procedures for dealing with an acetylene cylinder with heat or mechanical shock.

1. Establish a 200 m hot zone.
2. Request presence of Hazmat, Police and the gas company that owns the cylinder.
3. Cool cylinder from substantial cover with water monitor for 2 hours.

   If insufficient water is available for cooling, there is a high probability that the cylinder will explode. Maintain the 200 metre hot zone for 24 hours.
4. After 2 hours, check for cylinder venting and conduct a thermal check. *See Note 1.*
5. Then follow one of the following steps as appropriate:

Cylinder venting *See Note 2.*	**Cylinder not venting** **Thermal check successful.**	**Cylinder not venting** **Thermal check fails**	**Cylinder not venting** **Thermal check cannot be done**
200 m hot zone. Apply cooling water until cylinder has stopped venting.	200 m hot zone. Cool cylinder with water monitor for 1 hour.	200 m hot zone. Cool cylinder with water monitor for 1 hour.	200 m hot zone. Cool cylinder with water monitor for 24 hours.
Repeat thermal check	**Repeat thermal check**	**Repeat thermal check**	
Thermal check successful: • submerge cylinder in water tank for 24 hours • no hot zone required. Thermal check fails: • maintain 200 m hot zone • maintain water cooling for 24 hours.	Thermal check successful: • reduce hot zone to 50 metres • maintain water cooling for 24 hours.	Thermal check fails: • maintain 200 m hot zone • maintain water cooling for 24 hours. • Reduce hot zone only if substantial shielding is available. *See Note 3.*	Reduce hot zone only if substantial shielding is available. *See Note 3.*

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Note 1: Thermal Check. The temperature of the cylinder wall may give some indication of any internal decomposition and the integrity of the cylinder walls.

A thermal check can be conducted at a safe distance by one of the following methods:

- Thermal imaging camera (hot spot or higher temperatures than surrounding objects)
- Infrared thermometer (60° C or hot spot)
- Wetting test:
  - get a clear view of the cylinder
  - ensure the cylinder is completely wet
  - stop spray and check for signs of steam or rapid drying of the cylinder
  - successful test: the entire cylinder remains wet for 30 minutes
  - failed test: the cylinder dries or steam rises; recommence cooling immediately.

Note 2: Venting. **A**n explosion and cylinder rupture is most likely when the gas is venting. However once fully vented, the cylinder is relatively safe.

Venting can be by:

- venting of a fusible plug
- leakage through an open control valve.

Note 3: Substantial Shielding will either stop or reduce the range a ruptured cylinder may travel and confine any fire ball, permitting a reduction in the hot zone to an area of approx 50 metres radius. Ruptured cylinders have been known to penetrate double brick walls and still travel a short distance.

These procedures can have a significant impact on the community and research into more efficient methods of dealing with acetylene gas incidents is continuing. However it is important to follow the procedures in this Operations Bulletin until advised otherwise.

Noted, Station Commander	A	B	C	D	Other

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Previous Operations Bulletin: 2007/01 SCBA procedures, checks and skills maintenance