

University Health & Safety Arrangements: Chapter 17



Acetylene cylinders

Key word(s):	Acetylene, C ₂ H ₂ , fire and explosion risk; fire fighters' response to fires affecting acetylene cylinders, Dangerous Substances & Explosive Atmosphere Regulations 2002.
Target audience:	PIs, staff and students using acetylene cylinders and preparing risk assessments. School safety advisors / other personnel responsible for completing form A1. Estates & Facilities staff responsible for specifying and managing work carried out by contractors.

Introduction

1. Acetylene is used for chemical synthesis, in analytical equipment such as atomic absorption, gas and mass spectrometers and cutting and welding operations. The University has numerous acetylene cylinders in locations such as workshops and laboratories. Exposure to heat can set off an exothermic decomposition reaction inside the cylinder which continues after any local fire or heat source has been removed. If unchecked, the cylinder will fail catastrophically and explosively.
2. In a fire, the presence of acetylene cylinders poses a serious risk of injury to those nearby. The Fire & Rescue Service will implement the following procedure when acetylene cylinders are known – or suspected of being – affected by heat.
 - Establish a 25m restricted area in all directions around the affected cylinder;
 - If required, introduce a maximum a 200m hazard zone in all directions around the affected cylinder. The 200m hazard zone can be reduced, dependant on buildings or topography;
 - Water will be continuously applied to the cylinder for a minimum of one hour;
 - The Incident Commander will assess the cylinder after one hour of cooling. This will be followed by a monitoring phase which will last for a minimum of one hour. During this time, water will be continuously applied to the cylinder. If the cylinder remains cool after this period, the Incident Commander will hand responsibility back to a competent person / occupier. The cylinder must not be

moved for a minimum period of 24 hours from commencement of cooling phase unless advised otherwise by the Incident Commander;

- If it is not possible to continuously apply cooling water the cylinder will be left in situ allowing it to cool naturally, significantly extending the period of the hazard exclusion zone until safety is achieved.
3. These actions are obviously highly disruptive and damaging, and may close down arterial road / rail links and University buildings, including halls of residence.
 4. A size G acetylene cylinder contains approximately 20 litres of acetone, in which approximately 7500 litres of acetylene is dissolved in a 15 bar cylinder. At atmospheric pressure, a nominally empty cylinder will still contain 500 litres of dissolved acetylene. Thus, these arrangements apply equally to "empty" cylinders.

Arrangements

5. The following arrangements must be implemented:
 - acetylene cylinders must be fitted with flashback arrestors downstream of pressure regulators. Flashback arrestors must be designed to BS EN 730 and replaced every 5 years or at the manufacturer's recommended interval. Acetylene manifolds must also be fitted with a flashback arrestor.
 - any unwanted or unnecessary acetylene cylinders should be returned to suppliers without delay (this includes "spares", "back-ups", etc., as suppliers can usually provide cylinders within 1-2 days).
 - risk assessments and assessments made under the Dangerous Substances and Explosive Atmosphere Regulations 20021 for any remaining acetylene cylinders should address rigorously the question of whether there are safer alternatives.
 - the assessments must always be carried out before acetylene cylinders are purchased and used, and must take into account the behaviour of acetylene cylinders in fires.
 - the minimum practicable cylinder size must be used.
 - the presence of all acetylene cylinders should be notified to the Safety Office using Form A1 Notification of acetylene cylinders.
 - when locating each cylinder, the consequences of Fire & Rescue Service policy on fighting fires must be taken into account. For example, there should be sufficient local drainage to avoid or minimise structural damage and damage to other equipment if a high pressure water hose is directed at the cylinder for 24 hours or more. The consequences of an evacuation lasting between 3 and 24 hour evacuation should also be considered e.g. will other equipment in the vicinity need to be isolated or attended to?
 - consideration should be given to the provision of a purpose-built enclosure for the cylinder, equipped with water shower and drainage, in areas where for example there is a higher risk of fire. This may mitigate the damage caused in the event of an incident, although it should be understood that the Fire & Rescue Service will follow their instructions.

¹ <http://www.hse.gov.uk/fireandexplosion/dsear.htm>

- where acetylene cylinders are used or stored, there must be a clear indication of their presence, e.g. a sign on the door, and the safety data sheet must be available, preferably displayed.
- School emergency and contingency plans must consider the implications of Fire & Rescue Service policy on fighting fires.
- the location of acetylene cylinders must be shown on the building fire risk assessment plans, and these plans kept up to date. Changes in location should be notified to the University Fire Officer (who will update the building's fire risk assessment).

Emergency planning/business continuity

6. At regular intervals and for the purposes of aiding the University's processes for emergency planning, Safety Services keep a list of acetylene cylinders in use.

Guidance

Additional guidance on acetylene cylinders and their risks in fires is at <http://documents.manchester.ac.uk/display.aspx?DocID=12104>

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